SDMS 367370

367370 - R8 SDMS
476780

PERFORMANCE OF REMEDIAL RESPONSE ACTIVITIES AT UNCONTROLLED HAZARDOUS WASTE SITES (REM II)

U.S. EPA CONTRACT NO. 68-01-6939

DRAFT
REMEDIAL INVESTIGATION
CLEAR CREEK/CENTRAL CITY, COLORADO

EPA Work Assignment No.: 106-8L13.0
REM II Document No.: 202-RI1-RT-EHRR-1

FILE PLAN
3.8

VOLUME 2

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APPENDIX 4

APPENDIX 4A

BORING LOGS

GEOLOGICAL BORING LOGS

(CDM)

G001 - G013
NT02 and NT03
QH01 and QH02
BF01
AT01 and AT03

CDM

BOREHOLE LOG RECORD

Project CLEAR CREEK / CENTRAL CITY
By J. LeClaire Date 10/01 1985 Page 1 of 1
Chkd By RWC 10/15/85 Date 1985

G001

Project ID* CC Hole No.* G.0.0.1
Record Type B L R Site No.* Date* 1.0.0.1 8.5 Time* 1.3.0.0

FILE COPY

Contractor Gormley Consultants Driller Drilling Engineers Rig CM 255
Bit(s) HSA
Borehole Diameter(s) 6" Total Depth 30 ft
Status Backfill + cement cap

Depth (ft)	Blow Counts 6"	6"	6"	6"	Sample Type*	Material Description and Comments
0-1.25	10	13	18	37	SS	Fill material - Green grey (7.5 YR 3/2 or 4) silty clay, some pyrite crystals - moist.
1.25-5		..			=	Coarser fill material. 40-50% sandy. Wood fragment at bottom Matrix (2.5 Y 4/2)
5						water
5-7	3	1	1	2	SS	Fill material.
10-11					ST	Down pressure by rig. No recovery by shelby
11-13	3	2	4	17	SS	11-12 ft DK brown sandy loam (10 YR 3/2)
						12-12.2' Darker grey/green/brown (2.5 Y 3/0) maybe creek mud. Saturated - organic odor
						12.2-12.3' Black muck - Creek bottom?
						12.3'-13' Mottles of black & dk. brown.
15'						Possible rock
15-16	40	41	-	-	SS	Coarse sand & gravel, bouldery. Brown to dk brown (7.5 YR 3/4) Rust brown quartz grains Granite gneiss cobbles.
16-17					—	Coarse sand, gravel
20-22	20	11	5	6	SS	Clayey sand. 1.6 ft recovery. Upper 0.8 ft - grey-green to dk. grey green (granodiorite) Lower 0.8 ft reddish brown.
25-25.5	100	-	-	-	SS	weathered schist, near solid bedrock
30-30	100	-	-	-	SS	No recovery

PROJ: 7777- 202 FILE: FD WELL 106

DOCUMENT CONTROL #:
DOC:DATE:10/--/85 ENTRY DATE:10/15/85
DESC-BOREHOLE LOGS

* SEE EXPLANAT

# SS = Split sp
ST = Shelby Tube

Q.C. RWC

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BOREHOLE LOG RECORD

Project CLEAR CREEK / CENTRAL CITY
By J. Leclair Date 10/09 1985 Page 1 of 1
Chkd By RWC 10/15/85 Date 1985

G 002

Project ID* CC Hole No.* G 0 0 2
Record Type B L R Site No.* Date* 1 0 0 9 8 5 Time* 1 3 1 5

Contractor Gormley Consultants Driller Drilling Engineers Rig CM 255
Bit(s) HSA
Borehole Diameter(s) 6" Total Depth 24.5 ft
Status Completed as well 10 ft screen

Depth (ft)	Blow Counts 6"	6"	6"	6"	Sample Type*	Recovery	Material Description and Comments
0-2	1	1	1	2	SS	2.0 ft	Fine homogeneous, gray mill tailings. Discrete yellow layer 0.5 ft below surface.
5-7	5	5	17	3	SS	1.0	Lt. to dk. brown wasterock. Fragments of a cobble. Some fine gray mill tailing, near surface.
10-12	3	32	82	7	SS	0.7	Fragmented cobble. Greenish gray weathering product
15-17	9	5	6	6	SS	0.8	Large rock fragments, quartz. Matrix - rust brown silty clay. Chunks of unweathered gneiss.
20-22	7	13	22	19	SS	1.5	Thick yellow slime. Slightly cemented gray mill tailing, containing pyrite. Chunk of wood. Alluvial creek material. Fine sand with flecks of pyrite.
22.5-24.5	21	17	12	13	SS	1.8	0.5 ft soupy light brown saturated silty sand. 0.8 ft of dk brown silty sand. 0.5 ft of black organic matter, imbedded with qtz. and potassium feldspar gravel.

* SEE EXPLANATIONS ON BACK

* SS = Split spoon
ST = Shelby Tube

Q.C. RWC

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BOREHOLE LOG RECORD

Project CLEAR CREEK / CENTRAL CITY
By J. Leftair Date 10/09 1985 Page 1 of 1
Chkd By RWC 10/15/85 Date 1985

G 003

Project ID* CC Hole No.* G.0.0.3
Record Type B L R Site No.* Date* 1 0 0 9 8 5 Time* 1 8 0 0

Contractor Gormley Consultants Driller Drilling Engineers Rig CM 255
Bit(s) HW
Borehole Diameter(s) 6" Total Depth 27 ft
Status Completed as well - 10' screen

Depth (ft)	Blow Counts 6" 6" 6" 6"	Sample Type*	Material Description and Comments
0-2		SJ	Fine gray mill tailings, some yellow. 0.7 ft recovery
5-7		SJ	Rust mine tailings - large rock fragments with
		--	quartz grains. Rust wash rock. 1.1 ft.
10-12		SS	recovery. Large grained unweathered gneiss. Wood
			fragments
16-18		SJ	Rock fragments with large qtz crystals. Yellow
			to rust silt matrix.
20-21		SJ	1.4 ft recovery. Clayey plastic pale rust
			colored slime. - gritty. - ft. Cemented rock -
			0.3 ft. Sharp boundary with organic layer
			0.6 ft thick.
25-27			0.9 ft recovery - Brown sand & gravel overlying
			rust rock fragments.

* SEE EXPLANATIONS ON BACK

* SS = Split spoon
ST = Shelby Tube

Q.C. RWC

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BOREHOLE LOG RECORD

Project CLEAR CREEK / CENTRAL CITY
By J. LeClaire Date 10/09 198 Page 1 of 1
Chkd By RWC 10/15/85 Date 1985

G004

Project ID* C C Hole No.* G.0.0.4
Record Type B L R Site No.* Date* 1.0.0.9.8.5 Time* 1.5.3.0

Contractor Gormley Consultants Driller Drilling Engineers Rig CM 255
Bit(s) HSA
Borehole Diameter(s) 6" Total Depth 28 ft
Status Completed as well - 10 ft screen

Depth (ft)	Blow Counts 6" 6" 6" 6"	Sample Type*	Material Description and Comments
0-2	2 1 1 1	SS	Fine mill tailings. Layers - yellow, gray (light & dk) Dry, 1.5 ft recovery
5-7		SS	Homogenous, medium gray sandy mill tailings. Yellow silt layer at 5 ft. 1.8 ft recovery.
10-12		SS	Mill tailings, gray; grading from coarse to fine.
14			Tool drop - probably through adit
17-19		SS	Chunks of wood. Matrix = yellow & gray mill tailings.
20-25		SS	Spoon dropped - went through wood section. Sand + gravel
26-28		SS	Brown to gray to black gritty matrix. Rock fragments - Possibly some organic. 1 ft recovery

* SEE EXPLANATIONS ON BACK

* SS = Split spoon
ST = Shelby Tube

Q.C. RWC

CDM

BOREHOLE LOG RECORD

Project CLEAR CREEK / CENTRAL CITY
By LeClaire Date 10/08 1985 Page 1 of 1
Chkd By RWC 10/15/85 Date 1985

G005

Project ID* CC Hole No.* G.0.0.5
Record Type BLR Site No.* Date* 10.08.85 Time* 15.50

Contractor Gormley Consultants Driller Drilling Engineers Rig CH 255
Bit(s) HSA
Borehole Diameter(s) 6" Total Depth 50 ft
Status Completed as well - 10' screen

Depth (ft)	Blow Counts 6"	6"	6"	6"	Sample Type*	Recovery	Material Description and Comments
0-2	1	1	1	1	SS	1.5 ft	Fine mill tailings - grey, white, yellow in layers
5-7	1	2	1	2	SS	1.7	Same as above, but with 0.5 ft slime layer at top
10-12	2	2	3	2	SS	1.3	Sandy mill tailings. Light to med gray. 0.6 ft slime layer at bottom
15-17	5	8	10	15	SS	1.6	15-15.7 ft dk gray slime
							15.7-15.8 ft yellow weathered waste rock
							15.8-16.1 ft black organic layer
							16.1-16.9 ft dk gray slime layer
							16.4-16.6 ft black organic layer, crumbly
20-22	5	9	100/1"	—	SS	0.6	Large cobble, matrix = dk gray, fine mill tailings
25-27	15	9	5	3	SS		1 Large cobble, with brown soup - probably slough.
30-32	3	4	4	17	SS		Rock, wood with brown slough
35-35.5	26	—	—	—	SS	1.5	Alluvial rock - bottom 0.3 ft. Sand & gravel slough
40-42					—		Sand & gravel
45-46	34	40	—	—	SS		" " rock fragments, light brown.

* SEE EXPLANATIONS ON BACK

* SS = Split spoon
ST = Shelby Tube

Q.C. RWC

CDM

BOREHOLE LOG RECORD

Project CLEAR CREEK / CENTRAL CITY
By J. LeClaire Date 10/02 1985 Page 1 of 1
Chkd By RWC 10/15/85 Date 1985

G006

Project ID* CC Hole No.* G.0.0.6
Record Type B L R Site No.* Date* 1 0 0 2 8 5 Time* 1 1 4 5

Contractor Gormley Consultants Driller Drilling Engineers Rig CM 255
Bit(s) HSA
Borehole Diameter(s) 6" Total Depth 42'
Status Completed as well - 10' screen

Depth (ft)	Blow Counts 6" 6" 6" 6"	Sample Type*	Material Description and Comments
0-2	5 4 3 4	SS	Recovery 1.2 ft. Fine mill tailings. Large amount of pyrite which occurs mostly in discrete layers.
		--	Tailings are light to medium gray. Medium gray
			tailings contain more clay
5-6		ST	
6-8	2 1 1 1	SS	Fine mill tailings. (dk. gray). Very plastic.
15.5-16.5		ST	
4.5-18.5	3 4 4 5	SS	Slimes
20-22	4 12 14 12	SS	Black mill tailings. 1ft recovery. Some gray to
			dk. gray, medium to coarse grained. Slimes
			upper 3 inches
25-27	100		Rock, Sand & gravel, rusty brown
	↑		
	1"		
27			Auger refusal.

* SEE EXPLANATIONS ON BACK

* SS = Split spoon
ST = Shelby Tube

Q.C. RWC

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BOREHOLE LOG RECORD

Project CLEAR CREEK / CENTRAL CITY
By J. LeClaire Date 10/07 1985 Page 1 of 1
Chkd By RWC 10/15/85 Date 1985

G007

Project ID* CC Hole No.* G007
Record Type BLR Site No.* Date* 100785 Time* 1125

Contractor Gormley Consultants Driller Drilling Engineers Rig CH 255
Bit(s) HSA
Borehole Diameter(s) 6" Total Depth 11 ft
Status Completed as well. 5' screen

Depth (ft)	Blow Counts 6"	6"	6"	6"	Sample Type*	Material Description and Comments
0-2	2	2	2	3	SS	Fine gray to yellow mill tailings. Some slime.
						Recovery < 1 ft. Some clay
5-7	1	1	1	1	SS	Recovery = 1.0 ft. Lower 0.7 ft = much higher
						clay & water content (slime). Moderate quantity
						of pyrite. Medium to dark gray.
10-11	1	2			—	Hit Bedrock & water table.

* SEE EXPLANATIONS ON BACK

* SS = Split spoon
ST = Shelby Tube

Q.C. RWC

CDM

BOREHOLE LOG RECORD

Project CLEAR CREEK / CENTRAL CITY
By J. Leclaire Date 10/07 1985 Page 1 of 1
Chkd By RWC 10/15/85 Date 1985

G 008

Project ID* CC Hole No.* G.0.0.8
Record Type B L R Site No.* Date* 1.0.0.7.8.5 Time* 1.3.4.5

Contractor Gormley Consultants Driller Drilling Engineers Rig CM 255
Bit(s) HSA
Borehole Diameter(s) 6" Total Depth 32.2 ft
Status Backfilled + cement cap

Depth (ft)	Blow Counts 6"	6"	6"	6"	Sample Type*	Material Description and Comments
0-2	4	5	3	3	SS	1.5 ft recovery. Fine, medium to dark gray, mill tailings. Layers of varying silt content. One layer of yellowish mill tailings.
5-6.5					ST	
6.5-8.5	½	½	½	½	SS	1.6 ft recovery. Fine grained, saturated slime. Dark gray. Plasticity increasing with depth.
10-12	7	7	7	4	SS	1.6 ft recovery. Might have encountered boulder at 11 ft & carried it down. Dark gray silty mine tailings to dry, coarser tailings to moist, fine tailings to white & dark gray silty dry tailings. Chunk of rock at bottom.
15-15.5					ST	
18.5-18.5	13	7	5	3	SS	0.85 ft recovery. Dark brown sandy silt with angular pebble fragments, overlying probably a boulder. Another dark brown layer, small boulder, dk brown layer.
20-22	4	7	14	10	SS	0.7 ft recovery. Large cobbles with gray slime matrix, large quartz crystals.
25-27	1	1	2	5	SS	1.75 ft recovery - Homogeneous, dark brown silt. Scattered pyrite crystals. Some cobbles.
30-32	17	15	11	9	SS	2.0 ft recovery Medium brown, soupy, gritty sand. Pebbles/gravel → alluvial deposit.
32-32.2					ST	No recovery
22.2						Auger refusal.

* SEE EXPLANATIONS ON BACK

* SS = Split spoon
ST = Shelby Tube

Q.C. RWC

CDM

BOREHOLE LOG RECORD

Project CLEAR CREEK / CENTRAL CITY
By J. LeClaire Date 10/07/1985 Page 1 of 1
Chkd By RWC 10/15/85 Date 1985

G 009

Project ID* CC Hole No.* G.0.0.9
Record Type B L R Site No.* Date* 1:0.0.7 8 5 Time* 1.5 4 0

Contractor Gormley Consultants Driller Drilling Engineers Rig CM 255
Bit(s) HSA
Borehole Diameter(s) 6" Total Depth 46.5 ft.
Status Completed as well 10' screen

Depth (ft)	Blow Counts 6"	6"	6"	6"	Sample Type*	Material Description and Comments
0-2	1	2	½	½	SS	1.3 ft. recovery. Fine mill tailings. Light gray to light green.
5-7	6	6	10	10	SS	1.8 ft recovery. Fine mill tailings. Coarseness increasing with depth. Sandy at bottom. Broken glass at 5ft.
10-12	3	2	16	11	SS	Silty mill tailings. Semi discrete layers, Gray to green to rust. Texture - sandy at top to clayey at contact with waste rock. Recovery 1.3 ft.
15-17	5	7	14	32	SS	0.9 ft recovery - Waste gravel, white slime matrix 3"; Wood fragment 2"; boulder 2"; rust red silt layer - 2", with quartz crystals.
20.5-22.5	14	10	7	7	SS	Waste rock & rubble. Boulder fragments. Rust slime matrix, some Quartz crystals. Recovery 1.1 ft.
26-28	7	9	7	9	SS	0.5 ft = slime, black, water saturated 0.6 ft = slime drier with depth. Very sharp interface with a chunk of waste rock. Silty mill tailings (0.5ft) below. Dark brown to black.
30-31	48	52	—			1 ft recovery. DK to light brown matrix surrounding alluvial gravel.
35-37	25	28	37	32		2' recovery. Saturated brown slime = 1.2 ft. 2" layer of dk weathered rock. 1 foot of rock fragments in brown clayey matrix.
40-41.7	25	37	32	50 ↑ 3"		Pebbles & rock fragments. Matrix of clay brown silt & weathered gneiss
45-46.5						weathered bedrock

* SEE EXPLANATIONS ON BACK

* SS = Split spoon
ST = Shelby Tube

Q.C. RWC

CDM

BOREHOLE LOG RECORD

Project CLEAR CREEK / CENTRAL CITY
By J. Leclaire Date 10/03 198 Page 1 of 1
Chkd By RWC 10/15/85 Date 1985

G010

Project ID* C C Hole No.* G 0 1 0
Record Type B L R Site No.* Date* 1 0 0 3 8 5 Time* 1 6 4 0

Contractor Gormley Consultants Driller Drilling Engineers Rig CH 255
Bit(s) HSA
Borehole Diameter(s) 6" Total Depth 30.2 ft
Status

Depth (ft)	Blow Counts 6" 6" 6" 6"	Sample Type*	Material Description and Comments
0-2	4 4 3 3	SS	Recovery 1.3 ft. Top 0.57 ft - loose, slightly moist, yellow fine tailings. Bottom = gray, loose very fine tailings.
5-7	2 1 1 2	SS	1.46 ft recovery. Slimy, gray, fine tailings Lots of pyrite. Layers of lighter colored, coarser tailings.
8-9.5			Gravel & cobbles
10-12	8 11 7 5	SS	Grades from dk gray at top to red to yellow to brown, loose waste rock. Large crystals of quartz. Poorly graded sand at bottom, low moisture.
15-16.5	16 35 80/-	SS	1.8' recovery - Dark to light brown. Medium to coarse sand & gravel. Darker matrix
20-22	41 46 32 31	SS	Sand & gravel. Slightly moist. White, brown & gray. Subangular to angular fragments.
23			Water
25-27	25 14 8 14	SS	1.7 ft recovery. Upper = saturated silty slime. Green grey, probably slough. Lower = sand, fine gravel Lower 0.3 ft = reddish material - probably weathered bedrock. Large quartz crystals - in place.
30-30.2	100 ↑ for 2"	SS	Wet sand collapsed on sample. Brown.

* SEE EXPLANATIONS ON BACK

* SS = Split spoon
ST = Shelby Tube

Q.C. RWC

CDM

BOREHOLE LOG RECORD

Project CLEAR CREEK / CENTRAL CITY
By R. Chappell Date 10/04 1985 Page 1 of 1
Chkd By J. LeClaire Date 10/15 1985

G011

Project ID* CC Hole No.* G.0.1.1
Record Type B L R Site No.* Date* 1.0.0.4.8.5 Time* 1.0.0.0

Contractor Gormley Consultants Driller Drilling Engineers Rig CH 25S
Bit(s) HSA
Borehole Diameter(s) 6" Total Depth 42'
Status Backfilled, cement cap.

Depth (ft)	Blow Counts 6"	6"	6"	6"	Sample Type*	Material Description and Comments
0-2	4	4	4	4	SS	Homogeneous, fine mill tailings/slime. 2 ft recovery
5-7	1	2	4	4	SS	1'7" recovery. Dark gray, fine mill tailings.
10-11					ST	cobbles.
11-13	8	11	10	14	SS	1'1" recovery. Loose, fine mill tailings. Dark brown to white.
12-19.5					—	Cobbles
15-17	15	14	12	13	SS	1'4" recovery. Mine waste rock, some tailings. Iron-stained sand + gravel
20-22	6	5	4	5	SS	1'10" recovery. Dark brown to black tailings. Some organic matter, waste rock
						Water at 20 ft. Smooth 19.5 ft to 27 ft.
25-27	30	20	17	30	SS	25'5" - 26'3" = Weathered gneiss cobbles
						26'3" - 26'4" = Rusty, medium sand, brown
						26'4" - 27' = DK. brown to black, fine to medium sand with some pebbles.
26-32					—	cobbles
32-40					—	Smooth & soft
30-31.7	17	15	47	30	SS	1.5 ft recovery. Medium to fine sand, brown to dk. brown with pebbles, some gneiss cobbles
35-37	14	16	11	12	SS	Recovery 1.6 ft Highly weathered gneiss. Iron stained.
40-42	33	20	29	35		Recovery 1.8ft. Highly weathered gneiss. Reddish iron coating. Layering. Loose & saturated at top.

* SEE EXPLANATIONS ON BACK

* SS = Split spoon
ST = Shelby Tube

Q.C. JPL

CDM

BOREHOLE LOG RECORD

Project CLEAR CREEK / CENTRAL CITY
By R. Chappell Date 10/04 1985 Page 1 of 1
Chkd By J. LeClaire Date 10/15 1985

G012

Project ID* CC Hole No.* G.0.1.2
Record Type B L R Site No.* Date* 1.0.0.4 8 5 Time* 1.3.3 0

Contractor Gormley Consultants Driller Drilling Engineers Rig CM 255
Bit(s) HSA
Borehole Diameter(s) 6" Total Depth 27'
Status Backfill + cement cap

Depth (ft)	Blow Counts 6" 6" 6" 6"				Sample Type*	Material Description and Comments
0-2	1	2	2	2	SS	Mill tailings & slimes, mostly grey. Some yellow larger grains. 1.8 ft recovery
5-7	3	5	3	4	SS	Mill tailings & slimes, grey sand 2.0 ft recovery
10-11					ST	
11-13	1	2	2	3	SS	Mill tailings & slimes. 1.8 ft recovery
15-17	2	2	5	7	SS	Mill tailings & slimes. Some sand & clay. Organic matter at bottom 1.9 ft recovery
20-22	4	7	11	27	SS	Coarse sand + gravel. Some weathered cobbles and slimes. 1.2 ft recovery.
25-26.5	43	39	100	—	SS	Top 0.9 ft = moist tailings, gray 0.7 ft = well preserved wood Bottom is weathered cobbles, dk brown & iron stained, sandy.

* SEE EXPLANATIONS ON BACK

* SS = Split spoon
ST = Shelby Tube

Q.C. JPL

CDM

BOREHOLE LOG RECORD

Project CLEAR CREEK / CENTRAL CITY
By R. Chappell Date 10/02 1985 Page 1 of 1
Chkd By J. Leclaire Date 10/15 1985

G013

Project ID* CC Hole No.* G013
Record Type BLR Site No.* Date* 100285 Time* 0900

Contractor Gormley Consultants Driller Drilling Engineers Rig CM 255
Bit(s) HSA
Borehole Diameter(s) 6" Total Depth 29 ft
Status Backfilled + cement cap.

Depth (ft)	Blow Counts 6"	6"	6"	6"	Sample Type*	Material Description and Comments
0-2	4	4	7	5	SS	0-1 ft Tailings, fine grained; wood fragments
						1-2 ft Moist, loose sand & gravel; wood fragments
2-5					=	Sand & gravel
5-7	4	10	5	5	SS	Sand, qtz fragment
10-12	15	26	20	18	SS	Hit water, saturated. Hard to retrieve split spoon.
						Fragments of waste rock. Matrix - dark green/grey
15-17	22	22	30	27	SS	water, coarse sand + gravel. Sub-angular to rounded
						Upper 1.3' - grey to dk. grey - Bottom - iron stained
						some cobbles.
20-22	10	12	13	17	SS	Fine to coarse sand with gravel. Few cobbles
						Rusty brown. Cobbles are quartzite & granite
						pegmatite, some gneiss.
25-26	30	70	-	-	SS	Top 7" - coarse sand & gravel, some fine sand
						Bottom is weathered granite gneiss bedrock.
29						Drilled into bedrock, no sample taken.

* SEE EXPLANATIONS ON BACK

* SS = Split spoon
ST = Shelby Tube

Q.C. JPL

CDM

BOREHOLE LOG RECORD

Project CLEAR CREEK No. NT-2 Q.A. No. F6132
By L. Bercaw Date 4/24/87 Page 1 of 1 Rev.
Chkd By ↘ Compiled from field notes of J. Hadley Date Page of

Project ID* Hole No.* NT-2
Record Type B L R Site No.* Date* 11 08 85 Time*
Tnsp Rng Sec 1/4 1/4 1/4
Location N E
SR. EL.* FT M Survey Elevation FT M

Contractor Shelton Drilling Driller D. Cerese Rig #22
Bit(s) 8 in Core N/A Fluid Water
Borehole Diameter(s) 8.5 in Total Depth 31 ft
Geophysical Log: Yes No Date: St 11/8 Fn 11/8 Status Completed As Well

Depth (ft)	Air Lift (Q)	Symbol	Material Description and Comments	
0-20		MINE	50 % fines, 50 % rock frags	FINES
		WASTE	and coarse to vcg. sand.	throughout
	...	ROCK	Coarse fraction consists of	boring:
			fragments of 65 % quartz and	clay
			granite, 35 % biotite schist.	silt
			Wood found in 5-10 ft. sample	fg-mg sand
			Sparse pyrite observed from 15-20 ft.	(qz with
				sparse
20-30			55 % fines, 45 % rock frags and	mica and
			coarse to vcg. sand. Crs. fraction	magnetite)
			fragments consist of 80 % Fe-	
			stained qz, 20 % biotite schist	
			(sparse pyrite).	
30-31			50 % fines, 50 % rock frags	
			and coarse to vcg. sand.	
		↓	Frags of 65 % Fe-stained qz,	
		BED-	35 % biotite schist.	
		ROCK	HIT BEDROCK AT 31 FT.	

* SEE EXPLANATIONS ON BACK

Q.C.

CDM

BOREHOLE LOG RECORD

Project CLEAR CK No. NT-3 Q.A. No. FS132
By L. Bercaw Date 4/24/87 Page 1 of 1 Rev.
Chkd By ↘ Compiled from field notes of J. Hadley / B. Lewis Date Page of

Project ID* [ ] Hole No.* NT-3
Record Type [B L R] Site No.* 202 Date* 1 1 1 8 5 Time* [ ]
Twsp [ ] Rng [ ] Sec [ ] 1/4 [ ] 1/4 [ ] 1/4 [ ]
Location N [ ] E [ ]
SR. EL* [ ] FT M Survey Elevation [ ] FT M

Contractor Shelton Drilling Driller D. Cerese Rig #22
Bit(s) 8 in. Core N/A Fluid Water
Borehole Diameter(s) 8.5 in. Total Depth 33.5
Geophysical Log: Yes ___ No X Date: St 11/11 Fn 11/12 Status Completed As Well

Depth (ft)	Air Lift (Q)	Symbol	Material Description and Comments	
0-5		MINE WASTE ROCK	50 % fines, 50 % rock fragments and coarse to vcg. sand. Frags of 75 % Fe-stained qz, 25 % biotite schist	FINES throughout boring: clay silt
5-15			45 % fines, 55 % rock frags and coarse to vcg. sand. Frags of 80 % Fe-stained qz (sparse pyrite), 20 % biotite schist	fg-mg sand (qz with sparse mica + magnetite)
15-20		ALLUVIUM	60 % fines, 40 % coarse sand. Coarse sand of 90 % Fe-stained qz (sparse pyrite), 10 % mafics (hornblende, biotite). Alluvial sand, angular to subrounded, fair sorting.	
20-25			Same as above except 75 % fines, 25 % coarse sand	
25-33.5			Fine to vcg sand of qz and feldspar with 15 % mafics (biotite, magnetite). No change in drilling.	

* SEE EXPLANATIONS ON BACK

Q.C. ___

CDM

BOREHOLE LOG RECORD

Project CLEAR CREEK / CENTRAL CITY
By R. Chappell Date 10/11 1985 Page 1 of 1
Chkd By J. LeClaire Date 10/15 1985

QH01

Project ID* CC Hole No.* Q.H.0.2
Record Type B L R Site No.* Date* 1.0.1.1.8.5 Time* 1.1.0.0

Contractor Gormley Consultants Driller Drilling Engineers Rig CM 255
Bit(s)
Borehole Diameter(s) Total Depth 22.5 ft
Status

Depth (ft)	Blow Counts 6" 6" 6" 6"	Sample Type*	Recovery	Material Description and Comments
0-2		SS	1.2 ft	Mine waste rock.
5-7		SS	1.0	" " " Lg. rock fragments
10-12		SS	1.0	" " " Weathered silty clay lenses. Lg. rock fragments.
15-17		SS	1.3	Water at 15 ft. Fine to medium sand. Some silt with lg. rock fragments. Mine waste rock? 16' - 16.2' gray mill tailings.
20-22		SS	0.8	Fine grained mica flakes in clayey matrix mill tailings? large rock fragment
22.5				Bed rock

* SEE EXPLANATIONS ON BACK

* SS = Split spoon
ST = Shelby Tube

Q.C. JPL

CDM

BOREHOLE LOG RECORD

Project CLEAR CREEK / CENTRAL CITY
By J. LeClaire Date 10/10 1985 Page 1 of 1
Chkd By RWC 10/15/85 Date 1985

QH02

Project ID* CC Hole No.* QH01
Record Type BLR Site No.* Date* 10 10 85 Time* 1145

Contractor Gormley Consultants Driller Drilling Engineers Rig CM 255
Bit(s) HSA
Borehole Diameter(s) 6" Total Depth 37ft
Status Completed well - 10ft screen

Depth (ft)	Blow Counts 6" 6" 6" 6"	Sample Type*	Material Description and Comments
	..	--	. . . . .
25-27		SS	Layers of sandy yellow waste rock. Lower portion is a clayey silt brown
30-30.5		SS	0.5 ft recovery. Hard clayey silt. Mica & pyrite grains visible - orange / black / brown.

* SEE EXPLANATIONS ON BACK

* SS = Split spoon
ST = Shelby Tube

Q.C. RWC

CDM

BOREHOLE LOG RECORD

Project CLEAR CREEK No. BF-1 Q.A. No. F6132
By L. Bercaw Date 4/24/87 Page 1 of 2 Rev.
Chkd By ↘ Compiled from field notes of B. Lewis Date Page of

Project ID* Hole No.* BF-1
Record Type BLR Site No.* 202 Date* 1.1.1885 Time*
Twsp Rng Sec 1/4 1/4 1/4
Location N E
SR. EL.* FT M Survey Elevation FT M

Contractor Shelton Drilling Driller D. Cerese Rig #22
Bit(s) 8 in. Core N/A Fluid Water
Borehole Diameter(s) 8.5 in. Total Depth 40 ft.
Geophysical Log: Yes No X Date: St 11/18 Fn 11/18 Status Completed As Well

Depth (ft)	Air Lift (Q)	Symbol	Material Description and Comments	
0-5			25 % fines, 35 % rock fragments,	FINES
			40 % angular/subangular coarse	throughout
	...	...	to vcg. sand. Rock fragments	boring:
			predominantly gneiss and graniteid.	clay
			Coarse sand of 65 % quartz	silt
			(common Fe staining), 35 % mafics.	fg-mg sand
				(mostly qz,
5-10			35 % fines, 30 % rock fragments,	sparse
			35 % angular coarse to vcg. sand.	mica and
			Rock frags predominantly mafic-rich	magnetite,
			gneiss. Crs sand of 80 % qz	local sparse
			(common Fe staining), 20 % mafics.	sulfides
10-15			50 % fines, 20 % rock frags, 30 %	
			coarse to vcg. sand. Rock frags	
			of 50 % mafic-rich gneiss and	
			biotite schist, 50 % graniteid.	
			Coarse sand of 90 % qz (common	
			Fe stain), 10 % feldspar.	
15-20			50 % fines, 15 % rock frags, 35 %	
			angular/subang coarse to vcg. sand.	
			Rock frags predominantly gneiss	
			(50 % mafics, 50 % felsic).	
			Coarse sand of 80 % qz (common	
			Fe stain), 10 % feld, 8 % mafics,	
			2 % muscovite.	

* SEE EXPLANATIONS ON BACK

Q.C.

CDM

BOREHOLE LOG RECORD (cont)

Project CLEAR CREEK No. BF-1
By L. Bercaw Date 4/24/87 Page 2 of 2
Chkd By _____ Date _____

Q.A. No. F8132
Rev. _____
Page _____ of _____

Depth (ft)	Air Lift (Q)	Symbol	Material Description and Comments
20-25			50 % fines, 20 % rock frags, 30 % ang/subang coarse to vcg. sand. Rock frags predominantly gneiss (40 % mafic, 60 % felsic). Coarse sand of 80 % qz (common Fe stain), 10 % feld, 8 % mafics, 2 % muscovite.
25-35			50 % fines, 20 % rock frags, 30 % ang/subang coarse to vcg. sand. Rock frags predominantly gneiss (50 % mafic, 50 % felsic). Coarse sand of 80 % qz (common Fe stain), 10 % mafics, 5 % feld.
35-40			60 % fines, 16 % rock frags, 24 % ang/subang coarse to vcg. sand. Rock frags of gneiss. Coarse sand of 70 % qz (common Fe stain), 20 % mafics, 5 % feld, 5 % sulfides.

* SEE EXPLANATIONS ON BACK

Q.C. _____

CDM

BOREHOLE LOG RECORD

Project CLEAR CREEK No. AT-1 Q.A. No. F6132
By L. Bercaw Date 4/24/87 Page 1 of 1 Rev.
Chkd By ↓ compiled from field notes of D. Chamberlin / B. Lewis Date Page of

Project ID* Hole No.* A.T.-1
Record Type B L R Site No.* 202 Date* 11/16/85 Time*
Twsp Rng Sec 1/4 1/4 1/4
Location N E
SR. EL.* FT M Survey Elevation FT M

Contractor Shelton Drilling Driller D. Cerese Rig #22
Bit(s) 8 in Core N/A Fluid Water
Borehole Diameter(s) 8.5 in Total Depth 20 ft
Geophysical Log: Yes No X Date: St 11/16 Fn 11/17 Status Completed As Well

Depth (ft)	Air Lift (Q)	Symbol	Material Description and Comments
0-7		mill tailings	TAILINGS. 80% is finer than medium-grained sand. Mostly fine sand and silt. Poorly sorted, angular to subang, yellow-brown. Mostly quartz (rose and milky).
7-10		alluvium	ALLUVIUM. Fine to medium sand with highly plastic clay layers (best embedded gravel). Medium to light brown. Coarse fragments (rounded to subround) of quartz with minor feldspar and ≤ 20% mafics.
10-15			Same as 7-10 ft, but with little silt or clay.
15-20		bed-rock	POSSIBLY BEDROCK. 40% fines, 60% rock frags and coarse to vcg sand. 50-60% of coarse material is fragments from biotite gneiss. Fines may represent contamination from upper part of hole.

* SEE EXPLANATIONS ON BACK

Q.C.

CDM

BOREHOLE LOG RECORD

Project CLEAR CREEK No. AT-3 Q.A. No. F6132
By L. Bercaw Date 4/24/87 Page 1 of 1 Rev.
Chkd By ↓Compiled from field notes of B. Lewis/J. Hadley Date Page of

Project ID* Hole No.* A.T.-3
Record Type B L R Site No.* 2 0 2 Date* 1 1 1 4 8 5 Time*
Twsp Rng Sec 1/4 1/4 1/4
Location N E
SR. EL.* FT M Survey Elevation FT M

Contractor Shelton Drilling Driller D. Cerese Rig #22
Bit(s) 8 in Core N/A Fluid Water
Borehole Diameter(s) 8.5 Total Depth 25.5
Geophysical Log: Yes No X Date: St 11/14 Fn 11/15 Status Completed As Well

Depth (ft)	Air Lift (Q)	Symbol	Material Description and Comments	
0-10		mine waste rock	45 % fines, 55 % coarse to vcg. sand and rock fragments. Rock frags. of 80 % Fe-stained qz, 20 % biotite schist.	FINES throughout boring: clay silt
10-15			50 % fines, 15 % rock frags, 35 % angular coarse to vcg. quartz sand (common Fe stain). Rock frags of 50 % biotite schist, 50 % felsic-rich gneiss.	fg-mg sand (quartz with sparse mica and magnetite)
15-20			55 % fines, 15 % rock frags, 30 % angular coarse to vcg. qz sand (common Fe stain). Rock frags predominantly biotite schist.	
20-25.5		bedrk	25 % fines, 75 % angular coarse to vcg. sand and rock frags. Coarse material consists of 40 % milky qz, 30 % Fe-stained qz, 30 % biotite schist.	

* SEE EXPLANATIONS ON BACK

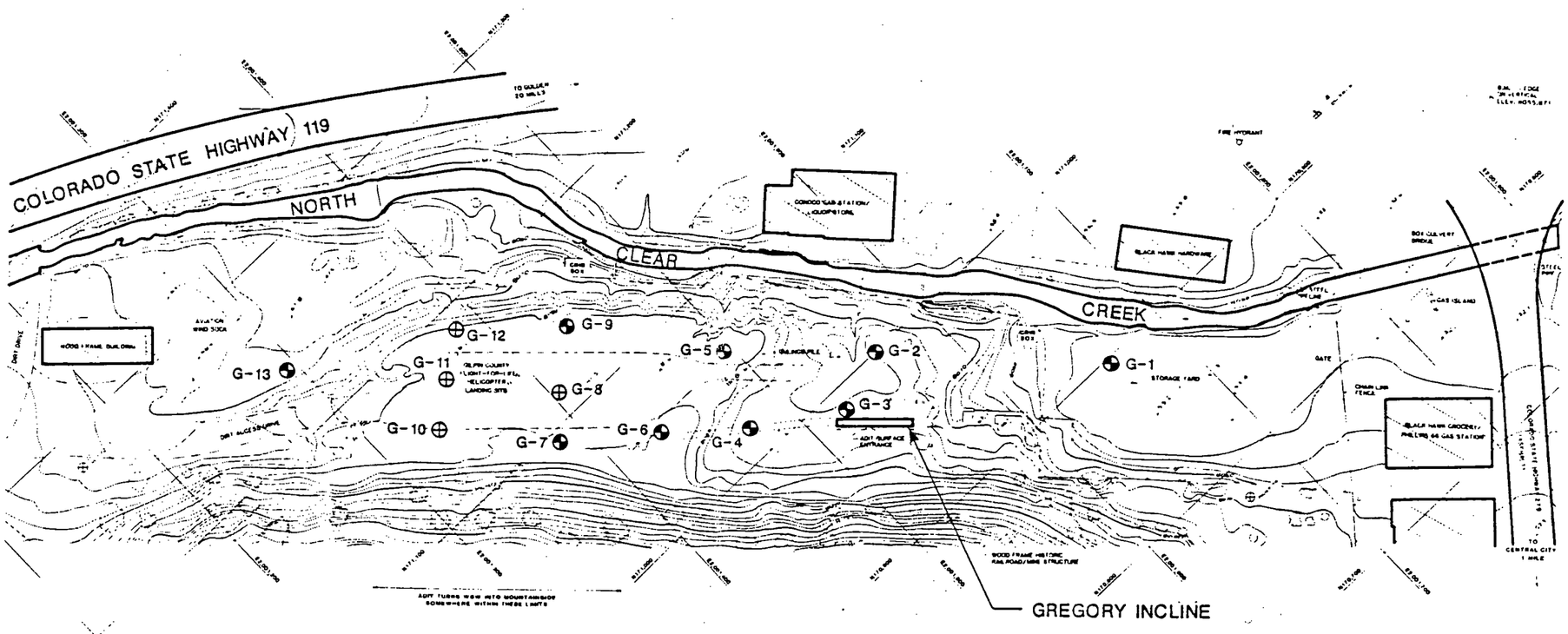
Q.C.

GEOTECHNICAL BORING LOGS

(Gormley Consultants)

G001 - G013
NT01
QH1 - QH2
Argo #1 - Argo #3

Note: Argo #1 and Argo #2 were not completed as wells and are not the same as CDM's wells AT01 and AT02. Argo #3 was completed as a well and was re-identified as CDM well AT02.



LEGEND

G-2 ◓ MONITOR WELL LOCATION AND NUMBER

G-8 ⊕ BORE HOLE LOCATION AND NUMBER

SCALE

0 20 40 60 80 FEET

CLEAR CREEK/CENTRAL CITY RI/FS

GREGORY INCLINE AND TAILINGS

CAMP DRESSER & McKEE INC.

CDM

environmental engineers, scientists, planners, & management consultants

SHEET NO. 4-1

DATE BEGAN: 10-1-85
DATE FINISHED: 10-1-85
GROUND SURFACE EL.: _____

BORING NO. Gregory 1

N _____ E _____

FIELD ENGINEER: Sennett
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	0.7			Sand, fine to coarse, brn, loose, moist.			
	1.2			Clayey fine sand, gray green, med. dense, moist.			
	2.0			Sand & gravel, light brn, med. dense to dense, moist. Full recovery.			
				Sand & gravel, lt. brn, med dense. Encountered water @ 5.0'.			
	5.0			Sand, fine to coarse, brn, loose wet some fine gravel in lower end of sampler. Very little sample recovery.			
	7.0			Sand, fine to coarse, brn, loose wet, auger cuttings too wet for good recovery.			
	10.0			Drillhead used to apply down pressure (amount unknown). No sample recovery.			
	11.0			Organic material and fine sand, brn to blk, loose to med dense, very moist, some gravel in sample, full recovery.			
	13.0			Sand, fine & course, brn, loose to med dense.			
	15.0			Sand, fine to coarse, some med gravel, very dense, very moist (Large gravel in end of drive shoe). Recovery 0.5'.			
	16.0			Coarse gravel & cobbles, slow augering.			
	17.0			Sand, brn, loose easy to auger.			
	20.0						

DATE BEGAN: 10-1-85
DATE FINISHED: 10-1-85
GROUND SURFACE EL.: _____

BORING NO. Gregory 1

N _____ E _____

FIELD ENGINEER: Sennett
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	20.0			Clayey silty fine to coarse sand, brn to blk, med dense to loose, very moist, some small gravel, full recovery.			
	22.0			Same as 20 to 22, augered easy.			
	24.0			Weathered schist bedrock moderately hard augering.			
	25.0			Weathered schist bedrock, full recovery with difficulty.			
	25.5			Firm drilling with easy drilling @ 28', all in weathered schist.			
T.D.	30.0			Bounced, no sample recovered.			

DATE BEGAN: 10/9/85
DATE FINISHED: 10/9/85
GROUND SURFACE EL.: _____

BORING NO. Gregory 2

N _____ E _____

FIELD ENGINEER: J.T. Gormely
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	U.S.C.S.	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	2.0			No record/recovery.			
	3.5						
	5.0			Veneer at grey tailings, reddish moist sand (6"), coarse sand w/ pebble size red rock frags (6").			
	6.0						
	7.0						
	8.0			No record/recovery.			
	10.0						
	12.0			Very moist silty sand, broken rock, coarse sand, cobble at bottom.			
	13.5			No record/recovery.			
	14.0						
	16.0			Moist grey sand w/broken rock, mixed coarse red sand, waste rock.			
	17.0						
	18.0			No record/recovery.			
	18.5						

DATE BEGAN: 10/9/85
DATE FINISHED: 10/9/85
GROUND SURFACE EL.: _____

BORING NO. Gregory 2

N _____ E _____

FIELD ENGINEER: J.T. Gormley
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	18.5						
	20.0			Tan mill tailings, clayey; very wet mill tailings & waste rock mixture; quartz rubble (4"); timber shavings; 2" of coarse, moist, stream sand.			
	22.0						
	22.5			No record/recovery.			
				Coarse, very wet brown stream sand; pebbles; coarse sand w/broken rock, black shaley (schistose?) mat'l.			
T.D.	24.5			Bedrock?			

DATE BEGAN: 10/9/85
DATE FINISHED: 10/9/85
GROUND SURFACE EL.: _____

BORING NO. Gregory 3

N _____ E _____

FIELD ENGINEER: J.T. Gormley
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	2.0			Moist grey green sandy tailings.			
	5.0			No record/recovery.			
	7.0			Grey sandy tailings (2"); red sandy tailings w/pebbles.			
	10.0			No record/recovery.			
	12.0			Black (schistose?) pebbles; coarse red sand w/quartz pebbles.			
	15.0			No record/recovery.			
	15.5			Recovered 0.5' in Shelby Tube. Water?			
	16.0						
	18.0			Pebble size black broken rock; quartz rock fragment; very wet, lt. brn silty sand.			
	20.0			No record/recovery.			

DATE BEGAN: 10/9/85
DATE FINISHED: 10/9/85
GROUND SURFACE EL.: _____

BORING NO. Gregory 3

N _____ E _____

FIELD ENGINEER: J.T. Gormley
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	U.S.C.S.	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	20.0			V. moist lt. brn. clayey sand (6"); moist clayey brn. sand (3"); quartz pebbles & red sand (2"); black peat (6"); river gravels.			
	22.0			No record/recovery.			
	25.0			Gravelly silts & sands, alluvial, dk brn to blk, (9"); silty sands w/pebbles, red sand (3").			
T.D.	27.0						

DATE BEGAN: 10/9/85
DATE FINISHED: 10/9/85
GROUND SURFACE EL.: _____

BORING NO. Gregory 4

N _____ E _____

FIELD ENGINEER: J.T. Gormley
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	2.0			Minor 1" pebbles; sli moist, sandy grey tailings.			
	3.5			No record/recovery.			
	7.0			Silty fine gr. sand; greenish tailings; uniform, dk grey sandy tailings.			
	8.5			No record/recovery.			
	12.0			Very fine gr. grey sand, uniform, moist.			
	13.0			Slimes.			
	15.0			2' tool drop-void..			
	17.0			No record/recovery.			
	19.0			Mine timber; black pebbles; clayey tailings.			

DATE BEGAN: 10/9/85
DATE FINISHED: 10/9/85
GROUND SURFACE EL.: _____

BORING NO. Gregory 4

N _____ E _____

FIELD ENGINEER: J.T. Gormley
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	19.0						
	20.0			No record/recovery.			
				Wood splinters; gravel; sand; sampler filled with water.			
	25.0						
	26.0			No record/recovery.			
	28.0			Coarse red sand (4"); grey sandy tailings, black rock mixed w/ coarse red sand.			
				Bedrock?			
T.D.	29.5						

DATE BEGAN: 10-8-85
DATE FINISHED: 10-8-85
GROUND SURFACE EL.: _____

BORING NO. Gregory 5

N _____ E _____

FIELD ENGINEER: Sennett
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
				Tails, fine sand, gray hellow, loose, sli moist.			
	2.0			Tails.			
	5.0			Slimes, Clay, gray, soft, moist.			
	5.5			Tails, sand, gray, loose, moist.			
	7.0			Tails.			
	10.0			Tails, sand, gray, loose, moist.			
	11.5			Slime, clay, gray soft, wet.			
	12.0			Slimes.			
	15.0			Slimes, clay, gray, stiff , wet.			
	15.7			Organic, sandy, blk, dense, moist.			
	17.0			No record,/recovery.			
	20.0						

DATE BEGAN: 10-8-85
DATE FINISHED: _____
GROUND SURFACE EL.: _____

BORING NO. Gregory 5

N _____ E _____

FIELD ENGINEER: Sennett
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	20.0			Sand & gravel, tan to brn, dense,			
	21.5			Hit cobbles.			
	22.0			Stopped drilling. Moved over 5' and started drilling again.			
				No record/recovery.			
	25.0			Fine sand & broken gravel, brn, loose, wet.			
	27.0			Some gravel & cobbles, then easy drilling, probably wet sand & gravel.			
	30.0			No recovery. (Shelby Tube)			
	31.0			One piece of rock, one piece of wood, sandy material, prebably in auger.			
	33.0			Sand & gravel layered w / some hard drilling.			
	35.0			Recovered 1.5' of sloppy, wet sand & fine gravel, brn, very dense, moist.			
	35.5			Sand & fine gravel, brn, dense, very moist.			
	40.0						

DATE BEGAN: 10-8-85
DATE FINISHED: 10-8-85
GROUND SURFACE EL.: _____

BORING NO. Gregory 5

N _____ E _____

FIELD ENGINEER: Sennett
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	40.0			Sand & fine gravel, brn, dense, very moist.			
	42.0			No record/recovery.			
	45.0			About 1' of sand & fine gravel, alluvial, coarse sand & small gravel, brn, very dense, very moist.			
	46.0			Sand sucked back up in auger, drilled like sand & fine gravel.			
T.D.	50.0						

DATE BEGAN: 10-2-85
DATE FINISHED: 10-3-85
GROUND SURFACE EL.: _____

BORING NO. Gregory 6

N _____ E _____

FIELD ENGINEER: RBS
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	2.0			Mill tailings very fine, gray, loose, moist, recovered 1.2', some small rock fragments on top of sample.			
				No record/recovery.			
	5.0			Mill tailings, 1' recovered, sandy.			
	6.0			Mill tailings, 2' recovered, clayey.			
	8.0			Mill tailings.			
	10.0			Mill tailings.			
	12.0			No record/recovery.			
	15.0			Mill tailings, 1.5 recovered, sandy clayey.			
	16.5			Mill tailings, 2.0 recovered, sandy clayey. Note: In tailings the sands are slightly moist and the slimes (clays) are very moist.			
	18.5			No record/recovery.			
	20.0						

DATE BEGAN: 10-2-85
DATE FINISHED: 10-3-85
GROUND SURFACE EL.: _____

BORING NO. Gregory 6

N _____ E _____

FIELD ENGINEER: RBS
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	20.0			Recovery 1.0' tailings sandy, blk, loose to med dense, moist, bottom of shoe had broken brn rock.			
	22.0			Sand & brocken rock rough drilling.			
	25.0			Weathered bedrock?? Driller noted the change, thought it to be rock.			
				Recovered about 0.3' material, sand & brocked rock, brn, wet, drive was very hard.			
	27.0			Hit hard spot (boulder?) @ 27'. Stopped trying to auger, change rotary.			
	29.5			Lost circulation @ 27.5' regained circulation @ 29.5'. As drilling proceeded it looked like we were making water, no way to measure it.			
				No record/recovery.			
	37.0			Soft layer 37' to 38'.			
	38.0						

DATE BEGAN: 10-2-85
DATE FINISHED: 10-3-85
GROUND SURFACE EL.:

BORING NO. Gregory 6

N E

FIELD ENGINEER: RBS
CHECKED BY:

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	U.S.C.S.	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	38.0			No record/recovery.			
	41.0			In bedrock, no samples recovered. Stopped hole @ 41.9'.			
T.D.	41.9						

DATE BEGAN: 10-7-85
DATE FINISHED: 10-7-85
GROUND SURFACE EL.: _____

BORING NO. Gregory 7

N _____ E _____

FIELD ENGINEER: Sennett
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
				Mill tails, fine sand, yellow gray, loose, sli moist, 0.9' rec., no Unc.			
	2.0						
				No record/recovery.			
	5.0			Tails & slimes, fine sand & clay, gray, very loose, moist, 1.0' rec., 0.6 T/□'.			
	7.0			Sand, gravel & cobbles.			
	10.0			Could not penetrate with split spoon, no sample recovered.			
T.D.	11.0			Drilled in broken rock, Could not get any deeper than 11.0'. Rock outcrop about 12' west.			
				Bedrock.			

DATE BEGAN: 10-7-85
DATE FINISHED: 10-7-85
GROUND SURFACE EL.: _____

BORING NO. Gregory 8

N _____ E _____

FIELD ENGINEER: Sennett
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	U.S.C.S.	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
				Mill tails & slimes, sandy, clayey gray, loose, moist, 1.7' rec., Unc. 1.0 T/□'.			
	2.0			Tails & slimes, loose & soft.			
	5.0			Tails & slimes , sandy, clayey, very loose and soft, wet, gray, 0.7' rec., no Unc.			
	6.5			Slimes (some tails @ bottom 0.4') gray, very loose & soft, wet, 1.6' rec., no Unc.			
	8.5			Tails & slimes, soft.			
	10.0			Tails, sandy, gray, med dense, moist.			
	11.4			Broken rock gneiss, light gray to white, med dense, sli moist, total rec. 1.6', no Unc. (Harder drilling at about 9'.)			
	12.0			Cobbles & boulders.			
	14.0			Sands & fine gravel.			
	15.0			Sand & gravel, dk brn, dense, moist, rec. 0.5', Unc. .75T/□', stopped on rock.			
	15.5			Sand & gravel, brn, med dense, sli moist, rec. 0.9, no Unc.			
	17.5			(16.5-20.0) Sand-gravel, brn, med dense, moist, med hard drilling.			
	20.0						

DATE BEGAN: 10-7-85
DATE FINISHED: 10-7-85
GROUND SURFACE EL.:

BORING NO. Gregory 8

N E

FIELD ENGINEER: Sennett
CHECKED BY:

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	20.0			Broken rock, sand, gravel, gray brn, med dense, wet, rec. 0.7', no Unc.			
	22.0			Easy drilling @ 22.5', sand & fine gravel.			
	25.0			Sand & fine gravel, brn, loose, very moist, rec. 1.75, no Unc.			
	27.0			Hard gravel cobble layer 27.5 to 28.5.			
	30.0			Sand gravel, brn, med dense, very moist (too wet), rec. 2.0', 1.5T/ft Unc.			
	32.0			Could not push shelby more than 0.2', no recovery.			
T.D.	32.2			Could not auger beyond. The auger ran fairly smooth, sounds like bed rock, but may be large boulder.			

DATE BEGAN: 10-7-85
DATE FINISHED: 10-7-85
GROUND SURFACE EL.: _____

BORING NO. Gregory 9

N _____ E _____

FIELD ENGINEER: Sennett
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
				Tails, fine sand, gray, loose, sli moist, rec. 1.3', 1.5 T/□ Unc.			
	2.0			Coarse Tails			
	5.0			Tails, fine to coarse sand, gray, loose, sli moist, rec. 1.8', 3.5 T/□ Unc., some broken glass in sample.			
	7.0			No record/recovery.			
	10.0			Bottom 0.4 broken rock, lt brn, med dense, sli moist. Top 1.3 - tails & slimes, sand, clay, loose & soft, moist, total rec. 1.7, no Unc. Gravel started about 11'.			
	12.0			No record/recovery.			
	15.0			Sand & gravel, wood, brn, gray white, med dense, wet.			
	17.0			Sand & gravel, broken rock.			
	20.0						

DATE BEGAN: 10-7-85
DATE FINISHED: 10-7-85
GROUND SURFACE EL.: _____

BORING NO. Gregory 9
N _____ E _____

FIELD ENGINEER: Sennett
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	20.0						
	20.4			Broken rock & sand & gravel, brn, moist.			
				Sand & gravel, lt gray to brn, loose to med dense, sli moist.			
	22.4			Sand & gravel, grading into loose dark gray sand, easy drilling.			
	25.0			Top sand & gravel, brn, med dense, sli moist, bottom sand, dk gray, loose, sli moist.			
	26.0			Fine to coarse sand (top 1' is blk lower 0.8' is dk brn), med dense (top is wet, bottom is moist).			
	28.0						
	28.5			Gravels & cobbles.			
	30.0			Sand & gravel (broken rock), brn, very dense, wet.			
	31.0			Sand & gravel & cabbles, hard to drill.			
	35.0			Top 0.5' coarse sand, dk brn, dense wet. Mid 0.5' weathered schist, dk gray, dense, wet. Bottom 1.0' sand & gravel, lt brn, very dense, moist (alluvial).			
	37.0			Smooth drilling.			
	40.0						

DATE BEGAN: 10-7-85
DATE FINISHED: 10-7-85
GROUND SURFACE EL.: _____

BORING NO. Gregory 9

N _____ E _____

FIELD ENGINEER: Sennett
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	40.0			Coarse sand with gravel at lower end of sample, brn, very dense, wet.			
	41.7			No record/recovery.			
	45.0			Coarse sand & gravel (on top), dk gray, brn, dense, wet. Gneiss bedrock at bottom, weathered but fairly hard.			
T.D.	46.5			Bedrock.			

DATE BEGAN: 10-3-85
DATE FINISHED: 10-3-85
GROUND SURFACE EL.:

BORING NO. Gregory 10

N E

FIELD ENGINEER: Sennett
CHECKED BY:

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
				Tailings sandy, clayey, yellow to gray, loose, sli moist, 1.3' recovered, unc 1.6 T/□'			
	2.0			Tailings & slimes, sandy, clayey, gray, loose.			
	5.0			Tailings sandy, gray, loose, sli moist, 1.4 Rec. 0.5 T/□'			
	7.0			Tailings.			
	8.0			Gravel & cobbles.			
	9.5			No record/recovery .			
	10.0			Dump rock, sand & gravel, loose, lt brn to brn, sli moist, 1.4 rec., no Unc, very top of sample tailings 0.1'.			
	12.0			Dump rock.			
	15.0			Dump rock, sand & fine gravel, lt brn to brn, dense, dry to sli moist, 1.8' rec, no Unc.			
	16.5			Dump rock.			
	20.0						

DATE BEGAN: 10-3-85
DATE FINISHED: 10-3-85
GROUND SURFACE EL.: _____

BORING NO. Gregory 10

N _____ E _____

FIELD ENGINEER: Sennett
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	20.0			Sand & fine gravel, brn, dense, sli moist, 1.8 rec, no Unc.			
	22.0						
				No record/recovery.			
	23.0			Hit water.			
				No record/recovery.			
	25.0			25.0 to 26.0 sand, gray-blk, med dense to dense, wet.			
	26.0			26.0 to 27.0 sand & fine gravel, blk to brn, moist, med dense, rec. 1.8', no Unc.			
	27.0						
				No record/recovery.			
	30.0			Some gray-blk, wet sand on top of sample. Sample is sand, gravel, brn, very moist, very dense, rec. 0.2, no Unc.			
	30.2						
T.D.	32.0			Bedrock, no progress with auger, did not try to sample.			

DATE BEGAN: 10-4-85
DATE FINISHED: 10-4-85
GROUND SURFACE EL.:

BORING NO. ~~Gregory~~ 11

N E

FIELD ENGINEER: Sennett
CHECKED BY:

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
				Tails & slimes, sandy, clayey, gray, loose, sli moist, 2' rec., no Unc.			
	2.0			Tails & slimes.			
	5.0			Tails, fine sand, dk gray, loose, sli moist, 1.6 rec., no Unc.			
	7.0			Tails & slimes.			
	10.0			Tails on top, fine sand & clay, gray, moist. Waste rock on bottom sand, gravel, brown.			
	11.0			Mine rock, fine sand, dk brn, blk, loose to med dense, moist, 1.1 rec., no Unc.			
	13.0			Mine rock.			
	15.0			Mine rock with tails on top, sands & gravel, gray-brn, med dense, moist, 1.3 rec., no Unc.			
	17.0			Waste rock, water @ 20'.			
	20.0						

DATE BEGAN: 10-4-85
DATE FINISHED: 10-4-85
GROUND SURFACE EL.: _____

BORING NO. Gregory 11

N _____ E _____

FIELD ENGINEER: Sennett
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	20.0			Water. Waste rock, course sand, brn to blk, some organic material, moist, 1.8' rec., no Unc.			
	22.0			Waste rock?			
	25.0			Gneiss gravel, w/sand, moist, brn.			
	26.0			Course sand, fine gravel, red brn, blk, moist, 1.6' rec., no Unc.			
	27.0			Sand, gravel, cobbles.			
	30.0			Sand, brn to dk brn, dense, med to course grained, fine gravel, rec. 1.5', no Unc.			
	31.7			Sand, fine gravel.			
	35.0			Coarse sand, brn, iron stain, loose to med dense, moist, 1.6' rec., no Unc.			
	37.0			Sand, fine gravel.			
	to 40.0						

DATE BEGAN: 10-4-85
DATE FINISHED: 10-4-85
GROUND SURFACE EL.: _____

BORING NO. Gregory 11

N _____ E _____

FIELD ENGINEER: Sennett
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	40.0			Top 0.5 sand, gray blk, loose, wet,			
	40.5			Weathered gneissic bedrock, 1.8 rec., no Unc.			
	42.0			Weathered bedrock, slow to drill.			
T.D.	45.0			Hammer bounced, no recovery.			

DATE BEGAN: 10-4-85
DATE FINISHED: 10-4-85
GROUND SURFACE EL.:

BORING NO. Gregory 12

N E

FIELD ENGINEER: Sennett
CHECKED BY:

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
				Tails, sandy, yellow & gray, loose, sli moist, 1.8 rec., no Unc.			
	2.0			No record/recovery.			
	5.0			Tails, sand, gray, loose, sli moist, 2.0 rec., no Unc, broken glass in sample.			
	7.0			Tailings.			
	10.0			Tails, fine sand, gray, loose, sli moist, 1.0 rec., too loose to make Unc. test.			
	11.0			Tails, sand, dk gray to gray, loose, sli moist, 1.8 rec., no Unc.			
	13.0			Tailings.			
	15.0			Tails & slimes, sand & clay (w/2" piece of wood in bottom), gray, loose, moist, 1.9 rec., no Unc.			
	17.0			Sandy gravel.			
	20.0						

DATE BEGAN: 10-4-85
DATE FINISHED: 10-4-85
GROUND SURFACE EL.: _____

BORING NO. Gregory 12

N _____ E _____

FIELD ENGINEER: Sennett
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	20.0			Coarse sand with gravel, lt gray to blk, loose, sli moist, 1.2 rec., no Unc. End of drive in weathered rock.			
	22.0			Hit boulder @ 23.5, pulled out and moved hole 5' south.			
	23.5			Difficult drilling 17' to 25' cobbles?			
	25.0			Top of sample 0.5' organic mud, middle of sample 0.7' wood, bottom of sample 0.4 broken rock & sand, 1.6 rec., no Unc.			
	26.5			(Moved 5' south). Very difficult drilling in sand gravel cobbles & boulders.			
T.D.	28.0			Stop.			

DATE BEGAN: 10-2-85
DATE FINISHED: 10-2-85
GROUND SURFACE EL.: _____

BORING NO. Gregory 13

N _____ E _____

FIELD ENGINEER: RBS
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
				Tailings fine grained, pieces of wood.			
	1.0			Sand & Gravel, brn, loose, pieces of wood, moist.			
	2.0			No sample recovered.			
				Sand & small broken rock, loose to med dense, brn, moist, hard drilling 2.5' to 4.0' (broken rock).			
	5.0			5 blows to seat spoon, 24 total but considerable bouncing on second 6" drive. Recovered small sample of sand & broken rock (mine waste). Hit water between 6' to 7' of depth.			
	7.0			Very soft material, clayey silty fine sand, organic, blk, loose, very moist, wood fragments.			
	9.0			Hard to auger, very rocky, no cuttings to surface.			
	10.0			Recovered about 1.5' of sand & fine gravel, gray-blk, dense, wet.			
	12.0			Sand gravel with some cobbles, no cuttings recovered.			
	15.0			Sand & fine gravel, brn, dense, very moist, 2' sample recovered. Bottom 0.5' of sample 16.5 to 17.0 sand gravel with heavy iron stain.			
	17.0			Gravel & cobbles, hard drilling.			
	17.5			Sand & gravel, easy drilling.			
	20.0						

DATE BEGAN: 10-2-85
DATE FINISHED: 10-2-85
GROUND SURFACE EL.:

BORING NO. Gregory 13

N E

FIELD ENGINEER: RBS
CHECKED BY:

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	20.0			Sand & fine gravel, brn, med dense to dense, very moist, about 1.2' recovered.			
	22.0			Sand gravel with some cobbles, easy drilling.			
	25.0			Top 0.5 sand gravel, brn, med dense, wet bottom 0.5' weathered schist bedrock, full recovery.			
	26.0			Hard drilling began @ 28.0. stop hole @ 29.0'.			
T.D.	29.0						

DATE BEGAN: 10-14-85
DATE FINISHED: 10-14-85
GROUND SURFACE EL.:

BORING NO. NT1

N E

FIELD ENGINEER: Sennett
CHECKED BY:

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
				Sand & gravel, brn wh blk, dense, moist.			
	2.0			Sand & gravel.			
	5.0			0.2' recovered, sand & gravel.			
	6.0			Sand & gravel, brn to dk brn, med dense, sli moist.			
	8.0			Sand & coarse gravel.			
	10.0			Drove through a weathered piece of rock, then into a schist rock. Sand & gravel, brn lt gray, blk, med dense to dense, sli moist.			
	12.0			Easy drilling.			
	14.5			Rough drilling.			
	15.0			Sand & gravel, brn, dense, wet.			
	17.0			Sand & gravel.			
	20.0						

DATE BEGAN: 10-14-85
DATE FINISHED: 10-14-85
GROUND SURFACE EL.: _____

BORING NO. NT1

N _____ E _____

FIELD ENGINEER: Sennett
CHECKED BY: _____

ELEV (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	20.0			Top .5' sand & gravel, brn med dense, wet. Bottom 1' schist bed rock, brn, very dense, med moist.			
	21.6			Drilled smooth w/hard layer @ 24.0			
	25.0			No sample recovered, drive was hard and sample, if any, broke up.			
T.D.	25.4						

DATE BEGAN: 10/11/85
DATE FINISHED: 10/11/85
GROUND SURFACE EL.: _____

BORING NO. QH-#1

N _____ E _____

FIELD ENGINEER: J.T. Gormley
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	U S C S	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	2.0			Reddish moist sand w/pebbly size quartz; some silt.			
	5.0			No record/recovery.			
	7.0			Red moist sand; black country rock; quartz pebbles; iron stained sandy gravel.			
	10.0			No record/recovery.			
	12.0			Moist brn pebbly sand (4"); yellow silty clay (3"); moist red sand (3"); cemented sand (1").			
	15.0			No record/recovery.			
				Water.			
	17.0			Black-grey tailings (1"); moist brn sand; quartz pebbles; silty gravel w/sand; brn & wht silty sand w/quartz frags (4").			
	20.0			No record/recovery.			

DATE BEGAN: 10/11/85
DATE FINISHED: 10/11/85
GROUND SURFACE EL.: _____

BORING NO. QH-#1

N _____ E _____

FIELD ENGINEER: J.T. Gormley
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	U.S.C.S.	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	20.0						
T.D.	20.6			Sand rock (1"); moist very fine dense pyritic sand (4").			

DATE BEGAN: 10/10/85
DATE FINISHED: 10/10/85
GROUND SURFACE EL.: _____

BORING NO. QH-#2

N _____ E _____

FIELD ENGINEER: J.T. Gormley
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	U.S.C.S.	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	2.0			Dry silty sand w/red quartz pebbles.			
	5.0			No record/recovery.			
	7.0			Dry red quartz sand.			
	10.0			No record/recovery.			
	11.0			10" Shelby Tube sample recovered.			
	13.0			Moist orange silty clay; quartz pebbles in sand matrix.			
	15.0			No record/recovery.			
	17.0			Yellow brn moist quartz sand with quartz pebbles.			
	20.0			No record/recovery.			

DATE BEGAN: 10/10/85
DATE FINISHED: 10/10/85
GROUND SURFACE EL.: _____

BORING NO. AH-#2

N _____ E _____

FIELD ENGINEER: J.T. Gormley
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	20.0			Red pabbly quartz sand; dk brn moist coarse sand w/pebbles (6"); broken quartz rock frags (2").			
	22.0			No record/recovery.			
	25.0			8" Shelby Tube sample recovered.			
	25.5			Reddish brn moist silty sand (6"); lt brn moist coarse sand (4"); reddish brn moist silty sand (4").			
	27.5			No record/recovery.			
	30.0			Dry sm silt; dk brn to orange, very dense fine pyritic sand. Twin hole.			
	32.0			No record/recovery.			
	34.5			Water.			
				V. hard grey dry fine sand (8"); V. wet clayey sand (16").			
	36.5			No record/recovery.			
	38.0			Note: Break in scale.			
T.D.	to 44.0						

DATE BEGAN: 10-15-85
DATE FINISHED: 10-15-85
GROUND SURFACE EL.: _____

BORING NO. Argo 1

N _____ E _____

FIELD ENGINEER: Sennett
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
				Sand & gravel, brn-gray, med dense sli moist.			
	2.0			Sand & gravel (broken rock).			
	5.0			Sand & gravel, anjular, brn, loose, sli moist.			
	7.0			Sand & gravel, angular.			
	10.0			Coarse sand w/pieces of broken rock, brn, sli moist.			
	12.0			Coarse sand and broken rock.			
	15.0			Sand & gravel with some clay, yellow brn, loose to med dense, moist.			
	16.0			No record, 1.3' recovered.			
	18.0			No record/recovery.			
	20.0						

DATE BEGAN: 10-15-85
DATE FINISHED: 10-15-85
GROUND SURFACE EL.: _____

BORING NO. Argo 1

N _____ E _____

FIELD ENGINEER: Sennett
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	20.0			Coarse sand & rock w/clay, yellow brn, loose to med dense, moist.			
	21.0			Sand & broken rock, brown, med dense, moist.			
	23.0			Sand & broken rock.			
	25.0			Sand & broken rock, clay, yellow brn, med dense, moist.			
	26.0			Sand & broken rock, some clay, yellow brn-gray, med dense, moist.			
	28.0			Sand, gravel & cobbles.			
	30.0			Sand, broken rock w/some clay layers, yellow brn, med dense, moist.			
	31.0			Sand, broken rock w/some clay layers, yellow brn, med dense to dense, moist.			
	33.0			Sand & broken rock.			
	35.0			Fine sand, broken rock, yellow to brn, med dense, moist.			
	35.3			Sand & broken rock (drove through a quartz cobble), brn to white, dense?, moist.			
	37.3			Sand & broken rock.			
	40.0						

DATE BEGAN: 10-15-85
DATE FINISHED: 10-15-85
GROUND SURFACE EL.: _____

BORING NO. Argo 1

N _____ E _____

FIELD ENGINEER: Sennett
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	40.0			Sand & broken rock w/clay, med dense, yellow brn, moist.			
	40.5			Middle part of sample a fine, sandy clay. Top & bottom sand & broken rock, yellow brn, stiff, moist.			
	42.5			Sand & broken rock.			
	45.0			Sand & broken rock w/some clay, yellow-brn, dense, moist.			
	46.00			Sand & broken rock, some clay, yellow, brn, lt gray, dry to moist hit large cobble or boulder.			
	47.5			Sand & broken rock.			
	49.0			Auger sounded like it was grinding on bedrock. Move hole 5' east.			
	50.0			Sand & broken rock, lt brn to gray, med dense, moist to very moist at bottom.			
	52.0			Sand, gravelly & cobbly.			
	55.0			Top .4' coarse sand, brn, dense, moist. Mid .4' silty, clayey, organic mt'l, blk, stiff to very stiff, moist. Lower .4' coarse sand & gravel, brn to lt gray, dense, moist.			
	57.0			Sand & gravel.			
	60.0						

DATE BEGAN: 10-15-85
DATE FINISHED: 10-15-85
GROUND SURFACE EL.: _____

BORING NO. Argo 1

N _____ E _____

FIELD ENGINEER: Sennett
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	60.0			Sand & gravel, brn some greenish gray, med dense to dense, moist.			
	62.0			Gravelly & cobbly at bottom.			
	65.0			Hard driving.			
T.D.	67.0			Stopped.			

DATE BEGAN: 10-16-85
DATE FINISHED: 10-16-85
GROUND SURFACE EL.: _____

BORING NO. Argo 2

N _____ E _____

FIELD ENGINEER: Sennett
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
				Sand & broken rock, brn loose to med dense, sli moist.			
	2.0			Sand & broken rock.			
	5.0			Sand & broken rock, brn, loose, sli moist.			
	7.0			Sand & broken rock.			
	10.0			Sand & broken rock w/some clay layers, yellow to brn, loose, sli moist.			
	12.0			Sand & broken rock.			
	15.0			Sand & broken rock, brn, loose, sli moist.			
	17.0			Sand & broken rock.			
	20.0						

DATE BEGAN: 10-16-85
DATE FINISHED: 10-16-85
GROUND SURFACE EL.:

BORING NO. Argo 2

N E

FIELD ENGINEER: Sennett
CHECKED BY:

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	20.0			Sand & broken rock w/some clay, yellow to brn, loose, sli moist.			
	22.0			No record/recovery.			
	25.0			Sand & broken rock, clayey, lt brn med dense, moist.			
	27.0			No record/recovery.			
	30.0			Sand & broken rock, upper half clayey, yellow to lt brn, loose, moist, wood in tip.			
	32.0			Sand & broken rock.			
	35.0			Clayey sand and broken rock on top Brn, med dense, moist rock on bottom, gray, hard, dry.			
	36.0			Clayey sand & rock.			
	38.0			Cobbles.			
	40.0			Clayey sand & rock.			

DATE BEGAN: 10-16-85
DATE FINISHED: 10-16-85
GROUND SURFACE EL.:

BORING NO. Argo 2

N E

FIELD ENGINEER: Sennett
CHECKED BY:

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	40.0			Clayey sand & broken rock, brn, loose to med dense, moist.			
	42.0			Clayey sand & broken rock cobbles.			
	45.0			Sand & broken rock, brn, med dense, sli moist to moist.			
	47.0			Sand & broken rock.			
	50.0			Sand & broken rock, gray to brn, loose to med dense, sli moist.			
	52.0			Sand & broken rock.			
	55.0			Sand & broken rock, gray to brn, loose to med dense, sli moist.			
	57.0			Sand & broken rock.			
	60.0						

DATE BEGAN: 10-16-85
DATE FINISHED: 10-16-85
GROUND SURFACE EL.: _____

BORING NO. Argo 2

N _____ E _____

FIELD ENGINEER: Sennett
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	60.0			Sand & broken rock, gray to brn, med dense, sli moist.			
	62.0			Sand & broken rock.			
T.D.	64.5			Boulder or bed rock.			

DATE BEGAN: 10-16-85
DATE FINISHED: 10-16-85
GROUND SURFACE EL.: _____

BORING NO. Argo 3

N _____ E _____

FIELD ENGINEER: Sennett
CHECKED BY: _____

ELEV (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
				Clayey sand & broken rock, lt brn, med dense, sli moist.			
	2.0			Clayey sand & broken rock.			
	5.0			Sand & broken rock, gray to brn, loose to med dense, sli moist.			
	7.0			Sand & broken rock.			
	8.0			Cobbles.			
	9.0			Drilling smoothed out.			
	10.0			Sand & broken rock, lt gray to brn med dense, moist.			
	12.0			Sand & broken rock.			
	14.5			Water.			
	15.0			Sand & Broken rock, brn, med danse to dense (cobble?), wet.			
	16.5			Sand & broken rock, some cobbles at 18'.			
	18.0			Some cobbles.			
	20.0			Sand & broken rock.			

DATE BEGAN: 10-16-85
DATE FINISHED: 10-16-85
GROUND SURFACE EL.: _____

BORING NO. Argo 3

N _____ E _____

FIELD ENGINEER: Sennett
CHECKED BY: _____

ELEV. (FEET)	DEPTH (FEET)	SAMPLE TYPE	PROFILE	DESCRIPTION	USCS	PENETRATION RESISTANCE (BLOWS PER FOOT) 10 30 50	WATER CONTENT (PERCENT) 20 40
	20.0			Alluvial coarse sand and gravel (sub rounded), gray brn, dense to very dense, wet.			
	21.0			Drilling hard.			
	22.0			Cobbles.			
T.D.	24.0			Sand, gravel and cobbles; stopped on boulder?			

APPENDIX 4B

SPECIAL ANALYTICAL SERVICES (SAS) REQUESTS

APPENDIX 4B

SPECIAL ANALYTICAL SERVICES (SAS) REQUESTS

FIRST SAMPLING SESSION SAS

July-August 1985

For July, 1985

June 10, 1985

Mr. Keith Schwab
ATC Director
U.S. Environmental Protection Agency
999 18th Street, Suite 1300
Denver, Colorado 80202-2413

Document Control No.: 202-WP1-EP-BDSE-1

Subject: Clear Creek RI/FS Sampling Effort

Dear Keith:

As we discussed on May 29th, Camp Dresser & McKee Inc. (CDM) is planning to conduct a tailings and surface water sampling effort during the week of June 24-28, 1985. CDM is planning to collect 21 surface water samples and three tailings samples during this period. As a part of this effort, CDM would like to utilize the Contract Laboratory Program (CLP) for the analyses.

CDM has developed a Project Operations Plan (POP) for the Clear Creek. RI/FS. As part of the POP, a detailed sampling plan has been developed. The pertinent sections of the POP are attached for your review. Section 2.0 provides the Quality Assurance Plan for the project, whereas Section 6.0 provides a detailed Field Investigation and Sampling Plan. The parameters to be included in this surface water and tailings sampling effort are provided in Tables 6-4 and 6-5, respectively. The analytical procedures for these parameters are provided in Table 2-5. Table 2-5 also provides information on which parameters can be performed under Routine or Special Analytical services.

If you have any questions or comments regarding this sampling effort, please feel free to give me a call.

Sincerely,

CAMP DRESSER & McKEE INC.

Kevin E. Kelly
Hydrogeologist

KEK/cs

cc: R. Olsen
D. Chamberlin
PF-202

Table 2-1

Summary of Parameter Measurement Objectives [1]

Parameter	Spike Recovery Control Limits (% R)	Duplicate Control Limits RPD (%)	Laboratory Check Sample (% R)	QC Check Sample (% R)	Percent Complete (%)
Al	75-125	± 10[2]	80-120	90-110	>90
As	75-125	± 10[2]	80-120	90-110	>90
Au	75-125	± 10[2]	80-120	90-110	>90
Cd	75-125	± 10[2]	80-120	90-110	>90
Cr	75-125	± 10[2]	80-120	90-110	>90
Pb	75-125	± 10[2]	80-120	90-110	>90
Cu	75-125	± 10[2]	80-120	90-110	>90
Zn	75-125	± 10[2]	80-120	90-110	>90
Ag	75-125	± 10[2]	80-120	90-110	>90
Mn	75-125	± 10[2]	80-120	90-110	>90
Mo	75-125	± 10[2]	80-120	90-110	>90
Se	75-125	± 10[2]	80-120	90-110	>90
Fe	75-125	± 10[2]	80-120	90-110	>90
Ni	75-125	± 10[2]	80-120	90-110	>90
Hg	75-125	± 10[2]	N/R	80-120	>90
HCO_3	75-125	± 10	80-120	90-110	>90
CO_3	75-125	± 10	80-120	90-110	>90
B	75-125	± 10[2]	80-120	90-110	>90
SO_4	75-125	± 10[2]	80-120	90-110	>90
NO_3/NO_2	75-125	± 10[2]	80-120	90-110	>90
Cl	75-125	± 10[2]	80-120	90-110	>90
F	75-125	± 10[2]	80-120	90-110	>90
CN	-[1]	-[1]	-[1]	-[1]	>90
SCN	75-125	± 10[2]	80-120	90-110	>90
Na	75-125	± 10[2]	80-120	90-110	>90
Mg	75-125	± 10[2]	80-120	90-110	>90
Ca	75-125	± 10[2]	80-120	90-110	>90
Acidity	N/A	± 10[2]	80-120	90-110	>90
K	75-125	± 10[2]	80-120	90-110	>90
TSS	75-125	± 10[2]	80-120	90-110	>90
TDS	75-125	± 10[2]	80-120	90-110	>90
pH	N/A	± 10	N/A	90-110	>90
Specific Conductance	75-125	± 10[2]	N/A	90-110	>90
Acid Potential	N/A	± 10	N/A	90-110	>90
Neutralization Potential	N/A	± 10	80-120	90-110	>90
Forms of Sulfur	75-125	± 10[2]	80-120	90-110	>90

Table 2-1 (continued)

Summary of Parameter Measurement Objectives [1]

Parameter	Spike Recovery Control Limits (% R)	Duplicate Control Limits RPD (%)	Laboratory Check Sample (% R)	QC Check Sample (% R)	Percent Complete (%)
Permeability	N/A	N/A	N/A	N/A	N/A
Leachability	75-125	± 10[2]	80-120	90-110	>90
EP Toxicity	75-125	± 10[2]	80-120	90-110	>90
Oil and Grease	75-125	± 10[2]	80-120	90-110	>90
Total Organic Carbon	75-125	± 10[2]	80-120	90-110	>90
Grain Size Distribution	N/A	N/A	N/A	N/A	N/A
Mineralogical Composition	N/A	N/A	N/A	N/A	N/A

N/A = Not Applicable

(1) Unless Special Analytical Services are required, measurement objectives are consistent with CLP as defined in CLP/IFB #WA84J092, Appendix E, 7/1984.

(2) ± 10% if concentration if > 5x the Method Detection Limits or ± MDL if concentration is < 5x the Method Detection Limit.

Table 2-5

ANALYTICAL PROCEDURES

Constituent	Solids			Water		
	Method	Reference	Type of CLP Service[b]	Method	Reference	Type of CLP Service[b]
Al	N/A	-	-	202.2	c	SAS
As	CLP	d,e	RAS	CLP	d	RAS
Au	231.2	c,e	SAS	231.2	c	SAS
Cd	CLP	d,e	RAS	CLP-M 213.2	d	SAS
Cr	CLP	d,e	RAS	CLP	d	RAS
Pb	CLP	d,e	RAS	CLP-M 239.2	d	SAS
Cu	CLP	d,e	RAS	CLP-M 220.2	d	SAS
Zn	CLP	d,e	RAS	CLP	d	RAS
Ag	CLP	d,e	RAS	CLP-M 272.2	d	SAS
Mn	CLP	d,e	RAS	CLP	d	RAS
Mo	246.2	c,e	SAS	246.2	c	SAS
Se	CLP	d,e	RAS	CLP	d	RAS
Fe	CLP	d,e	RAS	CLP	d	RAS
Ni	CLP	d,e	RAS	CLP	d	RAS
Hg	CLP	d,e	RAS	CLP	d	RAS
HCO_3	N/A	-	-	310.1	c	SAS
CO_3	N/A	-	-	310.1	c	SAS
B	N/A	-	-	212.3	c	SAS
SO_4	N/A	-	-	375.3	c	SAS
NO_3/NO_2	N/A	-	-	353.1	c	SAS
Cl	N/A	-	-	325.1	c	SAS
F	N/A	-	-	340.2	c	SAS
CN	CLP	d	RAS	CLP	d	RAS
SCN	412K	h	SAS	412K	h	SAS
Na	N/A	-	-	CLP	c	RAS
Mg	N/A	-	-	CLP	c	RAS
Ca	N/A	-	-	CLP	c	RAS
Acidity	N/A	-	-	305.1	c	SAS
Sr	N/A	-	-	303A	h	SAS
K	N/A	-	-	CLP	c	RAS
TSS	N/A	-	-	160.2	c	SAS
TDS	N/A	-	-	160.1	c	SAS
pH	12-2.6	i	SAS	9040	a	SAS
Specific Conductance	10-2.3.1	i	SAS	9050	a	SAS
Acid Potential	3.2.11	f	SAS	N/A	-	-
Neutralization Potential	3.2.3	f	SAS	N/A	-	-
Forms of Sulfur	ASTM 2492-74	g	SAS	N/A	-	-

Table 2-5 (continued)

ANALYTICAL PROCEDURES

Constituent	Solids			Water		
	Method	Reference	Type of CLP Service[b]	Method	Reference	Type of CLP Service[b]
Permeability	ASTM D3441-79	g	SAS	N/A	-	-
Leachability	ASTM D3987-81	g	SAS	N/A	-	-
EP Toxicity	1310	a	SAS	N/A	-	-
Oil and Grease	N/A	-	-	413.1	c	SAS
Total Organic Carbon	N/A	-	-	9060	a	SAS
Grain Size Distribution	43-5	i	SAS	N/A	-	-
Mineralogical Composition	49	i	SAS	N/A	-	-

[a] Methods from U.S. EPA, Test Methods for Evaluating Solid Waste, SW-846, 1982.

[b] Refers to type of Contract Laboratory Program (CLP) request - RAS (Routine Analytical Services) or SAS (Special Analytical Services)

[c] Methods from U.S. EPA, Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, 1983.

[d] CLP - Indicates procedures defined under Routine Analytical Services of the Contract Laboratory Program, Document CLP/IFB #WA84J092, 7/1984.

[e] Digestion method 3020 proceeds method listed.

[f] A.A. Sobek, W.A. Schuller, J.R. Freeman, 1978, Field and Laboratory Methods Applicable to Overburdens and Minesoils, EPA-600/2-78-054.

[g] ASTM, American Society for Testing and Materials, Philadelphia, PA.

[h] APHA - AWWA - WPCF, 1980, Standard Methods for Examination of Water and Wastewater, 15th Edition.

[i] Black, C.A., 1965, Methods of Soil Analysis

N/A - Not Applicable.

Table 2-5

ANALYTICAL PROCEDURES

Constituent	Type of CLP Service[b]	Solid Method	Reference	Water Method	Reference
Al	SAS	N/A	-	202.2	c
As	RAS	CLP	d,e	CLP	d
Au	SAS	231.2	c,e	231.2	c
Cd	SAS	7131	a,e	7131	a
Cr	RAS	CLP	d,e	CLP	d
Pb	SAS	7421	a,e	7421	a
Cu	SAS	7211	a,e	7211	a
Zn	RAS	CLP	d,e	CLP	d
Ag	SAS	7761	a,e	7761	a
Mn	RAS	CLP	d,e	CLP	d
Mo	SAS	246.2	c,e	246.2	c
Se	RAS	CLP	d,e	CLP	d
Fe	RAS	CLP	d,e	CLP	d
Ni	RAS	CLP	d,e	CLP	d
Hg	RAS	CLP	d,e	CLP	d
HCO_3	SAS	N/A	-	310.1	c
CO_3	SAS	N/A	-	310.1	c
B	SAS	N/A	-	212.3	c
SO_4	SAS	N/A	-	375.3	c
NO_3/NO_2	SAS	N/A	-	353.1	c
Cl	SAS	N/A	-	325.1	c
F	SAS	N/A	-	340.2	c
CN	RAS	CLP	d	CLP	d
SCN	SAS	412K	h	412K	h
Na	SAS	N/A	-	273.1	c
Mg	SAS	N/A	-	242.1	c
Ca	SAS	N/A	-	215.2	c
Acidity	SAS	N/A	-	305.1	c
Sr	SAS	N/A	-	303A	h
K	SAS	N/A	-	258.1	c
TSS	SAS	N/A	-	160.2	c
TDS	SAS	N/A	-	160.1	c
pH	SAS	9045	a	9040	a
Specific Conductance	SAS	9050	a	9050	a
Acid Potential	SAS	3.2.11	f	N/A	-
Neutralization Potential	SAS	3.2.3	f	N/A	-
Forms of Sulfur	SAS	ASTM 2492-74	g	N/A	-

Table 2-5 (continued)

ANALYTICAL PROCEDURES

Constituent	Type of CLP Service[b]	Solid Method	Reference	Water Method	Reference
Permeability	SAS	ASTM D3441-79	g	N/A	-
Leachability	SAS	ASTM D3987-81	g	N/A	-
EP Toxicity	SAS	1310	a	N/A	-
Oil and Grease	SAS	N/A	-	413.1	c
Total Organic Carbon	SAS	N/A	-	9060	a
Grain Size Distribution	SAS	43-5	i	N/A	-
Mineralogical Composition	SAS	49	i	N/A	-

[a] Methods from U.S. EPA, Test Methods for Evaluating Solid Waste, SW-846, 1982.

[b] Refers to type of Contract Laboratory Program (CLP) request - RAS (Routine Analytical Services) or SAS (Special Analytical Services)

[c] Methods from U.S. EPA, Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, 1983.

[d] CLP - Indicates procedures defined under Routine Analytical Services of the Contract Laboratory Program.

[e] Digestion method 3020 proceeds method listed.

[f] A.A. Sobek, W.A. Schuller, J.R. Freeman, 1978, Field and Laboratory Methods Applicable to Overburdens and Minesoils, EPA-600/2-78-054.

[g] ASTM, American Society for Testing and Materials, Philadelphia, PA.

[h] APHA - AWWA - WPCF, 1980, Standard Methods for Examination of Water and Wastewater, 15th Edition.

[i] Black, C.A., 1965, Methods of Soil Analysis

N/A - Not Applicable.

CDM
environmental engineers, scientists, planners, & management consultants

CAMP DRESSER & McKEE INC.
Riverpoint
2300 15th Street, Suite 400
Denver, Colorado 80202
303 458-1311

June 13, 1985

Mr. Keith Schwab
ATC Director
U.S. Environmental Protection Agency
999 18th Street
Denver, Colorado 80202-2413

Document Number:

Subject: Revised Clear Creek RI/FS Sampling Effort For July, 1985

Dear Keith:

As we discussed yesterday, CDM revised the sampling plan for the Clear Creek sampling effort. As a result, the following enclosed tables are the corrected version and should be inserted into the appropriate sections you received on June 10th: Table 2-5, Table 6-3, Table 6-4, and Table 6-6. Contrary to the June 10th transmittal letter, Table 6-6 provides the parameters to be included in the solids sampling effort. I have also enclosed a second, corrected copy of the pertinent sections.

If you have any questions or comments, please give me a call.

Sincerely,

CAMP DRESSER & McKEE INC.

Kevin E. Kelly
Hydrogeologist

KEK/clm

Enclosures

cc: D. Chamberlin
R. Olsen
PF 202

ANALYTICAL REQUIREMENTS

Constituent	Solids			Water		
	Method	Reference	Type of CLP Service[b]	Method	Reference	Type of CLP Service[b]
Al	CLP	d	RAS	CLP	d	RAS
As	CLP	d	RAS	CLP	d	RAS
Au	231.2	c	SAS	231.2	c	SAS
Cd	CLP	d	RAS	CLP-M 213.2	d,c	SAS
Cr	CLP	d	RAS	CLP	d	RAS
Pb	CLP	d	RAS	CLP	d	RAS
Cu	CLP	d	RAS	CLP-M 220.2	d,c	SAS
Zn	CLP	d	RAS	CLP	d	RAS
Ag	CLP	d	RAS	CLP-M 272.2	d,c	SAS
Mn	CLP	d	RAS	CLP	d	RAS
Mo	200.7	c	SAS	200.7	c	SAS
Se	CLP	d	RAS	CLP	d	RAS
Fe	CLP	d	RAS	CLP	d	RAS
Ni	CLP	d	RAS	CLP	d	RAS
Hg	CLP	d	RAS	CLP	d	RAS
Na	CLP	d	RAS	CLP	d	RAS
Mg	CLP	d	RAS	CLP	d	RAS
Ca	CLP	d	RAS	CLP	d	RAS
Sr	N/A	-	-	303A (or ICP)	g	SAS
K	CLP	d	RAS	CLP	d	RAS
Co	CLP	d	RAS	CLP	d	RAS
Be	CLP	d	RAS	CLP	d	RAS
Tl	CLP	d	RAS	CLP	d	RAS
V	CLP	d	RAS	CLP	d	RAS
Ba	CLP	d	RAS	CLP	d	RAS
Sb	CLP	d	RAS	CLP	d	RAS
CN	CLP	d	RAS	CLP	d	RAS
B	N/A	-	-	200.7	c	SAS
Cr (VI)	N/A	-	-	218.5	c	SAS
SO_4	N/A	-	-	375.3	c	SAS
NO_3/NO_2	N/A	-	-	353.3	c	SAS
Cl	N/A	-	-	325.1	c	SAS
F	N/A	-	-	340.2	c	SAS
HCO_3	N/A	-	-	403	g	SAS
CO_3	N/A	-	-	403	g	SAS

ANALYTICAL REQUIREMENTS
(continued)

Constituent	Solids			Water		
	Method	Reference	Type of CLP Service[b]	Method	Reference	Type of CLP Service[b]
Acidity	N/A	-	-	305.1	c	SAS
TSS	N/A	-	-	160.2	c	SAS
TDS	N/A	-	-	160.1	c	SAS
pH	10-2.3.2/3.2	h	SAS	150.1	c	SAS
Specific Conductance	10-2.3.2/3.3	h	SAS	120.1	c	SAS
Acid Potential	3.2.11	e	SAS	N/A	-	-
Neutralization Potential	3.2.3	e	SAS	N/A	-	-
Forms of Sulfur	ASTM 2492-74	f	SAS	N/A	-	-
Oil and Grease	N/A	-	-	413.2	c	SAS
Total Organic Carbon	N/A	-	-	415.2	c	SAS
Grain Size Distribution(i)	3.4.3	e	SAS	N/A	-	-
Gross Alpha Radioactivity	703	g	SAS	703	g	SAS
Gross Beta Radioactivity	703	g	SAS	703	g	SAS
Pulverizing(i)	3.1.2	e	SAS	-	-	-

[a] Methods from U.S. EPA, Test Methods for Evaluating Solid Waste, SW-846, 1982.

[b] Refers to type of Contract Laboratory Program (CLP) request - RAS (Routine Analytical Services) or SAS (Special Analytical Services)

[c] Methods from U.S. EPA, Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, 1983.

[d] CLP - Indicated procedures defined under Routine Analytical Services of the Contract Laboratory Program, Document CLP/IFB #WA84J092, 7/1984.

[e] A.A. Sobek, W.A. Schuller, J.R. Freeman, 1978, Field and Laboratory Methods Applicable to Overburdens and Minesoils, EPA-600/2-78-054.

[f] ASTM, American Society for Testing and Materials, Philadelphia, PA.

[g] APHA - AWWA - WPCF, 1980, Standard Methods for Examination of Water and Wastewater, 15th Edition.

[h] Page, A.L., Miller, R.H., Keeney, D.R., 1982, Methods of Soil Analysis Part 2.

[i] Pulverization method, to be carried out before all analysis of solids except Grain Size Distribution.

N/A - Not Applicable.

Additional requests include:

1) Filter a portion of the 'Total' water samples before chloride, fluoride, sulfate, carbonate, bicarbonate and acidity analysis.

2) Increase spike levels by ten times the normal amount for Mn, Fe ad Zn in water samples.

TABLE 6-3 DATA PARAMETERS TO BE INCLUDED IN GROUND WATER SAMPLING PROGRAM[1]

Constituent	Container	Filtered	Preservative	Holding Time
Acidity	1-Liter, high-density polyethylene with poly cap	No	Cool to 4°C	14 Days
Aluminum (dissolved)	"	Yes	HNO_3	6 Months
Arsenic (dissolved)	"	Yes	HNO_3	6 Months
Barium (dissolved)	"	Yes	HNO_3	6 Months
Bicarbonate	"	No	Cool to 4°C	14 Days
Boron	"	Yes	HNO_3	6 Months
Cadmium (dissolved)	"	Yes	HNO_3	6 Months
Calcium	"	Yes	HNO_3	6 Months
Carbonate	"	No	Cool to 4°C	14 Days
Chloride	"	No	None	28 Days
Chromium (dissolved)	"	Yes	HNO_3	6 Months
Copper (dissolved)	"	Yes	HNO_3	6 Months
Cyanide	"	No	Cool to 4°C, NaOH	14 Days
Fluoride	"	No	None	28 Days
Iron (dissolved)	"	Yes	HNO_3	6 Months
Lead (dissolved)	"	Yes	HNO_3	6 Months
Magnesium	"	Yes	HNO_3	6 Months
Manganese (dissolved)	"	Yes	HNO_3	6 Months
Molybdenum (dissolved)	"	Yes	HNO_3	6 Months
Mercury (dissolved)	"	Yes	HNO_3	6 Months
Nickel (dissolved)	"	Yes	HNO_3	6 Months
Potassium	"	Yes	HNO_3	6 Months
Selenium (dissolved)	"	Yes	HNO_3	6 Months
Silver (dissolved)	"	Yes	HNO_3	6 Months
Sodium	"	Yes	HNO_3	6 Months
Strontium	"	Yes	HNO_3	6 Months
Sulfate	"	No	Cool to 4°C	28 Days
Thiocyanate	"	No	None	28 Days
Total Dissolved Solids	"	No	Cool to 4°C	48 Hours
Zinc (dissolved)	"	Yes	HNO_3	6 Months
Total Organic Carbon	1-Liter, glass	No	Cool to 4°C, H_2SO_4	28 Days
Oil and Grease	"	No	Cool to 4°C, H_2SO_4	28 Days
Nitrate/Nitrite	"	No	Cool to 4°C, H_2SO_4	28 Days

(1) For each sample, a total of 4 bottles will be required; 3 polyethylene (1 with HNO_3 (filtered), 1 with NaOH (nonfiltered) and 1 with no preservative (nonfiltered)) and 1 glass (with H_2SO_4; nonfiltered).

TABLE 6-4

DATA PARAMETERS TO BE INCLUDED IN SURFACE WATER SAMPLING PROGRAM

Constituent	Containers[1]	Filtered	Preservative	Holding Time
Acidity	1-Liter, high-density polyethylene bottle with poly cap	No	Cool to 4°C	14 Days
Aluminum				
- Total	"	No	HNO_3	6 Months
- Dissolved	"	Yes	HNO_3	6 Months
Arsenic				
- Total	"	No	HNO_3	6 Months
- Dissolved	"	Yes	HNO_3	6 Months
Barium				
- Total	"	No	HNO_3	6 Months
- Dissolved	"	Yes	HNO_3	6 Months
Bicarbonate	"	No	Cool to 4°C	14 Days
Boron	"	Yes	HNO_3	6 months
Cadmium				
- Total	"	No	HNO_3	6 Months
- Dissolved	"	Yes	HNO_3	6 Months
Calcium	"	Yes	HNO_3	6 Months
Carbonate	"	No	Cool to 4°C	14 Days
Chloride	"	No	None	28 Days
Carbonate	"	No	Cool to 4°C	14 Days
Chromium				
- Total	"	No	HNO_3	6 Months
- Dissolved	"	Yes	HNO_3	6 Months
Copper				
- Total	"	No	HNO_3	6 Months
- Dissolved	"	Yes	HNO_3	6 Months
Cyanide	"	No	Cool to 4°C, NaOH	14 Days
Fluoride	"	No	None	28 Days
Iron				
- Total	"	No	HNO_3	6 Months
- Dissolved	"	Yes	HNO_3	6 Months
Lead				
- Total	"	No	HNO_3	6 Months
- Dissolved	"	Yes	HNO_3	6 Months
Magnesium	"	Yes	HNO_3	6 Months
Manganese				
- Total	"	No	HNO_3	6 Months
- Dissolved	"	Yes	HNO_3	6 Months
Mercury				
- Total	"	No	HNO_3	28 Days
- Dissolved	"	Yes	HNO_3	28 Days

TABLE 6-4

DATA PARAMETERS TO BE INCLUDED IN SURFACE WATER SAMPLING PROGRAM (Cont.)

Constituent	Containers[1]	Filtered	Preservative	Holding Time
Molybdenum				
- Total	"	No	HNO_3	6 Months
- Dissolved	"	Yes	HNO_3	6 Months
Nickel				
- Total	"	No	HNO_3	6 Months
- Dissolved	"	Yes	HNO_3	6 Months
Nitrate/Nitrite	"	No	Cool to 4°C, H_2SO_4	28 Days
pH[2]	"	No	None	----
Potassium	"	Yes	HNO_3	6 Months
Selenium				
- Total	"	No	HNO_3	6 Months
- Dissolved	"	Yes	HNO_3	6 Months
Silver				
- Total	"	No	HNO_3	6 Months
- Dissolved	"	Yes	HNO_3	6 Months
Sodium	"	Yes	HNO_3	6 Months
Specific Conductance[2]	"	No	None	28 Days
Strontium	"	Yes	HNO_3	6 Months
Sulfate	"	No	Cool to 4°C	28 Days
Temperature[2]	"	No	None	----
Thiocyanate	"	No	None	28 Days
Zinc				
- Total	"	No	HNO_3	6 Months
- Dissolved	"	Yes	HNO_3	6 Months
Total Dissolved Solids	"	No	Cool to 4°C	48 Hours
Total Suspended Solids	"	No	Cool to 4°C	7 Days

[1] Five containers are required for each sample: 2 with HNO_3 with one for total metals (nonfiltered) and one for dissolved metals (filtered), 1 with H_2SO_4 for Nitrate/Nitrite (nonfiltered), 1 with NaOH for cyanide (unfiltered) and 1 with no preservatives (nonfiltered).

[2] Both field and laboratory measurements.

TABLE 6-6 DATA PARAMETERS TO BE INCLUDED IN SOLID SAMPLING PROGRAM[1]

Constituent	Container	Preservative	Holding Time
Arsenic	1-Liter, high-density polyethylene with poly cap.	Cool to 4°C	6 Months
Cadmium	"	"	"
Chromium	"	"	"
Copper	"	"	"
Gold	"	"	"
Iron	"	"	"
Lead	"	"	"
Manganese	"	"	"
Mercury	"	"	"
Nickel	"	"	"
Selenium	"	"	"
Silver	"	"	"
Zinc	"	"	"
Potential Acidity	"	"	14 Days
Neutralization Potential	"	"	14 Days
pH	"	"	"
Forms of Sulfur	"	"	"
Specific Conductivity	"	"	"
Grain Size Distribution	"	N/A	N/A
Mineralogical Composition	"	N/A	N/A
Cyanide	"	Cool to 4°C	14 Days
Thiocyanate	"	"	"

[1] Solids includes soils, waste rock, tailings, and sediments.

SECOND SAMPLING SESSION SAS

October-November 1985

For Nov., 1985

CDM
environmental engineers, scientists, planners, & management consultants

CAMP DRESSER & McKEE INC.
Riverpoint
2300 15th Street, Suite 400
Denver, Colorado 80202
303 458-1311

10/16/85

M E M O R A N D U M

TO: Keith Schwab, Region 8 RSCC

FROM: Richard Cheatham, CCJA/CDM

DOCUMENT NO: 202-RI1-EP-BUSQ-1

RE: Clear Creek/Central City RI/FS SAS Request

Enclosed is the SAS Request Form for Quarterly Sampling program for the Clear Creek/Central City RI/FS.

Please Note Sampling & shipping dates carefully

U.S. ENVIRONMENTAL PROTECTION AGENCY
CLP Sample Management Office
P.O. Box 818 - Alexandria, Virginia 22313
Phone: 703/557-2490 - FTS/557-2490

SAS Number

SPECIAL ANALYTICAL SERVICES

Client Request

☐ Regional Transmittal ☐ Telephone Request

A. EPA Region/Client: Reg. VIII/CDM

B. RSCC Representative: Keith Schwab

C. Telephone Number: ( )

D. Date of Request: October 15, 1985

E. Site Name: Clear Creek/Central City

Please provide below description of your request for Special Analytical Services under the Contract Laboratory Program. In order to most efficiently obtain laboratory capability for your request, please address the following considerations, if applicable. Incomplete or erroneous information may result in a delay in the processing of your request. Please continue response on additional sheets, or attach supplementary information as needed.

1. General description of analytical service requested: Inorganic RAS plus SAS on water and solid samples (see attached pages 4 & 5 for specifics)

(RAS includes metals plus CN)

2. Definition and number of work units involved (specify whether whole samples or fractions; whether organics or inorganics; whether aqueous or soil and sediments; and whether low, medium or high concentration):
48 Low Water (Total & Dissolved). This includes 11 QC samples.
23 Low Water (Dissolved). This includes 8 QC samples.
105 Low Solids. This includes 15 QC samples.

3. Purpose of analysis (specify whether Superfund (enforcement or remedial action), RCRA, NPDES, etc.): Superfund-remedial action

4. **Estimated date(s) of collection:** Oct. 28-Nov. 1 and Nov. 21, 1985 for water samples. Nov. 13 & 14, 1985 for solids.

5. **Estimated date(s) and method of shipment:** Oct. 29, 30, 31 & Nov. 1 = 12 (Total & Dissolved) water each day. Nov. 2 = 11(Dissolved) water. Nov. 21 = 12 (Dissolved) water. Nov. 14 = 105 solids. Shipped Fed. Ex. or hand delivered.

6. **Number of days analysis and data required after laboratory receipt of samples:** 30

7. **Analytical protocol required (attach copy if other than a protocol currently used in this program):** Air drying and grinding according to attached method (3.1.2 from EPA-600 278-054) is required for all solid samples. Filtering through 45 micron filter is required for the portion of water sample used for analysis of CO_3, HCO_3, Cl^-, F^-, SO_4^{-2} and acidity.

8. **Special technical instructions (if outside protocol requirements, specify compound names, CAS numbers, detection limits, etc.):** For SAS detection limits follow the CLP Inorganic SOW decision tree process, page E-11 (SOW No. 784) for Cd, Cu, Ag & Mo. Other method references are indicated on pages 4 & 5 or are attached. The QA/QC requirements and limits are also indicated on pages 6 & 7. Det. Limit requirements: Cd = 1 ug/L, Cu = 5 ug/L, Ag = 0.1 ug/L.

9. **Analytical results required (if known, specify format for data sheets, QA/QC reports, Chain-of-Custody documentation, etc.) If not completed, format of results will be left to program discretion.** Normal CLP format and requirements as indicated on attached pages 4-7. A summary of SAS requested results for each sample and a QA/QC summary report are requested.

10. **Other (use additional sheets or attach supplementary information, as needed):** Grain Size Distribution required on 20 samples, only. Spike all water samples at 10x normal levels for Mn, Fe and Zn.

11. **Name of sampling/shipping contact:** Roger Olsen/Richard Cheatham

Phone: (303) 458-1311

12. **Data Requirements**

Parameter	Detection Limit	Precision Desired (±% or Concentration)
see attached		

13. **QC Requirements**

Audits Required	Frequency of Audits	Limits (Percent or Concentration)
see attached		

14. **Action Required if Limits are Exceeded**

Actions required when indicated limits for SAS requested parameters are not met are consistent with the normal CLP protocols as defined in SOW 784, CLP/IFB #WA84J092, July 21, 1984.

Please return this request to the Sample Management Office as soon as possible to expedite processing of your request for special analytical services. Should you have any questions or need any assistance, please contact your Regional representative at the Sample Management Office.

ANALYTICAL REQUIREMENTS
SAS Requests

Constituent	Solids			Water		
	Method	Reference	Type of CLP Service[b]	Method	Reference	Type of CLP Service[b]
Au	231.2	c	SAS	231.2	c	SAS
Cd	-	-	-	CLP-M 213.2	d,c	SAS
Cu	-	-	-	CLP-M 220.2	d,c	SAS
Ag	-	-	-	CLP-M 272.2	d,c	SAS
Mo	200.7	c	SAS	200.7	c	SAS
Sr	-	-	-	303A (or ICP)	g	SAS
B	N/A	-	-	200.7	c	SAS
Cr (VI)	N/A	-	-	218.5	c	SAS
SO_4	N/A	-	-	375.3	c	SAS
NO_3/NO_2	N/A	-	-	353.3	c	SAS
Cl	N/A	-	-	325.1	c	SAS
F	N/A	-	-	340.2	c	SAS
HCO_3	N/A	-	-	403	g	SAS
CO_3	N/A	-	-	403	g	SAS
Acidity	N/A	-	-	305.1	c	SAS
TSS	N/A	-	-	160.2	c	SAS
TDS	N/A	-	-	160.1	c	SAS
pH	10-2.3.2/3.2	h	SAS	150.1	c	SAS
Specific Conductance	10-2.3.2/3.3	h	SAS	120.1	c	SAS
Acid Potential	3.2.11	e	SAS	N/A	-	-
Neutralization Potential	3.2.3	e	SAS	N/A	-	-
Forms of Sulfur	ASTM 2492-74	f	SAS	N/A	-	-
Oil and Grease	N/A	-	-	413.2	c	SAS
Total Organic Carbon	N/A	-	-	415.2	c	SAS
Grain Size Distribution[(i)]	3.4.3	e	SAS	N/A	-	-
Gross Alpha Radioactivity	703	g	SAS	703	g	SAS
Gross Beta Radioactivity	703	g	SAS	703	g	SAS
Pulverizing[(j)]	3.1.2	e	SAS	-	-	-

ANALYTICAL REQUIREMENTS
SAS Requests
(continued)

[a] Methods from U.S. EPA, Test Methods for Evaluating Solid Waste, SW-846, 1982.

[b] Refers to type of Contract Laboratory Program (CLP) request - RAS (Routine Analytical Services) or SAS (Special Analytical Services)

[c] Methods from U.S. EPA, Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, 1983.

[d] CLP - Indicated procedures defined under Routine Analytical Services of the Contract Laboratory Program, Document CLP/IFB #WA84J092, 7/1984.

[e] A.A. Sobek, W.A. Schuller, J.R. Freeman, 1978, Field and Laboratory Methods Applicable to Overburdens and Minesoils, EPA-600/2-78-054.

[f] ASTM, American Society for Testing and Materials, Philadelphia, PA.

[g] APHA - AWWA - WPCF, 1980, Standard Methods for Examination of Water and Wastewater, 15th Edition.

[h] Page, A.L., Miller, R.H., Keeney, D.R., 1982, Methods of Soil Analysis, Part 2.

[i] Pulverization method, to be carried out before all analysis of solids except Grain Size Distribution.

N/A - Not Applicable.

Additional requests include:

1) Filter a portion of the 'Total' water samples before chloride, fluoride, sulfate, carbonate, bicarbonate and acidity analysis.

2) Increase spike levels by ten times the normal CLP spike amount for Mn, Fe and Zn in water samples.

Summary of Parameter Measurement Objectives
For SAS Requests

Parameter	Matrix	Det. Limit (ug/L)	Spike Recovery Control Limits (% R)	Duplicate[1] Control Limits RPD (%)	Laboratory Check Sample (% R)	EPA QC Check Sample (% R)	QA Sample Frequency
Au	Water	1	75-125	±20	80-120	90-110	1/20
Au	Solid	0.5 mg/Kg	75-125	±35	80-120	90-110	1/20
Cd	Water	1	75-125	±20	80-120	90-110	1/20
Cu[2]	Water	5	75-125	±20	80-120	90-110	1/20
Zn[2]	Water	20	75-125	±20	80-120	90-110	1/20
Ag[2]	Water	0.1	75-125	±20	80-120	90-110	1/20
Mn[2]	Water	15	75-125	±20	80-120	90-110	1/20
Mo	Water	10	75-125	±20	80-120	90-110	1/20
Mo[2]	Solid	10 mg/Kg	75-125	±35	80-120	90-110	1/20
Fe[2]	Water	100	75-125	±20	80-120	90-110	1/20
Cr (VI)	Water	5	75-125	±20	80-120	90-110	1/20
B	Water	10	75-125	±20	80-120	90-110	1/20
HCO_3	Water	5	75-125	±20	80-120	90-110	1/10
CO_3	Water	5	75-125	±20	80-120	90-110	1/10
SO_4	Water	5	75-125	±20	80-120	90-110	1/10
NO_3/NO_2	Water	0.1	75-125	±20	80-120	90-110	1/10
Cl	Water	3	75-125	±20	80-120	90-110	1/10
F	Water	0.1	75-125	±20	80-120	90-110	1/10
Acidity	Water	5	N/A	±20	80-120	90-110	1/10
TSS	Water	2	75-125	±20	80-120	90-110	1/20
TDS	Water	10	75-125	±20	80-120	90-110	1/20
pH	Water	N/A	N/A	±20	N/A	90-110	1/10
Specific Conductance	Water	1 umhos/cm	75-125	±20	N/A	90-110	1/10
Oil and Grease	Water	200	75-125	±20	80-120	90-110	1/20
Total Organic Carbon	Water	50	75-125	±20	80-120	90-110	1/20
Gross Alpha Radioactivity	Water	-	75-125	±20	N/A	90-110	1/20
Gross Beta Radioactivity	Water	-	75-125	±20	N/A	90-110	1/20
Gross Alpha Radioactivity	Solid	-	75-125	±35	N/A	90-110	1/20
Gross Beta Radioactvity	Solid	-	75-125	±35	N/A	90-110	1/20
pH	Solid	N/A	N/A	±35	N/A	90-110	1/20
Specific Conductance	Solid	N/A	75-125	±35	N/A	90-110	1/20
Acid Potential	Solid	N/A	N/A	±35	N/A	90-110	1/20
Neutralization Potential	Solid	N/A	N/A	±35	80-120	90-110	1/20
Forms of Sulfur	Solid	N/A	75-125	±35	80-120	90-110	1/20
Grain Size Distribution	Solid	N/A	N/A	N/A	N/A	N/A	N/A

Summary of Parameter Measurement Objectives
For SAS Requests
(continued)

(1) ± 20% of concentration for water and ±35% of concentration for solids if > 5x the Method Detection Limits or ± MDL if concentration is < 5x the Method Detection Limit.

(2) Spiking is required at 10x the normal CLP spike amount for Zn, Mn and Fe.
All other requirements are consistent with CLP inorganic protocols.

d. Total overburden thickness has been recorded.

e. For each sample the correct site location, sample number, soil or rock type (if done in field), sampling interval represented by sample, depth from surface, and date sampled have been recorded in the record book. NOTE: Both the interval represented by the sample and the depth from the surface should be recorded even though one can be calculated from the other.

2. For each overburden column, check to make sure that each sample container has a sample, is numbered correctly, and is labeled correctly.

3. Determine rock type in the laboratory if not completed in the field.

4. Determine color in the laboratory on ground (less than 60 mesh) sample.

3.1.2 Subsampling and Grinding Rock and Native Soil Samples

3.1.2.1 Principle--

Crushing reduces the field sample into a convenient size range for use with various laboratory analyses. Samples are crushed, subsampled, and ground to pass a 0.25 mm (60 mesh) sieve.

3.1.2.2 Comments--

Crusher and pulverizer should be cleaned after each sample to avoid contamination between samples.

Native soils are soil horizons which are taken above and are treated as an extension of a core, blast hole, or hand sampled highwall column. Soil and rock samples should be air dried, not oven dried, before subsampling and grinding.

3.1.2.3 Chemicals--

None required.

3.1.2.4 Materials--

1. Crusher, chipmunk, motor driven, capable of crushing samples to less than 6.35 mm (0.25 in) (Cat. No. 5-60836, Sargent-Welch Scientific Company; or equivalent).

2. Pulverizer, capable of crushing samples to less than 60 mesh (Fen Corp., Wickliffe, Ohio, Model PA-M; or equivalent).

3. Mortar and pestle, cast iron (Cat. No. 12-976, Fisher Scientific Company; or equivalent).

4. Sieve, 0.25 mm openings (60 mesh).

5. Sieve, 6.35 mm (0.25 in) openings (optional).

6. Vials, plastic with snap caps, 148 cc (40 drams) capacity.

7. Container, plastic or waxed paper, 1 liter (32 oz) capacity.

3.1.2.5 Procedure (revised and updated from Smith et al., 1974)—

1. Spread sample evenly on a sheet of brown paper and allow to air dry. NOTE: Sample may have to be mixed periodically to speed drying.

2. After drying, the field sample is split into two representative subsamples. One subsample is placed in a container, labeled, and stored for physical analyses or individual preference tests.

3. The other subsample is crushed to 6.35 mm (0.25 in) or smaller with a Chipmunk crusher. If a crusher is not available, the material can be crushed using a hammer or mortar and pestle until it passes through a sieve with 6.35 mm openings. NOTE: This step may be omitted on most native soil samples.

4. Place sample in 1 liter container and cover. NOTE: Containers should not be more than two-thirds full or mixing (step 5) will be impaired.

5. Tumble container end-over-end until material is thoroughly mixed.

6. Place three heaping teaspoons of the mixed material in the pulverizer. Material is pulverized until it passes a 0.25 mm (60 mesh) sieve. NOTE: A cast iron mortar and pestle can be substituted for the pulverizer.

NOTE: Quantity indicated here is likely not enough for all requested analyses.

7. Place pulverized material in plastic vial for laboratory use.

8. Label vial with the sample identification shown on the field container.

9. Mix sample thoroughly by tumbling the vial end-over-end before subsampling for laboratory procedures (primarily chemical analyses).

3.1.3 Subsampling and Grinding Minesoil Samples

3.1.3.1 Principle—

See 3.1.2.1

3.1.3.2 Comments—

Samples should be air dried before processing begins. Samples should never be oven dried before processing.

Pulverizer should be cleaned after each sample to avoid contamination between samples.

3.1.3.3 Chemicals—

None required.

2. Place pH 4.0 and pH 7.0 standard buffers in two plastic cups (one buffer in each cup). NOTE: NEVER return used buffers to stock bottles.

3. Place electrode in the pH 7.0 buffer.

4. Adjust pH meter to read pH 7.0.

5. Remove electrode from buffer solution and wash with a jet of distilled water from a wash bottle.

6. Place electrode in the pH 4.0 buffer and check the pH reading. NOTE: If pH meter varies more than ± 0.1 pH units from 4.0, something is wrong with the pH meter, electrode, or buffers.

7. Weigh 10 g of less than 60 mesh material into a paper cup.

8. Add 5 ml of distilled water to sample. NOTE: Do not stir! Allow water to wet sample by capillary action without stirring. With most overburden and minesoils materials, the 2:1 (soil:water) ratio provides a satisfactory paste for pH measurements; however, for the very coarse textured and the very fine textured material, more material or water can be added to bring the soil near saturation. At near saturation conditions, water should not be puddled nor dry soil appear at the surface.

9. Stir sample with a spatula until a thin paste is formed adding more water or soil as required to keep soil at saturation point. NOTE: At saturation, the soil paste glistens as it reflects light and the mixture slides off the spatula easily. Wash the spatula with a jet of distilled water before stirring another sample.

10. Place electrode in paste and move carefully about to insure removal of water film around the electrode. CAUTION: Do not trap particles between electrode and inside surface of the sample container. Electrodes are easily scratched. Contact between paste and electrode should be gentle to avoid both impact and scratching damage, especially in sandy samples.

11. When reading remains constant, record pH and remove electrode from paste. Carefully wash electrode with distilled water to insure removal of all paste. If all pH measurements are completed, the electrode should be stored in a beaker of distilled water. NOTE: After every 10 samples, check meter calibration with standard buffers.

3.2.3 Neutralization Potential

3.2.3.1 Principles—

The amount of neutralizing bases, including carbonates, present in overburden materials is found by treating a sample with a known excess of standardized hydrochloric acid. The sample and acid are heated to insure that the reaction between the acid and the neutralizers goes to completion.

The calcium carbonate equivalent of the sample is obtained by determining the amount of unconsumed acid by titration with standardized sodium hydroxide (Jackson, 1958).

3.2.3.2 Comments—

A fizz rating of the neutralization potential is made for each sample to insure the addition of sufficient acid to react all the calcium carbonate present.

During digestion, do not boil samples. If boiling occurs, discard sample and rerun. Before titrating with acid, fill buret with acid and drain completely. Before titrating with base, fill buret with base and drain completely to assure that free titrant is being added to the sample.

3.2.3.3 Chemicals—

1. Carbon dioxide-free water: Heat distilled water just to boiling in a beaker. Allow to cool slightly and pour into a container equipped with ascarite tube. Cool to room temperature before using.

2. Hydrochloric acid (HCl) solution, 0.1 N, certified grade (Fisher So-A-54 or equivalent).

3. Sodium hydroxide (NaOH), approximately 0.5 N: Dissolve 20.0 g of NaOH pellets in carbon dioxide-free water and dilute to 1 liter. Protect from CO_2 in the air with ascarite tube. Standardize solution by placing 50 ml of certified 0.1 N HCl in a beaker and titrating with the prepared 0.5 N NaOH until a pH of 7.00 is obtained. Calculate the Normality of the NaOH using the following equation:

$$N_2 = (N_1V_1)/V_2, \text{ where:}$$

V_1 = Volume of HCl used.

N_1 = Normality of HCl used.

V_2 = Volume of NaOH used.

N_2 = Calculated Normality of NaOH.

4. Sodium hydroxide (NaOH) approximately 0.1 N: Dilute 200 ml of 0.5 N NaOH with carbon dioxide-free water to a volume of 1 liter. Protect from CO_2 in air with ascarite tube. Standardize solution by placing 20 ml of certified 0.1 N HCl in a beaker and titrating with the prepared 0.1 N NaOH until a pH of 7.00 is obtained. Calculate the Normality of the NaOH using the equation in 3.2.3.3 No. 3.

5. Hydrochloric acid (HCl), approximately 0.5 N: Dilute 42 ml of concentrated HCl to a volume of 1 liter with distilled water. Standardize solution by placing 20 ml of the known Normality NaOH prepared in 3.2.3.3 No. 3 in a beaker and titrating with the prepared HCl until a pH of 7.00 is obtained.

Calculate the Normality of the HCl using the following equation:

$$N_1 = (N_2V_2)/V_1, \text{ where:}$$

V_2 = Volume of NaOH used.

N_2 = Normality of NaOH used.

V_1 = Volume of HCl used.

N_1 = Calculated Normality of HCl.

6. Hydrochloric acid (HCl), approximately 0.1 N: Dilute 200 ml of 0.5 N HCl to a volume of 1 liter with distilled water. Standardize solution as in 3.2.3.3.5, but use 20 ml of the known Normality NaOH prepared in 3.2.3.3 No. 4.

7. Hydrochloric acid (HCl), 1 part acid to 3 parts water: Dilute 250 ml of concentrated HCl with 750 ml of distilled water.

3.2.3.4 Materials—

1. Flasks, Erlenmeyer, 250 ml.

2. Buret, 100 ml (one required for each acid and one for each base).

3. Hotplate, steam bath can be substituted.

4. pH meter (Corning Model 12 or equivalent) equipped with combination electrode.

5. Balance, can be read to 0.01 g.

3.2.3.5 Procedure (revised and updated from Smith et al., 1974)—

1. Place approximately 0.5 g of sample (less than 60 mesh) on a piece of aluminum foil.

2. Add one or two drops of 1:3 HCl to the sample. The presence of $CaCO_3$ is indicated by a bubbling or audible "fizz."

3. Rate the bubbling or "fizz" in step 2 as indicated in Table 1.

4. Weigh 2.00 g of sample (less than 60 mesh) into a 250 ml Erlenmeyer flask.

5. Carefully add HCl indicated by Table 1 into the flask containing sample.

6. Heat nearly to boiling, swirling flask every 5 minutes, until reaction is complete. NOTE: Reaction is complete when no gas evolution is visible and particles settle evenly over the bottom of the flask.

TABLE 1. VOLUME AND NORMALITY OF HYDROCHLORIC ACID USED FOR EACH FIZZ RATING

Fizz Rating	HCl (ml)	HCl (Normality)
None	20	0.1
Slight	40	0.1
Moderate	40	0.5
Strong	80	0.5

7. Add distilled water to make a total volume of 125 ml.

8. Boil contents of flask for one minute and cool to slightly above room temperature. Cover tightly and cool to room temperature. CAUTION: Do not place rubber stopper in hot flask as it may implode upon cooling.

9. Titrate using 0.1 N NaOH or 0.5 N NaOH (concentration exactly known), to pH 7.0 using an electrometric pH meter and buret. The concentration of NaOH used in the titration should correspond to the concentration of the HCl used in step 5. NOTE: Titrate with NaOH until a constant reading of pH 7.0 remains for at least 30 seconds.

10. If less than 3 ml of the NaOH is required to obtain a pH of 7.0, it is likely that the HCl added was not sufficient to neutralize all of the base present in the 2.00 g sample. A duplicate sample should be run using the next higher volume or concentration of acid as indicated in Table 1.

11. Run a blank for each volume or normality of acid using steps 5,7, 8, and 9.

3.2.3.6 Calculations—

1. Constant (C) = (ml acid in blank)/(ml base in blank).

2. ml acid consumed = (ml acid added) - (ml base added X C).

3. Tons $CaCO_3$ equivalent/thousand tons of material = (ml of acid consumed) X (25.0) X (N of acid).

TABLE 3. SOIL-SMP BUFFER pH AND CORRESPONDING LIME REQUIREMENT (L.R.) TO BRING MATERIAL TO pH 6.5*

pH	L.R. (Tons/1000 Tons)**	pH	L.R. (Tons/1000 Tons)**
6.9	0.3	5.8	8.1
6.8	1.0	5.7	8.9
6.7	1.8	5.6	9.6
6.6	2.4	5.5	10.4
6.5	3.1	5.4	11.1
6.4	3.9	5.3	11.7
6.3	4.6	5.2	12.5
6.2	5.3	5.1	13.2
6.1	6.1	5.0	14.0
6.0	6.0	4.9	14.7
5.9	5.9	4.8	15.5

*Adapted from Shoemaker, McLean, and Pratt, 1962.

**Agricultural ground limestone ENP at least 90%.

3.2.10.6 Calculations—

Determine lime requirement from Table 3.

3.2.11 Total Sulfur Estimation By Peroxide Oxidation

3.2.11.1 Principles—

Pyritic minerals begin to change into two new products when exposed to the atmosphere. The change may proceed slowly over a long period of time before the final products (yellowboy and sulfuric acid) are formed. The end product, "yellowboy," actually may form only when the sulfate is partially or completely neutralized by a basic substance. The chemical equation for this complete change in pyrite follows:

Pyrite + Oxygen + Water equals Yellowboy + Sufluric Acid

$$4FeS_2 + 15O_2 + 14H_2O = 4Fe(OH)_3 + 8H_2SO_4$$

Hydrogen peroxide greatly reduced the time needed for pyrite to oxidize to sulfuric acid and yellowboy.

3.2.11.2 Comments—

Alkaline materials interfere with the efficiency of hydrogen peroxide in oxidizing pyrite; therefore, overburden rock and minesoil samples containing carbonates need to be leached with acid and water as prescribed in steps 2 through 5 of the procedure.

When samples contain readily oxidizable organic matter, step 7 in the procedure may have to be repeated until the reaction stops.

The hydrogen peroxide used in this method must be 30% hydrogen peroxide. It must not contain stabilizers.

An important thing to remember is that this procedure works with fresh overburden and not with complex mixtures of minesoil material.

3.2.11.3 Chemicals—

1. Silver nitrate ($AgNO_3$), 10%: Dissolve 10.0 g of $AgNO_3$ with distilled water and make to a volume of 100 ml. Store in brown bottle away from light.

2. Hydrochloric acid (HCl), 2 parts acid to 3 parts water: Mix 400 ml of concentrated HCl with 600 ml of distilled water.

3. Hydrogen peroxide (H_2O_2), 30% (Fisher certified No. H-325 or equivalent).

4. Sodium hydroxide (NaOH), 1.0 N: Dissolve 40.0 g of NaOH pellets in carbon dioxide-free water (see 3.2.3.3. No. 1) and make to a volume of 1 liter. Protect from CO_2 in air with ascarite tube.

5. Sodium hydroxide (NaOH), 0.1 N: Dilute 10 ml of 1.0 N NaOH to a volume of 1 liter with carbon dioxide-free water (see 3.2.3.3. No. 1). Standardize solution (see 3.2.3.3. No. 4). Protect from CO_2 in air with ascarite tube.

3.2.11.4 Materials—

1. Sample, ground to pass a 60 mesh sieve.

2. Funnels.

3. Hotplate. NOTE: Bunsen burner may be substituted.

4. Thermometer, °C.

5. Beakers, 300 ml tall form.

6. Graduated cylinder, 25 ml.

7. Glass fiber filter (Reeve Angel 934AH or equivalent).

8. Burets, 50 ml capacity.

9. Balance, can be read to 0.01 g.

10. pH Meter (Corning Model 12 or equivalent) with combination electrode.

3.2.11.5 Procedure (modified and updated from Smith et al., 1974)--

1. Weigh 2.00 grams of less than 60 mesh sample.

NOTE: If the sample contains no carbonates and no sulfates, and the paste pH is less than 5.5, then steps 2 through 5 can be eliminated and procedure can be continued at step 6.

2. Place sample into a funnel fitted with filter paper and leach with 200 ml of 2:3 HCl in funnel-full increments.

3. Leach sample with distilled water (in funnel-full increments) until effluent is free from chloride as detected by 10% silver nitrate. Note: Add three drops of silver nitrate. If a white precipitate forms, chlorides are present.

4. Air dry filter and sample overnight, or place in 50°C forced air oven until dry.

5. Carefully scrape dried sample from filter surface and mix sample.

6. Place sample in a 300 ml tall form beaker.

7. Add 24 ml of 30% H_2O_2 and heat beaker on hotplate until solution is approximately 40°C. Remove beaker from hotplate and allow reaction to go to completion as shown when bubbling ceases. NOTE: Three blanks for each batch of samples should be handled in the same manner. CAUTION: Initial reaction may be quite turbulent when samples contain more than 0.1% sulfur.

8. Add an additional 12 ml of H_2O_2 (30%) to beaker and allow reaction to go to completion as shown when bubbling ceases..

9. Place beaker on hotplate and heat to approximately 90 to 95°C, solution temperature, until any unreacted H_2O_2 left in beaker is destroyed as shown when bubbling ceases. Do not allow to go to dryness.

10. Wash down the sides of the beaker with distilled water and make the volume of the solution to approximately 100 ml.

11. Place beaker on the hotplate and heat the solution to boiling to drive off any dissolved CO_2, then cool the solution to room temperature.

12. Titrate the solution with 0.0100 N NaOH, that is free to CO_2 and protected from the atmosphere, to pH 7.0 using a pH meter.

3.2.11.6 Calculations—

1. meq H^+/100 g = (ml of NaOH) X (N of NaOH) X (100g/weight of sample).

2. % S = 0.0185 (meq H^+/100g) - 0.0806. (Grube, et al., 1973).

3. To convert percent sulfur (% S) to maximum $CaCO_3$ equivalents: Multiply %S by 31.25 to get tons $CaCO_3$ equivalent/1000 tons of material.

3.2.12 Double Acid Extractable Phosphorus, Potassium, Calcium, and Magnesium

3.2.12.1 Principle—

The method is a modified North Carolina Double Acid Method first published by Mehlich (1953) and then by Nelson, Mehlich and Winters (1953). Phosphorus, potassium, calcium, and magnesium are extracted from the sample using a solution containing dilute hydrochloric and sulfuric acid. Phosphorus concentration in the extract is determined using a colorimeter and calibration curve. The concentrations of potassium, calcium, and magnesium in the extract are determined using an atomic absorption spectrophotometer and calibration curve. The concentrations of each element can then be converted into pounds/1000 tons by calculations.

3.2.12.2 Comments—

With some soils a light to dark yellow color may develop in the extract. Decolorization is accomplished by the addition of activated charcoal in the extraction procedure. Lanthanum is added as a compensating element to remove phosphate and sulfate interference in the atomic absorption spectrophotometer methods for calcium and magnesium.

After the initial extraction, individual elements can be determined if data for all four elements are not required. Samples with elements higher in concentration than given in the calibration curves must be diluted and the resulting reading multiplied by the dilution factor.

3.2.12.3 Chemicals—

1. Hydrochloric acid (HCl), concentrated.

2. Sulfuric acid (H_2SO_4), concentrated.

3. Extracting solution: To make 0.05 N HCl and 0.025 N H_2SO_4, measure about 10 liters deionized water into an 18 liter pyrex bottle. Add 12 ml H_2SO_4 (96%) and 73 ml HCl (37%). Make to 18 liters with distilled water and mix thoroughly by shaking. Allow 12 hours to come to equilibrium.

3.4.2.6 Calculations—

1. % sand = (Weight of sand fraction/Weight of oven-dry, organic-free total sample) X 100.

2. Constant (K) = 1000/Volume of pipette.

3. D = 100/Weight oven-dry, organic-free total sample.

4. % Clay = (A - B) KD, where:

A = Weight in grams of the less than 2 micron fraction plus dispersing agent.

B = Weight in grams of dispersing agent correction.

5. % (20 to 2 micron) = [(A - B)KD] - (% clay), where:

A = Weight in grams of the less than 20 micron fraction plus dispersing agent.

B = Weight in grams of dispersing agent correction.

6. % (50 to 20 micron) = 100 - [% sand + % clay + % (20 to 2 micron)].

7. % silt = (% 20 to 2 micron) + (% 50 to 20 micron).

3.4.3 Particle Size Analysis (Hydrometer Method)

3.4.3.1 Principle—

This method depends on the rate at which soil particles settle from a water suspension. The soil particles are put into suspension by mechanical stirring with the aid of a dispersing agent. Sodium metaphosphate solution is used to disperse the soil and avoid flocculation of the clays. Sodium replaces exchangeable calcium and the precipitation of the calcium, in the form of calcium phosphate, prevents its recombination with the clays. The net negative charge on the clay particles increases due to the addition of sodium ions, causing the particles to repel each other and disperse. Since large particles settle faster than the same kind of small particles as stated by Stokes' Law, the concentration of soil particles in suspension at a given time is dependent upon the size of the particles.

3.4.3.2 Comments—

Temperature is important in the sedimentation procedure since the density and viscosity of water change with temperature. As the temperature increases, the time required for particles to settle out of suspension decreases. The hydrometer is usually calibrated for 19.4 or 20°C (67 or 68°F). For each °F above the hydrometer calibration temperature, add 0.2 g to the reading. Subtract 0.2 g from the hydrometer reading for each °F below the calibration temperature. Although the correction factor for

temperature can be used, it is best to carry out the procedure in a constant temperature room or maintain the sedimentation cylinders in a constant temperature bath.

The material is mixed using a reciprocating shaker; however, a soil dispersion mixer with baffled cup (similar to a drink mixer) can be used as an alternate method if a reciprocating shaker is not available. With this apparatus, a weighed sample is placed in the baffled cup with distilled water and dispersing agent. The cup is placed on the mixer and stirred for a maximum of 5 minutes. Many minesoil samples can usually be mixed in 3 minutes.

3.4.3.3 Chemicals—

1. Dispersing agent: Dissolve 35.7 g sodium metaphosphate ($Na(PO_3)_6$) (Fisher Scientific Co. No. S-333 or equivalent) and 7.94 g sodium carbonate (Na_2CO_3) in distilled water and dilute to a volume of 1 liter. The Na_2CO_3 is used as an alkaline buffer to prevent the hydrolysis of the metaphosphate back to orthophosphate which occurs in acidic solutions. NOTE: Instant Calgon available from Calgon Corp., Pittsburgh, Pa. can be substituted.

2. Distilled water.

3.4.3.4 Materials—

1. Bottles, French square, 1 liter (32 oz) with caps.

2. Shaker, horizontal reciprocating type, 6.3 cm (2.5 in) stroke, 120 strokes per minute.

3. Glass sedimentation cylinder with markings at the 1130 ml and 1205 ml levels (Bouyoucos cylinder).

4. Standard hydrometer (ASTM 152 H, with Bouyoucos scale in grams per liter).

5. Balance, can be read to 0.1 g.

6. Plunger. NOTE: This can be made using 3 mm (0.125 in) diameter wire. At one end make a circle 5.5 cm (2.125 in) in diameter. The wire should be manipulated so the handle extends at a right angle from the center of the circle for 56 cm (22 in). Stretched rubber bands bisecting the wire circle are spaced around the circumference until it is largely covered by rubber bands overlapping at the center.

7. Thermometer, 0-100°F.

3.4.3.5 Procedure (Modified from Bouyoucos, 1951)—

1. Weigh 50 g (oven-dried at 105°C overnight) of a fine textured or 100 g of coarse textured (90-100% sand) soil and place in a shaker bottle.

2. Add 125 ml of dispersing agent and 400 ml of distilled water to shaker bottle.

3. Cap bottle snugly and place horizontally on a reciprocating shaker for 16 hours at 120 strokes per minute.

4. Remove bottle and bring suspension to room temperature.

5. Wash all contents of shaker bottle into a sedimentation cylinder.

6. Set cylinder in a place away from vibrations.

7. Place hydrometer in suspension.

8. Fill to lower mark (1130 ml) with distilled water for a 50 g sample. Fill to upper mark (1205 ml) for a 100 g sample.

9. Remove hydrometer. Take plunger in one hand holding the cylinder with the other. Strongly move plunger up and down being careful not to spill contents of cylinder.

10. After all sediment is off cylinder bottom, carefully remove plunger and record time immediately. NOTE: Add a drop of amyl alcohol if the surface is covered with foam and restir the suspension if necessary.

11. Record hydrometer reading at meniscus top at the end of 40 seconds. NOTE: About 10 seconds before taking reading, carefully insert hydrometer and steady by hand.

12. Remove hydrometer from suspension. CAUTION: Do not leave hydrometer in suspension longer than 20 seconds as particles will settle out on its shoulders.

13. Measure and record suspension temperature. For each °F above the calibrated temperature of the hydrometer add 0.2 g to the reading. For each °F below the calibrated temperature subtract 0.2 g.

14. Record corrected hydrometer reading.

15. With the plunger, restir suspension. Take a reading at the end of two hours. Correct hydrometer reading (see step 13) and record corrected hydrometer reading.

16. Make 3 blanks by placing 125 ml of dispersing agent in 3 sedimentation cylinders. NOTE: Blanks should be run for each new batch of dispersing agent.

17. Fill cylinders two-thirds full with distilled water. Insert hydrometer and fill cylinder to the lower mark (1130 ml) with distilled water.

18. Take hydrometer reading and temperature of suspension. Correct hydrometer reading using step 13.

3.4.3.6 Calculations--

1. Dispersing agent correction factor = Sum total of temperature corrected hydrometer readings of blanks/3.

2. Weight corrected 2 hour reading = (Temperature corrected 2 hour hydrometer reading) - (Dispersing agent correction factor).

3. Weight corrected 40 second reading = (Temp. corrected 40 second hydrometer reading) - (Dispersing agent correction factor).

4. % Clay = (Weight corrected 2 hour reading/oven-dry weight of total sample) X 100.

5. % Silt = [(Weight corrected 40 second reading - Weight corrected 2 hour reading)/oven-dry weight of total sample] X 100.

6. % Sand = 100 - (% clay + % silt).

3.4.4 Bulk Density (Core Method)

3.4.4.1 Principles--

The soil bulk density determination is based on two measurements, a mass measurement and a volume measurement. The mass is measured by oven drying the sample at 105°C until a constant weight is obtained. The bulk volume measurement includes the space between the soil particles as well as the space occupied by the soil particles. Bulk density, the ratio of sample mass to sample volume, is expressed as grams per cubic centimeter (Blake, 1965).

3.4.4.2 Comments--

This method may be difficult or impractical in soil containing many rock fragments.

A flat soil surface is prepared at the desired depth and the core sampler is driven into the soil. If driven with a heavy hammer, the head of the tool must be protected with a tough wooden plank or block. Care must be taken to see that no compaction takes place so that a known volume of soil is obtained. The sample is transferred to the laboratory and weighed while still moist. The sample is then dried in an oven and weighed again. This sample must be immediately placed in a desiccator after removing from the oven as the dry sample will absorb moisture from the atmosphere (Baver, 1956, p. 180-182).

3.4.4.3 Chemicals--

None required.

3.4.4.4 Materials--

1. Double-cylinder core sampler with steel cutting edge, driving head,

mple collection and chemical analy-
changes with time and characteriz-
or the latter, use of EM and four-
ith supplemental use of the other
obtaining aqueous extracts of soil

ethods for determining soluble salts
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TRACT AND OTHER XTRACTS

inciples

position of solutes in soil water at
ever, present methods of obtaining
ontents are not practical for routine
often must be made at higher than
solute and relative amounts of vari-
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st be standardized to obtain results
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xtracts of saturated soil pastes (U.S.
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ough extract for analysis can be
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ten related to the electrical conduc-
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tion exchange, and mineral dissolu-
ts. As a compromise, Sonnevelt and
1:2 volume extract. When relative
oncentrations are monitored, these
dvantage.
ained, laboratory chemical analyses
ical conductivity of the extract (σ_e)
(section 10-3).

leagent

$)_3)_6$] solutions, 0.1%: Dissolve 0.1 g
solution to 100 ml.

10-2.3 Procedure

10-2.3.1 SATURATION EXTRACT

Weigh 200 to 400 g of air-dry soil of known water content into a plastic container having a snaptight lid. Weigh the container plus contents. Add distilled water to the soil with stirring until it is nearly saturated. Allow the mixture to stand covered for several hours to permit the soil to imbibe the water, and then add more water to achieve a uniformly saturated soil-water paste. At this point, which is generally reproducible to within ± 5%, the soil paste glistens as it reflects light, flows slightly when the container is tipped, slides freely and cleanly off a spatula, and consolidates easily by tapping or jarring the container after a trench is formed in the paste with the side of the spatula. After mixing, allow the sample to stand (preferably overnight, but at least 4 hours), and then recheck the criteria for saturation. Free water should not collect on the soil surface, nor should the paste stiffen markedly or lose its glisten. If the paste is too wet, add additional dry soil to the paste mixture. Upon attainment of saturation, reweigh the container plus contents. Record the increase in weight, which is the amount of water added. Calculate the saturation water percentage from the weight of oven-dry soil and the sum of the weights of water added and that initially present in the air-dry sample. After allowing the saturated soil paste to stand 4 or more hours, transfer it to a Büchner or Richards (1949) filter funnel fitted with highly retentive filter paper. Apply vacuum, and collect the filtrate in a test tube or bottle. If the initial filtrate is turbid, refilter or discard it. Terminate the filtration when air begins to pass through the filter. Add 1 drop of 0.1% $(NaPO_3)_6$ solution for each 25 ml of extract.

10-2.3.2 EXTRACTS AT SOIL/WATER RATIOS OF 1:1 AND 1:5

Use 1:5 Ratio

Weigh a sample of air-dry soil of appropriate size, and transfer it to a flask or bottle. Add the required amount of distilled water, stopper the container, and shake it in a mechanical shaker for 1 hour. If a mechanical shaker is not available, shake the container vigorously by hand for 1 min at least 4 times at 30-min intervals. Filter the suspension using highly retentive filter paper. (Discard or refilter the initial filtrate if it is turbid.) Add 0.1% $(NaPO_3)_6$ solution at the rate of 1 drop/25 ml of extract.

10-2.4 Comments

The weight of soil required will depend on the number and kind of determinations to be made on the extract, the analytical methods employed, and the salt content of the soil. In general, from one fourth to one third of the water in saturated soil pastes can be removed by vacuum filtration.

Soil samples should not be oven-dried before extracting for determination of soluble salts, because heating to 105°C converts at least a part of the gypsum ($CaSO_4 \cdot 2H_2O$) to plaster of paris ($CaSO_4 \cdot 1/2H_2O$). The latter hydrate has a higher solubility in water than does the former.

In determinations of extract water contents when a low ratio of soil to water is used, it is desirable to correct for the water content of the air-dry soil. For example, an air-dry sample containing 2% water on an oven-dry basis can be adjusted to a soil/water ratio of 1:1 by adding 98 ml of water to 102 g of air-dry soil. At soil/water ratios of 1:5 or greater, no correction is ordinarily made for water in the air-dry sample.

Special precautions should be taken in preparing a saturated soil paste with peat and muck soils or very fine or very coarse-textured soils. If possible, peat and muck soils should not be allowed to dry following collection because their saturation water content changes. Peat and muck, especially if coarse or woody, require an overnight imbibition period to obtain a definite endpoint for the saturation point. After the first wetting, pastes of these soils usually stiffen upon standing. Adding water and remixing then give a mixture that usually retains the characteristics of a saturated paste. With fine-textured soils, enough water should be added immediately, with a minimum of mixing, to bring the sample nearly to saturation. This minimizes the formation of clumps of soil during stirring, speeds the mixing process, and helps attain a more definite endpoint. Care should also be taken not to overwet coarse-textured soils. The presence of free water on the surface of the paste after standing is a very important indication of oversaturation in the case of coarse-textured soils. Even small amounts of free water can lead to appreciable errors in saturation paste water contents for these materials.

Sodium hexametaphosphate is added to the extract to prevent the precipitation of $CaCO_3$ from the extract upon standing. The quantity of $(NaPO_3)_6$ solution added increases the Na concentration ~0.5 ppm, or 0.02 meq/liter, which is inconsequential compared with the possible loss of $CaCO_3$. Alternatively, a subsample of the extract could be immediately diluted twofold and used for the Ca and alkalinity determinations.

Alternative methods of preparing the saturated soil paste have been described by Longenecker and Lyerly (1964), who proposed wetting the soil sample on a capillary saturation table, Beatty and Loveday (1974) and Loveday (1972), who recommended predetermining the amount of water at saturation on a separate soil sample using a capillary wetting technique, and Allison (1973), who recommended slowly adding soil to water (oversaturation method). Similar results are obtained with these methods. The choice of method is primarily one of personal preference.

Thymol can be added to the paste to minimize the effect of microbial activity on saturation extract composition during equilibration (Carlson et al., 1971).

The extracts should be stored at ~4°C until analyzed.

10-3 SOLUBLE CONSTITUENTS IN SOIL WATERS AND AQUEOUS EXTRACTS

The major solutes of interest found in soil waters and aqueous extracts of salt-affected soils are Ca^{2+}, Mg^{2+}, Na^+, K^+, CO_3^{2-}, HCO_3^-, SO_4^{2-}, Cl^-, NO_3^-, and H_3BO_3. There are many satisfactory analytical methods for de-

ontents when a low ratio of soil to
r the water content of the air-dry
taining 2% water on an oven-dry
of 1:1 by adding 98 ml of water to
of 1:5 or greater, no correction is
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5 IN SOIL WATERS AND TRACTS

n soil waters and aqueous extracts
, K^+, CO_3^{2-}, HCO_3^-, SO_4^{2-}, Cl^-,
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termining these solutes. These methods range from wholly automated to manual. The choice of which to use is usually determined by the number of samples being processed and the availability of analysts, automated equipment, or both. The methods described here are those in common use in laboratories having typical modern but not fully automated instrumentation. Methodology more suited to laboratories without such conveniences was given previously by Bower and Wilcox (1965).

10-3.1 Sequence of Analyses

Alkalinity and pH determinations should be made immediately on fresh extracts or on the solutions treated with hexametaphosphate. Next, electrical conductivity, σ, should be determined; it is a useful means of estimating total salt concentration (meq/liter $\cong 10\ \sigma$, in deci-Siemens per meter, dS/m). The cations can be determined in any sequence. After any three of the four major cations have been determined, the appropriate aliquot for the remaining cation can be estimated by deducting the sum of the three concentrations, in milliequivalents per liter, from 10 σ, in deci-Siemens per meter. Among the anions, NO_3^- and Cl^- determinations are normally made after alkalinity since they are simpler to measure than SO_4^{2-}. After that, SO_4^{2-} is determined; the appropriate aliquot is estimated from the difference between (Ca^{2+} + Mg^{2+} + Na^+ + K^+) and (alkalinity + NO_3^- + Cl^-). Finally, B is determined. Concentration of this solute is negligible compared with that of the major cations and anions, but it is still extremely important because of its pronounced toxicity even in small concentrations to many plants.

10-3.2 pH and Alkalinity

10-3.2.1 APPARATUS

1. Automatic potentiometric titrator.
2. Single probe combination pH electrode.

10-3.2.2 REAGENTS

1. Standard buffer solutions, pH 4.00 and 7.00.
2. Standard hydrochloric acid (HCl), approximately 0.0200*N*.

10-3.2.3 PROCEDURE

With electrode immersed in standard pH buffer, set the potentiometer to the pH (7.00) of the first buffer solution. Rinse electrode, and repeat calibration using the second pH buffer. Rinse electrode, immerse in 1 to 20 ml of sample solution (contained in a 50-ml plastic beaker along with a microsize, Teflon-coated magnetic stirring bar), and initiate the automatic titration operation using the full titration curve display mode. The initial potential recorded on the strip chart gives the sample pH. The volumes of titrant delivered to produce inflection points for CO_3^{2-} and HCO_3^- are ob-

tained from the titration curve (pH vs. volume of standard acid delivered from automatic burette).

10-3.2.4 CALCULATIONS

$$CO_3^{2-} \text{ in meq/liter} = 2PN\,1{,}000/\text{aliq}$$

where P is the number of milliliters of standard HCl of normality N to reach the CO_3^{2-} inflection point (pH = 8.3), and aliquot is the sample volume in milliliters.

$$HCO_3^- \text{ in meq/liter} = (T - 2P)N\,1{,}000/\text{aliquot}$$

where T is the total number of milliliters of standard HCl of normality N to reach the HCO_3^- inflection point (pH = 4.5), P is the number of milliliters of standard HCl required to reach the CO_3^{2-} inflection point, and aliquot is the sample volume in milliliters. The blank is determined using CO_3^{2-} free distilled water.

10-3.3 Electrical Conductivity

For this determination, use a direct readout from a temperature compensating conductivity meter.

10-3.3.1 APPARATUS

1. Conductivity meter.
2. Conductivity flow cell with automatic temperature compensation.
3. Vacuum line and suction flask.

10-3.3.2 REAGENT

1. Standard potassium chloride (KCl) solutions, 0.010 and 0.100N: For 0.010N solution (1.412 dS/m at 25°C) dissolve 0.7456 g of KCl in distilled water, and add water to make 1 liter at 25°C. For 0.100N solution (12.900 dS/m at 25°C), use 7.456 g of KCl.

10-3.3.3 PROCEDURE

Rinse and fill the conductivity cell with standard KCl solution. Adjust the conductivity meter to read the standard conductivity. Rinse and fill the cell with the soil extract or water sample, and read the σ, corrected to 25°C, directly from the digital display.

10-3.3.4 COMMENTS

Because of marked differences in the equivalent weights, equivalent conductivities, and proportions of major solutes in soil extracts and water samples, the relationships between σ and salt concentration or between σ

and osmotic pressure are only approximate. They are still quite useful, however. These relationships are:

1) Total cation (or anion concentration), meq/liter ≅ 10 × σ, in dS/m.
2) Salt concentration, mg/liter ≅ 640 × σ, in dS/m.
3) Osmotic pressure, bars at 25°C ≅ 0.39 × σ, in dS/m.

10-3.4 Soluble Cations

Determine Ca^{2+}, Mg^{2+}, Na^{+}, and K^{+} using an atomic absorption spectrometer or by methods outlined in sections 13-3.3.2 and 13-3.3.4 for K, 13-4.3.3 and 13-4.3.5 for Na, and 14-3.1 for Ca and Mg. If large numbers of samples are to be routinely analyzed, it is extremely helpful to have this unit equipped for automatic sample transport, sequencing, siphoning, reading, and recording.

10-3.4.1 APPARATUS

1. Atomic absorption spectrometer.
2. Sampling and sequencing system.
3. Acetylene gas (C_2H_2), commercial grade.

10-3.4.2 REAGENTS

1. Suppressant solution for Ca^{2+} and Mg^{2+}: Add 29.0 g of lanthanum oxide (La_2O_3), 250 ml of conc hydrochloric acid (HCl), and enough distilled water to make up to 500-ml volume. Add sufficient to aliquot and diluent (distilled water) to give 10% (by volume) of this $LaCl_3$ solution in the final solution.
2. Suppressant solution for Na^{+} and K^{+}: Add 6.358 g of lithium chloride (LiCl) and make to 1 liter in distilled water (0.15*N*). Add enough to aliquot, and diluent (distilled water) to give 10% (by volume) of this LiCl solution in the final solution.
3. Standard cation solutions: Ca^{2+} (0–0.4 meq/liter), Mg^{2+} (0–0.1 meq/liter), Na^{+} (0–1.0 meq/liter), and K^{+} (0–0.1 meq/liter).

10-3.4.3 PROCEDURE

Adjust the atomic absorption spectrometer controls and settings for the cation to be run as recommended by the manufacturer. Set the atomic absorption spectrometer readout to read the upper and lower standard solutions. Then initiate transport/readout system, which automatically positions a sequence of samples, siphons and aspirates the samples in the air-acetylene flame, and reads and records (as a digital printout) the concentration of the cation in the aspirated solution. Standard solutions are inserted into the sampling rack every 20 samples to ensure stability of instrument calibration during the automated run. Two-hundred samples can be processed per hour without attendance after the automatic sample processing system is initiated. Alternatively, the same sequence of operations can be performed by hand.

For Feb., 1986

CDM

environmental engineers, scientists,
planners, & management consultants

CAMP DRESSER & McKEE INC.

Riverpoint
2300 15th Street, Suite 400
Denver, Colorado 80202
303 458 1311

MEMORANDUM

TO: Keith Schwab, Region 8 RSCC

FROM: Richard Cheatham, CCJA/CDM

DATE: January 30, 1986

PROJECT: EPA Contract No. 68-01-6939

DOCUMENT NO.: 202-RI1-EP-CEAP-1

Enclosed is the Revised SAS Request Form for Quarterly Sampling program for the Clear Creek/Central City RI/FS.

RMAL 5530 Marshall St, Arvada.
Kathy Hutchinson
421-6611

THIRD SAMPLING SESSION SAS

February 1986

U.S. ENVIRONMENTAL PROTECTION AGENCY
CLP Sample Management Office
P.O. Box 818, Alexandria, Virginia 22313
Phone: 703/557-2490 FTS/557-2490

SAS Number

SPECIAL ANALYTICAL SERVICES
Client Request

☐ Regional Transmittal ☐ Telephone Request

A. EPA Region/Client: Reg. VIII/CDM

B. RSCC Representative: Keith Schwab

C. Telephone Number: (303) 293-1710

D. Date of Request: January 8, 1986

E. Site Name: Clear Creek/Central City

Please provide below description of your request for Special Analytical Services under the Contract Laboratory Program. In order to most efficiently obtain laboratory capability for your request, please address the following considerations, if applicable. Incomplete or erroneous information may result in a delay in the processing of your request. Please continue response on additional sheets, or attach supplementary information as needed.

1. General description of analytical service requested: Inorganic RAS for Metals (No Cyanide) on all waters and all solid samples plus SAS on selected water samples (see attached Tables 1, 2, and 3 for specifics).

2. Definition and number of work units involved (specify whether whole samples or fractions; whether organics or inorganics; whether aqueous or soil and sediments; and whether low, medium or high concentration):

Sample Set A. 15 low ground water (See Table 1) (RAS + SAS)

Sample Set B. /5 low surface water (See Table 1) (RAS + SAS)

Sample Set C. 10 low ground waters (See Table 1) RAS only

Sample Set D. 25 low surface waters (See Table 1) RAS only

Sample Set E. 32 low solids (See Table 1) RAS only

Sample Set F. 70 low waters (See Table 1) RAS only

Sample Set G. 30 low waters (See Table 1) SAS only

3. Purpose of analysis (specify whether Superfund (enforcement or remedial action), RCRA, NPDES, etc.): Superfund-remedial action

4. Estimated date(s) of collection: Feb. 5-7 and Feb. 10-18 for water samples, Feb. 20-21 for solids.

5. Estimated date(s) and method of shipment: Set A. Feb. 10-11 (4 per day); Set B. Feb. 6-7 (5 per day); Set C. Feb. 12-13 (7 per day); Set D. Feb. 14, 17, 18 (10 per day); Set E. Feb. 20-21 (16 per day); Set F. Feb 24-26 (20 per day); Set G. Feb. 6, 7, 10, 11 (7 per day)

6. Number of days analysis and data required after laboratory receipt of samples: Consistent with normal CLP reporting schedule.

7. Analytical protocol required (attach copy if other than a protocol currently used in this program): See Table 2.

8. Special technical instruction (if outside protocol requirements, specify compound names, CAS numbers, detection limits, etc.):

Detection limit requirements are shown in Table 3.

9. Analytical results required (if known, specify format for data sheets, QA/QC reports, Chain-of-Custody documentation, etc.) If not completed, format of results will be left to program discretion. Normal CLP format and requirements as indicated on attached pages 4-7. A summary of SAS results for each sample and a QA/QC summary report are requested. All raw data for SAS analyses must be submitted with analyses results.

10. Other (use additional sheets or attach supplementary information, as needed): All spiking of water samples is to be t 10x normal CLP spike levels for Fe, Mn and Zn. When additional volume of a water sample is provided (i.e., 3 times usual amount) that sample is to be used for laboratory QC, e.g. Duplicates and Matrix Spikes. This applies to the RAS as well as the SAS parameters.

11. Name of sampling/shipping contact: Roger Olsen/Richard Cheatham

Phone: (303) 458-1311

12. Data Requirements

Parameter	Detection Limit	± Precision Desired (-% or Concentration)
See attached Tables.		

13. QC Requirements

Audits Required	Frequency of Audits	Limits (Percent or Concentration)
See attached Tables.		

Note All samples must be analyzed concurrently with QC samples. All QC data must be reported.

14. Action Required if Limits are Exceeded

Actions required when indicated analytical QC limits for SAS requested parameters are not met are consistent with the normal CLP Protocols. All samples not meeting required method performance criteria (i.e., having unacceptable associated QC data) must be re-analyzed. Documentation must be submitted for all factors affecting analytical performance.

Please return this request to the Sample Management Office as soon as possible to expedite processing of your request for special analytical services. Should you have any questions or need any assistance, please contact your Regional representative at the Sample Management Office.

TABLE 1

SAMPLE SETS

Set A: 15 low ground water samples:

All RAS metals plus all SAS parameters shown in Table 2. RAS metals + Si will be analyzed from the field filtered, HNO_3-preserved sample portion only. This is a total of 15 analyses of each metal for this sample set.

Set B: 15 low surface water samples:

All RAS metals plus all SAS parameters shown in Table 2. RAS metals + Si will be analyzed two times for each sample: once from the field-filtered, HNO_3-preserved sample portion and once from the non-filtered, HNO_3-preserved sample portion. This is a total of 30 analyses of each RAS metal + Si for this sample set.

Set C: 10 low ground water samples:

All RAS metals only. Metals will be analyzed from the field-filtered, HNO_3-preserved sample portion only.

Set D: 25 low surface water samples:

All RAS metals only. Metals will be analyzed two times for each sample: once from the field-filtered, HNO_3-preserved sample portion and once from the non-filtered HNO_3-preserved sample portion. This is a total of 50 analyses of each RAS metal for this sample set.

Set E: 32 low solids:

All RAS metals only.

Set F: 70 low waters:

All RAS metals only.

Set G: 30 low water samples.

Analyses for Arsenic only (SAS)

Summary of Total Number of Analyses of Each Type

SAS-Waters only; All parameters except Si: (15x1)+(15x1)=30 analyses
ST: (15x1)+(15x2)=45 analyses
As (only, Set G): (30x1) =30 analyses

RAS; Metals (waters): (15x1)+(15x2)+(10x1)+(25x2)+(70x1)=175 analyses
Metals (solids): (32x1)=32 analyses

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TABLE 2

ANALYTICAL REQUIREMENTS
SAS Requests

Constituent	Water/Solids		
	Method	Reference	Type of CLP Service
Si	370.1 (or 200.7)	a	SAS
Cr (VI)	312B	c	SAS
Sulfate	375.3	a	SAS
Sulfide	376.1 or 376.2	a	SAS
Nitrite[1]	353.3	a	SAS
Nitrate/Nitrite[1]	353.3	a	SAS
Ammonia	350.1	a	SAS
Chloride	325.1	a	SAS
Fluoride	340.2	a	SAS
Bicarbonate	403	c	SAS
Carbonate	403	c	SAS
Acidity	305.1	a	SAS
TSS	160.2	a	SAS
TDS	160.1	a	SAS
pH	150.1	a	SAS
Specific Conductance	120.1	a	SAS
As	CLP (RAS)	b	SAS

[a] Methods from U.S. EPA, Methods for Chemical Analysis of Water and Wastes, EPA-6/4-79-020, 1983.

[b] CLP - Indicated procedures defined under Routine Analytical Services of the Contract Laboratory Program, Document CLP/IFB #0A84J092, 7/1984.

[c] APHA - AWWA - WPCF, 1980, Standard Methods for Examination of Water and Wastewater, 15th Edition.

Note: [1]These are reported as nitrite originally present and total nitrate/nitrite.

TABLE 3

SUMMARY OF PARAMETER MEASUREMENT OBJECTIVES
For SAS Requests

Parameter	Matrix	Det. Limit (ug/L)	Spike Recovery[3] Control Limits (% R)	Duplicate[1]&[3] Control Limits RPD (%)	Laboratory Check Sample (% R)	EPA QC Check Sample (% R)	QA Sample Frequency
Zn[2]	Water	20	75-125	±20	80-120	90-110	1/20
Mn[2]	Water	15	75-125	±20	80-120	90-110	1/20
Fe[2]	Water	100	75-125	±20	80-120	90-110	1/20
Si	Water	30	75-125	±20	80-120	90-110	1/20
Cr(VI)	Water	5	75-125	±20	80-120	90-110	1/20
As	Water	10	75-125	±20	80-120	90-110	1/20
Bicarbonate	Water	5	75-125	±20	80-120	90-110	1/20
Carbonate	Water	5	75-125	±20	80-120	90-110	1/20
Sulfate	Water	5	75-125	±20	80-120	90-110	1/20
Sulfide	Water	100	75-125	±20	80-120	90-110	1/20
Nitrite	Water	10	75-125	±20	80-120	90-110	1/20
Nitrate/Nitrite	Water	10	75-125	±20	80-120	90-110	1/20
Ammonia	Water	10	75-125	±20	80-120	90-110	1/20
Chloride	Water	3	75-125	±20	80-120	90-110	1/20
Fluoride	Water	0.1	75-125	±20	80-120	90-110	1/20
Acidity	Water	5	N/A	±20	80-120	90-110	1/20
TSS	Water	2	75-125	±20	80-120	90-110	1/20
TDS	Water	10	75-125	±20	80-120	90-110	1/20
pH	Water	N/A	N/A	±20	N/A	90-110	1/20
Specific Conductance	Water	1 umhos/cm	75-125	±20	N/A	90-110	1/20

(1) ± 20% of concentration for water and ±35% of concentration for solids if > 5x the Method Detection Limits or ± MDL if concentration is < 5x the Method Detection Limit.

(2) Spiking is required at 10x the normal CLP spike amount for Fe, Mn and Zn.

(3) All other requirements are consistent with CLP inorganic protocols for these three analytes.
When additional volume of a water sample is provided (3 times usual amount) that sample is to be used for laboratory QC, ie. Duplicates and Matrix Spikes. This applies to the RAS as well as the SAS parameters.

FOURTH SAMPLING SESSION SAS

May-June 1986

MEMORANDUM

TO: Keith Schwab, EPA Region 8 RSCC

FROM: Richard Cheatham, CCJA/CDM/Denver

DATE: April 28, 1986

PROJECT: EPA Contract No. 68-01-6939, Site #202

DOCUMENT NO.: 202-RI1-EP-CNHT-1

SUBJECT: Clear Creek/Central City RI/FS SAS Request

ACTION: Review and Forward to SMO

Enclosed is the SAS Client Request Form for the Clear Creek/Central City Colorado Superfund site, sampling campaign for May, 1986.

U.S. ENVIRONMENTAL PROTECTION AGENCY
CLP Sample Management Office
P.O. Box 818 - Alexandria, Virginia 22313
Phone: 703/557-2490 - FTS/557-2490

SAS Number

SPECIAL ANALYTICAL SERVICES

Client Request

☐ Regional Transmittal ☐ Telephone Request

A. EPA Region/Client: Reg. VIII/CDM

B. RSCC Representative: Keith Schwab

C. Telephone Number: (303) 293-1710

D. Date of Request: April 21, 1986

E. Site Name: Clear Creek/Central City

Please provide below description of your request for Special Analytical Services under the Contract Laboratory Program. In order to most efficiently obtain laboratory capability for your request, please address the following considerations, if applicable. Incomplete or erroneous information may result in a delay in the processing of your request. Please continue response on additional sheets, or attach supplementary information as needed.

1. General description of analytical service requested: Inorganic RAS Metals (No Cyanide) on all waters and all solid samples plus SAS on selected water and solid samples (see attached Tables 1, 2, and 3 for specifics.

2. Definition and number of work units involved (specify whether whole samples or fractions; whether organics or inorganics; whether aqueous or soil and sediments; and whether low, medium or high concentration):

Sample Set A. 12 low ground water (See Table 1) RAS + SAS

Sample Set B. 12 low surface water (See Table 1) RAS + SAS

Sample Set C. 12 low ground waters (See Table 1) RAS only

Sample Set D. 14 low surface waters (See Table 1) RAS only

Sample Set E. 20 low solids (See Table 1) RAS only

2. Continued

Sample Set F. 72 low waters (See Table 1) RAS only

Sample Set G. 40 low waters (See Table 1) SAS only

Sample Set H. 10 low solids (See Table 1) SAS only

3. Purpose of analysis (specify whether Superfund (enforcement or remedial action), RCRA, NPDES, etc.): Superfund-remedial action

4. Estimated date(s) of collection: May 19-23 and May 26-29 for water samples, May 30 for solids.

5. Estimated date(s) and method of shipment: Set A. May 19, 28, 29 (4 per day); Set B. May 22, 27 (6 per day); Set C. May 22 (12 samples); Set D. May 27 (14 samples); Set E. June 2 (20 samples); Set F. June 6 (72 samples); Set G. June 2 (20 samples); Set H. June 2 (10 samples)

6. Number of days analysis and data required after laboratory receipt of samples: Consistent with normal CLP reporting schedule. Short holding times require that analysis for Cr (VI) and Nitrite be started within 12 hrs. of receipt at lab.

7. Analytical protocol required (attach copy if other than a protocol currently used in this program): See Table 2. Standard CLP QA/QC protocols and limits apply to SAS, unless other requirements are specifically described in the method used.

8. Special technical instruction (if outside protocol requirements, specify compound names, CAS numbers, detection limits, etc.):

Detection limit requirements are shown in Table 3. All samples must be run concurrently with QC samples (i.e., lab QC are "per batch" basis).

9. Analytical results required (if known, specify format for data sheets, QA/QC reports, Chain-of-Custody documentation, etc.) If not completed, format of results will be left to program discretion. Consistent with CLP protocols. SAS data package must be consistent with and equivalent to CLP RAS format (including submission of deliverables, calibrations,

9. Continued

all raw and reduced data, all QA/QC data). A narrative summary of all procedures actually used for sample analysis, including discussion of factors affecting the analyses and of all corrective actions taken, must be submitted.

10. Other (use additional sheets or attach supplementary information, as needed): All spiking of water samples is to be 10x normal CLP spike levels for Fe, Mn and Zn. When additional volume of a water sample is provided (i.e., 2 or 3 times usual amount) that sample is to be used for laboratory QC, e.g., Duplicates and Matrix Spikes. This applies to the RAS as well as the SAS parameters.

11. Name of sampling/shipping contact: Roger Olsen/Richard Cheatham

Phone: (303) 458-1311

12. Data Requirements

Parameter	Detection Limit	Precision Desired (±% or Concentration)
See attached tables.		

13. QC Requirements **Note** All samples must be analyzed concurrently with QC samples. All QC data must be reported.

Audits Required	Frequency of Audits	Limits (Percent or Concentration)
Prep Blank	Minimum 1/20	Less than MDL (shown Table 3)
Spike	Minimum 1/20	See Table 3
Duplicate	Minimum 1/20	Shown Table 3
Internal Lab Control Sample (ILCS)	Minimum 1/20	Shown Table 3
EPA QC Reference Std	Minimum 1/20	Shown Table 3

Note: If ILCS is prepared from an EPA approved reference source material(s) and the "true value" of all constituents is reported, then an EPA Ref. Std. is not required.

14. Action Required if Limits are Exceeded

Prep Blank: 1. Prepare and Analyze an additional blank and an additional aliquot of All samples associated with the "out of control" blank.

2. Repeat step 1 until criterion is met. Report sample values from the analysis associated with the acceptable blank. Report all raw data.

Duplicate: 1. Re-analyze sample extract or digestate.

2. If criterion still exceeded, prepare and analyze an additional aliquot of sample.

3. Report all results; calculate %RSD on acceptable results.

Matrix Spike: 1. Perform an analytical spike on the extract or digestate to determine if preparation step was inadequate.

2. If analytical spike is within control limits, prepare and analyze an additional aliquot of all samples associated with that matrix spike and prepare an additional matrix spike.

3. If analytical spike recovery is not within control limits qualify values and report percent recovery "problem" as due to matrix interference.

Internal Laboratory Control Sample or EPA QC Reference Standard:

1. Re-analyze all samples associated with the QC Sample along with an additional QC Reference. Repeat until criterion is met. Report acceptable re-analysis results.

14. Continued

Documentation must be submitted for all factors affecting analytical performance.

Please return this request to the Sample Management Office as soon as possible to expedite processing of your request for special analytical services. Should you have any questions or need any assistance, please contact your Regional representative at the Sample Management Office.

TABLE 1

SAMPLE SETS

Set A: 12 low ground water samples:

All RAS metals plus all SAS parameters shown in Table 2. RAS metals + Si will be analyzed from the field filtered, HNO_3-preserved sample portion only. This is a total of 12 analyses of each metal for this sample set.

Set B: 12 low surface water samples:

All RAS metals plus all SAS parameters shown in Table 2. RAS metals + Si will be analyzed two times for each sample: once from the field-filtered, HNO_3-preserved sample portion and once from the non-filtered, HNO_3-preserved sample portion. This is a total of 24 analyses of each RAS metal + Si for this sample set.

Set C: 12 low ground water samples:

All RAS metals only. Metals will be analyzed from the field-filtered, HNO_3-preserved sample portion only. This is a total of 12 analyses of each RAS metal for this sample set.

Set D: 14 low surface water samples:

All RAS metals only. Metals will be analyzed two times for each sample: once from the field-filtered, HNO_3-preserved sample portion and once from the non-filtered HNO_3-preserved sample portion. This is a total of 28 analyses of each RAS metal for this sample set.

Set E: 20 low solids:

All RAS metals only.

Set F: 72 low waters:

All RAS metals only.

Set G: 40 low water samples.

Analyses for Arsenic only (SAS) - Samples will be 15mL each.

Set H: 10 low solids

EP Toxicity analysis. Digestion followed by RAS metals only.

Summary of Total Number of Analyses of Each Type

SAS-Waters only; All parameters except Si: (12x1)+(12x1)=24 analyses
$\overline{Si}$: (12x1)+(12x2)=36 analyses
Arsenic only (Set $\overline{G}$): (40x1) =40 analyses

RAS; Metals (waters): (12x1)+(12x2)+(12x1)+(14x2)+(72x1)=136 analyses
Metals (solids): (20x1)+(10x1)=30 analyses

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TABLE 2

ANALYTICAL REQUIREMENTS
SAS Requests

Constituent	Water/Solids		
	Method	Reference	Type of CLP Service
Si	370.1 (or 200.7)	a	SAS
Cr (VI)	312B	c	SAS
Sulfate	375.3	a	SAS
Nitrite[1]	353.3	a	SAS
Nitrate/Nitrite[1]	353.3	a	SAS
Ammonia	350.1	a	SAS
Chloride	325.1	a	SAS
Fluoride	340.2	a	SAS
Bicarbonate	403	c	SAS
Carbonate	403	c	SAS
Acidity	305.1	a	SAS
TSS	160.2	a	SAS
TDS	160.1	a	SAS
pH	150.1	a	SAS
Specific Conductance	120.1	a	SAS
As	CLP (RAS)	b	SAS
EP Toxic Metals	1310	d	SAS

[a] Methods from U.S. EPA, Methods for Chemical Analysis of Water and Wastes, EPA-6/4-79-020, 1983.

[b] CLP - Indicated procedures defined under Routine Analytical Services of the Contract Laboratory Program, Document CLP/IFB #@A84J092, 7/1984.

[c] APHA - AWWA - WPCF, 1980, Standard Methods for Examination of Water and Wastewater, 15th Edition.

[d] Test Methods for Evaluating Solid Waste. United States EPA SW-846, 1982.

Note: [1]These are reported as nitrite originally present and total nitrate/nitrite.

TABLE 3

SUMMARY OF PARAMETER MEASUREMENT OBJECTIVES
For SAS Requests

Parameter	Matrix	Det. Limit (ug/L)	Spike Recovery[3] Control Limits (% R)	Duplicate[1]&[3] Control Limits RPD (%)	Internal Laboratory Control Sample (% R)	EPA QC[4] Reference Standard (% R)	QA Sample Frequency
Zn[2]	Water	20	75-125	±20	80-120	90-110	1/20
Mn[2]	Water	15	75-125	±20	80-120	90-110	1/20
Fe[2]	Water	100	75-125	±20	80-120	90-110	1/20
Si	Water	30	75-125	±20	80-120	90-110	1/20
Cr(VI)	Water	5	75-125	±20	80-120	90-110	1/20
As	Water	10	75-125	±20	80-120	90-110	1/20
Bicarbonate	Water	5	~~75-125~~ N/A	±20	80-120	90-110	1/20
Carbonate	Water	5	~~75-125~~ N/A	±20	80-120	90-110	1/20
Sulfate	Water	5	75-125	±20	80-120	90-110	1/20
Nitrite	Water	10	75-125	±20	80-120	90-110	1/20
Nitrate/Nitrite	Water	10	75-125	±20	80-120	90-110	1/20
Ammonia	Water	10	75-125	±20	80-120	90-110	1/20
Chloride	Water	3	75-125	±20	80-120	90-110	1/20
Fluoride	Water	0.1	75-125	±20	80-120	90-110	1/20
Acidity	Water	5	N/A	±20	80-120	90-110	1/20
TSS	Water	2	75-125	±20	80-120	90-110	1/20
TDS	Water	10	75-125	±20	80-120	90-110	1/20
pH	Water	N/A	N/A	±20	N/A	90-110	1/20
Specific Conductance	Water	1 umhos/cm	75-125	±20	N/A	90-110	1/10

(1) ± 20% of concentration for water and ±35% of concentration for solids if > 5x the Method Detection Limits or ± MDL if concentration is < 5x the Method Detection Limit.

(2) Spiking is required at 10x the normal CLP spike amount for Fe, Mn and Zn.

(3) All other requirements are consistent with CLP inorganic protocols for these three analytes. When additional volume of a water sample is provided (3 times usual amount) that sample is to be used for laboratory QC, ie. Duplicates and Matrix Spikes. This applies to the RAS as well as the SAS parameters.

(4) If the Internal Laboratory Control Sample is prepared from an EPA-approved reference source material (e.g. EPA QC Repository Sample) then an additional QC Reference Std. will not be required.

APPENDIX 4C

COMPARISON OF WATER QUALITY RESULTS FOLLOWING TWO FILTRATION METHODS

INTRODUCTION

The recent widespread use of geochemical computer codes as a predictive tool has had a profound effect on the interpretation of surface and ground water data, and on the rock/water interactions predicted by mass transfer simulations.

Current Environmental Protection Agency (EPA) protocol requires that dissolved solute concentrations found in natural waters be determined after passing the water through a 0.45 um filter. Several workers have observed that there are differences in the 'soluble' metal concentrations when the same solution is passed through either a 0.1 um or a 0.45 um filter (Laxen and Chandler, 1982; Mitteilung, 1983). However, to date, no assessment of the effect of filter pore size on computerized geochemical predictions has been made.

This is an important aspect of aqueous geochemistry because simulations are based on dissolved metal concentrations. If particulates are passing through the filter, this may affect the analyzed metal concentration which impinges on metal ion activity calculations and mineral saturation indices.

The object of this paper is to present water analyses for identical surface and ground waters filtered through both 0.1 um and 0.45 um Millipore ^{R} filters. The analytical concentrations for both treatments were evaluated using the computer code MINTEQ (Felmy et al., 1983) to determine differences in ion activities and saturation indices.

FIELD METHODS

Under the auspices of the Clear Creek, Colorado, CERCLA remedial investigation, four surface water samples and four ground water samples were collected during February 1986 from various locations at the Clear Creek, Colorado Superfund site.

Three of the surface waters (the SW21 series) were taken at intervals downstream of the Argo discharge at Clear Creek, Idaho Springs, CO. The fourth surface water sample was taken from the Argo Tunnel portal. The Argo discharges acid mine waters to Clear Creek, so the pH of the samples ranged from 2.5 to 6.4.

The surface waters were collected in decontaminated plastic buckets. Both surface and ground waters were filtered through either 0.45 μm or 0.1 μm filters using a peristaltic pump.

Three of the groundwaters (G4, G6 and G12) were obtained from shallow wells (20 ft to water) at Gregory Tailings, Black Hawk, CO. The fourth (QH1) was taken from a well (30 ft to water) at Quartz Hill, Central City, CO.

The well samples were collected using a three inch diameter stainless steel bailer. Two bore volumes were evacuated prior to collection of the sample. A separate test showed that there was no significant difference in water chemistry between samples taken after 1 or after 3 casing volumes using a stainless steel bailer. Therefore, the samples are assumed to represent ground water at equilibrium with the tailings.

For all samples, water was filtered through the Millipore filter of the desired pore size. After filtration, the samples were fixed with nitric acid for trace metal analysis, sulfuric acid for nutrient samples and with hydrochloric acid for ferrous and total iron determinations. Sulfate and alkalinity were determined on unacidified samples. Blanks and duplicate samples were collected to allow for an estimate of contamination and analytical precision. pH measurements were made using an Orion pH meter and redox measured using an Orion platinum electrode. The redox measurement was checked for accuracy using ZoBell's (1946) solution in conjunction with Nordstrom's (1977) calibration curve. Temperature and specific conductance were also recorded.

Redox measurements in these iron poised waters appear to be accurate based on a comparison between field Eh measurements and the Eh values calculated from Fe^{2+}/Fe^{3+} ratios. This aspect of Clear Creek acid mine chemistry will be addressed in a subsequent paper.

ANALYTICAL TECHNIQUES

Major cations and anions were analysed using AA, ICP and auto analyzer techniques under the auspices of the EPA's contract laboratory program (CLP). Trace metals were determined by ICP or graphite furnace, depending on the desired detection limits. Detection limits and methods are shown in Table 4B1.

Ferrous and ferric iron was determined within 12 hours of sample collection using the bipyridine method (4). Those samples with more than 10 mg/L zinc were diluted to prevent the interference associated with this metal. Total iron as determined by the bipyridine technique was compared with the CLP value as a check for accuracy. Generally the difference was less than 5 percent.

Duplicate analyses of both groundwater and surface water were used to indicate analytical variability. Except for arsenic and cadmium, the variability was always less than ± 2 percent of the mean, indicating an analytical precision of 4 percent. Deviation beyond this limit therefore represented chemical differences generated by using different filter sizes.

SURFACE WATER RESULTS

Table 4B1 shows chemical analyses of the Argo Tunnel effluent (SW20) which drains into Clear Creek, and the SW21 series collected below the Argo/Clear Creek confluence.

For most constituents in the Argo Tunnel water (SW20), the variation between 0.1 and 0.45 um filtered samples is within the 4 percent previously

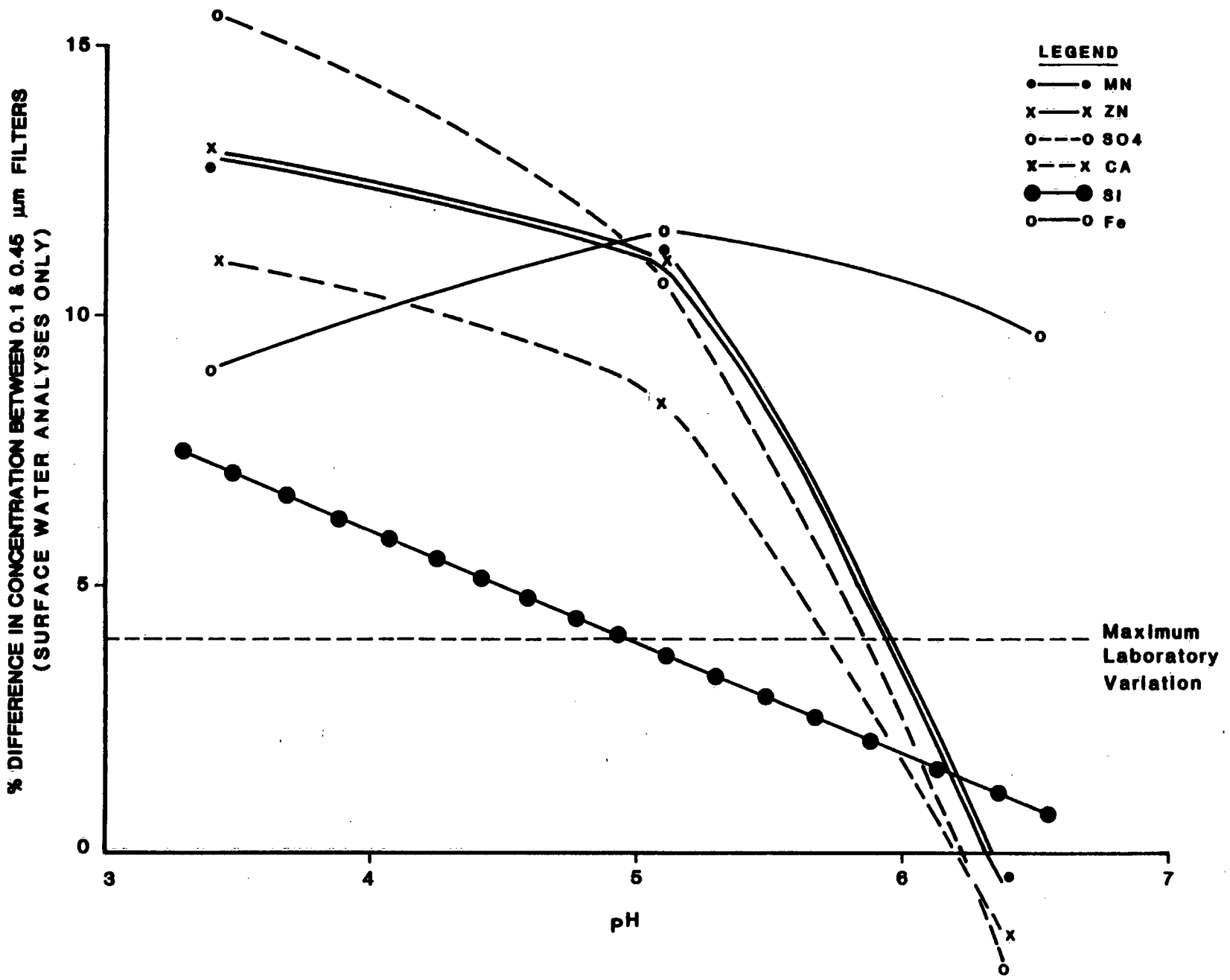
ascribed to laboratory variability. Therefore, there is no significant difference between 0.1 and 0.45 um filtration under the acidic conditions found in the Argo drainage.

As acidic water emanating from the Argo Tunnel is diluted by alkaline Clear Creek water (the SW21 series) a corresponding decrease in the concentrations of all constituents occurs. Amorphous ferric hydroxide precipitates at all three sample sites (as evidenced by the filter papers). At the pH 6.4 site, flocculant iron hydroxide was visible in the water column.

As the acid water is neutralized (SW21C to SW21F) the difference in aqueous concentrations (e.g., Ca, Mn, Si, SO_4, and Zn) between 0.1 and 0.45 um filters decreases as the pH increases (Figure 4B1). This is contrary to what would be expected, based on the solubility of most metals as a function of pH because trace metals are known to sorb strongly to ferric hydroxides (Leckie et al., 1980).

The Argo Tunnel effluent (SW21A and SW21B) is sufficiently acidic (pH=2.6) and oxidizing (pE=13) that the chemistry of iron is controlled by the Fe^{+2}/Fe^{+3} couple (see Appendix 13A). Consequently the discharge is clear, although substantial quantities of acid tolerant algae are interlayered with ferric hydroxide in the benthos. The data is interpreted as representing colloidal material which is less than 0.1 μm hence the metal concentrations are similar in both the 0.45 μm and 0.1 μm filtered samples. Little material was found to have accumulated on the filter following filtration.

In the other surface water samples (SW21C, D, E and F) theory would dictate that the largest difference in metal concentrations should be observed at higher pH values. However the reverse was true at Clear Creek. To explain this apparent anomaly it is necessary to consider the precipitation of the amorphous iron hydroxide in terms of the size of the flocculant.


% DIFFERENCE IN CONCENTRATION BETWEEN 0.1 & 0.45 µm FILTERS
(SURFACE WATER ANALYSES ONLY)
15
10
5
0
3
4
5
6
7
pH
LEGEND
MN
ZN
SO4
CA
SI
Fe
Maximum
Laboratory
Variation

When the Argo discharge first impacts Clear Creek, iron will start to precipitate as a colloid. The data suggests that this material is fine enough to pass through the 0.45 µm filter but is retained on the 0.1 µm filter. Consequently upon acidification the 0.1 to 0.45 µm iron hydroxide fraction residing in the 0.45 µm iron filtered bottle should dissolve, resulting in apparently elevated soluble metal concentrations in the 0.45 µm filtered sample over the 0.10 µm filtered sample (Table 4B1).

As the acidic drainage becomes mixed with Clear Creek the pH increases and the size of the floccular iron hydroxide visibly increases. At this point the majority of the precipitate is larger than 0.45 µm, therefore all the particulate material is retained on both filter sizes and similar metal concentrations are observed in the filtrate of both treatments.

Hydroxide precipitation appears to only control metal solubility where the iron is in the ferric form. At the Gregory seep (G12), the iron is present principally in the Fe^{2+} oxidation state. At this site, no visible flocculant material precipitates as the seep water enters North Clear Creek, so most constituents in the 0.1 and 0.45 um filtered samples are within the four percent analytical variability.

In conclusion, the surface water chemistry appears to be significantly filter pore-size dependent below a pH of approximately 5.0, generating a maximum variability of 15% for sulfate.

GROUND WATER RESULTS

The pH of the groundwaters ranged from 2.4 at Quartz Hill to 5.6 at Gregory tailings. Iron in the Gregory wells exists predominantly in the ferrous form while at Quartz Hill it is principally ferric iron (Table 4B2).

A comparison of the 0.1 um with the 0.45 um filtered samples indicates that at Quartz Hill the 0.1 um filtered sample has consistently lower concentrations (approximately 10%) than the 0.45 um filtered sample. The

other ground water samples show significantly less variation between the two filter sizes. In G4, G6 and G12, there are higher concentrations for some constituents in the 0.1 um filter. However, with the exception of sulfate, the variability between the two filters is within the laboratory precision (4 percent), so that the analyses may be considered similar.

GEOCHEMICAL SIMULATIONS

There are currently more than fifty computer programs available for the geochemical speciation of natural waters. These models are being used to evaluate a wide range of geochemical problems including radioactive waste disposal, acid mine drainage and sediment diagenesis. Recently, additional programs have been developed which incorporate mass transfer and sorption capabilities).

MINTEQ (Felmy et al., 1983) was used to simulate the natural waters in this paper. This model was chosen because it uses an extensive, carefully evaluated data base which has undergone rigorous quality assurance/quality control testing.

In this study, MINTEQ was used to determine the effect of filter size on some important geochemical calculations. The filter size affects the initial analytical input concentrations into the model. These differences may be carried through the calculations and affect ion pair activities, saturation indices and the mass of minerals predicted to precipitate or dissolve.

The samples used for the comparative geochemical modeling are the surface waters SW21A and SW21B, and the ground water samples QH1A and QH1B. These samples were chosen because they had the most significant differences between the 0.1 and 0.45 um filtered sample chemistry. Sulfate, iron, copper and zinc were all well above the differences previously ascribed to laboratory variation, which should produce the maximum differences in MINTEQ predictions.

RESULTS OF GEOCHEMICAL SIMULATIONS

Table 4B3 compares ion-pair activities and saturation indices (SI) predicted by MINTEQ at sites SW21 and QH1. For SW21 the differences in predicted aqueous ion-pair activities appear negligible despite up to 10 percent variation in the 'dissolved' analytical concentrations. The reason for the lack of response in the SI values to analytical variation lies in the simple fact that the logarithmic ratio of activities (IAP) is much less than the ratio of the same arithmetic values (concentrations).

Minerals that have constituents with similar activities in SW21A and SW21B (e.g., Fe^{3+}) have similar SI values (e.g., $Fe(OH)_3(s)$). Minerals that have aqueous components with different activities in SW21A and SW21B (e.g., SO_4^{2-}) show discrepancies in their SI values (e.g., gypsum). The maximum error induced by this variability does not appear significant (e.g., 0.07 SI units for gypsum). However this may not be the case if mass transfer operations are undertaken utilizing the affected minerals, or if the SI value is close to zero. In the latter case, apparent supersaturation may be predicted, rather than undersaturation which may actually be the case.

Because the saturation indices are similar, the potential mass of amorphous precipitate predicted to be removed by mass transfer from solutions SW21A and SW21B is similar. The ramification is that the potential sorption of trace metals (Pb, Zn, As, etc.) onto a ferric hydroxide substrate would also appear to be similar.

The Quartz Hill ground water shows the same trend, in that different sulfate concentrations lead to discrepancies in the gypsum SI value (0.05 units).

However, a general rule is to assume log K error values of $\pm$ 0.05 log units, therefore, the differences in SI values propagated by the different filter sizes do not appear to be of particular significance.

CONCLUSIONS

We have shown that there are detectable differences in the concentrations of solutes filtered through 1.0 um and 0.45 um filters. These differences appear to be enhanced in environments where there is rapid precipitation of amorphous mineral phases. However, even in waters which show large analytical differences between the two filter sizes, there were no major differences in the geochemical computations. The practical application of this work is that significant differences in solution chemistry due to a selected filter pore size will have only negligible effects on the results of geochemical computations.

REFERENCES

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TABLE 4B1

	Units	Instrument Detection Limits	SW20		SW21A	SW21B
			0.1 um	0.45 um	0.1 um	0.45 um
Field Determination						
Temperature	°C	n.a.		16		11
pH	stand. units	n.a.		2.5		3.4
Eh	mV	n.a.		+725		+720
Spec. conductance	mS/cm at 25°C	n.a.		2480		720
Ferrous Iron	mg L^{-1}	0.01	19.9	28.6	5.4	6.2
Ferric Iron	mg L^{-1}	0.01	119.9	111.5	34.3	37.0
Total Iron	mg L^{-1}	0.01	139.8	140.1	39.7	43.2
Lab Determinations(1)						
Tot. Diss. Solids	mg L^{-1}	10	3460	3470	1230	1430
Acidity (as H^+)	mg L^{-1}	5	621	604	176	203
Cations						
Calcium	mg L^{-1}	0.28	344.0	333.0	135.0	151.0
Magnesium	mg L^{-1}	0.25	138.0	134.0	48.6	54.3
Potassium	mg L^{-1}	0.99	4.1	4.0	4.2	3.8
Sodium	mg L^{-1}	0.59	28.8	27.7	20.7	21.4
Silica (as H_4SiO_4)	mg L^{-1}		49.0	45.8	24.6	26.5
Anions						
Alkalinity (as HCO_3^-)	mg L^{-1}	5	<5	<5	<5	<5
Fluoride	mg L^{-1}	0.1	2.5	2.4	1.5	1.7
Sulfate	mg L^{-1}	5	2220	2250	775	905
Nitrate	mg L^{-1}	0.1	<0.1	<0.1	0.26	N.M.
Minor & Trace Elements						
Aluminum	mg L^{-1}	0.025	19.6	19.0	6.4	7.3
Arsenic	mg L^{-1}	0.01	0.06	0.064	0.013	0.013
Cadmium	mg L^{-1}	0.001	0.134	0.128	0.05	0.06
Chromium	mg L^{-1}	0.004	0.021	0.016	0.012	0.012
Cobalt	mg L^{-1}	0.006	0.143	0.139	0.049	0.056
Copper	mg L^{-1}	0.003	4.75	4.58	1.62	1.83
Iron	mg L^{-1}	0.015	152.0	147.0	41.7	47.4
Manganese	mg L^{-1}	0.005	94.3	91.0	32.5	36.9
Nickel	mg L^{-1}	0.005	0.194	0.187	0.08	0.09
Zinc	mg L	0.002	44.8	43.4	15.9	18.1
Ionic Strength	(molar)		n.d.	n.d.	0.023	0.026
Charge Imbalance	% difference		n.d.	n.d.	3.2	2.5

(1) Analyses performed by authors
(2) Analyses performed by Rocky Mountain Analytical Laboratories
N.M. = Not measured
< = concentration below detection limit
n.d. = not determined
n.a. = not applicable

TABLE 4B1 (Continued)

	Units	Instrument Detection Limits	SW21C 0.1 um	SW21D 0.45 um	SW21E 0.1 um	SW21F 0.45 um
Field Determination[1]						
Temperature	°C	n.a.		12.5		11.5
pH	stand. units	n.a.		5.1		6.4
Eh	mV	n.a.		+504		+435
Spec. conductance	mS/cm at 25°C	n.a.		310		160
Ferrous Iron	mg L^{-1}	0.01	0.57	0.60	0.06	0.08
Ferric Iron	mg L^{-1}	0.01	3.27	2.69	0.16	0.12
Total Iron	mg L^{-1}	0.01	3.84	3.29	0.22	0.20
Lab Determinations[2]						
Tot. Diss. Solids	mg L^{-1}	10	440	475	320	310
Acidity (as H^+)	mg L^{-1}	5	15	26	<5	<5
Cations						
Calcium	mg L^{-1}	0.280	58.0	62.9	44.0	43.3
Magnesium	mg L^{-1}	0.250	19.2	21.1	14.0	13.7
Potassium	mg L^{-1}	0.990	3.4	3.7	3.5	3.5
Sodium	mg L^{-1}	0.590	17.8	18.4	18.1	18.1
Silica (as H_4SiO_4)	mg L^{-1}		16.8	17.4	15.4	15.6
Anions						
Alkalinity (as HCO_3^-)	mg L^{-1}	5	<5	<5	28.0	27.0
Fluoride	mg L^{-1}	0.1	1.1	1.1	0.9	0.9
Sulfate	mg L^{-1}	5	269	299	182	178
Chloride		N.M	N.M	N.M	N.M	N.M
Nitrate	mg L^{-1}	0.1	0.25	0.31	0.3	0.28
Minor & Trace Elements						
Aluminum	mg L^{-1}	0.025	1.2	1.8	0.15	0.20
Arsenic	mg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg L^{-1}	0.001	0.015	0.016	0.005	0.008
Chromium	mg L^{-1}	0.004	<0.004	<0.004	<0.004	<0.004
Cobalt	mg L^{-1}	0.006	0.014	0.015	<0.006	<0.006
Copper	mg L^{-1}	0.003	0.39	0.51	0.05	0.06
Iron	mg L^{-1}	0.015	0.55	0.59	0.19	0.21
Manganese	mg L^{-1}	0.005	10.8	12.1	6.6	6.5
Nickel	mg L^{-1}	0.005	0.03	0.03	0.017	0.014
Zinc	mg L	0.002	5.1	5.8	2.8	2.8

(1) Analyses performed by authors
(2) Analyses performed by Rocky Mountain Analytical Laboratories
N.M. = Not measured
< = concentration below detection limit
n.a. = not applicable

TABLE 4B2

	Units	Instrument Detection Limits	QH1		G4	
			0.1 um	0.45 um	0.1 um	0.45 um
Field Determination (1)						
Temperature	°C	n.a.	3.0			
pH	stand. units	n.a.	2.4		4.9	
Eh	mV	n.a.	+736		+365	
Spec. conductance	mS/cm at 25°C	n.a.	2630		1420	
Ferrous Iron	mg L^{-1}	0.01	62.0	NM	139.2	141.5
Ferric Iron	mg L^{-1}	0.01	345.0	NM	13.9	15.4
Total Iron	mg L^{-1}	0.01	407.0	NM	153.1	156.9
Lab Determinations (2)						
Tot. Diss. Solids	mg L^{-1}	10	5800	5810	2290	2240
Acidity (as H^+)	mg L^{-1}	5	1920	1840	302	276
Cations						
Calcium	mg L^{-1}	0.280	365.0	390.0	302.0	315.0
Magnesium	mg L^{-1}	0.250	203.0	218.0	96.3	102.0
Potassium	mg L^{-1}	0.990	1.42	1.42	8.58	8.98
Sodium	mg L^{-1}	0.590	6.04	5.4	32.7	31.7
Silica (as H_4SiO_4)	mg L^{-1}	93.1	95.1	41.7	42.2	
Ammonia	mg L^{-1}	0.10	0.12	0.13	0.15	0.14
Anions						
Alkalinity (as HCO_3^-)	mg L^{-1}	5	<5.0	<5.0	<5.0	<5.0
Nitrate	mg L^{-1}	0.10	<0.1	<0.1	<0.1	<0.1
Chloride	mg L^{-1}	3	<3.0	<3.0	6.5	4.9
Fluoride	mg L^{-1}	0.1	<0.1	0.11	1.4	1.4
Sulfate	mg L^{-1}	5	3360.0	3700.0	1500	1090
Nitrite (as N)	mg L^{-1}	0.1	<0.1	<0.1	0.2	0.2
Minor & Trace Elements						
Aluminum	mg L^{-1}	0.025	69.7	75.5	2.39	2.66
Arsenic	mg L^{-1}	0.01	0.72	0.767	<0.01	<0.01
Cadmium	mg L^{-1}	0.001	0.505	0.507	0.019	0.018
Chromium	mg L^{-1}	0.004	0.086	0.092	0.012	0.017
Cobalt	mg L^{-1}	0.004	0.405	0.437	0.165	0.175
Copper	mg L^{-1}	0.003	44.3	48.2	0.658	0.724
Iron	mg L^{-1}	0.015	437.0	470.0	156.0	167.0
Lead	mg L^{-1}	0.002	0.116	0.118	0.054	0.067
Manganese	mg L^{-1}	0.005	68.5	73.5	31.3	32.8
Nickel	mg L^{-1}	0.005	0.509	0.545	0.224	0.235
Zinc	mg L	0.002	107.0	113.0	6.58	6.68
Ionic Strength	(molar)		0.085	0.079	n.d.	n.d.
Charge Balance	% difference		7.7	10.3	n.d.	n.d.

(1) Analyses performed by authors
(2) Analyses performed by Rocky Mountain Analytical Laboratories
NM = Not measured
< = concentration below detection limit
n.d. = not determined
n.a. = not applicable

TABLE 4B2 (Continued)

	Units	Instrument Detection Limits	G12		G6	
			0.1 um	0.45 um	0.1 um	0.45 um
Field Determination[1]						
Temperature	°C	n.a.		9.0		9.3
pH	stand. units	n.a.		4.9		5.6
Eh	mV	n.a.		+446		+317
Spec. conductance uS/cm	at 25°C	n.a.		1070		1090
Ferrous Iron	mg L^{-1}	0.01	110.9	116.7	65.0	52.8
Ferric Iron	mg L^{-1}	0.01	35.7	18.2	2.0	4.4
Total Iron	mg L^{-1}	0.011	46.6	134.9	67.0	57.2
Lab Determinations[2]						
Tot. Diss. Solids	mg L^{-1}	10	2310	2300	1500	1500
Acidity (as H^+)	mg L^{-1}	5	283	NM	73	78
Cations						
Calcium	mg L^{-1}	0.280	284.0	287.0	244.0	248.0
Magnesium	mg L^{-1}	0.250	102.0	83.9	70.8	70.5
Potassium	mg L^{-1}	0.990	7.8	7.5	5.1	4.8
Sodium	mg L^{-1}	0.590	29.6	30.0	21.2	21.5
Silica (as H_4SiO_4)	mg L^{-1}		37.9	38.6	2.58	2.66
Ammonia	mg L^{-1}	0.10	0.2	0.2	<0.1	<0.1
Anions						
Alkalinity (as HCO_3^-)	mg L^{-1}	5	<5.0	<5.0	6	<5.0
Chloride	mg L^{-1}	3	4.5	5.5	<3.0	<3.0
Fluoride	mg L^{-1}	0.1	1.2	1.2	1.5	1.5
Sulfate	mg L^{-1}	5	1560.0	1420.0	900	700
Nitrate	mg L^{-1}	0.10	<0.1	<0.1	<0.1	<0.1
Nitrite (as N)	mg L^{-1}	0.1	0.31	NM	0.12	0.12
Minor & Trace Elements						
Aluminum	mg L^{-1}	0.025	2.8	2.6	1.17	1.34
Arsenic	mg L^{-1}	0.01	<0.01	<0.01	<0.01	<0.01
Cadmium	mg L^{-1}	0.001	0.011	0.011	0.019	0.022
Chromium	mg L^{-1}	0.004	<0.004	<0.004	0.005	0.009
Cobalt	mg L^{-1}	0.004	0.154	0.149	0.072	0.077
Copper	mg L^{-1}	0.003	0.624	0.594	0.255	0.286
Iron	mg L^{-1}	0.015	153.0	148.0	60.0	61.4
Lead	mg L^{-1}	0.002	0.031	0.025	<0.005	<0.005
Manganese	mg L^{-1}	0.005	31.0	29.6	27.1	27.6
Nickel	mg L^{-1}	0.005	0.18	0.20	0.121	0.123
Zinc	mg L	0.002	6.4	6.0	2.58	2.66

(1) Analyses performed by authors
(2) Analyses performed by Rocky Mountain Analytical Laboratories
NM = Not measured
< = concentration below detection limit
n.a. = not applicable

TABLE 4B3

	SW21A	SW21B	QH1 0.1	QH1 0.45
Activities of some major components				
$CaOH^+$	-12.6	-12.6	-13.6	-13.6
$Al(OH)_3$	-10.5	-10.5	12.5	-12.5
$FeSO_4$	-4.7	-4.6	-3.5	-3.6
$Fe(OH)_3$	-8.4	-8.4	-10.2	-10.2
$Fe(SO_4)^{-2}$	-4.7	-4.6	-3.0	-3.1
$Zn(OH)_2$	-14.1	-14.1	-15.4	-15.4
H_2AsO_4	-6.9	-6.9	5.5	-5.5
SO_4^{-2}	-2.5	-2.4	2.1	-2.2
Ca	-2.6	-2.8	-2.6	-2.6
Saturation indices for selected solid phases				
$AlOHSO_4$	-0.5	-0.5	-0.3	-0.3
Ferrihydrite	0.3	0.3	-1.5	-1.5
Gypsum	-0.5	-0.4	0.2	0.1
Scoradite	0.4	0.4	0.8	0.8
Goethite	4.2	4.2	2.0	2.0
Gibbsite	-4.1	-4.1	-6.6	-6.6
Jarosite(K)	10.2	10.2	7.0	6.9
$Fe_2(SO_4)_3$	-23.1	-22.9	-21.3	-21.4

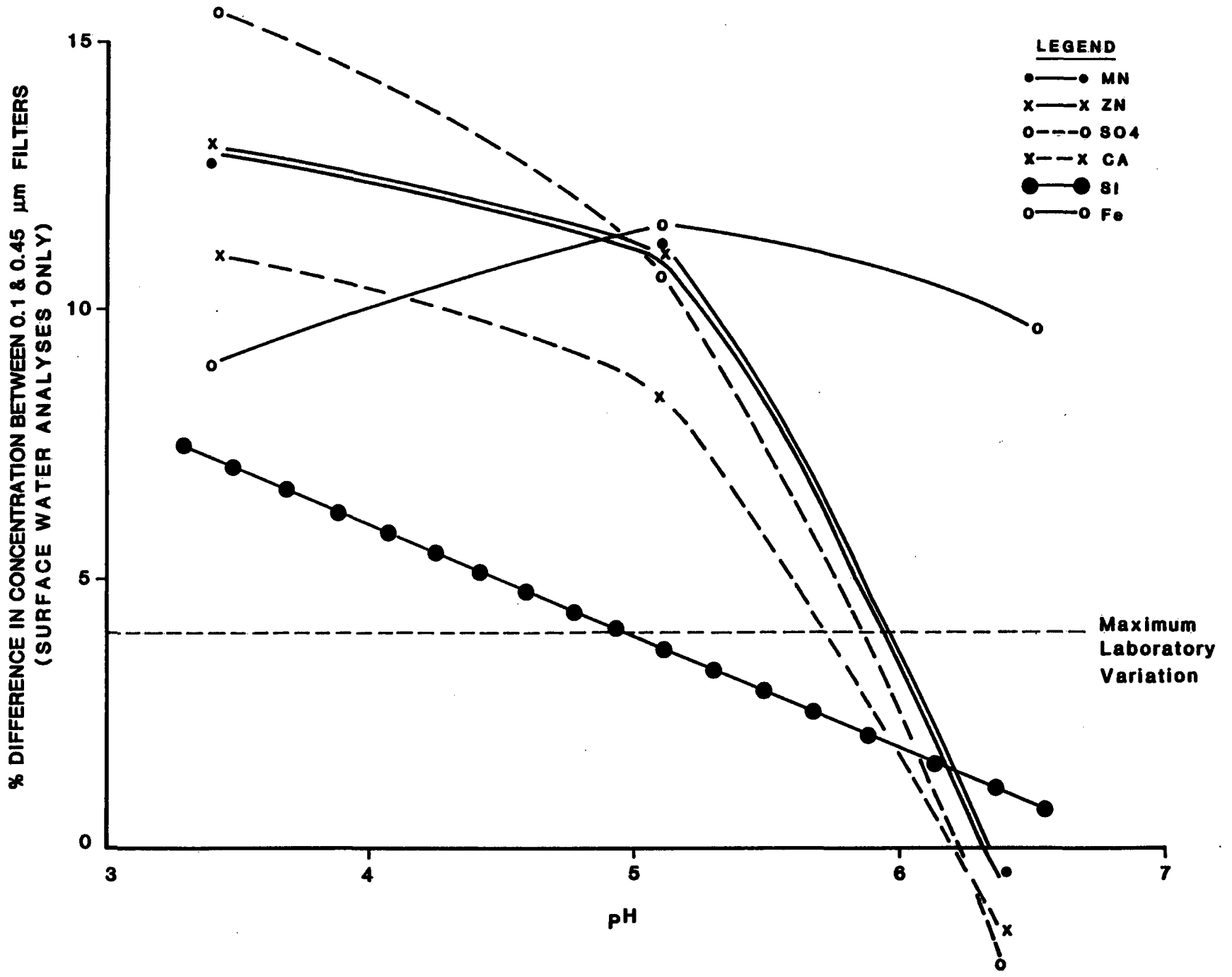
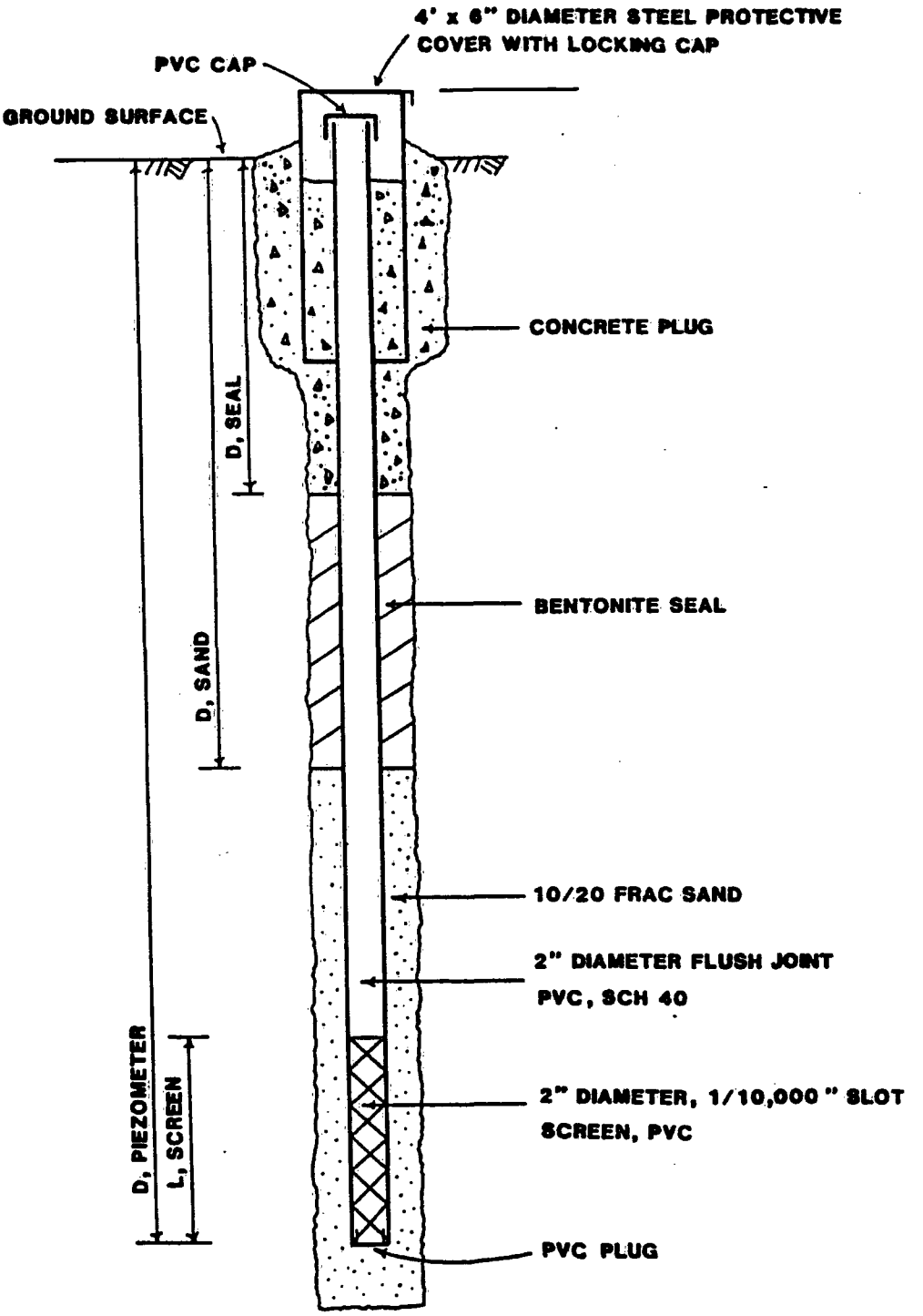

% DIFFERENCE IN CONCENTRATION BETWEEN 0.1 & 0.45 µm FILTERS
(SURFACE WATER ANALYSES ONLY)
15
10
5
0
3
4
5
6
7
pH
LEGEND
MN
ZN
SO4
CA
SI
Fe
Maximum
Laboratory
Variation

FIGURE 4B-1

APPENDIX 4D

WELL COMPLETION INFORMATION



WELL COMPLETION DIAGRAM

HOLE NO.	TD HOLE (FT)	D PIEZOMETER (FT)	L SCREEN (FT)	D SAND (FT)	D SEAL (FT)
GREGORY					
GG01	30	20	10	5*	2*
GG02	24.5	23.4	10	9.4	3.4*
GG03	27	21	10	8	5*
GG04	29.5	29.5	10	16	5
GG05	50	30	10	15*	12*
GG06	41.9	41.9	10	27*	24*
GG07	11	11	5	4	2
GG09	47.5	47.5	10	32.5*	29.5*
GG13	29	29	10	17*	14*
QUARTZ HILL					
QH01	22.5	22.5	10	10.5	8.5
QH02(2)	38	38	10	26*	12*
NATIONAL TUNNEL					
NT01	25.4	25.4	10	13*	10*
NT02	31.5	31.5	15	10	5
NT03	33.8	33.8	20	6	3
ARGO TUNNEL					
AT01	20	20	10	8	6
AT02(2)	24	22	10	12*	8*
AT03	26	26	15	9	5
BIG FIVE TUNNEL					
BF01	38	38	20	16	11

NOTES:

(1) Screen silted in to 36.5'. Hole caved at 15'. Well cleaned, responds ok.

(2) Screen silted in. Hole caved at 16'. Well cleaned, responds ok.

(*) Estimate.

APPENDIX 4E

WELL TEST RESULTS

WELL TEST RESULTS

1.0 OBJECTIVES

These tests were designed to:

1. Determine the purgeable volume of water to be removed from a well in order to provide a representative ground water sample.

2. Compare a pumped sample with a bailed sample to detect any differences in ground water chemistry which may be induced by bailing the well.

2.0 METHODS AND RESULTS

Previous work (Wilson and Rouse, 1983; Barcelona and Helfrich, 1986) has shown that there can be significant differences in water chemistry, depending both on the length of time a well is pumped, and on whether a well is purged by pumping or bailing. To evaluate this effect on Clear Creek RI well sites, a test was performed at Quartz Hill Well #1 where historically, analyte concentrations are high enough to determine any variations in ground water chemistry induced by the volume of water purged. The well chosen for this test contained ground water representative of an acid oxidizing environment. The objective was to demonstrate that ground water containing high levels of contaminants will come to equilibrium and produce representative samples of ground water within a short time period. The well was evacuated using a nitrogen driven Well Wizard pump with linear polyethylene tubing. Samples were taken every 5 gallons for a total of 4.3 bores (one bore volume equals 9.3 gallons). Specific conductivity, Eh, pH, and temperature were measured in the field (Table 4D-1). In addition, samples were analyzed by the CLP for RAS and SAS parameters, for $Fe2^{+}/Fe3^{+}$ using the bipyrdine method and $As\ 3^{+}/As5^{+}$ seperated by chromatography in the field. The data show that there is

little variation (less than 10 percent) for Al, Be, Ca, Cd, Co, Cr, Cu, Fe, Mg, Mn, and Zn (Table 4D-1) which is within the error limits of analytical variability (Section 12). Arsenic, Cl and SO_4 showed the greatest range in the pump test (Table 4D-1). However, As and SO_4 had qualifiers on the data indicating that standard addition recoveries were outside the limits ensuring analytical accuracy. Cl had no qualifier and there is no obvious reason for the variability (coefficient of variability = 0.91). Field contamination by a chloride salt would require a matching anion, probably sodium. However, the sodium concentrations do not follow the chloride values.

Based on a comparison between the average concentrations of major analytes with those concentrations as a function of purge volume (Table 4D-1) we conclude that purging one bore volume (approximately 6.5 gallons in this well) will provide a representative ground water sample.

3.0 Comparison Between Pump and Bailer.

Gregory Well #4 was selected for this test because its chemical characteristics were representative of 'average' ground water contamination in the Clear Creek wells. In addition the ground water environment was sufficiently reducing (based on previous redox measurements) that both Fe^{2+} and Fe^{3+} are present. The objective of this test was to determine if the ratio of redox sensitive species is affected by sample agitation during bailing of the well. A sample was collected at the start of the test (MHE 565) and then again after 1.5 bore volumes (MHE 566). At this point the water was clear and easily filtered. The major variation appears to be in the ratio of Fe^{+2}/Fe^{+3} concentrations. Ferric ion increases from 1 percent to 7 percent of the total iron between zero and 2 bore volumes (Table 4D-2).

After the pumping was complete, a further casing volume (2 gallons) was purged using the bailer, and a sample collected (MHE 567). The water contained visible sediment which required a Whatman prefilter (No 4), in addition to the 0.45 μm membrane to enable filtration.

A comparison of the pumped and bailed sample shows that the only significant difference is in the total iron concentrations (Table 4D-2). Ferric ion constitutes 11 percent of the bailer total iron while ferric iron in the pumped sample comprised only 7 percent. However, this observation is not supported by the Eh measurements which remain approximately constant. From this test we conclude that minimal oxidation occurs as a result of the bailing process.

TABLE 4D-1
QUARTZ HILL PUMP TEST

MHE	200	201	202	203	204	205	206	$\bar{x}$	S	C.V.
Gallons pumped	1.5	6.5	11.5	16.5	24.0	31.5	40.0			
Bore Volumes	0	0.7	1.2	1.8	2.6	3.4	4.3			
Eh (mV.)	+786	+790	+776	+780	+774	+761	+763			
pH (s.u)	2.7	2.8	2.7	2.8	2.9	2.7	2.5			
Sp Cond. (µS/cm)	3,493	3,811	3,986	4,033	3,800	4,083	5,015	4,031	477	0.12
As Tot† (µg/L)	1,180	410	1,340	1,250	450	420	420	-		
As+3*	150	175	180	150	260	290	190	-		
As+5	1,030	235	1,160	1,100	190	130	130	-		
Be	36	35	34.8	35	34	35	36	35.1	0.7	0.02
Cd	352	344	360	369	329	342	350	349	12.9	0.04
Cr	56	51	54	56	49	51	48	52.1	3.2	0.06
Co	319	312	318	320	300	307	341	316.7	12.9	0.04
Cu	42.5	42.3	39.8	41.0	43.4	42.0	41.5	41.8	1.2	0.03
Mn	47.9	47.1	47.3	47.7	45.5	46.4	46.9	47.0	0.8	0.02
Ni	611	592	630	633	559	581	799	629	79.4	0.13
Pb	5	4	3	3	3	3	3	3.4	0.8	0.23
Sb	<50	<50	<50	73	<50	<50	<50	-	-	
Si	n.r.	58	56	55	61	62.7	57.9	58.4	2.9	0.05
V	47	47	58	58	37	42	49	48	7.7	0.16
Al (mg/L)	66.6	66.0	62.7	64.0	66.6	66.1	64.3	65.2	1.5	0.02
Ca	289,000	283,000	293,000	295,000	268,000	277,000	286,000	284,000	9,450	0.03
Fe (Tot)+	406	400	402	404	386	392	396	398	7.1	0.02
Fe+2 C.S.F.	34	136	84	88	22	67	99	-		
Fe+3 C.S.F.*	372	264	318	316	364	325	297	-		
K	<500	<500	<500	<500	<500	<500	<500	-		
Mg	146,000	144,000	143,000	145,000	142,000	143,000	143,000	144,000	1,380	0.01
Na	7,280	6,560	5,550	5,900	7,590	6,770	6,210	6,551	730	0.11
Zn	76	74.8	75.9	76.7	72.2	73.6	74.8	74.9	1.6	0.02
F	n.r.	3.2	3.2	4.0	3.9	3.3	3.3	3.5	0.4	0.11
Cl	n.r.	7	75	80	10	40	10	37	33.6	0.91
SO_4	n.r.	921	1,027	1,040	1,031	1,049	1,080	1,024	54.2	0.05
NH_3	n.r.	0.18	0.16	0.16	0.14	0.15	0.16	0.16	0.01	0.06

* = calculated by difference
† = qualified data
n.r. = not reported
Average values (x) calculated for CLP data only

TABLE 4D-2
GREGORY TAILINGS GROUND WATER SAMPLING, mg/L

Sample ID	MHE 565	MHE 566	MHE 567	
Field pH (s.V.)	4.9	5.1	5.2	
Eh (m.V.)	+416	+380	+365	
Temp. (°C)	9	10	10	
Sp. Cond. (µS/cm)	800	1150	1200	
Ca (mg/L)	297.0	292.0	304.0	
Fe (CLP)	157.0	154.0	161.0	
Fe II	143.5	130.5	126.0	)
Fe III	1.5	9.5	15.0	) CSF analyses
Fe (Tot)	145.0	140.0	141.0	)
K	8.25	8.04	8.03	
Mg	94.1	91.9	94.4	
Mn	31.1	30.5	31.9	
Na	30.8	30.7	32.1	
Zn	6.34	6.27	6.52	
Al	2.72	2.66	2.72	
As (µg/L)	<0.01	<0.01	<0.01	
Be	0.005	0.005	0.005	
Cd	0.009	0.008	0.014	
Cr	0.006	<0.004	0.007	
Co	0.150	0.149	0.156	
Cu	0.632	0.612	0.627	
Pb	0.025	0.028	0.027	
Ni	0.215	0.218	0.221	

MHE 565 Sampled after 0 bore volumes (pump)
MHE 566 Sampled after 2 bore volumes (pump)
MHE 567 Sampled after 2 bore and 1 casing volume (bailed)

APPENDIX 5

APPENDIX 5A
TAILINGS AND WASTE ROCK
ANALYTICAL RESULTS

CLEAR CREEK TAILINGS CHEMISTRY DATA

		11/22/85 MHE204 TAG0204 11'5"-11'10" GREGORY BORING #2 POWDER		12/03/85 MHE277 TAG0211 11'5"-11'10 GREGORY BORING #2 RAW SPLIT		11/22/85 MHE213 TAG0209 22'10"-23'5" GREGORY BORING #2 POWDER		12/03/85 MHE274 TAG0212 22'10"-23'5 GREGORY BORING #2 RAW SPLIT		11/22/85 MHE205 TAG0210 23'7"-24'6" GREGORY BORING #2 POWDER	
LAB DETERMINATIONS											
pH	S.U.	6.80	Y	3.40	Y	6.00	Y	4.90	Y	4.60	Y
ACID POTENTIAL	meq/100g	9.00	Y	5.40	Y	49.0	Y	25.0	Y	11.0	Y
NEUTRALIZATION POTENTIAL	tons/1000	50.0	Y	6.10	Y	45.0	Y	15.0	Y	15.0	Y
ALUMINUM (TOTAL)	mg/kg	5460	YJE	4730	Y	10100	YJE	13800	Y	5550	YJE
ANTIMONY (TOTAL)	mg/kg	12.0	YU	12.0	YUJS	42.0	Y	27.0	YJS	13.0	Y
ARSENIC (TOTAL)	mg/kg	5.50	Y	79.0	Y	111.	Y	206.	Y	88.0	Y
BARIUM (TOTAL)	mg/kg	31.0	Y	37.0	Y	134.	Y	188.	Y	105.	Y
BERYLLIUM (TOTAL)	mg/kg	0.560	Y	0.510	Y	1.80	Y	2.10	Y	0.370	Y
CADMIUM (TOTAL)	mg/kg	2.70	Y	5.60	Y	26.0	Y	46.0	Y	2.40	Y
CALCIUM (TOTAL)	mg/kg	8400	Y	11100	Y	2790	Y	2660	Y	1920	Y
CHROMIUM (TOTAL)	mg/kg	56.0	Y	15.0	Y	70.0	Y	19.0	Y	44.0	Y
COBALT (TOTAL)	mg/kg	9.20	Y	9.40	Y	41.0	Y	40.0	Y	7.30	Y
CONDUCTIVITY	mmhos/cm	2.40	Y	6.70	Y	0.630	Y	3.50	Y	0.460	Y
COPPER (TOTAL)	mg/kg	177.	Y	363.	Y	1340	Y	2120	Y	1040	Y
CYANIDE (TOTAL)	mg/kg	0.500	YUJHT	0.500	YU	0.500	YUJHT	0.500	YU	0.850	YJHT
GOLD (TOTAL)	mg/kg	0.500	YU	0.500	YUJS	0.500	YU	1.10	YJS	0.500	YU
IRON (TOTAL)	mg/kg	19800	Y	39000	Y	42800	Y	45900	Y	26700	Y
LEAD (TOTAL)	mg/kg	138.	Y	1350	Y	1770	Y	2100	Y	372.	Y
MAGNESIUM (TOTAL)	mg/kg	5220	Y	3960	Y	2680	Y	3480	Y	2620	Y
MANGANESE (TOTAL)	mg/kg	567.	Y	579.	Y	1510	Y	691.	Y	138.	Y
MERCURY (TOTAL)	mg/kg	0.0500	YU	0.360	YJS	4.60	Y	5.70	YJS	4.10	Y
MOLYBDENUM (TOTAL)	mg/kg	5.00	YU	10.0	YU	6.80	Y	11.0	Y	5.00	YU
NICKEL (TOTAL)	mg/kg	11.0	Y	11.0	Y	76.0	Y	96.0	Y	10.0	Y
POTASSIUM (TOTAL)	mg/kg	3440	Y	3920	Y	2620	Y	3060	Y	2910	Y
SELENIUM (TOTAL)	mg/kg	2.50	YUR	25.0	YR	25.0	YUR	25.0	YR	2.50	Y
SILVER (TOTAL)	mg/kg	2.00	Y	6.60	Y	21.0	Y	37.0	Y	8.70	Y
SODIUM (TOTAL)	mg/kg	1210	Y	718.	Y	1040	Y	548.	Y	1100	Y
SULFUR (TOTAL)	%	0.500	Y	1.50	Y	1.80	Y	2.60	Y	0.710	Y
SULFATE SULFUR	%	0.380	Y	1.20	Y	0.100	Y	0.210	Y	0.200	Y
PYRITIC SULFUR	%	0.0200	YJ*	0.330	Y	0.140	YJ*	2.10	Y	0.0600	YJ*
ORGANIC SULFUR	%	0.100	YJ*	0.0100	YU	1.60	YJ*	0.390	Y	0.450	YJ*
THALLIUM (TOTAL)	mg/kg	5.00	YUJS	5.00	YU	5.00	YUJS	5.00	YU	5.00	YUJS
TIN (TOTAL)	mg/kg	8.00	YU	8.00	YU	19.0	Y	8.00	YU	8.00	YU
VANADIUM (TOTAL)	mg/kg	16.0	Y	17.0	Y	27.0	Y	30.0	Y	25.0	Y
ZINC (TOTAL)	mg/kg	311.	Y	1120	Y	5390	Y	7860	Y	212.	Y
PERCENT SOLID	mg/kg	--		--		--		--		--	
CLAY	%	--		--		--		--		--	
SILT	%	--		--		--		--		--	
SAND	%	--		--		--		--		--	
COARSE FRACTION	%	--		--		--		--		--	

FOOTNOTES

(R) = REJECTED ('R' used by laboratory indicated recovery problems)
(JHT) = ESTIMATED due to holding time violation
(JL) = ESTIMATED due to exceeding ICP linear range
(*) = DUPLICATE control limits exceeded
(EJ) = ESTIMATED due to interference problems (ICP serial dilution or not spike recovery by graphite furnance)
(mmhos) = mmhos/cm
(I) = QUANTIFIED due to exceeding ICP linear range
(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(JS) = ESTIMATED due to spike recoveries outside limits
(meq) = meq of hydrogen ion
(--) = NOT analyzed
(tons) = tons CaCO3/1000 ton of material
(H,HT) = QUALIFIED due to holding time violation

CLEAR CREEK TAILINGS CHEMISTRY DATA

		11/22/85 MHE222 TAG0301 1'-1'5" GREGORY BORING #3 POWDER		11/22/85 MHE206 TAG0303 14'-14'5" GREGORY BORING #3 POWDER		12/03/85 MHE278 TAG0304 16'-18' GREGORY BORING #3 RAW		12/03/85 MHE267 TAG0305 20'9"-21'2" GREGORY BORING #3 RAW		12/03/85 MHE268 TAG0310 20'9"-21'2" GREGORY BORING #3 RAW SPLIT	
LAB DETERMINATIONS											
pH	S.U.	3.40	Y	2.70	Y	3.60	Y	2.90	Y	2.90	Y
ACID POTENTIAL	meq/100g	399.	Y	1.50	Y	26.0	Y	11.0	Y	8.90	Y
NEUTRALIZATION POTENTIAL	tons/1000	1.30	Y	1.30	YU	16.0	Y	2.40	Y	1.20	YU
ALUMINUM (TOTAL)	mg/kg	1270	Y	2790	YJE	1520	Y	5590	Y	5400	Y
ANTIMONY (TOTAL)	mg/kg	21.0	Y	12.0	YU	12.0	YUJS	22.0	YJS	25.0	YJS
ARSENIC (TOTAL)	mg/kg	8.50	Y	30.0	Y	5.00	YU	93.0	Y	83.0	Y
BARIUM (TOTAL)	mg/kg	8.90	Y	31.0	Y	60.0	Y	137.	Y	130.	Y
BERYLLIUM (TOTAL)	mg/kg	0.200	YU	0.200	YU	0.200	YU	0.340	Y	0.430	Y
CADMIUM (TOTAL)	mg/kg	3.50	Y	2.20	Y	2.00	YU	5.50	Y	4.80	Y
CALCIUM (TOTAL)	mg/kg	104.	YU	4730	Y	2200	Y	10300	Y	13600	Y
CHROMIUM (TOTAL)	mg/kg	49.0	Y	40.0	Y	4.70	Y	27.0	Y	28.0	Y
COBALT (TOTAL)	mg/kg	8.60	Y	3.90	Y	2.50	YU	12.0	Y	11.0	Y
CONDUCTIVITY	mmhos/cm	1.90	Y	3.90	Y	4.10	Y	6.20	Y	6.00	Y
COPPER (TOTAL)	mg/kg	26.0	Y	87.0	Y	37.0	Y	174.	Y	162.	Y
CYANIDE (TOTAL)	mg/kg	4.00	YJHT	0.500	YUJHT	5.60	Y	0.500	YU	0.500	YU
GOLD (TOTAL)	mg/kg	0.500	YU	0.500	YU	0.500	YUJS	0.500	YUJS	0.500	YUJS
IRON (TOTAL)	mg/kg	78500	Y	27100	Y	20800	Y	99000	Y	101000	Y
LEAD (TOTAL)	mg/kg	135.	Y	480.	Y	207.	Y	117.	Y	92.0	Y
MAGNESIUM (TOTAL)	mg/kg	214.	Y	1260	Y	715.	Y	3340	Y	3400	Y
MANGANESE (TOTAL)	mg/kg	16.0	Y	205.	Y	62.0	Y	229.	Y	235.	Y
MERCURY (TOTAL)	mg/kg	0.200	Y	0.920	Y	1.20	YJS	4.20	YJS	4.10	YJS
MOLYBDENUM (TOTAL)	mg/kg	14.0	Y	5.00	YU	12.0	Y	13.0	Y	16.0	Y
NICKEL (TOTAL)	mg/kg	7.40	Y	3.50	YU	3.50	YU	11.0	Y	12.0	Y
POTASSIUM (TOTAL)	mg/kg	1900	Y	2880	Y	3190	Y	3770	Y	3510	Y
SELENIUM (TOTAL)	mg/kg	25.0	YR	2.50	YUR	25.0	YR	25.0	YR	25.0	YR
SILVER (TOTAL)	mg/kg	14.0	Y	2.80	Y	9.50	Y	7.10	Y	7.90	Y
SODIUM (TOTAL)	mg/kg	292.	YU	1050	Y	530.	Y	1210	Y	1170	Y
SULFUR (TOTAL)	%	8.70	YJS	1.30	Y	0.540	Y	1.50	Y	1.70	Y
SULFATE SULFUR	%	0.250	Y	0.990	Y	0.650	Y	1.60	Y	1.90	Y
PYRITIC SULFUR	%	0.900	YJ*	0.130	YJ*	0.0500	Y	0.0800	Y	0.0700	Y
ORGANIC SULFUR	%	7.60	YJ*S	0.0500	YJ*	--		--		--	
THALLIUM (TOTAL)	mg/kg	5.00	YU	5.00	YUJS	5.00	YU	5.00	YU	5.00	YU
TIN (TOTAL)	mg/kg	8.00	YU	8.00	YU	8.00	YU	8.00	YU	8.00	YU
VANADIUM (TOTAL)	mg/kg	4.40	Y	8.10	Y	6.70	Y	43.0	Y	44.0	Y
ZINC (TOTAL)	mg/kg	54.0	Y	224.	Y	41.0	Y	150.	Y	147.	Y
PERCENT SOLID	mg/kg	--		--		--		--		--	
CLAY	%	--		--		--		--		--	
SILT	%	--		--		--		--		--	
SAND	%	--		--		--		--		--	
COARSE FRACTION	%	--		--		--		--		--	

FOOTNOTES

(R) = REJECTED ('R' used by laboratory indicated recovery problems)
(JHT) = ESTIMATED due to holding time violation
(JL) = ESTIMATED due to exceeding ICP linear range
(*) = DUPLICATE control limits exceeded
(EJ) = ESTIMATED due to interference problems (ICP serial dilution or not spike recovery by graphite furnance)
(mmhos) = mmhos/cm
(I) = QUANTIFIED due to exceeding ICP linear range
(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(JS) = ESTIMATED due to spike recoveries outside limits
(meq) = meq of hydrogen ion
(--) = NOT analyzed
(tons) = tons CaCO3/1000 ton of material
(H,HT) = QUALIFIED due to holding time violation

05/28/87

CLEAR CREEK TAILINGS CHEMISTRY DATA

		12/03/85 MHE269 TAG0307 21'5"-21'10 GREGORY BORING #3 RAW		12/03/85 MHE270 TAG0311 21'5"-21'10 GREGORY BORING #3 RAW SPLIT		12/03/85 MHE280 TAG0308 26'-26'5" GREGORY BORING #3 RAW		11/22/85 MHE219 TAG0402 5'8"-6'10" GREGORY BORING #4 POWDER		11/22/85 MHE201 TAG0403 11'1"-11'10" GREGORY BORING #4 POWDER	
LAB DETERMINATIONS											
pH	S.U.	3.70	Y	3.80	Y	3.20	Y	3.40	Y	3.40	Y
ACID POTENTIAL	meq/100g	20.0	Y	11.0	Y	3.00	Y	531.	Y	297.	Y
NEUTRALIZATION POTENTIAL	tons/1000	4.90	Y	8.60	Y	1.20	YU	1.30	YU	7.70	Y
ALUMINUM (TOTAL)	mg/kg	8220	Y	9680	Y	7220	Y	1520	Y	1790	YJE
ANTIMONY (TOTAL)	mg/kg	35.0	YJS	27.0	YJS	16.0	YJS	18.0	Y	12.0	YU
ARSENIC (TOTAL)	mg/kg	186.	Y	196.	Y	56.0	Y	68.0	Y	52.0	Y
BARIUM (TOTAL)	mg/kg	130.	Y	162.	Y	113.	Y	12.0	Y	14.0	Y
BERYLLIUM (TOTAL)	mg/kg	0.600	Y	0.600	Y	0.260	Y	0.200	YU	0.200	YU
CADMIUM (TOTAL)	mg/kg	5.60	Y	5.20	Y	2.50	Y	6.30	Y	2.20	Y
CALCIUM (TOTAL)	mg/kg	1980	Y	1730	Y	1530	Y	104.	YU	1360	Y
CHROMIUM (TOTAL)	mg/kg	27.0	Y	24.0	Y	26.0	Y	48.0	Y	41.0	Y
COBALT (TOTAL)	mg/kg	26.0	Y	30.0	Y	8.80	Y	11.0	Y	8.30	Y
CONDUCTIVITY	mmhos/cm	3.30	Y	3.80	Y	3.60	Y	1.90	Y	2.50	Y
COPPER (TOTAL)	mg/kg	1350	Y	913.	Y	172.	Y	26.0	Y	22.0	Y
CYANIDE (TOTAL)	mg/kg	0.500	YU	0.500	YU	0.650	Y	0.500	YJHT	1.30	YUJHT
GOLD (TOTAL)	mg/kg	3.60	YJS	3.70	YJS	0.500	YUJS	0.750	Y	0.500	YU
IRON (TOTAL)	mg/kg	17000	Y	19000	Y	28300	Y	85800	Y	53000	Y
LEAD (TOTAL)	mg/kg	1290	Y	1210	Y	62.0	Y	302.	Y	219.	Y
MAGNESIUM (TOTAL)	mg/kg	2100	Y	2570	Y	4160	Y	220.	Y	214.	Y
MANGANESE (TOTAL)	mg/kg	144.	Y	148.	Y	180.	Y	16.0	Y	9.60	Y
MERCURY (TOTAL)	mg/kg	29.0	YJS	8.20	YJS	0.230	YJS	0.180	Y	0.270	Y
MOLYBDENUM (TOTAL)	mg/kg	10.0	YU	10.0	YU	10.0	YU	13.0	Y	9.00	Y
NICKEL (TOTAL)	mg/kg	31.0	Y	33.0	Y	12.0	Y	12.0	Y	8.20	Y
POTASSIUM (TOTAL)	mg/kg	2250	Y	3070	Y	4120	Y	1650	Y	2370	Y
SELENIUM (TOTAL)	mg/kg	25.0	YR	25.0	YR	25.0	YR	25.0	YR	25.0	YUR
SILVER (TOTAL)	mg/kg	34.0	Y	33.0	Y	4.00	Y	21.0	Y	11.0	Y
SODIUM (TOTAL)	mg/kg	337.	Y	307.	Y	292.	YU	874.	Y	810.	Y
SULFUR (TOTAL)	%	0.540	Y	0.550	Y	0.180	Y	11.0	YJS	5.60	Y
SULFATE SULFUR	%	0.340	Y	0.400	Y	0.120	Y	0.240	Y	0.330	Y
PYRITIC SULFUR	%	0.110	Y	0.100	Y	0.0700	Y	1.60	YJ*	1.20	YJ*
ORGANIC SULFUR	%	0.0900	Y	0.0500	Y	--		9.20	YJ*S	4.10	YJ*
THALLIUM (TOTAL)	mg/kg	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YUJS
TIN (TOTAL)	mg/kg	8.00	YU	8.00	YU	8.00	YU	8.00	YU	8.00	YU
VANADIUM (TOTAL)	mg/kg	47.0	Y	49.0	Y	37.0	Y	5.40	Y	4.00	Y
ZINC (TOTAL)	mg/kg	1180	Y	1250	Y	95.0	Y	103.	Y	86.0	Y
PERCENT SOLID	mg/kg	--		--		--		--		--	
CLAY	%	--		--		--		--		--	
SILT	%	--		--		--		--		--	
SAND	%	--		--		--		--		--	
COARSE FRACTION	%	--		--		--		--		--	

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(JS) = ESTIMATED due to spike recoveries outside limits
(meq) = meq of hydrogen ion
(--) = NOT analyzed
(tons) = tons CaCO3/1000 ton of material
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CLEAR CREEK TAILINGS CHEMISTRY DATA

		11/22/85 MHE207 TAG0407 27'5"-27'10" GREGORY BORING #4 POWDER		11/22/85 MHE211 TAG0502 5'5"-6'10" GREGORY BORING #5 POWDER		11/22/85 MHE210 TAG0515 5'5"-6'10" GREGORY BORING #5 POWDER (SPLIT)		11/22/85 MHE208 TAG0511 31'3"-31'10" GREGORY BORING #5 POWDER		11/22/85 MHE209 TAG0512 35'1"-35'8" GREGORY BORING #5 POWDER	
LAB DETERMINATIONS											
pH	S.U.	5.70	Y	2.70	Y	2.60	Y	5.80	Y	6.10	Y
ACID POTENTIAL	meq/100g	113.	Y	430.	Y	434.	Y	25.0	Y	0.500	YU
NEUTRALIZATION POTENTIAL	tons/1000	27.0	Y	1.30	YU	1.30	YU	21.0	Y	15.0	Y
ALUMINUM (TOTAL)	mg/kg	3420	YJE	1510	YJE	1710	YJE	5310	YJE	3340	YJE
ANTIMONY (TOTAL)	mg/kg	19.0	Y	18.0	Y	19.0	Y	19.0	Y	12.0	YU
ARSENIC (TOTAL)	mg/kg	79.0	Y	97.0	Y	98.0	Y	52.0	Y	5.00	YU
BARIUM (TOTAL)	mg/kg	604.	Y	21.0	Y	22.0	Y	130.	Y	39.0	Y
BERYLLIUM (TOTAL)	mg/kg	1.40	Y	0.200	YU	0.200	YU	1.10	Y	0.280	Y
CADMIUM (TOTAL)	mg/kg	32.0	Y	4.10	Y	4.30	Y	4.70	Y	2.00	YU
CALCIUM (TOTAL)	mg/kg	1300	Y	1740	Y	1740	Y	1490	Y	1660	Y
CHROMIUM (TOTAL)	mg/kg	47.0	Y	34.0	Y	35.0	Y	69.0	Y	44.0	Y
COBALT (TOTAL)	mg/kg	42.0	Y	11.0	Y	11.0	Y	8.50	Y	5.40	Y
CONDUCTIVITY	mmhos/cm	0.490	Y	4.10	Y	4.10	Y	0.480	Y	0.240	Y
COPPER (TOTAL)	mg/kg	1760	Y	56.0	Y	53.0	Y	572.	Y	96.0	Y
CYANIDE (TOTAL)	mg/kg	0.500	YUJHT	0.500	YUJHT	0.500	YUJHT	0.500	YUJHT	0.500	YJHT
GOLD (TOTAL)	mg/kg	0.500	YU	1.60	Y	1.40	Y	2.00	Y	0.500	YU
IRON (TOTAL)	mg/kg	90800	Y	86700	Y	86900	Y	22300	Y	11200	Y
LEAD (TOTAL)	mg/kg	384.	Y	436.	Y	438.	Y	586.	Y	28.0	Y
MAGNESIUM (TOTAL)	mg/kg	1020	Y	265.	Y	291.	Y	1950	Y	1700	Y
MANGANESE (TOTAL)	mg/kg	147.	Y	12.0	Y	13.0	Y	185.	Y	95.0	Y
MERCURY (TOTAL)	mg/kg	0.860	Y	0.220	Y	0.0500	YU	9.15	Y	0.300	Y
MOLYBDENUM (TOTAL)	mg/kg	15.0	Y	16.0	Y	13.0	Y	8.80	Y	5.00	YU
NICKEL (TOTAL)	mg/kg	72.0	Y	11.0	Y	8.30	Y	18.0	Y	6.30	Y
POTASSIUM (TOTAL)	mg/kg	2200	Y	2910	Y	2970	Y	3280	Y	2010	Y
SELENIUM (TOTAL)	mg/kg	25.0	YUR	25.0	YUR	25.0	YUR	2.50	YUR	2.50	YUR
SILVER (TOTAL)	mg/kg	13.0	Y	22.0	Y	22.0	Y	15.0	Y	1.50	YU
SODIUM (TOTAL)	mg/kg	752.	Y	972.	Y	1140	Y	1490	Y	1380	Y
SULFUR (TOTAL)	%	8.90	Y	9.00	Y	8.80	Y	0.950	Y	0.110	Y
SULFATE SULFUR	%	0.160	Y	0.810	Y	0.810	Y	0.0800	Y	0.0300	Y
PYRITIC SULFUR	%	0.0700	YJ*	1.60	YJ*	1.50	YJ*	0.110	YJ*	0.0600	YJ*
ORGANIC SULFUR	%	8.70	YJ*	6.60	YJ*	6.50	YJ*	0.760	YJ*	0.0200	YJ*
THALLIUM (TOTAL)	mg/kg	5.00	YUJS	5.00	YUJS	5.00	YUJS	5.00	YUJS	5.00	YUJS
TIN (TOTAL)	mg/kg	8.00	YU	8.00	YU	8.00	YU	8.00	YU	8.00	YU
VANADIUM (TOTAL)	mg/kg	12.0	Y	6.40	Y	6.40	Y	19.0	Y	17.0	Y
ZINC (TOTAL)	mg/kg	2320	Y	27.0	Y	26.0	Y	619.	Y	50.0	YUJHT
PERCENT SOLID	mg/kg	--		--		--		--		--	
CLAY	%	8.00	Y	--		--		12.0	Y	--	
SILT	%	11.0	Y	--		--		12.0	Y	--	
SAND	%	60.0	Y	--		--		32.0	Y	--	
COARSE FRACTION	%	21.0	Y	--		--		44.0	Y	--	

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(meq) = meq of hydrogen ion
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05/28/87

CLEAR CREEK TAILINGS CHEMISTRY DATA

		11/22/85 MHE216 TAG06001 6'4"-8' GREGORY BORING #6 POWDER		11/25/85 MHC365 TAG0602 10'4"-12' GREGORY BORING #6 POWDER		11/25/85 MHC363 TAG0701 1'4"-2' GREGORY BORING #7 POWDER		11/22/85 MHE215 TAG0802 6'9"-8'5" GREGORY BORING #8 POWDER		11/25/85 MHE238 TAG0901 5"-1'10" GREGORY BORING #9 POWDER	
LAB DETERMINATIONS											
pH	S.U.	2.60	Y	2.80	Y	2.50	Y	2.40	Y	2.90	Y
ACID POTENTIAL	meq/100g	413.	Y	166.	Y	33.0	Y	494.	Y	492.	Y
NEUTRALIZATION POTENTIAL	tons/1000	1.30	YU	362.	Y	378.	Y	1.30	YU	1.30	YU
ALUMINUM (TOTAL)	mg/kg	--		2190	Y	1800	Y	2760	YJE	1190	Y
ANTIMONY (TOTAL)	mg/kg	--		24.0	YJS	17.0	YJS	44.0	Y	36.0	Y
ARSENIC (TOTAL)	mg/kg	--		162.	Y	15.0	Y	130.	Y	72.0	Y
BARIUM (TOTAL)	mg/kg	--		20.0	Y	24.0	Y	20.0	Y	12.0	Y
BERYLLIUM (TOTAL)	mg/kg	--		0.350	Y	0.440	Y	0.280	Y	0.200	YU
CADMIUM (TOTAL)	mg/kg	--		10.0	Y	5.60	Y	13.0	Y	11.0	Y
CALCIUM (TOTAL)	mg/kg	--		1790	Y	104.	YU	127.	Y	460.	Y
CHROMIUM (TOTAL)	mg/kg	--		40.0	Y	69.0	Y	22.0	Y	56.0	Y
COBALT (TOTAL)	mg/kg	--		16.0	Y	9.60	Y	25.0	Y	18.0	Y
CONDUCTIVITY	mmhos/cm	3.80	Y	3.00	Y	3.70	Y	4.30	Y	3.50	Y
COPPER (TOTAL)	mg/kg	--		1340	Y	40.0	Y	1300	Y	35.0	Y
CYANIDE (TOTAL)	mg/kg	0.500	YJHT	7.60	YJHT	6.00	YJHT	35.0	YJHT	1.90	YJHT
GOLD (TOTAL)	mg/kg	--		0.900	Y	2.40	Y	0.500	YU	3.50	Y
IRON (TOTAL)	mg/kg	--		111000	Y	85800	Y	158000	Y	185000	Y
LEAD (TOTAL)	mg/kg	--		428.	Y	446.	Y	647.	Y	393.	Y
MAGNESIUM (TOTAL)	mg/kg	--		318.	Y	253.	Y	444.	Y	309.	Y
MANGANESE (TOTAL)	mg/kg	--		16.0	YJE	15.0	YJE	20.0	Y	24.0	Y
MERCURY (TOTAL)	mg/kg	--		0.540	Y	0.420	Y	0.500	Y	0.160	YJHT
MOLYBDENUM (TOTAL)	mg/kg	--		21.0	Y	24.0	Y	36.0	Y	36.0	Y
NICKEL (TOTAL)	mg/kg	--		20.0	Y	9.40	Y	23.0	Y	9.90	Y
POTASSIUM (TOTAL)	mg/kg	--		2300	Y	3330	Y	3400	Y	1700	Y
SELENIUM (TOTAL)	mg/kg	--		25.0	YUJS	25.0	YUJS	0.0000	YR	25.0	YU
SILVER (TOTAL)	mg/kg	--		28.0	Y	33.0	Y	48.0	Y	43.0	Y
SODIUM (TOTAL)	mg/kg	--		292.	YU	292.	YU	1000	Y	292.	YU
SULFUR (TOTAL)	%	13.0	YJS	11.0	Y	8.30	Y	16.0	Y	17.0	Y
SULFATE SULFUR	%	0.510	Y	0.400	Y	0.670	Y	0.540	Y	0.350	Y
PYRITIC SULFUR	%	3.40	YJ*	11.0	YJS	8.00	YJS	5.00	YJ*	18.0	Y
ORGANIC SULFUR	%	9.10	YJ*S	--		--		10.0	YJ*	--	
THALLIUM (TOTAL)	mg/kg	--		5.00	YU	5.00	YU	5.00	YUJS	5.00	YU
TIN (TOTAL)	mg/kg	--		8.00	YU	8.00	YU	8.00	YU	8.00	YU
VANADIUM (TOTAL)	mg/kg	--		8.40	Y	6.90	Y	8.90	Y	11.0	Y
ZINC (TOTAL)	mg/kg	--		424.	Y	48.0	Y	186.	Y	49.0	Y
PERCENT SOLID	mg/kg	--		--		--		--		--	
CLAY	%	--		--		--		--		7.00	Y
SILT	%	--		--		--		--		37.0	Y
SAND	%	--		--		--		--		55.0	Y
COARSE FRACTION	%	--		--		--		--		1.00	Y

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(meq) = meq of hydrogen ion
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05/28/87

CLEAR CREEK TAILINGS CHEMISTRY DATA

		11/25/85 MHE249 TAG0902 5'4"-6'10" GREGORY BORING #9 POWDER		11/25/85 MHE237 TAG0903 10'4"-11'7" GREGORY BORING #9 POWDER		11/25/85 MHE236 TAG0905 19'5"-20'5" GREGORY BORING #9 POWDER		11/25/85 MHE230 TAG0906 26'5"-27'3" GREGORY BORING #9 POWDER		11/25/85 MHC366 TAG0908 30'-30'10" GREGORY BORING #9 POWDER	
LAB DETERMINATIONS											
pH	S.U.	2.40	Y	2.90	Y	3.70	Y	4.70	Y	4.80	Y
ACID POTENTIAL	meq/100g	28.0	Y	0.500	YU	255.	Y	59.0	Y	0.500	YU
NEUTRALIZATION POTENTIAL	tons/1000	352.	Y	14.0	Y	1.30	YU	7.50	Y	349.	Y
ALUMINUM (TOTAL)	mg/kg	2160	Y	2730	Y	2900	Y	5560	Y	3530	Y
ANTIMONY (TOTAL)	mg/kg	26.0	YJS	12.0	YU	12.0	YU	124.	Y	12.0	YUJS
ARSENIC (TOTAL)	mg/kg	110.	Y	120.	Y	14.0	Y	253.	Y	5.00	YU
BARIUM (TOTAL)	mg/kg	8.20	Y	17.0	Y	26.0	Y	75.0	Y	40.0	Y
BERYLLIUM (TOTAL)	mg/kg	0.200	YU	0.200	YU	0.200	YU	0.270	Y	0.250	Y
CADMIUM (TOTAL)	mg/kg	6.10	Y	5.40	Y	2.00	YU	13.0	Y	2.00	YU
CALCIUM (TOTAL)	mg/kg	1040	Y	1320	Y	4060	Y	900.	Y	1080	Y
CHROMIUM (TOTAL)	mg/kg	40.0	Y	35.0	Y	43.0	Y	70.0	Y	55.0	Y
COBALT (TOTAL)	mg/kg	14.0	Y	10.0	Y	4.10	Y	9.50	Y	4.50	Y
CONDUCTIVITY	mmhos/cm	9.40	Y	5.00	Y	3.20	Y	0.660	Y	0.310	Y
COPPER (TOTAL)	mg/kg	323.	Y	258.	Y	214.	Y	3880	Y	46.0	Y
CYANIDE (TOTAL)	mg/kg	2.00	YJHT	0.500	YUJHT	3.80	YJHT	2.90	YJHT	1.70	YJHT
GOLD (TOTAL)	mg/kg	1.50	YJ	0.500	YU	0.500	YU	5.00	Y	0.500	Y
IRON (TOTAL)	mg/kg	111000	Y	78900	Y	29400	Y	40800	Y	12200	Y
LEAD (TOTAL)	mg/kg	352.	Y	280.	Y	24.0	Y	2050	Y	12.0	Y
MAGNESIUM (TOTAL)	mg/kg	357.	Y	427.	Y	958.	Y	2020	Y	1620	Y
MANGANESE (TOTAL)	mg/kg	37.0	YJE	105.	Y	131.	Y	127.	Y	98.0	YJE
MERCURY (TOTAL)	mg/kg	0.160	Y	0.220	YJHT	0.140	YJHT	19.0	YJHT	0.160	Y
MOLYBDENUM (TOTAL)	mg/kg	28.0	Y	19.0	Y	6.40	Y	16.0	Y	2.80	Y
NICKEL (TOTAL)	mg/kg	13.0	Y	13.0	Y	5.50	Y	29.0	Y	8.10	Y
POTASSIUM (TOTAL)	mg/kg	2240	Y	3530	Y	1610	Y	3000	Y	1670	Y
SELENIUM (TOTAL)	mg/kg	25.0	YUJS	25.0	YU	2.50	YU	25.0	YU	2.50	YUJS
SILVER (TOTAL)	mg/kg	22.0	Y	16.0	Y	1.80	Y	44.0	Y	2.00	Y
SODIUM (TOTAL)	mg/kg	500.	Y	292.	YU	292.	YU	292.	YU	318.	Y
SULFUR (TOTAL)	%	12.0	Y	0.590	Y	0.690	Y	3.30	Y	0.140	Y
SULFATE SULFUR	%	1.70	Y	1.30	Y	0.640	Y	0.120	Y	0.0100	YU
PYRITIC SULFUR	%	9.30	YJS	5.50	Y	0.170	Y	2.70	Y	0.0100	YUJS
ORGANIC SULFUR	%	1.00	YJS	--		--		0.510	Y	0.140	YJS
THALLIUM (TOTAL)	mg/kg	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
TIN (TOTAL)	mg/kg	8.00	YU	8.00	YU	8.00	YU	8.00	YU	8.00	YU
VANADIUM (TOTAL)	mg/kg	7.90	Y	11.0	Y	11.0	Y	22.0	Y	12.0	Y
ZINC (TOTAL)	mg/kg	88.0	Y	137.	Y	124.	Y	1210	Y	52.0	Y
PERCENT SOLID	mg/kg	--		--		--		--		--	
CLAY	%	--		--		--		11.0	Y	--	
SILT	%	--		--		--		20.0	Y	--	
SAND	%	--		--		--		62.0	Y	--	
COARSE FRACTION	%	--		--		--		7.00	Y	--	

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(mmhos) = mmhos/cm
(I) = QUANTIFIED due to exceeding ICP linear range
(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(JS) = ESTIMATED due to spike recoveries outside limits
(meq) = meq of hydrogen ion
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CLEAR CREEK TAILINGS CHEMISTRY DATA

		11/25/85 MHE244 TAG0909 35'7"-36'10 GREGORY BORING #9 POWDER		11/25/85 MHE224 TAG0910 40'5"-41'7" GREGORY BORING #9 POWDER		11/25/85 MHE231 TAG0912 46'0"-46'10" GREGORY BORING #9 POWDER		12/03/85 MHC387 TAG1001 9"-1'2" GREGORY BORING #10 RAW		12/03/85 MHE266 TAG1013 9"-1'2" GREGORY BORING #10 RAW (SPLIT)	
LAB DETERMINATIONS											
pH	S.U.	5.70	Y	7.80	Y	7.50	Y	2.50	Y	2.00	Y
ACID POTENTIAL	meq/100g	0.500	YU	1.00	Y	4.90	Y	8.90	Y	4.00	Y
NEUTRALIZATION POTENTIAL	tons/1000	405.	Y	83.0	Y	6.30	Y	1.30	YU	1.20	Y U
ALUMINUM (TOTAL)	mg/kg	6340	Y	4350	Y	3110	Y	940.	Y	1320	Y
ANTIMONY (TOTAL)	mg/kg	12.0	YUJS	12.0	YU	12.0	YU	12.0	YUJS	16.0	YJS
ARSENIC (TOTAL)	mg/kg	5.00	YU	5.00	YU	41.0	Y	5.50	Y	9.50	Y
BARIUM (TOTAL)	mg/kg	75.0	Y	45.0	Y	59.0	Y	35.0	Y	42.0	Y
BERYLLIUM (TOTAL)	mg/kg	0.440	Y	0.270	Y	0.760	Y	0.200	YU	0.200	YU
CADMIUM (TOTAL)	mg/kg	2.00	YU	2.00	YU	2.00	Y	2.00	YU	2.00	YU
CALCIUM (TOTAL)	mg/kg	1910	Y	1770	Y	1380	Y	109.	Y	134.	Y
CHROMIUM (TOTAL)	mg/kg	49.0	Y	39.0	Y	39.0	Y	2.60	Y	3.10	Y
COBALT (TOTAL)	mg/kg	9.20	Y	5.90	Y	8.70	Y	2.50	YU	3.10	Y
CONDUCTIVITY	mmhos/cm	0.130	Y	0.140	Y	0.170	Y	4.40	Y	8.30	Y
COPPER (TOTAL)	mg/kg	46.0	Y	28.0	Y	36.0	Y	120.	Y	167.	Y
CYANIDE (TOTAL)	mg/kg	0.500	YJHT	0.500	YJHT	0.500	YUJHT	8.60	Y	8.00	Y
GOLD (TOTAL)	mg/kg	0.500	YU	0.500	YU	0.500	YU	0.500	YU	1.20	YJS
IRON (TOTAL)	mg/kg	16100	Y	11500	Y	43800	Y	26100	Y	33600	Y
LEAD (TOTAL)	mg/kg	34.0	Y	14.0	Y	55.0	Y	445.	Y	572.	Y
MAGNESIUM (TOTAL)	mg/kg	3380	Y	1890	Y	1150	Y	156.	YU	173.	Y
MANGANESE (TOTAL)	mg/kg	277.	YJE	287.	Y	529.	Y	13.0	Y	10.0	Y
MERCURY (TOTAL)	mg/kg	0.0600	Y	0.0500	YJHT	0.120	YJHT	0.590	Y	0.880	YJS
MOLYBDENUM (TOTAL)	mg/kg	5.00	YU	5.00	YU	7.40	Y	12.0	Y	13.0	Y
NICKEL (TOTAL)	mg/kg	20.0	Y	32.0	Y	14.0	Y	3.50	YU	3.50	YU
POTASSIUM (TOTAL)	mg/kg	3020	Y	1920	Y	2240	Y	4550	Y	6060	Y
SELENIUM (TOTAL)	mg/kg	2.50	YUJS	2.50	YU	2.50	YU	2.50	YUJS	25.0	Y
SILVER (TOTAL)	mg/kg	1.50	YU	1.50	YU	6.20	Y	25.0	Y	31.0	Y
SODIUM (TOTAL)	mg/kg	292.	YU	292.	YU	292.	YU	692.	Y	592.	Y
SULFUR (TOTAL)	%	0.240	Y	0.130	Y	0.440	Y	1.50	Y	1.60	Y
SULFATE SULFUR	%	0.0100	YU	0.0100	YU	0.0200	Y	1.40	Y	1.90	Y
PYRITIC SULFUR	%	0.0800	YJS	0.0400	Y	0.370	Y	0.0700	YJ*	0.0600	Y
ORGANIC SULFUR	%	0.160	YJS	0.0900	Y	0.0500	Y	0.0300	YJ*	--	
THALLIUM (TOTAL)	mg/kg	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
TIN (TOTAL)	mg/kg	8.00	YU	8.00	YU	8.00	YU	8.00	YU	8.00	YU
VANADIUM (TOTAL)	mg/kg	24.0	Y	14.0	Y	12.0	Y	2.70	Y	3.00	Y
ZINC (TOTAL)	mg/kg	92.0	Y	67.0	Y	184.	Y	33.0	Y	28.0	Y
PERCENT SOLID	mg/kg	--		--		--		--		--	
CLAY	%	--		--		--		--		--	
SILT	%	--		--		--		--		--	
SAND	%	--		--		--		--		--	
COARSE FRACTION	%	--		--		--		--		--	

FOOTNOTES

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(mmhos) = mmhos/cm
(I) = QUANTIFIED due to exceeding ICP linear range
(J) = ESTIMATED
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(U) = UNDETECTED
(JS) = ESTIMATED due to spike recoveries outside limits
(meq) = meq of hydrogen ion
(--) = NOT analyzed
(tons) = tons CaCO3/1000 ton of material
(H,HT) = QUALIFIED due to holding time violation

05/28/87

CLEAR CREEK TAILINGS CHEMISTRY DATA

		12/03/85 MHC391 TAG1003 5'4"-7' GREGORY BORING #10 RAW		12/03/85 MHC392 TAG1006 15'8"-16'6" GREGORY BORING #10 RAW		12/03/85 MHC385 TAG1007A 19'11"-20'1" GREGORY BORING #10 RAW		12/03/85 MHC388 TAG1007B 20'4"-20'9" GREGORY BORING #10 RAW		12/03/85 MHC389 TAG1007C 20'9"-21'2" GREGORY BORING #10 RAW	
LAB DETERMINATIONS											
pH	S.U.	2.50	Y	2.80	Y	3.50	Y	3.60	Y	4.00	Y
ACID POTENTIAL	meq/100g	369.	Y	0.500	YU	12.0	Y	0.500	YU	0.500	YU
NEUTRALIZATION POTENTIAL	tons/1000	1.30	YU	2.50	YU	23.0	Y	20.0	Y	19.0	Y
ALUMINUM (TOTAL)	mg/kg	391.	Y	4540	Y	6240	Y	5880	Y	5070	Y
ANTIMONY (TOTAL)	mg/kg	40.0	YJS	12.0	YUJS	12.0	YUJS	12.0	YUJS	12.0	YUJS
ARSENIC (TOTAL)	mg/kg	96.0	Y	8.50	Y	16.0	Y	7.50	Y	5.00	YU
BARIUM (TOTAL)	mg/kg	11.0	Y	65.0	Y	72.0	Y	62.0	Y	64.0	Y
BERYLLIUM (TOTAL)	mg/kg	0.200	YU	0.240	Y	0.320	Y	0.240	Y	0.200	YU
CADMIUM (TOTAL)	mg/kg	8.20	Y	2.40	Y	2.00	YU	2.00	YU	2.00	YU
CALCIUM (TOTAL)	mg/kg	104.	YU	646.	Y	1170	Y	1000	Y	942.	Y
CHROMIUM (TOTAL)	mg/kg	6.70	Y	9.50	Y	14.0	Y	12.0	Y	6.70	Y
COBALT (TOTAL)	mg/kg	21.0	Y	5.40	Y	6.00	Y	5.50	Y	5.40	Y
CONDUCTIVITY	mmhos/cm	3.80	Y	1.50	Y	0.530	Y	0.210	Y	0.130	Y
COPPER (TOTAL)	mg/kg	346.	Y	52.0	Y	41.0	Y	38.0	Y	24.0	Y
CYANIDE (TOTAL)	mg/kg	2.40	Y	0.500	YU	0.500	YU	0.500	YU	0.500	YU
GOLD (TOTAL)	mg/kg	0.500	YU	0.500	YU	0.500	YU	0.500	YU	0.500	YU
IRON (TOTAL)	mg/kg	155000	Y	27500	Y	24400	Y	16600	Y	13800	Y
LEAD (TOTAL)	mg/kg	475.	Y	42.0	Y	40.0	Y	45.0	Y	9.50	Y
MAGNESIUM (TOTAL)	mg/kg	245.	Y	2750	Y	3760	Y	3660	Y	3430	Y
MANGANESE (TOTAL)	mg/kg	15.0	Y	158.	Y	384.	Y	394.	Y	359.	Y
MERCURY (TOTAL)	mg/kg	0.0500	YU	0.0500	YU	0.0500	YU	0.0500	YU	0.0500	YU
MOLYBDENUM (TOTAL)	mg/kg	37.0	Y	6.60	Y	6.40	Y	5.00	YU	5.00	YU
NICKEL (TOTAL)	mg/kg	17.0	Y	5.90	Y	7.70	Y	6.70	Y	5.10	Y
POTASSIUM (TOTAL)	mg/kg	1220	Y	3300	Y	3550	Y	2830	Y	3140	Y
SELENIUM (TOTAL)	mg/kg	2.50	YUJS	2.50	YUJS	2.50	YUJS	2.50	YUJS	2.50	YUJS
SILVER (TOTAL)	mg/kg	43.0	Y	2.50	Y	3.20	Y	2.70	Y	1.60	Y
SODIUM (TOTAL)	mg/kg	836.	Y	633.	Y	596.	Y	834.	Y	688.	Y
SULFUR (TOTAL)	%	17.0	Y	0.480	Y	0.430	Y	0.100	Y	0.0500	Y
SULFATE SULFUR	%	0.460	Y	0.410	Y	0.130	Y	0.0200	Y	0.0100	YU
PYRITIC SULFUR	%	17.0	YJ*	0.0600	YJ*	0.320	YJ*	0.0300	YJ*	0.0500	YJ*
ORGANIC SULFUR	%	--		0.0100	YJ*	--		0.0500	YJ*	0.0100	YUJ*
THALLIUM (TOTAL)	mg/kg	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
TIN (TOTAL)	mg/kg	8.00	YU	8.00	YU	8.00	YU	8.00	YU	8.00	YU
VANADIUM (TOTAL)	mg/kg	8.70	Y	15.0	Y	14.0	Y	11.0	Y	9.90	Y
ZINC (TOTAL)	mg/kg	101.	Y	54.0	Y	87.0	Y	82.0	Y	74.0	Y
PERCENT SOLID	mg/kg	--		--		--		--		--	
CLAY	%	--		--		--		--		--	
SILT	%	--		--		--		--		--	
SAND	%	--		--		--		--		--	
COARSE FRACTION	%	--		--		--		--		--	

FOOTNOTES

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(*) = DUPLICATE control limits exceeded
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(mmhos) = mmhos/cm
(I) = QUANTIFIED due to exceeding ICP linear range
(J) = ESTIMATED
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CLEAR CREEK TAILINGS CHEMISTRY DATA

		12/03/85 MHC390 TAG1007D 21'7"-22' GREGORY BORING #10 RAW		12/03/85 MHE271 TAG1008 25'4"-25'9" GREGORY BORING #10 RAW		12/03/85 MHE272 TAG1009 25'9"-26'2" GREGORY BORING #10 RAW		11/25/85 MHC367 TAG1101 2"-1'10" GREGORY BORING #11 POWDER		11/25/85 MHC364 TAG1102 5"9"-6'10" GREGORY BORING #11 POWDER	
LAB DETERMINATIONS											
pH	S.U.	4.30	Y	4.80	Y	4.10	Y	2.70	Y	2.50	Y
ACID POTENTIAL	meq/100g	0.500	YU	0.500	YU	0.500	YU	50.0	Y	46.0	Y
NEUTRALIZATION POTENTIAL	tons/1000	23.0	Y	71.0	Y	77.0	Y	404.	Y	402.	Y
ALUMINUM (TOTAL)	mg/kg	5790	Y	11300	Y	14900	Y	1030	Y	1410	Y
ANTIMONY (TOTAL)	mg/kg	12.0	YUJS	15.0	YJS	12.0	YUJS	45.0	YJS	28.0	YJS
ARSENIC (TOTAL)	mg/kg	5.00	YU	5.00	YU	8.50	Y	104.	Y	71.0	Y
BARIUM (TOTAL)	mg/kg	66.0	Y	174.	Y	258.	Y	6.70	Y	11.0	Y
BERYLLIUM (TOTAL)	mg/kg	0.240	Y	0.430	Y	0.600	Y	0.200	YU	0.200	YU
CADMIUM (TOTAL)	mg/kg	2.00	YU	2.00	YU	2.00	YU	10.0	Y	6.90	Y
CALCIUM (TOTAL)	mg/kg	995.	Y	27000	Y	25000	Y	970.	Y	615.	Y
CHROMIUM (TOTAL)	mg/kg	7.70	Y	28.0	Y	35.0	Y	28.0	Y	28.0	Y
COBALT (TOTAL)	mg/kg	6.10	Y	16.0	Y	21.0	Y	23.0	Y	13.0	Y
CONDUCTIVITY	mmhos/cm	0.110	Y	2.60	Y	3.20	Y	3.40	Y	3.30	Y
COPPER (TOTAL)	mg/kg	41.0	Y	32.0	Y	39.0	Y	980.	Y	53.0	Y
CYANIDE (TOTAL)	mg/kg	0.500	YU	0.500	YU	0.500	YU	2.70	YJHT	11.0	YJHT
GOLD (TOTAL)	mg/kg	0.500	YU	0.500	YUJS	0.500	YUJS	1.80	Y	1.10	Y
IRON (TOTAL)	mg/kg	16500	Y	24000	Y	29500	Y	188000	Y	110000	Y
LEAD (TOTAL)	mg/kg	13.0	Y	21.0	Y	16.0	Y	302.	Y	310.	Y
MAGNESIUM (TOTAL)	mg/kg	3620	Y	14900	Y	20000	Y	318.	Y	246.	Y
MANGANESE (TOTAL)	mg/kg	446.	Y	360.	Y	448.	Y	12.0	YJE	7.60	YJE
MERCURY (TOTAL)	mg/kg	0.0500	YU	0.0600	YJS	0.0500	YUJS	0.220	Y	0.340	Y
MOLYBDENUM (TOTAL)	mg/kg	5.00	YU	10.0	YU	10.0	YU	40.0	Y	25.0	Y
NICKEL (TOTAL)	mg/kg	6.50	Y	46.0	Y	62.0	Y	17.0	Y	8.60	Y
POTASSIUM (TOTAL)	mg/kg	2850	Y	7400	Y	10100	Y	1350	Y	1840	Y
SELENIUM (TOTAL)	mg/kg	2.50	YUJS	25.0	YR	25.0	YR	25.0	YUJS	25.0	YUJS
SILVER (TOTAL)	mg/kg	1.70	Y	1.50	YU	1.80	Y	38.0	Y	25.0	Y
SODIUM (TOTAL)	mg/kg	701.	Y	1140	Y	1290	Y	579.	Y	292.	YU
SULFUR (TOTAL)	%	0.0600	Y	0.0100	YU	0.0100	YU	20.0	Y	12.0	Y
SULFATE SULFUR	%	0.0100	YU	0.0100	YU	0.0100	YU	0.420	Y	0.380	Y
PYRITIC SULFUR	%	0.0700	YJ*	0.0400	Y	0.0300	Y	19.0	YJS	12.0	YJS
ORGANIC SULFUR	%	--		--		--		0.580	YJS	--	
THALLIUM (TOTAL)	mg/kg	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
TIN (TOTAL)	mg/kg	8.00	YU	8.00	YU	8.00	YU	8.00	YU	8.00	YU
VANADIUM (TOTAL)	mg/kg	13.0	Y	52.0	Y	65.0	Y	11.0	Y	7.10	Y
ZINC (TOTAL)	mg/kg	89.0	Y	109.	Y	134.	Y	157.	Y	32.0	Y
PERCENT SOLID	mg/kg	--		--		--		--		--	
CLAY	%	--		--		--		36.0	Y	--	
SILT	%	--		--		--		60.0	Y	--	
SAND	%	--		--		--		4.00	Y	--	
COARSE FRACTION	%	--		--		--		1.00	YU	--	

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(meq) = meq of hydrogen ion
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CLEAR CREEK TAILINGS CHEMISTRY DATA

		11/25/85 MHC362 TAG1107 15'11"-16'10" GREGORY BORING #11 POWDER		11/25/85 MHE245 TAG1115 40'6"-41'10 GREGORY BORING #11 POWDER		11/25/85 MHE248 TAG1201 2"-1'5" GREGORY BORING #12 POWDER		11/22/85 MHE214 TAG1204 11'4"-12'10" GREGORY BORING #12 POWDER		11/25/85 MHE226 TAG1205 20'5"-21'10" GREGORY BORING #12 POWDER	
LAB DETERMINATIONS											
pH	S.U.	4.00	Y	6.40	Y	2.90	Y	2.50	Y	4.50	Y
ACID POTENTIAL	meq/100g	14.0	Y	5.40	Y	21.0	Y	345.	Y	250.	Y
NEUTRALIZATION POTENTIAL	tons/1000	395.	Y	280.	Y	390.	Y	1.30	YU	112.	Y
ALUMINUM (TOTAL)	mg/kg	6220	Y	10700	Y	803.	Y	1380	YJE	5370	Y
ANTIMONY (TOTAL)	mg/kg	12.0	YUJS	12.0	YUJS	24.0	YJS	30.0	Y	27.0	Y
ARSENIC (TOTAL)	mg/kg	14.0	Y	6.00	Y	56.0	Y	115.	Y	156.	Y
BARIUM (TOTAL)	mg/kg	31.0	Y	330.	Y	8.40	Y	6.50	YU	30.0	Y
BERYLLIUM (TOTAL)	mg/kg	1.00	Y	1.90	Y	0.200	YU	0.200	YU	0.930	Y
CADMIUM (TOTAL)	mg/kg	2.80	Y	3.70	Y	9.10	Y	8.30	Y	17.0	Y
CALCIUM (TOTAL)	mg/kg	1290	Y	14700	Y	769.	Y	1220	Y	2310	Y
CHROMIUM (TOTAL)	mg/kg	45.0	Y	56.0	Y	27.0	Y	25.0	Y	56.0	Y
COBALT (TOTAL)	mg/kg	6.70	Y	38.0	Y	13.0	Y	20.0	Y	28.0	Y
CONDUCTIVITY	mmhos/cm	0.860	Y	0.160	Y	2.20	Y	5.20	Y	1.90	Y
COPPER (TOTAL)	mg/kg	298.	Y	47.0	Y	37.0	Y	735.	Y	1260	Y
CYANIDE (TOTAL)	mg/kg	3.60	YJHT	0.500	YUJHT	6.80	YJHT	0.850	YUJHT	13.0	YJHT
GOLD (TOTAL)	mg/kg	0.600	Y	0.500	YU	1.00	YJ	0.500	YU	0.500	YU
IRON (TOTAL)	mg/kg	19900	Y	57900	Y	125000	Y	137000	Y	139000	Y
LEAD (TOTAL)	mg/kg	66.0	Y	10.0	Y	282.	Y	479.	Y	567.	Y
MAGNESIUM (TOTAL)	mg/kg	2060	Y	9740	Y	233.	Y	297.	Y	1790	Y
MANGANESE (TOTAL)	mg/kg	132.	YJE	2400	YJE	12.0	YJE	14.0	Y	833.	Y
MERCURY (TOTAL)	mg/kg	0.380	Y	0.0500	YU	0.420	Y	0.140	Y	0.660	YJHT
MOLYBDENUM (TOTAL)	mg/kg	5.00	YU	10.0	Y	31.0	Y	25.0	Y	32.0	Y
NICKEL (TOTAL)	mg/kg	14.0	Y	65.0	Y	14.0	Y	17.0	Y	49.0	Y
POTASSIUM (TOTAL)	mg/kg	1820	Y	6480	Y	1520	Y	1880	Y	3720	Y
SELENIUM (TOTAL)	mg/kg	2.50	YUJS	2.50	YUJS	25.0	YUJS	0.0000	YR	25.0	YU
SILVER (TOTAL)	mg/kg	1.90	Y	5.10	Y	26.0	Y	26.0	Y	27.0	Y
SODIUM (TOTAL)	mg/kg	292.	YU	889.	Y	492.	Y	933.	Y	292.	YU
SULFUR (TOTAL)	%	1.00	Y	0.220	Y	12.0	Y	15.0	Y	12.0	Y
SULFATE SULFUR	%	0.220	Y	0.0100	YU	0.260	Y	0.740	Y	0.360	Y
PYRITIC SULFUR	%	0.500	YJS	0.290	YJS	12.0	YJS	1.80	YJ*	11.0	Y
ORGANIC SULFUR	%	0.280	YJS	--		--		12.0	YJ*	0.640	Y
THALLIUM (TOTAL)	mg/kg	5.00	YU	5.00	YU	5.00	YU	5.00	YUJS	5.00	YU
TIN (TOTAL)	mg/kg	8.00	YU	8.00	YU	8.00	YU	8.00	YU	8.00	YU
VANADIUM (TOTAL)	mg/kg	12.0	Y	62.0	Y	7.40	Y	10.0	Y	23.0	Y
ZINC (TOTAL)	mg/kg	140.	Y	343.	Y	81.0	Y	316.	Y	965.	Y
PERCENT SOLID	mg/kg	--		--		--		--		--	
CLAY	%	--		--		8.00	Y	--		--	
SILT	%	--		--		14.0	Y	--		--	
SAND	%	--		--		78.0	Y	--		--	
COARSE FRACTION	%	--		--		1.00	YU	--		--	

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(I) = QUANTIFIED due to exceeding ICP linear range
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(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(JS) = ESTIMATED due to spike recoveries outside limits
(meq) = meq of hydrogen ion
(--) = NOT analyzed
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(H,HT) = QUALIFIED due to holding time violation

CLEAR CREEK TAILINGS CHEMISTRY DATA

		11/25/85 MHC368 TAG1206 25'7"-26'10" GREGORY BORING #12 POWDER		11/25/85 MHE255 TAG1209 26'5"-26'10" GREGORY BORING #12 POWDER		11/25/85 MHE247 TAG1116 40'6"-41'10 GREGORY BORING #12 POWDER		11/22/85 MHE212 TAG1302 10'-12' GREGORY BORING #13 POWDER		11/22/85 MHE218 TAG1304 20'-22' GREGORY BORING #13 POWDER	
LAB DETERMINATIONS											
pH	S.U.	4.70	Y	--		6.40	Y	5.80	Y	6.70	Y
ACID POTENTIAL	meq/100g	262.	Y	--		18.0	Y	1.00	Y	0.500	YU
NEUTRALIZATION POTENTIAL	tons/1000	402.	Y	--		414.	Y	28.0	Y	32.0	Y
ALUMINUM (TOTAL)	mg/kg	4990	Y	--		10400	Y	3620	YJE	7050	Y
ANTIMONY (TOTAL)	mg/kg	18.0	YJS	--		12.0	YUJS	12.0	YU	12.0	YU
ARSENIC (TOTAL)	mg/kg	20.0	Y	--		7.00	Y	6.00	Y	5.00	YU
BARIUM (TOTAL)	mg/kg	62.0	Y	--		339.	Y	38.0	Y	93.0	Y
BERYLLIUM (TOTAL)	mg/kg	0.440	Y	--		1.90	Y	0.280	Y	0.360	Y
CADMIUM (TOTAL)	mg/kg	3.40	Y	--		4.30	Y	2.00	YU	2.00	YU
CALCIUM (TOTAL)	mg/kg	2100	Y	--		15000	Y	901.	Y	1570	Y
CHROMIUM (TOTAL)	mg/kg	46.0	Y	--		53.0	Y	39.0	Y	73.0	Y
COBALT (TOTAL)	mg/kg	8.40	Y	--		38.0	Y	3.20	Y	9.50	Y
CONDUCTIVITY	mmhos/cm	0.670	Y	--		0.160	Y	0.140	Y	0.180	Y
COPPER (TOTAL)	mg/kg	199.	Y	--		52.0	Y	74.0	Y	26.0	Y
CYANIDE (TOTAL)	mg/kg	3.80	YJHT	--		0.560	YJHT	0.500	YUJHT	0.500	YJHT
GOLD (TOTAL)	mg/kg	0.850	Y	--		0.500	YU	0.500	YU	0.500	YU
IRON (TOTAL)	mg/kg	30500	Y	--		58800	Y	7490	Y	17000	Y
LEAD (TOTAL)	mg/kg	103.	Y	--		8.50	Y	47.0	Y	33.0	Y
MAGNESIUM (TOTAL)	mg/kg	2050	Y	--		9930	Y	1460	Y	3070	Y
MANGANESE (TOTAL)	mg/kg	320.	YJE	--		2460	Y	105.	Y	775.	Y
MERCURY (TOTAL)	mg/kg	0.380	Y	--		0.0500	YU	0.120	Y	0.0500	YU
MOLYBDENUM (TOTAL)	mg/kg	8.20	Y	--		9.50	Y	5.00	YU	5.00	YU
NICKEL (TOTAL)	mg/kg	8.10	Y	--		64.0	Y	5.90	Y	16.0	Y
POTASSIUM (TOTAL)	mg/kg	2810	Y	--		6740	Y	1790	Y	3250	Y
SELENIUM (TOTAL)	mg/kg	2.50	YUJS	--		2.50	YUJS	2.50	YUR	2.50	YR
SILVER (TOTAL)	mg/kg	5.90	Y	--		4.10	Y	1.50	YU	1.50	YU
SODIUM (TOTAL)	mg/kg	606.	Y	--		767.	Y	1100	Y	684.	Y
SULFUR (TOTAL)	%	1.60	Y	--		0.110	Y	0.0400	Y	0.0500	YJS
SULFATE SULFUR	%	0.0700	Y	--		0.0100	YU	0.0400	Y	0.0600	Y
PYRITIC SULFUR	%	1.40	YJS	--		0.310	YJS	0.0600	YJ*	0.100	YJ*
ORGANIC SULFUR	%	0.130	YJS	--		--		--		--	
THALLIUM (TOTAL)	mg/kg	5.00	YU	--		5.00	YU	5.00	YUJS	5.00	YU
TIN (TOTAL)	mg/kg	8.00	YU	--		8.00	YU	8.00	YU	8.00	YU
VANADIUM (TOTAL)	mg/kg	9.20	Y	--		61.0	Y	11.0	Y	23.0	Y
ZINC (TOTAL)	mg/kg	172.	Y	--		342.	Y	143.	Y	208.	Y
PERCENT SOLID	mg/kg	--		--		--		--		--	
CLAY	%	--		5.00	Y	--		--		--	
SILT	%	--		7.00	Y	--		--		--	
SAND	%	--		60.0	Y	--		--		--	
COARSE FRACTION	%	--		28.0	Y	--		--		--	

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CLEAR CREEK TAILINGS CHEMISTRY DATA

		11/22/85 MHE223 TAG1403 11'-13' GREGORY BORING #14 POWDER		11/22/85 MHE221 TAG1406 25'-25'5" GREGORY BORING #14 POWDER		07/17/85 MHC308 TA01 GREGORY COMPOSITE #1		07/17/85 MHC309 TA02 GREGORY COMPOSITE #2		11/25/85 MHE225 TANT102 1-2' NATIONAL TUNNEL BORING #1 POWDER	
LAB DETERMINATIONS											
pH	S.U.	4.80	Y	7.80	Y	1.80	Y	2.60	Y	6.20	Y
ACID POTENTIAL	meq/100g	2.50	Y	0.500	YU	--		--		32.0	Y
NEUTRALIZATION POTENTIAL	tons/1000	17.0	Y	142.	Y	--		--		153.	Y
ALUMINUM (TOTAL)	mg/kg	12500	Y	24800	Y	13.0	YU	1960	Y	3030	Y
ANTIMONY (TOTAL)	mg/kg	12.0	YU	12.0	YU	32.0	Y	21.0	Y	28.0	Y
ARSENIC (TOTAL)	mg/kg	9.50	Y	24.0	Y	40.0	Y	154.	Y	113.	Y
BARIUM (TOTAL)	mg/kg	154.	Y	832.	Y	6.30	YU	103.	Y	243.	Y
BERYLLIUM (TOTAL)	mg/kg	0.870	Y	1.50	Y	0.160	YU	0.160	YU	0.200	YU
CADMIUM (TOTAL)	mg/kg	6.00	Y	4.00	Y	6.60	Y	4.70	Y	38.0	Y
CALCIUM (TOTAL)	mg/kg	1750	Y	28100	Y	629.	Y	2890	Y	2040	Y
CHROMIUM (TOTAL)	mg/kg	97.0	Y	63.0	Y	4.50	Y	15.0	Y	39.0	Y
COBALT (TOTAL)	mg/kg	32.0	Y	40.0	Y	12.0	Y	8.20	Y	21.0	Y
CONDUCTIVITY	mmhos/cm	0.900	Y	0.190	Y	--		--		1.00	Y
COPPER (TOTAL)	mg/kg	524.	Y	176.	Y	51.0	Y	146.	Y	1950	Y
CYANIDE (TOTAL)	mg/kg	0.500	YJHT	0.500	YJHT	3.70	YJS	0.550	YJS	0.500	YJHT
GOLD (TOTAL)	mg/kg	1.60	Y	0.500	YU	--		--		0.500	YU
IRON (TOTAL)	mg/kg	16000	Y	56100	Y	110000	Y	61300	Y	116000	Y
LEAD (TOTAL)	mg/kg	46.0	Y	61.0	Y	216.	Y	292.	Y	3950	Y
MAGNESIUM (TOTAL)	mg/kg	4250	Y	31600	Y	170.	Y	1800	Y	1730	Y
MANGANESE (TOTAL)	mg/kg	168.	Y	1800	Y	24.0	Y	82.0	Y	789.	Y
MERCURY (TOTAL)	mg/kg	1.20	Y	0.230	Y	0.140	YJS	1.20	YJS	0.740	YJHT
MOLYBDENUM (TOTAL)	mg/kg	6.10	Y	8.20	Y	--		--		22.0	Y
NICKEL (TOTAL)	mg/kg	56.0	Y	115.	Y	9.00	Y	14.0	Y	17.0	Y
POTASSIUM (TOTAL)	mg/kg	3690	Y	9410	Y	957.	Y	4620	Y	2860	Y
SELENIUM (TOTAL)	mg/kg	2.50	YR	2.50	YR	2.60	YJS	2.70	YJS	2.50	YU
SILVER (TOTAL)	mg/kg	2.20	Y	3.70	Y	19.0	Y	7.90	Y	126.	Y
SODIUM (TOTAL)	mg/kg	381.	Y	1260	Y	449.	Y	2090	Y	292.	YU
SULFUR (TOTAL)	%	0.460	YJS	0.170	YJS	--		--		1.00	Y
SULFATE SULFUR	%	0.140	Y	0.0100	Y	--		--		0.210	Y
PYRITIC SULFUR	%	0.0500	YJ*	0.290	YJ*	--		--		1.60	Y
ORGANIC SULFUR	%	0.270	YJ*S	--		--		--		--	
THALLIUM (TOTAL)	mg/kg	5.00	YU	5.00	YU	1.60	YU	1.60	YU	5.00	YU
TIN (TOTAL)	mg/kg	8.00	YU	8.00	YU	8.90	YJS	9.30	YJS	8.00	YU
VANADIUM (TOTAL)	mg/kg	47.0	Y	131.	Y	6.40	Y	44.0	Y	18.0	Y
ZINC (TOTAL)	mg/kg	1170	Y	821.	Y	49.0	Y	72.0	Y	34700	Y
PERCENT SOLID	mg/kg	--		--		--		--		--	
CLAY	%	--		--		--		--		--	
SILT	%	--		--		--		--		--	
SAND	%	--		--		--		--		--	
COARSE FRACTION	%	--		--		--		--		--	

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CLEAR CREEK TAILINGS CHEMISTRY DATA

		11/25/85 MHE228 TANT104 10-12' NATIONAL TUNNEL BORING #1 POWDER		11/25/85 MHE240 TANT107 20'-21'6" NATIONAL TUNNEL BORING #1 POWDER		12/03/85 MHC396 TAQH101 0-2' QUARTZ HILL BORING #1 RAW		12/13/85 MHC394 TAQH108 26'-26'10" QUARTZ HILL BORING #1 RAW		12/13/85 MHC395 TAQH109 30'-30'5" QUARTZ HILL BORING #1 RAW	
LAB DETERMINATIONS											
pH	S.U.	7.20	Y	7.90	Y	2.80	Y	2.90	Y	3.30	Y
ACID POTENTIAL	meq/100g	0.500	YU	4.40	Y	5.40	Y	2.50	Y	0.500	YU
NEUTRALIZATION POTENTIAL	tons/1000	26.0	Y	19.0	Y	1.20	YU	10.0	Y	23.0	Y
ALUMINUM (TOTAL)	mg/kg	14600	Y	15700	Y	5910	Y	8740	Y	18600	Y
ANTIMONY (TOTAL)	mg/kg	12.0	YU	13.0	Y	23.0	YJS	13.0	YJS	13.0	YJS
ARSENIC (TOTAL)	mg/kg	12.0	Y	10.0	Y	601.	Y	21.0	Y	18.0	Y
BARIUM (TOTAL)	mg/kg	130.	Y	120.	Y	109.	Y	42.0	Y	198.	Y
BERYLLIUM (TOTAL)	mg/kg	0.360	Y	0.520	Y	0.510	Y	0.760	Y	1.50	Y
CADMIUM (TOTAL)	mg/kg	3.10	Y	2.10	Y	8.90	Y	3.50	Y	4.30	Y
CALCIUM (TOTAL)	mg/kg	720.	Y	690.	Y	2360	Y	2330	Y	6900	Y
CHROMIUM (TOTAL)	mg/kg	99.0	Y	79.0	Y	7.40	Y	27.0	Y	24.0	Y
COBALT (TOTAL)	mg/kg	26.0	Y	18.0	Y	12.0	Y	8.70	Y	25.0	Y
CONDUCTIVITY	mmhos/cm	0.110	Y	0.130	Y	4.10	Y	3.80	Y	2.50	Y
COPPER (TOTAL)	mg/kg	44.0	Y	26.0	Y	552.	Y	560.	Y	534.	Y
CYANIDE (TOTAL)	mg/kg	0.500	YUJHT	0.500	YUJHT	0.500	YU	0.500	YU	0.500	YU
GOLD (TOTAL)	mg/kg	0.500	YU	0.500	YU	0.850	YJS	0.500	YU	0.500	YU
IRON (TOTAL)	mg/kg	31300	Y	47700	Y	73200	Y	49100	Y	49600	Y
LEAD (TOTAL)	mg/kg	44.0	Y	9.00	Y	364.	Y	556.	Y	371.	Y
MAGNESIUM (TOTAL)	mg/kg	9900	Y	9820	Y	2940	Y	2200	Y	14000	Y
MANGANESE (TOTAL)	mg/kg	1160	Y	749.	Y	361.	Y	176.	Y	1760	Y
MERCURY (TOTAL)	mg/kg	0.140	YJHT	0.0500	YUJHT	0.680	YJS	0.0500	YU	0.0500	YU
MOLYBDENUM (TOTAL)	mg/kg	6.10	YU	8.00	Y	28.0	Y	14.0	Y	12.0	Y
NICKEL (TOTAL)	mg/kg	50.0	Y	36.0	Y	6.90	Y	17.0	Y	67.0	Y
POTASSIUM (TOTAL)	mg/kg	13800	Y	14100	Y	7260	Y	3590	Y	9860	Y
SELENIUM (TOTAL)	mg/kg	2.50	YU	2.50	YU	25.0	YR	2.50	YUJS	2.50	YUJS
SILVER (TOTAL)	mg/kg	3.40	Y	4.00	Y	14.0	Y	4.90	Y	4.40	Y
SODIUM (TOTAL)	mg/kg	292.	YU	348.	Y	1050	Y	805.	Y	1050	Y
SULFUR (TOTAL)	%	0.0500	Y	0.100	Y	1.30	Y	1.10	Y	0.570	Y
SULFATE SULFUR	%	0.0100	YU	0.0100	YU	1.20	Y	0.680	Y	0.340	Y
PYRITIC SULFUR	%	0.420	Y	0.700	Y	0.0400	Y	0.170	YJ*	0.270	YJ*
ORGANIC SULFUR	%	--		--		0.0600	Y	0.250	YJ*	--	
THALLIUM (TOTAL)	mg/kg	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
TIN (TOTAL)	mg/kg	8.00	YU	8.00	YU	8.00	YU	8.00	YU	8.00	YU
VANADIUM (TOTAL)	mg/kg	60.0	Y	64.0	Y	32.0	Y	37.0	Y	60.0	Y
ZINC (TOTAL)	mg/kg	190.	Y	340.	Y	311.	Y	423.	Y	2060	Y
PERCENT SOLID	mg/kg	--		--		--		--		--	
CLAY	%	--		--		--		--		--	
SILT	%	--		--		--		--		--	
SAND	%	--		--		--		--		--	
COARSE FRACTION	%	--		--		--		--		--	

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05/28/87

CLEAR CREEK TAILINGS CHEMISTRY DATA

		12/03/85 MHC386 TAQH110 34'5"-36'5" QUARTZ HILL BORING #1 RAW		12/03/85 MHC393 TAQH201 12"-24" QUARTZ HILL BORING #2 RAW		11/22/85 MHE202 TAQH203 11'-12' QUARTZ HILL BORING #2 RAW		11/22/85 MHE217 TAQH204 16'-16'10" QUARTZ HILL BORING #2 RAW		11/22/85 MHE203 TAQH205 20'-20'7" QUARTZ HILL BORING #2 RAW	
LAB DETERMINATIONS											
pH	S.U.	3.60	Y	2.90	Y	4.00	Y	4.80	Y	3.60	Y
ACID POTENTIAL	meq/100g	26.0	Y	0.500	YU	0.500	YU	0.500	YU	0.500	YU
NEUTRALIZATION POTENTIAL	tons/1000	13.0	Y	1.30	YU	13.0	Y	2.60	Y	41.0	Y
ALUMINUM (TOTAL)	mg/kg	3710	Y	3020	Y	3510	YJE	2310	Y	14100	YJE
ANTIMONY (TOTAL)	mg/kg	12.0	YUJS	12.0	YUJS	34.0	Y	26.0	Y	21.0	Y
ARSENIC (TOTAL)	mg/kg	16.0	Y	118.	Y	125.	Y	211.	Y	10.0	Y
BARIUM (TOTAL)	mg/kg	94.0	Y	84.0	Y	54.0	Y	41.0	Y	97.0	Y
BERYLLIUM (TOTAL)	mg/kg	0.540	Y	0.200	YU	0.280	Y	0.200	YU	0.560	Y
CADMIUM (TOTAL)	mg/kg	2.00	YU	3.80	Y	2.00	YU	4.60	Y	3.40	Y
CALCIUM (TOTAL)	mg/kg	1010	Y	536.	Y	606.	Y	558.	Y	5310	Y
CHROMIUM (TOTAL)	mg/kg	13.0	Y	7.30	Y	42.0	Y	49.0	Y	87.0	Y
COBALT (TOTAL)	mg/kg	4.60	Y	5.10	Y	5.20	Y	4.20	Y	27.0	Y
CONDUCTIVITY	mmhos/cm	0.690	Y	0.830	Y	0.370	Y	0.420	Y	0.490	Y
COPPER (TOTAL)	mg/kg	118.	Y	259.	Y	288.	Y	209.	Y	99.0	Y
CYANIDE (TOTAL)	mg/kg	50.0	Y	0.500	YU	0.500	YUJHT	0.500	YJHT	0.500	YUJHT
GOLD (TOTAL)	mg/kg	0.500	YU	0.500	YU	1.40	Y	1.80	Y	0.500	YU
IRON (TOTAL)	mg/kg	16400	Y	46300	Y	28300	Y	24700	Y	63900	Y
LEAD (TOTAL)	mg/kg	65.0	Y	219.	Y	2160	Y	4410	Y	64.0	Y
MAGNESIUM (TOTAL)	mg/kg	1940	Y	1930	Y	1420	Y	813.	Y	13500	Y
MANGANESE (TOTAL)	mg/kg	326.	Y	180.	Y	95.0	Y	70.0	Y	474.	Y
MERCURY (TOTAL)	mg/kg	0.0500	YU	0.500	Y	5.30	Y	8.70	Y	0.190	Y
MOLYBDENUM (TOTAL)	mg/kg	6.80	Y	13.0	Y	19.0	Y	13.0	Y	9.20	Y
NICKEL (TOTAL)	mg/kg	6.90	Y	4.70	Y	5.90	Y	4.40	Y	60.0	Y
POTASSIUM (TOTAL)	mg/kg	2190	Y	4670	Y	3510	Y	2050	Y	8840	Y
SELENIUM (TOTAL)	mg/kg	2.50	YUJS	2.50	YUJS	2.50	YUR	2.50	YR	2.50	YUR
SILVER (TOTAL)	mg/kg	1.90	Y	7.10	Y	22.0	Y	18.0	Y	4.90	Y
SODIUM (TOTAL)	mg/kg	367.	Y	883.	Y	975.	Y	292.	YU	1860	Y
SULFUR (TOTAL)	%	0.260	Y	0.880	Y	0.600	Y	1.00	YJS	0.130	Y
SULFATE SULFUR	%	0.200	Y	0.860	Y	0.580	Y	0.330	Y	0.0400	Y
PYRITIC SULFUR	%	0.0400	YJ*	0.0800	YJ*	0.0800	YJ*	0.230	YJ*	0.290	YJ*
ORGANIC SULFUR	%	0.0200	YJ*	--		--		0.440	YJ*S	--	
THALLIUM (TOTAL)	mg/kg	5.00	YU	5.00	YU	5.00	YUJS	5.00	YU	5.00	YUJS
TIN (TOTAL)	mg/kg	8.00	YU	8.00	YU	8.00	YU	8.00	YU	8.00	YU
VANADIUM (TOTAL)	mg/kg	9.90	Y	19.0	Y	11.0	Y	9.90	Y	79.0	Y
ZINC (TOTAL)	mg/kg	260.	Y	176.	Y	279.	Y	505.	Y	383.	Y
PERCENT SOLID	mg/kg	--		--		--		--		--	
CLAY	%	--		--		--		--		--	
SILT	%	--		--		--		--		--	
SAND	%	--		--		--		--		--	
COARSE FRACTION	%	--		--		--		--		--	

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05/28/87

CLEAR CREEK TAILINGS CHEMISTRY DATA

		11/26/85 MHC499 TAQH0301 QUARTZ HILL COMPOSITE #1		02/27/86 MHE580 TA001003 BIG FIVE GRAB #1		02/27/86 MHE581 TA002003 BIG FIVE GRAB #2		02/27/86 MHE582 TA003003 BIG FIVE GRAB #3		02/27/86 MHE583 TA004003 BIG FIVE GRAB #4	
LAB DETERMINATIONS											
pH	S.U.	4.30	Y	--		--		--		--	
ACID POTENTIAL	meq/100g	11.0	Y	--		--		--		--	
NEUTRALIZATION POTENTIAL	tons/1000	9.80	Y	--		--		--		--	
ALUMINUM (TOTAL)	mg/kg	3020	Y	748.	Y	296.	Y	1230	Y	270.	Y
ANTIMONY (TOTAL)	mg/kg	12.0	YU	14.0	YUJS	14.0	YUJS	14.0	YUJS	54.0	Y
ARSENIC (TOTAL)	mg/kg	56.0	Y	21.0	Y	11.0	Y	13.0	Y	171.	Y
BARIUM (TOTAL)	mg/kg	56.0	Y	22.0	Y	18.0	Y	30.0	Y	9.30	Y
BERYLLIUM (TOTAL)	mg/kg	0.720	Y	0.210	YU	0.220	YU	0.220	YU	0.210	YU
CADMIUM (TOTAL)	mg/kg	29.0	Y	2.10	YU	2.20	YU	2.20	YU	2.10	YU
CALCIUM (TOTAL)	mg/kg	1420	Y	5170	Y	479.	Y	905.	Y	941.	Y
CHROMIUM (TOTAL)	mg/kg	7.90	Y	2.10	YU	2.20	YU	2.20	YU	2.10	YU
COBALT (TOTAL)	mg/kg	6.80	Y	3.10	YU	3.20	YU	3.30	YU	3.20	YU
CONDUCTIVITY	mmhos/cm	1.70	Y	--		--		--		--	
COPPER (TOTAL)	mg/kg	561.	Y	50.0	Y	73.0	Y	46.0	Y	353.	Y
CYANIDE (TOTAL)	mg/kg	0.500	YJHT	--		--		--		--	
GOLD (TOTAL)	mg/kg	0.500	YJS	--		--		--		--	
IRON (TOTAL)	mg/kg	35700	Y	24200	Y	16200	Y	20800	Y	76300	Y
LEAD (TOTAL)	mg/kg	413.	Y	189.	Y	229.	Y	150.	Y	806.	Y
MAGNESIUM (TOTAL)	mg/kg	2390	Y	592.	Y	209.	YU	821.	Y	207.	YU
MANGANESE (TOTAL)	mg/kg	879.	YJE	68.0	Y	5.10	Y	45.0	Y	5.70	Y
MERCURY (TOTAL)	mg/kg	0.0900	YJHT	0.0730	Y	0.220	Y	0.0540	YU	51.0	Y
MOLYBDENUM (TOTAL)	mg/kg	11.0	Y	--		--		--		--	
NICKEL (TOTAL)	mg/kg	12.0	Y	3.10	YU	3.20	YU	3.30	YU	11.0	Y
POTASSIUM (TOTAL)	mg/kg	3440	Y	1860	Y	1310	Y	1810	Y	1300	Y
SELENIUM (TOTAL)	mg/kg	2.50	Y	2.60	YUJS	2.70	YUJS	2.70	YUJS	27.0	YU
SILVER (TOTAL)	mg/kg	8.50	Y	2.10	YU	4.30	Y	2.20	YU	51.0	Y
SODIUM (TOTAL)	mg/kg	292.	YU	1500	Y	979.	Y	1480	Y	1380	Y
SULFUR (TOTAL)	%	0.910	Y	--		--		--		--	
SULFATE SULFUR	%	0.310	YJS	--		--		--		--	
PYRITIC SULFUR	%	0.420	Y	--		--		--		--	
ORGANIC SULFUR	%	0.180	YJS	--		--		--		--	
THALLIUM (TOTAL)	mg/kg	5.00	YJS	5.20	YU	5.40	YU	5.40	YU	5.30	YU
TIN (TOTAL)	mg/kg	8.00	YJS	9.40	YU	9.70	YU	9.80	YU	9.60	YU
VANADIUM (TOTAL)	mg/kg	9.50	Y	2.60	YU	2.70	YU	7.40	Y	2.70	YU
ZINC (TOTAL)	mg/kg	4940	Y	56.0	YJ*	20.0	YJ*	42.0	YJ*	102.	Y
PERCENT SOLID	mg/kg	--		--		--		--		--	
CLAY	%	--		--		--		--		--	
SILT	%	--		--		--		--		--	
SAND	%	--		--		--		--		--	
COARSE FRACTION	%	--		--		--		--		--	

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(meq) = meq of hydrogen ion
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CLEAR CREEK TAILINGS CHEMISTRY DATA

		02/27/86 MHC941 TA005003 BIG FIVE GRAB #5		11/26/85 MHC495 TABF0101 BIG FIVE COMPOSITE #1		11/26/85 MHC496 TABF0201 BIG FIVE COMPOSITE #2		11/25/85 MHE241 TAA0101 0'-2' ARGO BORING #1 POWDER		11/25/85 MHE243 TAA0105 21-23' ARGO BORING #1 POWDER	
LAB DETERMINATIONS											
pH	S.U.	--		3.20	Y	2.90	Y	5.40	Y	3.50	Y
ACID POTENTIAL	meq/100g	--		25.0	Y	39.0	Y	0.500	YU	58.0	Y
NEUTRALIZATION POTENTIAL	tons/1000	--		1.20	YU	7.30	Y	21.0	Y	1.30	YU
ALUMINUM (TOTAL)	mg/kg	1210	Y	7990	Y	2720	Y	6560	Y	2010	Y
ANTIMONY (TOTAL)	mg/kg	14.0	YUJS	79.0	Y	28.0	Y	15.0	Y	13.0	Y
ARSENIC (TOTAL)	mg/kg	11.0	Y	783.	Y	80.0	Y	85.0	Y	133.	Y
BARIUM (TOTAL)	mg/kg	31.0	Y	76.0	Y	47.0	Y	116.	Y	99.0	Y
BERYLLIUM (TOTAL)	mg/kg	0.220	YU	0.720	Y	0.440	Y	0.850	Y	0.200	YU
CADMIUM (TOTAL)	mg/kg	2.20	YU	20.0	Y	5.00	Y	3.20	Y	12.0	Y
CALCIUM (TOTAL)	mg/kg	858.	Y	7470	Y	3960	Y	1640	Y	2640	Y
CHROMIUM (TOTAL)	mg/kg	3.00	Y	38.0	Y	9.30	Y	57.0	Y	27.0	Y
COBALT (TOTAL)	mg/kg	3.30	YU	19.0	Y	6.30	Y	8.40	Y	6.10	Y
CONDUCTIVITY	mmhos/cm	--		4.40	Y	3.70	Y	0.880	Y	2.70	Y
COPPER (TOTAL)	mg/kg	55.0	Y	1190	Y	228.	Y	180.	Y	446.	Y
CYANIDE (TOTAL)	mg/kg	--		0.500	YJHT	0.500	YJHT	0.500	YUJHT	0.500	YUJHT
GOLD (TOTAL)	mg/kg	--		0.500	YJS	0.500	YJS	0.500	YU	0.600	Y
IRON (TOTAL)	mg/kg	21700	Y	242000	Y	40600	Y	37000	Y	53500	Y
LEAD (TOTAL)	mg/kg	154.	Y	197.	Y	735.	Y	394.	Y	4830	Y
MAGNESIUM (TOTAL)	mg/kg	831.	Y	3530	Y	1230	Y	4150	Y	392.	Y
MANGANESE (TOTAL)	mg/kg	44.0	Y	411.	YJE	227.	YJE	256.	Y	40.0	Y
MERCURY (TOTAL)	mg/kg	0.0540	YU	0.820	YJHT	0.400	YJHT	0.750	YJHT	1.60	YJHT
MOLYBDENUM (TOTAL)	mg/kg	--		5140	Y	24.0	Y	17.0	Y	22.0	Y
NICKEL (TOTAL)	mg/kg	3.30	YU	15.0	Y	7.80	Y	9.60	Y	5.10	Y
POTASSIUM (TOTAL)	mg/kg	1890	Y	3030	Y	3010	Y	4840	Y	4620	Y
SELENIUM (TOTAL)	mg/kg	2.70	YUJS	25.0	Y	2.50	Y	2.50	YU	2.50	YU
SILVER (TOTAL)	mg/kg	3.00	Y	19.0	Y	17.0	Y	10.0	Y	38.0	Y
SODIUM (TOTAL)	mg/kg	1550	Y	787.	Y	292.	YU	665.	Y	292.	YU
SULFUR (TOTAL)	%	--		1.90	Y	2.80	Y	0.710	Y	4.90	Y
SULFATE SULFUR	%	--		1.70	YJS	1.20	YJS	0.470	Y	0.590	Y
PYRITIC SULFUR	%	--		0.500	Y	1.50	Y	0.200	Y	3.40	Y
ORGANIC SULFUR	%	--		--		0.100	YJS	0.0400	Y	0.910	Y
THALLIUM (TOTAL)	mg/kg	5.40	YU	5.00	YJS	5.00	YJS	5.00	YU	5.00	YU
TIN (TOTAL)	mg/kg	9.80	YU	8.00	YJS	8.00	YJS	8.00	YU	8.00	YU
VANADIUM (TOTAL)	mg/kg	8.70	Y	49.0	Y	10.0	Y	31.0	Y	6.80	Y
ZINC (TOTAL)	mg/kg	53.0	YJ*	441.	Y	204.	Y	283.	Y	1280	Y
PERCENT SOLID	mg/kg	--		--		--		--		--	
CLAY	%	--		--		--		13.0	Y	--	
SILT	%	--		--		--		9.00	Y	--	
SAND	%	--		--		--		35.0	Y	--	
COARSE FRACTION	%	--		--		--		43.0	Y	--	

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(U) = UNDETECTED
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(meq) = meq of hydrogen ion
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05/28/87

CLEAR CREEK TAILINGS CHEMISTRY DATA

		11/25/85 MHE242 TAA0110 46'-47'5" ARGO BORING #1 POWDER		11/25/85 MHE233 TAA0114 55-57' ARGO BORING #1 POWDER		12/03/85 MHE273 TAA0201 0-2' ARGO BORING #2 RAW		11/25/85 MHE239 TAA0205 10-12' ARGO BORING #2 POWDER		11/25/85 MHE232 TAA0211 40-42' ARGO BORING #2 POWDER	
LAB DETERMINATIONS											
pH	S.U.	3.00	Y	5.30	Y	2.60	Y	3.70	Y	5.10	Y
ACID POTENTIAL	meq/100g	22.0	Y	0.500	Y	4.90	Y	3.90	Y	36.0	Y
NEUTRALIZATION POTENTIAL	tons/1000	1.30	YU	395.	Y	1.20	YU	1.30	YU	39.0	Y
ALUMINUM (TOTAL)	mg/kg	3300	Y	6020	Y	3300	Y	5640	Y	10300	Y
ANTIMONY (TOTAL)	mg/kg	12.0	YU	12.0	YU	21.0	YJS	14.0	Y	17.0	Y
ARSENIC (TOTAL)	mg/kg	28.0	Y	68.0	Y	285.	Y	38.0	Y	62.0	Y
BARIUM (TOTAL)	mg/kg	29.0	Y	72.0	Y	125.	Y	68.0	Y	165.	Y
BERYLLIUM (TOTAL)	mg/kg	0.200	YU	0.270	Y	0.200	YU	0.520	Y	2.00	Y
CADMIUM (TOTAL)	mg/kg	2.70	Y	2.00	YU	7.40	Y	6.20	Y	12.0	Y
CALCIUM (TOTAL)	mg/kg	2590	Y	1080	Y	3820	Y	6670	Y	3360	Y
CHROMIUM (TOTAL)	mg/kg	39.0	Y	74.0	Y	11.0	Y	34.0	Y	49.0	Y
COBALT (TOTAL)	mg/kg	3.80	Y	7.40	Y	6.80	Y	11.0	Y	14.0	Y
CONDUCTIVITY	mmhos/cm	3.40	Y	0.400	Y	5.40	Y	3.10	Y	2.10	Y
COPPER (TOTAL)	mg/kg	93.0	Y	42.0	Y	534.	Y	261.	Y	418.	Y
CYANIDE (TOTAL)	mg/kg	0.500	YUJHT	0.500	YUJHT	0.500	YU	0.500	YUJHT	0.500	YUJHT
GOLD (TOTAL)	mg/kg	0.500	YU	0.500	YU	1.60	YJS	0.500	YU	0.500	YU
IRON (TOTAL)	mg/kg	28900	Y	20400	Y	62800	Y	73700	Y	49400	Y
LEAD (TOTAL)	mg/kg	365.	Y	10.0	Y	1820	Y	93.0	Y	253.	Y
MAGNESIUM (TOTAL)	mg/kg	557.	Y	2480	Y	1620	Y	3190	Y	5700	Y
MANGANESE (TOTAL)	mg/kg	51.0	Y	103.	Y	151.	Y	1180	Y	2650	Y
MERCURY (TOTAL)	mg/kg	0.780	YJHT	0.0500	YJHT	0.910	YJS	0.0500	YUJHT	0.240	YJHT
MOLYBDENUM (TOTAL)	mg/kg	9.00	Y	7.10	Y	22.0	Y	11.0	Y	14.0	Y
NICKEL (TOTAL)	mg/kg	6.10	Y	13.0	Y	4.80	Y	8.30	Y	15.0	Y
POTASSIUM (TOTAL)	mg/kg	4050	Y	4120	Y	6200	Y	6570	Y	6260	Y
SELENIUM (TOTAL)	mg/kg	2.50	YU	2.50	YU	25.0	YR	25.0	YU	2.50	YU
SILVER (TOTAL)	mg/kg	8.30	Y	1.90	Y	38.0	Y	5.60	Y	6.40	Y
SODIUM (TOTAL)	mg/kg	292.	YU	292.	YU	1000	Y	1280	Y	292.	YU
SULFUR (TOTAL)	%	1.90	Y	0.300	Y	1.70	Y	2.10	Y	1.70	Y
SULFATE SULFUR	%	1.70	Y	0.170	Y	1.60	Y	1.80	Y	0.540	Y
PYRITIC SULFUR	%	0.600	Y	0.180	Y	0.150	Y	0.290	Y	0.940	Y
ORGANIC SULFUR	%	--		--		0.0100	YU	0.0100	Y	0.220	Y
THALLIUM (TOTAL)	mg/kg	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
TIN (TOTAL)	mg/kg	8.00	YU	8.00	YU	8.00	YU	8.00	YU	8.00	YU
VANADIUM (TOTAL)	mg/kg	8.60	Y	25.0	Y	29.0	Y	30.0	Y	36.0	Y
ZINC (TOTAL)	mg/kg	124.	Y	44.0	Y	308.	Y	402.	Y	2290	Y
PERCENT SOLID	mg/kg	--		--		--		--		--	
CLAY	%	--		--		--		--		--	
SILT	%	--		--		--		--		--	
SAND	%	--		--		--		--		--	
COARSE FRACTION	%	--		--		--		--		--	

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(JC) = ESTIMATED due to instrument calibration problems
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05/28/87

CLEAR CREEK TAILINGS CHEMISTRY DATA

		12/03/85 MHE276 TAA0301 0-2' ARGO BORING #3 POWDER		11/25/85 MHE234 TAA0302 5-7' ARGO BORING #3 POWDER		11/25/85 MHE235 TAA0309 5-7' ARGO BORING #3 POWDER (SPLIT)		12/03/85 MHE275 TAA0305 10-12' ARGO BORING #3 RAW		11/25/85 MHE229 TAA0306 15-16.5' ARGO BORING #3 POWDER	
LAB DETERMINATIONS											
pH	S.U.	2.90	Y	4.80	Y	4.70	Y	3.70	Y	6.40	Y
ACID POTENTIAL	meq/100g	4.40	Y	31.0	Y	29.0	Y	0.500	YU	0.500	YU
NEUTRALIZATION POTENTIAL	tons/1000	12.0	Y	400.	Y	7.50	Y	16.0	Y	7.50	Y
ALUMINUM (TOTAL)	mg/kg	6740	Y	4530	Y	4420	Y	8050	Y	6980	Y
ANTIMONY (TOTAL)	mg/kg	29.0	YJS	47.0	Y	54.0	Y	12.0	YUJS	12.0	YU
ARSENIC (TOTAL)	mg/kg	175.	Y	96.0	Y	94.0	Y	7.00	Y	5.00	YU
BARIUM (TOTAL)	mg/kg	152.	Y	65.0	Y	68.0	Y	90.0	Y	69.0	Y
BERYLLIUM (TOTAL)	mg/kg	0.340	Y	0.270	Y	0.200	YU	0.430	Y	0.270	Y
CADMIUM (TOTAL)	mg/kg	5.90	Y	5.80	Y	5.90	Y	2.00	YU	2.00	YU
CALCIUM (TOTAL)	mg/kg	6570	Y	4020	Y	4060	Y	845.	Y	898.	Y
CHROMIUM (TOTAL)	mg/kg	28.0	Y	41.0	Y	41.0	Y	30.0	Y	78.0	Y
COBALT (TOTAL)	mg/kg	9.20	Y	6.70	Y	6.00	Y	10.0	Y	7.50	Y
CONDUCTIVITY	mmhos/cm	5.60	Y	2.30	Y	2.30	Y	2.90	Y	0.120	Y
COPPER (TOTAL)	mg/kg	248.	Y	258.	Y	267.	Y	91.0	Y	29.0	Y
CYANIDE (TOTAL)	mg/kg	0.500	YU	0.500	YJHT	0.500	YUJHT	0.500	YU	0.500	YUJHT
GOLD (TOTAL)	mg/kg	10.0	YJS	0.500	YU	0.500	YU	0.500	YUJS	0.500	YU
IRON (TOTAL)	mg/kg	57200	Y	33400	Y	34400	Y	23400	Y	18200	Y
LEAD (TOTAL)	mg/kg	2310	Y	708.	Y	747.	Y	16.0	Y	19.0	Y
MAGNESIUM (TOTAL)	mg/kg	4380	Y	2360	Y	2380	Y	3860	Y	2960	Y
MANGANESE (TOTAL)	mg/kg	339.	Y	436.	Y	456.	Y	334.	Y	170.	Y
MERCURY (TOTAL)	mg/kg	3.50	YJS	1.30	YJHT	1.20	YJHT	0.0800	YJS	0.0500	YUJHT
MOLYBDENUM (TOTAL)	mg/kg	29.0	Y	42.0	Y	43.0	Y	10.0	YU	6.10	Y
NICKEL (TOTAL)	mg/kg	12.0	Y	9.10	Y	7.00	Y	14.0	Y	13.0	Y
POTASSIUM (TOTAL)	mg/kg	7590	Y	3960	Y	3950	Y	5690	Y	4710	Y
SELENIUM (TOTAL)	mg/kg	25.0	YR	2.50	YU	2.50	YU	25.0	YR	2.50	YU
SILVER (TOTAL)	mg/kg	23.0	Y	9.80	Y	9.50	Y	1.50	YU	1.50	YU
SODIUM (TOTAL)	mg/kg	764.	Y	292.	YU	292.	YU	466.	Y	292.	YU
SULFUR (TOTAL)	%	1.80	Y	1.80	Y	1.60	Y	0.100	Y	0.0900	Y
SULFATE SULFUR	%	1.60	Y	0.590	Y	0.610	Y	0.0700	Y	0.0100	YU
PYRITIC SULFUR	%	0.200	Y	0.970	Y	0.930	Y	0.0300	Y	0.0600	Y
ORGANIC SULFUR	%	0.0100	YU	0.240	Y	0.0600	Y	0.0100	YU	0.0300	Y
THALLIUM (TOTAL)	mg/kg	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
TIN (TOTAL)	mg/kg	8.00	YU	8.00	YU	8.00	YU	8.00	YU	8.00	YU
VANADIUM (TOTAL)	mg/kg	36.0	Y	26.0	Y	25.0	Y	30.0	Y	29.0	Y
ZINC (TOTAL)	mg/kg	480.	Y	541.	Y	527.	Y	87.0	Y	66.0	Y
PERCENT SOLID	mg/kg	--		--		--		--		--	
CLAY	%	--		--		--		--		--	
SILT	%	--		--		--		--		--	
SAND	%	--		--		--		--		--	
COARSE FRACTION	%	--		--		--		--		--	

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05/28/87

CLEAR CREEK TAILINGS CHEMISTRY DATA

		12/03/85 MHE279 TAA0310 15-16.5' ARGO BORING RAW (SPLIT)		07/22/85 MHC336 TA03 ARGO COMPOSITE #1		11/27/85 MHE262 TANG0101 NEVADA GULCH COMPOSITE TAILING #1		11/27/85 MHE263 TANG0201 NEVADA GULCH COMPOSITE TAILING #2		11/27/85 MHE264 TANG0301 NEVADA GULCH COMPOSITE TAILING #3	
LAB DETERMINATIONS											
pH	S.U.	4.00	Y	3.10	Y	4.10	Y	3.70	Y	4.10	Y
ACID POTENTIAL	meq/100g	9.40	Y	--		4.90	Y	6.40	Y	2.00	Y
NEUTRALIZATION POTENTIAL	tons/1000	1.20	YU	--		10.0	Y	10.0	Y	21.0	Y
ALUMINUM (TOTAL)	mg/kg	5530	Y	3220	Y	6820	Y	3700	Y	4460	Y
ANTIMONY (TOTAL)	mg/kg	12.0	YUJS	41.0	Y	17.0	YJS	15.0	YJS	12.0	YUJS
ARSENIC (TOTAL)	mg/kg	5.00	YU	352.	Y	260.	Y	99.0	Y	30.0	Y
BARIUM (TOTAL)	mg/kg	56.0	Y	145.	Y	89.0	Y	78.0	Y	58.0	Y
BERYLLIUM (TOTAL)	mg/kg	0.340	Y	0.180	Y	0.390	Y	0.240	Y	0.320	Y
CADMIUM (TOTAL)	mg/kg	2.00	YU	9.70	Y	7.50	Y	14.0	Y	5.70	Y
CALCIUM (TOTAL)	mg/kg	1160	Y	1840	Y	924.	Y	1090	Y	952.	Y
CHROMIUM (TOTAL)	mg/kg	26.0	Y	18.0	Y	26.0	Y	11.0	Y	9.80	Y
COBALT (TOTAL)	mg/kg	5.60	Y	7.40	Y	8.90	Y	5.70	Y	5.40	Y
CONDUCTIVITY	mmhos/cm	3.40	Y	--		0.270	Y	0.890	Y	0.570	Y
COPPER (TOTAL)	mg/kg	34.0	Y	460.	Y	207.	Y	438.	Y	217.	Y
CYANIDE (TOTAL)	mg/kg	0.500	YU	--		0.500	YU	50.0	Y	0.500	YU
GOLD (TOTAL)	mg/kg	0.500	YUJS	--		0.500	YU	0.500	YU	0.500	YU
IRON (TOTAL)	mg/kg	17300	Y	69500	Y	26000	Y	26200	Y	22400	Y
LEAD (TOTAL)	mg/kg	29.0	Y	2390	Y	1180	Y	10400	Y	597.	Y
MAGNESIUM (TOTAL)	mg/kg	2530	Y	1820	Y	3220	Y	1740	Y	1980	Y
MANGANESE (TOTAL)	mg/kg	162.	Y	166.	Y	275.	Y	727.	Y	309.	Y
MERCURY (TOTAL)	mg/kg	0.0500	YUJS	1.30	YJS	0.500	Y	11.9	Y	0.0500	YU
MOLYBDENUM (TOTAL)	mg/kg	10.0	YU	--		15.0	Y	12.0	Y	5.60	Y
NICKEL (TOTAL)	mg/kg	9.40	Y	11.0	Y	16.0	Y	7.90	Y	8.10	Y
POTASSIUM (TOTAL)	mg/kg	3020	Y	6290	Y	3660	Y	2980	Y	2790	Y
SELENIUM (TOTAL)	mg/kg	25.0	YR	29.0	YJS	2.50	YUJS	2.50	YUJS	2.50	YUJS
SILVER (TOTAL)	mg/kg	1.50	YU	26.0	Y	14.0	Y	24.0	Y	6.50	Y
SODIUM (TOTAL)	mg/kg	375.	Y	1100	Y	422.	Y	292.	YU	422.	Y
SULFUR (TOTAL)	%	0.0100	YU	--		0.230	Y	0.630	Y	0.270	Y
SULFATE SULFUR	%	0.0100	YU	--		0.190	Y	0.500	Y	0.180	Y
PYRITIC SULFUR	%	0.0300	Y	--		0.0400	YJ*	0.0400	YJ*	0.0500	YJ*
ORGANIC SULFUR	%	--		--		0.0100	YUJ*	0.0900	YJ*	0.0400	YJ*
THALLIUM (TOTAL)	mg/kg	5.00	YU	1.70	YU	5.00	YU	5.00	YU	5.00	YU
TIN (TOTAL)	mg/kg	8.00	YU	9.80	YJS	8.00	YU	8.00	YU	8.00	YU
VANADIUM (TOTAL)	mg/kg	29.0	Y	30.0	Y	26.0	Y	14.0	Y	14.0	Y
ZINC (TOTAL)	mg/kg	65.0	Y	240.	Y	474.	Y	2590	Y	1110	Y
PERCENT SOLID	mg/kg	--		--		--		--		--	
CLAY	%	--		--		--		--		--	
SILT	%	--		--		--		--		--	
SAND	%	--		--		--		--		--	
COARSE FRACTION	%	--		--		--		--		--	

FOOTNOTES

(R) = REJECTED ("R" used by laboratory indicated recovery problems)
(JHT) = ESTIMATED due to holding time violation
(JL) = ESTIMATED due to exceeding ICP linear range
(*) = DUPLICATE control limits exceeded
(EJ) = ESTIMATED due to interference problems (ICP serial dilution or MSA spike recovery by graphite furnance)
(mmhos) = mmhos/cm
(I) = QUANTIFIED due to exceeding ICP linear range
(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(JS) = ESTIMATED due to spike recoveries outside limits
(meq) = meq of hydrogen ion
(--) = NOT analyzed
(tons) = tons CaCO3/1000 ton of material
(U,HT) = QUALIFIED due to holding time violation

CLEAR CREEK TAILINGS CHEMISTRY DATA

		11/22/85 MHE220 TAS0101		11/25/85 MHE246 TAS0201		11/26/85 MHC497 TAVC0101		11/26/85 MHC498 TAVC0201		11/27/85 MHE250 TANCC0101	
		SOLID BLIND STANDARD #1		SOLID BLIND STANDARD #2		VIRGINIA CANYON TAILINGS COMPOSITE #1		VIRGINIA CANYON TAILINGS COMPOSITE #2		NORTH CLEAR CREEK COMPOSITE #1	
LAB DETERMINATIONS											
pH	S.U.	7.20	Y	5.10	Y	3.20	Y	3.20	Y	4.40	Y
ACID POTENTIAL	meq/100g	6.50	Y	5.40	Y	7.40	Y	26.0	Y	24.0	Y
NEUTRALIZATION POTENTIAL	tons/1000	405.	Y	391.	Y	1.20	YU	1.20	Y	10.0	Y
ALUMINUM (TOTAL)	mg/kg	1690	Y	11200	Y	4340	Y	4070	Y	3450	Y
ANTIMONY (TOTAL)	mg/kg	12.0	YU	30.0	YJS	19.0	Y	105.	Y	21.0	YJS
ARSENIC (TOTAL)	mg/kg	63.0	Y	1820	Y	90.0	Y	560.	Y	417.	Y
BARIUM (TOTAL)	mg/kg	2150	Y	237.	Y	339.	Y	344.	Y	99.0	Y
BERYLLIUM (TOTAL)	mg/kg	1.20	Y	1.40	Y	0.350	Y	0.540	Y	0.680	Y
CADMIUM (TOTAL)	mg/kg	103.	Y	54.0	Y	4.60	Y	20.0	Y	84.0	Y
CALCIUM (TOTAL)	mg/kg	92000	Y	2580	Y	418.	Y	2080	Y	1830	Y
CHROMIUM (TOTAL)	mg/kg	10.0	Y	19.0	Y	21.0	Y	12.0	Y	29.0	Y
COBALT (TOTAL)	mg/kg	8.00	Y	12.0	Y	7.30	Y	8.70	Y	15.0	Y
CONDUCTIVITY	mmhos/cm	2.40	Y	0.0800	Y	0.470	Y	2.10	Y	1.50	Y
COPPER (TOTAL)	mg/kg	161.	Y	2190	Y	55.0	Y	1280	Y	792.	Y
CYANIDE (TOTAL)	mg/kg	0.500	YJHT	0.720	YJHT	0.500	YJHT	0.500	YJHT	0.500	YU
GOLD (TOTAL)	mg/kg	0.500	YU	0.500	YU	0.500	YJS	0.500	YJS	0.500	YU
IRON (TOTAL)	mg/kg	28400	Y	19000	Y	38100	Y	42800	Y	31700	Y
LEAD (TOTAL)	mg/kg	12100	Y	1040	Y	571.	Y	3640	Y	13700	Y
MAGNESIUM (TOTAL)	mg/kg	50300	Y	2330	Y	2120	Y	2000	Y	3630	Y
MANGANESE (TOTAL)	mg/kg	1250	Y	1130	YJE	136.	YJE	429.	YJE	2600	Y
MERCURY (TOTAL)	mg/kg	1.60	Y	1.80	Y	0.0800	YJHT	0.580	YJHT	0.220	Y
MOLYBDENUM (TOTAL)	mg/kg	6.60	Y	6.40	Y	18.0	Y	82.0	Y	5.60	Y
NICKEL (TOTAL)	mg/kg	11.0	Y	14.0	Y	13.0	Y	13.0	Y	35.0	Y
POTASSIUM (TOTAL)	mg/kg	1080	YU	2820	Y	5860	Y	4450	Y	4010	Y
SELENIUM (TOTAL)	mg/kg	2.50	YR	2.50	YUJS	2.50	Y	2.50	Y	2.50	YUJS
SILVER (TOTAL)	mg/kg	51.0	Y	9.60	Y	17.0	Y	43.0	Y	35.0	Y
SODIUM (TOTAL)	mg/kg	1220	Y	292.	YU	292.	YU	292.	YU	292.	YU
SULFUR (TOTAL)	%	3.10	YJS	0.270	Y	1.00	Y	2.70	Y	2.40	Y
SULFATE SULFUR	%	0.820	Y	0.0300	Y	0.790	YJS	0.920	YJS	0.630	Y
PYRITIC SULFUR	%	0.0800	YJ*	0.120	YJS	0.100	Y	1.30	Y	0.600	YJ*
ORGANIC SULFUR	%	2.20	YJ*S	0.120	YJS	0.110	YJS	0.480	YJS	1.20	YJ*
THALLIUM (TOTAL)	mg/kg	5.00	YU	5.00	YU	5.00	YJS	5.00	YJS	5.00	YU
TIN (TOTAL)	mg/kg	8.00	YU	29.0	Y	8.00	YJS	8.00	YJS	8.00	YU
VANADIUM (TOTAL)	mg/kg	10.0	Y	30.0	Y	24.0	Y	15.0	Y	15.0	Y
ZINC (TOTAL)	mg/kg	7480	Y	1240	Y	358.	Y	3570	Y	12400	Y
PERCENT SOLID	mg/kg	--		--		--		--		--	
CLAY	%	--		--		--		--		--	
SILT	%	--		--		--		--		--	
SAND	%	--		--		--		--		--	
COARSE FRACTION	%	--		--		--		--		--	

FOOTNOTES

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(mmhos) = mmhos/cm
(I) = QUANTIFIED due to exceeding ICP linear range
(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(JS) = ESTIMATED due to spike recoveries outside limits
(meq) = meq of hydrogen ion
(---) = NOT analyzed
(tons) = tons CaCO3/1000 ton of material
(H,HT) = QUALIFIED due to holding time violation

05/28/87

CLEAR CREEK TAILINGS CHEMISTRY DATA

		11/26/85 MHC350 TAGG0101		11/27/85 MHE265 TAGG0201		11/25/85 MHE227 TAS0301	
		GREGORY GULCH COMPOSITE TAILINGS #1		GREGORY GULCH COMPOSITE TAILING #2		SOLID BLIND STANDARD #3	
LAB DETERMINATIONS							
pH	S.U.	2.90	Y	2.90	Y	5.20	Y
ACID POTENTIAL	meq/100g	19.0	Y	4.40	Y	5.40	Y
NEUTRALIZATION POTENTIAL	tons/1000	2.40	Y	7.50	Y	11.0	Y
ALUMINUM (TOTAL)	mg/kg	3870	Y	3310	Y	7330	Y
ANTIMONY (TOTAL)	mg/kg	36.0	Y	12.0	YUJS	17.0	Y
ARSENIC (TOTAL)	mg/kg	200.	Y	53.0	Y	973.	Y
BARIUM (TOTAL)	mg/kg	91.0	Y	106.	Y	123.	Y
BERYLLIUM (TOTAL)	mg/kg	0.440	Y	0.200	YU	0.440	Y
CADMIUM (TOTAL)	mg/kg	12.0	Y	2.30	Y	20.0	Y
CALCIUM (TOTAL)	mg/kg	4850	Y	2400	Y	1510	Y
CHROMIUM (TOTAL)	mg/kg	12.0	Y	8.20	Y	10.0	Y
COBALT (TOTAL)	mg/kg	8.60	Y	5.00	Y	3.40	Y
CONDUCTIVITY	mmhos/cm	3.60	Y	1.10	Y	0.150	Y
COPPER (TOTAL)	mg/kg	771.	Y	120.	Y	1050	Y
CYANIDE (TOTAL)	mg/kg	0.500	YJHT	0.560	Y	0.560	YJHT
GOLD (TOTAL)	mg/kg	0.500	YJS	0.500	YU	0.500	YU
IRON (TOTAL)	mg/kg	47600	Y	32100	Y	10300	Y
LEAD (TOTAL)	mg/kg	2060	Y	506.	Y	410.	Y
MAGNESIUM (TOTAL)	mg/kg	2120	Y	2340	Y	1850	Y
MANGANESE (TOTAL)	mg/kg	227.	YJE	156.	Y	204.	Y
MERCURY (TOTAL)	mg/kg	5.59	YJHT	0.0500	YU	0.930	YJHT
MOLYBDENUM (TOTAL)	mg/kg	17.0	Y	8.20	Y	5.00	YU
NICKEL (TOTAL)	mg/kg	12.0	Y	6.40	Y	8.00	Y
POTASSIUM (TOTAL)	mg/kg	4550	Y	4040	Y	2380	Y
SELENIUM (TOTAL)	mg/kg	2.50	Y	2.50	YUJS	2.50	YU
SILVER (TOTAL)	mg/kg	27.0	Y	6.20	Y	4.30	Y
SODIUM (TOTAL)	mg/kg	292.	YU	591.	Y	292.	YU
SULFUR (TOTAL)	%	2.50	Y	0.660	Y	0.160	Y
SULFATE SULFUR	%	1.40	YJS	0.610	Y	0.0100	Y
PYRITIC SULFUR	%	1.00	Y	0.0800	YJ*	0.0700	Y
ORGANIC SULFUR	%	0.100	YJS	--		0.0800	Y
THALLIUM (TOTAL)	mg/kg	5.00	YJS	5.00	YU	5.00	YU
TIN (TOTAL)	mg/kg	8.00	YJS	8.00	YU	31.0	Y
VANADIUM (TOTAL)	mg/kg	24.0	Y	20.0	Y	17.0	Y
ZINC (TOTAL)	mg/kg	1410	Y	159.	Y	464.	Y
PERCENT SOLID	mg/kg	--		--		--	
CLAY	%	--		--		--	
SILT	%	--		--		--	
SAND	%	--		--		--	
COARSE FRACTION	%	--		--		--	

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(U) = UNDETECTED
(JS) = ESTIMATED due to spike recoveries outside limits
(meq) = meq of hydrogen ion
(-) = NOT analyzed
(tons) = tons CaCO3/1000 ton of material
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APPENDIX 5B

STREAM SEDIMENT AND MISCELLANEOUS ANALYTICAL RESULTS

05/28/87

CLEAR CREEK TAILINGS CHEMISTRY DATA

		02/24/86 MHC922 DT001003		02/24/86 MHC939 DT002003		02/24/86 MHC940 DT003003		10/29/85 MHC371 SD00201		10/29/85 MHC372 SD00202	
		BIG FIVE IRON HYDROXIDE		ARGO PORTAL IRON HYDROXIDE		NATIONAL DISCHARGE IRON HYDROXIDE		CLEAR CREEK 50' BELOW NORTH CLEAR CREEK		CLEAR CREEK 200' BELOW NORTH CLEAR CREEK	
LAB DETERMINATIONS											
pH	S.U.	--		--		--		6.70	Y	5.40	Y
ACID POTENTIAL	meq/100g	--		--		--		7.60	Y	14.0	Y
NEUTRALIZATION POTENTIAL	tons/1000	--		--		--		7.80	Y	6.50	Y
ALUMINUM (TOTAL)	mg/kg	1740	Y	365.	Y	3290	Y	5790	Y	2980	Y
ANTIMONY (TOTAL)	mg/kg	26.0	YJS	75.0	YJS	47.0	YJS	12.0	YU	12.0	YU
ARSENIC (TOTAL)	mg/kg	16.0	Y	1160	Y	118.	Y	8.50	Y	5.00	YU
BARIUM (TOTAL)	mg/kg	44.0	Y	22.0	YU	46.0	Y	84.0	Y	50.0	Y
BERYLLIUM (TOTAL)	mg/kg	0.200	YU	1.00	YU	0.920	Y	0.340	Y	0.340	Y
CADMIUM (TOTAL)	mg/kg	2.10	Y	10.0	YU	4.00	YU	2.00	YU	2.50	Y
CALCIUM (TOTAL)	mg/kg	1790	Y	2560	Y	2060	Y	1700	Y	1310	Y
CHROMIUM (TOTAL)	mg/kg	14.0	Y	10.0	YU	10.0	Y	28.0	Y	18.0	Y
COBALT (TOTAL)	mg/kg	3.80	Y	15.0	YU	6.00	YU	11.0	Y	8.50	Y
CONDUCTIVITY	mmhos/cm	--		--		--		2.50	Y	3.00	Y
COPPER (TOTAL)	mg/kg	310.	Y	52.0	Y	328.	Y	88.0	Y	64.0	Y
CYANIDE (TOTAL)	mg/kg	--		--		--		0.500	YU	0.500	YU
GOLD (TOTAL)	mg/kg	--		--		--		0.500	YU	0.500	YU
IRON (TOTAL)	mg/kg	196000	Y	416000	Y	374000	Y	20700	Y	17500	Y
LEAD (TOTAL)	mg/kg	151.	Y	22.0	Y	137.	Y	74.0	Y	56.0	Y
MAGNESIUM (TOTAL)	mg/kg	1850	Y	1020	Y	2720	Y	3470	Y	1780	Y
MANGANESE (TOTAL)	mg/kg	370.	Y	311.	Y	398.	Y	411.	Y	1360	Y
MERCURY (TOTAL)	mg/kg	0.100	Y	0.520	Y	0.110	Y	0.140	Y	0.110	Y
MOLYBDENUM (TOTAL)	mg/kg	--		--		--		10.0	YUJC	10.0	YUJC
NICKEL (TOTAL)	mg/kg	7.00	Y	15.0	YU	11.0	Y	17.0	Y	10.0	Y
POTASSIUM (TOTAL)	mg/kg	2900	Y	1770	YU	2360	Y	3750	Y	1800	Y
SELENIUM (TOTAL)	mg/kg	25.0	YUJS	25.0	YUJS	25.0	YUJS	2.50	YUJS	2.50	YUJS
SILVER (TOTAL)	mg/kg	2.00	YU	10.0	YU	4.00	YU	1.50	Y	1.50	YU
SODIUM (TOTAL)	mg/kg	1500	Y	4470	Y	2690	Y	678.	Y	705.	Y
SULFUR (TOTAL)	%	--		--		--		0.100	Y	0.560	Y
SULFATE SULFUR	%	--		--		--		0.0100	YU	0.0300	Y
PYRITIC SULFUR	%	--		--		--		0.0500	Y	0.380	Y
ORGANIC SULFUR	%	--		--		--		0.0500	Y	0.150	Y
THALLIUM (TOTAL)	mg/kg	5.00	YU	25.0	YU	10.0	YU	5.00	YUJS	5.00	YUJS
TIN (TOTAL)	mg/kg	9.00	YU	45.0	YU	18.0	YU	8.00	YU	8.00	YU
VANADIUM (TOTAL)	mg/kg	2.60	Y	62.0	Y	5.00	YU	27.0	Y	21.0	Y
ZINC (TOTAL)	mg/kg	142.	YJ*	150.	YJ*	521.	YJ*	378.	Y	542.	Y
PERCENT SOLID	mg/kg	--		--		--		--		--	
CLAY	%	--		--		--		8.00	Y	3.00	Y
SILT	%	--		--		--		6.00	Y	1.00	YU
SAND	%	--		--		--		71.0	Y	32.0	Y
COARSE FRACTION	%	--		--		--		15.0	Y	65.0	Y

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(meq) = meq of hydrogen ion
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CLEAR CREEK TAILINGS CHEMISTRY DATA

		10/29/85 MHC370 SD00301		10/31/85 MHC379 SD00501		10/31/85 MHC380 SD00502		10/31/85 MHC378 SD007001		11/26/85 MHC384 SD00901	
		NORTH CLEAR CREEK 50' ABOVE CLEAR CREEK		NORTH CLEAR CREEK 18' BELOW NATIONAL		NORTH CLEAR CREEK 50' BELOW NATIONAL		MARSH BELOW NATIONAL TUNNEL AT N. CLEAR CREEK		NORTH CLEAR CREEK BELOW GREGORY GULCH	
LAB DETERMINATIONS											
pH	S.U.	6.00	Y	6.10	Y	5.10	Y	2.40	Y	5.10	Y
ACID POTENTIAL	meq/100g	0.500	Y	14.0	Y	9.10	Y	32.0	Y	3.50	Y
NEUTRALIZATION POTENTIAL	tons/1000	6.50	Y	9.00	Y	17.0	Y	1.30	YU	21.0	Y
ALUMINUM (TOTAL)	mg/kg	6150	Y	3890	Y	3240	Y	3210	Y	3620	Y
ANTIMONY (TOTAL)	mg/kg	14.0	Y	12.0	YU	13.0	Y	76.0	YJS	12.0	YU
ARSENIC (TOTAL)	mg/kg	10.0	Y	8.50	Y	12.0	Y	186.	Y	6.00	Y
BARIUM (TOTAL)	mg/kg	83.0	Y	67.0	Y	77.0	Y	51.0	Y	65.0	Y
BERYLLIUM (TOTAL)	mg/kg	0.600	Y	0.600	Y	0.340	Y	0.400	YU	0.200	YU
CADMIUM (TOTAL)	mg/kg	2.90	Y	2.40	Y	5.90	Y	24.0	Y	2.00	YU
CALCIUM (TOTAL)	mg/kg	1450	Y	1070	Y	1470	Y	952.	Y	1040	Y
CHROMIUM (TOTAL)	mg/kg	25.0	Y	13.0	Y	16.0	Y	30.0	Y	10.0	Y
COBALT (TOTAL)	mg/kg	16.0	Y	5.70	Y	7.60	Y	29.0	Y	5.40	Y
CONDUCTIVITY	mmhos/cm	2.20	Y	3.70	Y	3.70	Y	5.00	Y	3.70	Y
COPPER (TOTAL)	mg/kg	173.	Y	120.	Y	212.	Y	278.	Y	73.0	Y
CYANIDE (TOTAL)	mg/kg	0.500	YU	0.500	YU	0.500	YU	0.500	YU	0.500	YU
GOLD (TOTAL)	mg/kg	0.500	YU	0.500	YU	0.500	YU	0.500	YU	0.500	YU
IRON (TOTAL)	mg/kg	23600	Y	16600	Y	24900	Y	408000	Y	15900	Y
LEAD (TOTAL)	mg/kg	123.	Y	83.0	Y	119.	Y	380.	Y	53.0	Y
MAGNESIUM (TOTAL)	mg/kg	3330	Y	2880	Y	2550	Y	2580	Y	2510	Y
MANGANESE (TOTAL)	mg/kg	1240	Y	218.	Y	296.	Y	223.	Y	304.	Y
MERCURY (TOTAL)	mg/kg	0.260	Y	0.100	Y	0.120	Y	0.300	Y	0.140	Y
MOLYBDENUM (TOTAL)	mg/kg	13.0	YJC	10.0	YUJC	10.0	YUJC	86.0	YU	10.0	YUJC
NICKEL (TOTAL)	mg/kg	16.0	Y	8.40	Y	11.0	Y	23.0	Y	7.00	Y
POTASSIUM (TOTAL)	mg/kg	3280	Y	2690	Y	2340	Y	2660	Y	2220	Y
SELENIUM (TOTAL)	mg/kg	2.50	YUJS	2.50	YUJS	2.50	YUJS	2.50	YUJS	2.50	YUJS
SILVER (TOTAL)	mg/kg	1.50	YU	1.80	Y	3.00	Y	34.0	Y	1.50	YU
SODIUM (TOTAL)	mg/kg	912.	Y	885.	Y	876.	Y	1980	Y	696.	Y
SULFUR (TOTAL)	%	0.0700	Y	0.0800	Y	0.480	Y	3.50	Y	0.530	Y
SULFATE SULFUR	%	0.0100	Y	0.0300	Y	0.220	Y	2.80	Y	0.0300	Y
PYRITIC SULFUR	%	0.0500	Y	0.0300	Y	0.220	Y	0.550	YJ*	0.330	Y
ORGANIC SULFUR	%	0.0100	Y	0.0400	Y	0.240	Y	0.150	YJ*	0.170	Y
THALLIUM (TOTAL)	mg/kg	5.00	YU	5.00	YUJS	5.00	YUJS	5.00	YU	5.00	YUJS
TIN (TOTAL)	mg/kg	8.00	YU	8.00	YU	8.00	YU	16.0	YU	8.00	YU
VANADIUM (TOTAL)	mg/kg	24.0	Y	14.0	Y	21.0	Y	32.0	Y	15.0	Y
ZINC (TOTAL)	mg/kg	350.	Y	406.	Y	1030	Y	402.	Y	293.	Y
PERCENT SOLID	mg/kg	--		--		--		--		--	
CLAY	%	11.0	Y	6.00	Y	3.00	Y	--		5.00	Y
SILT	%	6.00	Y	5.00	Y	2.00	Y	--		2.00	Y
SAND	%	65.0	Y	73.0	Y	48.0	Y	--		86.0	Y
COARSE FRACTION	%	18.0	Y	16.0	Y	47.0	Y	--		7.00	Y

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(--) = NOT analyzed
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05/28/87

CLEAR CREEK TAILINGS CHEMISTRY DATA

		11/26/85 MHC382 SD01001		10/29/85 MHC383 SD01101		10/29/85 MHC369 SD01601		10/29/85 MHC381 SD020001		10/30/85 MHC376 SD02101	
		NORTH CLEAR CREEK 10' BELOW GREGORY TAILINGS		NORTH CLEAR CREEK ABOVE GREGORY TAILINGS		QUARTZ HILL 30' BELOW PORTAL		ARGO TUNNEL AT PORTAL		CLEAR CREEK 75' BELOW ARGO	
LAB DETERMINATIONS											
pH	S.U.	6.60	Y	6.80	Y	2.80	Y	2.30	Y	5.70	Y
ACID POTENTIAL	meq/100g	0.500	YU	4.50	Y	0.500	YU	54.0	Y	7.60	Y
NEUTRALIZATION POTENTIAL	tons/1000	3.90	Y	9.00	Y	1.30	YU	1.30	YU	9.00	Y
ALUMINUM (TOTAL)	mg/kg	1590	Y	2940	Y	6120	Y	233.	Y	4510	Y
ANTIMONY (TOTAL)	mg/kg	12.0	YU	12.0	YU	28.0	Y	84.0	YJS	12.0	YU
ARSENIC (TOTAL)	mg/kg	5.00	YU	5.00	YU	223.	Y	1140	Y	18.0	Y
BARIUM (TOTAL)	mg/kg	15.0	Y	42.0	Y	62.0	Y	13.0	YU	79.0	Y
BERYLLIUM (TOTAL)	mg/kg	0.340	Y	0.260	Y	0.260	Y	0.400	YU	0.510	Y
CADMIUM (TOTAL)	mg/kg	2.00	YU	2.00	YU	3.40	Y	32.0	Y	2.00	YU
CALCIUM (TOTAL)	mg/kg	444.	Y	1340	Y	1070	Y	2890	Y	1020	Y
CHROMIUM (TOTAL)	mg/kg	7.50	Y	10.0	Y	15.0	Y	17.0	Y	22.0	Y
COBALT (TOTAL)	mg/kg	3.20	Y	5.00	Y	7.50	Y	25.0	Y	7.50	Y
CONDUCTIVITY	mmhos/cm	2.20	Y	2.60	Y	3.60	Y	11.0	Y	3.10	Y
COPPER (TOTAL)	mg/kg	44.0	Y	41.0	Y	94.0	Y	177.	Y	94.0	Y
CYANIDE (TOTAL)	mg/kg	0.500	YU	0.500	YU	0.500	YU	0.500	YU	0.500	YU
GOLD (TOTAL)	mg/kg	0.500	YU	0.500	YU	0.500	YU	1.60	Y	0.500	YU
IRON (TOTAL)	mg/kg	8640	Y	12100	Y	45600	Y	392000	Y	16600	Y
LEAD (TOTAL)	mg/kg	46.0	Y	77.0	Y	128.	Y	85.0	Y	77.0	Y
MAGNESIUM (TOTAL)	mg/kg	758.	Y	1900	Y	3590	Y	1850	Y	2970	Y
MANGANESE (TOTAL)	mg/kg	71.0	Y	249.	Y	242.	Y	867.	Y	853.	Y
MERCURY (TOTAL)	mg/kg	0.0600	Y	0.0500	YU	0.180	Y	0.100	YU	0.100	Y
MOLYBDENUM (TOTAL)	mg/kg	10.0	YUJC	10.0	YUJC	11.0	Y	83.0	Y	10.0	YUJC
NICKEL (TOTAL)	mg/kg	3.50	YU	5.90	Y	9.10	Y	16.0	Y	12.0	Y
POTASSIUM (TOTAL)	mg/kg	1080	YU	1660	Y	4420	Y	2170	YU	3090	Y
SELENIUM (TOTAL)	mg/kg	2.50	YUJS	2.50	YUJS	2.50	YUJS	2.50	YUJS	2.50	YUJS
SILVER (TOTAL)	mg/kg	2.10	Y	1.50	YU	3.30	Y	29.0	Y	1.60	Y
SODIUM (TOTAL)	mg/kg	775.	Y	826.	Y	797.	Y	1920	Y	887.	Y
SULFUR (TOTAL)	%	0.200	Y	0.270	Y	1.10	Y	4.80	Y	0.150	Y
SULFATE SULFUR	%	0.0100	YU	0.0100	YU	0.860	Y	4.50	Y	0.0500	Y
PYRITIC SULFUR	%	0.0500	Y	0.0300	Y	0.0500	Y	0.840	YJ*	0.100	Y
ORGANIC SULFUR	%	0.150	Y	0.240	Y	0.190	Y	--		0.0100	YU
THALLIUM (TOTAL)	mg/kg	5.00	YUJS	5.00	YU	5.00	YUJS	5.00	YU	5.00	YUJS
TIN (TOTAL)	mg/kg	8.00	YU	8.00	YU	8.00	YU	16.0	YU	8.00	YU
VANADIUM (TOTAL)	mg/kg	9.50	Y	14.0	Y	34.0	Y	88.0	Y	19.0	Y
ZINC (TOTAL)	mg/kg	72.0	Y	253.	Y	219.	Y	744.	Y	339.	Y
PERCENT SOLID	mg/kg	--		--		--		--		--	
CLAY	%	7.00	Y	5.00	Y	10.0	Y	--		10.0	Y
SILT	%	1.00	Y	1.00	Y	7.00	Y	--		2.00	Y
SAND	%	85.0	Y	83.0	Y	53.0	Y	--		74.0	Y
COARSE FRACTION	%	7.00	Y	11.0	Y	30.0	Y	--		14.0	Y

FOOTNOTES

(R) = REJECTED ('R' used by laboratory indicated recovery problems)
(JHT) = ESTIMATED due to holding time violation
(JL) = ESTIMATED due to exceeding ICP linear range
(*) = DUPLICATE control limits exceeded
(EJ) = ESTIMATED due to interference problems (ICP serial dilution or not spike recovery by graphite furnance)
(mmhos) = mmhos/cm
(I) = QUANTIFIED due to exceeding ICP linear range
(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(JS) = ESTIMATED due to spike recoveries outside limits
(meq) = meq of hydrogen ion
(--) = NOT analyzed
(tons) = tons CaCO3/1000 ton of material
(H,HT) = QUALIFIED due to holding time violation

05/28/87

CLEAR CREEK TAILINGS CHEMISTRY DATA

		10/30/85 MHC377 SD02102		10/30/85 MHC374 SD02501		10/30/85 MHC375 SD026001		10/29/85 MHC373 SD027001		06/25/86 MHD313 SD11004	
		CLEAR CREEK 400' BELOW ARGO		BOOMERANG AT PORTAL		VIRGINIA CANYON ABOVE CLEAR CREEK		GILSON GULCH ABOVE CLEAR CREEK		NATIONAL SEDIMENT (80 MESH)	
LAB DETERMINATIONS											
pH	S.U.	6.10	Y	3.20	Y	5.80	Y	6.20	Y	--	
ACID POTENTIAL	meq/100g	3.00	Y	4.00	Y	0.500	YU	5.40	Y	--	
NEUTRALIZATION POTENTIAL	tons/1000	21.0	Y	2.60	Y	11.0	Y	25.0	Y	--	
ALUMINUM (TOTAL)	mg/kg	5840	Y	6830	Y	4200	Y	6180	Y	5030	Y
ANTIMONY (TOTAL)	mg/kg	12.0	YU	20.0	Y	12.0	YUJS	12.0	YUJS	11.0	YUJS
ARSENIC (TOTAL)	mg/kg	23.0	Y	63.0	Y	20.0	Y	127.	Y	8.60	YJ*
BARIUM (TOTAL)	mg/kg	79.0	Y	96.0	Y	58.0	Y	112.	Y	95.0	Y
BERYLLIUM (TOTAL)	mg/kg	0.510	Y	0.340	Y	0.240	Y	0.830	Y	0.900	YU
CADMIUM (TOTAL)	mg/kg	2.60	Y	5.00	Y	2.30	Y	6.10	Y	3.40	Y
CALCIUM (TOTAL)	mg/kg	1220	Y	1240	Y	542.	Y	2940	Y	1400	Y
CHROMIUM (TOTAL)	mg/kg	21.0	Y	27.0	Y	17.0	Y	20.0	Y	13.0	Y
COBALT (TOTAL)	mg/kg	7.60	Y	8.00	Y	4.90	Y	7.80	Y	5.70	Y
CONDUCTIVITY	mmhos/cm	3.20	Y	3.40	Y	0.110	Y	0.280	Y	--	
COPPER (TOTAL)	mg/kg	86.0	Y	72.0	Y	79.0	Y	191.	Y	137.	Y
CYANIDE (TOTAL)	mg/kg	0.500	YU	0.500	YU	0.500	YU	0.500	YU	--	
GOLD (TOTAL)	mg/kg	0.500	YU	0.500	YU	0.500	YU	0.500	YU	--	
IRON (TOTAL)	mg/kg	18600	Y	29500	Y	13100	Y	20600	Y	17800	Y
LEAD (TOTAL)	mg/kg	111.	Y	562.	Y	128.	Y	384.	Y	106.	Y
MAGNESIUM (TOTAL)	mg/kg	3440	Y	3610	Y	2060	Y	3050	Y	3370	Y
MANGANESE (TOTAL)	mg/kg	1010	Y	326.	Y	286.	Y	1250	Y	303.	Y
MERCURY (TOTAL)	mg/kg	0.120	Y	0.210	Y	0.0500	YU	0.190	Y	0.110	YU
MOLYBDENUM (TOTAL)	mg/kg	10.0	YUJC	10.0	YUJC	6.20	Y	17.0	Y	--	
NICKEL (TOTAL)	mg/kg	12.0	Y	13.0	Y	11.0	Y	13.0	Y	10.0	Y
POTASSIUM (TOTAL)	mg/kg	3430	Y	4060	Y	3010	Y	3580	Y	3110	Y
SELENIUM (TOTAL)	mg/kg	2.50	YUJS	2.50	YUJS	2.50	YUJS	2.50	YUJS	0.600	YURS
SILVER (TOTAL)	mg/kg	1.50	YU	6.80	Y	2.10	Y	6.60	Y	1.10	YUJC
SODIUM (TOTAL)	mg/kg	692.	Y	938.	Y	350.	Y	491.	Y	335.	Y
SULFUR (TOTAL)	%	0.160	Y	0.360	Y	0.130	Y	0.300	Y	--	
SULFATE SULFUR	%	0.0500	Y	0.300	Y	0.0400	Y	0.0800	Y	--	
PYRITIC SULFUR	%	0.0400	Y	0.0200	Y	0.0400	YJ*	0.150	YJ*	--	
ORGANIC SULFUR	%	0.0700	Y	0.0400	Y	0.0500	YJ*	0.0700	YJ*	--	
THALLIUM (TOTAL)	mg/kg	5.00	YUJS	5.00	YUJS	5.00	YU	5.00	YU	1.70	YU
TIN (TOTAL)	mg/kg	8.00	YU	8.00	YU	8.00	YU	8.00	YU	--	
VANADIUM (TOTAL)	mg/kg	23.0	Y	29.0	Y	15.0	Y	21.0	Y	16.0	Y
ZINC (TOTAL)	mg/kg	461.	Y	581.	Y	231.	Y	561.	Y	995.	YJ*
PERCENT SOLID	mg/kg	--		--		--		--		--	
CLAY	%	7.00	Y	5.00	Y	--		--		--	
SILT	%	5.00	Y	4.00	Y	--		--		--	
SAND	%	66.0	Y	20.0	Y	--		--		--	
COARSE FRACTION	%	22.0	Y	71.0	Y	--		--		--	

FOOTNOTES

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(I) = QUANTIFIED due to exceeding ICP linear range
(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(JS) = ESTIMATED due to spike recoveries outside limits
(meq) = meq of hydrogen ion
(--) = NOT analyzed
(tons) = tons CaCO3/1000 ton of material
(UT) = QUALIFIED due to holding time violation

CLEAR CREEK TAILINGS CHEMISTRY DATA

		06/25/86 MHD314 SD11104		06/25/86 MHD315 SD11204		06/25/86 MHD316 SD11304		06/25/86 MHD317 SD11404		06/25/86 MHD318 SD11504	
		NATIONAL SEDIMENT (80-270 MESH)		NATIONAL SEDIMENT ((270 MESH)		BELOW GREGORY TAILINGS SEDIMENT ()80 MESH)		BELOW GREGORY TAILINGS SEDIMENT (80-270 MESH)		BELOW GREGORY TAILINGS SEDIMENT ((270 MESH)	
LAB DETERMINATIONS											
pH	S.U.	--		--		--		--		--	
ACID POTENTIAL	meq/100g	--		--		--		--		--	
NEUTRALIZATION POTENTIAL	tons/1000	--		--		--		--		--	
ALUMINUM (TOTAL)	mg/kg	4650	Y	6980	Y	3920	Y	3890	Y	4730	Y
ANTIMONY (TOTAL)	mg/kg	10.0	YUJS	10.0	YUJS	10.0	YUJS	10.0	YUJS	10.0	YUJS
ARSENIC (TOTAL)	mg/kg	16.0	YJ*	42.0	YJ*	18.2	YJ*	34.0	YJ*	90.6	YJ*
BARIUM (TOTAL)	mg/kg	89.0	Y	209.	Y	95.0	Y	84.0	Y	175.	Y
BERYLLIUM (TOTAL)	mg/kg	0.800	YU	1.00	Y	0.800	YU	0.800	YU	0.800	YU
CADMIUM (TOTAL)	mg/kg	5.70	Y	4.80	Y	1.00	YU	1.00	YU	1.80	Y
CALCIUM (TOTAL)	mg/kg	4480	Y	4690	Y	974.	Y	2020	Y	1790	Y
CHROMIUM (TOTAL)	mg/kg	12.0	Y	19.0	Y	11.0	Y	12.0	Y	12.0	Y
COBALT (TOTAL)	mg/kg	5.80	Y	9.10	Y	4.30	Y	5.10	Y	4.40	Y
CONDUCTIVITY	mmhos/cm	--		--		--		--		--	
COPPER (TOTAL)	mg/kg	261.	Y	421.	Y	48.0	Y	68.0	Y	200.	Y
CYANIDE (TOTAL)	mg/kg	--		--		--		--		--	
GOLD (TOTAL)	mg/kg	--		--		--		--		--	
IRON (TOTAL)	mg/kg	25300	Y	46300	Y	15100	Y	37000	Y	56900	Y
LEAD (TOTAL)	mg/kg	153.	Y	291.	Y	169.	Y	453.	Y	1050	Y
MAGNESIUM (TOTAL)	mg/kg	2600	Y	3070	Y	2430	Y	2110	Y	1840	Y
MANGANESE (TOTAL)	mg/kg	344.	Y	516.	Y	192.	Y	134.	Y	156.	Y
MERCURY (TOTAL)	mg/kg	0.200	Y	0.800	Y	0.300	Y	0.800	Y	2.60	Y
MOLYBDENUM (TOTAL)	mg/kg	--		--		--		--		--	
NICKEL (TOTAL)	mg/kg	12.0	Y	16.0	Y	8.20	Y	9.50	Y	9.90	Y
POTASSIUM (TOTAL)	mg/kg	2550	Y	3000	Y	2260	Y	2420	Y	2960	Y
SELENIUM (TOTAL)	mg/kg	0.600	YURS	0.600	YURS	0.600	YURS	0.600	YURS	6.00	YURS
SILVER (TOTAL)	mg/kg	1.90	YJC	4.70	YJC	1.10	YJC	5.80	YJC	14.0	YJC
SODIUM (TOTAL)	mg/kg	234.	Y	281.	Y	261.	Y	289.	Y	439.	Y
SULFUR (TOTAL)	%	--		--		--		--		--	
SULFATE SULFUR	%	--		--		--		--		--	
PYRITIC SULFUR	%	--		--		--		--		--	
ORGANIC SULFUR	%	--		--		--		--		--	
THALLIUM (TOTAL)	mg/kg	1.60	YU	1.60	YU	1.60	YU	1.60	YU	1.60	YU
TIN (TOTAL)	mg/kg	--		--		--		--		--	
VANADIUM (TOTAL)	mg/kg	15.0	Y	24.0	Y	15.0	Y	16.0	Y	18.0	Y
ZINC (TOTAL)	mg/kg	1510	YJ*	1200	YJ*	77.0	YJ*	165.	YJ*	814.	YJ*
PERCENT SOLID	mg/kg	--		--		--		--		--	
CLAY	%	--		--		--		--		--	
SILT	%	--		--		--		--		--	
SAND	%	--		--		--		--		--	
COARSE FRACTION	%	--		--		--		--		--	

FOOTNOTES

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(JL) = ESTIMATED due to exceeding ICP linear range
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(EJ) = ESTIMATED due to interference problems (ICP serial dilution or not spike recovery by graphite furnance)
(mmhos) = mmhos/cm
(I) = QUANTIFIED due to exceeding ICP linear range
(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(JS) = ESTIMATED due to spike recoveries outside limits
(meq) = meq of hydrogen ion
(--) = NOT analyzed
(tons) = tons CaCO3/1000 ton of material
(H,HT) = QUALIFIED due to holding time violation

CLEAR CREEK TAILINGS CHEMISTRY DATA

		06/25/86 MHD319 SD11604		06/25/86 MHD320 SD11704		06/25/86 MHD321 SD11804		06/25/86 MHD322 SD11904		06/25/86 MHD323 SD12004	
		ABOVE GREGORY TAILINGS SEDIMENT ()80 MESH)		ABOVE GREGORY TAILINGS SEDIMENT (80-270 MESH)		ABOVE GREGORY TAILINGS SEDIMENT ((270 MESH)		POST LEACH SED BELOW GREGORY TAILINGS ()80)		POST LEACH SED BELOW GREGORY TAILINGS 80-270	
LAB DETERMINATIONS											
pH	S.U.	--		--		--		--		--	
ACID POTENTIAL	meq/100c	--		--		--		--		--	
NEUTRALIZATION POTENTIAL	tons/1000	--		--		--		--		--	
ALUMINUM (TOTAL)	mg/kg	3770	Y	6570	Y	9490	Y	3120	Y	3440	Y
ANTIMONY (TOTAL)	mg/kg	10.0	YUJS	10.0	YUJS	10.0	YUJS	10.0	YUJS	10.0	YUJS
ARSENIC (TOTAL)	mg/kg	5.60	YJ*	7.20	YJ*	--		--		--	
BARIUM (TOTAL)	mg/kg	73.0	Y	114.	Y	193.	Y	68.0	Y	72.0	Y
BERYLLIUM (TOTAL)	mg/kg	0.800	YU	1.00	Y	1.10	Y	0.800	YU	1.00	Y
CADMIUM (TOTAL)	mg/kg	1.00	YU	1.20	Y	3.20	Y	1.00	YU	1.00	YU
CALCIUM (TOTAL)	mg/kg	1610	Y	3070	Y	4010	Y	892.	Y	2010	Y
CHROMIUM (TOTAL)	mg/kg	9.50	Y	22.0	Y	28.0	Y	9.70	Y	10.0	Y
COBALT (TOTAL)	mg/kg	5.50	Y	8.00	Y	10.0	Y	4.00	YU	4.10	Y
CONDUCTIVITY	mmhos/cm	--		--		--		--		--	
COPPER (TOTAL)	mg/kg	47.0	Y	72.0	Y	191.	Y	31.0	Y	57.0	Y
CYANIDE (TOTAL)	mg/kg	--		--		--		--		--	
GOLD (TOTAL)	mg/kg	--		--		--		--		--	
IRON (TOTAL)	mg/kg	9560	Y	16100	Y	24500	Y	8940	Y	34900	Y
LEAD (TOTAL)	mg/kg	61.0	Y	125.	Y	252.	Y	70.0	Y	399.	Y
MAGNESIUM (TOTAL)	mg/kg	2020	Y	3370	Y	3860	Y	2010	Y	1870	Y
MANGANESE (TOTAL)	mg/kg	658.	Y	620.	Y	1330	Y	61.0	Y	59.0	Y
MERCURY (TOTAL)	mg/kg	0.100	YU	0.200	Y	0.800	Y	0.100	Y	2.50	Y
MOLYBDENUM (TOTAL)	mg/kg	--		--		--		--		--	
NICKEL (TOTAL)	mg/kg	7.40	Y	15.0	Y	20.0	Y	7.10	Y	10.0	Y
POTASSIUM (TOTAL)	mg/kg	1610	Y	2610	Y	3080	Y	1760	Y	2060	Y
SELENIUM (TOTAL)	mg/kg	0.600	YURS	0.600	YURS	--		--		--	
SILVER (TOTAL)	mg/kg	1.00	YUJC	1.00	YUJC	2.50	YJC	1.00	YUJC	4.80	YJC
SODIUM (TOTAL)	mg/kg	209.	Y	235.	Y	280.	Y	230.	Y	250.	Y
SULFUR (TOTAL)	%	--		--		--		--		--	
SULFATE SULFUR	%	--		--		--		--		--	
PYRITIC SULFUR	%	--		--		--		--		--	
ORGANIC SULFUR	%	--		--		--		--		--	
THALLIUM (TOTAL)	mg/kg	1.60	YU	1.60	YU	--		--		--	
TIN (TOTAL)	mg/kg	--		--		--		--		--	
VANADIUM (TOTAL)	mg/kg	12.0	Y	22.0	Y	31.0	Y	11.0	Y	13.0	Y
ZINC (TOTAL)	mg/kg	164.	YJ*	333.	YJ*	637.	YJ*	118.	YJ*	140.	YJ*
PERCENT SOLID	mg/kg	--		--		--		--		--	
CLAY	%	--		--		--		--		--	
SILT	%	--		--		--		--		--	
SAND	%	--		--		--		--		--	
COARSE FRACTION	%	--		--		--		--		--	

FOOTNOTES

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(mmhos) = mmhos/cm
(I) = QUANTIFIED due to exceeding ICP linear range
(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(JS) = ESTIMATED due to spike recoveries outside limits
(meq) = meq of hydrogen ion
(--) = NOT analyzed
(tons) = tons CaCO3/1000 ton of material
(H,HT) = QUALIFIED due to holding time violation

05/28/87

CLEAR CREEK TAILINGS CHEMISTRY DATA

		06/25/86 MHD324 SD12104		06/25/86 MHD325 SD12204		06/25/86 MHD326 SD12304		06/25/86 MHD327 SD12404		06/25/86 MHD328 SD12504	
		POST LEACH SED BELOW GREGORY TAILINGS ((270)		SEDIMENT BELOW GREGORY TAILINGS ()80 MESH)		SEDIMENT BELOW GREGORY TAILINGS (80-270 MESH)		SEDIMENT BELOW GREGORY TAILINGS ((270 MESH)		SEDIMENT BELOW NATIONAL ()80 MESH)	
LAB DETERMINATIONS											
pH	S.U.	--		--		--		--		--	
ACID POTENTIAL	meq/100g	--		--		--		--		--	
NEUTRALIZATION POTENTIAL	tons/1000	--		--		--		--		--	
ALUMINUM (TOTAL)	mg/kg	5380	Y	2670	Y	6530	Y	8380	Y	3940	Y
ANTIMONY (TOTAL)	mg/kg	10.0	YUJS	10.0	YUJS	10.0	YUJS	10.0	YUJS	10.0	YUJS
ARSENIC (TOTAL)	mg/kg	--		--		--		--		--	
BARIUM (TOTAL)	mg/kg	200.	Y	26.0	Y	58.0	Y	110.	Y	68.0	Y
BERYLLIUM (TOTAL)	mg/kg	1.60	Y	0.800	YU	1.20	Y	1.80	Y	0.800	YU
CADMIUM (TOTAL)	mg/kg	2.00	Y	1.00	YU	1.00	YU	1.00	YU	4.20	Y
CALCIUM (TOTAL)	mg/kg	1160	Y	567.	Y	2120	Y	2440	Y	1270	Y
CHROMIUM (TOTAL)	mg/kg	13.0	Y	7.20	Y	21.0	Y	23.0	Y	9.20	Y
COBALT (TOTAL)	mg/kg	4.00	YU	4.00	YU	5.60	Y	6.40	Y	4.20	Y
CONDUCTIVITY	mmhos/cm	--		--		--		--		--	
COPPER (TOTAL)	mg/kg	211.	Y	13.0	Y	52.0	Y	143.	Y	95.0	Y
CYANIDE (TOTAL)	mg/kg	--		--		--		--		--	
GOLD (TOTAL)	mg/kg	--		--		--		--		--	
IRON (TOTAL)	mg/kg	41200	Y	6152	Y	13500	Y	18200	Y	12200	Y
LEAD (TOTAL)	mg/kg	1340	Y	19.0	Y	49.0	Y	157.	Y	74.0	Y
MAGNESIUM (TOTAL)	mg/kg	2160	Y	1460	Y	3210	Y	3410	Y	2640	Y
MANGANESE (TOTAL)	mg/kg	79.0	Y	63.0	Y	125.	Y	194.	Y	125.	Y
MERCURY (TOTAL)	mg/kg	3.20	Y	0.500	Y	0.200	Y	0.800	Y	0.100	YU
MOLYBDENUM (TOTAL)	mg/kg	--		--		--		--		--	
NICKEL (TOTAL)	mg/kg	11.0	Y	5.60	Y	14.0	Y	16.0	Y	8.00	Y
POTASSIUM (TOTAL)	mg/kg	3230	Y	1160	Y	2730	Y	2830	Y	2480	Y
SELENIUM (TOTAL)	mg/kg	--		--		--		--		--	
SILVER (TOTAL)	mg/kg	18.0	YJC	1.00	YUJC	1.00	YUJC	2.80	YJC	1.00	YUJC
SODIUM (TOTAL)	mg/kg	436.	Y	200.	YU	208.	Y	206.	Y	200.	YU
SULFUR (TOTAL)	%	--		--		--		--		--	
SULFATE SULFUR	%	--		--		--		--		--	
PYRITIC SULFUR	%	--		--		--		--		--	
ORGANIC SULFUR	%	--		--		--		--		--	
THALLIUM (TOTAL)	mg/kg	--		--		--		--		--	
TIN (TOTAL)	mg/kg	--		--		--		--		--	
VANADIUM (TOTAL)	mg/kg	18.0	Y	8.40	Y	21.0	Y	25.0	Y	13.0	Y
ZINC (TOTAL)	mg/kg	687.	YJ*	38.0	YJ*	154.	YJ*	273.	YJ*	1000	YJ*
PERCENT SOLID	mg/kg	--		--		--		--		--	
CLAY	%	--		--		--		--		--	
SILT	%	--		--		--		--		--	
SAND	%	--		--		--		--		--	
COARSE FRACTION	%	--		--		--		--		--	

FOOTNOTES

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(mmhos) = mmhos/cm
(I) = QUANTIFIED due to exceeding ICP linear range
(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(JS) = ESTIMATED due to spike recoveries outside limits
(meq) = meq of hydrogen ion
(--) = NOT analyzed
(tons) = tons CaCO3/1000 ton of material
(H,HT) = QUALIFIED due to holding time violation

CLEAR CREEK TAILINGS CHEMISTRY DATA

		06/25/86 MHD329 SD12604		05/30/86 MHD330 SD12704		06/25/86 MHD331 SD12804		05/30/86 MHD333 SD12904		05/30/86 MHD334 SD13004	
		SEDIMENT BELOW NATIONAL (80-270 MESH)		SEDIMENT BIG FIVE COMPOSITE		SEDIMENT BELOW NATIONAL (<270 MESH)		SEDIMENT ARGO COMPOSITE		SEDIMENT NATIONAL TUNNEL COMPOSITE	
LAB DETERMINATIONS											
pH	S.U.	--		--		--		--		--	
ACID POTENTIAL	meq/100g	--		--		--		--		--	
NEUTRALIZATION POTENTIAL	tons/1000	--		--		--		--		--	
ALUMINUM (TOTAL)	mg/kg	4040	Y	2070	Y	6900	Y	2400	Y	3870	Y
ANTIMONY (TOTAL)	mg/kg	10.0	YUJS	11.0	YUJS	10.0	YUJS	11.0	YUJS	11.0	YUJS
ARSENIC (TOTAL)	mg/kg	--		78.0	YJ*	--		222.	YJ*	51.7	YJ*
BARIUM (TOTAL)	mg/kg	68.0	Y	48.0	Y	186.	Y	85.0	Y	100.	Y
BERYLLIUM (TOTAL)	mg/kg	1.30	Y	0.800	YU	1.80	Y	0.900	YU	0.900	YU
CADMIUM (TOTAL)	mg/kg	8.60	Y	2.00	Y	5.80	Y	3.40	Y	1.10	YU
CALCIUM (TOTAL)	mg/kg	4400	Y	1860	Y	3900	Y	2950	Y	582.	Y
CHROMIUM (TOTAL)	mg/kg	11.0	Y	9.00	Y	13.0	Y	5.20	Y	18.0	Y
COBALT (TOTAL)	mg/kg	4.00	YU	4.30	YU	6.70	Y	4.30	YU	4.30	Y
CONDUCTIVITY	mmhos/cm	--		--		--		--		--	
COPPER (TOTAL)	mg/kg	215.	Y	175.	Y	381.	Y	271.	Y	74.0	Y
CYANIDE (TOTAL)	mg/kg	--		--		--		--		--	
GOLD (TOTAL)	mg/kg	--		--		--		--		--	
IRON (TOTAL)	mg/kg	23300	Y	38900	Y	41600	Y	50100	Y	30400	Y
LEAD (TOTAL)	mg/kg	122.	Y	860.	Y	235.	Y	1600	Y	988.	Y
MAGNESIUM (TOTAL)	mg/kg	2210	Y	966.	Y	2950	Y	1300	Y	1970	Y
MANGANESE (TOTAL)	mg/kg	153.	Y	60.0	Y	200.	Y	243.	Y	261.	Y
MERCURY (TOTAL)	mg/kg	0.600	Y	1.20	Y	0.100	YU	0.900	Y	0.900	Y
MOLYBDENUM (TOTAL)	mg/kg	--		--		--		--		--	
NICKEL (TOTAL)	mg/kg	11.0	Y	7.50	Y	17.0	Y	7.70	Y	11.0	Y
POTASSIUM (TOTAL)	mg/kg	2200	Y	2770	Y	2940	Y	3820	Y	3860	Y
SELENIUM (TOTAL)	mg/kg	--		0.600	YURS	--		0.600	YURS	6.40	YURS
SILVER (TOTAL)	mg/kg	2.60	Y	0.50	Y	4.70	Y	13.0	Y	11.0	Y
SODIUM (TOTAL)	mg/kg	242.	Y	362.	Y	290.	Y	613.	Y	308.	Y
SULFUR (TOTAL)	%	--		--		--		--		--	
SULFATE SULFUR	%	--		--		--		--		--	
PYRITIC SULFUR	%	--		-		--		--		--	
ORGANIC SULFUR	%	--		--		--		--		--	
THALLIUM (TOTAL)	mg/kg	--		1.70	YU	--		1.70	YU	1.70	YU
TIN (TOTAL)	mg/kg	--		--		--		--		--	
VANADIUM (TOTAL)	mg/kg	14.0	Y	9.10	Y	24.0	Y	17.0	Y	16.0	Y
ZINC (TOTAL)	mg/kg	1580	YJ*	110.	YJ*	1000	YJ*	274.	YJ*	387.	YJ*
PERCENT SOLID	%	--		--		--		--		--	
CLAY	%	--		--		--		--		--	
SILT	%	--		--		--		--		--	
SAND	%	--		--		--		--		--	
COARSE FRACTION	%	--		--		--		--		--	

FOOTNOTES

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(JL) = ESTIMATED due to exceeding ICP linear range
(*) = DUPLICATE control limits exceeded
(EJ) = ESTIMATED due to interference problems (ICP serial dilution or not spike recovery by graphite furnance)
(mmhos) = mmhos/cm
(I) = QUANTIFIED due to exceeding ICP linear range
(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(JS) = ESTIMATED due to spike recoveries outside limits
(meq) = meq of hydrogen ion
(--) = NOT analyzed
(tons) = tons CaCO3/1000 ton of material
(UJHT) = QUALIFIED due to holding time violation

05/28/87

CLEAR CREEK TAILINGS CHEMISTRY DATA

		05/30/86 MHD332 SD13204		02/24/86 MHE574 CB01201		02/24/86 MHE575 CB01202	
		SEDIMENT QUARTZ HILL COMPOSITE		ABOVE SEEP ON CRIBBING - GREGORY TAILINGS		EAST WALL OF CRIBBING - GREGORY TAILINGS	
LAB DETERMINATIONS							
pH	S.U.	--		--		--	
ACID POTENTIAL	meq/100g	--		--		--	
NEUTRALIZATION POTENTIAL	tons/1000	--		--		--	
ALUMINUM (TOTAL)	mg/kg	3580	Y	1250	Y	1600	Y
ANTIMONY (TOTAL)	mg/kg	11.0	YUJS	62.0	Y	13.0	YU
ARSENIC (TOTAL)	mg/kg	75.0	YJ*	26.0	Y	59.0	Y
BARIUM (TOTAL)	mg/kg	67.0	Y	25.0	Y	71.0	Y
BERYLLIUM (TOTAL)	mg/kg	1.00	Y	0.420	Y	0.200	YU
CADMIUM (TOTAL)	mg/kg	5.10	Y	2.70	YU	3.80	Y
CALCIUM (TOTAL)	mg/kg	1440	Y	1680	Y	8180	Y
CHROMIUM (TOTAL)	mg/kg	4.70	Y	5.30	Y	2.50	Y
COBALT (TOTAL)	mg/kg	4.30	YU	4.10	YU	7.00	Y
CONDUCTIVITY	mmhos/cm	--		--		--	
COPPER (TOTAL)	mg/kg	361.	Y	229.	Y	359.	Y
CYANIDE (TOTAL)	mg/kg	--		--		--	
GOLD (TOTAL)	mg/kg	--		--		--	
IRON (TOTAL)	mg/kg	40900	Y	330000	Y	66700	Y
LEAD (TOTAL)	mg/kg	477.	Y	285.	Y	714.	Y
MAGNESIUM (TOTAL)	mg/kg	1640	Y	937.	Y	1730	Y
MANGANESE (TOTAL)	mg/kg	458.	Y	105.	Y	503.	Y
MERCURY (TOTAL)	mg/kg	0.500	Y	0.590	Y	3.00	Y
MOLYBDENUM (TOTAL)	mg/kg	--		--		--	
NICKEL (TOTAL)	mg/kg	9.60	Y	4.10	YU	5.70	Y
POTASSIUM (TOTAL)	mg/kg	3680	Y	1610	Y	2930	Y
SELENIUM (TOTAL)	mg/kg	0.600	YURS	34.0	YUR	26.0	YUR
SILVER (TOTAL)	mg/kg	7.00	Y	3.00	Y	8.70	Y
SODIUM (TOTAL)	mg/kg	316.	Y	1730	Y	1200	Y
SULFUR (TOTAL)	%	--		--		--	
SULFATE SULFUR	%	--		--		--	
PYRITIC SULFUR	%	--		--		--	
ORGANIC SULFUR	%	--		--		--	
THALLIUM (TOTAL)	mg/kg	1.70	YU	6.80	YU	5.10	YU
TIN (TOTAL)	mg/kg	--		12.0	YU	9.20	YU
VANADIUM (TOTAL)	mg/kg	12.0	Y	6.70	Y	2.60	YU
ZINC (TOTAL)	mg/kg	733.	YJ*	60.0	YJE	440.	YJE
PERCENT SOLID	mg/kg	--		--		--	
CLAY	%	--		--		--	
SILT	%	--		--		--	
SAND	%	--		--		--	
COARSE FRACTION	%	--		--		--	

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(mmhos) = mmhos/cm
(I) = QUANTIFIED due to exceeding ICP linear range
(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(JS) = ESTIMATED due to spike recoveries outside limits
(meq) = meq of hydrogen ion
(--) = NOT analyzed
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(H,HT) = QUALIFIED due to holding time violation

APPENDIX 5C
EP TOXICITY RESULTS

05/28/87

EP TOXIC CHEMISTRY DATA

		05/30/86 MHD230 CB0402 CRIBBING FROM GREGORY TAILINGS	05/30/86 MHD231 CB0502 CRIBBINGS FROM GREGORY TAILINGS	05/30/86 MHD232 CB0602 CRIBBINGS FROM GREGORY TAILINGS	05/30/86 MHD227 TAAR04 ARGO COMPOSITE #2	05/30/86 MHD225 TABF04 BIG FIVE COMPOSITE #3
LAB DETERMINATIONS						
ALUMINUM	mg/L	127. YR	2.36 YR	9.27 YR	16.7 YR	7.97 YR
ANTIMONY	mg/L	0.0600 Y	0.0500 YU	0.0500 YU	0.0500 YU	0.0500 YU
ARSENIC	mg/L	1.84 YJS	0.0070 YJS	0.0040 YUJS	0.0060 YJS	0.0040 YUJS
BARIUM	mg/L	0.0500 YUR	0.0500 YUR	0.0500 YUR	0.0500 YUR	0.0500 YR
BERYLLIUM	mg/L	0.0150 Y	0.0050 YU	0.0050 YU	0.0050 YU	0.0050 YU
CADMIUM	mg/L	0.0780 Y	0.0050 YU	0.0050 YU	0.0350 Y	0.0050 YU
CALCIUM	mg/L	290. Y	18.3 Y	108. Y	121. Y	68.2 Y
CHROMIUM	mg/L	0.158 Y	0.0080 YU	0.0080 Y	0.0130 Y	0.0110 Y
COBALT	mg/L	0.191 Y	0.0200 YU	0.0200 YU	0.0530 Y	0.0200 YU
COPPER	mg/L	31.6 YJS	1.45 YJS	0.724 YJS	1.89 YJS	0.720 YJS
IRON	mg/L	986. YJ*	7.90 YJ*	55.2 YJ*	3.76 YJ*	12.1 YJ*
LEAD	mg/L	0.0500 YU	0.0500 YU	0.0500 YU	0.351 Y	1.26 Y
MAGNESIUM	mg/L	46.9 Y	4.91 Y	29.6 Y	16.3 Y	3.83 Y
MANGANESE	mg/L	17.1 Y	1.46 Y	1.89 Y	7.59 Y	0.853 Y
MERCURY	mg/L	0.0002 YUJHS	0.0002 YUJHS	0.0002 YUJHS	0.0002 YUJHS	0.0008 YJHJS
NICKEL	mg/L	0.310 Y	0.460 Y	0.0380 Y	0.0640 Y	0.0400 Y
POTASSIUM	mg/L	0.500 YU	0.500 YU	0.500 YU	0.740 Y	0.870 Y
SELENIUM	mg/L	0.0400 YUR	0.0040 YUR	0.0400 YUR	0.0400 YUR	0.0040 YUR
SILVER	mg/L	0.0050 YUR	0.0050 YUR	0.0050 YUR	0.0050 YUR	0.0050 YUR
SODIUM	mg/L	3.20 Y	3.82 Y	3.98 Y	3.23 Y	3.06 Y
THALLIUM	mg/L	0.0060 YUJS	0.0060 YUJS	0.0060 YUJS	0.0060 YUJS	0.0060 YUJS
VANADIUM	mg/L	0.297 Y	0.0200 YU	0.0200 YU	0.0200 YU	0.0200 YU
ZINC	mg/L	38.4 Y	0.820 Y	0.860 Y	5.38 Y	0.590 Y

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(I) = QUANTIFIED due to exceeding ICP linear range
(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(JS) = ESTIMATED due to spike recoveries outside limits
(meq) = meq of hydrogen ion
(--) = NOT analyzed
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(H,HT) = QUALIFIED due to holding time violation

05/28/87

EP TOXIC CHEMISTRY DATA

		05/30/86 MHD229 TAGT04 GREGORY TAILINGS SURFACE COMPOSITE #3		05/30/86 MHD228 TANT04 NATIONAL TUNNEL SURFACE COMPOSITE #1		05/30/86 MHD226 TAQHQ4 QUARTZ HILL SURFACE COMPOSITE #2	
LAB DETERMINATIONS							
ALUMINUM	mg/L	63.7	YR	1.29	YR	0.530	YR
ANTIMONY	mg/L	0.0500	YU	0.0500	YU	0.0500	YU
ARSENIC	mg/L	0.0640	YJS	0.0040	YUJS	0.0040	YUJS
BARIUM	mg/L	0.0500	YUR	0.0500	YUR	0.0500	YUR
BERYLLIUM	mg/L	0.0070	Y	0.0050	YU	0.0050	YU
CADMIUM	mg/L	0.0640	Y	0.0050	YU	0.0490	Y
CALCIUM	mg/L	201.	Y	16.9	Y	28.7	Y
CHROMIUM	mg/L	0.0890	Y	0.0080	YU	0.0080	YU
COBALT	mg/L	0.0800	Y	0.0280	Y	0.0230	Y
COPPER	mg/L	14.9	YJS	0.260	YJS	4.73	YJS
IRON	mg/L	164.	YJ*	0.0210	YJ*	0.0750	YJ*
LEAD	mg/L	0.0500	YU	0.271	Y	0.0500	YU
MAGNESIUM	mg/L	16.9	Y	4.42	Y	6.80	Y
MANGANESE	mg/L	5.09	Y	3.68	Y	5.98	Y
MERCURY	mg/L	0.0002	YUJHS	0.0002	YUJHS	0.0002	YUJHS
NICKEL	mg/L	0.151	Y	0.0700	Y	0.0550	Y
POTASSIUM	mg/L	0.500	YU	0.740	Y	2.11	Y
SELENIUM	mg/L	0.0400	YUR	0.0040	YUR	0.0400	YUR
SILVER	mg/L	0.0050	YUR	0.0050	YUR	0.0050	YUR
SODIUM	mg/L	2.52	Y	2.57	Y	2.86	Y
THALLIUM	mg/L	0.0060	YUJS	0.0060	YUJS	0.0060	YUJS
VANADIUM	mg/L	0.0400	Y	0.0200	YU	0.0200	YU
ZINC	mg/L	14.4	Y	1.08	Y	9.65	Y

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(I) = QUANTIFIED due to exceeding ICP linear range
(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(JS) = ESTIMATED due to spike recoveries outside limits
(meq) = meq of hydrogen ion
(--) = NOT analyzed
(tons) = tons CaCO3/1000 ton of material
(H,HT) = QUALIFIED due to holding time violation

APPENDIX 5D

LEACHATE ANALYSES RESULTS

/28/87

CLEAR CREEK GROUND WATER CHEMISTRY DATA

		06/20/86 MHD242 LW08804 TAILINGS LEACH GREGORY 1:8		06/18/86 MHD237 LW08304 TAILINGS LEACH GREGORY 1:16		06/16/86 MHD236 LW08204 TAILINGS LEACH GREGORY 1:64		06/20/86 MHD243 LW08904 TAILINGS LEACH GREGORY 1:512		06/20/86 MHD241 LW08704 TAILINGS LEACH BIG FIVE 1:8	
MAJOR CATIONS											
CALCIUM	mg/L	165.	Y	57.4	Y	10.1	Y	2.28	Y	121.	Y
MAGNESIUM	mg/L	17.1	Y	5.25	Y	1.79	Y	0.316	Y	7.99	Y
POTASSIUM	mg/L	0.500	YU	0.620	Y	0.829	Y	0.500	YU	0.500	YU
SODIUM	mg/L	2.70	Y	2.32	Y	2.62	Y	1.14	Y	2.78	Y
MINOR & TRACE ELEMENTS											
ALUMINUM	ug/L	59400	YJSE	14400	YJSE	1670	YJSE	944.	YJSE	15300	YJSE
ANTIMONY	ug/L	50.0	YUJS	50.0	YUJS	50.0	YUJS	50.0	YUJS	50.0	YUJS
ARSENIC	ug/L	75.0	YJSE	5.00	YUJS	5.00	YUJS	5.00	YUJS	5.00	YUJS
BARIUM	ug/L	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	YU
BERYLLIUM	ug/L	7.00	YJE	4.00	YUJE	4.00	YUJE	4.00	YUJE	4.00	YUJE
BORON	ug/L	--		--		--		--		--	
CADMIUM	ug/L	62.0	YJS	18.0	YJS	5.00	YUJS	5.00	YUJS	5.00	YUJS
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	83.0	Y	15.0	Y	8.00	YU	8.00	YU	20.0	Y
COBALT	ug/L	73.0	Y	20.0	YU	20.0	YU	20.0	YU	33.0	Y
COPPER	ug/L	14200	Y	3620	Y	477.	Y	244.	Y	1320	Y
CYANIDE	ug/L	--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--	
IRON	ug/L	146000	YJE	14500	YJE	540.	YJE	1270	YJE	40900	YJE
LEAD	ug/L	27.0	YJSE	11.0	YJSE	8.00	YJSE	5.00	YJSE	40.0	YJSE
MANGANESE	ug/L	4750	YJE	1280	YJE	216.	YJE	92.0	YJE	1790	YJE
MERCURY	ug/L	--		--		--		--		--	
MOLYBDENUM	ug/L	--		--		--		--		--	
NICKEL	ug/L	327.	Y	128.	Y	74.0	Y	20.0	YU	151.	Y
SELENIUM	ug/L	30.0	YURS	3.00	YURS	3.00	YURS	30.0	YURS	30.0	YURS
SILVER	ug/L	--		--		--		--		--	
SILICA	ug/L	--		--		--		--		--	
STRONTIUM	ug/L	--		--		--		--		--	
THALLIUM	ug/L	8.00	YURS	8.00	YURS	8.00	YURS	8.00	YURS	8.00	YURS
TIN	ug/L	--		--		--		--		--	
VANADIUM	ug/L	26.0	Y	20.0	YU	20.0	YU	20.0	YU	20.0	YU
ZINC	ug/L	13800	Y	3570	Y	585.	Y	301.	Y	1060	Y

FOOTNOTES

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(--) = Not analyzed
(umhos) = umhos/cm

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(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(H,HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = EPA Validated
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK GROUND WATER CHEMISTRY DATA

		06/20/86 MHD240 LW08604 TAILINGS LEACH BIG FIVE 1:64		06/20/86 MHD238 LW08404 TAILINGS LEACH BIG FIVE 1:256		06/18/86 MHD233 LW07904 TAILINGS LEACH ARGO 1:2		06/18/86 MHD234 LW08004 TAILINGS LEACH ARGO 1:8		06/18/86 MHD235 LW08104 TAILINGS LEACH ARGO 1:32	
MAJOR CATIONS											
CALCIUM	mg/L	23.7	Y	10.5	Y	374.	Y	195.	Y	69.0	Y
MAGNESIUM	mg/L	2.58	YJE	1.76	Y	73.4	Y	33.1	Y	9.28	Y
POTASSIUM	mg/L	0.737	Y	1.21	Y	0.500	YU	0.500	YU	0.597	Y
SODIUM	mg/L	2.79	Y	2.65	Y	2.56	Y	2.83	Y	3.30	Y
MINOR & TRACE ELEMENTS											
ALUMINUM	ug/L	1520	YJSE	290.	YJSE	93800	YJSE	41200	YJSE	6830	YJSE
ANTIMONY	ug/L	50.0	YUJS	50.0	YU	50.0	YUJS	50.0	YUJS	50.0	YUJS
ARSENIC	ug/L	5.00	YUJS	5.00	YUJS	50.0	YJSE	50.0	YUJS	5.00	YUJS
BARIUM	ug/L	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	YU
BERYLLIUM	ug/L	4.00	YUJE	4.00	YUJE	14.0	YJE	6.00	YJE	4.00	YUJE
BORON	ug/L	--		--		--		--		--	
CADMIUM	ug/L	5.00	YUJS	5.00	YU	153.	YJS	71.0	Y	19.0	YJS
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	8.00	YU	8.00	YU	82.0	Y	44.0	Y	8.00	YU
COBALT	ug/L	20.0	YU	20.0	YU	236.	Y	102.	Y	25.0	Y
COPPER	ug/L	219.	Y	21.0	YU	8710	Y	3710	Y	911.	Y
CYANIDE	ug/L	--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--	
IRON	ug/L	723.	YJE	103.	YJE	77800	YJE	23600	YJE	876.	YJE
LEAD	ug/L	193.	YJSE	123.	YJE	12.0	YJE	15.0	YJSE	23.0	YJSE
MANGANESE	ug/L	552.	Y	240.	YJE	34400	YJE	15700	YJE	4010	YJE
MERCURY	ug/L	--		--		--		--		--	
MOLYBDENUM	ug/L	--		--		--		--		--	
NICKEL	ug/L	36.0	Y	46.0	Y	255.	Y	112.	Y	36.0	Y
SELENIUM	ug/L	3.00	YURS	3.00	YU	30.0	YURS	30.0	YURS	3.00	YURS
SILVER	ug/L	--		--		--		--		--	
SILICA	ug/L	--		--		--		--		--	
STRONTIUM	ug/L	--		--		--		--		--	
THALLIUM	ug/L	8.00	YURS	8.00	YU	8.00	YURS	8.00	YURS	8.00	YURS
TIN	ug/L	--		--		--		--		--	
VANADIUM	ug/L	20.0	YU	20.0	YU	21.0	Y	20.0	YU	20.0	YU
ZINC	ug/L	335.	Y	157.	Y	24700	Y	11400	Y	2900	Y

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(umhos) = umhos/cm

(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(H,HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = EPA Validated
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK GROUND WATER CHEMISTRY DATA

		06/20/86 MHD239 LW08504 IRON OXIDE LEACH		06/25/86 MHD244 LW09004 SEDIMENT LEACH ABOVE GREGORY ()80 MESH)A		06/25/86 MHD245 LW09104 SEDIMENT LEACH ABOVE GREGORY (80-270 MESH)A		06/25/86 MHD246 LW09204 SEDIMENT LEACH ABOVE GREGORY ((270 MESH)A		06/25/86 MHD247 LW09304 SEDIMENT LEACH GREGORY TAIL ()80 MESH)A	
MAJOR CATIONS											
CALCIUM	mg/L	2.50	Y	11.0	Y	27.4	Y	55.7	Y	7.64	Y
MAGNESIUM	mg/L	5.89	Y	1.57	Y	3.92	Y	7.71	Y	2.63	Y
POTASSIUM	mg/L	3.08	Y	0.893	Y	1.83	Y	4.79	Y	0.959	Y
SODIUM	mg/L	1.18	Y	2.53	Y	2.65	Y	2.74	Y	2.67	Y
MINOR & TRACE ELEMENTS											
ALUMINUM	ug/L	9740	YJSE	53.0	YUJSE	53.0	YUJSE	53.0	YU	53.0	YUJSE
ANTIMONY	ug/L	50.0	YUJS	50.0	YUJS	50.0	YUJS	50.0	YU	50.0	YUJS
ARSENIC	ug/L	560.	YJS	5.00	YUJS	6.00	YJS	5.00	YU	5.00	YUJS
BARIUM	ug/L	152.	Y	450.	Y	989.	Y	1590	Y	116.	Y
BERYLLIUM	ug/L	4.00	YUJE	4.00	YUJE	4.00	YUJE	4.00	YUJE	4.00	YUJE
BORON	ug/L	--		--		--		--		--	
CADMIUM	ug/L	5.00	YUJS	5.00	YJS	12.0	YJS	25.0	YJS	5.00	YUJS
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	42.0	Y	8.00	YU	8.00	YU	8.00	YU	8.00	YU
COBALT	ug/L	20.0	YU	20.0	YU	20.0	YU	20.0	YU	20.0	YU
COPPER	ug/L	276.	Y	67.0	Y	65.0	Y	94.0	Y	60.0	Y
CYANIDE	ug/L	--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--	
IRON	ug/L	254000	YJE	94.0	YJE	29.0	YJE	30.0	YJE	1730	YJE
LEAD	ug/L	988.	YJSE	31.0	YJSE	47.0	YJSE	30.0	YJSE	10.0	YJSE
MANGANESE	ug/L	941.	YJE	129.	YJE	237.	YJE	3730	YJE	1070	YJE
MERCURY	ug/L	--		--		--		--		--	
MOLYBDENUM	ug/L	--		--		--		--		--	
NICKEL	ug/L	31.0	Y	20.0	YU	20.0	YU	20.0	YU	20.0	YU
SELENIUM	ug/L	3.00	YURS	30.0	YURS	30.0	YURS	30.0	YURS	30.0	YURS
SILVER	ug/L	--		--		--		--		--	
SILICA	ug/L	--		--		--		--		--	
STRONTIUM	ug/L	--		--		--		--		--	
THALLIUM	ug/L	80.0	YURS	80.0	YURS	80.0	YURS	80.0	YURS	80.0	YURS
TIN	ug/L	--		--		--		--		--	
VANADIUM	ug/L	51.0	Y	20.0	YU	20.0	YU	20.0	YU	20.0	YU
ZINC	ug/L	1520	Y	432.	Y	672.	YUJSE	1020	Y	218.	Y

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(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(H_2HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = EPA Validated
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L $CaCO_3$

CLEAR CREEK GROUND WATER CHEMISTRY DATA

		06/25/86 MHD248 LW09404 SEDIMENT LEACH GREGORY TAIL (80-270 MESH)A		06/25/86 MHD249 LW09504 SEDIMENT LEACH NATIONAL ()80 MESH)A		06/25/86 MHD250 LW09604 SEDIMENT LEACH NATIONAL (80-270 MESH)A		06/25/86 MHD290 LW09704 SEDIMENT LEACH NATIONAL ((270 MESH)A		06/25/86 MHD291 LW09804 SEDIMENT LEACH NATIONAL ((270 MESH)A SPLIT	
MAJOR CATIONS											
CALCIUM	mg/L	13.2	Y	23.1	Y	12.6	Y	14.3	Y	35.9	Y
MAGNESIUM	mg/L	3.71	Y	5.33	Y	2.19	Y	2.53	Y	4.90	Y
POTASSIUM	mg/L	0.643	Y	0.825	Y	0.948	Y	1.19	Y	3.28	Y
SODIUM	mg/L	2.66	Y	2.71	Y	2.63	Y	2.91	Y	3.46	Y
MINOR & TRACE ELEMENTS											
ALUMINUM	ug/L	53.0	YUJSE	80.0	YJSE	53.0	YUJSE	53.0	YUJSE	53.0	YUJSE
ANTIMONY	ug/L	50.0	YUJS	50.0	YUJS	50.0	YUJS	50.0	YUJS	50.0	YUJS
ARSENIC	ug/L	5.00	YUJS	5.00	YUJS	5.00	YUJS	5.00	YU	5.00	YUJS
BARIUM	ug/L	132.	Y	162.	Y	270.	Y	409.	Y	720.	Y
BERYLLIUM	ug/L	4.00	YUJE	4.00	YUJE	4.00	YUJE	4.00	YUJE	4.00	YUJE
BORON	ug/L	--		--		--		--		--	
CADMIUM	ug/L	5.00	YUJS	5.00	YUJS	8.00	YJS	12.0	YJS	28.0	YJS
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	8.00	YU	8.00	YU	8.00	YU	8.00	YU	8.00	YU
COBALT	ug/L	20.0	YU	20.0	YU	20.0	YU	20.0	YU	20.0	YU
COPPER	ug/L	35.0	Y	52.0	Y	177.	Y	192.	Y	321.	Y
CYANIDE	ug/L	--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--	
IRON	ug/L	49.0	YJE	165.	YJE	51.0	YJE	38.0	YJE	45.0	YJE
LEAD	ug/L	7.00	YJSE	7.00	YJSE	23.0	YJSE	21.0	YJSE	38.0	YJSE
MANGANESE	ug/L	1360	YJE	1980	YJE	194.	YJE	267.	YJE	631.	YJE
MERCURY	ug/L	--		--		--		--		--	
MOLYBDENUM	ug/L	--		--		--		--		--	
NICKEL	ug/L	20.0	YU	20.0	YU	20.0	YU	20.0	YU	20.0	YU
SELENIUM	ug/L	30.0	YURS	3.00	YURS	3.00	YURS	3.00	YURS	3.00	YURS
SILVER	ug/L	--		--		--		--		--	
SILICA	ug/L	--		--		--		--		--	
STRONTIUM	ug/L	--		--		--		--		--	
THALLIUM	ug/L	80.0	YURS	80.0	YURS	80.0	YURS	80.0	YURS	80.0	YURS
TIN	ug/L	--		--		--		--		--	
VANADIUM	ug/L	20.0	YU	20.0	YU	20.0	YU	20.0	YU	20.0	YU
ZINC	ug/L	185.	Y	234.	Y	41.0	Y	547.	Y	1000	Y

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Acidity reported as mg/L CaCO3

CLEAR CREEK GROUND WATER CHEMISTRY DATA

		06/25/86 MHD292 LW09904 SEDIMENT LEACH ABOVE GREGORY ()80 MESH)B		06/25/86 MHD293 LW10004 SEDIMENT LEACH ABOVE GREGORY (80-270 MESH)B		06/25/86 MHD294 LW10104 SEDIMENT LEACH ABOVE GREGORY ((270 MESH)B		06/25/86 MHD295 LW10204 SEDIMENT LEACH BELOW GREGORY ()80 MESH)B		06/25/86 MHD296 LW10304 SEDIMENT LEACH BELOW GREGORY (80-270 MESH)B	
MAJOR CATIONS											
CALCIUM	mg/L	4.96	Y	6.35	Y	15.4	Y	1.56	Y	2.96	Y
MAGNESIUM	mg/L	2.15	Y	2.06	Y	2.56	Y	2.61	Y	2.01	Y
POTASSIUM	mg/L	0.649	Y	0.872	Y	1.24	Y	3.81	Y	5.94	Y
SODIUM	mg/L	1.86	Y	1.87	Y	1.94	Y	1.85	Y	2.93	Y
MINOR & TRACE ELEMENTS											
ALUMINUM	ug/L	11700	YJSE	11700	YJSE	16300	YJSE	7110	YJSE	8200	YJSE
ANTIMONY	ug/L	50.0	YUJS	50.0	YUJS	50.0	YUJS	50.0	YUJS	50.0	YUJS
ARSENIC	ug/L	8.00	YJS	50.0	YU	5.00	YUJS	26.0	YJS	26.0	YJS
BARIUM	ug/L	768.	Y	1370	Y	2660	Y	236.	Y	251.	Y
BERYLLIUM	ug/L	570.	YJE	530.	YJE	483.	YJE	569.	YJE	568.	YJE
BORON	ug/L	--		--		--		--		--	
CADMIUM	ug/L	20.0	YJS	22.0	YJS	67.0	YJS	5.00	YUJS	5.00	YUJS
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	40.0	Y	84.0	Y	99.0	Y	38.0	Y	60.0	Y
COBALT	ug/L	74.0	Y	89.0	Y	165.	Y	20.0	YU	20.0	YU
COPPER	ug/L	962.	Y	627.	Y	1340	Y	457.	Y	484.	Y
CYANIDE	ug/L	--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--	
IRON	ug/L	81700	YJE	134000	YJE	210.	YJE	149.	YJE	218000	YJE
LEAD	ug/L	1540	YJSE	1670	YJSE	2480	YJSE	929.	YJSE	1560	YJSE
MANGANESE	ug/L	19700	YJE	20500	YJE	47200	YJE	2730	YJE	2330	YJE
MERCURY	ug/L	--		--		--		--		--	
MOLYBDENUM	ug/L	--		--		--		--		--	
NICKEL	ug/L	32.0	Y	41.0	Y	97.0	Y	20.0	YU	20.0	YU
SELENIUM	ug/L	30.0	YURS	30.0	YURS	30.0	YURS	30.0	YURS	3.00	YURS
SILVER	ug/L	--		--		--		--		--	
SILICA	ug/L	--		--		--		--		--	
STRONTIUM	ug/L	--		--		--		--		--	
THALLIUM	ug/L	80.0	YURS	80.0	YURS	80.0	YURS	80.0	YURS	80.0	YURS
TIN	ug/L	--		--		--		--		--	
VANADIUM	ug/L	39.0	Y	81.0	Y	114.	Y	55.0	Y	81.0	Y
ZINC	ug/L	3560	Y	4460	Y	1040	Y	646.	Y	948.	Y

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CLEAR CREEK GROUND WATER CHEMISTRY DATA

		06/25/86 MHD297 LW10404 SEDIMENT LEACH BELOW GREGORY ((270 MESH)B		06/25/86 MHD298 LW10504 SEDIMENT LEACH NATIONAL ()80 MESH)B		06/25/86 MHD299 LW10604 SEDIMENT LEACH NATIONAL (80-270 MESH)B		06/25/86 MHD300 LW10704 SEDIMENT LEACH NATIONAL ((270 MESH)B		06/26/86 MHD311 LW10804 SEDIMENT LEACH A BLANK	
MAJOR CATIONS											
CALCIUM	mg/L	3.88	Y	3.85	Y	4.30	Y	7.68	Y	0.309	Y
MAGNESIUM	mg/L	0.908	Y	5.36	Y	3.11	Y	3.85	Y	0.211	YU
POTASSIUM	mg/L	5.10	Y	1.21	Y	1.05	Y	1.18	Y	0.500	YU
SODIUM	mg/L	2.56	Y	1.86	Y	1.92	Y	1.79	Y	4.61	Y
MINOR & TRACE ELEMENTS											
ALUMINUM	ug/L	8240	YJSE	1230	YJSE	10590	YJSE	19200	YJSE	53.0	YJSE
ANTIMONY	ug/L	50.0	YUJS	50.0	YUJS	50.0	YUJS	50.0	YUJS	50.0	YUJS
ARSENIC	ug/L	8.00	YJS	6.00	YJS	5.00	YUJS	5.00	YUJS	5.00	YUJS
BARIUM	ug/L	143.	Y	427.	Y	552.	Y	1090	Y	50.0	YU
BERYLLIUM	ug/L	470.	YJE	581.	YJE	577.	YJE	568.	YJE	4.00	YJE
BORON	ug/L	--		--		--		--		--	
CADMIUM	ug/L	5.00	YUJS	5.00	YUJS	8.00	YJS	22.0	YJS	5.00	YUJS
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	65.0	Y	66.0	Y	56.0	Y	90.0	Y	8.00	YU
COBALT	ug/L	20.0	YU	51.0	Y	60.0	Y	110.	Y	20.0	YU
COPPER	ug/L	281.	Y	1680	Y	678.	Y	1890	Y	21.0	YU
CYANIDE	ug/L	--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--	
IRON	ug/L	265000	YJE	224600	YJE	189000	YJE	333000	YJE	78.0	YJE
LEAD	ug/L	281.	YJSE	1620	YJSE	1680	YJSE	2350	YJSE	4.00	YJSE
MANGANESE	ug/L	2070	YJE	7070	YJE	8780	YJE	15700	YJE	9.00	YJE
MERCURY	ug/L	--		--		--		--		--	
MOLYBDENUM	ug/L	--		--		--		--		--	
NICKEL	ug/L	20.0	YU	29.0	Y	20.0	YU	67.0	Y	20.0	YU
SELENIUM	ug/L	3.00	YURS	30.0	YU	30.0	YURS	30.0	YURS	3.00	YURS
SILVER	ug/L	--		--		--		--		--	
SILICA	ug/L	--		--		--		--		--	
STRONTIUM	ug/L	--		--		--		--		--	
THALLIUM	ug/L	80.0	YURS	80.0	YURS	80.0	YURS	80.0	YURS	80.0	YURS
TIN	ug/L	--		--		--		--		--	
VANADIUM	ug/L	80.0	Y	43.0	Y	20.0	YU	78.0	Y	20.0	YU
ZINC	ug/L	1060	Y	4590	Y	4940	Y	8870	Y	19.0	Y

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CLEAR CREEK GROUND WATER CHEMISTRY DATA

06/25/86
MHD312
LW10904
SEDIMENT LEACH B BLANK

MAJOR CATIONS			
CALCIUM	mg/L	0.217	YU
MAGNESIUM	mg/L	0.211	YU
POTASSIUM	mg/L	0.500	YU
SODIUM	mg/L	1.00	YU
MINOR & TRACE ELEMENTS			
ALUMINUM	ug/L	53.0	YJSE
ANTIMONY	ug/L	138.	YJS
ARSENIC	ug/L	5.00	YUJS
BARIUM	ug/L	50.0	YU
BERYLLIUM	ug/L	1820	YUJE
BORON	ug/L	--	
CADMIUM	ug/L	5.00	YUJS
CHROMIUM (Cr+6)	ug/L	--	
CHROMIUM (TOTAL)	ug/L	8.00	YU
COBALT	ug/L	20.0	YU
COPPER	ug/L	21.0	YU
CYANIDE	ug/L	--	
GOLD	ug/L	--	
IRON	ug/L	22.0	YUJE
LEAD	ug/L	64.0	YJSE
MANGANESE	ug/L	9.00	YUJE
MERCURY	ug/L	--	
MOLYBDENUM	ug/L	--	
NICKEL	ug/L	20.0	YU
SELENIUM	ug/L	3.00	YURS
SILVER	ug/L	--	
SILICA	ug/L	--	
STRONTIUM	ug/L	--	
THALLIUM	ug/L	80.0	YURS
TIN	ug/L	--	
VANADIUM	ug/L	20.0	YU
ZINC	ug/L	20.0	Y

FOOTNOTES

(R) = REJECTED
(L) = QUALIFIED due to LCS recoveries outside control limits
(I) = QUANTIFIED due to exceeding ICP linear range
(*) = DUPLICATE control limits exceeded
(EJ) = ESTIMATED due to interference problems (ICP serial dilution or low spike recovery by graphite furnance)
(--) = Not analyzed
(umhos) = umhos/cm

(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(H_2HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = EPA Validated
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L $CaCO_3$

APPENDIX 5E

RESULTS OF SEQUENTIAL EXTRACTION OF NORTH CLEAR CREEK SEDIMENTS

APPENDIX 5E

RESULTS OF SEQUENTIAL EXTRACTION OF NORTH CLEAR CREEK SEDIMENTS

Sediments were collected from three locations on North Clear Creek, above Gregory Tailings, below Gregory Tailings, and below the National Discharge. The objective was to define the concentration of base metals which may be leached from sediment surfaces by ion-exchange or by the more acidic waters which would be generated following collapse of tailings into the creek.

Methods

Five grams of each mesh size were weighed out and extracted with 1N ammonium acetate at pH 7 on a shaker table at room temperature. After 1 hour, the mixture was centrifuged at 4000 r.p.m. and the supernatant decanted. The remaining sediment was rinsed twice with de-ionized water. The rinse water was added to the initial fluid and the final volume was made up to 100 mL.

The sediment was then leached with glacial acetic acid for 12-1/2 hours in a water bath at 70°C. The centrifusing procedure was repeated to provide another 100 mL aliquot of sample. The extraction methodology follows that of Tessler et al. (1979) with modifications.

The first step is designed to release the exchangeable trace metal fraction because numerous studies (Penult, et al., 1968; Murray, 1975; James & MacNaughton, 1977, etc.) have demonstrated that changes in ionic composition (e.g., following a tailings collapse upstream) are likely to effect sorption/desorption processes.

The second step is designed to release iron and manganese oxide bound metals. Oxides have been shown (Jenne, 1968) to be excellent scavengers

for trace metals. However, they are thermodynamically unstable under low Eh conditions such as might be anticipated if pyrite containing tailings collapsed into the creek.

Results

Three size fractions were separated, extracted and analyzed for each sample in order to determine the distribution of metals with grain size. The concentration of the metals Mn, Cu, Fe, Pb, and Zn generally increased with decreasing grain size for all three fractions (total, exchangeable and Fe-Mn oxide bound). Al, As, and Cd concentrations were frequently below detection limits so that data are not included here.

The results of the trace metal partitioning are presented in Table 5E-1. Total trace metals are generally highest in the <270 mesh size. Also concentrations are higher for the Fe-Mn oxide bound phase than for the exchangeable phase. The exchangeable trace metals are predominantly Mn and Zn at each site. The high total concentration of metals in the sediment in part reflects the mineralogy of the detrital particles. These findings are consistent with those of Tessier, et al., 1982.

The distribution of trace metals with distance downstream did not change consistently. This could be due to different distribution of grain sizes within samples. An analysis of the particle size distribution or chemical analysis of the sediment before size separation is necessary to determine distance relationships.

Conclusion

The sediment samples from North Clear Creek have higher concentrations of trace metals in the small size fraction. The use of a sequential extraction technique to determine the concentrations of metals which could be leached from the sediment showed that the concentration of the easily exchangeable metals is much lower than the metals bound to the Fe-Mn

TABLE 5E-1

CONCENTRATIONS[a] OF TRACE METALS
IN VARIOUS SIZE FRACTIONS AND EXTRACTIONS

Sample[c]	Particle Size[b]	Fe	Mn	Cu	Pb	Zn
Exchangeable						
AbGT	>80	9	13	7	3	43
	80-270	3	24	7	5	67
	<270	3	373	9	3	102
BGT	>80	173	107	6	1	22
	80-270	5	136	4	<1	19
	<270	17	198	5	<1	23
NT	>80	5	19	18	2	4
	80-270	4	27	19	2	55
	<270	5	63	32	4	100
Bound to Fe-Mn Oxides						
AbGT	>80	8,170	1,970	96	154	356
	80-270	13,400	2,050	63	167	446
	<270	21	4,720	134	248	104
BGT	>80	15	273	46	93	65
	80-270	21,800	233	48	156	95
	<270	26,500	207	28	28	106
NT	>80	22,500	707	168	162	459
	80-270	18,900	878	68	168	494
	<270	33,300	1,570	189	235	887
Total						
AbGT	>80	47,800	3,290	235	305	820
	80-270	80,500	3,100	360	625	1,665
	<270	122,500	6,650	955	1,260	3,185
BGT	>80	75,500	960	240	845	385
	80-270	185,000	670	340	2,265	825
	<270	284,500	780	1,000	5,250	4,070
NT	>80	89,000	1,515	685	530	4,975
	80-270	126,500	1,720	1,305	765	7,550
	<270	231,500	2,590	2,105	1,455	6,000

[a] All results are in total µg for the 5g sample. All data in Appendix 5D.
[b] Sieve sizes.
[c] AbGT = above Gregory Tailings
BGT = below Gregory Tailings
NT = National Tunnel

oxides. These metals could be released from the sediment following a change in the water chemistry of North Clear Creek which could result from the collapse of tailings into the creek.

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APPENDIX 6A

SUMMARY OF METEOROLOGICAL DATA

PRECIPITATION DATA

APPENDIX 6A

SUMMARY OF TEMPERATURE AND PRECIPITATION DATA
IDAHO SPRINGS, COLORADO

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Monthly Mean Average Temp, 'F	26.8	28.4	32.6	40.5	48.3	57.3	62.5	61.3	54.2	44.8	34.8	28.0	43.2
Monthly Precipitation, Inches													
Average	0.36	0.50	0.92	1.90	1.93	1.52	2.56	2.08	1.33	1.04	0.64	0.47	15.46
Maximum	1.60	2.82	2.52	6.54	7.32	6.86	5.62	5.53	4.55	3.60	4.15	4.92	23.92
Minimum	0.00	0.00	0.00	0.12	0.00	0.00	0.42	0.34	0.0	0.0	0.0	0.0	5.82

Summaries of temperature and precipitation data for Idaho Springs were prepared by the Colorado Climate Center based on data collected from 1970-1984.

APPENDIX 6A

SUMMARY OF TEMPERATURE AND PRECIPITATION DATA
NEDERLAND, COLORADO

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Monthly Mean Average Temp, 'F	22.1	22.5	28.6	34.8	42.8	52.7	58.9	57.1	49.8	40.1	30.2	25.5	39.2
Monthly Precipitation, Inches													
Average	0.57	0.53	1.39	2.15	2.68	1.65	2.40	2.13	1.74	1.01	1.06	0.68	17.5
Maximum	1.52	1.16	3.30	4.61	4.76	3.08	3.54	4.77	3.98	2.45	3.29	2.01	21.49
Minimum	0.11	0.06	0.59	0.65	0.07	0.06	0.48	0.48	0.21	0.1	0.12	0.00	13.11

Summaries of temperature and precipitation data for Nederland were prepared by the Colorado Climate Center based on data collected from 1970-1984.

APPENDIX 6B
HISTORICAL SURFACE WATER GAGE AND FLOW STATISTICS

APPENDIX 6B

Lawson Gage

At an elevation of 8,080 feet, the Lawson gage drains a basin encompassing 145 square miles and has a channel length of 20.6 miles (distance from Lawson to basin divide). The basin spans an 8.4 mile width and a 17.2 mile length and has a mean elevation of 10,800 feet and an average slope of 0.446. Land use in the basin is estimated to be 55 percent urban, 41 percent forested lands, 2 percent range land, and 2 percent water. At the Lawson gage, the channel slope is 0.032 and the annual precipitation is 27.3 inches.

Average monthly flow at the Lawson gage over a 35-year period has ranged from a high of 583 cfs in June to a low of 27 cfs in February (Figure 6-2). An average monthly high flow of 573 cfs was observed in June 1985. The average monthly low flow of 28.4 cfs was observed in February of 1985.

Golden Gage

At an elevation of 5,735 feet, the Golden gage drains a basin encompassing 399 square miles. The basin spans an 11.3 mile width and a 35.4 mile length and has a mean elevation of 9,600 feet and an average slope of 0.390. Land use in the basin is estimated to be 71 percent forested lands, 27 percent range land, and 2 percent urban. The channel slope at the Golden gage is 0.016.

Over a 65-year period of record, average monthly flow at the Golden gage has ranged from a high of 928 cfs in June to a low of 45 cfs in February (Figure 6-3). However, an average monthly high flow of 730 cfs was observed in June 1985. The average monthly low flow of 47.3 cfs for the 1985 water year was observed in March 1985.

Yearly runoff at the Golden gage is listed in Table 6A-1 for the period 1912-1985. The 1912-1985 mean runoff is estimated at 163,200 acre feet.

Blackhawk Gage

The only four years of record on North Clear Creek are from a gaging station near Blackhawk that was maintained from 1951-55. At that station, the highest monthly mean was 43 cfs in June and the lowest was 1.5 cfs in February (Figure 6-3).

Idaho Springs Gage

A gaging station was maintained on Clear Creek at Idaho Springs from 1910-12 (Figure 6-2). The highest monthly mean was 702 cfs in June and low monthly means of 25 and 26 cfs were observed in January and February respectively.

Hydrologic Analyses

Normalized monthly flows have been plotted for the Lawson, Golden, Idaho Springs and Blackhawk gages (Figure 6B-1). Flows are normalized to depict the degree to which the basin area contributes to the instream flow. From this Figure it is apparent that the Lawson gage contributes the most flow per unit area. Since there are no major water diversions along this reach, the gages are comparable. The period of record used at each gage varied, however. The period of record used is indicated as follows: Clear Creek at Idaho Springs 1910-1912, Clear Creek at Lawson 1946-1974, Clear Creek at Golden 1909-1974 and North Clear Creek at Blackhawk 1951-1955.

Additional hydrologic calculations have been made by the USGS for the Lawson, Golden and Blackhawk gaging stations including the 7-day mean flood volumes and low flow values (Table 6B-2). The flood volume values represent the highest mean flow for a consecutive 7-day period at 2, 5, 10, 20, 50 and 100 year recurrence intervals. These values were determined

TABLE 6B-1

CLEAR CREEK RUNOFF MEASURED NEAR GOLDEN[1]

(All values are in acre-feet)

Water[2] Year	Runoff	Water[2] Year	Runoff	Water[2] Year	Runoff
1912	224,700	1937	148,100	1962	167,100
1913	160,200	2938	242,200	1963	80,340
1914	305,600	1939	138,300	1964	105,700
1915	182,400			1965	213,400
1916	144,500	1940	111,000	1966	93,600
1917	178,200	1941	175,300	1967	109,500
1918	196,700	1942	170,800	1968	130,000
1919	146,600	1943	161,500	1969	201,600
		1944	159,700		
1920	183,900	1945	153,500	1970	211,400
1921	278,300	1946	127,400	1971	192,400
1922	124,700	1947	221,900	1972	122,500
1923	193,200	1948	164,900	1973	193,200
1924	207,800	1949	220,000	1974	155,500
1925	106,700			1975	158,600
1926	240,800	1950	120,600	1976	109,600
1927	160,700	1951	170,400	1977	87,700
1928	178,000	1952	195,800	1978	133,500
1929	141,800	1953	140,500	1979	157,480
		1954	66,630		
1930	156,300	1955	110,200	1980	201,200
1931	110,000	1956	139,900	1981	79,400
1932	119,000	1957	275,900	1982	119,400
1933	189,300	1958	153,400	1983	228,500
1934	134,300	1959	135,000	1984	223,400
1935	167,900			1985	133,100
1936	215,200	1960	171,200		
		1961	151,900		

1912 - 1985 Mean Runoff = 163,200 Acre-Feet

(1) USGS gaging station was moved downstream 0.8 miles and downstream of Church Ditch on September, 1974. Diversions by the Church Ditch and the City of Golden have been added to the measured USGS flow from 1975 through 1980.

(2) Water Year is the period October through September.

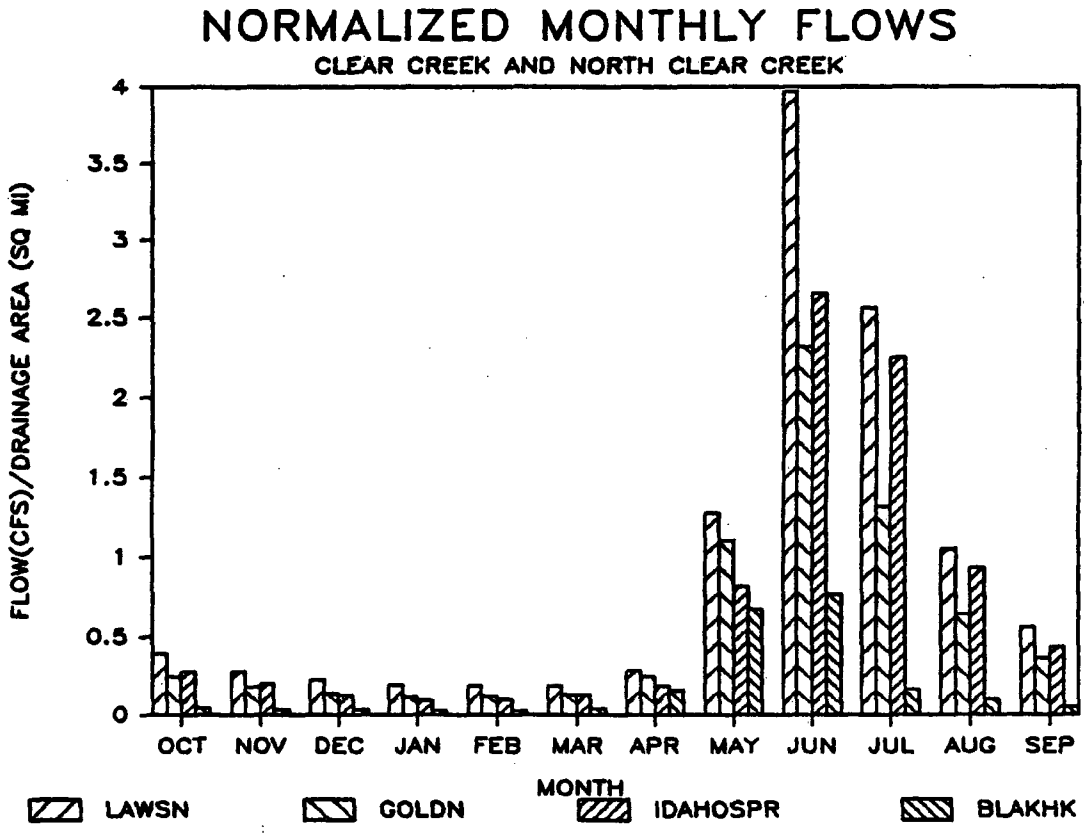

Figure 6B-1 Normalized Monthly Flows for Lawson, Golden, Idaho Springs and Blackhawk Gaging Stations

TABLE 6B-2
7-DAY MEAN FLOOD VOLUME AND LOW FLOW VALUES

(Values in cfs)

Station Name	Station Number	Flood Volume Values					
		2-Year	5-Year	10-Year	20-Year	50-Year	100-Year
Clear Creek near Lawson	06716500	797	1,082	1,232	1,351	1,478	1,557
Clear Creek near Golden	06719500	1,169	1,652	1,944	2,203	2,514	2,731
North Clear Creek near Blackhawk	06718500	44	123	206	312	492	662
		Low Flow Values					
Clear Creek near Lawson	06716500	23	19	18	16	15	14
Clear Creek near Golden	06719500	36	27	23	21	18	16
North Clear Creek near Blackhawk	06718500	0.9	0.5	0.3	0.2	0.1	0.1

from high-flow frequency curves using the log-Pearson Type III method described by the Water Resource Council (USGS 1984). The low-flow values represent the minimum mean flow for a consecutive 7-day period at 2, 5, 10, 20, 50 and 100 year recurrence intervals computed from low-flow frequency curves using the log-Pearson Type III method (USGS 1984).

Flow-duration values for Clear Creek near Lawson, Clear Creek near Golden and North Clear Creek near Blackhawk are given in Table 6B-3. These were derived from the station's flow duration curve for those streamflows that are equaled or exceeded 95, 90, 75, 70, 50, 25 and 10 percent of the time (USGS 1984).

Peak flow statistics, shown in Table 6B-4, are from discharges at recurrence intervals of 1.25, 2, 5, 10, 25, 50, 100, 200 and 500 years, as estimated from the annual flood-frequency curve. This curve is also computed according to the log-Pearson Type III method (USGS 1984).

TABLE 6B-3

FLOW DURATION VALUES
(Values in cfs)

Station Name	Station Number	Flow Equaled or Exceeded						
		95%	90%	75%	70%	50%	25%	10%
Clear Creek near Lawson	06716500	23	25	31	33	49	144	392
Clear Creek near Golden	06719500	35	41	52	56	89	261	645
North Clear Creek near Blackhawk	06718500	1.0	1.2	1.7	1.8	2.5	6.8	21

TABLE 6B-4

PEAK FLOW STATISTICS[1]
(Values in cfs)

Station Name	Station Number	Weighted Peak Flow Estimates								
		1.25-Year	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year	200-Year	500-Year
Clear Creek near Lawson	06716500	722	998	1,340	1,540	1,780	1,940	2,100	2,240	2,430
Clear Creek near Golden	06719500	1,010	1,570	2,490	3,190	4,180	5,000	5,880	6,840	8,230

[1] USGS (1984)

APPENDIX 6C
HISTORICAL SURFACE WATER QUALITY DATA (STORET DATA)

APPENDIX 6C

WATER QUALITY DATA
CLEAR CREEK ABOVE GOLDEN[1]

Parameters	Units	Arithmetic Mean	Number of Samples	Standard Deviation	Maximum	Minimum	SDWA Standards (mg/l) Primary	SDWA Standards (mg/l) Secondary	AWQC[4] mg/l	CDH Stream[3] Standards (mg/l)	Period of Record
Specific conductance	umhos/cm	241.6	239	85.3	402	61	-	-	-		4/68-8/85
pH	s.u.	7.7	269	0.573	9.3	6.1	-	6.5-9.0	-	6.5-9.0	4/68-8/85
Sulfate total	mg/l	63.8	97	28.76	162	13	-	250	-	250	4/68-8/85
Arsenic total	mg/l	0.0003	47	0.0023	0.016	0[5]	0.05	-	0.19	0.05	4/68-5/83
Zinc (total recoverable)	mg/l	0.5994	173	0.924	11.40	0[5]	-	5	0.049[2]	0.57	4/68-8/85
Cadmium (total recoverable)	mg/l	0.0018	106	0.0024	0.019	0[5]	0.01	-	0.00066[2]	0.003	4/68-8/85
Lead (total recoverable)	mg/l	0.0163	128	0.0821	0.920	0[5]	0.05	-	0.0013[2]	0.01	4/68-8/85

[1] EPA STORET data base.

[2] At hardness = 50 mg/l $CaCO_3$

[3] Nondegradation standards

[4] Acid soluble

[5] Detection limit values averaged in as zeros

No analysis was done to determine if data is normally distributed.

APPENDIX 6C

WATER QUALITY DATA[1]
CLEAR CREEK BELOW IDAHO SPRINGS

Parameters	Units	Arithmetic Mean	Number of Samples	Standard Deviation	Maximum	Minimum	SDWA Standards (mg/l) Primary	SDWA Standards (mg/l) Secondary	AWQC[4] mg/l	CDH Stream[3] Standards (mg/l)	Period of Record
Specific conductance	umhos/cm	210.2	63	85.5	380	74	-	-	-	-	4/79-8/85
pH	s.u.	7.2	75	0.400	8.4	6.2	-	6.5-9.0	-	6.5-9.0	4/79-8/85
Sulfate (total)	mg/l	52.9	38	28.2	120	12	-	250	-	250	4/79-8/83
Arsenic (total)	mg/l	0.018	3	0.031	0.054	0[5]	0.05	-	0.19	0.05	4/79-5/83
Zinc (total (recoverable)	mg/l	0.745	74	0.620	3.500	0.020	-	5	0.049[2]	0.57	4/79-8/85
Cadmium (total recoverable)	mg/l	0.0037	50	0.0036	0.021	0[5]	0.01	-	0.0006[2]	0.003	4/79-8/85
Lead (total recoverable)	mg/l	0.0141	48	0.025	0.130	0[5]	0.05	-	0.0013[2]	0.01	4/79-8/85

[1] EPA STORET data base.

[2] At hardness = 50 mg/l $CaCO_3$

[3] Nondegradation standards

[4] Acid soluble

5 Detection limit values averaged in as zeros

No analysis was done to determine if data is normally distributed.

APPENDIX 6C

WATER QUALITY DATA[1]

NORTH CLEAR CREEK ABOVE CONFLUENCE WITH CLEAR CREEK

Parameters	Units	Arithmetic Mean	Number of Samples	Standard Deviation	Maximum	Minimum	SDWA Standards (mg/l) Primary	SDWA Standards (mg/l) Secondary	AWQC[4] mg/l	CDH Stream[3] Standards (mg/l)	Period of Record
Specific Conductance	umhos/cm	446.8	4	212.9	587	130	-	-	-	-	12/71-6/73
pH	s.u.	6.3	3	0.208	6.50	6.10	-	6.5-9.0	-	6.5-9.0	12/71-6/73
Sulfate (total)	mg/l	250	1	-	250	250	-	250	-	-	12/71-6/73
Arsenic (total)	mg/l	0.0065	2	0.0035	0.009	0.004	0.05	-	-	0.05	12/71-6/73
Zinc (total)	mg/l	1.740	2	1.640	2.900	0.580	-	5	-	0.50	1/73-6/73
Cadmium (total)	mg/l	0.020	2	-	0.020	0.020	0.01	-	-	0.0004	1/73-6/73
Lead (total)	mg/l	0.200	2	-	0.200	0.200	0.05	-	-	0.045	1/73-6/73
Arsenic (dissolved)	mg/l	0.005	2	0.0042	0.008	0.002	-	-	0.19	-	12/71-1/73
Zinc (dissolved)	mg/l	2.23	3	1.536	3.400	0.490	-	-	0.049[2]	-	12/71-1/73
Cadmium (dissolved)	mg/l	0.0085	2	0.0007	0.009	0.008	-	-	0.00066[2]	-	12/71-1/73
Lead (dissolved)	mg/l	0.0033	3	0.0023	0.006	0.002	-	-	0.013[2]	-	12/71-6/73

[1] EPA STORET data base.

[2] At hardness = 50 mg/L $CaCO^3$

[3] Nondegradation standards

[4] Acid soluble

No analysis was done to determine if data is normally distributed.

APPENDIX 6C

WATER QUALITY DATA[1]

NORTH CLEAR CREEK ABOVE RUSSELL GULCH NEAR BLACKHAWK

Parameters	Units	Arithmetic Mean	Number of Samples	Standard Deviation	Maximum	Minimum	SDWA Standards (mg/l) Primary	SDWA Standards (mg/l) Secondary	AWQC[4] mg/l	CDH Stream[3] Standards (mg/l)	Period of Record
Specific Conductance	umhos/cm	654	2	91.2	719	590	-	-	-	-	12/71
pH	s.u.	5.2	1	-	5.2	5.2	-	6.5-9.0	-	6.5-9.0	12/71
Sulfate (total)	mg/l	290	1	-	290	290	-	250	-	-	12/71
Arsenic (dissolved)	mg/l	0.008	1	-	0.008	0.008	0.05	-	0.19	0.05	12/71
Zinc (dissolved)	mg/l	3.80	1	-	3.80	3.80	-	5	0.049[2]	0.50	12/71
Cadmium (dissolved)	mg/l	0.010	1	-	0.010	0.010	0.01	-	0.00066[2]	0.0004	12/71
Lead (dissolved)	mg/l	0.011	1	-	0.011	0.011	0.05	-	0.0013	0.045	12/71

[1] EPA STORET data base.

[2] At hardness = 50 mg/l $CaCO_3$.

[3] Nondegradation standards.

[4] Acid soluble.

No analysis was done to determine if data is normally distributed.

APPENDIX 6C

WATER QUALITY DATA[1]
ARGO TUNNEL AT IDAHO SPRINGS

Parameters	Units	Arithmetic Mean	Number of Samples	Standard Deviation	Maximum	Minimum	SDWA Standards (mg/l) Primary	SDWA Standards (mg/l) Secondary	AWQC[4] mg/l	CDH Stream[3] Standards (mg/l)	Period of Record
Specific conductance	umhos/cm	3120	18	132	3400	2870	-	-	-	-	1/73-3/77
pH	s.u.	2.9	18	0.14	3.1	2.6	-	6.5-9.0	-	6.5-9.0	1/73-3/77
Sulfate (total)	mg/l	2008	13	126	2300	1900	-	250	-	250	3/76-3/77
Arsenic (total)	mg/l	0.135	13	0.228	0.180	0.100	0.05	-	-	0.05	3/76-3/77
Zinc (total)	mg/l	46.500	16	8.254	76.000	40.000	-	5	-	0.57	1/73-3/77
Cadmium (total)	mg/l	0.163	15	0.045	0.320	0.140	0.01	-	-	0.003	1/73-3/77
Lead (total)	mg/l	0.170	14	0.038	0.200	0.120	0.05	-	-	0.01	6/73-9/76
Arsenic (dissolved)	mg/l	0.130	13	0.018	0.160	0.100	-	-	0.19	-	3/76-3/77
Zinc (dissolved)	mg/l	46.933	15	9.794	81.000	40.000	-	-	0.049[2]	-	1/73-3/77
Cadmium (dissolved)	mg/l	0.161	13	0.043	0.300	0.130	-	-	0.00066[2]	-	1/73-3/77
Lead (dissolved)	mg/l	0.040	16	0.043	0.206	0.015	-	-	0.0013[2]	-	1/73-3/77

[1] EPA STORET data base.

[2] At hardness = 50 mg/l $CaCO_3$

[3] Nondegradation standards

[4] Acid soluble

No analysis was done to determine if data is normally distributed.

APPENDIX 6C

WATER QUALITY DATA[1]

CHICAGO CREEK ABOVE SPRING GULCH AT IDAHO SPRINGS

Parameters	Units	Arithmetic Mean	Number of Samples	Standard Deviation	Maximum	Minimum	SDWA Standards (mg/l) Primary	SDWA Standards (mg/l) Secondary	AWQC[4] mg/l	CDH Stream[3] Standards (mg/l)	Period of Record
Specific Conductance	umhos/cm	91.5	2	12.0	100	83	-	-	-	-	-
pH	S.U.	7.5	1	-	7.5	7.5	-	6.5-9.0	-	6.5-9.0	12/71
Sulfate (total)	mg/l	12	1	-	12	12	-	250	-	250	12/71
Arsenic (dissolved)	mg/l	0.001	1	-	0.001	0.001	0.05	-	0.19	0.05	12/71
Zinc (dissolved)	mg/l	0.070	1	-	0.070	0.070	-	5	0.049[2]	0.11	12/71
Cadmium (dissolved)	mg/l	0.0	1	-	0.0[5]	0.0	0.01	-	0.00066[2]	0.0004	12/71
Lead (dissolved)	mg/l	0.002	1	-	0.002	0.002	0.05	-	0.0013[2]	0.004	12/71

[1] EPA STORET data base.

[2] AT HARDNESS = 50 mg/L $CaCO^3$

[3] Nondegradation standards

[4] Acid soluble

[5] Detection limit value averaged in as zeros

No analysis was done to determine if data is normally distributed.

APPENDIX 6D

SURFACE WATER ANALYTICAL RESULTS

FIRST SAMPLING SESSION RESULTS

SURFACE WATER

July-August 1985

06/03/87

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

Sample I.D

		07/18/85 MHC316 SW001001 CLEAR CREEK ABOVE NORTH CLEAR CREEK				07/18/85 MHC317 SW002001 CLEAR CREEK BELOW NORTH CLEAR CREEK				07/18/85 MHC315 SW003001 NORTH CLEAR CREEK ABOVE CLEAR CREEK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		116.	Y	--		14.4	Y	--		146.	Y
pH	S.U.	--		7.36	Y	--		6.60	Y	--		7.48	Y
Eh (REDOX POTENTIAL)	MV	--		437.	Y	--		419.	Y	--		555.	Y
SPECIFIC CONDUCTANCE	umhos	--		120.	Y	--		120.	Y	--		150.	Y
DISSOLVED OXYGEN	mg/L	7.81	Y	--		5.40	Y	--		5.50	Y	--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		--		--		--		--		10.5	Y
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	5.00	YU	--		5.00	YU	--		5.00	YU	--	
pH	S.U.	--		7.50	Y	--		7.50	Y	--		7.10	Y
SPECIFIC CONDUCTANCE	umhos	--		103.	Y	--		114.	Y	--		213.	Y
TOTAL DISSOLVED SOLIDS	mg/L	75.0	Y	--		85.0	Y	--		155.	Y	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		2.00	YU	--		2.00	YU	--		43.0	Y
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	10.4	Y	10.3	YU	11.2	Y	10.8	Y	20.7	Y	20.9	Y
MAGNESIUM	mg/L	2.56	Y	2.49	Y	2.81	Y	2.66	Y	6.13	Y	6.36	Y
POTASSIUM	mg/L	1.04	Y	1.09	Y	1.02	Y	1.00	Y	1.74	Y	2.32	Y
SODIUM	mg/L	1.40	Y	2.88	Y	1.72	Y	0.59	YU	3.75	Y	2.77	Y
MAJOR ANIONS													
BICARBONATE	mg/L	32.0	Y	--		30.0	Y	--		15.0	Y	--	
CARBONATE	mg/L	5.00	YU	--		5.00	YU	--		5.00	YU	--	
FLUORIDE	mg/L	0.43	Y	--		0.43	Y	--		0.18	Y	--	
CHLORIDE	mg/L	3.00	YU	--		3.00	YU	--		3.00	YU	--	
SULFATE	mg/L	15.0	Y	--		22.0	Y	--		86.0	Y	--	

FOOTNOTES

(R) = REJECTED
(L) = QUALIFIED due to LCS recoveries outside control limits
(I) = QUANTIFIED due to exceeding ICP linear range
(*) = DUPLICATE control limits exceeded
(EJ) = ESTIMATED due to interference problems (ICP serial dilution or low spike recovery by graphite furnance)
(--) = Not analyzed
(umhos) = umhos/cm
(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(H_4HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		07/18/85 MHC316 SW001001 CLEAR CREEK ABOVE NORTH CLEAR CREEK				07/18/85 MHC317 SW002001 CLEAR CREEK BELOW NORTH CLEAR CREEK				07/18/85 MHC315 SW003001 NORTH CLEAR CREEK ABOVE CLEAR CREEK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	0.10	YU	--		0.10	YU	--		0.10	YU	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	171.	Y	202.	Y	51.0	Y	371.	Y	25.0	YU	1400	Y
ANTIMONY	ug/L	31.0	YU	31.0	YU	31.0	YU	31.0	YU	31.0	YU	31.0	YU
ARSENIC	ug/L	3.00	YU	3.00	YU	3.00	YU	3.00	YU	3.00	YU	3.00	YU
BARIUM	ug/L	20.0	Y	19.0	Y	16.0	Y	21.0	Y	30.0	Y	47.0	Y
BERYLLIUM	ug/L	0.30	YU	0.30	YU	0.30	YU	0.30	YU	0.30	YU	0.30	YU
BORON	ug/L	17.0	YJS	50.0	YJS	17.0	Y	30.0	YJS	28.0	YJS	54.0	YJS
CADMIUM	ug/L	1.00	YU	5.00	YU	5.00	YU	1.00	YU	2.10	Y	1.40	YJ
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.70	Y
COBALT	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU
COPPER	ug/L	19.0	Y	22.0	Y	12.0	Y	22.0	Y	9.80	Y	60.0	Y
CYANIDE	ug/L	--		10.0	YU	--		10.0	YU	--		10.0	YU
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	449.	Y	544.	Y	87.0	Y	1100	Y	39.0	Y	6030	Y
LEAD	ug/L	2.30	Y	5.60	Y	2.00	YU	8.00	Y	2.00	YU	24.0	Y
MANGANESE	ug/L	478.	Y	474.	Y	531.	Y	555.	Y	1160	Y	1250	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU
NICKEL	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	8.50	Y	11.0	Y
SELENIUM	ug/L	5.00	YJS	5.00	YJS	5.00	YJS	5.00	YJS	5.00	YJS	5.00	YJS
SILVER	ug/L	0.10	YJC	0.10	YJC	0.10	YJC	0.10	YJC	0.10	YJC	0.10	YJC
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	85.0	Y	80.0	Y	89.0	Y	85.0	Y	156.	Y	156.	Y
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	3.00	YU	3.00	YU	3.00	YU	10.0	YU	3.00	YU	10.0	YU
TIN	ug/L	17.0	YJS	17.0	YJS	17.0	YJS	17.0	YJS	17.0	YJS	17.0	YJS
VANADIUM	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.80	Y
ZINC	ug/L	221.	Y	214.	Y	168.	Y	244.	Y	308.	Y	552.	Y

FOOTNOTES

(R) = REJECTED
(L) = QUALIFIED due to LCS recoveries outside control limits
(I) = QUANTIFIED due to exceeding ICP linear range
(*) = DUPLICATE control limits exceeded
(EJ) = ESTIMATED due to interference problems (ICP serial dilution or low spike recovery by graphite furnance)
(--) = Not analyzed
(umhos) = umhos/cm

(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(H,HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		07/19/85 MHC329 SW004001 RUSSELL GULCH AT NORTH CLEAR CREEK				07/18/85 MHC312 SW005001 NORTH CLEAR CREEK BELOW NATIONAL				07/17/85 MHC304 SW006001 NORTH CLEAR CREEK ABOVE NATIONAL			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		15.6	Y	--		15.8	Y	--		16.7	Y
pH	S.U.	--		6.40	Y	--		6.92	Y	--		6.80	Y
Eh (REDOX POTENTIAL)	MV	--		--		--		216.	Y	--		287.	Y
SPECIFIC CONDUCTANCE	umhos	--		375.	Y	--		180.	Y	--		179.	Y
DISSOLVED OXYGEN	mg/L	6.45	Y	--		6.80	Y	--		6.20	Y	--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		0.08	Y	--		8.72	Y	--		7.39	Y
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	5.00	YU	--		5.00	YU	--		5.00	YU	--	
pH	S.U.	--		7.40	Y	--		6.70	Y	--		6.40	Y
SPECIFIC CONDUCTANCE	umhos	--		470.	Y	--		180.	Y	--		195.	Y
TOTAL DISSOLVED SOLIDS	mg/L	250.	Y	--		125.	Y	--		130.	Y	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		6.50	Y	--		26.0	Y	--		12.0	Y
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	36.1	Y	34.0	Y	18.8	Y	18.4	Y	18.9	Y	18.2	Y
MAGNESIUM	mg/L	10.4	YJS	9.76	Y	5.56	Y	5.47	Y	5.57	Y	5.24	Y
POTASSIUM	mg/L	4.56	Y	4.62	Y	1.35	Y	1.65	Y	1.26	Y	1.13	Y
SODIUM	mg/L	17.3	Y	14.7	Y	2.52	Y	2.74	Y	5.43	Y	3.24	Y
MAJOR ANIONS													
BICARBONATE	mg/L	27.0	Y	--		15.0	Y	--		12.0	Y	--	
CARBONATE	mg/L	5.00	YU	--		5.00	YU	--		5.00	YU	--	
FLUORIDE	mg/L	0.80	Y	--		0.12	Y	--		0.14	Y	--	
CHLORIDE	mg/L	3.00	YU	--		3.00	YU	--		3.00	YU	--	
SULFATE	mg/L	135.	Y	--		87.0	Y	--		113.	Y	--	

FOOTNOTES

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(EJ) = ESTIMATED due to interference problems (ICP serial dilution or low spike recovery by graphite furnance)
(--) = Not analyzed
(umhos) = umhos/cm
(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(H,HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		07/19/85 MHC329 SW004001 RUSSELL GULCH AT NORTH CLEAR CREEK				07/18/85 MHC312 SW005001 NORTH CLEAR CREEK BELOW NATIONAL				07/17/85 MHC304 SW006001 NORTH CLEAR CREEK ABOVE NATIONAL			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	0.10	YU	--		0.10	YU	--		0.10	YU	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	88.0	Y	987.	Y	200.	Y	829.	Y	25.0	YU	331.	Y
ANTIMONY	ug/L	31.0	YU	31.0	YU	31.0	YU	31.0	YU	31.0	YU	31.0	YU
ARSENIC	ug/L	3.00	YU	3.00	YU	10.0	YU	3.00	YU	3.00	YU	3.00	YU
BARIUM	ug/L	27.0	Y	33.0	Y	28.0	Y	35.0	Y	21.0	Y	21.0	Y
BERYLLIUM	ug/L	0.30	YU	0.30	YU	0.30	YU	0.30	YU	0.30	YU	0.30	YU
BORON	ug/L	52.0	YJS	71.0	YJS	28.0	YJS	44.0	YJS	34.0	YJS	51.0	YJS
CADMIUM	ug/L	4.00	Y	3.00	YJ	1.40	Y	14.0	YJ	1.30	Y	1.60	Y
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	4.00	YU	4.00	YU	4.00	YU	4.20	Y	4.00	YU	4.00	YU
COBALT	ug/L	6.30	Y	5.00	Y	5.00	Y	5.30	Y	6.20	Y	5.50	Y
COPPER	ug/L	41.0	Y	330.	Y	23.0	Y	41.0	Y	7.00	Y	44.0	Y
CYANIDE	ug/L	--		10.0	YU	--		10.0	YU	--		10.0	YU
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	32.0	Y	934.	Y	3570	Y	6360	Y	1380	Y	6430	Y
LEAD	ug/L	5.00	YU	5.00	YU	5.00	YU	14.0	Y	5.00	YU	8.80	Y
MANGANESE	ug/L	833.	Y	780.	Y	1270	Y	1260	Y	1410	Y	1370	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU
NICKEL	ug/L	19.0	Y	30.0	Y	9.70	Y	12.0	Y	9.30	Y	7.70	Y
SELENIUM	ug/L	5.00	YJS	5.00	YJS	5.00	YJS	5.00	YJS	5.00	YJS	5.00	YJS
SILVER	ug/L	0.10	YJC	0.10	YJC	0.10	YJC	0.10	YJC	0.10	YJC	0.10	YJC
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	384.	Y	377.	Y	144.	Y	138.	Y	141.	Y	131.	Y
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	10.0	YJS	10.0	YJS	3.00	YU	3.00	YU	3.00	YU	3.00	YU
TIN	ug/L	17.0	YJS	17.0	YJS	17.0	YJS	17.0	YJS	17.0	YJS	17.0	YJS
VANADIUM	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU
ZINC	ug/L	800.	Y	850.	Y	518.	Y	533.	Y	463.	Y	563.	Y

FOOTNOTES

(R) = REJECTED
(L) = QUALIFIED due to LCS recoveries outside control limits
(I) = QUANTIFIED due to exceeding ICP linear range
(*) = DUPLICATE control limits exceeded
(EJ) = ESTIMATED due to interference problems (ICP serial dilution or low spike recovery by graphite furnance)
(--) = Not analyzed
(umhos) = umhos/cm

(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(H,HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		07/18/85 MHC311 SW007001 NATIONAL TUNNEL AT NORTH CLEAR CREEK				07/19/85 MHC319 SW008001 NATIONAL TUNNEL AT PORTAL				07/17/85 MHC303 SW009001 NORTH CLEAR CREEK BELOW GREGORY GULCH			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		14.1	Y	--		10.9	Y	--		15.5	Y
pH	S.U.	--		6.05	Y	--		4.39	Y	--		6.49	Y
Eh (REDOX POTENTIAL)	MV	--		370.	Y	--		--		--		--	
SPECIFIC CONDUCTANCE	umhos	--		1390	Y	--		1420	Y	--		160.	Y
DISSOLVED OXYGEN	mg/L	6.80	Y	--		5.45	Y	--		6.05	Y	--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		0.09	Y	--		0.08	Y	--		7.60	Y
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	68.0	Y	--		84.0	Y	--		5.00	YU	--	
pH	S.U.	--		4.00	Y	--		4.70	Y	--		6.20	Y
SPECIFIC CONDUCTANCE	umhos	--		1420	Y	--		1570	Y	--		194.	Y
TOTAL DISSOLVED SOLIDS	mg/L	1300	Y	--		1410	Y	--		135.	Y	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		23.0	Y	--		58.0	Y	--		11.0	Y
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	190.	Y	187.	Y	219.	Y	209.	Y	19.0	Y	17.9	Y
MAGNESIUM	mg/L	54.9	Y	52.2	Y	63.8	YJS	60.0	Y	5.59	Y	5.16	Y
POTASSIUM	mg/L	7.13	Y	7.08	Y	8.53	Y	7.99	Y	1.26	Y	1.20	Y
SODIUM	mg/L	25.9	YJC	24.9	Y	28.4	Y	28.7	Y	4.10	Y	3.75	Y
MAJOR ANIONS													
BICARBONATE	mg/L	5.00	YU	--		5.00	YU	--		7.00	Y	--	
CARBONATE	mg/L	5.00	YU	--		5.00	YU	--		5.00	YU	--	
FLUORIDE	mg/L	0.40	Y	--		0.49	Y	--		0.14	Y	--	
CHLORIDE	mg/L	3.10	Y	--		3.00	YU	--		3.00	YU	--	
SULFATE	mg/L	740.	Y	--		990.	Y	--		104.	Y	--	

FOOTNOTES

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(umhos) = umhos/cm

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(H,HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		07/18/85 NHC311 SW007001 NATIONAL TUNNEL AT NORTH CLEAR CREEK				07/19/85 NHC319 SW008001 NATIONAL TUNNEL AT PORTAL				07/17/85 NHC303 SW009001 NORTH CLEAR CREEK BELOW GREGORY GULCH			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	0.10	YU	--		0.10	YU	--		0.10	YU	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	175.	Y	440.	Y	25.0	YU	292.	Y	25.0	YU	306.	Y
ANTIMONY	ug/L	31.0	YU	31.0	YU	31.0	YU	31.0	YU	31.0	YU	31.0	YU
ARSENIC	ug/L	3.00	YU	10.0	YU	3.00	YU	6.30	Y	3.00	YU	3.00	YU
BARIUM	ug/L	12.0	YU	12.0	YU	12.0	YU	12.0	YU	22.0	Y	22.0	Y
BERYLLIUM	ug/L	0.70	Y	1.40	Y	1.30	Y	1.60	Y	0.30	YU	0.30	YU
BORON	ug/L	131.	YJS	143.	YJS	109.	YJS	114.	YJS	35.0	YJS	68.0	YJS
CADMIUM	ug/L	7.40	Y	6.70	Y	10.0	Y	8.10	Y	1.70	Y	1.80	Y
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	7.00	Y	7.10	Y	8.40	Y	7.40	Y	4.00	YU	4.00	YU
COBALT	ug/L	91.0	Y	90.0	Y	110.	Y	103.	Y	6.70	Y	6.90	Y
COPPER	ug/L	186.	Y	284.	Y	191.	Y	336.	Y	15.0	Y	48.0	Y
CYANIDE	ug/L	--		10.0	YU	--		10.0	YU	--		10.0	YU
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	30800	Y	37800	Y	48000	Y	50900	Y	5000	Y	6590	Y
LEAD	ug/L	5.00	YU	20.0	Y	5.00	YU	15.0	Y	5.00	YU	5.30	Y
MANGANESE	ug/L	17400	Y	17200	Y	20500	Y	19400	Y	1440	Y	1350	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU
NICKEL	ug/L	217.	Y	214.	Y	260.	Y	246.	Y	9.80	Y	10.0	Y
SELENIUM	ug/L	--		50.0	YJS	50.0	YJS	50.0	YJS	5.00	YJS	5.00	YJS
SILVER	ug/L	0.10	YJC	0.17	YJC	0.10	YJC	0.10	YJC	0.10	YJC	0.10	YJC
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	1520	Y	1470	Y	1810	Y	1700	Y	144.	Y	127.	Y
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	3.00	YU	3.00	YU	10.0	YJS	10.0	YJS	3.00	YU	3.00	YU
TIN	ug/L	17.0	YJS	17.0	YJS	17.0	YJS	17.0	YJS	17.0	YJS	17.0	YJS
VANADIUM	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU
ZINC	ug/L	7000	Y	6700	Y	7940	Y	7480	Y	606.	Y	565.	Y

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(umhos) = umhos/cm
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(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
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(JS) = ESTIMATED due to spike recoveries outside limits
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Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		07/17/85 MHC301 SW010001 NORTH CLEAR CREEK BELOW GREGORY TAILINGS				07/17/85 MHC302 SW011001 NORTH CLEAR CREEK ABOVE GREGORY TAILINGS				07/17/85 MHC300 SW012001 GREGORY TAILINGS AT NORTH CLEAR CREEK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		13.2	Y	--		19.3	Y	--		11.2	Y
pH	S.U.	--		--		--		6.50	Y	--		5.09	Y
Eh (REDOX POTENTIAL)	MV	--		191.	Y	--		535.	Y	--		402.	Y
SPECIFIC CONDUCTANCE	umhos	--		190.	Y	--		78.0	Y	--		2220	Y
DISSOLVED OXYGEN	mg/L	6.20	Y	--		6.10	Y	--		4.30	Y	--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		8.06	Y	--		6.66	Y	--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	5.00	YU	--		5.00	YU	--		268.	Y	--	
pH	S.U.	--		5.40	Y	--		7.00	Y	--		4.00	Y
SPECIFIC CONDUCTANCE	umhos	--		189.	Y	--		77.0	Y	--		2190	Y
TOTAL DISSOLVED SOLIDS	mg/L	135.	Y	--		60.0	Y	--		2240	Y	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		21.0	Y	--		2.00	YU	--		24.0	Y
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	18.4	Y	17.8	Y	7.22	Y	7.26	Y	285.	Y	272.	Y
MAGNESIUM	mg/L	5.40	Y	5.15	Y	1.90	Y	1.98	Y	89.7	Y	83.6	Y
POTASSIUM	mg/L	1.26	Y	1.25	Y	1.06	Y	1.01	Y	8.01	Y	7.63	Y
SODIUM	mg/L	4.70	Y	5.49	Y	3.00	Y	5.51	Y	34.7	Y	31.3	Y
MAJOR ANIONS													
BICARBONATE	mg/L	5.00	YU	--		26.0	Y	--		5.00	YU	--	
CARBONATE	mg/L	5.00	YU	--		5.00	YU	--		5.00	YU	--	
FLUORIDE	mg/L	0.14	Y	--		0.10	YU	--		1.30	Y	--	
CHLORIDE	mg/L	3.00	YU	--		3.00	YU	--		7.60	Y	--	
SULFATE	mg/L	104.	Y	--		10.0	Y	--		1000	Y	--	

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		07/17/85 MHC301 SW010001 NORTH CLEAR CREEK BELOW GREGORY TAILINGS				07/17/85 MHC302 SW011001 NORTH CLEAR CREEK ABOVE GREGORY TAILINGS				07/17/85 MHC300 SW012001 GREGORY TAILINGS AT NORTH CLEAR CREEK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	0.10	YU	--		0.10	YU	--		0.10	YU	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	25.0	YU	314.	Y	25.0	YU	172.	Y	2250	Y	2420	Y
ANTIMONY	ug/L	31.0	YU	31.0	YU	31.0	YU	31.0	YU	31.0	YU	31.0	YU
ARSENIC	ug/L	3.00	YU	3.00	YU	3.00	YU	3.00	YU	3.00	YU	3.00	YU
BARIUM	ug/L	21.0	Y	23.0	Y	19.0	Y	23.0	Y	12.0	YU	12.0	YU
BERYLLIUM	ug/L	0.30	YU	0.30	YU	0.30	YU	0.30	YU	4.80	Y	4.70	Y
BORON	ug/L	32.0	YJS	31.0	YJS	24.0	YJS	31.0	YJS	374.	YJS	358.	YJS
CADMIUM	ug/L	1.40	Y	4.40	Y	1.00	YU	1.00	YU	12.0	Y	12.0	Y
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	13.0	Y	11.0	Y
COBALT	ug/L	7.00	Y	6.30	Y	4.00	YU	4.00	YU	159.	Y	149.	Y
COPPER	ug/L	23.0	Y	40.0	Y	10.0	Y	12.0	Y	673.	Y	669.	Y
CYANIDE	ug/L	--		10.0	YU	--		10.0	YU	--		10.0	YU
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	6030	Y	6760	Y	35.0	Y	328.	Y	152000	Y	146000	Y
LEAD	ug/L	5.00	YU	5.60	Y	2.00	YU	3.00	Y	14.0	Y	13.0	Y
MANGANESE	ug/L	1350	Y	1300	Y	146.	Y	149.	Y	29800	Y	28600	Y
MERCURY	ug/L	0.10	Y	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU
NICKEL	ug/L	9.80	Y	9.20	Y	5.00	YU	5.00	YU	219.	Y	207.	Y
SELENIUM	ug/L	3.00	YJS	5.00	YJS	5.00	YJS	5.00	YJS	--		50.0	YJS
SILVER	ug/L	0.10	YJC	0.10	YJC	0.10	YJC	0.10	YJC	0.10	YJC	0.93	YJC
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	137.	Y	127.	Y	62.0	Y	60.0	Y	1950	Y	1830	Y
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	3.00	YU	3.00	YU	3.00	YU	3.00	YU	10.0	YU	10.0	YU
TIN	ug/L	17.0	YJS	17.0	YJS	17.0	YJS	17.0	YJS	17.0	YJS	17.0	YJS
VANADIUM	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.80	Y	4.00	YU
ZINC	ug/L	526.	Y	507.	Y	231.	Y	258.	Y	6740	Y	6270	Y

FOOTNOTES

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		07/18/85 MHC314 SW014001 GREGORY GULCH ABOVE NORTH CLEAR CREEK				07/18/85 MHC313 SW015001 GREGORY GULCH ABOVE CENTRAL CITY				07/19/85 MHC320 SW016001 QUARTZ HILL TUNNEL AT PORTAL			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		309.	Y	--		15.4	Y	--		7.10	Y
pH	S.U.	--		6.59	Y	--		7.34	Y	--		2.54	Y
Eh (REDOX POTENTIAL)	MV	--		450.	Y	--		241.	Y	--		--	
SPECIFIC CONDUCTANCE	umhos	--		310.	Y	--		230.	Y	--		4250	Y
DISSOLVED OXYGEN	mg/L	5.30	Y	--		6.10	Y	--		5.70	Y	--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		0.17	Y	--		0.31	Y	--		2.30	Y
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	5.00	YU	--		5.00	YU	--		1870	Y	--	
pH	S.U.	--		6.40	Y	--		7.20	Y	--		2.60	Y
SPECIFIC CONDUCTANCE	umhos	--		331.	Y	--		238.	Y	--		4070	Y
TOTAL DISSOLVED SOLIDS	mg/L	230.	Y	--		180.	Y	--		5300	YJS	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		69.0	Y	--		5.00	Y	--		4.00	Y
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	30.0	Y	30.0	Y	23.7	Y	23.4	Y	325.	Y	316.	Y
MAGNESIUM	mg/L	10.7	Y	10.9	Y	7.18	Y	6.98	Y	174.	YJS	168.	Y
POTASSIUM	mg/L	3.69	Y	4.78	Y	3.00	Y	3.23	Y	0.99	YU	1.98	YU
SODIUM	mg/L	5.62	Y	5.86	Y	4.09	Y	4.67	Y	0.59	YU	1.18	YU
MAJOR ANIONS													
BICARBONATE	mg/L	8.00	Y	--		38.0	Y	--		5.00	YU	--	
CARBONATE	mg/L	5.00	YU	--		5.00	YU	--		5.00	YU	--	
FLUORIDE	mg/L	0.23	Y	--		0.15	Y	--		0.19	Y	--	
CHLORIDE	mg/L	3.00	YU	--		3.00	YU	--		6.00	YU	--	
SULFATE	mg/L	149.	Y	--		66.0	Y	--		3900	Y	--	

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		07/18/85 MHC314 SW014001 GREGORY GULCH ABOVE NORTH CLEAR CREEK				07/18/85 MHC313 SW015001 GREGORY GULCH ABOVE CENTRAL CITY				07/19/85 MHC320 SW016001 QUARTZ HILL TUNNEL AT PORTAL			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	0.11	Y	--		0.10	YU	--		0.10	YU	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	25.0	YU	2400	Y	25.0	YU	335.	Y	54400	Y	53300	Y
ANTIMONY	ug/L	31.0	YU	31.0	YU	31.0	YU	31.0	YU	31.0	YU	62.0	YU
ARSENIC	ug/L	3.00	YU	6.60	Y	10.0	YU	3.00	YU	640.	Y	637.	Y
BARIUM	ug/L	44.0	Y	73.0	Y	52.0	Y	59.0	Y	12.0	YU	24.0	YU
BERYLLIUM	ug/L	0.30	YU	0.30	Y	0.30	YU	0.30	YU	44.0	Y	43.0	Y
BORON	ug/L	69.0	YJS	104.	YJS	40.0	YJS	59.0	YJS	464.	YJS	491.	YJS
CADMIUM	ug/L	24.0	YJ	24.0	YJ	2.50	Y	3.20	Y	436.	Y	413.	Y
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	4.00	YU	6.30	Y	4.00	YU	4.00	YU	69.0	Y	65.0	Y
COBALT	ug/L	6.90	Y	9.00	Y	4.00	YU	4.00	YU	366.	Y	359.	Y
COPPER	ug/L	19.0	Y	186.	Y	7.90	Y	25.0	Y	43500	Y	42600	Y
CYANIDE	ug/L	--		10.0	YU	--		10.0	YU	--		10.0	YU
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	34.0	Y	6910	Y	491.	Y	2150	Y	481000	Y	471000	Y
LEAD	ug/L	5.00	YU	194.	Y	2.00	YU	36.0	Y	194.	Y	187.	Y
MANGANESE	ug/L	2390	Y	2490	Y	1890	Y	1890	Y	60900	Y	59600	Y
MERCURY	ug/L	0.10	YU	0.44	Y	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU	20.0	YU
NICKEL	ug/L	18.0	Y	24.0	Y	6.40	Y	5.60	Y	480.	Y	470.	Y
SELENIUM	ug/L	5.00	YJS	5.00	YJS	5.00	YJS	5.00	YJS	--		--	
SILVER	ug/L	0.10	YJC	1.30	YJC	0.10	YJC	0.10	YJC	30.0	Y	30.0	Y
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	148.	Y	140.	Y	140.	Y	132.	Y	397.	Y	373.	Y
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	10.0	YU	10.0	YU	3.00	YU	3.00	YU	10.0	YJS	10.0	YJS
TIN	ug/L	17.0	YJS	17.0	YJS	17.0	YJS	17.0	YJS	17.0	YJS	34.0	YJS
VANADIUM	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	21.0	Y	25.0	Y
ZINC	ug/L	3680	Y	3940	Y	951.	Y	1040	Y	93000	Y	90200	Y

FOOTNOTES

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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		07/19/85 MHC321 SW017001 NEVADA GULCH BELOW NEVADAVILLE				07/19/85 MHC322 SW018001 NEVADA GULCH ABOVE NEVADAVILLE				07/19/85 MHC323 SW019001 VIRGINIA CANYON			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		14.4	Y	--		13.8	Y	--		10.8	Y
pH	S.U.	--		3.42	Y	--		--		--		2.89	Y
Eh (REDOX POTENTIAL)	MV	--		682.	Y	--		421.	Y	--		750.	Y
SPECIFIC CONDUCTANCE	umhos	--		920.	Y	--		200.	Y	--		2760	Y
DISSOLVED OXYGEN	mg/L	5.90	Y	--		4.70	Y	--		6.30	Y	--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		--		--		0.005	Y	--		0.01	Y
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	130.	Y	--		5.00	YU	--		970.	Y	--	
pH	S.U.	--		3.50	Y	--		6.20	Y	--		2.70	Y
SPECIFIC CONDUCTANCE	umhos	--		930.	Y	--		190.	Y	--		2610	Y
TOTAL DISSOLVED SOLIDS	mg/L	645.	Y	--		95.0	Y	--		2670	Y	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		2.00	YU	--		3.00	Y	--		6.00	Y
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	64.4	Y	60.5	Y	11.8	Y	10.7	Y	132.	Y	131.	Y
MAGNESIUM	mg/L	27.5	YJS	26.0	Y	4.14	Y	3.84	Y	88.6	YJS	88.0	Y
POTASSIUM	mg/L	6.33	Y	6.51	Y	2.74	Y	3.57	Y	0.99	YU	1.98	YU
SODIUM	mg/L	0.59	YU	0.59	YU	4.06	Y	4.55	Y	0.59	YU	1.18	YU
MAJOR ANIONS													
BICARBONATE	mg/L	5.00	YU	--		6.50	Y	--		5.00	YU	--	
CARBONATE	mg/L	5.00	YU	--		5.00	YU	--		5.00	YU	--	
FLUORIDE	mg/L	0.34	Y	--		0.10	YU	--		1.80	Y	--	
CHLORIDE	mg/L	3.00	YU	--		3.00	YU	--		3.00	YU	--	
SULFATE	mg/L	425.	Y	--		55.0	Y	--		1950	Y	--	

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Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		07/19/85 MHC321 SW017001 NEVADA GULCH BELOW NEVADAVILLE				07/19/85 MHC322 SW018001 NEVADA GULCH ABOVE NEVADAVILLE				07/19/85 MHC323 SW019001 VIRGINIA CANYON			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	0.24	Y	--		0.10	YU	--		1.50	Y	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	3940	Y	3780	Y	73.0	Y	169.	Y	83800	Y	84700	Y
ANTIMONY	ug/L	31.0	YU	31.0	YU	31.0	YU	31.0	YU	31.0	YU	62.0	YU
ARSENIC	ug/L	3.00	YU	3.00	YU	3.00	YU	3.00	YU	122.	Y	138.	Y
BARIUM	ug/L	24.0	Y	24.0	Y	54.0	Y	50.0	Y	12.0	YU	24.0	YU
BERYLLIUM	ug/L	3.50	Y	3.30	Y	0.30	YU	0.30	YU	19.0	Y	19.0	Y
BORON	ug/L	126.	YJS	126.	YJS	30.0	YJS	35.0	YJS	141.	YJS	148.	YJS
CADMIUM	ug/L	326.	Y	310.	Y	6.30	Y	5.50	Y	518.	Y	506.	Y
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	4.00	YU	4.40	Y	4.00	YU	4.00	YU	67.0	Y	70.0	Y
COBALT	ug/L	41.0	Y	38.0	Y	4.00	YU	4.00	YU	304.	Y	302.	Y
COPPER	ug/L	1780	Y	1690	Y	60.0	Y	63.0	Y	20000	Y	20200	Y
CYANIDE	ug/L	--		10.0	YU	--		10.0	YU	--		10.0	YU
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	1910	Y	999.	Y	470.	Y	669.	Y	72200	Y	72500	Y
LEAD	ug/L	456.	Y	445.	Y	49.0	Y	65.0	Y	425.	Y	437.	Y
MANGANESE	ug/L	8330	Y	7750	Y	538.	Y	478.	Y	48400	Y	47700	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU	20.0	YU
NICKEL	ug/L	85.0	Y	77.0	Y	11.0	Y	7.20	Y	784.	Y	781.	Y
SELENIUM	ug/L	5.00	YJS	30.0	YJS	5.00	YJS	5.00	YJS	50.0	YJS	50.0	YJS
SILVER	ug/L	0.12	YJC	0.14	YJC	0.10	YJC	0.10	YJC	0.10	YJC	0.43	YJC
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	268.	Y	238.	Y	91.0	Y	76.0	Y	302.	Y	295.	Y
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	10.0	YJS	10.0	YJS	3.00	YJS	3.00	YJS	10.0	YJS	3.00	YJS
TIN	ug/L	17.0	YJS	17.0	YJS	17.0	YJS	17.0	YJS	17.0	YJS	34.0	YJS
VANADIUM	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	8.00	YU
ZINC	ug/L	57200	Y	54000	Y	2140	Y	1900	Y	98200	Y	96700	Y

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06/03/87

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		07/19/85 MHC324 SW020001 ARGO TUNNEL AT PORTAL				07/19/85 MHC325 SW021001 CLEAR CREEK BELOW ARGO				07/19/85 MHC326 SW022001 CLEAR CREEK ABOVE ARGO			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		16.7	Y	--		13.2	Y	--		13.4	Y
pH	S.U.	--		2.62	Y	--		6.80	Y	--		6.24	Y
Eh (REDOX POTENTIAL)	MV	--		717.	Y	--		383.	Y	--		320.	Y
SPECIFIC CONDUCTANCE	umhos	--		2990	Y	--		155.	Y	--		110.	Y
DISSOLVED OXYGEN	mg/L	4.60	Y	--		6.28	Y	--		6.35	Y	--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		0.40	Y	--		--		--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	700.	Y	--		5.00	YU	--		5.00	YU	--	
pH	S.U.	--		2.80	Y	--		7.20	Y	--		7.50	Y
SPECIFIC CONDUCTANCE	umhos	--		3060	Y	--		140.	Y	--		97.0	Y
TOTAL DISSOLVED SOLIDS	mg/L	3120	Y	--		70.0	Y	--		45.0	Y	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		2.00	YU	--		2.00	YU	--		2.00	YU
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	323.	Y	309.	Y	11.6	Y	11.1	Y	9.66	Y	9.04	Y
MAGNESIUM	mg/L	119.	YJS	112.	Y	3.16	YJS	2.94	Y	2.44	YJS	2.32	Y
POTASSIUM	mg/L	4.08	Y	4.08	Y	1.03	Y	0.99	YU	1.05	Y	0.99	YU
SODIUM	mg/L	11.3	Y	17.1	Y	4.24	Y	4.82	Y	3.78	Y	4.67	Y
MAJOR ANIONS													
BICARBONATE	mg/L	5.00	YU	--		24.0	Y	--		29.0	Y	--	
CARBONATE	mg/L	5.00	YU	--		5.00	YU	--		5.00	YU	--	
FLUORIDE	mg/L	2.50	Y	--		0.47	Y	--		0.41	Y	--	
CHLORIDE	mg/L	3.00	YU	--		3.00	YU	--		3.00	YU	--	
SULFATE	mg/L	1820	Y	--		26.0	Y	--		14.0	Y	--	

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		07/19/85 MHC324 SW020001 ARGO TUNNEL AT PORTAL				07/19/85 MHC325 SW021001 CLEAR CREEK BELOW ARGO				07/19/85 MHC326 SW022001 CLEAR CREEK ABOVE ARGO			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	0.10	YU	--		0.10	YU	--		0.37	Y	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	21100	Y	20300	Y	64.0	Y	355.	Y	59.0	Y	210.	Y
ANTIMONY	ug/L	31.0	YU	62.0	YU	31.0	YU	31.0	YU	31.0	YU	31.0	YU
ARSENIC	ug/L	139.	Y	120.	Y	3.00	YU	3.00	YU	3.00	YU	3.00	YU
BARIUM	ug/L	12.0	YU	24.0	YU	16.0	Y	20.0	Y	16.0	Y	20.0	Y
BERYLLIUM	ug/L	14.0	Y	13.0	Y	0.30	YU	0.30	YU	0.30	YU	0.30	YU
BORON	ug/L	227.	YJS	233.	YJS	18.0	YJS	24.0	YJS	18.0	YJS	31.0	YJS
CADMIUM	ug/L	149.	Y	144.	Y	5.00	YU	1.00	YU	5.00	YU	5.00	YU
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	28.0	Y	27.0	Y	5.00	Y	4.00	YU	4.00	YU	4.00	YU
COBALT	ug/L	156.	Y	153000	Y	4.00	YU	4.00	YU	4.00	YU	4.00	YU
COPPER	ug/L	6010	Y	5690000	Y	19.0	Y	47.0	Y	10.0	Y	15.0	Y
CYANIDE	ug/L	--		10.0	YU	--		10.0	YU	--		10.0	YU
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	154000	Y	150000	Y	241.	Y	1400	Y	84.0	Y	450.	Y
LEAD	ug/L	110.	Y	95.0	Y	2.00	YU	3.70	Y	2.00	YU	8.50	Y
MANGANESE	ug/L	92800	Y	89500	Y	953.	Y	929.	Y	356.	Y	354.	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	10.0	YU	20.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU
NICKEL	ug/L	252.	Y	256.	Y	5.90	Y	5.00	YU	5.00	YU	5.00	YU
SELENIUM	ug/L	50.0	YJS	50.0	YUJS	5.00	YJS	5.00	YJS	30.0	YJS	5.00	YJS
SILVER	ug/L	7.10	Y	290.	YJC	0.10	YJC	0.10	YJC	0.10	YJC	0.10	YJC
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	1380	Y	1330	Y	93.0	Y	87.0	Y	82.0	Y	69.0	Y
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	10.0	YJS	10.0	YJS	3.00	YJS	3.00	YJS	3.00	YJS	3.00	YJS
TIN	ug/L	17.0	YJS	34.0	YJS	17.0	YJS	17.0	YJS	17.0	YJS	17.0	YJS
VANADIUM	ug/L	4.00	YU	8.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU
ZINC	ug/L	47400	Y	45100	Y	397.	Y	639.	Y	161.	Y	167.	Y

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		07/19/85 MHC328 SW024001 BIG FIVE AT CLEAR CREEK				07/19/85 MHC327 SW025001 ARGO TUNNEL AT PORTAL - SPLIT				07/17/85 MHC305 SW027001 DECON BLANK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		15.4	Y	--		16.2	Y	--		23.1	Y
pH	S.U.	--		2.40	Y	--		--		--		8.70	Y
Eh (REDOX POTENTIAL)	MV	--		728.	Y	--		708.	Y	--		403.	Y
SPECIFIC CONDUCTANCE	umhos	--		3880	Y	--		3080	Y	--		310.	Y
DISSOLVED OXYGEN	mg/L	5.00	Y	--		4.70	Y	--		5.90	Y	--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		--		--		--		--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	480.	Y	--		690.	Y	--		5.00	YU	--	
pH	S.U.	--		2.60	Y	--		2.80	Y	--		8.30	Y
SPECIFIC CONDUCTANCE	umhos	--		3710	YJC	--		3000	YJC	--		317.	Y
TOTAL DISSOLVED SOLIDS	mg/L	3300	Y	--		3230	Y	--		215.	Y	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		2.00	YU	--		2.00	YU	--		2.00	YU
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	399.	Y	368.	Y	329.	Y	302.	Y	3.51	Y	3.65	Y
MAGNESIUM	mg/L	166.	YJS	155.	Y	119.	YJS	112.	Y	0.25	YU	0.25	YU
POTASSIUM	mg/L	6.78	Y	7.18	Y	3.80	Y	4.08	Y	0.99	YU	0.99	YU
SODIUM	mg/L	48.5	Y	45.7	Y	12.9	Y	9.38	Y	76.4	Y	70.6	Y
MAJOR ANIONS													
BICARBONATE	mg/L	5.00	YU	--		5.00	YU	--		176.	Y	--	
CARBONATE	mg/L	5.00	YU	--		5.00	YU	--		5.00	YU	--	
FLUORIDE	mg/L	1.90	Y	--		2.40	Y	--		1.50	Y	--	
CHLORIDE	mg/L	4.30	Y	--		4.30	Y	--		3.00	YU	--	
SULFATE	mg/L	3770	Y	--		2050	Y	--		10.0	YU	--	

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		07/19/85 MHC328 SW024001 BIG FIVE AT CLEAR CREEK				07/19/85 MHC327 SW025001 ARGO TUNNEL AT PORTAL - SPLIT				07/17/85 MHC305 SW027001 DECON BLANK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	0.10	YU	--		0.57	Y	--		0.10	YU	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	28200	Y	26800	Y	21100	Y	20000	Y	25.0	YU	25.0	YU
ANTIMONY	ug/L	31.0	YU	31.0	YU	31.0	YU	62.0	YU	31.0	YU	31.0	YU
ARSENIC	ug/L	45.0	Y	7.80	Y	159.	Y	141.	Y	10.0	YU	3.00	YU
BARIUM	ug/L	12.0	YU	12.0	YU	12.0	YU	24.0	YU	19.0	Y	23.0	Y
BERYLLIUM	ug/L	8.90	Y	8.40	Y	14.0	Y	13.0	Y	0.30	YU	0.30	YU
BORON	ug/L	168.	YJS	157.	YJS	236.	YJS	221.	YJS	59.0	YJS	70.0	YJS
CADMIUM	ug/L	40.0	Y	34.0	Y	157.	Y	142.	Y	1.00	YU	1.00	YU
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	29.0	Y	29.0	Y	31.0	Y	27.0	Y	4.00	YU	4.00	YU
COBALT	ug/L	174.	Y	160.	Y	153.	Y	149.	Y	4.00	YU	4.00	YU
COPPER	ug/L	2030	Y	1980	Y	5940	Y	5670	Y	3.00	YU	6.60	Y
CYANIDE	ug/L	--		10.0	YU	--		10.0	YU	--		10.0	YU
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	34300	Y	32000	Y	157000	Y	146000	Y	19.0	Y	67.0	Y
LEAD	ug/L	143.	Y	136.	Y	117.	Y	99.0	Y	5.00	YU	2.00	YU
MANGANESE	ug/L	39500	Y	36300	Y	95000	Y	87500	Y	5.00	Y	5.50	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	10.0	YU	10.0	YU	10.0	YU	20.0	YU	10.0	YU	10.0	YU
NICKEL	ug/L	366.	Y	341.	Y	262.	Y	242.	Y	5.00	YU	5.00	YU
SELENIUM	ug/L	50.0	YJS	50.0	YJS	--		50.0	YJS	5.00	YJS	3.00	YJS
SILVER	ug/L	0.10	YJC	0.52	YJC	9.70	Y	0.15	YJC	0.10	YJC	0.10	YJC
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	2350	Y	2100	Y	1400	Y	1260	Y	39.0	Y	42.0	Y
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	10.0	YJS	10.0	YJS	10.0	YJS	10.0	YJS	3.00	YU	10.0	YU
TIN	ug/L	17.0	YJS	17.0	YJS	17.0	YJS	34.0	YJS	17.0	YJS	17.0	YJS
VANADIUM	ug/L	4.00	YU	4.00	YU	4.00	YU	8.00	YU	4.00	YU	4.00	YU
ZINC	ug/L	13200	Y	12200	Y	48300	Y	44600	Y	2.00	YU	8.80	Y

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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		07/17/85 MHC307 SW028001 TRAVEL BLANK				07/18/85 MHC318 SW029001 DECON BLANK				07/17/85 MHC310 SW030001 TRAVEL BLANK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		--		--		--		--		--	
pH	S.U.	--		--		--		--		--		--	
Eh (REDOX POTENTIAL)	MV	--		--		--		--		--		--	
SPECIFIC CONDUCTANCE	umhos	--		--		--		--		--		--	
DISSOLVED OXYGEN	mg/L	--		--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		--		--		--		--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	5.00	YU	--		5.00	YU	--		5.00	YU	--	
pH	S.U.	--		5.40	Y	--		5.40	Y	--		5.40	Y
SPECIFIC CONDUCTANCE	umhos	--		9.70	Y	--		2.60	Y	--		3.90	Y
TOTAL DISSOLVED SOLIDS	mg/L	110.	Y	--		105.	Y	--		50.0	YU	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		2.00	YU	--		2.00	YU	--		2.00	YU
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	0.28	YU	0.28	YU	3.62	Y	0.28	YU	0.28	YU	0.28	YU
MAGNESIUM	mg/L	0.25	YU	0.25	YU	0.25	YU	0.25	YU	0.25	YU	0.25	YU
POTASSIUM	mg/L	0.99	YU	0.99	YU	0.99	YU	0.99	YU	0.99	YU	0.99	YU
SODIUM	mg/L	0.59	YU	0.59	YU	75.2	Y	0.59	YU	0.59	YU	0.59	YU
MAJOR ANIONS													
BICARBONATE	mg/L	5.00	YU	--		5.00	YU	--		5.00	YU	--	
CARBONATE	mg/L	5.00	YU	--		5.00	YU	--		5.00	YU	--	
FLUORIDE	mg/L	0.10	YU	--		0.10	YU	--		0.10	YU	--	
CHLORIDE	mg/L	3.00	YU	--		3.00	YU	--		3.00	YU	--	
SULFATE	mg/L	5.00	YU	--		5.00	YU	--		5.00	YU	--	

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Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		07/17/85 MHC307 SW028001 TRAVEL BLANK				07/18/85 MHC318 SW029001 DECON BLANK				07/17/85 MHC310 SW030001 TRAVEL BLANK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	0.10	YU	--		0.10	YU	--		0.10	YU	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	25.0	YU	36.0	Y	25.0	YU	25.0	YU	25.0	YU	25.0	YU
ANTIMONY	ug/L	31.0	YU	31.0	YU	31.0	YU	31.0	YU	31.0	YU	31.0	YU
ARSENIC	ug/L	3.00	YU	10.0	YU	3.00	YU	3.00	YU	3.00	YU	3.00	YU
BARIUM	ug/L	12.0	YU	12.0	YU	20.0	Y	12.0	YU	12.0	YU	12.0	YU
BERYLLIUM	ug/L	0.30	YU	0.30	YU	0.30	YU	0.30	YU	0.30	YU	0.80	Y
BORON	ug/L	14.0	YJS	18.0	YJS	60.0	YJS	18.0	YJS	11.0	YJS	24.0	YJS
CADMIUM	ug/L	5.00	YU	5.00	YU	1.00	YU	1.00	YU	1.00	YU	1.00	YU
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU
COBALT	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU
COPPER	ug/L	3.00	YU	3.80	Y	5.30	Y	3.00	YU	3.00	YU	3.00	YU
CYANIDE	ug/L	--		10.0	YU	--		10.0	YU	--		10.0	YU
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	15.0	YU	47.0	Y	24.0	Y	25.0	Y	15.0	YU	24.0	Y
LEAD	ug/L	2.00	YU	5.00	YU	2.00	YU	2.00	YU	2.00	YU	2.00	YU
MANGANESE	ug/L	5.00	YU	5.00	YU	14.0	Y	5.00	YU	5.00	YU	5.00	YU
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU
NICKEL	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
SELENIUM	ug/L	5.00	YJS	--		5.00	YJS	3.00	YJS	5.00	YJS	3.00	YJS
SILVER	ug/L	0.10	YJC	0.10	YJC	0.10	YJC	0.10	YJC	0.10	YJC	0.10	YJC
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	5.00	YU	5.00	YU	43.0	Y	5.00	YU	5.00	YU	5.00	YU
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	3.00	YU	3.00	YU	3.00	YU	3.00	YU	3.00	YU	3.00	YU
TIN	ug/L	17.0	YJS	17.0	YJS	17.0	YJS	17.0	YJS	17.0	YJS	17.0	YJS
VANADIUM	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU
ZINC	ug/L	2.00	YU	4.30	Y	14.0	Y	3.30	Y	2.00	YU	3.70	Y

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		07/17/85 MHC306 SW033001 NORTH CLEAR CREEK ABOVE NATIONAL; RAIN EVENT				07/19/85 MHC330 SW034001 RUSSELL GULCH AT NORTH CLEAR CREEK - SPLIT				07/19/85 MHC331 SW035001 RUSSELL GULCH AT NORTH CLEAR CREEK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		13.8	Y	--		--		--		--	
pH	S.U.	--		7.23	Y	--		--		--		--	
Eh (REDOX POTENTIAL)	MV	--		415.	Y	--		--		--		--	
SPECIFIC CONDUCTANCE	umhos	--		130.	Y	--		--		--		--	
DISSOLVED OXYGEN	mg/L	6.80	Y	--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		--		--		--		--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	27.0	Y	--		5.00	YU	--		5.00	YU	--	
pH	S.U.	--		6.60	Y	--		7.40	Y	--		7.40	Y
SPECIFIC CONDUCTANCE	umhos	--		126.	Y	--		380.	YJC	--		370.	YJC
TOTAL DISSOLVED SOLIDS	mg/L	250.	Y	--		255.	Y	--		250.	Y	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		1350	Y	--		19.0	Y	--		7.00	Y
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	11.5	Y	18.6	Y	35.6	Y	34.0	Y	35.6	Y	34.0	Y
MAGNESIUM	mg/L	3.33	Y	17.5	Y	10.3	YJS	10.0	Y	10.2	YJS	9.95	Y
POTASSIUM	mg/L	2.00	Y	16.5	Y	4.85	Y	5.26	Y	4.68	Y	5.20	Y
SODIUM	mg/L	6.50	Y	5.41	Y	17.6	Y	15.2	Y	17.8	Y	15.7	Y
MAJOR ANIONS													
BICARBONATE	mg/L	17.0	Y	--		28.0	Y	--		27.0	Y	--	
CARBONATE	mg/L	5.00	YU	--		5.00	YU	--		5.00	YU	--	
FLUORIDE	mg/L	0.10	Y	--		0.75	Y	--		0.80	Y	--	
CHLORIDE	mg/L	3.40	Y	--		3.00	YU	--		3.00	YU	--	
SULFATE	mg/L	93.0	Y	--		142.	Y	--		137.	Y	--	

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		07/17/85 MHC306 SW033001 NORTH CLEAR CREEK ABOVE NATIONAL; RAIN EVENT				07/19/85 MHC330 SW034001 RUSSELL GULCH AT NORTH CLEAR CREEK - SPLIT				07/19/85 MHC331 SW035001 RUSSELL GULCH AT NORTH CLEAR CREEK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	0.10	YU	--		0.10	YU	--		0.10	YU	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	117.	Y	39400	Y	67.0	Y	853.	Y	68.0	Y	1020	Y
ANTIMONY	ug/L	31.0	YU	31.0	YU	31.0	YU	31.0	YU	31.0	YU	31.0	YU
ARSENIC	ug/L	3.00	YU	26.0	Y	3.00	YU	3.00	YU	3.00	YU	3.00	YU
BARIUM	ug/L	32.0	Y	622.	Y	28.0	Y	30.0	Y	28.0	Y	31.0	Y
BERYLLIUM	ug/L	0.30	YU	2.20	Y	0.30	YU	0.30	Y	0.30	YU	0.30	Y
BORON	ug/L	46.0	YJS	174.	YJS	53.0	YJS	54.0	YJS	54.0	YJS	57.0	YJS
CADMIUM	ug/L	5.00	YU	6.40	Y	1.00	YU	3.30	YJ	6.20	Y	6.40	Y
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	4.00	YU	112.	Y	4.00	YU	4.00	YU	4.00	YU	4.00	YU
COBALT	ug/L	4.00	YU	38.0	Y	4.10	Y	4.00	YU	6.10	Y	6.10	Y
COPPER	ug/L	9.60	Y	237.	Y	42.0	Y	238.	Y	40.0	Y	218.	Y
CYANIDE	ug/L	--		10.0	YU	--		10.0	YU	--		10.0	YU
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	142.	Y	84300	Y	15.0	YU	472.	Y	15.0	YU	540.	Y
LEAD	ug/L	2.00	YU	593.	Y	5.00	YU	2.00	YU	5.00	YU	5.00	YU
MANGANESE	ug/L	405.	Y	2450	Y	801.	Y	777.	Y	803.	Y	790.	Y
MERCURY	ug/L	0.10	YU	0.71	Y	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU
NICKEL	ug/L	5.00	YU	81.0	Y	21.0	Y	26.0	Y	21.0	Y	26.0	Y
SELENIUM	ug/L	5.00	YJS	5.00	YJS	5.00	YJS	5.00	YJS	5.00	YJS	5.00	YJS
SILVER	ug/L	0.10	YJC	3.20	YJC	0.10	YJC	0.10	YJC	0.10	YJC	0.10	YJC
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	83.0	Y	119.	Y	393.	Y	362.	Y	397.	Y	381.	Y
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	3.00	YU	3.00	YU	10.0	YJS	10.0	YJS	10.0	YJS	10.0	YJS
TIN	ug/L	17.0	YJS	17.0	YJS	17.0	YJS	17.0	YJS	17.0	YJS	17.0	YJS
VANADIUM	ug/L	4.00	YU	112.	Y	4.00	YU	4.00	YU	4.00	YU	4.00	YU
ZINC	ug/L	20.0	Y	1230	Y	769.	Y	863.	Y	748.	Y	890.	Y

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(--) = Not analyzed
(umhos) = umhos/cm

(J) = ESTIMATED
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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		07/19/85 MHC332 SW036001 DECON BLANK				07/19/85 MHC333 SW037001 TRAVEL BLANK				07/22/85 MHC334 SW038001 BLIND STANDARD			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		--		--		--		--		--	
pH	S.U.	--		--		--		--		--		--	
Eh (REDOX POTENTIAL)	MV	--		--		--		--		--		--	
SPECIFIC CONDUCTANCE	umhos	--		--		--		--		--		--	
DISSOLVED OXYGEN	mg/L	--		--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		--		--		--		--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	5.00	YU	--		5.00	YU	--		210.	Y	--	
pH	S.U.	--		6.20	Y	--		5.40	Y	--		2.40	Y
SPECIFIC CONDUCTANCE	umhos	--		9.70	YJC	--		1.90	YJC	--		1800	YJC
TOTAL DISSOLVED SOLIDS	mg/L	10.0	YU	--		10.0	YU	--		50.0	Y	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		2.00	YU	--		2.00	YU	--		2.00	YU
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	0.28	YU	0.28	YU	0.28	YU	0.28	YU	25.7	Y	25.8	Y
MAGNESIUM	mg/L	0.25	YUJS	0.25	YU	0.25	YJS	0.25	YU	0.25	YJS	0.25	YU
POTASSIUM	mg/L	0.99	YU	0.99	YU	0.99	YU	0.99	YU	0.99	YU	0.99	YU
SODIUM	mg/L	2.04	Y	0.59	YU	0.59	YU	2.96	Y	0.82	Y	1.73	Y
MAJOR ANIONS													
BICARBONATE	mg/L	5.00	YU	--		5.00	YU	--		5.00	YU	--	
CARBONATE	mg/L	5.00	YU	--		5.00	YU	--		5.00	YU	--	
FLUORIDE	mg/L	0.10	YU	--		0.10	YU	--		0.10	YU	--	
CHLORIDE	mg/L	3.00	YU	--		3.00	YU	--		3.00	YU	--	
SULFATE	mg/L	5.00	YU	--		5.00	YU	--		5.00	YU	--	

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(umhos) = umhos/cm

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(U) = UNDETECTED
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(JS) = ESTIMATED due to spike recoveries outside limits
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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		07/19/85 MHC332 SW036001 DECON BLANK				07/19/85 MHC333 SW037001 TRAVEL BLANK				07/22/85 MHC334 SW038001 BLIND STANDARD			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	0.10	YU	--		0.10	YU	--		77.0	Y	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	25.0	YU	25.0	YU	25.0	YU	25.0	YU	25.0	YU	25.0	YU
ANTIMONY	ug/L	31.0	YU	31.0	YU	31.0	YU	31.0	YU	31.0	YU	31.0	YU
ARSENIC	ug/L	3.00	YU	3.00	YU	3.00	YU	3.00	YU	36.0	Y	46.0	Y
BARIUM	ug/L	12.0	YU	12.0	YU	12.0	YU	12.0	YU	344.	Y	345.	Y
BERYLLIUM	ug/L	0.30	YU	0.30	YU	0.30	YU	0.30	YU	0.30	YU	0.30	YU
BORON	ug/L	12.0	YJS	14.0	YJS	12.0	YJS	12.0	YJS	24.0	YJS	24.0	YJS
CADMIUM	ug/L	1.00	YU	1.00	YU	1.00	YU	1.00	YU	36.0	Y	36.0	Y
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	52.0	Y	53.0	Y
COBALT	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU
COPPER	ug/L	3.00	YU	15.0	Y	3.00	YU	3.00	YU	3.00	YU	3.00	YU
CYANIDE	ug/L	--		10.0	YU	--		10.0	YU	--		10.0	YU
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	30.0	Y	56.0	Y	15.0	YU	15.0	YU	146.	Y	139.	Y
LEAD	ug/L	2.00	YU	3.60	Y	2.00	YU	3.70	Y	110.	Y	101.	Y
MANGANESE	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	115.	Y	114.	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	1.50	Y	1.50	Y
MOLYBDENUM	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU
NICKEL	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
SELENIUM	ug/L	50.0	YUJS	3.00	YUJS	30.0	YJS	5.00	YJS	40.0	YJS	28.0	YJS
SILVER	ug/L	0.10	YUJC	0.10	YUJC	0.10	YJC	0.10	YJC	101.	Y	102.	Y
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	9.30	Y	6.20	Y	13.0	Y
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	3.00	YUJS	10.0	YUJS	3.00	YJS	10.0	YJS	3.00	YJS	3.00	YJS
TIN	ug/L	17.0	YUJS	17.0	YUJS	17.0	YJS	17.0	YJS	17.0	Y JS	17.0	Y JS
VANADIUM	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU
ZINC	ug/L	36.0	Y	5.00	Y	2.00	YU	2.00	YU	2.00	YU	2.00	YU

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(--) = Not analyzed
(umhos) = umhos/cm

(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(H,HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		07/22/85 MHC335 SW039001 BLIND STANDARD				08/25/85 NONE SW007 NATIONAL TUNNEL AT NORTH CLEAR CREEK-FLD ONLY				08/28/85 NONE SW007U NATIONAL TUNNEL ABOVE MARSH - FLD ONLY			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		--		--		13.1	Y	--		14.4	Y
pH	S.U.	--		--		--		5.43	Y	--		5.90	Y
Eh (REDOX POTENTIAL)	MV	--		--		--		349.	Y	--		208.	Y
SPECIFIC CONDUCTANCE	umhos	--		--		--		1520	Y	--		1500	Y
DISSOLVED OXYGEN	mg/L	--		--		4.35	Y	--		4.10	Y	--	
Fe+2	mg/L	--		--		14.6	Y	--		15.2	Y	--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		14.7	Y	--		15.6	Y	--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		--		--		--		--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	85.0	Y	--		--		--		--		--	
pH	S.U.	--		2.80	Y	--		--		--		--	
SPECIFIC CONDUCTANCE	umhos	--		760.	YJC	--		--		--		--	
TOTAL DISSOLVED SOLIDS	mg/L	50.0	Y	--		--		--		--		--	
TOTAL SUSPENDED SOLIDS	mg/L	--		2.00	YU	--		--		--		--	
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	10.4	Y	10.3	Y	--		--		--		--	
MAGNESIUM	mg/L	0.25	YJS	0.25	YU	--		--		--		--	
POTASSIUM	mg/L	0.99	YU	0.99	YU	--		--		--		--	
SODIUM	mg/L	0.68	Y	1.32	Y	--		--		--		--	
MAJOR ANIONS													
BICARBONATE	mg/L	5.00	YU	--		--		--		--		--	
CARBONATE	mg/L	5.00	YU	--		--		--		--		--	
FLUORIDE	mg/L	0.10	YU	--		--		--		--		--	
CHLORIDE	mg/L	3.00	YU	--		--		--		--		--	
SULFATE	mg/L	5.00	YU	--		--		--		--		--	

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Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		07/22/85 MHC335 SW039001 BLIND STANDARD				08/25/85 NONE SW007 NATIONAL TUNNEL AT NORTH CLEAR CREEK-FLD ONLY		08/28/85 NONE SW007U NATIONAL TUNNEL ABOVE MARSH - FLD ONLY	
		DISSOLVED		TOTAL		DISSOLVED	TOTAL	DISSOLVED	TOTAL
NUTRIENTS									
AMMONIA	mg/L	--		--		--	--	--	--
NITRITE (NO2) (NO2-N)	mg/L	--		--		--	--	--	--
NITRATE (NO3) (NO3-N)	mg/L	--		--		--	--	--	--
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	31.0	Y	--		--	--	--	--
PHOSPHATE	mg/L	--		--		--	--	--	--
MINOR & TRACE ELEMENTS									
ALUMINUM	ug/L	25.0	YU	25.0	YU	--	--	--	--
ANTIMONY	ug/L	31.0	YU	31.0	YU	--	--	--	--
ARSENIC	ug/L	18.0	Y	15.0	Y	--	--	--	--
BARIUM	ug/L	137.	Y	138.	Y	--	--	--	--
BERYLLIUM	ug/L	0.30	YU	0.30	YU	--	--	--	--
BORON	ug/L	20.0	YJS	15.0	YJS	--	--	--	--
CADMIUM	ug/L	15.0	Y	15.0	Y	--	--	--	--
CHROMIUM (Cr+6)	ug/L	--		--		--	--	--	--
CHROMIUM (TOTAL)	ug/L	22.0	Y	22.0	Y	--	--	--	--
COBALT	ug/L	4.00	YU	4.00	YU	--	--	--	--
COPPER	ug/L	3.00	YU	3.00	YU	--	--	--	--
CYANIDE	ug/L	--		10.0	YU	--	--	--	--
GOLD	ug/L	--		--		--	--	--	--
IRON	ug/L	54.0	Y	53.0	Y	--	--	--	--
LEAD	ug/L	40.0	Y	39.0	Y	--	--	--	--
MANGANESE	ug/L	46.0	Y	46.0	Y	--	--	--	--
MERCURY	ug/L	0.56	Y	0.65	Y	--	--	--	--
MOLYBDENUM	ug/L	10.0	YU	10.0	YU	--	--	--	--
NICKEL	ug/L	5.00	YU	5.00	YU	--	--	--	--
SELENIUM	ug/L	50.0	YJS	11.0	YJS	--	--	--	--
SILVER	ug/L	40.0	Y	42.0	Y	--	--	--	--
SILICA	ug/L	--		--		--	--	--	--
STRONTIUM	ug/L	5.00	YU	5.00	YU	--	--	--	--
SULFIDE	ug/L	--		--		--	--	--	--
THALLIUM	ug/L	10.0	YJS	3.00	YJS	--	--	--	--
TIN	ug/L	17.0	YJS	17.0	YJS	--	--	--	--
VANADIUM	ug/L	4.00	YU	4.00	YU	--	--	--	--
ZINC	ug/L	2.00	YU	2.00	YU	--	--	--	--

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Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		08/28/85 NONE SW008 NATIONAL TUNNEL AT PORTAL - FLD ONLY				08/29/85 NONE SW016 QUARTZ HILL TUNNEL AT PORTAL - FLD ONLY				08/30/85 NONE SW019 VIRGINIA CANYON - FLD ONLY			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		9.40	Y	--		6.00	Y	--		10.7	Y
pH	S.U.	--		6.22	Y	--		2.54	Y	--		2.62	Y
Eh (REDOX POTENTIAL)	MV	--		241.	Y	--		808.	Y	--		807.	Y
SPECIFIC CONDUCTANCE	umhos	--		1540	Y	--		4160	Y	--		2750	Y
DISSOLVED OXYGEN	mg/L	4.50	Y	--		4.70	Y	--		3.50	Y	--	
Fe+2	mg/L	18.3	Y	--		10.9	Y	--		5.50	Y	--	
Fe+3	mg/L	1.90	Y	--		460.	Y	--		92.6	Y	--	
IRON (TOTAL)	mg/L	20.2	Y	--		471.	Y	--		98.1	Y	--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		--		--		--		--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	--		--		--		--		--		--	
pH	S.U.	--		--		--		--		--		--	
SPECIFIC CONDUCTANCE	umhos	--		--		--		--		--		--	
TOTAL DISSOLVED SOLIDS	mg/L	--		--		--		--		--		--	
TOTAL SUSPENDED SOLIDS	mg/L	--		--		--		--		--		--	
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	--		--		--		--		--		--	
MAGNESIUM	mg/L	--		--		--		--		--		--	
POTASSIUM	mg/L	--		--		--		--		--		--	
SODIUM	mg/L	--		--		--		--		--		--	
MAJOR ANIONS													
BICARBONATE	mg/L	--		--		--		--		--		--	
CARBONATE	mg/L	--		--		--		--		--		--	
FLUORIDE	mg/L	--		--		--		--		--		--	
CHLORIDE	mg/L	--		--		--		--		--		--	
SULFATE	mg/L	--		--		--		--		--		--	

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		08/28/85 NONE SW008 NATIONAL TUNNEL AT PORTAL - FLD ONLY		08/29/85 NONE SW016 QUARTZ HILL TUNNEL AT PORTAL - FLD ONLY		08/30/85 NONE SW019 VIRGINIA CANYON - FLD ONLY	
		DISSOLVED	TOTAL	DISSOLVED	TOTAL	DISSOLVED	TOTAL
NUTRIENTS							
AMMONIA	mg/L	--	--	--	--	--	--
NITRITE (NO2) (NO2-N)	mg/L	--	--	--	--	--	--
NITRATE (NO3) (NO3-N)	mg/L	--	--	--	--	--	--
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	--	--	--	--	--	--
PHOSPHATE	mg/L	--	--	--	--	--	--
MINOR & TRACE ELEMENTS							
ALUMINUM	ug/L	--	--	--	--	--	--
ANTIMONY	ug/L	--	--	--	--	--	--
ARSENIC	ug/L	--	--	--	--	--	--
BARIUM	ug/L	--	--	--	--	--	--
BERYLLIUM	ug/L	--	--	--	--	--	--
BORON	ug/L	--	--	--	--	--	--
CADMIUM	ug/L	--	--	--	--	--	--
CHROMIUM (Cr+6)	ug/L	--	--	--	--	--	--
CHROMIUM (TOTAL)	ug/L	--	--	--	--	--	--
COBALT	ug/L	--	--	--	--	--	--
COPPER	ug/L	--	--	--	--	--	--
CYANIDE	ug/L	--	--	--	--	--	--
GOLD	ug/L	--	--	--	--	--	--
IRON	ug/L	--	--	--	--	--	--
LEAD	ug/L	--	--	--	--	--	--
MANGANESE	ug/L	--	--	--	--	--	--
MERCURY	ug/L	--	--	--	--	--	--
MOLYBDENUM	ug/L	--	--	--	--	--	--
NICKEL	ug/L	--	--	--	--	--	--
SELENIUM	ug/L	--	--	--	--	--	--
SILVER	ug/L	--	--	--	--	--	--
SILICA	ug/L	--	--	--	--	--	--
STRONTIUM	ug/L	--	--	--	--	--	--
SULFIDE	ug/L	--	--	--	--	--	--
THALLIUM	ug/L	--	--	--	--	--	--
TIN	ug/L	--	--	--	--	--	--
VANADIUM	ug/L	--	--	--	--	--	--
ZINC	ug/L	--	--	--	--	--	--

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(H,HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		08/29/85 NONE SW020 ARGO TUNNEL AT PORTAL - FLD ONLY		08/29/85 NONE SWR1 HEAD OF RUSSELL GULCH #1 - FLD ONLY		08/29/85 NONE SWR2 HEAD OF RUSSELL GULCH #2 - FLD ONLY	
		DISSOLVED	TOTAL	DISSOLVED	TOTAL	DISSOLVED	TOTAL
FIELD DETERMINATIONS							
TEMPERATURE	C	--	16.6 Y	--	11.5 Y	--	12.5 Y
pH	S.U.	--	2.75 Y	--	3.75 Y	--	3.80 Y
Eh (REDOX POTENTIAL)	MV	--	737. Y	--	--	--	574. Y
SPECIFIC CONDUCTANCE	umhos	--	3060 Y	--	--	--	--
DISSOLVED OXYGEN	mg/L	--	--	--	--	--	--
Fe+2	mg/L	4.60 Y	--	--	--	--	--
Fe+3	mg/L	158. Y	--	--	--	--	--
IRON (TOTAL)	mg/L	163. Y	--	--	--	--	--
As+3	mg/L	--	--	--	--	--	--
As+5	mg/L	--	--	--	--	--	--
DISCHARGE	CFS	--	--	--	--	--	--
LAB DETERMINATIONS							
GENERAL							
ACIDITY	mg/L	--	--	--	--	--	--
pH	S.U.	--	--	--	--	--	--
SPECIFIC CONDUCTANCE	umhos	--	--	--	--	--	--
TOTAL DISSOLVED SOLIDS	mg/L	--	--	--	--	--	--
TOTAL SUSPENDED SOLIDS	mg/L	--	--	--	--	--	--
TOTAL ORGANIC CARBON	mg/L	--	--	--	--	--	--
MAJOR CATIONS							
CALCIUM	mg/L	--	--	--	--	--	--
MAGNESIUM	mg/L	--	--	--	--	--	--
POTASSIUM	mg/L	--	--	--	--	--	--
SODIUM	mg/L	--	--	--	--	--	--
MAJOR ANIONS							
BICARBONATE	mg/L	--	--	--	--	--	--
CARBONATE	mg/L	--	--	--	--	--	--
FLUORIDE	mg/L	--	--	--	--	--	--
CHLORIDE	mg/L	--	--	--	--	--	--
SULFATE	mg/L	--	--	--	--	--	--

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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		08/29/85 NONE SW020 ARGO TUNNEL AT PORTAL - FLD ONLY		08/29/85 NONE SWR1 HEAD OF RUSSELL GULCH #1 - FLD ONLY		08/29/85 NONE SWR2 HEAD OF RUSSELL GULCH #2 - FLD ONLY	
		DISSOLVED	TOTAL	DISSOLVED	TOTAL	DISSOLVED	TOTAL
NUTRIENTS							
AMMONIA	mg/L	--	--	--	--	--	--
NITRITE (NO2) (NO2-N)	mg/L	--	--	--	--	--	--
NITRATE (NO3) (NO3-N)	mg/L	--	--	--	--	--	--
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	--	--	--	--	--	--
PHOSPHATE	mg/L	--	--	--	--	--	--
MINOR & TRACE ELEMENTS							
ALUMINUM	ug/L	--	--	--	--	--	--
ANTIMONY	ug/L	--	--	--	--	--	--
ARSENIC	ug/L	--	--	--	--	--	--
BARIUM	ug/L	--	--	--	--	--	--
BERYLLIUM	ug/L	--	--	--	--	--	--
BORON	ug/L	--	--	--	--	--	--
CADMIUM	ug/L	--	--	--	--	--	--
CHROMIUM (Cr+6)	ug/L	--	--	--	--	--	--
CHROMIUM (TOTAL)	ug/L	--	--	--	--	--	--
COBALT	ug/L	--	--	--	--	--	--
COPPER	ug/L	--	--	--	--	--	--
CYANIDE	ug/L	--	--	--	--	--	--
GOLD	ug/L	--	--	--	--	--	--
IRON	ug/L	--	--	--	--	--	--
LEAD	ug/L	--	--	--	--	--	--
MANGANESE	ug/L	--	--	--	--	--	--
MERCURY	ug/L	--	--	--	--	--	--
MOLYBDENUM	ug/L	--	--	--	--	--	--
NICKEL	ug/L	--	--	--	--	--	--
SELENIUM	ug/L	--	--	--	--	--	--
SILVER	ug/L	--	--	--	--	--	--
SILICA	ug/L	--	--	--	--	--	--
STRONTIUM	ug/L	--	--	--	--	--	--
SULFIDE	ug/L	--	--	--	--	--	--
THALLIUM	ug/L	--	--	--	--	--	--
TIN	ug/L	--	--	--	--	--	--
VANADIUM	ug/L	--	--	--	--	--	--
ZINC	ug/L	--	--	--	--	--	--

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(umhos) = umhos/cm

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(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(H,HT) = QUALIFIED due to holding time violation
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(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

06/03/87

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		08/29/85 NONE SWV1 VIRGINIA CANYON V1 - FLD ONLY		08/29/85 NONE SWV2 VIRGINIA CANYON V2 - FLD ONLY		08/29/85 NONE SWV4 VIRGINIA CANYON V4 - FLD ONLY	
		DISSOLVED	TOTAL	DISSOLVED	TOTAL	DISSOLVED	TOTAL
FIELD DETERMINATIONS							
TEMPERATURE	C	--	14.0 Y	--	10.0 Y	--	13.5 Y
pH	S.U.	--	2.50 Y	--	2.47 Y	--	2.70 Y
Eh (REDOX POTENTIAL)	MV	--	818. Y	--	691. Y	--	--
SPECIFIC CONDUCTANCE	umhos	--	--	--	--	--	--
DISSOLVED OXYGEN	mg/L	--	--	--	--	--	--
Fe+2	mg/L	--	--	--	--	--	--
Fe+3	mg/L	--	--	--	--	--	--
IRON (TOTAL)	mg/L	--	--	--	--	--	--
As+3	mg/L	--	--	--	--	--	--
As+5	mg/L	--	--	--	--	--	--
DISCHARGE	CFS	--	--	--	--	--	--
LAB DETERMINATIONS							
GENERAL							
ACIDITY	mg/L	--	--	--	--	--	--
pH	S.U.	--	--	--	--	--	--
SPECIFIC CONDUCTANCE	umhos	--	--	--	--	--	--
TOTAL DISSOLVED SOLIDS	mg/L	--	--	--	--	--	--
TOTAL SUSPENDED SOLIDS	mg/L	--	--	--	--	--	--
TOTAL ORGANIC CARBON	mg/L	--	--	--	--	--	--
MAJOR CATIONS							
CALCIUM	mg/L	--	--	--	--	--	--
MAGNESIUM	mg/L	--	--	--	--	--	--
POTASSIUM	mg/L	--	--	--	--	--	--
SODIUM	mg/L	--	--	--	--	--	--
MAJOR ANIONS							
BICARBONATE	mg/L	--	--	--	--	--	--
CARBONATE	mg/L	--	--	--	--	--	--
FLUORIDE	mg/L	--	--	--	--	--	--
CHLORIDE	mg/L	--	--	--	--	--	--
SULFATE	mg/L	--	--	--	--	--	--

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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		08/29/85 NONE SWV1 VIRGINIA CANYON V1 - FLD ONLY		08/29/85 NONE SWV2 VIRGINIA CANYON V2 - FLD ONLY		08/29/85 NONE SWV4 VIRGINIA CANYON V4 - FLD ONLY	
		DISSOLVED	TOTAL	DISSOLVED	TOTAL	DISSOLVED	TOTAL
NUTRIENTS							
AMMONIA	mg/L	--	--	--	--	--	--
NITRITE (NO2) (NO2-N)	mg/L	--	--	--	--	--	--
NITRATE (NO3) (NO3-N)	mg/L	--	--	--	--	--	--
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	--	--	--	--	--	--
PHOSPHATE	mg/L	--	--	--	--	--	--
MINOR & TRACE ELEMENTS							
ALUMINUM	ug/L	--	--	--	--	--	--
ANTIMONY	ug/L	--	--	--	--	--	--
ARSENIC	ug/L	--	--	--	--	--	--
BARIUM	ug/L	--	--	--	--	--	--
BERYLLIUM	ug/L	--	--	--	--	--	--
BORON	ug/L	--	--	--	--	--	--
CADMIUM	ug/L	--	--	--	--	--	--
CHROMIUM (Cr+6)	ug/L	--	--	--	--	--	--
CHROMIUM (TOTAL)	ug/L	--	--	--	--	--	--
COBALT	ug/L	--	--	--	--	--	--
COPPER	ug/L	--	--	--	--	--	--
CYANIDE	ug/L	--	--	--	--	--	--
GOLD	ug/L	--	--	--	--	--	--
IRON	ug/L	--	--	--	--	--	--
LEAD	ug/L	--	--	--	--	--	--
MANGANESE	ug/L	--	--	--	--	--	--
MERCURY	ug/L	--	--	--	--	--	--
MOLYBDENUM	ug/L	--	--	--	--	--	--
NICKEL	ug/L	--	--	--	--	--	--
SELENIUM	ug/L	--	--	--	--	--	--
SILVER	ug/L	--	--	--	--	--	--
SILICA	ug/L	--	--	--	--	--	--
STRONTIUM	ug/L	--	--	--	--	--	--
SULFIDE	ug/L	--	--	--	--	--	--
THALLIUM	ug/L	--	--	--	--	--	--
TIN	ug/L	--	--	--	--	--	--
VANADIUM	ug/L	--	--	--	--	--	--
ZINC	ug/L	--	--	--	--	--	--

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		08/29/85 NONE SWV5 VIRGINIA CANYON V5 - FLD ONLY		08/29/85 NONE SWV6 VIRGINIA CANYON V6 - FLD ONLY		08/29/85 NONE SWV7 VIRGINIA CANYON V7 - FLD ONLY	
		DISSOLVED	TOTAL	DISSOLVED	TOTAL	DISSOLVED	TOTAL
FIELD DETERMINATIONS							
TEMPERATURE	C	--	9.20 Y	--	13.3 Y	--	12.5 Y
pH	S.U.	--	2.73 Y	--	2.65 Y	--	2.71 Y
Eh (REDOX POTENTIAL)	MV	--	761. Y	--	769. Y	--	786. Y
SPECIFIC CONDUCTANCE	umhos	--	3650 Y	--	2770 Y	--	--
DISSOLVED OXYGEN	mg/L	--	--	--	--	--	--
Fe+2	mg/L	0.80 Y	--	--	--	--	--
Fe+3	mg/L	21.7 Y	--	--	--	--	--
IRON (TOTAL)	mg/L	22.5 Y	--	--	--	--	--
As+3	mg/L	--	--	--	--	--	--
As+5	mg/L	--	--	--	--	--	--
DISCHARGE	CFS	--	--	--	--	--	--
LAB DETERMINATIONS							
GENERAL							
ACIDITY	mg/L	--	--	--	--	--	--
pH	S.U.	--	--	--	--	--	--
SPECIFIC CONDUCTANCE	umhos	--	--	--	--	--	--
TOTAL DISSOLVED SOLIDS	mg/L	--	--	--	--	--	--
TOTAL SUSPENDED SOLIDS	mg/L	--	--	--	--	--	--
TOTAL ORGANIC CARBON	mg/L	--	--	--	--	--	--
MAJOR CATIONS							
CALCIUM	mg/L	--	--	--	--	--	--
MAGNESIUM	mg/L	--	--	--	--	--	--
POTASSIUM	mg/L	--	--	--	--	--	--
SODIUM	mg/L	--	--	--	--	--	--
MAJOR ANIONS							
BICARBONATE	mg/L	--	--	--	--	--	--
CARBONATE	mg/L	--	--	--	--	--	--
FLUORIDE	mg/L	--	--	--	--	--	--
CHLORIDE	mg/L	--	--	--	--	--	--
SULFATE	mg/L	--	--	--	--	--	--

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

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		DISSOLVED	TOTAL	DISSOLVED	TOTAL	DISSOLVED	TOTAL
NUTRIENTS							
AMMONIA	mg/L	--	--	--	--	--	--
NITRITE (NO2) (NO2-N)	mg/L	--	--	--	--	--	--
NITRATE (NO3) (NO3-N)	mg/L	--	--	--	--	--	--
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	--	--	--	--	--	--
PHOSPHATE	mg/L	--	--	--	--	--	--
MINOR & TRACE ELEMENTS							
ALUMINUM	ug/L	--	--	--	--	--	--
ANTIMONY	ug/L	--	--	--	--	--	--
ARSENIC	ug/L	--	--	--	--	--	--
BARIUM	ug/L	--	--	--	--	--	--
BERYLLIUM	ug/L	--	--	--	--	--	--
BORON	ug/L	--	--	--	--	--	--
CADMIUM	ug/L	--	--	--	--	--	--
CHROMIUM (Cr+6)	ug/L	--	--	--	--	--	--
CHROMIUM (TOTAL)	ug/L	--	--	--	--	--	--
COBALT	ug/L	--	--	--	--	--	--
COPPER	ug/L	--	--	--	--	--	--
CYANIDE	ug/L	--	--	--	--	--	--
GOLD	ug/L	--	--	--	--	--	--
IRON	ug/L	--	--	--	--	--	--
LEAD	ug/L	--	--	--	--	--	--
MANGANESE	ug/L	--	--	--	--	--	--
MERCURY	ug/L	--	--	--	--	--	--
MOLYBDENUM	ug/L	--	--	--	--	--	--
NICKEL	ug/L	--	--	--	--	--	--
SELENIUM	ug/L	--	--	--	--	--	--
SILVER	ug/L	--	--	--	--	--	--
SILICA	ug/L	--	--	--	--	--	--
STRONTIUM	ug/L	--	--	--	--	--	--
SULFIDE	ug/L	--	--	--	--	--	--
THALLIUM	ug/L	--	--	--	--	--	--
TIN	ug/L	--	--	--	--	--	--
VANADIUM	ug/L	--	--	--	--	--	--
ZINC	ug/L	--	--	--	--	--	--

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Acidity reported as mg/L CaCO3

SECOND SAMPLING SESSION RESULTS

SURFACE WATER

October-November 1985

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		10/29/85 MHC449 SW001002 CLEAR CREEK ABOVE NORTH CLEAR CREEK				10/29/85 MHC450 SW002002 CLEAR CREEK BELOW NORTH CLEAR CREEK				10/29/85 MHC448 SW003002 NORTH CLEAR CREEK ABOVE CLEAR CREEK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		5.85	Y	--		6.30	Y	--		9.10	Y
pH	S.U.	--		6.80	Y	--		6.65	Y	--		6.04	Y
Eh (REDOX POTENTIAL)	MV	--		459.	Y	--		473.	Y	--		161.	Y
SPECIFIC CONDUCTANCE	umhos	--		216.	Y	--		210.	Y	--		310.	Y
DISSOLVED OXYGEN	mg/L	8.65	Y	--		9.05	Y	--		7.90	Y	--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		77.2	Y	--		74.8	Y	--		4.88	Y
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	5.00	YUJHT	--		5.00	YUJHT	--		12.0	YJHT	--	
pH	S.U.	--		6.60	Y	--		6.70	Y	--		5.80	Y
SPECIFIC CONDUCTANCE	umhos	--		358.	Y	--		224.	Y	--		224.	Y
TOTAL DISSOLVED SOLIDS	mg/L	80.0	YJSHT	--		100.	YJSHT	--		200.	YJSHT	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		2.00	YU	--		8.00	Y	--		6.00	Y
TOTAL ORGANIC CARBON	mg/L	--		2.00	YJHT	--		2.40	YJHT	--		1.40	YJHT
MAJOR CATIONS													
CALCIUM	mg/L	21.1	Y	21.4	Y	24.2	Y	22.3	Y	37.7	Y	38.3	Y
MAGNESIUM	mg/L	5.61	Y	5.69	Y	6.55	Y	6.07	Y	11.5	Y	11.7	Y
POTASSIUM	mg/L	2.25	Y	2.39	Y	2.46	Y	2.31	Y	2.50	Y	2.58	Y
SODIUM	mg/L	12.2	Y	10.3	Y	13.0	Y	10.6	Y	11.2	Y	10.3	Y
MAJOR ANIONS													
BICARBONATE	mg/L	43.0	YJHT	--		35.0	YJHT	--		5.00	YUJHT	--	
CARBONATE	mg/L	5.00	YUJHT	--		5.00	YUJHT	--		5.00	YUJHT	--	
FLUORIDE	mg/L	0.77	Y	--		0.77	Y	--		0.23	Y	--	
CHLORIDE	mg/L	3.00	YU	--		6.20	Y	--		9.50	Y	--	
SULFATE	mg/L	58.0	YJS	--		71.0	YJS	--		148.	YJS	--	

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		10/29/85 MHC449 SW001002 CLEAR CREEK ABOVE NORTH CLEAR CREEK				10/29/85 MHC450 SW002002 CLEAR CREEK BELOW NORTH CLEAR CREEK				10/29/85 MHC448 SW003002 NORTH CLEAR CREEK ABOVE CLEAR CREEK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	0.19	YJHT	--		0.16	YJHT	--		0.18	YJHT	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	68.0	Y	244.	Y	67.0	Y	304.	Y	25.0	YU	455.	Y
ANTIMONY	ug/L	25.0	YU	25.0	YU	25.0	YU	25.0	YU	25.0	YU	25.0	YU
ARSENIC	ug/L	2.00	YU	10.0	YU	2.00	YU	2.00	YU	2.00	YU	2.00	YU
BARIUM	ug/L	29.0	Y	30.0	YJS	32.0	Y	30.0	YJS	32.0	Y	30.0	YJS
BERYLLIUM	ug/L	0.40	YU	0.40	YUJS	0.40	Y	0.40	YUJS	0.40	Y	0.40	YUJS
BORON	ug/L	18.0	Y	9.00	Y	30.0	Y	12.0	Y	36.0	Y	22.0	Y
CADMIUM	ug/L	2.00	Y	2.00	YJE	2.00	Y	2.00	Y	5.00	Y	2.00	Y
CHROMIUM (Cr+6)	ug/L	10.0	YUJHT	--		10.0	YUJHT	--		10.0	YUJHT	--	
CHROMIUM (TOTAL)	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU
COBALT	ug/L	6.00	Y	5.00	YU	6.00	Y	5.00	YU	12.0	Y	11.0	Y
COPPER	ug/L	13.0	Y	37.0	Y	9.00	Y	48.0	Y	17.0	Y	104.	Y
CYANIDE	ug/L	--		10.0	YUJR	--		10.0	YUJR	--		10.0	YUJR
GOLD	ug/L	1.00	YUJS	1.00	YU	1.00	YUJS	1.00	YU	1.00	YUJS	1.00	YU
IRON	ug/L	24.0	Y	883.	Y	37.0	Y	1410	Y	971.	Y	5270	Y
LEAD	ug/L	2.00	YU	5.00	YU	2.00	YU	5.00	YU	5.00	YU	5.00	YU
MANGANESE	ug/L	1370	Y	1430	Y	1540	Y	1480	Y	2480	Y	2530	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	11.0	Y	11.0	YJ*	10.0	YU	10.0	YUJ*	10.0	YU	10.0	YUJ*
NICKEL	ug/L	7.00	YU	7.00	YUJS	11.0	Y	7.00	YUJS	20.0	Y	22.0	YJS
SELENIUM	ug/L	5.00	YUR	5.00	YUR	5.00	YUR	5.00	YUR	5.00	YUR	20.0	YUR
SILVER	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	169.	Y	173.	Y	195.	Y	180.	Y	285.	Y	272.	Y
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	2.00	YU	2.00	YU	2.00	YU	2.00	YU	10.0	YU	2.00	YU
TIN	ug/L	16.0	YUJS	16.0	YUJS	16.0	YUJS	16.0	YUJS	16.0	YUJS	16.0	YUJS
VANADIUM	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU
ZINC	ug/L	296.	Y	449.	Y	396.	Y	547.	Y	1400	Y	1400	Y

FOOTNOTES

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(umhos) = umhos/cm

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(JS) = ESTIMATED due to spike recoveries outside limits
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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		10/30/85 MHC462 SW004002 RUSSELL GULCH AT NORTH CLEAR CREEK				10/31/85 MHC468 SW005002 NORTH CLEAR CREEK ABOVE NATIONAL				10/31/85 MHC467 SW006002 NORTH CLEAR CREEK BELOW NATIONAL			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		5.35	Y	--		2.81	Y	--		2.83	Y
pH	S.U.	--		6.50	Y	--		--		--		5.85	Y
Eh (REDOX POTENTIAL)	MV	--		445.	Y	--		--		--		167.	Y
SPECIFIC CONDUCTANCE	umhos	--		400.	Y	--		350.	Y	--		370.	Y
DISSOLVED OXYGEN	mg/L	8.46	Y	--		6.61	Y	--		7.68	Y	--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		0.06	Y	--		3.05	Y	--		3.30	Y
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	5.00	YUJHT	--		17.0	YJHT	--		19.0	YJHT	--	
pH	S.U.	--		6.10	Y	--		4.10	Y	--		4.40	Y
SPECIFIC CONDUCTANCE	umhos	--		431.	Y	--		350.	Y	--		370.	Y
TOTAL DISSOLVED SOLIDS	mg/L	310.	YJHT	--		240.	YJHT	--		260.	YJHT	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		3.00	Y	--		40.0	Y	--		30.0	Y
TOTAL ORGANIC CARBON	mg/L	--		2.30	YJHT	--		2.00	YJHT	--		1.70	YJHT
MAJOR CATIONS													
CALCIUM	mg/L	43.6	Y	46.2	Y	35.7	Y	36.2	Y	38.8	Y	39.6	Y
MAGNESIUM	mg/L	13.4	Y	13.6	Y	11.6	Y	11.3	Y	12.4	Y	12.5	Y
POTASSIUM	mg/L	4.71	Y	5.01	Y	2.17	YU	2.17	YU	2.17	YU	2.17	YU
SODIUM	mg/L	23.1	Y	23.9	Y	9.46	Y	9.79	Y	10.1	Y	9.88	Y
MAJOR ANIONS													
BICARBONATE	mg/L	22.0	YJHT	--		5.00	YUJHT	--		5.00	YUJHT	--	
CARBONATE	mg/L	5.00	YUJHT	--		5.00	YUJHT	--		5.00	YUJHT	--	
FLUORIDE	mg/L	0.83	YJHT	--		0.22	YJHT	--		0.18	YJHT	--	
CHLORIDE	mg/L	5.60	Y	--		6.80	Y	--		3.00	YU	--	
SULFATE	mg/L	175.	YJHT	--		161.	YJHT	--		166.	YJHT	--	

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(JS) = ESTIMATED due to spike recoveries outside limits
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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		10/30/85 MHC462 SW004002 RUSSELL GULCH AT NORTH CLEAR CREEK				10/31/85 MHC468 SW005002 NORTH CLEAR CREEK ABOVE NATIONAL				10/31/85 MHC467 SW006002 NORTH CLEAR CREEK BELOW NATIONAL			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	2.50	YUJHT	--		2.50	YUJHT	--		2.50	YUJHT	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	66.0	Y	474.	Y	25.0	YU	532.	Y	25.0	YU	540.	Y
ANTIMONY	ug/L	25.0	YU	25.0	YU	25.0	YU	25.0	YU	25.0	YU	25.0	YU
ARSENIC	ug/L	2.00	YU	2.00	YU	2.00	YU	2.00	YU	2.00	YU	2.00	YU
BARIUM	ug/L	28.0	Y	34.0	Y	27.0	Y	27.0	Y	22.0	Y	22.0	Y
BERYLLIUM	ug/L	0.40	YU	0.40	YU	0.40	YU	0.40	YU	0.40	YU	0.40	YU
BORON	ug/L	47.0	Y	42.0	Y	43.0	Y	56.0	Y	43.0	Y	34.0	Y
CADMIUM	ug/L	3.00	Y	3.00	Y	4.00	Y	3.00	Y	3.00	Y	4.00	Y
CHROMIUM (Cr+6)	ug/L	10.0	YUJHT	--		200.	YUJHT	--		200.	YUJHT	--	
CHROMIUM (TOTAL)	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU
COBALT	ug/L	5.00	YU	5.00	YU	17.0	Y	16.0	Y	18.0	Y	18.0	Y
COPPER	ug/L	12.0	Y	70.0	Y	12.0	Y	106.	Y	10.0	Y	10.	Y
CYANIDE	ug/L	--		10.0	YU	--		10.0	YU	--		10.0	YU
GOLD	ug/L	1.00	YUJS	1.00	YU	1.00	YUJS	1.00	YU	1.00	YUJS	1.00	YU
IRON	ug/L	16.0	Y	461.	Y	12300	Y	15800	Y	11700	Y	15900	Y
LEAD	ug/L	2.00	YU	5.00	YU	2.00	YU	7.00	Y	5.00	YU	7.00	Y
MANGANESE	ug/L	364.	YJS	381.	Y	3250	YJS	3190	Y	3500	YJS	3460	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU
NICKEL	ug/L	15.0	Y	15.0	Y	23.0	Y	26.0	Y	27.0	Y	27.0	Y
SELENIUM	ug/L	50.0	YUR	5.00	YUJS	50.0	YUR	5.00	YUJS	5.00	YUR	5.00	YUJS
SILVER	ug/L	0.10	YUJC	0.10	Y	0.30	YJS	0.10	YU	0.30	YJS	0.10	YU
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	468.	Y	484.	Y	263.	Y	247.	Y	287.	Y	291.	Y
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	2.00	YU	2.00	YU	2.00	YU	2.00	YU	2.00	YU	2.00	YU
TIN	ug/L	16.0	YU	16.0	YU	16.0	YU	16.0	YU	16.0	YU	16.0	YU
VANADIUM	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU
ZINC	ug/L	670.	YJS	748.	YJS	1250	YJS	1260	YJS	1330	YJS	1390	YJS

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Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		10/31/85 MHC466 SW007002 NATIONAL TUNNEL AT NORTH CLEAR CREEK				10/31/85 MHC463 SW008002 NATIONAL TUNNEL AT PORTAL				10/30/85 MHC470 SW009002 NORTH CLEAR CREEK BELOW GREGORY GULCH			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		5.43	Y	--		8.36	Y	--		4.62	Y
pH	S.U.	--		6.51	Y	--		6.21	Y	--		--	
Eh (REDOX POTENTIAL)	MV	--		209.	Y	--		152.	Y	--		--	
SPECIFIC CONDUCTANCE	umhos	--		1480	Y	--		1470	Y	--		360.	Y
DISSOLVED OXYGEN	mg/L	7.69	Y	--		7.41	Y	--		8.85	Y	--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		0.05	Y	--		0.09	Y	--		3.20	Y
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	90.0	YJHT	--		85.0	YJHT	--		21.0	YJHT	--	
pH	S.U.	--		3.40	Y	--		3.40	Y	--		4.60	Y
SPECIFIC CONDUCTANCE	umhos	--		1520	Y	--		1530	Y	--		3460	Y
TOTAL DISSOLVED SOLIDS	mg/L	1390	YJHT	--		1340	YJHT	--		240.	YJHT	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		110.	Y	--		128.	Y	--		32.0	Y
TOTAL ORGANIC CARBON	mg/L	--		1.40	YJHT	--		1.60	YJHT	--		2.20	YJHT
MAJOR CATIONS													
CALCIUM	mg/L	201.	Y	209.	Y	204.	Y	205.	Y	35.8	Y	34.4	Y
MAGNESIUM	mg/L	60.6	Y	60.7	Y	61.7	Y	59.5	Y	11.6	Y	10.8	Y
POTASSIUM	mg/L	8.27	Y	8.39	Y	8.11	Y	8.09	Y	2.17	YU	2.17	YU
SODIUM	mg/L	29.0	Y	29.0	Y	29.0	Y	28.1	Y	9.50	Y	8.70	Y
MAJOR ANIONS													
BICARBONATE	mg/L	5.00	YUJHT	--		5.00	YUJHT	--		5.00	YUJHT	--	
CARBONATE	mg/L	5.00	YUJHT	--		5.00	YUJHT	--		5.00	YUJHT	--	
FLUORIDE	mg/L	0.28	YJHT	--		0.47	YJHT	--		0.22	YJHT	--	
CHLORIDE	mg/L	3.00	YU	--		4.20	Y	--		8.60	Y	--	
SULFATE	mg/L	1060	YJHT	--		980.	YJHT	--		153.	YJHT	--	

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Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		10/31/85 MHC466 SW007002 NATIONAL TUNNEL AT NORTH CLEAR CREEK				10/31/85 MHC463 SW008002 NATIONAL TUNNEL AT PORTAL				10/30/85 MHC470 SW009002 NORTH CLEAR CREEK BELOW GREGORY GULCH			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	2.50	YUJHT	--		2.50	YUJHT	--		2.50	YUJHT	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	25.0	YU	353.	Y	25.0	YU	104.	Y	554.	Y	530.	Y
ANTIMONY	ug/L	25.0	YU	25.0	YU	25.0	YU	25.0	YU	25.0	YU	25.0	YU
ARSENIC	ug/L	2.00	YU	8.00	Y	2.00	YU	6.00	Y	2.00	YU	2.00	YU
BARIUM	ug/L	13.0	YU	13.0	YU	13.0	YU	13.0	YU	28.0	Y	26.0	Y
BERYLLIUM	ug/L	0.40	YU	2.00	Y	1.00	Y	1.00	Y	0.60	Y	0.40	YU
BORON	ug/L	102.	Y	137.	Y	113.	Y	114.	Y	48.0	Y	29.0	Y
CADMIUM	ug/L	5.00	Y	5.00	Y	5.00	Y	5.00	Y	3.00	Y	4.00	Y
CHROMIUM (Cr+6)	ug/L	500.	YUJHT	--		250.	YUJHT	--		200.	YUJHT	--	
CHROMIUM (TOTAL)	ug/L	4.00	YU	6.00	Y	6.00	Y	4.00	Y	4.00	YU	4.00	YU
COBALT	ug/L	90.0	Y	94.0	Y	92.0	Y	91.0	Y	16.0	Y	17.0	Y
COPPER	ug/L	8.00	Y	156.	Y	26.0	Y	109.	Y	103.	Y	103.	Y
CYANIDE	ug/L	--		10.0	YU	--		10.0	YU	--		10.0	YU
GOLD	ug/L	1.00	YUJS	1.00	YU	1.00	YUJS	1.00	YU	1.00	YUJS	1.00	YU
IRON	ug/L	31100	Y	57900	Y	45800	Y	51600	Y	16000	Y	15400	Y
LEAD	ug/L	5.00	YU	50.0	Y	5.00	YU	6.00	YJ	7.00	Y	8.00	Y
MANGANESE	ug/L	17000	YJS	17100	Y	17400	YJS	16800	Y	3260	YJS	3040	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU
NICKEL	ug/L	210.	Y	216.	Y	216.	Y	209.	Y	23.0	Y	24.0	Y
SELENIUM	ug/L	50.0	YUR	50.0	YUJS	--		--		50.0	YUR	5.00	YUJS
SILVER	ug/L	0.20	YJS	0.10	Y	0.20	YJS	0.10	YU	0.30	YJC	0.10	YU
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	1650	Y	1650	Y	1670	Y	1640	Y	256.	Y	243.	Y
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	2.00	YU	2.00	YU	2.00	YU	2.00	YU	2.00	YU	2.00	YU
TIN	ug/L	16.0	YU	16.0	YU	16.0	YU	16.0	YU	16.0	YU	16.0	YU
VANADIUM	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU
ZINC	ug/L	5790	YJS	6060	YJS	5980	YJS	5890	YJS	1270	YJS	1180	YJS

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Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		10/31/85 MHC483 SW010002 NORTH CLEAR CREEK BELOW GREGORY TAILINGS				10/31/85 MHC472 SW011002 NORTH CLEAR CREEK ABOVE GREGORY TAILINGS				10/31/85 MHC471 SW012002 GREGORY TAILINGS AT NORTH CLEAR CREEK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		4.25	Y	--		--		--		8.20	Y
pH	S.U.	--		--		--		--		--		--	
Eh (REDOX POTENTIAL)	MV	--		--		--		--		--		--	
SPECIFIC CONDUCTANCE	umhos	--		360.	Y	--		--		--		--	
DISSOLVED OXYGEN	mg/L	9.00	Y	--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		2.69	Y	--		2.63	Y	--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	25.0	YJHT	--		5.00	YUJHT	--		296.	YJHT	--	
pH	S.U.	--		4.50	Y	--		6.30	Y	--		3.20	Y
SPECIFIC CONDUCTANCE	umhos	--		344.	Y	--		111.	Y	--		2190	Y
TOTAL DISSOLVED SOLIDS	mg/L	260.	YJHT	--		60.0	YJHT	--		2200	YJHT	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		36.0	Y	--		6.00	Y	--		76.0	Y
TOTAL ORGANIC CARBON	mg/L	--		1.90	YJHT	--		1.70	YJHT	--		2.20	YJHT
MAJOR CATIONS													
CALCIUM	mg/L	36.4	Y	36.7	Y	10.1	Y	10.1	Y	283.	Y	276.	Y
MAGNESIUM	mg/L	11.7	Y	11.5	Y	2.99	Y	2.93	Y	94.2	Y	88.5	Y
POTASSIUM	mg/L	2.17	YU	2.17	YU	2.17	YU	2.17	YU	8.11	Y	7.72	Y
SODIUM	mg/L	8.93	Y	11.2	Y	7.10	Y	7.14	Y	30.5	Y	29.5	Y
MAJOR ANIONS													
BICARBONATE	mg/L	5.00	YUJHT	--		22.0	YJHT	--		5.00	YUJHT	--	
CARBONATE	mg/L	5.00	YUJHT	--		5.00	YUJHT	--		5.00	YUJHT	--	
FLUORIDE	mg/L	0.20	YJHT	--		0.10	YJHT	--		1.40	YJHT	--	
CHLORIDE	mg/L	7.40	Y	--		8.60	Y	--		8.60	Y	--	
SULFATE	mg/L	161.	YJHT	--		24.0	YJHT	--		1290	YJHT	--	

FOOTNOTES

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(JS) = ESTIMATED due to spike recoveries outside limits
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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		10/31/85 MHC483 SW010002 NORTH CLEAR CREEK BELOW GREGORY TAILINGS				10/31/85 MHC472 SW011002 NORTH CLEAR CREEK ABOVE GREGORY TAILINGS				10/31/85 MHC471 SW012002 GREGORY TAILINGS AT NORTH CLEAR CREEK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	10.0	YUJHT	--		0.21	YJHT	--		5.00	YUJHT	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	130.	Y	520.	Y	73.0	Y	159.	Y	3200	Y	3180	Y
ANTIMONY	ug/L	25.0	YU	25.0	YU	25.0	YU	25.0	YU	25.0	YU	25.0	YU
ARSENIC	ug/L	2.00	YU	2.00	YU	2.00	YU	2.00	YU	2.00	YU	2.00	YU
BARIUM	ug/L	27.0	Y	28.0	Y	37.0	Y	35.0	Y	13.0	YU	13.0	YU
BERYLLIUM	ug/L	0.40	Y	0.40	YU	0.40	YU	0.40	YU	5.00	Y	5.00	Y
BORON	ug/L	46.0	Y	36.0	Y	35.0	Y	25.0	Y	267.	Y	240.	Y
CADMIUM	ug/L	3.00	Y	3.00	Y	2.00	Y	2.00	Y	14.0	Y	14.0	Y
CHROMIUM (Cr+6)	ug/L	10.0	YUJHT	--		10.0	YUJHT	--		250.	YUJHT	--	
CHROMIUM (TOTAL)	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	11.0	Y	--	
COBALT	ug/L	19.0	Y	18.0	Y	5.00	YU	5.00	YU	164.	Y	159.	Y
COPPER	ug/L	88.0	Y	106.	Y	9.00	Y	19.0	Y	927.	Y	872.	Y
CYANIDE	ug/L	--		10.0	YU	--		10.0	YU	--		10.0	YU
GOLD	ug/L	1.00	YUJS	1.00	YU	1.00	YUJS	1.00	YU	1.00	YUJS	1.00	YU
IRON	ug/L	16100	Y	16700	Y	137.	Y	242.	Y	148000	Y	--	
LEAD	ug/L	2.10	Y	2.00	YU	2.00	Y	7.00	Y	13.0	Y	20.0	YU
MANGANESE	ug/L	3310	YJS	3240	Y	378.	YJS	359.	Y	30200	YJS	28600	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU
NICKEL	ug/L	23.0	Y	24.0	Y	7.00	YU	7.00	YU	219.	Y	209.	Y
SELENIUM	ug/L	50.0	YUR	5.00	YU	5.00	YUR	2.00	YUJS	--		--	
SILVER	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.40	YJS	0.20	Y
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	266.	Y	263.	Y	74.0	Y	76.0	Y	1970	Y	1900	Y
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	2.00	YU	2.00	YU	2.00	YU	2.00	YU	2.00	YU	2.00	YU
TIN	ug/L	16.0	YU	16.0	YU	16.0	YU	16.0	YU	16.0	YU	16.0	YU
VANADIUM	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU
ZINC	ug/L	1220	YJS	1180	Y	568.	YJS	556.	YJS	6880	YJS	6520	YJS

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Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		10/29/85 MHC447 SW014002 GREGORY GULCH ABOVE NORTH CLEAR CREEK				10/29/85 MHC446 SW015002 GREGORY GULCH ABOVE CENTRAL CITY				10/29/85 MHC444 SW016002 QUARTZ HILL TUNNEL AT PORTAL			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		4.46	Y	--		4.05	Y	--		3.60	Y
pH	S.U.	--		4.50	Y	--		6.02	Y	--		2.52	Y
Eh (REDOX POTENTIAL)	MV	--		239.	Y	--		235.	Y	--		843.	Y
SPECIFIC CONDUCTANCE	umhos	--		190.	Y	--		130.	Y	--		4120	Y
DISSOLVED OXYGEN	mg/L	8.95	Y	--		8.60	Y	--		7.91	Y	--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		0.24	Y	--		0.14	Y	--		0.005	Y
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	8.90	YJHT	--		5.00	YUJHT	--		2000	YJHT	--	
pH	S.U.	--		6.10	Y	--		6.30	Y	--		2.70	Y
SPECIFIC CONDUCTANCE	umhos	--		222.	Y	--		134.	Y	--		4160	Y
TOTAL DISSOLVED SOLIDS	mg/L	100.	YJSHT	--		40.0	YJSHT	--		6020	YJSHT	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		20.0	Y	--		2.00	YU	--		3.00	Y
TOTAL ORGANIC CARBON	mg/L	--		1.50	YJHT	--		2.00	YJHT	--		2.60	YJHT
MAJOR CATIONS													
CALCIUM	mg/L	21.4	Y	21.8	Y	18.8	Y	13.3	Y	343.	Y	348.	Y
MAGNESIUM	mg/L	7.10	Y	7.51	Y	6.56	Y	3.81	Y	189.	Y	189.	Y
POTASSIUM	mg/L	2.53	Y	2.64	Y	2.17	YU	2.17	YU	2.17	YU	2.17	YU
SODIUM	mg/L	7.85	Y	6.11	Y	5.44	Y	4.25	Y	4.92	Y	7.46	Y
MAJOR ANIONS													
BICARBONATE	mg/L	9.70	YJHT	--		29.0	YJHT	--		5.00	YUJHT	--	
CARBONATE	mg/L	5.00	YUJHT	--		5.00	YUJHT	--		5.00	YUJHT	--	
FLUORIDE	mg/L	0.18	Y	--		0.10	YU	--		6.50	Y	--	
CHLORIDE	mg/L	6.80	Y	--		3.00	YU	--		75.0	YU	--	
SULFATE	mg/L	79.0	YJS	--		31.0	YJS	--		3780	YJS	--	

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		10/29/85 MHC447 SW014002 GREGORY GULCH ABOVE NORTH CLEAR CREEK				10/29/85 MHC446 SW015002 GREGORY GULCH ABOVE CENTRAL CITY				10/29/85 MHC444 SW016002 QUARTZ HILL TUNNEL AT PORTAL			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	0.10	YUJHT	--		0.10	YUJHT	--		10.0	YUJHT	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	28.0	Y	1160	Y	761.	Y	31.0	Y	55200	Y	56400	Y
ANTIMONY	ug/L	25.0	YU	25.0	YU	25.0	YU	25.0	YU	57.0	Y	27.0	Y
ARSENIC	ug/L	2.00	YU	10.0	YU	8.00	Y	2.00	YU	852.	Y	745.	YJS
BARIUM	ug/L	26.0	Y	34.0	YJS	27.0	Y	26.0	YJS	13.0	YU	13.0	YUJS
BERYLLIUM	ug/L	0.40	YU	0.40	YUJS	0.40	Y	0.40	YUJS	43.0	Y	45.0	YJS
BORON	ug/L	54.0	Y	66.0	Y	27.0	Y	9.00	Y	390.	Y	500.	Y
CADMIUM	ug/L	8.00	Y	5.00	YJE	1.00	YU	1.00	YU	410.	Y	360.	Y
CHROMIUM (Cr+6)	ug/L	10.0	YUJHT	--		10.0	YUJHT	--		3000	YUJHT	--	
CHROMIUM (TOTAL)	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	62.0	Y	64.0	Y
COBALT	ug/L	7.00	Y	7.00	Y	9.00	Y	5.00	YU	366.	Y	373.	Y
COPPER	ug/L	25.0	Y	210.	Y	589.	Y	12.0	Y	43100	Y	43400	Y
CYANIDE	ug/L	--		10.0	YUJR	--		10.0	YUJR	--		10.0	YUJR
GOLD	ug/L	1.00	YUJS	1.00	YU	1.00	YUJS	1.00	YU	1.00	YUJS	1.00	YU
IRON	ug/L	144.	Y	3150	Y	6680	Y	977.	Y	480000	Y	490000	Y
LEAD	ug/L	2.00	YU	66.0	Y	2.00	YU	5.00	YU	255.	Y	222.	Y
MANGANESE	ug/L	1190	Y	1310	Y	1590	Y	676.	Y	62500	Y	63100	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	10.0	YU	10.0	YUJ*	10.0	YU	10.0	YUJ*	89.0	Y	78.0	YJ*
NICKEL	ug/L	14.0	Y	12.0	YJS	10.0	Y	7.00	YUJS	447.	Y	456.	YJS
SELENIUM	ug/L	2.00	YUR	5.00	YUR	2.00	YUR	5.00	YUR	50.0	YUR	50.0	YUR
SILVER	ug/L	0.10	YU	0.10	YU	0.10	Y	0.10	Y	0.20	Y	0.30	Y
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	92.0	Y	98.0	Y	77.0	Y	67.0	Y	234.	Y	355.	Y
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	2.00	YU	2.00	YU	2.00	YU	10.0	YU	10.0	YU	2.00	YU
TIN	ug/L	16.0	YUJS	16.0	YUJS	16.0	YUJS	16.0	YUJS	16.0	YUJS	16.0	YUJS
VANADIUM	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	44.0	Y	23.0	Y
ZINC	ug/L	2010	Y	2220	Y	1580	Y	178.	Y	94900	Y	91600	Y

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		10/30/85 MHC454 SW019002 VIRGINIA CANYON				10/29/85 MHC453 SW020002 ARGO TUNNEL AT PORTAL				10/30/85 MHC459 SW021002 CLEAR CREEK BELOW ARGO			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		5.43	Y	--		15.6	Y	--		5.15	Y
pH	S.U.	--		2.61	Y	--		2.50	Y	--		4.70	Y
Eh (REDOX POTENTIAL)	MV	--		764.	Y	--		697.	Y	--		414.	Y
SPECIFIC CONDUCTANCE	umhos	--		3000	Y	--		3030	Y	--		330.	Y
DISSOLVED OXYGEN	mg/L	6.05	Y	--		2.70	Y	--		9.10	Y	--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		0.002	Y	--		0.32	Y	--		77.5	Y
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	1350	YJHT	--		692.	YJHT	--		78.0	YJHT	--	
pH	S.U.	--		2.80	Y	--		2.80	Y	--		6.70	Y
SPECIFIC CONDUCTANCE	umhos	--		3050	Y	--		3060	Y	--		331.	Y
TOTAL DISSOLVED SOLIDS	mg/L	3710	YJSHT	--		3500	YJSHT	--		200.	YJSHT	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		6.00	Y	--		5.00	Y	--		18.0	Y
TOTAL ORGANIC CARBON	mg/L	--		3.00	YJHT	--		1.20	YJHT	--		1.90	YJHT
MAJOR CATIONS													
CALCIUM	mg/L	169.	Y	159.	Y	337.	Y	334.	Y	35.0	Y	30.8	Y
MAGNESIUM	mg/L	117.	Y	112.	Y	120.	Y	121.	Y	10.5	Y	9.18	Y
POTASSIUM	mg/L	4.34	YU	4.34	YU	4.13	Y	4.20	Y	2.44	Y	2.19	Y
SODIUM	mg/L	1.17	YU	1.17	YU	21.3	Y	22.1	Y	11.6	Y	10.2	Y
MAJOR ANIONS													
BICARBONATE	mg/L	5.00	YUJHT	--		5.00	YUJHT	--		22.0	YJHT	--	
CARBONATE	mg/L	5.00	YUJHT	--		5.00	YUJHT	--		5.00	YUJHT	--	
FLUORIDE	mg/L	1.40	Y	--		3.50	Y	--		0.80	Y	--	
CHLORIDE	mg/L	3.60	Y	--		2.70	Y	--		3.00	YU	--	
SULFATE	mg/L	2540	YJS	--		2500	YJS	--		144.	YJS	--	

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		10/30/85 MHC454 SW019002 VIRGINIA CANYON				10/29/85 MHC453 SW020002 ARGO TUNNEL AT PORTAL				10/30/85 MHC459 SW021002 CLEAR CREEK BELOW ARGO			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	2.50	YUJHT	--		10.0	YUJHT	--		0.10	YUJHT	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	119000	Y	114000	Y	19200	Y	19600	Y	419.	Y	976.	Y
ANTIMONY	ug/L	50.0	YU	50.0	YU	25.0	YU	25.0	YU	25.0	YU	25.0	YU
ARSENIC	ug/L	461.	Y	358.	YJS	194.	Y	123.	YJS	2.00	YU	2.00	YU
BARIUM	ug/L	26.0	YU	26.0	YUJS	13.0	YU	13.0	YUJS	27.0	Y	23.0	YJS
BERYLLIUM	ug/L	26.0	Y	23.0	YJS	12.0	Y	12.0	YJS	0.60	Y	0.40	YJS
BORON	ug/L	163.	Y	138.	Y	198.	Y	216.	Y	33.0	Y	23.0	Y
CADMIUM	ug/L	670.	Y	700.	Y	120.	Y	130.	Y	4.00	Y	3.00	Y
CHROMIUM (Cr+6)	ug/L	2000	YUJHT	--		500.	YUJHT	--		10.0	YUJHT	--	
CHROMIUM (TOTAL)	ug/L	92.0	Y	87.0	Y	20.0	Y	23.0	Y	4.00	YU	4.00	YU
COBALT	ug/L	396.	Y	375.	Y	147.	Y	146.	Y	10.0	Y	8.00	Y
COPPER	ug/L	29300	Y	27500	Y	5090	Y	5060	Y	104.	Y	230.	Y
CYANIDE	ug/L	--		10.0	YUJR	--		10.0	YUJR	--		10.0	YUJR
GOLD	ug/L	10.0	YUJS	1.00	YU	1.00	YUJS	1.00	YU	1.00	YUJS	1.00	YU
IRON	ug/L	102000	Y	97000	Y	150000	Y	150000	Y	235.	Y	6620	Y
LEAD	ug/L	579.	Y	547.	Y	112.	Y	100.	Y	2.00	YU	5.00	YU
MANGANESE	ug/L	62700	Y	58400	Y	89000	Y	87700	Y	5340	Y	4690	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	20.0	YU	20.0	YUJ*	10.0	YU	10.0	YUJ*	10.0	YU	12.0	YJ*
NICKEL	ug/L	975.	Y	917.	YJS	223.	Y	220.	YJS	13.0	Y	11.0	YJS
SELENIUM	ug/L	50.0	YU	50.0	YUR	50.0	YU	50.0	YUR	5.00	YUR	5.00	YUR
SILVER	ug/L	0.20	Y	0.40	Y	0.20	Y	0.40	Y	0.10	YU	0.10	YU
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	266.	Y	250.	Y	1330	Y	1340	Y	229.	Y	199.	Y
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	2.00	YU	2.00	YU	2.00	YU	2.00	YU	2.00	YU	2.00	YU
TIN	ug/L	32.0	YU	32.0	YUJS	16.0	YU	16.0	YUJS	16.0	YUJS	16.0	YUJS
VANADIUM	ug/L	8.00	YU	8.00	YU	9.00	Y	4.00	YU	4.00	YU	4.00	YU
ZINC	ug/L	152000	Y	140000	Y	44100	Y	42300	Y	2420	Y	2090	Y

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(JS) = ESTIMATED due to spike recoveries outside limits
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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		10/30/85 MHC457 SW022002 CLEAR CREEK ABOVE ARGO				10/31/85 MHC474 SW023002 BIG FIVE AT PORTAL				10/30/85 MHC460 SW024002 BIG FIVE AT CLEAR CREEK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		4.35	Y	--		--		--		8.35	Y
pH	S.U.	--		6.99	Y	--		--		--		2.60	Y
Eh (REDOX POTENTIAL)	MV	--		454.	Y	--		--		--		757.	Y
SPECIFIC CONDUCTANCE	umhos	--		160.	Y	--		--		--		2730	Y
DISSOLVED OXYGEN	mg/L	9.39	Y	--		--		--		5.68	Y	--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		71.0	Y	--		0.05	Y	--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	5.00	YUJHT	--		304.	YJHT	--		326.	YJHT	--	
pH	S.U.	--		6.40	Y	--		3.00	Y	--		2.90	Y
SPECIFIC CONDUCTANCE	umhos	--		187.	Y	--		2980	Y	--		3210	Y
TOTAL DISSOLVED SOLIDS	mg/L	80.0	YJSHT	--		3160	YJHT	--		3120	YJHT	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		2.00	YU	--		44.0	Y	--		2.00	YU
TOTAL ORGANIC CARBON	mg/L	--		1.70	YJHT	--		1.10	Y	--		1.40	YJHT
MAJOR CATIONS													
CALCIUM	mg/L	20.3	Y	17.1	Y	385.	Y	352.	Y	394.	Y	398.	Y
MAGNESIUM	mg/L	5.15	Y	4.35	Y	163.	Y	138.	Y	167.	Y	162.	Y
POTASSIUM	mg/L	2.45	Y	2.17	YU	10.2	Y	8.85	Y	9.26	Y	9.15	Y
SODIUM	mg/L	12.1	Y	9.80	Y	53.2	Y	45.1	Y	54.0	Y	53.5	Y
MAJOR ANIONS													
BICARBONATE	mg/L	47.0	YJHT	--		5.00	YUJHT	--		5.00	YUJHT	--	
CARBONATE	mg/L	5.00	YUJHT	--		5.00	YUJHT	--		5.00	YUJHT	--	
FLUORIDE	mg/L	0.79	Y	--		1.40	YJHT	--		1.40	YJHT	--	
CHLORIDE	mg/L	3.00	YU	--		7.10	Y	--		7.40	Y	--	
SULFATE	mg/L	38.0	YJS	--		2140	YJHT	--		2600	YJHT	--	

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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		10/30/85 MHC457 SW022002 CLEAR CREEK ABOVE ARGO				10/31/85 MHC474 SW023002 BIG FIVE AT PORTAL				10/30/85 MHC460 SW024002 BIG FIVE AT CLEAR CREEK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	0.10	YUJHT	--		10.0	YU	--		2.50	YUJHT	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	101.	Y	180.	Y	17900	Y	16200	Y	19500	Y	19300	Y
ANTIMONY	ug/L	25.0	YU	25.0	YU	25.0	YU	25.0	YU	25.0	YU	25.0	YU
ARSENIC	ug/L	2.00	YU	2.00	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU
BARIUM	ug/L	29.0	Y	24.0	YJS	13.0	YU	13.0	YU	13.0	YU	13.0	YU
BERYLLIUM	ug/L	0.40	YU	0.40	YUJS	6.00	Y	5.00	Y	6.00	Y	5.00	Y
BORON	ug/L	28.0	Y	27.0	Y	195.	Y	153.	Y	163.	Y	155.	Y
CADMIUM	ug/L	1.00	Y	2.00	Y	26.0	Y	28.0	Y	28.0	Y	28.0	Y
CHROMIUM (Cr+6)	ug/L	10.0	YUJHT	--		200.	YUJHT	--		250.	YUJHT	--	
CHROMIUM (TOTAL)	ug/L	4.00	YU	4.00	YU	13.0	Y	15.0	Y	15.0	Y	16.0	Y
COBALT	ug/L	5.00	YU	5.00	YU	137.	Y	123.	Y	141.	Y	141.	Y
COPPER	ug/L	12.0	Y	19.0	Y	1640	Y	1450	Y	1520	Y	1480	Y
CYANIDE	ug/L	--		10.0	YUJR	--		10.0	YU	--		10.0	YU
GOLD	ug/L	1.00	YUJS	1.00	YU	1.00	YUJS	1.00	YU	1.00	YUJS	1.00	YU
IRON	ug/L	15.0	Y	202.	Y	64100	Y	60300	Y	22400	Y	22800	Y
LEAD	ug/L	2.00	YU	5.00	YU	91.0	Y	88.0	Y	104.	Y	113.	Y
MANGANESE	ug/L	1030	Y	852.	Y	31600	YJS	28100	Y	33400	YJS	32700	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	12.0	Y	10.0	YJ*	10.0	YU	10.0	YU	10.0	YU	10.0	YU
NICKEL	ug/L	7.00	YU	7.00	YUJS	276.	Y	248.	Y	291.	Y	285.	Y
SELENIUM	ug/L	2.00	YUR	2.00	YUR	--		--		--		--	
SILVER	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	Y	0.40	YJC	0.40	Y
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	161.	Y	133.	Y	2160	Y	1850	Y	2250	Y	2220	Y
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	2.00	YU	2.00	YU	10.0	YU	2.00	YU	2.00	YU	2.00	YU
TIN	ug/L	16.0	YUJS	16.0	YUJS	16.0	YU	16.0	YU	16.0	YU	16.0	YU
VANADIUM	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU
ZINC	ug/L	309.	Y	258.	Y	9570	YJS	7750	YJS	10400	YJS	10100	YJS

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Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		10/30/85 MHC455 SW025002 ARGO TUNNEL AT PORTAL - SPLIT				10/30/85 MHC456 SW026002 VIRGINIA CANYON ABOVE CLEAR CREEK				10/29/85 MHC451 SW027002 RUSSELL GULCH AT HEAD			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		4.35	Y	--		7.35	Y	--		8.55	Y
pH	S.U.	--		2.50	Y	--		2.91	Y	--		3.18	Y
Eh (REDOX POTENTIAL)	MV	--		727.	Y	--		703.	Y	--		752.	Y
SPECIFIC CONDUCTANCE	umhos	--		3390	Y	--		2527	Y	--		2650	Y
DISSOLVED OXYGEN	mg/L	7.80	Y	--		7.80	Y	--		8.50	Y	--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		--		--		0.01	Y	--		0.006	Y
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	738.	YJHT	--		605.	YJHT	--		221.	YJHT	--	
pH	S.U.	--		2.90	Y	--		3.10	Y	--		3.60	Y
SPECIFIC CONDUCTANCE	umhos	--		3400	Y	--		2470	Y	--		2600	Y
TOTAL DISSOLVED SOLIDS	mg/L	3990	YJSHT	--		2780	YJSHT	--		3140	YJSHT	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		8.00	Y	--		7.00	Y	--		2.00	YU
TOTAL ORGANIC CARBON	mg/L	--		1.40	YJHT	--		2.20	YJHT	--		1.50	YJHT
MAJOR CATIONS													
CALCIUM	mg/L	407.	Y	384.	Y	236.	Y	213.	Y	235.	Y	224.	Y
MAGNESIUM	mg/L	149.	Y	144.	Y	103.	Y	94.0	Y	139.	Y	133.	Y
POTASSIUM	mg/L	4.34	YU	4.34	YU	3.02	Y	2.76	Y	10.8	YU	7.13	Y
SODIUM	mg/L	18.4	Y	22.2	Y	19.6	Y	19.0	Y	44.2	Y	42.5	Y
MAJOR ANIONS													
BICARBONATE	mg/L	5.00	YUJHT	--		5.00	YUJHT	--		5.00	YUJHT	--	
CARBONATE	mg/L	5.00	YUJHT	--		5.00	YUJHT	--		5.00	YUJHT	--	
FLUORIDE	mg/L	1.30	Y	--		1.30	Y	--		1.50	Y	--	
CHLORIDE	mg/L	3.90	Y	--		13.0	Y	--		5.10	Y	--	
SULFATE	mg/L	2560	YJS	--		1840	YJS	--		2120	YJS	--	

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Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		10/30/85 MHC455 SW025002 ARGO TUNNEL AT PORTAL - SPLIT				10/30/85 MHC456 SW026002 VIRGINIA CANYON ABOVE CLEAR CREEK				10/29/85 MHC451 SW027002 RUSSELL GULCH AT HEAD			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	2.50	YUJHT	--		2.50	YUJHT	--		0.33	YJHT	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	55900	Y	53800	Y	56200	Y	51600	Y	24200	Y	22800	Y
ANTIMONY	ug/L	50.0	YU	50.0	YU	25.0	YU	25.0	YU	125.	YU	25.0	YU
ARSENIC	ug/L	208.	Y	108.	YJS	140.	Y	44.0	Y	15.0	Y	11.0	Y
BARIUM	ug/L	26.0	YU	26.0	YUJS	13.0	YU	13.0	YUJS	65.0	YU	13.0	YUJS
BERYLLIUM	ug/L	23.0	Y	21.0	YJS	16.0	Y	14.0	YJS	12.0	Y	13.0	YJS
BORON	ug/L	145.	Y	113.	Y	106.	Y	86.0	Y	153.	Y	145.	Y
CADMIUM	ug/L	540.	Y	770.	Y	400.	Y	420.	Y	380.	Y	390.	Y
CHROMIUM (Cr+6)	ug/L	250.	YUJHT	--		100.	YUJHT	--		10.0	YUJHT	--	
CHROMIUM (TOTAL)	ug/L	53.0	Y	62.0	Y	37.0	Y	40.0	Y	20.0	YU	45.0	Y
COBALT	ug/L	318.	Y	296.	Y	249.	Y	225.	Y	173.	Y	165.	Y
COPPER	ug/L	6720	Y	6290	Y	8560	Y	7720	Y	3640	Y	3400	Y
CYANIDE	ug/L	--		10.0	YUJR	--		10.0	YUJHT	--		10.0	YUJR
GOLD	ug/L	1.00	YUJS	1.00	YU	1.00	YUJS	1.00	YU	10.0	YUJS	1.00	YU
IRON	ug/L	20400	Y	19700	Y	7250	Y	6690	Y	194.	Y	10.0	YU
LEAD	ug/L	292.	Y	262.	Y	281.	Y	257.	Y	37.0	Y	151.	Y
MANGANESE	ug/L	149000	Y	140000	Y	70800	Y	63400	Y	298000	Y	282000	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	20.0	YU	20.0	YUJ*	10.0	YU	10.0	YUJ*	50.0	YU	50.0	YUJ*
NICKEL	ug/L	628.	Y	610.	YJS	604.	Y	550.	YJS	505.	Y	473.	YJS
SELENIUM	ug/L	50.0	YU	5.00	YUR	--		50.0	YUR	50.0	YUR	50.0	YUR
SILVER	ug/L	0.90	Y	0.70	Y	0.10	Y	0.30	Y	0.20	Y	0.30	Y
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	1020	Y	959.	Y	718.	Y	632.	Y	965.	Y	862.	Y
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	2.00	YU	2.00	YU	10.0	YU	10.0	YU	10.0	YU	2.00	YU
TIN	ug/L	32.0	YU	32.0	YUJS	16.0	YU	16.0	YUJS	80.0	YUJS	16.0	YUJS
VANADIUM	ug/L	8.00	YU	8.00	YU	4.00	YU	4.00	YU	20.0	YU	4.00	YU
ZINC	ug/L	116000	Y	108000	Y	79200	Y	69500	Y	85400	Y	81000	Y

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Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		10/31/85 MHC473 SW028002 RUSSELL GULCH AT HEAD				11/01/85 MHC475 SW029002 CLEAR CREEK ABOVE BIG FIVE				11/01/85 MHC476 SW030002 CHICAGO CREEK ABOVE CLEAR CREEK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		--		--		3.52	Y	--		3.43	Y
pH	S.U.	--		--		--		--		--		6.20	Y
Eh (REDOX POTENTIAL)	MV	--		--		--		515.	Y	--		--	
SPECIFIC CONDUCTANCE	umhos	--		--		--		180.	Y	--		78.0	Y
DISSOLVED OXYGEN	mg/L	--		--		6.78	Y	--		--		--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		--		--		--		--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	66.0	YJHT	--		5.00	YUJHT	--		5.00	YUJHT	--	
pH	S.U.	--		4.00	Y	--		7.13	Y	--		6.53	Y
SPECIFIC CONDUCTANCE	umhos	--		798.	Y	--		196.	Y	--		86.1	Y
TOTAL DISSOLVED SOLIDS	mg/L	700.	YJHT	--		100.	YJHT	--		40.0	YJHT	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		11.0	Y	--		4.00	Y	--		6.00	Y
TOTAL ORGANIC CARBON	mg/L	--		3.50	YJHT	--		1.80	YJHT	--		2.00	YJHT
MAJOR CATIONS													
CALCIUM	mg/L	97.0	Y	98.2	Y	--		19.6	YJE	--		9.08	Y
MAGNESIUM	mg/L	31.4	Y	31.1	Y	--		5.05	Y	--		2.68	Y
POTASSIUM	mg/L	4.62	Y	4.60	Y	--		2.26	Y	--		2.17	YU
SODIUM	mg/L	8.29	Y	7.65	Y	--		11.2	Y	--		4.14	Y
MAJOR ANIONS													
BICARBONATE	mg/L	5.00	YUJHT	--		47.0	YJHT	--		26.0	YJHT	--	
CARBONATE	mg/L	5.00	YUJHT	--		5.00	YUJHT	--		5.00	YUJHT	--	
FLUORIDE	mg/L	0.54	YJHT	--		0.87	YJHT	--		0.27	YJHT	--	
CHLORIDE	mg/L	3.00	YU	--		3.90	Y	--		3.00	YU	--	
SULFATE	mg/L	500.	YJHT	--		40.0	YJHT	--		14.0	YJHT	--	

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Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		10/31/85 MHC473 SW028002 RUSSELL GULCH AT HEAD				11/01/85 MHC475 SW029002 CLEAR CREEK ABOVE BIG FIVE				11/01/85 MHC476 SW030002 CHICAGO CREEK ABOVE CLEAR CREEK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	0.10	YUJHT	--		0.10	YUJHT	--		0.10	YUJHT	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	4350	Y	4530	Y	--		158.	Y	--		84.0	Y
ANTIMONY	ug/L	25.0	YU	25.0	YU	--		25.0	YU	--		25.0	YU
ARSENIC	ug/L	2.00	YU	3.00	Y	--		2.00	YU	--		2.00	YUJ*
BARIUM	ug/L	19.0	Y	24.0	Y	--		28.0	Y	--		26.0	YJE
BERYLLIUM	ug/L	2.00	Y	2.00	Y	--		0.40	YU	--		0.40	YU
BORON	ug/L	69.0	Y	79.0	Y	--		57.0	YJ*	--		29.0	YJ*
CADMIUM	ug/L	82.0	Y	73.0	Y	--		1.00	YJ*	--		1.00	YUJ*
CHROMIUM (Cr+6)	ug/L	10.0	YUJHT	--		10.0	YUJHT	--		10.0	YUJHT	--	
CHROMIUM (TOTAL)	ug/L	4.00	YU	4.00	YU	--		4.00	YU	--		4.00	YU
COBALT	ug/L	13.0	Y	12.0	Y	--		5.00	YU	--		5.00	YU
COPPER	ug/L	260.	Y	263.	Y	--		15.0	Y	--		11.0	Y
CYANIDE	ug/L	--		10.0	YU	--		10.0	YUJHT	--		10.0	YUJHT
GOLD	ug/L	1.00	YUJS	1.00	YU	--		1.00	YU	--		1.00	YU
IRON	ug/L	1140	Y	1890	Y	--		254.	Y	--		443.	Y
LEAD	ug/L	194.	Y	200.	Y			6.00	Y	--		5.00	YU
MANGANESE	ug/L	5870	YJS	5780	Y	--		878.	Y	--		142.	Y
MERCURY	ug/L	0.10	YU	0.10	YU	--		0.10	YUJHT	--		0.10	YUJHT
MOLYBDENUM	ug/L	10.0	YU	10.0	YU	--		14.0	Y	--		10.0	YU
NICKEL	ug/L	104.	Y	102.	Y	--		7.00	YU	--		7.00	YU
SELENIUM	ug/L	50.0	YUR	20.0	YUJS	--		5.00	YUJS	--		2.00	YUJS
SILVER	ug/L	0.10	YU	0.20	Y	--		0.10	YU	--		0.10	YU
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	365.	Y	372.	Y	--		162.	Y	--		69.0	Y
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	2.00	YU	2.00	YU	--		10.0	YUJS	--		2.00	YUJS
TIN	ug/L	16.0	YU	16.0	YU	--		16.0	YU	--		16.0	YU
VANADIUM	ug/L	4.00	YU	4.00	YU	--		4.00	YU	--		4.00	YU
ZINC	ug/L	17400	YJS	17200	YJS	--		208.	YJE	--		82.0	YJE

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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		11/01/85 MHC477 SW031002 SODA CREEK ABOVE CLEAR CREEK				10/29/85 MHC445 SW032002 SPLIT QUARTZ HILL AT PORTAL				10/30/85 MHC458 SW033002 SPLIT CLEAR CREEK ABOVE ARGO			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		4.30	Y	--		3.60	Y	--		4.35	Y
pH	S.U.	--		6.45	Y	--		2.52	Y	--		6.99	Y
Eh (REDOX POTENTIAL)	MV	--		--		--		840.	Y	--		454.	Y
SPECIFIC CONDUCTANCE	umhos	--		280.	Y	--		4120	Y	--		160.	Y
DISSOLVED OXYGEN	mg/L	9.10	Y	--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		--		--		0.005	Y	--		71.0	Y
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	5.00	YUJHT	--		2120	YJHT	--		5.00	YUJHT	--	
pH	S.U.	--		6.49	Y	--		2.70	Y	--		6.60	Y
SPECIFIC CONDUCTANCE	umhos	--		244.	Y	--		4170	Y	--		188.	Y
TOTAL DISSOLVED SOLIDS	mg/L	140.	YJHT	--		6200	YJSHT	--		90.0	YJSHT	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		4.00	Y	--		2.00	YU	--		2.00	YU
TOTAL ORGANIC CARBON	mg/L	--		2.00	YJHT	--		2.20	YJHT	--		1.60	YJHT
MAJOR CATIONS													
CALCIUM	mg/L	--		14.6	YJE	--		328.	Y	19.7	Y	17.5	Y
MAGNESIUM	mg/L	--		4.75	Y	--		178.	Y	4.97	Y	4.42	Y
POTASSIUM	mg/L	--		4.84	Y	--		2.17	YU	2.26	Y	2.17	YU
SODIUM	mg/L	--		28.6	Y	--		7.29	Y	10.7	Y	9.88	Y
MAJOR ANIONS													
BICARBONATE	mg/L	81.0	YJHT	--		5.00	YUJHT	--		43.0	YJHT	--	
CARBONATE	mg/L	5.00	YUJHT	--		5.00	YUJHT	--		5.00	YUJHT	--	
FLUORIDE	mg/L	0.34	YJHT	--		6.70	Y	--		0.78	Y	--	
CHLORIDE	mg/L	4.20	Y	--		75.0	YU	--		3.00	YU	--	
SULFATE	mg/L	34.0	YJHT	--		3700	YJS	--		37.0	YJS	--	

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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		11/01/85 MHC477 SW031002 SODA CREEK ABOVE CLEAR CREEK				10/29/85 MHC445 SW032002 SPLIT QUARTZ HILL AT PORTAL				10/30/85 MHC458 SW033002 SPLIT CLEAR CREEK ABOVE ARGO			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	0.13	YJHT	--		10.0	YUJHT	--		0.13	YJHT	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	--		63.0	Y	--		53400	Y	91.0	Y	142.	Y
ANTIMONY	ug/L	--		25.0	YU	--		35.0	Y	25.0	YU	25.0	YU
ARSENIC	ug/L	--		2.00	YU	--		711.	YJS	2.00	YU	2.00	YU
BARIUM	ug/L	--		27.0	Y	--		13.0	YUJS	29.0	Y	23.0	YJS
BERYLLIUM	ug/L	--		0.40	Y	--		43.0	YJS	0.40	Y	0.40	YUJS
BORON	ug/L	--		48.0	YJ*	--		474.	Y	23.0	Y	6.00	Y
CADMIUM	ug/L	--		1.00	YUJ*	--		380.	Y	2.00	Y	2.00	Y
CHROMIUM (Cr+6)	ug/L	10.0	YUJHT	--		3000	YUJHT	--		10.0	YUJHT	--	
CHROMIUM (TOTAL)	ug/L	--		4.00	YU	--		60.0	Y	4.00	YU	4.00	YU
COBALT	ug/L	--		5.00	YU	--		350.	Y	5.00	YU	5.00	YU
COPPER	ug/L	--		19.0	Y	--		40800	Y	13.0	Y	19.0	Y
CYANIDE	ug/L	--		10.0	YUJHT	--		10.0	YR	--		10.0	YUJR
GOLD	ug/L	--		1.00	YU	--		1.00	YU	1.00	YUJS	1.00	YU
IRON	ug/L	--		378.	Y	--		461000	Y	15.0	Y	242.	Y
LEAD	ug/L	--		3.00	Y	--		201.	Y	2.00	YU	5.00	YU
MANGANESE	ug/L	--		67.0	Y	--		59400	Y	1010	Y	901.	Y
MERCURY	ug/L	--		0.10	YUJHT	--		0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	--		10.0	YU	--		76.0	YJ*	12.0	Y	13.0	YJ*
NICKEL	ug/L	--		7.00	YU	--		430.	YJS	7.00	YU	7.00	YUJS
SELENIUM	ug/L	--		2.00	YUJS	--		--		2.00	YUR	2.00	YUR
SILVER	ug/L	--		0.10	YU	--		0.37	YJE	0.10	YU	0.10	YU
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	--		304.	Y	--		335.	Y	173.	Y	142.	Y
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	--		10.0	YUJS	--		10.0	YU	2.00	YU	2.00	YU
TIN	ug/L	--		16.0	YU	--		16.0	YUJS	16.0	YUJS	16.0	YUJS
VANADIUM	ug/L	--		4.00	YU	--		23.0	Y	4.00	YU	4.00	YU
ZINC	ug/L	--		49.0	YJE	--		85900	Y	302.	Y	279.	Y

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(umhos) = umhos/cm

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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		10/31/85 MHC464 SW034002 TRIPLICATE, NATIONAL AT PORTAL				10/31/85 MHC465 SW035002 TRIPLICATE, NATIONAL AT PORTAL				10/28/85 MHC441 SW036002 TRAVEL BLANK #1			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		--		--		8.50	Y	--		--	
pH	S.U.	--		--		--		6.10	Y	--		--	
Eh (REDOX POTENTIAL)	MV	--		--		--		287.	Y	--		--	
SPECIFIC CONDUCTANCE	umhos	--		--		--		1250	Y	--		--	
DISSOLVED OXYGEN	mg/L	--		--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		--		--		0.07	Y	--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	88.0	YJHT	--		95.0	YJHT	--		5.00	YUJHT	--	
pH	S.U.	--		3.50	Y	--		3.50	Y	--		6.70	Y
SPECIFIC CONDUCTANCE	umhos	--		1510	Y	--		1490	Y	--		94.0	Y
TOTAL DISSOLVED SOLIDS	mg/L	1370	YJHT	--		1360	YJHT	--		20.0	YJSHT	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		76.0	Y	--		72.0	Y	--		2.00	YU
TOTAL ORGANIC CARBON	mg/L	--		1.10	YJHT	--		2.30	YJHT	--		0.77	YJHT
MAJOR CATIONS													
CALCIUM	mg/L	208.	Y	208.	Y	205.	Y	208.	Y	7.37	Y	7.32	Y
MAGNESIUM	mg/L	62.8	Y	60.4	Y	61.5	Y	60.3	Y	3.30	Y	3.36	Y
POTASSIUM	mg/L	8.19	Y	8.17	Y	8.16	Y	8.18	Y	2.17	YU	2.17	YU
SODIUM	mg/L	29.2	Y	28.4	Y	29.1	Y	29.3	Y	7.45	Y	7.28	Y
MAJOR ANIONS													
BICARBONATE	mg/L	5.00	YUJHT	--		5.00	YUJHT	--		19.0	YJHT	--	
CARBONATE	mg/L	5.00	YUJHT	--		5.00	YUJHT	--		5.00	YUJHT	--	
FLUORIDE	mg/L	0.35	YJHT	--		0.43	YJHT	--		0.80	Y	--	
CHLORIDE	mg/L	3.00	YU	--		3.60	Y	--		3.00	YU	--	
SULFATE	mg/L	1120	YJHT	--		1160	YJHT	--		20.0	YJS	--	

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		10/31/85 MHC464 SW034002 TRIPLICATE, NATIONAL AT PORTAL				10/31/85 MHC465 SW035002 TRIPLICATE, NATIONAL AT PORTAL				10/28/85 MHC441 SW036002 TRAVEL BLANK #1			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	2.50	YUJHT	--		2.50	YUJHT	--		0.10	YUJHT	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	25.0	YU	96.0	Y	25.0	YU	82.0	Y	98.0	Y	111.	Y
ANTIMONY	ug/L	25.0	YU	25.0	YU	25.0	YU	25.0	YU	25.0	YU	25.0	YU
ARSENIC	ug/L	2.00	YU	10.0	YU	2.00	YU	5.00	Y	2.00	YU	2.00	YUJS
BARIUM	ug/L	13.0	YU	13.0	YU	13.0	YU	13.0	YU	13.0	YU	13.0	YUJS
BERYLLIUM	ug/L	1.00	Y	1.00	Y	1.00	Y	1.00	Y	0.40	YU	0.40	YUJS
BORON	ug/L	116.	Y	103.	Y	111.	Y	102.	Y	19.0	Y	5.00	YU
CADMIUM	ug/L	5.00	Y	5.00	Y	5.00	Y	4.00	Y	1.00	YU	1.00	YU
CHROMIUM (Cr+6)	ug/L	100.	YUJHT	--		500.	YUJHT	--		10.0	YUJHT	--	
CHROMIUM (TOTAL)	ug/L	5.00	Y	5.00	Y	5.00	Y	5.00	Y	4.00	YU	4.00	YU
COBALT	ug/L	95.0	Y	92.0	Y	94.0	Y	93.0	Y	5.00	YU	5.00	YU
COPPER	ug/L	31.0	Y	108.	Y	32.0	Y	106.	Y	17.0	Y	10.0	Y
CYANIDE	ug/L	--		10.0	YU	--		10.0	YU	--		10.0	YUJR
GOLD	ug/L	1.00	YUJS	1.00	YU	1.00	YUJS	1.00	YU	1.00	YUJS	1.00	YU
IRON	ug/L	46600	Y	52300	Y	46300	Y	52000	Y	18.0	Y	14.0	Y
LEAD	ug/L	5.00	YU	20.0	YU	5.00	YU	20.0	YU	2.00	YU	5.00	YU
MANGANESE	ug/L	17600	YJS	17100	Y	17400	YJS	17100	Y	5.00	Y	7.00	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YUJ*
NICKEL	ug/L	223.	Y	214.	Y	217.	Y	219.	Y	7.00	YU	7.00	YUJS
SELENIUM	ug/L	--		50.0	YUJS	--		50.0	YUJS	2.00	YU	5.00	YUR
SILVER	ug/L	0.30	YJS	0.10	YU	0.30	YJS	0.10	YU	0.10	YU	0.10	YU
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	1700	Y	1660	Y	1670	Y	1670	Y	23.0	Y	12.0	Y
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	2.00	YU	2.00	YU	2.00	YU	2.00	YU	2.00	YU	2.00	YU
TIN	ug/L	16.0	YU	16.0	YU	16.0	YU	16.0	YU	16.0	YU	16.0	YUJS
VANADIUM	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU
ZINC	ug/L	6110	YJS	5960	YJS	6030	YJS	5970	YJS	11.0	Y	4.00	Y

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		10/28/85 MHC442 SW037002 TRAVEL BLANK #2				10/28/85 MHC443 SW038002 TRAVEL BLANK # 3				10/29/85 MHC452 SW039002 DECON BLANK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		--		--		--		--		--	
pH	S.U.	--		--		--		--		--		--	
Eh (REDOX POTENTIAL)	MV	--		--		--		--		--		--	
SPECIFIC CONDUCTANCE	umhos	--		--		--		--		--		--	
DISSOLVED OXYGEN	mg/L	--		--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		--		--		--		--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	5.00	YUJHT	--		5.00	YUJHT	--		9.40	YJHT	--	
pH	S.U.	--		6.60	Y	--		7.60	Y	--		6.00	Y
SPECIFIC CONDUCTANCE	umhos	--		98.0	Y	--		99.0	Y	--		11.0	Y
TOTAL DISSOLVED SOLIDS	mg/L	20.0	YJSHT	--		40.0	YJHT	--		20.0	YJSHT	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		2.00	YU	--		2.00	YU	--		2.00	YU
TOTAL ORGANIC CARBON	mg/L	--		0.72	YJHT	--		2.30	YJHT	--		0.37	YJHT
MAJOR CATIONS													
CALCIUM	mg/L	0.69	Y	7.18	Y	7.17	Y	7.31	Y	0.77	Y	0.64	Y
MAGNESIUM	mg/L	3.12	YU	3.18	Y	3.32	Y	3.27	Y	0.32	Y	0.31	YU
POTASSIUM	mg/L	2.17	YU	2.17	YU	2.17	YU	2.17	YU	2.17	YU	2.17	YU
SODIUM	mg/L	1.83	Y	5.57	Y	7.42	Y	6.78	Y	1.78	Y	0.58	YU
MAJOR ANIONS													
BICARBONATE	mg/L	19.0	YJHT	--		17.0	YJHT	--		5.00	YUJHT	--	
CARBONATE	mg/L	5.00	YUJHT	--		5.00	YUJHT	--		5.00	YUJHT	--	
FLUORIDE	mg/L	0.82	Y	--		0.87	YJHT	--		0.10	YU	--	
CHLORIDE	mg/L	3.00	YU	--		3.00	YU	--		3.00	YU	--	
SULFATE	mg/L	20.0	YJS	--		20.0	YJHT	--		5.00	YUJS	--	

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Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		10/28/85 MHC442 SW037002 TRAVEL BLANK #2				10/28/85 MHC443 SW038002 TRAVEL BLANK # 3				10/29/85 MHC452 SW039002 DECON BLANK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	0.10	YUJHT	--		0.14	YJHT	--		0.10	YUJHT	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	25.0	YU	108.	Y	110.	Y	110.	Y	25.0	YU	26.0	Y
ANTIMONY	ug/L	25.0	YU	25.0	YU	25.0	YU	25.0	YU	25.0	YU	25.0	YU
ARSENIC	ug/L	2.00	YU	2.00	YU	2.00	YU	2.00	YU	2.00	YU	2.00	YU
BARIUM	ug/L	13.0	YU	13.0	YUJS	13.0	YU	13.0	YU	13.0	YU	13.0	YUJS
BERYLLIUM	ug/L	0.40	Y	0.40	YUJS	0.40	YU	0.40	YU	0.40	YU	0.40	YUJS
BORON	ug/L	7.00	Y	7.00	Y	21.0	Y	15.0	Y	11.0	Y	17.0	Y
CADMIUM	ug/L	1.00	YU	1.00	YU	1.00	YU	1.00	YU	1.00	YU	1.00	YU
CHROMIUM (Cr+6)	ug/L	10.0	YUJHT	--		10.0	YUJHT	--		10.0	YUJHT	--	
CHROMIUM (TOTAL)	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU
COBALT	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
COPPER	ug/L	3.00	YU	12.0	Y	5.00	Y	14.0	Y	3.00	YU	3.00	YU
CYANIDE	ug/L	--		10.0	YUJR	--		10.0	YU	--		10.0	YUJR
GOLD	ug/L	1.00	YUJS	1.00	YU	1.00	YUJS	1.00	YU	1.00	YUJS	1.00	YU
IRON	ug/L	13.0	Y	22.0	Y	11.0	Y	31.0	Y	18.0	Y	10.0	YU
LEAD	ug/L	2.00	YU	5.00	YU	5.00	YU	2.00	YU	5.00	YU	2.00	YU
MANGANESE	ug/L	5.00	YU	15.0	Y	5.00	YUJS	11.0	Y	62.0	Y	41.0	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	10.0	YU	10.0	YUJ*	10.0	YU	10.0	YU	10.0	YU	10.0	YUJ*
NICKEL	ug/L	7.00	YU	7.00	YUJS	7.00	YU	7.00	YU	7.00	YU	7.00	YUJS
SELENIUM	ug/L	2.00	YUR	5.00	YUR	2.00	YUR	2.00	YUJS	2.00	YUR	5.00	YUR
SILVER	ug/L	0.20	Y	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	5.00	YU	10.0	Y	23.0	Y	20.0	Y	5.00	YU	5.00	YU
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	2.00	YU	2.00	YU	10.0	YU	10.0	YU	2.00	YU	2.00	YU
TIN	ug/L	16.0	YUJS	16.0	YUJS	16.0	YU	16.0	YU	16.0	YUJS	16.0	YUJS
VANADIUM	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU
ZINC	ug/L	8.00	Y	4.00	Y	3.00	YJS	7.00	YJS	28.0	Y	12.0	Y

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Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		10/30/85 MHC461 SW040002 DECON BLANK				10/31/85 MHC469 SW041002 DECON BLANK DAY 2				11/08/85 MHC490 SW042002 BLIND STANDARD			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		--		--		--		--		--	
pH	S.U.	--		--		--		--		--		--	
Eh (REDOX POTENTIAL)	MV	--		--		--		--		--		--	
SPECIFIC CONDUCTANCE	umhos	--		--		--		--		--		--	
DISSOLVED OXYGEN	mg/L	--		--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		--		--		--		--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	5.00	YUJHT	--		5.00	YUJHT	--		218.	YJHT	--	
pH	S.U.	--		4.70	Y	--		4.10	Y	--		2.54	Y
SPECIFIC CONDUCTANCE	umhos	--		3.40	Y	--		35.0	Y	--		1780	Y
TOTAL DISSOLVED SOLIDS	mg/L	10.0	YUJHT	--		10.0	YUJHT	--		260.	YJHT	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		2.00	YU	--		4.00	Y	--		2.00	YU
TOTAL ORGANIC CARBON	mg/L	--		0.50	Y	--		1.50	YJHT	--		2.10	Y
MAJOR CATIONS													
CALCIUM	mg/L	0.21	YU	0.21	YU	0.21	YU	0.21	YU	--		24.4	YJE
MAGNESIUM	mg/L	0.31	YU	0.31	YU	0.31	YU	0.31	YU	--		0.31	YU
POTASSIUM	mg/L	2.17	YU	2.17	YU	2.17	YU	2.17	YU	--		2.17	YU
SODIUM	mg/L	1.39	YU	0.58	YU	0.64	Y	1.31	Y	--		0.78	Y
MAJOR ANIONS													
BICARBONATE	mg/L	5.00	YUJHT	--		5.00	YUJHT	--		5.00	YUJHT	--	
CARBONATE	mg/L	5.00	YUJHT	--		5.00	YUJHT	--		5.00	YUJHT	--	
FLUORIDE	mg/L	0.10	YUJHT	--		0.10	YUJHT	--		0.10	YU	--	
CHLORIDE	mg/L	3.00	YU	--		3.00	YU	--		3.00	YU	--	
SULFATE	mg/L	5.00	YUJHT	--		5.00	YUJHT	--		5.00	YU	--	

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		10/30/85 MHC461 SW040002 DECON BLANK				10/31/85 MHC469 SW041002 DECON BLANK DAY 2				11/08/85 MHC490 SW042002 BLIND STANDARD			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	0.10	YU	--		0.10	YUJHT	--		72.0	Y	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	25.0	YU	25.0	YU	25.0	YU	25.0	YU	--		25.0	YU
ANTIMONY	ug/L	25.0	YU	25.0	YU	25.0	YU	25.0	YU	--		25.0	YU
ARSENIC	ug/L	2.00	YU	10.0	YU	2.00	YU	2.00	YU	--		35.0	Y
BARIUM	ug/L	13.0	YU	13.0	YU	13.0	YU	13.0	YU	--		295.	Y
BERYLLIUM	ug/L	0.40	YU	0.40	YU	0.40	YU	0.40	YU	--		0.40	YU
BORON	ug/L	17.0	Y	5.00	YU	13.0	Y	5.00	YU	--		42.0	YJ*
CADMIUM	ug/L	1.00	YU	1.00	YU	1.00	YU	1.00	YU	--		48.0	YJ*
CHROMIUM (Cr+6)	ug/L	10.0	YUJHT	--		20.0	YUJHT	--		10.0	YUJHT	--	
CHROMIUM (TOTAL)	ug/L	10.0	YU	10.0	YU	4.00	YU	4.00	YU	--		51.0	Y
COBALT	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	--		5.00	YU
COPPER	ug/L	3.00	YU	--		3.00	YU	3.00	YU	--		3.00	YU
CYANIDE	ug/L	--		10.0	YU	--		10.0	YU	--		10.0	YU
GOLD	ug/L	1.00	YUJS	1.00	YU	1.00	YUJS	1.00	YU	--		1.00	YU
IRON	ug/L	10.0	YU	10.0	Y	20.0	Y	24.0	Y	--		162.	Y
LEAD	ug/L	2.00	YU	2.00	YU	2.00	YU	2.00	YU	--		103.	Y
MANGANESE	ug/L	5.00	YUJS	5.00	YU	5.00	YUJS	6.00	Y	--		113.	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	--		0.50	Y
MOLYBDENUM	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	--		10.0	YU
NICKEL	ug/L	7.00	YU	7.00	YU	7.00	YU	7.00	YU	--		7.00	YU
SELENIUM	ug/L	5.00	YR	2.00	YUJS	2.00	YUR	2.00	YUJS	--		36.0	YUJS
SILVER	ug/L	0.10	YUJC	0.10	YU	0.30	YJS	0.10	YU	--		36.0	Y
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	--		6.00	Y
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	10.0	YU	10.0	YU	2.00	YU	2.00	YU	--		2.00	YUJS
TIN	ug/L	16.0	YU	16.0	YU	16.0	YU	16.0	YU	--		16.0	YU
VANADIUM	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	--		4.00	YU
ZINC	ug/L	2.00	YUJS	7.00	YJS	5.00	YJS	3.00	YJS	--		2.00	YJE

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

11/06/85
MHC486
SW044002
NAT. TUNNEL AT PORTAL
(TRIPLE VOL OF SW008)

		DISSOLVED		TOTAL	
FIELD DETERMINATIONS					
TEMPERATURE	C	--		--	
pH	S.U.	--		--	
E_h (REDOX POTENTIAL)	MV	--		--	
SPECIFIC CONDUCTANCE	umhos	--		--	
DISSOLVED OXYGEN	mg/L	--		--	
Fe+2	mg/L	--		--	
Fe+3	mg/L	--		--	
IRON (TOTAL)	mg/L	--		--	
As+3	mg/L	--		--	
As+5	mg/L	--		--	
DISCHARGE	CFS	--		--	
LAB DETERMINATIONS					
GENERAL					
ACIDITY	mg/L	82.0	YJHT	--	
pH	S.U.	--		4.49	Y
SPECIFIC CONDUCTANCE	umhos	--		1420	Y
TOTAL DISSOLVED SOLIDS	mg/L	1360	YJHT	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		59.0	Y
TOTAL ORGANIC CARBON	mg/L	--		--	
MAJOR CATIONS					
CALCIUM	mg/L	--		203.	YJE
MAGNESIUM	mg/L	--		60.0	Y
POTASSIUM	mg/L	--		8.03	Y
SODIUM	mg/L	--		28.1	Y
MAJOR ANIONS					
BICARBONATE	mg/L	5.00	YUJHT	--	
CARBONATE	mg/L	5.00	YUJHT	--	
FLUORIDE	mg/L	0.44	Y	--	
CHLORIDE	mg/L	3.60	Y	--	
SULFATE	mg/L	950.	YJHT	--	

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

11/06/85
MHC486
SW044002
NAT. TUNNEL AT PORTAL
(TRIPLE VOL OF SW008)

		DISSOLVED		TOTAL	
NUTRIENTS					
AMMONIA	mg/L	--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	0.10	YU	--	
PHOSPHATE	mg/L	--		--	
MINOR & TRACE ELEMENTS					
ALUMINUM	ug/L	--		129.	Y
ANTIMONY	ug/L	--		25.0	YU
ARSENIC	ug/L	--		7.00	Y
BARIUM	ug/L	--		13.0	YU
BERYLLIUM	ug/L	--		1.00	Y
BORON	ug/L	--		139.	YJ*
CADMIUM	ug/L	--		9.00	YJ*
CHROMIUM (Cr+6)	ug/L	10.0	YUJHT	--	
CHROMIUM (TOTAL)	ug/L	--		8.00	Y
COBALT	ug/L	--		98.0	Y
COPPER	ug/L	--		115.	Y
CYANIDE	ug/L	--		10.0	YU
GOLD	ug/L	--		1.00	YU
IRON	ug/L	--		57700	Y
LEAD	ug/L	--		14.0	Y
MANGANESE	ug/L	--		18200	Y
MERCURY	ug/L	--		0.10	YU
MOLYBDENUM	ug/L	--		14.0	Y
NICKEL	ug/L	--		226.	Y
SELENIUM	ug/L	--		50.0	YUJS
SILVER	ug/L	--		0.10	YU
SILICA	ug/L	--		--	
STRONTIUM	ug/L	--		1710	Y
SULFIDE	ug/L	--		--	
THALLIUM	ug/L	--		2.00	YUJS
TIN	ug/L	--		16.0	YU
VANADIUM	ug/L	--		4.00	YU
ZINC	ug/L	--		6280	YJE

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THIRD SAMPLING SESSION RESULTS

SURFACE WATER

February 1986

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/05/86 MHE455 SW001003 CLEAR CREEK ABOVE NORTH CLEAR CREEK		02/05/86 MHE456 SW002003 CLEAR CREEK BELOW NORTH CLEAR CREEK		02/05/86 MHE457 SW003003 NORTH CLEAR CREEK ABOVE CLEAR CREEK	
		DISSOLVED	TOTAL	DISSOLVED	TOTAL	DISSOLVED	TOTAL
FIELD DETERMINATIONS							
TEMPERATURE	C	--	0.80 Y	--	0.50 Y	--	3.00 Y
pH	S.U.	--	7.05 Y	--	7.10 Y	--	6.30 Y
Eh (REDOX POTENTIAL)	MV	--	--	--	--	--	--
SPECIFIC CONDUCTANCE	umhos	--	300. Y	--	420. Y	--	390. Y
DISSOLVED OXYGEN	mg/L	--	--	--	--	--	--
Fe+2	mg/L	--	--	--	--	--	--
Fe+3	mg/L	--	--	--	--	--	--
IRON (TOTAL)	mg/L	--	--	--	--	--	--
As+3	mg/L	--	--	--	--	--	--
As+5	mg/L	--	--	--	--	--	--
DISCHARGE	CFS	--	--	--	31.3 Y	--	--
LAB DETERMINATIONS							
GENERAL							
ACIDITY	mg/L	--	--	--	--	--	--
pH	S.U.	--	--	--	--	--	--
SPECIFIC CONDUCTANCE	umhos	--	--	--	--	--	--
TOTAL DISSOLVED SOLIDS	mg/L	--	--	--	--	--	--
TOTAL SUSPENDED SOLIDS	mg/L	--	--	--	--	--	--
TOTAL ORGANIC CARBON	mg/L	--	--	--	--	--	--
MAJOR CATIONS							
CALCIUM	mg/L	33.9 Y	30.4 Y	32.5 Y	30.4 Y	48.3 Y	41.3 Y
MAGNESIUM	mg/L	8.93 Y	8.25 Y	8.49 Y	8.06 Y	14.3 Y	12.3 Y
POTASSIUM	mg/L	3.42 Y	3.20 Y	3.57 Y	3.42 Y	3.36 Y	2.58 Y
SODIUM	mg/L	19.5 Y	17.1 Y	19.8 Y	18.4 Y	15.3 Y	12.0 Y
MAJOR ANIONS							
BICARBONATE	mg/L	--	--	--	--	--	--
CARBONATE	mg/L	--	--	--	--	--	--
FLUORIDE	mg/L	--	--	--	--	--	--
CHLORIDE	mg/L	--	--	--	--	--	--
SULFATE	mg/L	--	--	--	--	--	--

FOOTNOTES

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(--) = Not analyzed
(umhos) = umhos/cm
(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(H,HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/05/86 MHE455 SW001003 CLEAR CREEK ABOVE NORTH CLEAR CREEK				02/05/86 MHE456 SW002003 CLEAR CREEK BELOW NORTH CLEAR CREEK				02/05/86 MHE457 SW003003 NORTH CLEAR CREEK ABOVE CLEAR CREEK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	--		--		--		--		--		--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	37.0	Y	340.	Y	47.0	Y	288.	Y	23.0	YU	538.	Y
ANTIMONY	ug/L	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS
ARSENIC	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU
BARIUM	ug/L	37.0	Y	30.0	Y	37.0	Y	32.0	Y	51.0	Y	31.0	Y
BERYLLIUM	ug/L	1.00	Y	0.50	Y	0.50	Y	0.50	Y	1.00	Y	1.00	Y
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	5.60	Y	4.00	YU
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	5.60	Y	4.00	YU
COBALT	ug/L	6.00	YU	6.00	YU	6.00	YU	6.00	YU	17.0	Y	9.90	Y
COPPER	ug/L	10.0	Y	62.0	Y	9.80	Y	51.0	Y	20.0	Y	99.0	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	11.0	YU	1340	Y	11.0	YU	912.	Y	162.	Y	3870	Y
LEAD	ug/L	5.00	YUJS	5.50	Y	5.00	YUJS	5.00	YU	5.00	YUJS	5.00	YU
MANGANESE	ug/L	2420	Y	2200	Y	2450	Y	2300	Y	2350	Y	2010	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	7.90	Y	10.0	Y	6.20	Y	9.60	Y	29.0	Y	22.0	Y
SELENIUM	ug/L	5.00	YU	5.00	YUJS	5.00	YU	5.00	YUJS	5.00	YU	5.00	YUJS
SILVER	ug/L	4.00	YUJS	4.00	YU	4.00	YUJS	4.00	YU	4.10	YJS	4.00	YU
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	10.0	YUJS	10.0	YUJS	10.0	YUJS	10.0	YUJS	10.0	YUJS	10.0	YUJS
TIN	ug/L	18.0	YU	18.0	YU	18.0	YU	18.0	YU	18.0	YU	18.0	YU
VANADIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
ZINC	ug/L	720.	Y	849.	Y	653.	Y	793.	Y	1610	Y	1440	Y

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(U) = UNDETECTED
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(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

06/03/87

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/05/86 MHE458 SW004003 RUSSELL GULCH AT NORTH CLEAR CREEK		02/05/86 MHE459 SW005003 NORTH CLEAR CREEK BELOW NATIONAL		02/05/86 MHE460 SW006003 NORTH CLEAR CREEK ABOVE NATIONAL	
		DISSOLVED	TOTAL	DISSOLVED	TOTAL	DISSOLVED	TOTAL
FIELD DETERMINATIONS							
TEMPERATURE	C	--	0.70 Y	--	0.60 Y	--	0.30 Y
pH	S.U.	--	6.20 Y	--	6.40 Y	--	6.40 Y
Eh (REDOX POTENTIAL)	MV	--	--	--	332. Y	--	357. Y
SPECIFIC CONDUCTANCE	umhos	--	440. Y	--	460. Y	--	480. Y
DISSOLVED OXYGEN	mg/L	--	--	--	--	4.15 Y	--
Fe+2	mg/L	--	--	--	--	--	--
Fe+3	mg/L	--	--	--	--	--	--
IRON (TOTAL)	mg/L	--	--	--	--	--	--
As+3	mg/L	--	--	--	--	--	--
As+5	mg/L	--	--	--	--	--	--
DISCHARGE	CFS	--	--	--	2.16 Y	--	--
LAB DETERMINATIONS							
GENERAL							
ACIDITY	mg/L	--	--	--	--	--	--
pH	S.U.	--	--	--	--	--	--
SPECIFIC CONDUCTANCE	umhos	--	--	--	--	--	--
TOTAL DISSOLVED SOLIDS	mg/L	--	--	--	--	--	--
TOTAL SUSPENDED SOLIDS	mg/L	--	--	--	--	--	--
TOTAL ORGANIC CARBON	mg/L	--	--	--	--	--	--
MAJOR CATIONS							
CALCIUM	mg/L	49.5 Y	45.3 Y	54.3 Y	49.2 Y	158. Y	148. Y
MAGNESIUM	mg/L	14.3 Y	13.1 Y	16.5 Y	15.0 Y	44.8 Y	42.0 Y
POTASSIUM	mg/L	4.32 Y	4.32 Y	2.36 Y	2.19 Y	6.37 Y	5.96 Y
SODIUM	mg/L	22.5 Y	21.3 Y	11.9 Y	11.7 Y	23.0 Y	21.4 Y
MAJOR ANIONS							
BICARBONATE	mg/L	--	--	--	--	--	--
CARBONATE	mg/L	--	--	--	--	--	--
FLUORIDE	mg/L	--	--	--	--	--	--
CHLORIDE	mg/L	--	--	--	--	--	--
SULFATE	mg/L	--	--	--	--	--	--

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(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
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(JS) = ESTIMATED due to spike recoveries outside limits
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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

06/03/87

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/05/86 MHE458 SW004003 RUSSELL GULCH AT NORTH CLEAR CREEK		02/05/86 MHE459 SW005003 NORTH CLEAR CREEK BELOW NATIONAL		02/05/86 MHE460 SW006003 NORTH CLEAR CREEK ABOVE NATIONAL	
		DISSOLVED	TOTAL	DISSOLVED	TOTAL	DISSOLVED	TOTAL
FIELD DETERMINATIONS							
TEMPERATURE	C	--	0.70 Y	--	0.60 Y	--	0.30 Y
pH	S.U.	--	6.20 Y	--	6.40 Y	--	6.40 Y
Eh (REDOX POTENTIAL)	MV	--	--	--	332. Y	--	357. Y
SPECIFIC CONDUCTANCE	umhos	--	440. Y	--	460. Y	--	480. Y
DISSOLVED OXYGEN	mg/L	--	--	--	--	4.15 Y	--
Fe+2	mg/L			--	--	--	--
Fe+3	mg/L			--	--	--	--
IRON (TOTAL)	mg/L			--	--	--	--
As+3	mg/L			--	--	--	--
As+5	mg/L			--	--	--	--
DISCHARGE	CFS			--	2.16 Y	--	--
LAB DETERMINATIONS							
GENERAL							
ACIDITY	mg/			--	--	--	--
pH	S.U			--	--	--	--
SPECIFIC CONDUCTANCE	umh			--	--	--	--
TOTAL DISSOLVED SOLIDS	mg/L	--	--	--	--	--	--
TOTAL SUSPENDED SOLIDS	mg/L	--	--	--	--	--	--
TOTAL ORGANIC CARBON	mg/L	--	--	--	--	--	--
MAJOR CATIONS							
CALCIUM	mg/L	49.5 Y	45.3 Y	54.3 Y	49.2 Y	158. Y	148. Y
MAGNESIUM	mg/L	14.3 Y	13.1 Y	16.5 Y	15.0 Y	44.8 Y	42.0 Y
POTASSIUM	mg/L	4.32 Y	4.32 Y	2.36 Y	2.19 Y	6.37 Y	5.96 Y
SODIUM	mg/L	22.5 Y	21.3 Y	11.9 Y	11.7 Y	23.0 Y	21.4 Y
MAJOR ANIONS							
BICARBONATE	mg/L	--	--	--	--	--	--
CARBONATE	mg/L	--	--	--	--	--	--
FLUORIDE	mg/L	--	--	--	--	--	--
CHLORIDE	mg/L	--	--	--	--	--	--
SULFATE	mg/L	--	--	--	--	--	--

creek = NCC (not RCC)

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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/05/86 MHE458 SW004003 RUSSELL GULCH AT NORTH CLEAR CREEK				02/05/86 MHE459 SW005003 NORTH CLEAR CREEK BELOW NATIONAL				02/05/86 MHE460 SW006003 NORTH CLEAR CREEK ABOVE NATIONAL			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	--		--		--		--		--		--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	77.0	Y	199.	Y	23.0	YU	946.	Y	478.	Y	723.	Y
ANTIMONY	ug/L	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS
ARSENIC	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU
BARIUM	ug/L	32.0	Y	28.0	Y	32.0	Y	24.0	Y	17.0	Y	17.0	Y
BERYLLIUM	ug/L	1.00	Y	0.50	Y	1.00	Y	1.50	Y	1.00	Y	1.00	Y
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	4.00	YU	4.00	YU	4.60	Y	4.30	Y	4.00	YU	5.40	Y
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	4.00	YU	4.00	YU	4.00	YU	4.10	Y	4.40	Y	4.00	YU
COBALT	ug/L	6.00	YU	6.00	YU	26.0	Y	24.0	Y	71.0	Y	66.0	Y
COPPER	ug/L	20.0	Y	44.0	Y	43.0	Y	166.	Y	141.	Y	183.	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	124.	Y	230.	Y	16700	Y	20600	Y	20400	Y	25900	Y
LEAD	ug/L	5.00	YUJS	5.00	YU	5.00	YUJS	15.0	Y	5.00	YUJS	21.0	Y
MANGANESE	ug/L	164.	Y	229.	Y	5170	Y	4660	Y	14300	Y	13200	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	9.60	Y	15.0	Y	37.0	Y	36.0	Y	168.	Y	156.	Y
SELENIUM	ug/L	5.00	YU	5.00	YUJS	5.00	YU	5.00	YUJS	0.0000	Y	50.0	YUJS
SILVER	ug/L	4.00	YUJS	4.00	YU	4.00	YUJS	4.00	Y	4.40	YJS	4.00	YU
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	10.0	YUJS	10.0	YUJS	10.0	YUJS	10.0	YUJS	10.0	YUJS	10.0	YUJS
TIN	ug/L	18.0	YU	18.0	YU	18.0	YU	18.0	YU	18.0	YU	18.0	YU
VANADIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
ZINC	ug/L	528.	Y	652.	Y	2000	Y	1870	Y	5150	Y	4860	Y

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Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/05/86 MHE461 SW007003 NATIONAL TUNNEL AT NORTH CLEAR CREEK				02/19/86 MHE469 SW00803 NATIONAL TUNNEL AT PORTAL				02/19/86 MHE423 SW008A03 NATIONAL TUNNEL AT PORTAL (0.1 FILTER SAMPLE)			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		3.50	Y	--		8.50	Y	--		8.50	Y
pH	S.U.	--		5.61	Y	--		6.10	Y	--		6.10	Y
Eh (REDOX POTENTIAL)	MV	--		365.	Y	--		287.	Y	--		287.	Y
SPECIFIC CONDUCTANCE	umhos	--		1130	Y	--		1250	Y	--		1250	Y
DISSOLVED OXYGEN	mg/L	--		--		--		--		--		--	
Fe+2	mg/L	--		--		21.2	Y	--		23.4	Y	--	
Fe+3	mg/L	--		--		10.0	Y	--		7.80	Y	--	
IRON (TOTAL)	mg/L	--		--		31.2	Y	--		31.2	Y	--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		--		--		0.07	Y	--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	--		--		63.0	Y	--		63.0	Y	--	
pH	S.U.	--		--		--		5.52	Y	--		5.65	Y
SPECIFIC CONDUCTANCE	umhos	--		--		--		1390	Y	--		1400	Y
TOTAL DISSOLVED SOLIDS	mg/L	--		--		1320	Y	--		1280	Y	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		--		--		42.0	Y	--		50.0	Y
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	64.4	Y	58.2	Y	207.	Y	196.	Y	195.	Y	186.	Y
MAGNESIUM	mg/L	19.5	Y	17.6	Y	69.4	Y	55.0	Y	65.3	Y	53.5	Y
POTASSIUM	mg/L	2.50	Y	2.27	Y	8.08	Y	7.55	Y	7.74	Y	7.19	Y
SODIUM	mg/L	13.7	Y	12.2	Y	28.8	Y	28.4	Y	27.4	Y	25.9	Y
MAJOR ANIONS													
BICARBONATE	mg/L	--		--		5.00	YU	--		5.00	YU	--	
CARBONATE	mg/L	--		--		5.00	YU	--		5.00	YU	--	
FLUORIDE	mg/L	--		--		0.47	Y	--		0.49	Y	--	
CHLORIDE	mg/L	--		--		3.00	YU	--		3.00	YU	--	
SULFATE	mg/L	--		--		675.	YJC	--		750.	YJC	--	

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/05/86 MHE461 SW007003 NATIONAL TUNNEL AT NORTH CLEAR CREEK				02/19/86 MHE469 SW00803 NATIONAL TUNNEL AT PORTAL				02/19/86 MHE423 SW008A03 NATIONAL TUNNEL AT PORTAL (0.1 FILTER SAMPLE)			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		3.50	Y	--		8.50	Y	--		8.50	Y
pH	S.U.	--		5.61	Y	--		6.10	Y	--		6.10	Y
Eh (REDOX POTENTIAL)	MV	--		365.	Y	--		287.	Y	--		287.	Y
SPECIFIC CONDUCTANCE	umhos	--		1130	Y	--		1250	Y	--		1250	Y
DISSOLVED OXYGEN	mg/L	--		--		--		--		--		--	
Fe+2	mg/L	--		--		21.2	Y	--		23.4	Y	--	
Fe+3	mg/L	--		--						7.80	Y	--	
IRON (TOTAL)	mg/L	--		--						31.2	Y	--	
As+3	mg/L	--		--						--		--	
As+5	mg/L	--		--						--		--	
DISCHARGE	CFS	--		--						--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	--		--						63.0	Y	--	
pH	S.U.	--		--						--		5.65	Y
SPECIFIC CONDUCTANCE	umhos	--		--						--		1400	Y
TOTAL DISSOLVED SOLIDS	mg/L	--		--		1360	Y	--		1280	Y	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		--		--		42.0	Y	--		50.0	Y
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	64.4	Y	58.2	Y	207.	Y	196.	Y	195.	Y	186.	Y
MAGNESIUM	mg/L	19.5	Y	17.6	Y	69.4	Y	55.0	Y	65.3	Y	53.5	Y
POTASSIUM	mg/L	2.50	Y	2.27	Y	8.08	Y	7.55	Y	7.74	Y	7.19	Y
SODIUM	mg/L	13.7	Y	12.2	Y	28.8	Y	28.4	Y	27.4	Y	25.9	Y
MAJOR ANIONS													
BICARBONATE	mg/L	--		--		5.00	YU	--		5.00	YU	--	
CARBONATE	mg/L	--		--		5.00	YU	--		5.00	YU	--	
FLUORIDE	mg/L	--		--		0.47	Y	--		0.49	Y	--	
CHLORIDE	mg/L	--		--		3.00	YU	--		3.00	YU	--	
SULFATE	mg/L	--		--		675.	YJC	--		750.	YJC	--	

SW-08

(not SW--08)

FOOTNOTES

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(--) = Not analyzed
(umhos) = umhos/cm

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(U) = UNDETECTED
(H,HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/05/86 MHE461 SW007003 NATIONAL TUNNEL AT NORTH CLEAR CREEK				02/19/86 MHE469 SW00803 NATIONAL TUNNEL AT PORTAL				02/19/86 MHE423 SW008A03 NATIONAL TUNNEL AT PORTAL (0.1 FILTER SAMPLE)			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		0.10	YU	--		0.10	YU	--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		0.10	YU	--		0.10	YU	--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	--		--		0.10	YU	--		0.10	YU	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	23.0	YU	788.	Y	267.	Y	257.	Y	23.0	YU	243.	Y
ANTIMONY	ug/L	26.0	YUJS	26.0	YUJS	26.0	YU	26.0	YUJS	26.0	YU	26.0	YUJS
ARSENIC	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU
BARIUM	ug/L	26.0	Y	22.0	Y	9.00	YU	9.00	YU	9.00	YU	9.00	YU
BERYLLIUM	ug/L	1.00	Y	1.50	Y	0.40	YU	1.80	YJE	1.20	Y	1.80	YJE
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	4.80	Y	4.10	Y	9.00	YU	4.00	YUJE	4.00	YU	4.20	YJE
CHROMIUM (Cr+6)	ug/L	--		--		10.0	YU	--		10.0	YU	--	
CHROMIUM (TOTAL)	ug/L	5.90	Y	4.00	YU	--		4.70	YU	4.70	Y	4.00	YU
COBALT	ug/L	32.0	Y	23.0	Y	94.0	Y	84.0	Y	91.0	Y	84.0	Y
COPPER	ug/L	48.0	Y	170.	Y	59.0	Y	103.	Y	21.0	Y	96.0	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	23000	Y	26200	Y	41100	Y	46400	Y	36800	Y	44200	Y
LEAD	ug/L	5.00	YUJS	5.00	YU	5.00	YU	11.0	Y	5.00	YU	12.0	Y
MANGANESE	ug/L	6370	Y	5690	Y	13000	Y	16500	Y	17500	Y	15700	Y
MERCURY	ug/L	0.11	Y	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	41.0	Y	39.0	Y	202.	Y	202.	Y	187.	Y	195.	Y
SELENIUM	ug/L	5.00	YU	5.00	YUJS	50.0	YUJS	50.0	YUJS	50.0	YU	50.0	YUJS
SILVER	ug/L	6.00	YJS	4.00	YU	4.00	YUJS	4.00	YUJS	4.00	YU	4.00	YUJS
SILICA	ug/L	--		--		43600	Y	43600	Y	42900	Y	41800	Y
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	10.0	YUJS	10.0	YUJS	10.0	YU	10.0	YUJS	10.0	YU	10.0	YUJS
TIN	ug/L	18.0	YU	18.0	YU	18.0	YU	18.0	YU	18.0	YU	18.0	YU
VANADIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
ZINC	ug/L	2270	Y	2080	Y	6550	Y	6550	Y	6010	Y	5300	Y

FOOTNOTES

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(--) = Not analyzed
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(JC) = ESTIMATED due to instrument calibration problems
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(H,HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/06/86 MHE462 SW009003 NORTH CLEAR CREEK BELOW GREGORY GULCH		02/19/86 MHE472 SW010003 NORTH CLEAR CREEK BELOW GREGORY TAILINGS		02/06/86 MHE463 SW011003 NORTH CLEAR CREEK ABOVE GREGORY TAILINGS	
		DISSOLVED	TOTAL	DISSOLVED	TOTAL	DISSOLVED	TOTAL
FIELD DETERMINATIONS							
TEMPERATURE	C	--	0.50 Y	--	4.30 Y	--	0.0000 Y
pH	S.U.	--	5.65 Y	--	5.60 Y	--	6.30 Y
Eh (REDOX POTENTIAL)	MV	--	--	--	368. Y	--	--
SPECIFIC CONDUCTANCE	umhos	--	490. Y	--	400. Y	--	130. Y
DISSOLVED OXYGEN	mg/L	--	--	--	--	--	--
Fe+2	mg/L	--	--	11.4 Y	--	--	--
Fe+3	mg/L	--	--	6.30 Y	--	--	--
IRON (TOTAL)	mg/L	--	--	17.7 Y	--	--	--
As+3	mg/L	--	--	--	--	--	--
As+5	mg/L	--	--	--	--	--	--
DISCHARGE	CFS	--	--	--	--	--	1.57 Y
LAB DETERMINATIONS							
GENERAL							
ACIDITY	mg/L	--	--	34.0 Y	--	--	--
pH	S.U.	--	--	--	5.53 Y	--	--
SPECIFIC CONDUCTANCE	umhos	--	--	--	494. Y	--	--
TOTAL DISSOLVED SOLIDS	mg/L	--	--	385. Y	--	--	--
TOTAL SUSPENDED SOLIDS	mg/L	--	--	--	18.0 Y	--	--
TOTAL ORGANIC CARBON	mg/L	--	--	--	--	--	--
MAJOR CATIONS							
CALCIUM	mg/L	54.1 Y	52.1 Y	55.6 Y	49.9 Y	13.0 Y	11.8 Y
MAGNESIUM	mg/L	17.0 Y	16.2 Y	19.9 Y	15.2 Y	3.78 Y	3.46 Y
POTASSIUM	mg/L	3.15 Y	2.93 Y	2.22 Y	2.12 Y	1.19 Y	1.15 Y
SODIUM	mg/L	12.6 Y	11.2 Y	10.7 Y	11.9 Y	8.19 Y	6.97 Y
MAJOR ANIONS							
BICARBONATE	mg/L	--	--	5.00 YU	--	--	--
CARBONATE	mg/L	--	--	5.00 YU	--	--	--
FLUORIDE	mg/L	--	--	0.26 Y	--	--	--
CHLORIDE	mg/L	--	--	8.10 Y	--	--	--
SULFATE	mg/L	--	--	182. YJC	--	--	--

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Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/06/86 MHE462 SW009003 NORTH CLEAR CREEK BELOW GREGORY GULCH				02/19/86 MHE472 SW010003 NORTH CLEAR CREEK BELOW GREGORY TAILINGS				02/06/86 MHE463 SW011003 NORTH CLEAR CREEK ABOVE GREGORY TAILINGS			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		0.10	YU	--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		0.10	YU	--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	--		--		0.10	Y	--		--		--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	50.0	Y	716.	Y	299.	Y	254.	Y	85.0	Y	143.	Y
ANTIMONY	ug/L	26.0	YUJS	26.0	YU	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS
ARSENIC	ug/L	10.0	YU	10.0	YUJS	10.0	YU	10.0	YU	10.0	YU	10.0	YU
BARIUM	ug/L	38.0	Y	37.0	Y	27.0	Y	23.0	Y	31.0	Y	31.0	Y
BERYLLIUM	ug/L	11.0	Y	9.70	Y	0.40	Y	0.90	YJE	1.50	Y	1.50	Y
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	14.0	Y	15.0	Y	6.30	Y	4.00	YUJE	4.00	YU	4.00	YU
CHROMIUM (Cr+6)	ug/L	--		--		20.0	YU	--		--		--	
CHROMIUM (TOTAL)	ug/L	12.0	Y	11.0	Y	4.00	YU	4.00	YU	4.00	YU	4.00	YU
COBALT	ug/L	34.0	Y	36.0	Y	26.0	Y	19.0	Y	6.00	YU	6.00	YU
COPPER	ug/L	124.	Y	180.	Y	113.	Y	104.	Y	26.0	Y	41.0	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	22600	Y	23200	Y	24900	Y	21900	Y	498.	Y	322.	Y
LEAD	ug/L	5.00	YUJS	9.60	Y	5.00	YU	7.30	Y	5.00	YUJS	7.00	Y
MANGANESE	ug/L	5140	Y	4920	Y	5680	Y	4710	Y	665.	Y	600.	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	44.0	Y	46.0	Y	16.0	Y	50.0	Y	6.00	YU	6.00	YU
SELENIUM	ug/L	5.00	YU	5.00		5.00	YUJS	50.0	YUJS	5.00	YU	5.00	YUJS
SILVER	ug/L	15.0	YJS	20.0		4.00	YUJS	4.00	YUJS	4.00	YUJS	6.90	Y
SILICA	ug/L	--		--		17500	Y	16800	Y	--		--	
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	10.0	YUJS	10.0	YUJS	10.0	YU	10.0	YUJS	10.0	YUJS	10.0	YUJS
TIN	ug/L	18.0	YU	18.0	YU	18.0	YU	18.0	YU	18.0	YU	18.0	YU
VANADIUM	ug/L	10.0	Y	11.0	Y	5.00	YU	5.00	YU	5.00	YU	5.00	YU
ZINC	ug/L	1920	Y	1840	Y	2040	Y	1680	Y	849.	Y	778.	Y

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/20/86 MHE475 SW01203 GREGORY TAILINGS AT NORTH CLEAR CREEK				02/20/86 MHE429 SW012A03 GREGORY TAILINGS AT N. CLEAR CR. (0.1 FILT.)				02/06/86 MHE465 SW014003 GREGORY GULCH ABOVE NORTH CLEAR CREEK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		9.00	Y	--		9.00	Y	--		0.0000	Y
pH	S.U.	--		4.86	Y	--		4.86	Y	--		5.40	Y
Eh (REDOX POTENTIAL)	MV	--		446.	Y	--		446.	Y	--		--	
SPECIFIC CONDUCTANCE	umhos	--		1540	Y	--		1540	Y	--		240.	YUJHT
DISSOLVED OXYGEN	mg/L	--		--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		0.19	Y	--		0.19	Y	--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	5.00	YU	--		283.	Y	--		--		--	
pH	S.U.	--		4.68	Y	--		4.81	Y	--		--	
SPECIFIC CONDUCTANCE	umhos	--		2160	Y	--		2170	Y	--		--	
TOTAL DISSOLVED SOLIDS	mg/L	2300	Y	--		2310	Y	--		--		--	
TOTAL SUSPENDED SOLIDS	mg/L	--		6.50	Y	--		6.50	Y	--		--	
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	266.	Y	287.	Y	284.	Y	276.	Y	24.3	Y	22.4	Y
MAGNESIUM	mg/L	95.7	Y	83.9	Y	102.	Y	81.7	Y	8.05	Y	7.42	Y
POTASSIUM	mg/L	7.42	Y	7.53	Y	7.79	Y	7.24	Y	2.50	Y	2.39	Y
SODIUM	mg/L	28.8	Y	30.0	Y	29.6	Y	29.0	Y	8.15	Y	8.23	Y
MAJOR ANIONS													
BICARBONATE	mg/L	5.00	YU	--		5.00	YU	--		--		--	
CARBONATE	mg/L	5.00	YU	--		5.00	YU	--		--		--	
FLUORIDE	mg/L	1.20	Y	--		1.20	Y	--		--		--	
CHLORIDE	mg/L	5.50	Y	--		4.50	Y	--		--		--	
SULFATE	mg/L	1420	YJC	--		1560	Y	--		--		--	

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/20/86 MHE475 SW01203 GREGORY TAILINGS AT NORTH CLEAR CREEK				02/20/86 MHE429 SW012A03 GREGORY TAILINGS AT N. CLEAR CR. (0.1 FILT.)				02/06/86 MHE465 SW014003 GREGORY GULCH ABOVE NORTH CLEAR CREEK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	0.22	Y	--		0.22	Y	--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	0.10	YU	--		0.31	Y	--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	0.10	YU	--		0.10	YU	--		--		--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	2670	Y	2580	Y	2770	Y	2480	Y	187.	Y	1480	Y
ANTIMONY	ug/L	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YU	26.0	YUJS
ARSENIC	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU
BARIUM	ug/L	9.00	YU	9.00	YU	9.00	YU	9.00	YU	27.0	Y	26.0	Y
BERYLLIUM	ug/L	4.90	Y	5.70	YJE	4.90	Y	4.80	Y	1.00	Y	1.00	Y
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	14.0	Y	11.0	YJE	11.0	Y	10.0	Y	16.0	Y	16.0	Y
CHROMIUM (Cr+6)	ug/L	100.	YU	--		50.0	YU	--		--		--	
CHROMIUM (TOTAL)	ug/L	5.60	YU	4.00	YU	6.70	Y	4.00	Y	4.00	YU	4.00	YU
COBALT	ug/L	143.	Y	149.	Y	154.	Y	140.	Y	7.50	Y	6.00	YU
COPPER	ug/L	578.	Y	594.	Y	624.	Y	571.	Y	352.	Y	434.	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	143000	Y	148000	Y	153000	Y	142000	Y	1370	Y	2700	Y
LEAD	ug/L	14.0	Y	25.0	Y	31.0	Y	31.0	Y	8.40	YUJS	72.0	Y
MANGANESE	ug/L	29100	Y	29.6	Y	31000	Y	28300	Y	1410	Y	1270	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	171.	Y	199.	Y	183.	Y	188.	Y	18.0	Y	16.0	Y
SELENIUM	ug/L	50.0	YUJS	50.0	YUJS	50.0	YUJS	50.0	YUJS	5.00	YU	5.00	YUJS
SILVER	ug/L	4.00	YUJS	4.00	YUJS	4.00	YUJS	4.00	YUJS	4.00	YUJS	5.80	Y
SILICA	ug/L	37500	Y	38600	Y	37900	Y	35900	Y	--		--	
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	10.0	YU	10.0	YUJS	10.0	YU	10.0	YUJS	10.0	YUJS	10.0	YUJS
TIN	ug/L	18.0	YU	18.0	YU	18.0	YU	18.0	YU	18.0	YU	18.0	YU
VANADIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
ZINC	ug/L	6090	Y	5980	Y	6400	Y	5790	Y	3110	Y	2830	Y

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(umhos) = umhos/cm
(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(H,HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/06/86 MHE466 SW015003 GREGORY GULCH ABOVE CENTRAL CITY				02/19/86 MHE482 SW02003 ARGO TUNNEL AT PORTAL				02/19/86 MHE428 SW020A03 ARGO TUNNEL AT PORTAL (0.1 FILTERED SAMPLE)			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		1.00	Y	--		16.0	Y	--		16.0	Y
pH	S.U.	--		6.25	Y	--		2.50	Y	--		2.50	Y
Eh (REDOX POTENTIAL)	MV	--		--		--		725.	Y	--		725.	Y
SPECIFIC CONDUCTANCE	umhos	--		130.	Y	--		2990	Y	--		2990	Y
DISSOLVED OXYGEN	mg/L	--		--		--		--		--		--	
Fe+2	mg/L	--		--		28.6	Y	--		19.9	Y	--	
Fe+3	mg/L	--		--		111.	Y	--		119.	Y	--	
IRON (TOTAL)	mg/L	--		--		140.	Y	--		139.	Y	--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		--		--		0.46	Y	--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	--		--		604.	Y	--		621.	Y	--	
pH	S.U.	--		--		--		3.03	Y	--		3.02	Y
SPECIFIC CONDUCTANCE	umhos	--		--		--		2950	Y	--		2950	Y
TOTAL DISSOLVED SOLIDS	mg/L	--		--		3470	Y	--		3460	Y	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		--		--		9.50	Y	--		3.50	Y
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	15.0	Y	14.0	Y	333.	Y	313.	Y	344.	Y	258.	Y
MAGNESIUM	mg/L	4.41	Y	4.02	Y	134.	Y	106.	Y	138.	Y	88.5	Y
POTASSIUM	mg/L	1.57	Y	1.49	Y	3.97	Y	3.57	Y	4.10	Y	2.94	Y
SODIUM	mg/L	3.99	Y	4.11	Y	27.7	Y	26.1	Y	28.8	Y	22.2	Y
MAJOR ANIONS													
BICARBONATE	mg/L	--		--		5.00	YU	--		5.00	YU	--	
CARBONATE	mg/L	--		--		5.00	YU	--		5.00	YU	--	
FLUORIDE	mg/L	--		--		2.40	Y	--		2.50	Y	--	
CHLORIDE	mg/L	--		--		3.00	YU	--		3.00	YU	--	
SULFATE	mg/L	--		--		2250	YJC	--		2220	YJC	--	

FOOTNOTES

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(I) = QUANTIFIED due to exceeding ICP linear range
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(EJ) = ESTIMATED due to interference problems (ICP serial dilution or low spike recovery by graphite furnance)
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(umhos) = umhos/cm

(J) = ESTIMATED
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(U) = UNDETECTED
(H_2HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/06/86 MHE466 SW015003 GREGORY GULCH ABOVE CENTRAL CITY				02/19/86 MHE482 SW02003 ARGO TUNNEL AT PORTAL				02/19/86 MHE428 SW020A03 ARGO TUNNEL AT PORTAL (0.1 FILTERED SAMPLE)			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		0.10	YU	--		0.10	YU	--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		0.10	YU	--		0.10	YU	--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	--		--		0.10	YU	--		0.10	YU	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	23.0	YU	50.0	Y	19000	Y	16200	Y	19600	Y	13400	Y
ANTIMONY	ug/L	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS	30.0	YJS	26.0	YUJS
ARSENIC	ug/L	10.0	YU	10.0	YU	64.0	Y	71.0	Y	60.0	Y	68.0	Y
BARIUM	ug/L	25.0	Y	26.0	Y	9.00	YU	9.00	YU	9.00	YU	9.00	YU
BERYLLIUM	ug/L	0.50	Y	0.50	Y	12.0	Y	12.0	YJE	12.0	Y	9.70	YJE
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	4.00	YU	4.00	YU	128.	Y	111.	YJE	134.	Y	94.0	YJE
CHROMIUM (Cr+6)	ug/L	--		--		200.	YU	--		200.	YU	--	
CHROMIUM (TOTAL)	ug/L	4.00	YU	4.00	YU	16.0	Y	16.0	Y	21.0	Y	16.0	Y
COBALT	ug/L	6.00	YU	6.00	YU	139.	Y	122.	Y	143.	Y	102.	Y
COPPER	ug/L	8.30	Y	13.0	Y	4590	Y	4100	Y	4750	Y	3360	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	322.	Y	788.	Y	147000	Y	132000	Y	152000	Y	109000	Y
LEAD	ug/L	5.00	YUJS	5.00	YU	25.0	Y	23.0	Y	21.0	Y	20.0	Y
MANGANESE	ug/L	683.	Y	628.	Y	91000	Y	80400	Y	94300	Y	66500	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	6.00	YU	6.00	YU	187.	Y	191.	Y	194.	Y	157.	Y
SELENIUM	ug/L	5.00	YU	5.00	YUJS	50.0	YUJS	50.0	YUJS	50.0	YUJS	50.0	YUJS
SILVER	ug/L	4.00	YUJS	4.30	Y	4.00	YUJS	4.00	YUJS	4.00	YUJS	4.00	YUJS
SILICA	ug/L	--		--		45800	Y	47400	Y	49000	Y	36900	Y
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		100.	YJS
THALLIUM	ug/L	10.0	YUJS	10.0	YUJS	10.0	YU	10.0	YUJS	10.0	YU	10.0	YUJS
TIN	ug/L	18.0	YU	18.0	YU	18.0	YU	18.0	YU	18.0	YU	18.0	YU
VANADIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
ZINC	ug/L	289.	Y	268.	Y	43400	Y	37800	Y	44800	Y	31600	Y

FOOTNOTES

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(UJ,HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/25/86 MHE434 SW021AA03 CLEAR CREEK BELOW ARGO (0.1 FILTERED SAMPLE)				02/25/86 MHE437 SW021AC03 CLEAR CREEK BELOW ARGO (0.1 FILTERED SAMPLE)				02/25/86 MHE571 SW021AD03 CLEAR CREEK BELOW ARGO (0.1 FILTERED SAMPLE)			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		11.0	Y	--		12.5	Y	--		--	
pH	S.U.	--		3.43	Y	--		5.25	Y	--		--	
Eh (REDOX POTENTIAL)	MV	--		720.	Y	--		504.	Y	--		--	
SPECIFIC CONDUCTANCE	umhos	--		1030	Y	--		250.	Y	--		--	
DISSOLVED OXYGEN	mg/L	--		--		--		--		--		--	
Fe+2	mg/L	5.70	Y	--		0.48	Y	--		1.35	Y	--	
Fe+3	mg/L	21.9	Y	--		0.05	Y	--		0.95	Y	--	
IRON (TOTAL)	mg/L	27.6	Y	--		0.53	Y	--		2.40	Y	--	
As+3	mg/L	0.01	YU	--		0.01	YU	--		0.01	YU	--	
As+5	mg/L	0.01	YU	--		0.01	YU	--		0.01	YU	--	
DISCHARGE	CFS	--		--		--		--		--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	176.	Y	--		15.0	Y	--		--		--	
pH	S.U.	--		3.14	Y	--		4.99	Y	--		--	
SPECIFIC CONDUCTANCE	umhos	--		1500	Y	--		558.	Y	--		--	
TOTAL DISSOLVED SOLIDS	mg/L	1230	Y	--		440.	Y	--		--		--	
TOTAL SUSPENDED SOLIDS	mg/L	--		56.0	Y	--		24.0	Y	--		--	
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	135.	Y	128.	Y	58.0	Y	58.2	Y	78.4	Y	74.5	Y
MAGNESIUM	mg/L	48.6	Y	46.5	Y	19.2	Y	19.5	Y	27.4	Y	26.6	Y
POTASSIUM	mg/L	4.18	Y	3.36	Y	3.35	Y	3.23	Y	3.77	Y	3.58	Y
SODIUM	mg/L	20.7	Y	18.7	Y	17.8	Y	17.8	Y	19.5	Y	17.4	Y
MAJOR ANIONS													
BICARBONATE	mg/L	5.00	YU	--		5.00	YU	--		--		--	
CARBONATE	mg/L	5.00	YU	--		5.00	YU	--		--		--	
FLUORIDE	mg/L	1.50	Y	--		1.10	Y	--		--		--	
CHLORIDE	mg/L	3.00	YU	--		3.00	YU	--		--		--	
SULFATE	mg/L	775.	Y	--		269.	Y	--		--		--	

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(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/25/86 MHE434 SW021AA03 CLEAR CREEK BELOW ARGO (0.1 FILTERED SAMPLE)				02/25/86 MHE437 SW021AC03 CLEAR CREEK BELOW ARGO (0.1 FILTERED SAMPLE)				02/25/86 MHE571 SW021AD03 CLEAR CREEK BELOW ARGO (0.1 FILTERED SAMPLE)			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	0.10	Y	--		0.10	YU	--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	0.10	YU	--		0.10	YU	--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	0.26	Y	--		0.25	Y	--		--		--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	6360	YJS	6380	YJS	1190	YJS	2180	YJS	3250	YJS	3230	YJS
ANTIMONY	ug/L	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS
ARSENIC	ug/L	13.0	Y	10.0	Y	10.0	YU	10.0	YU	10.0	YU	10.0	YU
BARIUM	ug/L	33.0	Y	14.0	Y	27.0	Y	25.0	Y	26.0	Y	26.0	Y
BERYLLIUM	ug/L	4.70	Y	5.20	Y	1.40	Y	2.10	Y	4.70	Y	8.30	Y
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	47.0	Y	42.0	Y	15.0	Y	18.0	Y	26.0	Y	26.0	Y
CHROMIUM (Cr+6)	ug/L	10.0	YU	--		10.0	YU	--		10.0	YU	--	
CHROMIUM (TOTAL)	ug/L	12.0	Y	5.80	Y	4.60	Y	4.00	YU	6.20	Y	11.0	Y
COBALT	ug/L	49.0	Y	46.0	Y	14.0	Y	18.0	Y	24.0	Y	29.0	Y
COPPER	ug/L	1620	Y	1590	Y	392.	Y	519.	Y	805.	Y	795.	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	41700	Y	40200	YJE	552.	Y	15700	YJE	3630	Y	23600	YJE
LEAD	ug/L	50.0	YURS	13.0	Y	5.00	YURS	7.70	Y	5.00	YURS	7.00	Y
MANGANESE	ug/L	32500	Y	32200	Y	10800	Y	11300	Y	16700	Y	16500	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	81.0	YJE	76.0	Y	27.0	YJE	27.0	Y	43.0	YJE	45.0	Y
SELENIUM	ug/L	50.0	YURS	50.0	YUR	5.00	YURS	5.00	YUR	5.00	YURS	50.0	YUR
SILVER	ug/L	4.00	YUJS	4.00	YUJS	4.00	YUJS	4.00	YUJS	4.00	YUJS	8.90	YJS
SILICA	ug/L	25600	Y	24600	Y	16000	Y	16800	Y	17900	Y	17500	Y
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU
TIN	ug/L	18.0	YU	18.0	YU	18.0	YU	18.0	YU	18.0	YU	18.0	YU
VANADIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
ZINC	ug/L	15900	Y	14800	Y	5130	Y	5110	Y	8080	Y	7460	Y

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(--) = Not analyzed
(umhos) = umhos/cm

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(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/25/86 MHE569 SW021AH03 CLEAR CREEK BELOW ARGO (0.1 FILTERED SAMPLE)				02/25/86 MHE572 SW021B03 CLEAR CREEK BELOW ARGO				02/25/86 MHE440 SW021E03 CLEAR CREEK BELOW ARGO			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		11.5	Y	--		11.0	Y	--		12.5	Y
pH	S.U.	--		6.39	Y	--		3.43	Y	--		5.11	Y
Eh (REDOX POTENTIAL)	MV	--		435.	Y	--		720.	Y	--		--	
SPECIFIC CONDUCTANCE	umhos	--		--		--		1030	Y	--		250.	Y
DISSOLVED OXYGEN	mg/L	--		--		--		--		--		--	
Fe+2	mg/L	0.05	Y	--		3.40	Y	--		0.58	Y	--	
Fe+3	mg/L	0.02	Y	--		18.4	Y	--		0.01	Y	--	
IRON (TOTAL)	mg/L	0.07	Y	--		21.8	Y	--		0.59	Y	--	
As+3	mg/L	0.01	YU	--		0.01	YU	--		0.01	YU	--	
As+5	mg/L	0.01	YU	--		0.01	YU	--		0.01	YU	--	
DISCHARGE	CFS	--		--		--		--		--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	5.00	YU	--		203.	Y	--		26.0	Y	--	
pH	S.U.	--		5.98	Y	--		3.04	Y	--		4.60	Y
SPECIFIC CONDUCTANCE	umhos	--		426.	Y	--		1670	Y	--		599.	Y
TOTAL DISSOLVED SOLIDS	mg/L	320.	Y	--		1430	Y	--		475.	Y	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		31.0	Y	--		58.0	Y	--		24.0	Y
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	44.0	Y	41.2	Y	151.	Y	143.	Y	62.9	Y	61.0	Y
MAGNESIUM	mg/L	14.0	Y	13.3	Y	54.3	Y	53.0	Y	21.1	Y	20.6	Y
POTASSIUM	mg/L	3.52	Y	3.19	Y	3.82	Y	3.35	Y	3.74	Y	3.42	Y
SODIUM	mg/L	18.1	Y	16.9	Y	21.4	Y	20.4	Y	18.4	Y	17.9	Y
MAJOR ANIONS													
BICARBONATE	mg/L	28.0	Y	--		5.00	YU	--		5.00	YU	--	
CARBONATE	mg/L	5.00	YU	--		5.00	YU	--		5.00	YU	--	
FLUORIDE	mg/L	0.92	Y	--		1.70	Y	--		1.10	Y	--	
CHLORIDE	mg/L	3.00	YU	--		3.00	YU	--		3.00	YU	--	
SULFATE	mg/L	182.	Y	--		905.	Y	--		299.	Y	--	

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Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/25/86 MHE569 SW021AH03 CLEAR CREEK BELOW ARGO (0.1 FILTERED SAMPLE)				02/25/86 MHE572 SW021B03 CLEAR CREEK BELOW ARGO				02/25/86 MHE440 SW021E03 CLEAR CREEK BELOW ARGO			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	0.10	YU	--		0.10	YU	--		0.10	YU	--	
NITRITE (NO2) (NO2-N)	mg/L	0.10	YU	--		0.10	YU	--		0.10	YU	--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	0.30	Y	--		0.10	YU	--		0.31	Y	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	148.	YJS	1420	YJS	7310	Y	7240	YJS	1760	YJS	2350	YJS
ANTIMONY	ug/L	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS
ARSENIC	ug/L	10.0	YU	10.0	YU	13.0	Y	23.0	Y	10.0	YU	10.0	YU
BARIUM	ug/L	27.0	Y	27.0	Y	23.0	Y	12.0	Y	26.0	Y	24.0	Y
BERYLLIUM	ug/L	0.40	YU	1.30	Y	5.20	Y	6.00	Y	1.40	Y	2.10	Y
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	5.30	Y	7.50	Y	55.0	Y	51.0	Y	16.0	Y	15.0	Y
CHROMIUM (Cr+6)	ug/L	10.0	YU	--		100.	YU	--		10.0	YU	--	
CHROMIUM (TOTAL)	ug/L	4.00	YU	4.00	YU	12.0	Y	7.50	Y	4.00	YU	5.50	Y
COBALT	ug/L	6.00	YU	12.0	Y	56.0	Y	56.0	Y	15.0	Y	18.0	Y
COPPER	ug/L	54.0	Y	289.	Y	1830	Y	1800	Y	506.	Y	567.	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	192.	Y	8100	YJE	47400	Y	54700	YJE	592.	Y	17000	YJE
LEAD	ug/L	5.00	YURS	7.00	Y	50.0	YURS	15.0	Y	5.00	YURS	5.80	Y
MANGANESE	ug/L	6550	Y	6440	Y	36900	Y	36800	Y	12100	Y	12200	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	17.0	YJE	18.0	Y	91.0	YJE	86.0	Y	31.0	YJE	28.0	Y
SELENIUM	ug/L	5.00	YURS	5.00	YUR	50.0	YURS	50.0	YUR	5.00	YURS	50.0	YUR
SILVER	ug/L	4.00	YUJS	4.00	YU	4.00	YUJS	4.60	YJS	4.00	YUJS	4.00	YUJS
SILICA	ug/L	13600	Y	15400	Y	26500	Y	26500	Y	16500	Y	17400	Y
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU
TIN	ug/L	18.0	YU	18.0	YU	18.0	YU	18.0	YU	18.0	YU	18.0	YU
VANADIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
ZINC	ug/L	2840	Y	2800	Y	18100	Y	16900	Y	5750	Y	5570	Y

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Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/25/86 MHE570 SW021F03 CLEAR CREEK BELOW ARGO				02/25/86 MHE443 SW021G03 CLEAR CREEK BELOW ARGO				02/19/86 MHE485 SW023003 BIG FIVE AT PORTAL			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		9.50	Y	--		11.5	Y	--		13.0	Y
pH	S.U.	--		3.90	Y	--		6.39	Y	--		2.80	Y
Eh (REDOX POTENTIAL)	MV	--		580.	Y	--		435.	Y	--		675.	Y
SPECIFIC CONDUCTANCE	umhos	--		440.	Y	--		--		--		2980	Y
DISSOLVED OXYGEN	mg/L	--		--		--		--		--		--	
Fe+2	mg/L	1.25	Y	--		0.08	Y	--		34.1	Y	--	
Fe+3	mg/L	0.55	Y	--		0.22	Y	--		18.2	Y	--	
IRON (TOTAL)	mg/L	1.80	Y	--		0.30	Y	--		52.3	Y	--	
As+3	mg/L	0.01	YU	--		0.01	YU	--		--		--	
As+5	mg/L	0.01	YU	--		--		--		--		--	
DISCHARGE	CFS	--		--		--		--		--		0.03	Y
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	74.0	Y	--		5.00	YU	--		305.	Y	--	
pH	S.U.	--		3.55	Y	--		5.85	Y	--		3.12	Y
SPECIFIC CONDUCTANCE	umhos	--		806.	Y	--		427.	Y	--		2900	Y
TOTAL DISSOLVED SOLIDS	mg/L	635.	Y	--		310.	Y	--		3120	Y	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		38.0	Y	--		30.0	Y	--		14.0	Y
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	76.6	Y	74.6	Y	43.3	Y	39.8	Y	365.	Y	367.	Y
MAGNESIUM	mg/L	26.5	Y	26.0	Y	13.7	Y	12.8	Y	165.	Y	137.	Y
POTASSIUM	mg/L	3.52	Y	3.27	Y	3.45	Y	3.04	Y	11.2	Y	9.76	Y
SODIUM	mg/L	18.2	Y	17.8	Y	18.1	Y	15.8	Y	49.6	Y	46.8	Y
MAJOR ANIONS													
BICARBONATE	mg/L	5.00	YU	--		27.0	Y	--		5.00	YU	--	
CARBONATE	mg/L	5.00	YU	--		5.00	YU	--		5.00	YU	--	
FLUORIDE	mg/L	1.20	Y	--		0.92	Y	--		1.40	Y	--	
CHLORIDE	mg/L	3.00	YU	--		3.00	YU	--		3.00	YU	--	
SULFATE	mg/L	374.	Y	--		178.	Y	--		1750	Y	--	

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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/25/86 MHE570 SW021F03 CLEAR CREEK BELOW ARGO				02/25/86 MHE443 SW021G03 CLEAR CREEK BELOW ARGO				02/19/86 MHE485 SW023003 BIG FIVE AT PORTAL			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	0.10	YU	--		0.10	YU	--		0.10	YU	--	
NITRITE (NO2) (NO2-N)	mg/L	0.10	YU	--		0.10	YU	--		0.10	YU	--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	0.16	Y	--		0.28	Y	--		0.10	YU	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	3110	YJS	3260	YJS	195.	YJS	1380	YJS	14100	Y	12600	Y
ANTIMONY	ug/L	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS	35.0	Y	26.0	YU
ARSENIC	ug/L	10.0	YU	11.0	Y	10.0	YU	10.0	YU	10.0	YU	10.0	YU
BARIUM	ug/L	25.0	Y	23.0	Y	27.0	Y	26.0	Y	9.00	YU	9.00	YU
BERYLLIUM	ug/L	2.20	Y	2.90	Y	0.40	YU	1.30	Y	21.0	Y	14.0	Y
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	23.0	Y	23.0	Y	8.40	Y	7.00	Y	48.0	Y	34.0	Y
CHROMIUM (Cr+6)	ug/L	10.0	YU	--		10.0	YU	--		100.	YU	--	
CHROMIUM (TOTAL)	ug/L	4.70	Y	6.30	Y	4.00	YU	4.00	YU	30.0	Y	20.0	Y
COBALT	ug/L	20.0	Y	24.0	Y	6.00	YU	7.20	Y	141.	Y	128.	Y
COPPER	ug/L	779.	Y	785.	Y	62.0	Y	285.	Y	1370	Y	1290	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	3400	Y	23700	YJE	212.	Y	7850	YJE	57600	Y	56200	Y
LEAD	ug/L	5.00	YURS	14.0	Y	5.00	YURS	5.00	YU	53.0	Y	18.0	Y
MANGANESE	ug/L	16200	Y	16400	Y	6460	Y	6220	Y	31400	Y	29400	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	40.0	YJE	41.0	Y	14.0	YJE	18.0	Y	241.	Y	247.	Y
SELENIUM	ug/L	5.00	YURS	50.0	YUR	5.00	YURS	5.00	YUR	50.0	YU	50.0	YU
SILVER	ug/L	4.00	YUJS	4.50	YJS	4.00	YUJS	4.00	YUJS	17.0	Y	14.0	Y
SILICA	ug/L	18000	Y	19100	Y	13800	Y	15600	Y	44400	Y	41400	Y
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU
TIN	ug/L	18.0	YU	18.0	YU	18.0	YU	18.0	YU	31.0	Y	18.0	YU
VANADIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	13.0	Y	5.60	Y
ZINC	ug/L	7740	Y	7440	Y	2830	Y	2710	Y	9420	Y	8390	Y

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/06/86 MHE468 SW024003 BIG FIVE AT CLEAR CREEK		02/05/86 MHE515 SW025003 BOOMERANG GULCH		02/05/86 MHE516 SW026003 VIRGINIA CANYON ABOVE CLEAR CREEK	
		DISSOLVED	TOTAL	DISSOLVED	TOTAL	DISSOLVED	TOTAL
FIELD DETERMINATIONS							
TEMPERATURE	C	--	4.00 Y	--	0.50 Y	--	0.50 Y
pH	S.U.	--	2.53 Y	--	2.90 Y	--	3.10 Y
Eh (REDOX POTENTIAL)	MV	--	--	--	667. Y	--	747. Y
SPECIFIC CONDUCTANCE	umhos	--	3260 Y	--	3080 Y	--	2200 Y
DISSOLVED OXYGEN	mg/L	--	--	--	--	--	--
Fe+2	mg/L	--	--	--	--	--	--
Fe+3	mg/L	--	--	--	--	--	--
IRON (TOTAL)	mg/L	--	--	--	--	--	--
As+3	mg/L	--	--	--	--	--	--
As+5	mg/L	--	--	--	--	--	--
DISCHARGE	CFS	--	--	--	0.004 Y	--	--
LAB DETERMINATIONS							
GENERAL							
ACIDITY	mg/L	--	--	--	--	--	--
pH	S.U.	--	--	--	--	--	--
SPECIFIC CONDUCTANCE	umhos	--	--	--	--	--	--
TOTAL DISSOLVED SOLIDS	mg/L	--	--	--	--	--	--
TOTAL SUSPENDED SOLIDS	mg/L	--	--	--	--	--	--
TOTAL ORGANIC CARBON	mg/L	--	--	--	--	--	--
MAJOR CATIONS							
CALCIUM	mg/L	399. Y	378. Y	415. Y	374. Y	302. Y	257. Y
MAGNESIUM	mg/L	151. Y	141. Y	142. Y	128. Y	122. Y	104. Y
POTASSIUM	mg/L	8.20 Y	7.75 Y	1.42 YU	1.74 Y	3.17 Y	3.00 Y
SODIUM	mg/L	47.4 Y	45.8 Y	21.0 Y	19.2 Y	22.7 Y	20.1 Y
MAJOR ANIONS							
BICARBONATE	mg/L	--	--	--	--	--	--
CARBONATE	mg/L	--	--	--	--	--	--
FLUORIDE	mg/L	--	--	--	--	--	--
CHLORIDE	mg/L	--	--	--	--	--	--
SULFATE	mg/L	--	--	--	--	--	--

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/06/86 MHE468 SW024003 BIG FIVE AT CLEAR CREEK				02/05/86 MHE515 SW025003 BOOMERANG GULCH				02/05/86 MHE516 SW026003 VIRGINIA CANYON ABOVE CLEAR CREEK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	--		--		--		--		--		--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	14400	Y	13700	Y	49100	Y	47700	Y	64800	Y	56300	Y
ANTIMONY	ug/L	26.0	YUJS	26.0	YUJS	52.0	YUJS	52.0	YUJS	26.0	YUJS	26.0	YUJS
ARSENIC	ug/L	10.0	YU	10.0	YU	21.0	Y	32.0	Y	173.	Y	129.	Y
BARIUM	ug/L	9.00	YU	9.00	YU	18.0	YU	28.0	Y	9.00	YU	9.00	YU
BERYLLIUM	ug/L	5.30	Y	5.30	Y	21.0	Y	20.0	Y	16.0	Y	16.0	Y
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	23.0	Y	20.0	Y	423.	Y	386.	Y	466.	Y	390.	Y
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	17.0	Y	20.0	Y	62.0	Y	65.0	Y	57.0	Y	42.0	Y
COBALT	ug/L	134.	Y	127.	Y	296.	Y	286.	Y	302.	Y	248.	Y
COPPER	ug/L	1480	Y	1410	Y	5160	Y	4720	Y	9240	Y	7810	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	26700	Y	25500	Y	17100	Y	21000	Y	4140	Y	4840	Y
LEAD	ug/L	5.00	YUJS	5.00	YU	50.0	YUJS	101.	Y	65.0	Y	57.0	Y
MANGANESE	ug/L	33100	Y	31000	Y	134000	Y	122000	Y	90500	Y	75700	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.23	Y	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	271.	Y	260.	Y	558.	Y	508.	Y	779.	Y	663.	Y
SELENIUM	ug/L	--		--		5.00	YU	5.00	YUJS	0.0000	YJS	5.00	YUJS
SILVER	ug/L	5.30	YJS	5.70	Y	8.00	YUJS	8.00	YU	6.20	YJS	4.00	YU
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	10.0	YUJS	10.0	YU	10.0	YUJS	10.0	YUJS	10.0	YUJS	10.0	YUJS
TIN	ug/L	18.0	YU	18.0	YU	36.0	YU	36.0	YU	22.0	Y	18.0	YU
VANADIUM	ug/L	5.00	YU	5.00	YU	10.0	YU	10.0	YU	5.00	YU	5.00	YU
ZINC	ug/L	9390	Y	8940	Y	96800	Y	89800	Y	91200	Y	76800	Y

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/20/86 MHE431 SW022003 CLEAR CREEK ABOVE BIG FIVE				02/05/86 MHE519 SW029003 CLEAR CREEK ABOVE BIG FIVE				02/05/86 MHE520 SW030003 SODA CREEK ABOVE CLEAR CREEK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		5.00	Y	--		0.50	Y	--		2.70	Y
pH	S.U.	--		6.80	Y	--		6.70	Y	--		6.55	Y
Eh (REDOX POTENTIAL)	MV	--		334.	Y	--		--		--		--	
SPECIFIC CONDUCTANCE	umhos	--		260.	Y	--		250.	Y	--		270.	Y
DISSOLVED OXYGEN	mg/L	--		--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		35.4	Y	--		--		--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	5.00	YU	--		--		--		--		--	
pH	S.U.	--		7.50	Y	--		--		--		--	
SPECIFIC CONDUCTANCE	umhos	--		280.	Y	--		--		--		--	
TOTAL DISSOLVED SOLIDS	mg/L	175.	Y	--		--		--		--		--	
TOTAL SUSPENDED SOLIDS	mg/L	--		2.00	YU	--		--		--		--	
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	25.9	Y	27.2	Y	29.3	Y	25.2	Y	19.8	Y	18.1	Y
MAGNESIUM	mg/L	6.97	Y	6.00	Y	7.12	Y	6.34	Y	5.76	Y	5.32	Y
POTASSIUM	mg/L	3.19	Y	3.20	Y	3.13	Y	2.56	Y	5.98	Y	5.04	Y
SODIUM	mg/L	17.8	Y	18.9	Y	15.9	Y	13.7	Y	38.2	Y	33.0	Y
MAJOR ANIONS													
BICARBONATE	mg/L	67.0	Y	--		--		--		--		--	
CARBONATE	mg/L	5.00	YU	--		--		--		--		--	
FLUORIDE	mg/L	1.00	Y	--		--		--		--		--	
CHLORIDE	mg/L	3.30	Y	--		--		--		--		--	
SULFATE	mg/L	53.0	YJC	--		--		--		--		--	

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(--) = Not analyzed
(umhos) = umhos/cm
(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(H,HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/20/86 MHE431 SW022003 CLEAR CREEK ABOVE BIG FIVE				02/05/86 MHE519 SW029003 CLEAR CREEK ABOVE BIG FIVE				02/05/86 MHE520 SW030003 SODA CREEK ABOVE CLEAR CREEK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	0.10	YU	--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	0.10	YU	--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	0.46	Y	--		--		--		--		--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	67.0	Y	165.	Y	296.	Y	779.	Y	38.0	Y	389.	Y
ANTIMONY	ug/L	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS
ARSENIC	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU
BARIUM	ug/L	28.0	Y	30.0	Y	33.0	Y	28.0	Y	34.0	Y	26.0	Y
BERYLLIUM	ug/L	0.40	YU	0.40	YJE	0.50	Y	1.00	Y	1.00	Y	0.50	Y
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	4.00	YU	4.00	YUJE	4.00	YU	4.00	YU	4.00	YU	4.00	YU
CHROMIUM (Cr+6)	ug/L	10.0	YU	--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	4.00	YU	4.00	YU	5.20	Y	4.90	Y	4.00	YU	4.00	YU
COBALT	ug/L	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU
COPPER	ug/L	5.40	Y	20.0	Y	44.0	Y	100.	Y	4.50	Y	47.0	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	25.0	Y	243.	Y	21.0	Y	311.	Y	120.	Y	456.	Y
LEAD	ug/L	5.00	YU	5.00	YU	5.00	YUJS	5.10	Y	5.00	YUJS	5.00	YU
MANGANESE	ug/L	1430	Y	1420	Y	1910	Y	2160	Y	89.0	Y	507.	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	6.00	YU	6.00	YU	6.00	YU	7.30	Y	6.00	YU	6.00	YU
SELENIUM	ug/L	5.00	YUJS	5.00	YUJS	5.00	YU	5.00	YUJS	5.00	YU	5.00	YUJS
SILVER	ug/L	4.00	YUJS	4.00	YUJS	4.00	YUJS	4.00	YU	4.00	YUJS	4.00	YU
SILICA	ug/L	11800	Y	11300	Y	--		--		--		--	
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	10.0	YU	10.0	YUJS	10.0	YUJS	10.0	YUJS	10.0	YUJS	10.0	YUJS
TIN	ug/L	18.0	YU	18.0	YU	18.0	YU	18.0	YU	18.0	YU	18.0	YU
VANADIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
ZINC	ug/L	324.	Y	356.	Y	726.	Y	1260	Y	54.0	Y	455.	Y

FOOTNOTES

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(JS) = ESTIMATED due to spike recoveries outside limits
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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/05/86 MHE521 SW031003 CHICAGO CREEK ABOVE CLEAR CREEK		02/06/86 MHE524 SW032003 DECON BLANK		02/19/86 MHE540 SW033003 DECON BLANK	
		DISSOLVED	TOTAL	DISSOLVED	TOTAL	DISSOLVED	TOTAL
FIELD DETERMINATIONS							
TEMPERATURE	C	--	0.0000 Y	--	--	--	--
pH	S.U.	--	6.50 Y	--	--	--	--
Eh (REDOX POTENTIAL)	MV	--	--	--	--	--	--
SPECIFIC CONDUCTANCE	umhos	--	92.0 Y	--	--	--	--
DISSOLVED OXYGEN	mg/L	--	--	--	--	--	--
Fe+2	mg/L	--	--	--	--	--	--
Fe+3	mg/L	--	--	--	--	--	--
IRON (TOTAL)	mg/L	--	--	--	--	--	--
As+3	mg/L	--	--	--	--	--	--
As+5	mg/L	--	--	--	--	--	--
DISCHARGE	CFS	--	--	--	--	--	--
LAB DETERMINATIONS							
GENERAL							
ACIDITY	mg/L	--	--	--	--	5.00 YU	--
pH	S.U.	--	--	--	--	--	5.09 Y
SPECIFIC CONDUCTANCE	umhos	--	--	--	--	--	2.30 Y
TOTAL DISSOLVED SOLIDS	mg/L	--	--	--	--	10.0 YU	--
TOTAL SUSPENDED SOLIDS	mg/L	--	--	--	--	--	3.50 Y
TOTAL ORGANIC CARBON	mg/L	--	--	--	--	--	--
MAJOR CATIONS							
CALCIUM	mg/L	11.4 Y	10.4 Y	0.32 YU	0.32 YU	0.32 YU	0.32 YU
MAGNESIUM	mg/L	3.21 Y	2.93 Y	0.39 YU	0.39 YU	0.39 YU	0.39 YU
POTASSIUM	mg/L	1.24 Y	1.19 Y	0.71 YU	0.71 YU	0.71 YU	0.71 YU
SODIUM	mg/L	4.63 Y	4.89 Y	1.90 Y	1.15 Y	0.77 YU	1.99 Y
MAJOR ANIONS							
BICARBONATE	mg/L	--	--	--	--	5.00 YU	--
CARBONATE	mg/L	--	--	--	--	5.00 YU	--
FLUORIDE	mg/L	--	--	--	--	0.10 YU	--
CHLORIDE	mg/L	--	--	--	--	3.00 YU	--
SULFATE	mg/L	--	--	--	--	5.00 YUJS	--

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(JS) = ESTIMATED due to spike recoveries outside limits
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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/05/86 MHE521 SW031003 CHICAGO CREEK ABOVE CLEAR CREEK				02/06/86 MHE524 SW032003 DECON BLANK				02/19/86 MHE540 SW033003 DECON BLANK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		0.10	YU	--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		0.10	YU	--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	--		--		--		--		0.10	YU	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	23.0	YU	153.	Y	23.0	YU	28.0	Y	23.0	YU	63.0	Y
ANTIMONY	ug/L	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS
ARSENIC	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU
BARIUM	ug/L	35.0	Y	31.0	Y	9.00	YU	9.00	YU	9.00	YU	9.00	YU
BERYLLIUM	ug/L	0.50	Y	0.40	YU	0.40	YU	0.40	YU	0.40	YU	0.40	YJE
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YUJE
CHROMIUM (Cr+6)	ug/L	--		--		--		--		10.0	YU	--	
CHROMIUM (TOTAL)	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU
COBALT	ug/L	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU
COPPER	ug/L	5.20	Y	23.0	Y	4.00	YU	4.00	YU	4.00	YU	8.20	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	50.0	Y	191.	Y	26.0	Y	32.0	YUJE	14.0	Y	194.	Y
LEAD	ug/L	5.00	YUJS	5.00	YU	5.00	YU	5.00	YU	5.00	YU	8.40	Y
MANGANESE	ug/L	162.	Y	297.	Y	5.40	YUJE	20.0	YJS	5.70	Y	11.0	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU
SELENIUM	ug/L	5.00	YU	5.00	YUJS	5.00	YURS	5.00	YURS	5.00	YUJS	5.00	YUJS
SILVER	ug/L	4.50	YJS	4.00	YU	4.00	YUJS	4.00	YUJS	4.00	YUJS	4.00	YUJS
SILICA	ug/L	--		--		--		--		123.	Y	147.	YU
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	10.0	YUJS	10.0	YUJS	10.0	YU	10.0	YUJS	10.0	YU	10.0	YUJS
TIN	ug/L	18.0	YU	18.0	YU	18.0	YU	18.0	YU	18.0	YU	18.0	YU
VANADIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
ZINC	ug/L	120.	Y	253.	Y	12.0	Y	19.0	Y	15.0	Y	10.0	Y

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Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/06/86 MHE525 SW036003 LAWSON AT GAUGING STATION				02/07/86 MHE526 SW037003 ABOVE STANLEY MINE				02/06/86 MHE523 SW038003 TRIPLICATE AT MCC BELOW GREGORY GULCH			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		1.00	Y	--		0.0000	Y	--		0.50	Y
pH	S.U.	--		7.05	Y	--		6.95	Y	--		5.65	Y
Eh (REDOX POTENTIAL)	MV	--		--		--		--		--		--	
SPECIFIC CONDUCTANCE	umhos	--		260.	Y	--		250.	Y	--		490.	Y
DISSOLVED OXYGEN	mg/L	--		--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		--		--		--		--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	--		--		--		--		--		--	
pH	S.U.	--		--		--		--		--		--	
SPECIFIC CONDUCTANCE	umhos	--		--		--		--		--		--	
TOTAL DISSOLVED SOLIDS	mg/L	--		--		--		--		--		--	
TOTAL SUSPENDED SOLIDS	mg/L	--		--		--		--		--		--	
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	28.0	Y	24.9	Y	27.2	Y	25.2	Y	49.5	Y	44.5	Y
MAGNESIUM	mg/L	6.64	Y	5.85	Y	6.64	Y	6.09	Y	16.3	Y	14.5	Y
POTASSIUM	mg/L	3.71	Y	3.31	Y	3.50	Y	3.22	Y	2.29	Y	2.01	Y
SODIUM	mg/L	19.5	Y	16.8	Y	18.5	Y	16.7	Y	13.0	Y	10.4	Y
MAJOR ANIONS													
BICARBONATE	mg/L	--		--		--		--		--		--	
CARBONATE	mg/L	--		--		--		--		--		--	
FLUORIDE	mg/L	--		--		--		--		--		--	
CHLORIDE	mg/L	--		--		--		--		--		--	
SULFATE	mg/L	--		--		--		--		--		--	

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Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/06/86 MHE525 SW036003 LAWSON AT GAUGING STATION				02/07/86 MHE526 SW037003 ABOVE STANLEY MINE				02/06/86 MHE523 SW038003 TRIPLICATE AT NCC BELOW GREGORY GULCH			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	--		--		--		--		--		--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	43.0	Y	159.	Y	43.0	Y	158.	Y	114.	Y	694.	Y
ANTIMONY	ug/L	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS
ARSENIC	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU
BARIUM	ug/L	34.0	Y	34.0	Y	31.0	Y	29.0	Y	25.0	Y	19.0	Y
BERYLLIUM	ug/L	0.40	Y	0.80	Y	0.80	Y	0.80	Y	0.40	Y	1.20	Y
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU
COBALT	ug/L	6.00	YU	6.00	YU	6.00	YU	6.00	YU	24.0	Y	20.0	Y
COPPER	ug/L	4.00	YU	9.90	Y	4.00	YU	9.70	Y	104.	Y	134.	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	11.0	YU	228.	YJE	11.0	YU	226.	YJE	21200	Y	20200	YJE
LEAD	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU	11.0	Y
MANGANESE	ug/L	2110	YJE	1900	YJS	1650	YJE	1580	YJS	4710	YJE	4280	YJS
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	6.00	YU	6.00	YU	6.00	YU	6.00	YU	31.0	Y	29.0	Y
SELENIUM	ug/L	5.00	YURS	5.00	YURS	5.00	YURS	5.00	YURS	50.0	YURS	5.00	YURS
SILVER	ug/L	4.00	YUJS	4.00	YUJS	4.00	YUJS	4.00	YUJS	4.00	YUJS	4.00	YUJS
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	10.0	YU	10.0	YUJS	10.0	YU	10.0	YUJS	10.0	YU	10.0	YUJS
TIN	ug/L	18.0	YU	18.0	YU	18.0	YU	18.0	YU	18.0	YU	18.0	YU
VANADIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
ZINC	ug/L	217.	Y	238.	Y	342.	Y	365.	Y	1870	Y	1630	Y

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(JC) = ESTIMATED due to instrument calibration problems
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(H,HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/06/86 MHE522 SW039003 TRIPLICATE AT NCC BELOW GREGORY GULCH		02/18/86 MHE557 SW040003 TRAIL CREEK		02/19/86 MHE426 SW041003 NORM BLAKE DOMESTIC SUPPLY	
		DISSOLVED	TOTAL	DISSOLVED	TOTAL	DISSOLVED	TOTAL
FIELD DETERMINATIONS							
TEMPERATURE	C	--	0.50 Y	--	1.30 Y	--	3.60 Y
pH	S.U.	--	5.65 Y	--	4.50 Y	--	6.00 Y
Eh (REDOX POTENTIAL)	MV	--	--	--	421. Y	--	335. Y
SPECIFIC CONDUCTANCE	umhos	--	490. Y	--	257. Y	--	120. Y
DISSOLVED OXYGEN	mg/L	--	--	--	--	--	--
Fe+2	mg/L	--	--	--	--	--	--
Fe+3	mg/L	--	--	--	--	--	--
IRON (TOTAL)	mg/L	--	--	--	--	--	--
As+3	mg/L	--	--	--	--	--	--
As+5	mg/L	--	--	--	--	--	--
DISCHARGE	CFS	--	--	--	--	--	--
LAB DETERMINATIONS							
GENERAL							
ACIDITY	mg/L	--	--	--	--	5.00 YU	--
pH	S.U.	--	--	--	--	--	6.49 Y
SPECIFIC CONDUCTANCE	umhos	--	--	--	--	--	129. Y
TOTAL DISSOLVED SOLIDS	mg/L	--	--	--	--	75.0 Y	--
TOTAL SUSPENDED SOLIDS	mg/L	--	--	--	--	--	2.00 YU
TOTAL ORGANIC CARBON	mg/L	--	--	--	--	--	--
MAJOR CATIONS							
CALCIUM	mg/L	50.2 Y	46.0 Y	21.9 Y	20.2 Y	11.2 Y	10.5 Y
MAGNESIUM	mg/L	16.7 Y	14.8 Y	12.1 Y	11.3 Y	3.71 Y	3.03 Y
POTASSIUM	mg/L	2.34 Y	2.10 Y	2.03 Y	2.14 Y	1.21 Y	1.16 Y
SODIUM	mg/L	12.8 Y	11.0 Y	11.9 Y	9.48 Y	7.66 Y	7.31 Y
MAJOR ANIONS							
BICARBONATE	mg/L	--	--	--	--	22.0 Y	--
CARBONATE	mg/L	--	--	--	--	5.00 YU	--
FLUORIDE	mg/L	--	--	--	--	0.11 Y	--
CHLORIDE	mg/L	--	--	--	--	7.40 Y	--
SULFATE	mg/L	--	--	--	--	22.0 YJC	--

FOOTNOTES

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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/06/86 MHE522 SW039003 TRIPLICATE AT NCC BELOW GREGORY GULCH				02/18/86 MHE557 SW040003 TRAIL CREEK				02/19/86 MHE426 SW041003 NORM BLAKE DOMESTIC SUPPLY			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		0.10	YU	--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		0.10	YU	--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3 N) + NITRITE (NO2-N)	mg/L	--		--		--		--		0.17	Y	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	103.	Y	683.	Y	586.	Y	1090	Y	44.0	Y	46.0	Y
ANTIMONY	ug/L	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS
ARSENIC	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU
BARIUM	ug/L	21.0	Y	25.0	Y	28.0	Y	31.0	Y	33.0	Y	28.0	Y
BERYLLIUM	ug/L	0.40	Y	0.80	Y	0.40	YU	0.40	Y	0.40	YU	0.40	YUJE
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	4.00	YU	4.00	YU	5.70	Y	4.00	YU	4.00	YU	4.00	YUJE
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU
COBALT	ug/L	24.0	Y	20.0	Y	6.00	YU	6.00	YU	6.00	YU	6.00	YU
COPPER	ug/L	104.	Y	136.	Y	264.	Y	266.	Y	54.0	Y	59.0	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	21500	Y	20700	YJE	42.0	Y	1180	YJE	47.0	Y	184.	Y
LEAD	ug/L	5.00	YU	12.0	Y	17.0	Y	45.0	Y	5.00	YU	7.80	Y
MANGANESE	ug/L	4800	YJE	4410	YJS	498.	Y	482.	YJS	288.	Y	270.	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	33.0	Y	34.0	Y	21.0	Y	23.0	Y	6.00	YU	6.00	YU
SELENIUM	ug/L	50.0	YURS	50.0	YURS	50.0	YURS	5.00	YURS	5.00	YUJS	5.00	YUJS
SILVER	ug/L	4.00	YUJS	4.00	YUJS	4.00	YUJS	4.00	YUJS	4.00	YUJS	4.00	YUJS
SILICA	ug/L	--		--		--		--		13900	Y	13400	YUJS
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	10.0	YU	10.0	YUJS	10.0	YU	10.0	YU	10.0	YU	10.0	YUJS
TIN	ug/L	18.0	YU	18.0	YU	18.0	YU	18.0	YU	18.0	YU	18.0	YU
VANADIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
ZINC	ug/L	1900	Y	1690	Y	1380	Y	1230	Y	664.	Y	433.	Y

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Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/19/86 MHE427 SW042003 CENTRAL CITY DOMESTIC WATER SUPPLY				02/20/86 MHE430 SW043003 IDAHO SPRINGS DOMESTIC WATER SUPPLY				02/20/86 MHE562 SW044003 DUPLICATE AT CLEAR CREEK ABOVE BIG FIVE			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		5.00	Y	--		7.00	Y	--		--	
pH	S.U.	--		6.05	Y	--		6.40	Y	--		--	
Eh (REDOX POTENTIAL)	MV	--		355.	Y	--		472.	Y	--		--	
SPECIFIC CONDUCTANCE	umhos	--		50.0	Y	--		60.0	Y	--		--	
DISSOLVED OXYGEN	mg/L	--		--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		--		--		--		--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	5.00	YU	--		5.00	YU	--		5.00	YU	--	
pH	S.U.	--		6.57	Y	--		6.54	Y	--		7.44	Y
SPECIFIC CONDUCTANCE	umhos	--		53.0	Y	--		75.0	Y	--		282.	Y
TOTAL DISSOLVED SOLIDS	mg/L	35.0	Y	--		55.0	Y	--		170.	Y	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		2.00	YU	--		2.00	YU	--		2.00	YU
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	6.44	Y	6.20	Y	7.62	Y	8.20	Y	27.3	Y	27.7	Y
MAGNESIUM	mg/L	1.78	Y	1.51	Y	2.08	Y	1.90	Y	7.40	Y	6.07	Y
POTASSIUM	mg/L	0.94	Y	1.05	Y	1.04	Y	1.22	Y	3.52	Y	3.32	Y
SODIUM	mg/L	1.46	Y	2.98	Y	3.49	Y	5.01	Y	19.2	Y	19.6	Y
MAJOR ANIONS													
BICARBONATE	mg/L	18.0	Y	--		24.0	Y	--		69.0	Y	--	
CARBONATE	mg/L	5.00	YU	--		5.00	YU	--		5.00	YU	--	
FLUORIDE	mg/L	0.10	YU	--		0.25	Y	--		1.00	Y	--	
CHLORIDE	mg/L	3.00	YU	--		3.00	YU	--		4.20	Y	--	
SULFATE	mg/L	5.00	YUJC	--		6.00	YJC	--		52.0	YJC	--	

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/19/86 MHE427 SW042003 CENTRAL CITY DOMESTIC WATER SUPPLY				02/20/86 MHE430 SW043003 IDAHO SPRINGS DOMESTIC WATER SUPPLY				02/20/86 MHE562 SW044003 DUPLICATE AT CLEAR CREEK ABOVE BIG FIVE			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	0.10	YU	--		0.10	YU	--		0.10	YU	--	
NITRITE (NO2) (NO2-N)	mg/L	0.10	YU	--		0.10	YU	--		0.10	YU	--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	0.12	Y	--		0.24	Y	--		0.45	Y	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	23.0	YU	23.0	YU	29.0	Y	57.0	Y	98.0	Y	185.	Y
ANTIMONY	ug/L	26.0	YUJS	28.0	YJS	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS
ARSENIC	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU
BARIUM	ug/L	22.0	Y	21.0	Y	21.0	Y	22.0	Y	29.0	Y	30.0	Y
BERYLLIUM	ug/L	0.40	YU	0.40	YJE	0.40	YU	0.40	YUJE	0.40	YU	0.40	YJE
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	4.00	YU	4.00	YUJE	4.00	YU	4.00	YUJE	4.00	YU	4.00	YUJE
CHROMIUM (Cr+6)	ug/L	10.0	YU	--		10.0	YU	--		10.0	YU	--	
CHROMIUM (TOTAL)	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU
COBALT	ug/L	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU
COPPER	ug/L	29.0	Y	34.0	Y	10.0	Y	28.0	Y	12.0	Y	23.0	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	63.0	Y	119.	Y	76.0	Y	219.	Y	20.0	Y	255.	Y
LEAD	ug/L	5.00	YU	8.00	Y	5.00	YU	6.00	Y	5.00	YU	5.00	YU
MANGANESE	ug/L	10.0	Y	17.0	Y	9.10	Y	9.30	Y	1530	Y	1460	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU
SELENIUM	ug/L	5.00	YUJS	5.00	YUJS	5.00	YUJS	5.00	YUJS	5.00	YUJS	5.00	YUJS
SILVER	ug/L	4.00	YUJS	4.00	YUJS	4.00	YUJS	4.00	YUJS	4.00	YUJS	4.00	YUJS
SILICA	ug/L	12000	Y	11700	Y	15200	Y	15200	Y	12800	Y	11900	Y
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	10.0	YU	10.0	YUJS	10.0	YU	10.0	YUJS	10.0	YU	10.0	YUJS
TIN	ug/L	18.0	YU	18.0	YU	18.0	YU	18.0	YU	18.0	YU	18.0	YU
VANADIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
ZINC	ug/L	46.0	Y	29.0	Y	23.0	Y	21.0	Y	808.	Y	404.	Y

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/20/86 MHE563 SW045003 DUPLICATE AT CLEAR CREEK ABOVE BIG FIVE				02/20/86 MHE564 SW046003 DECON BLANK				02/24/86 MHE560 SW050003 ROCKFORD TUNNEL			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		--		--		--		--		9.00	Y
pH	S.U.	--		--		--		--		--		3.12	Y
Eh (REDOX POTENTIAL)	MV	--		--		--		--		--		--	
SPECIFIC CONDUCTANCE	umhos	--		--		--		--		--		1360	Y
DISSOLVED OXYGEN	mg/L	--		--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		0.02	Y	--	
Fe+3	mg/L	--		--		--		--		14.8	Y	--	
IRON (TOTAL)	mg/L	--		--		--		--		14.9	Y	--	
As+3	mg/L	--		--		--		--		10.0	YU	--	
As+5	mg/L	--		--		--		--		10.0	YU	--	
DISCHARGE	CFS	--		--		--		--		--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	5.00	YU	--		5.00	YU	--		--		--	
pH	S.U.	--		7.54	Y	--		5.83	Y	--		--	
SPECIFIC CONDUCTANCE	umhos	--		284.	Y	--		1.20	Y	--		--	
TOTAL DISSOLVED SOLIDS	mg/L	170.	Y	--		10.0	YU	--		--		--	
TOTAL SUSPENDED SOLIDS	mg/L	--		2.00	YU	--		2.00	YU	--		--	
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	26.0	Y	27.1	Y	0.32	YU	0.32	YU	140.	Y	134.	Y
MAGNESIUM	mg/L	7.03	Y	5.85	Y	0.39	YU	0.39	YU	71.8	Y	69.8	Y
POTASSIUM	mg/L	3.36	Y	3.22	Y	0.71	YU	0.71	YU	3.70	Y	3.34	Y
SODIUM	mg/L	18.1	Y	18.7	Y	0.77	YU	1.71	Y	21.0	Y	18.8	Y
MAJOR ANIONS													
BICARBONATE	mg/L	72.0	Y	--		5.00	YU	--		--		--	
CARBONATE	mg/L	5.00	YU	--		5.00	YU	--		--		--	
FLUORIDE	mg/L	1.00	Y	--		0.10	YU	--		--		--	
CHLORIDE	mg/L	4.50	Y	--		5.00	YU	--		--		--	
SULFATE	mg/L	52.0	YJC	--		5.00	YUJC	--		--		--	

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/20/86 MHE563 SW045003 DUPLICATE AT CLEAR CREEK ABOVE BIG FIVE				02/20/86 MHE564 SW046003 DECON BLANK				02/24/86 MHE560 SW050003 ROCKFORD TUNNEL			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	0.10	YU	--		0.10	YU	--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	0.10	YU	--		0.10	YU	--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	0.44	Y	--		0.10	YU	--		--		--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	72.0	Y	160.	Y	23.0	YU	26.0	Y	6320	YJS	6240	YJS
ANTIMONY	ug/L	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS
ARSENIC	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU
BARIUM	ug/L	26.0	Y	30.0	Y	9.00	YU	9.00	YU	9.10	Y	9.00	YU
BERYLLIUM	ug/L	0.40	YU	0.40	YJE	0.40	YU	0.40	YJE	2.70	Y	4.00	Y
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	4.00	YU	4.00	YU	4.30	Y	4.00	YUJE	16.0	Y	18.0	Y
CHROMIUM (Cr+6)	ug/L	10.0	YU	--		10.0	YU	--		--		--	
CHROMIUM (TOTAL)	ug/L	4.00	YU	4.00	YU	4.40	Y	4.00	YU	15.0	Y	12.0	Y
COBALT	ug/L	6.00	YU	6.00	YU	6.00	YU	6.00	YU	135.	Y	135.	Y
COPPER	ug/L	6.40	Y	25.0	Y	4.00	YU	8.20	Y	974.	Y	960.	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	13.0	Y	236.	Y	11.0	YU	106.	Y	18200	Y	17800	YJE
LEAD	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	106.	YRS	88.0	Y
MANGANESE	ug/L	1450	Y	1400	Y	8.70	Y	8.00	Y	13800	Y	13800	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	6.00	YU	6.00	YU	6.00	YU	6.00	YU	479.	YJE	471.	Y
SELENIUM	ug/L	5.00	YUJS	5.00	YUJS	5.00	YUJS	5.00	YUJS	50.0	YURS	50.0	YUR
SILVER	ug/L	4.00	YUJS	4.00	YUJS	4.00	YUJS	4.00	YUJS	4.00	YUJS	4.00	YUJS
SILICA	ug/L	12200	Y	11200	Y	160.	Y	64.0	Y	--		--	
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	10.0	YU	10.0	YUJS	10.0	YU	10.0	YUJS	10.0	YU	10.0	YU
TIN	ug/L	18.0	YU	18.0	YU	18.0	YU	18.0	YU	18.0	YU	18.0	YU
VANADIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
ZINC	ug/L	353.	Y	366.	Y	54.0	Y	10.0	Y	6130	Y	5750	Y

FOOTNOTES

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(H,HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/24/86 MHE561 SW051003 CULVERT BELOW ROCKFORD TUNNEL				02/24/86 MHE568 SW052003 CLEAR CREEK ABOVE ARGO				02/26/86 MHE576 SW053003 BACKGROUND GRANITE WATER			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		4.00	Y	--		6.00	Y	--		15.0	Y
pH	S.U.	--		3.50	Y	--		6.58	Y	--		6.50	Y
Eh (REDOX POTENTIAL)	MV	--		615.	Y	--		365.	Y	--		--	
SPECIFIC CONDUCTANCE	umhos	--		920.	Y	--		240.	Y	--		370.	Y
DISSOLVED OXYGEN	mg/L	--		--		--		--		--		--	
Fe+2	mg/L	0.01	Y	--		--		--		--		--	
Fe+3	mg/L	0.18	Y	--		--		--		--		--	
IRON (TOTAL)	mg/L	0.19	Y	--		--		--		--		--	
As+3	mg/L	10.0	YU	--		10.0	YU	--		--		--	
As+5	mg/L	10.0	YU	--		10.0	YU	--		--		--	
DISCHARGE	CFS	--		--		--		--		--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	--		--		5.00	YU	--		5.00	YU	--	
pH	S.U.	--		--		--		6.98	Y	--		6.72	Y
SPECIFIC CONDUCTANCE	umhos	--		--		--		248.	Y	--		373.	Y
TOTAL DISSOLVED SOLIDS	mg/L	--		--		140.	Y	--		260.	Y	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		--		--		2.00	YU	--		2.00	YU
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	96.2	Y	90.0	Y	24.7	Y	23.3	Y	52.3	Y	48.6	Y
MAGNESIUM	mg/L	53.9	Y	51.4	Y	6.59	Y	6.30	Y	16.5	Y	15.8	Y
POTASSIUM	mg/L	4.22	Y	3.84	Y	3.80	Y	3.43	Y	5.04	Y	4.49	Y
SODIUM	mg/L	14.4	Y	14.2	Y	17.8	Y	15.4	Y	10.1	Y	7.88	Y
MAJOR ANIONS													
BICARBONATE	mg/L	--		--		63.0	Y	--		165.	Y	--	
CARBONATE	mg/L	--		--		5.00	YU	--		5.00	YU	--	
FLUORIDE	mg/L	--		--		0.85	Y	--		0.19	Y	--	
CHLORIDE	mg/L	--		--		3.00	YU	--		3.30	Y	--	
SULFATE	mg/L	--		--		50.0	Y	--		17.0	Y	--	

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(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		02/24/86 MHE561 SW051003 CULVERT BELOW ROCKFORD TUNNEL				02/24/86 MHE560 SW052003 CLEAR CREEK ABOVE ARGO				02/26/86 MHE576 SW053003 BACKGROUND GRANITE WATER			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		0.10	YU	--		0.10	YU	--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		0.10	YU	--		0.10	YU	--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	--		--		0.53	Y	--		2.20	Y	--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	15500	YJS	14700	YJS	86.0	YJS	205.	YJS	23.0	YUJS	23.0	YUJS
ANTIMONY	ug/L	27.0	YJS	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS
ARSENIC	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU
BARIUM	ug/L	11.0	Y	9.00	YU	26.0	Y	27.0	Y	46.0	Y	42.0	Y
BERYLLIUM	ug/L	3.00	Y	3.20	Y	0.40	YU	1.30	Y	0.40	YU	0.40	YU
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	15.0	Y	13.0	Y	4.00	YU	4.00	YU	4.00	YU	4.00	YU
CHROMIUM (Cr+6)	ug/L	--		--		10.0	YU	--		10.0	YU	--	
CHROMIUM (TOTAL)	ug/L	21.0	Y	20.0	Y	4.00	YU	4.30	Y	4.00	YU	4.00	YU
COBALT	ug/L	106.	Y	104.	Y	6.00	YU	6.00	YU	6.00	YU	6.00	YU
COPPER	ug/L	1330	Y	1240	Y	11.0	Y	26.0	Y	25.0	Y	33.0	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	3700	Y	4120	YJE	11.0	YU	261.	YJE	11.0	YU	63.0	YJE
LEAD	ug/L	5.00	YURS	5.00	YU	5.00	YURS	5.00	YU	5.00	YURS	5.00	YU
MANGANESE	ug/L	9780	Y	9580	Y	1120	Y	1120	Y	6.80	Y	24.0	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	351.	YJE	335.	Y	6.00	YUJE	6.00	YU	6.00	YUJE	6.00	YU
SELENIUM	ug/L	5.00	YURS	50.0	YUR	5.00	YURS	5.00	YUR	5.00	YURS	5.00	YUR
SILVER	ug/L	4.70	YJS	4.00	YUJS	4.00	YUJS	4.00	YUJS	4.00	YUJS	4.00	YUJS
SILICA	ug/L	--		--		12300	Y	13200	Y	17400	Y	17200	Y
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	YU
TIN	ug/L	18.0	YU	18.0	YU	18.0	YU	18.0	YU	18.0	YU	18.0	YU
VANADIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
ZINC	ug/L	3830	Y	3570	Y	335.	Y	368.	Y	19.0	Y	30.0	Y

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(umhos) = umhos/cm

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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

FOURTH SAMPLING SESSION RESULTS

SURFACE WATER

May-June 1986

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		05/21/86 MHC945 SW00104 CLEAR CREEK ABOVE NORTH CLEAR CREEK				06/02/86 MHD212 SW001A04 CLEAR CREEK ABOVE NORTH CLEAR CREEK .1 FILTER				05/20/86 MHC946 SW00204 CLEAR CREEK BELOW NORTH CLEAR CREEK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		7.75	Y	--		--		--		8.82	Y
pH	S.U.	--		6.85	Y	--		--		--		6.90	Y
Eh (REDOX POTENTIAL)	MV	--		472.	Y	--		--		--		447.	Y
SPECIFIC CONDUCTANCE	umhos	--		110.	Y	--		--		--		142.	Y
DISSOLVED OXYGEN	mg/L	--		--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		--		--		--		--		566.	Y
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	--		--		--		--		--		--	
pH	S.U.	--		--		--		--		--		--	
SPECIFIC CONDUCTANCE	umhos	--		--		--		--		--		--	
TOTAL DISSOLVED SOLIDS	mg/L	--		--		--		--		--		--	
TOTAL SUSPENDED SOLIDS	mg/L	--		--		--		--		--		--	
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	14.5	Y	13.4	Y	9.24	YRS	--		15.5	Y	13.6	Y
MAGNESIUM	mg/L	3.77	Y	4.25	Y	2.60	YRS	--		3.88	Y	3.60	Y
POTASSIUM	mg/L	0.88	Y	0.82	Y	0.65	YJS	--		0.83	Y	0.84	Y
SODIUM	mg/L	5.72	Y	5.30	Y	3.47	YRS	--		7.45	Y	6.19	Y
MAJOR ANIONS													
BICARBONATE	mg/L	--		--		--		--		--		--	
CARBONATE	mg/L	--		--		--		--		--		--	
FLUORIDE	mg/L	--		--		--		--		--		--	
CHLORIDE	mg/L	--		--		--		--		--		--	
SULFATE	mg/L	--		--		--		--		--		--	

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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

06/03/87

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		05/21/86 MHC945 SW00104 CLEAR CREEK ABOVE NORTH CLEAR CREEK				06/02/86 MHD212 SW001A04 CLEAR CREEK ABOVE NORTH CLEAR CREEK .1 FILTER				05/20/86 MHC946 SW00204 CLEAR CREEK BELOW NORTH CLEAR CREEK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	--		--		--		--		--		--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	193.	Y	1500	Y	245.	Y	--		135.	Y	633.	Y
ANTIMONY	ug/L	50.0	YU	50.0	YU	50.0	YU	--		50.0	YU	50.0	YU
ARSENIC	ug/L	4.00	YU	4.00	YU	4.00	YU	--		4.00	YU	4.00	YU
BARIUM	ug/L	50.0	YU	50.0	YU	50.0	YU	--		50.0	YU	50.0	YU
BERYLLIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	--		5.00	YU	5.00	YU
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	5.00	YU	9.00	Y	5.00	YU	--		5.00	YU	5.00	YU
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	8.00	YU	8.00	YU	8.00	YU	--		8.00	YU	8.00	YU
COBALT	ug/L	20.0	YU	20.0	YU	20.0	YU	--		20.0	YU	20.0	YU
COPPER	ug/L	12.0	Y	281.	Y	30.0	Y	--		11.0	YU	51.0	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	493.	Y	2500	Y	498.	YJE	--		20.0	YU	1100	Y
LEAD	ug/L	3.00	YU	4.00	YJS	3.00	Y	--		3.00	YU	3.00	YJS
MANGANESE	ug/L	1040	Y	1560	Y	508.	Y	--		1270	Y	1310	Y
MERCURY	ug/L	0.12	YUJSH	0.12	YUJH	0.21	Y	--		0.12	YUJSH	0.12	YUJH
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	20.0	YU	20.0	YU	22.0	YJE	--		20.0	YU	20.0	YU
SELENIUM	ug/L	40.0	YU	4.00	YURS	4.00	YURS	--		4.00	YU	4.00	YURS
SILVER	ug/L	5.00	YUJS	5.00	YURS	5.00	YU	--		5.00	YUJS	5.00	YURS
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	6.00	YU	6.00	YU	6.00	YU	--		6.00	YU	6.00	YU
TIN	ug/L	19.0	YU	190.	YURS	19.0	YUJS	--		19.0	YU	19.0	YURS
VANADIUM	ug/L	20.0	YU	20.0	YU	20.0	YU	--		20.0	YU	20.0	YU
ZINC	ug/L	431.	Y	1680	Y	285.	Y	--		364.	Y	525.	Y

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(JS) = ESTIMATED due to spike recoveries outside limits
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Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		05/20/86 MHC947 SW00304 NORTH CLEAR CREEK ABOVE CLEAR CREEK		06/02/86 MHD216 SW003A04 NORTH CLEAR CREEK ABOVE CLEAR CREEK .1 FILTER		05/20/86 MHC948 SW00504 NORTH CLEAR CREEK BELOW NATIONAL	
		DISSOLVED	TOTAL	DISSOLVED	TOTAL	DISSOLVED	TOTAL
FIELD DETERMINATIONS							
TEMPERATURE	C	--	7.75 Y	--	--	--	8.50 Y
pH	S.U.	--	6.60 Y	--	--	--	6.40 Y
Eh (REDOX POTENTIAL)	MV	--	442. Y	--	--	--	272. Y
SPECIFIC CONDUCTANCE	umhos	--	116. Y	--	--	--	87.0 Y
DISSOLVED OXYGEN	mg/L	--	--	--	--	--	--
Fe+2	mg/L	--	--	--	--	--	--
Fe+3	mg/L	--	--	--	--	--	--
IRON (TOTAL)	mg/L	--	--	--	--	--	--
As+3	mg/L	--	--	--	--	--	--
As+5	mg/L	--	--	--	--	--	--
DISCHARGE	CFS	--	--	--	--	--	--
LAB DETERMINATIONS							
GENERAL							
ACIDITY	mg/L	--	--	--	--	--	--
pH	S.U.	--	--	--	--	--	--
SPECIFIC CONDUCTANCE	umhos	--	--	--	--	--	--
TOTAL DISSOLVED SOLIDS	mg/L	--	--	--	--	--	--
TOTAL SUSPENDED SOLIDS	mg/L	--	--	--	--	--	--
TOTAL ORGANIC CARBON	mg/L	--	--	--	--	--	--
MAJOR CATIONS							
CALCIUM	mg/L	11.6 Y	9.98 Y	9.20 YRS	8.87 Y	9.03 Y	77.0 Y
MAGNESIUM	mg/L	3.56 Y	3.31 Y	2.93 YRS	3.09 Y	2.81 Y	2.60 Y
POTASSIUM	mg/L	0.65 Y	0.66 Y	0.64 YJS	0.83 Y	0.59 Y	0.55 Y
SODIUM	mg/L	5.19 Y	3.82 Y	3.86 YRS	3.36 Y	4.22 Y	2.82 Y
MAJOR ANIONS							
BICARBONATE	mg/L	--	--	--	--	--	--
CARBONATE	mg/L	--	--	--	--	--	--
FLUORIDE	mg/L	--	--	--	--	--	--
CHLORIDE	mg/L	--	--	--	--	--	--
SULFATE	mg/L	--	--	--	--	--	--

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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

06/03/87

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		05/20/86 MHC947 SW00304 NORTH CLEAR CREEK ABOVE CLEAR CREEK				06/02/86 MHD216 SW003A04 NORTH CLEAR CREEK ABOVE CLEAR CREEK .1 FILTER				05/20/86 MHC948 SW00504 NORTH CLEAR CREEK BELOW NATIONAL			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	--		--		--		--		--		--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	127.	Y	524.	Y	247.	Y	855.	Y	125.	Y	395.	Y
ANTIMONY	ug/L	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	YU
ARSENIC	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU
BARIUM	ug/L	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	YU
BERYLLIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	8.00	YU	8.00	YU	8.00	YU	8.00	YU	8.00	YU	8.00	YU
COBALT	ug/L	20.0	YU	20.0	YU	20.0	YU	20.0	YU	20.0	YU	20.0	YU
COPPER	ug/L	19.0	Y	61.0	Y	48.0	Y	52.0	Y	22.0	Y	34.0	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	799.	Y	2140	Y	503.	Y	2970	Y	1400	Y	2120	Y
LEAD	ug/L	3.00	YU	4.00	YJS	4.00	Y	26.0	YJS	3.00	YU	4.00	YJS
MANGANESE	ug/L	528.	Y	521.	Y	430.	Y	463.	Y	438.	Y	423.	Y
MERCURY	ug/L	0.21	YJSH	0.12	YUJM	0.12	YU	0.12	YU	0.12	YUJSH	0.50	YJH
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	20.0	YU	20.0	YU	20.0	YU	20.0	YUJC	20.0	YU	20.0	YU
SELENIUM	ug/L	4.00	YU	4.00	YURS	4.00	YURS	4.00	YURS	4.00	YU	4.00	YURS
SILVER	ug/L	5.00	YUJS	5.00	YURS	5.00	YU	5.00	YURS	5.00	YUJS	5.00	YURS
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU
TIN	ug/L	19.0	YU	19.0	YU	19.0	YUJS	19.0	YURS	19.0	YU	19.0	YURS
VANADIUM	ug/L	20.0	YU	20.0	YU	20.0	YU	20.0	YU	20.0	YU	20.0	YU
ZINC	ug/L	452.	Y	475.	Y	336.	Y	467.	Y	426.	Y	403.	Y

FOOTNOTES

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(umhos) = umhos/cm

(J) = ESTIMATED
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(U) = UNDETECTED
(H_2HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L $CaCO_3$

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		05/20/86 MHC949 SW00604 NORTH CLEAR CREEK ABOVE NATIONAL				05/21/86 MHD183 SW00804 NATIONAL TUNNEL AT PORTAL				05/19/86 MHD161 SW00904 NORTH CLEAR CREEK BELOW GREGORY GULCH			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		8.50	Y	--		9.00	Y	--		11.0	Y
pH	S.U.	--		6.45	Y	--		6.43	Y	--		6.00	Y
Eh (REDOX POTENTIAL)	MV	--		262.	Y	--		301.	Y	--		550.	Y
SPECIFIC CONDUCTANCE	umhos	--		90.0	Y	--		1322	Y	--		107.	Y
DISSOLVED OXYGEN	mg/L	--		--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		--		--		0.23	Y	--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	--		--		--		--		--		--	
pH	S.U.	--		--		--		--		--		--	
SPECIFIC CONDUCTANCE	umhos	--		--		--		--		--		--	
TOTAL DISSOLVED SOLIDS	mg/L	--		--		--		--		--		--	
TOTAL SUSPENDED SOLIDS	mg/L	--		--		--		--		--		--	
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	8.97	Y	7.56	Y	193.	Y	177.	Y	6.19	Y	5.16	Y
MAGNESIUM	mg/L	2.79	Y	2.57	Y	52.6	Y	49.1	Y	1.82	Y	1.75	Y
POTASSIUM	mg/L	0.61	Y	0.58	Y	7.90	Y	5.14	Y	0.64	Y	0.64	YJS
SODIUM	mg/L	3.92	Y	2.85	Y	22.2	Y	21.0	Y	2.76	Y	2.62	YJS
MAJOR ANIONS													
BICARBONATE	mg/L	--		--		--		--		--		--	
CARBONATE	mg/L	--		--		--		--		--		--	
FLUORIDE	mg/L	--		--		--		--		--		--	
CHLORIDE	mg/L	--		--		--		--		--		--	
SULFATE	mg/L	--		--		--		--		--		--	

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(JC) = ESTIMATED due to instrument calibration problems
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(H,HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		05/20/86 MHC949 SW00604 NORTH CLEAR CREEK ABOVE NATIONAL				05/21/86 MHD183 SW00804 NATIONAL TUNNEL AT PORTAL				05/19/86 MHD161 SW00904 NORTH CLEAR CREEK BELOW GREGORY GULCH			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	--		--		--		--		--		--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	106.	Y	422.	Y	123.	Y	460.	Y	143.	Y	422.	Y
ANTIMONY	ug/L	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	YU
ARSENIC	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	Y	4.00	YU	4.00	YU
BARIUM	ug/L	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	YU
BERYLLIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	8.00	YU	8.00	YU	8.00	YU	8.00	YU	8.00	YU	8.00	YU
COBALT	ug/L	20.0	YU	20.0	YU	85.0	Y	80.0	Y	20.0	YU	20.0	YU
COPPER	ug/L	26.0	Y	44.0	Y	45.0	Y	234.	Y	11.0	YU	19.0	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	1240	Y	2200	Y	37900	Y	46300	Y	135.	Y	819.	YJS
LEAD	ug/L	3.00	YU	3.00	YJS	3.00	YU	7.00	Y	3.00	YU	3.00	Y
MANGANESE	ug/L	428.	Y	412.	Y	15900	Y	15300	Y	59.0	Y	82.0	Y
MERCURY	ug/L	0.12	YUJHS	0.12	YUJH	0.12	YUJSH	0.12	YU	0.21	YJSH	0.12	YUJH
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	20.0	YU	20.0	YU	209.	Y	191.	Y	20.0	YU	20.0	YU
SELENIUM	ug/L	4.00	YU	4.00	YURS	4.00	YU	4.00	YU	4.00	YU	4.00	YU
SILVER	ug/L	5.00	YUJS	5.00	YURS	5.00	YUJS	5.00	YU	5.00	YUJS	5.00	YUJS
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU
TIN	ug/L	19.0	YU	19.0	YURS	190.	YU	190.	YU	19.0	YU	19.0	YU
VANADIUM	ug/L	20.0	YU	20.0	YU	20.0	YU	20.0	YU	20.0	YU	20.0	YU
ZINC	ug/L	420.	Y	396.	Y	5350	Y	5290	Y	101.	Y	149.	Y

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(--) = Not analyzed
(umhos) = umhos/cm

(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(H,HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		05/22/86 MHD185 SW01004 NORTH CLEAR CREEK BELOW GREGORY TAILINGS				05/27/86 MHD186 SW01104 NORTH CLEAR CREEK ABOVE GREGORY TAILINGS				05/22/86 MHD187 SW01204 GREGORY TAILINGS AT NORTH CLEAR CREEK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		5.30	Y	--		7.00	Y	--		14.5	Y
pH	S.U.	--		6.45	Y	--		6.50	Y	--		3.95	Y
Eh (REDOX POTENTIAL)	MV	--		239.	Y	--		333.	Y	--		478.	Y
SPECIFIC CONDUCTANCE	umhos	--		62.0	Y	--		59.0	Y	--		1311	Y
DISSOLVED OXYGEN	mg/L	--		--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		--		--		48.3	Y	--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	10.0	YJ*	--		14.0	YJ*	--		344.	YJ*	--	
pH	S.U.	--		6.14	Y	--		6.59	Y	--		3.00	Y
SPECIFIC CONDUCTANCE	umhos	--		69.0	Y	--		57.0	Y	--		2163	Y
TOTAL DISSOLVED SOLIDS	mg/L	194.	YJC	--		1224	YJC	--		1350	YJC	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		73.0	YJC	--		68.0	YJC	--		68.0	YJC
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	6.68	YJE	5.73	Y	6.03	YJE	5.06	Y	234.	YJE	196.	Y
MAGNESIUM	mg/L	1.94	Y	1.79	Y	1.73	Y	1.58	Y	71.9	Y	64.0	Y
POTASSIUM	mg/L	0.53	YJS	0.56	Y	0.53	YJS	0.65	Y	5.13	YRJS	4.39	Y
SODIUM	mg/L	2.62	YJS	2.49	Y	2.56	YUJS	2.34	Y	20.8	YJS	19.1	Y
MAJOR ANIONS													
BICARBONATE	mg/L	24.4	Y	--		29.3	Y	--		--		--	
CARBONATE	mg/L	--		--		--		--		--		--	
FLUORIDE	mg/L	0.10	Y	--		0.10	YU	--		1.60	Y	--	
CHLORIDE	mg/L	26.0	Y	--		15.0	Y	--		22.0	Y	--	
SULFATE	mg/L	22.0	YJC	--		17.0	YJC	--		920.	YJC	--	

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Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		05/22/86 MHD185 SW01004 NORTH CLEAR CREEK BELOW GREGORY TAILINGS				05/27/86 MHD186 SW01104 NORTH CLEAR CREEK ABOVE GREGORY TAILINGS				05/22/86 MHD187 SW01204 GREGORY TAILINGS AT NORTH CLEAR CREEK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	0.01	YU	--		0.01	YU	--		0.16	Y	--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	--		--		--		--		--		--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	463.	Y	244.	Y	406.	Y	303.	Y	5480	Y	4970	Y
ANTIMONY	ug/L	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	YU
ARSENIC	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU
BARIUM	ug/L	50.0	YURS	50.0	YU	50.0	YURS	50.0	YU	50.0	YUJS	50.0	YU
BERYLLIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	6.80	Y	7.00	Y
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	7.60	Y	5.00	YU
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	8.00	YU	8.00	YU	8.00	YU	8.00	YU	8.00	YU	8.00	YU
COBALT	ug/L	20.0	YU	20.0	YU	20.0	YU	20.0	YU	130.	Y	115.	Y
COPPER	ug/L	11.0	YUJE	15.0	Y	11.0	YUJE	11.0	YU	1520	YJE	1380	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	881.	Y	1340	Y	57.0	Y	659.	Y	129000	Y	121000	Y
LEAD	ug/L	3.00	YUJS	3.00	YUJS	3.00	YUJS	3.00	YU	22.0	YJS	22.0	YJS
MANGANESE	ug/L	208.	Y	204.	Y	56.0	Y	77.0	Y	27000	Y	25000	Y
MERCURY	ug/L	0.12	YUJSH	0.12	YUJH	0.12	YUJSH	0.12	YU	0.12	YUJSH	0.12	YUJH
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	41.0	Y	20.0	YU	40.0	Y	20.0	YU	180.	Y	154.	Y
SELENIUM	ug/L	4.00	YURS	4.00	YURS	40.0	YURS	4.00	YU	40.0	YURS	40.0	YURS
SILVER	ug/L	5.00	YUJS	5.00	YURS	5.00	YUJS	5.00	YU	5.00	YUJS	5.00	YURS
SILICA	ug/L	6740	Y	6700	Y	6300	Y	7000	Y	33900	Y	34700	Y
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU
TIN	ug/L	19.0	YUJS	19.0	YURS	19.0	YUJS	19.0	YU	190.	YUJS	190.	YURS
VANADIUM	ug/L	32.0	Y	20.0	YU	32.0	Y	20.0	YU	20.0	YU	20.0	YU
ZINC	ug/L	138.	Y	14.0	Y	98.0	Y	9.00	YU	7070	Y	6380	Y

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(JS) = ESTIMATED due to spike recoveries outside limits
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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		05/20/86 MHD162 SW01404 GREGORY GULCH ABOVE NORTH CLEAR CREEK		05/20/86 MHD163 SW01504 GREGORY GULCH ABOVE CENTRAL CITY		05/21/86 MHD182 SW01604 QUARTZ HILL TUNNEL AT PORTAL	
		DISSOLVED	TOTAL	DISSOLVED	TOTAL	DISSOLVED	TOTAL
FIELD DETERMINATIONS							
TEMPERATURE	C	--	15.0 Y	--	7.90 Y	--	7.50 Y
pH	S.U.	--	5.10 Y	--	6.55 Y	--	2.60 Y
Eh (REDOX POTENTIAL)	MV	--	490. Y	--	277. Y	--	852. Y
SPECIFIC CONDUCTANCE	umhos	--	285. Y	--	214. Y	--	3845 Y
DISSOLVED OXYGEN	mg/L	--	--	--	--	--	--
Fe+2	mg/L	--	--	--	--	--	--
Fe+3	mg/L	--	--	--	--	--	--
IRON (TOTAL)	mg/L	--	--	--	--	--	--
As+3	mg/L	--	--	--	--	--	--
As+5	mg/L	--	--	--	--	--	--
DISCHARGE	CFS	--	--	--	--	--	0.003 Y
LAB DETERMINATIONS							
GENERAL							
ACIDITY	mg/L	--	--	--	--	--	--
pH	S.U.	--	--	--	--	--	--
SPECIFIC CONDUCTANCE	umhos	--	--	--	--	--	--
TOTAL DISSOLVED SOLIDS	mg/L	--	--	--	--	--	--
TOTAL SUSPENDED SOLIDS	mg/L	--	--	--	--	--	--
TOTAL ORGANIC CARBON	mg/L	--	--	--	--	--	--
MAJOR CATIONS							
CALCIUM	mg/L	30.9 Y	29.9 Y	21.2 Y	22.6 Y	351. Y	334. Y
MAGNESIUM	mg/L	12.2 Y	11.6 Y	7.02 Y	7.45 Y	183. Y	177. Y
POTASSIUM	mg/L	1.98 Y	1.72 YJS	1.56 Y	1.38 YJS	0.59 Y	0.54 Y
SODIUM	mg/L	7.78 Y	6.14 YJS	6.19 Y	5.06 YJS	10.8 Y	10.3 Y
MAJOR ANIONS							
BICARBONATE	mg/L	--	--	--	--	--	--
CARBONATE	mg/L	--	--	--	--	--	--
FLUORIDE	mg/L	--	--	--	--	--	--
CHLORIDE	mg/L	--	--	--	--	--	--
SULFATE	mg/L	--	--	--	--	--	--

FOOTNOTES

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(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(H,HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		05/20/86 MHD162 SW01404 GREGORY GULCH ABOVE NORTH CLEAR CREEK				05/20/86 MHD163 SW01504 GREGORY GULCH ABOVE CENTRAL CITY				05/21/86 MHD182 SW01604 QUARTZ HILL TUNNEL AT PORTAL			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	--		--		--		--		--		--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	941.	Y	2370	Y	70.0	YU	281.	Y	85200	Y	80500	Y
ANTIMONY	ug/L	50.0	YU	50.0	YU	50.0	YU	50.0	YU	250.	YU	250.	YU
ARSENIC	ug/L	4.00	YU	5.00	Y	4.00	YU	4.00	YU	80.0	Y	3040	Y
BARIUM	ug/L	50.0	YU	50.0	YU	50.0	YU	50.0	YU	250.	YU	250.	YU
BERYLLIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	50.0	Y	49.0	Y
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	52.0	Y	51.0	Y	5.10	Y	5.00	YU	318.	Y	317.	Y
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	8.00	YU	8.00	YU	8.00	YU	8.00	YU	54.0	Y	40.0	YU
COBALT	ug/L	20.0	YU	20.0	YU	20.0	YU	20.0	YU	409.	Y	399.	Y
COPPER	ug/L	763.	Y	791.	Y	17.0	Y	44.0	Y	61300	Y	60200	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	796.	Y	4520	YJS	340.	Y	1170	YJS	691000	Y	688000	Y
LEAD	ug/L	22.0	Y	62.0	Y	3.00	YU	10.0	Y	3.00	YU	3.00	YJS
MANGANESE	ug/L	2340	Y	2290	Y	642.	Y	863.	Y	64500	Y	63600	Y
MERCURY	ug/L	0.65	YJSH	0.12	YUJS	0.12	YUJSH	0.12	YUJS	0.70	YJSH	0.12	YUJH
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	27.0	Y	26.0	Y	20.0	YU	20.0	YU	553.	Y	513.	Y
SELENIUM	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	40.0	YURS
SILVER	ug/L	5.00	YUJS	5.00	YUJS	5.00	YUJS	5.00	YUJS	25.0	YUJS	25.0	YURS
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU
TIN	ug/L	19.0	YU	19.0	YU	19.0	YU	19.0	YU	190.	YU	190.	YURS
VANADIUM	ug/L	20.0	YU	20.0	YU	20.0	YU	20.0	YU	100.	YU	100.	YU
ZINC	ug/L	8250	Y	8130	Y	1230	Y	1320	Y	86500	Y	86100	Y

FOOTNOTES

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(JS) = ESTIMATED due to spike recoveries outside limits
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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		05/21/86 MHD180 SW01704 NEVADA GULCH BELOW NEVADAVILLE		05/21/86 MHD179 SW01804 NEVADA GULCH ABOVE NEVADAVILLE		05/21/86 MHD184 SW01904 VIRGINIA CANYON	
		DISSOLVED	TOTAL	DISSOLVED	TOTAL	DISSOLVED	TOTAL
FIELD DETERMINATIONS							
TEMPERATURE	C	--	16.5 Y	--	12.2 Y	--	7.20 Y
pH	S.U.	--	4.05 Y	--	5.91 Y	--	2.65 Y
Eh (REDOX POTENTIAL)	MV	--	567. Y	--	489. Y	--	823. Y
SPECIFIC CONDUCTANCE	umhos	--	568. Y	--	142. Y	--	3117 Y
DISSOLVED OXYGEN	mg/L	--	--	--	--	--	--
Fe+2	mg/L	--	--	--	--	--	--
Fe+3	mg/L	--	--	--	--	--	--
IRON (TOTAL)	mg/L	--	--	--	--	--	--
As+3	mg/L	--	--	--	--	--	--
As+5	mg/L	--	--	--	--	--	--
DISCHARGE	CFS	--	0.20 Y	--	0.15 Y	--	--
LAB DETERMINATIONS							
GENERAL							
ACIDITY	mg/L	--	--	--	--	--	--
pH	S.U.	--	--	--	--	--	--
SPECIFIC CONDUCTANCE	umhos	--	--	--	--	--	--
TOTAL DISSOLVED SOLIDS	mg/L	--	--	--	--	--	--
TOTAL SUSPENDED SOLIDS	mg/L	--	--	--	--	--	--
TOTAL ORGANIC CARBON	mg/L	--	--	--	--	--	--
MAJOR CATIONS							
CALCIUM	mg/L	43.0 Y	36.9 Y	14.5 Y	11.6 Y	145. Y	130. Y
MAGNESIUM	mg/L	23.4 Y	20.7 Y	4.86 Y	4.03 Y	102. Y	93.0 Y
POTASSIUM	mg/L	3.61 Y	2.44 Y	1.50 Y	1.10 Y	0.50 YU	0.50 YU
SODIUM	mg/L	5.35 Y	4.64 Y	3.55 Y	3.15 Y	8.16 Y	7.16 Y
MAJOR ANIONS							
BICARBONATE	mg/L	--	--	--	--	--	--
CARBONATE	mg/L	--	--	--	--	--	--
FLUORIDE	mg/L	--	--	--	--	--	--
CHLORIDE	mg/L	--	--	--	--	--	--
SULFATE	mg/L	--	--	--	--	--	--

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(JC) = ESTIMATED due to instrument calibration problems
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(H_2HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L $CaCO_3$

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		05/21/86 MHD180 SW01704 NEVADA GULCH BELOW NEVADAVILLE				05/21/86 MHD179 SW01804 NEVADA GULCH ABOVE NEVADAVILLE				05/21/86 MHD184 SW01904 VIRGINIA CANYON			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	--		--		--		--		--		--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	4800	Y	4290	Y	200.	Y	101.	Y	127000	Y	115000	Y
ANTIMONY	ug/L	50.0	Y	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	YU
ARSENIC	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	840.	YS	1020	Y
BARIUM	ug/L	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	YU
BERYLLIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	22.0	Y	24.0	Y
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	254.	Y	228.	Y	18.0	Y	12.0	Y	713.	Y	671.	Y
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	8.00	YU	8.00	YU	8.00	YU	8.00	YU	74.0	Y	76.0	Y
COBALT	ug/L	28.0	Y	25.0	Y	20.0	YU	20.0	YU	381.	Y	358.	Y
COPPER	ug/L	1740	Y	1600	Y	86.0	Y	68.0	Y	28700	Y	26300	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	350.	Y	808.	Y	65.0	Y	177.	Y	128000	Y	121000	Y
LEAD	ug/L	194.	Y	190.	YJS	42.0	Y	16.0	YJS	4.00	Y	16.0	YJS
MANGANESE	ug/L	6520	Y	5940	Y	140.	Y	117.	Y	62500	Y	58400	Y
MERCURY	ug/L	0.21	YJSH	0.12	YUJH	0.21	YJSH	0.12	YUJH	0.12	YUJSH	0.12	YUJH
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	72.0	Y	61.0	Y	20.0	YU	20.0	YU	967.	Y	878.	Y
SELENIUM	ug/L	4.00	YU	4.00	YURS	4.00	YU	4.00	YURS	40.0	YU	40.0	YURS
SILVER	ug/L	5.00	YUJS	5.00	YURS	5.00	YUJS	5.00	YURS	5.00	YUJS	5.00	YURS
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU
TIN	ug/L	19.0	YU	19.0	YURS	19.0	YU	19.0	YURS	190.	YU	19.0	YURS
VANADIUM	ug/L	20.0	YU	20.0	YU	20.0	YU	20.0	YU	26.0	Y	20.0	YU
ZINC	ug/L	38100	Y	34600	Y	4000	Y	3130	Y	140000	Y	131000	Y

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Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		06/03/86 MHD206 SW02004 ARGO TUNNEL AT PORTAL				06/03/86 MHD171 SW02104 CLEAR CREEK BELOW ARGO				05/22/86 MHD172 SW02204 CLEAR CREEK ABOVE ARGO			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		18.0	Y	--		13.0	Y	--		11.5	Y
pH	S.U.	--		2.90	Y	--		6.20	Y	--		6.95	Y
Eh (REDOX POTENTIAL)	MV	--		786.	Y	--		379.	Y	--		370.	Y
SPECIFIC CONDUCTANCE	umhos	--		2939	Y	--		130.	Y	--		112.	Y
DISSOLVED OXYGEN	mg/L	--		--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		0.86	Y	--		--		--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	946.	YJ*	--		102.	YJ*	--		12.0	YJ*	--	
pH	S.U.	--		2.90	Y	--		7.60	Y	--		5.76	Y
SPECIFIC CONDUCTANCE	umhos	--		3170	Y	--		125.	Y	--		127.	Y
TOTAL DISSOLVED SOLIDS	mg/L	3244	YJC	--		4746	YJC	--		54.0	YJC	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		73.0	YJC	--		65.0	YJC	--		69.0	YJC
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	309.	YRS	276.	Y	11.7	YJS	11.4	Y	13.2	YJE	11.3	Y
MAGNESIUM	mg/L	107.	YRS	103.	Y	3.26	Y	3.49	Y	3.10	Y	2.88	Y
POTASSIUM	mg/L	2.29	YJS	2.17	Y	0.73	YJS	0.95	Y	0.77	YJS	0.73	Y
SODIUM	mg/L	16.9	YRS	17.4	Y	3.45	YJS	3.53	Y	5.28	YJS	5.30	Y
MAJOR ANIONS													
BICARBONATE	mg/L	--		--		24.4	Y	--		39.0	Y	--	
CARBONATE	mg/L	--		--		--		--		--		--	
FLUORIDE	mg/L	2.50	Y	--		0.59	Y	--		0.83	Y	--	
CHLORIDE	mg/L	25.0	Y	--		5.00	Y	--		25.0	Y	--	
SULFATE	mg/L	1028	YJC	--		40.0	YJC	--		37.9	Y	--	

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06/03/87

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		06/03/86 MHD206 SW02004 ARGO TUNNEL AT PORTAL				06/03/86 MHD171 SW02104 CLEAR CREEK BELOW ARGO				05/22/86 MHD172 SW02204 CLEAR CREEK ABOVE ARGO			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	0.01	YU	--		0.01	YU	--		0.04	Y	--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	--		--		--		--		--		--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	22800	Y	22300	Y	199.	Y	1120	Y	470.	Y	391.	Y
ANTIMONY	ug/L	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	YU
ARSENIC	ug/L	108.	Y	226.	Y	4.00	YUJS	6.00	Y	4.00	YU	4.00	YU
BARIUM	ug/L	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	YURS	50.0	YU
BERYLLIUM	ug/L	12.0	Y	12.0	Y	5.00	YU	5.00	YU	5.00	YU	5.00	YU
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	122.	Y	119.	Y	5.00	YU	5.00	YU	5.00	YU	5.00	YU
CHROMIUM (Cr+6)	ug/L	18.6	Y	--		8.80	Y	--		--		--	
CHROMIUM (TOTAL)	ug/L	17.0	YJC	8.00	YU	8.00	YU	8.00	YU	8.00	YU	8.00	YU
COBALT	ug/L	133.	Y	138.	Y	20.0	YU	20.0	YU	20.0	YU	20.0	YU
COPPER	ug/L	6060	Y	5920	Y	43.0	YJS	69.0	Y	11.0	YUJE	14.0	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	137000	YJE	138000	Y	495.	Y	4140	Y	67.0	Y	698.	Y
LEAD	ug/L	11.0	Y	17.0	YJS	3.00	YU	15.0	YJS	3.00	YUJS	3.00	YJS
MANGANESE	ug/L	77700	Y	78600	Y	1330	Y	2030	Y	935.	Y	1090	Y
MERCURY	ug/L	0.12	YU	0.12	YU	0.12	YU	0.12	YU	0.12	YUJSH	0.12	YUJH
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	252.	YJE	203.	Y	20.0	YUJE	20.0	YU	42.0	Y	20.0	YU
SELENIUM	ug/L	40.0	YURS	40.0	YURS	4.00	YURS	4.00	YURS	4.00	YURS	4.00	YURS
SILVER	ug/L	5.00	YU	5.00	YURS	5.00	YURS	5.00	YURS	5.00	YUJS	5.00	YURS
SILICA	ug/L	40700	Y	40800	Y	7040	Y	5600	Y	5320	Y	5900	Y
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU
TIN	ug/L	19.0	YUJS	190.	YURS	19.0	YUJS	19.0	YURS	19.0	YUJS	19.0	YURS
VANADIUM	ug/L	40.0	Y	25.0	Y	20.0	YU	20.0	YU	34.0	Y	20.0	YU
ZINC	ug/L	42500	Y	44300	Y	611.	Y	801.	Y	190.	Y	226.	Y

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(JS) = ESTIMATED due to spike recoveries outside limits
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Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		05/21/86 MHD173 SW02304 BIG FIVE AT PORTAL				05/19/86 MHD164 SW02404 BIG FIVE AT CLEAR CREEK				05/19/86 MHD165 SW02504 BOOMERANG GULCH			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		15.0	Y	--		17.0	Y	--		15.0	Y
pH	S.U.	--		2.65	Y	--		2.80	Y	--		3.10	Y
Eh (REDOX POTENTIAL)	MV	--		708.	Y	--		806.	Y	--		788.	Y
SPECIFIC CONDUCTANCE	umhos	--		2799	Y	--		3101	Y	--		3096	Y
DISSOLVED OXYGEN	mg/L	--		--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		0.04	Y	--		--		--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	480.	YJ*	--		--		--		--		--	
pH	S.U.	--		2.80	Y	--		--		--		--	
SPECIFIC CONDUCTANCE	umhos	--		2995	Y	--		--		--		--	
TOTAL DISSOLVED SOLIDS	mg/L	2960	YJC	--		--		--		--		--	
TOTAL SUSPENDED SOLIDS	mg/L	--		78.0	YJC	--		--		--		--	
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	373.	YJE	310.	Y	375000	Y	340.	Y	340.	Y	302.	Y
MAGNESIUM	mg/L	143.	Y	124.	Y	140000	Y	122.	Y	114.	Y	105.	Y
POTASSIUM	mg/L	9.83	YJS	6.31	Y	9380	Y	6.20	YJS	0.60	Y	0.70	Y
SODIUM	mg/L	49.1	YJS	37.6	Y	44400	Y	33.9	YJS	21.0	Y	19.4	YJS
MAJOR ANIONS													
BICARBONATE	mg/L	--		--		--		--		--		--	
CARBONATE	mg/L	--		--		--		--		--		--	
FLUORIDE	mg/L	1.90	Y	--		--		--		--		--	
CHLORIDE	mg/L	35.0	Y	--		--		--		--		--	
SULFATE	mg/L	921.	YJC	--		--		--		--		--	

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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

06/03/87

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		05/21/86 MHD173 SW02304 BIG FIVE AT PORTAL				05/19/86 MHD164 SW02404 BIG FIVE AT CLEAR CREEK				05/19/86 MHD165 SW02504 BOOMERANG GULCH			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	0.04	Y	--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	--		--		--		--		--		--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	14600	Y	13400	Y	15000	Y	13100	Y	48700	Y	45800	Y
ANTIMONY	ug/L	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	YU
ARSENIC	ug/L	4.00	Y	4.00	Y	7.00	Y	4.00	YU	24.0	Y	50.0	Y
BARIUM	ug/L	50.0	YURS	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	YU
BERYLLIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	18.6	Y	19.3	Y
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	24.0	Y	20.0	Y	29.0	Y	25.0	Y	557.	Y	491.	Y
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	8.00	YU	8.00	YU	8.00	YU	9.00	Y	32.0	Y	44.0	Y
COBALT	ug/L	130.	Y	109.	Y	124.	Y	107.	Y	274.	Y	24.0	Y
COPPER	ug/L	1710	YJE	1520	Y	1450	Y	1280	Y	6190	Y	5970	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	48000	Y	45800	Y	18000	Y	16500	YJS	22600	Y	22700	YJS
LEAD	ug/L	14.0	YJS	14.0	YJS	3.00	YU	4.00	Y	3.00	YU	12.0	Y
MANGANESE	ug/L	31700	YJSH	28700	Y	31900	Y	28400	Y	128000	Y	114000	Y
MERCURY	ug/L	0.40	YJSH	0.12	YUJH	0.12	YUJSH	0.12	YUJH	0.12	YUJSH	0.12	YUJH
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	265.	Y	222.	Y	260.	Y	226.	Y	514.	Y	453.	Y
SELENIUM	ug/L	40.0	YURS	40.0	YU	40.0	YU	40.0	YU	40.0	YU	40.0	YU
SILVER	ug/L	5.00	YUJS	5.00	YURS	5.00	YU	5.00	YUJS	5.00	YUJS	5.00	YUJS
SILICA	ug/L	30600	Y	31300	Y	--		--		--		--	
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU
TIN	ug/L	190.	YUJS	19.0	YURS	190.	YU	190.	YU	190.	YU	190.	YU
VANADIUM	ug/L	22.0	Y	20.0	YU	21.0	Y	20.0	YU	38.0	Y	25.0	Y
ZINC	ug/L	9770	Y	8620	Y	9400	Y	8550	Y	102000	Y	94900	Y

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(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(H,HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		05/19/86 MHD166 SW02604 VIRGINIA CANYON ABOVE CLEAR CREEK				05/21/86 MHD169 SW02904 CLEAR CREEK ABOVE BIG FIVE				05/20/86 MHD167 SW03004 CHICAGO CREEK ABOVE CLEAR CREEK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		16.0	Y	--		13.5	Y	--		9.20	Y
pH	S.U.	--		2.85	Y	--		7.05	Y	--		6.95	Y
Eh (REDOX POTENTIAL)	MV	--		762.	Y	--		479.	Y	--		391.	Y
SPECIFIC CONDUCTANCE	umhos	--		2780	Y	--		139.	Y	--		64.0	Y
DISSOLVED OXYGEN	mg/L	--		--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		0.06	Y	--		--		--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	--		--		8.00	YJ*	--		--		--	
pH	S.U.	--		--		--		6.62	Y	--		--	
SPECIFIC CONDUCTANCE	umhos	--		--		--		139.	Y	--		--	
TOTAL DISSOLVED SOLIDS	mg/L	--		--		152.	YJC	--		--		--	
TOTAL SUSPENDED SOLIDS	mg/L	--		--		--		69.0	YJC	--		--	
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	196.	Y	173.	Y	14.5	Y	12.1	Y	7.87	Y	6.35	Y
MAGNESIUM	mg/L	97.4	Y	89.2	Y	3.45	Y	2.98	Y	2.25	Y	2.02	Y
POTASSIUM	mg/L	0.80	Y	0.80	YJS	0.85	Y	0.75	Y	0.73	Y	0.62	YJS
SODIUM	mg/L	12.6	Y	12.0	YJS	8.53	Y	5.82	Y	2.95	Y	3.23	YJS
MAJOR ANIONS													
BICARBONATE	mg/L	--		--		39.0	Y	--		--		--	
CARBONATE	mg/L	--		--		--		--		--		--	
FLUORIDE	mg/L	--		--		0.92	Y	--		--		--	
CHLORIDE	mg/L	--		--		25.0	Y	--		--		--	
SULFATE	mg/L	--		--		31.0	YJC	--		--		--	

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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L $CaCO_3$

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		05/19/86 MHD166 SW02604 VIRGINIA CANYON ABOVE CLEAR CREEK				05/21/86 MHD169 SW02904 CLEAR CREEK ABOVE BIG FIVE				05/20/86 MHD167 SW03004 CHICAGO CREEK ABOVE CLEAR CREEK			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		0.01	YU	--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	--		--		--		--		--		--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	88000	Y	84700	Y	107.	Y	288.	Y	571.	Y	152.	Y
ANTIMONY	ug/L	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	YU
ARSENIC	ug/L	70.0	Y	134.	Y	4.00	YU	4.00	YU	4.00	YU	4.00	YU
BARIUM	ug/L	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	YU
BERYLLIUM	ug/L	18.0	Y	19.0	Y	5.00	YU	5.00	YU	5.00	YU	5.00	YU
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	618.	Y	540.	Y	5.00	YU	5.00	YU	5.00	YU	5.00	YU
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	55.0	Y	58.0	Y	8.00	YU	8.00	YU	8.00	YU	8.00	YU
COBALT	ug/L	315.	Y	282.	Y	20.0	YU	20.0	YU	20.0	YU	20.0	YU
COPPER	ug/L	16000	Y	16100	Y	11.0	YUE	13.0	Y	11.0	YU	25.0	YJS
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	45100	Y	43500	YJS	20.0	YU	411.	Y	274.	Y	3020	Y
LEAD	ug/L	3.00	YU	29.0	Y	3.00	YU	3.00	Y	3.00	YU	3.00	YU
MANGANESE	ug/L	63200	Y	58200	Y	1060	Y	1070	Y	52.0	Y	124.	Y
MERCURY	ug/L	0.12	YUJSH	0.12	YUJH	0.12	YU	0.12	YU	0.12	YUJSH	0.12	YUJH
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	797.	Y	681.	Y	20.0	YU	20.0	YU	41.0	Y	20.0	YU
SELENIUM	ug/L	40.0	YU	40.0	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU
SILVER	ug/L	5.00	YUJS	5.00	YUJS	5.00	YU	5.00	YU	5.00	YUJS	5.00	YUJS
SILICA	ug/L	--		--		4720	Y	4840	Y	--		--	
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU
TIN	ug/L	190.	YU	190.	YU	19.0	YU	19.0	YU	19.0	YU	19.0	YU
VANADIUM	ug/L	47.0	Y	20.0	YU	20.0	YU	20.0	YU	35.0	Y	20.0	YU
ZINC	ug/L	114.	Y	106000	Y	159.	Y	174.	Y	34.0	Y	202.	Y

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		05/20/86 MHD168 SW03104 SODA CREEK ABOVE CLEAR CREEK				05/19/86 MHD181 SW06004 DECON BLANK (TWO RINSES ONLY)				05/22/86 MHD188 SW06104 SPLIT OF SW01204			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		11.0	Y	--		--		--		14.5	Y
pH	S.U.	--		7.30	Y	--		--		--		3.95	Y
Eh (REDOX POTENTIAL)	MV	--		420.	Y	--		--		--		478.	Y
SPECIFIC CONDUCTANCE	umhos	--		150.	Y	--		--		--		1310	Y
DISSOLVED OXYGEN	mg/L	--		--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		--		--		--		--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	--		--		--		--		350.	Y	--	
pH	S.U.	--		--		--		--		--		2.96	Y
SPECIFIC CONDUCTANCE	umhos	--		--		--		--		--		2174	Y
TOTAL DISSOLVED SOLIDS	mg/L	--		--		--		--		1432	YJC	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		--		--		--		--		64.0	YJC
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	13.4	Y	11.4	Y	0.26	YU	0.26	YU	232.	YJE	198.	Y
MAGNESIUM	mg/L	4.00	Y	3.61	Y	0.20	YU	0.20	YU	71.7	Y	64.7	Y
POTASSIUM	mg/L	3.26	Y	2.33	Y	0.50	YU	0.50	YU	5.34	YJS	4.30	Y
SODIUM	mg/L	19.4	Y	14.5	Y	2.00	YU	2.00	YU	21.0	YJS	19.0	Y
MAJOR ANIONS													
BICARBONATE	mg/L	--		--		--		--		--		--	
CARBONATE	mg/L	--		--		--		--		--		--	
FLUORIDE	mg/L	--		--		--		--		1.64	Y	--	
CHLORIDE	mg/L	--		--		--		--		22.0	Y	--	
SULFATE	mg/L	--		--		--		--		907.	YJC	--	

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06/03/87

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		05/20/86 MHD168 SW03104 SODA CREEK ABOVE CLEAR CREEK				05/19/86 MHD181 SW06004 DECON BLANK (TWO RINSES ONLY)				05/22/86 MHD188 SW06104 SPLIT OF SW01204			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		0.15	Y	--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	--		--		--		--		--		--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	516.	Y	379.	Y	70.0	YU	70.0	YU	5480	Y	5020	Y
ANTIMONY	ug/L	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	YU
ARSENIC	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00	YU
BARIUM	ug/L	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	YURS	50.0	YU
BERYLLIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	6.50	Y	6.40	Y
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	6.90	Y	5.00	YU
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	8.00	YU	8.00	YU	8.00	YU	8.00	YU	8.00	YU	8.00	YU
COBALT	ug/L	20.0	YU	20.0	YU	20.0	YU	20.0	YU	131.	Y	118.	Y
COPPER	ug/L	11.0	YU	11.0	YU	11.0	YU	12.0	Y	1520	YJE	1390	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	104.	Y	804.	Y	20.0	YU	29.0	Y	128000	Y	122000	Y
LEAD	ug/L	3.00	YU	3.00	YU	3.00	YU	3.00	YUJS	22.0	YJS	23.0	YJS
MANGANESE	ug/L	37.0	Y	60.0	Y	29.0	Y	13.0	Y	26800	Y	25200	Y
MERCURY	ug/L	0.40	Y	0.12	YU	0.21	YJSH	0.12	YUJH	0.12	YUJSH	0.12	YUJHU
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	43.0	Y	20.0	YU	20.0	YU	20.0	YU	180.	Y	161.	Y
SELENIUM	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YURS	4.00	YURS	40.0	YURS
SILVER	ug/L	5.00	YU	5.00	YU	5.00	YUJS	5.00	YURS	5.00	YUJS	5.00	YURS
SILICA	ug/L	--		--		--		--		35100	Y	35300	Y
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU
TIN	ug/L	19.0	YU	19.0	YU	19.0	YU	19.0	YURS	190.	YUJS	190.	YURS
VANADIUM	ug/L	36.0	Y	20.0	YU	20.0	YU	20.0	YU	20.0	YU	20.0	YU
ZINC	ug/L	17.0	Y	19.0	Y	39.0	Y	64.0	Y	6990	Y	6460	Y

FOOTNOTES

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(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		05/22/86 MHD190 SW06204 DISCHARGE ABOVE IDAHO SPRINGS (NO NAME)				06/03/86 MHD207 SW06404 NEVADA GULCH ABOVE QUARTZ HILL CONFLUENCE				06/03/86 MHD209 SW06504 QUARTZ HILL ABOVE NEVADA GULCH CONFLUENCE			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		16.2	Y	--		13.0	Y	--		13.0	Y
pH	S.U.	--		6.85	Y	--		4.05	Y	--		2.75	Y
Eh (REDOX POTENTIAL)	MV	--		397.	Y	--		601.	Y	--		844.	Y
SPECIFIC CONDUCTANCE	umhos	--		935.	Y	--		389.	Y	--		5114	Y
DISSOLVED OXYGEN	mg/L	--		--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		--		--		--		--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	--		--		128.	YJ*	--		3600	YJ*	--	
pH	S.U.	--		--		--		4.20	Y	--		2.74	Y
SPECIFIC CONDUCTANCE	umhos	--		--		--		604.	Y	--		4930	Y
TOTAL DISSOLVED SOLIDS	mg/L	--		--		484.	YJC	--		8032	YJC	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		--		--		58.0	YJC	--		61.0	YJC
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	171.	YJE	146.	Y	41.6	YRS	36.3	Y	358.	YRS	317.	Y
MAGNESIUM	mg/L	57.9	Y	52.6	Y	22.6	YRS	21.9	Y	193.	YRS	194.	Y
POTASSIUM	mg/L	2.31	YJS	2.15	Y	2.98	YJS	2.85	Y	0.58	YJS	0.60	Y
SODIUM	mg/L	16.2	YJS	14.6	Y	4.45	YRS	4.70	Y	10.0	YURS	10.7	Y
MAJOR ANIONS													
BICARBONATE	mg/L	--		--		2.40	Y	--		--		--	
CARBONATE	mg/L	--		--		--		--		--		--	
FLUORIDE	mg/L	--		--		0.46	Y	--		2.50	Y	--	
CHLORIDE	mg/L	--		--		10.0	Y	--		232.	Y	--	
SULFATE	mg/L	--		--		304.	YJC	--		1087	YJC	--	

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(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		05/22/86 MHD190 SW06204 DISCHARGE ABOVE IDAHO SPRINGS (NO NAME)				06/03/86 MHD207 SW06404 NEVADA GULCH ABOVE QUARTZ HILL CONFLUENCE				06/03/86 MHD209 SW06504 QUARTZ HILL ABOVE NEVADA GULCH CONFLUENCE			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		0.01	YU	--		0.01	YU	--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	--		--		--		--		--		--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	70.0	YU	1090	Y	4630	Y	4390	Y	91100	Y	91900	Y
ANTIMONY	ug/L	50.0	YU	50.0	YU	50.0	YU	50.0	YU	250.	YU	250.	YU
ARSENIC	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	2820	YJSE	1540	Y
BARIUM	ug/L	50.0	YURS	50.0	YU	50.0	YU	50.0	YU	250.	YU	25.0	YU
BERYLLIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	50.0	Y	51.0	Y
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	26.4	Y	25.0	Y	243.	Y	248.	Y	395.	Y	385.	Y
CHROMIUM (Cr+6)	ug/L	--		--		6.20	Y	--		18.6	Y	--	
CHROMIUM (TOTAL)	ug/L	8.00	YU	8.00	YU	8.00	YU	8.00	YU	40.0	YU	40.0	YU
COBALT	ug/L	42.0	Y	41.0	Y	27.0	Y	28.0	Y	420.	Y	435.	Y
COPPER	ug/L	158.	YJE	527.	Y	1710	Y	1670	Y	68700	Y	69900	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	57.0	Y	1970	Y	357.	YJE	451.	Y	770000	YJE	785000	Y
LEAD	ug/L	3.00	YUJS	6.00	YJS	196.	Y	227.	YJS	3.00	YU	3.00	YUJS
MANGANESE	ug/L	11400	Y	10700	Y	6430	Y	6300	Y	66200	Y	66900	Y
MERCURY	ug/L	0.12	YUJSH	0.12	YUJH	0.12	YU	0.12	YU	0.12	YU	0.12	YU
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	110.	Y	76.0	YU	86.0	YJE	41.0	Y	693.	Y	530.	Y
SELENIUM	ug/L	40.0	YURS	4.00	YURS	4.00	YURS	4.00	YURS	40.0	YURS	40.0	YURS
SILVER	ug/L	5.00	YUJS	5.00	YURS	5.00	YU	5.00	YURS	25.0	YU	25.0	YURS
SILICA	ug/L	--		--		18600	Y	18900	Y	68300	Y	76900	Y
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU
TIN	ug/L	19.0	YUJS	19.0	YURS	19.0	YUJS	19.0	YURS	190.	YUJS	190.	YURS
VANADIUM	ug/L	20.0	YU	20.0	YU	20.0	YU	20.0	YU	121.	Y	100.	YU
ZINC	ug/L	3820	Y	3890	Y	36000	Y	36700	Y	95600	Y	102000	Y

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(---) = Not analyzed
(umhos) = umhos/cm

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Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		06/03/86 MHD210 SW06604 DECON BLANK				06/03/86 MHD211 SW06804 BELOW CONFLUENCE - QUARTZ HILL & NEVADA GULCH				06/03/86 MHD214 SW06904 CULVERT WATER FROM QUARTZ HILL - CENTRAL CITY			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		--		--		14.5	Y	--		18.5	Y
pH	S.U.	--		--		--		3.30	Y	--		6.45	Y
Eh (REDOX POTENTIAL)	MV	--		--		--		786.	Y	--		455.	Y
SPECIFIC CONDUCTANCE	umhos	--		--		--		5793	Y	--		201.	Y
DISSOLVED OXYGEN	mg/L	--		--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		--		--		--		--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	3680	YJ*	--		254.	YJ*	--		--		--	
pH	S.U.	--		4.40	Y	--		3.30	Y	--		7.90	Y
SPECIFIC CONDUCTANCE	umhos	--		23.0	Y	--		948.	Y	--		203.	Y
TOTAL DISSOLVED SOLIDS	mg/L	24.0	YJC	--		564.	YJC	--		80.0	YJC	--	
TOTAL SUSPENDED SOLIDS	mg/L	--		59.0	Y	--		68.0	YJC	--		11.0	YJC
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	0.26	YURS	0.26	YUE	44.8	YRS	43.0	Y	20.0	YRS	18.4	Y
MAGNESIUM	mg/L	0.20	YURS	0.20	YU	26.6	YRS	25.9	Y	6.63	YRS	6.42	Y
POTASSIUM	mg/L	0.50	YUJS	0.50	YU	3.09	YJS	2.80	Y	1.34	YJS	1.39	Y
SODIUM	mg/L	2.00	YURS	2.00	YU	4.61	YRS	4.90	Y	5.29	YRS	5.09	Y
MAJOR ANIONS													
BICARBONATE	mg/L	9.80	Y	--		--		--		44.0	Y	--	
CARBONATE	mg/L	--		--		--		--		--		--	
FLUORIDE	mg/L	0.10	YU	--		0.67	Y	--		0.16	Y	--	
CHLORIDE	mg/L	0.30	YU	--		10.0	Y	--		12.0	Y	--	
SULFATE	mg/L	392.	YJC	--		26.3	YJC	--		64.6	YJC	--	

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		06/03/86 MHD210 SW06604 DECON BLANK				06/03/86 MHD211 SW06804 BELOW CONFLUENCE - QUARTZ HILL & NEVADA GULCH				06/03/86 MHD214 SW06904 CULVERT WATER FROM QUARTZ HILL - CENTRAL CITY			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	0.01	YU	--		0.01	YU	--		0.01	YU	--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	--		--		--		--		--		--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	126.	Y	70.0	YU	6690	Y	6520	Y	70.0	YU	70.0	YU
ANTIMONY	ug/L	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	YU
ARSENIC	ug/L	4.00	YU	4.00	YU	11.0	Y	34.0	Y	4.00	YU	4.00	YU
BARIUM	ug/L	50.0	YU	50.0	YU	70.0	Y	50.0	YU	50.0	YU	50.0	YU
BERYLLIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	5.00	YU	5.00	YU	248.	Y	250.	Y	5.00	YU	5.00	YU
CHROMIUM (Cr+6)	ug/L	5.00	YU	--		19.5	Y	--		13.3	Y	--	
CHROMIUM (TOTAL)	ug/L	8.00	YU	8.00	YU	8.00	YU	8.00	YU	8.00	YU	8.00	YU
COBALT	ug/L	20.0	YU	20.0	YU	37.0	Y	36.0	Y	20.0	YU	20.0	YU
COPPER	ug/L	11.0	YU	11.0	YU	3350	Y	3330	Y	19.0	Y	13.0	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	76.0	YJE	459.	Y	14700	YJE	19600	Y	314.	YJE	938.	Y
LEAD	ug/L	3.00	YU	3.00	YUJS	187.	Y	224.	YJS	3.00	Y	7.00	YJS
MANGANESE	ug/L	9.00	YU	18.0	Y	7830	Y	7740	Y	516.	Y	507.	Y
MERCURY	ug/L	0.21	Y	0.12	YU	0.12	YU	0.12	YU	0.12	YU	0.12	YU
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	20.0	YU	20.0	YU	100.	Y	54.0	Y	20.0	YUJE	20.0	YU
SELENIUM	ug/L	4.00	YURS	4.00	YURS	4.00	YURS	4.00	YURS	4.00	YURS	4.00	YURS
SILVER	ug/L	5.00	YU	5.00	YURS	5.00	YU	5.00	YURS	5.00	YU	5.00	YURS
SILICA	ug/L	2400	Y	2600	Y	18300	Y	18800	Y	9600	Y	9900	Y
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	YU
TIN	ug/L	19.0	YUJS	19.0	YURS	19.0	YUJS	19.0	YURS	19.0	YUJS	19.0	YURS
VANADIUM	ug/L	20.0	YUJS	20.0	YU	20.0	YU	20.0	YU	20.0	YU	20.0	YU
ZINC	ug/L	9.00	YU	31.0	Y	37100	Y	38000	Y	920.	Y	1020	Y

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		06/03/86 MHD215 SW07004 MIX OF QUARTZ HILL/NEVADA GULCH W/CLEAR CREEK				06/09/86 MHD217 SW07104 GREGORY GULCH AT BLACKHAWK - RAIN				06/09/86 MHD218 SW07204 NORTH CLEAR CREEK 3-4 MI BELOW BLACKHAWK-RAIN			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		18.0	Y	--		--		--		--	
pH	S.U.	--		5.10	Y	--		--		--		--	
Eh (REDOX POTENTIAL)	MV	--		531.	Y	--		--		--		--	
SPECIFIC CONDUCTANCE	umhos	--		292.	Y	--		--		--		--	
DISSOLVED OXYGEN	mg/L	--		--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		--		--		--		--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	30.0	YJ*	--		--		--		--		--	
pH	S.U.	--		5.00	Y	--		--		--		--	
SPECIFIC CONDUCTANCE	umhos	--		26700	Y	--		--		--		--	
TOTAL DISSOLVED SOLIDS	mg/L	230.	YJC	--		--		--		--		--	
TOTAL SUSPENDED SOLIDS	mg/L	--		50.0	YJC	--		--		--		--	
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	29.8	YRS	25.5	Y	32.7	Y	39.4	Y	7.40	Y	11.9	Y
MAGNESIUM	mg/L	12.3	YRS	11.3	Y	13.2	Y	27.2	Y	2.53	Y	8.44	Y
POTASSIUM	mg/L	1.77	YJS	1.90	Y	2.39	Y	12.0	Y	0.68	Y	7.54	Y
SODIUM	mg/L	5.67	YRS	5.17	Y	9.22	Y	8.40	Y	3.49	Y	4.35	Y
MAJOR ANIONS													
BICARBONATE	mg/L	9.80	Y	--		--		--		--		--	
CARBONATE	mg/L	--		--		--		--		--		--	
FLUORIDE	mg/L	0.31	Y	--		--		--		--		--	
CHLORIDE	mg/L	5.00	Y	--		--		--		--		--	
SULFATE	mg/L	2512	YJC	--		--		--		--		--	

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CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		06/03/86 MHD215 SW07004 MIX OF QUARTZ HILL/NEVADA GULCH W/CLEAR CREEK				06/09/86 MHD217 SW07104 GREGORY GULCH AT BLACKHAWK - RAIN				06/09/86 MHD218 SW07204 NORTH CLEAR CREEK 3-4 MI BELOW BLACKHAWK-RAIN			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	0.01	YU	--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	--		--		--		--		--		--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	932.	Y	2250	Y	712.	Y	41700	Y	70.0	YU	15200	Y
ANTIMONY	ug/L	50.0	YU	50.0	YU	50.0	YU	50.0	YUJS	50.0	YU	50.0	YUJS
ARSENIC	ug/L	4.00	YU	9.00	Y	4.00	YU	44.0	YR	4.00	YU	19.0	YR
BARIUM	ug/L	50.0	YU	50.0	YU	64.0	Y	642.	Y	50.0	YU	252.	Y
BERYLLIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	Y	5.00	YU	5.00	YU
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	58.0	Y	52.0	Y	64.0	Y	67.0	Y	5.00	YU	5.00	Y
CHROMIUM (Cr+6)	ug/L	5.00	YU	--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	8.00	YU	8.00	YU	8.00	YU	94.0	Y	8.00	YU	38.0	Y
COBALT	ug/L	20.0	YU	20.0	YU	20.0	YU	41.0	Y	20.0	YU	20.0	YU
COPPER	ug/L	942.	Y	946.	Y	440.	Y	1390	Y	11.0	YU	497.	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	255.	Y	8520	Y	299.	Y	124000	Y	72.0	Y	48500	Y
LEAD	ug/L	10.0	Y	82.0	YJS	15.0	Y	1830	YR	3.00	Y	706.	YR
MANGANESE	ug/L	2420	Y	2220	Y	3460	Y	5210	Y	620.	Y	1450	Y
MERCURY	ug/L	0.12	YU	0.12	YU	0.20	YUJHT	2.30	YJSHT	0.20	YUJH	0.55	YJHS
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	27.0	Y	20.0	YUJC	26.0	Y	114.	Y	20.0	YU	51.0	Y
SELENIUM	ug/L	4.00	YURS	4.00	YURS	4.00	YU	4.00	YUJS	4.00	YUJS	4.00	YUJS
SILVER	ug/L	5.00	YU	5.00	YURS	5.00	YU	14.0	Y	5.00	YU	6.00	Y
SILICA	ug/L	11200	Y	12600	Y	--		--		--		--	
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	6.00	YU	6.00	YU	6.00	YU	60.0	YUR	6.00	YU	6.00	YUR
TIN	ug/L	19.0	YUJS	19.0	YURS	--		--		--		--	
VANADIUM	ug/L	20.0	YU	20.0	YU	20.0	YU	118.	Y	20.0	YU	56.0	Y
ZINC	ug/L	8700	Y	8210	Y	9910	Y	13200	Y	359.	Y	1830	Y

FOOTNOTES

(R) = REJECTED
(L) = QUALIFIED due to LCS recoveries outside control limits
(I) = QUANTIFIED due to exceeding ICP linear range
(*) = DUPLICATE control limits exceeded
(EJ) = ESTIMATED due to interference problems (ICP serial dilution or low spike recovery by graphite furnance)
(--) = Not analyzed
(umhos) = umhos/cm
(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(H,HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		06/09/86 MHD219 SW07304 CLEAR CREEK ABOVE NORTH CLEAR CREEK-RAIN				06/09/86 MHD220 SW07404 NORTH CLEAR CREEK ABOVE CLEAR CREEK-RAIN				06/09/86 MHD221 SW07504 NORTH CLEAR CREEK BELOW GREGORY GULCH-RAIN			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
FIELD DETERMINATIONS													
TEMPERATURE	C	--		--		--		--		--		--	
pH	S.U.	--		--		--		--		--		--	
Eh (REDOX POTENTIAL)	MV	--		--		--		--		--		--	
SPECIFIC CONDUCTANCE	umhos	--		--		--		--		--		--	
DISSOLVED OXYGEN	mg/L	--		--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--		--	
As+3	mg/L	--		--		--		--		--		--	
As+5	mg/L	--		--		--		--		--		--	
DISCHARGE	CFS	--		--		--		--		--		--	
LAB DETERMINATIONS													
GENERAL													
ACIDITY	mg/L	--		--		--		--		--		--	
pH	S.U.	--		--		--		--		--		--	
SPECIFIC CONDUCTANCE	umhos	--		--		--		--		--		--	
TOTAL DISSOLVED SOLIDS	mg/L	--		--		--		--		--		--	
TOTAL SUSPENDED SOLIDS	mg/L	--		--		--		--		--		--	
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--		--	
MAJOR CATIONS													
CALCIUM	mg/L	7.09	Y	7.92	Y	4.35	Y	6.59	Y	6.20	Y	8.30	Y
MAGNESIUM	mg/L	1.83	Y	2.21	Y	1.27	Y	3.07	Y	1.98	Y	4.18	Y
POTASSIUM	mg/L	0.61	YU	0.95	Y	0.59	Y	1.67	Y	0.63	Y	2.50	Y
SODIUM	mg/L	3.09	Y	3.81	Y	2.56	Y	3.58	Y	2.53	Y	4.02	Y
MAJOR ANIONS													
BICARBONATE	mg/L	--		--		--		--		--		--	
CARBONATE	mg/L	--		--		--		--		--		--	
FLUORIDE	mg/L	--		--		--		--		--		--	
CHLORIDE	mg/L	--		--		--		--		--		--	
SULFATE	mg/L	--		--		--		--		--		--	

FOOTNOTES

(R) = REJECTED
(L) = QUALIFIED due to LCS recoveries outside control limits
(I) = QUANTIFIED due to exceeding ICP linear range
(*) = DUPLICATE control limits exceeded
(EJ) = ESTIMATED due to interference problems (ICP serial dilution or low spike recovery by graphite furnance)
(--) = Not analyzed
(umhos) = umhos/cm
(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration probleas
(U) = UNDETECTED
(H,HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		06/09/86 MHD219 SW07304 CLEAR CREEK ABOVE NORTH CLEAR CREEK-RAIN				06/09/86 MHD220 SW07404 NORTH CLEAR CREEK ABOVE CLEAR CREEK-RAIN				06/09/86 MHD221 SW07504 NORTH CLEAR CREEK BELOW GREGORY GULCH-RAIN			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	--		--		--		--		--		--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	70.0	YU	1900	Y	70.0	YU	5240	Y	70.0	YU	7100	Y
ANTIMONY	ug/L	50.0	YU	50.0	YUJS	50.0	YU	50.0	YUJS	50.0	YU	50.0	YUJS
ARSENIC	ug/L	4.00	YU	4.00	YUR	4.00	YU	4.00	YUR	4.00	YU	4.00	YUR
BARIUM	ug/L	50.0	YU	50.0	YU	50.0	YU	96.0	Y	50.0	YU	123.	Y
BERYLLIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	Y	5.00	YU
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	8.00	YU	8.00	YU	8.00	YU	11.0	Y	8.00	YU	15.0	Y
COBALT	ug/L	20.0	YU	20.0	YU	20.0	YU	20.0	YU	20.0	YU	20.0	YU
COPPER	ug/L	11.0	YU	43.0	Y	11.0	YU	56.0	Y	17.0	Y	128.	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	110.	Y	3220	Y	75.0	Y	9320	Y	265.	Y	15900	Y
LEAD	ug/L	3.00	YU	36.0	YR	3.70	Y	57.0	YR	3.00	YU	142.	YR
MANGANESE	ug/L	300.	Y	816.	Y	50.0	Y	412.	Y	359.	Y	720.	Y
MERCURY	ug/L	0.20	YUJHT	0.20	YUJSH	0.20	YUJH	0.20	YUJSH	0.20	YUJHT	0.20	YUJSH
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	20.0	YU	20.0	YU	20.0	YU	20.0	YU	20.0	YU	20.0	YU
SELENIUM	ug/L	4.00	YUJS	4.00	YUJS	4.00	YUJS	4.00	YUJS	4.00	YUJS	4.00	YUJS
SILVER	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	6.00	YU	6.00	YUR	6.00	YU	6.00	YUR	6.00	YU	6.00	YUR
TIN	ug/L	--		--		--		19.0	YU	--		--	
VANADIUM	ug/L	20.0	YU	20.0	YU	20.0	YU	20.0	YU	20.0	YU	20.0	YU
ZINC	ug/L	121.	Y	295.	Y	50.0	Y	203.	Y	417.	Y	767.	Y

FOOTNOTES

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(I) = QUANTIFIED due to exceeding ICP linear range
(*) = DUPLICATE control limits exceeded
(EJ) = ESTIMATED due to interference problems (ICP serial dilution or low spike recovery by graphite furnance)
(--) = Not analyzed
(umhos) = umhos/cm

(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(H,HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		06/09/86 MHD222 SW07604 NORTH CLEAR CREEK ABOVE GREGORY GULCH-RAIN		06/09/86 MHD223 SW07704 CLEAR CREEK BELOW NORTH CLEAR CREEK - RAIN		06/09/86 MHD224 SW07804 CLEAR CREEK 1 MILE BELOW N CLEAR CK - RAIN	
		DISSOLVED	TOTAL	DISSOLVED	TOTAL	DISSOLVED	TOTAL
FIELD DETERMINATIONS							
TEMPERATURE	C	--	--	--	--	--	--
pH	S.U.	--	--	--	--	--	--
Eh (REDOX POTENTIAL)	MV	--	--	--	--	--	--
SPECIFIC CONDUCTANCE	umhos	--	--	--	--	--	--
DISSOLVED OXYGEN	mg/L	--	--	--	--	--	--
Fe+2	mg/L	--	--	--	--	--	--
Fe+3	mg/L	--	--	--	--	--	--
IRON (TOTAL)	mg/L	--	--	--	--	--	--
As+3	mg/L	--	--	--	--	--	--
As+5	mg/L	--	--	--	--	--	--
DISCHARGE	CFS	--	--	--	--	--	--
LAB DETERMINATIONS							
GENERAL							
ACIDITY	mg/L	--	--	--	--	--	--
pH	S.U.	--	--	--	--	--	--
SPECIFIC CONDUCTANCE	umhos	--	--	--	--	--	--
TOTAL DISSOLVED SOLIDS	mg/L	--	--	--	--	--	--
TOTAL SUSPENDED SOLIDS	mg/L	--	--	--	--	--	--
TOTAL ORGANIC CARBON	mg/L	--	--	--	--	--	--
MAJOR CATIONS							
CALCIUM	mg/L	5.24 Y	6.88 Y	8.12 Y	9.72 Y	7.41 Y	8.02 Y
MAGNESIUM	mg/L	1.54 Y	2.97 Y	2.43 Y	4.28 Y	2.01 Y	2.80 Y
POTASSIUM	mg/L	0.58 Y	1.57 Y	0.70 Y	2.37 Y	0.62 Y	1.23 Y
SODIUM	mg/L	2.41 Y	3.56 Y	3.67 Y	4.47 Y	3.41 Y	5.14 Y
MAJOR ANIONS							
BICARBONATE	mg/L	--	--	--	--	--	--
CARBONATE	mg/L	--	--	--	--	--	--
FLUORIDE	mg/L	--	--	--	--	--	--
CHLORIDE	mg/L	--	--	--	--	--	--
SULFATE	mg/L	--	--	--	--	--	--

FOOTNOTES

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(*) = DUPLICATE control limits exceeded
(EJ) = ESTIMATED due to interference problems (ICP serial dilution or low spike recovery by graphite furnance)
(--) = Not analyzed
(umhos) = umhos/cm
(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(H,HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

06/03/87

CLEAR CREEK SURFACE WATER CHEMISTRY DATA

		06/09/86 MHD222 SW07604 NORTH CLEAR CREEK ABOVE GREGORY GULCH-RAIN				06/09/86 MHD223 SW07704 CLEAR CREEK BELOW NORTH CLEAR CREEK - RAIN				06/09/86 MHD224 SW07804 CLEAR CREEK 1 MILE BELOW N CLEAR CK - RAIN			
		DISSOLVED		TOTAL		DISSOLVED		TOTAL		DISSOLVED		TOTAL	
NUTRIENTS													
AMMONIA	mg/L	--		--		--		--		--		--	
NITRITE (NO2) (NO2-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3) (NO3-N)	mg/L	--		--		--		--		--		--	
NITRATE (NO3-N) + NITRITE (NO2-N)	mg/L	--		--		--		--		--		--	
PHOSPHATE	mg/L	--		--		--		--		--		--	
MINOR & TRACE ELEMENTS													
ALUMINUM	ug/L	70.0	YU	4870	Y	70.0	YU	5860	Y	78.0	Y	3040	Y
ANTIMONY	ug/L	50.0	YU	50.0	YUJS	50.0	YU	50.0	YUJS	50.0	YU	50.0	YUJS
ARSENIC	ug/L	4.00	YU	4.00	YUR	4.00	YU	4.00	YUR	4.00	YU	4.00	YUR
BARIUM	ug/L	50.0	YU	83.0	Y	50.0	YU	98.0	Y	50.0	YU	56.0	Y
BERYLLIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
BORON	ug/L	--		--		--		--		--		--	
CADMIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--		--	
CHROMIUM (TOTAL)	ug/L	8.00	YU	11.0	Y	8.00	YU	11.0	Y	8.00	YU	8.00	YU
COBALT	ug/L	20.0	YU	20.0	YU	20.0	YU	20.0	YU	20.0	YU	20.0	YU
COPPER	ug/L	11.0	YU	69.0	Y	16.0	Y	163.	Y	13.0	Y	85.0	Y
CYANIDE	ug/L	--		--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--		--	
IRON	ug/L	386.	Y	9540	Y	398.	Y	16000	Y	237.	Y	6770	Y
LEAD	ug/L	3.00	YU	58.0	YR	5.00	Y	134.	YR	4.70	Y	57.0	YR
MANGANESE	ug/L	237.	Y	499.	Y	384.	Y	705.	Y	319.	Y	748.	Y
MERCURY	ug/L	0.20	YUJH	0.20	YUJSH	0.20	YUJHT	0.20	YUJSH	0.20	YUJH	0.20	YUJSH
MOLYBDENUM	ug/L	--		--		--		--		--		--	
NICKEL	ug/L	20.0	YU	20.0	YU	20.0	YU	20.0	YU	20.0	YU	20.0	YU
SELENIUM	ug/L	4.00	YUJS	4.00	YUJS	4.00	YUJS	4.00	YUJS	4.00	YUJS	4.00	YUJS
SILVER	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
SILICA	ug/L	--		--		--		--		--		--	
STRONTIUM	ug/L	--		--		--		--		--		--	
SULFIDE	ug/L	--		--		--		--		--		--	
THALLIUM	ug/L	6.00	YU	6.00	YUR	6.00	YU	6.00	YUR	6.00	YU	60.0	YUR
TIN	ug/L	--		--		--		--		--		--	
VANADIUM	ug/L	20.0	YU	20.0	YU	20.0	YU	20.0	YU	20.0	YU	20.0	YU
ZINC	ug/L	99.0	Y	226.	Y	259.	Y	537.	Y	152.	Y	370.	Y

FOOTNOTES

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(L) = QUALIFIED due to LCS recoveries outside control limits
(I) = QUANTIFIED due to exceeding ICP linear range
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(EJ) = ESTIMATED due to interference problems (ICP serial dilution or low spike recovery by graphite furnance)
(--) = Not analyzed
(umhos) = umhos/cm

(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(H,HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

APPENDIX 6E
DATA QUALIFIER DEFINITIONS

APPENDIX 6E

DEFINITION OF ORGANIC QUALIFIERS
EPA REGION 8

Code letters and associated definitions in the analysis summaries are provided below.

BDL - The material was analyzed for, but was not detected. The associated numerical value is the estimated sample quantitation limit.

U - The material was analyzed for, but was not detected. The associated numerical value is the estimated sample quantitation limit.

J - The associated numerical value is an estimated quantity because the amount detected is below the required limits or because quality control criteria were not met.

UB - Estimated sample quantitation limit increased. Amount found in sample reported. Compound detected at <5 X the amount in blank (<10 X for methylene chloride, acetone, toluene and phthalates).

UJ - Detection limit is estimated because quality control criteria were not met.

JB - The value is an estimated amount detected below required limits and also detected in the blank.

B - Compound was detected in the blank. Quantity reported is >5 X the amount found in the blank (>10 X for methylene chloride, acetone, toluene, and phthalates).

R - Quality Control indicates that data is <u>not</u> usable (compound may or may not be present). Resampling and reanalysis is necessary for verification.

Z - No analytical result.

N - Presumptive evidence of presence of material (tentative identification).

APPENDIX 6E

DEFINITION OF INORGANIC QUALIFIERS
EPA REGION 8

(R) = Rejected ('R' used by laboratory indicates recovery problems)

(J) = Estimated

(JHT) = Estimated due to holding time violation

(EJ) = Estimated due to interference problems (ICP serial dilution or no spike recovery by graphite furnace)

(JL) = Estimated due to exceeding ICP linear range

(U) = Undetected

(*) = Duplicate control limits exceeded

(*J) = Estimated due to duplicate control limits being exceeded

(JS) = Estimated due to spike recoveries outside limits

(JC) = Estimated due to instrument calibration problems

APPENDIX 6F

STATISTICAL SUMMARIES

FOR CURRENT SURFACE WATER DATA

LOCATION = SW001 Clear creek Above North Clear Creek

TOTAL OBSERVATIONS: 4

PARAMETER	UNITS	N CASES	MINIMUM	MAXIMUM	ARITHMETIC MEAN	STANDARD DEVIATION	PROB > STAND	GEOMETRIC MEAN	GEOMETRIC DEVIATION	PROB > STAND	STANDARD *
Aluminum (total)	ug/l	4.	202.	1500.	571.500	621.689	.751	398.218	2.484	.858	150.00
Arsenic (total)	ug/l	4.	3.00	10.00	6.750	3.775	.000	5.888	1.865	.000	50.00
Cadmium (total)	ug/l	4.	2.00	9.00	5.000	2.944	.941	4.358	1.863	1.000	.40
Chromium (total)	ug/l	4.	4.00	8.00	5.000	2.000	.000	4.759	1.415	.000	49.00
Copper (total)	ug/l	4.	22.00	281.	100.500	121.459	.781	61.375	3.001	.979	6.50
Lead (total)	ug/l	4.	4.00	5.60	5.025	.732	1.000	4.983	1.168	1.000	1.30
Manganese (total)	ug/l	4.	474.	2200.	1416.000	712.496	.720	1235.215	1.944	.625	1000.00
Nickel (total)	ug/l	4.	5.00	20.00	10.500	6.658	.250	9.143	1.809	.202	15.00
Silver (total)	ug/l	4.	.100	5.00	2.300	2.573	.665	.669	8.989	.395	1.20
Zinc (total)	ug/l	4.	214.	1680.	798.000	643.786	.878	608.502	2.413	.998	47.00
Aluminum (dissolved)	ug/l	4.	37.00	193.	117.250	76.360	.334	95.488	2.192	.283	150.00
Arsenic (dissolved)	ug/l	4.	2.00	10.00	4.750	3.594	.000	3.935	1.982	.000	50.00
Cadmium (dissolved)	ug/l	4.	1.00	5.00	3.000	1.826	.923	3.421	1.613	1.000	.40
Chromium (dissolved)	ug/l	4.	4.00	8.00	5.000	2.000	.000	4.759	1.415	.000	49.00
Copper (dissolved)	ug/l	4.	10.00	19.00	13.500	3.873	.965	13.118	1.310	.995	6.50
Lead (dissolved)	ug/l	4.	2.00	5.00	3.075	1.350	.906	2.883	1.498	.976	1.30
Manganese (dissolved)	ug/l	4.	478.	2420.	1327.000	816.429	.656	1133.426	1.962	.574	1000.00
Nickel (dissolved)	ug/l	4.	5.00	20.00	9.975	6.792	.230	8.619	1.809	.175	15.00
Silver (dissolved)	ug/l	4.	.100	5.00	2.300	2.573	.665	.669	8.989	.395	1.20
Zinc (dissolved)	ug/l	4.	221.	720.	417.000	219.895	.954	377.662	1.665	1.000	47.00
Fluoride	mg/l	2.	.430	.770	.600	.240	.000	.575	1.510	.000	4.00
Sulfate	mg/l	2.	15.00	58.00	36.500	30.406	-----	29.488	2.601		
Field pH	S.U.	4.	6.80	7.36	7.015	.254	-----	7.015	1.037		

LOCATION = SW002 Clear Creek Below North Clear Creek

TOTAL OBSERVATIONS: 4

PARAMETER	UNITS	N CASES	MINIMUM	MAXIMUM	ARITHMETIC MEAN	STANDARD DEVIATION	PROB > STAND	GEOMETRIC MEAN	GEOMETIC DEVIATION	PROB > STAND	STANDARD *
Aluminum (total)	ug/l	4.	288.	633.	399.000	160.090	.940	378.797	1.432	.995	150.00
Arsenic (total)	ug/l	4.	2.00	10.00	4.750	3.594	.000	3.935	1.982	.000	50.00
Cadmium (total)	ug/l	4.	1.00	5.00	3.000	1.826	.923	3.421	1.613	1.000	.40
Chromium (total)	ug/l	4.	4.00	8.00	5.000	2.000	.000	4.759	1.415	.000	49.00
Copper (total)	ug/l	4.	22.00	51.00	43.000	14.071	.995	40.691	1.508	1.000	6.50
Lead (total)	ug/l	4.	3.00	8.00	5.250	2.062	.972	4.948	1.493	1.000	1.30
Manganese (total)	ug/l	4.	555.	2300.	1411.250	716.012	.717	1253.882	1.813	.648	1000.00
Nickel (total)	ug/l	4.	5.00	20.00	10.400	6.671	.245	9.052	1.808	.197	15.00
Silver (total)	ug/l	4.	.100	5.00	2.300	2.573	.665	.669	8.989	.395	1.20
Zinc (total)	ug/l	4.	244.	793.	527.250	224.536	.984	485.413	1.640	1.000	47.00
Aluminum (dissolved)	ug/l	4.	47.00	135.	75.000	40.923	.033	68.238	1.614	.050	150.00
Arsenic (dissolved)	ug/l	4.	2.00	10.00	4.750	3.594	.000	3.935	1.982	.000	50.00
Cadmium (dissolved)	ug/l	4.	2.00	5.00	4.000	1.414	.995	3.762	1.543	1.000	.40
Chromium (dissolved)	ug/l	4.	4.00	8.00	5.000	2.000	.000	4.759	1.415	.000	49.00
Copper (dissolved)	ug/l	4.	9.00	12.00	10.450	1.320	.999	10.392	1.135	1.000	6.50
Lead (dissolved)	ug/l	4.	2.00	5.00	3.000	1.414	.885	2.784	1.545	.960	1.30
Manganese (dissolved)	ug/l	4.	531.	2450.	1447.750	792.683	.714	1262.690	1.896	.642	1000.00
Nickel (dissolved)	ug/l	4.	5.00	20.00	10.550	6.812	.257	9.088	1.863	.210	15.00
Silver (dissolved)	ug/l	4.	.100	5.00	2.300	2.573	.665	.669	8.989	.395	1.20
Zinc (dissolved)	ug/l	4.	168.	653.	395.250	199.211	.960	354.603	1.752	1.000	47.00
Fluoride	mg/l	2.	.430	.770	.600	.240	.000	.575	1.510	.000	4.00
Sulfate	mg/l	2.	22.00	71.00	46.500	34.648	-----	39.528	2.291		
Field pH	S.U.	4.	6.60	7.10	6.813	.232	-----	6.807	1.035		

LOCATION = SW003 North Clear Creek Above Clear Creek

TOTAL OBSERVATIONS: 4

PARAMETER	UNITS	N CASES	MINIMUM	MAXIMUM	ARITHMETIC MEAN	STANDARD DEVIATION	PROB > STAND	GEOMETRIC MEAN	GEOMETIC DEVIATION	PROB > STAND	STANDARD *
Aluminum (total)	ug/l	4.	455.	1400.	729.250	448.636	.902	650.668	1.675	.998	150.00
Arsenic (total)	ug/l	4.	2.00	10.00	4.750	3.594	.000	3.935	1.982	.000	50.00
Cadmium (total)	ug/l	4.	1.40	5.00	3.100	1.685	.945	2.735	1.809	.999	.40
Chromium (total)	ug/l	4.	4.00	8.00	5.175	1.912	.000	4.953	1.390	.000	49.00
Copper (total)	ug/l	4.	60.00	104.	81.000	23.763	.999	78.335	1.349	1.000	6.50
Lead (total)	ug/l	4.	4.00	24.00	9.500	9.678	.802	7.001	2.289	.979	1.30
Manganese (total)	ug/l	4.	521.	2530.	1577.750	878.969	.745	1348.839	2.012	.666	1000.00
Nickel (total)	ug/l	4.	11.00	22.00	18.750	5.252	.762	18.065	1.397	.711	15.00
Silver (total)	ug/l	4.	.100	5.00	2.300	2.573	.665	.669	8.989	.395	1.20
Zinc (total)	ug/l	4.	475.	1440.	966.750	524.565	.960	852.352	1.808	1.000	47.00
Aluminum (dissolved)	ug/l	4.	23.00	127.	50.000	51.342	.026	36.745	2.286	.044	150.00
Arsenic (dissolved)	ug/l	4.	2.00	10.00	4.750	3.594	.000	3.935	1.982	.000	50.00
Cadmium (dissolved)	ug/l	4.	2.10	5.60	4.425	1.576	.995	4.141	1.578	1.000	.40
Chromium (dissolved)	ug/l	4.	4.00	8.00	5.400	1.890	.000	5.176	1.392	.000	49.00
Copper (dissolved)	ug/l	4.	9.80	20.00	16.450	4.605	.985	15.863	1.388	.997	6.50
Lead (dissolved)	ug/l	4.	2.00	5.00	3.750	1.500	.949	3.501	1.559	.987	1.30
Manganese (dissolved)	ug/l	4.	528.	2480.	1629.500	944.493	.747	1374.712	2.067	.669	1000.00
Nickel (dissolved)	ug/l	4.	8.50	29.00	19.375	8.400	.699	17.725	1.682	.626	15.00
Silver (dissolved)	ug/l	4.	.100	5.00	2.325	2.595	.668	.673	9.052	.396	1.20
Zinc (dissolved)	ug/l	4.	308.	1610.	942.500	657.785	.913	748.447	2.273	1.000	47.00
Fluoride	mg/l	2.	.180	.230	.205	.035	.000	.204	1.189	.000	4.00
Sulfate	mg/l	2.	86.00	148.	117.000	43.841	-----	112.843	1.468		
Field pH	S.U.	4.	6.04	7.48	6.605	.627	-----	6.586	1.096		

LOCATION = SW004 Russell Gulch at North Clear Creek

TOTAL OBSERVATIONS: 3

PARAMETER	UNITS	N CASES	MINIMUM	MAXIMUM	ARITHMETIC MEAN	STANDARD DEVIATION	PROB > STAND	GEOMETRIC MEAN	GEOMETIC DEVIATION	PROB > STAND	STANDARD *
Aluminum (total)	ug/l	3.	199.	987.	553.333	399.945	.843	453.049	2.230	.916	150.00
Arsenic (total)	ug/l	3.	2.00	10.00	5.000	4.359	.000	3.916	2.309	.001	50.00
Cadmium (total)	ug/l	3.	3.00	4.00	3.333	.577	1.000	3.304	1.181	1.000	.40
Chromium (total)	ug/l	3.	4.00	4.00	4.000	.000	-----	3.999	1.000	-----	49.00
Copper (total)	ug/l	3.	44.00	330.	148.000	158.152	.815	100.585	2.872	.995	6.50
Lead (total)	ug/l	3.	5.00	5.00	5.000	.000	-----	4.998	1.000	-----	1.30
Manganese (total)	ug/l	3.	229.	780.	463.333	284.577	.030	408.299	1.852	.073	1000.00
Nickel (total)	ug/l	3.	15.00	30.00	20.000	8.660	.718	18.897	1.492	.718	15.00
Silver (total)	ug/l	3.	.100	4.00	1.400	2.252	.535	.342	8.415	.278	1.20
Zinc (total)	ug/l	3.	652.	850.	750.000	99.015	1.000	745.459	1.142	1.000	47.00
Aluminum (dissolved)	ug/l	3.	66.00	88.00	77.000	11.000	.000	76.478	1.155	.000	150.00
Arsenic (dissolved)	ug/l	3.	2.00	10.00	5.000	4.359	.000	3.916	2.309	.001	50.00
Cadmium (dissolved)	ug/l	3.	3.00	4.00	3.667	.577	1.000	3.633	1.181	1.000	.40
Chromium (dissolved)	ug/l	3.	4.00	4.00	4.000	.000	-----	3.999	1.000	-----	49.00
Copper (dissolved)	ug/l	3.	12.00	41.00	24.333	14.978	.883	21.434	1.853	.973	6.50
Lead (dissolved)	ug/l	3.	2.00	5.00	4.000	1.732	.940	3.684	1.697	.976	1.30
Manganese (dissolved)	ug/l	3.	164.	833.	453.667	343.395	.056	367.602	2.255	.109	1000.00
Nickel (dissolved)	ug/l	3.	9.60	19.00	14.533	4.717	.461	13.985	1.415	.420	15.00
Silver (dissolved)	ug/l	3.	.100	4.00	1.400	2.252	.535	.342	8.415	.278	1.20
Zinc (dissolved)	ug/l	3.	528.	800.	666.000	136.044	1.000	656.551	1.231	1.000	47.00
Fluoride	mg/l	2.	.800	.830	.815	.021	.000	.815	1.026	.000	4.00
Sulfate	mg/l	2.	135.	175.	155.000	28.284	-----	153.700	1.201		
Field pH	S.U.	3.	6.20	6.50	6.367	.153	-----	6.366	1.024		

LOCATION = SW005 North Clear Creek below National

TOTAL OBSERVATIONS: 4

PARAMETER	UNITS	N CASES	MINIMUM	MAXIMUM	ARITHMETIC MEAN	STANDARD DEVIATION	PROB > STAND	GEOMETRIC MEAN	GEOMETIC DEVIATION	PROB > STAND	STANDARD *
Aluminum (total)	ug/l	4.	395.	946.	677.500	254.137	.981	639.700	1.493	1.000	150.00
Arsenic (total)	ug/l	4.	2.00	10.00	4.750	3.594	.000	3.935	1.982	.000	50.00
Cadmium (total)	ug/l	4.	4.00	14.00	6.825	4.802	.910	5.888	1.795	1.000	.40
Chromium (total)	ug/l	4.	4.00	8.00	5.075	1.952	.000	4.845	1.398	.000	49.00
Copper (total)	ug/l	4.	34.00	166.	85.750	61.603	.901	69.686	2.121	.999	6.50
Lead (total)	ug/l	4.	4.00	15.00	10.000	5.354	.948	8.758	1.870	.999	1.30
Manganese (total)	ug/l	4.	423.	4660.	2450.750	1951.839	.771	1712.998	2.965	.690	1000.00
Nickel (total)	ug/l	4.	12.00	36.00	23.750	10.210	.804	21.977	1.598	.792	15.00
Silver (total)	ug/l	4.	.100	5.00	2.300	2.573	.665	.669	8.989	.395	1.20
Zinc (total)	ug/l	4.	403.	1870.	1049.000	700.927	.924	864.369	2.094	1.000	47.00
Aluminum (dissolved)	ug/l	4.	23.00	200.	93.250	85.629	.254	61.559	3.022	.210	150.00
Arsenic (dissolved)	ug/l	4.	2.00	10.00	6.500	4.123	.000	5.317	2.186	.002	50.00
Cadmium (dissolved)	ug/l	4.	1.40	5.00	3.500	1.645	.970	3.136	1.790	1.000	.40
Chromium (dissolved)	ug/l	4.	4.00	8.00	5.000	2.000	.000	4.759	1.415	.000	49.00
Copper (dissolved)	ug/l	4.	10.00	43.00	24.500	13.675	.906	21.607	1.818	.978	6.50
Lead (dissolved)	ug/l	4.	3.00	5.00	4.500	1.000	.999	4.402	1.290	1.000	1.30
Manganese (dissolved)	ug/l	4.	438.	5170.	2594.500	2149.257	.771	1781.124	3.025	.699	1000.00
Nickel (dissolved)	ug/l	4.	9.70	37.00	23.425	11.506	.768	20.989	1.772	.722	15.00
Silver (dissolved)	ug/l	4.	.100	5.00	2.350	2.517	.676	.880	6.903	.436	1.20
Zinc (dissolved)	ug/l	4.	426.	2000.	1068.500	742.054	.916	875.679	2.100	1.000	47.00
Fluoride	mg/l	2.	.120	.180	.150	.042	.000	.147	1.332	.000	4.00
Sulfate	mg/l	2.	87.00	166.	126.500	55.861	-----	120.181	1.579		
Field pH	S.U.	4.	5.85	6.92	6.393	.437	-----	6.379	1.071		

LOCATION = SW006 North Clear Creek above National

TOTAL OBSERVATIONS: 4

PARAMETER	UNITS	N CASES	MINIMUM	MAXIMUM	ARITHMETIC MEAN	STANDARD DEVIATION	PROB > STAND	GEOMETRIC MEAN	GEOMETIC DEVIATION	PROB > STAND	STANDARD *
Aluminum (total)	ug/l	4.	331.	723.	502.000	168.703	.982	481.545	1.395	1.000	150.00
Arsenic (total)	ug/l	4.	2.00	10.00	4.750	3.594	.000	3.935	1.982	.000	50.00
Cadmium (total)	ug/l	4.	1.60	5.40	3.750	1.777	.970	3.374	1.754	1.000	.40
Chromium (total)	ug/l	4.	4.00	8.00	5.000	2.000	.000	4.759	1.415	.000	49.00
Copper (total)	ug/l	4.	44.00	183.	94.250	65.992	.908	78.257	2.018	1.000	6.50
Lead (total)	ug/l	4.	3.00	21.00	9.950	7.755	.868	7.893	2.226	.988	1.30
Manganese (total)	ug/l	4.	412.	13200.	4543.000	5885.217	.726	2208.348	4.297	.707	1000.00
Nickel (total)	ug/l	4.	7.70	156.	52.425	69.469	.705	28.106	3.511	.691	15.00
Silver (total)	ug/l	4.	.100	5.00	2.300	2.573	.665	.669	8.989	.395	1.20
Zinc (total)	ug/l	4.	396.	4860.	1769.750	2093.874	.795	1081.387	3.043	.998	47.00
Aluminum (dissolved)	ug/l	4.	25.00	478.	158.500	216.395	.516	75.038	4.096	.312	150.00
Arsenic (dissolved)	ug/l	4.	2.00	10.00	4.750	3.594	.000	3.935	1.982	.000	50.00
Cadmium (dissolved)	ug/l	4.	1.30	5.00	3.575	1.588	.977	3.193	1.837	1.000	.40
Chromium (dissolved)	ug/l	4.	4.00	8.00	5.100	1.943	.000	4.870	1.397	.000	49.00
Copper (dissolved)	ug/l	4.	7.00	141.	46.500	63.511	.736	23.547	3.702	.837	6.50
Lead (dissolved)	ug/l	4.	2.00	5.00	3.750	1.500	.949	3.501	1.559	.987	1.30
Manganese (dissolved)	ug/l	4.	428.	14300.	4847.000	6409.632	.726	2300.772	4.371	.714	1000.00
Nickel (dissolved)	ug/l	4.	9.30	168.	55.075	75.513	.702	29.108	3.435	.704	15.00
Silver (dissolved)	ug/l	4.	.100	5.00	2.450	2.611	.684	.901	7.078	.442	1.20
Zinc (dissolved)	ug/l	4.	420.	5150.	1820.750	2252.054	.785	1057.857	3.206	.996	47.00
Fluoride	mg/l	2.	.140	.220	.180	.057	.000	.176	1.377	.000	4.00
Sulfate	mg/l	2.	113.	161.	137.000	33.941	-----	134.828	1.284		
Field pH	S.U.	3.	6.40	6.80	6.550	.218	-----	6.547	1.034		

LOACTION = SW007 National at Marsh

TOTAL OBSERVATIONS: 3

PARAMETER	UNITS	N CASES	MINIMUM	MAXIMUM	ARITHMETIC MEAN	STANDARD DEVIATION	PROB > STAND	GEOMETRIC MEAN	GEOMETIC DEVIATION	PROB > STAND	STANDARD *
Aluminum (total)	ug/l	3.	353.	788.	527.000	230.180	.949	496.707	1.514	.998	150.00
Arsenic (total)	ug/l	3.	8.00	10.00	9.333	1.155	.000	9.281	1.138	.000	50.00
Cadmium (total)	ug/l	3.	4.10	6.70	5.267	1.320	1.000	5.160	1.280	1.000	.40
Chromium (total)	ug/l	3.	4.00	7.10	5.700	1.572	.000	5.546	1.343	.000	49.00
Copper (total)	ug/l	3.	156.	284.	203.333	70.209	.997	195.978	1.383	1.000	6.50
Lead (total)	ug/l	3.	5.00	50.00	25.000	22.913	.850	17.099	3.187	.987	1.30
Manganese (total)	ug/l	3.	5690.	17200.	13330.000	6616.623	.969	11872.740	1.891	1.000	1000.00
Nickel (total)	ug/l	3.	39.00	216.	156.333	101.619	.918	121.754	2.680	.983	15.00
Silver (total)	ug/l	3.	.100	4.00	1.423	2.232	.540	.408	7.345	.294	1.20
Zinc (total)	ug/l	3.	2080.	6700.	4946.667	2503.145	.975	4389.629	1.912	1.000	47.00
Aluminum (dissolved)	ug/l	3.	23.00	175.	74.333	87.186	.193	46.525	3.152	.154	150.00
Arsenic (dissolved)	ug/l	3.	2.00	10.00	5.000	4.359	.000	3.916	2.309	.001	50.00
Cadmium (dissolved)	ug/l	3.	4.80	7.40	5.733	1.447	1.000	5.624	1.270	1.000	.40
Chromium (dissolved)	ug/l	3.	4.00	7.00	5.633	1.518	.000	5.485	1.332	.000	49.00
Copper (dissolved)	ug/l	3.	8.00	186.	80.667	93.388	.786	41.471	4.845	.880	6.50
Lead (dissolved)	ug/l	3.	5.00	5.00	5.000	.000	-----	4.998	1.000	-----	1.30
Manganese (dissolved)	ug/l	3.	6370.	17400.	13590.000	6255.901	.978	12357.270	1.775	1.000	1000.00
Nickel (dissolved)	ug/l	3.	41.00	217.	156.000	99.654	.921	123.224	2.593	.986	15.00
Silver (dissolved)	ug/l	3.	.100	6.00	2.100	3.378	.605	.493	8.944	.342	1.20
Zinc (dissolved)	ug/l	3.	2270.	7000.	5020.000	2457.214	.979	4514.275	1.828	1.000	47.00
Fluoride	mg/l	2.	.280	.400	.340	.085	.000	.335	1.287	.000	4.00
Sulfate	mg/l	2.	740.	1060.	900.000	226.274	-----	885.365	1.289		
Field pH	S.U.	3.	5.61	6.51	6.057	.450	-----	6.044	1.077		

LOCATION = SW008 National Portal

TOTAL OBSERVATIONS: 4

PARAMETER	UNITS	N CASES	MINIMUM	MAXIMUM	ARITHMETIC MEAN	STANDARD DEVIATION	PROB > STAND	GEOMETRIC MEAN	GEOMETIC DEVIATION	PROB > STAND	STANDARD *
Aluminum (total)	ug/l	4.	104.	460.	242.750	168.518	.709	200.137	2.063	.655	150.00
Arsenic (total)	ug/l	4.	4.00	10.00	6.575	2.501	.000	6.234	1.455	.000	50.00
Cadmium (total)	ug/l	4.	5.00	9.00	6.775	2.082	.999	6.534	1.366	1.000	.40
Chromium (total)	ug/l	4.	4.00	8.00	6.025	1.970	.000	5.778	1.404	.000	49.00
Copper (total)	ug/l	4.	59.00	336.	184.500	124.971	.923	149.905	2.179	1.000	6.50
Lead (total)	ug/l	4.	5.00	15.00	8.250	4.573	.936	7.493	1.621	1.000	1.30
Manganese (total)	ug/l	4.	15300.	19400.	17625.000	1925.920	1.000	17535.810	1.117	1.000	1000.00
Nickel (total)	ug/l	4.	191.	246.	212.000	23.847	1.000	211.030	1.115	1.000	15.00
Silver (total)	ug/l	4.	.100	5.00	2.300	2.573	.665	.669	8.989	.395	1.20
Zinc (total)	ug/l	4.	5290.	7480.	6302.500	938.629	1.000	6247.894	1.160	1.000	47.00
Aluminum (dissolved)	ug/l	4.	25.00	267.	110.000	114.409	.363	67.289	3.277	.250	150.00
Arsenic (dissolved)	ug/l	4.	2.00	10.00	4.750	3.594	.000	3.935	1.982	.000	50.00
Cadmium (dissolved)	ug/l	4.	4.00	10.00	6.000	2.708	.981	5.624	1.489	1.000	.40
Chromium (dissolved)	ug/l	4.	4.00	8.40	6.600	2.026	.000	6.334	1.406	.000	49.00
Copper (dissolved)	ug/l	4.	26.00	191.	91.250	74.128	.874	69.269	2.416	.996	6.50
Lead (dissolved)	ug/l	4.	3.00	11.00	6.000	3.464	.913	5.360	1.709	.996	1.30
Manganese (dissolved)	ug/l	4.	15900.	20500.	17575.000	2045.116	1.000	17483.280	1.119	1.000	1000.00
Nickel (dissolved)	ug/l	4.	202.	260.	221.750	26.133	1.000	220.743	1.120	1.000	15.00
Silver (dissolved)	ug/l	4.	.100	5.00	2.325	2.545	.671	.795	7.508	.419	1.20
Zinc (dissolved)	ug/l	4.	5350.	7940.	6220.000	1175.443	1.000	6142.577	1.194	1.000	47.00
Fluoride	mg/l	3.	.470	.490	.477	.012	.000	.477	1.024	.000	4.00
Sulfate	mg/l	3.	675.	990.	881.667	179.048	-----	868.702	1.244		
Field pH	S.U.	4.	4.39	6.43	5,783	.938	-----	5.720	1.195		

LOCATION = SW009 North Clear Creek Below Gregory Gulch

TOTAL OBSERVATIONS: 4

PARAMETER	UNITS	N CASES	MINIMUM	MAXIMUM	ARITHMETIC MEAN	STANDARD DEVIATION	PROB > STAND	GEOMETRIC MEAN	GEOMETIC DEVIATION	PROB > STAND	STANDARD *
Aluminum (total)	ug/l	4.	306.	716.	493.500	174.267	.976	470.596	1.432	.999	150.00
Arsenic (total)	ug/l	4.	2.00	10.00	4.750	3.594	.000	3.935	1.982	.000	50.00
Cadmium (total)	ug/l	4.	1.80	15.00	6.450	5.855	.849	4.821	2.399	.998	.40
Chromium (total)	ug/l	4.	4.00	11.00	6.750	3.403	.000	6.123	1.664	.000	49.00
Copper (total)	ug/l	4.	19.00	180.	87.500	70.826	.874	64.136	2.651	.991	6.50
Lead (total)	ug/l	4.	3.00	9.60	6.475	2.918	.962	5.912	1.675	.998	1.30
Manganese (total)	ug/l	4.	82.00	4920.	2348.000	2099.588	.740	1134.560	6.240	.527	1000.00
Nickel (total)	ug/l	4.	10.00	46.00	25.000	15.188	.745	21.672	1.874	.721	15.00
Silver (total)	ug/l	4.	.100	20.00	6.300	9.421	.706	1.000	15.150	.473	1.20
Zinc (total)	ug/l	4.	149.	1840.	933.500	737.956	.885	653.930	3.004	.992	47.00
Aluminum (dissolved)	ug/l	4.	25.00	554.	193.000	245.963	.569	99.783	3.854	.381	150.00
Arsenic (dissolved)	ug/l	4.	2.00	10.00	4.750	3.594	.000	3.935	1.982	.000	50.00
Cadmium (dissolved)	ug/l	4.	1.70	14.00	5.925	5.552	.840	4.345	2.450	.996	.40
Chromium (dissolved)	ug/l	4.	4.00	12.00	7.000	3.830	.000	6.259	1.721	.000	49.00
Copper (dissolved)	ug/l	4.	11.00	124.	63.250	58.676	.833	38.092	3.540	.919	6.50
Lead (dissolved)	ug/l	4.	3.00	7.00	5.000	1.633	.988	4.787	1.419	1.000	1.30
Manganese (dissolved)	ug/l	4.	59.00	5140.	2474.750	2208.071	.748	1092.255	7.508	.517	1000.00
Nickel (dissolved)	ug/l	4.	9.80	44.00	24.200	14.358	.739	21.094	1.852	.710	15.00
Silver (dissolved)	ug/l	4.	.100	15.00	5.100	6.978	.712	1.225	10.444	.504	1.20
Zinc (dissolved)	ug/l	4.	101.	1920.	974.250	791.641	.879	621.416	3.677	.976	47.00
Fluoride	mg/l	2.	.140	.220	.180	.057	.000	.176	1.377	.000	4.00
Sulfate	mg/l	2.	104.	153.	128.500	34.648	-----	126.090	1.314		
Field pH	S.U.	3.	5.65	6.49	6.047	.422	-----	6.038	1.073		

LOCATION = SW010 North Clear Creek Below Gregory Tailings

TOTAL OBSERVATIONS: 4

PARAMETER	UNITS	N CASES	MINIMUM	MAXIMUM	ARITHMETIC MEAN	STANDARD DEVIATION	PROB > STAND	GEOMETRIC MEAN	GEOMETIC DEVIATION	PROB > STAND	STANDARD *
Aluminum (total)	ug/l	4.	244.	520.	333.000	128.442	.923	317.031	1.416	.984	150.00
Arsenic (total)	ug/l	4.	2.00	10.00	4.750	3.594	.000	3.935	1.982	.000	50.00
Cadmium (total)	ug/l	4.	3.00	5.00	4.100	.841	1.000	4.031	1.242	1.000	.40
Chromium (total)	ug/l	4.	4.00	8.00	5.000	2.000	.000	4.759	1.415	.000	49.00
Copper (total)	ug/l	4.	15.00	106.	66.250	45.901	.903	50.704	2.537	.986	6.50
Lead (total)	ug/l	4.	2.00	7.30	4.475	2.419	.905	3.959	1.800	.971	1.30
Manganese (total)	ug/l	4.	204.	4710.	2363.500	2005.724	.752	1417.996	4.059	.598	1000.00
Nickel (total)	ug/l	4.	9.20	28.00	20.300	8.089	.744	18.746	1.639	.674	15.00
Silver (total)	ug/l	4.	.100	5.00	2.300	2.573	.665	.669	8.989	.395	1.20
Zinc (total)	ug/l	4.	14.00	1680.	845.250	733.543	.862	344.468	8.971	.818	47.00
Aluminum (dissolved)	ug/l	4.	25.00	463.	229.250	192.417	.660	145.620	3.626	.491	150.00
Arsenic (dissolved)	ug/l	4.	2.00	10.00	4.750	3.594	.000	3.935	1.982	.000	50.00
Cadmium (dissolved)	ug/l	4.	1.40	6.30	3.925	2.162	.948	3.391	1.946	.999	.40
Chromium (dissolved)	ug/l	4.	4.00	8.00	5.000	2.000	.000	4.759	1.415	.000	49.00
Copper (dissolved)	ug/l	4.	11.00	113.	58.750	49.520	.854	39.845	3.022	.949	6.50
Lead (dissolved)	ug/l	4.	2.10	5.00	3.775	1.461	.955	3.543	1.528	.991	1.30
Manganese (dissolved)	ug/l	4.	208.	5680.	2637.000	2399.249	.752	1516.257	4.267	.613	1000.00
Nickel (dissolved)	ug/l	4.	9.80	41.00	22.450	13.491	.710	19.609	1.828	.672	15.00
Silver (dissolved)	ug/l	4.	.100	5.00	2.300	2.573	.665	.669	8.989	.395	1.20
Zinc (dissolved)	ug/l	4.	138.	2040.	981.000	835.918	.868	651.971	3.241	.987	47.00
Fluoride	mg/l	4.	.100	.260	.175	.070	.000	.164	1.517	.000	4.00
Sulfate	mg/l	4.	22.00	182.	117.250	71.542	-----	90.468	2.646		
Field pH	S.U.	2.	5.60	6.45	6.025	.601	-----	6.007	1.105		

LOCATION = SW011 North Clear Creek Above Gregory Tailings

TOTAL OBSERVATIONS: 4

PARAMETER	UNITS	N CASES	MINIMUM	MAXIMUM	ARITHMETIC MEAN	STANDARD DEVIATION	PROB > STAND	GEOMETRIC MEAN	GEOMETIC DEVIATION	PROB > STAND	STANDARD *
Aluminum (total)	ug/l	4.	143.	303.	194.250	73.464	.727	185.490	1.399	.736	150.00
Arsenic (total)	ug/l	4.	2.00	10.00	4.750	3.594	.000	3.935	1.982	.000	50.00
Cadmium (total)	ug/l	4.	1.00	5.00	3.000	1.826	.923	3.421	1.613	1.000	.40
Chromium (total)	ug/l	4.	4.00	8.00	5.000	2.000	.000	4.759	1.415	.000	49.00
Copper (total)	ug/l	4.	11.00	41.00	20.750	13.961	.846	17.904	1.826	.954	6.50
Lead (total)	ug/l	4.	3.00	7.00	5.000	2.309	.945	4.581	1.631	.995	1.30
Manganese (total)	ug/l	4.	77.00	600.	296.250	235.198	.001	222.962	2.492	.050	1000.00
Nickel (total)	ug/l	4.	5.00	20.00	9.500	7.047	.218	8.053	1.863	.159	15.00
Silver (total)	ug/l	4.	.100	6.90	3.025	3.465	.701	.766	10.538	.425	1.20
Zinc (total)	ug/l	4.	9.00	778.	400.250	336.781	.853	178.039	7.714	.743	47.00
Aluminum (dissolved)	ug/l	4.	25.00	406.	147.250	174.437	.494	89.121	3.155	.325	150.00
Arsenic (dissolved)	ug/l	4.	2.00	10.00	4.750	3.594	.000	3.935	1.982	.000	50.00
Cadmium (dissolved)	ug/l	4.	1.00	5.00	3.000	1.826	.923	3.421	1.613	1.000	.40
Chromium (dissolved)	ug/l	4.	4.00	8.00	5.000	2.000	.000	4.759	1.415	.000	49.00
Copper (dissolved)	ug/l	4.	9.00	26.00	14.000	8.042	.824	12.667	1.626	.915	6.50
Lead (dissolved)	ug/l	4.	2.00	5.00	3.000	1.414	.885	2.784	1.545	.960	1.30
Manganese (dissolved)	ug/l	4.	56.00	665.	311.250	272.063	.006	212.938	2.968	.078	1000.00
Nickel (dissolved)	ug/l	4.	5.00	40.00	14.500	17.020	.488	9.574	2.620	.320	15.00
Silver (dissolved)	ug/l	4.	.100	5.00	2.300	2.573	.665	.669	8.989	.395	1.20
Zinc (dissolved)	ug/l	4.	98.00	849.	436.500	338.753	.875	323.112	2.622	.977	47.00
Fluoride	mg/l	3.	.100	.100	.100	.000	-----	.100	1.000	-----	4.00
Sulfate	mg/l	3.	10.00	24.00	17.000	7.000	-----	15.975	1.554		
Field pH	S.U.	3.	6.30	6.50	6.433	.115	-----	6.430	1.018		

LOCATION = SW012 Gregory Tailings at North Clear Creek

TOTAL OBSERVATIONS: 4

PARAMETER	UNITS	N CASES	MINIMUM	MAXIMUM	ARITHMETIC MEAN	STANDARD DEVIATION	PROB > STAND	GEOMETRIC MEAN	GEOMETIC DEVIATION	PROB > STAND	STANDARD *
Aluminum (total)	ug/l	4.	2420.	4970.	3287.500	1168.400	.996	3152.654	1.384	1.000	150.00
Arsenic (total)	ug/l	4.	2.00	10.00	4.750	3.594	.000	3.935	1.982	.000	50.00
Cadmium (total)	ug/l	4.	5.00	14.00	10.500	3.873	.995	9.806	1.584	1.000	.40
Chromium (total)	ug/l	3.	4.00	11.00	7.667	3.512	.000	7.064	1.677	.000	49.00
Copper (total)	ug/l	4.	594.	1380.	878.750	354.201	.993	831.308	1.454	1.000	6.50
Lead (total)	ug/l	4.	13.00	25.00	20.000	5.099	1.000	19.453	1.328	1.000	1.30
Manganese (total)	ug/l	4.	25000.	29600.	27950.000	2022.375	1.000	4959.201	30.417	.680	1000.00
Nickel (total)	ug/l	4.	154.	209.	192.250	25.863	1.000	190.757	1.155	1.000	15.00
Silver (total)	ug/l	4.	.200	5.00	2.533	2.327	.717	1.388	4.446	.539	1.20
Zinc (total)	ug/l	4.	5980.	6520.	6287.500	229.111	1.000	6285.498	1.038	1.000	47.00
Aluminum (dissolved)	ug/l	4.	2250.	5480.	3400.000	1440.116	.988	3203.501	1.471	1.000	150.00
Arsenic (dissolved)	ug/l	4.	2.00	10.00	4.750	3.594	.000	3.935	1.982	.000	50.00
Cadmium (dissolved)	ug/l	4.	7.60	14.00	11.900	3.018	1.000	11.565	1.335	1.000	.40
Chromium (dissolved)	ug/l	4.	5.60	13.00	9.400	3.262	.000	8.944	1.451	.000	49.00
Copper (dissolved)	ug/l	4.	578.	1520.	924.500	423.454	.985	860.058	1.533	1.000	6.50
Lead (dissolved)	ug/l	4.	13.00	22.00	15.750	4.193	1.000	15.394	1.273	1.000	1.30
Manganese (dissolved)	ug/l	4.	27000.	30200.	29025.000	1424.488	1.000	5156.433	31.563	.683	1000.00
Nickel (dissolved)	ug/l	4.	171.	219.	197.250	25.382	1.000	195.978	1.139	1.000	15.00
Silver (dissolved)	ug/l	4.	.100	5.00	2.375	2.490	.681	.946	6.573	.450	1.20
Zinc (dissolved)	ug/l	4.	6090.	7070.	6695.000	425.402	1.000	6687.528	1.067	1.000	47.00
Fluoride	mg/l	4.	1.20	1.60	1.375	.171	.000	1.368	1.130	.000	4.00
Sulfate	mg/l	4.	920.	1420.	1157.500	236.414	-----	1139.107	1.228		
Field pH	S.U.	3.	3.95	5.09	4.633	.603	-----	4.604	1.145		

LOCATION = SW014 Gregory Gulch Above North Clear Creek and Gregory Gulch Confluence

TOTAL OBSERVATIONS: 4

PARAMETER	UNITS	N CASES	MINIMUM	MAXIMUM	ARITHMETIC MEAN	STANDARD DEVIATION	PROB > STAND	GEOMETRIC MEAN	GEOMETIC DEVIATION	PROB > STAND	STANDARD *
Aluminum (total)	ug/l	4.	1160.	2400.	1852.500	628.722	.997	1766.932	1.433	1.000	150.00
Arsenic (total)	ug/l	4.	5.00	10.00	7.900	2.511	.000	7.576	1.405	.000	50.00
Cadmium (total)	ug/l	4.	5.00	51.00	24.000	19.613	.886	17.690	2.638	1.000	.40
Chromium (total)	ug/l	4.	4.00	8.00	5.575	1.947	.000	5.328	1.412	.000	49.00
Copper (total)	ug/l	4.	186.	791.	405.250	280.370	.923	340.359	1.964	1.000	6.50
Lead (total)	ug/l	4.	62.00	194.	98.500	63.799	.936	86.921	1.714	1.000	1.30
Manganese (total)	ug/l	4.	1270.	2490.	1840.000	640.521	.905	1754.606	1.429	.942	1000.00
Nickel (total)	ug/l	4.	12.00	26.00	19.500	6.608	.752	18.597	1.435	.724	15.00
Silver (total)	ug/l	4.	.100	5.80	3.050	2.777	.747	1.394	6.560	.532	1.20
Zinc (total)	ug/l	4.	2220.	8130.	4280.000	2663.594	.944	3766.872	1.758	1.000	47.00
Aluminum (dissolved)	ug/l	4.	25.00	941.	295.250	437.100	.630	105.320	5.624	.419	150.00
Arsenic (dissolved)	ug/l	4.	2.00	10.00	4.750	3.594	.000	3.935	1.982	.000	50.00
Cadmium (dissolved)	ug/l	4.	8.00	52.00	25.000	19.149	.901	19.985	2.186	1.000	.40
Chromium (dissolved)	ug/l	4.	4.00	8.00	5.000	2.000	.000	4.759	1.415	.000	49.00
Copper (dissolved)	ug/l	4.	19.00	763.	289.750	351.776	.790	106.272	6.424	.933	6.50
Lead (dissolved)	ug/l	4.	2.00	22.00	9.350	8.829	.819	6.554	2.724	.947	1.30
Manganese (dissolved)	ug/l	4.	1190.	2390.	1832.500	621.738	.910	1749.351	1.425	.943	1000.00
Nickel (dissolved)	ug/l	4.	14.00	27.00	19.250	5.500	.780	18.709	1.313	.792	15.00
Silver (dissolved)	ug/l	4.	.100	5.00	2.300	2.573	.665	.669	8.989	.395	1.20
Zinc (dissolved)	ug/l	4.	2010.	8250.	4262.500	2747.209	.938	3710.789	1.804	1.000	47.00
Fluoride	mg/l	2.	.180	.230	.205	.035	.000	.204	1.189	.000	4.00
Sulfate	mg/l	2.	79.00	149.	114.000	49.497	-----	108.527	1.567		
Field pH	S.U.	4.	4.50	6.59	5.398	.879	-----	5.344	1.172		

LOCATION = SW015 Gregory Gulch Above Central City

TOTAL OBSERVATIONS: 4

PARAMETER	UNITS	N CASES	MINIMUM	MAXIMUM	ARITHMETIC MEAN	STANDARD DEVIATION	PROB > STAND	GEOMETRIC MEAN	GEOMETIC DEVIATION	PROB > STAND	STANDARD *
Aluminum (total)	ug/l	4.	31.00	335.	174.250	156.199	.562	109.947	3.333	.398	150.00
Arsenic (total)	ug/l	4.	2.00	10.00	4.750	3.594	.000	3.935	1.982	.000	50.00
Cadmium (total)	ug/l	4.	1.00	5.00	3.300	1.701	.956	3.999	1.250	1.000	.40
Chromium (total)	ug/l	4.	4.00	8.00	5.000	2.000	.000	4.759	1.415	.000	49.00
Copper (total)	ug/l	4.	12.00	44.00	23.500	14.888	.873	20.348	1.840	.969	6.50
Lead (total)	ug/l	4.	5.00	36.00	14.000	14.855	.804	9.738	2.537	.985	1.30
Manganese (total)	ug/l	4.	628.	1890.	1014.250	592.570	.510	912.328	1.655	.428	1000.00
Nickel (total)	ug/l	4.	5.60	20.00	9.650	6.925	.220	8.281	1.813	.159	15.00
Silver (total)	ug/l	4.	.100	5.00	2.375	2.642	.672	.681	9.171	.399	1.20
Zinc (total)	ug/l	4.	178.	1320.	701.500	565.420	.876	505.728	2.689	.992	47.00
Aluminum (dissolved)	ug/l	4.	23.00	761.	219.750	361.485	.577	74.366	5.109	.334	150.00
Arsenic (dissolved)	ug/l	4.	4.00	10.00	8.000	2.828	.000	7.523	1.543	.000	50.00
Cadmium (dissolved)	ug/l	4.	1.00	5.10	3.150	1.786	.938	3.710	1.436	1.000	.40
Chromium (dissolved)	ug/l	4.	4.00	8.00	5.000	2.000	.000	4.759	1.415	.000	49.00
Copper (dissolved)	ug/l	4.	7.90	589.	155.550	288.997	.697	28.474	7.768	.764	6.50
Lead (dissolved)	ug/l	4.	2.00	5.00	3.000	1.414	.885	2.784	1.545	.960	1.30
Manganese (dissolved)	ug/l	4.	642.	1890.	1201.250	634.257	.624	1071.699	1.752	.549	1000.00
Nickel (dissolved)	ug/l	4.	6.00	20.00	10.600	6.520	.250	9.365	1.742	.198	15.00
Silver (dissolved)	ug/l	4.	.100	5.00	2.300	2.573	.665	.669	8.989	.395	1.20
Zinc (dissolved)	ug/l	4.	289.	1580.	1012.500	546.686	.961	854.913	2.121	1.000	47.00
Fluoride	mg/l	2.	.100	.150	.125	.035	.000	.122	1.332	.000	4.00
Sulfate	mg/l	2.	31.00	66.00	48.500	24.749	-----	45.241	1.706		
Field pH	S.U.	4.	6.02	7.34	6.540	.576	-----	6.521	1.090		

LOCATION = SW016 Quartz Hill Portal

TOTAL OBSERVATIONS: 3

PARAMETER	UNITS	N CASES	MINIMUM	MAXIMUM	ARITHMETIC MEAN	STANDARD DEVIATION	PROB > STAND	GEOMETRIC MEAN	GEOMETIC DEVIATION	PROB > STAND	STANDARD *
Aluminum (total)	ug/l	3.	53300.	80500.	63400.000	14889.930	1.000	62317.650	1.251	1.000	150.00
Arsenic (total)	ug/l	3.	637.	3040.	1474.000	1357.270	.853	1130.031	2.366	1.000	50.00
Cadmium (total)	ug/l	3.	317.	413.	363.333	48.087	1.000	361.044	1.141	1.000	.40
Chromium (total)	ug/l	3.	40.00	65.00	56.333	14.154	.698	54.982	1.318	.662	49.00
Copper (total)	ug/l	3.	42600.	60200.	48733.330	9938.477	1.000	48098.200	1.215	1.000	6.50
Lead (total)	ug/l	3.	3.00	222.	137.333	117.645	.876	49.949	11.439	.933	1.30
Manganese (total)	ug/l	3.	59600.	63600.	62100.000	2179.449	1.000	62068.890	1.036	1.000	1000.00
Nickel (total)	ug/l	3.	456.	513.	479.667	29.704	1.000	479.143	1.063	1.000	15.00
Silver (total)	ug/l	3.	.300	30.00	18.433	15.902	.861	6.080	13.572	.733	1.20
Zinc (total)	ug/l	3.	86100.	91600.	89300.000	2858.321	1.000	89232.460	1.033	1.000	47.00
Aluminum (dissolved)	ug/l	3.	54400.	85200.	64933.330	17556.010	1.000	63513.010	1.290	1.000	150.00
Arsenic (dissolved)	ug/l	3.	80.00	852.	524.000	398.858	.883	352.130	3.636	.935	50.00
Cadmium (dissolved)	ug/l	3.	318.	436.	388.000	62.000	1.000	384.522	1.182	1.000	.40
Chromium (dissolved)	ug/l	3.	54.00	69.00	61.667	7.506	.954	61.375	1.131	.966	49.00
Copper (dissolved)	ug/l	3.	43100.	61300.	49300.000	10394.230	1.000	48630.190	1.223	1.000	6.50
Lead (dissolved)	ug/l	3.	3.00	255.	150.667	131.470	.872	52.932	12.061	.932	1.30
Manganese (dissolved)	ug/l	3.	60900.	64500.	62633.330	1803.700	1.000	13494.000	14.629	.834	1000.00
Nickel (dissolved)	ug/l	3.	447.	553.	493.333	54.243	1.000	491.273	1.114	1.000	15.00
Silver (dissolved)	ug/l	3.	.200	30.00	18.400	15.959	.859	5.312	17.150	.700	1.20
Zinc (dissolved)	ug/l	3.	86500.	94900.	91466.660	4404.921	1.000	91399.960	1.050	1.000	47.00
Fluoride	mg/l	2.	.190	6.50	3.345	4.462	.000	1.112	12.158	.304	4.00
Sulfate	mg/l	2.	3780.	3900.	3840.000	84.853	-----	3839.127	1.022		
Field pH	S.U.	3.	2.52	2.60	2.553	.042	-----	2.552	1.016		

LOCATION = SN017 Nevada Gulch Above Nevadaville

TOTAL OBSERVATIONS: 2

PARAMETER	UNITS	N CASES	MINIMUM	MAXIMUM	ARITHMETIC MEAN	STANDARD DEVIATION	PROB > STAND	GEOMETRIC MEAN	GEOMETIC DEVIATION	PROB > STAND	STANDARD *
Aluminum (total)	ug/l	2.	3780.	4290.	4035.000	360.624	1.000	4027.897	1.093	1.000	150.00
Arsenic (total)	ug/l	2.	3.00	4.00	3.500	.707	.000	3.463	1.225	.000	50.00
Cadmium (total)	ug/l	2.	228.	310.	269.000	57.983	1.000	265.868	1.242	1.000	.40
Chromium (total)	ug/l	2.	4.40	8.00	6.200	2.546	.000	5.936	1.527	.000	49.00
Copper (total)	ug/l	2.	1600.	1690.	1645.000	63.640	1.000	1644.185	1.040	1.000	6.50
Lead (total)	ug/l	2.	190.	445.	317.500	180.312	.960	290.906	1.826	1.000	1.30
Manganese (total)	ug/l	2.	5940.	7750.	6845.000	1279.863	1.000	6781.812	1.207	1.000	1000.00
Nickel (total)	ug/l	2.	61.00	77.00	69.000	11.314	1.000	68.511	1.179	1.000	15.00
Silver (total)	ug/l	2.	.140	5.00	2.570	3.437	.655	.837	12.528	.443	1.20
Zinc (total)	ug/l	2.	34600.	54000.	44300.000	13717.870	.999	43217.460	1.370	1.000	47.00
Aluminum (dissolved)	ug/l	2.	3940.	4800.	4370.000	608.112	1.000	4350.301	1.150	1.000	150.00
Arsenic (dissolved)	ug/l	2.	3.00	4.00	3.500	.707	.000	3.463	1.225	.000	50.00
Cadmium (dissolved)	ug/l	2.	254.	326.	290.000	50.912	1.000	287.724	1.192	1.000	.40
Chromium (dissolved)	ug/l	2.	4.00	8.00	6.000	2.828	.000	5.658	1.632	.000	49.00
Copper (dissolved)	ug/l	2.	1740.	1780.	1760.000	28.284	1.000	1759.879	1.016	1.000	6.50
Lead (dissolved)	ug/l	2.	194.	456.	325.000	185.262	.960	297.377	1.829	1.000	1.30
Manganese (dissolved)	ug/l	2.	6520.	8330.	7425.000	1279.863	1.000	7368.723	1.189	1.000	1000.00
Nickel (dissolved)	ug/l	2.	72.00	85.00	78.500	9.192	1.000	78.257	1.124	1.000	15.00
Silver (dissolved)	ug/l	2.	.120	5.00	2.560	3.451	.653	.775	13.971	.434	1.20
Zinc (dissolved)	ug/l	2.	38100.	57200.	47650.000	13505.740	1.000	46676.700	1.332	1.000	47.00
Fluoride	mg/l	1.	.340	.340	.340	.000	-----	.340	1.000	-----	4.00
Sulfate	mg/l	1.	425.	425.	425.000	.000	-----	424.962	1.000		
Field pH	S.U.	2.	3.42	4.05	3.735	.445	-----	3.721	1.127		

LOCATION = SN018 Nevada Gulch Below Nevadaville

TOTAL OBSERVATIONS: 2

PARAMETER	UNITS	N CASES	MINIMUM	MAXIMUM	ARITHMETIC MEAN	STANDARD DEVIATION	PROB > STAND	GEOMETRIC MEAN	GEOMETIC DEVIATION	PROB > STAND	STANDARD *
Aluminum (total)	ug/l	2.	101.	169.	135.000	48.083	.378	130.712	1.439	.353	150.00
Arsenic (total)	ug/l	2.	3.00	4.00	3.500	.707	.000	3.463	1.225	.000	50.00
Cadmium (total)	ug/l	2.	5.50	12.00	8.750	4.596	.965	8.125	1.737	1.000	.40
Chromium (total)	ug/l	2.	4.00	8.00	6.000	2.828	.000	5.658	1.632	.000	49.00
Copper (total)	ug/l	2.	63.00	68.00	65.500	3.536	1.000	65.431	1.055	1.000	6.50
Lead (total)	ug/l	2.	16.00	65.00	40.500	34.648	.871	32.266	2.694	.999	1.30
Manganese (total)	ug/l	2.	117.	478.	297.500	255.266	.003	236.512	2.705	.074	1000.00
Nickel (total)	ug/l	2.	7.20	20.00	13.600	9.051	.439	12.001	2.059	.379	15.00
Silver (total)	ug/l	2.	.100	5.00	2.550	3.465	.652	.707	15.895	.424	1.20
Zinc (total)	ug/l	2.	1900.	3130.	2515.000	869.741	.998	2438.162	1.423	1.000	47.00
Aluminum (dissolved)	ug/l	2.	73.00	200.	136.500	89.803	.440	120.784	2.040	.381	150.00
Arsenic (dissolved)	ug/l	2.	3.00	4.00	3.500	.707	.000	3.463	1.225	.000	50.00
Cadmium (dissolved)	ug/l	2.	6.30	18.00	12.150	8.273	.922	10.644	2.100	1.000	.40
Chromium (dissolved)	ug/l	2.	4.00	8.00	6.000	2.828	.000	5.658	1.632	.000	49.00
Copper (dissolved)	ug/l	2.	60.00	86.00	73.000	18.385	1.000	71.808	1.290	1.000	6.50
Lead (dissolved)	ug/l	2.	42.00	49.00	45.500	4.950	1.000	45.377	1.115	1.000	1.30
Manganese (dissolved)	ug/l	2.	140.	538.	339.000	281.428	.009	274.513	2.591	.087	1000.00
Nickel (dissolved)	ug/l	2.	11.00	20.00	15.500	6.364	.531	14.835	1.527	.490	15.00
Silver (dissolved)	ug/l	2.	.100	5.00	2.550	3.465	.652	.707	15.895	.424	1.20
Zinc (dissolved)	ug/l	2.	2140.	4000.	3070.000	1315.219	.989	2924.854	1.556	1.000	47.00
Fluoride	mg/l	1.	.100	.100	.100	.000	-----	.100	1.000	-----	4.00
Sulfate	mg/l	1.	55.00	55.00	55.000	.000	-----	54.982	1.000		
Field pH	S.U.	1.	5.91	5.91	5.910	.000	-----	5.912	1.000		

LOCATION = SW019 Virginia Gulch at Head

TOTAL OBSERVATIONS: 3

PARAMETER	UNITS	N CASES	MINIMUM	MAXIMUM	ARITHMETIC MEAN	STANDARD DEVIATION	PROB > STAND	GEOMETRIC MEAN	GEOMETIC DEVIATION	PROB > STAND	STANDARD *
Aluminum (total)	ug/l	3.	84700.	115000.	104566.700	17212.300	1.000	103569.700	1.190	1.000	150.00
Arsenic (total)	ug/l	3.	138.	1020.	505.333	459.088	.839	369.444	2.721	.977	50.00
Cadmium (total)	ug/l	3.	506.	700.	625.667	104.644	1.000	619.554	1.192	1.000	.40
Chromium (total)	ug/l	3.	70.00	87.00	77.667	8.622	1.000	77.324	1.116	1.000	49.00
Copper (total)	ug/l	3.	20200.	27500.	24666.670	3914.503	1.000	24440.580	1.182	1.000	6.50
Lead (total)	ug/l	3.	16.00	547.	333.333	280.268	.882	156.335	7.221	.992	1.30
Manganese (total)	ug/l	3.	47700.	58400.	54833.330	6177.648	1.000	54611.510	1.124	1.000	1000.00
Nickel (total)	ug/l	3.	781.	917.	858.667	70.031	1.000	856.625	1.087	1.000	15.00
Silver (total)	ug/l	3.	.400	5.00	1.943	2.647	.611	.951	4.212	.436	1.20
Zinc (total)	ug/l	3.	96700.	140000.	122566.700	22848.710	1.000	121055.000	1.218	1.000	47.00
Aluminum (dissolved)	ug/l	3.	83800.	127000.	109933.300	22982.890	1.000	108228.500	1.251	1.000	150.00
Arsenic (dissolved)	ug/l	3.	122.	840.	474.333	359.186	.881	361.405	2.683	.977	50.00
Cadmium (dissolved)	ug/l	3.	518.	713.	633.667	102.452	1.000	627.661	1.184	1.000	.40
Chromium (dissolved)	ug/l	3.	67.00	92.00	77.667	12.897	.987	77.015	1.176	.997	49.00
Copper (dissolved)	ug/l	3.	20000.	29300.	26000.000	5204.805	1.000	25616.710	1.240	1.000	6.50
Lead (dissolved)	ug/l	3.	4.00	579.	336.000	297.652	.870	99.484	16.232	.940	1.30
Manganese (dissolved)	ug/l	3.	48400.	62700.	57866.670	8198.984	1.000	57468.930	1.161	1.000	1000.00
Nickel (dissolved)	ug/l	3.	784.	975.	908.667	108.039	1.000	904.154	1.132	1.000	15.00
Silver (dissolved)	ug/l	3.	.100	5.00	1.767	2.801	.580	.464	8.061	.324	1.20
Zinc (dissolved)	ug/l	3.	98200.	152000.	130066.700	28242.050	1.000	127899.500	1.261	1.000	47.00
Fluoride	mg/l	2.	1.40	1.80	1.600	.283	.000	1.587	1.195	.000	4.00
Sulfate	mg/l	2.	1950.	2540.	2245.000	417.193	-----	2226.086	1.206		
Field pH	S.U.	3.	2.61	2.89	2.717	.151	-----	2.713	1.057		

LOCATION = SW020 Argp Portal

TOTAL OBSERVATIONS: 4

PARAMETER	UNITS	N CASES	MINIMUM	MAXIMUM	ARITHMETIC MEAN	STANDARD DEVIATION	PROB > STAND	GEOMETRIC MEAN	GEOMETIC DEVIATION	PROB > STAND	STANDARD *
Aluminum (total)	ug/l	4.	16200.	22300.	19600.000	2539.029	1.000	19477.200	1.143	1.000	150.00
Arsenic (total)	ug/l	4.	71.00	226.	135.000	65.182	.904	124.089	1.605	.973	50.00
Cadmium (total)	ug/l	4.	111.	144.	126.000	14.306	1.000	125.336	1.120	1.000	.40
Chromium (total)	ug/l	4.	8.00	27.00	18.500	8.347	.000	16.794	1.718	.024	49.00
Copper (total)	ug/l	4.	4100.	5920.	5170.000	796.743	1.000	5120.464	1.176	1.000	6.50
Lead (total)	ug/l	4.	17.00	100.	58.750	44.858	.900	43.904	2.532	1.000	1.30
Manganese (total)	ug/l	4.	78600.	89500.	84050.000	5355.682	1.000	83951.980	1.066	1.000	1000.00
Nickel (total)	ug/l	4.	191.	256.	217.500	28.290	1.000	216.156	1.135	1.000	15.00
Silver (total)	ug/l	4.	.400	290.	74.850	143.447	.696	6.938	15.456	.739	1.20
Zinc (total)	ug/l	4.	37800.	45100.	42375.000	3269.429	1.000	42277.080	1.082	1.000	47.00
Aluminum (dissolved)	ug/l	4.	19000.	22800.	20525.000	1787.689	1.000	20475.820	1.090	1.000	150.00
Arsenic (dissolved)	ug/l	4.	64.00	194.	126.250	54.653	.919	116.863	1.597	.965	50.00
Cadmium (dissolved)	ug/l	4.	120.	149.	129.750	13.276	1.000	129.283	1.104	1.000	.40
Chromium (dissolved)	ug/l	4.	16.00	28.00	20.250	5.439	.000	19.747	1.285	.000	49.00
Copper (dissolved)	ug/l	4.	4580.	6060.	5435.000	723.717	1.000	5399.167	1.146	1.000	6.50
Lead (dissolved)	ug/l	4.	11.00	112.	64.500	54.003	.879	42.906	3.152	.999	1.30
Manganese (dissolved)	ug/l	4.	77700.	92800.	87625.000	6796.261	1.000	87378.130	1.083	1.000	1000.00
Nickel (dissolved)	ug/l	4.	187.	252.	228.500	30.860	1.000	226.784	1.151	1.000	15.00
Silver (dissolved)	ug/l	4.	.200	7.10	4.075	2.888	.840	2.309	5.197	.654	1.20
Zinc (dissolved)	ug/l	4.	42500.	47400.	44350.000	2136.196	1.000	44311.540	1.048	1.000	47.00
Fluoride	mg/l	4.	2.40	3.50	2.725	.519	.000	2.691	1.192	.012	4.00
Sulfate	mg/l	4.	1028.	2500.	1899.500	645.312	-----	1800.824	1.486		
Field pH	S.U.	4.	2.50	2.90	2.630	.189	-----	2.625	1.073		

LOCATION = SW021 Clear Creek Below Argo Discharge

TOTAL OBSERVATIONS: 4

PARAMETER	UNITS	N CASES	MINIMUM	MAXIMUM	ARITHMETIC MEAN	STANDARD DEVIATION	PROB > STAND	GEOMETRIC MEAN	GEOMETIC DEVIATION	PROB > STAND	STANDARD *
Aluminum (total)	ug/l	4.	355.	1380.	957.750	435.224	.968	855.768	1.828	.998	150.00
Arsenic (total)	ug/l	4.	2.00	10.00	5.250	3.594	.000	4.358	2.046	.000	50.00
Cadmium (total)	ug/l	4.	1.00	7.00	4.000	2.582	.918	4.716	1.533	1.000	.40
Chromium (total)	ug/l	4.	4.00	8.00	5.000	2.000	.000	4.759	1.415	.000	49.00
Copper (total)	ug/l	4.	47.00	285.	157.750	117.693	.901	120.784	2.425	1.000	6.50
Lead (total)	ug/l	4.	3.70	15.00	7.175	5.253	.868	6.104	1.852	.994	1.30
Manganese (total)	ug/l	4.	929.	6220.	3467.250	2420.823	.846	2724.390	2.363	.878	1000.00
Nickel (total)	ug/l	4.	5.00	20.00	13.500	6.856	.413	11.858	1.881	.355	15.00
Silver (total)	ug/l	4.	.100	5.00	2.300	2.573	.665	.669	8.989	.395	1.20
Zinc (total)	ug/l	4.	639.	2710.	1560.000	1004.610	.934	1305.054	2.030	1.000	47.00
Aluminum (dissolved)	ug/l	4.	64.00	419.	219.250	147.197	.681	179.648	2.171	.592	150.00
Arsenic (dissolved)	ug/l	4.	2.00	10.00	4.750	3.594	.000	3.935	1.982	.000	50.00
Cadmium (dissolved)	ug/l	4.	4.00	8.40	5.600	1.925	.997	5.382	1.370	1.000	.40
Chromium (dissolved)	ug/l	4.	4.00	8.00	5.250	1.893	.000	5.028	1.387	.000	49.00
Copper (dissolved)	ug/l	4.	19.00	104.	57.000	35.935	.920	47.894	2.044	.997	6.50
Lead (dissolved)	ug/l	4.	2.00	5.00	3.000	1.414	.885	2.784	1.545	.960	1.30
Manganese (dissolved)	ug/l	4.	953.	6460.	3520.750	2789.360	.817	2570.872	2.630	.836	1000.00
Nickel (dissolved)	ug/l	4.	5.90	20.00	13.225	5.779	.379	12.110	1.674	.339	15.00
Silver (dissolved)	ug/l	4.	.100	5.00	2.300	2.573	.665	.669	8.989	.395	1.20
Zinc (dissolved)	ug/l	4.	397.	2830.	1564.500	1239.030	.890	1135.695	2.670	.999	47.00
Fluoride	mg/l	4.	.470	.920	.695	.203	.000	.672	1.353	.000	4.00
Sulfate	mg/l	4.	26.00	178.	97.000	75.410	-----	71.880	2.575		
Field pH	S.U.	4.	4.70	6.80	6.023	.917	-----	5.966	1.177		

LOCATION = SW022 Clear Creek Above Argo Discharge

TOTAL OBSERVATIONS: 4

PARAMETER	UNITS	N CASES	MINIMUM	MAXIMUM	ARITHMETIC MEAN	STANDARD DEVIATION	PROB > STAND	GEOMETRIC MEAN	GEOMETIC DEVIATION	PROB > STAND	STANDARD *
Aluminum (total)	ug/l	4.	165.	391.	236.500	104.685	.796	222.294	1.477	.843	150.00
Arsenic (total)	ug/l	4.	2.00	10.00	4.750	3.594	.000	3.935	1.982	.000	50.00
Cadmium (total)	ug/l	4.	2.00	5.00	4.000	1.414	.995	3.762	1.543	1.000	.40
Chromium (total)	ug/l	4.	4.00	8.00	5.000	2.000	.000	4.759	1.415	.000	49.00
Copper (total)	ug/l	4.	14.00	20.00	17.000	2.944	1.000	16.810	1.191	1.000	6.50
Lead (total)	ug/l	4.	3.00	8.50	5.375	2.287	.963	5.023	1.530	.999	1.30
Manganese (total)	ug/l	4.	354.	1420.	929.000	448.537	.437	826.335	1.828	.376	1000.00
Nickel (total)	ug/l	4.	5.00	20.00	9.500	7.047	.218	8.053	1.863	.159	15.00
Silver (total)	ug/l	4.	.100	5.00	2.300	2.573	.665	.669	8.989	.395	1.20
Zinc (total)	ug/l	4.	167.	356.	251.750	79.063	.995	242.742	1.369	1.000	47.00
Aluminum (dissolved)	ug/l	4.	59.00	470.	174.250	198.006	.549	117.097	2.599	.398	150.00
Arsenic (dissolved)	ug/l	4.	2.00	10.00	4.750	3.594	.000	3.935	1.982	.000	50.00
Cadmium (dissolved)	ug/l	4.	1.00	5.00	3.750	1.893	.962	4.641	1.138	1.000	.40
Chromium (dissolved)	ug/l	4.	4.00	8.00	5.000	2.000	.000	4.759	1.415	.000	49.00
Copper (dissolved)	ug/l	4.	5.40	12.00	9.600	2.917	.856	9.189	1.436	.831	6.50
Lead (dissolved)	ug/l	4.	2.00	5.00	3.000	1.414	.885	2.784	1.545	.960	1.30
Manganese (dissolved)	ug/l	4.	356.	1430.	937.750	443.193	.444	837.147	1.818	.383	1000.00
Nickel (dissolved)	ug/l	4.	5.00	42.00	15.000	18.019	.500	9.689	2.683	.329	15.00
Silver (dissolved)	ug/l	4.	.100	5.00	2.300	2.573	.665	.669	8.989	.395	1.20
Zinc (dissolved)	ug/l	4.	161.	324.	246.000	82.490	.992	235.333	1.418	1.000	47.00
Fluoride	mg/l	4.	.410	1.00	.758	.249	.000	.645	1.483	.000	4.00
Sulfate	mg/l	4.	14.00	53.00	35.725	16.128	-----	32.169	1.779		
Field pH	S.U.	4.	6.24	6.99	6.745	.346	-----	6.740	1.054		

LOCATION = SW023 Big Five Portal

TOTAL OBSERVATIONS: 3

PARAMETER	UNITS	N CASES	MINIMUM	MAXIMUM	ARITHMETIC MEAN	STANDARD DEVIATION	PROB > STAND	GEOMETRIC MEAN	GEOMETIC DEVIATION	PROB > STAND	STANDARD *
Aluminum (total)	ug/l	3.	12600.	16200.	14066.670	1890.326	1.000	13988.620	1.140	1.000	150.00
Arsenic (total)	ug/l	3.	4.00	10.00	8.000	3.464	.000	7.367	1.697	.000	50.00
Cadmium (total)	ug/l	3.	20.00	34.00	27.333	7.024	1.000	26.709	1.309	1.000	.40
Chromium (total)	ug/l	3.	8.00	20.00	14.333	6.028	.000	13.383	1.598	.003	49.00
Copper (total)	ug/l	3.	1290.	1520.	1420.000	117.898	1.000	1416.579	1.088	1.000	6.50
Lead (total)	ug/l	3.	14.00	88.00	40.000	41.617	.824	28.106	2.710	.999	1.30
Manganese (total)	ug/l	3.	28100.	29400.	28733.330	650.641	1.000	28738.700	1.023	1.000	1000.00
Nickel (total)	ug/l	3.	222.	248.	239.000	14.731	1.000	238.650	1.065	1.000	15.00
Silver (total)	ug/l	3.	.100	14.00	6.367	7.050	.768	1.914	13.558	.571	1.20
Zinc (total)	ug/l	3.	7750.	8620.	8253.333	450.814	1.000	8242.016	1.057	1.000	47.00
Aluminum (dissolved)	ug/l	3.	14100.	17900.	15533.330	2064.784	1.000	15444.380	1.138	1.000	150.00
Arsenic (dissolved)	ug/l	3.	4.00	10.00	8.000	3.464	.000	7.367	1.697	.000	50.00
Cadmium (dissolved)	ug/l	3.	24.00	48.00	32.667	13.317	.992	31.062	1.461	1.000	.40
Chromium (dissolved)	ug/l	3.	8.00	30.00	17.000	11.533	.003	14.614	1.952	.035	49.00
Copper (dissolved)	ug/l	3.	1370.	1710.	1573.333	179.536	1.000	1565.562	1.125	1.000	6.50
Lead (dissolved)	ug/l	3.	14.00	91.00	54.667	38.682	.916	42.224	2.664	1.000	1.30
Manganese (dissolved)	ug/l	3.	31400.	31700.	31566.670	152.753	1.000	31571.170	1.005	1.000	1000.00
Nickel (dissolved)	ug/l	3.	241.	276.	260.667	17.898	1.000	260.343	1.073	1.000	15.00
Silver (dissolved)	ug/l	3.	.100	17.00	7.367	8.695	.761	2.040	14.629	.578	1.20
Zinc (dissolved)	ug/l	3.	9420.	9770.	9586.667	175.594	1.000	9585.437	1.018	1.000	47.00
Fluoride	mg/l	3.	1.40	1.90	1.567	.289	.000	1.550	1.192	.000	4.00
Sulfate	mg/l	3.	921.	2140.	1603.667	622.535	-----	1511.715	1.553		
Field pH	S.U.	2.	2.65	2.80	2.725	.106	-----	2.724	1.040		

LOCATION = SW024 Big Five at Clear Creek

TOTAL OBSERVATIONS: 4

PARAMETER	UNITS	N CASES	MINIMUM	MAXIMUM	ARITHMETIC MEAN	STANDARD DEVIATION	PROB > STAND	GEOMETRIC MEAN	GEOMETIC DEVIATION	PROB > STAND	STANDARD *
Aluminum (total)	ug/l	4.	13100.	26800.	18225.000	6362.062	.998	17448.350	1.397	1.000	150.00
Arsenic (total)	ug/l	4.	4.00	10.00	7.950	2.830	.000	7.471	1.542	.000	50.00
Cadmium (total)	ug/l	4.	20.00	34.00	26.750	5.852	1.000	26.259	1.249	1.000	.40
Chromium (total)	ug/l	4.	9.00	29.00	18.500	8.347	.000	16.996	1.632	.015	49.00
Copper (total)	ug/l	4.	1280.	1980.	1537.500	306.417	1.000	1516.257	1.207	1.000	6.50
Lead (total)	ug/l	4.	4.00	136.	64.500	69.917	.817	23.547	6.835	.934	1.30
Manganese (total)	ug/l	4.	28400.	36300.	32100.000	3311.596	1.000	31984.290	1.108	1.000	1000.00
Nickel (total)	ug/l	4.	226.	341.	278.000	48.463	1.000	274.788	1.188	1.000	15.00
Silver (total)	ug/l	4.	.400	5.70	2.905	2.838	.726	1.560	4.158	.573	1.20
Zinc (total)	ug/l	4.	8550.	12200.	9947.500	1639.621	1.000	9847.764	1.172	1.000	47.00
Aluminum (dissolved)	ug/l	4.	13100.	28200.	18800.000	6848.357	.997	17943.800	1.413	1.000	150.00
Arsenic (dissolved)	ug/l	4.	4.00	45.00	17.250	18.715	.040	11.588	2.726	.072	50.00
Cadmium (dissolved)	ug/l	4.	23.00	40.00	29.000	7.616	1.000	28.332	1.276	1.000	.40
Chromium (dissolved)	ug/l	4.	9.00	29.00	17.500	8.386	.000	16.055	1.616	.010	49.00
Copper (dissolved)	ug/l	4.	1280.	2030.	1577.500	319.414	1.000	1554.641	1.213	1.000	6.50
Lead (dissolved)	ug/l	4.	4.00	143.	64.000	70.527	.813	23.359	6.787	.934	1.30
Manganese (dissolved)	ug/l	4.	28400.	39500.	33600.000	4551.190	1.000	33356.230	1.145	1.000	1000.00
Nickel (dissolved)	ug/l	4.	226.	366.	288.500	58.381	1.000	284.292	1.220	1.000	15.00
Silver (dissolved)	ug/l	4.	.100	5.30	2.700	2.834	.702	1.015	7.092	.466	1.20
Zinc (dissolved)	ug/l	4.	8550.	13200.	10385.000	2023.339	1.000	10249.660	1.206	1.000	47.00
Fluoride	mg/l	2.	1.40	1.90	1.650	.354	.000	1.631	1.241	.000	4.00
Sulfate	mg/l	2.	2600.	3770.	3185.000	827.315	-----	3130.662	1.301		
Field pH	S.U.	4.	2.40	2.80	2.583	.167	-----	2.578	1.066		

LOCATION = SW026 Virginia Canyon Above Clear Creek

TOTAL OBSERVATIONS: 3

PARAMETER	UNITS	N CASES	MINIMUM	MAXIMUM	ARITHMETIC MEAN	STANDARD DEVIATION	PROB > STAND	GEOMETRIC MEAN	GEOMETIC DEVIATION	PROB > STAND	STANDARD *
Aluminum (total)	ug/l	3.	51600.	84700.	64200.000	17908.380	1.000	62692.650	1.303	1.000	150.00
Arsenic (total)	ug/l	3.	44.00	134.	102.333	50.580	.850	91.286	1.881	.830	50.00
Cadmium (total)	ug/l	3.	390.	540.	450.000	79.373	1.000	445.412	1.186	1.000	.40
Chromium (total)	ug/l	3.	40.00	58.00	46.667	9.866	.407	46.016	1.224	.378	49.00
Copper (total)	ug/l	3.	7720.	16100.	10543.330	4812.425	.986	9897.127	1.523	1.000	6.50
Lead (total)	ug/l	3.	29.00	257.	114.333	124.344	.818	75.189	3.056	1.000	1.30
Manganese (total)	ug/l	3.	58200.	75700.	65766.660	8986.842	1.000	65381.870	1.143	1.000	1000.00
Nickel (total)	ug/l	3.	550.	681.	631.333	71.009	1.000	628.289	1.123	1.000	15.00
Silver (total)	ug/l	3.	.300	5.00	3.100	2.476	.779	1.817	4.778	.605	1.20
Zinc (total)	ug/l	3.	69500.	106000.	84100.000	19313.980	1.000	82702.070	1.247	1.000	47.00
Aluminum (dissolved)	ug/l	3.	56200.	88000.	69666.660	16449.110	1.000	68459.650	1.257	1.000	150.00
Arsenic (dissolved)	ug/l	3.	70.00	173.	127.667	52.596	.930	119.224	1.605	.967	50.00
Cadmium (dissolved)	ug/l	3.	400.	618.	494.667	111.791	1.000	486.385	1.247	1.000	.40
Chromium (dissolved)	ug/l	3.	37.00	57.00	49.667	11.015	.524	48.764	1.271	.492	49.00
Copper (dissolved)	ug/l	3.	8560.	16000.	11266.670	4113.263	.997	10818.360	1.406	1.000	6.50
Lead (dissolved)	ug/l	3.	3.00	281.	116.333	145.936	.785	37.978	10.145	.927	1.30
Manganese (dissolved)	ug/l	3.	63200.	90500.	74833.340	14089.830	1.000	74013.290	1.202	1.000	1000.00
Nickel (dissolved)	ug/l	3.	604.	797.	726.667	106.613	1.000	721.260	1.166	1.000	15.00
Silver (dissolved)	ug/l	2.	.100	5.00	2.550	3.465	.652	.707	15.895	.424	1.20
Zinc (dissolved)	ug/l	3.	114.	91200.	56838.000	49489.480	.874	9376.857	45.559	.917	47.00
Fluoride	mg/l	1.	1.30	1.30	1.300	.000	-----	1.300	1.000	-----	4.00
Sulfate	mg/l	1.	1840.	1840.	1840.000	.000	-----	1840.882	1.000		
Field pH	S.U.	3.	2.85	3.10	2.953	.131	-----	2.951	1.045		

LOCATION = SW029 Clear Creek Above Big Five

TOTAL OBSERVATIONS: 4

PARAMETER	UNITS	N CASES	MINIMUM	MAXIMUM	ARITHMETIC MEAN	STANDARD DEVIATION	PROB > STAND	GEOMETRIC MEAN	GEOMETIC DEVIATION	PROB > STAND	STANDARD *
Aluminum (total)	ug/l	4.	25.00	779.	312.500	329.013	.689	172.604	4.246	.539	150.00
Arsenic (total)	ug/l	4.	2.00	10.00	4.750	3.594	.000	3.935	1.982	.000	50.00
Cadmium (total)	ug/l	4.	1.00	5.00	2.750	2.062	.873	4.473	1.171	1.000	.40
Chromium (total)	ug/l	4.	4.00	8.00	5.225	1.898	.000	5.003	1.387	.000	49.00
Copper (total)	ug/l	4.	3.00	100.	32.750	45.140	.720	15.549	4.212	.728	6.50
Lead (total)	ug/l	4.	2.00	6.00	4.025	1.845	.930	3.680	1.654	.981	1.30
Manganese (total)	ug/l	4.	5.00	2160.	1028.250	885.479	.513	317.348	16.346	.341	1000.00
Nickel (total)	ug/l	4.	5.00	20.00	9.825	6.860	.225	8.457	1.818	.169	15.00
Silver (total)	ug/l	4.	.100	5.00	2.300	2.573	.665	.669	8.989	.395	1.20
Zinc (total)	ug/l	4.	3.30	1260.	411.325	572.829	.738	110.719	12.268	.634	47.00
Aluminum (dissolved)	ug/l	3.	25.00	296.	142.667	138.976	.479	92.481	3.463	.348	150.00
Arsenic (dissolved)	ug/l	3.	3.00	10.00	5.667	3.786	.000	4.933	1.876	.000	50.00
Cadmium (dissolved)	ug/l	3.	1.00	5.00	3.333	2.082	.921	4.473	1.171	1.000	.40
Chromium (dissolved)	ug/l	3.	4.00	8.00	5.733	2.053	.000	5.501	1.419	.000	49.00
Copper (dissolved)	ug/l	3.	5.30	44.00	20.100	20.893	.742	13.695	2.930	.756	6.50
Lead (dissolved)	ug/l	3.	2.00	5.00	3.333	1.528	.908	3.108	1.582	.971	1.30
Manganese (dissolved)	ug/l	3.	14.00	1910.	994.667	949.687	.498	304.905	14.644	.329	1000.00
Nickel (dissolved)	ug/l	3.	5.00	20.00	10.333	8.386	.289	8.432	2.123	.222	15.00
Silver (dissolved)	ug/l	3.	.100	5.00	3.033	2.589	.761	1.260	8.998	.509	1.20
Zinc (dissolved)	ug/l	3.	14.00	726.	299.667	376.266	.749	117.331	7.330	.677	47.00
Fluoride	mg/l	3.	.100	.920	.630	.460	.000	.431	3.543	.039	4.00
Sulfate	mg/l	3.	5.00	40.00	25.333	18.175	-----	18.375	3.108		
Field pH	S.U.	2.	6.70	7.05	6.875	.247	-----	6.876	1.037		

LOCATION = SW031 Soda Creek

TOTAL OBSERVATIONS: 3

PARAMETER	UNITS	N CASES	MINIMUM	MAXIMUM	ARITHMETIC MEAN	STANDARD DEVIATION	PROB > STAND	GEOMETRIC MEAN	GEOMETIC DEVIATION	PROB > STAND	STANDARD *
Aluminum (total)	ug/l	3.	63.00	379.	198.333	162.805	.617	154.007	2.452	.512	150.00
Arsenic (total)	ug/l	3.	2.00	10.00	5.333	4.163	.000	4.310	2.241	.001	50.00
Cadmium (total)	ug/l	3.	1.00	5.00	3.333	2.082	.921	4.473	1.171	1.000	.40
Chromium (total)	ug/l	3.	4.00	8.00	5.333	2.309	.000	5.038	1.492	.000	49.00
Copper (total)	ug/l	3.	11.00	23.00	17.667	6.110	.966	16.878	1.467	.994	6.50
Lead (total)	ug/l	3.	3.00	5.00	3.667	1.155	.980	3.557	1.343	1.000	1.30
Manganese (total)	ug/l	3.	60.00	297.	141.333	134.857	.000	106.059	2.442	.006	1000.00
Nickel (total)	ug/l	3.	6.00	20.00	11.000	7.810	.304	9.431	1.925	.239	15.00
Silver (total)	ug/l	3.	.100	5.00	3.033	2.589	.761	1.260	8.998	.509	1.20
Zinc (total)	ug/l	3.	19.00	253.	107.000	127.326	.681	61.744	3.706	.582	47.00
Aluminum (dissolved)	ug/l	2.	23.00	516.	269.500	348.604	.634	108.962	9.025	.442	150.00
Arsenic (dissolved)	ug/l	2.	4.00	10.00	7.000	4.243	.000	6.322	1.912	.001	50.00
Cadmium (dissolved)	ug/l	2.	4.00	5.00	4.500	.707	1.000	4.473	1.171	1.000	.40
Chromium (dissolved)	ug/l	2.	4.00	8.00	6.000	2.828	.000	5.658	1.632	.000	49.00
Copper (dissolved)	ug/l	2.	5.20	11.00	8.100	4.101	.652	7.561	1.699	.612	6.50
Lead (dissolved)	ug/l	2.	3.00	5.00	4.000	1.414	.972	3.873	1.435	.999	1.30
Manganese (dissolved)	ug/l	2.	37.00	162.	99.500	88.388	.000	77.401	2.841	.007	1000.00
Nickel (dissolved)	ug/l	2.	6.00	43.00	24.500	26.163	.642	16.071	4.027	.520	15.00
Silver (dissolved)	ug/l	2.	4.50	5.00	4.750	.354	1.000	4.745	1.077	1.000	1.20
Zinc (dissolved)	ug/l	2.	17.00	120.	68.500	72.832	.616	45.150	3.983	.488	47.00
Fluoride	mg/l	1.	.340	.340	.340	.000	-----	.340	1.000	-----	4.00
Sulfate	mg/l	1.	34.00	34.00	34.000	.000	-----	33.988	1.000		
Field pH	S.U.	3.	6.45	7.30	6.750	.477	-----	6.740	1.071		

APPENDIX 7A

GROUND WATER ANALYTICAL RESULTS

FIRST SAMPLING SESSION RESULTS

GROUND WATER

November 1985

CLEAR CREEK GROUND WATER CHEMISTRY DATA

		11/05/85 MHC482 GWG0101 GREGORY WELL #1		11/07/85 MHC488 GWG02001 GREGORY WELL #2		11/05/85 MHC481 GWG0401 GREGORY WELL #4		11/07/85 MHC487 GWG0501 GREGORY WELL #5		11/02/85 MHC479 GWG0601 GREGORY WELL #6	
ELD DETERMINATIONS											
TEMPERATURE	C	9.50	Y	9.00	Y	9.50	Y	9.00	Y	10.0	Y
pH	S.U.	4.02	Y	2.83	Y	4.55	Y	5.24	Y	5.55	Y
Eh (REDOX POTENTIAL)	MV	521.	Y	581.	Y	444.	Y	58.0	Y	--	
SPECIFIC CONDUCTANCE	umhos	1710	Y	--		2110	Y	3490	Y	1730	Y
DISSOLVED OXYGEN	mg/L	--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--	
As+3	mg/L	--		--		--		--		--	
As+5	mg/L	--		--		--		--		--	
DISCHARGE	CFS	--		--		--		--		--	
DETERMINATIONS											
ENERAL											
ACIDITY	mg/L	563.	YJHT	885.	YJHT	343.	YJHT	1340	YJHT	162.	YJHT
pH	S.U.	3.30	Y	3.00	Y	3.10	Y	3.60	Y	3.30	Y
SPECIFIC CONDUCTANCE	umhos	2560	Y	3070	Y	2290	Y	3930	Y	1750	Y
TOTAL DISSOLVED SOLIDS	mg/L	2830	YJS	3720	YJS	2300	YJS	4650	YJS	1590	YJS
TOTAL SUSPENDED SOLIDS	mg/L	--		--		--		--		--	
TOTAL ORGANIC CARBON	mg/L	5.10	YJHT	3.60	YJHT	4.20	YJHT	8.60	YJHT	7.70	YJHT
SULFIDE	mg/L	--		--		--		--		--	
AJOR CATIONS											
CALCIUM	mg/L	362.	Y	425.	Y	308.	Y	346.	Y	240.	Y
MAGNESIUM	mg/L	129.	Y	152.	Y	105.	Y	122.	Y	70.9	Y
POTASSIUM	mg/L	5.84	Y	2.17	YU	8.66	Y	34.2	Y	5.38	Y
SODIUM	mg/L	35.3	Y	33.8	Y	30.9	Y	78.7	Y	19.5	Y
AJOR ANIONS											
BICARBONATE	mg/L	5.00	YUJ	5.00	YUJ	5.00	YUJ	5.00	YUJ	22.0	YJ
CARBONATE	mg/L	5.00	YUJ	5.00	YUJ	5.00	YUJ	5.00	YUJ	5.00	YUJ
FLUORIDE	mg/L	1.60	Y	2.00	Y	1.40	Y	0.31	Y	1.00	YJHT
CHLORIDE	mg/L	7.10	Y	12.0	Y	9.50	Y	18.0	Y	3.00	YU
SULFATE	mg/L	1820	YJHT	2530	Y	1500	YJHT	2900	Y	1050	YJHT

FOOTNOTES

(R) = REJECTED
(L) = QUALIFIED due to LCS recoveries outside control limits
(I) = QUANTIFIED due to exceeding ICP linear range
(*) = DUPLICATE control limits exceeded
(EJ) = ESTIMATED due to interference problems (ICP serial dilution or low spike recovery by graphite furnance)
(--) = Not analyzed
(umhos) = umhos/cm

(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(H,HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK GROUND WATER CHEMISTRY DATA

		11/05/85 MHC482 GWG0101 GREGORY WELL #1		11/07/85 MHC488 GWG02001 GREGORY WELL #2		11/05/85 MHC481 GWG0401 GREGORY WELL #4		11/07/85 MHC487 GWG0501 GREGORY WELL #5		11/02/85 MHC479 GWG0601 GREGORY WELL #6
NUTRIENTS										
AMMONIA	mg/L	--		--		--		--		--
NITRITE (NO2-N)	mg/L	--		--		--		--		--
NITRATE (NO3-N)	mg/L	--		--		--		--		--
NITRATE (NO3-N)+NITRITE (NO2-N)	mg/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	2.50
PHOSPHATE	mg/L	--		--		--		--		--
MINOR & TRACE ELEMENTS										
ALUMINUM	ug/L	18600	Y	36400	Y	3200	Y	50.0	YU	506.
ANTIMONY	ug/L	58.0	Y	47.0	Y	38.0	Y	136.	Y	25.0
ARSENIC	ug/L	208.	Y	224.	Y	101.	Y	424.	Y	2.00
BARIUM	ug/L	18.0	Y	13.0	YU	13.0	YU	26.0	YU	29.0
BERYLLIUM	ug/L	6.60	Y	13.0	Y	6.60	Y	1.00	Y	0.80
BORON	ug/L	265.	Y	316.	Y	190.	Y	537.	Y	119.
CADMIUM	ug/L	18.0	Y	55.0	Y	17.0	Y	1.00	YU	6.00
CHROMIUM (Cr+6)	ug/L	10.0	YUJHT	--		10.0	YUJHT	250.	YUJHT	10.0
CHROMIUM (TOTAL)	ug/L	21.0	Y	55.0	Y	6.40	Y	25.0	Y	4.00
COBALT	ug/L	233.	Y	334.	Y	183.	Y	442.	Y	82.0
COPPER	ug/L	230.	Y	5000	Y	956.	Y	163.	Y	16.0
CYANIDE	ug/L	10.0	YU	18.0	Y	10.0	YU	12.0	Y	16.0
GOLD	ug/L	1.00	YU	1.00	YU	1.00	YU	1.00	YU	1.00
IRON	ug/L	255000	Y	356000	Y	168000	Y	793000	Y	89000
LEAD	ug/L	148.	YJ*	63.0	YJ*	61.0	YJ*	108.	YJ*	2.00
MANGANESE	ug/L	41900	Y	54000	Y	34400	Y	128000	Y	20300
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10
MOLYBDENUM	ug/L	12.0	Y	16.0	Y	10.0	YU	94.0	Y	10.0
NICKEL	ug/L	301.	Y	573.	Y	248.	Y	182.	Y	150.
SELENIUM	ug/L	0.0000	Y	50.0	YUR	50.0	YUR	0.0000	Y	50.0
SILVER	ug/L	--		--		--		--		--
SILICA	ug/L	--		--		--		--		--
STRONTIUM	ug/L	1200	Y	1760	Y	2000	Y	1250	Y	1170
THALLIUM	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0
TIN	ug/L	16.0	YU	16.0	YU	16.0	YU	32.0	YU	16.0
VANADIUM	ug/L	22.0	Y	17.0	Y	7.40	Y	39.0	Y	4.00
ZINC	ug/L	10600	Y	13900	Y	7520	Y	3600	Y	1730

FOOTNOTES

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(umhos) = umhos/cm

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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK GROUND WATER CHEMISTRY DATA

		11/02/85 MHC478 GWG0901 GREGORY WELL #9		11/05/85 MHC480 GWG1301 GREGORY WELL #13		11/05/85 MHC484 GWG15001 BAILER BLANK		11/27/85 MHE260 GWNT101 NATIONAL WELL #1		11/27/85 MHE259 GWNT201 NATIONAL WELL #2	
FIELD DETERMINATIONS											
TEMPERATURE	C	7.50	Y	9.50	Y	--		5.00	Y	6.50	Y
pH	S.U.	4.70	Y	4.48	Y	--		5.00	Y	5.60	Y
Eh (REDOX POTENTIAL)	MV	--		356.	Y	--		334.	Y	488.	Y
SPECIFIC CONDUCTANCE	umhos	1930	Y	1160	Y	--		1675	Y	845.	Y
DISSOLVED OXYGEN	mg/L	--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--	
As+3	mg/L	--		--		--		--		--	
As+5	mg/L	--		--		--		--		--	
DISCHARGE	CFS	--		--		--		--		--	
LAB DETERMINATIONS											
GENERAL											
ACIDITY	mg/L	706.	YJHT	241.	YJHT	13.0	YJHT	143.	YJHT	22.0	YJHT
pH	S.U.	3.70	Y	4.00	Y	5.20	Y	5.26	Y	5.96	Y
SPECIFIC CONDUCTANCE	umhos	2010	Y	1240	Y	5.60	Y	1520	Y	849.	Y
TOTAL DISSOLVED SOLIDS	mg/L	3020	YJS	1080	YJS	10.0	YUJS	1620	YJHT	670.	YJHT
TOTAL SUSPENDED SOLIDS	mg/L	--		--		--		--		--	
TOTAL ORGANIC CARBON	mg/L	3.00	YJHT	9.40	YJHT	30.0	YJHT	1.50	Y	1.80	Y
SULFIDE	mg/L	--		--		--		--		--	
MAJOR CATIONS											
CALCIUM	mg/L	245.	Y	129.	Y	0.21	YU	241.	Y	128.	Y
MAGNESIUM	mg/L	83.8	Y	43.2	Y	0.31	YU	85.0	Y	29.5	Y
POTASSIUM	mg/L	20.4	Y	8.64	Y	2.17	YU	13.9	Y	5.97	Y
SODIUM	mg/L	24.3	Y	14.4	Y	0.58	YU	31.5	Y	19.2	Y
MAJOR ANIONS											
BICARBONATE	mg/L	5.00	YUJ	5.00	YUJ	5.00	YUJ	5.00	YUJ	17.0	YJ
CARBONATE	mg/L	5.00	YUJ	5.00	YUJ	5.00	YUJ	5.00	YUJ	5.00	YUJ
FLUORIDE	mg/L	2.10	YJHT	2.10	Y	0.10	YU	1.80	Y	0.18	Y
CHLORIDE	mg/L	4.20	Y	10.0	Y	3.00	YU	9.90	Y	10.0	Y
SULFATE	mg/L	2020	YJHT	700.	YJHT	5.00	YUJHT	1060	Y	400.	Y

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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK GROUND WATER CHEMISTRY DATA

		11/02/85 MHC478 GWG0901 GREGORY WELL #9		11/05/85 MHC480 GWG1301 GREGORY WELL #13		11/05/85 MHC484 GWG15001 BAILER BLANK		11/27/85 MHE260 GWNT101 NATIONAL WELL #1		11/27/85 MHE259 GWNT201 NATIONAL WELL #2	
NUTRIENTS											
AMMONIA	mg/L	--		--		--		--		--	
NITRITE (NO2-N)	mg/L	--		--		--		--		--	
NITRATE (NO3-N)	mg/L	--		--		--		--		--	
NITRATE (NO3-N)+NITRITE (NO2-N)	mg/L	2.50	YUJHT	0.10	YU	0.11	Y	0.68	YJ*	0.15	
PHOSPHATE	mg/L	--		--		--		--		--	
MINOR & TRACE ELEMENTS											
ALUMINUM	ug/L	10300	Y	1230	Y	25.0	YU	1880	Y	74.0	
ANTIMONY	ug/L	50.0	YU	25.0	YU	25.0	YU	25.0	YU	25.0	
ARSENIC	ug/L	2.00	YU	2.00	YU	2.00	YU	10.0	YU	10.0	
BARIUM	ug/L	26.0	YU	24.0	Y	13.0	YU	43.0	Y	54.0	
BERYLLIUM	ug/L	2.80	Y	1.00	Y	0.40	YU	0.70	Y	0.40	
BORON	ug/L	250.	Y	185.	Y	5.00	YU	78.0	Y	40.0	
CADMIUM	ug/L	41.0	Y	22.0	Y	1.00	YU	97.0	Y	16.0	
CHROMIUM (Cr+6)	ug/L	10.0	YUJHT	10.0	YUJHT	10.0	YUJHT	10.0	YUJHT	10.0	
CHROMIUM (TOTAL)	ug/L	14.0	Y	4.00	YU	4.00	YU	11.0	Y	4.40	
COBALT	ug/L	628.	Y	95.0	Y	5.00	YU	43.0	Y	43.0	
COPPER	ug/L	682.	Y	12.0	Y	3.00	YU	21.0	Y	74.0	
CYANIDE	ug/L	16.0	YJHT	10.0	YU	10.0	YU	10.0	YUJHT	10.0	
GOLD	ug/L	1.00	YU	1.00	YU	1.00	YU	1.00	YUJ	10.0	
IRON	ug/L	322000	Y	109000	Y	54.0	Y	1460	Y	10.0	
LEAD	ug/L	100.	YJ*	5.00	YUJ*	2.00	YUJ*	5.00	YU	10.0	
MANGANESE	ug/L	139000	Y	20700	Y	5.00	YU	47200	Y	14400	
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YUJHT	0.10	
MOLYBDENUM	ug/L	10.0	YU	12.0	Y	10.0	YU	10.0	YU	10.0	
NICKEL	ug/L	600.	Y	134.	Y	7.00	YU	992.	Y	106.	
SELENIUM	ug/L	50.0	YUR	50.0	YUR	2.00	YUR	50.0	YUR	5.00	
SILVER	ug/L	--		--		--		--		--	
SILICA	ug/L	--		--		--		--		--	
STRONTIUM	ug/L	653.	Y	559.	Y	5.00	YU	1670	YJS	1000	
THALLIUM	ug/L	10.0	YU	10.0	YU	2.00	YU	10.0	YU	10.0	
TIN	ug/L	32.0	YU	16.0	YU	17.0	Y	16.0	YU	16.0	
VANADIUM	ug/L	8.00	YU	6.70	Y	4.00	YU	4.00	YU	4.00	
ZINC	ug/L	9480	Y	15600	Y	2.00	YU	19800	Y	5380	

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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK GROUND WATER CHEMISTRY DATA

		11/27/85 MHE261 GWNT301 NATIONAL WELL #3		11/06/85 MHC485 GWQH101 QUARTZ HILL WELL #1		11/07/85 MHC489 GWQH02001 QUARTZ HILL WELL #2		11/25/85 MHC398 GWBF0101 BIG FIVE WELL #1		11/25/85 MHC397 GWBF0201 BIG FIVE WELL #1 SPLIT	
ELD DETERMINATIONS											
TEMPERATURE	C	6.00	Y	4.50	Y	6.00	Y	10.5	Y	--	
pH	S.U.	5.65	Y	2.64	Y	2.50	Y	3.36	Y	--	
Eh (REDOX POTENTIAL)	MV	443.	Y	574.	Y	683.	Y	671.	Y	--	
SPECIFIC CONDUCTANCE	umhos	520.	Y	3900	Y	--		2760	Y	--	
DISSOLVED OXYGEN	mg/L	--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--	
As+3	mg/L	--		--		--		--		--	
As+5	mg/L	--		--		--		--		--	
DISCHARGE	CFS	--		--		--		--		--	
) DETERMINATIONS											
ENERAL											
ACIDITY	mg/L	8.60	YJHT	1640	YJHT	1910	YJHT	189.	YJHT	240.	YJHT
pH	S.U.	5.95	Y	2.90	Y	2.60	Y	3.39	Y	3.57	Y
SPECIFIC CONDUCTANCE	umhos	516.	Y	3910	Y	4260	Y	2800	Y	2760	Y
TOTAL DISSOLVED SOLIDS	mg/L	365.	YJHT	5700	YJS	4790	YJS	2960	YJHT	2960	Y
TOTAL SUSPENDED SOLIDS	mg/L	--		--		--		--		--	
TOTAL ORGANIC CARBON	mg/L	1.40	Y	5.70	YJHT	3.50	YJHT	2.50	Y	3.10	Y
SULFIDE	mg/L	--		--		--		--		--	
AJOR CATIONS											
CALCIUM	mg/L	60.5	Y	375.	Y	362.	Y	337.	Y	367.	Y
MAGNESIUM	mg/L	17.4	Y	214.	Y	196.	Y	139.	Y	151.	Y
POTASSIUM	mg/L	3.51	Y	10.5	Y	4.34	YU	9.21	Y	10.5	Y
SODIUM	mg/L	12.0	Y	23.4	Y	5.24	Y	52.5	Y	55.9	Y
AJOR ANIONS											
BICARBONATE	mg/L	18.0	YJ	5.00	YUJ	5.00	YUJ	5.00	YUJ	5.00	YUJ
CARBONATE	mg/L	5.00	YUJ	5.00	YUJ	5.00	YUJ	5.00	YUJ	5.00	YUJ
FLUORIDE	mg/L	0.37	Y	0.24	Y	0.22	Y	1.30	Y	1.30	Y
CHLORIDE	mg/L	17.0	Y	3.90	Y	10.0	Y	11.0	YJ*	14.0	YJ*
SULFATE	mg/L	201.	Y	3750	YJHT	3780	Y	1870	Y	1320	Y

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Acidity reported as mg/L CaCO3

CLEAR CREEK GROUND WATER CHEMISTRY DATA

		11/27/85 MHE261 GWNT301 NATIONAL WELL #3		11/06/85 MHC485 GWQH101 QUARTZ HILL WELL #1		11/07/85 MHC489 GWQH02001 QUARTZ HILL WELL #2		11/25/85 MHC398 GWBF0101 BIG FIVE WELL #1		11/25/85 MHC397 GWBF0201 BIG FIVE WELL #1 SPLIT
NUTRIENTS										
AMMONIA	mg/L	--		--		--		--		--
NITRITE (NO2-N)	mg/L	--		--		--		--		--
NITRATE (NO3-N)	mg/L	--		--		--		--		--
NITRATE (NO3-N)+NITRITE (NO2-N)	mg/L	0.11	YJ*	0.10	YU	0.10	YU	0.18	Y	0.24
PHOSPHATE	mg/L	--		--		--		--		--
MINOR & TRACE ELEMENTS										
ALUMINUM	ug/L	144.	Y	120000	Y	70000	Y	31200	Y	33300
ANTIMONY	ug/L	25.0	YU	50.0	YU	50.0	YU	25.0	YU	25.0
ARSENIC	ug/L	10.0	YU	374.	Y	699.	Y	39.0	Y	30.0
BARIUM	ug/L	46.0	Y	71.0	Y	26.0	YU	27.0	Y	25.0
BERYLLIUM	ug/L	0.40	YU	52.0	Y	50.0	Y	8.70	Y	9.60
BORON	ug/L	36.0	Y	218.	Y	340.	Y	129.	Y	124.
CADMIUM	ug/L	12.0	Y	640.	Y	460.	Y	43.0	YU	45.0
CHROMIUM (Cr+6)	ug/L	10.0	YUJHT	200.	YUJHT	250.	YUJHT	10.0	YUJHT	10.0
CHROMIUM (TOTAL)	ug/L	4.00	YU	178.	Y	99.0	Y	36.0	Y	26.0
COBALT	ug/L	19.0	Y	902.	Y	425.	Y	167.	Y	187.
COPPER	ug/L	120.	Y	54600	Y	47900	Y	2410	Y	2600
CYANIDE	ug/L	10.0	YUJHT	13.0	Y	10.0	YU	10.0	YUR	10.0
GOLD	ug/L	1.00	YUJ	1.00	YU	1.00	YU	1.00	YU	1.00
IRON	ug/L	10.0	YU	231000	Y	470000	Y	1640	Y	1210
LEAD	ug/L	10.0	Y	50.0	YUJ*	291.	YJ*	277.	Y	250.
MANGANESE	ug/L	5540	Y	153000	Y	70500	Y	34300	Y	37700
MERCURY	ug/L	0.10	YUJHT	0.10	YU	0.10	YU	0.10	YUJHT	0.10
MOLYBDENUM	ug/L	10.0	YU	10.0	YU	19.0	Y	10.0	YU	10.0
NICKEL	ug/L	41.0	Y	899.	Y	544.	Y	323.	Y	352.
SELENIUM	ug/L	50.0	YUR	0.0000	Y	--		50.0	YUR	50.0
SILVER	ug/L	--		--		--		--		--
SILICA	ug/L	--		--		--		--		--
STRONTIUM	ug/L	420.	YJS	296.	Y	271.	Y	2270	Y	2300
THALLIUM	ug/L	10.0	YU	2.00	YU	2.00	YU	10.0	YUJS	10.0
TIN	ug/L	16.0	YU	32.0	YU	32.0	YU	74.0	Y	16.0
VANADIUM	ug/L	4.00	YU	8.00	YU	8.00	YU	15.0	Y	4.00
ZINC	ug/L	3400	Y	110000	Y	108000	Y	10500	Y	11400

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CLEAR CREEK GROUND WATER CHEMISTRY DATA

		11/25/85 MHC399 GWBF0301 BAILER BLANK		11/26/85 MHC492 GWA01001 ARGO WELL #1		11/25/85 MHC493 GWA02001 ARGO WELL #2		11/25/85 MHC494 GWA03001 ARGO WELL #3		11/08/85 MHC491 GW04301 BAILER BLANK	
FLD DETERMINATIONS											
TEMPERATURE	C	--		9.00	Y	10.5	Y	10.0	Y	--	
pH	S.U.	--		4.10	Y	3.60	Y	5.65	Y	--	
Eh (REDOX POTENTIAL)	MV	--		376.	Y	506.	Y	146.	Y	--	
SPECIFIC CONDUCTANCE	umhos	--		2000	Y	1890	Y	940.	Y	--	
DISSOLVED OXYGEN	mg/L	--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--	
As+3	mg/L	--		--		--		--		--	
As+5	mg/L	--		--		--		--		--	
DISCHARGE	CFS	--		--		--		--		--	
B DETERMINATIONS											
GENERAL											
ACIDITY	mg/L	5.00	YUJHT	781.	YJHT	743.	YJHT	5.00	YUJHT	93.0	YJHT
pH	S.U.	5.71	Y	4.04	Y	3.75	Y	5.73	Y	2.90	Y
SPECIFIC CONDUCTANCE	umhos	3.00	Y	2030	Y	1930	Y	968.	Y	672.	Y
TOTAL DISSOLVED SOLIDS	mg/L	10.0	YUJHT	2460	YJHT	2220	YJHT	680.	YJHT	160.	YJS
TOTAL SUSPENDED SOLIDS	mg/L	--		--		--		--		--	
TOTAL ORGANIC CARBON	mg/L	0.99	Y	2.70	Y	1.90	Y	8.20	Y	2.00	YJHT
SULFIDE	mg/L	--		--		--		--		--	
MAJOR CATIONS											
CALCIUM	mg/L	0.21	YU	99.3	Y	131.	Y	60.6	Y	10.6	Y
MAGNESIUM	mg/L	0.31	YU	145.	Y	92.8	Y	20.8	Y	0.31	YU
POTASSIUM	mg/L	2.17	YU	3.89	Y	4.54	Y	12.4	Y	2.17	YU
SODIUM	mg/L	0.58	YU	26.5	Y	23.5	Y	102.	Y	0.58	Y
MAJOR ANIONS											
BICARBONATE	mg/L	5.00	YUJ	5.00	YUJ	5.00	YUJ	132.	YJ	5.00	YUJ
CARBONATE	mg/L	5.00	YUJ	5.00	YUJ	5.00	YUJ	5.00	YUJ	5.00	YUJ
FLUORIDE	mg/L	0.10	YU	3.20	Y	3.40	Y	0.14	Y	0.10	YU
CHLORIDE	mg/L	5.40	YJ*	9.90	YJ*	18.0	YJ*	26.0	YJ*	3.00	YU
SULFATE	mg/L	5.00	YU	2490	Y	1250	Y	324.	Y	5.00	YU

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(umhos) = umhos/cm

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(U) = UNDETECTED
(H,HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK GROUND WATER CHEMISTRY DATA

		11/25/85 MHC399 GWBF0301 BAILER BLANK		11/26/85 MHC492 GWA01001 ARGO WELL #1		11/25/85 MHC493 GWA02001 ARGO WELL #2		11/25/85 MHC494 GWA03001 ARGO WELL #3		11/08/85 MHC491 GW04301 BAILER BLANK
NUTRIENTS										
AMMONIA	mg/L	--		--		--		--		--
NITRITE (NO2-N)	mg/L	--		--		--		--		--
NITRATE (NO3-N)	mg/L	--		--		--		--		--
NITRATE (NO3-N)+NITRITE (NO2-N)	mg/L	0.10	YJHT	0.10	YU	7.00	Y	0.12	YU	32.0
PHOSPHATE	mg/L	--		--		--		--		--
MINOR & TRACE ELEMENTS										
ALUMINUM	ug/L	25.0	YU	102000	Y	97000	Y	550.	Y	25.0
ANTIMONY	ug/L	25.0	YU	25.0	YU	25.0	YU	25.0	YU	25.0
ARSENIC	ug/L	10.0	YU	103.	Y	84.0	Y	10.0	YU	17.0
BARIUM	ug/L	13.0	YU	22.0	Y	39.0	Y	35.0	Y	128.
BERYLLIUM	ug/L	0.40	YU	18.0	Y	11.0	Y	0.40	YU	0.40
BORON	ug/L	5.00	YU	110.	Y	174.	Y	114.	Y	5.00
CADMIUM	ug/L	1.00	YU	89.0	Y	89.0	Y	4.50	Y	9.00
CHROMIUM (Cr+6)	ug/L	10.0	YUJHT	10.0	YUJHT	100.	YUJHT	10.0	YUJHT	10.0
CHROMIUM (TOTAL)	ug/L	4.00	YU	34.0	Y	16.0	Y	4.00	YU	22.0
COBALT	ug/L	5.00	YU	322.	Y	272.	Y	36.0	Y	5.00
COPPER	ug/L	3.00	YU	8920	Y	3200	Y	48.0	Y	4.20
CYANIDE	ug/L	10.0	YUR	10.0	YUR	10.0	YUR	10.0	YUR	10.0
GOLD	ug/L	1.00	YUJS	10.0	YUJS	10.0	YUJS	1.00	YUJS	1.00
IRON	ug/L	10.0	YU	4570	Y	5180	Y	13500	Y	134.
LEAD	ug/L	5.00	YU	525.	Y	428.	Y	5.00	YU	44.0
MANGANESE	ug/L	5.00	YU	82600	Y	42600	Y	9150	Y	60.0
MERCURY	ug/L	0.10	YUJHT	0.10	YUJHT	0.10	YUJHT	0.10	YUJHT	0.16
MOLYBDENUM	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0
NICKEL	ug/L	7.00	YU	382.	Y	378.	Y	35.0	Y	7.00
SELENIUM	ug/L	5.00	YUR	50.0	YUR	50.0	YUR	50.0	YUR	12.0
SILVER	ug/L	--		--		--		--		--
SILICA	ug/L	--		--		--		--		--
STRONTIUM	ug/L	5.00	YU	370.	Y	174.	Y	580.	Y	5.00
THALLIUM	ug/L	10.0	YUJS	10.0	YUJS	10.0	YUJS	10.0	YUJS	2.00
TIN	ug/L	16.0	YU	16.0	YU	16.0	YU	16.0	YU	16.0
VANADIUM	ug/L	4.00	YU	4.00	YU	4.00	YU	4.00	YU	4.00
ZINC	ug/L	2.20	Y	39600	Y	16400	Y	613.	Y	14.0

FOOTNOTES

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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

SECOND SAMPLING SESSION RESULTS

GROUND WATER

February 1986

CLEAR CREEK GROUND WATER CHEMISTRY DATA

		02/18/86 MHE488 GWG0102 GREGORY WELL #1		02/18/86 MHE554 GWG01A02 GREGORY WELL #1 (0.1 U FILTER)		02/18/86 MHE548 GWG0202 GREGORY WELL #2		02/13/86 MHE497 GWG0402 GREGORY WELL #4		02/13/86 MHE512 GWG04A02 GREGORY WELL #4 (.1 U FILTER)	
ELD DETERMINATIONS											
TEMPERATURE	C	6.30	Y	6.30	Y	8.00	Y	10.0	Y	10.0	Y
pH	S.U.	3.72	Y	3.72	Y	—		4.85	Y	4.85	Y
Eh (REDOX POTENTIAL)	MV	483.	Y	483.	Y	—		365.	Y	365.	Y
SPECIFIC CONDUCTANCE	umhos	2360	Y	2360	Y	2610	Y	1980	Y	1980	Y
DISSOLVED OXYGEN	mg/L	—		—		—		—		—	
Fe+2	mg/L	—		—		—		—		—	
Fe+3	mg/L	—		—		—		—		—	
IRON (TOTAL)	mg/L	—		—		—		—		—	
As+3	mg/L	—		—		—		—		—	
As+5	mg/L	—		—		—		—		—	
DISCHARGE	CFS	—		—		—		—		—	
8 DETERMINATIONS											
GENERAL											
ACIDITY	mg/L	464.	Y	472.	Y	446.	Y	276.	YJS	302.	YJS
pH	S.U.	4.21	Y	4.15	Y	3.09	Y	5.04	Y	4.96	Y
SPECIFIC CONDUCTANCE	umhos	2430	Y	2440	Y	2690	Y	2100	Y	2070	Y
TOTAL DISSOLVED SOLIDS	mg/L	2920	Y	2960	Y	2710	Y	2240	Y	2290	Y
TOTAL SUSPENDED SOLIDS	mg/L	7720	Y	1180	Y	6600	Y	6.00	YJH	28.0	YJH
TOTAL ORGANIC CARBON	mg/L	—		—		—		—		—	
SULFIDE	mg/L	0.50	YUJS	0.50	YUJS	—		0.10	YUJS	0.10	YUJS
MAJOR CATIONS											
CALCIUM	mg/L	345.	Y	378.	Y	342.	Y	315.	YJS	302.	YJS
MAGNESIUM	mg/L	108.	Y	122.	Y	109.	Y	102.	YJS	96.3	YJS
POTASSIUM	mg/L	1.70	Y	2.16	Y	1.81	Y	8.98	Y	8.58	Y
SODIUM	mg/L	32.4	Y	35.0	Y	33.0	Y	31.7	Y	32.7	Y
MAJOR ANIONS											
BICARBONATE	mg/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
CARBONATE	mg/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
FLUORIDE	mg/L	2.00	Y	2.00	Y	1.70	Y	1.40	Y	1.40	Y
CHLORIDE	mg/L	4.90	YJ*	5.20	YJ*	5.20	YJ*	4.90	Y	6.50	Y
SULFATE	mg/L	1720	Y	1750	Y	1570	Y	1090	Y	1500	Y

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Acidity reported as mg/L CaCO3

CLEAR CREEK GROUND WATER CHEMISTRY DATA

		02/18/86 MHE488 GWG0102 GREGORY WELL #1		02/18/86 MHE554 GWG01A02 GREGORY WELL #1 (0.1 U FILTER)		02/18/86 MHE548 GWG0202 GREGORY WELL #2		02/13/86 MHE497 GWG0402 GREGORY WELL #4		02/13/86 MHE512 GWG04A02 GREGORY WELL #4 (.1 U FILTER)	
NUTRIENTS											
AMMONIA	mg/L	0.61	Y	0.51	Y	0.22	Y	0.14	Y	0.15	
NITRITE (NO2-N)	mg/L	0.16	Y	0.17	Y	0.10	YU	0.20	Y	0.20	
NITRATE (NO3-N)	mg/L	--		--		--		--		--	
NITRATE (NO3-N)+NITRITE (NO2-N)	mg/L	599.	Y	1.00	YU	1.00	YU	2.00	YU	0.10	
PHOSPHATE	mg/L	--		--		--		--		--	
MINOR & TRACE ELEMENTS											
ALUMINUM	ug/L	25100	Y	27400	Y	13100	Y	2660	YJS	2390	
ANTIMONY	ug/L	26.0	YUJ	26.0	YU	26.0	YUJS	26.0	YUJS	26.0	
ARSENIC	ug/L	7.80	Y	6.00	Y	10.0	YU	10.0	YU	10.0	
BARIUM	ug/L	9.00	YU	9.00	YU	9.00	YU	12.0	Y	9.00	
BERYLLIUM	ug/L	7.40	Y	8.60	Y	5.80	Y	5.50	Y	4.50	
BORON	ug/L	--		--		--		--		--	
CADMIUM	ug/L	21.0	Y	24.0	Y	12.0	Y	18.0	Y	19.0	
CHROMIUM (Cr+6)	ug/L	50.0	YU	11.0	Y	2000	YU	1000	YU	100.	
CHROMIUM (TOTAL)	ug/L	19.0	Y	22.0	Y	21.0	Y	17.0	Y	12.0	
COBALT	ug/L	188.	Y	206.	Y	181.	Y	175.	Y	165.	
COPPER	ug/L	716.	Y	820.	Y	1200	Y	724.	YJS	658.	
CYANIDE	ug/L	--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--	
IRON	ug/L	171000	Y	188000	Y	150000	Y	167000	Y	156000	
LEAD	ug/L	115.	YR	140.	YR	50.0	YUR	67.0	Y	54.0	
MANGANESE	ug/L	34600	Y	37700	Y	34500	Y	32800	Y	31300	
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	
MOLYBDENUM	ug/L	--		--		--		--		--	
NICKEL	ug/L	261.	Y	296.	Y	259.	Y	235.	Y	224.	
SELENIUM	ug/L	50.0	YUJER	50.0	YUJER	50.0	YUJER	50.0	YUR	50.0	
SILVER	ug/L	--		--		--		--		--	
SILICA	ug/L	110000	Y	114000	Y	67500	Y	42200	Y	41700	
STRONTIUM	ug/L	--		--		--		--		--	
THALLIUM	ug/L	10.0	YUJS	10.0	YUJS	10.0	YU	10.0	YUJS	10.0	
TIN	ug/L	28.0	Y	18.0	YU	18.0	YU	18.0	YUJS	18.0	
VANADIUM	ug/L	6.20	Y	5.30	Y	5.00	YU	15.0	Y	9.70	
ZINC	ug/L	7590	YJS	8480	YJS	7550	YJS	6680	YJS	6580	

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Acidity reported as mg/L CaCO3

CLEAR CREEK GROUND WATER CHEMISTRY DATA

		02/24/86 MHE565 GW04702 GREGORY WELL #4 (2 BUCKET PURGE)		02/24/86 MHE566 GW04802 GREGORY WELL #4 (14 BUCKET PURGE)		02/24/86 MHE567 GW04902 GREGORY WELL #4 (BAILED)		02/13/86 MHE500 GW05O2 GREGORY WELL #5 (0.1 U FILTER)		02/13/86 MHE491 GW05A02 GREGORY WELL #5	
FIELD DETERMINATIONS											
TEMPERATURE	C	9.00	Y	10.0	Y	10.0	Y	8.60	Y	8.60	Y
pH	S.U.	4.92	Y	5.06	Y	5.20	Y	5.50	Y	5.50	Y
Eh (REDOX POTENTIAL)	MV	458.	Y	376.	Y	365.	Y	317.	Y	317.	Y
SPECIFIC CONDUCTANCE	umhos	1430	Y	1610	Y	1680	Y	2140	Y	2140	Y
DISSOLVED OXYGEN	mg/L	--		--		--		--		--	
Fe+2	mg/L	0.44	Y	0.40	Y	0.39	Y	--		--	
Fe+3	mg/L	2.46	Y	2.40	Y	2.43	Y	--		--	
IRON (TOTAL)	mg/L	2.90	Y	2.80	Y	2.82	Y	--		--	
As+3	mg/L	0.01	YU	--		0.01	YU	--		--	
As+5	mg/L	0.01	YU	--		0.01	YU	--		--	
DISCHARGE	CFS	--		--		--		--		--	
LAB DETERMINATIONS											
GENERAL											
ACIDITY	mg/L	--		--		--		351.	YJS	341.	Y
pH	S.U.	--		--		--		5.83	Y	5.90	Y
SPECIFIC CONDUCTANCE	umhos	--		--		--		2180	Y	2170	Y
TOTAL DISSOLVED SOLIDS	mg/L	--		--		--		2400	Y	2390	Y
TOTAL SUSPENDED SOLIDS	mg/L	--		--		--		490.	YJH	328.	Y
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--	
SULFIDE	mg/L	--		--		--		0.10	YUJS	0.10	YUJS
MAJOR CATIONS											
CALCIUM	mg/L	297.	Y	292.	Y	304.	Y	275.	YJS	283.	YJS
MAGNESIUM	mg/L	94.1	Y	91.9	Y	94.4	Y	84.7	YJS	87.2	YJS
POTASSIUM	mg/L	8.25	Y	8.04	Y	8.03	Y	11.8	Y	12.4	Y
SODIUM	mg/L	30.8	Y	30.7	Y	32.1	Y	33.4	Y	33.9	Y
MAJOR ANIONS											
BICARBONATE	mg/L	--		--		--		33.0	Y	41.0	Y
CARBONATE	mg/L	--		--		--		5.00	YU	5.00	YU
FLUORIDE	mg/L	--		--		--		1.30	Y	1.30	Y
CHLORIDE	mg/L	--		--		--		6.50	Y	7.80	Y
SULFATE	mg/L	--		--		--		1430	Y	1350	Y

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CLEAR CREEK GROUND WATER CHEMISTRY DATA

		02/24/86 MHE565 GW04702 GREGORY WELL #4 (2 BUCKET PURGE)		02/24/86 MHE566 GW04802 GREGORY WELL #4 (14 BUCKET PURGE)		02/24/86 MHE567 GW04902 GREGORY WELL #4 (BAILED)		02/13/86 MHE500 GW0502 GREGORY WELL #5 (0.1 U FILTER)		02/13/86 MHE491 GW05A02 GREGORY WELL #5	
NUTRIENTS											
AMMONIA	mg/L	--		--		--		0.20	Y	0.28	Y
NITRITE (NO2-N)	mg/L	--		--		--		0.24	Y	0.24	Y
NITRATE (NO3-N)	mg/L	--		--		--		--		--	
NITRATE (NO3-N)+NITRITE (NO2-N)	mg/L	--		--		--		0.10	YU	0.10	Y
PHOSPHATE	mg/L	--		--		--		--		--	
MINOR & TRACE ELEMENTS											
ALUMINUM	ug/L	2720	YJS	2660	YJS	2720	YJS	441.	YJS	432.	Y
ANTIMONY	ug/L	26.0	YU	35.0	Y	26.0	YU	32.0	YJS	39.0	Y
ARSENIC	ug/L	10.0	YU	10.0	YU	10.0	YU	115.	Y	10.0	Y
BARIUM	ug/L	9.00	YU	9.00	YU	9.00	YU	14.0	Y	15.0	Y
BERYLLIUM	ug/L	5.40	Y	4.90	Y	5.40	Y	0.60	Y	0.60	Y
BORON	ug/L	--		--		--		--		--	
CADMIUM	ug/L	9.00	Y	7.50	Y	14.0	Y	18.0	Y	20.0	Y
CHROMIUM (Cr+6)	ug/L	--		--		--		10.0	YU	10.0	Y
CHROMIUM (TOTAL)	ug/L	5.90	Y	4.00	YU	6.60	Y	15.0	Y	14.0	Y
COBALT	ug/L	150.	Y	149.	Y	156.	Y	129.	Y	132.	Y
COPPER	ug/L	632.	YJS	612.	YJS	627.	YJS	20.0	YJS	18.0	Y
CYANIDE	ug/L	--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--	
IRON	ug/L	157000	Y	154000	Y	161000	Y	193000	Y	198000	Y
LEAD	ug/L	25.0	Y	28.0	Y	27.0	Y	5.00	YU	5.00	Y
MANGANESE	ug/L	31100	Y	30500	Y	31900	Y	41900	Y	43200	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.15	Y	0.10	YU	0.10	Y
MOLYBDENUM	ug/L	--		--		--		--		--	
NICKEL	ug/L	215.	YJE	218.	YJE	221.	YJE	149.	Y	154.	Y
SELENIUM	ug/L	50.0	YUR	50.0	YUR	50.0	YUR	5.00	YUR	50.0	Y
SILVER	ug/L	--		--		--		--		--	
SILICA	ug/L	--		--		--		43600	Y	45200	Y
STRONTIUM	ug/L	--		--		--		--		--	
THALLIUM	ug/L	10.0	YUJS	10.0	YUJS	10.0	YUJS	10.0	YUJS	10.0	Y
TIN	ug/L	18.0	YU	18.0	YU	18.0	YU	18.0	YUJS	18.0	Y
VANADIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	9.20	Y	13.0	Y
ZINC	ug/L	6340	YJS	6270	YJS	6520	YJS	3820	YJS	3870	Y

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Acidity reported as mg/L $CaCO_3$

CLEAR CREEK GROUND WATER CHEMISTRY DATA

		02/13/86 MHE503 GWG0602 GREGORY WELL #6		02/13/86 MHE506 GWG06A02 GREGORY WELL #6 (0.1 U FILTER)		02/13/86 MHE509 GWG0902 GREGORY WELL #9		02/18/86 MHE551 GWG13002 GREGORY WELL #13		02/12/86 MHE450 GWNT102 NATIONAL WELL #1	
FIELD DETERMINATIONS											
TEMPERATURE	C	9.30	Y	9.30	Y	7.90	Y	6.30	Y	4.90	Y
pH	S.U.	5.60	Y	5.60	Y	5.55	Y	4.55	Y	4.20	Y
Eh (REDOX POTENTIAL)	MV	356.	Y	356.	Y	348.	Y	426.	Y	654.	Y
SPECIFIC CONDUCTANCE	umhos	1550	Y	1550	Y	1390	Y	980.	Y	1490	Y
DISSOLVED OXYGEN	mg/L	--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--	
As+3	mg/L	--		--		--		--		--	
As+5	mg/L	--		--		--		--		--	
DISCHARGE	CFS	--		--		--		--		--	
LAB DETERMINATIONS											
GENERAL											
ACIDITY	mg/L	78.0	YJS	73.0	YJS	113.	YJS	156.	Y	--	
pH	S.U.	5.57	Y	5.45	Y	5.82	Y	4.87	Y	--	
SPECIFIC CONDUCTANCE	umhos	1540	Y	1430	Y	1380	Y	1070	Y	--	
TOTAL DISSOLVED SOLIDS	mg/L	1500	Y	1500	Y	1340	Y	1060	Y	--	
TOTAL SUSPENDED SOLIDS	mg/L	100.	YJH	150.	YJH	2850	YJH	3760	Y	--	
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--	
SULFIDE	mg/L	0.10	YUJS	0.10	YUJS	0.10	YUJS	0.50	YUJS	--	
MAJOR CATIONS											
CALCIUM	mg/L	248.	YJS	244.	YJS	195.	YJS	129.	Y	238.	Y
MAGNESIUM	mg/L	70.5	YJS	70.8	YJS	56.6	YJS	42.5	Y	78.2	Y
POTASSIUM	mg/L	4.84	Y	5.12	Y	7.14	Y	6.83	Y	10.6	Y
SODIUM	mg/L	21.5	Y	21.2	Y	15.8	Y	17.1	Y	33.2	Y
MAJOR ANIONS											
BICARBONATE	mg/L	19.0	Y	6.00	Y	18.0	Y	5.00	YU	--	
CARBONATE	mg/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	--	
FLUORIDE	mg/L	1.50	Y	1.50	Y	0.68	Y	1.90	Y	--	
CHLORIDE	mg/L	3.00	YU	3.00	YU	3.00	YU	7.80	YJ*	--	
SULFATE	mg/L	700.	Y	900.	Y	740.	Y	590.	Y	--	

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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK GROUND WATER CHEMISTRY DATA

		02/13/86 MHE503 GWG0602 GREGORY WELL #6		02/13/86 MHE506 GWG06A02 GREGORY WELL #6 (0.1 U FILTER)		02/13/86 MHE509 GWG0902 GREGORY WELL #9		02/18/86 MHE551 GWG13002 GREGORY WELL #13		02/12/86 MHE450 GWNT102 NATIONAL WELL #1	
NUTRIENTS											
AMMONIA	mg/L	0.10	YU	0.10	YU	0.10	YU	0.89	Y	--	
NITRITE (NO2-N)	mg/L	0.12	Y	0.12	Y	0.10	Y	0.10	YU	--	
NITRATE (NO3-N)	mg/L	--		--		--		--		--	
NITRATE (NO3-N)+NITRITE (NO2-N)	mg/L	0.10	YU	0.10	YU	0.10	YU	1.00	YU	--	
PHOSPHATE	mg/L	--		--		--		--		--	
MINOR & TRACE ELEMENTS											
ALUMINUM	ug/L	1340	YJS	1170	YJS	326.	YJS	2880	Y	5920	Y
ANTIMONY	ug/L	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	Y
ARSENIC	ug/L	10.0	YU	10.0	YU	10.0	YU	10.0	YU	10.0	Y
BARIUM	ug/L	32.0	Y	30.0	Y	30.0	Y	23.0	Y	26.0	Y
BERYLLIUM	ug/L	0.60	Y	0.60	Y	0.40	YU	2.50	Y	2.80	Y
BORON	ug/L	--		--		--		--		--	
CADMIUM	ug/L	22.0	Y	19.0	Y	28.0	Y	38.0	Y	59.0	Y
CHROMIUM (Cr+6)	ug/L	100.	YU	100.	YU	10.0	YU	10.0	YU	--	
CHROMIUM (TOTAL)	ug/L	9.10	Y	5.20	Y	21.0	Y	4.10	Y	6.10	Y
COBALT	ug/L	77.0	Y	72.0	Y	272.	Y	63.0	Y	44.0	Y
COPPER	ug/L	286.	YJS	255.	YJS	8.50	YJS	38.0	Y	403.	Y
CYANIDE	ug/L	--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--	
IRON	ug/L	61400	Y	60000	Y	40900	Y	74300	Y	11.0	Y
LEAD	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YUR	5.00	Y
MANGANESE	ug/L	27600	Y	27100	Y	69600	Y	17300	Y	37200	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	Y
MOLYBDENUM	ug/L	--		--		--		--		--	
NICKEL	ug/L	123.	Y	121.	Y	339.	Y	127.	Y	556.	Y
SELENIUM	ug/L	50.0	YUR	50.0	YUR	50.0	YUR	50.0	YUJER	5.00	Y
SILVER	ug/L	--		--		--		--		--	
SILICA	ug/L	33400	Y	34300	Y	43000	Y	66200	Y	--	
STRONTIUM	ug/L	--		--		--		--		--	
THALLIUM	ug/L	10.0	YUJS	10.0	YUJS	10.0	YUJS	10.0	YUJS	10.0	Y
TIN	ug/L	18.0	YUJS	18.0	YUJS	18.0	YUJS	18.0	YU	18.0	Y
VANADIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	Y
ZINC	ug/L	2660	YJS	2580	YJS	3720	YJS	16400	YJS	14200	Y

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CLEAR CREEK GROUND WATER CHEMISTRY DATA

		02/12/86 MHE451 GWNT202 NATIONAL WELL #2		02/12/86 MHE452 GWNT302 NATIONAL WELL #3		02/14/86 MHE545 GWQH102 QUARTZ HILL WELL #1		02/14/86 MHE537 GWQH1A02 QUARTZ HILL WELL #1 (0.1 U FILTER)		02/14/86 MHE534 GWQH202 QUARTZ HILL WELL #2	
FIELD DETERMINATIONS											
TEMPERATURE	C	4.20	Y	4.70	Y	3.00	Y	3.00	Y	4.00	Y
pH	S.U.	3.80	Y	3.90	Y	2.40	Y	2.40	Y	2.45	Y
Eh (REDOX POTENTIAL)	MV	664.	Y	659.	Y	736.	Y	736.	Y	736.	Y
SPECIFIC CONDUCTANCE	umhos	820.	Y	550.	Y	4450	Y	4450	Y	4500	Y
DISSOLVED OXYGEN	mg/L	--		--		--		--		--	
Fe+2	mg/L	--		--		71.0	Y	77.0	Y	33.0	Y
Fe+3	mg/L	--		--		131.	Y	131.	Y	69.0	Y
IRON (TOTAL)	mg/L	--		--		202.	Y	208.	Y	102.	Y
As+3	mg/L	--		--		--		--		--	
As+5	mg/L	--		--		--		--		--	
DISCHARGE	CFS	--		--		--		--		--	
LAB DETERMINATIONS											
GENERAL											
ACIDITY	mg/L	--		--		1840	YJS	1920	Y	1810	YJS
pH	S.U.	--		--		2.58	Y	2.60	Y	2.73	Y
SPECIFIC CONDUCTANCE	umhos	--		--		4420	Y	4440	Y	4510	Y
TOTAL DISSOLVED SOLIDS	mg/L	--		--		5810	Y	5800	Y	5760	Y
TOTAL SUSPENDED SOLIDS	mg/L	--		--		26.0	Y	26.0	Y	10500	Y
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--	
SULFIDE	mg/L	--		--		0.10	YUJS	0.10	YUJS	0.10	YUJS
MAJOR CATIONS											
CALCIUM	mg/L	96.9	Y	59.2	Y	390.	YJS	365.	YJS	382.	YJS
MAGNESIUM	mg/L	33.5	Y	19.7	Y	218.	YJS	203.	YJS	219.	Y
POTASSIUM	mg/L	4.46	Y	3.24	Y	1.42	YU	1.42	YU	2.12	Y
SODIUM	mg/L	16.2	Y	13.0	Y	5.40	Y	6.04	Y	5.62	Y
MAJOR ANIONS											
BICARBONATE	mg/L	--		--		5.00	YU	5.00	YU	5.00	YU
CARBONATE	mg/L	--		--		5.00	YU	5.00	YU	5.00	YU
FLUORIDE	mg/L	--		--		0.11	Y	0.10	YU	0.11	Y
CHLORIDE	mg/L	--		--		3.00	YU	3.00	YU	3.00	YU
SULFATE	mg/L	--		--		3700	Y	3360	Y	3220	Y

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CLEAR CREEK GROUND WATER CHEMISTRY DATA

		02/12/86 MHE451 GWNT202 NATIONAL WELL #2		02/12/86 MHE452 GWNT302 NATIONAL WELL #3		02/14/86 MHE545 GWQH102 QUARTZ HILL WELL #1		02/14/86 MHE537 GWQH1A02 QUARTZ HILL WELL #1 (0.1 U FILTER)		02/14/86 MHE534 GWQH202 QUARTZ HILL WELL #2	
NUTRIENTS											
AMMONIA	mg/L	--		--		0.13	Y	0.12	Y	0.16	Y
NITRITE (NO2-N)	mg/L	--		--		0.10	YU	0.10	YU	0.10	Y
NITRATE (NO3-N)	mg/L	--		--		--		--		--	
NITRATE (NO3-N)+NITRITE (NO2-N)	mg/L	--		--		0.10	YU	0.10	YU	0.10	Y
PHOSPHATE	mg/L	--		--		--		--		--	
MINOR & TRACE ELEMENTS											
ALUMINUM	ug/L	6590	Y	2380	Y	75500	YJS	69700	YJS	123000	Y
ANTIMONY	ug/L	26.0	YUJS	26.0	YUJS	58.0	YJS	52.0	YUJS	52.0	Y
ARSENIC	ug/L	10.0	YU	10.0	YU	767.	Y	720.	Y	364.	Y
BARIUM	ug/L	19.0	Y	23.0	Y	18.0	YU	18.0	YU	102.	Y
BERYLLIUM	ug/L	1.40	Y	0.40	YU	51.0	Y	46.0	Y	54.0	Y
BORON	ug/L	--		--		--		--		--	
CADMIUM	ug/L	25.0	Y	12.0	Y	507.	Y	505.	Y	589.	Y
CHROMIUM (Cr+6)	ug/L	--		--		10.0	YU	10.0	YU	10.0	Y
CHROMIUM (TOTAL)	ug/L	5.70	Y	4.70	Y	92.0	Y	86.0	Y	184.	Y
COBALT	ug/L	59.0	Y	26.0	Y	437.	Y	405.	Y	639.	Y
COPPER	ug/L	1030	Y	430.	Y	48200	YJS	44300	YJS	53700	Y
CYANIDE	ug/L	--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--	
IRON	ug/L	129.	Y	69.0	Y	470000	Y	437000	Y	272000	Y
LEAD	ug/L	10.0	Y	76.0	Y	118.	Y	116.	Y	5.00	Y
MANGANESE	ug/L	18500	Y	6250	Y	73500	Y	68500	Y	103000	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.20	Y	0.35	Y	0.10	Y
MOLYBDENUM	ug/L	--		--		--		--		--	
NICKEL	ug/L	144.	Y	53.0	Y	545.	Y	509.	Y	733.	Y
SELENIUM	ug/L	5.00	YURS	5.00	YURS	50.0	YUR	50.0	YUR	50.0	Y
SILVER	ug/L	--		--		--		--		--	
SILICA	ug/L	--		--		95100	Y	93100	Y	148000	Y
STRONTIUM	ug/L	--		--		--		--		--	
THALLIUM	ug/L	10.0	YUJS	10.0	YUJS	10.0	YUJS	10.0	YUJS	10.0	Y
TIN	ug/L	18.0	YU	18.0	YU	36.0	YUJS	36.0	YUJS	36.0	Y
VANADIUM	ug/L	5.00	YU	5.00	YU	28.0	Y	24.0	Y	10.0	Y
ZINC	ug/L	7230	Y	3650	Y	113000	YJS	107000	YJS	116000	Y

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CLEAR CREEK GROUND WATER CHEMISTRY DATA

		02/12/86 MHE453 GWBF102 BIG FIVE WELL #1		02/12/86 MHE454 GWBB102 BAILER BLANK		02/14/86 MHE531 GWA0102 ARGO WELL #1		02/14/86 MHE528 GWA0401 ARGO WELL #1 TRIPLICATE		02/14/86 MHE542 GWA0502 ARGO WELL #1 TRIPLICATE	
IELD DETERMINATIONS											
TEMPERATURE	C	8.00	Y	--		7.80	Y	--		7.80	Y
pH	S.U.	3.30	Y	--		3.40	Y	--		3.40	Y
Eh (REDOX POTENTIAL)	MV	702.	Y	--		502.	Y	--		502.	Y
SPECIFIC CONDUCTANCE	umhos	2570	Y	--		1430	Y	--		1430	Y
DISSOLVED OXYGEN	mg/L	--		--		--		--		--	
Fe+2	mg/L	--		--		3.00	Y	--		3.00	Y
Fe+3	mg/L	--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		3.00	Y	--		3.00	Y
As+3	mg/L	--		--		--		--		--	
As+5	mg/L	--		--		--		--		--	
DISCHARGE	CFS	--		--		--		--		--	
AB DETERMINATIONS											
GENERAL											
ACIDITY	mg/L	--		--		389.	YJS	374.	YJS	386.	YJS
pH	S.U.	--		--		3.62	Y	3.64	Y	3.63	Y
SPECIFIC CONDUCTANCE	umhos	--		--		1440	Y	1380	Y	1410	Y
TOTAL DISSOLVED SOLIDS	mg/L	--		--		1520	Y	1450	Y	1480	Y
TOTAL SUSPENDED SOLIDS	mg/L	--		--		372.	Y	2380	Y	1900	Y
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--	
SULFIDE	mg/L	--		--		0.10	YUJS	0.10	YUJS	0.10	YUJS
MAJOR CATIONS											
CALCIUM	mg/L	371.	Y	0.32	YU	108.	YJS	109.	YJS	122.	YJS
MAGNESIUM	mg/L	149.	Y	0.39	YU	63.3	YJS	62.2	YJS	71.1	YJS
POTASSIUM	mg/L	11.2	Y	0.71	YU	1.73	Y	2.43	Y	1.89	Y
SODIUM	mg/L	70.2	Y	0.83	Y	26.4	Y	25.9	Y	28.6	Y
MAJOR ANIONS											
BICARBONATE	mg/L	--		--		5.00	YU	5.00	YU	5.00	YU
CARBONATE	mg/L	--		--		5.00	YU	5.00	YU	5.00	YU
FLUORIDE	mg/L	--		--		3.20	Y	3.20	Y	3.10	Y
CHLORIDE	mg/L	--		--		15.0	Y	14.0	Y	14.0	Y
SULFATE	mg/L	--		--		695.	Y	500.	Y	760.	Y

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NUTRIENTS											
AMMONIA	mg/L	--		--		0.10	YU	0.10	YU	0.10	YU
NITRITE (NO2-N)	mg/L	--		--		0.10	YU	0.10	YU	0.10	YU
NITRATE (NO3-N)	mg/L	--		--		--		--		--	
NITRATE (NO3-N)+NITRITE (NO2-N)	mg/L	--		--		9.20	Y	8.80	Y	9.00	Y
PHOSPHATE	mg/L	--		--		--		--		--	
MINOR & TRACE ELEMENTS											
ALUMINUM	ug/L	23200	Y	23.0	YU	62600	YJS	60100	YJS	67900	Y
ANTIMONY	ug/L	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YUJS	26.0	YU
ARSENIC	ug/L	10.0	YU	10.0	YU	120.	Y	139.	Y	160.	Y
BARIUM	ug/L	9.50	Y	9.00	YU	14.0	Y	17.0	Y	14.0	Y
BERYLLIUM	ug/L	6.60	Y	0.50	Y	6.90	Y	13.0	Y	7.90	Y
BORON	ug/L	--		--		--		--		--	
CADMIUM	ug/L	29.0	Y	4.00	YU	59.0	Y	66.0	Y	68.0	Y
CHROMIUM (Cr+6)	ug/L	--		--		10.0	YU	10.0	YU	10.0	YU
CHROMIUM (TOTAL)	ug/L	20.0	Y	4.00	YU	10.0	Y	18.0	Y	6.80	Y
COBALT	ug/L	128.	Y	6.00	YU	150.	Y	152.	Y	165.	Y
COPPER	ug/L	1830	Y	4.00	YU	2210	YJS	2190	YJS	2580	YJ
CYANIDE	ug/L	--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--	
IRON	ug/L	1740	Y	11.0	YU	425.	Y	410.	Y	1140	Y
LEAD	ug/L	174.	Y	5.00	YU	5.00	YU	5.00	YU	5.00	YU
MANGANESE	ug/L	33000	Y	14.0	Y	23000	Y	22100	Y	25200	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.10	YU	0.10	YU	0.10	YU
MOLYBDENUM	ug/L	--		--		--		--		--	
NICKEL	ug/L	289.	Y	6.00	YU	185.	Y	191.	Y	204.	Y
SELENIUM	ug/L	50.0	YURS	5.00	YURS	0.0000	Y	50.0	YUR	5.00	YU
SILVER	ug/L	--		--		--		--		--	
SILICA	ug/L	--		--		100000	Y	103000	Y	103000	Y
STRONTIUM	ug/L	--		--		--		--		--	
THALLIUM	ug/L	10.0	YUJS	10.0	YU	10.0	YUJS	10.0	YUJS	10.0	YU
TIN	ug/L	18.0	YU	18.0	YU	18.0	YUJS	18.0	YUJS	18.0	YU
VANADIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	YU
ZINC	ug/L	9380	Y	7.60	Y	9580	YJS	9190	YJS	10400	YJ

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(H,HT) = QUALIFIED due to holding time violation
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(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK GROUND WATER CHEMISTRY DATA

		02/12/86 MHE448 GWA0202 ARGO WELL #2		02/12/86 MHE449 GWA0302 ARGO WELL #3		03/19/86 MHC942 GWBS103 BLIND STANDARD #1		03/19/86 MHC943 GWBS203 BLIND STANDARD #2	
FIELD DETERMINATIONS									
TEMPERATURE	C	7.00	Y	5.80	Y	--		--	
pH	S.U.	6.00	Y	4.10	Y	--		--	
Eh (REDOX POTENTIAL)	MV	314.	Y	479.	Y	--		--	
SPECIFIC CONDUCTANCE	umhos	860.	Y	1270	Y	--		--	
DISSOLVED OXYGEN	mg/L	--		--		--		--	
Fe+2	mg/L	--		--		--		--	
Fe+3	mg/L	--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--	
As+3	mg/L	--		--		--		--	
As+5	mg/L	--		--		--		--	
DISCHARGE	CFS	--		--		--		--	
LAB DETERMINATIONS									
GENERAL									
ACIDITY	mg/L	--		--		--		--	
pH	S.U.	--		--		--		--	
SPECIFIC CONDUCTANCE	umhos	--		--		--		--	
TOTAL DISSOLVED SOLIDS	mg/L	--		--		--		--	
TOTAL SUSPENDED SOLIDS	mg/L	--		--		--		--	
TOTAL ORGANIC CARBON	mg/L	--		--		--		--	
SULFIDE	mg/L	--		--		--		--	
MAJOR CATIONS									
CALCIUM	mg/L	59.9	Y	66.7	Y	0.28	Y	26.6	Y
MAGNESIUM	mg/L	20.7	Y	80.3	Y	0.39	YU	0.39	YU
POTASSIUM	mg/L	13.2	Y	2.63	Y	0.71	YU	0.71	YU
SODIUM	mg/L	107.	Y	19.4	Y	0.86	Y	1.04	Y
MAJOR ANIONS									
BICARBONATE	mg/L	--		--		--		--	
CARBONATE	mg/L	--		--		--		--	
FLUORIDE	mg/L	--		--		--		--	
CHLORIDE	mg/L	--		--		--		--	
SULFATE	mg/L	--		--		--		--	

FOOTNOTES

(R) = REJECTED
(L) = QUALIFIED due to LCS recoveries outside control limits
(I) = QUANTIFIED due to exceeding ICP linear range
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(--) = Not analyzed
(umhos) = umhos/cm

(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(H,HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK GROUND WATER CHEMISTRY DATA

		02/12/86 MHE448 GWA0202 ARGO WELL #2		02/12/86 MHE449 GWA0302 ARGO WELL #3		03/19/86 MHC942 GWBS103 BLIND STANDARD #1		03/19/86 MHC943 GWBS203 BLIND STANDARD #2	
NUTRIENTS									
AMMONIA	mg/L	--		--		--		--	
NITRITE (NO2-N)	mg/L	--		--		--		--	
NITRATE (NO3-N)	mg/L	--		--		--		--	
NITRATE (NO3-N)+NITRITE (NO2-N)	mg/L	--		--		--		--	
PHOSPHATE	mg/L	--		--		--		--	
MINOR & TRACE ELEMENTS									
ALUMINUM	ug/L	23.0	YU	52600	Y	40.0	Y	47.0	Y
ANTIMONY	ug/L	26.0	YUJS	26.0	YUJS	26.0	YU	26.0	YU
ARSENIC	ug/L	10.0	YU	31.0	Y	38.0	Y	14.0	Y
BARIUM	ug/L	9.40	Y	9.00	YU	130.	Y	308.	Y
BERYLLIUM	ug/L	0.40	YU	8.90	Y	0.40	YU	0.40	YU
BORON	ug/L	--		--		--		--	
CADMIUM	ug/L	4.00	YU	116.	Y	13.0	Y	37.0	Y
CHROMIUM (Cr+6)	ug/L	--		--		--		--	
CHROMIUM (TOTAL)	ug/L	4.00	YU	18.0	Y	19.0	Y	48.0	Y
COBALT	ug/L	6.00	YU	160.	Y	6.00	YU	6.00	YU
COPPER	ug/L	4.00	YU	4890	Y	4.00	YU	4.00	YU
CYANIDE	ug/L	--		--		--		--	
GOLD	ug/L	--		--		--		--	
IRON	ug/L	1340	Y	1260	Y	183.	Y	265.	Y
LEAD	ug/L	5.00	YU	54.0	Y	39.0	Y	120.	Y
MANGANESE	ug/L	4690	Y	41000	Y	45.0	Y	116.	Y
MERCURY	ug/L	0.10	YU	0.10	YU	0.23	Y	0.90	Y
MOLYBDENUM	ug/L	--		--		--		--	
NICKEL	ug/L	10.0	Y	199.	Y	6.00	YU	6.00	YU
SELENIUM	ug/L	5.00	YURS	50.0	YURS	32.0	Y	13.0	Y
SILVER	ug/L	--		--		--		--	
SILICA	ug/L	--		--		--		--	
STRONTIUM	ug/L	--		--		--		--	
THALLIUM	ug/L	10.0	YUJS	10.0	YUJS	10.0	YU	10.0	YU
TIN	ug/L	18.0	YU	18.0	YU	18.0	YU	18.0	YU
VANADIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU
ZINC	ug/L	292.	Y	20700	Y	2.00	YU	2.00	YU

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(umhos) = umhos/cm

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Acidity reported as mg/L CaCO3

THIRD SAMPLING SESSION RESULTS

GROUND WATER

May-June 1986

)6/03/87

CLEAR CREEK GROUND WATER CHEMISTRY DATA

		05/28/86 MHD198 GWG0103 GREGORY WELL #1		05/26/86 MHD174 GWG0203 GREGORY WELL #2		05/26/86 MHD199 GWG0303 GREGORY WELL #3		05/28/86 MHD175 GWG0403 GREGORY WELL #4		05/27/86 MHD197 GWG0503 GREGORY WELL #5	
IELD DETERMINATIONS											
TEMPERATURE	C	17.0	Y	12.0	Y	13.5	Y	11.5	Y	14.0	Y
pH	S.U.	4.15	Y	2.90	Y	3.25	Y	4.55	Y	4.50	Y
Eh (REDOX POTENTIAL)	MV	606.	Y	680.	Y	609.	Y	510.	Y	488.	Y
SPECIFIC CONDUCTANCE	umhos	1993	Y	2337	Y	1968	Y	1873	Y	1420	Y
DISSOLVED OXYGEN	mg/L	--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--	
As+3	mg/L	--		--		--		--		--	
As+5	mg/L	--		--		--		--		--	
DISCHARGE	CFS	--		--		--		--		--	
AB DETERMINATIONS											
GENERAL											
ACIDITY	mg/L	--		--		--		--		370.	YJ*
pH	S.U.	--		--		--		--		3.19	Y
SPECIFIC CONDUCTANCE	umhos	--		--		--		--		2049	Y
TOTAL DISSOLVED SOLIDS	mg/L	--		--		--		--		1074	YJC
TOTAL SUSPENDED SOLIDS	mg/L	--		--		--		--		245.	YJC
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--	
SULFIDE	mg/L	--		--		--		--		--	
MAJOR CATIONS											
CALCIUM	mg/L	342.	YJS	300.	YJE	248.	YJS	289.	YJSE	298.	YJE
MAGNESIUM	mg/L	109.	Y	77.5	Y	74.5	Y	74.4	Y	82.0	Y
POTASSIUM	mg/L	0.78	YJS	1.54	YJS	4.66	YJS	5.47	YJS	8.97	YJS
SODIUM	mg/L	23.3	YJS	13.4	YJS	20.9	YJS	11.7	YJS	19.8	YJS
MAJOR ANIONS											
BICARBONATE	mg/L	--		--		--		--		--	
CARBONATE	mg/L	--		--		--		--		--	
FLUORIDE	mg/L	--		--		--		--		2.48	Y
CHLORIDE	mg/L	--		--		--		--		22.0	Y
SULFATE	mg/L	--		--		--		--		932.	YJC

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CLEAR CREEK GROUND WATER CHEMISTRY DATA

		05/28/86 MHD198 GWG0103 GREGORY WELL #1		05/26/86 MHD174 GWG0203 GREGORY WELL #2		05/26/86 MHD199 GWG0303 GREGORY WELL #3		05/28/86 MHD175 GWG0403 GREGORY WELL #4		05/27/86 MHD197 GWG0503 GREGORY WELL #5	
NUTRIENTS											
AMMONIA	mg/L	--		--		--		--		0.20	)
NITRITE (NO2-N)	mg/L	--		--		--		--		--	
NITRATE (NO3-N)	mg/L	--		--		--		--		--	
NITRATE (NO3-N)+NITRITE (NO2-N)	mg/L	--		--		--		--		--	
PHOSPHATE	mg/L	--		--		--		--		--	
MINOR & TRACE ELEMENTS											
ALUMINUM	ug/L	31600	Y	13200	Y	6930	Y	5160	Y	1930	)
ANTIMONY	ug/L	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	)
ARSENIC	ug/L	4.00	YUJS	4.00	YU	4.00	YUJS	4.00	YUJS	4.00	)
BARIUM	ug/L	50.0	YURS	50.0	YURS	50.0	YURS	50.0	YURS	50.0	)
BERYLLIUM	ug/L	7.50	Y	7.90	Y	8.20	Y	6.60	Y	5.00	)
BORON	ug/L	--		--		--		--		--	
CADMIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	)
CHROMIUM (Cr+6)	ug/L	--		--		--		--		5.00	)
CHROMIUM (TOTAL)	ug/L	10.3	Y	11.9	Y	8.00	YU	8.00	YU	8.00	)
COBALT	ug/L	186.	Y	163.	Y	135.	Y	153.	Y	148.	)
COPPER	ug/L	963.	YJS	1810	YJE	1810	YJS	1460	YJSE	17.0	)
CYANIDE	ug/L	--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--	
IRON	ug/L	155000	YJE	160000	Y	120000	YJE	148000	Y	167000	)
LEAD	ug/L	106.	Y	57.0	YJS	4.00	Y	33.0	Y	17.0	)
MANGANESE	ug/L	34900	Y	30600	Y	27800	Y	30200	Y	40600	)
MERCURY	ug/L	0.65	Y	0.21	YJS	0.21	Y	0.40	Y	0.21	)
MOLYBDENUM	ug/L	--		--		--		--		--	
NICKEL	ug/L	257.	YJE	266.	Y	193.	YJE	260.	Y	208.	)
SELENIUM	ug/L	40.0	YURS	40.0	YURS	40.0	YURS	40.0	YURS	40.0	)
SILVER	ug/L	--		--		--		--		--	
SILICA	ug/L	--		--		--		--		35900	)
STRONTIUM	ug/L	--		--		--		--		--	
THALLIUM	ug/L	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	)
TIN	ug/L	190.	YURS	190.	YUJS	190.	YURS	190.	YURS	190.	)
VANADIUM	ug/L	37.0	Y	45.0	Y	20.0	YU	51.0	Y	34.0	)
ZINC	ug/L	7340	Y	8080	Y	7040	Y	7750	Y	5080	)

FOOTNOTES

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Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK GROUND WATER CHEMISTRY DATA

		05/27/86 MHD176 GWG0603 GREGORY WELL #6		05/28/86 MHD177 GWG0903 GREGORY WELL #9		05/27/86 MHD178 GWG1303 GREGORY WELL #13		05/23/86 MHD192 GWNT103 NATIONAL WELL #1		05/23/86 MHD193 GWNT203 NATIONAL WELL #2	
FIELD DETERMINATIONS											
TEMPERATURE	C	13.0	Y	16.0	Y	15.0	Y	11.0	Y	10.0	Y
pH	S.U.	4.50	Y	5.40	Y	5.35	Y	4.40	Y	3.70	Y
Eh (REDOX POTENTIAL)	MV	497.	Y	317.	Y	358.	Y	665.	Y	656.	Y
SPECIFIC CONDUCTANCE	umhos	1752	Y	1281	Y	2353	Y	1012	Y	726.	Y
DISSOLVED OXYGEN	mg/L	--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--	
As+3	mg/L	--		--		--		--		--	
As+5	mg/L	--		--		--		--		--	
DISCHARGE	CFS	--		--		--		--		--	
LAB DETERMINATIONS											
GENERAL											
ACIDITY	mg/L	--		--		406.	YJ*	--		--	
pH	S.U.	--		--		3.02	Y	--		--	
SPECIFIC CONDUCTANCE	umhos	--		--		1477	Y	--		--	
TOTAL DISSOLVED SOLIDS	mg/L	--		--		1408	YJC	--		--	
TOTAL SUSPENDED SOLIDS	mg/L	--		--		288.	YJC	--		--	
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--	
SULFIDE	mg/L	--		--		--		--		--	
MAJOR CATIONS											
CALCIUM	mg/L	207.	YJSE	170.	YJS	147.	YJE	202.	YJE	81.4	YJE
MAGNESIUM	mg/L	55.8	Y	47.3	Y	44.2	Y	61.4	Y	27.3	Y
POTASSIUM	mg/L	7.10	YJS	4.95	YJS	5.09	YJS	8.88	YJS	2.72	YJS
SODIUM	mg/L	7.59	YJS	9.59	YJS	12.1	YJS	17.5	YJS	10.1	YJS
MAJOR ANIONS											
BICARBONATE	mg/L	--		--		--		--		--	
CARBONATE	mg/L	--		--		--		--		--	
FLUORIDE	mg/L	--		--		2.25	Y	--		--	
CHLORIDE	mg/L	--		--		20.0	Y	--		--	
SULFATE	mg/L	--		--		837.	YJC	--		--	

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CLEAR CREEK GROUND WATER CHEMISTRY DATA

		05/27/86 MHD176 GWG0603 GREGORY WELL #6		05/28/86 MHD177 GWG0903 GREGORY WELL #9		05/27/86 MHD178 GWG1303 GREGORY WELL #13		05/23/86 MHD192 GWNT103 NATIONAL WELL #1		05/23/86 MHD193 GWNT203 NATIONAL WELL #2	
NUTRIENTS											
AMMONIA	mg/L	--		--		0.98	Y	--		--	
NITRITE (NO2-N)	mg/L	--		--		--		--		--	
NITRATE (NO3-N)	mg/L	--		--		--		--		--	
NITRATE (NO3-N)+NITRITE (NO2-N)	mg/L	--		--		--		--		--	
PHOSPHATE	mg/L	--		--		--		--		--	
MINOR & TRACE ELEMENTS											
ALUMINUM	ug/L	10600	Y	675.	Y	19100	Y	7140	Y	9150	Y
ANTIMONY	ug/L	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0	Y
ARSENIC	ug/L	4.00	YUJS	4.00	YUJS	4.00	YU	4.00	YU	4.00	Y
BARIUM	ug/L	50.0	YURS	50.0	YURS	50.0	YURS	50.0	YURS	50.0	Y
BERYLLIUM	ug/L	5.00	YU	5.00	YU	5.00	YU	5.00	YU	5.00	Y
BORON	ug/L	--		--		--		--		--	
CADMIUM	ug/L	19.4	Y	19.1	Y	117.	Y	53.0	Y	39.4	Y
CHROMIUM (Cr+6)	ug/L	--		--		5.00	YUJS	--		--	
CHROMIUM (TOTAL)	ug/L	8.00	YU	8.00	YU	8.00	YU	8.00	YU	8.00	Y
COBALT	ug/L	112.	Y	21.4	Y	84.5	Y	42.0	Y	62.0	Y
COPPER	ug/L	930.	YJSE	11.0	YUJS	528.	YJE	412.	YJE	1410	Y
CYANIDE	ug/L	--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--	
IRON	ug/L	229000	Y	53700	YJE	108000	Y	31.0	Y	464.	Y
LEAD	ug/L	24.0	Y	3.00	YU	59.0	YJS	3.00	YUJS	16.0	Y
MANGANESE	ug/L	24900	Y	54900	Y	20500	Y	35300	Y	23600	Y
MERCURY	ug/L	0.12	YU	0.12	YU	0.21	YJSH	0.12	YUJSH	0.12	Y
MOLYBDENUM	ug/L	--		--		--		--		--	
NICKEL	ug/L	193.	Y	292.	YJE	180.	Y	516.	Y	163.	Y
SELENIUM	ug/L	40.0	YURS	40.0	YURS	40.0	YURS	40.0	YURS	4.00	Y
SILVER	ug/L	--		--		--		--		--	
SILICA	ug/L	--		--		37700	Y	--		--	
STRONTIUM	ug/L	--		--		--		--		--	
THALLIUM	ug/L	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	Y
TIN	ug/L	190.	YURS	190.	YURS	19.0	YUJS	190.	YUJS	19.0	Y
VANADIUM	ug/L	53.3	Y	20.0	YU	44.0	Y	20.0	YU	20.0	Y
ZINC	ug/L	3540	Y	3680	Y	21400	Y	12400	Y	8310	Y

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Acidity reported as mg/L CaCO3

CLEAR CREEK GROUND WATER CHEMISTRY DATA

		05/23/86 MHD194 GWNT303 NATIONAL WELL #3		05/29/86 MHD200 GWQH1A03 QUARTZ HILL WELL #1 (1.5 GAL. PUMPED)		05/29/86 MHD201 GWQH1B03 QUARTZ HILL WELL #1 (6.5 GAL. PUMPED)		05/29/86 MHD202 GWQH1C03 QUARTZ HILL WELL #1 (11.5 GAL. PUMPED)		05/29/86 MHD203 GWQH1D03 QUARTZ HILL WELL #1 (16.5 GAL. PUMPED)	
IELD DETERMINATIONS											
TEMPERATURE	C	9.00	Y	10.0	Y	6.00	Y	8.00	Y	5.50	Y
pH	S.U.	4.15	Y	2.70	Y	2.80	Y	2.70	Y	2.78	Y
Eh (REDOX POTENTIAL)	MV	656.	Y	783.	Y	782.	Y	770.	Y	772.	Y
SPECIFIC CONDUCTANCE	umhos	445.	Y	3493	Y	3811	Y	3986	Y	4033	Y
DISSOLVED OXYGEN	mg/L	--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--	
As+3	mg/L	--		0.15	Y	0.17	Y	0.18	Y	0.15	Y
As+5	mg/L	--		1.03	Y	0.23	Y	1.16	Y	1.10	Y
DISCHARGE	CFS	--		--		--		--		--	
AB DETERMINATIONS											
GENERAL											
ACIDITY	mg/L	--		--		2184	YJ*	2120	YJ*	2096	YJ*
pH	S.U.	--		--		2.62	Y	2.63	Y	2.64	Y
SPECIFIC CONDUCTANCE	umhos	--		--		3869	Y	3900	Y	3817	Y
TOTAL DISSOLVED SOLIDS	mg/L	--		--		3134	YJC	4772	YJC	3910	YJC
TOTAL SUSPENDED SOLIDS	mg/L	--		--		389.	YJC	135.	YJC	89.0	YJC
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--	
SULFIDE	mg/L	--		--		--		--		--	
MAJOR CATIONS											
CALCIUM	mg/L	48.0	YJE	289.	YJS	283.	YJS	293.	YJS	295.	YJS
MAGNESIUM	mg/L	14.4	Y	146.	Y	144.	Y	143.	Y	145.	Y
POTASSIUM	mg/L	1.76	YJS	0.50	YUJS	0.50	YUJS	0.50	YUJS	0.50	YUJS
SODIUM	mg/L	9.31	YJS	7.28	YJS	6.56	YJS	5.55	YJS	5.90	YJS
MAJOR ANIONS											
BICARBONATE	mg/L	--		--		--		--		--	
CARBONATE	mg/L	--		--		--		--		--	
FLUORIDE	mg/L	--		--		3.23	Y	3.20	Y	4.00	Y
CHLORIDE	mg/L	--		--		7.00	Y	75.0	Y	80.0	Y
SULFATE	mg/L	--		--		921.	YJC	1027	YJC	1040	YJC

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(U) = UNDETECTED
(H,HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK GROUND WATER CHEMISTRY DATA

		05/23/86 MHD194 GWNT303 NATIONAL WELL #3		05/29/86 MHD200 GWQH1A03 QUARTZ HILL WELL #1 (1.5 GAL. PUMPED)		05/29/86 MHD201 GWQH1B03 QUARTZ HILL WELL #1 (6.5 GAL. PUMPED)		05/29/86 MHD202 GWQH1C03 QUARTZ HILL WELL #1 (11.5 GAL. PUMPED)		05/29/86 MHD203 GWQH1D03 QUARTZ HILL WELL #1 (16.5 GAL. PUMPED)	
NUTRIENTS											
AMMONIA	mg/L	--		--		0.18	Y	0.16	Y	0.16	
NITRITE (NO2-N)	mg/L	--		--		--		--		--	
NITRATE (NO3-N)	mg/L	--		--		--		--		--	
NITRATE (NO3-N)+NITRITE (NO2-N)	mg/L	--		--		--		--		--	
PHOSPHATE	mg/L	--		--		--		--		--	
MINOR & TRACE ELEMENTS											
ALUMINUM	ug/L	1820	Y	66600	Y	66000	Y	62700	Y	64200	
ANTIMONY	ug/L	50.0	YU	50.0	YU	50.0	YU	50.0	YU	73.0	
ARSENIC	ug/L	4.00	YU	1180	Y	410.	YJS	1340	Y	1250	
BARIUM	ug/L	50.0	YURS	50.0	YURS	50.0	YURS	50.0	YURS	50.0	
BERYLLIUM	ug/L	5.00	YU	35.8	Y	35.3	Y	34.8	Y	35.0	
BORON	ug/L	--		--		--		--		--	
CADMIUM	ug/L	10.6	Y	352.	Y	344.	Y	360.	Y	369.	
CHROMIUM (Cr+6)	ug/L	--		--		26.3	Y	15.0	Y	15.0	
CHROMIUM (TOTAL)	ug/L	8.00	YU	56.0	Y	51.3	Y	54.4	Y	56.0	
COBALT	ug/L	21.0	Y	319.	Y	312.	Y	318.	Y	320.	
COPPER	ug/L	357.	YJE	42500	YJS	42300	YJS	39800	YJS	41000	
CYANIDE	ug/L	--		--		--		--		--	
GOLD	ug/L	--		--		--		--		--	
IRON	ug/L	221.	Y	406000	YJE	400000	YJE	402000	YJE	404000	
LEAD	ug/L	62.0	YJS	5.00	YJE	4.00	Y	3.00	Y	3.00	
MANGANESE	ug/L	4740	Y	47900	Y	47100	Y	47300	Y	47700	
MERCURY	ug/L	0.12	YUJSH	0.12	YU	0.12	YU	0.12	YU	0.12	
MOLYBDENUM	ug/L	--		--		--		--		--	
NICKEL	ug/L	50.2	Y	611.	YJE	592.	YJE	630.	YJE	633.	
SELENIUM	ug/L	4.00	YURS	40.0	YURS	40.0	YURS	40.0	YURS	40.0	
SILVER	ug/L	--		--		--		--		--	
SILICA	ug/L	--		--		57600	Y	56100	Y	54900	
STRONTIUM	ug/L	--		--		--		--		--	
THALLIUM	ug/L	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00	
TIN	ug/L	19.0	YUJS	190.	YURS	190.	YURS	190.	YURS	190.	
VANADIUM	ug/L	20.0	YU	47.0	Y	47.0	Y	58.0	Y	58.0	
ZINC	ug/L	2800	Y	76000	Y	74800	Y	75900	Y	76700	

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(umhos) = umhos/cm

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Acidity reported as mg/L CaCO3

CLEAR CREEK GROUND WATER CHEMISTRY DATA

		05/29/86 MHD204 GWQH1E03 QUARTZ HILL WELL #1 (24.0 GAL. PUMPED)		05/29/86 MHD205 GWQH1F03 QUARTZ HILL WELL #1 (31.5 GAL. PUMPED)		05/29/86 MHD206 GWQH1G03 QUARTZ HILL WELL #1 (40.0 GAL. PUMPED)		05/29/86 MHD196 GWQH203 QUARTZ HILL WELL #2		05/23/86 MHD191 GWBF103 BIG FIVE WELL #1	
ELD DETERMINATIONS											
TEMPERATURE	C	7.50	Y	15.5	Y	14.0	Y	10.0	Y	14.0	Y
pH	S.U.	2.85	Y	2.65	Y	2.51	Y	2.90	Y	3.30	Y
Eh (REDOX POTENTIAL)	MV	767.	Y	762.	Y	763.	Y	751.	Y	768.	Y
SPECIFIC CONDUCTANCE	umhos	3800	Y	4083	Y	4122	Y	5015	Y	2042	Y
DISSOLVED OXYGEN	mg/L	--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--	
As+3	mg/L	0.26	YJ*	0.29	YJ*	0.19	YJ*	--		--	
As+5	mg/L	0.19	YJ*	0.13	YJ*	0.23	YJ*	--		--	
DISCHARGE	CFS	--		--		--		--		--	
B DETERMINATIONS											
GENERAL											
ACIDITY	mg/L	1880	YJ*	1976	YJ*	1800	YJ*	--		--	
pH	S.U.	2.64	Y	2.64	Y	2.62	Y	--		--	
SPECIFIC CONDUCTANCE	umhos	3838	Y	3775	Y	3786	Y	--		--	
TOTAL DISSOLVED SOLIDS	mg/L	5500	YJC	5766	YJC	3552	YJC	--		--	
TOTAL SUSPENDED SOLIDS	mg/L	110.	YJC	72.0	YJC	171.	YJC	--		--	
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--	
SULFIDE	mg/L	--		--		--		--		--	
1AJOR CATIONS											
CALCIUM	mg/L	268.	YJS	277.	YJS	0.29	YJS	336.	YJS	325.	YJE
MAGNESIUM	mg/L	142.	Y	143.	Y	143.	Y	212.	Y	120.	Y
POTASSIUM	mg/L	0.50	YUJS	0.50	YUJS	0.50	YUJS	0.52	YJS	9.04	YJS
SODIUM	mg/L	7.59	YJS	6.77	YJS	6.21	YJS	9.79	YJS	42.6	YJS
1AJOR ANIONS											
BICARBONATE	mg/L	--		--		--		--		--	
CARBONATE	mg/L	--		--		--		--		--	
FLUORIDE	mg/L	3.93	Y	3.30	Y	3.28	Y	--		--	
CHLORIDE	mg/L	10.0	Y	40.0	Y	10.0	Y	--		--	
SULFATE	mg/L	1031	YJC	1049	YJC	1080	YJC	--		--	

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CLEAR CREEK GROUND WATER CHEMISTRY DATA

		05/29/86 MHD204 GWQH1E03 QUARTZ HILL WELL #1 (24.0 GAL. PUMPED)		05/29/86 MHD205 GWQH1F03 QUARTZ HILL WELL #1 (31.5 GAL. PUMPED)		05/29/86 MHD206 GWQH1G03 QUARTZ HILL WELL #1 (40.0 GAL. PUMPED)		05/29/86 MHD196 GWQH203 QUARTZ HILL WELL #2		05/23/86 MHD191 GWBF103 BIG FIVE WELL #1
NUTRIENTS										
AMMONIA	mg/L	0.14	Y	0.15	Y	0.16	Y	--		--
NITRITE (NO2-N)	mg/L	--		--		--		--		--
NITRATE (NO3-N)	mg/L	--		--		--		--		--
NITRATE (NO3-N)+NITRITE (NO2-N)	mg/L	--		--		--		--		--
PHOSPHATE	mg/L	--		--		--		--		--
MINOR & TRACE ELEMENTS										
ALUMINUM	ug/L	66600	Y	66100	Y	64300	Y	216000	Y	21200
ANTIMONY	ug/L	50.0	YU	50.0	YU	50.0	YU	62.0	Y	50.0
ARSENIC	ug/L	450.	YJS	420.	YJS	420.	YJS	50.0	Y	4.00
BARIUM	ug/L	50.0	YUR	50.0	YURS	50.0	YURS	62.0	YURS	50.0
BERYLLIUM	ug/L	33.8	Y	34.6	Y	36.0	Y	61.0	Y	5.50
BORON	ug/L	--		--		--		--		--
CADMIUM	ug/L	329.	Y	342.	Y	350.	Y	456.	Y	31.4
CHROMIUM (Cr+6)	ug/L	18.8	Y	18.8	Y	45.0	Y	--		--
CHROMIUM (TOTAL)	ug/L	48.5	Y	51.3	Y	48.0	Y	240.	Y	8.00
COBALT	ug/L	300.	Y	307.	Y	341.	Y	762.	Y	116.
COPPER	ug/L	43400	YJS	42000	YJS	41500	YJS	84100	YJS	1640
CYANIDE	ug/L	--		--		--		--		--
GOLD	ug/L	--		--		--		--		--
IRON	ug/L	386000	YJE	393000	YJE	396000	YJE	319000	YJE	3200
LEAD	ug/L	3.00	Y	3.00	Y	3.00	YU	30.0	YU	109.
MANGANESE	ug/L	45500	Y	46400	Y	46900	Y	9510	Y	28100
MERCURY	ug/L	0.12	YU	0.12	YU	0.12	YU	0.12	YU	0.12
MOLYBDENUM	ug/L	--		--		--		--		--
NICKEL	ug/L	559.	YJE	581.	YJE	799.	YJE	854.	YJE	251.
SELENIUM	ug/L	40.0	YURS	40.0	YURS	40.0	YURS	40.0	YURS	40.0
SILVER	ug/L	--		--		--		--		--
SILICA	ug/L	60600	Y	62700	Y	57900	Y	--		--
STRONTIUM	ug/L	--		--		--		--		--
THALLIUM	ug/L	6.00	YURS	6.00	YU	6.00	YU	6.00	YU	6.00
TIN	ug/L	190.	YURS	190.	YURS	190.	YURS	190.	YURS	190.
VANADIUM	ug/L	37.0	Y	42.0	Y	49.0	Y	42.0	Y	20.0
ZINC	ug/L	72200	Y	73600	Y	74800	Y	98800	Y	8640

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CLEAR CREEK GROUND WATER CHEMISTRY DATA

		05/23/86 MHD195 GW06303 BAILER BLANK		05/19/86 MHC944 GWA0103A ARGO WELL #1		05/23/86 MHD189 GWA0203 ARGO WELL #2		05/23/86 MHD170 GWA0303 ARGO WELL #3		06/02/86 MHD213 GW06703 BLIND STANDARD	
LD DETERMINATIONS											
TEMPERATURE	C	--		16.0	Y	11.5	Y	--		--	
pH	S.U.	--		4.85	Y	6.25	Y	--		--	
Eh (REDOX POTENTIAL)	MV	--		602.	Y	405.	Y	--		--	
SPECIFIC CONDUCTANCE	umhos	--		1350	Y	808.	Y	--		--	
DISSOLVED OXYGEN	mg/L	--		--		--		--		--	
Fe+2	mg/L	--		--		--		--		--	
Fe+3	mg/L	--		--		--		--		--	
IRON (TOTAL)	mg/L	--		--		--		--		--	
As+3	mg/L	--		--		--		--		--	
As+5	mg/L	--		--		--		--		--	
DISCHARGE	CFS	--		--		--		--		--	
DETERMINATIONS											
ENERAL											
ACIDITY	mg/L	--		--		--		--		--	
pH	S.U.	--		--		--		--		--	
SPECIFIC CONDUCTANCE	umhos	--		--		--		--		--	
TOTAL DISSOLVED SOLIDS	mg/L	--		--		--		--		--	
TOTAL SUSPENDED SOLIDS	mg/L	--		--		--		--		--	
TOTAL ORGANIC CARBON	mg/L	--		--		--		--		--	
SULFIDE	mg/L	--		--		--		--		--	
AJOR CATIONS											
CALCIUM	mg/L	0.26	YUJE	114.	Y	70.4	YJE	85.6	Y	23.9	YRS
MAGNESIUM	mg/L	0.20	YU	93.0	Y	23.2	Y	113.	Y	0.20	YURS
POTASSIUM	mg/L	0.50	YUJS	0.66	Y	13.7	YJS	1.77	YJS	0.50	YUJS
SODIUM	mg/L	2.00	YUJS	17.6	YU	78.1	YJS	21.3	YJS	2.00	YURS
AJOR ANIONS											
BICARBONATE	mg/L	--		--		--		--		--	
CARBONATE	mg/L	--		--		--		--		--	
FLUORIDE	mg/L	--		--		--		--		--	
CHLORIDE	mg/L	--		--		--		--		--	
SULFATE	mg/L	--		--		--		--		--	

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CLEAR CREEK GROUND WATER CHEMISTRY DATA

		05/23/86 MHD195 GW06303 BAILER BLANK		05/19/86 MHC944 GWA0103A ARGO WELL #1		05/23/86 MHD189 GWA0203 ARGO WELL #2		05/23/86 MHD170 GWA0303 ARGO WELL #3		06/02/86 MHD213 GW06703 BLIND STANDARD
NUTRIENTS										
AMMONIA	mg/L	--		--		--		--		--
NITRITE (NO2-N)	mg/L	--		--		--		--		--
NITRATE (NO3-N)	mg/L	--		--		--		--		--
NITRATE (NO3-N)+NITRITE (NO2-N)	mg/L	--		--		--		--		--
PHOSPHATE	mg/L	--		--		--		--		--
MINOR & TRACE ELEMENTS										
ALUMINUM	ug/L	130.	Y	108000	Y	154.	Y	92100	Y	70.0
ANTIMONY	ug/L	50.0	YU	50.0	YU	50.0	YU	50.0	YU	50.0
ARSENIC	ug/L	4.00	YU	54.0	Y	4.00	YU	19.0	Y	37.0
BARIUM	ug/L	50.0	YURS	50.0	YU	50.0	YURS	50.0	YURS	307.
BERYLLIUM	ug/L	5.00	YU	10.0	Y	5.00	YU	13.8	Y	5.00
BORON	ug/L	--		--		--		--		--
CADMIUM	ug/L	5.00	YU	106.	Y	5.00	YU	185.	Y	36.0
CHROMIUM (Cr+6)	ug/L	--		--		--		--		--
CHROMIUM (TOTAL)	ug/L	8.00	YU	8.00	YU	8.00	YU	10.4	Y	47.0
COBALT	ug/L	20.0	YU	260.	Y	20.0	YU	260.	Y	20.0
COPPER	ug/L	11.0	YUJE	3440	Y	11.0	YUJE	7700	Y	11.0
CYANIDE	ug/L	--		--		--		--		--
GOLD	ug/L	--		--		--		--		--
IRON	ug/L	45.0	Y	466.	Y	864.	Y	2530	Y	134.
LEAD	ug/L	3.00	YUJS	3.00	YU	3.00	YURS	34.0	YJS	97.0
MANGANESE	ug/L	37.2	Y	43100	Y	4290	Y	63300	Y	107.
MERCURY	ug/L	0.40	YJSH	0.12	YUJSH	0.12	YUJHS	0.12	YUJSH	1.30
MOLYBDENUM	ug/L	--		--		--		--		--
NICKEL	ug/L	20.0	YU	342.	Y	20.0	YU	302.	Y	20.0
SELENIUM	ug/L	4.00	YURS	40.0	YU	40.0	YURS	4.00	YURS	37.0
SILVER	ug/L	--		--		--		--		--
SILICA	ug/L	--		--		--		--		--
STRONTIUM	ug/L	--		--		--		--		--
THALLIUM	ug/L	6.00	YU	6.00	YU	6.00	YU	6.00	YU	6.00
TIN	ug/L	19.0	YUJS	190.	YU	19.0	YUJS	190.	YUJS	19.0
VANADIUM	ug/L	20.0	YU	20.0	YU	20.0	YU	20.0	YU	20.0
ZINC	ug/L	37.0	Y	17000	Y	436.	Y	31100	Y	9.00

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CLEAR CREEK GROUND WATER CHEMISTRY DATA

		06/02/86 SASBS2 GWASBS203 BLIND STANDARD (93 ug/L As III)
IELD DETERMINATIONS		
TEMPERATURE	C	--
pH	S.U.	--
Eh (REDOX POTENTIAL)	MV	--
SPECIFIC CONDUCTANCE	umhos	--
DISSOLVED OXYGEN	mg/L	--
Fe+2	mg/L	--
Fe+3	mg/L	--
IRON (TOTAL)	mg/L	--
As+3	mg/L	--
As+5	mg/L	--
DISCHARGE	CFS	--
AB DETERMINATIONS		
GENERAL		
ACIDITY	mg/L	--
pH	S.U.	--
SPECIFIC CONDUCTANCE	umhos	--
TOTAL DISSOLVED SOLIDS	mg/L	--
TOTAL SUSPENDED SOLIDS	mg/L	--
TOTAL ORGANIC CARBON	mg/L	--
SULFIDE	mg/L	--
MAJOR CATIONS		
CALCIUM	mg/L	--
MAGNESIUM	mg/L	--
POTASSIUM	mg/L	--
SODIUM	mg/L	--
MAJOR ANIONS		
BICARBONATE	mg/L	--
CARBONATE	mg/L	--
FLUORIDE	mg/L	--
CHLORIDE	mg/L	--
SULFATE	mg/L	--

FOOTNOTES

(R) = REJECTED
(L) = QUALIFIED due to LCS recoveries outside control limits
(I) = QUANTIFIED due to exceeding ICP linear range
(*) = DUPLICATE control limits exceeded
(EJ) = ESTIMATED due to interference problems (ICP serial dilution or low spike recovery by graphite furnance)
(--) = Not analyzed
(umhos) = umhos/cm

(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(H_2HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

CLEAR CREEK GROUND WATER CHEMISTRY DATA

		06/02/86 SASBS2 GWASBS203 BLIND STANDARD (93 ug/L As III)	
NUTRIENTS			
AMMONIA	mg/L	--	
NITRITE (NO2-N)	mg/L	--	
NITRATE (NO3-N)	mg/L	--	
NITRATE (NO3-N)+NITRITE (NO2-N)	mg/L	--	
PHOSPHATE	mg/L	--	
MINOR & TRACE ELEMENTS			
ALUMINUM	ug/L	--	
ANTIMONY	ug/L	--	
ARSENIC	ug/L	90.0	YJ*
BARIUM	ug/L	--	
BERYLLIUM	ug/L	--	
BORON	ug/L	--	
CADMIUM	ug/L	--	
CHROMIUM (Cr+6)	ug/L	--	
CHROMIUM (TOTAL)	ug/L	--	
COBALT	ug/L	--	
COPPER	ug/L	--	
CYANIDE	ug/L	--	
GOLD	ug/L	--	
IRON	ug/L	--	
LEAD	ug/L	--	
MANGANESE	ug/L	--	
MERCURY	ug/L	--	
MOLYBDENUM	ug/L	--	
NICKEL	ug/L	--	
SELENIUM	ug/L	--	
SILVER	ug/L	--	
SILICA	ug/L	--	
STRONTIUM	ug/L	--	
THALLIUM	ug/L	--	
TIN	ug/L	--	
VANADIUM	ug/L	--	
ZINC	ug/L	--	

FOOTNOTES

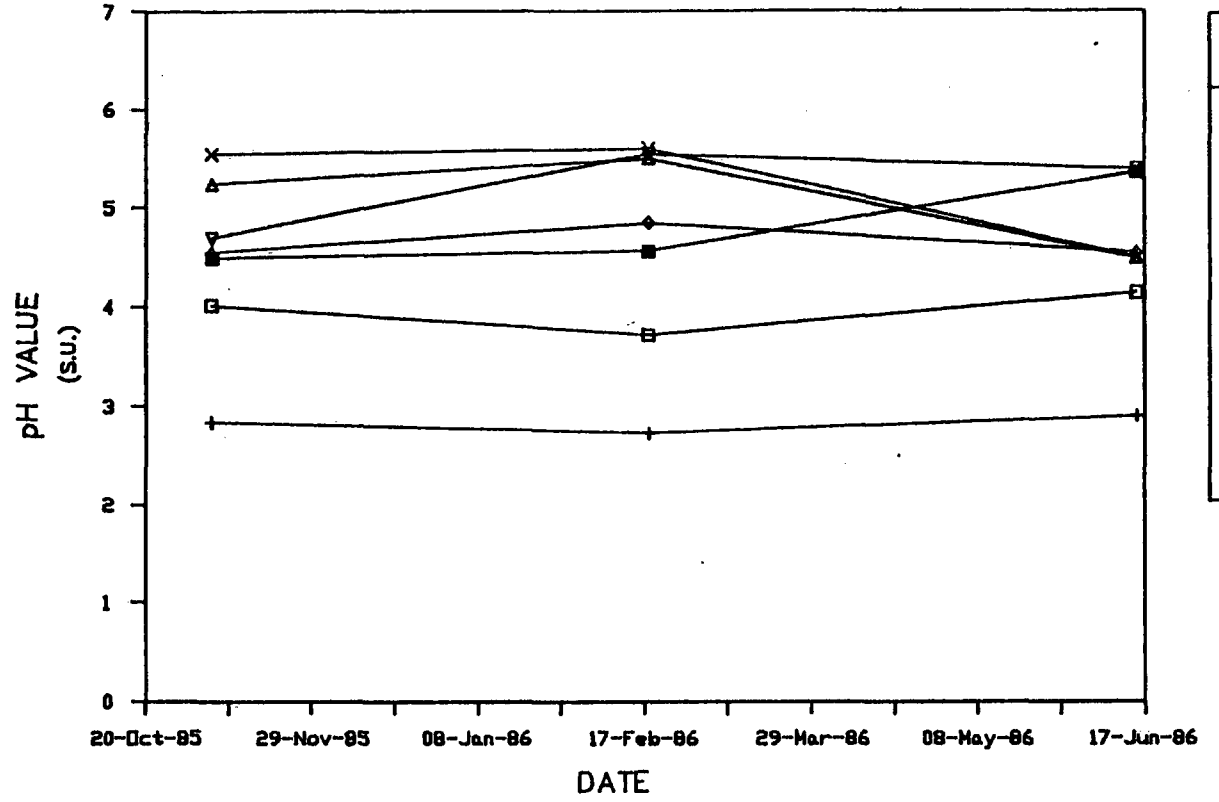
(R) = REJECTED
(L) = QUALIFIED due to LCS recoveries outside control limits
(I) = QUANTIFIED due to exceeding ICP linear range
(*) = DUPLICATE control limits exceeded
(EJ) = ESTIMATED due to interference problems (ICP serial dilution or low spike recovery by graphite furnance)
(--) = Not analyzed
(umhos) = umhos/cm
(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(H,HT) = QUALIFIED due to holding time violation
(JS) = ESTIMATED due to spike recoveries outside limits
(Y) = CHECKED and/or VALIDATED
Specific Conductance reported at 25 degrees C
Acidity reported as mg/L CaCO3

APPENDIX 7B

GROUND WATER METAL CONCENTRATIONS VS. TIME

TEMPORAL PLOTS OF GROUND WATER DATA FOR
pH, ALUMINUM, ARSENIC, COPPER, LEAD, AND ZINC
ARE INCLUDED FOR THE FOLLOWING SITES:

Gregory Incline Wells GG01, GG04, GG05, GG06, GG09, and GG13
National Tunnel Wells NT01, NT02, and NT03
Quartz Hill Tunnel Wells QH01 and QH02
Big Five Tunnel Well BF01
Argo Tunnel Wells AT01, AT02 and AT03



LEGEND

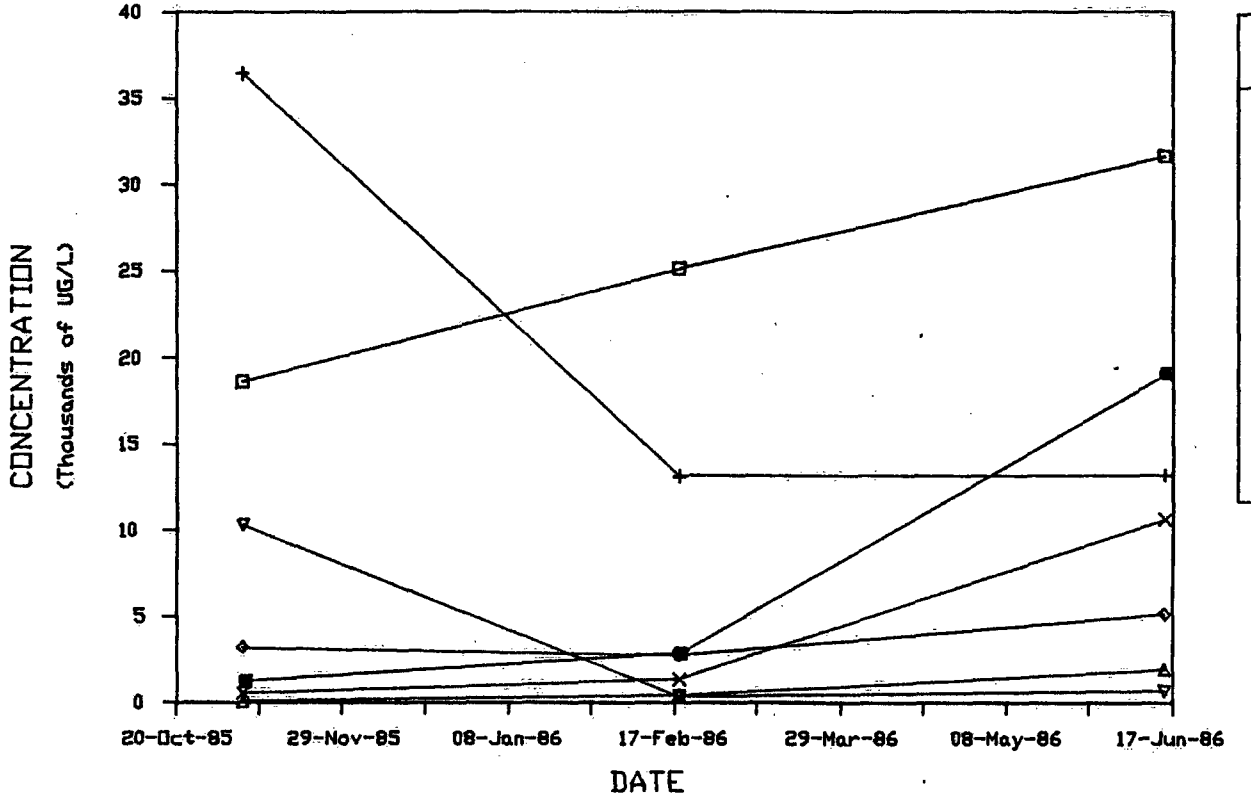
- WELL GG01
- WELL GG02
- WELL GG04
- WELL GG05
- WELL GG06
- WELL GG09
- WELL GG13

CLEAR CREEK / CENTRAL CITY RI/FS

pH VALUE WITH TIME
AT GREGORY INCLINE WELLS

CAMP DRESSER & McKEE INC.

CDM



LEGEND

- WELL GG01
- WELL GG02
- WELL GG04
- WELL GG05
- WELL GG06
- WELL GG09
- WELL GG13

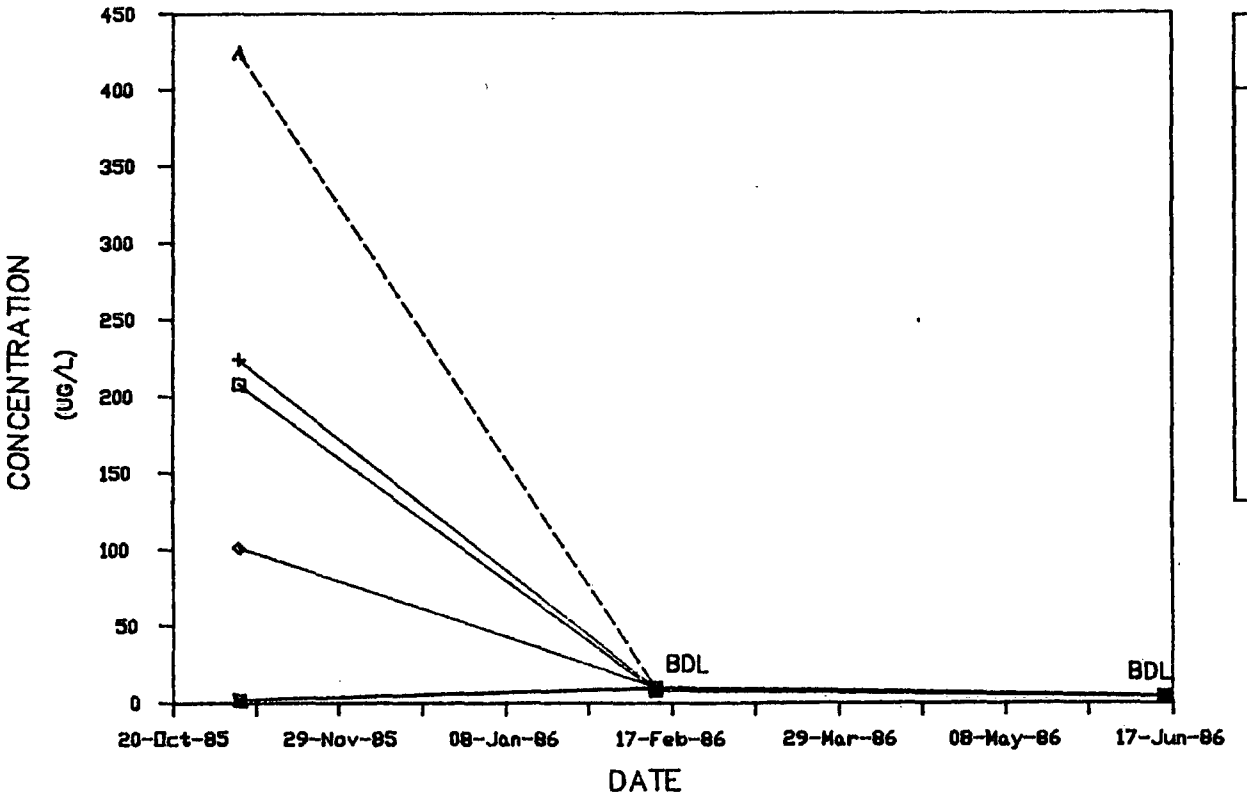
CLEAR CREEK / CENTRAL CITY RI/FS

ALUMINUM CONCENTRATION WITH TIME AT GREGORY INCLINE WELLS

CAMP DRESSER & McKEE INC.

CDM

SHEET NO.



LEGEND

- WELL GG01
- WELL GG02
- WELL GG04
- WELL GG05
- WELL GG06
- WELL GG09
- WELL GG13

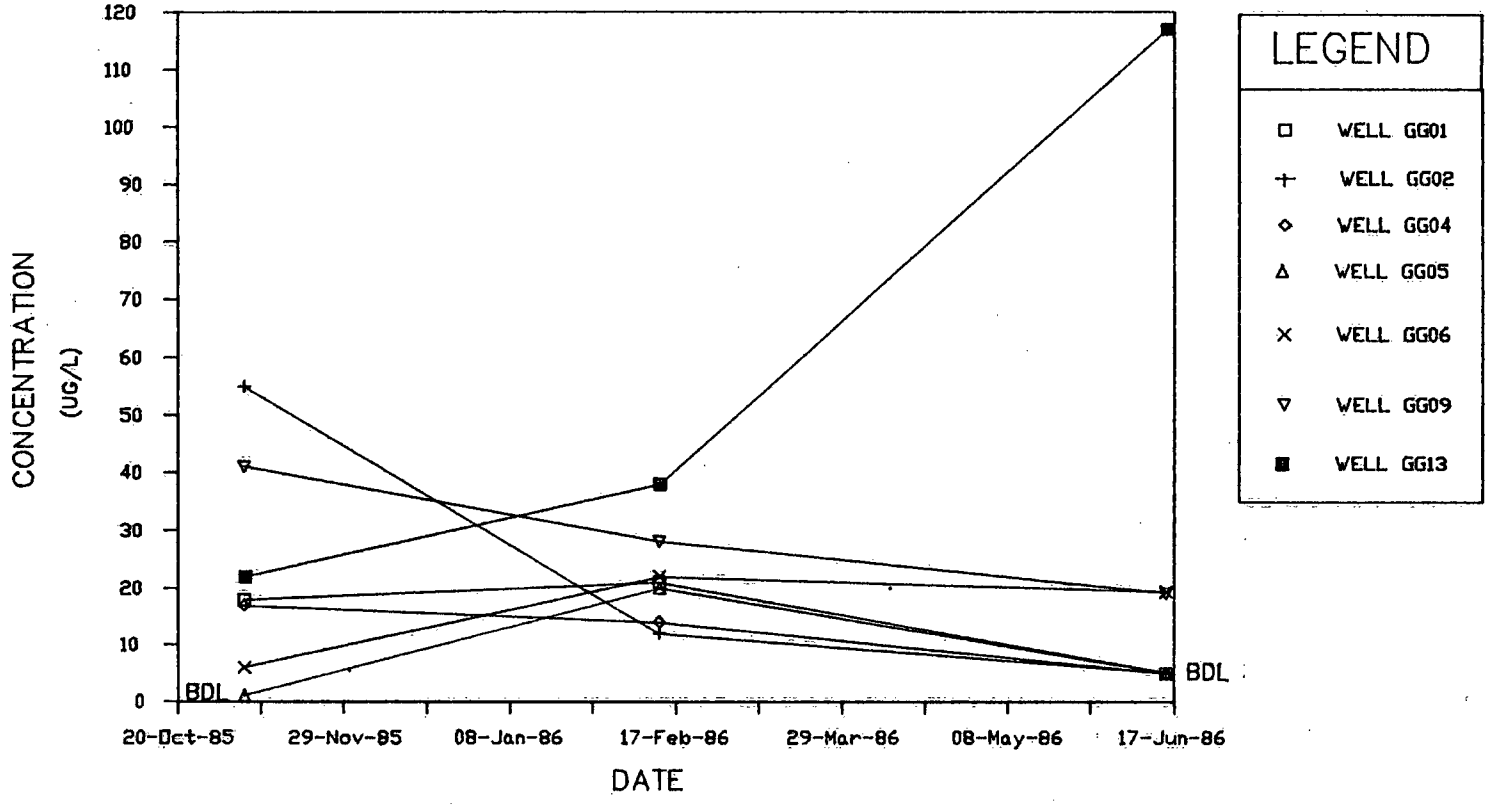
BDL = BELOW DETECTION LIMIT

CLEAR CREEK / CENTRAL CITY RI/FS

ARSENIC CONCENTRATION WITH TIME AT GREGORY INCLINE WELLS

CAMP DRESSER & McKEE INC.

CDM



BDL = BELOW DETECTION LIMIT

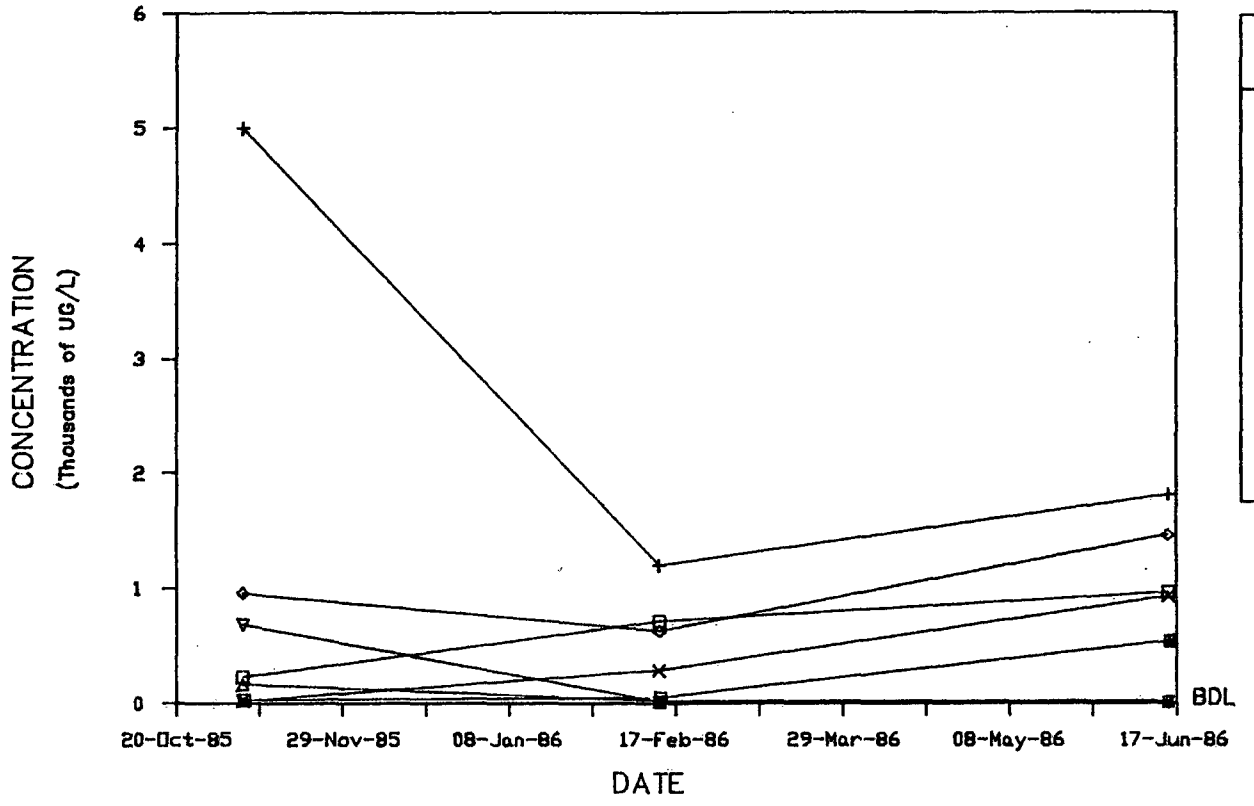
CLEAR CREEK / CENTRAL CITY RI/FS

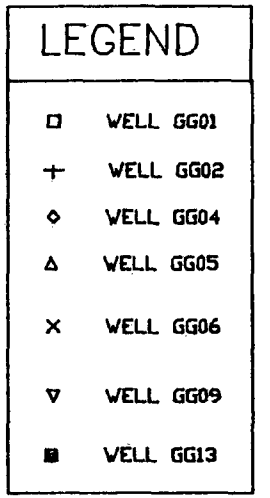
CADMIUM CONCENTRATION WITH TIME AT GREGORY INCLINE WELLS

CAMP DRESSER & McKEE INC.

CDM

SHEET NO.





BDL = BELOW DETECTION LIMIT

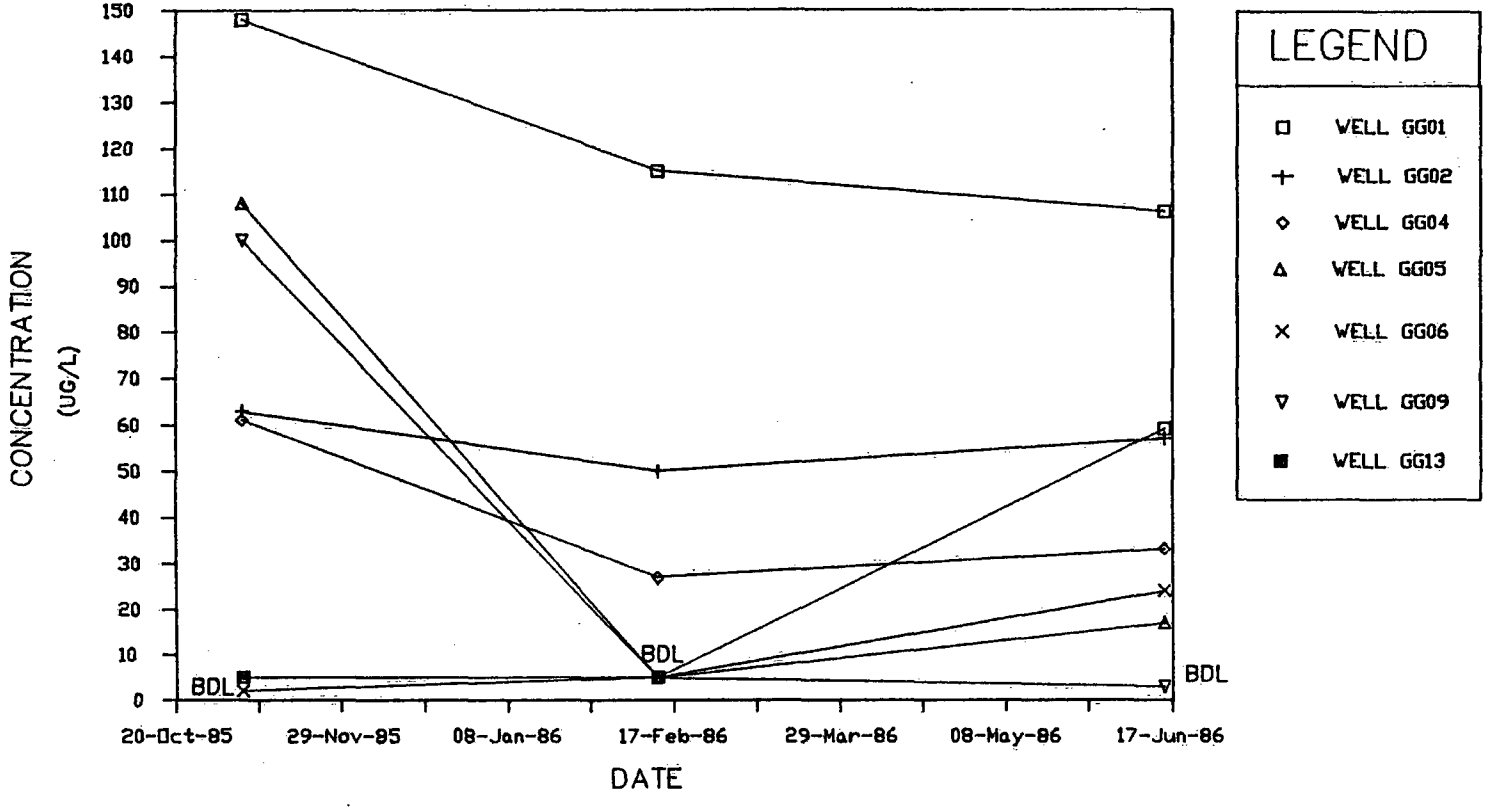
CLEAR CREEK / CENTRAL CITY RI/FS

COPPER CONCENTRATION WITH TIME
AT GREGORY INCLINE WELLS

CAMP DRESSER & McKEE INC.

CDM

SHEET NO.



BDL = BELOW DETECTION LIMIT

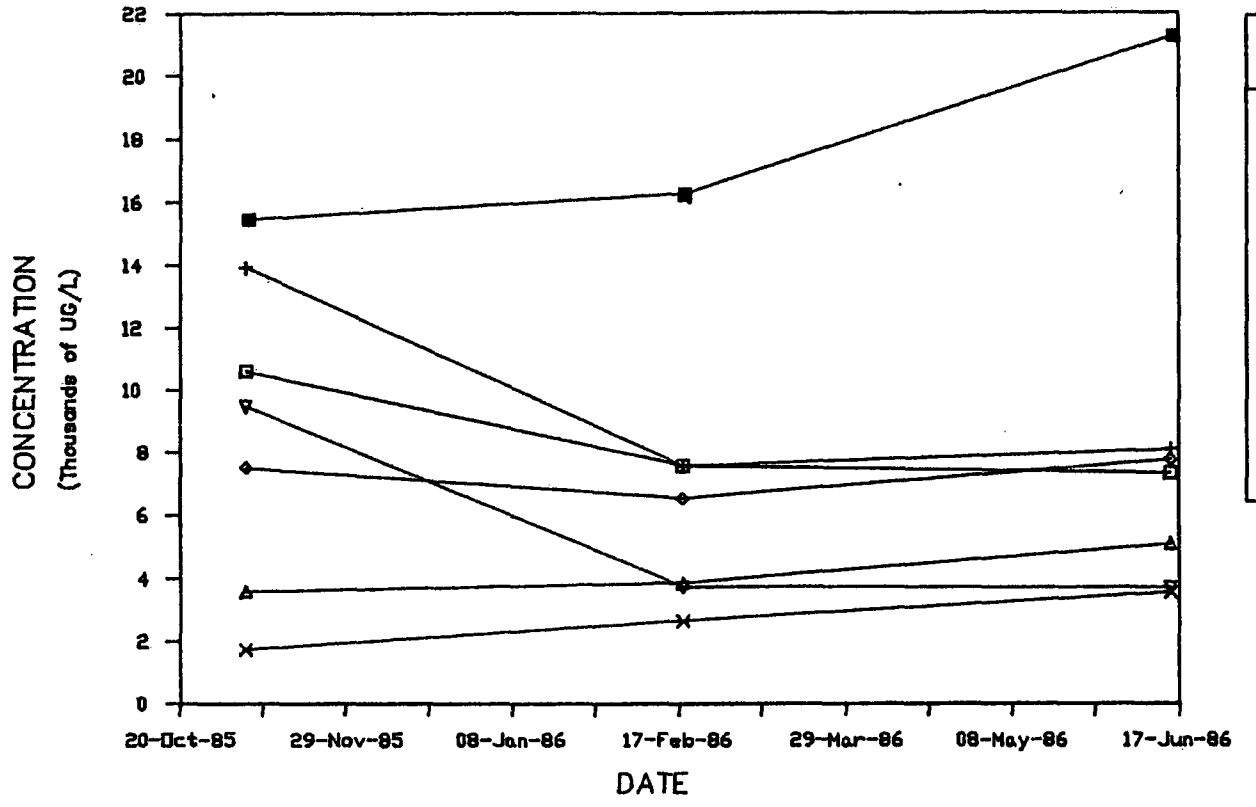
CLEAR CREEK / CENTRAL CITY RI/FS

LEAD CONCENTRATION WITH TIME
AT GREGORY INCLINE WELLS

CAMP DRESSER & McKEE INC.

CDM

SHEET NO.



LEGEND

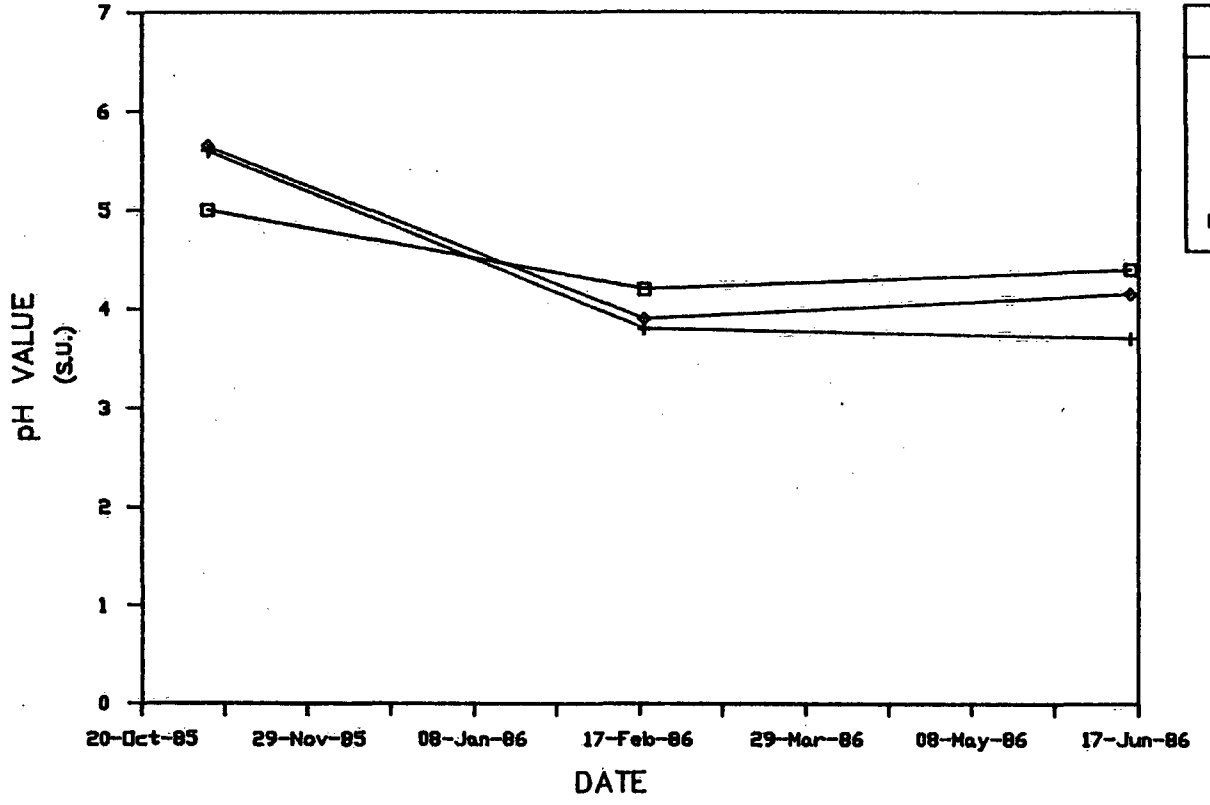
- WELL GG01
- WELL GG02
- WELL GG04
- WELL GG05
- WELL GG06
- WELL GG09
- WELL GG13

CLEAR CREEK / CENTRAL CITY RI/FS

ZINC CONCENTRATION WITH TIME
AT GREGORY INCLINE WELLS

CAMP DRESSER & McKEE INC.

CDM

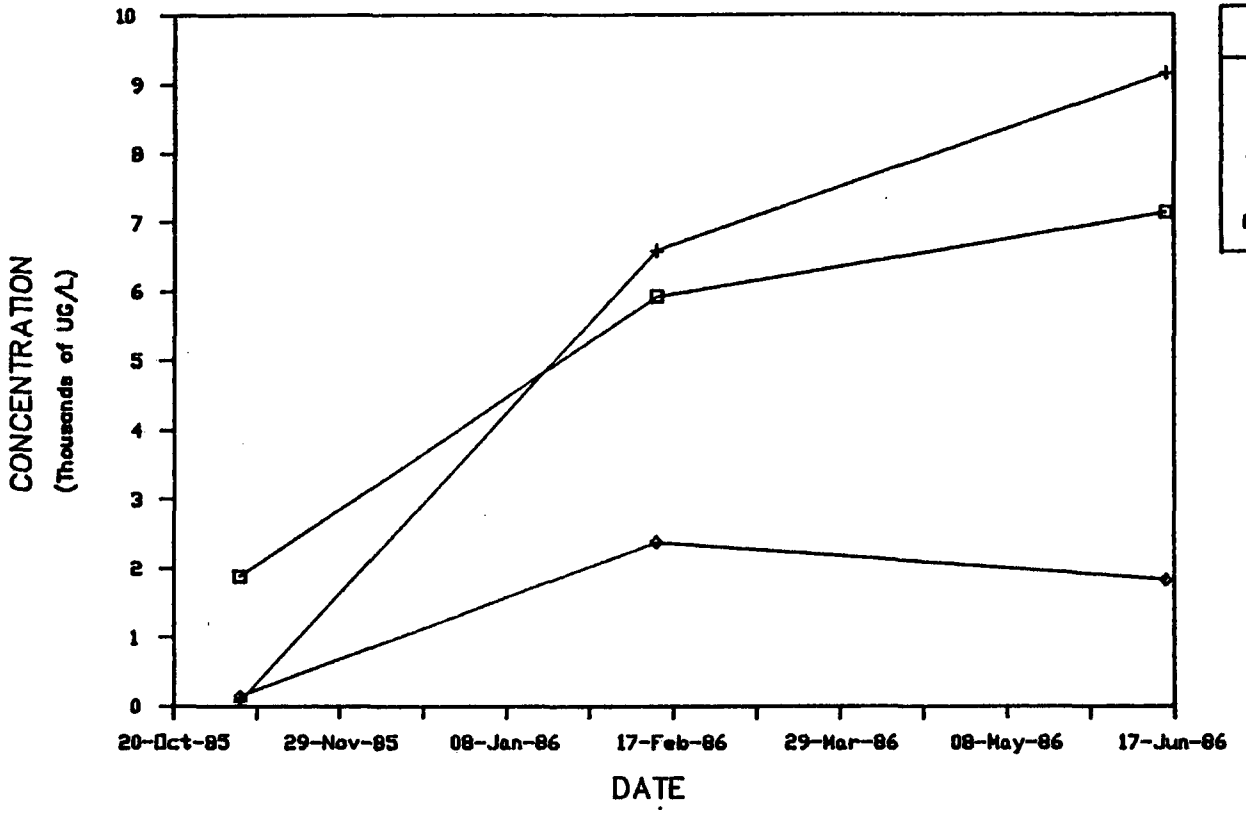


CLEAR CREEK / CENTRAL CITY RI/FS

pH VALUE WITH TIME
AT NATIONAL TUNNEL WELLS

CAMP DRESSER & McKEE INC.

CDM

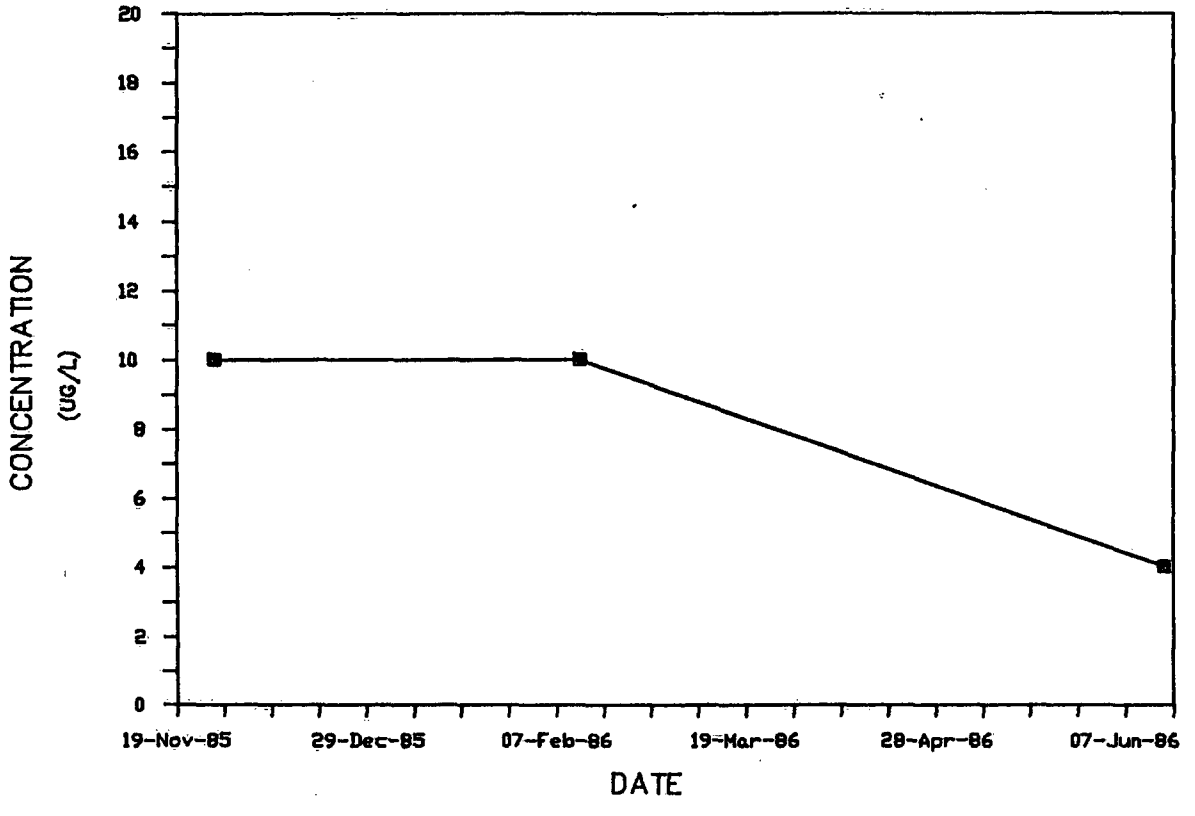


CLEAR CREEK / CENTRAL CITY RI/FS

ALUMINUM CONCENTRATION WITH TIME AT NATIONAL TUNNEL WELLS

CAMP DRESSER & McKEE INC.

CDM



LEGEND

- ◇ WELL NT03
- \+ WELL NT02
- □ WELL NT01

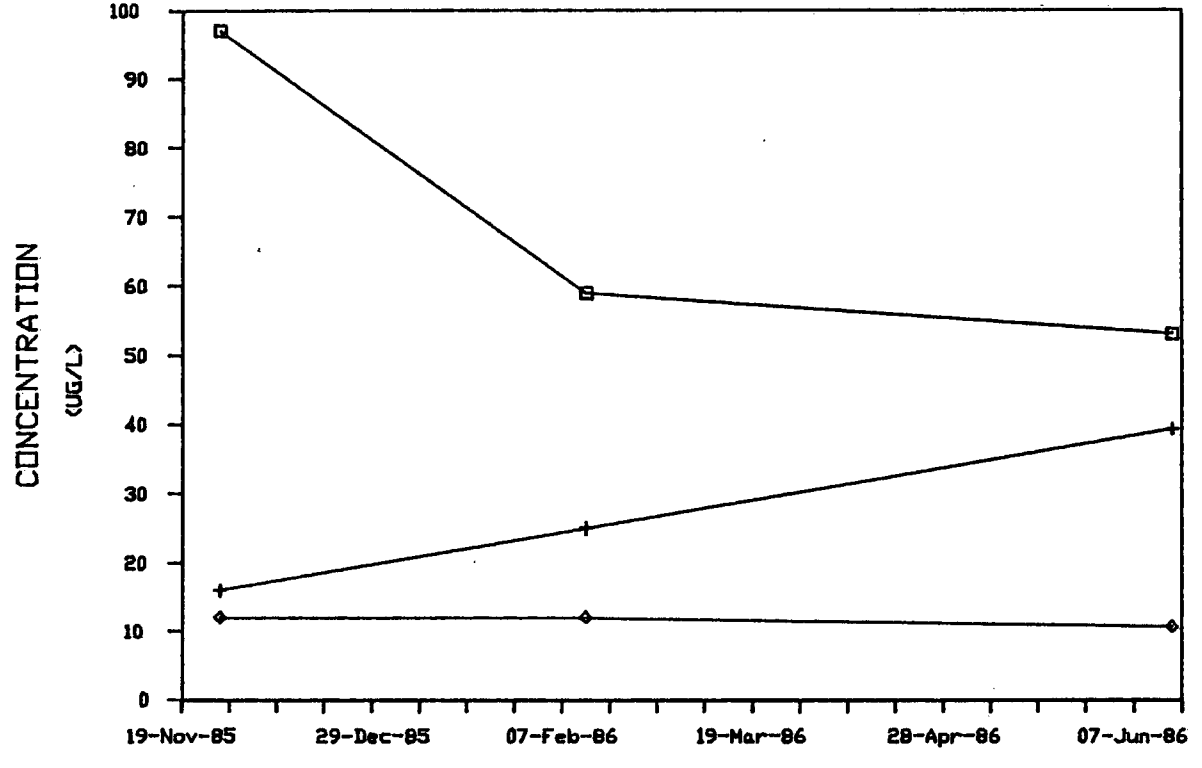
CLEAR CREEK / CENTRAL CITY RI/FS

ARSENIC CONCENTRATION WITH TIME AT NATIONAL TUNNEL WELLS

CAMP DRESSER & McKEE INC.

CDM

SHEET NO.



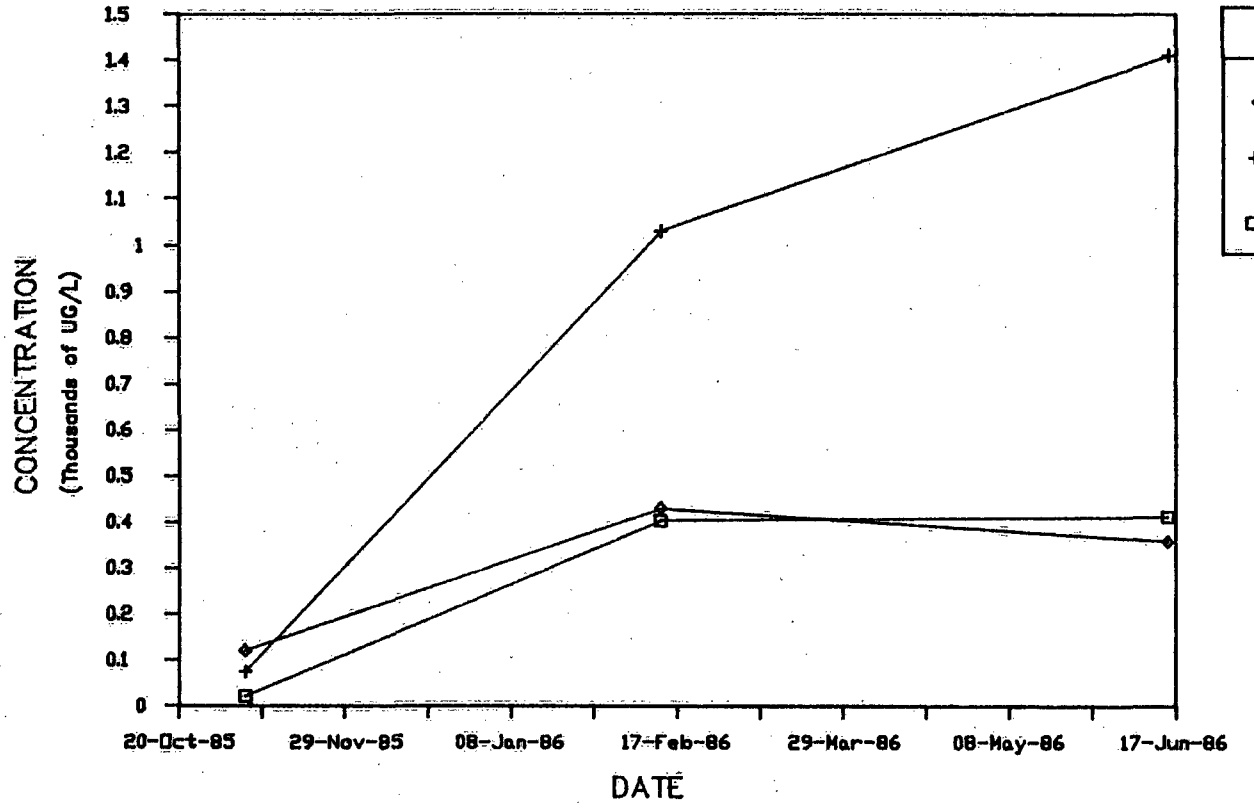
CLEAR CREEK / CENTRAL CITY RI/FS

CADMIUM CONCENTRATION WITH TIME AT NATIONAL TUNNEL WELLS

CAMP DRESSER & McKEE INC.

CDM

SHEET NO.

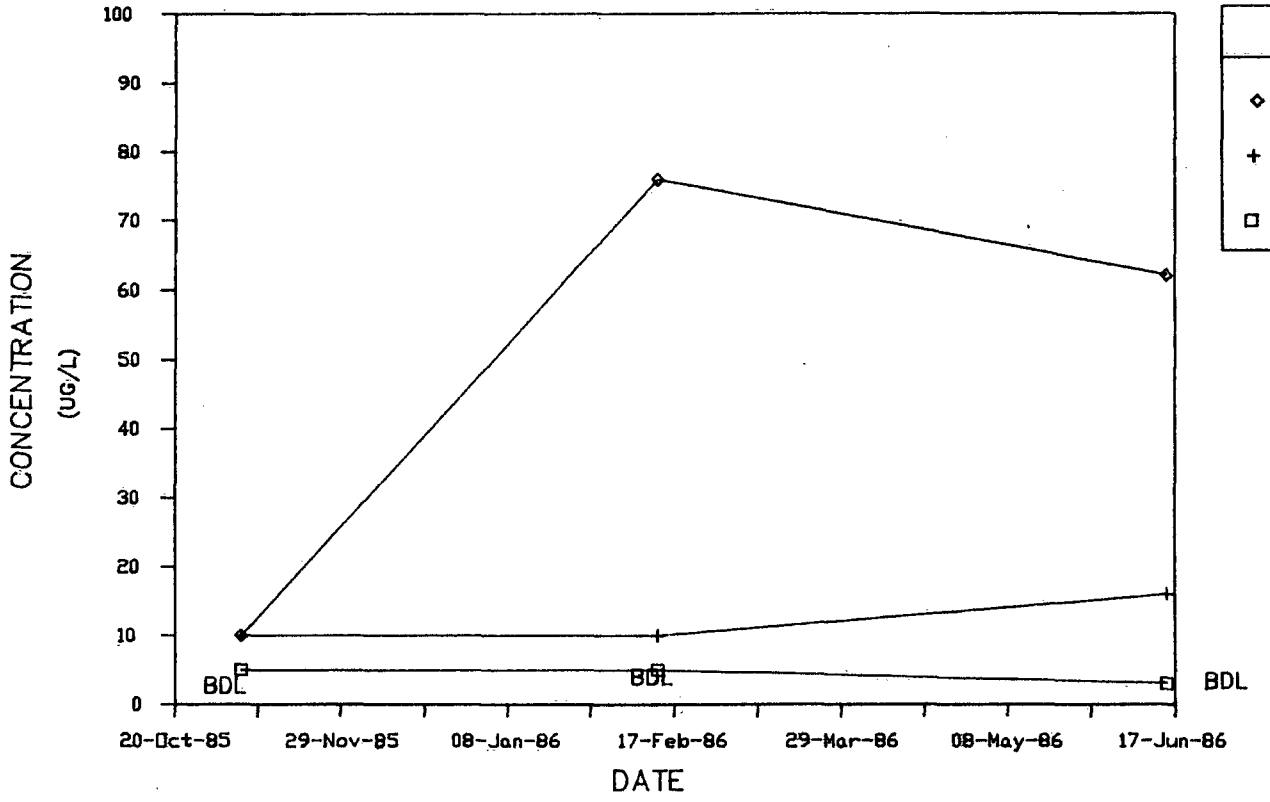


CLEAR CREEK / CENTRAL CITY RI/FS

COPPER CONCENTRATION WITH TIME AT NATIONAL TUNNEL WELLS

CAMP DRESSER & McKEE INC.

CDM



BDL = BELOW DETECTION LIMIT

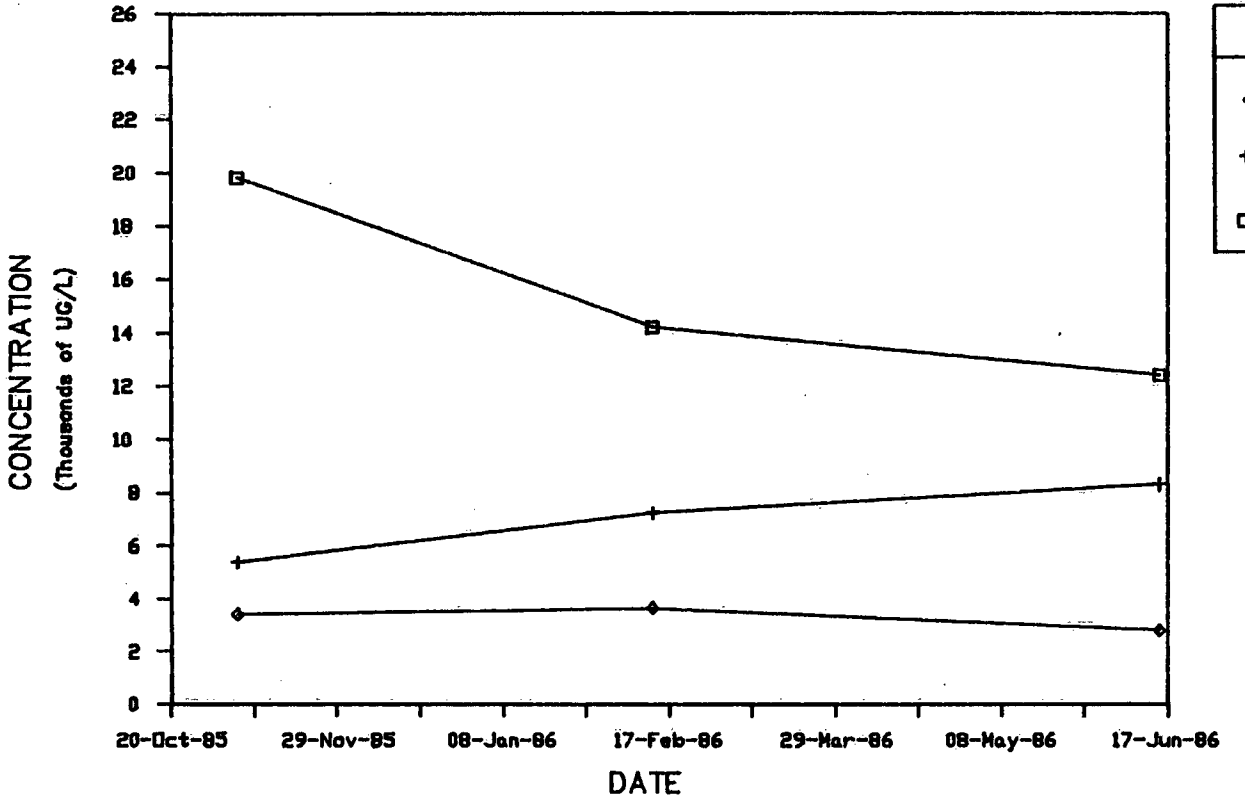
CLEAR CREEK / CENTRAL CITY RI/FS

LEAD CONCENTRATION WITH TIME
AT NATIONAL TUNNEL WELLS

CAMP DRESSER & McKEE INC.

CDM

SHEET NO.

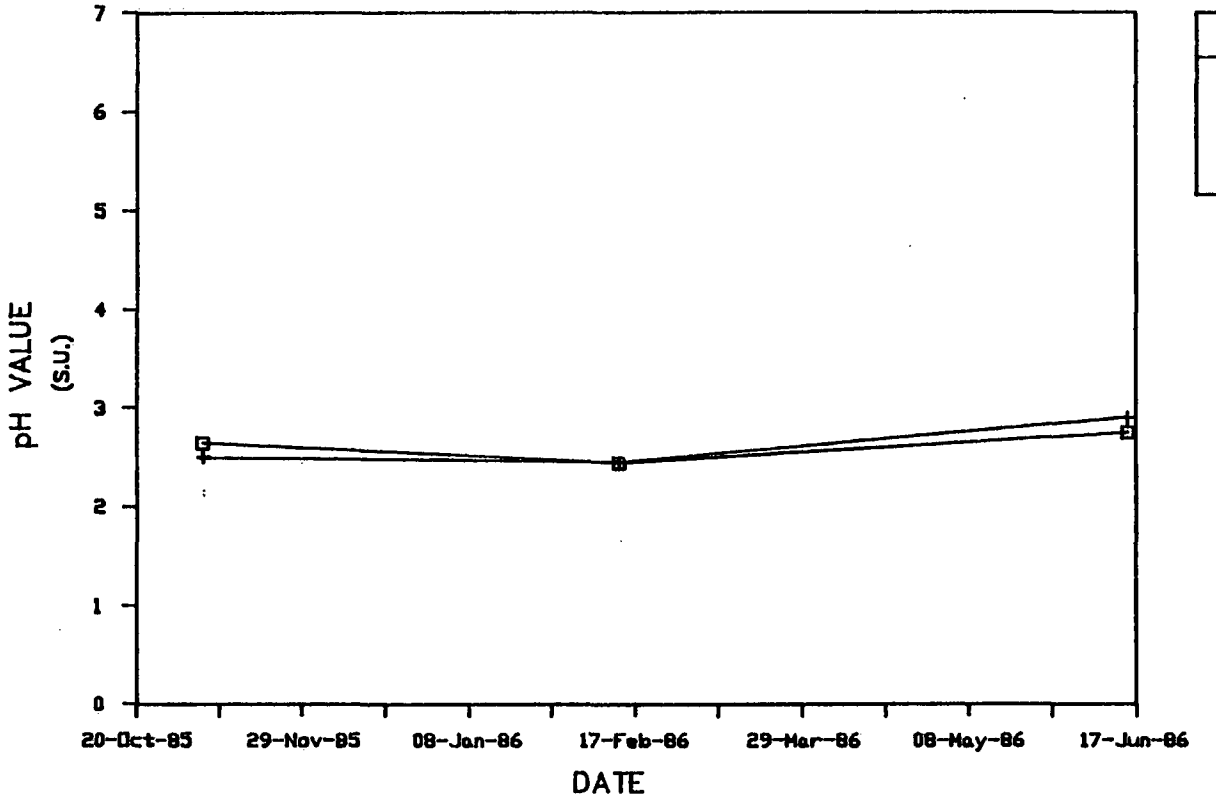


CLEAR CREEK / CENTRAL CITY RI/FS

ZINC CONCENTRATION WITH TIME
AT NATIONAL TUNNEL WELLS

CAMP DRESSER & McKEE INC.

CDM

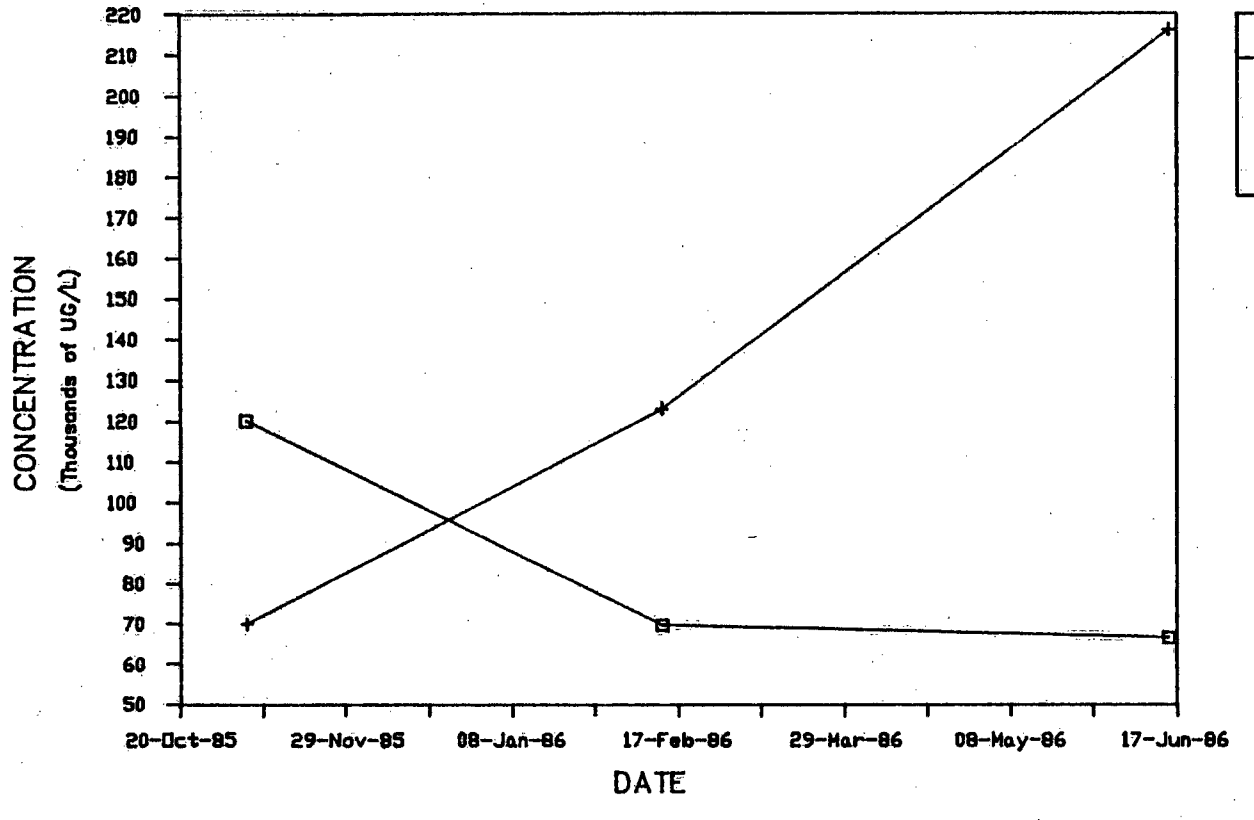


CLEAR CREEK / CENTRAL CITY RI/FS

pH VALUE WITH TIME
AT QUARTZ HILL TUNNEL WELLS

CAMP DRESSER & McKEE INC.

CDM



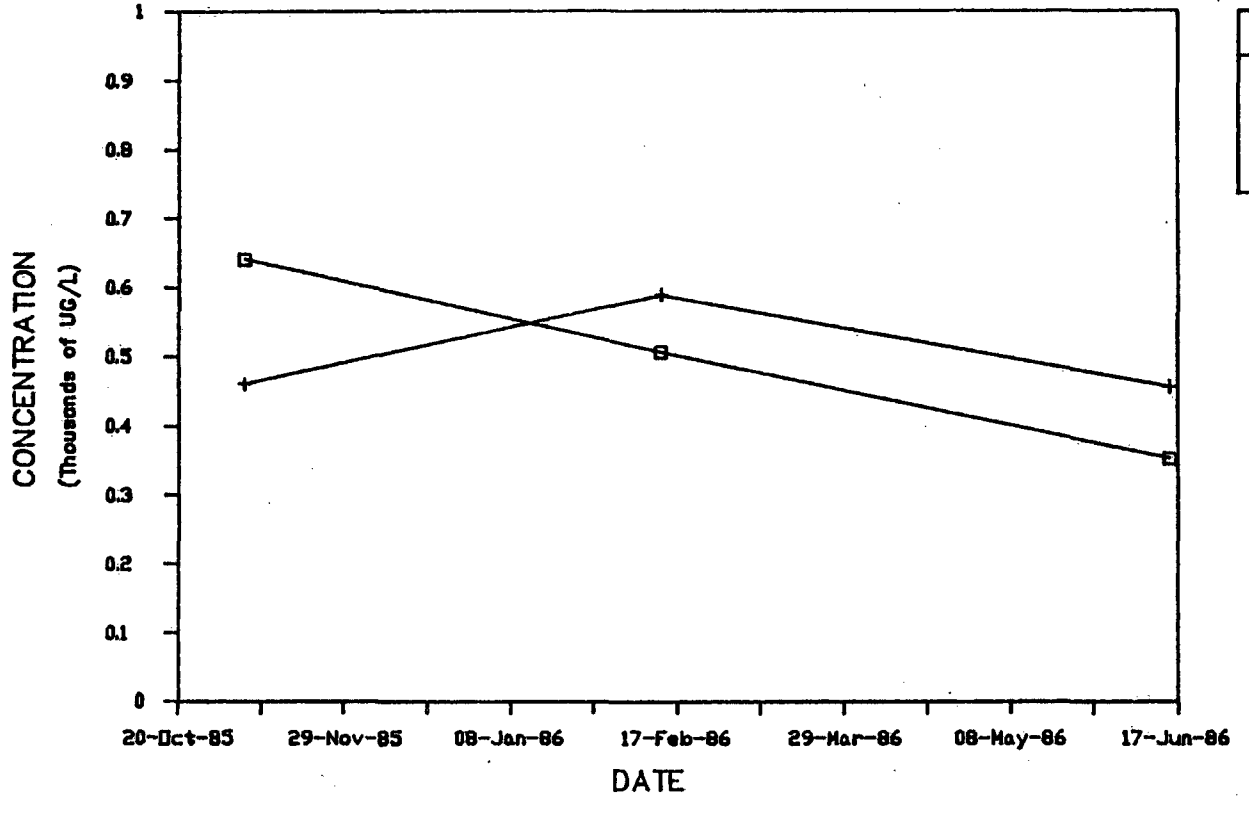
CLEAR CREEK / CENTRAL CITY RI/FS

ALUMINUM CONCENTRATION WITH TIME AT QUARTZ HILL TUNNEL WELLS

CAMP DRESSER & McKEE INC.

CDM

SHEET NO.

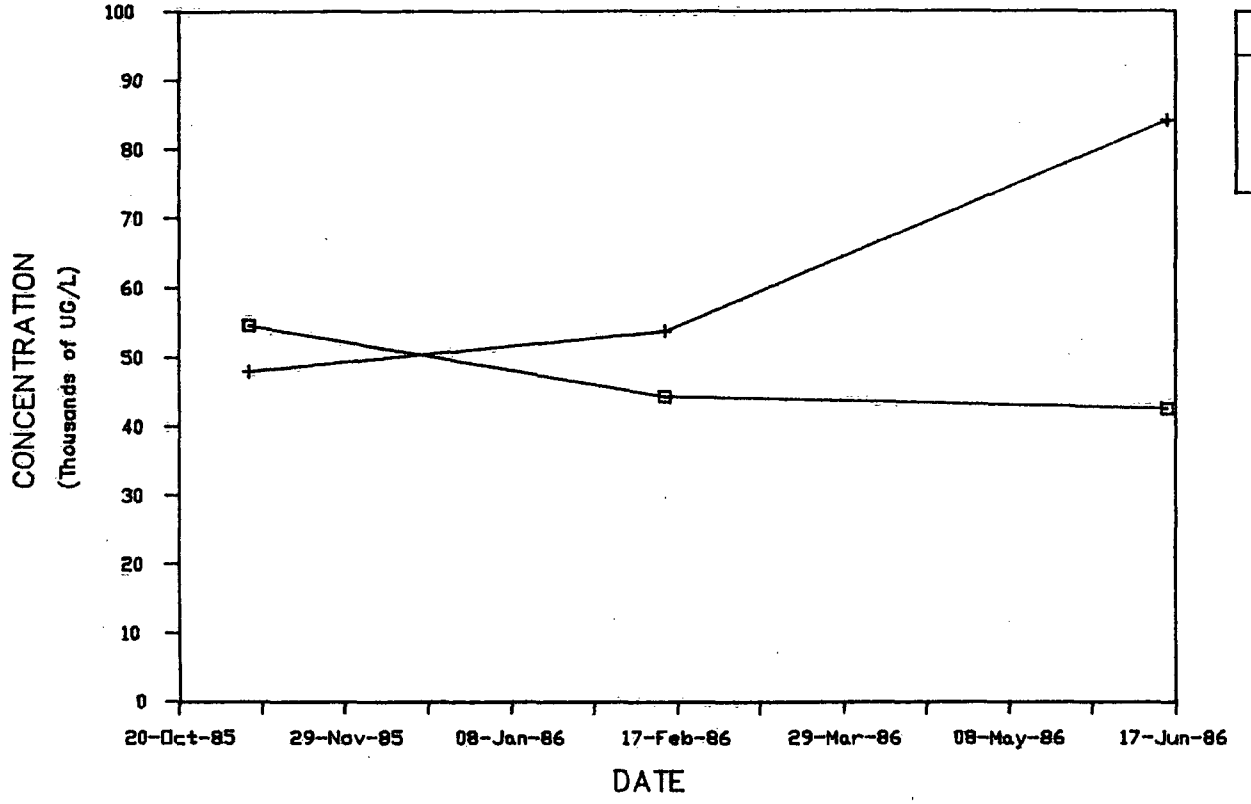


CLEAR CREEK / CENTRAL CITY RI/FS

CADMIUM CONCENTRATION WITH TIME
AT QUARTZ HILL TUNNEL WELLS

CAMP DRESSER & McKEE INC.

CDM

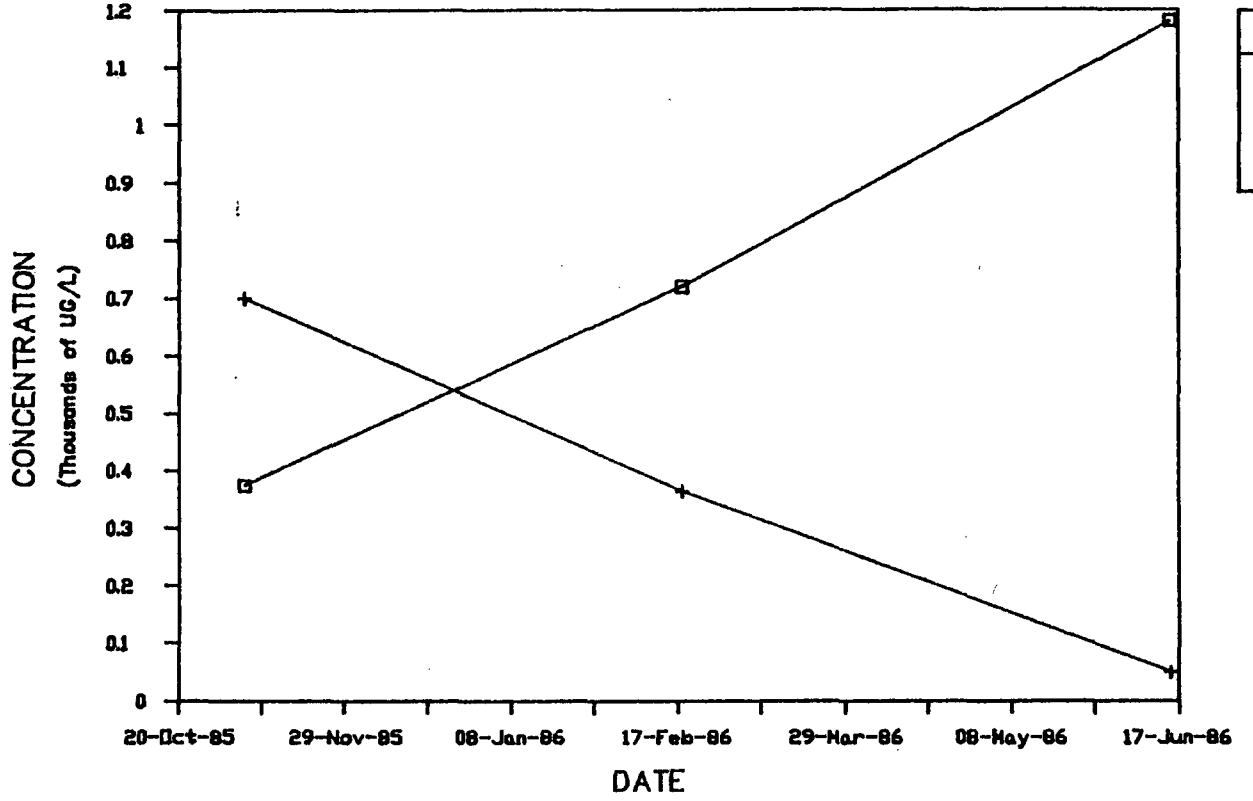


CLEAR CREEK / CENTRAL CITY RI/FS

COPPER CONCENTRATION WITH TIME
AT QUARTZ HILL TUNNEL WELLS

CAMP DRESSER & McKEE INC.

CDM

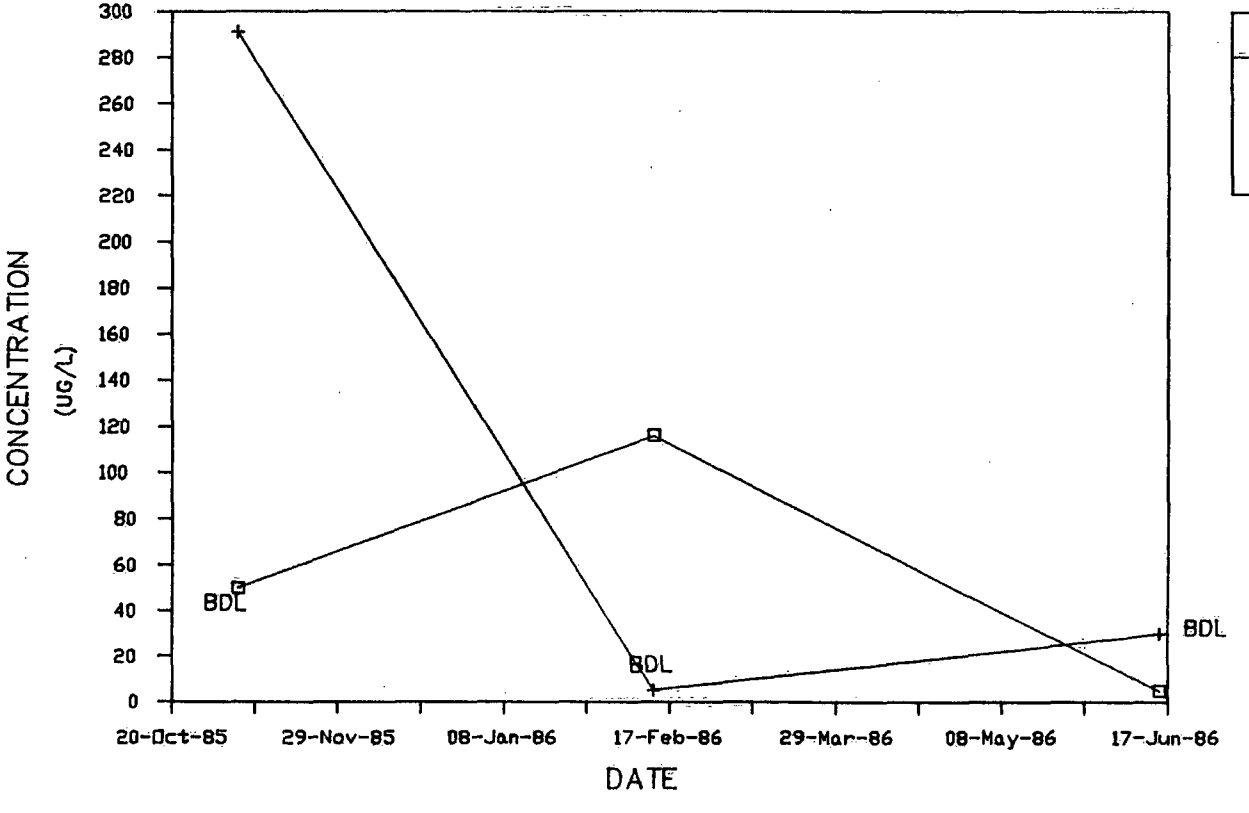


CLEAR CREEK / CENTRAL CITY RI/FS

ARSENIC CONCENTRATION WITH TIME
AT QUARTZ HILL TUNNEL WELLS

CAMP DRESSER & McKEE INC.

CDM



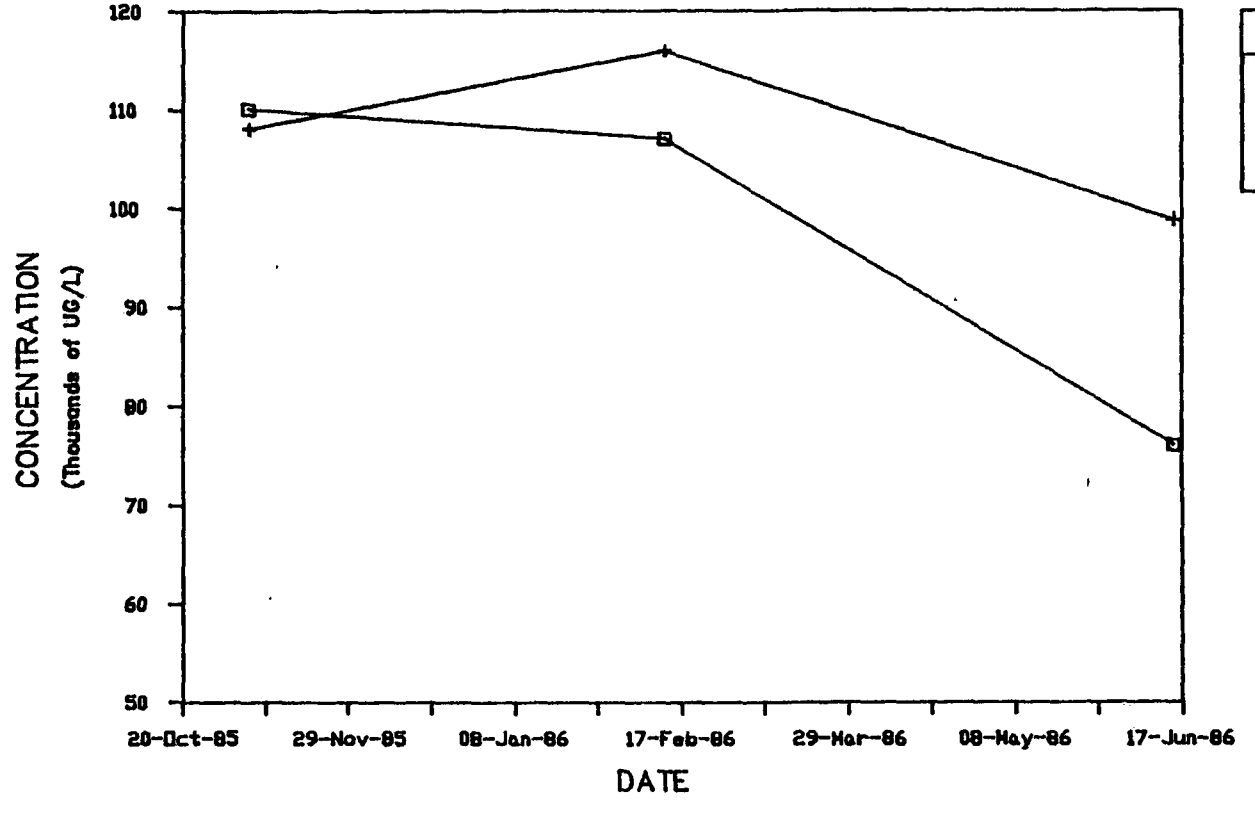
BDL = BELOW DETECTION LIMIT

CLEAR CREEK / CENTRAL CITY RI/FS

LEAD CONCENTRATION WITH TIME
AT QUARTZ HILL TUNNEL WELLS

CAMP DRESSER & McKEE INC.

CDM

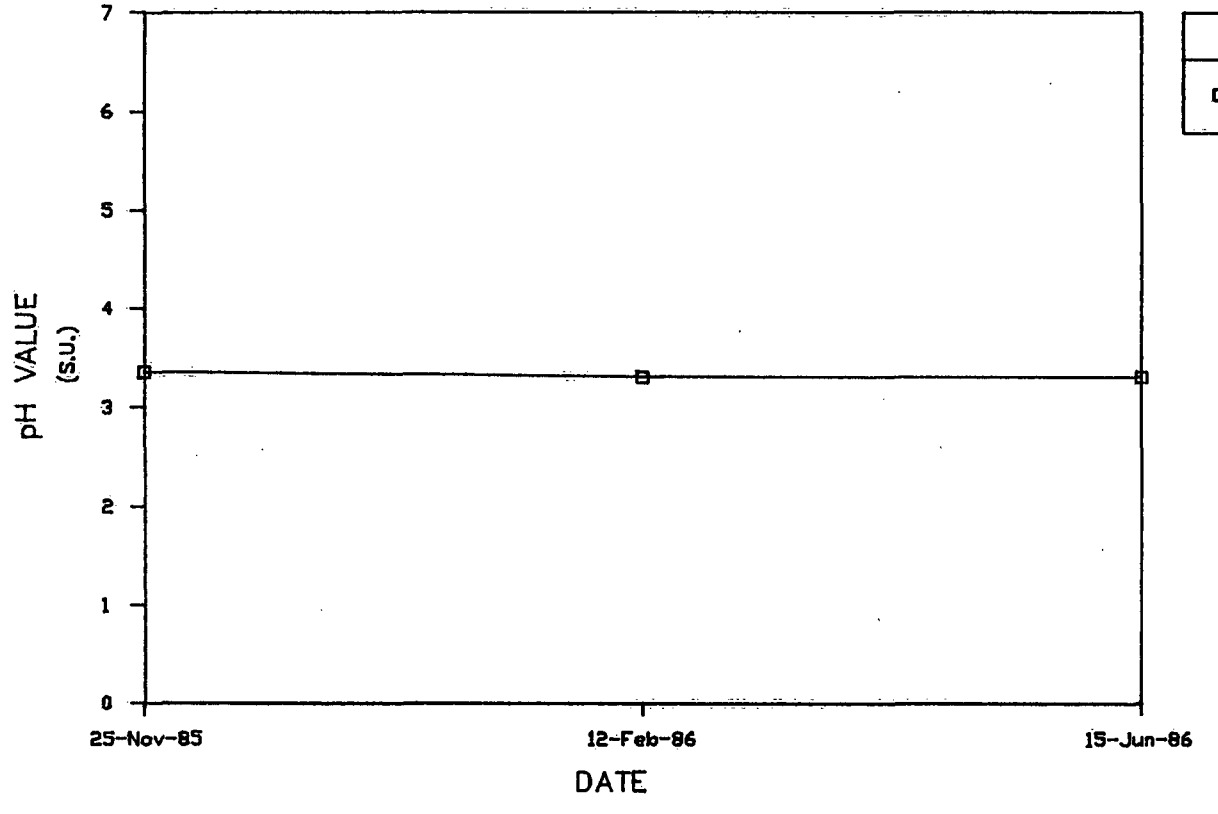


CLEAR CREEK / CENTRAL CITY RI/FS

ZINC CONCENTRATION WITH TIME
AT QUARTZ HILL TUNNEL WELLS

CAMP DRESSER & McKEE INC.

CDM



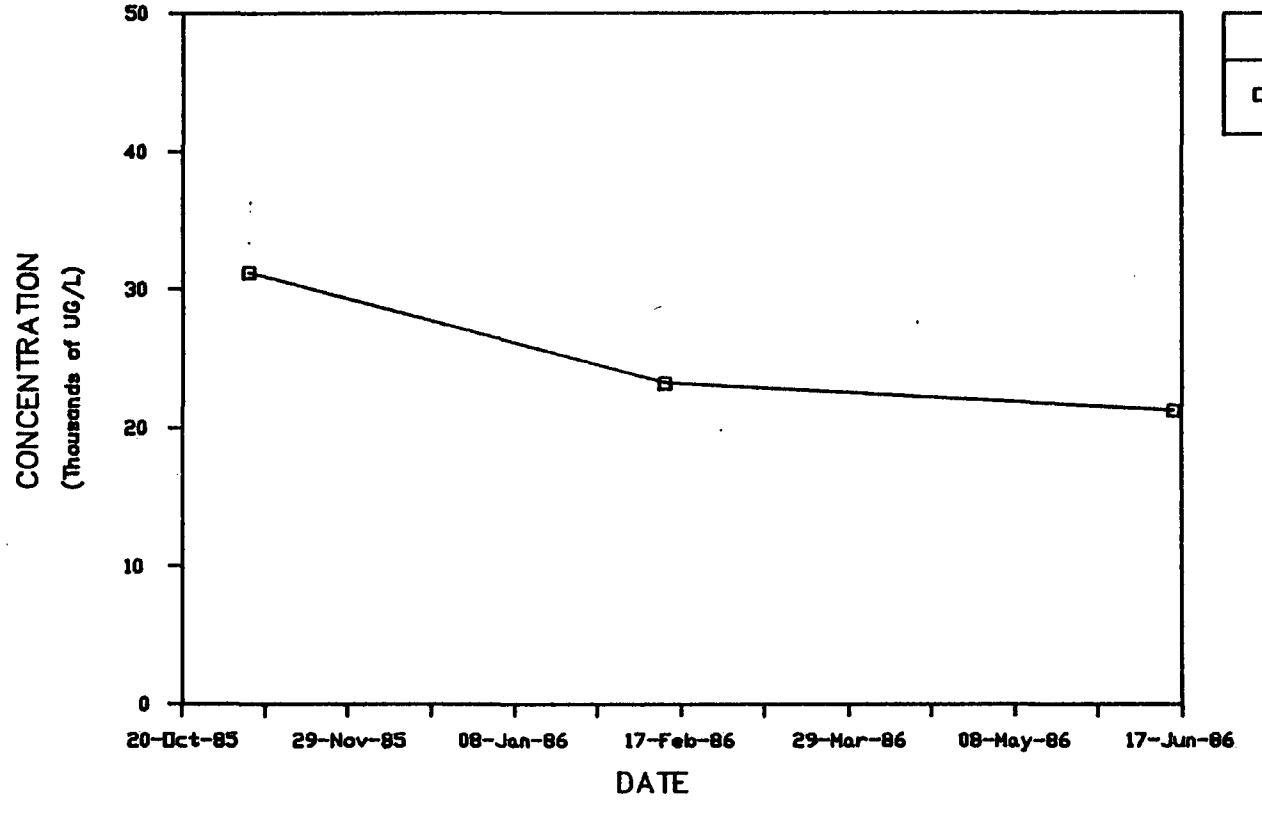
CLEAR CREEK / CENTRAL CITY RI/FS

pH VALUE WITH TIME
AT BIG FIVE TUNNEL WELL

CAMP DRESSER & McKEE INC.

CDM

SHEET NO.

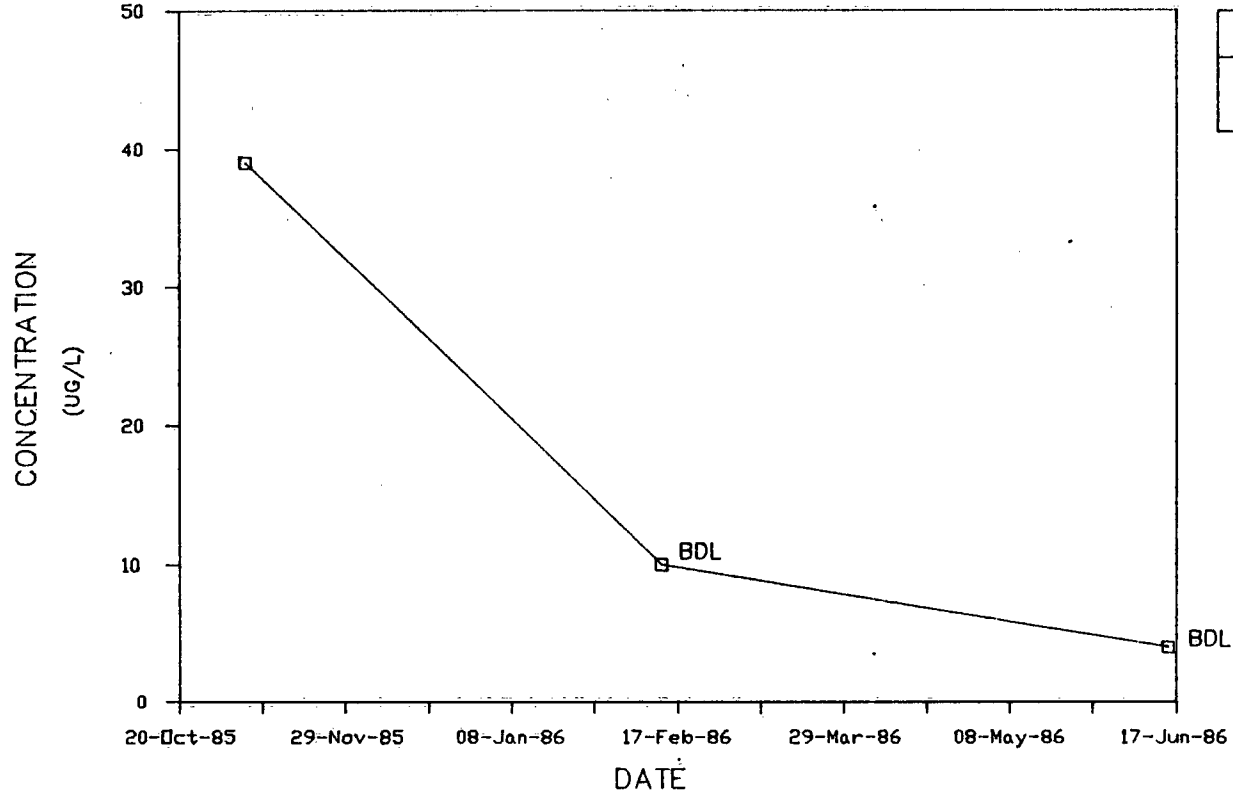


CLEAR CREEK / CENTRAL CITY RI/FS

ALUMINUM CONCENTRATION WITH TIME AT BIG FIVE TUNNEL WELL

CAMP DRESSER & McKEE INC.

CDM



BDL = BELOW DETECTION LIMIT

CLEAR CREEK / CENTRAL CITY RI/FS

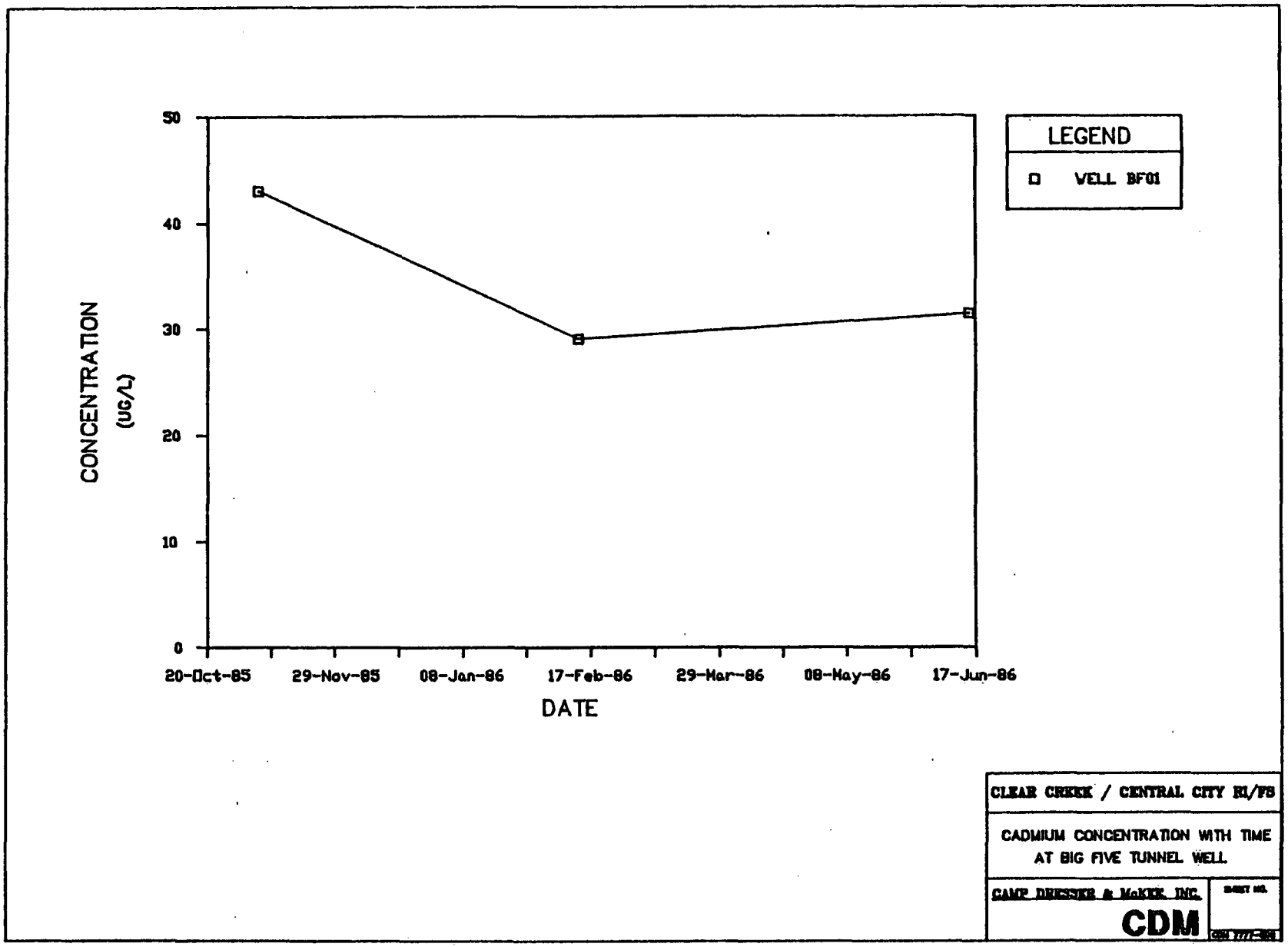
ARSENIC CONCENTRATION WITH TIME
AT BIG FIVE TUNNEL WELL

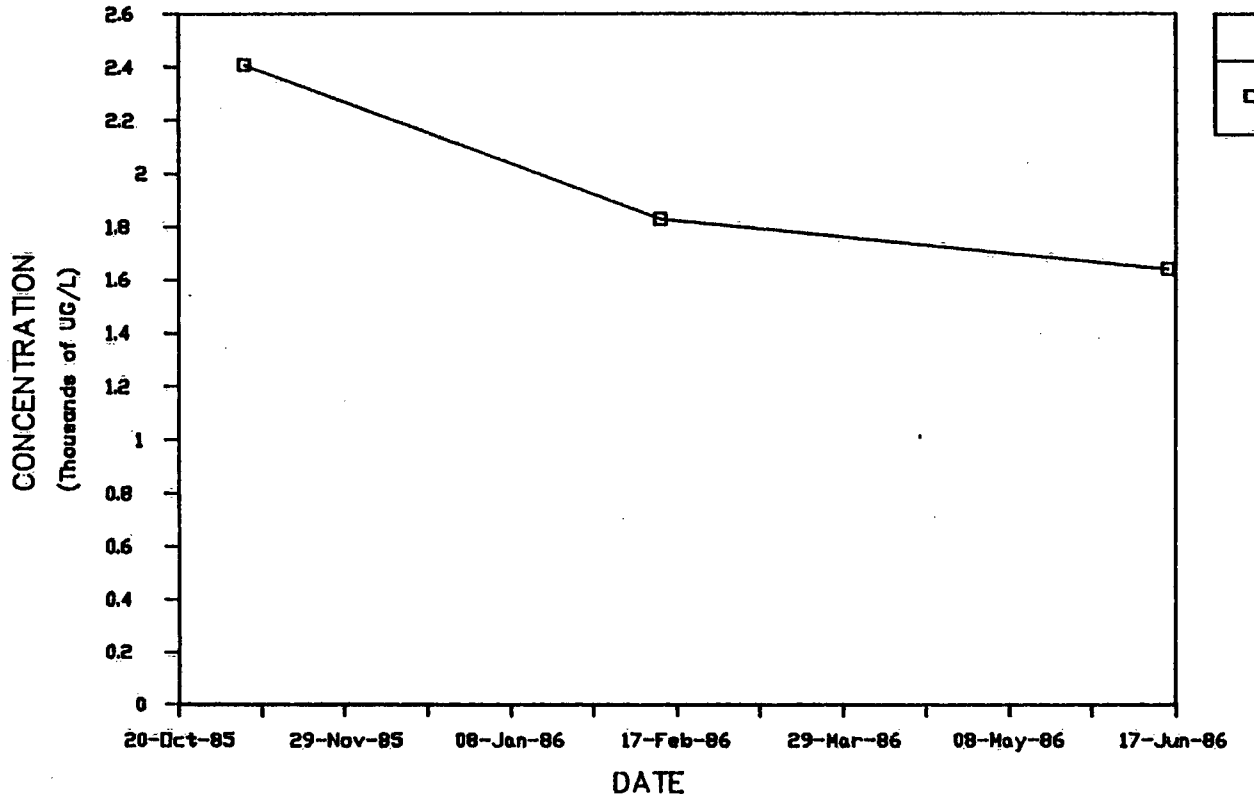
CAMP DRESSER & McKEE INC.

CDM

SHEET NO.

CDM 7777-202


50
40
30
20
10
0
CONCENTRATION
(UG/L)
20-Oct-85
29-Nov-85
08-Jan-86
17-Feb-86
29-Mar-86
08-May-86
17-Jun-86
DATE
LEGEND
WELL BF01
CLEAR CREEK / CENTRAL CITY RI/FS
CADMIUM CONCENTRATION WITH TIME
AT BIG FIVE TUNNEL WELL
CAMP DRESSER & McKEE INC.
CDM

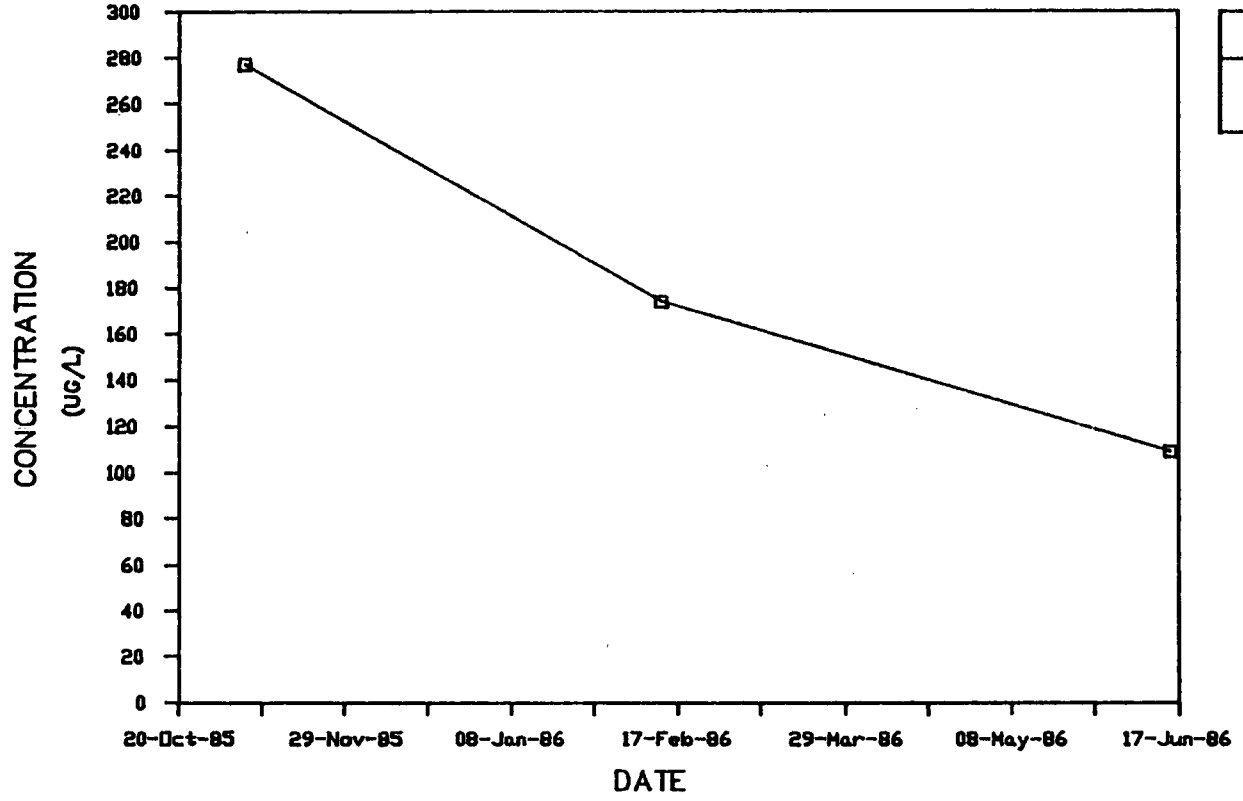


CLEAR CREEK / CENTRAL CITY RI/FS

COPPER CONCENTRATION WITH TIME
AT BIG FIVE TUNNEL WELL

CAMP DRESSER & McKEE INC.

CDM

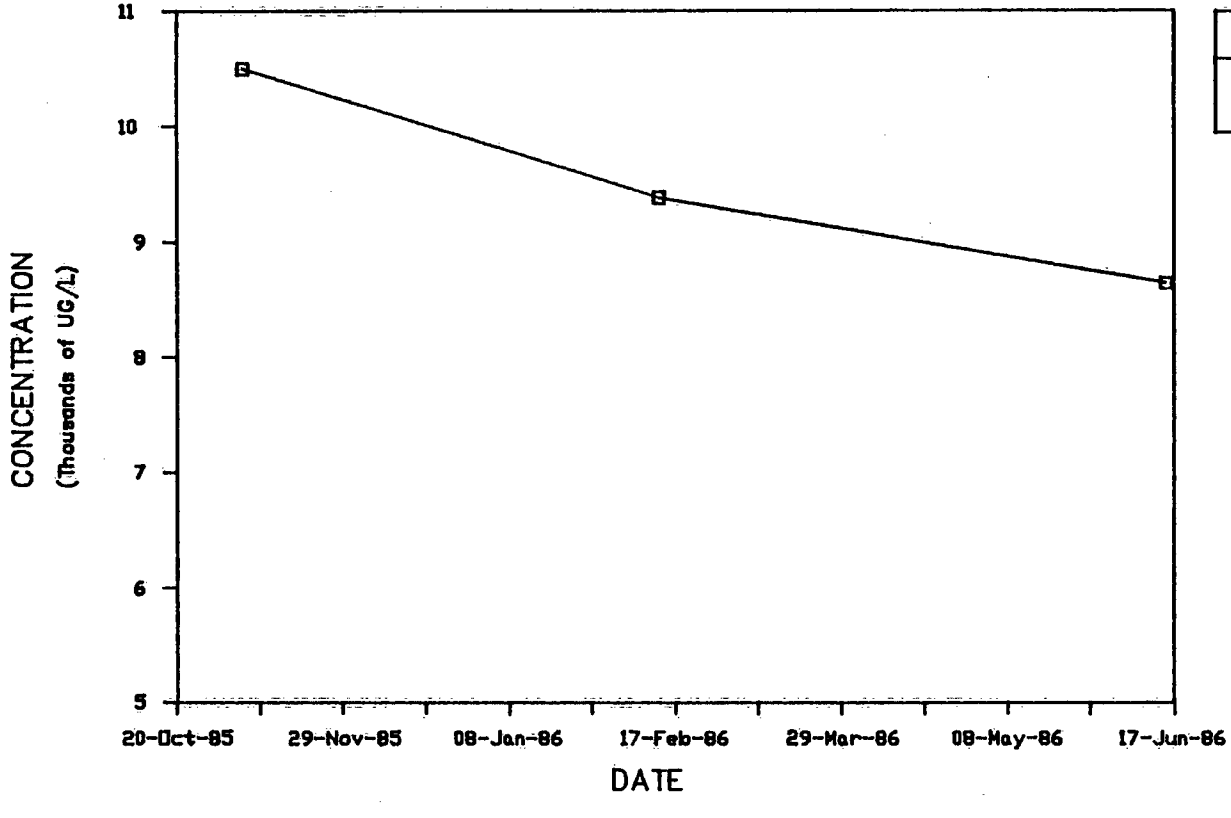


CLEAR CREEK / CENTRAL CITY RI/FS

LEAD CONCENTRATION WITH TIME
AT BIG FIVE TUNNEL WELL

CAMP DRESSER & McKEE INC.

CDM

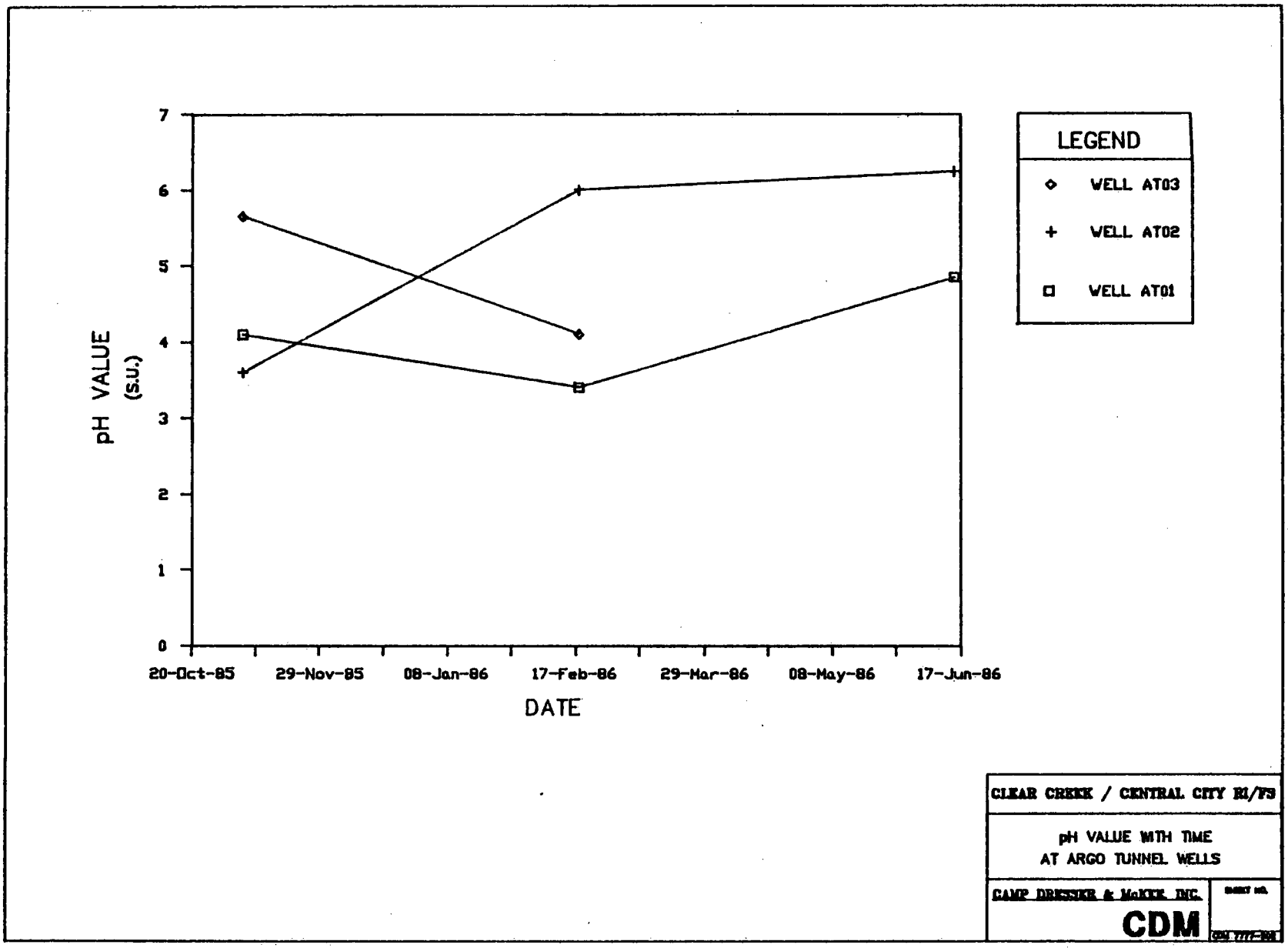


CLEAR CREEK / CENTRAL CITY RI/FS

ZINC CONCENTRATION WITH TIME
AT BIG FIVE TUNNEL WELL

CAMP DRESSER & McKEE INC.

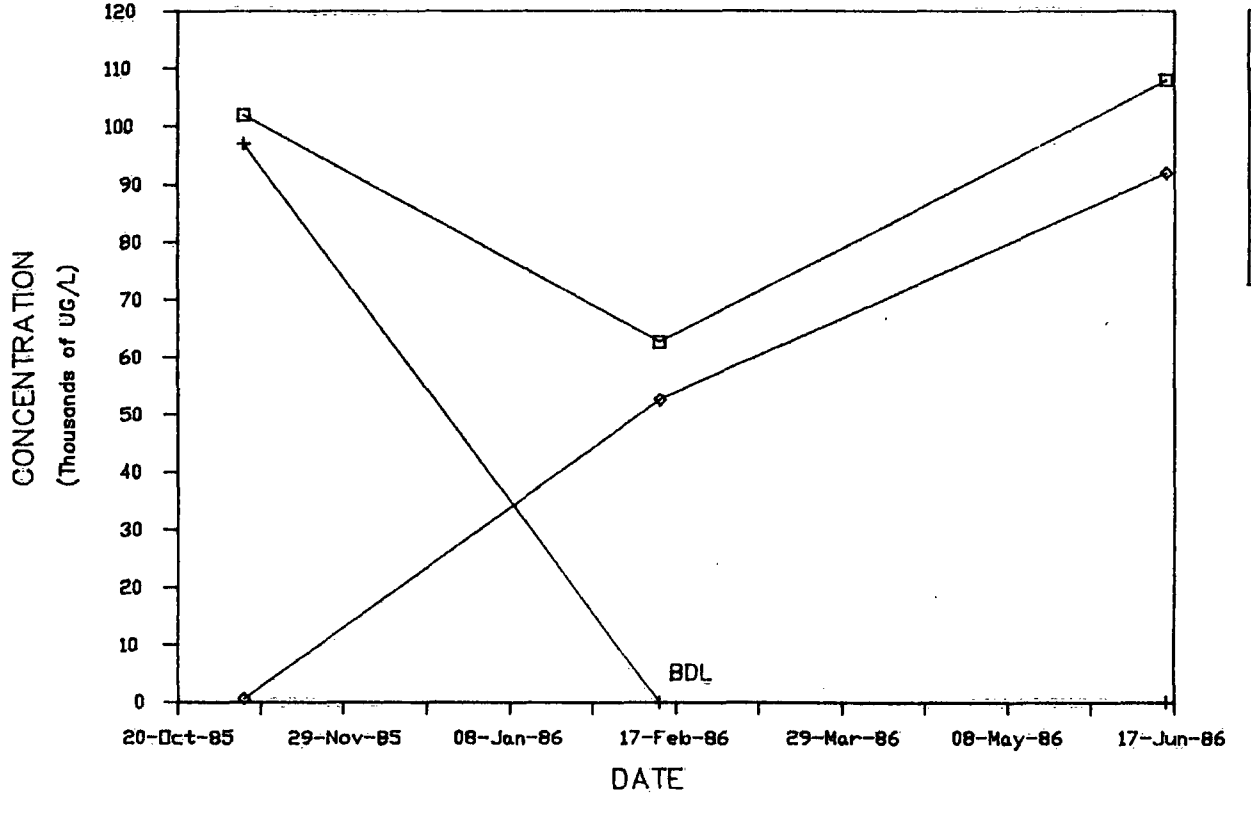
CDM



CLEAR CREEK / CENTRAL CITY RI/FS

pH VALUE WITH TIME
AT ARGO TUNNEL WELLS

CAMP DRESSER & McKEE INC.
CDM



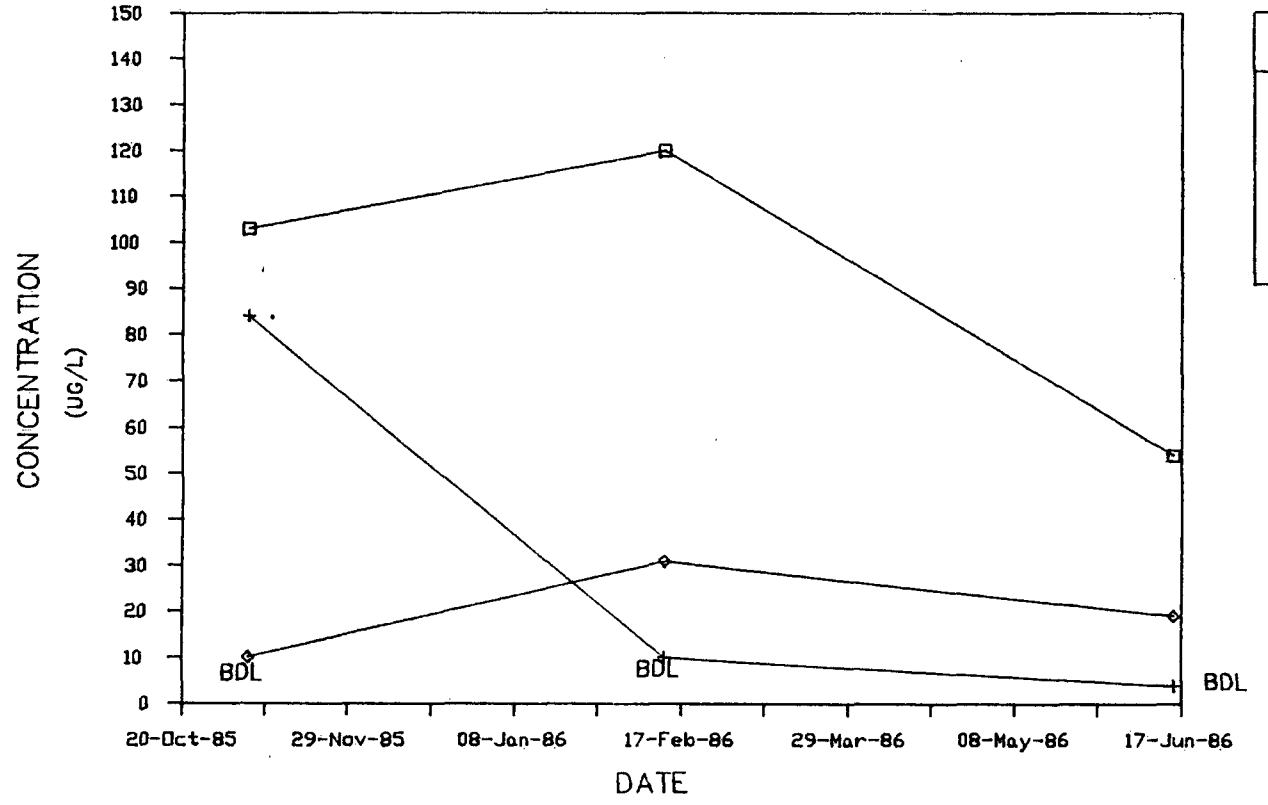
BDL = BELOW DETECTION LIMIT

CLEAR CREEK / CENTRAL CITY RI/FS

ALUMINUM CONCENTRATION WITH TIME AT ARGO TUNNEL WELLS

CAMP DRESSER & McKEE INC.

CDM



BDL = BELOW DETECTION LIMIT

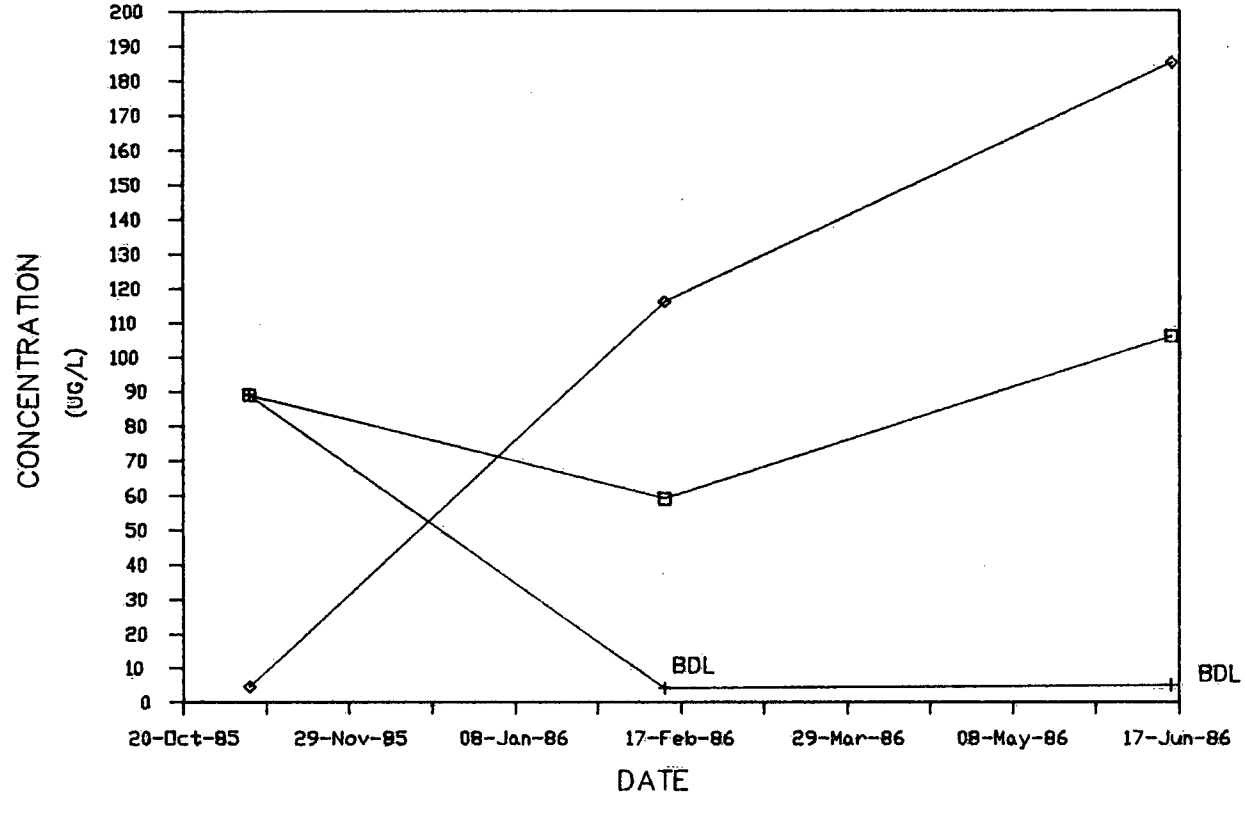
CLEAR CREEK / CENTRAL CITY RI/FS

ARSENIC CONCENTRATION WITH TIME
AT ARGO TUNNEL WELLS

CAMP DRESSER & McKEE INC.

CDM

SHEET NO.



BDL = BELOW DETECTION LIMIT

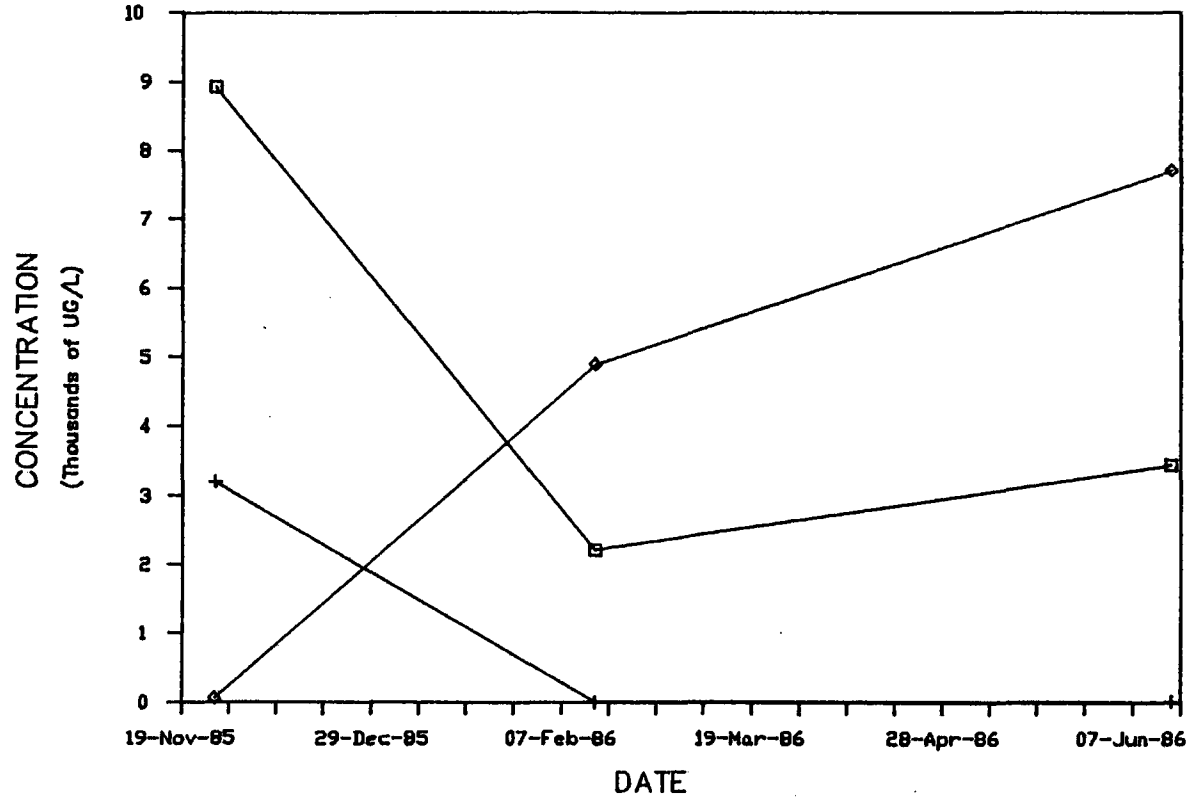
CLEAR CREEK / CENTRAL CITY RI/FS

CADMIUM CONCENTRATION WITH TIME AT ARGO TUNNEL WELLS

CAMP DRESSER & McKEE INC.

CDM

SHEET NO.



LEGEND

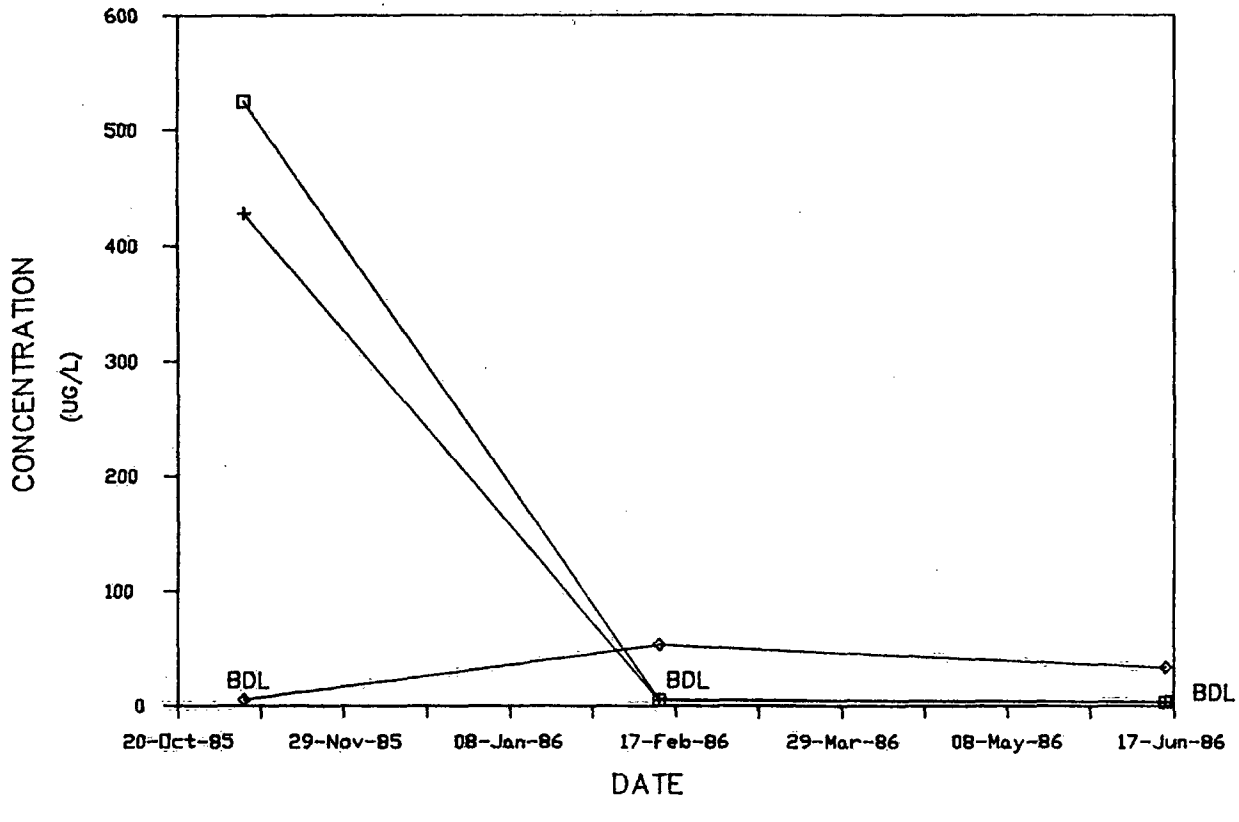
- ◇ WELL AT03
- \+ WELL AT02
- □ WELL AT01

CLEAR CREEK / CENTRAL CITY RI/FS

COPPER CONCENTRATION WITH TIME
AT ARGO TUNNEL WELLS

CAMP DRESSER & McKEE INC.

CDM



BDL = BELOW DETECTION LIMIT

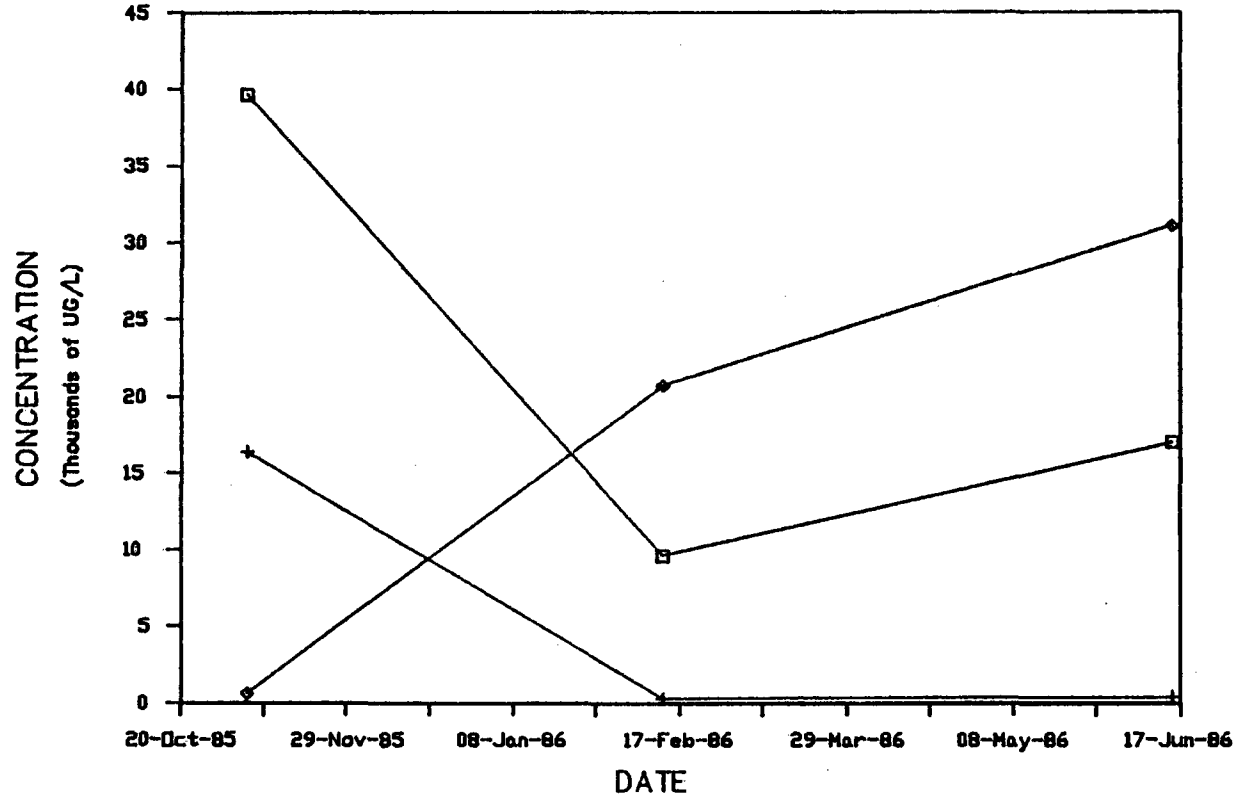
CLEAR CREEK / CENTRAL CITY RI/FS

LEAD CONCENTRATION WITH TIME
AT ARGO TUNNEL WELLS

CAMP DRESSER & McKEE INC.

CDM

SHEET NO.



CLEAR CREEK / CENTRAL CITY RI/FS

ZINC CONCENTRATION WITH TIME
AT ARGO TUNNEL WELLS

CAMP DRESSER & McKEE INC.

CDM

APPENDIX 7C

GROUND WATER ELEVATION DATA

GROUND WATER ELEVATION DATA ARE INCLUDED
FOR THE FOLLOWING SITES:

TABLE

7C-1	Gregory Incline Wells GG01, GG02, GG03, GG04, GG05, GG06, GG09 and GG13
7C-2	National Tunnel Wells NT01, NT02 and NT03
7C-3	Quartz Hill Tunnel Wells QH01 and QH02
7C-4	Big Five Tunnel Well BF01
7C-5	Argo Tunnel Wells AT01, AT02 and AT03

TABLE 7C-1.

MONTHLY GROUND WATER ELEVATION AT GREGORY INCLINE

WELL	DATE	GROUND WATER ELEVATION (FT. MSL)	DEPTH TO WATER (FT.)	GROUND SURFACE ELEVATION (FT. MSL)	COLLAR ELEVATION (FT. MSL)	TOTAL WELL DEPTH (FT.)
GG01	25-Nov-85	8049.64	4.33	8053.52	8053.97	30.0
GG01	30-Dec-85	8049.62	4.35	8053.52	8053.97	30.0
GG01	04-Feb-86	8049.62	4.35	8053.52	8053.97	30.0
GG01	03-Mar-86	8049.62	4.35	8053.52	8053.97	30.0
GG01	01-Apr-86	8049.77	4.2	8053.52	8053.97	30.0
GG01	23-May-86	8050.73	3.24	8053.52	8053.97	30.0
GG01	02-Jul-86	8050.17	3.8	8053.52	8053.97	30.0
GG01	25-Aug-86	8049.82	4.15	8053.52	8053.97	30.0
GG01	08-Oct-86	8049.67	4.3	8053.52	8053.97	30.0
GG01	22-Dec-86	8049.62	4.35	8053.52	8053.97	30.0
GG02	25-Nov-85	8055.92	18.68	8073.95	8074.6	24.5
GG02	30-Dec-85	8055.60	19	8073.95	8074.6	24.5
GG02	04-Feb-86	8055.03	19.57	8073.95	8074.6	24.5
GG02	03-Mar-86	8054.80	19.8	8073.95	8074.6	24.5
GG02	01-Apr-86	8054.85	19.75	8073.95	8074.6	24.5
GG02	23-May-86	8058.75	15.85	8073.95	8074.6	24.5
GG02	02-Jul-86	8056.50	18.1	8073.95	8074.6	24.5
GG02	25-Aug-86	8055.50	19.1	8073.95	8074.6	24.5
GG02	08-Oct-86	8056.10	18.5	8073.95	8074.6	24.5
GG02	22-Dec-86	8055.20	19.4	8073.95	8074.6	24.5
GG03	25-Nov-85	8056.55	18.94	8074.69	8075.49	27.0
GG03	30-Dec-85	8056.24	19.25	8074.69	8075.49	27.0
GG03	04-Feb-86	8055.74	19.75	8074.69	8075.49	27.0
GG03	03-Mar-86	8055.59	19.9	8074.69	8075.49	27.0
GG03	01-Apr-86	8055.66	19.83	8074.69	8075.49	27.0
GG03	23-May-86	8060.62	14.87	8074.69	8075.49	27.0
GG03	02-Jul-86	8057.39	18.1	8074.69	8075.49	27.0
GG03	25-Aug-86	8056.09	19.4	8074.69	8075.49	27.0
GG03	08-Oct-86	8056.99	18.5	8074.69	8075.49	27.0
GG03	22-Dec-86	8055.89	19.6	8074.69	8075.49	27.0
GG04	25-Nov-85	8061.59	14.52	8075.51	8076.11	29.5
GG04	30-Dec-85	8061.31	14.8	8075.51	8076.11	29.5
GG04	04-Feb-86	8060.80	15.31	8075.51	8076.11	29.5
GG04	03-Mar-86	8060.59	15.52	8075.51	8076.11	29.5
GG04	01-Apr-86	8060.44	15.67	8075.51	8076.11	29.5
GG04	23-May-86	8063.33	12.78	8075.51	8076.11	29.5

GG04	02-Jul-86	8061.81	14.3	8075.51	8076.11	29.5
GG04	25-Aug-86	8061.11	15	8075.51	8076.11	29.5
GG04	08-Oct-86	8061.71	14.4	8075.51	8076.11	29.5
GG04	22-Dec-86	8061.11	15	8075.51	8076.11	29.5
GG05	25-Nov-85	8055.31	26.8	8081.76	8082.11	50.0
GG05	30-Dec-85	8055.26	26.85	8081.76	8082.11	50.0
GG05	04-Feb-86	8055.07	27.04	8081.76	8082.11	50.0
GG05	03-Mar-86	8054.96	27.15	8081.76	8082.11	50.0
GG05	01-Apr-86	8055.26	26.85	8081.76	8082.11	50.0
GG05	23-May-86	8055.58	26.53	8081.76	8082.11	50.0
GG05	02-Jul-86	8055.81	26.3	8081.76	8082.11	50.0
GG05	25-Aug-86	8055.31	26.8	8081.76	8082.11	50.0
GG05	08-Oct-86	8055.36	26.75	8081.76	8082.11	50.0
GG05	22-Dec-86	8055.16	26.95	8081.76	8082.11	50.0
GG06	25-Nov-85	8057.34	25.59	8082.21	8082.93	41.9
GG06	30-Dec-85	8057.18	25.75	8082.21	8082.93	41.9
GG06	04-Feb-86	8056.88	26.05	8082.21	8082.93	41.9
GG06	03-Mar-86	8056.48	26.45	8082.21	8082.93	41.9
GG06	01-Apr-86	8056.93	26	8082.21	8082.93	41.9
GG06	23-May-86	8059.08	23.85	8082.21	8082.93	41.9
GG06	02-Jul-86	8058.03	24.9	8082.21	8082.93	41.9
GG06	25-Aug-86	8057.28	25.65	8082.21	8082.93	41.9
GG06	08-Oct-86	8057.63	25.3	8082.21	8082.93	41.9
GG06	22-Dec-86	8057.13	25.8	8082.21	8082.93	41.9
GG09	25-Nov-85	8056.40	25.66	8081.52	8082.06	47.5
GG09	30-Dec-85	8056.34	25.72	8081.52	8082.06	47.5
GG09	04-Feb-86	8056.19	25.87	8081.52	8082.06	47.5
GG09	03-Mar-86	8056.06	26	8081.52	8082.06	47.5
GG09	01-Apr-86	8056.40	25.66	8081.52	8082.06	47.5
GG09	23-May-86	8057.61	24.45	8081.52	8082.06	47.5
GG09	02-Jul-86	8056.96	25.1	8081.52	8082.06	47.5
GG09	25-Aug-86	8056.41	25.65	8081.52	8082.06	47.5
GG09	08-Oct-86	8056.46	25.6	8081.52	8082.06	47.5
GG09	22-Dec-86	8056.26	25.8	8081.52	8082.06	47.5
GG13	25-Nov-85	8061.73	8.28	8069.21	8070.01	29.0
GG13	30-Dec-85	8061.66	8.35	8069.21	8070.01	29.0
GG13	04-Feb-86	8061.69	8.32	8069.21	8070.01	29.0
GG13	03-Mar-86	8061.86	8.15	8069.21	8070.01	29.0
GG13	01-Apr-86	8062.16	7.85	8069.21	8070.01	29.0
GG13	23-May-86	8062.96	7.05	8069.21	8070.01	29.0
GG13	02-Jul-86	8062.61	7.4	8069.21	8070.01	29.0
GG13	25-Aug-86	8062.06	7.95	8069.21	8070.01	29.0
GG13	08-Oct-86	8062.01	8	8069.21	8070.01	29.0
GG13	22-Dec-86	8061.91	8.1	8069.21	8070.01	29.0

TABLE 7C-2.

MONTHLY GROUND WATER ELEVATION AT NATIONAL TUNNEL

WELL	DATE	GROUND WATER ELEVATION (FT. MSL)	DEPTH TO WATER (FT.)	GROUND SURFACE ELEVATION (FT. MSL)	COLLAR ELEVATION (FT. MSL)	TOTAL WELL DEPTH (FT.)
NT01	25-Nov-85	7952.04	14.03	7964.83	7966.07	25.4
NT01	30-Dec-85	7951.97	14.1	7964.83	7966.07	25.4
NT01	04-Feb-86	7952.02	14.05	7964.83	7966.07	25.4
NT01	03-Mar-86	7952.12	13.95	7964.83	7966.07	25.4
NT01	01-Apr-86	7952.36	13.71	7964.83	7966.07	25.4
NT01	23-May-86	7952.30	13.77	7964.83	7966.07	25.4
NT01	02-Jul-86	7952.22	13.85	7964.83	7966.07	25.4
NT01	25-Aug-86	7952.20	13.87	7964.83	7966.07	25.4
NT01	08-Oct-86	7952.17	13.9	7964.83	7966.07	25.4
NT01	22-Dec-86	7952.27	13.8	7964.83	7966.07	25.4
NT02	25-Nov-85	7952.99	14.74	7965.58	7967.73	31.5
NT02	30-Dec-85	7952.98	14.75	7965.58	7967.73	31.5
NT02	04-Feb-86	7953.10	14.63	7965.58	7967.73	31.5
NT02	03-Mar-86	7953.13	14.6	7965.58	7967.73	31.5
NT02	01-Apr-86	7953.23	14.5	7965.58	7967.73	31.5
NT02	23-May-86	7953.50	14.23	7965.58	7967.73	31.5
NT02	02-Jul-86	7953.33	14.4	7965.58	7967.73	31.5
NT02	25-Aug-86	7953.03	14.7	7965.58	7967.73	31.5
NT02	08-Oct-86	7952.93	14.8	7965.58	7967.73	31.5
NT02	22-Dec-86	7952.78	14.95	7965.58	7967.73	31.5
NT03	25-Nov-85	7973.05	6.44	7977.19	7979.49	33.8
NT03	30-Dec-85	7972.99	6.5	7977.19	7979.49	33.8
NT03	04-Feb-86	7973.07	6.42	7977.19	7979.49	33.8
NT03	03-Mar-86	7973.14	6.35	7977.19	7979.49	33.8
NT03	01-Apr-86	7973.24	6.25	7977.19	7979.49	33.8
NT03	23-May-86	7973.19	6.3	7977.19	7979.49	33.8
NT03	02-Jul-86	7973.19	6.3	7977.19	7979.49	33.8
NT03	25-Aug-86	7972.68	6.81	7977.19	7979.49	33.8
NT03	08-Oct-86	7972.49	7	7977.19	7979.49	33.8
NT03	22-Dec-86	7972.74	6.75	7977.19	7979.49	33.8

TABLE 7C-3.

MONTHLY GROUND WATER ELEVATION AT QUARTZ HILL TUNNEL

WELL	DATE	GROUND WATER ELEVATION (FT. MSL)	DEPTH TO WATER (FT.)	GROUND SURFACE ELEVATION (FT. MSL)	COLLAR ELEVATION (FT. MSL)	TOTAL WELL DEPTH (FT.)
QH01	25-Nov-85	8573.21	17.72	8589.03	8590.93	22.5
QH01	30-Dec-85	8573.43	17.5	8589.03	8590.93	22.5
QH01	04-Feb-86	8573.83	17.1	8589.03	8590.93	22.5
QH01	03-Mar-86	8572.98	17.95	8589.03	8590.93	22.5
QH01	01-Apr-86	8572.68	18.25	8589.03	8590.93	22.5
QH01	23-May-86	8575.55	15.38	8589.03	8590.93	22.5
QH01	02-Jul-86	8573.63	17.3	8589.03	8590.93	22.5
QH01	25-Aug-86	8573.28	17.65	8589.03	8590.93	22.5
QH01	08-Oct-86	8573.93	17	8589.03	8590.93	22.5
QH01	22-Dec-86	8572.88	18.05	8589.03	8590.93	22.5
QH02	25-Nov-85	8556.37	34.78	8588.85	8591.15	38.0
QH02	30-Dec-85	8556.90	34.25	8588.85	8591.15	38.0
QH02	04-Feb-86	8557.81	33.34	8588.85	8591.15	38.0
QH02	03-Mar-86	8558.15	33	8588.85	8591.15	38.0
QH02	01-Apr-86	8557.07	34.08	8588.85	8591.15	38.0
QH02	23-May-86	8561.65	29.5	8588.85	8591.15	38.0
QH02	02-Jul-86	8558.55	32.6	8588.85	8591.15	38.0
QH02	25-Aug-86	8557.20	33.95	8588.85	8591.15	38.0
QH02	08-Oct-86	8557.25	33.9	8588.85	8591.15	38.0
QH02	22-Dec-86	8555.80	35.35	8588.85	8591.15	38.0

TABLE 7C-4.

MONTHLY GROUND WATER ELEVATION AT BIG FIVE TUNNEL

WELL	DATE	GROUND WATER ELEVATION (FT. MSL)	DEPTH TO WATER (FT.)	GROUND SURFACE ELEVATION (FT. MSL)	COLLAR ELEVATION (FT. MSL)	TOTAL WELL DEPTH (FT.)
BF01	25-Nov-85	7576.50	30.89	7604.79	7607.39	38.0
BF01	30-Dec-85	7576.29	31.1	7604.79	7607.39	38.0
BF01	04-Feb-86	7576.16	31.23	7604.79	7607.39	38.0
BF01	03-Mar-86	7576.19	31.2	7604.79	7607.39	38.0
BF01	01-Apr-86	7576.39	31	7604.79	7607.39	38.0
BF01	23-May-86	7576.74	30.65	7604.79	7607.39	38.0
BF01	02-Jul-86	7577.59	29.8	7604.79	7607.39	38.0
BF01	25-Aug-86	7576.76	30.63	7604.79	7607.39	38.0
BF01	08-Oct-86	7576.19	31.2	7604.79	7607.39	38.0
BF01	22-Dec-86	7576.34	31.05	7604.79	7607.39	38.0

TABLE 7C-5.

MONTHLY GROUND WATER ELEVATION AT ARGO TUNNEL

WELL	DATE	GROUND WATER ELEVATION (FT. MSL)	DEPTH TO WATER (FT.)	GROUND SURFACE ELEVATION (FT. MSL)	COLLAR ELEVATION (FT. MSL)	TOTAL WELL DEPTH (FT.)
AT01	25-Nov-85	7492.56	15.62	7505.78	7508.18	20.0
AT01	30-Dec-85	7492.51	15.67	7505.78	7508.18	20.0
AT01	04-Feb-86	7492.48	15.70	7505.78	7508.18	20.0
AT01	03-Mar-86	7492.63	15.55	7505.78	7508.18	20.0
AT01	01-Apr-86	7492.91	15.27	7505.78	7508.18	20.0
AT01	23-May-86	7493.23	14.95	7505.78	7508.18	20.0
AT01	02-Jul-86	7493.53	14.65	7505.78	7508.18	20.0
AT01	25-Aug-86	7493.18	15.00	7505.78	7508.18	20.0
AT01	08-Oct-86	7492.88	15.30	7505.78	7508.18	20.0
AT01	22-Dec-86	7492.73	15.45	7505.78	7508.18	20.0
AT02	25-Nov-85	7476.90	15.58	7491.28	7492.48	24.0
AT02	30-Dec-85	7476.83	15.65	7491.28	7492.48	24.0
AT02	04-Feb-86	7476.72	15.76	7491.28	7492.48	24.0
AT02	03-Mar-86	7476.78	15.70	7491.28	7492.48	24.0
AT02	01-Apr-86	7476.98	15.50	7491.28	7492.48	24.0
AT02	23-May-86	7477.88	14.60	7491.28	7492.48	24.0
AT02	02-Jul-86	7478.98	13.50	7491.28	7492.48	24.0
AT02	25-Aug-86	7477.68	14.80	7491.28	7492.48	24.0
AT02	08-Oct-86	7477.18	15.30	7491.28	7492.48	24.0
AT02	22-Dec-86	7476.68	15.80	7491.28	7492.48	24.0
AT03	25-Nov-85	7466.50	6.54	7470.64	7473.04	26.0
AT03	30-Dec-85	7466.44	6.60	7470.64	7473.04	26.0
AT03	04-Feb-86	7466.31	6.73	7470.64	7473.04	26.0
AT03	03-Mar-86	7466.34	6.70	7470.64	7473.04	26.0
AT03	01-Apr-86	7466.46	6.58	7470.64	7473.04	26.0
AT03	23-May-86	7466.59	6.45	7470.64	7473.04	26.0
AT03	02-Jul-86	7468.59	4.45	7470.64	7473.04	26.0
AT03	25-Aug-86	7467.44	5.60	7470.64	7473.04	26.0
AT03	08-Oct-86	7466.79	6.25	7470.64	7473.04	26.0
AT03	22-Dec-86	7466.89	6.15	7470.64	7473.04	26.0

APPENDIX 10A

HUMAN HEALTH TOXICITY PROFILES

ALUMINUM

INTRODUCTION

Aluminum is a silver-white malleable and ductile metal which is abundant in the earth's crust and is commonly found in a combined state with various silicates as bauxite and cryolite. Aluminum is used extensively in cosmetics, deodorants, and in medicine, particularly as an antacid.

PHARMACOKINETICS

The major sources of aluminum in the normal human diet include plants and processed food (NAS 1982). Because of a lack of detection methods and because many laboratory reagents and chemicals are contaminated with aluminum, very little is known about the absorption, distribution, and excretion of aluminum. Studies have reported gastrointestinal absorption of aluminum in normal persons who consumed some aluminum salts (Kaehny et al. 1977) and in dialysis patients taking antacids containing 2 to 3.4 mg aluminum daily for. 20-32 days (Clarkson et al. 1972). Following absorption or parenteral administration, aluminum is distributed to almost all organs, including the brain (NAS 1982). In humans, aluminum is excreted primarily in the bile; a small amount is excreted via the urine (Gorsky et al. 1979).

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

CARCINOGENICITY

Aluminum has not been found to be carcinogenic as aluminum powder or as aluminum salts in rabbits, mice, or guinea pigs following administration by various routes (NAS 1982).

MUTAGENICITY

Oral administration of 3 to 50 mg/kg/day aluminum chloride for 20 to 30 days did not induce chromosomal aberrations in the bone marrow cells of rats,

guinea pigs, and rabbits. Oral exposure of 0.025 to 2.5 mg/kg aluminum chloride for 6 to 12 months did not induce chromosomal aberrations in rat bone marrow cells (Krasovskii et al. 1979).

TERATOGENICITY/REPRODUCTIVE EFFECTS

Concentrations of aluminum from 500 to 1,000 ug/g body weight added to the diets of pregnant rats from days 6 to 19 of gestation did not affect embryo or fetal mortality rate, litter size, fetal body weight, or fetal length (McCormack et al. 1979).

Aluminum has also been reported to affect male reproductive capacity. Reduced sperm count and mobility have been reported in rats exposed to 2.5 mg/kg aluminum by gavage for 6 months (EPA 1985).

ACUTE/CHRONIC TOXICITY

In general, aluminum is regarded as nontoxic. However, a number of investigators have demonstrated the neurotoxicity of aluminum in cats, rats, rabbits, and monkeys following subcutaneous injection or direct introduction into the central nervous system. The major symptom exhibited was neurofibrillar degeneration (NAS 1982). Berlyne et al. (1972) reported that rats exposed to aluminum following parenteral or oral administration of aluminum hydroxide, chloride, or sulfate exhibited lethargy, anorexia, and death. Other studies in experimental animals have found that intratracheal instillation and intraperitoneal injection of aluminum compounds produced pulmonary fibroses and fibrotic peritonitis, respectively (NAS 1982).

In humans, pulmonary fibrosis has been found to occur after inhalation of aluminum as bauxite fumes (Goyer 1986). It has also been suggested that aluminum deposition in the brain may be an etiological factor in two neurological disorders: Alzheimer's disease and chronic renal failure accompanied by senile dementia (EPA 1985). However, the importance of aluminum in these disorders has not been fully established.

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

Because there are limited dose-response data available from which to estimate an acceptable daily intake level for ionic aluminum in drinking water, EPA has not proposed to establish a recommended maximum contaminant level or primary regulation (EPA 1985). The National Academy Sciences Committee on Water Quality Criteria (NAS 1973) recommended maximum concentrations of aluminum of 5 ug/ml for water used continuously on all soil and 20 ug/ml for waters used not more than 20 years on fine textured neutral to alkaline soils.

The American Conference of Governmental Industrial Hygienists (ACGIH 1986) has recommended time-weighted average threshold limits values of 10 mg/m^3 for metal dust as Al, 5 mg/m^3 for pyro powders and welding fumes as Al, and 2 mg/m^3 for soluble salts and all types of alkyls as Al.

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ARSENIC

INTRODUCTION

Arsenic is a naturally occurring metalloid which can be present in a number of different valence states and as a constituent in both inorganic and organic compounds. Elemental arsenic is used in industry as an alloying agent; both inorganic and organic arsenical compounds have been used as pesticides.

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

Toxicological information on arsenic has been reviewed by EPA in its ambient water quality criteria document (EPA 1980) and health assessment document (EPA 1984). Acute poisoning of humans with arsenic may result in gastrointestinal effects, hemolysis, and neuropathy. Chronic exposure has characteristic toxic effects on the peripheral nervous system and, in children, on the central nervous system. In humans, keratosis, hyperpigmentation, precancerous dermal lesions, and cardiovascular injury frequently follow chronic exposure to arsenic. Aresenic has been found to be embryotoxic, fetotoxic, and teratogenic in several animal species.

Arsenic induces chromosome aberrations and impairs DNA repair but has not been shown to be a point mutagen. Epidemiological studies have shown that inhalation of arsenic is strongly associated with lung cancer and perhaps with hepatic angiosarcoma, while ingestion has been linked to a form of skin cancer and more recently to bladder, liver, and lung cancer (Tseng et al. 1968, Chen et al. 1986). Although arsenic's potential as a human carcinogen has long been recognized, it is only recently that its carcinogenicity has been demonstrated in animal models.

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

The EPA (1984) has classified arsenic in Group A--Human Carcinogen. This category applies to chemical agents for which there is sufficient evidence of carcinogenicity from animal and human studies.

INGESTION TOXICITY

To estimate the risks posed by ingestion of arsenic, EPA (1980) used the data that Tseng et al. (1968) obtained in Taiwan. Tseng et al. used the Weibull model to relate skin cancer incidence, age, and level of exposure via drinking water. In 37 villages that had obtained drinking water from artesian wells with various elevated levels of arsenic for 45 years, 40,421 individuals were examined for hyperpigmentation, keratosis, skin cancer, and blackfoot disease (in which impaired peripheral circulation leads to gangrene). The local well waters were analyzed for arsenic, and age-specific cancer prevalence rates were found to be correlated with both local arsenic concentrations and age (duration of exposure). Extrapolation to low dose levels yielded a risk of 4.29×10^{-3} associated with lifetime exposure to 10 ug/liter of arsenic in drinking water (EPA 1984). In the same area, Chen et al. (1986) reported an association between bladder, lung, and liver tumors and ingestion of arsenic-contaminated drinking water.

Another recent study (Astolfi et al. 1981) has shown an association between the ingestion of arsenic in drinking water (at concentrations around 1 ppm) and skin cancer. Epidemiological studies conducted in the United States have not yet shown such an association, but the reported studies were generally too insensitive to have shown such an association if it had existed at the predicted magnitude (EPA 1984).

The EPA interim primary drinking water standard for arsenic is 50 ug/liter (CFR 1984). This value was established as a maximum allowable level for arsenic in drinking water by the U.S. Public Health Service in 1942, and it continues to be used in the current EPA regulations (EPA 1985). EPA's

Office of Drinking Water is considering maintaining the present maximum contaminant level of 50 ug/liter for arsenic in municipal drinking water supplies (EPA 1985).

One factor complicating risk assessments for ingested arsenic is possible variation in carcinogenic potency according to the chemical form of arsenic. Trivalent inorganic arsenic compounds are generally more toxic than pentavalent inorganic arsenic compounds or organic arsenic compounds (EPA 1980, 1984). Epidemiological studies of copper smelter workers have often reported that increased lung cancer incidences were associated with exposure to trivalent inorganic arsenic (see below). For this reason, it has been speculated that the CAG unit risk for ingested arsenic may be applicable only to trivalent inorganic arsenic (EPA 1980). However, recent studies have shown that water samples from the area of Taiwan where Tseng et al.'s studies were carried out contain primarily pentavalent inorganic arsenic and no organic arsenicals (EPA 1984). The CAG unit risk is therefore applicable to other circumstances in which pentavalent arsenic compounds are ingested.

INHALATION TOXICITY

The health risks posed by airborne arsenic compounds have been reviewed in considerable detail by EPA (1984), and studies on the carcinogenicity of arsenic compounds were reviewed by the International Agency for Research on Cancer (IARC) in 1980. Risk assessments for exposure to airborne arsenic were presented by OSHA (1983) and EPA (1984). The following summary is based on these reviews and risk assessments and on an extensive review of the primary literature.

It is well established that inhalation of certain arsenic compounds can cause cancer in humans. Several studies of workers in smelters and plants manufacturing arsenical pesticides have shown significant excess rates of death from lung cancer (EPA 1984). The carcinogenic effects of inhaled arsenic have only recently been demonstrated in experimental animals,

using a model that enhanced retention of arsenic in the lung (Ishinishi et al. 1983, Pershagen et al. 1983).

EPA (1984) based its quantitative risk assessment for inhaled arsenic on five studies of three exposed worker populations (Higgins et al. 1982, Lee-Feldstein 1983, Brown and Chu 1982, 1983a,b, Enterline and Marsh 1980, Ott et al. 1974). All five studies showed excess risks of lung cancer that were related to the intensity and duration of exposure and the duration of follow-up (latency). The estimates of unit risk[1] obtained from the five studies were in reasonably good agreement, ranging from 1.25×10^{-3} to 1.36×10^{-2} $(ug/m^3)^{-1}$. EPA omitted the highest value, derived from the study of Ott et al. which was considered least reliable, and calculated the geometric mean for each of the two remaining populations and then an overall geometric mean to obtain a best estimate of 4.3×10^{-3} $(ug/m^3)^{-1}$ for the unit risk.

Given the limitations of the available data on exposure and risk, EPA's procedures appear reasonable, and the consistency of results among the studies is impressive. The figure of 4.3×10^{-3} $(ug/m^3)^{-1}$ is thus an estimate of the unit risk for exposure to the high levels characteristic of the three work environments where the data were obtained. It was not intended to be a "conservative" (upper limit) estimate of risk, but a reasonable upper limit would be the highest value derived from these studies, 1.36×10^{-2} $(ug/m^3)^{-1}$.

The American Conference of Governmental Industrial Hygienists (ACGIH 1986) recommends a time-weighted average Threshold Limit Value (TLV) of 0.2 mg/m^3 for arsenic and soluble compounds of arsenic.

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[1]The unit risk is the risk associated with lifetime exposure to 1 unit (generally 1 mg/kg/day, 1 mg/liter, or 1 ug/m^3) of a substance.

SUMMARY

Arsenic's carcinogenic potential in humans has been amply demonstrated. The quantitative estimates of dose-response relationships derived from Tseng et al. (1968) upon which the EPA assessment was based are concordant with other estimates of arsenic's carcinogenic potency based on inhalation exposure (EPA 1984).

Both unit risks were derived from epidemiological studies and are appropriate for application to human populations exposed to arsenic under comparable circumstances. Neither unit risk is based on a calculation that incorporates important conservative assumptions, except for the assumption of a linear dose-response relationship, which is supported by the data from the occupational studies.

Summary of Arsenic Criteria

EPA carcinogen classification	Group A
Oral carcinogenic potency (q_1*)	15 $(mg/kg/day)^{-1}$
Inhalation carcinogenic potency (q_1*)	50.1 $(mg/kg/day)^{-1}$
Maximum Contaminant Level (MCL)	50 ug/liter
AWQC (concentration associated with a 10^{-6} excess lifetime cancer risk)	
Ingestion of water and aquatic organisms	2.2 ng/liter
Ingestion of aquatic organisms	17.5 ng/liter
Freshwater aquatic life chronic toxicity	0.19 mg/liter

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CADMIUM

INTRODUCTION

Cadmium is an element of the transitional metal series that occurs widely in nature, usually in lead or zinc ores. Elemental cadmium is insoluble in water, although many cadmium salts are quite soluble (EPA 1985 a,b). The general human population is exposed to cadmium in drinking water and food; cigarette smoke also contains high levels of cadmium. Additional inhalation exposure occurs in industrial settings (EPA 1985a,b).

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

The toxicology of cadmium has been reviewed by Friberg et al. (1974), IARC (1976), and EPA (1980, 1981, 1985b,c). Injection of cadmium into laboratory animals results in injection-site sarcomas and testicular tumors of the Leydig cells (EPA 1981). A relationship between human exposure to cadmium and cancer of the prostate, lung, or kidney has been suggested by several epidemiological studies (Thun et al. 1985, EPA 1985b). Cadmium may impair DNA repair but has not been shown to be mutagenic. It is a well-documented animal teratogen.

Cadmium bioaccumulates in mammals, particularly in the kidney and liver (EPA 1981, 1985c). Epidemiological studies have revealed an association between nonmalignant pulmonary diseases and inhalation of cadmium. Renal tubular dysfunction, of which the first sign is proteinuria, occurs at lower levels of oral or inhalation exposure to cadmium and may be the primary defect responsible for the bone damage characteristic of Itai-Itai disease. It is also suspected that chronic exposure to cadmium produces hypertension, anemia, sensory loss (particularly smell), endocrine alterations, and immunosuppression in humans.

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

INGESTION TOXICITY

The maximum contaminant level (MCL) established for cadmium by EPA in its national interim primary drinking water standards and the Ambient Water Quality Criterion for the protection of human health are both 10 ug/liter (EPA 1980, CFR 1984). EPA established the standard for cadmium on the basis of the "generally accepted" estimate of 200 ug/g wet weight of cadmium in the renal cortex as the critical concentration for renal toxicity. Friberg et al. (1974) estimated that daily ingestion of 250-350 ug cadmium over 50 years would result in such renal concentrations. Other more recent reviews suggest that 200 ug/day is an acceptable daily limit for cadmium intake.

The EPA Office of Drinking Water has recently promulgated a proposed Recommended Maximum Contaminant Level (RMCL) of 0.005 mg/liter. The proposed RMCL is based on the estimate of 200 ug/g wet weight of cadmium in the renal cortex as the critical concentration for renal toxicity (Freiberg et al. 1974) and a 25% contribution to daily exposure from drinking water. The proposed RMCL is comparable to the NAS and WHO guidelines of 0.005 mg/liter (EPA 1985a).

Aughey et al. (1984) reported that treatment of male Wistar rats for only 24 weeks with 50 mg/liter cadmium in their drinking water produced clear symptoms of nephritis when the accumulated renal concentration of cadmium was 60 ug/g wet weight. This last concentration is less than one-third the 200 ug/g wet weight identified as the critical level in humans.

Cadmium and some of its compounds are known to be carcinogenic in experimental animals exposed by injection or inhalation, but the carcinogenic effects are absent when cadmium is administered orally (EPA 1985b). It is not known which cadmium compounds are responsible for the inhalation carcinogenic effects in humans.

INHALATION TOXICITY

EPA (1981) has reviewed the health risks posed by airborne cadmium compounds in considerable detail, while studies on the carcinogenicity of cadmium compounds have been reviewed by the IARC (1976). Both reviews were updated by EPA (1985b), which also presented a risk assessment for exposure to airborne cadmium.

Applying the criteria described in EPA's Guidelines for Assessment of Carcinogenic Risk (EPA 1986), cadmium has been classified by EPA (1985a) on the basis of inhalation data in Group B1--Probable Human Carcinogen. This category applies to agents for which there is limited evidence from human studies and sufficient evidence from animal studies (EPA 1984).

The evidence that exposure to airborne cadmium compounds increases the risk of cancer in humans is characterized as limited (IARC 1982, EPA 1985b). Although several studies of exposed workers have suggested that airborne cadmium increases the risk of cancer of the lung or prostate, most of the results have been inconclusive because of small sample sizes, lack of statistical significance, confounding effects of other exposures, or other factors. The most recent study (Thun et al. 1985), however, showed a significant increase in the number of lung cancer deaths (16 observed versus 6.99 expected) among a group of cadmium smelter workers. Although this finding may be somewhat confounded by the effects of smoking and exposure to arsenic, EPA (1985b) concluded that neither of the latter was sufficient to explain the observed effect.

EPA (1985b) based its quantitative risk assessment for inhaled cadmium on the study by Thun et al. (1985). Very scanty information on exposure levels and incomplete information on exposure duration were used to compile a single average measure of cumulative exposure of the exposed workers. This was converted to a lifetime average exposure level. The extent of the deviations of the exposure estimates from the actual exposure is unknown. Use of the lifetime average exposure level in the risk calculations incorporates the questionable assumption that exposure to cadmium at any time

during life would lead to the same increase in lifetime risk of lung cancer. The data were then fitted to a model which assumed that the effect of exposure to cadmium would be to increase the background rate of lung cancer by a factor proportional to the lifetime average exposure level. The selection of this model was arbitrary, in that no information on the dose-response relationship was provided between exposure and induction of lung cancers, and excess risk is likely to be very conservative. The best estimate of the exposure and response of the exposed population gave rise to a "unit risk" estimate of 1.8×10^{-3} $(ug/m^3)^{-1}$. However, because of uncertainties in the estimates of both exposure and response, the range of uncertainties in the unit risk estimate was very wide, ranging from 4.3×10^{-6} to 3.8×10^{-2} $(ug/m^3)^{-1}$. The last figure was obtained by combining "worst case" estimates of all exposure and risk parameters, and probably represents a "worse than worst case" calculation.

Given the severe limitations of the available date, this quantitative risk assessment appears as reasonable as could be achieved. However, the estimate of "unit risk" is extremely uncertain and probably extremely conservative. The study itself is not regarded as fully conclusive in showing any increased cancer risk and at least part of this is attributable to confounding factors. The exposure estimates are very uncertain, the assumption of a linear exposure response relationship is arbitrary, and the extrapolation over a range of 5 orders of magnitude in dose is very tenuous. Thus, the estimate of "unit risk" presented by EPA (1985b) could be inaccurate and is likely to be conservative when applied to general population exposure.

Recent studies have firmly associated inhalation of airborne cadmium with lung cancer in animals. In a bioassay in which male Wistar rats were administered cadmium chloride aerosols 23 hours/day for 18 months at concentrations of 0, 12.5, 25, and 50 ug/m^3, Takenaka et al. (1983) found a highly significant dose-response relationship. The incidence of lung carcinomas was 0/38, 6/39, 20/38, and 25/35 in the four treatment groups. This marked response adds further support to the evidence on the carcinogenicity of inhaled cadmium and justifies the use of Thun et al.'s (1985)

data as the basis for risk assessments of airborne cadmium. Like the injection-site sarcomas and Leydigomas reported in animals (EPA 1985b), these lung carcinomas might be interpreted as carcinogenic responses in the directly exposed tissue only.

The American Conference of Governmental Industrial Hygienists (ACGIH 1986) recommends a time-weighted average Threshold Limit Value (TLV) of 0.05 mg/m^3 for all forms of cadmium dusts and salts and a ceiling limit of 0.05 mg/m^3 for cadmium oxide fume.

SUMMARY

Cadmium has not been demonstrated to be a systemic carcinogen, but it has been shown to be a highly potent pulmonary carcinogen (see Takenaka et al. 1983) and renal effects are associated with ingestion. For inhalation, the unit risk value of 1.8×10^{-3} $(ug/m^3)^{-1}$ is an appropriate basis for risk assessment. This unit risk was derived from epidemiological data and does not incorporate any conservative assumptions (except that the dose-response relationship is linear), but it is subject to a wide range of uncertainty. For ingestion, the calculations upon which the MCL and ambient water quality criterion are based are equally applicable to ingestion via soil or other media. Based on the assessment of Friberg et al. (1974), daily ingestion of 20 ug cadmium (in addition to background exposure via food) would contribute between 6% and 8% of the estimated critical daily intake of cadmium. This intake of 20 ug/day from other than normal dietary sources was intended to provide an ample margin of safety, but Aughey et al.'s (1984) study suggests that it may not be as conservative as originally intended. The EPA Office of Drinking Water has recently promulgated a proposed Recommended Maximum Contaminant Level of 5 ug/liter for cadmium (EPA 1985d). This value is based on a reference dose of 5×10^{-4} mg/kg/day after allowing for contribution to daily exposure by other routes.

Summary of Cadmium Criteria

EPA carcinogen classification	Group B1
Oral chronic allowable intake	5×10^{-4} mg/kg/day
Inhalation carcinogenic potency (q_1^*)	6.1 $(mg/kg/day)^{-1}$
Maximum Contaminant Level (MCL)	10 ug/liter
Proposed RMCL	5 ug/liter
EPA Drinking Water Health Advisories	
Lifetime Health Advisory (HA)	5 ug/liter
Longer-term HA	
Child	5 ug/liter
Adult	18 ug/liter
Shorter-term HA	
10-day HA (child)	8 ug/liter
One-day HA (child)	43 ug/liter
AWQC	
Ingestion of water and aquatic organisms	10 ug/liter
Freshwater aquatic life chronic toxicity	exp(0.7852(ln hardness)-3.490)

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CHROMIUM

INTRODUCTION

Chromium is a steel-grey lustrous metal with the atomic number 24 and an atomic weight of 52 g/mole. It can have a valence of 2, 3, or 6. Chromium is used in stainless and alloy steels, in corrosion-resistant products, in pigments, and as a tanning agent for leather.

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

Chromium is an essential nutrient for normal glucose metabolism, and low level exposure to chromium compounds has not been found to result in systemic toxicity. However, hexavalent chromium (Cr VI) compounds are strong oxidizing agents, a characteristic that explains much of their irritating and toxic properties (EPA 1980). Chronic inhalation of dust or air containing Cr VI in the form of chromic acid or as soluble salts may cause respiratory problems including irritation, perforated or ulcerated nasal septa, and decreased spirometric values. Studies of acute exposure of humans and animals using a variety of routes of administration have indicated that soluble Cr VI and trivalent chromium (Cr III) compounds can produce kidney and liver damage, although the dose levels employed were relatively high. From the evidence available from both human case reports and animal studies, it is uncertain whether the kidneys and liver may be target organs following chronic exposure to chromium compounds. Dermal exposure to chromic acid or chromium VI salts may cause contact dermatitis, sensitivity, and ulceration of the skin (EPA 1984a).

Epidemiological studies of worker populations have clearly established that inhaled Cr VI is a human carcinogen, with the respiratory passages and the lungs as target organs. Convincing evidence for carcinogenicity of Cr VI compounds in animals is not available, except for the induction of sarcomas at the sites of implantation or injection of certain chromium VI salts and chromium trioxide (EPA 1980, 1984a).

Neither chromium III or chromium IV compounds have been shown to be carcinogenic by the oral route. Rats administered chromium III oxide at doses up to 5% of their diet for two years had no increase in tumor rates over control animals (Ivankovic and Preussmann 1975 as cited in EPA 1984a). Dogs given Cr VI as potassium chromate at concentrations of 0.45 to 11.2 mg/liter in drinking water for 4 years had no observed adverse effects (Anwar et al. 1961 as cited in EPA 1984a).

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

The health risks posed by airborne chromium III and chromium VI have been reviewed in considerable detail by EPA (1984b). Studies on the carcinogenicity of chromium compounds were earlier reviewed by the International Agency for Research on Cancer (1980). A risk assessment for exposure to airborne chromium VI was included in the health assessment document by EPA (1984b). The following summary is based in part on these reviews and risk assessments, augmented by review of key primary papers. However, Clement scientists were not able to review the unpublished study by Mancuso (1975) which served as the primary basis for EPA's risk assessment.

EPA (1984b) based its quantitative risk assessment for inhaled hexavalent chromium on an unpublished study by Mancuso (1975). This study, although limited, was judged to be more adequate for risk assessment than three other studies (conducted in Norway, Sweden, and the USSR) which suffered from deficiencies in measurement of exposure, statistical power, and reporting. Mancuso's study showed excess risks of lung cancer in workers exposed to chromates between 1931 and 1937 and followed until 1974. Lung cancer risks increased with duration of exposure and with age. Estimates of cumulative exposure to soluble, insoluble, and total chromium were derived from a single set of industrial hygiene measurements taken in 1949. Smoking habits of the workers were not determined or discussed.

To construct dose-response relationships, EPA (1984b) converted all exposure data into average lifetime ambient concentrations. This is equivalent to assuming that exposure to chromium at any time during life leads to

the same increase in lifetime risk of lung cancer; this assumption is questionable, especially in view of the fact that measures of exposure were available for only one year. The data were fitted to a dose-response relationship of the Weibull type, in which cancer risk is assumed to be proportional to age raised to the kth power and to a second order polynominal $(ad + bd^2)$ in dose d. Fitting the data to observed estimates of age-specific cancer risk and average exposure of the chromate workers, EPA estimated that k was approximately 1.9 and both the linear and quadratic terms in d were significant. At low doses, the term ad dominates the risk calculations, and for lifetime exposure the "unit risk" was calculated to be 1.2×10^{-2} $(ug/m^3)^{-1}$. However, because of small sample size (only 35 observed lung cancer deaths distributed over 9 age-exposure classes), the statistical uncertainty of this estimate was very high (standard deviation = 7 x mean). Expressed in terms of total intake, the cancer potency factor was calculated as 41 $(mg/kg/day)^{-1}$ (EPA 1984b).

Although Mancuso's unpublished study is not available for independent review, EPA's procedures in using the data appear reasonable. However, the results are subject to a wide range of statisitcal uncertainty, in addition to their incorporation of a number of assumptions that are uncertain and/or conservative. EPA suggested that the assumptions made about exposure and the failure to control for smoking might have led to overestimation of risk by a factor of up to 4. The assumption that risk would be proportional to average lifetime exposure introduces additional uncertainties. More important, the linear extrapolation of the dose-response relationship estimated for highly-exposed workers to predict risks of the general population exposure to concentrations about 10^5 times lower is likely to be very conservative. Finally, the unit risk estimate is directly applicable only to persons exposed to chromium compounds similar to those involved in the study by Mancuso. EPA (1984b) stated (without giving details) that trivalent and hexavalent chromium compounds were present in the ratio 6:1, so that the unit risk for hexavalent chromium might be 7 times higher than that estimated for total chromium. Overall, therefore, EPA's estimate of the unit risk for exposure to chromium in ambient air must be characterized as extremely uncertain (primarily because of statistical uncertainty and

uncertainty in measuring exposure) and probably very conservative (primarily because of the wide range of extrapolation, but also because of assumptions about exposure and failure to control for smoking).

Based on exposure via inhalation, the IARC (1982) classified Cr VI as Group 1, human carcinogen. The evidence for the carcinogenicity of Cr III compounds was judged to be inadequate. However, IARC (1980) concluded that the epidemiological data do not allow elucidation of the relative contributions to carcinogenic risk of Cr III or Cr VI or of soluble versus insoluble compounds. EPA classified inhaled Cr VI as Group A--Human Carcinogen and inhaled Cr III as Group D--Not Classified (EPA 1984b, 1984c). Ingested chromium compounds were classified as Group D (EPA 1984d).

Hexavalent chromium's potent carcinogenic effects when inhaled make calculation of subchronic or chronic allowable intakes by inhalation for non-carcinogenic endpoints of toxicity inappropriate (EPA 1984b). For trivalent chromium, a chronic allowable intake (AIC) by inhalation of 0.0051 mg/kg/day was calculated in the Health Effects Assessment for Trivalent Chromium (EPA 1984c). This number was derived from a TLV. The studies used for derivation of the TLV involved workers concomitantly exposed to other dusts and fumes (ACGIH 1986).

For oral exposure to Cr VI, a subchronic allowable intake (AIS) of 0.025 mg/kg/day was derived in the Health Effects Assessment for Hexavalent Chromium (EPA 1984b). The AIS was based on a one-year study in which rats were exposed to 0-25 mg/liter Cr VI as potassium chromate in drinking water. Increased tissue concentrations of chromium, but no adverse health effects were reported at the highest dose (Mackenzie et al. 1958 as cited in EPA 1984b). An oral chronic allowable intake (AIC) of 0.005 mg/kg/day was derived from the same study, with application of an additional safety factor of 5 to adjust for less than lifetime exposure (EPA 1984b).

For oral exposure to Cr III, a subchronic allowable intake of 14 mg/kg/day was established based on a study by Ivankovic and Preussmann (1975 as cited in EPA 1984c). Rats were fed Cr III as chromium oxide at 2% and

5% of the diet for 90 days. A NOAEL of 5% Cr III was suggested, which corresponds to I,399 mg/kg/day based on measured food consumption and body weight. Slightly depressed spleen and liver weights were reported.

For chronic oral exposure to Cr III, the EPA RfD Workgroup identified a risk reference dose (RfD) of 1 mg/kg/day based on the Ivankovic and Preussman (1975) study. Rats were fed chromic oxide baked in bread at dietary levels of 0, 1, 2, or 5%, 5 days/week for 600 feedings (840 total days). No effects due to chromic oxide treatment were observed at any dose levels.

The interim MCL for total chromium under the National Interim Primary Drinking Water Regulations is 0.05 mg/liter. A proposed Recommended Maximum Contaminant Level (RMCL) of 0.12 mg/liter is proposed for total chromium, based on an Adjusted Allowable Daily Intake (AADI) of 0.17 mg/liter with data on human exposure by other routes factored in (0.10 mg/day via the diet and 0 mg/day via air) (EPA 1985).

SUMMARY

Chromium is an essential micronutrient and is not toxic in trace quantities. High levels of soluble Cr VI and Cr III produce kidney and liver damage. Chronic inhalation exposure may lead to respiratory system damage. Epidemiological studies of workers exposed to Cr VI via inhalation demonstrate that it is a human carcinogen. EPA's (1984b) quantitative risk assessment is based upon a single study of a cohort of workers exposed over a six year period and followed for approximately 40 years. Smoking habits were not considered in the study. Assumptions and extrapolations included in the calculations lead to a very wide range of uncertainty in the risk factor. The relative carcinogenic potency of Cr III has not been demonstrated. A Risk Reference Dose (RfD) of 1 mg/kg/day has been established for oral exposure to Cr III. An oral AIC of 0.005 mg/kg/day was derived for Cr VI.

Summary of Chromium Criteria

EPA carcinogen classification (inhalation of Cr VI only)	Group A
Inhalation carcinogenic potency factor (q_1*)	41 $(mg/kg/day)^{-1}$
Oral AIC (Cr VI)	0.005 mg/kg/day
Oral risk reference dose (Cr III)	1 mg/kg/day
Maximum Contaminant Level (MCL) (total Cr)	0.05 mg/liter
Proposed RMCL (total Cr)	0.12 mg/liter

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COPPER

INTRODUCTION

Copper (Cu) is a reddish colored metal with the atomic number 29 and an atomic weight of 63.5 g/mole. It is widely used as a structural metal, particularly when high electrical and thermal conductivity are required. Copper salts are used as fungicides, in ceramics, and for electroplating, and have a wide variety of other industrial uses (ACGIH 1986).

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

Copper is an essential element in human nutrition. A daily copper intake of 2 mg is considered to be adequate for health and normal copper metabolism. The normal daily adult intake of copper from food in the U.S. is reported to range from 2 to 4 mg per day. The reported average intake of copper in youhg children is 1.5 mg per day; the minimum dietary requirement is 0.10 ug/kg of body weight per day (EPA 1985a).

Copper can be absorbed following dermal, oral, or inhalation exposure. The metal is controlled by a homeostatic mechanism and therefore does not tend to bioaccumulate. Elimination of copper occurs primarily through fecal excretion (EPA 1985b).

Toxic effects resulting from acute over-exposure to copper in laboratory animals and humans include gastrointestinal disturbances, hemolytic anemia, renal damage, liver damage, and glucose-6-phosphate dehydrogenase inhibition. Limited data are available on the chronic toxicity of copper; however, chronic over-exposure may cause anemia. Efficient homeostatic mechanisms generally protect mammals from the adverse effects of dietary copper excess. In humans, individuals with Wilson's disease are at additional risk from the toxic effects of copper. Wilson's disease is an inborne error of copper metabolism in which copper accumulates in the liver, brain, and kidney, resulting in hemolytic anemia, neurological abnormalities, and corneal opacities. In

addition, individuals with glucose-6-phosphate dehydrogenase (G6PD) deficiency are likely to be at increased risk to the toxic effects of copper (EPA 1985a).

Ingestion of copper salts by humans can cause salivation, gastrointestinal irritation, nausea, vomiting, gastric pain, hemorrhagic gastritis, and diarrhea. Dermal exposure to copper salts can produce skin irritation and eczema. Ocular contact with copper salts may produce conjunctivitis and corneal lesions. Inhalation of dusts and mists of copper salts may result in irritation of the mucous membranes and pharynx, as well as ulceration and perforation of the nasal septum. A condition similar to metal fume fever has been observed in workers exposed by inhalation to metallic copper dust at concentrations of approximately 0.1 mg/m^3. Metal fume fever is characterized by short-term chills, fever, aching muscles, dryness of throat and mouth, and headache. Extensive industrial experience with copper-welding operations and copper-metal refining suggest that no adverse effects result from exposure to copper fumes at concentrations of up to 0.4 mg Cu/m^3 (ACGIH 1986).

Copper compounds have generally provided negative results in microbial mutation assays. Copper sulfate was observed to increase the frequency of recessive lethal mutations in D. melanogaster at high concentrations. Equivocal results have been obtained from carcinogenicity studies. Administration of copper compounds to mice by subcutaneous injection has been reported to induce tumor formation. Orally-administered copper compounds were not found to increase tumor incidence in several studies (EPA 1985a). There is little evidence in the literature to suggest that copper has a teratogenic effect in either animals or humans (EPA 1980).

The health effects of copper in man and animals are reviewed in more detail by EPA (1980, 1984, 1985b)

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

The International Agency for Research on Cancer (IARC) has not evaluated the carcinogenic potential of copper. Applying the criteria for carcinogenicity as proposed by EPA's Carcinogen Assessment Group, copper is classified in

Group D—Not Classified. This category applies to chemical agents for which there is inadequate evidence of carcinogenicity in animals and humans (EPA 1984, 1986).

EPA has established an Ambient Water Quality Criterion (AWQC) for copper of 1 mg/liter. This level is based on organoleptic data for controlling taste and odor (EPA 1980). It should be noted that organoleptic data have no demonstrated relationship to adverse human health effects. Copper is included in the National Secondary Drinking Water Regulations as a secondary standard of 1.0 mg/liter based upon taste and odor. The World Health Organization (WHO) has not proposed a guideline for copper based upon health effects; however they have proposed a guideline value of 1 mg/liter based upon the ability of copper to stain laundry and plumbing fixtures at concentrations above 1 mg/liter (EPA 1985a). EPA (1985a) has proposed a Recommended Maximum Contaminant Level (RMCL) of 1.3 mg/liter for drinking water. This value is based on the observation that copper exposure at high levels may cause gastrointestinal disturbances and other acute toxic effects.

A one-day drinking water health advisory of 1.3 mg Cu/liter has been established by EPA for both children and adults. This value was derived based on an uncertainty factor of 2 and on results of a human case study in which 5.3 mg was the lowest oral dose at which gastrointestinal effects were observed (Chuttani et al. 1965).

EPA (1984) used the American Conference of Governmental Industrial Hygienists (ACGIH) recommended time-weighted average Threshold Limit Value (TLV) of 1 mg/m^3 (copper dust or mist) to derive a reference dose of 0.71 mg/day for inhalation exposure to copper. A reference concentration can be derived from this value by dividing 0.71 mg/day by the inhalation rate for the average person (20 m^3 in a 24-hour day). The reference concentration for airborne copper is 36 ug/m^3. ACGIH also recommends a time-weighted average TLV of 0.2 mg/m^3 for copper fume.

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FLUORIDE

INTRODUCTION

The fluoride ion is found in igneous and sedimentary rock, soil, surface water, sea water, and air. Sodium fluoride (NaF) is used for drinking water fluoridation and for prevention of dental caries. Sodium fluoride is also occasionally used as an insecticide and wood preservative (EPA 1985a).

PHARMACOKINETICS

The gastrointestinal absorption of fluoride anion has been studied in human volunteers. Subjects consumed 1 mg of fluoride, as sodium fluoride, in 250 ml of water. Maximum plasma concentrations (0.13 to 0.17 ug/liter) were reached within 1 hour. The absorption of fluoride was estimated at 97% of the administered dose (Carlson et al. 1960). In another experiment, volunteers had their normal diets supplemented with sodium fluoride in water, calcium fluoride in water, calcium fluoride in food, bone meal in food, and cryolite in food (McClure et al. 1945). Analysis of fecal excretion indicated that fluoride in bone meal and in mineral cryolite--administered as solids--were less well absorbed than fluoride administered in aqueous solution.

Fluoride is absorbed via the lungs as evidenced by biological monitoring of workers involved in mining and manufacturing operations (NIOSH 1975). No specific figures were found for the extent of lung absorption, although based on the urine measurements, it is an efficient process.

Fluoride is distributed rapidly but does not accumulate in soft tissues. The tissue distributed profile at equilibrium is similar for different routes of absorption. Transport of fluoride in the blood occurs as the free ion and not in a protein-bound form. The target tissues for fluoride accumulation, in decreasing order of retention, are: kidney, lung, aorta, spleen, liver, and heart (IARC 1982). Typically, an increase in fluoride intake results in increased tissue concentrations. When the exposure source responsible for the increased intake is removed, fluoride levels in tissues return to normal

levels within days. Fluoride anion also accumulates in bones and teeth (EPA 1985a).

The principal route of excretion of absorbed fluoride is via the urine (EPA 1985a). The relative ease of elimination of fluoride is attributable to the inefficiency of the human kidney in reabsorbing filtered fluoride.

In warm climates, fluoride excretion via perspiration has been determined to be significant. Overall elimination of absorbed fluoride via perspiration has been measured at 25%-46%, depending on temperature and humidity (McClure et al. 1945).

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

CARCINOGENICITY

There is insufficient evidence available from which to establish that sodium fluoride, and hence fluoride ion, causes or can be reasonably anticipated to cause cancer in humans. Both human epidemiological studies and studies in experimental animals were reviewed in several secondary sources (EPA 1985a,b, Knox 1985, NAS 1977, IARC 1982). After a critical evaluation of the literature, all three groups have concluded that there is no evidence linking fluoride exposure to cancer in humans.

MUTAGENICITY

The mutagenicity of sodium fluoride has been tested in bacterial, yeast, and mammalian test systems. Martin et al. (1979) found that sodium fluoride was nonmutagenic in Salmonella typhimurium and Saccharomyces cerevisiae tested with and without metabolic activation. In mice, fluoride administered in the diet did not increase the frequencies of chromosomal aberrations or sister-chromatid exchanges (Martin et al. 1979, Kram et al. 1978).

Mohamed and Chandler (1976) maintained BALB/C mice on a low fluoride diet (0.26 ppm) and dosed them with 0-200 mg/liter fluoride as sodium fluoride in their drinking water for 3-6 weeks. Cytological studies of bone marrow cells

and spermatocytes showed that even the lowest dose of 1 mg/liter fluoride was able to significantly increase the frequency of chromosomal damage in a dose-dependent manner compared with control groups. The observed abnormalities included translocations, dicentrics, ring chromosomes, and bridges plus fragments or fragments alone.

Jagiello and Liu (1975) observed cytological changes in the chromosomes of cow and ewe ocytes cultured in the presence of up to 100 and 200 mg/liter sodium fluoride, respectively. Chromosomal damage was observed in cultures of mouse oocytes at a concentration of 400 mg/liter. The effects, which included inhibition of division, atresia, and chromosome fragmentation, were not dose related.

TERATOGENICITY/REPRODUCTIVE EFFECTS

There is insufficient evidence available from which to establish that fluoride causes or can be reasonably anticipated to cause teratogenic or reproductive effects in humans. High intraperitoneal doses of stannous fluoride were reported by Stratmann (1979) to cause varying degrees of embryolethality and teratogenicity in mice. The dose administered was greater than or equal to 10 mg/kg body weight. However, this dose is very near a lethal dose of fluoride for mice.

ACUTE/CHRONIC EFFECTS

Leone et al. (1986) administered fluoride (sodium fluoride) intravenously and orally to male white mice and found that the oral LD_{50} was 46 mg/kg fluoride compared with the intravenous LD_{50} of 23 mg/kg.

Chronic fluoride toxicity in humans and cattle primarily involves bones and teeth. In the skeletal system, mild skeletal fluorosis consists of osterosclerosis (increased bone density). Crippling skeletal fluorosis affects all bones but particularly cancellous bones. Lesions consist of thickening of bones, exostoses, periosteal proliferation, and calcification of ligaments particularly of the neck and vertebral column (EPA 1985a,b).

Fluoride affects ameloblasts in the epithelial enamel organ during tooth formation, although the lesions in teeth are permanent. Mild dental fluorosis consists of white opaque areas, covering at least 50% of the tooth surface. In moderate dental fluorosis, a greater proportion of the tooth surface is involved, and the surface may be stained brown. Severe dental fluorosis consists of pitting of enamel, a corroded-like appearance of teeth, and widespread brown to black staining (EPA 1985a,b).

Hodge and Smith (1965) reviewed a number of chronic studies of fluoride ingestion of various species and concluded that histological and functional changes in the kidneys can develop if the drinking water contains more than 100 mg/liter fluoride.

Cardiovascular effects have also been reported following exposure to fluoride. Leone et al. (1956) reported hypertension, electrocardiogram irregularities, and slowing of the heart in dogs following oral doses of 9 mg/kg fluoride.

The beneficial effects of fluorides in humans are reduction in dental caries and stimulation of substituted bone growth in patients with osteoporosis. At therapeutic levels (0.7-2.0 mg/liter), fluorides may also have beneficial effects on the cardiovascular system by decreasing aortic calcification and on the auditory system by stabilizing patients with active otospongiosis (EPA 1985a).

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

Fluoride levels in drinking water of 1 mg/liter are effective in preventing dental caries. Between 1-2 mg/liter, mild dental fluorosis may occur, while moderate to severe dental fluorosis can occur at concentrations above 2 mg/liter. Skeletal fluorosis does not occur in humans consuming drinking water with fluoride concentrations as high as 4 mg/liter. At higher concentrations, a small percentage of individuals may have asymptomatic osteosclerosis; individuals chronically consuming water with fluoride concentrations of 10 mg/liter to 40 mg/liter are at risk of developing crippling skeletal fluorosis (EPA 1985b).

EPA has proposed a drinking water RMCL and MCL of 4 mg/liter to prevent crippling skeletal fluorosis (EPA 1985b,c). In addition, based on the cosmetic and psychosocial effects of dental fluorosis, EPA has recommended a secondary MCL of 2 mg/liter.

The American Conference of Governmental Industrial Hygienists (ACGIH 1986) recommended a time-weighted average threshold limit value of 2.5 mg/m^3 to prevent irritant effects and disabling bone changes of fluoride exposure.

SUMMARY OF FLUORIDE CRITERIA

Current MCL	1.4-2.4 mg/liter (dependent on annual average air temperatures)
Proposed RMCL	4 mg/liter
Proposed MCL	4 mg/liter
Secondary MCL	2 mg/liter

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LEAD

INTRODUCTION

Elemental lead is heavy, ductile, and bluish-white in color, with the atomic number 82 and an atomic weight of 207 g/mole. It is used widely in industry because of its softness, resistance to corrosion and radiation, and high density. Lead is also used as a paint pigment, in solders, and in storage batteries.

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

The following information has been summarized from EPA (1984a). Lead has diverse biological effects in humans and animals. Its effects are seen at the subcellular level of structures and processes as well as at the overall level of general functioning of the body. Considerable data exist on the effects of lead exposure in humans, but the effects are generally related to blood lead levels rather than to estimated exposure.

Absorption of lead from the gastrointestinal tract is estimated at 10-15%. For adult humans, the deposition rate of particulate airborne lead is 30-50%, and essentially all of the lead deposited is absorbed. Respiratory uptake by children appears to be greater on a body weight basis. More than 99% of blood lead in humans is associated with the erythrocytes, but it is the very small fraction of lead transported in plasma and extracellular fluid that provides lead to the various body organs. Lead is stored in the body in bone, kidney, and liver, where it may remain for long periods of time. Lead is primarily excreted by the kidneys into the urine, and lesser amounts are eliminated by biliary excretion (EPA 1984a).

A major problem associated with lead exposure is the ubiquitous nature of the compound. Unlike most other contaminants for which exposure may be related to a specific route or situation, substantial background lead exposure occurs, primarily through food. This background exposure must be considered when additional significant exposure routes are identified.

The major toxic effects caused by exposure to lead are alterations in the hematopoietic and nervous systems. Anemia caused by lead exposure has the following pathogenesis. Heme synthesis is inhibited by the effects of lead on a number of steps in the biosynthetic pathway. Specifically, lead stimulates delta-aminolevulinic acid synthetase (ALA-S) and therefore increases the production of delta-aminolevulinic acid dehydrase (ALA-D) and therefore decreases the production of porphyrobilinogen from ALA; and finally, lead inhibits the incorporation of iron into protoporphyrin to form heme. No threshold has been identified for this effect on heme production. Decreased heme production results in decreased hemoglobin production and anemia. Decreased heme production can also have deleterious effects on other heme-containing proteins, such as cytochrome P450, which detoxify certain chemicals in the body. Impaired heme synthesis has been reported in adults at levels of less than 30 ug/dl lead in the blood (EPA 1984a).

Two types of neurotoxic effects are associated with exposure to lead. Levels of lead in the blood (PbB) of over 80 ug/dl in children and over 100 ug/dl in sensitive adults can cause severe, irreversible brain damage, encephalopathy, and possibly death. Persons with these high levels may be asymptomatic or show only slight signs of intoxication, but rapid deterioration can occur. In children, permanent learning disabilities are seen at these levels, even if there are no overt signs of lead poisoning (EPA 1984a).

Other adverse effects are associated with exposure to low levels of lead. Slow nerve conduction in peripheral nerves has been seen in adults at 30-40 ug/dl blood lead level (PbB); altered testicular function was observed in men with PbB levels as low as 40-50 ug/dl; and renal dysfunction has been associated with PbB levels as low as 40 ug/dl (EPA 1984a).

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

Oral ingestion of certain lead salts (lead acetate, lead phosphate, lead subacetate) have been associated with increased renal tumor frequency in rats (EPA 1985a), but no quantitative estimate of excess cancer risk

has been performed by the Carcinogen Assessment Group of EPA. EPA (1985b) has noted that the available data provide an insufficient basis on which to regulate lead acetate, lead phosphate, and lead subacetate as human carcinogens. However, applying the criteria described in EPA's Guidelines for Carcinogenic Risk Assessment (EPA 1986), these lead salts have been classified by EPA (1985b) in Group B2--Probable Human Carcinogen. This category applies to agents for which there is inadequate evidence from human studies and sufficient evidence from animal studies.

The interim maximum contaminant level (MCL) for drinking water and the ambient water quality criterion are both 50 ug/liter (EPA 1980, CFR 1984). In deriving the ambient water quality criterion, EPA determined that consumption of water contaminated with 50 ug/liter would increase PbB levels to around 15 ug/dl in children. If the population average was 15 ug/dl, the Centers for Disease Control (CDC) calculated that 99% of all children would have a PbB level of less than 30 ug/dl. This was based on a CDC definition of "lead toxicity" in a child as a PbB level greater than or equal to 30 ug/dl and an erythrocyte protoporphyrin (EP) level greater than or equal to 50 ug/dl. Based on this calculation, EPA determined that the present drinking water standard was acceptable as an upper limit. However, based primarily on the new information suggesting that neurological impairment may occur in children at PbB levels of less than 30 ug/dl, CDC has revised its criteria for lead toxicity to PbB levels greater than or equal to 25 ug/dl and EP levels greater than or equal to 35 ug/dl (CDC 1985).

A drinking water recommended maximum contaminant level (RMCL) of 20 ug/liter has been proposed. The proposed RMCL is based upon the health effects of lead in infants as a sensitive subpopulation (EPA 1985b).

The EPA Office of Drinking Water issued a draft health advisory of 20 ug/day for all extended periods of exposure (EPA 1985a). Blood levels above 15 ug/dl were identified as the level of concern, and fetuses and infants under 2 years of age are the sensitive subpopulation. In order to protect the fetus, it was considered advisable to limit the blood lead level in

women of child-bearing age to between 15 ug/dl since studies indicate that the ratio of fetal/maternal blood lead values in close to 1:1 (Hubermont et al. 1978 as cited in EPA 1985a). An absorption constant of 0.16 was identified as the ratio of blood lead in infants to lead intake in the diet (Ryu et al. 1983 as cited in EPA 1985a)

The Clean Air Act National Ambient Air Quality Standard for lead is 1.5 ug/m^3. This standard is currently being evaluated for revision (EPA 1985c).

Acceptable intakes for chronic or subchronic periods of exposure were not calculated for either inhalation or oral ingestion in the Health Effects Assessment Document (EPA 1984b) because the general population is already accruing unavoidable background exposures through food, water, and dust. Any significant increase above background exposure would represent a cause for concern.

At present, human health criteria for lead in soil have not been established in the United States. The United Kingdom Directorate of the Environment has developed a tentative guideline of 550 ppm for lead in soil in residential areas (Smith 1981). Vernon Houk of the Centers for Disease Control has been quoted as indicating that levels of lead in soil of 300-400 ppm are acceptable based on studies of childhood lead poisoning (Mielke et al. 1984).

The American Conference of Governmental Industrial Hygienists (ACGIH 1986) recommends a time-weighted average Threshold Limit Value (TLV) of 0.15 mg/m^3 lead in air.

SUMMARY OF LEAD CRITERIA

EPA carcinogen classification	Group B2
Interim MCL	50 ug/liter
Proposed RMCL	20 ug/liter
Draft HA	20 ug/liter
NAAQS	1.5 ug/m^3
AWQC Freshwater aquatic chronic toxicity	exp(1.266(ln hardness)-4.661)

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MANGANESE

INTRODUCTION

Elemental mangagnese is a grey-white metal resembling iron, with the atomic number 25 and an atomic weight of 55 g/mole. It is a highly reactive metal and can be present in 7 oxidation states. Manganese is often used as an alloy to impart hardness.

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

The toxic effects of manganese have been studied primarily in workers who have inhaled manganese-containing dust (EPA 1984a). Exposure to high levels of manganese causes pneumonitis in exposed workers. Chronic exposure has also been associated with manganism, a progressive neurological disease similar to Parkinson's disease, manifested by speech disturbances, a masklike face, tremors, difficulties in walking, and sexual disturbances (EPA 1984a). Although exposure in the cases of manganism reported by EPA (1984a) was by inhalation, some of the manganese that is inhaled can be removed by mucociliary clearance and consequently swallowed (EPA 1984a) and then becomes available for absorption from the gastrointestinal tract. One case study reported apparent manganism associated with extremely high levels of manganese in a drinking water well, further suggesting that ingestion, as well as inhalation, is an important route of exposure (Kawamura et al. 1941). Chronic exposure to manganese also causes increased production of erythrocytes, with consequent increases in hemoglobin values and erythrocyte counts.

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

EPA (1984b) has established acceptable levels for chronic intake (AIC) for manganese for both the oral and inhalation exposure routes. The derivation of the oral AIC was based upon studies by Leung et al. (1981) and Lai et al. (1982) in which rats were exposed up until 120 days of age to drinking water containing 0, 1, 10, or 20 mg/ml manganese chloride. No adverse effects were observed in rats receiving drinking water containing 1 mg/ml

manganese corresponding to a dose of 22 mg/kg bw/day. Based on these results, an AIC is calculated by multiplying the animal dose by 70 kg (assumed weight of an adult human) and dividing by an uncertainty factor of 100. The resultant AIC is 15.4 mg/day.

The inhalation AIC established by EPA (1984b) was based upon a review of human epidemiological data and a determination of an exposure threshold for manganese of 300 ug/m^3. An AIC of 21 ug/day is derived by assuming the average person inhales 10 m^3 of air during the workday and by expanding exposure from 5 to 7 days/week. An uncertainty factor of 100 is also applied.

The American Conference of Governmental Industrial Hygienists (ACGIH 1986) recommends a ceiling limit of 5 mg/m^3 for manganese dust.

The National Academy of Sciences (NAS 1972) recommended that 0.05 mg/liter soluble manganese not be excedded in public water sources to prevent staining of plumbing fixtures and spotting of laundered clothes.

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NICKEL

INTRODUCTION

Nickel is a lustrous white, hard metal with atomic number 28 and an atomic weight of 58.7 g/mole. It is used in welding, in electroplating, in storage batteries, and in numerous high temperature and corrosion-resistant alloys.

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

The occurrence of statistically significant excesses of nasal cavity and lung cancers in nickel refinery workers has been conclusively demonstrated in a number of epidemiologic studies. It is generally believed that these excess risks are primarily due to inhalation of metallic nickel, nickel subsulfide, nickel oxide, and nickel carbonyl. These conclusions have been supported by observations in experimental animals, and the International Agency for Research on Cancer (IARC) has concluded that it is likely that some forms of nickel are carcinogenic to man by inhalation (IARC 1982). However, because simultaneous exposure to several nickel compounds usually occurs in the workplace, it has been difficult to determine which specific compounds are carcinogenic under these conditions. In addition, there is no evidence that nickel is carcinogenic in humans when ingested, and EPA (1985) does not consider nickel to be carcinogenic by ingestion.

Nickel salts are known to produce allergic contact dermatitis. In this allergic condition, symptoms may develop in 7 to 10 days following exposure to nickel salts. However, nickel dermatitis more frequently develops after several years of continued low exposure (Klaassen and Amdur 1986). Once acquired, nickel sensitivity tends to persist. Sensitized subjects may experience allergic reactions at concentrations between 0.5 and 2 ug/ml nickel (Clayton and Clayton 1981).

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

Applying the criteria described in EPA's Guidelines for Assessment of Carcinogenic Risk (EPA 1986), nickel and certain nickel compounds can be classified in Group A--Human Carcinogen. This category applies to agents for which there is sufficient evidence to support the causal association between human exposure to the agents and cancer.

The Carcinogen Assessment Group (CAG) of the Environmental Protection Agency (EPA) has estimated unit risks for development of cancer associated with inhalation exposure to nickel (EPA 1983). CAG based its unit risk estimates on the results of two epidemiologic studies of nickel refinery workers. These studies (Doll et al. 1977, Pedersen et al. 1973) provide comprehensive documentation of the association between inhalation exposure to nickel and excess risk for cancers of the nasal cavities and lungs, and contain the best data currently available for estimation of inhalation unit risks. EPA (1983) noted that the forms and particulate sizes of nickel compounds in ambient air and in the workplace are likely to be qualitatively different.

Particle sizes of nickel compounds are generally smaller in ambient air than in the occupational environment. Consequently, exposure to these compounds in ambient air in comparison with exposure in the workplace would be likely to result in greater deposition in the lungs than in the nasal cavities. In addition, Pedersen et al. (1973) suggest that the nasal cavity cancers observed among nickel refinery workers are specifically associated with exposure to forms of nickel present in the refineries, but not in ambient air. Accordingly, the rates of lung cancer associated with occupational exposure to nickel may not be appropriate for estimation of the risks associated with exposure to nickel in the general environment. CAG computed the geometric means of the individual unit risks calculated using the Pedersen et al. (1973) and Doll et al. (1977) data. Based on low and high exposure estimates, the composite unit risk ranged from 7.5×10^{-5} to 5.8×10^{-4} $(ug/m^3)^{-1}$, with a midpoint of 3.3×10^{-4} $(ug/m^3)^{-1}$. This value may be used as an upper bound estimate of cancer risk to nonoccupationally exposed individuals.

EPA (1980) established an Ambient Water Quality Criterion (AWQC) of 13.4 ug/liter for the protection of human health from the toxic properties of nickel ingested through water and aquatic organisms, and an AWQC of 100 ug/liter for protecion of human health from nickel ingested through aquatic organisms alone.

The American Conference of Governmental Industrial Hygienists (ACGIH 1986) recommends time-weighted average Threshold Limit Values (TLV) of 1.0 mg/m^3 for nickel metal and insoluble inorganic nickel compounds and 0.1 mg/m^3 for soluble nickel compounds.

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SILVER

INTRODUCTION

Silver is a white, ductile metal which occurs naturally in the environment as metallic silver and as part of mineral compounds. The principal uses of silver are in photographic materials, electric and electronic products, sterling ware, and in alloys and solders. Silver was used extensively in the United States as a therapeutic agent for the treatment of syphilis and other illnesses until 1939. Since then, medicinal use of silver in the United States has declined drastically, probably due to the development of antibiotics (EPA 1985a).

PHARMACOKINETICS

Silver in various forms is absorbed to a limited extent following oral and inhalation exposures. Based on a study in which colloidal silver was administered orally to Wistar rats, the rate of oral absorption was estimated to be between 1 and 3 percent (Dequidt et al. 1974). However, East et al. (1980) determined that about 18% of a single oral dose of 4 mg silver was absorbed by a human patient with argyria (silver poisoning). Immediately following tracheal intubation and exposure for 7 to 15 minutes to 10 to 20 liters of air containing metallic silver aerosol, 17 percent of the administered dose was deposited in the lungs of six female beagle dogs (Phalen and Morrow 1973). In a single dog sacrificed 6 hours after exposure, 3% of the amount initially deposited in the lungs was absorbed and distributed to other parts of the body, primarily to the liver and blood. Silver may be absorbed through broken skin and through mucous membranes, but absorption through intact skin is negligible. Following topical application of silver nitrate to guinea pigs for 5 hours, less than 1% of the substance was absorbed (Wahlberg 1965).

The relative amounts of absorbed silver distributed to various tissues is influenced by the route of exposure. A larger fraction of silver is distributed to the liver following oral administration than following exposure

via other routes. However, once silver reaches the circulatory system, it is distributed, irrespective of route of exposure, to the liver, muscle, bone, spleen, skin, and lungs (EPA 1985a).

Silver is excreted from the liver into the gastrointestinal (GI) tract in the bile, and fecal excretion is the primary elimination pathway (EPA 1985a). Enterohepatic recyling occurs and can lead to the prolongation of the activity of an administered dose.

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

CARCINOGENICITY

Despite the extensive therapeutic use of silver in the past, no evidence of cancer in humans has been reported. However, injection site and implantation site tumors have been induced with silver in laboratory animals. Schmal and Steinhoff (1960) reported in an abstract that colloidal silver injected both intravenously and subcutaneously into rats induced tumors in 8 of 26 rats surviving longer than 14 months. In six of these eight rats, the tumor was located at the site of the subcutaneous injection. In 700 untreated rats, the rate of spontaneous tumor formation was 1 to 3 percent. However, Furst and Schlauder (1977) did not observe injection site tumors in male and female Fischer 344 rats (25 rats per sex) that received monthly intramuscular injections of silver powder for 10 months. The total dose received was 75 mg silver. Injection site sarcomas were observed only in the vehicle control and positive control animals.

TERATOGENICITY

Only very preliminary evidence is available on the potential teratogenicity of silver. Robkin et al. (1973) determined concentrations of silver in dry human liver tissues of 12 anecephalic fetuses, 9 premature infants, 12 fetuses from therapeutic abortions, and 14 fetuses from spontaneous abortions. The concentrations of silver in the tissues of anecephalic fetuses were found to be significantly greater than those in tissues of fetuses from therapeutic or

spontaneous abortions. No information on the teratogenicity or reproductive toxicity of silver in animals was available in the literature reviewed.

ACUTE/CHRONIC TOXICITY

The toxic effects in humans following acute oral exposure to silver include corrosive damage to the GI tract leading to shock, convulsions, and death. The estimated fatal oral dose of silver nitrate for humans is 10 g (Hill and Pillsbury 1939). In animals, acute exposure has been shown to affect the central nervous system and to cause respiratory paralysis (Hill and Pillsbury 1939). In addition, injection of silver nitrate has been observed to induce circulatory disturbances, and lung edema and congestion in animals (EPA 1985a).

Following chronic exposures, the primary effect of silver in humans is argyria, a permanent bluish-metallic discoloration of the skin and mucous membranes. The majority of reported cases of argyria in humans have been observed following therapeutic use of silver.

Human cases of argyria and the doses to which affected individuals were exposed were summarized by Gaul and Staud (1935) and Hill and Pillsbury (1939). In those cases in which patients received therapeutic injections of silver, 30 to 40 injections were received over a period of 2 to 3 years. The lowest total doses of silver found to produce argyria were between 0.9 and 1.5 g. Assuming an 18% absorption by the oral route (East et al. 1980), the total oral dose equivalent to 0.9 to 1.5 g silver administered intravenously is 5 to 8.3 g. Hill and Pillsbury (1939) examined reports of generalized argyria resulting from ingestion of silver salts and concluded that a minimum total dose of silver nitrate associated with argyria was 6 g, equivalent to 3.8 g silver. Based on a case of argyremia (the presence of silver in the blood), Blumberg and Carey (1934) estimated that the total dose of silver necessary to cause argyria was 6.4 g.

East et al. (1980) reported argyria of the face and neck in a 47-year-old female who had taken an unspecified amount of oral antismoking lozenges (each lozenge contained 6 mg silver acetate) for 2.5 years. Symptoms of argyria

appeared after the first 6 months of exposure, and total body silver content at the end of 2.5 years was 6.4 ± 2 g. Body burden at the onset of argyria was estimated by EPA (1985a) to be 1.3 g. Using the oral absorption value of 18% observed in this individual and assuming no other intake, EPA (1985a) calculated total dietary intake in the 6-month period to be 7.2 g.

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

The EPA Office of Drinking Water has developed an adjusted acceptable daily intake (AADI) and a guidance level for silver in drinking water of 90 ug/liter based on the assumption that a 70-kg adult consumes 2 liters of water per day. This value corresponds to an oral reference dose (RfD) of approximately 0.003 mg/kg/day (EPA 1986) and is based on the average RfD calculated from the total oral doses of silver producing argyria in humans, as estimated from case reports. Based on case reports summarized by Gaul and Staud (1935) and Hill and Pillsbury (1939), and reported by Blumberg and Carey (1934) and East et al. (1980), EPA estimated the total doses of silver producing argyria in humans to be 5.6 g, 6.4 g, and 7.2 g. In estimating these values, EPA assumed 18% absorption of ingested silver.

The EPA (1980) adopted the standard proposed by the National Academy of Sciences (NAS 1977) and recommended an ambient water quality criterion (AWQC) of 50 ug/liter for a 70-kg adult ingesting 2 liters of water per day. The NAS standard was based upon a case of argyria after an intravenous injection of 0.9 g silver reported by Hill and Pillsbury (1939). In the calculation of this standard, the NAS (1977) assumed that 50% of ingested silver is deposited and that silver deposits in excess of 1 g would cause argyria. Based on these assumptions, the NAS (1977) and EPA (1980) standards would be protective against argyria for 55 years of exposure.

The current maximum contaminant level (MCL) for silver established under the Interim Primary Drinking Water Regulatory is also 50 ug/liter and was based upon a dose of 1 g silver which could result in argyria (EPA 1985b).

For occupational exposure, the American Conference of Governmental Industrial Hygienists (ACGIH 1986) has recommended a time-weighted average threshold limit value (TWA-TLV) of 0.1 mg/m^3 for silver dust and fumes. A TWA-TLV of 0.01 mg/m^3 is recommended for soluble compounds as silver.

SUMMARY OF SILVER CRITERIA

AADI	90 ug/liter
Oral RfD	0.003 mg/kg/day
AWQC	50 ug/liter
MCL	50 ug/liter

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ZINC

INTRODUCTION

Zinc (Zn) is a silvery metal of low to intermediate hardness, atomic number 30 and atomic weight 65.38 g/mole. Primary uses of zinc in industry are as a component of dry cells and other batteries, in electrogalvanizing, and as alloys. Zinc compounds are used therapeutically as topical astringents, antidandruff products, antiseptics, and emetics.

QUALITATIVE DESCRIPTION OF HEALTH EFFECTS

Zinc is an essential element, and it is present in a number of metalloenzymes, including carbonic anhydrase carboxypeptidase, alcohol dehydrogenase, glutamic dehydrogenase, lactic dehydrogenase, and alkaline phosphatase (Vallee 1959 as cited by Hammond and Beliles 1980). Zinc is necessary for normal growth and development. Human dwarfism and a lack of sexual development have been related to Zn deficiency (Halsted et al. 1974 as cited by Hammond and Beliles 1980).

There is no evidence that zinc is carcinogenic. Studies which have been performed on zinc-containing organics failed to demonstrate teratogenic effects (Stokinger 1981).

Zinc salts of strong acids are astringent and corrosive. Upon ingestion they act as emetics, and they can cause symptoms of fever, nausea, vomiting, stomach cramps and diarrhea.

Zinc chloride is caustic and causes severe and occasionally fatal irritation of the epithelium lining the trachea and bronchi. Acute interstitial fibrosis of the lung occurred in one fatal case following inhalation of $ZnCl_2$ smoke from a smoke generator (Milliken et al. 1963).

Chronic administration of 0.5-34.4 mg zinc oxide per day for periods of 1 month to 1 year failed to produce signs of toxicity in rats

(Drinker et al. 1927 as cited by Stokinger 1981). In another study, 0.1% zinc was tolerated in the diet of rats, but more than 0.5% zinc reduced their capacity to reproduce, and 1% inhibited growth and caused severe anemia and death (Sutton and Nelson 1937 as cited by Stokinger 1981).

Zinc oxide has been implicated as the cause of metal fume fever in industrial situations. Typically, brass foundry workers exposed to fumes containing zinc experience an unusual metallic taste which is accompanied by dryness and irritation of the throat, with coughing and dyspnea, weakness, pains in the muscles and joints, and a high fever which is followed by profuse sweating. Recovery occurs within 24-48 hours after an attack provided exposure is discontinued. Gastrointestinal disturbances and localized dermatitis may also occur after exposure to zinc oxide.

QUANTITATIVE DESCRIPTION OF HEALTH EFFECTS

EPA (1984) derived an inhalation reference dose for zinc of 0.7 mg/day based on the American Conference of Governmental Industrial Hygienists (ACGIH 1980) recommended time-weighted average Threshold Limit Value (TLV) for zinc chloride of 1 mg/m^3. This TLV was adjusted to account for differences in the likely exposure of worker and nonoccupationally-exposed individuals, and was divided by an uncertainty factor of 10 to protect individuals in the general population who might be especially sensitive to the chemical agent. Dividing this reference dose of 0.7 mg/day by the breathing rate of the average person (20 m^3/day) gives a reference concentration for zinc in air of 35 ug/m^3.

An oral reference dose of 14.9 mg/day (0.21 mg/kg/day) was derived by EPA (1984) based on the occurrence of anemia and reduced blood copper in some patients receiving therapeutic doses of approximately 150 mg/day zinc for extended periods of time. A safety factor of 10 was used to protect sensitive individuals.

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APPENDIX 10B
AQUATIC TOXICITY PROFILES

ALUMINUM

TOXICITY TO INVERTEBRATES

In acute toxicity tests, the most sensitive invertebrate is the cladoceran Ceriodaphnia sp.. Under static test conditions using organisms less than 24 hours old, Call (1984) reported an effect concentration (EC_{50}) of 3,690 µg/liter. Studies using Daphnia magna reported EC_{50} values under static test conditions ranging from 3,900 µg/liter (Biesinger and Christensen 1972) to 38,200 µg/liter (Kimball manuscript). The most tolerant invertebrate species is the midge Tanytarsus dissimilis with a larval EC_{50} of 79,900 ug/liter (Lamb and Bailey 1981).

In a chronic life cycle test using D. magna, a maximum acceptable toxicant concentration (MATC) of 1,388 µg/liter was reported (Kimball manuscript). Using the data reported by Kimball, EPA (1986) has calculated an acute-chronic ratio of 28 for D. magna. Anderson (1944) reported incipient immobilization in D. magna following 16 hours of exposure to 21,450 - 21,530 µg/liter aluminum. Biesinger and Christensen (1972) reported a 21-day LC_{50} of 1,400 µg/liter for D. magna. Sixteen percent reproductive impairment was reported in D. magna at a concentration of 320 µg/liter.

TOXICITY TO VERTEBRATES

Most studies regarding toxicity of aluminum to vertebrates were conducted using juvenile fish. The most sensitive vertebrate species is the brook trout Salvelinus fontinalis, with a 96-hour lethal concentration (LC_{50}) of 3,600 µg/liter under flow-through conditions (Decker and Menenez 1974). The green sunfish Lepomis cyanellus is the most tolerant species, with a 96-hour LC_{50} of greater than 50,000 µg/liter under static test conditions (Call 1984).

In an early life stage test using the fathead minnow Pimephales promelas, an MATC of 5,777 µg/liter was reported (Kimball manuscript). EPA (1986) has calculated an acute-chronic ratio of 6.1 for the fathead minnow.

Birge et al. (1978) reported an 8-day EC_{50} of 170 µg/liter based on death and deformity in an early-life-stage test using largemouth bass Micropterus salmoides, a 7-day EC_{50} of 150 µg/liter for the goldfish Carassius auratus, and a 28-day EC_{50} of 560 ug/liter for rainbow trout (Salmo gairdneri). Freeman and Everhart (1971) conducted studies using fingerling rainbow trout. After exposures of 3, 7.5, 32, and 39 days EC_{50} values based on mortality were all within the range of 5,140 ug/liter to 5,230 ug/liter. Following a 44-day exposure period an EC_{50} of 513 ug/liter was reported. In a later study Everhart and Freeman (1973) reported that a concentration of 5,200 µg/liter had no effect on fertility of rainbow trout embryos exposed from fertilization to hatch.

In high altitude Adirondack lakes, survival of stocked trout appears to be determined primarily by aluminum concentration rather than by acidity. Gills appear to be the primary target for aluminum. Exposure of fish to metals such as aluminum results in the formation of a precipitate that coats gill fillaments, impairing respiration and increasing both the frequency and amplitude of respiratory movements (Driscoll et al. 1980). A significant increase in the mean cough rate has been observed in fish exposed to aluminum, with increases observed at concentrations as low as 100 µg/liter (Ogilvie and Stechey 1983). Other pathological changes have also been associated with exposure to alumimum, including brain damage and skin hyperplasia. Extensive necrosis of the liver and severe inflammatory glomerular nephrosis in kidney tissue have also been observed (Hunter et al. 1980).

Birge et al. (1978, 1979) have conducted early-life-stage tests using amphibians. They report a 7-day EC_{50} of 50 µg/liter based on death and deformity for the narrow-mouthed toad Gastrophryne carolinensis, and an 8-day EC_{50} of 2,280 µg/liter based on death and deformity for the marbled salamander Ambystoma opacum.

No measured bioconcentration factors (BCFs) were available, but Chapman et al. (1968) estimated a BCF of 10 for edible portions of freshwater fish.

TOXICITY TO PLANTS

Call (1984) reportrd 4-day EC_{50} values based on biomass of 460 µg/liter and 570 µg/liter for the green algae Selenastrum capricornutum, and a 4-day EC_{50} of greater than 45,700 µg/liter based on reduced frond production for duckweed Lemna minor. Bringmann and Kuhn (1959a,b) reported growth inhibition at 1,500-2,000 µg/liter in Scenedesmus quadricauda in a 96-hour study conducted in river water. DeJong (1965) reported growth inhibition in Chlorella vulgaris following 3-4 months of exposure to 4,000 µg/liter aluminum.

CRITERIA

EPA (1986) has proposed a continuous concentration criterion for aluminum of 150 µg/liter not to be exceeded more than once every 3 years and a 1-hour average concentration criterion of 950 µg/liter not to be exceeded more than once every 3 years.

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TOXICITY TO INVERTEBRATES

The exact mechanisms of arsenic toxicity are not known; however, it is suspected that arsenic may inhibit enzymes (EPA 1984). Acute toxicity values have been reported for both trivalent [As (III)] and pentavalent [As (V)] arsenic. For tests using invertebrates, reported 48-hour effect concentrations (EC_{50} values) for trivalent arsenic in static test conditions range from 812 ug/liter for the cladoceran Simocephalus serrulatus to 97,000 µg/liter for the midge Tanytarsus dissimilis (Call et al. 1983, Lima et al. 1984, Holcombe et al. 1983). Toxicity data for pentavalent arsenic are limited to cladocerans. The lowest reported result is an EC_{50} of 840 µg/liter in static conditions for Bosmina longirostris (Passino and Novak 1984). In static tests, EC_{50} values of 3,600 ug/liter and 49,000 ug/liter have both been reported for Daphnia pulex (Jurewicz and Buikema 1980, Passino and Novak 1984). In life cycle exposure to As (III), a maximum acceptable toxicant concentration (MATC) of 914 µg/liter is reported for Daphnia magna (Call et al. 1983, Lima et al. 1984) No other chronic data for invertebrates were found. Using an LC_{50} of 4,340 µg/liter for D. magna and the MATC of 914.1 ug/liter, an acute-chronic ratio of 4.7 was calculated by EPA (1984).

Cowell (1965) reported a significant population reduction in cladocerans and copepods when exposed to 2,320 ug/liter As (III) for 1 week. In a test using Daphnia magna, reproductive impairment was reported following 3 weeks of exposure to 520 ug/liter As (V) (Biesinger and Christensen 1972).

EPA (1984) reported that arsenic may bioaccumulate in lower forms of aquatic life more readily than in fish. Whole body bioconcentration factors of 3 and 17 [As (III)] and 3 and 6 [As (V)] were reported for the snails Stagnicola emarginata and Helisoma campanulatum, respectively. In Daphnia magna, whole body bioconcentration factors of 10 and 4 were reported for As (III) and As (V), respectively, following a 21-day exposure (Spehar et al. 1980).

TOXICITY TO VERTEBRATES

Rainbow trout (Salmo gairdneri) appear to be the most sensitive vertebrate species to both forms of arsenic. In a 96-hour static test using 2-month-old rainbow trout, acute effects were reported at 10,800 µg/liter of As (V) (Hale 1977). When adult rainbow trout were exposed in static conditions to As (III), a median lethal dose (LC_{50}) of 13,340 µg/liter was reported (Johnson and Finley 1980). In a 96-hour flow-through test using brook trout Salvelinus fontinalis exposed to As (III), an LC_{50} of 14,960 µg/liter was reported. The mosquito fish Gambusia affinis was the most tolerant vertebrate of those reported with an LC_{50} of 49,000 µg/liter (Jurewicz and Buikema 1980).

MATCs from early-life-stage tests using the fathead minnow Pimephales promelas were 3,026 µg/liter for As (III) and 891.6 µg/liter for As (V) (Call et al. 1983, Lima et al. 1984, DeFoe 1982). In another early life stage test, an EC_{50} of 42,100 ug/liter based on death and deformity was reported for the largemouth bass Micropterus salmoides following an 8-day exposure (Birge et al. 1978). For As (III), acute-chronic ratios of 4.7 and 4.9 were determined for the fathead minnow and flagfish Jordanella floridae, respectively. For the fathead minnow, an acute-chronic ratio for As (V) was calculated to be 29 (EPA 1984).

Two studies reporting effects on amphibians were found. For the narrow-mouthed toad Gastrophryne carolinensis in an early life-stage test, an EC_{50} of 40 ug/liter As (III) was reported following a 7-day exposure (Birge 1978). An EC_{50} of 4,450 ug/liter based on death and deformity was reported for the marbled salamander Ambystoma opacum following 8 days of exposure (Birge et al. 1978).

In 28-day exposures, rainbow trout did not concentrate As (III) or As (V) (Spehar 1980). A whole-body bioconcentration factor of 4 was reported for the bluegill when exposed to As (III) for 28 days (Barrows et al. 1980), and a bioconcentration factor of 3 was reported for the fathead minnow when exposed to As (V) for 30 days (DeFoe 1982).

Acclimation of fish to arsenic has been reported. Following exposure to about 0.22 of the lethal level of arsenic, the threshold LC_{50} of arsenic increased by a factor of 1.5 (Rand and Petrocelli 1985).

TOXICITY TO PLANTS

Exposure to As (III) resulted in 100% mortality in three species of alga and a submerged plant at a concentration of 2,320 µg/liter (Cowell 1965). A concentration of 59,200 µg/liter did not kill a significant number of Selanastrum capricornutum cells in 5 days (Richter 1982). Data for As (V) vary significantly. A 14-day EC_{50} of 48 µg/liter was reported for the alga Scenedesmus obliquus (Vocke et al. 1980); 50% growth inhibition at a concentration of 202,000 ug/liter was reported for the alga Chlamydomonas reinhardi (Jurewicz and Buikema 1980). Data regarding bioconcentration in plants were not available.

CRITERIA

In the Ambient Water Quality Criteria Document, EPA (1984) recommended that the 4-day average concentration of dissolved As (III) should not exceed 190 µg/liter more than once every 3 years on the average, and the 1-hour average concentration should not exceed 360 ug/liter more than once every 3 years on the average.

No aquatic life criteria for As (V) have been established because of insufficient data.

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TOXICITY TO INVERTEBRATES

The acute toxic effects of cadmium to invertebrates is well documented. The main factor influencing the acute toxic effect of cadmium is water hardness; toxicity decreases with increasing water hardness. In static tests using tubificid worms, 48-hour lethal concentrations (LC_{50}) ranged from 2,137 µg/liter to 7,921 µg/liter in water with a hardness of 5.3 mg/liter (as $CaCO_3$) (Chapman et al. 1982). The cladocerans Daphnia magna and D. pulex appear to be much more sensitive. The 48-hour effect concentrations (EC_{50}) reported from a static test in which water hardness was measured ranged from 9.9 µg/liter at a water hardness of 51 mg/liter $CaCO_3$ to 63 µg/liter at a water hardness of 197 mg/liter (Chapman et al. manuscript). Spehar and Carlson (1984a,b) conducted static tests in river water at a hardness of 55-79 mg/liter. For the cladoceran Simocephalus serrulatus, a 48-hour EC_{50} of 123 µg/liter was reported. Another study conducted by Bringmann and Kuhn (1959) reported a 48-hour EC_{50} of 100 µg/liter for D. magna in river water. In tests recording water hardness, the most tolerant of the invertebrates was a damselfly with a 48-hour EC_{50} of 8,100 µg/liter at a water hardness of 50 mg/liter $CaCO_3$ (Rehwoldt et al. 1973). An EC_{50} of 28,000 µg/liter was reported for the mayfly Ephemerella grandis. However, water hardness was not specified, and another study at a water hardness of 44 mg/liter $CaCO_3$ using the same test organism reported an EC_{50} of 2,000 µg/liter (Warnick and Bell 1969).

In chronic life-cycle exposures, the cladocerans again were the most sensitive. Maximum acceptable toxicant levels (MATCs) for D. magna ranged from 0.15 µg/liter at a water hardness of 53 mg/liter $CaCO_3$ to 0.44 µg/liter at a water hardness of 209 mg/liter $CaCO_3$ (Chapman et al. manuscript). The snail Aplexa hypnorum was the most tolerant invertebrate, with a life cycle MATC of 5.8 µg/liter at a water hardness of 44 mg/liter $CaCO_3$ (Holcombe et al. 1984). Acute-chronic ratios calculated by EPA (1984) for invertebrates range from 16 for the snail A. hypnorum using studies with a

water hardness of 45.3 mg/liter $CaCO_3$ to 251.9 for the cladoceran Moina macrocopa using studies with a water hardness of 80-84 mg/liter $CaCO_3$.

Whole-body bioconcentration factors for invertebrates range from 164 for the beetle Dytiscidae in a 1-year study (Giesy et al. 1979) to 4,190 for the caddisfly Hydropsyche betteni in a 28-day study (Spehar et al. 1978).

TOXICITY TO VERTEBRATES

Studies of acute toxicity to fish report LC_{50} values ranging from 1 µg/liter for the rainbow trout Salmo gairdneri with static conditions and a water hardness of 34.5 mg/liter $CaCO_3$ (Hughes 1973) to 73,500 µg/liter for the fathead minnow Pimephales promelas with static conditions and a water hardness of 360 mg/liter (Pickering and Henderson 1966). A study in river water with a hardness of 55-79 mg/liter $CaCO_3$ reported a 96-hour LC_{50} of 10.2 µg/liter for rainbow trout (Spehar and Carlson 1984a,b). In static tests in softer water (39-103 mg/liter) LC_{50} values ranged from 1,280 µg/liter to 3,100 µg/liter for the fathead minnow (Spehar and Carlson 1984a,b, Birge et al. 1983).

Two studies were found reporting acute toxic effects of cadmium to the African clawed frog Xenopus laevis. The two 48-hour LC_{50} values were 11,700 ug/liter and 3,200 µg/liter at water hardnesses of 209 and 170 mg/liter, respectively (Slooff et al. 1983, Canton and Slooff 1982).

Cadmium is a dangerous cumulative poison. Chronic poisoning occurs because there is almost no excretion of this metal (NAS 1972). MATCs from early-life-stage tests ranged from 1.653 µg/liter for the chinook salmon Oncorhynchus tshawytscha with a water hardness of 25 mg/liter $CaCO_3$ (Chapman 1975) to 45.92 µg/liter for the fathead minnow Pimephales promelas with a water hardness of 201 mg/liter $CaCO_3$ (Pickering and Gast 1972). For rainbow trout, two 7-day early-life-stage tests were conducted (at a water hardness of 89-107 mg/liter), one after 24 days of acclimation to 5.9 µg/liter of cadmium. The 7-day LC_{50} for unacclimated trout was 700 µg/liter, and the 7-day LC_{50} for the acclimated trout was 1,590 µg/liter. A similar test was also conducted with fathead minnows, except the minnows were acclimated

for only 4 days. The 7-day LC_{50} for the unacclimated minnows was 200 mg/liter, and the 7-day LC_{50} for the acclimated minnows was 540 µg/liter (Birge et al. 1983).

Two studies report early life-stage effects of cadmium on amphibians. For the narrow-mouthed toad Gastrophryne carolinensis at a water hardness of 195 mg/liter $CaCO_3$, a 7-day EC_{50} of 40 µg/liter was reported based on death and deformity (Birge 1978). An 8-day EC_{50} of 150 µg/liter based on death and deformity was reported for the marbled salamander Ambystoma opacum at a water hardness of 99 mg/liter $CaCO_3$ (Birge et al. 1978). Acute-chronic ratios ranging from 0.9 for the chinook salmon to 424 for the bluegill were calculated by EPA (1984).

In a study using channel catfish Ictalurus punctatus and green sunfish Lepomis cyanellus, natural concentrations of cadmium appeared to be greatest in the heart, followed by the gills, kidney, liver, and finally muscle (Mathis et al. 1977)

Whole body bioconcentration factors range from 33 for the rainbow trout (Kumada et al. 1980) after 70 days of exposure to 2,213 for the mosquitofish Gambusia affinis after 180 days of exposure (Giesy et al. 1979). Muscle bioconcentration factors for the brook trout Salvelinus fontinalis range from 3 after a 490-day exposure period to 151 after an 84-day exposure period (Benoit et al. 1976). For the African clawed frog Xenopus laevis, a whole body bioconcentration factor of 130 was reported by Canton and Slooff (1982).

TOXICITY TO PLANTS

Concentrations ranging from 5-3,700 µg/liter of cadmium resulted in reduction in growth for green alga (Giesy et al. 1979; Canton and Slooff 1982). Actual 96-hour EC_{50} values range from 50 mg/liter for Selenastrum capricornutum to 3,700 µg/liter for Chlorella vulgaris (Bartlett et al. 1974, Canton and Slooff 1982). Bringmann and Kuhn (1959) reported that a concentration of 100 µg/liter cadmium caused incipient inhibition in the green alga Scenedesmus quadricauda when exposed for 96 hours in river water. Later studies report incipient inhibition to occur at 310 µg/liter in

laboratory conditions (Bringmann and Kuhn 1977, 1978a,b, 1979, 1980a,b). For duckweed Lemna valdiviana and the fern Salvina natans, a concentration of 10 µg/liter cadmium caused a reduction in the number of fronds (Hutchinson and Czyrska 1972). Data regarding bioconcentration in plants were not available.

CRITERIA

In the Ambient Water Quality Criteria Document, EPA (1984) recommended that the 4-day average concentration of cadmium (in µg/liter) does not exceed the numerical value given by $e^{(0.7852[\ln(\text{hardness})]-3.490)}$ more than once every 3 years on the average and that the 1-hour average concentration does not exceed the numerical value given by $e^{(1.128[\ln(\text{hardness})]-3.828)}$ more than once every 3 years on the average. However, toxicity data indicate that brook trout, brown trout, and striped bass may not be protected by this criterion.

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For the purposes of this assessment, it is assumed that all of the chromium found at the Clear Creek/Central City site is in the hexavalent oxidation state, which is more toxic to aquatic organisms under continuous exposure than the trivalent form.

TOXICITY TO INVERTEBRATES

Studies on acute effects of chromium to invertebrates report 48-hour effect concentrations (EC_{50} values) ranging from 67 µg/liter for the scud Gammarus pseudolimnaeus (EPA 1980) to 59,900 µg/liter for the midge Tanytarsus dissimilis, both under flow-through test conditions (EPA 1980).

No studies on the chronic effects of chromium on invertebrates were found in the literature. A study by Trabalka and Gehrs (1977) reported that at a concentration of 10 µg/liter chromium reduced the life span and fecundity of the cladoceran Daphnia magna. No bioconcentration factors for invertebrates were found. Chromium is considered to be an essential nutrient and is accumulated in a variety of aquatic biota, especially benthic organisms, to levels much higher than in ambient water (EPA 1985).

TOXICITY TO VERTEBRATES

Freshwater fish can regulate chromium over a wide range of ambient concentrations and are much more tolerant to chromium than invertebrates; 96-hour lethal concentrations (LC_{50} values) range from 17,600 µg/liter for the fathead minnow Pimephales promelas in a static test (Pickering and Henderson 1966) to 249,000 µg/liter for the goldfish Carassius auratus in a static test (Dowden and Bennett 1965). In flow-through tests using rainbow trout Salmo gairdneri and brook trout Salvelinus fontinalis, 96-hour LC_{50} values were 67,000 µg/liter and 59,000 µg/liter, respectively (Benoit 1976).

MATCs from two early-life-stage tests using rainbow trout and brook trout were 73 µg/liter and 265 µg/liter, respectively (Sauter et al. 1976, Benoit 1976). In a life-cycle test with brook trout, chronic effects were reported at 265 µg/liter (Benoit 1976). A life-cycle test using the fathead minnow reported chronic effects at 1,990 µg/liter (Pickering 1980). Acute-chronic ratios range from 19 for the fathead minnow to 260 for the rainbow trout (EPA 1984).

Other reported toxic effects include slowed growth for the chinook salmon Onchorhyncus tshawyscha following 4 months of exposure to 16 µg/liter of chromium (Olson and Foster 1956). Inhibition of sodium/potassium-ATPase was reported in rainbow trout after 2 days of exposure to 2,500 µg/liter (Kuhnert et al. 1976). Mortality in rainbow trout was reported following 15 days of exposure to 10,000 µg/liter (Strik et al. 1975). Ellgaard et al. (1978) reported increased locomotor activity in bluegill Lepomis macrochirus following 2 weeks of exposure to 50 µg/liter chromium. For the marbled salamander Ambystoma opacum, an LC_{50} of 2,130 µg/liter was reported for an 8-day exposure of early life stages (Birge et al. 1978).

Bioconcentration factors of 1 for whole body and less than 1 for muscle in the rainbow trout have been reported; however, study durations were only 22 and 30 days, respectively (Buhler 1976, Fromm and Stokes 1962). Calamari et al. (1982) reported a bioconcentration factor of 3.4 for muscle in rainbow trout, calculated for equilibrium based on uptake and depuration rates.

TOXICITY TO PLANTS

Two studies using the green alga Chlamydomonas reinhardi and Selenastrum capricornutum reported reduction or inhibition in growth at concentrations of 10 µg/liter and 45 µg/liter, respectively (Zarafonetis and Hampton 1974, Garton 1973). A 32% inhibition of photosynthesis was reported for an algal community following 25 hours of exposure to 20 µg/liter (Zarafonetis and Hampton 1974). Patrick et al. (1975) reported a bioconcentration factor of 400 for chromium for an algal community after a 1-month exposure period.

CRITERIA

EPA (1984) has established a continuous concentration criterion for chromium (VI) of 11 µg/liter not to be exceeded more than once every 3 years and a 1-hour average concentration criterion of 16 µg/liter not to be exceeded more than once every 3 years.

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TOXICITY TO INVERTEBRATES

Acute toxicity studies report 48-hour effect concentrations (EC_{50}) ranging from 6.5 µg/liter for the cladoceran Daphnia magna in static conditions at a water hardness of 250 mg/liter as $CaCO_3$ (Dave 1984) to 8,300 µg/liter for the stonefly Acroneuria lycorias in static conditions at a water hardness of 40 mg/liter as $CaCO_3$ (Warnick and Bell 1969). In life-cycle exposures to copper, maximum acceptable toxicant concentrations (MATCs) range from 6.006 µg/liter for the scud Gammarus pseudolimnaeus at a water hardness of 45 mg/liter $CaCO_3$ (Arthur and Leonard 1970) to 29.33 µg/liter for D. magna at a water hardness of 104 mg/liter $CaCO_3$ (Chapman et al. manuscript). For these invertebrates, acute-chronic ratios range from 1.023 for D. magna at a water hardness of 104-105 mg/liter $CaCO_3$ to 156.2 for the snail Campeloma decisum at a water hardness of 35-55 mg/liter $CaCO_3$ (EPA 1984). In a life-cycle study of Daphnia ambigua, Winner and Farrell (1976) reported reduced productivity at a concentration of 49 µg/liter. After 16 hours of exposure, an EC_{50} of 38 µg/liter, based on immobilization, was reported for D. magna (Anderson 1944). Biesinger and Christensen (1972) reported reproductive impairment in D. magna at 22 µg/liter following 21 days of exposure. Newly hatched young of the crayfish Orconectes rusticus were reported to survive 17 days following exposure to 125 µg/liter (Hubschman 1967).

TOXICITY TO VERTEBRATES

Toxicity of copper to fish has been well documented. Research indicates that osmoregulatory failure may be the mechanism of acute copper toxicity (Rand and Petrocelli 1985). Water hardness is a major influence on toxicity of copper to fish. As water hardness increases, acute toxicity decreases.

A 96-hour LC_{50} of 10 µg/liter is reported for the chinook salmon Oncorhynchus tshawytscha in a flow-through test at a water hardness of 13 mg/liter as $CaCO_3$ (Chapman and McCrady 1977). In this same study, toxicity

decreased to 130 µg/liter at a hardness of 359 mg/liter $CaCO_3$. The same trend was true for the cutthroat trout Salmo clarki; at a water hardness of 18 mg/liter $CaCO_3$, the reported LC_{50} is 36.8 µg/liter, at a hardness of 70 mg/liter, the LC_{50} is 186 µg/liter, and at a hardness of 205 mg/liter, the LC_{50} is 367 µg/liter (Chakoumakos et al. 1979). For rainbow trout Salmo gairdneri, 96-hour LC_{50} values range from 19.9 µg/liter at a water hardness of 30 mg/liter $CaCO_3$ (Howarth and Sprague 1978) to 890 µg/liter at a water hardness of 290 mg/liter $CaCO_3$ (Calamari and Marchetti 1973). The bluegill sunfish Lepomis macrochirus is the most tolerant of the tested species to copper, with LC_{50} values ranging from 200 µg/liter at a water hardness of 20 mg/liter to 10,200 µg/liter at a water hardness of 360 mg/liter (Tarzwell and Henderson 1960). Spear and Pierce (1979) reported that sunfishes (Centrarchidae) are about 15 times more tolerant of copper than are salmonids and minnows.

MATCs from early-life-stage tests range from 3.9 µg/liter for the brook trout Salvelinus fontinalis at a water hardness of 37.5 mg/liter $CaCO_3$ (Sauter et al. 1976) to 60.4 µg/liter for the northern pike Esox lucius. In a study by McKim et al. (1978), trout MATCs were 12.9 µg/liter, 19 µg/liter, and 30.8 µg/liter for the brook trout (S. fontinalis), rainbow trout (S. gairdneri), and brown trout (Salmo trutta), respectively, at a water hardness of 45.4 mg/liter $CaCO_3$. A life-cycle or partial life-cycle study by Horning and Neihelsel (1979) reported an MATC of 8.8 µg/liter for the bluntnose minnow Pimephales notatus at a water hardness of 194 mg/liter $CaCO_3$. MATCs from life-cycle or partial life-cycle studies on the fathead minnow (P. promelas) range from 14 µg/liter at a hardness of 30 mg/liter $CaCO_3$ (Mount and Stephan 1979) to 28 µg/liter at a hardness of 200 mg/liter $CaCO_3$ (Pickering et al. 1977). EPA (1984) has calculated acute-chronic ratios ranging from 5.4 for the fathead minnow (water hardness = 30-31 mg/liter) to 38 µg/liter for the bluegill Lepomis macrochirus (water hardness = 45 mg/liter). Birge et al. (1980) reported a 28-day EC_{50} of 110 ug/liter based on death and deformity of rainbow trout.

Birge et al. (1978, 1980) and Birge and Black (1979) reported several early-life-stage EC_{50} values for amphibians. EC_{50} values based on death and deformity were reported at a concentration of 40 µg/liter for the narrow

mouth toad Gastrophryne caroliniensis and southern gray tree frog Hyla chrysocselis after exposure periods of 7 days and 7 minutes, respectively. Birge and Black (1979) also reported an 8-day EC_{50} of 50 µg/liter based on death and deformity in the leopard frog Rana pipiens and an 8-day EC_{50} of 770 µg/liter for the marbled salamander Ambystoma opacum.

Data show that acclimation increases tolerance to copper. Continued ingestion of copper in excess of nutritional requirements leads to accumulation, especially in the liver (Rand and Petrocelli 1985). In the bluegill, a muscle bioconcentration factor of 1 was reported following 660 days of exposure to copper (Benoit 1975). A bioconcentration factor of 290 was reported in fathead minnow larva exposed for 30 days (Lind et al. manuscript).

TOXICITY TO PLANTS

Copper is an important trace nutrient in plant metabolism. However, it is known to inhibit photosynthesis and has been widely used as an algicide and herbicide to control aquatic weeds. Concentrations ranging from 1 µg/liter to 8,000 µg/liter have been reported to cause growth inhibition. Chlorella sp. appear to be most sensitive. EC_{50} values based on growth reduction for these species range from 1-550 µg/liter (Steeman-Nielsen and Wium-Andersen 1970). A 7-day EC_{50} of 119 µg/liter was reported for the duckweed Lemna minor (Walbridge 1977). For the aquatic macrophyte Elodea canadensis, a 50% reduction in photosynthetic oxygen production was reported following exposure to 150 µg/liter of copper (Brown and Rattigan 1979). Certain resistant strains of alga have a chelate-excretion mechanism that aids their resistance to copper toxicity (EPA 1984). A bioconcentration factor of 2,000 was reported by Sakaguchi et al. (1977) for the alga Chlorella regularis following 20 hours of exposure to copper. For the alga Chroococcus paris a 10-minute exposure period resulted in a bioconcentration factor of up to 4,000 (Les and Walker 1984).

CRITERIA

In the Ambient Water Quality Criteria Document, EPA (1984) recommended that the 4-day average concentration of copper (in µg/liter) should not exceed

the numerical value given by $e^{(0.8545[\ln(\text{hardness})]-1.465)}$ more than once every 3 years, and the 1-hour average concentration (in ug/liter) should not exceed the numerical value given by $e^{(0.942[\ln(\text{hardness})]-1.464)}$.

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TOXICITY TO INVERTEBRATES

Data regarding toxicity of fluoride to freshwater organisms are extremely limited. Fluoride had no effect on survival of freshwater protozoa and rotifera exposed to up to 450,000 µg/liter for up to 9 days (Wantland 1956). A 48-hour effect concentration (EC_{50}) of 225,000 µg/liter based on cessation of activity is reported for Daphnia sp. (Anderson 1946). A fluoride concentration of 122,000 µg/liter is reported to produce acute toxic effects in Daphnia (Bringmann and Kuhn 1959). A 48-hour lethal concentration (LC_{50}) for fluoride (as cryolite) of 5,000 µg/liter is reported by Sanders and Cope (1966) for Daphnia. These authors also report a 48 hour EC_{50} of 5,000-10,000 µg/liter based on cessation activity for Simocephalus.

TOXICITY TO VERTEBRATES

Neuhold and Sigler (1960) reported an LC_{50} of 75,000-91,000 µg/liter for freshwater carp exposed for up to 480 hours in soft water. They also reported 48- and 240-hour LC_{50} values of 2,700 µg/liter and 4,700 µg/liter respectively for rainbow trout Salmo gairdneri. Summerfelt and Lewis (1967) reported a 5-minute no-effect level (NOEL) of 20,000 µg/liter based on avoidance in the green sunfish Lepomis cyanella.

Herbert and Shurben (1964) reported 5% mortality in rainbow trout exposed for 3 weeks to 4,000 µg/liter in soft water. A fluoride concentration of 8,500 µg/liter, also in soft water, resulted in 50% mortality. However, in a 3 week study in hard water concentrations up to 75,000 µg/liter resulted in no increased mortality. This indicates that water hardness may have an antagonistic effect on fluoride toxicity, possibly by reducing fluoride available for uptake by fish. Trout eggs exposed to 1,500 ug/liter of fluoride during development experienced a 7-10 day delay in hatching (Ellis et al. 1948).

Bioaccumulation of significant amounts of fluoride has been reported in aquatic organisms, primarily in the skeleton (including the gills) and

exoskeleton (NRCC 1977). A bioconcentration factor of 1.3 is reported in trout fillets (Groth 1975). Fluoride concentrations of 450 ppm to 700 ppm have been detected in bone of brown trout Salmo trutta living in a stream with a natural fluoride content of 1-14 ppm (Groth 1975). A whole-body concentration of 10 ppm fluoride wet weight basis is reported in fry of brown trout exposed to 5 ppm fluoride in tap water for 200 hours (Wright 1977).

Only limited data are available regarding toxicity of fluoride to amphibians. For frogs immersed in fluoride-containing water for one week, an LC_{50} of 990,000 µg/liter was reported (Simonin and Pierron 1937). In frogs exposed to 5,000-3,000,000 µg/liter for prolonged periods of time, reduced red and white blood cell counts were observed (Kaplan et al. 1964). Other effects include premature hatching and retarded development in frog eggs kept in well water containing 1,000 µg/liter fluoride (Cameron 1940). Tadpoles kept in water at 500 and 4,500 µg/liter fluoride showed delayed metamorphosis and abnormal thyroid development (Kuusisto and Telkka 1961). Toad eggs and tadpoles kept in water at fluoride concentrations of 13,000-450,000 µg/liter experienced premature hatching, delayed metamorphosis, and retarded development (Kawahara and Kawahara 1971)

TOXICITY TO PLANTS

In the freshwater alga Chlorella, a 37% growth reduction was observed following exposure to 2,000 µg/liter for 48 hours. Exposure to concentrations of 200,000 µg/liter resulted in a 86-99% reduction in growth in Chlorella exposed for 48-72 hours (Smith and Woodson 1965). For Scenedesmus sp., a 4-day LC_{50} of 43,000 µg/liter fluoride (as sodium fluoride) was reported (McKee and Wolf 1963).

Some aquatic plants can accumulate fluoride from waters containing about 1 ppm, but magnification is nowhere near as great as seen in some terrestrial plant species (Groth 1975). Fluoride concentrations of 40.5 ppm was observed in freshwater plants, however, the fluoride content of the water was not reported (Danilova 1944).

CRITERIA

EPA has not established any criteria for fluoride based on protection of freshwater aquatic life. Adequate toxicity data to establish criteria are not available, and further research is necessary to accurately determine the toxic effect of fluoride on aquatic organisms.

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TOXICITY TO INVERTEBRATES

Data regarding the effects of lead on aquatic invertebrates are limited. In acute studies using invertebrates, 48-hour effect concentrations (EC_{50}) range from 124 µg/liter for the scud Gammarus pseudolimnaeus under flow-through test conditions at a water hardness of 46 mg/liter as $CaCO_3$ (Spehar et al. 1978) to 71,000 µg/liter for the snail Goniobasis livescens at a water hardness of 154 mg/liter $CaCO_3$ (Cairns et al. 1976). For the cladoceran Daphnia magna, 48-hour EC_{50} values of 450, 612, 952, and 1,910 µg/liter have been reported in static-renewal tests at water hardnesses of 45, 54, 110, and 152 mg/liter $CaCO_3$, respectively (Biesinger and Christensen 1972, Chapman et al. 1980).

In chronic life-cycle exposures using D. magna maximum acceptable toxicant concentrations (MATCs) of 12, 119, and 1,288 µg/liter were reported at water hardnesses of 52, 102, and 151 mg/liter $CaCO_3$, respectively (Chapman et al. manuscript). Borgman et al. (1978) reported a MATC of 25 µg/liter for the snail Lymnea palustris at a water hardness of 139 mg/liter $CaCO_3$. EPA (1980) has calculated acute-chronic ratios of 8, 15, and 51 for D. magna.

Spehar et al. (1978) reported whole-body bioconcentration factors following 28 days of exposure for three invertebrate species: 499 for the caddisfly Brachycentrus sp., 738 for the snail Physa integra, and 1,120 for the stonefly Petronarcys dorsata. After 120 days of exposure, a whole body bioconcentration factor of 1,700 was reported for the snail Lymnea palustris (Borgmann et al. 1978).

TOXICITY TO VERTEBRATES

The primary mechanism of acute toxicity of lead in fish is unknown. Acute toxicity data indicate that vertebrate species are much less sensitive to lead than are invertebrates. Data indicate a relationship between hardness and acute toxicity; toxicity decreases as hardness increases. At a water hardness

of 20-28 mg/liter $CaCo_3$, 96-hour LC_{50} values range from 1,170 µg/liter for the rainbow trout Salmo gairdneri to 31,500 µg/liter for the goldfish Carassius auratus. In harder water (360 mg/liter $CaCO_3$), LC_{50} values for three species were similarly high: 470,000 µg/liter for the rainbow trout, 482,000 µg/liter for the fathead minnow Pimephales promelas, and 442,000 µg/liter for the bluegill Lepomis macrochirus (Pickering and Henderson 1966, Davies et al. 1976).

Two studies report effects of lead on amphibians. In a study using the marbled salamander Ambystoma opacum, Birge et al. (1978) reported an 8-day LC_{50} of 1,450 µg/liter at a water hardness of 99 mg/liter $CaCO_3$. A concentration of 100 µg/liter resulted in mortality for the frog Rana pipiens following 30 days of exposure (Kaplan et al. 1967).

Sublethal lead poisoning in vertebrates is characterized by neurological defects, kidney dysfunction, and anemia (Rand and Petrocelli 1985). MATCs from early-life-stage tests range from 19 µg/liter for the rainbow trout at a water hardness of 128 mg/liter to 174 µg/liter for the white sucker Catostomus commersoni at a water hardness of 38 mg/liter (Davies et al. 1976, Sauter et al. 1976). Acute-chronic ratios of 49, 62, and 259 have been calculated for the brook trout Salvelinus fontinalis, rainbow trout, and bluegill, respectively (EPA 1980).

The presence of lead can result in inhibition of ALAD activity. ALAD is an enzyme involved in red blood cell metabolism. Concentrations of 10 µg/liter and 470 µg/liter have been reported to have this inhibiting effect on red blood cells in rainbow trout and the goldfish Carassius auratus following 14 days of exposure at a water hardness of 135 mg/liter $CaCO_3$ (Hodson et al. 1977).

Two studies reporting bioconcentration factors were available. Holcombe et al. (1976) reported a whole body bioconcentration factor of 42 in 3-month-old embryos of brook trout. In a field study using the natural population in a small lake, a whole body bioconcentration factor of 45 was reported for the bluegill (Atchison et al. 1977).

In a 38-week study, lead concentrations were measured in various fish tissues (Holcombe et al. 1976). There was no substantial accumulation in muscle. When the fish were transferred to uncontaminated water, the lead concentrations in tissues dissipated, indicating that lead excretion occurs. After 2 weeks, residues were lower in the gill and kidney but higher in the liver. After 12 weeks, lead levels were significantly reduced in all three tissues. Accumulation has been reported to occur in the liver of the mummichog Fundulus heteroclitus, a saltwater species, and winter flounder Pseudopleuronectes americanus, and in the blood of rainbow trout, brook trout, goldfish, and pumpkinseed (Lepomis gibbosus). Accumulation has also been found in the kidney, spleen, and blood of rainbow trout (Rand and Petrocelli 1985). A dietary deficiency of calcium appears to increase the storage of lead in the tissue, possibly because of redistribution of lead from storage in bone. In addition, lead may be actively transported to the gall bladder. In embryological studies, data indicate that lead accumulates in the embryo membrane and not in the embryo itself (Rand and Petrocelli 1985).

TOXICITY TO PLANTS

A study by Monahan (1976) reported that a concentration of 500 µg/liter resulted in 35-53% growth inhibition in the algae Scenedesmus sp., Selenastrum sp., and Chlorella sp.. Other reported effects include a 50% reduction of $^{14}CO_2$ fixation in the algae Anabaena sp. and Chlamydomonas sp. following exposure to lead concentrations ranging from 15,000 µg/liter to 26,000 µg/liter (Malanchuk and Gruendling 1973). No residue data were available for plants. However, Rand and Petrocelli (1985) reported that very high lead concentrations can occur in benthic algae. Their ability to grow in this condition is attributable to the fact that virtually all lead assimilated by cells is bound to cell walls and membranes (Rand and Petrocelli 1985).

CRITERIA

EPA (1985) has established the Ambient Water Quality Criteria for lead incorporating the antagonistic effect of water hardness on lead toxicity. The 4-day average concentration criterion (in µg/liter) is the numerical value given by the equation $e^{(1.266[\ln(\text{hardness})]-4.661)}$ more than once every 3

years. The 1-hour average concentration criterion (in µg/liter) is the numerical value given by the equation $e^{(1.266[\ln(\text{hardness})]-1.416)}$ more than once every 3 years on the average.

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Data concerning toxicity of manganese to freshwater organisms are extremely limited. Manganese is a micronutrient for both animals and plants; in plants it serves as an enzyme activator. Manganese is not highly toxic to freshwater organisms, in fact it is reported to stimulate growth of certain microorganisms in reservoirs and municipal water supplies when present in concentrations above 100 µg/liter.

TOXICITY TO INVERTEBRATES

For Daphnia magna the threshold concentration of manganous chloride is reported to be 50,000 µg/liter (McKee and Wolf 1963). No other data regarding toxic effects of manganese on invertebrates were available.

A bioconcentration factor of 1,300 is reported for the freshwater snail Physa sp. in a shallow freshwater pond (Mathis et al. 1977).

TOXICITY TO VERTEBRATES

A concentration of 12,000 µg/liter of manganous chloride was reported to be fatal to the minnow Fundulus sp. following 6 days of exposure. However, data for other freshwater fish indicate that this value may be exceptionally low. For the fish Orizias sp., the 24-hour LC_{50} was 7,850,000 µg/liter, and for other fish, it is reported to be 5,500,000 uµ/liter. Toxic effects for manganous chloride have been observed at 330,000 µg/liter, but mortality did not occur until 800,000 µg/liter.

Manganese in the form of manganese difluoride has a reported 48-hour LC_{50} of 500,000 µg/liter for freshwater tench Tinca tinca. As manganese nitrate, the minimum lethal concentration for sticklebacks in tap water is reported to be 40,000 µg/liter. Forty-eight hours was the average survival time at a concentration of 150,000 µg/liter. Toxicity of manganese sulfate to fish has reported to occur at a concentration of 500,000 µg/liter, but mortality

did not occur until 1,000,000 µg/liter (McKee and Wolf 1963). No other data concerning toxicity to vertebrates were found in the literature.

In a study using channel catfish Ictalurus punctatus and green sunfish lepomis cyanellus, natural concentrations of manganese appeared to be greatest in the heart, followed by the gills, kidney, liver, and finally muscle (Mathis et al. 1977). Although no measured bioconcentration factors (BCF) for fish were identified, Chapman et al. (1968) estimated a BCF of 25 for edible portions of freshwater fish.

TOXICITY TO PLANTS

No data are available concerning toxicity of manganese to aquatic plants. Bioaccumulation of manganese is reported to occur in freshwater algae (Stokes et al. 1985).

CRITERIA

No freshwater criteria have been established for manganese. McKee and Wolf (1963) suggest that 1,000 µg/liter is not deleterious to fish and aquatic life.

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TOXICITY TO INVERTEBRATES

The acute toxicity of nickel to nine invertebrate species has been reported by EPA (1986). Under comparable water hardness conditions (40 to 45 mg $CaCO_3$/liter), the reported median lethal or median effective concentrations (LC_{50} or EC_{50}) of nickel in static test conditions range from 51 µg/liter in the cladoceran, Daphnia magna (Biesinger and Christensen 1972) to 33,500 mg/liter in the stonefly, Acroneuria lycorias (Warnick and Bell 1969). The acute toxicity of nickel to invertebrates generally decreases with increased water hardness. In Daphnia magna, for example, acute toxicity values range from 510 µg/liter in soft water, as reported above, to a value of 4,970 µg/liter in hard water (Chapman et al. manuscript).

Similarly, the chronic toxicity of nickel is influenced by water hardness. Chronic toxicity values derived from life-cycle tests with Daphnia magna ranged from 14.8 µg/liter in soft water to 357 µg/liter in hard water (Chapman et al. manuscript). The acute-chronic ratios of nickel calculated by EPA (1986) based on these studies and available acute data are between 122 (soft water) and 14 (hard water).

EPA (1986) calculated bioconcentration factors between 100 and 192 in Daphnia magna.

TOXICITY TO VERTEBRATES

Nickel toxicity in vertebrates also decreases with increasing water hardness. In fathead minnows (Pimephales promelas), for example, acute toxicity values range from 4,580 µg/liter in soft water to 44,500 µg/liter in hard water (Pickering and Henderson 1966). In acute toxicity tests conducted under similar water hardness conditions (20 to 26 mg $CaCO_3$/liter), reported LC_{50} values range from 2,480 µg/liter in rock bass (Ambloplites rupestris) (Lind et al., manuscript) to 9,820 µg/liter in goldfish (Carassius auratus) (Pickering and Henderson 1966).

Data on the chronic toxicity of nickel to aquatic vertebrates are limited, but Pickering (1974) reported a chronic toxicity value of 527 µg/liter (at a water hardness of 210 mg $CaCO_3$/liter) in fathead minnows (Pimephales promelas) exposed to nickel for a lifetime. Based upon this chronic toxicity value and a mean acute toxicity value of 26,500 µg/liter (at a water hardness of 210 mg/liter), EPA (1986) calculated an acute-chronic ratio of 53 for nickel in hard water. Using the results derived by Lind et al. (manuscript) from early life-stage tests of fathead minnows and nickel in soft water, EPA (1986) also calculated a chronic value of 217 µg/liter, and an acute-chronic ratio of 24.

Nickel has been observed to adversely impact early life-stage success in carp (Cyprinus carpio) and rainbow trout (Salmo gairdneri). Blaylock and Frank (1979) reported a significant increase in abnormal carp larvae hatched from eggs exposed to nickel concentrations of 3 ppm or greater for 72 hours immediately following fertilization. Hatching success (number of eggs hatched) also decreased at concentrations of 7 ppm or more. Nebeker et al. (1985) examined early life stage sensitivity in rainbow trout and identified no-observed-effect-levels (NOELs) for early life-stage exposure. Newly fertilized eggs were the most sensitive to nickel exposure with a NOEL of 35 µg/liter, followed in sensitivity by eyed eggs and larval fish, each with a NOEL of 134 µg/liter.

A maximum bioconcentration factor of 106 was identified for fathead minnows exposed for 30 days to nickel at a concentration of 21 µg/liter (EPA 1986).

TOXICITY TO PLANTS

Nickel has been observed to reduce growth in several species of freshwater algae at concentrations between 100 and 700 ug/l (Hutchinson 1973, Hutchinson and Stokes 1975). Wang and Wood (1984) tested six strains of algae and one Euglena species for their sensitivity to nickel toxicity and for their ability to bioaccumulate nickel. The cyanobacteria tested were found to be more sensitive to nickel toxicity than the green algae or the Euglena species. Wang and Wood (1984) also reported concentration factors for the species study that ranged from 0 to $3x10^3$ and varied significantly with pH. Most strains

tested accumulated nickel optimally at approximately pH 8.0. EPA (1986) reported a bioconcentration factor (BCF) of 9.8 for green algae exposed for 6 days to nickel at a concentration of 1,000 µg/liter. The pH of the test solution was not specified. Bioconcentration in water hyacinths (Eichhornia crassipes) exposed for 12 days to nickel concentrations of 1,000 to 8,000 µg/liter ranged from 256 to 438 in the roots and 174 to 576 in the tops of the plants (EPA 1986).

CRITERIA

For total recoverable nickel, EPA (1986) has proposed an ambient water quality criterion (in µg/liter) for protection of freshwater aquatic life equal to the numerical value given by $e^{(0.8460\ [\ln(\text{hardness})]+1.1645)}$ as a 4-day average not to be exceeded more than once every 3 years. The 1-hour average concentration (in µg/liter), derived using the guidelines, should not exceed the numerical value given by $e^{(0.8460[\ln\ (\text{hardness})]+3.3612)}$ more than once every 3 years.

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TOXICITY TO INVERTEBRATES

The EPA (1980a) has reported values for the acute toxicity of silver in four freshwater invertebrate species. Median lethal or median effective concentrations (LC_{50} or EC_{50}), derived under similar test conditions, were reported to range from 0.25 µg/liter in Daphnia magna (Chapman et al. manuscript) to 4,500 µg/liter in the scud (Gammarus pseudolimnaeus) (EPA 1980b). The data indicate that the acute toxicity of silver decreases with increasing water hardness. However, no definitive relationship between water hardness and chronic toxicity has yet been established. Based upon data obtained from life-cycle studies in Daphnia magna, chronic toxicity values ranging between 2.6 and 29 µg/liter have been reported (Nebeker et al. manuscript). EPA (1980a) calculated an acute-chronic ratio of 2.0 for silver based upon average acute and chronic toxicity values obtained under similar test conditions.

EPA (1980a) also reported bioconcentration factors (BCF) for three invertebrate species. The maximum BCF for each species was 15 in the stonefly, Claasenia sabulosu, 170 in the stonefly, Pteronarcys californica, and 240 in the mayfly, Ephemerella grandis.

TOXICITY TO VERTEBRATES

Median lethal concentrations (LC_{50}) in freshwater fish have been reported to range from 3.9 µg/liter in fathead minnows (Pimephales promelas) in soft water (Goettl and Davies 1978) to 280 µg/liter in rainbow trout in hard water (Lemke, manuscript). Following longer-term exposure, silver has been shown to significantly reduce growth and survival in rainbow trout (Salmo gairdneri) (Davies et al. 1978). EPA (1980a) derived a chronic toxicity value for silver of 0.12 µg/liter in rainbow trout and an acute-chronic toxicity ratio of 54.

There is little information on the bioconcentration of silver in vertebrate species. EPA (1980a) reported a bioconcentration factor of less than one for

blue gills (Lepomis macrochirus) exposed to silver during a 20-day test. Chapman (1968), however, estimated a bioconcentration factor of 3,080 for edible portions of freshwater fish.

TOXICITY TO AQUATIC PLANTS

Silver has been observed to cause adverse effects in freshwater plants at concentrations ranging from 30 to 7,500 µg/liter (EPA 1980b). Toxic effects often involve lethality, or inhibition of growth or biochemical function. Stokes et al. (1973) found that 30 µg/liter of silver inhibited the growth of Chlorella vulgaris, with complete inhibition at 100 µg/liter, and Brown and Rattigan (1979) observed inhibition of oxygen evolution in Elodea canadensis at silver concentrations of 100 µg/liter.

Data regarding bioconcentration in plants were not available.

CRITERIA

In the Ambient Water Quality Criteria Document, EPA (1980a) recommended that the concentration (µg/liter) of total recoverable silver should not exceed the numerical value given by $e^{(1.72[\ln(\text{hardness})]-6.52)}$ at any time. The available data indicate that chronic toxicity to freshwater aquatic life may occur at concentrations as low as 0.12 ug/liter.

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TOXICITY TO INVERTEBRATES

Studies on acute effects of zinc to invertebrates report 48-hour effect concentrations (EC_{50}) ranging from 100 µg/liter for the cladoceran Daphnia magna at a water hardness of 45 mg/liter $CaCO_3$ (Biesinger and Christensen 1972) to 58,100 µg/liter for a caddisfly at a water hardness of 50 mg/liter $CaCO_3$ (Rehwoldt et al. 1973). Toxicity to the snail Physa heterostropha decreased as water hardness increased under static conditions (Cairns and Scheier 1958). The 48-hour EC_{50} values range from 600 µg/liter at a hardness of 41 mg/liter $CaCO_3$ to 4,400 µg/liter at a hardness of 178 mg/liter $CaCO_3$. Results reported by Chapman et al. (manuscript) show similar trends.

In life-cycle studies using D. magna the maximum acceptable toxicant concentrations (MATCs) indicated that there was no inverse relationship between chronic toxicity and water hardness. MATCs of 47, 47, 85, and 136 µg/liter were reported at water hardnesses of 104, 211, 45, and 52 mg/liter $CaCO_3$, respectively (Biesinger and Christensen 1972, Chapman et al. manuscript). Acute-chronic ratios calculated by EPA (1980) range from 1.2 to 14.

Reports by Cairns et al. (1976) indicated that in addition to the relationship between hardness and acute toxicity, there also may be a correlation between water temperature and zinc toxicity. At temperatures of 5^{o}, 10^{o}, 15^{o}, and $25^{o}C$, 48-hour LC_{50} values were 2,300, 1,700, 1,100, and 560 µg/liter, respectively, for D. magna at a water hardness of 45 mg/liter $CaCO_3$.

TOXICITY TO VERTEBRATES

Freshwater fish can regulate zinc over a wide range of ambient concentrations. A 96-hour LC_{50} of 90 µg/liter for both rainbow trout Salmo gairdneri under static renewal test conditions at a water hardness of 20

mg/liter $CaCO_3$ (Garton 1972), and cutthroat trout S. clarki also under static renewal test conditions (water hardness not specified). Rabe and Sappington (1970) showed trout to be among the most sensitive of the vertebrate species. The most tolerant species is the fathead minnow Pimephales promelas, with a 96-hour LC_{50} of 35,500 µg/liter under flow-through test conditions at a water hardness of 200 mg/liter $CaCO_3$ (Mount 1966). MATCs based on life cycle, partial life cycle, or early-life stage tests for vertebrates range from 47 µg/liter for the flagfish Jordanella floridae at a water hardness of 44 mg/liter $CaCO_3$ (Spehar 1976) to 852 µg/liter for the brook trout Salvelinus fontinalis at a water hardness of 45 mg/liter $CaCO_3$ (Holcombe et al. 1979). In an early-life-stage test on rainbow trout, a MATC of 277 µg/liter was reported at a water hardness of 26 mg/liter $CaCO_3$ (Sinley et al. 1974).

Chapman (1978) compared LC_{50} values for zinc-acclimated and nonacclimated sockeye salmon Oncorhyncus nerka. Following 115 hours of exposure to zinc, the LC_{50} for the nonacclimated salmon was 447 µg/liter; the LC_{50} for the zinc-acclimated salmon was greater than 630 µg/liter (both at a water hardness of 53 mg/liter $CaCO_3$). Acute-chronic ratios for vertebrate species range from 0.26 for the chinook salmon Oncorhyncus tshawytscha to 32 for the flagfish Jordanella floridae (EPA 1980).

Acute toxicity of zinc is influenced by hardness and pH. No chronic studies of zinc in hard water have been found; however, EPA (1980) indicates that chronic toxicity may not be affected by hardness (Rand and Petrocelli 1985).

A whole body bioconcentration factor of 432 was reported for the flagfish following 100 days of exposure (Spehar et al. 1978).

TOXICITY TO PLANTS

For aquatic plants, reported toxicity values range from a 7-day EC_{50} of 30 µg/liter based on incipient growth inhibition in the alga Selenastrum capricornutum (Bartlett et al. 1974) to a 28-day LC_{50} of 67,700 µg/liter for the duckweed Lemna minor (Brown and Rattigan 1979).

Data regarding bioconcentration factors in plants were not available.

CRITERIA

EPA (1986) has proposed an ambient water quality criterion for zinc (in µg/liter) for protection of freshwater aquatic life equal to the numerical value given by $e^{(0.8195[\ln(\text{hardness})]+0.6881)}$ as a 4-day average not to be exceeded more than once every 3 years. The 1-hour average concentration criterion (in µg/liter) derived using the guidelines, should not exceed the numerical value given by $e^{(0.8195[\ln(\text{hardness})]+0.7871)}$ more than once every 3 years.

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APPENDIX 10C
ESTIMATED SOIL INGESTION RATES
FOR USE IN RISK ASSESSMENTS

APPENDIX 10 C

ESTIMATED SOIL INGESTION RATES FOR USE IN RISK ASSESSMENTS

SUMMARY

Assessing the risks to human health posed by contaminants present in soil often requires some information on likely soil ingestion rates. Several authors have attempted to estimate these rates, but their estimates were based primarily on limited information about the amount of soil that people get on their hands and assumptions about mouthing behavior. However, some empirical data on soil ingestion rates have recently become available. These data can be used to derive more accurate estimates of soil ingestion rates for use in risk assessments. Estimates of the most probable soil ingestion rates range from 20 to 100 mg/day, depending on the age of the individual at risk. Realistic worst-case estimates unlikely to underestimate exposure range from 100 to 500 mg/day. A value of 5,000 mg/day is considered a reasonable worst-case estimate for children with habitual pica.

Exposure is a function of both the quantity of contaminants with which one comes into contact and the duration of that contact. Therefore, the frequency of exposure is also important in determining annual exposure rates and, consequently, the risks posed by contaminated soil. This factor can only be assessed on a site-specific basis. For sites where residential areas are contaminated, exposure should be considered to be year-round. Of course, people in warmer climates will spend more time outdoors and will be exposed to larger amounts of soil than people in areas that are covered with snow for much of the year. These factors should be considered at least qualitatively in assessing exposure. In situations where contact with contaminated soil is likely to be infrequent, the exposure frequency should be estimated.

INTRODUCTION

Scientists attempting to evaluate the risks posed by contamination at a hazardous waste site must generally examine several routes of exposure. Those usually considered of most concern are:

- o Ingestion of contaminated drinking water,
- o Ingestion of contaminated fish and shellfish, and
- o Inhalation of airborne contaminants.

These are probably the most significant routes of exposure to chemicals that are mobile in the environment. However, exposure via other routes may pose significant risks, particularly for contaminants that are quite toxic but not very mobile (e.g., polychlorinated biphenyls (PCBs), tetrachlorodibenzo- p-dioxin (TCDD), and some heavy metals). Exposure parameters such as liters of water consumed per day or cubic meters of air breathed per day have been fairly well defined for the more common routes of exposure. However, only limited work has been done to estimate these parameters for other pathways. This paper will address a potentially significant route of exposure to relatively immobile hazardous materials in contaminated soil, namely, ingestion.

PREVIOUS ESTIMATES OF SOIL INGESTION RATES

Exposure to contaminants via ingestion of soil[1] can occur by inadvertent consumption of soil on the hands or food items, mouthing behavior, consumption of nonfood items (pica[2]), or a combination of these routes. Several authors have attempted to quantify the amount of soil ingested by children. A review of these studies provides the information needed to derive a reasonable upper limit and a most probable estimate of soil ingestion rates for children and adults.

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[1]Although several authors distinguish between soil and dust in their assessments, the data do not appear to be complete enough to allow this type of differentiation. In addition, soil commonly makes up a major portion of indoor dust (Hawley, 1985). Consequently, the term "soil" will be used in this discussion to refer to soil and dust combined.

[2]See bottom of next page.

Lepow et al. (1974, 1975) measured the amount of dirt that could be removed from children's hands using an adhesive label and observed the frequency with which children mouthed nonfood objects and their hands. The average age of the children was 4.3 years. The authors measured an average of 11 mg of soil on the children's hands. They observed that a reasonable estimate of mouthing frequency is 10 times per day but that this value may underestimate the number of times children put their hands or nonfood objects into their mouths. They concluded that 100 mg/day was a reasonable estimate of the amount of soil ingested by children. They also performed several calculations using 250 mg as the amount of soil children ingest, apparently as an upper limit estimate.

Day et al. (1975) estimated that children playing outdoors could collect between 5 and 50 mg of soil on a sticky sweet. They estimated that children eat 2 to 20 sweets per day, which would lead to the ingestion of between 10 and 1,000 mg/day of soil.

Duggan and Williams (1977) attempted to determine the amount of street dust that urban children ingest daily. The authors estimated the amount of dust that was retained on the inside of the forefinger and thumb by rubbing a specified amount of dust between the fingers and reweighing the dust that was not retained. They ran several tests on different people and determined that about 4 mg (2 mg per finger) were retained. The authors then assumed that a child would suck his or her forefinger or thumb 10 times per day and concluded that 20 mg was a reasonable estimate of the amount of dust ingested daily. Duggan and Williams, (1977) also cited the estimates of Day et al. (1975) and Lepow et al. (1974) and a value

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[2]The term "pica" refers to both normal mouthing with subsequent ingestion of nonfood items, which is quite common among children at certain ages, and the unnatural craving for and habitual ingestion of nonfood items. The latter is an uncommon condition that is generally associated with medical conditions such as malnutrition, certain neurobehavioral disorders, and iron deficiency anemia or, less often, with a particular cultural background. The term "habitual pica" will be used in this paper to refer to this unusual type of ingestion of nonfood items. The term "pica" will be used for the normal ingestion of nonfood items common in children at certain ages.

from Bryce-Smith (1974 as cited in Duggan and Williams 1977) of one-thirtieth of a gram (derivation unspecified). They concluded that children probably ingest between 10 and 100 mg of street dust per day and estimated that the average daily ingestion rate is 25 mg.

Mahaffey (1977) examined sources of lead to which children might be exposed. She reported that the best clinical estimates indicate that children with pica (nonhabitual) are likely to ingest between 1,000 and 3,000 mg of paint per week. Assuming that similar amounts of soil are ingested, a child with pica would ingest between 140 and 430 mg of soil per day.

Schaum (1984) also estimated the amount of soil that children are likely to ingest. He cited the Lepow et al. (1975) estimate (100 mg/day) and also reported that habitual pica could increase ingestion levels to as much as 5,000 mg/day (Chisolm, 1982 as cited in Schaum, 1984). He determined that a range of 100 to 5,000 mg/day was reasonable for use in risk assessments.

Kimbrough et al. (1984) estimated age-specific levels of soil ingestion that the authors felt were reasonable yet unlikely to underestimate exposure (Table C-1). These estimates were reportedly based on a study of lead uptake from contaminated soils.

Hawley (1985) estimated outdoor soil and indoor dust ingestion rates for three age groups: young children (2.5 years old), older children (6 years old), and adults. He based his soil ingestion estimate for very young children on Lepow et al.'s (1975) calculations of the maximum soil intake (250 mg/day), and his other soil and dust ingestion estimates on assumptions about the amount of soil or dust likely to collect on the hands and subsequently be ingested. Hawley's (1985) values for daily soil and dust ingestion are presented in Table C-2; his average daily ingestion rates for soil and dust combined are also reported.

TABLE C-1

SOIL INGESTION BY AGE AS ESTIMATED BY KIMBROUGH ET AL. 1984

(mg/day)

Age	Level
0-9 months	0
9-18 months	1,000
1.5-3.5 years	10,000
3.5-5 years	1,000
Over 5 years	100

TABLE C-2

SOIL AND DUST CONTACT RATES AS ESTIMATED BY HAWLEY 1985

Age Exposure Route	Medium	Ingestion Rate (mg/day)	Frequency of Exposure	Comments
2.5 year old				
Outdoors (May-Oct.)	Soil	250	5 days/wk for 5 years	Based on Lepow et al. (1975) study
Indoors (May-Oct.)	Dust	50	Daily for 6 months	Assumes ingestion of dust on inside of hands
Indoors (Nov.-Apr.)	Dust	100	Daily for 6 months	
Total	Soil and dust	164	Daily	
6 year old				
Outdoors (May-Sept.)	Soil	50	Daily for 5 months	Assumes ingestion of half the dirt on fingers
Indoors	Dust	3	Daily	Assumes ingestion of dust on inside of hands
Total	Soil and dust	24	Daily	
Adult				
Outdoors (May-Sept.)	Soil	480	2 days/week for 5 months	Assumes ingestion of dirt while smoking
Attics	Dust	110	12 times/ year	Assumes ingestion of dirt on surface of hands while in dusty attic
Living space	Dust	0.56	Daily	
Total	Soil and dust	61	Daily	

The first empirical data on soil ingestion rates were recently collected by Binder et al. (1985), who measured soil ingestion by children 1 to 3 years old using a method previously employed to measure soil ingestion by ruminants. The trace elements silicon, aluminum, and titanium, all of which are present at high concentrations in soil and none of which are absorbed by humans, were measured in the soil and in stool samples from 59 children 1 to 3 years old. The concentrations of the elements in the soil and in daily fecal samples were then compared to estimate daily soil ingestion. The authors used several assumptions in their calculations. Two of these, that dietary intake of the elements was negligible and that fecal weight was 15 g (and not the 7 g they measured) would lead to an overestimation of soil ingestion rates, possibly by a significant amount. Their assumption that the elements were entirely unabsorbed might lead to a slight underestimation of exposure. They attempted to determine the likely qualitative effects of each of these assumptions but could not estimate the magnitude of any potential effect.

The arithmetic means of the soil ingestion levels that were estimated using two of the elements, silicon and aluminum, were in general agreement (184 vs. 181 mg/day), while the mean value reported for titanium (1,834 mg/day) was an order of magnitude higher (Table C-3). It appears likely that some other source of titanium in the diet was responsible for the high mean value. Therefore, the values reported for silicon and aluminum—approximately 180 mg/day—are probably more accurate. As noted above, the effect of the various assumptions on the reported values has not been quantified. However, it seems likely that the values overestimate soil consumption by the average child.

ESTIMATION OF SOIL INGESTION RATES

Soil ingestion can occur at any age but is most prevalent in young children. Baltrop (1966 as cited in Mahaffey, 1977) reported that over 75% of children 1 to 3 years old mouthed objects and that 35% ingested them. The author also noted that the prevalence of these activities decreased with age; only 33% of children 4 to 5 years old mouthed objects, and only 6% had pica.

TABLE C-3

SOIL INGESTION BY CHILDREN 1 TO 3 YEARS OLD AS ESTIMATED BY BINDER ET AL. 1985

(mg/day)

Estimation Method[a]	Arithmetic Mean	Geometric Mean	Standard Deviation	Upper 95th Percentile
Aluminum	181	128	203	584
Silicon	184	130	175	578
Titanium	1,834	401	3,091	9,590

[a]In other words, elements upon which estimates are based.

SOURCE: Binder et al., 1985

Mahaffey (1977) further reported that other estimates indicate that approximately one-half of all children 1 to 3 years old have pica. Mahaffey and Annest (1985) reported that pica is most prevalent in children 6 months to 3 years old, and it is significantly more common in children from lower income families.

The estimates of soil ingestion levels reported in previous studies are summarized in Table B-4. Reasonable estimates of soil ingestion by children can be derived from this information. To ensure that risk assessments based on these estimates do not underestimate risk, we will also calculate upper confidence levels.

The Binder et al. (1985) study is the only paper that presents clearly empirical data. Therefore, it is appropriate to use this study as the basis for estimating soil ingestion levels. The authors reported an average intake of 180 mg/day of soil (after excluding the results based on titanium levels) for children 1 to 3 years old. The standard deviation was approximately 200 mg/day, and the 95th percentile upper confidence limit was 580 mg/day. Binder and her colleagues assumed that none of the elements came from the normal diet, which, as mentioned above, is likely to lead to an overestimation of the amount of soil ingested. Consequently, a value of 500 mg/day, which is around the 95th percentile upper confidence limit of the arithmetic mean values reported, would appear to be a conservative yet reasonable estimate of soil ingestion for children 1 to 3 years old. As noted above, older children are less likely to exhibit pica. However, Lepow et al. (1974, 1975) observed children 2 to 6 years old mouthing objects, and it is probably reasonable to use this value of 500 mg/day as a worst-case estimate of soil ingestion for children 1 to 6 years old. A value of 100 mg/day, which is near the geometric mean of Binder et al.'s (1985) data, appears to be a reasonable estimate of the most probable ingestion rates.

Children less than 1 year old are not likely to come into direct contact with soil regularly. However, very young children may be exposed to contaminated house dust. No specific information is available on ingestion

TABLE C-4

ESTIMATED LEVELS OF SOIL INGESTION
REPORTED IN THE LITERATURE

(mg/day)

Reference	Age	Level	Comments
Lepow et al., 1974, 1975	4.3 years (mean)	100	Based on observations of mouthing behavior; (see text)
Day et al., 1975	Children 1-3 years	10-1,000	Based on ingestion of soil on candy
Duggan and Williams, 1977	Children 2-6 years	25	See text
Mahaffey, 1977	1-3 years	140-430	Based on estimate of paint consumption by children with pica
Schaum, 1984	2-6 years	100-5,000	See text
Kimbrough et al., 1984	0-9 months 9-18 months 1.5-3.5 years 3.5-5 years Over 5 years	0 1,000 10,000 1,000 100	Based on study of lead exposure; probably overestimates risk
Hawley, 1985	2.5 years 6 years Adults	164 24 61	Based on estimated ingestion of both and dust; see text
Binder et al., 1985	1-3 years	180±200	Based on measurement of trace elements; see text

of dust by children in this age group, and we suggest a value of half the previous value, or 250 mg/day, as a reasonable, worst-case estimate of ingestion levels. Similarly, 50 mg/day is probably a reasonable estimate of the most probable ingestion rate for children in this age group.

No empirical information on older children was available. Mahaffey (1977) reported that mouthing decreased in most children more than 4 years old. It seems reasonable to assume that almost all children 6 to 11 years old would have reduced their soil ingestion by at least 50%. Consequently, we suggest that 250 mg/day is a worst-case estimate and 50 mg/day, a most probable case estimate of soil ingestion by children in this age group.

For children more than 11 years old and adults, the value of 100 mg/day recommended by Kimbrough et al. (1984) appears to be a reasonable, worst-case estimate of daily soil ingestion. Based on Hawley's (1985) assumptions, 50 mg/day appears to be a reasonable estimate of the most probable ingestion rate for people who have frequent hand-to-mouth contact (e.g., smokers) or who are in direct contact with contaminated soil (e.g., construction workers, gardeners). A value of 20 mg/day appears to be a reasonable estimate of the most probable soil ingestion rates for adults who are not smokers and do not regularly engage in outdoor activities.

As noted earlier, certain individuals exhibit pica habitually, i.e., they eat nonfood items regularly, even daily. The values for soil ingestion reported above may underestimate exposure for people exhibiting this type of behavior. The upper limit on soil ingestion of 5,000 mg/day recommended by Schaum (1984) probably is a reasonable, worst-case estimate of soil ingestion by a person with habitual pica.

Our estimates of soil ingestion by persons in different age groups are presented in Table C-5. These values fall within the range of soil ingestion levels suggested by Schaum (1984) but are generally lower than the values presented by Kimbrough et al. (1984). However, it should be noted that these estimates are in general agreement with the estimated levels of soil ingestion presented in Table C-4. Consequently, we feel that these

TABLE C-5

ESTIMATES OF SOIL INGESTION RATES

Age	Average Weight[a] (kg)	Worst Case[b] (mg/day)	Most Probable Case (mg/day)
0-1 years	10	250	50
1-6 years	15	500	100
6-11 years	30	250	50
Over 11 years	70	100	50[c]

[a] EPA, 1985

[b] This does not include individuals who exhibit habitual pica. For them, the upper value presented in Schaum (1984) of 5,000 mg/day would be more appropriate.

[c] A value of 20 mg/day is probably a more reasonable estimate of soil ingestion rates for adults who do not exhibit frequent hand-to-mouth activity (e.g., most nonsmokers) and do not regularly engage in outdoor activities.

values are reasonable estimates that are unlikely to underestimate soil ingestion levels. Therefore, they are unlikely to lead to any underestimation of exposure via this route.

ESTIMATION OF EXPOSURE FREQUENCY

Several authors estimated the frequency of exposure to soil. Kimbrough et al. (1984) assumed that people would only come into contact and ingest soil for 6 months each year. Schaum (1984) noted that the ground is frozen for an average of 118 days/year in the coldest parts of the United States, while in other parts, people can come into contact with outdoor soil year-round. He therefore determined that exposure could occur for anywhere between 247 and 365 days/year. Hawley (1985) noted that people are likely to be exposed year-round to soil, both outdoors as soil and indoors as a major component of dust. Consequently, a reasonable, worst-case assumption appears to be that people come into contact with and ingest soil year-round.

Clearly, site-specific factors should be considered if in estimating likely contact and ingestion rates. It usually is not possible to determine the effect of these factors on the rates of exposure to soil quantitatively. However, any site-specific factors (such as climate) likely to affect the frequency of exposure should be addressed qualitatively.

This discussion of exposure frequency only applies to inhabitants of contaminated residential areas or to people living immediately adjacent to a source of contamination. In the case of people (children or adults) who infrequently use a contaminated area, a site-specific estimate of the frequency of exposure must be derived.

CONCLUSION

No single value will accurately reflect daily soil ingestion rates for all individuals. Too many factors can influence contact with soil and consequently affect the quantity of soil ingested. However, risk managers often need to estimate average soil ingestion rates in order to assess

potential exposure to soil-bound contaminants. The values for soil ingestion rates presented in this paper have been derived using the best information currently available. As such, they provide reasonable, yet conservative (unlikely to underestimate exposure), estimates for use in the risk assessment process.

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APPENDIX 10D

SELECTION OF INDICATOR CHEMICALS

SELECTION OF INDICATOR CHEMICALS
CLEAR CREEK/CENTRAL CITY SITE

In this appendix, the selection of indicator chemicals for the Clear Creek/Central City site is described. The criteria used for selection were the toxicity of the chemical via different exposure pathways and the concentration of the chemical in different media. Indicator chemicals were chosen prior to the RI/FS, and the selection was based on the most relevant information available at that time. For example, concentrations of chemicals in tailings and surface water were estimated based on historical data. Chemicals were selected separately for human receptors and for aquatic organisms.

INDICATOR CHEMICALS FOR HUMAN HEALTH

The methodology which served as the basis for selection of these chemicals is given in the Superfund Health Assessment Manual (EPA 1986a) with a few modifications. The modifications were primarily to adapt the methodology to materials not found in the manual. For example, since the manual does not address waste as a medium, the tailing piles were treated as soil.

The exposure pathways used to select indicator chemicals for human health effects were inhalation of airborne mine tailings dust, incidental ingestion of mine tailings and ingestion of contaminated surface water.

INDICATOR CHEMICALS FOR INHALATION IMPACTS

Under certain meteorological conditions, contaminated mine tailings may be suspended and dispersed to locations where inhalation exposures may be of concern. The methodology described in the PHE Manual (EPA 1986a) was not strictly followed to select indicator chemicals for air pathways because air contaminant concentrations were not available. The selection of indicator chemicals for inhalation impacts was based upon joint consideration of inhalation toxicity factors provided in the PHE Manual and measured concentrations in the mine tailings.

Six indicator chemicals, arsenic, cadmium, chromium (VI), nickel, silver, and lead were selected. Arsenic, chromium (VI), and nickel are present in relatively high quantities in the mine tailings and have been rated as Group A human carcinogens by EPA. Cadmium and beryllium are both group B1 carcinogens. Beryllium was not selected because concentrations estimated to be present in the tailings are within the normal background beryllium content of soils (Connor and Shacklette 1975). Silver was selected because its inhalation toxicity factor is far higher than for any other noncarcinogen and it has a fairly high tailings concentration. The concentration of lead in the mine tailings is significantly higher than the concentrations of other noncarcinogens. The remaining noncarcinogens had either lower tailings concentrations, lower toxicity factors, or both.

INDICATOR CHEMICALS FOR INCIDENTAL INGESTION OF MINE TAILINGS

The methodology in the EPA PHE Manual (EPA 1986a) was followed to select indicator chemicals for incidental ingestion of mine tailings. Because tailings are not addressed as a medium in the manual, tailings were treated as soil in this analysis. Arsenic was the only carcinogen (via ingestion) that was identified in the tailings and was selected as an indicator chemical. Indicator scores (IS) were derived for the noncarcinogenic chemicals having toxicity constants listed in Appendix C of the PHE Manual (Table 1). In addition to arsenic, lead and silver were chosen as indicator chemicals for this pathway. Barium, which had the next highest score, was not chosen since the concentration estimated to be present in the tailings is well below normal background concentrations of barium (Connor and Shacklette 1975).

INDICATOR CHEMICALS FOR DRINKING WATER IMPACTS

The methodology described in the EPA PHE manual was followed to select indicator chemicals for the drinking water exposure pathway. No arsenic had been identified in the water based on the preliminary data, so no carcinogens were selected for this pathway. Indicator scores (IS) were derived for those noncarcinogenic chemicals with toxicity constants listed in Appendix C of the PHE Manual (Table 2). The IS values were ranked according to the products of drinking water toxicity factors and average stream water concentrations.

TABLE 1

INDICATOR SELECTION FOR INGESTION OF TAILINGS
CLEAR CREEK/CENTRAL CITY SITE

Element	Mean Concentration[a] (mg/kg)	sTc[b] (kg/mg)	IS[c]
Arsenic	182	9×10^{-4}	0.16
Lead	966	4.4×10^{-5}	0.043
Silver	17.6	1×10^{-3}	0.018
Barium	83.7	2.04×10^{-4}	0.017
Copper	220	3.5×10^{-5}	0.0078
Selenium	1.4	5.26×10^{-3}	0.0073
Nickel	11.3	2.13×10^{-4}	0.0024
Cadmium	7	2.23×10^{-4}	0.0015
Silver	1.45	1.0×10^{-3}	0.0015
Mercury	0.88	9.21×10^{-4}	0.00081
Zinc	120	5×10^{-6}	0.00064
Vanadium	26.8	7×10^{-6}	0.00019

[a]Mean concentration in tailings

[b]Soil toxicity constant in kg/mg (EPA 1986a)

[c]Mean concentration x sTc

TABLE 2

INDICATOR SELECTION FOR INGESTION OF WATER
CLEAR CREEK/CENTRAL CITY SITE

Element	Mean Concentration[a] (mg/L)	wTc[b] (l/mg)	IS[c]
Nickel	0.038	4.26	0.16
Zinc	1.02	0.107	0.11
Barium	0.026	4.08	0.11
Cadmium	0.0051	4.45	0.022
Lead	0.0053	0.893	0.0047
Silver	0	20	0
Arsenic	0	18	0

[a]Dissolved in-stream concentration

[b]Water toxicity constant in liter/mg (EPA 1986a)

[c]IS = Mean concentration x wTc

Concentrations of chemicals in water bodies not likely to be drinking water sources (e.g., Virginia Canyon, Portals) were not included in the estimation of stream water concentrations.

Three chemicals, nickel, cadmium, and lead, were selected. Although the IS values for zinc and barium were high, they were not selected as indicators. Zinc was not selected since the in-stream concentration is much lower than the secondary maximum contaminant level (5 mg/liter) for drinking water. Barium was not selected because concentrations estimated to occur in the tailings (assumed to be the source of barium in the water) were well below background soil concentrations.

CONCLUSION

In summary, six indicator chemicals were selected for human health evaluation. The chemicals chosen are arsenic, chromium (VI), nickel, silver, lead, and cadmium.

For the metals which did not have toxicity factors in the ICF Manual, a general review of the potential for health effects associated with ingestion and inhalation was conducted. None were selected as indicator chemicals due to either their moderate to low toxicities or their low concentrations in stream water or mine tailings.

Aluminum. The average in-stream concentration of aluminum was 0.056 mg/liter. Aluminum is considered to be poorly absorbed from the gastrointestinal tract with minimal toxicity (Doull et al. 1980). The National Academy of Sciences has calculated a 7-day suggested no adverse response level of 5.0 mg/liter (NAS 1982).

Boron. The average in-stream concentration of boron was 0.039 mg/liter. Based on the animal studies of Weir and Fisher (1972), an acceptable daily intake (ADI) of 0.0875 mg/kg/day was calculated (Clement 1985). This translate to an aqueous concentration of 3.06 mg/liter assuming that a 70-kg human ingests 2 liters per day.

Copper, Iron, Manganese. The average in-stream concentrations of these elements was 0.027 mg/liter, 3.23 mg/liter and 2.12 mg/liter, respectively. These materials are generally recognized as safe at these concentrations. USEPA has published secondary maximum contaminant levels (SMCLs) primarily to control discoloration in water. The SMCLs are 1 mg/liter for copper, 0.3 mg/liter for iron, and 0.05 mg/liter for manganese.

Sulfate. The average in-stream concentration was 72.9 mg/liter. Sulfate can cause detectable tastes at concentrations as low as 300 mg/liter and exert a laxative effect at greater than 600 mg/liter (Faust and Aly 1983). The SMCL is 250 mg/liter.

Strontium. The average in-stream concentration was 0.22 mg/liter. NAS (1982) has calculated a 7-day suggested no adverse response level at 8.4 mg/liter.

INDICATOR CHEMICALS FOR AQUATIC LIFE IMPACTS

A review of the available literature indicated that the most severe impact of the Clear Creek/Central City site is on the biota of Clear Creek. a suite of indicator parameters was chosen for protection of aquatic life based on toxicity, concentration, and chemical speciation. The basis of toxicity choice was published criteria values, either from Colorado Department of Health or EPA. Some standard references were also used to supplement these data. It is recognized that suspended material regardless of chemical composition may be deleterious to aquatic life (e.g., by sedimentation with subsequent habitat destruction or by clogging gill epithelia).

The indicator chemicals selected were aluminum, copper zinc, and fluoride as well as pH. The rationale for each follows:

Aluminum. At the Argo Portal, the low pH dissolves most of the aluminum. After mixing with Clear Creek, however, the higher pH tends to convert most aluminum to particulate form. In both Clear Creek and North Clear Creek, dissolved aluminum concentrations up to 200 µg/liter were observed. This is twice the proposed Colorado water-quality standard for aquatic life (Wentz 1977).

Copper. Copper is more toxic to freshwater plants and fish than any heavy metal except mercury (Moore and Rammoorthy 1984). Input from the Argo tunnel and tailing pile increases the copper concentration in Clear Creek with substantial quantities in dissolved form. Dissolved in-stream concentrations of up to 5 times the proposed Colorado standards (Wentz 1977) were noted. Even in hard water (187 µg/liter $CaCO_3$), chronic toxic effects were noted in brook trout at levels as low as 6.3 µg/liter (USEPA 1980a). EPA (1985) has established a criteria for copper basis on the acid-soluble concentration. From 12 Clear Creek samples, the mean hardness is 103 mg/liter as $CaCo_3$. This translates to an average concentration criterion of 12 µg/liter. This may be approximately compared to an in-stream average total copper concentration of 57 µg/liter.

Zinc. The proposed ambient water quality criteria for zinc is 88 µg/liter (EPA 1980b) which compares to an average in-stream concentration at 1,070 µg/iter at the site. Additionally, there is evidence suggesting that zinc is more toxic as the pH increases and that zinc and copper act synergistically.

Fluoride. Fluoride is selected because of its demonstrated toxicity to plants and its tendency to bioaccumulate (NRCC 1977).

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APPENDIX 10E
SUMMARY OF VARIOUS WATER SAMPLE PREPARATION PROCEDURES

APPENDIX 10E

COMPARISON OF VARIOUS SAMPLE PREPARATION TECHNIQUES

A variety of sample preparation techniques can be used before analyses of water samples. These preparation steps result in a variety of concentrations which are given the following names:

EPA Total (EPA, 1979)

CLP Total (EPA, 1979)

EPA Total Recoverable (SOW, 1985)

Acid Soluble (EPA, 1986)

Dissolved (EPA, 1979)

Summaries of the various preparation steps for each of the methods are provided in Table 10E-1. As shown, the digestion steps typically become less vigorous in the order given above. That is, the methods will dissolve and measure less of the suspended material. If no suspended sediments are present, all methods should yield similar results. The EPA total shown, does not yield a true total. To dissolve all sediments, hydrofluoric acid or fusion techniques are required.

The "total" concentrations reported in this document were measured according to the contract laboratory program (CLP) total procedure. As shown on Table 10E-1, this procedure is a digestion with nitric acid and hydrochloric acid or hydrogen peroxide. However, the solutions are not boiled to dryness and reconstituted as in the EPA total (EPA, 1979) or USGS total (Skougstad, et al., 1979) procedures. Therefore, the CLP method is not as vigorous of a digestion as other "total" procedures. In fact, the CLP "total" procedure is most similar to the EPA total recoverable method (EPA, 1979). The CLP total method probably yields values slightly higher

than the total recoverable method depending upon the solid matrices present in the sample. The dissolved values should be independent of the digestion method because samples are filtered in the field. In most cases, the waters collected contained low concentrations of total suspended solids (TSS) and therefore the total and dissolved concentrations are very similar and the exact digestion procedure is not as important. However to determine the differences among the various total methods, several samples were collected during April 1987 and analyzed for CLP total, EPA total recoverable, acid soluble and dissolved fractions. These results will be contained in an Addendum to this report.

TABLE 10E-1

SUMMARY OF STEPS
SAMPLE PREPARATION TECHNIQUES

Step	EPA Total	CLP Total	Total Recoverable	Acid Soluble	Dissolved
Field Filtering	None	None	None	None	Yes (0.45 micron)
Field Preservation	HNO_3 pH<2	HNO_3 pH<2	HNO_3 pH<2	HNO_3 pH = 1.75–2.0	HNO_3 pH<2
Holding Time	usually <6 mo for metals	usually <6 mo for metals	usually <6 mo for metals	3 days	usually <6 mo for metals
Lab Filtering	After digestion	After digestion	After digestion	Yes (0.45 micron) (after 16 hours)	None
Lab Digestion	a. 50–100 mL sample b. 3 mL conc. HNO_3 c. digest to near dryness d. 3 mL conc HNO_3 e. more HNO_3 and digest to near dryness f. 5 mL 1:1 HCl or HNO_3 g. digest h. filter	ICP/flame AA: a. 100 mL samples b. 2 mL 1:1 HNO_3 10 mL 1:1 HCl c. digest to 25–50 mL d. filter Furance: a. 100 mL sample b. 1 mL 1:1 HNO_3 2 mL H_2O_2 (30%) c. digest to 25–50 mL d. filter	a. 100 mL sample b. 5 mL 1:1 HCL c. digest to 15–20 mL d. filter note: HCl is omitted for furance analysis	a. let stand for 16 hr at pH = 1.75 b. filter through 0.45 micron	Depends on specification: can directly analyze or any of the total preps may be followed.

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APPENDIX 12A

SUMMARY OF DATA VALIDATION RESULTS

TABLE 12A-1

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)

Sample	MHC 300	MHC 301	MHC 302	MHC 303	MHC 304	MHC 305	MHC 306	MHC 307	MHC 308	MHC 309	MHC 310
Metals (Total)											
Matrix	Water	Water	Water	Water	Water	Water	Water	Water	Soil	Soil	Water
Mercury	-	-	-	-	-	-	-	-	JS	JS	
Selenium	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Silver	JC	JC	JC	JC	JC	JC	JC	JC	-	-	JC
Thallium	-	-	-	-	-	-	-	-	-	-	
Tin	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Cyanide	-	-	-	-	-	-	-	-	-	JS	JS
Metals (Dissolved)											
Magnesium	-	-	-	-	-	-	-	-	NA	NA	-
Selenium	JS	JS	JS	JS	JS	JS	JS	JS	NA	NA	JS
Silver	JC	JC	JC	JC	JC	JC	JC	JC	NA	NA	JC
Thallium	-	-	-	-	-	-	-	-	NA	NA	-
Tin	JS	JS	JS	JS	JS	JS	JS	JS	NA	NA	JS
SAS Parameters											
TDS	-	-	-	-	-	-	-	-	NA	NA	-
Specific Conductance	-	-	-	-	-	-	-	-	NA	NA	-
B (Total)	JS	JS	JS	JS	JS	JS	JS	JS	-	-	JS
B (Dissolved)	JS	JS	JS	JS	JS	JS	JS	JS	NA	NA	JS

TABLE 12A-1

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHC 322	MHC 323	MHC 324	MHC 325	MHC 326	MHC 327	MHC 328	MHC 329	MHC 330	MHC 331	MHC 332
Metals (Total)											
Matrix	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
Mercury	-	-	-	-	-	-	-	-	-	-	-
Selenium	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Silver	JC	JC	JC	JC	JC	JC	JC	JC	JC	JC	JC
Thallium	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Tin	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Cyanide	-	-	-	-	-	-	-	-	-	-	-
Metals (Dissolved)											
Magnesium	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Selenium	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Silver	JC	JC	JC	JC	JC	JC	JC	JC	JC	JC	JC
Thallium	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Tin	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
SAS Parameters											
TDS	-	-	-	-	-	-	-	-	-	-	-
Specific Conductance	-	-	-	-	JC	JC	JC	JC	JC	JC	
B (Total)	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
B (Dissolved)	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS

TABLE 12A-1

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHC 311	MHC 312	MHC 313	MHC 314	MHC 315	MHC 316	MHC 317	MHC 318	MHC 319	MHC 320	MHC 321
Metals (Total)											
Matrix	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
Mercury	-	-	-	-	-	-	-	-	-	-	-
Selenium	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Silver	JC	JC	JC	JC	JC	JC	JC	JC	JC	JC	JC
Thallium	-	-	-	-	-	-	-	-	JS	JS	JS
Tin	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Cyanide	-	-	-	-	-	-	-	-	-	-	-
Metals (Dissolved)											
Magnesium	-	-	-	-	-	-	-	-	JS	JS	JS
Selenium	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Silver	JC	JC	JC	JC	JC	JC	JC	JC	JC	JC	JC
Thallium	-	-	-	-	-	-	-	-	JS	JS	JS
Tin	-	-	-	-	-	-	-	-	-	-	-
SAS Parameters											
TDS	-	-	-	-	-	-	-	-	-	JS	-
Specific Conductance	-	-	-	-	-	-	-	-	-	-	-
B (Total)	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
B (Dissolved)	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)

Sample	MHC 441	MHC 442	MHC 444	MHC 445	MHC 446	MHC 447	MHC 448	MHC 449	MHC 450	MHC 451	MHC 452
Matrix	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
Metals (Total)											
Aluminum	-	-	-	-	-	-	-	-	-	-	-
Antimony	-	-	-	-	-	-	-	-	-	-	-
Arsenic	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Barium	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Beryllium	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Cadmium	-	-	-	-	-	JE	-	-	-	-	-
Calcium	-	-	-	-	-	-	-	-	-	-	-
Lead	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-	-	-	-	-
Nickel	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Selenium	R	R	R	R	R	R	R	R	R	R	R
Silver	-	-	-	JE	-	-	-	-	-	-	-
Thallium	-	-	-	-	-	-	-	-	-	-	-
Tin	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Zinc	-	-	-	-	-	-	-	-	-	-	-
Cyanide	R	R	R	R	R	R	R	R	R	R	R
Metals (Dissolved)											
Aluminum	-	-	-	-	-	-	-	-	-	-	-
Chromium	-	-	-	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-	-	-	-	-
Selenium	R	R	R	R	R	R	R	R	R	R	R
Silver	-	-	-	-	-	-	-	-	-	-	-
Thallium	-	-	-	-	-	-	-	-	-	-	-
Tin	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Zinc	-	-	-	-	-	-	-	-	-	-	-
Cyanide	-	-	-	-	-	-	-	-	-	-	-

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHC 453	MHC 454	MHC 455	MHC 456	MHC 457	MHC 458	MHC 459	MHC 460	MHC 461	MHC 462	MHC 463
Matrix	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
Metals (Total)											
Aluminum	-	-	-	-	-	-	-	-	-	-	-
Arsenic	JS	JS	JS	JS	JS	JS	JS	-	-	-	-
Barium	JS	JS	JS	JS	JS	JS	JS	-	-	-	-
Beryllium	JS	JS	JS	JS	JS	JS	JS	-	-	-	-
Cadmium	-	-	-	-	-	-	JE	-	-	-	-
Calcium	-	-	-	-	-	-	-	-	-	-	-
Lead	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-	-	-	-	-
Nickel	JS	JS	JS	JS	JS	JS	JS	-	-	-	-
Selenium	R	R	R	R	R	R	R	JS,E	JS	JS	JS,E
Silver	-	-	-	-	-	-	-	-	-	-	-
Thallium	-	-	-	-	-	-	-	-	-	-	-
Tin	JS	JS	JS	JS	JS	JS	JS	-	-	-	-
Zinc	-	-	-	-	-	-	-	JS	JS	JS	JS
Cyanide	R	R	R	R	R	R	R	-	-	-	-
Metals (Dissolved)											
Aluminum	-	-	-	-	-	-	-	-	-	-	-
Chromium	-	-	-	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-	-	-	-	-
Selenium	R	R	R	R	R	R	R	R	R	R	R
Silver	-	-	-	-	-	-	-	JC	JC	JC	JC
Thallium	-	-	-	-	-	-	-	-	-	-	-
Tin	JS	JS	JS	JS	JS	JS	JS	-	-	-	-
Zinc	-	-	-	-	-	-	-	JS	JS	JS	JS
Cyanide	-	-	-	-	-	-	-	-	-	-	-

TABLE 12A-4

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHC 441	MHC 442	MHC 444	MHC 445	MHC 446	MHC 447	MHC 448	MHC 449	MHC 450	MHC 451	MHC 452
SAS Parameters											
$NO2^-/NO_3$	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT
$HCO3^-/CO3^{2-}$	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT
Acidity	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT
Cl^-	-	-	-	-	-	-	-	-	-	-	-
F^-	-	-	-	-	-	-	-	-	-	-	-
$SO4^{2-}$	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
TDS	JS,HT	JS,HT	JS,HT	JS,HT	JS,HT	JS,HT	JS,HT	JS,HT	JS,HT	JS,HT	JS,HT
TOC	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT
Cr^{6+}	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT
B (Total)	-	-	-	-	-	-	-	-	-	-	-
Mo (Total)	J*	J*	J*	J*	J*	J*	J*	J*	J*	J*	J*
Sr (Total)	-	-	-	-	-	-	-	-	-	-	-
Au (Total)	-	-	-	-	-	-	-	-	-	-	-
Au (Dissolved)	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Sulfate Sulfur	-	-	-	-	-	-	-	-	-	-	-
Pyritic Sulfur	-	-	-	-	-	-	-	-	-	-	-
Organic Sulfur	-	-	-	-	-	-	-	-	-	-	-

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHC 464	MHC 465	MHC 466	MHC 467	MHC 468	MHC 469	MHC 470	MHC 471	MHC 472	MHC 473	MHC 474
Matrix	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
Metals (Total)											
Aluminum	-	-	-	-	-	-	-	-	-	-	-
Antimony	-	-	-	-	-	-	-	-	-	-	-
Barium	-	-	-	-	-	-	-	-	-	-	-
Beryllium	-	-	-	-	-	-	-	-	-	-	-
Cadmium	-	-	-	-	-	-	-	-	-	-	-
Calcium	-	-	-	-	-	-	-	-	-	-	-
Lead	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-	-	-	-	-
Nickel	-	-	-	-	-	-	-	-	-	-	-
Selenium	JS	JS	JS	JS	JS	JS	JS	JS,E	JS	JS	JS
Silver	-	-	-	-	-	-	-	-	-	-	-
Thallium	-	-	-	-	-	-	-	-	-	-	-
Tin	-	-	-	-	-	-	-	-	-	-	-
Zinc	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Cyanide	-	-	-	-	-	-	-	-	-	-	-
Metals (Dissolved)											
Aluminum	-	-	-	-	-	-	-	-	-	-	-
Chromium	-	-	-	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-	-	-	-	-
Selenium	R	R	R	R	R	R	R	R	R	R	R
Silver	JC	JC	JC	JC	JC	JC	JC	JC	JC	JC	JC
Thallium	-	-	-	-	-	-	-	-	-	-	-
Tin	-	-	-	-	-	-	-	-	-	-	-
Zinc	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Cyanide	-	-	-	-	-	-	-	-	-	-	-

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHC 453	MHC 454	MHC 455	MHC 456	MHC 457	MHC 458	MHC 459	MHC 460	MHC 461	MHC 462	MHC 463
SAS Parameters											
$NO2^-/NO_3$	JHT	-	-	-	-	-	-	-	-	-	-
$HCO3^-/CO3^{2-}$	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT
Acidity	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT
Cl^-	-	-	-	-	-	-	-	-	-	-	-
F^-	-	-	-	-	-	-	-	-	-	-	-
$SO4^{2-}$	JS	JS	JS	JS	JS	JS	JS	JHT	JHT	JHT	JHT
TDS	JS,HT	JS,HT	JS,HT	JS,HT	JS,HT	JS,HT	JS,HT	JHT	JHT	JHT	JHT
TOC	JHT	-	-	-	-	-	-	-	-	-	-
Cr^{6+}	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT
B (Total)	-	-	-	-	-	-	-	-	-	-	-
Mo (Total)	J*	J*	J*	J*	J*	J*	J*	-	-	-	-
Sr (Total)	-	-	-	-	-	-	-	-	-	-	-
Au (Total)	-	-	-	-	-	-	-	-	-	-	-
Au (Dissolved)	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Sulfate Sulfur	-	-	-	-	-	-	-	-	-	-	-
Pyritic Sulfur	-	-	-	-	-	-	-	-	-	-	-
Organic Sulfur	-	-	-	-	-	-	-	-	-	-	-

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHC 443	MHC 483	MHC 478	MHC 749	MHC 480	MHC 481	MHC 482	MHC 484	MHC 485	MHC 487	MHC 488
Matrix	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
Metals (Total)											
Aluminum	-	-	-	-	-	-	-	-	-	-	-
Antimony	-	-	-	-	-	-	-	-	-	-	-
Barium	-	-	-	-	-	-	-	-	-	-	-
Beryllium	-	-	-	-	-	-	-	-	-	-	-
Cadmium	-	-	-	-	-	-	-	-	-	-	-
Calcium	-	-	-	-	-	-	-	-	-	-	-
Lead	-	-	J*	J*	J*	J*	J*	J*	J*	J*	J*
Manganese	-	-	-	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-	-	-	-	-
Nickel	-	-	-	-	-	-	-	-	-	-	-
Selenium	JS	JS	R	R	R	R	R	R	R	R	R
Silver	-	-	-	-	-	-	-	-	-	-	-
Thallium	-	-	-	-	-	-	-	-	-	-	-
Tin	-	-	-	-	-	-	-	-	-	-	-
Zinc	JS	JS	-	-	-	-	-	-	-	-	-
Cyanide	-	-	JHT	JHT	-	-	-	-	-	-	-
Metals (Dissolved)											
Aluminum	-	-	-	-	-	-	-	-	-	-	-
Chromium	-	-	-	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-	-	-	-	-
Selenium	R	R	-	-	-	-	-	-	-	-	-
Silver	-	-	-	-	-	-	-	-	-	-	-
Thallium	-	-	-	-	-	-	-	-	-	-	-
Tin	-	-	-	-	-	-	-	-	-	-	-
Zinc	JS	JS	-	-	-	-	-	-	-	-	-
Cyanide	-	-	-	-	-	-	-	-	-	-	-

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHC 464	MHC 465	MHC 466	MHC 467	MHC 468	MHC 469	MHC 470	MHC 471	MHC 472	MHC 473	MHC 474
SAS Parameters											
$NO2^-/NO_3^{2-}$	-	-	-	-	-	-	-	-	-	-	-
$HCO3^-/CO3^{2-}$	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT
Acidity	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT
Cl^-	-	-	-	-	-	-	-	-	-	-	-
F^-	-	-	-	-	-	-	-	-	-	-	-
$SO4^{2-}$	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT
TDS	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT
TOC	-	-	-	-	-	-	-	-	-	-	-
Cr^6	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT
B (Total)	-	-	-	-	-	-	-	-	-	-	-
Mo (Total)	-	-	-	-	-	-	-	-	-	-	-
Sr (Total)	-	-	-	-	-	-	-	-	-	-	-
Au (Total)	-	-	-	-	-	-	-	-	-	-	-
Au (Dissolved)	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Sulfate Sulfur	-	-	-	-	-	-	-	-	-	-	-
Pyritic Sulfur	-	-	-	-	-	-	-	-	-	-	-
Organic Sulfur	-	-	-	-	-	-	-	-	-	-	-

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHC 489	MHC 491	MHC 475	MHC 476	MHC 477	MHC 486	MHC 490	MHE 201	MHE 202	MHE 203	MHE 204
Matrix	Water	Water	Water	Water	Water	Water	Water	Soil	Soil	Soil	Soil
Metals (Total)											
Aluminum	-	-	-	-	-	-	-	JE	JE	JE	JE
Antimony	-	-	-	-	-	-	-	-	-	-	-
Barium	-	-	-	-	-	-	-	-	-	-	-
Beryllium	-	-	-	-	-	-	-	-	-	-	-
Cadmium	-	-	J*	J*	J*	J*	J*	-	-	-	-
Calcium	-	-	JE	JE	JE	JE	JE	-	-	-	-
Lead	J*	J*	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-
Mercury	-	-	JHT	JHT	JHT	JHT	JHT	-	-	-	-
Nickel											
Selenium	R	R	JS	JS	JS	JS	JS	R	R	R	R
Silver											
Thallium	-	-	JS	JS	JS	JS	JS	JS	JS	JS	JS
Tin											
Zinc	-	-	JE	JE	JE	JE	JE	-	-	-	-
Cyanide	-	-	JHT	-	-	-	-	JHT	JHT	JHT	JHT
Metals (Dissolved)											
Aluminum	-	-	JE	JE	JE	JE	JE	NA	NA	NA	NA
Chromium	-	-	JE	JE	JE	JE	JE	NA	NA	NA	NA
Mercury	-	-	JHT	JHT	JHT	JHT	JHT	NA	NA	NA	NA
Selenium	-	-	-	-	-	-	-	NA	NA	NA	NA
Silver	-	-	-	-	-	-	-	NA	NA	NA	NA
Thallium	-	-	JS	JS	JS	JS	JS	NA	NA	NA	NA
Tin	-	-	-	-	-	-	-	NA	NA	NA	NA
Zinc	-	-	-	-	-	-	-	NA	NA	NA	NA
Cyanide	-	-	-	-	-	-	-	NA	NA	NA	NA

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHC 443	MHC 483	MHC 478	MHC 479	MHC 480	MHC 481	MHC 482	MHC 484	MHC 485	MHC 487	MHC 488
SAS Parameters											
$NO2^-/NO_3$	-	-	JHT	JHT	-	-	-	-	-	-	-
$HCO3^-/CO3^{2-}$	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT
Acidity	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT
Cl^-	-	-	-	-	-	-	-	-	-	-	-
F^-	-	-	JHT	JHT	-	-	-	-	-	-	-
$SO4^{2-}$	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT
TDS	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT
TOC	-	-	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT
Cr^{6+}	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT
B (Total)	-	-	-	-	-	-	-	-	-	-	-
Mo (Total)	-	-	-	-	-	-	-	-	-	-	-
Sr (Total)	-	-	-	-	-	-	-	-	-	-	-
Au (Total)	-	-	-	-	-	-	-	-	-	-	-
Au (Dissolved)	JS	JS	-	-	-	-	-	-	-	-	-
Sulfate Sulfur	-	-	-	-	-	-	-	-	-	-	-
Pyritic Sulfur	-	-	-	-	-	-	-	-	-	-	-
Organic Sulfur	-	-	-	-	-	-	-	-	-	-	-

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHC 205	MHC 206	MHC 207	MHC 208	MHC 209	MHC 210	MHC 211	MHC 212	MHC 213	MHC 214	MHC 215
Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Metals (Total)											
Aluminum	JE	JE	JE	JE	JE	JE	JE	JE	JE	JE	JE
Antimony	-	-	-	-	-	-	-	-	-	-	-
Barium	-	-	-	-	-	-	-	-	-	-	-
Beryllium	-	-	-	-	-	-	-	-	-	-	-
Cadmium	-	-	-	-	-	-	-	-	-	-	-
Calcium	-	-	-	-	-	-	-	-	-	-	-
Lead	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-	-	-	-	-
Nickel	-	-	-	-	-	-	-	-	-	-	-
Selenium	R	R	R	R	R	R	R	R	R	R	R
Silver	-	-	-	-	-	-	-	-	-	-	-
Thallium	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Tin	-	-	-	-	-	-	-	-	-	-	-
Zinc	-	-	-	-	-	-	-	-	-	-	-
Cyanide	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT
Metals (Dissolved)											
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHC 489	MHC 491	MHC 475	MHC 476	MHC 477	MHC 486	MHC 490	MHE 201	MHE 202	MHE 203	MHE 204
SAS Parameters											
$NO2^-/NO_3^{2-}$	-	-	JHT	JHT	JHT	JHT	JHT	-	-	-	-
$HCO3^-/CO3^{2-}$	JHT	J	JHT	JHT	JHT	JHT	-	-	-	-	-
Acidity	JHT	JHT	JHT*	JHT*	JHT*	JHT*	JHT*	-	-	-	-
Cl^-	-	-	-	-	-	-	-	-	-	-	-
F^-	-	-	JHT	JHT	JHT	-	-	-	-	-	-
$SO4^{2-}$	-	-	JHT	JHT	JHT	JHT	-	-	-	-	-
TDS	JHT,S	JHT,S	JHT	JHT	JHT	JHT	JHT	-	-	-	-
TOC	JHT	JHT	JHT	-	-	-	-	-	-	-	-
Cr^{6+}	JHT	JHT	JHT	-	-	-	-	-	-	-	-
B (Total)	-	-	J*	J*	J*	J*	J*	-	-	-	-
Mo (Total)	-	-	-	-	-	-	-	-	-	-	-
Sr (Total)	-	-	-	-	-	-	-	-	-	-	-
Au (Total)	-	-	-	-	-	-	-	-	-	-	-
Au (Dissolved)	-	-	-	-	-	-	-	NA	NA	NA	NA
Sulfate Sulfur	-	-	-	-	-	-	-	-	-	-	-
Pyritic Sulfur	-	-	-	-	-	-	-	J*	J*	J*	J*
Organic Sulfur	-	-	-	-	-	-	-	J*	J*	J*	J*

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHE 216	MHE 217	MHE 218	MHE 219	MHE 220	MHE 221	MHE 222	MHE 223	MHE 224	MHE 225	MHE 226
Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Metals (Total)											
Aluminum	-	-	-	-	-	-	-	-	-	-	-
Antimony	-	-	-	-	-	-	-	-	-	-	-
Barium	-	-	-	-	-	-	-	-	-	-	-
Beryllium	-	-	-	-	-	-	-	-	-	-	-
Cadmium	-	-	-	-	-	-	-	-	-	-	-
Calcium	-	-	-	-	-	-	-	-	-	-	-
Lead	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-	-	-	-	-
Nickel	-	-	-	-	-	-	-	-	-	-	-
Selenium	R	R	R	R	R	R	R	R	-	-	-
Silver	-	-	-	-	-	-	-	-	-	-	-
Thallium	-	-	-	-	-	-	-	-	-	-	-
Tin	-	-	-	-	-	-	-	-	-	-	-
Zinc	-	-	-	-	-	-	-	-	-	-	-
Cyanide	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT
Metals (Dissolved)											
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHC 205	MHC 206	MHC 207	MHC 208	MHC 209	MHC 210	MHC 211	MHC 212	MHC 213	MHC 214	MHC 215
SAS Parameters											
$NO2^-/NO_3^{2-}$	-	-	-	-	-	-	-	-	-	-	-
$HCO3^-/CO3^{2-}$	-	-	-	-	-	-	-	-	-	-	-
Acidity	-	-	-	-	-	-	-	-	-	-	-
Cl^-	-	-	-	-	-	-	-	-	-	-	-
F^-	-	-	-	-	-	-	-	-	-	-	-
$SO4^{2-}$	-	-	-	-	-	-	-	-	-	-	-
TDS	-	-	-	-	-	-	-	-	-	-	-
TOC	-	-	-	-	-	-	-	-	-	-	-
Cr^{6+}	-	-	-	-	-	-	-	-	-	-	-
B (Total)	-	-	-	-	-	-	-	-	-	-	-
Mo (Total)	-	-	-	-	-	-	-	-	-	-	-
Sr (Total)	-	-	-	-	-	-	-	-	-	-	-
Au (Total)	-	-	-	-	-	-	-	-	-	-	-
Au (Dissolved)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate Sulfur	-	-	-	-	-	-	-	-	-	-	-
Pyritic Sulfur	J*	J*	J*	J*	J*	J*	J*	J*	J*	J*	J*
Organic Sulfur	J*	J*	J*	J*	J*	J*	J*	J*	J*	J*	J*

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHE 222	MHE 228	MHE 229	MHE 230	MHE 231	MHE 232	MHE 233	MHE 234	MHE 235	MHE 236	MHE 237
Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Metals (Total)											
Aluminum	-	-	-	-	-	-	-	-	-	-	-
Antimony	-	-	-	-	-	-	-	-	-	-	-
Barium	-	-	-	-	-	-	-	-	-	-	-
Beryllium	-	-	-	-	-	-	-	-	-	-	-
Cadmium	-	-	-	-	-	-	-	-	-	-	-
Calcium	-	-	-	-	-	-	-	-	-	-	-
Lead	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-	-	-	-	-
Nickel	-	-	-	-	-	-	-	-	-	-	-
Selenium	-	-	-	-	-	-	-	-	-	-	-
Silver	-	-	-	-	-	-	-	-	-	-	-
Thallium	-	-	-	-	-	-	-	-	-	-	-
Tin	-	-	-	-	-	-	-	-	-	-	-
Zinc	-	-	-	-	-	-	-	-	-	-	-
Cyanide	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT
Metals (Dissolved)											
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHE 216	MHE 217	MHE 218	MHE 219	MHE 220	MHE 221	MHE 222	MHE 223	MHE 224	MHE 225	MHE 226
SAS Parameters											
$NO2^-/NO_3^{2-}$	-	-	-	-	-	-	-	-	-	-	-
$HCO3^-/CO3^{2-}$	-	-	-	-	-	-	-	-	-	-	-
Acidity	-	-	-	-	-	-	-	-	-	-	-
Cl^-	-	-	-	-	-	-	-	-	-	-	-
F^-	-	-	-	-	-	-	-	-	-	-	-
$SO4^{2-}$	-	-	-	-	-	-	-	-	-	-	-
TDS	-	-	-	-	-	-	-	-	-	-	-
TOC	-	-	-	-	-	-	-	-	-	-	-
Cr^{6+}	-	-	-	-	-	-	-	-	-	-	-
B (Total)	-	-	-	-	-	-	-	-	-	-	-
Mo (Total)	-	-	-	-	-	-	-	-	-	-	-
Sr (Total)	-	-	-	-	-	-	-	-	-	-	-
Au (Total)	-	-	-	-	-	-	-	-	-	-	-
Au (Dissolved)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate Sulfur	JS	JS	JS	JS	JS	JS	JS	JS	-	-	-
Pyritic Sulfur	J*	J*	J*	J*	J*	J*	J*	J*	-	-	-
Organic Sulfur	J*,S	J*,S	J*,S	J*,S	J*,S	J*,S	J*,S	J*,S	-	-	-

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHE 238	MHE 239	MHE 240	MHE 241	MHE 242	MHE 243	MHE 244	MHE 245	MHE 246	MHE 247	MHE 248
Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Metals (Total)											
Aluminum	-	-	-	-	-	-	-	-	-	-	-
Antimony	-	-	-	-	-	-	JS	JS	JS	JS	JS
Barium	-	-	-	-	-	-	-	-	-	-	-
Beryllium	-	-	-	-	-	-	-	-	-	-	-
Cadmium	-	-	-	-	-	-	-	-	-	-	-
Calcium	-	-	-	-	-	-	-	-	-	-	-
Lead	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	JE	JE	JE	JE	JE
Mercury	-	-	-	-	-	-	-	-	-	-	-
Nickel	-	-	-	-	-	-	-	-	-	-	-
Selenium	-	-	-	-	-	-	JS	JS	JS	JS	JS
Silver	-	-	-	-	-	-	-	-	-	-	-
Thallium	-	-	-	-	-	-	-	-	-	-	-
Tin	-	-	-	-	-	-	-	-	-	-	-
Zinc	-	-	-	-	-	-	-	-	-	-	-
Cyanide	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT
Metals (Dissolved)											
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHE 222	MHE 228	MHE 229	MHE 230	MHE 231	MHE 232	MHE 233	MHE 234	MHE 235	MHE 236	MHE 237
SAS Parameters											
$NO2^-/NO_3$	-	-	-	-	-	-	-	-	-	-	-
$HCO3^-/CO3^{2-}$	-	-	-	-	-	-	-	-	-	-	-
Acidity	-	-	-	-	-	-	-	-	-	-	-
Cl^-	-	-	-	-	-	-	-	-	-	-	-
F^-	-	-	-	-	-	-	-	-	-	-	-
$SO4^{2-}$	-	-	-	-	-	-	-	-	-	-	-
TDS	-	-	-	-	-	-	-	-	-	-	-
TOC	-	-	-	-	-	-	-	-	-	-	-
Cr^{6+}	-	-	-	-	-	-	-	-	-	-	-
B (Total)	-	-	-	-	-	-	-	-	-	-	-
Mo (Total)	-	-	-	-	-	-	-	-	-	-	-
Sr (Total)	-	-	-	-	-	-	-	-	-	-	-
Au (Total)	-	-	-	-	-	-	-	-	-	-	-
Au (Dissolved)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate Sulfur	-	-	-	-	-	-	-	-	-	-	-
Pyritic Sulfur	-	-	-	-	-	-	-	-	-	-	-
Organic Sulfur	-	-	-	-	-	-	-	-	-	-	-

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHC 249	MHC 362	MHC 363	MHC 364	MHC 365	MHC 366	MHC 367	MHC 368
Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Metals (Total)								
Aluminum	-	-	-	-	-	-	-	-
Antimony	JS	JS	JS	JS	JS	JS	JS	JS
Barium	-	-	-	-	-	-	-	-
Beryllium	-	-	-	-	-	-	-	-
Cadmium	-	-	-	-	-	-	-	-
Calcium	-	-	-	-	-	-	-	-
Lead	-	-	-	-	-	-	-	-
Manganese	JE	JE	JE	JE	JE	JE	JE	JE
Mercury	-	-	-	-	-	-	-	-
Nickel	-	-	-	-	-	-	-	-
Selenium	JS	JS	JS	JS	JS	JS	JS	JS
Silver	-	-	-	-	-	-	-	-
Thallium	-	-	-	-	-	-	-	-
Tin	-	-	-	-	-	-	-	-
Zinc	-	-	-	-	-	-	-	-
Cyanide	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT
Metals (Dissolved)								
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	NA	NA	NA	NA	NA	NA	NA	NA
Silver	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	NA	NA	NA
Tin	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHE 238	MHE 239	MHE 240	MHE 241	MHE 242	MHE 243	MHE 244	MHE 245	MHE 246	MHE 247	MHE 248
SAS Parameters											
$NO2^-/NO_3^{2-}$	-	-	-	-	-	-	-	-	-	-	-
$HCO3^-/CO3^{2-}$	-	-	-	-	-	-	-	-	-	-	-
Acidity	-	-	-	-	-	-	-	-	-	-	-
Cl^-	-	-	-	-	-	-	-	-	-	-	-
F^-	-	-	-	-	-	-	-	-	-	-	-
$SO4^{2-}$	-	-	-	-	-	-	-	-	-	-	-
TDS	-	-	-	-	-	-	-	-	-	-	-
TOC	-	-	-	-	-	-	-	-	-	-	-
Cr^{6+}	-	-	-	-	-	-	-	-	-	-	-
B (Total)	-	-	-	-	-	-	-	-	-	-	-
Mo (Total)	-	-	-	-	-	-	-	-	-	-	-
Sr (Total)	-	-	-	-	-	-	-	-	-	-	-
Au (Total)	-	-	-	-	-	-	J	J	J	J	J
Au (Dissolved)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate Sulfur	-	-	-	-	-	-	-	-	-	-	-
Pyritic Sulfur	-	-	-	-	-	-	J*	J*	J*	J*	J*
Organic Sulfur	-	-	-	-	-	-	J*	J*	J*	J*	J*

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHC 397	MHC 398	MHC 299	MHC 492	MHC 493	MHC 494
Matrix	Water	Water	Water	Water	Water	Water
Metals (Total)						
Aluminum	-	-	-	-	-	-
Antimony	-	-	-	-	-	-
Barium	-	-	-	-	-	-
Beryllium	-	-	-	-	-	-
Cadmium	-	-	-	-	-	-
Calcium	-	-	-	-	-	-
Lead	-	-	-	-	-	-
Manganese	-	-	-	-	-	-
Mercury	-	-	-	-	-	-
Nickel	-	-	-	-	-	-
Selenium	-	-	-	-	-	-
Silver	-	-	-	-	-	-
Thallium	-	-	-	-	-	-
Tin	-	-	-	-	-	-
Zinc	-	-	-	-	-	-
Cyanide	-	-	-	-	-	-
Metals (Dissolved)						
Aluminum	-	-	-	-	-	-
Chromium	-	-	-	-	-	-
Mercury	JHT	JHT	JHT	JHT	JHT	JHT
Selenium	R	R	R	R	R	R
Silver	-	-	-	-	-	-
Thallium	JS	JS	JS	JS	JS	JS
Tin	-	-	-	-	-	-
Zinc	-	-	-	-	-	-
Cyanide	R	R	R	R	R	R

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHC 249	MHC 362	MHC 363	MHC 364	MHC 365	MHC 366	MHC 367	MHC 368
SAS Parameters								
$NO2^-/NO_3$	-	-	-	-	-	-	-	-
$HCO3^-/CO3^{2-}$	-	-	-	-	-	-	-	-
Acidity	-	-	-	-	-	-	-	-
Cl^-	-	-	-	-	-	-	-	-
F^-	-	-	-	-	-	-	-	-
$SO4^{2-}$	-	-	-	-	-	-	-	-
TDS	-	-	-	-	-	-	-	-
TOC	-	-	-	-	-	-	-	-
Cr^{6+}	-	-	-	-	-	-	-	-
B (Total)	-	-	-	-	-	-	-	-
Mo (Total)	-	-	-	-	-	-	-	-
Sr (Total)	-	-	-	-	-	-	-	-
Au (Total)	J	J	J	J	J	J	J	J
Au (Dissolved)	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate Sulfur	-	-	-	-	-	-	-	-
Pyritic Sulfur	J*	J*	J*	J*	J*	J*	J*	J*
Organic Sulfur	J*	J*	J*	J*	J*	J*	J*	J*

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHC 350	MHC 495	MHC 496	MHC 497	MHC 498	MHC 499
Matrix	Water	Water	Water	Water	Water	Water
Metals (Total)						
Aluminum	-	-	-	-	-	-
Antimony	-	-	-	-	-	-
Barium	-	-	-	-	-	-
Beryllium	-	-	-	-	-	-
Cadmium	-	-	-	-	-	-
Calcium	-	-	-	-	-	-
Lead	-	-	-	-	-	-
Manganese	-	-	-	-	-	-
Mercury	-	-	-	-	-	-
Nickel	-	-	-	-	-	-
Selenium	-	-	-	-	-	-
Silver	-	-	-	-	-	-
Thallium	-	-	-	-	-	-
Tin	-	-	-	-	-	-
Zinc	-	-	-	-	-	-
Cyanide	-	-	-	-	-	-
Metals (Dissolved)						
Aluminum	-	-	-	-	-	-
Chromium	-	-	-	-	-	-
Mercury	-	-	-	-	-	-
Selenium	-	-	-	-	-	-
Silver	-	-	-	-	-	-
Thallium	-	-	-	-	-	-
Tin	-	-	-	-	-	-
Zinc	-	-	-	-	-	-
Cyanide	-	-	-	-	-	-

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHC 397	MHC 398	MHC 399	MHC 492	MHC 493	MHC 494
SAS Parameters						
$NO2^-/NO_3$	-	-	-	-	-	-
$HCO3^-/CO3^{2-}$	JHT	JHT	JHT	JHT	JHT	JHT
Acidity	JHT	JHT	JHT	JHT	JHT	JHT
Cl^-	J*	J*	J*	J*	J*	J*
F^-	-	-	-	-	-	-
$SO4^{2-}$	-	-	-	-	-	-
TDS	JHT	JHT	JHT	JHT	JHT	JHT
TOC	-	-	-	-	-	-
Cr^{6+}	JHT	JHT	JHT	JHT	JHT	JHT
B (Total)	-	-	-	-	-	-
Mo (Total)	-	-	-	-	-	-
Sr (Total)	-	-	-	-	-	-
Au (Total)	-	-	-	-	-	-
Au (Dissolved)	JS	JS	JS	JS	JS	JS
Sulfate Sulfur	-	-	-	-	-	-
Pyritic Sulfur	-	-	-	-	-	-
Organic Sulfur	-	-	-	-	-	-

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHE 250	MHE 262	MHE 263	MHE 264	MHE 265	MHC 373	MHC 375	MHC 378	MHC 381	MHC 385	MHC 386
Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Metals (Total)											
Aluminum	-	-	-	-	-	-	-	-	-	-	-
Antimony	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Barium	-	-	-	-	-	-	-	-	-	-	-
Beryllium	-	-	-	-	-	-	-	-	-	-	-
Cadmium	-	-	-	-	-	-	-	-	-	-	-
Calcium	-	-	-	-	-	-	-	-	-	-	-
Lead	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-	-	-	-	-
Nickel	-	-	-	-	-	-	-	-	-	-	-
Selenium	-	-	-	-	-	-	-	-	-	-	-
Silver	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Thallium	-	-	-	-	-	-	-	-	-	-	-
Tin	-	-	-	-	-	-	-	-	-	-	-
Zinc	-	-	-	-	-	-	-	-	-	-	-
Cyanide	-	-	-	-	-	-	-	-	-	-	-
Metals (Dissolved)											
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHC 350	MHC 495	MHC 496	MHC 497	MHC 498	MHC 499
SAS Parameters						
$NO2^-/NO_3$	-	-	-	-	-	-
$HCO3^-/CO3^{2-}$	-	-	-	-	-	-
Acidity	-	-	-	-	-	-
CL^-	-	-	-	-	-	-
F^-	-	-	-	-	-	-
$SO4^{2-}$	-	-	-	-	-	-
TDS	-	-	-	-	-	-
TOC	-	-	-	-	-	-
Cr^{6+}	-	-	-	-	-	-
B (Total)	-	-	-	-	-	-
Mo (Total)	-	-	-	-	-	-
Sr (Total)	-	-	-	-	-	-
Au (Total)	-	-	-	-	-	-
Au (Dissolved)	-	-	-	-	-	-
Sulfate Sulfur	JS	JS	JS	JS	JS	JS
Pyritic Sulfur	-	-	-	-	-	-
Organic Sulfur	JS	JS	JS	JS	JS	JS

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHC 382	MHC 388	MHC 389	MHC 390	MHC 391	MHC 392	MHC 393	MHC 394	MHC 395
Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Metals (Total)									
Aluminum	-	-	-	-	-	-	-	-	-
Antimony	JS	JS	JS	JS	JS	JS	JS	JS	JS
Barium	-	-	-	-	-	-	-	-	-
Beryllium	-	-	-	-	-	-	-	-	-
Cadmium	-	-	-	-	-	-	-	-	-
Calcium	-	-	-	-	-	-	-	-	-
Lead	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-	-	-
Nickel	-	-	-	-	-	-	-	-	-
Selenium	JS	JS	JS	JS	JS	JS	JS	JS	JS
Silver	-	-	-	-	-	-	-	-	-
Thallium	-	-	-	-	-	-	-	-	-
Tin	-	-	-	-	-	-	-	-	-
Zinc	-	-	-	-	-	-	-	-	-
Cyanide	-	-	-	-	-	-	-	-	-
Metals (Dissolved)									
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tin	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHE 250	MHE 262	MHE 263	MHE 264	MHE 265	MHC 373	MHC 375	MHC 378	MHC 381	MHC 385	MHC 386
SAS Parameters											
$NO2^-/NO_3$	-	-	-	-	-	-	-	-	-	-	-
$HCO3^-/CO3^{2-}$	-	-	-	-	-	-	-	-	-	-	-
Acidity	-	-	-	-	-	-	-	-	-	-	-
Cl^-	-	-	-	-	-	-	-	-	-	-	-
F^-	-	-	-	-	-	-	-	-	-	-	-
$SO4^{2-}$	-	-	-	-	-	-	-	-	-	-	-
TDS	-	-	-	-	-	-	-	-	-	-	-
TOC	-	-	-	-	-	-	-	-	-	-	-
Cr^{6+}	-	-	-	-	-	-	-	-	-	-	-
B (Total)	-	-	-	-	-	-	-	-	-	-	-
Mo (Total)	-	-	-	-	-	-	-	-	-	-	-
Sr (Total)	-	-	-	-	-	-	-	-	-	-	-
Au (Total)	-	-	-	-	-	-	-	-	-	-	-
Au (Dissolved)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate Sulfur	-	-	-	-	-	-	-	-	-	-	-
Pyritic Sulfur	J*	J*	J*	J*	J*	J*	J*	J*	J*	J*	J*
Organic Sulfur	J*	J*	J*	J*	J*	J*	J*	J*	J*	J*	J*

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHC 396	MHE 266	MHE 267	MHE 268	MHE 269	MHE 270	MHE 271	MHE 272	MHE 273	MHE 274	MHE 275
Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Metals (Total)											
Aluminum	-	-	-	-	-	-	-	-	-	-	-
Antimony	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Barium	-	-	-	-	-	-	-	-	-	-	-
Beryllium	-	-	-	-	-	-	-	-	-	-	-
Cadmium	-	-	-	-	-	-	-	-	-	-	-
Calcium	-	-	-	-	-	-	-	-	-	-	-
Lead	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-
Mercury	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Nickel	-	-	-	-	-	-	-	-	-	-	-
Selenium	R	R	R	R	R	R	R	R	R	R	R
Silver	-	-	-	-	-	-	-	-	-	-	-
Thallium	-	-	-	-	-	-	-	-	-	-	-
Tin	-	-	-	-	-	-	-	-	-	-	-
Zinc	-	-	-	-	-	-	-	-	-	-	-
Cyanide	-	-	-	-	-	-	-	-	-	-	-
Metals (Dissolved)											
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHC 387	MHC 388	MHC 389	MHC 390	MHC 391	MHC 392	MHC 393	MHC 394	MHC 395
SAS Parameters									
$NO2^-/NO_3$	-	-	-	-	-	-	-	-	-
$HCO3^-/CO3^{2-}$	-	-	-	-	-	-	-	-	-
Acidity	-	-	-	-	-	-	-	-	-
Cl^-	-	-	-	-	-	-	-	-	-
F^-	-	-	-	-	-	-	-	-	-
$SO4^{2-}$	-	-	-	-	-	-	-	-	-
TDS	-	-	-	-	-	-	-	-	-
TOC	-	-	-	-	-	-	-	-	-
Cr^{6+}	-	-	-	-	-	-	-	-	-
B (Total)	-	-	-	-	-	-	-	-	-
Mo (Total)	-	-	-	-	-	-	-	-	-
Sr (Total)	-	-	-	-	-	-	-	-	-
Au (Total)	-	-	-	-	-	-	-	-	-
Au (Dissolved)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate Sulfur	-	-	-	-	-	-	-	-	-
Pyritic Sulfur	J*	J*	J*	J*	J*	J*	J*	J*	J*
Organic Sulfur	J*	J*	J*	J*	J*	J*	J*	J*	J*

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHE 276	MHE 277	MHE 278	MHE 279	MHE 280	MHC 369	MHC 370	MHC 371	MHC 372	MHC 374	MHC 376
Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Metals (Total)											
Aluminum	-	-	-	-	-	-	-	-	-	-	-
Antimony	JS	JS	JS	JS	JS	-	-	-	-	-	-
Barium	-	-	-	-	-	-	-	-	-	-	-
Beryllium	-	-	-	-	-	-	-	-	-	-	-
Cadmium	-	-	-	-	-	-	-	-	-	-	-
Calcium	-	-	-	-	-	-	-	-	-	-	-
Lead	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-
Mercury	JS	JS	JS	JS	JS	-	-	-	-	-	-
Nickel	-	-	-	-	-	-	-	-	-	-	-
Selenium	R	R	R	R	R	JS	JS	JS	JS	JS	JS
Silver	-	-	-	-	-	-	-	-	-	-	-
Thallium	-	-	-	-	-	JS	JS	JS	JS	JS	JS
Tin	-	-	-	-	-	-	-	-	-	-	-
Zinc	-	-	-	-	-	-	-	-	-	-	-
Cyanide	-	-	-	-	-	-	-	-	-	-	-
Metals (Dissolved)											
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHC 396	MHE 266	MHE 267	MHE 268	MHE 269	MHE 270	MHE 271	MHE 272	MHE 273	MHE 274	MHE 275
SAS Parameters											
$NO2^-/NO_3^-$	-	-	-	-	-	-	-	-	-	-	-
$HCO3^-/CO3^{2-}$	-	-	-	-	-	-	-	-	-	-	-
Acidity	-	-	-	-	-	-	-	-	-	-	-
Cl^-	-	-	-	-	-	-	-	-	-	-	-
F^-	-	-	-	-	-	-	-	-	-	-	-
$SO4^{2-}$	-	-	-	-	-	-	-	-	-	-	-
TDS	-	-	-	-	-	-	-	-	-	-	-
TOC	-	-	-	-	-	-	-	-	-	-	-
Cr^{6+}	-	-	-	-	-	-	-	-	-	-	-
B (Total)	-	-	-	-	-	-	-	-	-	-	-
Mo (Total)	-	-	-	-	-	-	-	-	-	-	-
Sr (Total)	-	-	-	-	-	-	-	-	-	-	-
Au (Total)	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Au (Dissolved)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate Sulfur	-	-	-	-	-	-	-	-	-	-	-
Pyritic Sulfur	-	-	-	-	-	-	-	-	-	-	-
Organic Sulfur	-	-	-	-	-	-	-	-	-	-	-

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHC 377	MHC 379	MHC 380	MHC 382	MHC 383	MHC 384	MHE 259	MHE 260	MHE 261
Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Metals (Total)									
Aluminum	-	-	-	-	-	-	-	-	-
Antimony	-	-	-	-	-	-	-	-	-
Barium	-	-	-	-	-	-	-	-	-
Beryllium	-	-	-	-	-	-	-	-	-
Cadmium	-	-	-	-	-	-	-	-	-
Calcium	-	-	-	-	-	-	-	-	-
Lead	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	JHT	JHT	JHT
Nickel	-	-	-	-	-	-	JS	JS	JS
Selenium	JS	JS	JS	JS	JS	JS	R	R	R
Silver	-	-	-	-	-	-	-	-	-
Thallium	JS	JS	JS	JS	JS	JS	-	-	-
Tin	-	-	-	-	-	-	-	-	-
Zinc	-	-	-	-	-	-	-	-	-
Cyanide	-	-	-	-	-	-	JHT	JHT	JHT
Metals (Dissolved)									
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tin	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyanide	NA	NA	NA	NA	NA	NA	NA	NA	NA

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHE 276	MHE 277	MHE 278	MHE 279	MHE 280	MHC 369	MHC 370	MHC 371	MHC 372	MHC 374	MHC 376
SAS Parameters											
$NO2^-/NO_3$	-	-	-	-	-	-	-	-	-	-	-
$HCO3^-/CO3^{2-}$	-	-	-	-	-	-	-	-	-	-	-
Acidity	-	-	-	-	-	-	-	-	-	-	-
CL^-	-	-	-	-	-	-	-	-	-	-	-
F^-	-	-	-	-	-	-	-	-	-	-	-
$SO4^{2-}$	-	-	-	-	-	-	-	-	-	-	-
TDS	-	-	-	-	-	-	-	-	-	-	-
TOC	-	-	-	-	-	-	-	-	-	-	-
Cr^{6+}	-	-	-	-	-	-	-	-	-	-	-
B (Total)	-	-	-	-	-	-	-	-	-	-	-
Mo (Total)	-	-	-	-	-	JC	JC	JC	JC	JC	JC
Sr (Total)	-	-	-	-	-	-	-	-	-	-	-
Au (Total)	JS	JS	JS	JS	JS	-	-	-	-	-	-
Au (Dissolved)	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate Sulfur	-	-	-	-	-	-	-	-	-	-	-
Pyritic Sulfur	-	-	-	-	-	-	-	-	-	-	-
Organic Sulfur	-	-	-	-	-	-	-	-	-	-	-

TABLE 12A-2

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHC 377	MHC 379	MHC 380	MHC 382	MHC 383	MHC 384	MHE 259	MHE 260	MHE 261
SAS Parameters									
$NO2^-/NO_3^{2-}$	-	-	-	-	-	-	J*	J*	J*
$HCO3^-/CO3^{2-}$	-	-	-	-	-	-	J	J	J
Acidity	-	-	-	-	-	-	JHT	JHT	JHT
CL^-	-	-	-	-	-	-	-	-	-
F^-	-	-	-	-	-	-	-	-	-
$SO4^{2-}$	-	-	-	-	-	-	-	-	-
TDS	-	-	-	-	-	-	JHT	JHT	JHT
TOC	-	-	-	-	-	-	-	-	-
Cr^{6+}	-	-	-	-	-	-	JHT	JHT	JHT
B (Total)	-	-	-	-	-	-	-	-	-
Mo (Total)	JC	JC	JC	JC	JC	JC	-	-	-
Sr (Total)	-	-	-	-	-	-	JS	JS	JS
Au (Total)	-	-	-	-	-	-	-	-	-
Au (Dissolved)	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sulfate Sulfur	-	-	-	-	-	-	-	-	-
Pyritic Sulfur	-	-	-	-	-	-	-	-	-
Organic Sulfur	-	-	-	-	-	-	-	-	-

TABLE 12A-3

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)

Sample	MHE 423	MHE 426	MHE 428	MHE 469
Matrix	Water	Water	Water	Water
Metals (Total)				
Antimony	JS	JS	JS	JS
Beryllium	JE	JE	JE	JE
Cadmium	JE	JE	JE	JE
Calcium	-	-	-	-
Copper	-	-	-	-
Iron	-	-	-	-
Magnesium	-	-	-	-
Manganese	-	-	-	-
Selenium	JS	JS	JS	JS
Silver	JS	JS	JS	JS
Thallium	JS	JS	JS	JS
Tin	-	-	-	-
Zinc	-	-	-	-
Metals (Dissolved)				
Antimony	JS	JS	JS	JS
Copper	-	-	-	-
Lead	-	-	-	-
Mercury	-	-	-	-
Nickel	-	-	-	-
Selenium	JS	JS	JS	JS
Silver	JS	JS	JS	JS
Thallium	-	-	-	-
SAS Parameters				
$NO2^-/NO_3$	-	-	-	-
$NO3^-$	-	-	-	-
Acidity	-	-	-	-
Cl^-	-	-	-	-
$SO4^{2-}$	JC	JC	JC	JC
TSS	-	-	-	-
Sulfide	JS	JS	JS	JS

TABLE 12A-3

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHE 472	MHE 482	MHE 485	MHE 540	MHE 429	MHE 430	MHE 431	MHE 475	MHE 479	MHE 562	MHE 563
Matrix	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
Metals (Total)											
Antimony	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Beryllium	JE	JE	JE	JE	JE	JE	JE	JE	JE	JE	JE
Cadmium	JE	JE	JE	JE	JE	JE	JE	JE	JE	JE	JE
Calcium	-	-	-	-	-	-	-	-	-	-	-
Copper	-	-	-	-	-	-	-	-	-	-	-
Iron	-	-	-	-	-	-	-	-	-	-	-
Magnesium	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-
Selenium	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Silver	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Thallium	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Tin	-	-	-	-	-	-	-	-	-	-	-
Zinc	-	-	-	-	-	-	-	-	-	-	-
Metals (Dissolved)											
Antimony	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Copper	-	-	-	-	-	-	-	-	-	-	-
Lead	-	-	-	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-	-	-	-	-
Nickel	-	-	-	-	-	-	-	-	-	-	-
Selenium	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Silver	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Thallium	-	-	-	-	-	-	-	-	-	-	-
SAS Parameters											
$NO2^-/NO_3$	-	-	-	-	R	-	-	-	-	-	-
$NO3^-$	-	-	-	-	R	-	-	-	-	-	-
Acidity	-	-	-	-	-	-	-	-	-	-	-
Cl^-	-	-	-	-	-	-	-	-	-	-	-
$SO4^{2-}$	JC	JC	JC	JC	JC	JC	JC	JC	JC	JC	JC
TSS	-	-	-	-	-	-	-	-	-	-	-
Sulfide	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS

TABLE 12A-3

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHE 564	MHE 448	MHE 449	MHE 450	MHE 451	MHE 452	MHE 453	MHE 454	MHE 455	MHE 456	MHE 457
Matrix	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
Metals (Total)											
Antimony	JS	-	-	-	-	-	-	-	JS	JS	JS
Beryllium	JE	-	-	-	-	-	-	-	-	-	-
Cadmium	JE	-	-	-	-	-	-	-	-	-	-
Calcium	-	-	-	-	-	-	-	-	-	-	-
Copper	-	-	-	-	-	-	-	-	-	-	-
Iron	-	-	-	-	-	-	-	-	-	-	-
Magnesium	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-
Selenium	JS	-	-	-	-	-	-	-	JS	JS	JS
Silver	JS	-	-	-	-	-	-	-	JS	JS	JS
Thallium	JS	-	-	-	-	-	-	-	JS	JS	JS
Tin	-	-	-	-	-	-	-	-	-	-	-
Zinc	-	-	-	-	-	-	-	-	-	-	-
Metals (Dissolved)											
Antimony	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Copper	-	-	-	-	-	-	-	-	-	-	-
Lead	-	-	-	-	-	-	-	-	JS	JS	JS
Mercury	-	-	-	-	-	-	-	-	-	-	-
Nickel	-	-	-	-	-	-	-	-	-	-	-
Selenium	JS	R	R	R	R	R	R	R	-	-	-
Silver	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Thallium	-	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
SAS Parameters											
$NO2^-/NO_3$	-	-	-	-	-	-	-	-	-	-	-
$NO3^-$	-	-	-	-	-	-	-	-	-	-	-
Acidity	-	-	-	-	-	-	-	-	-	-	-
Cl^-	-	-	-	-	-	-	-	-	-	-	-
$SO4^{2-}$	JC	-	-	-	-	-	-	-	-	-	-
TSS	-	-	-	-	-	-	-	-	-	-	-
Sulfide	JS	-	-	-	-	-	-	-	-	-	-

TABLE 12A-3

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHE 458	MHE 459	MHE 460	MHE 461	MHE 462	MHE 463	MHE 465	MHE 466	MHE 468	MHE 515	MHE 516
Matrix	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
Metals (Total)											
Antimony	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Beryllium	-	-	-	-	-	-	-	-	-	-	-
Cadmium	-	-	-	-	-	-	-	-	-	-	-
Calcium	-	-	-	-	-	-	-	-	-	-	-
Copper	-	-	-	-	-	-	-	-	-	-	-
Iron	-	-	-	-	-	-	-	-	-	-	-
Magnesium	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-
Selenium	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Silver	-	-	-	-	-	-	-	-	-	-	-
Thallium	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Tin	-	-	-	-	-	-	-	-	-	-	-
Zinc	-	-	-	-	-	-	-	-	-	-	-
Metals (Dissolved)											
Antimony	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Copper	-	-	-	-	-	-	-	-	-	-	-
Lead	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Mercury	-	-	-	-	-	-	-	-	-	-	-
Nickel	-	-	-	-	-	-	-	-	-	-	-
Selenium	-	-	-	-	-	-	-	-	-	-	-
Silver	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Thallium	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
SAS Parameters											
$NO2^-/NO_3$	-	-	-	-	-	-	-	-	-	-	-
$NO3^-$	-	-	-	-	-	-	-	-	-	-	-
Acidity	-	-	-	-	-	-	-	-	-	-	-
Cl^-	-	-	-	-	-	-	-	-	-	-	-
$SO4^{2-}$	-	-	-	-	-	-	-	-	-	-	-
TSS	-	-	-	-	-	-	-	-	-	-	-
Sulfide	-	-	-	-	-	-	-	-	-	-	-

TABLE 12A-3

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHE 519	MHE 520	MHE 521	MHE 488	MHE 548	MHE 551	MHE 554
Matrix	Water	Water	Water	Water	Water	Water	Water
Metals (Total)							
Antimony	JS	JS	JS	-	-	-	-
Beryllium	-	-	-	-	-	-	-
Cadmium	-	-	-	-	-	-	-
Calcium	-	-	-	-	-	-	-
Copper	-	-	-	-	-	-	-
Iron	-	-	-	-	-	-	-
Magnesium	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-
Selenium	JS	JS	JS	-	-	-	-
Silver	-	-	-	-	-	-	-
Thallium	JS	JS	JS	-	-	-	-
Tin	-	-	-	-	-	-	-
Zinc	-	-	-	-	-	-	-
Metals (Dissolved)							
Antimony	JS	JS	JS	JS	JS	JS	JS
Copper	-	-	-	-	-	-	-
Lead	JS	JS	JS	R	R	R	R
Mercury	-	-	-	-	-	-	-
Nickel	-	-	-	-	-	-	-
Selenium	-	-	-	R	R	R	R
Silver	JS	JS	JS	JS	JS	JS	JS
Thallium	JS	JS	JS	JS	JS	JS	JS
Zinc	-	-	-	JS	JS	JS	JS
SAS Parameters							
$NO2^-/NO_3$	-	-	-	-	-	-	-
$NO3^-$	-	-	-	-	-	-	-
Acidity	-	-	-	-	-	-	-
Cl^-	-	-	-	J*	J*	J*	J*
$SO4^{2-}$	-	-	-	-	-	-	-
TSS	-	-	-	-	-	-	-
Sulfide	-	-	-	JS	JS	JS	JS

TABLE 12A-3

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHE 491	MHE 497	MHE 500	MHE 503	MHE 506	MHE 509	MHE 512
Matrix	Water	Water	Water	Water	Water	Water	Water
Metals (Total)							
Aluminum	JS	JS	JS	JS	JS	JS	JS
Antimony	JS	JS	JS	JS	JS	JS	JS
Beryllium	-	-	-	-	-	-	-
Cadmium	-	-	-	-	-	-	-
Calcium	JS	JS	JS	JS	JS	JS	JS
Copper	JS	JS	JS	JS	JS	JS	JS
Iron	-	-	-	-	-	-	-
Magnesium	JS	JS	JS	JS	JS	JS	JS
Manganese	-	-	-	-	-	-	-
Selenium	R	R	R	R	R	R	R
Silver	JS	JS	JS	JS	JS	JS	JS
Thallium	JS	JS	JS	JS	JS	JS	JS
Tin	JS	JS	JS	JS	JS	JS	JS
Zinc	JS	JS	JS	JS	JS	JS	JS
Metals (Dissolved)							
Antimony	-	-	-	-	-	-	-
Copper	-	-	-	-	-	-	-
Lead	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-
Nickel	-	-	-	-	-	-	-
Selenium	-	-	-	-	-	-	-
Silver	-	-	-	-	-	-	-
Thallium	-	-	-	-	-	-	-
SAS Parameters							
$NO2^-/NO_3$	-	-	-	-	-	-	-
$NO3^-$	-	-	-	-	-	-	-
Acidity	JS	JS	JS	JS	JS	JS	JS
Cl^-	-	-	-	-	-	-	-
$SO4^{2-}$	-	-	-	-	-	-	-
TSS	JHT	JHT	JHT	JHT	JHT	JHT	JHT
Sulfide	JS	JS	JS	JS	JS	JS	JS

TABLE 12A-3

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHE 528	MHE 531	MHE 534	MHE 537	MHE 542	MHE 545
Matrix	Water	Water	Water	Water	Water	Water
Metals (Total)						
Alluminum	JS	JS	JS	JS	JS	JS
Antimony	JS	JS	JS	JS	JS	JS
Beryllium	-	-	-	-	-	-
Cadmium	-	-	-	-	-	-
Calcium	JS	JS	JS	JS	JS	JS
Copper	JS	JS	JS	JS	JS	JS
Iron	-	-	-	-	-	-
Magnesium	JS	JS	JS	JS	JS	JS
Manganese	JS	JS	JS	JS	JS	JS
Selenium	R	R	R	R	R	R
Silver	JS	JS	JS	JS	JS	JS
Thallium	JS	JS	JS	JS	JS	JS
Tin	JS	JS	JS	JS	JS	JS
Zinc	JS	JS	JS	JS	JS	JS
Metals (Dissolved)						
Antimony	-	-	-	-	-	-
Copper	-	-	-	-	-	-
Lead	-	-	-	-	-	-
Mercury	-	-	-	-	-	-
Nickel	-	-	-	-	-	-
Selenium	-	-	-	-	-	-
Silver	-	-	-	-	-	-
Thallium	-	-	-	-	-	-
SAS Parameters						
$NO2^-/NO_3$	-	-	-	-	-	-
$NO3^-$	-	-	-	-	-	-
Acidity	JS	JS	JS	JS	JS	JS
Cl^-	-	-	-	-	-	-
$SO4^{2-}$	-	-	-	-	-	-
TSS	-	-	-	-	-	-
Sulfide	JS	JS	JS	JS	JS	JS

TABLE 12A-3

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHE 522	MHE 523	MHE 524	MHE 525	MHE 526	MHE 557
Matrix	Water	Water	Water	Water	Water	Water
Metals (Total)						
Aluminum	-	-	-	-	-	-
Antimony	JS	JS	JS	JS	JS	JS
Beryllium	-	-	-	-	-	-
Cadmium	-	-	-	-	-	-
Calcium	-	-	-	-	-	-
Copper	-	-	-	-	-	-
Iron	JE,S	JE,S	JE,S	JE,S	JE,S	JE,S
Magnesium	-	-	-	-	-	-
Manganese	JS	JS	JS	JS	JS	JS
Selenium	R	R	R	R	R	R
Silver	JS	JS	JS	JS	JS	JS
Thallium	JS	JS	JS	JS	JS	JS
Tin	-	-	-	-	-	-
Zinc	-	-	-	-	-	-
Metals (Dissolved)						
Antimony	JS	JS	JS	JS	JS	JS
Copper	-	-	-	-	-	-
Lead	-	-	-	-	-	-
Mercury	JE	JE	JE	JE	JE	JE
Nickel	-	-	-	-	-	-
Selenium	R	R	R	R	R	R
Silver	JS	JS	JS	JS	JS	JS
Thallium	-	-	-	-	-	-
SAS Parameters						
$NO2^-/NO_3$	-	-	-	-	-	-
$NO3^-$	-	-	-	-	-	-
Acidity	-	-	-	-	-	-
Cl^-	-	-	-	-	-	-
$SO4^{2-}$	-	-	-	-	-	-
TSS	-	-	-	-	-	-
Sulfide	-	-	-	-	-	-

TABLE 12A-3

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHE 569	MHE 570	MHE 571	MHE 572	MHE 568	MHE 434
Matrix	Water	Water	Water	Water	Water	Water
Metals (Total)						
Aluminum	JS	JS	JS	JS	JS	JS
Antimony	JS	JS	JS	JS	JS	JS
Beryllium	-	-	-	-	-	-
Cadmium	-	-	-	-	-	-
Calcium	-	-	-	-	-	-
Copper	-	-	-	-	-	-
Iron	JE	JE	JE	JE	JE	JE
Magnesium	-	-	-	-	-	-
Manganese	-	-	-	-	-	-
Selenium	R	R	R	R	R	R
Silver	JS	JS	JS	JS	JS	JS
Thallium	-	-	-	-	-	-
Tin	-	-	-	-	-	-
Zinc	-	-	-	-	-	-
Metals (Dissolved)						
Aluminum	JS	JS	JS	JS	JS	JS
Antimony	-	-	-	-	-	-
Copper	-	-	-	-	-	-
Lead	R	R	R	R	R	R
Mercury	-	-	-	-	-	-
Nickel	JE	JE	JE	JE	JE	JE
Selenium	R	R	R	R	R	R
Silver	JS	JS	JS	JS	JS	JS
Thallium	-	-	-	-	-	-
Tin	JS	JS	JS	JS	JS	JS
SAS Parameters						
$NO2^-/NO_3$	-	-	-	-	-	-
$NO3^-$	-	-	-	-	-	-
Acidity	-	-	-	-	-	-
Cl^-	-	-	-	-	-	-
$SO4^{2-}$	-	-	-	-	-	-
TSS	-	-	-	-	-	-
Sulfide	-	-	-	-	-	-

TABLE 12A-3

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHE 437	MHE 440	MHE 443	MHE 576	MHE 560	MHE 561
Matrix	Water	Water	Water	Water	Water	Water
Metals (Total)						
Aluminum	JS	JS	JS	JS	JS	JS
Antimony	JS	JS	JS	JS	JS	JS
Beryllium	-	-	-	-	-	-
Cadmium	-	-	-	-	-	-
Calcium	-	-	-	-	-	-
Copper	-	-	-	-	-	-
Iron	JE	JE	JE	JE	JE	JE
Magnesium	-	-	-	-	-	-
Manganese	-	-	-	-	-	-
Selenium	R	R	R	R	R	R
Silver	JS	JS	JS	JS	JS	JS
Thallium	-	-	-	-	-	-
Tin	-	-	-	-	-	-
Zinc	-	-	-	-	-	-
Metals (Dissolved)						
Aluminum	JS	JS	JS	JS	JS	JS
Antimony	-	-	-	-	-	-
Copper	-	-	-	-	-	-
Lead	R	R	R	R	R	R
Mercury	-	-	-	-	-	-
Nickel	JE	JE	JE	JE	JE	JE
Selenium	R	R	R	R	R	R
Silver	JS	JS	JS	JS	JS	JS
Thallium	-	-	-	-	-	-
Tin	JS	JS	JS	JS	JS	JS
SAS Parameters						
$NO2^-/NO_3$	-	-	-	-	-	-
$NO3^-$	-	-	-	-	-	-
Acidity	-	-	-	-	-	-
Cl^-	-	-	-	-	-	-
$SO4^{2-}$	-	-	-	-	-	-
TSS	-	-	-	-	-	-
Sulfide	-	-	-	-	-	-

TABLE 12A-3

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHE 565	MHE 566	MHE 567	MHE 574	MHE 575	MHE 580	MHE 581	MHE 582	MHE 583	MHC 922	MHC 939
Matrix	Water	Water	Water	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Metals (Total)											
Antimony	-	-	-	-	-	JS	JS	JS	JS	JS	JS
Beryllium	-	-	-	J	-	-	-	-	-	-	-
Cadmium	-	-	-	-	J	-	-	-	-	-	-
Calcium	-	-	-	-	-	-	-	-	-	-	-
Copper	-	-	-	-	-	-	-	-	-	-	-
Iron	-	-	-	-	-	-	-	-	-	-	-
Magnesium	-	-	-	-	-	-	-	-	-	-	-
Manganese	-	-	-	-	-	-	-	-	-	-	-
Selenium	-	-	-	R	R	JS	JS	JS	JS	JS	JS
Silver	-	-	-	-	-	-	-	-	-	-	-
Thallium	-	-	-	-	-	-	-	-	-	-	-
Tin	-	-	-	-	-	-	-	-	-	-	-
Zinc	-	-	-	JE	JE	J*	J*	J*	J*	J*	J*
Metals (Dissolved)											
Aluminum	JS	JS	JS	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	-	-	-	NA	NA	NA	NA	NA	NA	NA	NA
Copper	JS	JS	JS	NA	NA	NA	NA	NA	NA	NA	NA
Lead	-	-	-	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	-	-	-	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	JE	JE	JE	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	R	R	R	NA	NA	NA	NA	NA	NA	NA	NA
Silver	-	-	-	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	JS	JS	JS	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	JS	JS	JS	NA	NA	NA	NA	NA	NA	NA	NA
SAS Parameters											
$NO2^-/NO_3$	-	-	-	-	-	-	-	-	-	-	-
$NO3^-$	-	-	-	-	-	-	-	-	-	-	-
Acidity	-	-	-	-	-	-	-	-	-	-	-
Cl^-	-	-	-	-	-	-	-	-	-	-	-
$SO4^{2-}$	-	-	-	-	-	-	-	-	-	-	-
TSS	-	-	-	-	-	-	-	-	-	-	-
Sulfide	-	-	-	-	-	-	-	-	-	-	-

TABLE 12A-3

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHC 940	MHC 941
Matrix	Soil	Soil
Metals (Total)		
Antimony	JS	JS
Beryllium	-	-
Cadmium	-	-
Calcium	-	-
Copper	-	-
Iron	-	-
Magnesium	-	-
Manganese	-	-
Selenium	JS	JS
Silver	-	-
Thallium	-	-
Tin	-	-
Zincq	J*	J*
Metals (Dissolved)		
Antimony	NA	NA
Copper	NA	NA
Lead	NA	NA
Mercury	NA	NA
Nickel	NA	NA
Selenium	NA	NA
Silver	NA	NA
Thallium	NA	NA
SAS Parameters		
$NO2^-/NO_3$	-	-
$NO3^-$	-	-
Acidity	-	-
Cl^-	-	-
$SO4^{2-}$	-	-
TSS	-	-
Sulfide	-	-

TABLE 12A-4

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)

Sample	MHD 161	MHD 162	MHD 163	MHD 164	MHD 165	MHD 166	MHD 167	MHD 168	MHD 169	MHD 171	MHD 172
Matrix	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
Metals (Total)											
Antimony	-	-	-	-	-	-	-	-	-	-	-
Arsenic	-	-	-	-	-	-	-	-	-	-	-
Copper	-	-	-	-	-	-	-	-	-	-	-
Iron	JS	JS	JS	JS	JS	JS	JS	JS	-	-	-
Lead	-	-	-	-	-	-	-	-	JS	JS	JS
Mercury	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT
Nickel	-	-	-	-	-	-	-	-	-	-	-
Potassium	JS	JS	JS	JS	JS	JS	JS	JS	-	-	-
Selenium	-	-	-	-	-	-	-	-	R	R	R
Silver	JS	JS	JS	JS	JS	JS	JS	JS	R	R	R
Sodium	JS	JS	JS	JS	JS	JS	JS	JS	-	-	-
Tin	-	-	-	-	-	-	-	-	R	R	R
Metals (Dissolved)											
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SAS Parameters											
$NO2^-$	-	-	-	-	-	-	-	-	-	-	-
$NO3^-$	-	-	-	-	-	-	-	-	-	-	-
Acidity	-	-	-	-	-	-	-	-	J*	J*	J*
$SO4^{2-}$	-	-	-	-	-	-	-	-	JC	JC	JC
TDS	-	-	-	-	-	-	-	-	JC	JC	JC
Cr^{6+}	-	-	-	-	-	-	-	-	-	-	JS
TSS	-	-	-	-	-	-	-	-	JC	JC	JC

TABLE 12A-4

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHD 173	MHD 178	MHD 179	MHD 180	MHD 181	MHD 182	MHD 183	MHD 184	MHD 185	MHD 186	MHD 187
Matrix	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
Metals (Total)											
Antimony	-	-	-	-	-	-	-	-	-	-	-
Arsenic	-	-	-	-	-	-	-	-	-	-	-
Copper	-	-	-	-	-	-	-	-	-	-	-
Iron	-	-	-	-	-	-	-	-	-	-	-
Lead	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Mercury	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT
Nickel	-	-	-	-	-	-	-	-	-	-	-
Potassium	-	-	-	-	-	-	-	-	-	-	-
Selenium	R	R	R	R	R	R	R	R	R	R	R
Silver	R	R	R	R	R	R	R	R	R	R	R
Sodium	-	-	-	-	-	-	-	-	-	-	-
Tin	R	R	R	R	R	R	R	R	R	R	R
Metals (Dissolved)											
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SAS Parameters											
$NO2^-$	-	-	-	-	-	-	-	-	-	-	-
$NO3^-$	-	-	-	-	-	-	-	-	-	-	-
Acidity	J*	J*	J*	J*	J*	J*	J*	J*	J*	J*	J*
$SO4^{2-}$	JC	JC	JC	JC	JC	JC	JC	JC	JC	JC	JC
TDS	JC	JC	JC	JC	JC	JC	JC	JC	JC	JC	JC
Cr^{6+}	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
TSS	JC	JC	JC	JC	JC	JC	JC	JC	JC	JC	JC

TABLE 12A-4

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHD 188	MHD 190	MHD 197	MHD 200	MHD 201	MHD 202	MHD 203	MHD 204	MHD 205	MHD 206	MHD 207
Matrix	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
Metals (Total)											
Antimony	-	-	-	-	-	-	-	-	-	-	-
Arsenic	-	-	-	-	-	-	-	-	-	-	-
Copper	-	-	-	-	-	-	-	-	-	-	-
Iron	-	-	-	-	-	-	-	-	-	-	-
Lead	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Mercury	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT	JHT
Nickel	-	-	-	-	-	-	-	-	-	-	-
Potassium	-	-	-	-	-	-	-	-	-	-	-
Selenium	R	R	R	R	R	R	R	R	R	R	R
Silver	R	R	R	R	R	R	R	R	R	R	R
Sodium	-	-	-	-	-	-	-	-	-	-	-
Tin	R	R	R	R	R	R	R	R	R	R	R
Metals (Dissolved)											
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SAS Parameters											
$NO2^-$	-	-	-	JS	JS	JS	JS	JS	JS	JS	JS
$NO3^-$	-	-	-	JS	JS	JS	JS	JS	JS	JS	JS
Acidity	J*	-	J*	J*	J*	J*	J*	J*	J*	J*	J*
$SO4^{2-}$	JC	-	JC	JC	JC	JC	JC	JC	JC	JC	JC
TDS	JC	-	JC	JC	JC	JC	JC	JC	JC	JC	JC
Cr^{6+}	JS	-	JS	-	-	-	-	-	-	-	-
TSS	JC	-	JC	JC	JC	JC	JC	JC	JC	JC	JC

TABLE 12A-4

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHD 209	MHD 210	MHD 211	MHD 212	MHD 214	MHD 215	MHD 216	MHD 217	MHD 218	MHD 219	MHD 220
Matrix	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
Metals (Total)											
Antimony	-	-	-	-	-	-	-	JS	JS	JS	JS
Arsenic	-	-	-	-	-	-	-	R	R	R	R
Copper	-	-	-	-	-	-	-	-	-	-	-
Iron	-	-	-	-	-	-	-	-	-	-	-
Lead	JS	JS	JS	JS	JS	JS	JS	R	R	R	R
Mercury	-	-	-	-	-	-	-	JS,H	JS,H	JS,H	JS,H
Nickel	-	-	-	-	JC	JC	JC	-	-	-	-
Potassium	-	-	-	-	-	-	-	-	-	-	-
Selenium	R	R	R	R	R	R	R	JS	JS	JS	JS
Silver	R	R	R	R	R	R	R	R	R	R	R
Sodium	-	-	-	-	-	-	-	-	-	-	-
Thallium	-	-	-	-	-	-	R	R	R	R	R
Tin	R	R	R	R	R	R	-	-	-	-	-
Metals (Dissolved)											
Aluminum	NA	NA	NA	NA	NA	NA	NA	-	-	-	-
Antimony	NA	NA	NA	NA	NA	NA	NA	-	-	-	-
Arsenic	NA	NA	NA	NA	NA	NA	NA	-	-	-	-
Beryllium	NA	NA	NA	NA	NA	NA	NA	-	-	-	-
Cadmium	NA	NA	NA	NA	NA	NA	NA	-	-	-	-
Iron	NA	NA	NA	NA	NA	NA	NA	-	-	-	-
Lead	NA	NA	NA	NA	NA	NA	NA	-	-	-	-
Manganese	NA	NA	NA	NA	NA	NA	NA	-	-	-	-
Mercury	NA	NA	NA	NA	NA	NA	NA	JHT	JHT	JHT	JHT
Selenium	NA	NA	NA	NA	NA	NA	NA	JS	JS	JS	JS
Thallium	NA	NA	NA	NA	NA	NA	NA	-	-	-	-
SAS Parameters											
$NO2^-$	-	-	-	-	-	-	-	-	-	-	-
$NO3^-$	-	-	-	-	-	-	-	-	-	-	-
Acidity	J*	J*	J*	J*	J*	J*	J*	-	-	-	-
$SO4^{2-}$	JC	JC	JC	JC	JC	JC	JC	-	-	-	-
TDS	JC	JC	JC	JC	JC	JC	JC	-	-	-	-
Cr^{6+}	-	-	-	-	-	-	-	-	-	-	-
TSS	JC	JC	JC	JC	JC	JC	JC	-	-	-	-

TABLE 12A-4

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHD 221	MHD 222	MHD 223	MHD 224	MHD 225	MHD 226	MHD 227	MHD 228	MHD 229	MHD 230	MHD 231
Matrix	Water	Water	Water	Water	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Metals (Total)											
Antimony	JS	JS	JS	JS	-	-	-	-	-	-	-
Arsenic	R	R	R	R	-	-	-	-	-	-	-
Copper	-	-	-	-	-	-	-	-	-	-	-
Iron	-	-	-	-	-	-	-	-	-	-	-
Lead	R	R	R	R	-	-	-	-	-	-	-
Mercury	JS,HT	JS,HT	JS,HT	JS,HT	JHT	JHT	JHT	JHT	JHT	JHT	JHT
Nickel	-	-	-	-	-	-	-	-	-	-	-
Potassium	-	-	-	-	-	-	-	-	-	-	-
Selenium	JS	JS	JS	JS	-	-	-	-	-	-	-
Silver	-	-	-	-	-	-	-	-	-	-	-
Sodium	-	-	-	-	-	-	-	-	-	-	-
Thallium	R	R	R	R	-	-	-	-	-	-	-
Tin	-	-	-	-	-	-	-	-	-	-	-
Metals (Dissolved)											
Aluminum	-	-	-	-	NA	NA	NA	NA	NA	NA	NA
Antimony	-	-	-	-	NA	NA	NA	NA	NA	NA	NA
Arsenic	-	-	-	-	NA	NA	NA	NA	NA	NA	NA
Beryllium	-	-	-	-	NA	NA	NA	NA	NA	NA	NA
Cadmium	-	-	-	-	NA	NA	NA	NA	NA	NA	NA
Iron	-	-	-	-	NA	NA	NA	NA	NA	NA	NA
Lead	-	-	-	-	NA	NA	NA	NA	NA	NA	NA
Manganese	-	-	-	-	NA	NA	NA	NA	NA	NA	NA
Mercury	JHT	JHT	JHT	JHT	NA	NA	NA	NA	NA	NA	NA
Selenium	JS	JS	JS	JS	NA	NA	NA	NA	NA	NA	NA
Thallium	-	-	-	-	NA	NA	NA	NA	NA	NA	NA
SAS Parameters											
$NO2^-$	-	-	-	-	-	-	-	-	-	-	-
$NO3^-$	-	-	-	-	-	-	-	-	-	-	-
Acidity	-	-	-	-	-	-	-	-	-	-	-
$SO4^{2-}$	-	-	-	-	-	-	-	-	-	-	-
TDS	-	-	-	-	-	-	-	-	-	-	-
Cr^{6+}	-	-	-	-	-	-	-	-	-	-	-
TSS	-	-	-	-	-	-	-	-	-	-	-

TABLE 12A-4

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHD 232	MHD 233	MHD 234	MHD 235	MHD 236	MHD 237	MHD 238	MHD 239	MHD 240	MHD 241	MHD 242
Matrix	Soil	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
Metals (Total)											
Antimony	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	JHT	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tin	-	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (Dissolved)											
Aluminum	NA	JS,E	JS,E	JS,E	JS,E	JS,E	JS,E	JS,E	JS,E	JS,E	JS,E
Antimony	NA	JS	JS	JS	JS	JS	-	JS	JS	JS	JS
Arsenic	NA	JS,E	JS	JS	JS	JS	JS	JS	JS	JS	JS,E
Beryllium	NA	JE	JE	JE	JE	JE	JE	JE	JE	JE	JE
Cadmium	NA	JS	JS	JS	JS	JS	-	JS	JS	JS	JS
Iron	NA	JE	JE	JE	JE	JE	JE	JE	JE	JE	JE
Lead	NA	JS,E	JS,E	JS,E	J,SE	J,SE	JE	JS,E	JS,E	JS,E	JS,E
Manganese	NA	JE	JE	JE	JE	JE	JE	JE	JE	JE	JE
Selenium	NA	R	R	R	R	R	-	R	R	R	R
Thallium	NA	R	R	R	R	R	-	R	R	R	R
SAS Parameters											
$NO2^-$	-	-	-	-	-	-	-	-	-	-	-
$NO3^-$	-	-	-	-	-	-	-	-	-	-	-
Acidity	-	-	-	-	-	-	-	-	-	-	-
$SO4^{2-}$	-	-	-	-	-	-	-	-	-	-	-
TDS	-	-	-	-	-	-	-	-	-	-	-
Cr^{6+}	-	-	-	-	-	-	-	-	-	-	-
TSS	-	-	-	-	-	-	-	-	-	-	-

TABLE 12A-4

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHD 243	MHD 244	MHD 245	MHD 246	MHD 247	MHD 248	MHD 249	MHD 250	MHD 290	MHD 291	MHD 292
Matrix	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water
Metals (Total)											
Antimony	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Metals (Dissolved)											
Aluminum	JS,E	JS,E	JS,E	JS,E	JS,E	JS,E	JS,E	JS,E	JS,E	JS,E	JS,E
Antimony	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Arsenic	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Beryllium	JE	JE	JE	JE	JE	JE	JE	JE	JE	JE	JE
Cadmium	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Iron	JE	JE	JE	JE	JE	JE	JE	JE	JE	JE	JE
Lead	JS,E	JS,E	JS,E	J,SE	J,SE	J,SE	JS,E	JS,E	JS,E	JS,E	JS,E
Manganese	JE	JE	JE	JE	JE	JE	JE	JE	JE	JE	JE
Selenium	R	R	R	R	R	R	R	R	R	R	R
Thallium	R	R	R	R	R	R	R	R	R	R	R
SAS Parameters											
$NO2^-$	-	-	-	-	-	-	-	-	-	-	-
$NO3^-$	-	-	-	-	-	-	-	-	-	-	-
Acidity	-	-	-	-	-	-	-	-	-	-	-
$SO4^{2-}$	-	-	-	-	-	-	-	-	-	-	-
TDS	-	-	-	-	-	-	-	-	-	-	-
Cr^{6+}	-	-	-	-	-	-	-	-	-	-	-
TSS	-	-	-	-	-	-	-	-	-	-	-

TABLE 12A-4

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHD 293	MHD 294	MHD 275	MHD 296	MHD 297	MHD 298	MHD 299	MHD 300	MHD 301	MHD 302	MHD 303
Matrix	Water	Water	Water	Water	Water	Water	Water	Water	Water	Water	Soil
Metals (Total)											
Antimony	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	JS
Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	J*
Copper	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	JE
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-
Mercury	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-
Nickel	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-
Potassium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-
Selenium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	R
Silver	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	JC
Sodium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-
Tin	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-
Metals (Dissolved)											
Aluminum	JS,E	JS,E	JS,E	JS,E	JS,E	JS,E	JS,E	JS,E	JS,E	JS,E	NA
Antimony	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	NA
Arsenic	JS	JS	JS	JS	JS	JS	JS	JS	JS	-	NA
Beryllium	JE	JE	JE	JE	JE	JE	JE	JE	JE	JE	NA
Cadmium	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	NA
Iron	JE	JE	JE	JE	JE	JE	JE	JE	JE	JE	NA
Lead	JS,E	JS,E	JS,E	J,SE	J,SE	J,SE	JS,E	JS,E	JS,E	JS,E	NA
Manganese	JE	JE	JE	JE	JE	JE	JE	JE	JE	JE	NA
Selenium	R	R	R	R	R	R	R	R	R	R	NA
Thallium	R	R	R	R	R	R	R	R	R	R	NA
SAS Parameters											
$NO2^-$	-	-	-	-	-	-	-	-	-	-	-
$NO3^-$	-	-	-	-	-	-	-	-	-	-	-
Acidity	-	-	-	-	-	-	-	-	-	-	-
$SO4^{2-}$	-	-	-	-	-	-	-	-	-	-	-
TDS	-	-	-	-	-	-	-	-	-	-	-
Cr^{6+}	-	-	-	-	-	-	-	-	-	-	-
TSS	-	-	-	-	-	-	-	-	-	-	-

TABLE 12A-4

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHD 314	MHD 315	MHD 316	MHD 317	MHD 318	MHD 319	MHD 320	MHD 321	MHD 322	MHD 323	MHD 324
Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Metals (Total)											
Antimony	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Arsenic	J*	J*	J*	J*	J*	J*	J*	-	-	-	-
Copper	JE	JE	JE	JE	JE	JE	JE	JE	JE	JE	JE
Iron	-	-	-	-	-	-	-	-	-	-	-
Lead	-	-	-	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-	-	-	-	-
Nickel	-	-	-	-	-	-	-	-	-	-	-
Potassium	-	-	-	-	-	-	-	-	-	-	-
Selenium	R	R	R	R	R	R	R	-	-	-	-
Silver	JC	JC	JC	JC	JC	JC	JC	JC	JC	JC	JC
Sodium	-	-	-	-	-	-	-	-	-	-	-
Zinc	-	J	J	J	J	J	J	J	J	J	J
Metals (Dissolved)											
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SAS Parameters											
$NO2^-$	-	-	-	-	-	-	-	-	-	-	-
$NO3^-$	-	-	-	-	-	-	-	-	-	-	-
Acidity	-	-	-	-	-	-	-	-	-	-	-
$SO4^{2-}$	-	-	-	-	-	-	-	-	-	-	-
TDS	-	-	-	-	-	-	-	-	-	-	-
Cr^{6+}	-	-	-	-	-	-	-	-	-	-	-
TSS	-	-	-	-	-	-	-	-	-	-	-

TABLE 12A-4

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	MHD 325	MHD 326	MHD 327	MHD 328	MHD 329	MHD 330	MHD 331	MHD 332	MHD 333	MHD 334	MHD 335
Matrix	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Metals (Total)											
Antimony	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS	JS
Arsenic	-	-	-	-	-	J*	-	J*	J*	J*	J*
Copper	JE	JE	JE	JE	JE	JE	JE	JE	JE	JE	JE
Iron	-	-	-	-	-	-	-	-	-	-	-
Lead	-	-	-	-	-	-	-	-	-	-	-
Mercury	-	-	-	-	-	-	-	-	-	-	-
Nickel	-	-	-	-	-	-	-	-	-	-	-
Potassium	-	-	-	-	-	-	-	-	-	-	-
Selenium	-	-	-	-	-	R	R	R	R	R	R
Silver	JC	JC	JC	JC	JC	JC	JC	JC	JC	JC	JC
Sodium	-	-	-	-	-	-	-	-	-	-	-
Tin	-	-	-	-	-	-	-	-	-	-	-
Zinc	-	-	-	-	-	-	-	-	-	-	-
Metals (Dissolved)											
Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SAS Parameters											
$NO2^-$	-	-	-	-	-	-	-	-	-	-	-
$NO3^-$	-	-	-	-	-	-	-	-	-	-	-
Acidity	-	-	-	-	-	-	-	-	-	-	-
$SO4^{2-}$	-	-	-	-	-	-	-	-	-	-	-
TDS	-	-	-	-	-	-	-	-	-	-	-
Cr^{6+}	-	-	-	-	-	-	-	-	-	-	-
TSS	-	-	-	-	-	-	-	-	-	-	-

TABLE 12A-4

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	QH IE1	QH IE2	QH IE3	QH IE4	QH IE5	QH IF1	QH IF2	QH IF3	QH IG1	QH IG4	QH IG5
Metals (Total)											
Arsenic	J*	J*	J*	J*	J*	J*	J*	J*	J*	J*	J*

TABLE 12A-4

SUMMARY OF SAMPLE DATA DEFICIENCIES (QUALIFIERS)
(Continued)

Sample	A SBS 1	A SBS 2	A SBS 3
Metals (Total)			
Arsenic	J*	J*	J*

APPENDIX 12B

SUMMARY OF FIELD QA/QC RESULTS

RESULTS OF TRAVEL BLANKS

FOOTNOTES

(R) = ('R' used by the laboratory indicated recovery problems)
(JHT) = ESTIMATED due to holding time violation
(JL) = ESTIMATED due to exceeding ICP linear range
(@) = DUPLICATE control limits exceeded
(EJ) = ESTIMATED die to interference problems (ICP serial dilution or not spike recovery by graphite furnance)
(I) = QUANTIFIED due to exceeding ICP linear range
RPD = relative percent difference
RSD = relative standard deviation
(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(JS) = ESTIMATED due to spike recoveries outside limits
(---) = not analyzed
(H) = QUALIFIED due to holding time violation

QUARTER	I	I	I
FIELD ID	TRAVEL BLANK	TRAVEL BLANK	TRAVEL BLANK
SAMPLE ID	SW030001	SW028001	SW037001
ITR#	MHC310	MHC307	MHC333
MATRIX	SURFACE WATER	SURFACE WATER	SURFACE WATER

MAJOR CATION		DET. LIMIT		DET. LIMIT		DET. LIMIT
(mg/l)						
CALCIUM						
MAGNESIUM					D(0.250JS)	0.250
POTASSIUM						
SODIUM					T(2.96)	0.590
MAJOR ANION						
BICARBONATE						
CARBONATE						
FLUORIDE						
CHLORIDE						
SULFATE						
NUTRIENTS						
AMMONIA						
NITRITE (NO2)						
NITRATE (NO3)						
NO2+NO3						
PHOSPHATE						
METALS						
(ug/l)						
ALUMINUM			T(36.0)	25.0		
ANTIMONY						
ARSENIC						
BARIUM						
BERYLLIUM	T(0.800)					
BORON	D(11.0JS),T(24.0JS)	0.300	D(14.0JS),T(18.0JS)		D(12.0JS),T(12.0JS)	
CADMIUM						
CHROMIUM (VI)						
CHROMIUM (TOT)						
COBALT						
COPPER			T(3.80)	3.00		
CYANIDE						
GOLD						
IRON	T(24.0)	15.0	T(47.0)	15.0		
LEAD					T(3.70)	2.00
MANGANESE						
MERCURY						
MOLYBDENUM						
NICKEL						
SELENIUM	D(5.00JS),T(3.00JS)		D(5.00JS)		D(30.0JS),T(5.00JS)	
SILVER	D(0.100JC),T(0.100JC)		D(0.100JC),T(0.100JC)		D(0.100JC),T(0.100JC)	
SILICA						
STRONTIUM						
SULFIDE						
THALLIUM					D(3.00JS),T(10.0JS)	
TIN	D(17.0JS),T(17.0JS)		D(17.0JS),T(17.0JS)		D(17.0JS),T(17.0JS)	17.0
VANADIUM						
ZINC	T(3.70)	2.00	T(4.30)	2.00		

QUARTER	II		II		II		
FIELD QC	TRAVEL BLANK		TRAVEL BLANK		TRAVEL BLANK		
SAMPLE ID	SW036002		SW037002		SW038002		
ITR#	MHC441		MHC442		MHC443		
MATRIX	SURFACE WATER		SURFACE WATER		SURFACE WATER		
MAJOR CATION (mg/l)		DET. LIMIT		DET. LIMIT		DET. LIMIT	
CALCIUM	D(7.73),T(7.32)		D(0.690),T(7.18)		D(7.17),T(7.31)		
MAGNESIUM	D(3.30),T(3.36)		T(3.18)		D(3.32),T(3.27)		
POTASSIUM							
SODIUM	D(7.45),T(7.28)		D(1.83),T(5.57)		D(7.42),T(6.78)		
MAJOR ANION							
BICARBONATE	D(19.0 JHT)		D(19.0 JHT)		D(17.0 JHT)		
CARBONATE							
FLUORIDE	D(0.80)		D(0.82)		D(0.87 JHT)		
CHLORIDE							
SULFATE	D(20.0 JS)		D(20.0 JS)		D(20.0 JHT)		
NUTRIENTS							
AMMONIA							
NITRITE (NO2)							
NITRATE (NO3)							
NO2+NO3					D(0.14 JHT)		
PHOSPHATE							
METALS (ug/l)							
ALUMINUM	D(98.0),T(111.)		T(108.)	25.0	D(110.),T(110.)		
ANTIMONY							
ARSENIC							
BARIUM							
BERYLLIUM			D(0.400)	0.400			
BORON	D(19.0)		D(7.00),T(7.00)		D(21.0),T(15.0)		
CADMIUM							
CHROMIUM (VI)							
CHROMIUM (TOT)							
COBALT							
COPPER	D(17.0),T(10.0)		T(12.0)	3.00	D(5.00),T(14.0)		
CYANIDE							
GOLD							
IRON	D(18.0),T(14.0)		D(13.0),T(22.0)		D(11.0),T(31.0)		
LEAD							
MANGANESE	D(5.00),T(7.00)		T(15.0)	5.00	T(11.0)		5.00
MERCURY							
MOLYBDENUM							
NICKEL							
SELENIUM			D(0.200)	0.100			
SILVER							
SILICA							
STRONTIUM	D(23.0),T(12.0)		T(10.0)	5.00	D(23.0),T(20.0)		
SULFIDE							
THALLIUM							
TIN							
VANADIUM							
ZINC	D(11.0),T(4.00)		D(8.00),T(4.00)		D(3.00JS),T(7.00JS)		

RESULTS OF DECONTAMINATION BLANKS

FOOTNOTES

(R) = ('R' used by the laboratory indicated recovery problems)
(JHT) = ESTIMATED due to holding time violation
(JL) = ESTIMATED due to exceeding ICP linear range
(@) = DUPLICATE control limits exceeded
(EJ) = ESTIMATED die to interference problems (ICP serial dilution or not spike recovery by graphite furnance)
(I) = QUANTIFIED due to exceeding ICP linear range
RPD = relative percent difference
RSD = relative standard deviation
(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(JS) = ESTIMATED due to spike recoveries outside limits
(---) = not analyzed
(H) = QUALIFIED due to holding time violation

QUARTER	I		I		I	
FIELD QC	FIELD BLANK		FIELD BLANK		FIELD BLANK	
SAMPLE ID	SW036001		SW027001		SW029001	
ITR#	MHC332		MHC305		MHC318	
MATRIX	SURFACE WATER		SURFACE WATER		SURFACE WATER	
MAJOR CATION		DET. LIMIT		DET. LIMIT		DET. LIMIT
(mg/l)						
CALCIUM			D(3.51),T(3.65)		D(3.62)	
MAGNESIUM						
POTASSIUM						
SODIUM			D(76.4),T(70.6)		D(75.2)	
MAJOR ANION						
BICARBONATE						
CARBONATE						
FLUORIDE						
CHLORIDE						
SULFATE						
NUTRIENTS						
AMMONIA						
NITRITE (NO2)						
NITRATE (NO3)						
NO2+NO3						
PHOSPHATE						
METALS						
(ug/l)						
ALUMINUM						
ANTIMONY						
ARSENIC						
BARIUM			D(19.0),T(23.0)		D(20.0)	
BERYLLIUM						
BORON	D(12.0JS),T(14.0JS		D(59.0JS),T(70.0JS)		D(60.0JS),T(18.0JS)	
CADMIUM						
CHROMIUM (VI)						
CHROMIUM (TOT)						
COBALT						
COPPER	T(15.0)		T(6.60)	3.00	D(5.30)	3.00
CYANIDE						
GOLD						
IRON	D(30.0),T(56.0)		D(19.0),T(67.0)		D(24.0),T(25.0)	
LEAD	T(3.60)					
MANGANESE			D(5.00),T(5.50)		D(14.0)	5.00
MERCURY						
MOLYBDENUM						
NICKEL						
SELENIUM			D(5.00JS),T(3.00JS)		D(5.00JS),T(3.00JS)	
SILVER			D(0.100JC),T(0.100JC)		D(0.100JC),T(0.100JC)	
SILICA						
STRONTIUM			D(39.0),T(42.0)		D(43.0)	5.00
SULFIDE						
THALLIUM						
TIN			D(17.0JS),T(17.0JS)		D(17.0JS),T(17.0JS)	
VANADIUM						
ZINC	D(36.0),T(5.00)		T(8.80)	2.00	D(14.0),T(3.30)	

QUARTER	II		II		II
FIELD QC	FIELD BLANK		FIELD BLANK		FIELD BLANK
SAMPLE ID	SW039002		SW040002		SW041002
ITR#	MHC452		MHC461		MHC469
MATRIX	SURFACE WATER		SURFACE WATER		SURFACE WATER
MAJOR CATION		DET. LIMIT		DET. LIMIT	
(mg/l)					
CALCIUM	D(0.771),T(0.645)				
MAGNESIUM	D(0.323)				
POTASSIUM					
SODIUM	D(1.78)				D(0.643),T(1.31)
MAJOR ANION					
BICARBONATE					
CARBONATE					
FLUORIDE					
CHLORIDE					
SULFATE					
NUTRIENTS					
AMMONIA					
NITRITE (NO2)					
NITRATE (NO3)					
NO2+NO3					
PHOSPHATE					
METALS					
(ug/l)					
ALUMINUM	T(26.0)				
ANTIMONY					
ARSENIC					
BARIUM					
BERYLLIUM					
BORON	D(11.0),T(17.0)				D(13.0)
CADMIUM					
CHROMIUM (VI)					
CHROMIUM (TOT)					
COBALT					
COPPER					
CYANIDE					
GOLD					
IRON	D(18.0)	10.0	T(10.0)	10.0	D(20.0),T(24.0)
LEAD					
MANGANESE	D(62.0),T(41.0)				
MERCURY					D(6.00)
MOLYBDENUM					
NICKEL					
SELENIUM					
SILVER					
SILICA					
STRONTIUM					
SULFIDE					
THALLIUM					
TIN					
VANADIUM					
ZINC	D(28.0),T(12.0)		T(7.00JS)	2.00	D(5.00JS),T(3.00JS)

QUARTER	III		III		III	
FIELD QC	FIELD BLANK		FIELD BLANK		FIELD BLANK	
SAMPLE ID	SW032003		SW033003		SW046003	
ITR#	MHC524		MHC540		MHC564	
MATRIX	SURFACE WATER		SURFACE WATER		SURFACE WATER	
MAJOR CATION		DET. LIMIT		DET. LIMIT		DET. LIMIT
(mg/l)						
CALCIUM						
MAGNESIUM						
POTASSIUM						
SODIUM	D(1.90),T(1.15)		T(1.99)		T(1.71)	0.775
MAJOR ANION						
BICARBONATE						
CARBONATE						
FLUORIDE						
CHLORIDE						
SULFATE						
NUTRIENTS						
AMMONIA						
NITRITE (NO2)						
NITRATE (NO3)						
NO2+NO3						
PHOSPHATE						
METALS						
(ug/l)						
ALUMINUM	T(28.0)	23.0	T(63.0)	23.0	T(26.0)	23.0
ANTIMONY						
ARSENIC						
BARIUM						
BERYLLIUM						
BORON						
CADMIUM					D(4.30)	4.00
CHROMIUM (VI)						
CHROMIUM (TOT)						
COBALT						
COPPER			T(8.20)	4.00	T(8.20)	4.00
CYANIDE						
GOLD						
IRON	D(26.0),T(32.0)		D(14.0),T(194.)		T(106.)	11.0
LEAD						
MANGANESE	D(5.40),T(20.0)		D(5.70),T(11.0)			
MERCURY						
MOLYBDENUM						
NICKEL						
SELENIUM						
SILVER						
SILICA					D(160),T(147)	
STRONTIUM						
SULFIDE						
THALLIUM						
TIN						
VANADIUM						
ZINC	D(12.0),T(19.0)		D(15.0),T(10.0)		D(54.0),T(10.0)	

QUARTER	III	IV	IV
FIELD QC	FIELD BLANK	FIELD BLANK	FIELD BLANK
SAMPLE ID	GWBB102	SW060004	GW06303
ITR#	MHE454	MHD181	MHD195
MATRIX	GROUND WATER	SURFACE WATER	GROUND WATER
MAJOR CATION	DET. LIMIT	DET. LIMIT	DET. LIMIT
(mg/l)			
CALCIUM			
MAGNESIUM			
POTASSIUM			
SODIUM	D(0.827)		
MAJOR ANION			
BICARBONATE			
CARBONATE			
FLUORIDE			
CHLORIDE			
SULFATE			
NUTRIENTS			
AMMONIA			
NITRITE (NO2)			
NITRATE (NO3)			
NO2+NO3			
PHOSPHATE			
METALS			
(ug/l)			
ALUMINUM			D(130)
ANTIMONY			
ARSENIC			
BARIUM			
BERYLLIUM	D(0.500)		
BORON			
CADMIUM			
CHROMIUM (VI)			
CHROMIUM (TOT)			
COBALT			
COPPER		T(12.0)	11.0
CYANIDE			
GOLD			
IRON		T(29.0)	20.0 D(45)
LEAD			
MANGANESE		D(29.0),T(13.0)	D(37.2)
MERCURY		D(0.210)	0.120 D(0.4)
MOLYBDENUM			
NICKEL			
SELENIUM			
SILVER			
SILICA			
STRONTIUM			
SULFIDE			
THALLIUM			
TIN			
VANADIUM			
ZINC	D(7.60)	D(39.0),T(64.0)	D(37.0)

RESULTS OF SPLITS AND TRIPLICATES

(Water Samples)

FOOTNOTES

(R) = ('R' used by the laboratory indicated recovery problems)
(JHT) = ESTIMATED due to holding time violation
(JL) = ESTIMATED due to exceeding ICP linear range
(@) = DUPLICATE control limits exceeded
(EJ) = ESTIMATED die to interference problems (ICP serial dilution or not spike recovery by graphite furnance)
(I) = QUANTIFIED due to exceeding ICP linear range
RPD = relative percent difference
RSD = relative standard deviation

(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(J5) = ESTIMATED due to spike recoveries outside limits
(---) = not analyzed
(H) = QUALIFIED due to holding time violation

QUARTER	I	I	II	II
MATRIX	SURFACE WATER	SURFACE WATER	GROUND WATER	SURFACE WATER
SAMPLE ID (ITR#)	SW004001 (MHC329)	SW020001 (MHC324)	GWA0501 (MHE542)	SW008002 (MHC463)
	SW034001 (MHC330)	SW025001 (MHC327)	GWA0401 (MHE528)	SW034002 (MHC464)
	SW035001 (MHC331)		GWA0102 (MHE531)	SW035002 (MHC465)

	RSD% DISS.	RSD% TOTAL	RPD% DISS.	RPD% TOTAL	RPD% DISS.	RPD% TOTAL	RSD% DISS.	RSD% TOTAL
MAJOR CATION								
CALCIUM	1	0	2	2	7	--	1	1
MAGNESIUM	1(JS)	1	0(JS)	0	7	--	1	1
POTASSIUM	3	7	7	0	18	--	0	1
SODIUM	1	3	13	58 @	5	--	0	2
MAJOR ANION								
BICARBONATE	2	--	NC	--	NC	--	NC	--
CARBONATE	NC	--	NC	--	NC	--	NC	--
FLUORIDE	4	--	4	--	2	--	15	--
CHLORIDE	NC	--	36 @	--	4	--	17	--
SULFATE	3	--	12	--	21 @	--	9	--
NUTRIENTS								
AMMONIA	--	--	--	--	NC	--	--	--
NITRITE (NO2)	--	--	--	--	NC	--	--	--
NITRATE (NO3)	--	--	--	--	--	--	--	--
NO2+NO3	NC	--	>140 @	--	2	--	NC	--
PHOSPHATE	--	--	--	--	--	--	--	--
METALS								
ALUMINUM	16	9	0	1	6	--	NC	12
ANTIMONY	NC	NC	NC	NC	NC	--	NC	NC
ARSENIC	NC	NC	13	16	14	--	NC	NC
BARIUM	2	5	NC	NC	12	--	NC	NC
BERYLLIUM	NC	0	0	0	35 @	--	0	0
BORON	2(JS)	5(JS)	4(JS)	5(JS)	--	--	2	6
CADMIUM	>70 @	44(@,J)	5	1	7	--	0	12
CHROMIUM (VI)	--	--	--	--	NC	--	NC	--
CHROMIUM (TOT)	NC	NC	10	0	50 @	--	11	12
COBALT	22 @	>21 @	2	3	5	--	2	1
COPPER	2	23 @	1	0	9	--	11	1
CYANIDE	--	NC	--	NC	--	--	--	NC
GOLD	--	--	--	--	--	--	NC	NC
IRON	NC	38 @	2	3	63 @	--	1	1
LEAD	NC	NC	6	4	NC	--	NC	NC
MANGANESE	2	1	2	2	7	--	1(JS)	1
MERCURY	NC	NC	NC	NC	NC	--	NC	NC
MOLYBDENUM	NC	NC	NC	NC	--	--	NC	NC
NICKEL	6	8	4	6	5	--	2	2
SELENIUM	0(JS)	0(JS)	NC	0(JS)	NC	--	--	NC
SILVER	NC	NC	31 @	NC	NC	--	22(JS,@)	NC
SILICA	--	--	--	--	2	--	--	--
STRONTIUM	2	3	1	5	--	--	1	1
SULFIDE	--	--	--	--	--	--	--	--
THALLIUM	NC	NC	0(JS)	0(JS)	NC	--	NC	NC
TIN	NC	NC	0(JS)	0(JS)	NC	--	NC	NC
VANADIUM	NC	NC	NC	NC	NC	--	NC	NC
ZINC	3	2		1	6	--	1	1(JS)

QUARTER	II	II	III	III
MATRIX	SURFACE WATER	SURFACE WATER	SURFACE WATER	SURFACE WATER
SAMPLE ID (ITR#)	SW016002 (MHC444) SW032002 (MHC445)	SW033002 (MHC458) SW022002 (MHC457)	SW022003 (MHE431) SW044003 (MHE562) SW045003 (MHE563) SW052003 (MHE568)	SW038003 (MHE523) SW039003 (MHE522)

	RPD% DISS.	RPD% TOTAL	RPD% DISS.	RPD% TOTAL	RPD% DISS.	RPD% TOTAL	RPD% DISS.	RPD% TOTAL
MAJOR CATION								
CALCIUM	--	6	3	2	4	8	1	3
MAGNESIUM	--	6	4	2	5	3	2	2
POTASSIUM	--	NC	8	NC	8	3	2	4
SODIUM	--	2	12	1	4	10	2	6
MAJOR ANION								
BICARBONATE	NC	--	9	--	6	--	--	--
CARBONATE	NC	--	NC	--	NC	--	--	--
FLUORIDE	3	--	1	--	8	--	--	--
CHLORIDE	NC	--	NC	--	16	--	--	--
SULFATE	2	--	3 J	--	2.4	--	--	--
NUTRIENTS								
AMMONIA	--	--	--	--	NC	--	--	--
NITRITE (NO2)	--	--	--	--	NC	--	--	--
NITRATE (NO3)	--	--	--	--	--	--	--	--
NO2+NO3	NC	--	NC	--	8	--	--	--
PHOSPHATE	--	--	--	--	--	--	--	--
METALS								
ALUMINUM		5	10	24 @	17	12	10	2
ANTIMONY		26 @	NC	NC	NC	NC	NC	NC
ARSENIC		5(JS)	NC	NC	NC	NC	NC	NC
BARIUM		NC	0	4(JS)	6	5	17	27 @
BERYLLIUM		5(JS)	>0	NC	NC	72 @	0	40 @
BORON		5	20	127 @	---	---	--	--
CADMIUM		5	67 @	0	NC	NC	NC	NC
CHROMIUM (VI)		--	NC	--	NC	---	--	--
CHROMIUM (TOT)		7	NC	NC	NC	NC	NC	NC
COBALT		6	NC	NC	NC	NC	0	0
COPPER		6	8	0	38 @	11	0	1
CYANIDE		NC	--	NC	---	---	--	--
GOLD		NC	NC	NC	---	---	--	--
IRON		6	0	18	37 @	5	1	2
LEAD		10	NC	NC	NC	NC	NC	9
MANGANESE		6	2	6	13	12	2	4
MERCURY		NC	NC	NC	NC	NC	NC	NC
MOLYBDENUM		3(JS)	0	26(UJ,@)	---	---	--	--
NICKEL		6(JS)	NC	NC	NC	NC	6	16
SELENIUM		--	NC	NC	NC	NC	NC	NC
SILVER		21(JE,@)	NC	NC	NC	NC	NC	NC
SILICA		--	--	--	3	8	--	--
STRONTIUM		6	7	7	---	---	--	--
SULFIDE		--	--	--	---	---	--	--
THALLIUM		NC	NC	NC	NC	NC	NC	NC
TIN		NC	NC	NC	NC	NC	NC	NC
VANADIUM		0	NC	NC	NC	NC	NC	NC
ZINC		6	2	---	52 @	6	2	4

QUARTER IV
MATRIX SURFACE WATER
SAMPLE ID (ITR#) SW012004 (MHD187)
SW061004 (MHD188)

	RPD% DISS.	TOTAL
MAJOR CATION		
CALCIUM	1(E)	1(E)
MAGNESIUM	0	1
POTASSIUM	4	2
SODIUM	1	0
MAJOR ANION		
BICARBONATE	--	--
CARBONATE	--	--
FLUORIDE	2	--
CHLORIDE	0	--
SULFATE	1	--
NUTRIENTS		
AMMONIA	6	--
NITRITE (NO2)	--	--
NITRATE (NO3)	--	--
NO2+NO3	--	--
PHOSPHATE	--	--
METALS		
ALUMINUM	0	1
ANTIMONY	NC	NC
ARSENIC	NC	NC
BARIUM	NC	NC
BERYLLIUM	5	9
BORON	--	--
CADMIUM	10	NC
CHROMIUM (VI)	--	--
CHROMIUM (TOT)	NC	NC
COBALT	1	3
COPPER	0	1
CYANIDE	--	--
GOLD	--	--
IRON	1	1(E)
LEAD	1	1
MANGANESE	NC	NC
MERCURY	NC	NC
MOLYBDENUM	--	--
NICKEL	0	4
SELENIUM	NC	NC
SILVER	NC	NC
SILICA	3	2
STRONTIUM	--	--
SULFIDE	--	--
THALLIUM	NC	NC
TIN	NC	NC
VANADIUM	NC	NC
ZINC	1	1

RESULTS OF BLIND STANDARDS

QUARTER		I	III	II	IV	IV
FIELD QC		BLIND STANDARD	BLIND STANDARD	BLIND STANDARD	BLIND STANDARD	BLIND STANDARD
MATRIX		SURFACE WATER	SURFACE WATER	SURFACE WATER	GROUND WATER	GRUND WATER
SAMPLE ID		SW038001	SW039001	SW042002	GWBS103	GWBS203
ITR#		MHC334	MHC335	MHC490	MHC942	MHC943
MAJOR CATIONS (mg/l)	TARGET RANGE					
CALCIUM	(24-34)	G		G	0.28	66.5
POTASSIUM	(13-19)	0.250 U		2.17 U	0.708	1.77
SODIUM	(50-58)	1.73		0.782	0.859	2.6
METALS (ug/l)						
ARSENIC	(36-46)	G	G	35	G	35
BARIUM	(292-364)	G	G	G	130	770
CADMIUM	(27-41)	G	G	48 J	13.0	92.5
CHROMIUM	(44-56)	G	G	G	19.0	120
IRON	(121-159)	G	G	162	183	662
LEAD	(85-121)	G	G	G	39	300
MANGANESE	(96-124)	G	G	G	45	290
MERCURY	(1.1-1.9)	G	G	0.500	0.23	2.25
SELENIUM	(26-46)	G	G	G	G	G
SILVER	(84-110)	G	G	36.0	41	253

G : analytical result within the target range

RESULTS OF SPLITS

(Solid Samples)

QUARTER	III *		III **		III **		III **		III **	
MATRIX	SOIL		SOIL		SOIL		SOIL		SOIL	
SAMPLE ID (ITR#)	TAA0302	(MHE234)	TAA0306	(MHE229)	TA60211	(MHE277)	TA61013	(MHE266)	TA60209	(MHE213)
	TAA0309	(MHE235)	TAA0310	(MHE279)	TA60204	(MHE204)	TA61001	(MHE387)	TA60212	(MHE274)
	RPD%		RPD%		RPD%		RPD%		RPD%	
METALS (TOTAL) (mg/kg)										
ALUMINUM	2.46		23.2		14.3		33.6 @		31	
ANTIMONY	13.9		NC		NC		> 28.6 JS		43.5 JS,@	
ARSENIC	2.11		NC		17.4		53.3 @		60 @	
BARIUM	4.51		20.8		17.6		18.2		33.5	
BERYLLIUM	> 29.8		23		9.35		NC		15.4	
CADMIUM	1.71		NC		69.9 @		NC		55.6 @	
CALCIUM	9.9		25.5		27.7		20.6		4.77	
CHROMIUM (TOT)	0		100 @		115 @		17.5		115 @	
COBALT	11		29		2.15		> 21.4		2.47	
COPPER	3.43		15.9		68.9 @		32.8 @		45.1 @	
CYANIDE	0 JHT		> 0 JS		> 0 JHT		7.22		NC	
GOLD	NC		NC		NC		> 82.4 JS,@		75 @	
IRON	2.95		5.07		65.3 @		25.1		6.99	
LEAD	5.36		41.7 @		162.9 @		25		17.1	
MAGNESIUM	.84		4.82		27.5		> 10.3		26	
MANGANESE	4.48		4.82		2.09		26.1		74.4 @	
MERCURY	8		> 0		> 151 @		39.5 JS,@		21.4	
MOLYBDENUM	2.35		> 48.4 @		NC		8		47.2 @	
NICKEL	26.1		32.1		0		NC		23.3	
POTASSIUM	.25		43.7 @		13		28.5		15.5	
SELENIUM	NC		> 163 @		163 @		> 164 @		0	
SILVER	3.11		NC		107 @		21.4		55.2 @	
SODIUM	NC		24.9		51 @		15.6		62 @	
SULFUR	11.8		> 160 @		100 @		6.5		36.4 @	
SULFATE SULFUR	---		---		---		---		---	
PYRITIC SULFUR	---		---		---		---		---	
ORGANIC SULFUR	120 @		---		> 163 @		---		---	
THALLIUM	NC		NC		NC		NC		NC	
TIN	NC		NC		NC		NC		> 81.5 @	
VANADIUM	3.92		0		6.06		10.5		10.5	
ZINC	2.62		1.53		113 @		16.4		37.3 @	

FOOTNOTES

(R) = ('R' used by the laboratory indicated recovery problems)
(JHT) = ESTIMATED due to holding time violation
(JL) = ESTIMATED due to exceeding ICP linear range
(@) = DUPLICATE control limits exceeded
(EJ) = ESTIMATED die to interference problems (ICP serial dilution or not spike recovery by graphite furnance)
(I) = QUANTIFIED due to exceeding ICP linear range
RPD = relative percent difference
RSD = relative standard deviation
* = powder splits
** = sample splits

(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(JS) = ESTIMATED due to spike recoveries outside limits
(---) = not analyzed
(H) = QUALIFIED due to holding time violation

QUARTER	III *	III *	III **	III **
MATRIX	SOIL	SOIL	SOIL	SOIL
SAMPLE ID (ITR#)	TA60502 (MHE211)	TA61115 (MHE245)	TA60305 (MHE267)	TA60311 (MHE270)
	TA60515 (MHE210)	TA61116 (MHE247)	TA60310 (MHE268)	TA60307 (MHE269)

	RPD%	RPD%	RPD%	RPD%
METALS (TOTAL) (mg/kg)				
ALUMINUM	12.4 EJ	2.84	3.46	16.3
ANTIMONY	5.41	NC	12.8 JS	25.8 JS
ARSENIC	1.03	15.4	11.4	5.24
BARIUM	4.65	2.69	5.24	21.9
BERYLLIUM	NC	0	23.4	0
CADMIUM	4.76	15	13.6	7.41
CALCIUM	0	2.02	27.6	13.5
CHROMIUM (TOT)	2.9	5.5	3.64	11.8
COBALT	0	0	8.7	14.3
COPPER	5.5	10.1	7.14	38.6 @
CYANIDE	0	11.3 JHT	NC	NC
GOLD	13.3	NC	NC	2.74 JS
IRON	.23	1.54	2	11.1
LEAD	.46	16.2	23.9	6.4
MAGNESIUM	9.35	1.93	1.78	20.1
MANGANESE	8	2.47 EJ	2.59	2.74
MERCURY	> 126 @	NC	2.41 JS	112 JS,@
MOLYBDENUM	20.7	5.13	20.7	NC
NICKEL	28	1.55	8.67	6.25
POTASSIUM	2.04	3.93	7.14	30.8
SELENIUM	0	NC	0	0
SILVER	0	21.7 @	10.7	2.99
SODIUM	15.9	14.7	3.36	9.32
SULFUR	2.25	66.7 @	12.5	1.83
SULFATE SULFUR	---	---	---	---
PYRITIC SULFUR	---	---	---	---
ORGANIC SULFUR	1.53	---	---	57.1 @
THALLIUM	NC	NC	NC	NC
TIN	NC	NC	NC	NC
VANADIUM	0	1.63	2.3	4.17
ZINC	3.77	2.92	2.02	5.76

FOOTNOTES

(R) = ('R' used by the laboratory indicated recovery problems)
(JHT) = ESTIMATED due to holding time violation
(JL) = ESTIMATED due to exceeding ICP linear range
(@) = DUPLICATE control limits exceeded
(EJ) = ESTIMATED die to interference problems (ICP serial dilution or not spike recovery by graphite furnance)
(I) = QUANTIFIED due to exceeding ICP linear range
RPD = relative percent difference
RSD = relative standard deviation
(J) = ESTIMATED
(JC) = ESTIMATED due to instrument calibration problems
(U) = UNDETECTED
(JS) = ESTIMATED due to spike recoveries outside limits
(---) = not analyzed
(H) = QUALIFIED due to holding time violation

APPENDIX 13

APPENDIX 13A

THE VALIDITY OF Eh MEASUREMENTS IN SOME WATERS CONTAMINATED BY ACID-MINE DRAINAGE

APPENDIX 13A
THE VALIDITY OF Eh MEASUREMENTS IN SOME WATERS CONTAMINATED BY ACID-MINE DRAINAGE

The Eh of an aqueous system is a parameter commonly measured used to describe the oxidizing or reducing capacity of a natural water. Unlike the pH (negative log of the hydrogen ion activity) the measured Eh usually reflects a mixed potential which may be a function of the state of equilibrium (or disequilibrium) of many redox couples. Indeed, a recent comprehensive review of ground water Eh measurements by Lindberg and Runnells (1984) has cast doubt upon the meaning and reliability of the measurement. They found that in low ionic strength ground waters, Eh values appear to be of dubious worth. However, Ball and Nordstrom (1982) demonstrated that for acid-mine drainage containing more than 1.2 mg/L total iron, the measured Eh using a platinum electrode corresponded well with that based on the dissolved Fe^{2+}/Fe^{3+} ratios.

The objective of this study was to examine the Eh measurements made in surface waters affected by iron rich, acid mine drainage in an attempt to evaluate the validity of the measured values in a system of this nature and to explore the role of the amorphous ferric hydroxide precipitate in the system. Visual evidence that iron chemistry is important in the Creek system is found in the concretion of iron oxide coatings on boulders and cobbles in the stream channels and by the precipitation of iron hydroxide observed below the Argo discharge as the acidic mine drainage interacts with alkaline surface waters. The implications are significant, because the redox potential is used in geochemical computer codes to speciate metals which occur in multiple valence states in natural waters. A knowledge of the valence states is important because some metals eg. As, Cr, have different toxicities in different redox states, while other metals eg. Pu, Tc, U, etc. (Barney, 1984) have been shown to be more mobile in ground water in their reduced forms. Valid Eh measurements are therefore

crucial in predicting the mobility and toxicity of contaminants. However they can only be used in geochemical modeling if it is established that the value obtained is meaningful and accurate in the aqueous system under study. This work presents a series of measurements of surface water Eh values which suggest that at least in environments affected by acid mine drainage, redox is a parameter representative of the aqueous oxidation potential. A total of 98 samples were collected for which Eh and pH field measurements were made and for which dissolved iron was analyzed.

Redox measurements in the Clear Creek RI were accompanied at some sites by the collection of samples for ferrous and total iron determinations. The waters were filtered through a 0.45 um membrane in the field, acidified with ultra-pure hydrochloric acid and maintained at 4°C until analysis (within 12 hours of collection). The bipyridine colorimetric method (USGS 1979) was used to analyze Fe^{2+} and total iron. Ferric iron was obtained by difference (Table 1). Samples were collected for RAS metals and SAS parameters from each site. pH, Eh, temperature and specific conductance were measured in the field.

The specific conductance was measured using a YSI conductivity meter, the pH using an Orion probe calibrated with pH 4 and pH 7 buffers, and the e.m.f. of the sample measured using an Orion platinum electrode calibrated using ZoBell's solution (1946) at the ambient temperature. The surface of the platinum redox probe was polished prior to each measurement using an alumina paste (grain size = 0.05 μm) on a felt pad (microcloth; Buehler, Inc.).

The e.m.f. measured was converted to an Eh using the temperature correction procedure suggested by Nordstrom (1977). Other couples, i.e., As^{3+}/As^{5+}, NO_2^-/NO_3^-, NH_4^+/NO_3^-, SO_4^{2-}/HS^-, Cr^{3+}/CrO_4^{2-} were also considered. However, sulfide concentrations were always below the analytical detection limit, the Cr VI analytical technique proved grossly inaccurate, and there were no cases where nitrite/nitrate or ammonium/nitrate were found to co-exist in solution. Arsenic III and arsenic V were both found in one

ground water, but the high levels of ferric iron negated an independent determination of the arsenate concentration because of interference with the resin in the speciation columns.

Surface and ground water samples to be analyzed for Fe^{2+}/Fe^{3+} analysis were selected following first quarter data evaluation. This was to ensure that only sites which contained metal levels above the detection limit would be chosen. The data covers a wide range of pH (2.5-6.1), pE (3.4-13.8), and iron concentrations (0.2 mg/L to 471.6 mg/L). Most of the spectrophotometrically determined total iron concentrations are in close agreement with the CLP values measured by atomic absorption (Table 1). Included in this data set are 8 determinations of Fe^{2+}/Fe^{3+} ratios, pH, pE and whole water analyses. The other pH/Eh measurements lack Fe^{2+}/Fe^{3+} measurements.

Interpretation of Results

The 98 samples for which pH, Eh, and dissolved iron values were reported were separated on the basis of dissolved iron concentration. A value of 1 mg/L was chosen because the laboratory studies of Morris and Stumm (1967) indicated that below a dissolved concentration of 10^{-6} M, redox values could not longer be measured accurately. Figure 13A1 shows the location in Eh-pH space of samples containing more than 1 mg/L, while Figure 13A2 shows those samples containing less than 1 mg/L dissolved iron. The correlation coefficients assigned to each plot are -0.74 for the 53 observations containing less than 1 mg/L and -0.91 for the 45 observations containing more than 1 mg/L dissolved iron. While these correlations are significant at the five percent level for both populations, the degree of scatter is much larger for the less than 1 mg/L data set. More importantly, the points in this data set do not fall on the line representing $Fe^{2+}/Fe(OH)_3$ equilibrium.

This indicates that when iron is present in the dissolved state at more than 1 mg/L, the Eh is determined by an equilibrium reaction. Potential

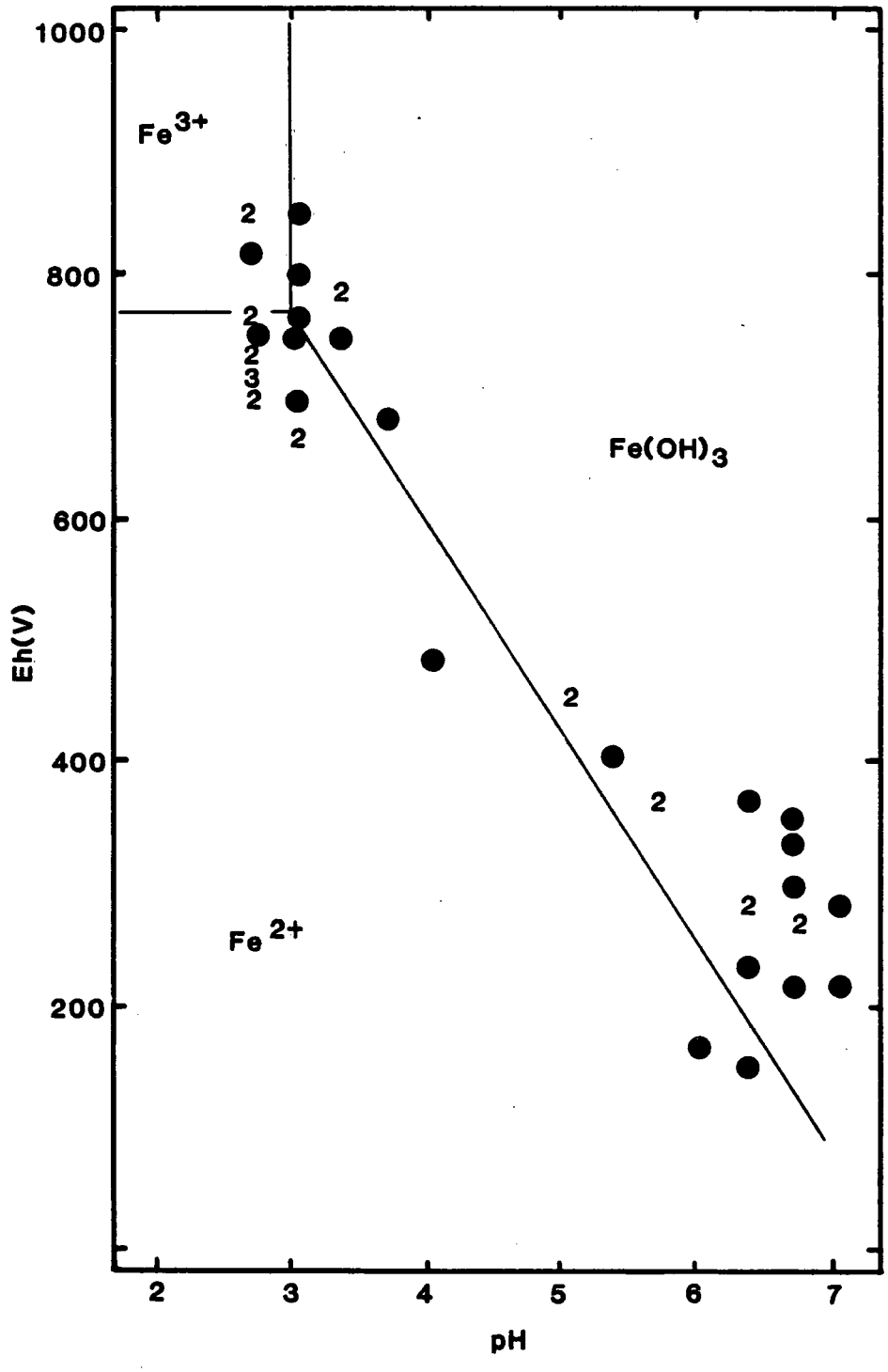

Figure 13-A1. Clear Creek Surface Waters Plotted in Eh-pH Space for Samples in Which Dissolved Iron is Greater Than 1mg/L. The $^{a}Fe^{+2}=10^{-4.2}m$ For the $Fe^{+2}/Fe(OH)_3$ Equilibrium. Multiple Occurrences of Data Points and Their Value Are Shown By Numerals.

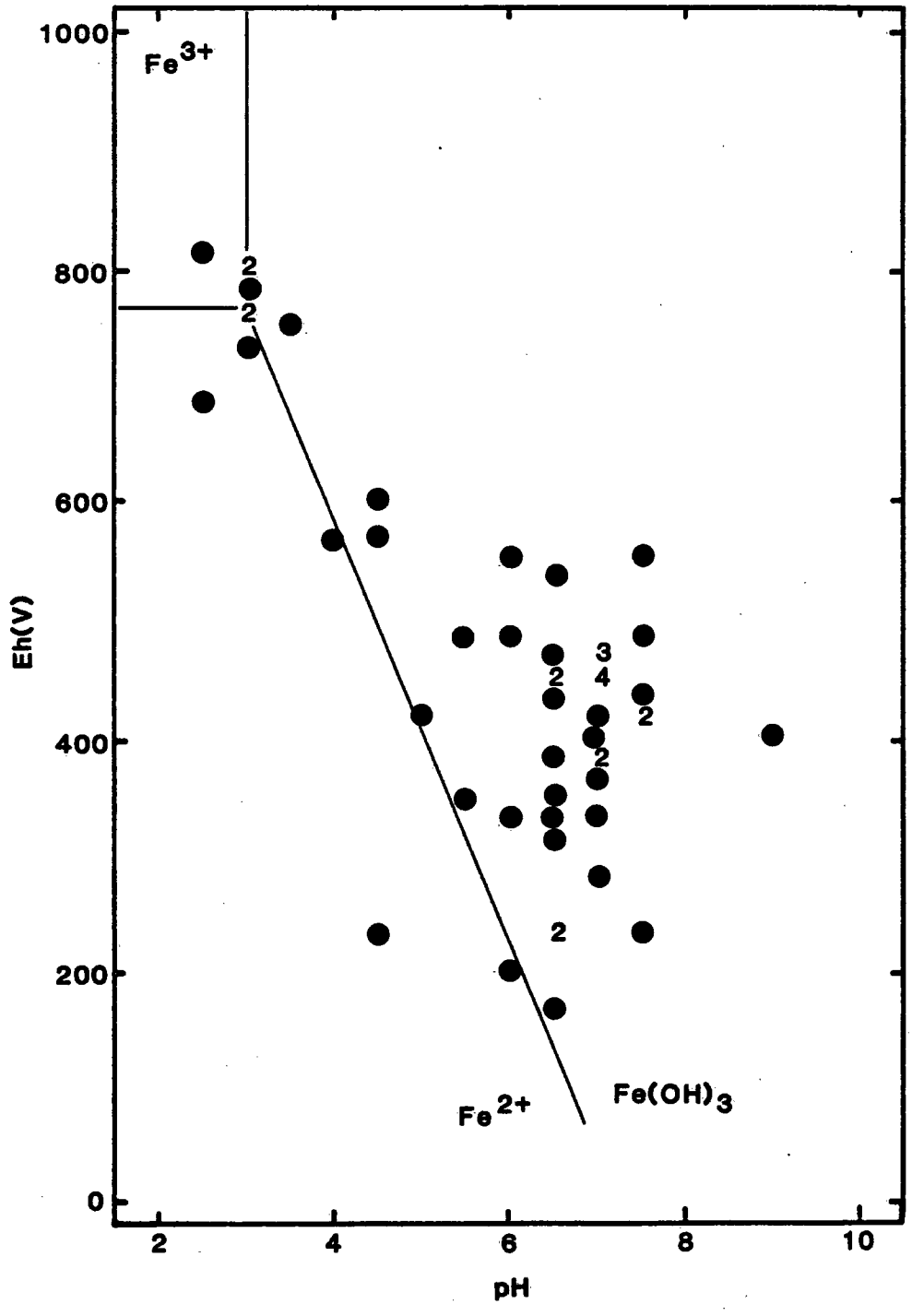

Figure 13-A2. Clear Creek Surface Waters Plotted In Eh-pH Space for Samples In Which Dissolved Iron is Less Than 1 mg/L. $^{a}Fe^{+2}=10^{-4.2}m$ For The $Fe^{+2}/Fe(OH)_3$ Equilibrium. Multiple Occurrences of Data Points and Their Value Are Shown By Numerals.

redox controls are examined in the next section through an analysis of a subset of eight samples which contain more than 1 mg/L dissolved Fe.

The eight samples are shown in pH/pE space on Figure 1. The location of these points suggests that the redox/pH conditions in the Clear Creek system are at equilibrium with a reaction which may be conceptualized by the equation

$$Fe^{2+} + 3H_2O \quad Fe(OH)_3(am) + 3H^+ + e^- \qquad (1)$$

Applying LeChatelier's principle, it is evident that as the system becomes more acidic and oxidizing, the reaction is driven to the right, leading to the dissolution of the precipitate. Conversely, a basic environment, or excess ferrous iron will lead to precipitation of the solid.

Under acidic conditions (pH<3.0, Figure 13A3) an alternative reaction proposed to control redox chemistry is:

$$Fe^{2+} \quad Fe^{3+} + e^- \qquad (2)$$

The equilibrium condition for this half cell reaction is shown as line B on Figure 13A3. In the Clear Creek System only at the low pH values characterised by samples SW5, SW16, SW19 and SW20 is the pH potentially low enough for the Fe^{2+}/Fe^{3+} couple to govern redox equilibria in the surface waters.

In order to verify this mechanism as a control on acid mine drainage iron chemistry, the geochemical equilibrium code MINTEQ (Felmy et al., 1983) was used to calculate the pE expected if equation (1) governs the pE and the pH in the system.

For a freshly precipitated amorphous ferric hydroxide, Langmuir and Whitemore (1970) experimentally determined a pKsp of 37.1. Using this value, and the thermodynamic data of Robie et al. (1979), the theoretical

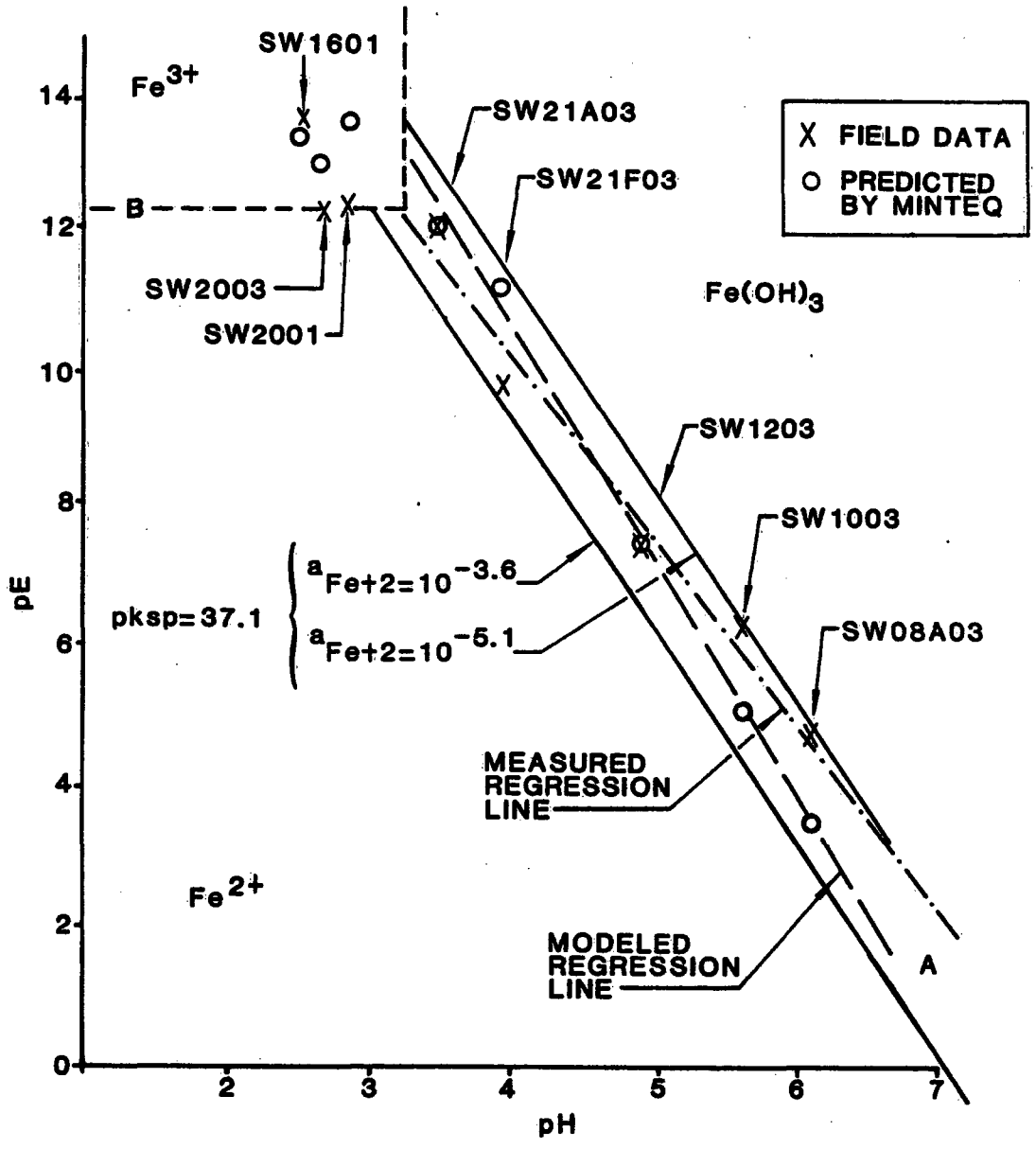

Figure 13-A3. Interpretation of Some Eh Values Measured During the Clear Creek R.I.

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equilibrium between Fe^{2+} and $Fe(OH)_3$ can be determined in pH-pE space. This is shown on Figure 13A3 for ${}^{a}Fe^{2+}$ of $10^{-4.9}$ and $10^{-3.6}$, intended to bracket the values determined using MINTEQ.

MINTEQ simulations were run for the set of eight waters for which complete water analyses, the measured pH and the analyzed concentrations of Fe^{2+} and Fe^{3+} were available, and which contained more than 1 mg/L dissolved iron. The pE was predicted assuming that the Eh, (dependent on the pH), was poised by either the Fe^{2+}/Fe^{3+} couple or by the $Fe^{2+}/Fe(OH)_3$ reaction (where log Ksp=-37.1). The pE values predicted by both scenarios are presented in Table 13A2-1. Reaction 1 more accurately predicts the Eh in samples SW01001, SW02001 and SW02003 than reaction 2. The pE in the other five samples is modeled best using reaction 1. Superimposing the measured values in Eh-pH space (Figure 13A2-2) indicates that the three acid waters fall in the Fe^{3+} domain while the other five occur along the equilibrium boundary represented by reaction (1) using the log Ksp of -37.1. Therefore the Eh is apparently controlled by different reaction mechanisms depending upon the the pH of the system.

From this analysis it is apparent that there is a strong interdependence between ${}^{a}Fe^{2+}$, Log Ksp $Fe(OH)_3$, the pE and the pH. The agreement between the measured and predicted location of natural waters in pE-pH space suggests that redox reactions in Clear Creek are driven predominantly by the chemistry of iron, and that the Eh measurements are both geochemically valid and accurate.

The error inherent in the Eh measurements can be determined by solution of the simultaneous regression equations which describe the measured and predicted Eh values, assuming that equation 1 accurately describes the system for the range of pH and Eh values measured.

The samples used in the regression analyses were those for which the pE values predicted using the $Fe^{+2}/Fe(OH)_3$ reaction were closer than those predicted using the Fe^{+2}/Fe^{+3} reaction. These were SW01203, SW008A03,

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TABLE 1

EVALUATION OF Eh VALUES MEASURED IN THE CREEKS

Site	CLP $Fe_{(Tot)}$ mg/L	CSF Fe(Tot) mg/L	(Fe^{2+}) mg/L	Measurements Eh (V)	Measurements pH (S.U.)	Predicted pE $Fe^{+2}/Fe(OH)_3$	Predicted pE Fe^{+2}/Fe^{+3}	Change Imbalance (Percent)	ITR #	$\log_{10} {}^{a}Fe^{+2}$	$\log_{10} {}^{a}Fe^{+3}$
SW01601	481	471.6	10.9	13.6	2.5	14.7	13.8	10	MHC 320	-4.2	-3.9
SW02001	154	163.1	4.6	12.3	2.8	14.7	13.7	5	MHC 324	-4.5	-4.2
SW01203	148	149.2	9.7	7.5	4.9	7.5	10.9	3	MHE 475	-4.1	-6.8
SW008A03	36.8	37.1	31.6	4.8	6.1	3.6	6.5	3	MHE 423	-3.6	-10.6
SW02003	152	144	21.1	12.2	2.5	14.4	12.8	13	MHE 453	-3.9	-4.5
SW01003	24.9	17.7	11.4	6.2	5.6	5.1	7.9	19	MHE 472	-3.9	-9.5
SW021A03	41.7	39.7	5.4	12.1	3.4	12.1	12.8	0	MHE 434	4.3	5.0
SW021F03	3.4	3.1	1.2	9.8	3.9	11.2	11.6	1	MHE 570	4.9	6.8

SW02003, SW21A03, SW21A03, SW021F03. These values were selected because they have pH values above 3.2, below which redox control appears to shift to the Fe^{2+}/Fe^{3+} couple. For the measured pE values the equation is:

$$pH_m = 7.96 - 0.39\ pE_m \qquad (3)$$

where: pH_m = the measured pH,

and, pE_m = the measured pE

For the predicted pE values (pE_p)

$$pH_m = 7.2 - 0.32\ pE_p \qquad (4)$$

Solving the simultaneous equations (3) and (4) in terms of pE gives

$$pE_m = 1.44 + 0.8\ pE_p \qquad (5)$$

From this equation a determination can be made of the error associated with the measured Eh value. If $pE_m = 10$, $pE_p = 9.44$ and the error is three percent.

Conclusions

This study has demonstrated that representative Eh measurements can only be made in water containing iron concentrations greater than 1 mg/L. In addition, control of the redox value in the system is determined by the Fe^{2+}/Fe^{3+} couple at low pH and by the $Fe^{2+}/Fe(OH)_3$ couple in less acidic environments.

Based on the results of this analysis, the Eh measurements are used in the geochemical modeling to predict the mass of $Fe(OH)_3$ which may precipitate at any pH when acidic discharges impact Clear Creek and North Clear Creek. This mass of solid is used in conjunction with the metal attenuation (Kp) values determined from the sorption of metals to the amorphous ferric

hydroxide during the filter pore size evaluation (Appendix 4B). These two pieces of information are necessary to predict the partitioning of metals between the sorbed (solid) phase and the dissolved phase.

APPENDIX 13B

DETERMINING PARTITION COEFFICIENTS

APPENDIX 13B - DETERMINING PARTITION COEFFICIENTS

Calculating metal partition coefficients onto precipitating amorphous ferric hydroxide allows for fine tuning of WASP. Partition coefficients were obtained in conjunction with the filter pore size analysis described in Appendix 4B.

The filters used in the filter pore size comparison were weighed prior to use, air dried for a week, and then reweighed. The filter and its associated iron hydroxide were submitted to the CLP for RAS metal analysis.

Partition coefficients (Kp) were calculated for Al, As, Cu, Cr, Ni, and Zn. These values are based on the mass of iron hydroxide, the mass of the metal on the solid phase, the volume of river water passed through the filter, and the concentration of the analyte in the filtered solution. Kp values may be calculated using the equation:

$$Kp = \frac{\dfrac{\text{Filtered water volume (L)}}{\text{Fe (OH)}_3 \text{ retained (g)}} * \dfrac{\text{Mass of metal in digestate (g)}}{\text{Digestate volume (L)}}}{\dfrac{\text{Metal in filtrate (g)}}{\text{Volume of creek water (L)}}} \qquad (1)$$

The dimensions of equation 1 are L^3/M, consistent with the units for Kp (also known as Kd). The partition coefficients as a function of pH are shown for the metals in Table 13B-1. As expected, Kp values for cations increase due to sorption as the pH increases. The Kp values decrease for As and Cr as the pH increases because these metals occur as anionic species in solution, and therefore desorb from particulates in more alkaline environments. In the Argo drainage, As and Cr occur at levels just above the analytical detection limit. Consequently the concentrations in Clear

Creek are mitigated both by dilution and by sorption so that analyzed concentrations are below the detection limit. In these cases the partition coefficients for As and Cr are expressed in terms of "less than" values.

The Kp values calculated for pH 6.4 are used in WASP to simulate the removal of dissolved metals onto particulate material in Clear Creek, because this pH is closest to those observed in the majority of the creek surface waters.

TABLE 13B-1
SYNOPSIS OF Kp CALCULATIONS IN CLEAR CREEK

	0.45 µm filter			0.10 µm filter		
pH	3.4	5.1	6.4	3.4	5.1	6.4
Al	23	665	44,800	538	1,295	27,000
As	28,000	<13,000	<15,000	30,500	<11,000	<6,000
Cu	60	2,800	280,000	130	5,230	154,000
Cr	81	<30	<81	15,000	<4,500	<6,500
Zn	27	172	4,290	69	149	1,910
Ni	131	763	3,464	183	229	2,235