APPENDIX C

WASHINGTON COUNTY PROFILE

WASHINGTON COUNTY
PROFILE

WASHINGTON COUNTY
PROFILE

Provided as a Public Service
for your information by:

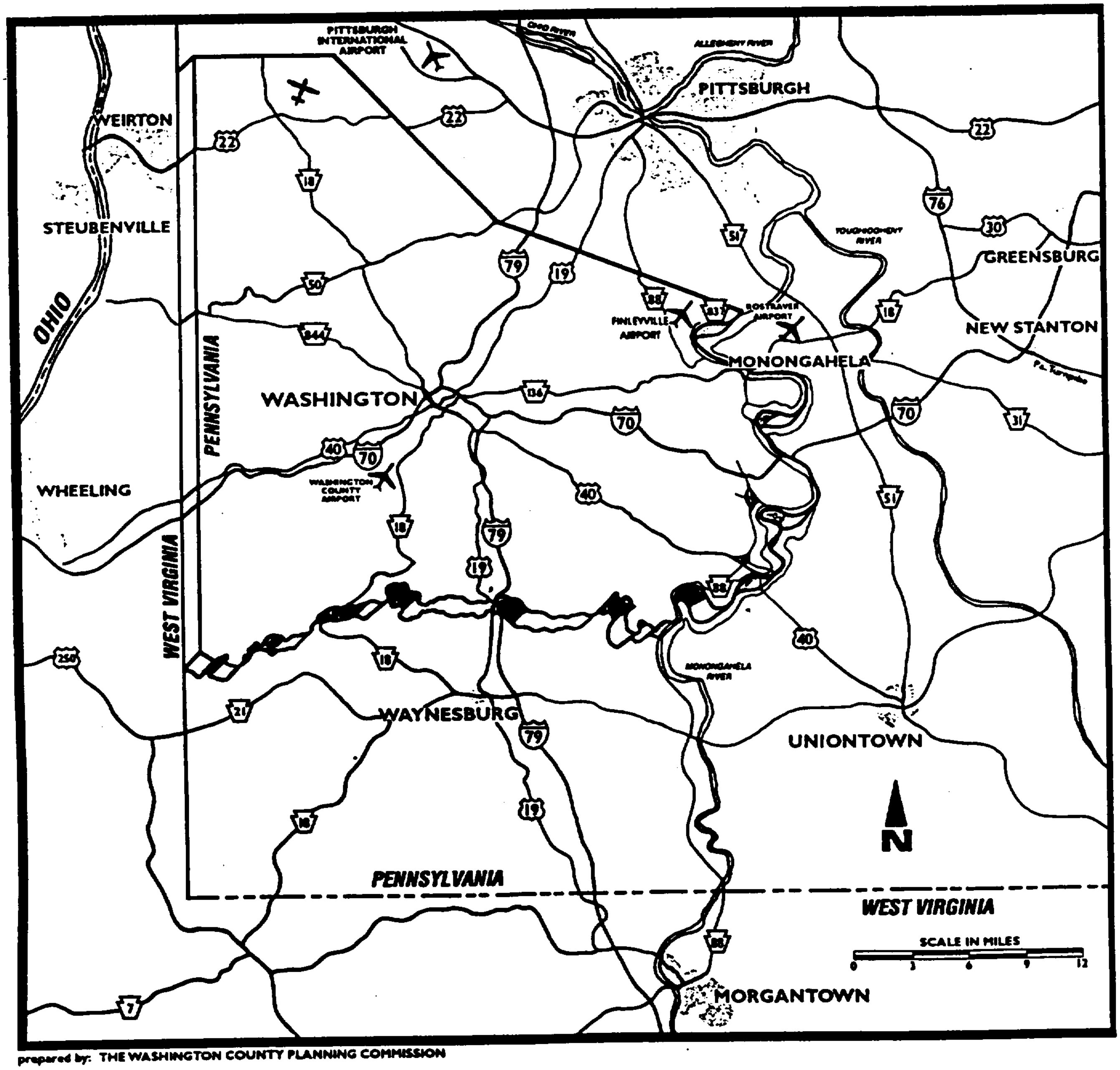
The Washington County
Board of Commissioners
Joseph A. Ford, Sr.
Diana L. Irey
J. Bracken Burns, Sr.

Prepared and Published by:
The Washington County
Planning Commission
100 West Beau Street, Suite 701
Washington, PA 15301

REGIONAL LOCATION

washington
county

pennsylvania



prepared by: THE WASHINGTON COUNTY PLANNING COMMISSION

Washington County

PROFILE

Washington County boasts a broad economic base ranging from agriculture to industry to diverse areas of technology which, directly and indirectly, impact the availability of other services through the economic growth spurred by new development.

In an effort to ensure an optimistic future for Washington County, government must be effective and efficient in adapting to an ever changing environment and responding to the fluctuating, often conflicting demands of residents and commerce.

The Washington County Profile serves as an example of our commitment to the advancement of employment, community, infrastructure and economy. This booklet, filled with information about Washington County's physical characteristics, residents and business/industry, is designed to encourage continued progress as we move toward the 21st century.

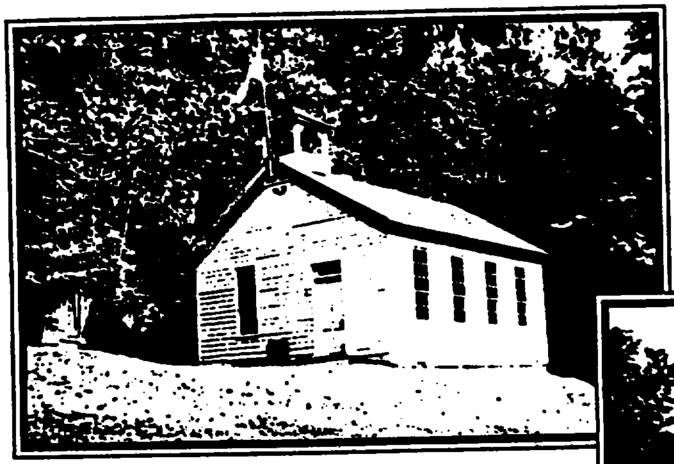
By supplying citizens and other interested parties with convenient, accurate information we hope to encourage comprehensive, insightful decisions which will benefit the entire region.

Washington County Commissioners:

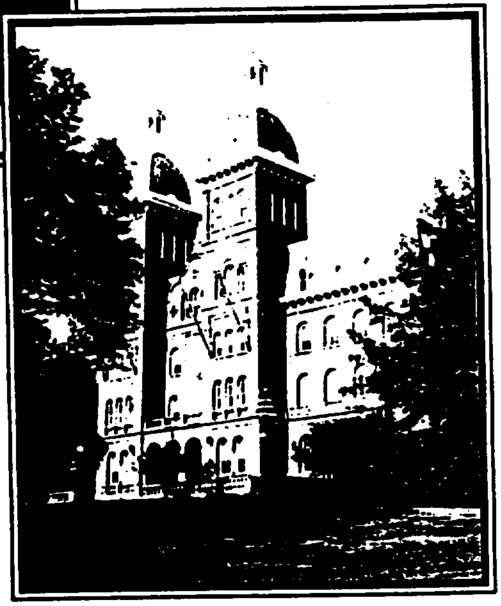
Joseph A. Ford, Sr., Chairman

Diana L. Irey

J. Bracken Burns, Sr.

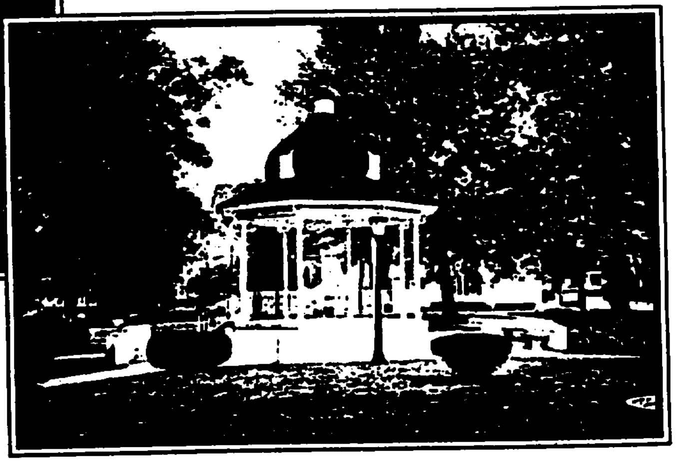


Meadowcroft Village



Washington & Jefferson College

California University
of Pennsylvania



Monongahela City Park

Washington County

HISTORY

On March 28, 1781,Washington County was created by an act of the Pennsylvania Assembly, thus becoming the first county in the United States of America to be named in honor of General George Washington. Carved from the western section of Westmoreland County, it was formed to allow "the inhabitants of the area west of the monongahela river to have more convenient courts and public offices, rather than the inconvenience and hardship of being so far remote from the seat of justice."

The town of Basset, later renamed Washington, served as the site of the first County Courthouse, a log structure built in 1787. The present-day Washington County Courthouse, completed in 1900 by the F.J. Osterling Company of Pittsburgh, is registered as a national landmark.

The Whiskey Rebellion, one of the most famous events of early American history, took place in Washington County when David Bradford, noted attorney and community leader, directed area farmers against the Federal excise tax on whiskey passed in 1791. Governor Henry "Lighthorse Harry" Lee, father of Civil War General Robert E. Lee, smashed the rebellion when he led Federal troops into Washington and Allegheny Counties. Bradford's main street residence, built in 1788, remains a historical site maintained by the David Bradford House Association.

The residence of Dr. Francis J. LeMoyne, a leading abolitionist and founder of the Western Abolition Society(1824), is preserved by the Washington County Historical Society as another tourist attraction.

The National Pike(Route 40), America's first Federally-built transportation system, runs through Washington County and exhibits numerous antique shops and historical points of interest such as the Century Inn of Scenery Hill.

A Few other amenities of present-day Washington County include: California University of Pennsylvania; Washington and Jefferson College; three modern hospitals; fourteen School Districts; fourteen public libraries; Monongahela Aquatorium; three county parks; Washington County Airport; the Meadows Racetrack; the Washington County Fairgrounds; Arden Trolley Museum; the Monongahela River Headwaters District Museum; Washington Park (world headquarters of Pony League Baseball; the antique shops of Scenery Hill and West Alexander; Westerwald Pottery; Little Lake Dinner Theatre of Canonsburg; Charleroi Amphitheater productions; Meadowcroft Village; the Miller one-room school house; the Miller log house and Star Lake Amphitheater.

boroughs: Allenport, Beallsville, Bentleyville, Burgettstown, California, Canonsburg, Centerville, Charleroi, Claysville, Coal Center, Cokeburg, Deemstown, Donora, Dunlevy, East Washington, Elco, Ellsworth, Finleyville, Green Hills, Houston, Long Branch, McDonald, Marianna, Midway, New Eagle, North Charleroi, Roscoe, Speers, Stockdale, Twilight, West Alexander, West Brownsville, West Middletown.

townships: Amwell, Blaine, Buffalo, Canton, Carroll, Cecil, Chartiers, Cross Creek, Donegal, East Bethlehem, East Finley, Fallowfield, Hanover, Hopewell, Independence, Jefferson, Morris, Mount Pleasant, North Bethlehem, North Franklin, North Strabane, Nottingham, Peters, Robinson, Smith, Somerset, South Franklin, South Strabane, Union, West Bethlehem, West Finley, West Pike Run.

cities: Monongahela, Washington.

date established: March 28, 1781

population: 204,584

county seat: The City of Washington

land area: 863.6 square miles

highest point: Mt. Wheeler
(North Franklin Township)
1,523 feet above sea level

lowest point: Elrama
(Union Township)
760 above sea level

climate:
Average Summer temperature - 82 (high)
Average Winter Temperature - 36.5 (high)
Average annual rainfall - 36.29 inches
Average annual snowfall - 45.3 inches

agriculture

principal products: Milk and Dairy Products

value of production: 37.9 million annually

industry

principal products: Coal, Primary and Fabricated Metals, Electric Machinery

value of production: 1.4 billion annually

real estate

assessed value of taxable real estate: Over $1 billion (1995)

governmental units:

67 Municipalities
- 2 Third Class Cities
- 33 Boroughs
- 32 Townships

vital statics:

Number of births (1994) - 2,253
Number of deaths (1994) - 2,359
Number of marriages (1994) - 1,211
Number of divorces (1994) - 675

Washington County

PEOPLE

Washington County's population has fluctuated from decade to decade, however, the population for the county has remained over 200,000 for the last few decades. At the present time the county's population is slightly over 204,000 of which 106,000 are female and 98,000 are male.

The majority of the Population can be found in the urban and suburban areas of the county: the City of Washington and the surrounding areas, the Monongahela River Valley, the Canonsburg/Houston area and Peters/Cecil Township areas.

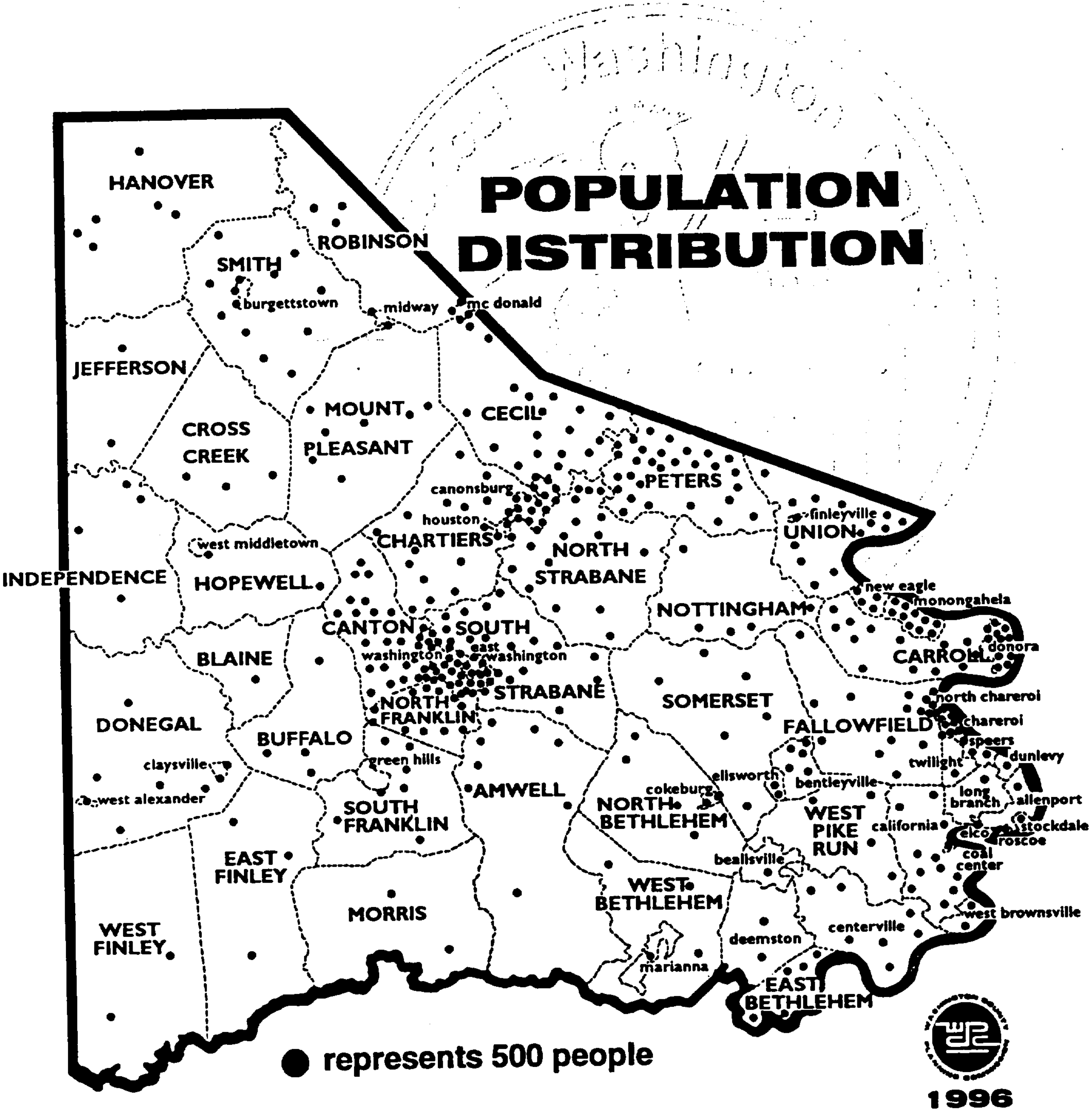
According to the 1990 census there are 45,955 persons under the age of 18; 122,852 persons between 18 and 64 years of age and 35,770 persons 65 years of age or older. The minority population totals nearly 8,000 or four percent of the total population.

The Average Washington County citizen is 37 years of age and resides in a home with a median market value of $53,600.

Listed below are some comparisons between the 1980 and 1990 Washington County Decennial Census.

	1980	**1990**
Population	**217,074**	**204,584**
Minority population	**8,117**	**7,774**
Number of males	**104,813**	**97,915**
Number of females	**112,261**	**106,669**
Median age	**N/A**	**37.5**
Household size	**2.76**	**2.54**
Median household income	**$17,664**	**$25,469**
Median market value per housing unit	**$38,700**	**$53,600**

POPULATION DISTRIBUTION



● represents 500 people

1996

POPULATION AND DENSITY

(Based on 1990 Data)

Municipality	1960	1970	1980	1990	Area (Square Miles)	Density (Persons Per Square Mile)
Allenport Borough	981	762	735	595	2.6	229
Amwell Township	2,808	3,030	3,563	4,176	42.9	97
Beallsville Borough	481	434	588	530	2.6	204
Bentleyville Borough	3,160	2,714	2,525	2,673	2.8	955
Blaine Township	643	579	734	682	11.8	58
Buffalo Township	1,270	1,530	2,022	2,148	20.7	104
Burgettstown Borough	2,383	2,118	1,867	1,634	.3	5,447
California Borough	5,978	6,635	5,703	5,748	13.6	423
Canonsburg Borough	11,877	11,439	10,459	9,200	1.1	8,364
Canton Township	7,820	8,869	10,311	9,256	14.9	621
Carroll Township	6,205	6,636	6,590	6,210	16.7	16
Cecil Township	8,563	8,362	8,923	8,948	27.8	322
Centerville Borough	5,088	4,175	4,207	3,842	13.0	296
Charleroi Borough	8,148	6,723	5,717	5,014	.8	6,380
Chartiers Township	7,225	7,324	7,715	7,603	24.6	309
Claysville Borough	986	951	1,029	962	.3	3,207
Coal Center Borough	419	317	255	184	.1	1,840
Cokeburg Borough	989	845	796	724	.4	290
Cross Creek Township	1,783	1,667	1,704	1,727	26.1	66
Deemston Borough	873	711	829	770	9.8	79
Donegal Township	1,916	1,949	2,361	2,347	41.7	56
Donora Borough	11,131	8,825	7,524	5,928	1.6	3,705
Dunlevy Borough	408	405	463	417	.6	695
East Bethlehem Township	4,180	3,347	3,353	2,799	5.4	518
East Finley Township	897	943	1,430	1,479	34.9	42
East Washington Borough	2,483	2,198	2,241	2,126	1.5	1,417
Elco Borough	521	459	417	373	.3	1,243
Ellsworth Borough	1,456	1,268	1,228	1,048	.8	1,310
Fallowfield Township	5,350	5,454	5,439	4,972	21.3	233
Finleyville Borough	582	379	402	446	.1	4,460
Green Hills Borough	0	0	18	21	1.0	21
Hanover Township	2,456	3,016	3,275	2,883	48.7	59
Hopewell Township	800	816	919	942	20.9	45
Houston Borough	1,865	1,812	1,568	1,445	.3	4,816
Independence Township	1,895	1,681	1,784	1,868	26.1	72
Jefferson Township	1,229	1,301	1,369	1,212	24.4	50
Long Branch Borough	517	582	610	482	2.3	209
Marianna Borough	1,088	875	907	616	.9	684
McDonald Borough	2,427	2,220	2,233	1,809	.4	4,523
Midway Borough	1,012	1,188	1,187	1,043	.3	3,477
Monongahela City	8,388	7,113	5,950	4,928	1.4	3,520
Morris Township	927	871	1,191	1,145	30.4	38
Mount Pleasant Township	3,007	3,359	3,612	3,555	36.1	98
New Eagle Borough	2,670	2,497	2,617	2,172	1.0	2,172
North Bethlehem Township	1,715	1,736	1,897	1,864	21.9	85
North Charleroi Borough	2,259	1,964	1,760	1,562	.2	7,810
North Franklin Township	3,882	4,444	4,648	4,997	7.3	685
North Strabane Township	7,322	7,578	8,490	8,157	27.7	294
Nottingham Township	1,463	1,862	2,270	2,303	19.2	120
Peters Township	7,126	10,672	13,104	14,467	19.4	746
Robinson Township	2,150	2,073	1,812	2,160	21.3	101
Roscoe Borough	1,315	1,176	1,123	872	.3	2,907
Smith Township	6,362	5,812	5,583	4,844	34.1	142
Somerset Township	2,282	2,293	3,150	2,947	33.0	89
South Franklin Township	1,308	1,730	3,548	3,665	21.1	174
South Strabane Township	5,872	6,555	7,389	7,676	22.0	349
Speers Borough	1,479	1,408	1,425	1,284	1.3	988
Stockdale Borough	815	720	641	630	.4	1,575
Twilight Borough	301	272	298	252	1.5	168
Union Township	5,611	6,071	6,692	6,322	15.7	403
Washington City	23,545	19,827	18,363	15,864	3.4	4,666
West Alexander Borough	468	402	286	301	.2	1,505
West Bethlehem Township	1,783	1,540	1,579	1,609	22.5	72
West Brownsville Borough	1,907	1,426	1,433	1,170	1.3	900
West Finley Township	780	769	964	972	39.4	25
West Middletown Borough	199	195	215	166	.4	415
West Pike Run Township	2,442	1,972	2,034	1,818	15.9	114
Washington County	217,271	210,876	217,074	204,584	863.6	237

PER CAPITA INCOME

Area Name	1979 Per Cap Income	1981 Per Cap Income	1983 Per Cap Income	1985 Per Cap Income	1987 Per Cap Income	1989 Per Cap Income	Percent Change 79-89
Washington County	7,070	8,320	8,594	9,533	10,442	12,744	80.3
Allenport Borough	7,657	8,706	8,484	9,222	10,056	9,713	26.9
Amwell Township	6,500	7,563	7,964	8,842	10,185	11,483	76.7
Beallsville Borough	6,498	7,858	8,017	9,378	10,204	10,930	68.2
Bentlyville Borough	6,819	7,595	8,056	8,694	9,018	9,632	41.3
Blaine Township	5,605	6,863	7,393	7,671	8,582	9,965	77.8
Buffalo Township	6,411	7,728	7,923	8,363	9,036	12,771	99.2
Burgettstown Borough	7,895	9,288	9,585	10,628	11,647	12,097	53.2
California Borough	5,635	6,745	7,082	7,845	8,608	7,749	37.5
Canonsburg Borough	6,838	7,991	8,523	9,155	9,990	11,157	63.2
Canton Township	6,278	7,375	7,742	8,285	9,195	11,328	80.4
Carroll Township	7,597	8,943	8,771	9,651	10,454	13,405	76.5
Cecil Township	6,499	7,795	7,966	9,036	9,938	15,084	132.0
Centerville Borough	6,867	8,118	8,179	8,653	8,898	10,152	47.8
Charleroi Borough	7,168	8,655	8,801	9,672	10,376	10,419	45.4
Chartiers Township	7,240	8,322	8,736	9,989	10,720	13,886	91.8
Claysville Borough	6,010	7,020	7,275	8,021	8,477	8,848	47.2
Coal Center Borough	6,308	7,636	8,096	8,978	9,883	9,440	49.7
Cokeburg Borough	7,284	8,674	9,184	10,111	10,510	12,183	67.3
Cross Creek Township	7,374	8,251	8,474	9,268	10,635	10,727	45.5
Deemston Borough	5,990	7,094	7,368	8,170	8,963	10,166	69.7
Donegal Township	5,744	7,232	7,093	7,727	8,730	10,806	88.1
Donora Borough	6,059	7,460	7,531	8,295	8,753	8,914	47.1
Dunlevy Borough	7,283	8,546	8,300	9,358	10,311	12,916	77.3
East Bethlehem Township	5,694	6,602	7,120	7,573	7,883	8,867	55.7
East Finley Township	5,075	6,016	6,010	6,774	7,349	9,124	79.8
East Washington Borough	10,386	12,094	12,355	13,698	14,986	20,184	94.3
Elco Borough	6,131	6,983	6,966	8,079	8,566	9,327	52.1
Ellsworth Borough	7,435	8,576	9,164	10,042	10,663	9,481	27.5
Fallowfield Township	7,520	8,863	8,587	9,420	9,953	12,033	60.0
Finleyville Borough	7,704	9,078	9,383	10,403	11,404	11,181	45.1
Green Hills Borough	N/A	N/A	N/A	N/A	N/A	17,771	N/A
Hanover Township	7,548	8,918	8,625	9,182	9,912	12,212	61.8
Hopewell Township	6,010	6,949	7,754	7,944	9,238	11,263	87.4
Houston Borough	7,124	8,421	8,731	9,681	10,617	11,043	55.0
Independence Township	6,144	7,151	6,982	7,619	8,406	10,148	65.2
Jefferson Township	7,145	8,392	8,326	9,591	10,135	13,555	89.7
Long Branch Borough	7,308	8,884	8,392	9,388	10,269	10,422	42.6
McDonald Borough (Part)	6,978	8,278	8,490	9,404	10,196	11,647	66.9
Marianna Borough	6,641	7,761	7,877	9,086	9,625	9,288	39.9
Midway Borough	6,905	8,066	7,857	9,123	9,533	12,076	74.9
Monongahela City	6,474	7,744	7,987	8,675	9,513	11,347	75.3
Morris Township	5,835	7,066	7,618	7,971	8,629	10,923	87.2
Mount Pleasant Township	7,089	8,400	8,289	9,256	10,173	12,842	81.2
New Eagle Borough	6,523	7,701	7,598	8,264	8,840	11,273	72.8
North Bethlehem Township	6,722	7,498	7,827	8,689	8,876	11,800	75.5
North Charleroi Borough	7,115	8,387	8,313	8,820	9,716	10,715	50.6
North Franklin Township	7,831	8,978	9,508	10,103	11,168	13,279	69.6
North Strabane Township	7,897	9,244	9,547	10,727	11,886	15,825	100.4
Nottingham Township	7,250	8,265	8,865	9,673	11,034	13,689	88.8
Peters Township	10,534	12,666	13,574	15,905	18,194	24,417	131.8
Robinson Township	6,961	8,196	8,151	9,179	10,034	11,182	60.6
Roscoe Borough	7,266	8,611	8,370	9,549	10,680	11,454	57.6
Smith Township	6,134	7,262	7,084	7,712	8,281	10,371	69.1
Somerset Township	6,559	7,769	7,885	9,005	9,833	13,529	106.3
South Franklin Township	6,175	7,181	7,380	8,052	8,878	11,233	81.9
South Strabane Township	8.612	9,878	10,383	11,413	12,267	17,021	97.6
Speers Borough	8.472	10,328	10,670	11,099	11,746	14,487	71.0
Stockdale Borough	7,112	7,891	7,654	8,880	9,503	13,014	83.0
Twilight Borough	8,399	9,829	10,091	11,188	12,250	11,487	36.8
Union Township	7,011	8,057	8,322	9,338	9,982	12,076	72.2
Washington City	6,359	7,353	7,882	8,756	9,679	9,492	49.3
West Alexander Borough	6,290	7,759	8,174	9,064	9,968	8,589	36.6
West Bethlehem Township	5,957	6,882	7,122	7,988	8,847	10,042	68.6
West Brownsville Borough	6,053	7,068	6,998	7,643	8,051	9,181	51.7
West Finley Township	5,263	5,715	5,886	6,334	6,905	9,540	81.3
West Middletown Borough	8,211	9,668	9,986	11,072	12,136	13,043	58.8
West Pike Run Township	6,315	7,569	7,232	8,493	9,161	10,657	68.8

N/A: Data unavailable for those years

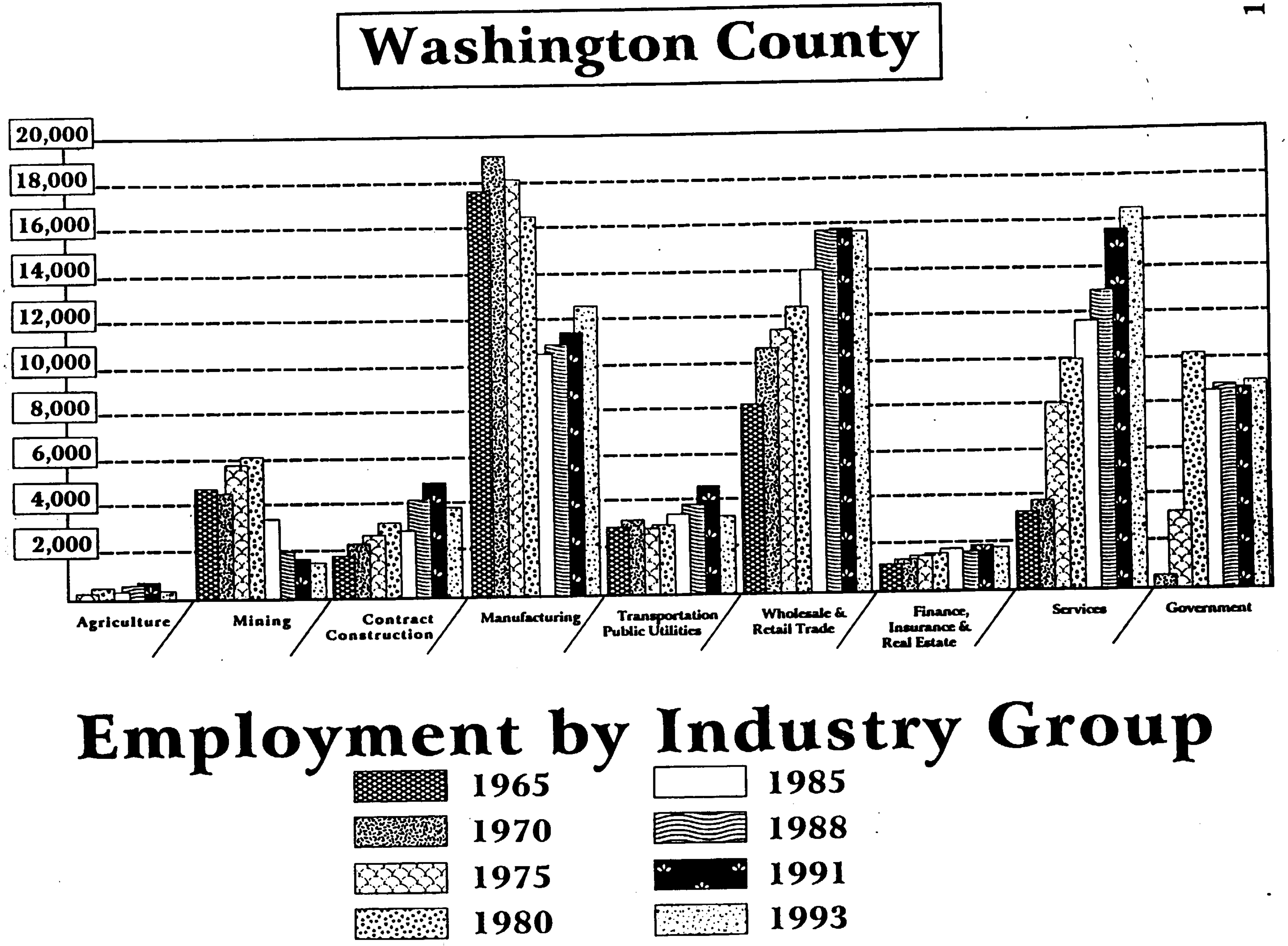
EMPLOYMENT

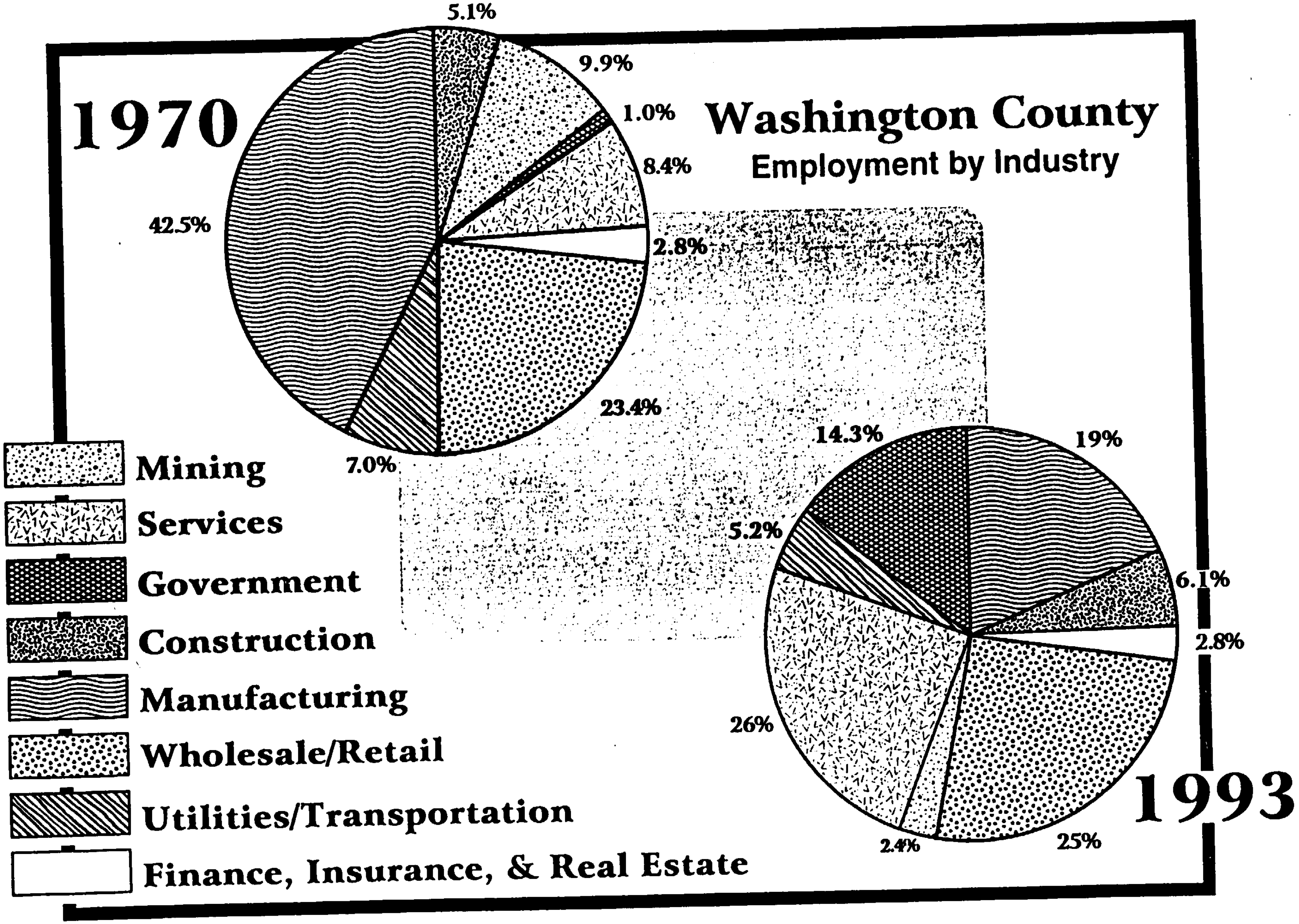
Washington County

Despite the decline in manufacturing, primarily in steel, glass and their supporting industries, Washington County has enjoyed an increase in employment within government, wholesale/retail trade and service industries, For example, in 1965 over 17,000 worked in the manufacturing industry while 1993 showed only 12,003 (a loss of approximately 5,000 jobs). Fortunately, in the same 25 year period the number of people employed in service industries increased by 12,000 from just under 4,000 people to over 16,000. Such offsetting of losses and gains resulted in stability through diversification.

In 1965 the difference between the number of people employed in the two highest employment industries, manufacturing and wholesale/retail trade, was close to 9,000 with manufacturing holding the edge. By 1993 the difference between the same two industries closed to only 3,800 employees with wholesale/retail trade on top. The two industries that employed the most people by 1993, wholesale/retail trade and services, had a difference of only 400 employees. In 1965, people employed in manufacturing made up only 45% of the people employed in the county. Yet, by 1993 manufacturing represented only 19% while the other major industries, wholesale/ retail trade and services, accounted for 25% and 26% of Washington County employment respectively. Since Washington County employment no longer centers around a single industry, the threat of economic instability from the collapse of one industry has dissipated.

If anything good came from the decline in the manufacturing industry, it is that this drop acted as a stimulus for the diversification that will secure Washington County's economic future.


Washington County
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
Agriculture
Mining
Contract Construction
Manufacturing
Transportation Public Utilities
Wholesale & Retail Trade
Finance, Insurance & Real Estate
Services
Government
Employment by Industry Group
1965
1970
1975
1980
1985
1988
1991
1993


Washington County
Employment by Industry
1970
5.1%
9.9%
1.0%
8.4%
2.8%
23.4%
7.0%
42.5%
1993
14.3%
19%
6.1%
2.8%
25%
2.4%
26%
5.2%
Mining
Services
Government
Construction
Manufacturing
Wholesale/Retail
Utilities/Transportation
Finance, Insurance, & Real Estate

Washington County

TRANSPORTATION

Washington County has 2,821 miles of highway. Interstates 70 and 79, which intersect just outside of the City of Washington, account for 64 of those miles, providing vital links to the Pennsylvania Turnpike, cities in the midwest, and the cities of Erie, Pittsburgh and Morgantown, WV. Route 22, traversing the northwestern sector of the county, also acts as an important connection with the Greater Pittsburgh International Airport, the city of Pittsburgh and cities in West Virginia and Ohio.

The Mon/Fayette Expressway, joining I-70 with route 40, exposes the Mon-Valley to I-70 and all of its vital connections. The I-70 to Route 51 section of the highway received Federal approval in May of 1994 and is currently under construction. The entire Mon/Fayette Expressway, a 65 mile limited access highway to connect Pittsburgh, PA and Morgantown,WV is scheduled for completion by the end of the decade.

Another proposed project that will impact Washington County and the region is the Southern Beltway, a 30 mile, $600 million expressway to serve as the first leg of a beltway around the city of Pittsburgh. Originating at the greater Pittsburgh International Airport and ending at the Mon Fayette Expressway, this road will provide residents and businesses with access to the airport and job opportunities while reducing congestion on I-79, the Parkway west and the Southern Expressway. In addition, the new interchange on I-79 at the northern end of the Southpointe development provides direct access to this mixed use industrial park.

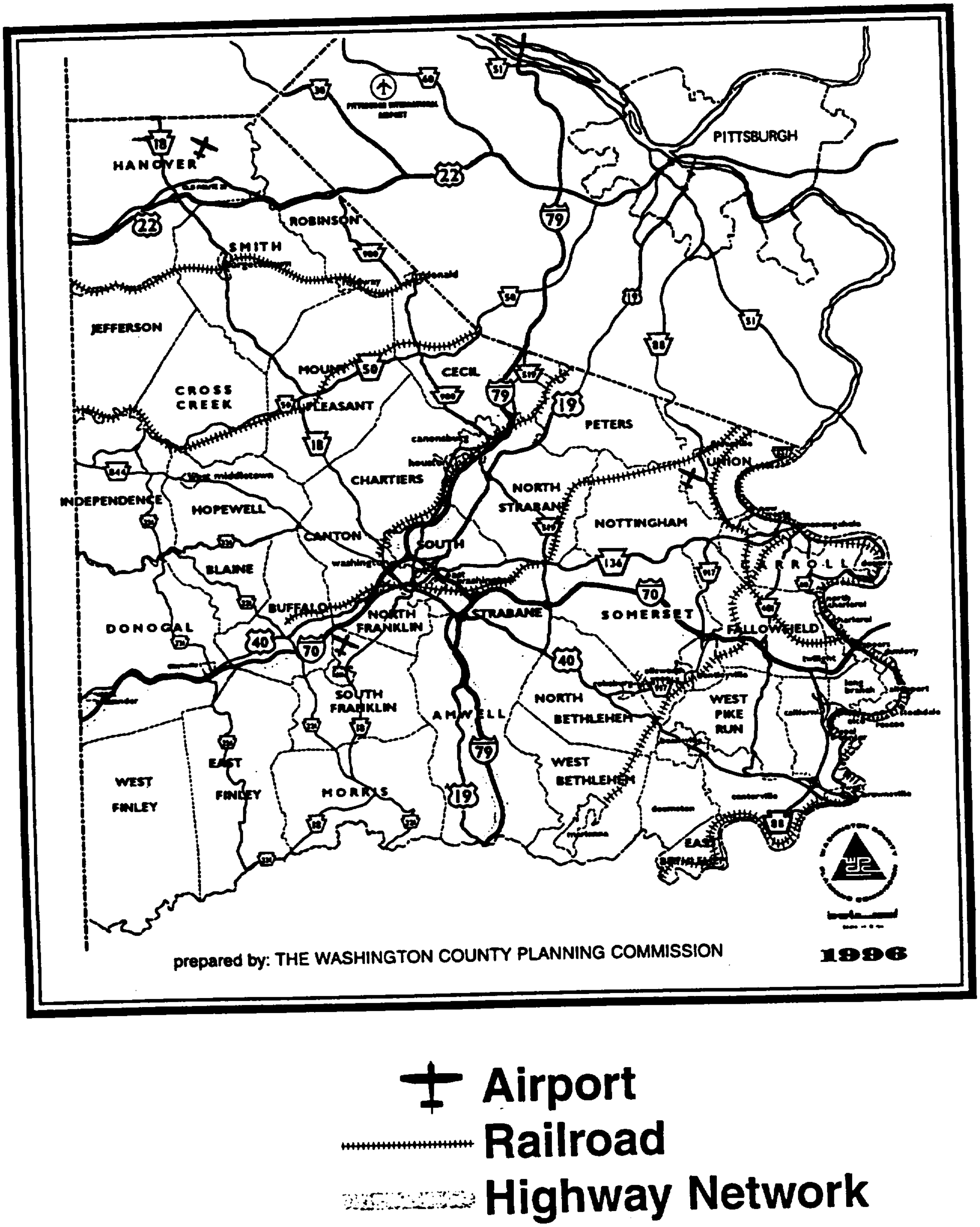
There are 73 trucking and warehouseing companies headquartered in Washington County which make good use of the County's highway system and provide services to local business and industry.

Washington County is served by three railroad carriers, CSX Transportation (B&O), Conrail and Norfolk Southern (N&W).

Along the eastern border of the county, the Monongahela River provides a link to ports along the Ohio and Mississippi Rivers. An estimated 36.8 million tons of coal, petroleum and other materials are shipped along the Monongahela annually.

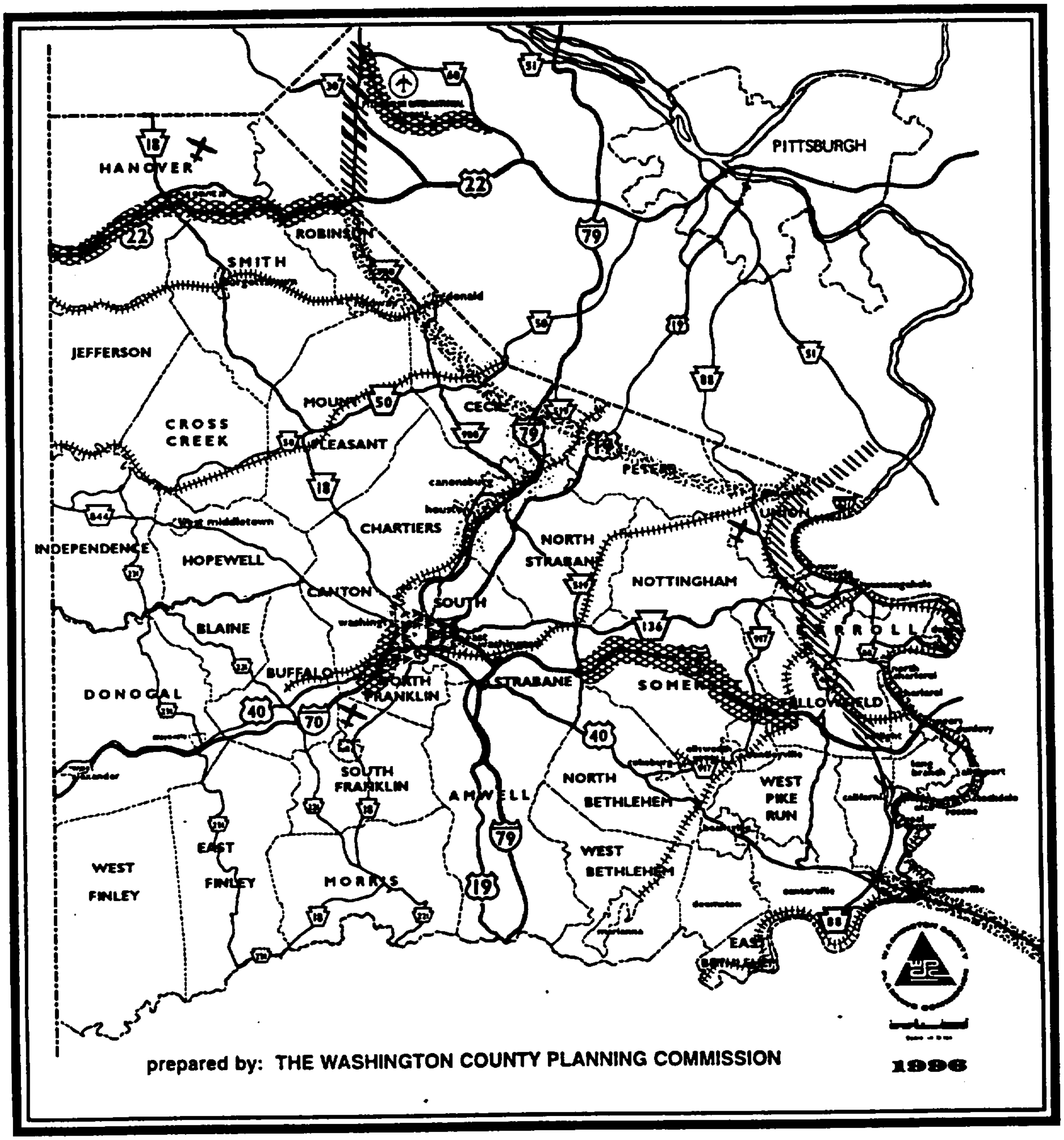
The County Airport, located south of the City of Washington on Route 18, operates under the direction of the County Commissioners. Since the airport can accommodate business jets, many companies operate aircraft from the facility, accounting for the Washington County Airport ranking as the fourth busiest in Southwestern Pennsylvania. With the recent installation of the first electronic guidance system (ILS), airport operations should increase from the 35,000 landings and take-offs in 1995.

TRANSPORTATION FACILITIES



prepared by: THE WASHINGTON COUNTY PLANNING COMMISSION 1996

HIGHWAY IMPROVEMENTS



prepared by: THE WASHINGTON COUNTY PLANNING COMMISSION 1996

▩ Completed Construction / Restoration

░ Under Construction

▦ Planned Restoration and Improvements

▨ Planned New Roads

▒ Proposed New Roads

RECREATION AND ENTERTAINMENT

Washington County owns and operates three parks, Cross Creek Park (3,500 acres), Mingo Creek Park (2,600 acres) and Ten Mile Creek Park (22 acres). Additionally, numerous other municipal parks and facilities and state game lands contribute to the recreational opportunities available to residents and visitors.

Washington County boasts sixteen (16) golf courses including Quicksilver, a championship quality course near Midway that serves as home to the Pittsburgh Senior Classic PGA tour, and Southpointe golf course in the mixed use industrial park.

Ladbroke at the Meadows, a pari-mutuel race track, features harness racing highlighted by two high stakes races, the Adios and the Messenger.

Coca-cola Star Lake Amphitheatre, located in Hanover Township at the intersection of Route 18 and Route 22, showcases musical artists from classical to contemporary venues.

Washington County is the international home of Pony League Baseball and the yearly Pony League World Series. Beyond that, numerous festivals and workshops take place throughout the year including, but not limited to, needle and yarn workshops, children's arts and crafts, nature walks, dog shows, maple tapping, National Pike Festival, Covered Bridge Festival, Pumpkin Festival, Maple Festival, Apple Festival and the Washington County Fair.

Sportsmen will also enjoy the abundant hunting and fishing opportunities available in the five state gamelands totaling 11,858 acres. Tournaments sponsored by the local Bass Masters organizations include an annual Bass Tournament, a Big Bass Buddy Tournament and the 2000 Turkeys Tournament.

As a bonus to all of this excitement, Washington County is optimally located to professional sporting events and other forms of top entertainment in Pittsburgh, PA and Wheeling, WV.

SERVICES AND AMENITIES

Washington County has some of the finest services and amenities in the Commonweath.

Health Care

Washington County has three General Hospitals: Washington, Canonsburg and Monongahela Valley. In addition to the general hospitals the county has eleven extended care hospitals and facilities, nine outpatient clinics and one state hospital. There are over 285 practicing physicians, 126 dentists and 12 separate ambulance services. These different and essential medical services help ensure excellent health care for all of Washington County's citizens.

Police and Fire Protection

Washington County is served by 51 volunteer fire departments and one paid department which is located in the City of Washington. Besides the 38 separate police departments in Washington County, the Pennsylvania State Police, which operates Troop B Headquarters in the City of Washington, provides patrols in all local municipalities and often assists local police departments.

Education

Washington County has 14 public school districts, 21 non-public schools, two vocational-technical schools, six trade and vocational schools and two institutions of higher education: California University of Pennsylvania and Washington and Jefferson College.

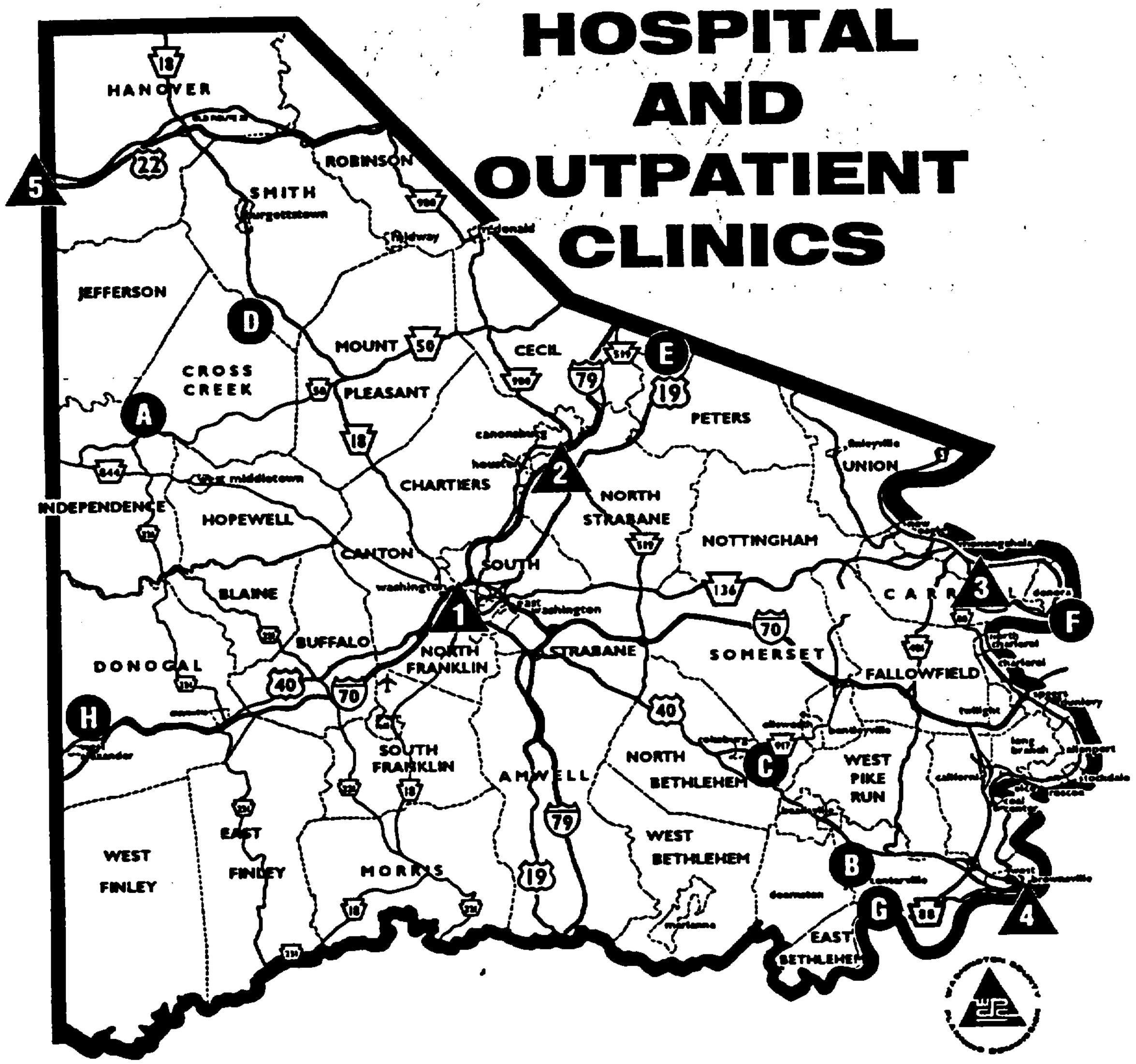
Community Facilities

Washington County has 14 public libraries and two private libraries, California University Library containing 338,000 volumes and the Washington and Jefferson College Library containing 195,000 volumes.

The county has over 321 churches representing every denomination, in addition to a synagogue.

Social and civic groups are also active in all parts of the county.

HOSPITAL AND OUTPATIENT CLINICS



1996

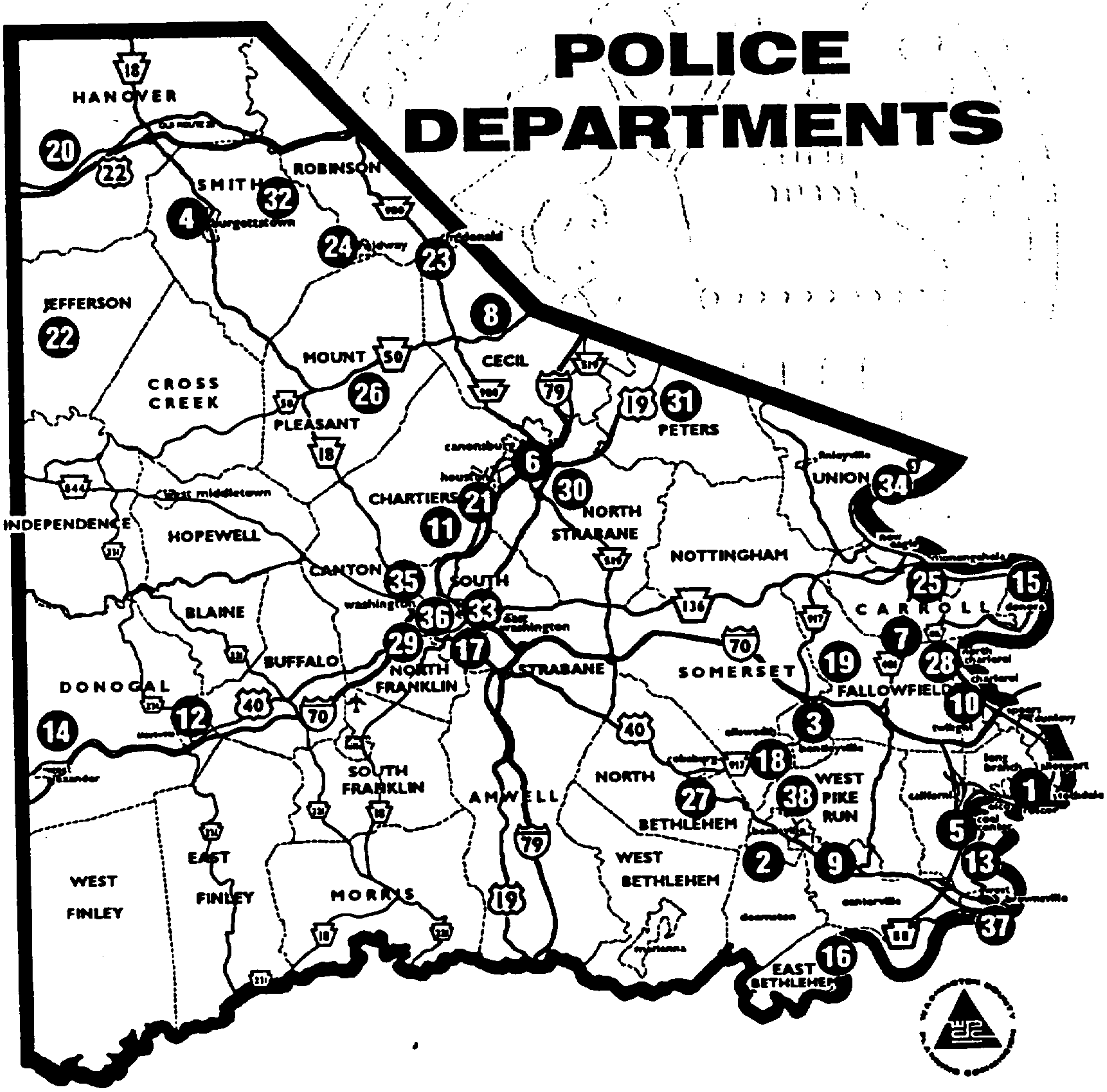
1. **The Washington Hospital**
2. **Canonsburg General Hospital**
3. **Monongahela Valley Hospital, Inc.**
4. **Brownsville General Hospital**
   (Fayette County)
5. **Weirton Medical Center**
   (Weirton, West Virginia)

A. **Avella Family Practice Office**
B. **Centerville Clinics, Inc.**
C. **Cokeburg Medical Building**
D. **Community Medical Center of Northwest Washington County, Inc.**
E. **Crossroads Medical Office**
F. **Mon Valley United Health Services, Inc.**
G. **Vestaburg Clinic**
H. **West Alexander Family Practice Office**

▲ **Hospitals**

● **Outpatient Clinics**

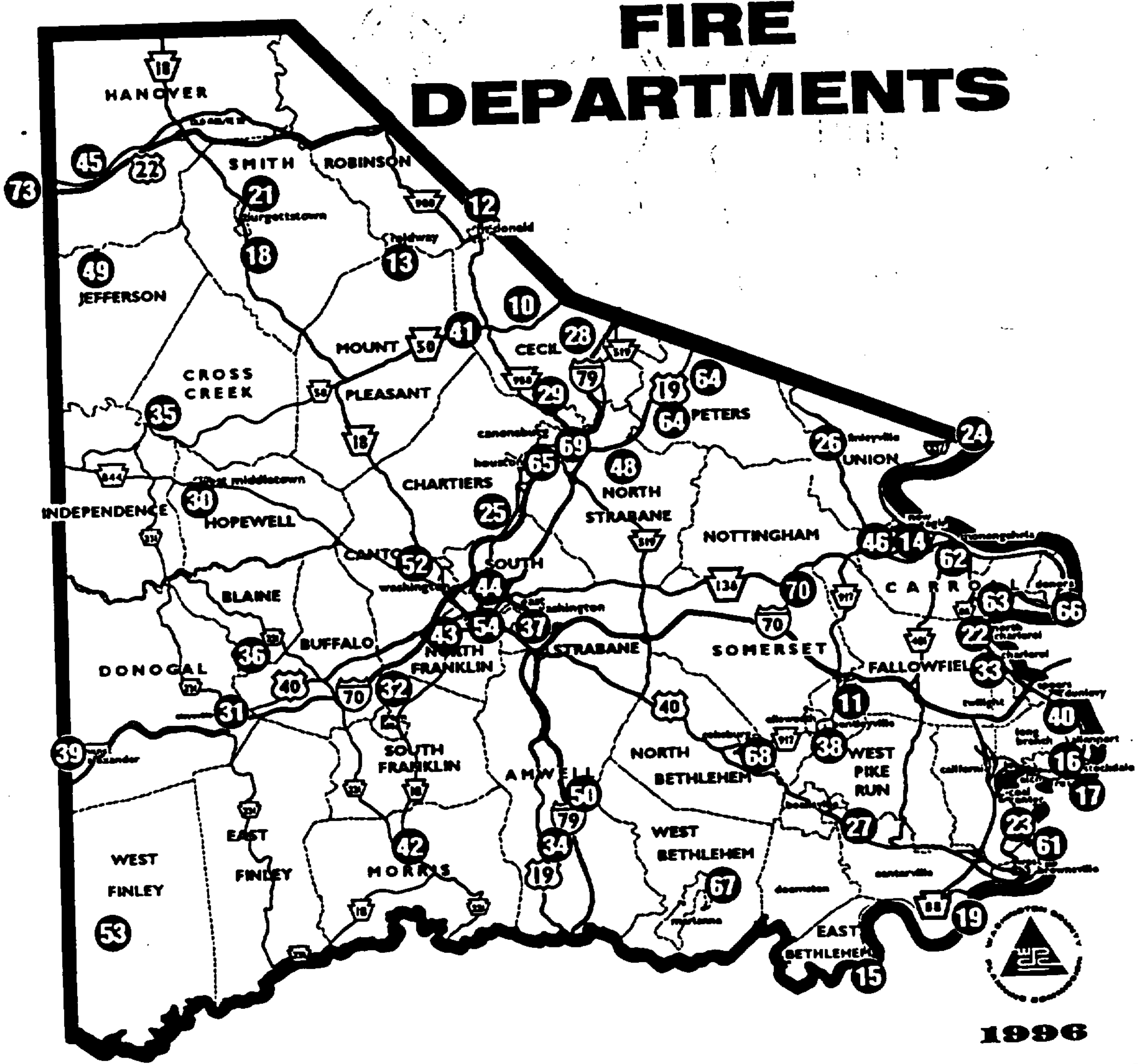
POLICE DEPARTMENTS



1996

1\. ALLENPORT BORO.
1\. ELCO BORO.
1\. ROSCOE BORO.
1\. STOCKDALE BORO.
2\. BEALLSVILLE BORO.
3\. BENTLEYVILLE BORO.
4\. BURGETTSTOWN BORO.
5\. CALIFORNIA BORO.
6\. CANONSBURG BORO.
7\. CARROLL TWP.
8\. CECIL TWP.
9\. CENTERVILLE BORO.
10\. CHARLEROI BORO.
11\. CHARTIERS TWP.
12\. CLAYSVILLE BORO.
13\. COAL CENTER BORO.
14\. DONEGAL TWP.
15\. DONORA BORO
16\. EAST BETHLEHAM TWP.
17\. EAST WASHINGTON BORO.
18\. ELLSWORTH (ELL-CO)
18\. COKEBURG (ELL-CO)
19\. FALLOWFIELD TWP.
20\. HANOVER TWP.
21\. HOUSTON BORO
22\. JEFFERSON TWP.
23\. McDONALD BORO.
24\. MIDWAY BORO
25\. MONONGAHELA CITY
26\. MT. PLEASANT TWP.
27\. NORTH BETHLEHEM TWP.
28\. NORTH CHARLEROI BORO.
29\. NORTH FRANKLIN TWP.
30\. NORTH STRABANE TWP.
31\. PETERS TWP.
32\. SMITH TWP.
33\. SOUTH STRABANE TWP.
34\. UNION TWP.
35\. WASHINGTON COUNTY SHERIFF
36\. WASHINGTON CITY
37\. WEST BROWNSVILLE BORO.
38\. WEST PIKE RUN TWP.

FIRE DEPARTMENTS



1996

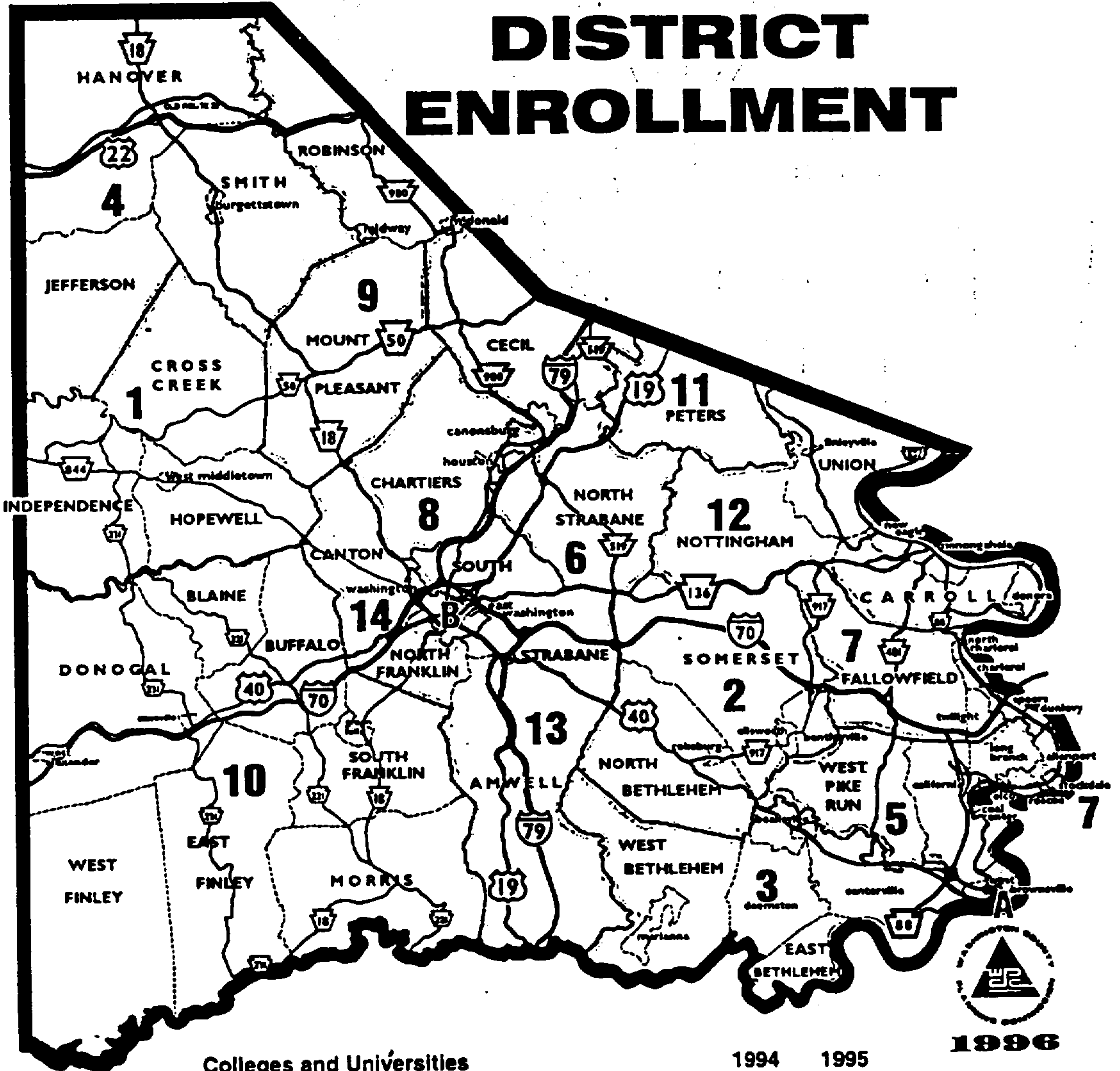
40. ALLENPORT
34. AMWELL
35. AVELLA
11. BENTLEYVILLE
21. BURGETTSTOWN
23. CALIFORNIA
52. CANTON TWP. NO. 1
69. CANONSBURG
63. CARROLL TWP.
28. CECIL TWP. NO. 1
29. CECIL TWP. NO. 2
10. CECIL TWP. NO. 3
33. CHARLEROI
25. CHARTIERS

31. CLAYSVILLE
68. COKEBURG
19. DENBO VESTA SIX
66. DONORA
15. EAST BETHLEHEM TWP.
38. ELLSWORTH
24. ELRAMA
47. FALLOWFIELD TWP.
26. FINLEYVILLE
45. HANOVER TWP.
65. HOUSTON
49. JEFFERSON TWP.
22. LOCK FOUR
50. LONE PINE
67. MARIANNA

12. McDONALD
13. MIDWAY
62. MONONGAHELA
42. MORRIS
41. MT. PLEASANT
14. NEW EAGLE
43. NORTH FRANKLIN TWP.
48. NORTH STRABANE TWP.
64. PETERS TWP. NO. 1
64. PETERS TWP. NO. 2
27. RICHEYVILLE
16. ROSCOE
18. SLOVAN
70. SOMERSET TWP.
32. SOUTH FRANKLIN TWP.

37. SOUTH STRABANE TWP. NO. 1
44. SOUTH STRABANE TWP. NO. 2
17. STOCKDALE
36. TAYLORSTOWN
46. VALLEY INN
54. WASHINGTON CITY
73. WEIRTON HEIGHTS
39. WEST ALEXANDER
61. WEST BROWNSVILLE
53. WEST FINLEY
30. WEST MIDDLETOWN

SCHOOL DISTRICT ENROLLMENT

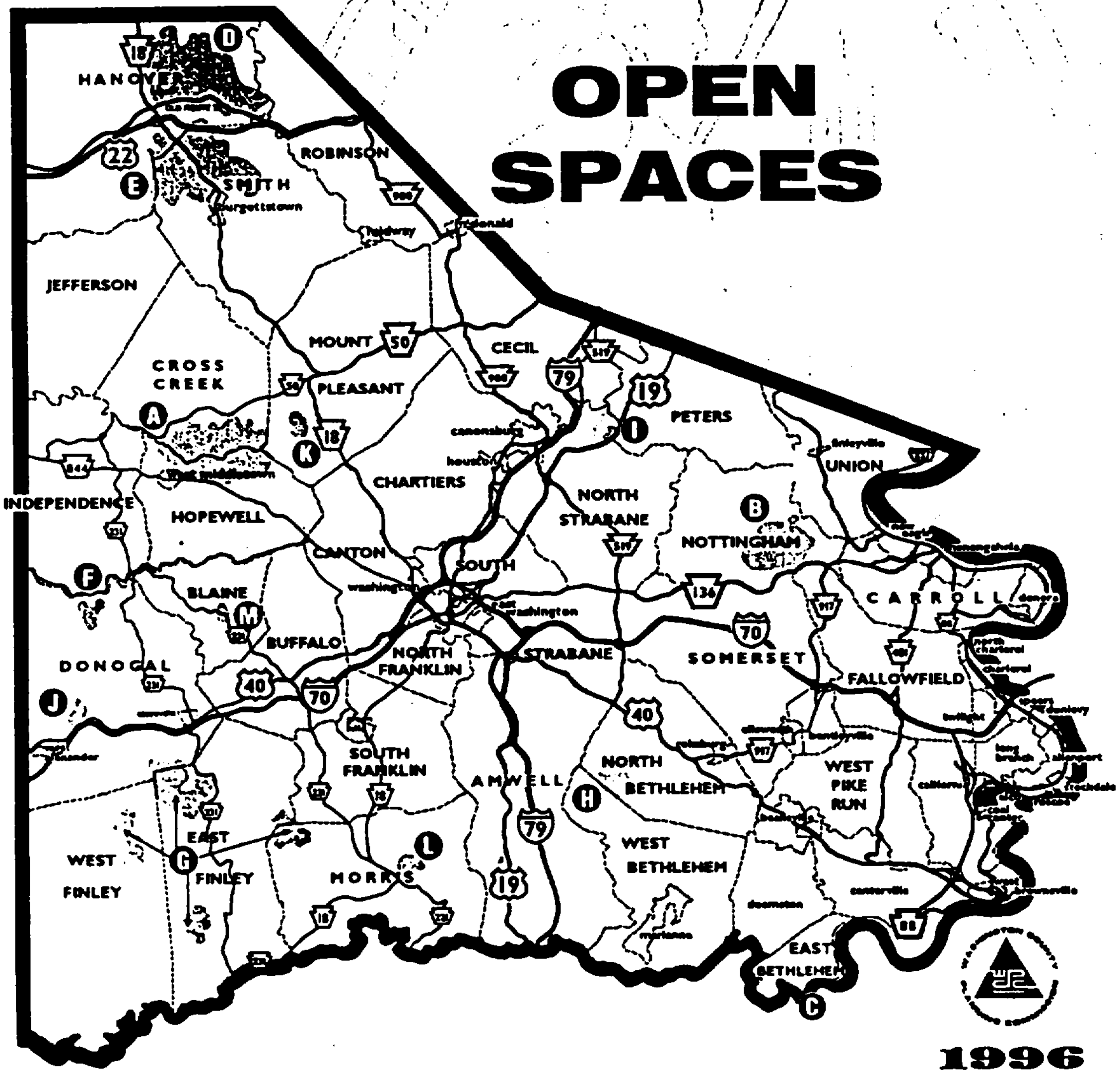


Colleges and Universities	1994	1995
A. California University of Pennsylvania	6,800	5,200
B. Washington & Jefferson College	1,150	1,128

SCHOOL DISTRICTS	84-85	85-86	86-87	87-88	88-89	89-90	90-91	91-92	92-93	93-94	94-95
1. Avella	910	908	906	916	883	900	852	850	831	841	821
2. Bentworth	1,580	1,504	1,600	1,450	1,475	1,401	1,371	1,383	1,344	1,327	1,355
3. Beth Center	1,854	1,861	1,875	1,830	1,814	1,821	1,786	1,741	1,717	1,658	1,676
4. Burgettstown	1,913	1,896	1,800	1,685	1,624	1,624	1,550	1,500	1,541	1,542	1,536
5. California	1,351	1,351	1,315	1,282	1,252	1,218	1,232	1,228	1,179	1,203	1,171
6. Canon McMillan	4,413	4,236	4,155	3,886	3,838	3,891	3,672	3,863	3,684	3,700	3,751
7. Charleroi	1,955	1,986	1,921	1,910	1,980	1,828	1,952	1,952	1,904	1,864	1,769
8. Chartiers Houston	1,458	1,376	1,400	1,265	1,207	1,152	1,142	1,178	1,160	1,180	1,205
9. Fort Cherry	1,589	1,528	1,516	1,479	1,471	1,448	1,478	1,455	1,491	1,484	1,467
10. McGuffey	2,868	2,816	2,900	2,577	2,729	2,761	2,765	2,830	2,772	2,741	2,786
11. Peters	2,693	2,545	2,478	2,419	2,426	2,488	2,571	2,665	2,753	2,911	3,022
12. Ringgold	4,243	4,101	4,013	3,921	3,808	3,729	3,737	3,759	3,724	3,701	3,743
13. Trinity	4,415	4,362	4,230	4,147	4,124	4,147	4,106	4,091	4,052	4,041	4,094
14. Washington	2,266	2,243	2,113	2,301	1,948	2,190	2,072	2,054	2,091	2,065	2,213
WASHINGTON COUNTY	34,120	33,361	32,222	31,068	30,579	30,616	30,286	30,549	30,243	30,258	30,609

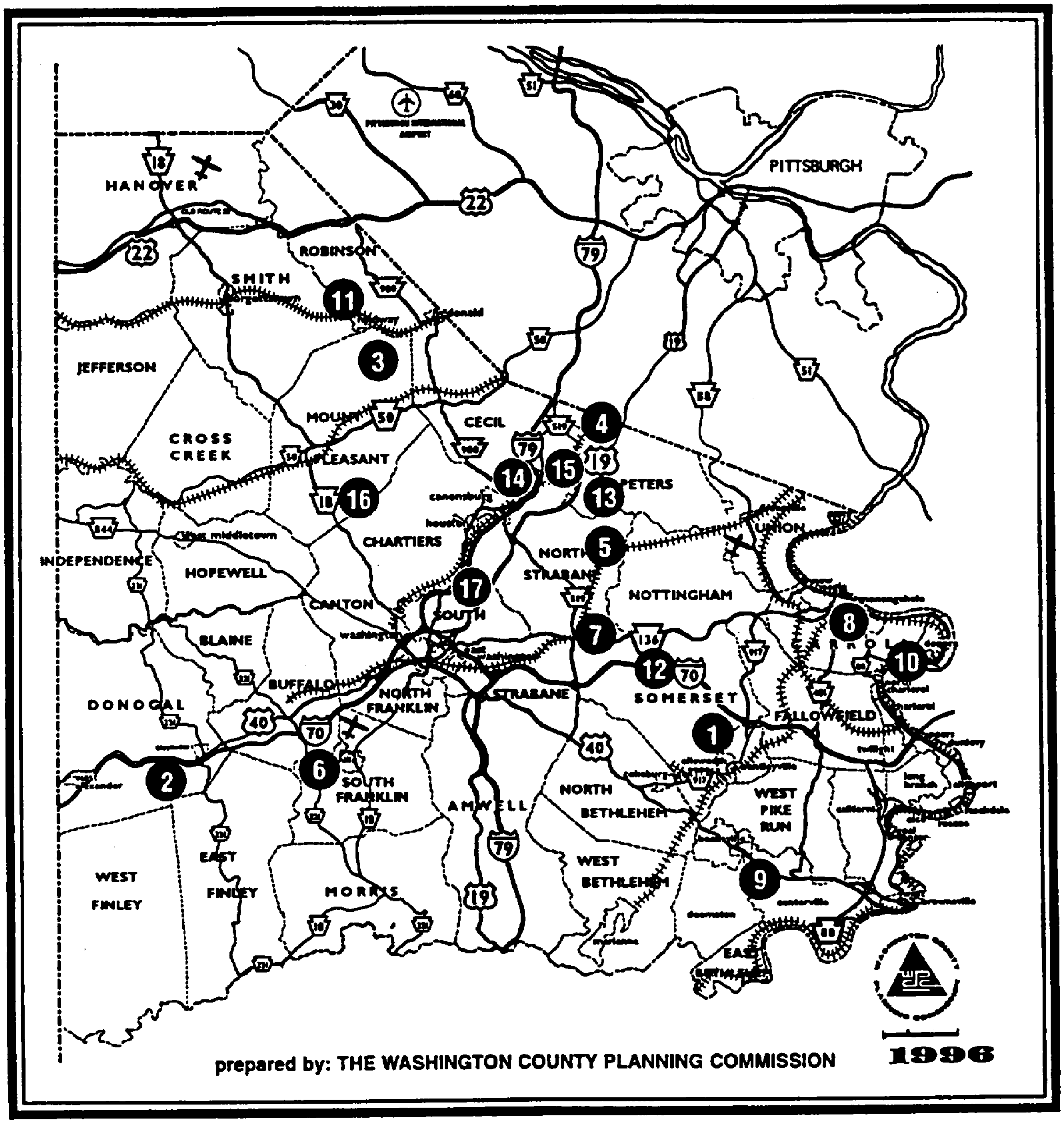
NOTE: Survey does not include intermediate unit (I. U.) enrollment.

OPEN SPACES



A. Cross Creek County Park
B. Mingo Creek County Park
C. Ten Mile Creek County Park
D. Hillman State Park
E. State Gamelands No. 117
F. State Gamelands No. 232
G. State Gamelands No. 245
H. State Gamelands No. 297
I. Canonsburg Lake - PA Fish Commission
J. Dutch Fork Lake - PA Fish Commission
K. Agape Bible Camp
(American Lutheran Church of Western PA)
L. Camp Anawanna
(Boy Scouts of America)
M. Camp Buffalo (Y.M.C.A.)

GOLF COURSES



prepared by: THE WASHINGTON COUNTY PLANNING COMMISSION

1996

1. **Chippewa** (Public)
2. **Double Dam** (Public)
3. **Fort Cherry** (Public)
4. **Hidden Valley** (Private)
5. **Linden Wood** (Public)
6. **Lone Pine** (Private)
7. **Maggi's** (Public)
8. **Monongahela** (Private)
9. **Nemacolin** (Private)
10. **Pine Oaks** (proposed)
11. **Quicksilver** (Public)
12. **Rolling Green** (Public)
13. **Rolling Hills** (Private)
14. **Southpointe** (Private)
15. **Valley Brook** (Private)
16. **Village Green** (Public)
17. **Washington** (Private)

Business & INDUSTRY

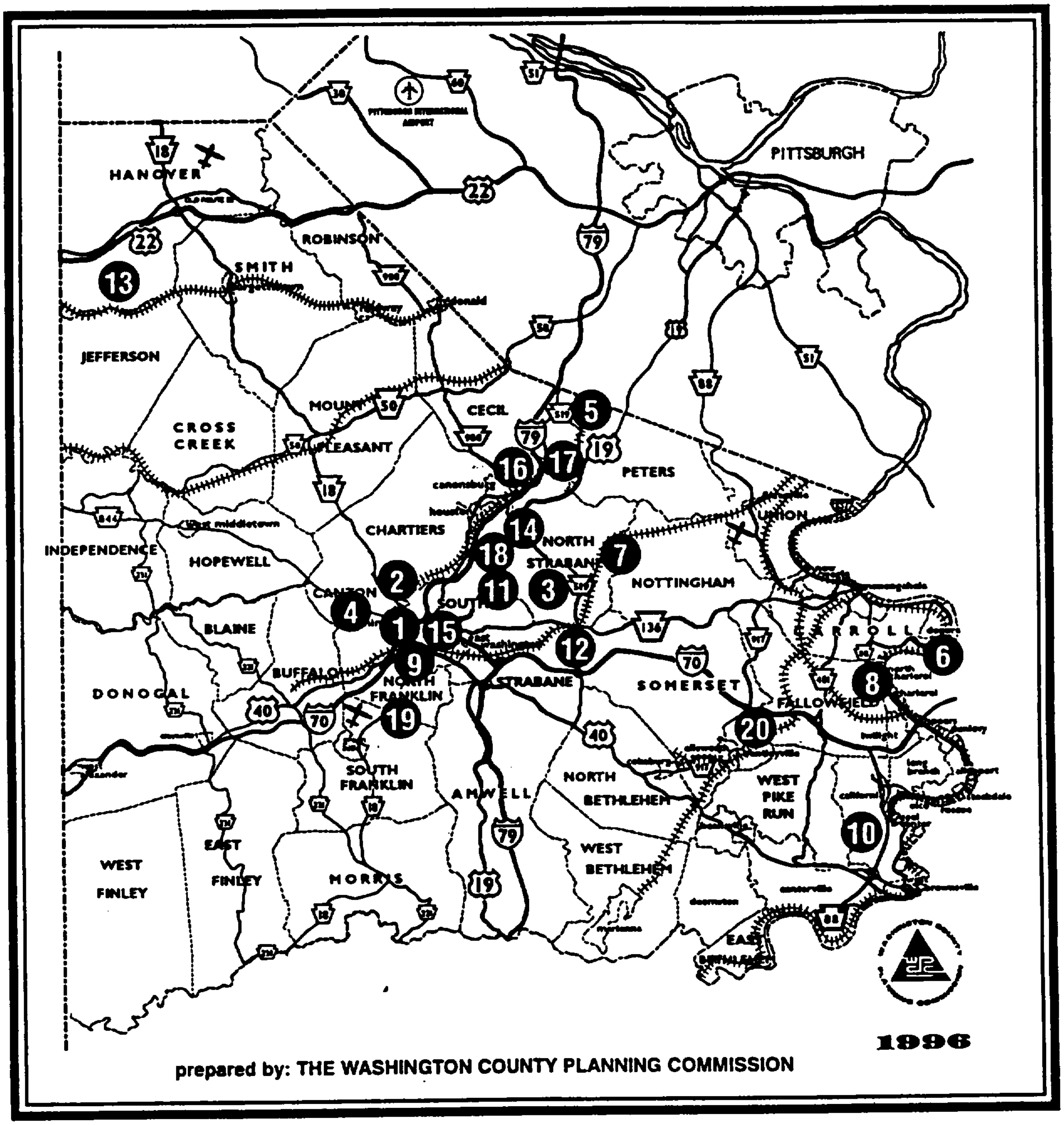
Washington County has over 4,000 industries, employing over 63,000 people in diverse areas ranging from manufacturing steel and primary metals to business services. Additionally, 20 industrial parks including Southpointe, a mixed use industrial park along I-79 north of Canonsburg contribute to the economic development of the County.

Over 270 manufacturers employ 12,000 people. Similarly, over 1,300 wholesale and retail establishments employ an excess of 15,000 people; 262 finance, insurance and real estate companies employ nearly 2,000 people and 1,381 service industries employ more than 16,000 people. A review of these numbers reveal diversification among business and industry resulting in a well-rounded county.

The residential and commercial construction industry in Washington County has begun to boom as evidenced by the Route 19 and Interstate 79 region. Communities such as Peters Township and Cecil Township experienced the highest growth rates over the past few years followed by North Strabane Township and South Strabane Township. However, during 1994-1995, for the first time, East Finley Township and West Finley Township enjoyed a significant boom in new construction, comparative to totals reflected in North and South Strabane. To adequately reflect the growth in some of these areas, a quick inspection of 1991 figures and 1995 figures show that in 1991, Peters, North Strabane, and South Strabane Townships experienced the most growth, closely followed by Cecil Township. Yet, in 1995, Peters remained the highest growth area, closely followed by Cecil Township and North Strabane, West Finley, South Strabane, and East Finley Townships respectively. With the growing availability of public sewer and water, the business and industrial future of Washington County continues to look bright.

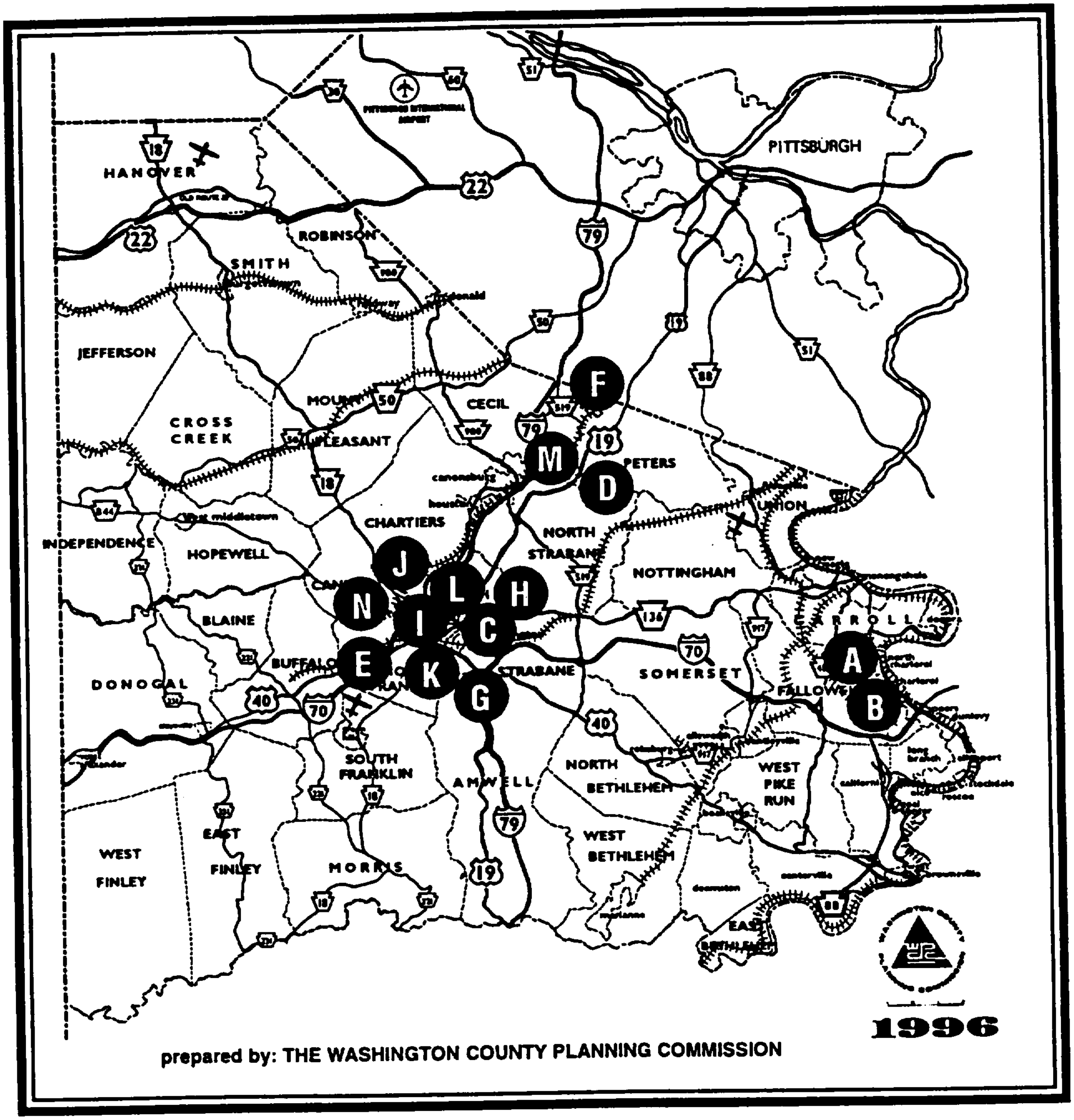
Southpoint Industrial Park

INDUSTRIAL PARKS



1. Arden
2. Arden Downs
3. Atlas Railroad / Eighty Four
4. Beatty
5. Conway
6. Donora
7. Gambles
8. Greater Charleroi
9. Henderson
10. Malden
11. Meadowlands Development
12. Needmore
13. Paris
14. Reata Development
15. Ruetom
16. Southpointe
17. Teodori
18. Washington County Industrial Park
    North Strabane
19. West Point
20. Wilson

RETAIL CENTERS

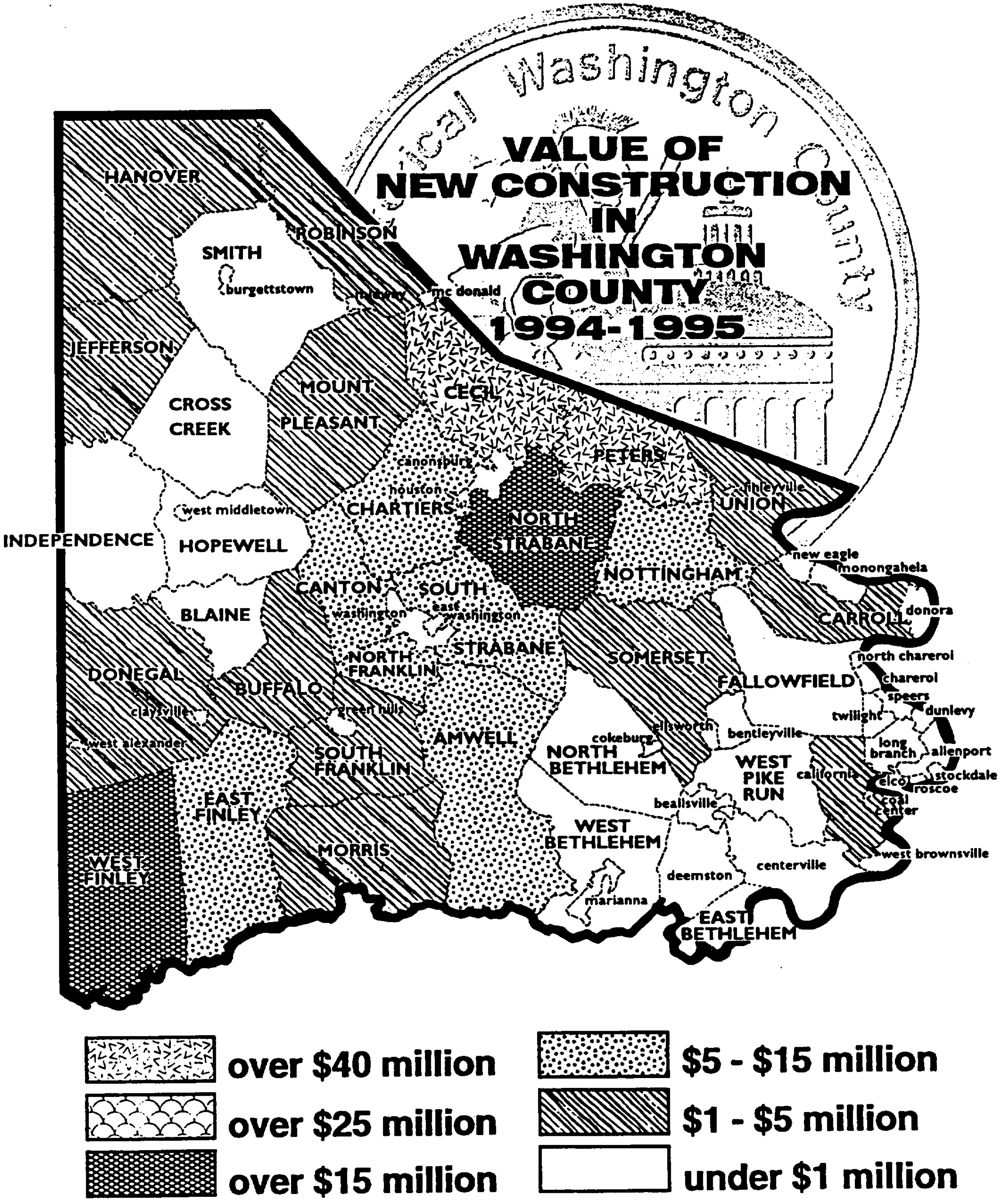


prepared by: THE WASHINGTON COUNTY PLANNING COMMISSION

1996

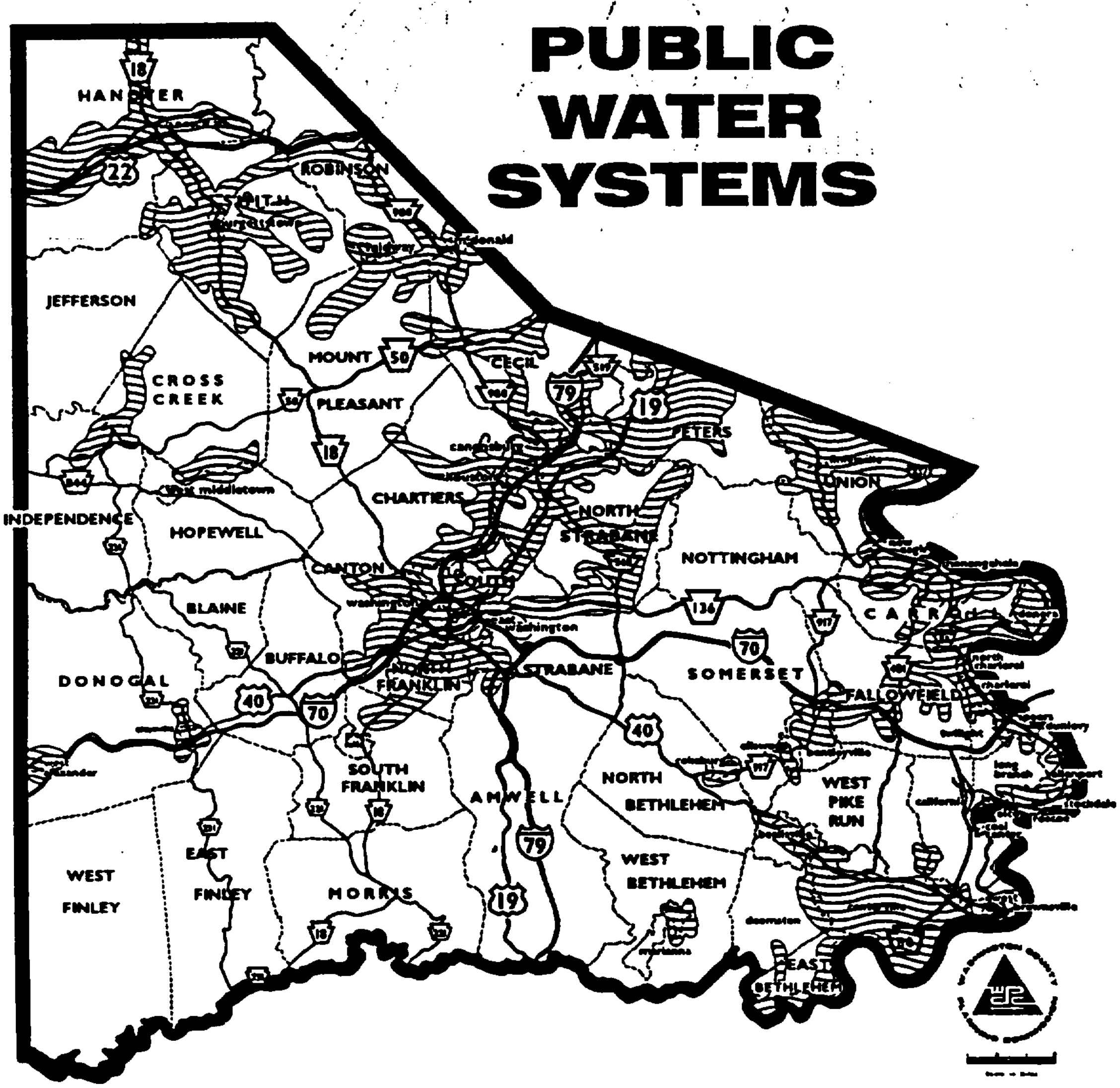
A. Charleroi
B. Charleroi Chamber Mall
C. DeBartolo (proposed)
D. Donaldson Crossroad Mall
E. Franklin Mall
F. Gallery Shops
G. Jefferson Court Plaza
H. North Gate Plaza
I. Oak Springs/Walmart
J. Route 18 Plaza
K. Washington Business District
L. Washington Mall and Plaza
M. Waterdam Plaza
N. Wolfdale Plaza

VALUE OF NEW CONSTRUCTION IN WASHINGTON COUNTY 1994-1995

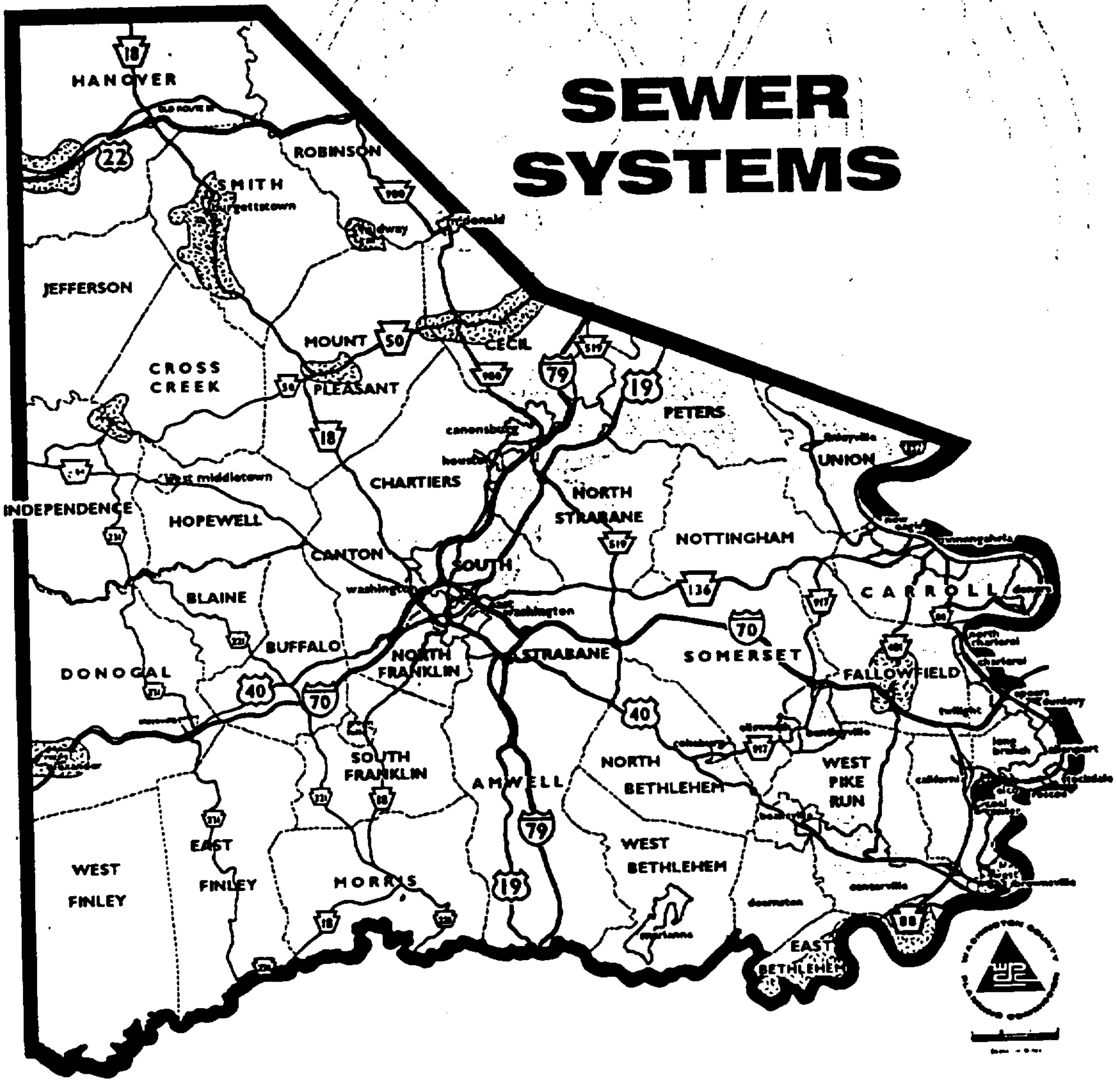


Total Value $226,577,096

PUBLIC WATER SYSTEMS



SEWER SYSTEMS



▭ **Sewered**

▨ **Proposed**

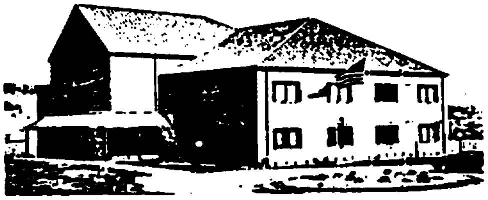
Municipal Telephone Numbers

Allenport Borough	326-4021
Amwell Township	267-3649
Beallsville Borough	632-5420
Bentleyville Borough	239-2112
Blaine Township	948-2157
Buffalo Township	222-8109
Burgettstown Borough	947-2011
California Borough	938-8878
Canonsburg Borough	745-1800
Canton Township	225-8990
Carroll Township	483-7330
Cecil Township	745-2227
Centerville Borough	632-6307
Charleroi Borough	483-6011
Chartiers Township	745-3415
Claysville Borough	663-4470
Coal Center	938-7560
Cokeburg	945-6082
Cross Creek Township	587-3442
Deemston Borough	267-3656
Donegal Township	663-5800
Donora Borough	379-6600
Dunlevy Borough	483-3672
East Bethlehem Township	377-1777
East Finley Township	663-4482
East Washington Borough	222-2929
Elco Borough	938-9454
Ellsworth Borough	239-3874
Fallowfield Township	483-8700
Finleyville Borough	348-6321
Green Hills Borough	225-8460
Hanover Township	947-9109
Hopewell Township	345-3333
Houston Borough	745-1112
Independence Township	587-3518
Jefferson Township	947-3377
Long Branch Borough	483-5950
Marianna Borough	267-4449
McDonald Borough	926-8711
Midway Borough	796-8700
Monongahela City	258-5500
Morris Township	225-1429
Mount Pleasant Township	356-7974
New Eagle Borough	258-4477
North Bethlehem Township	945-6289
North Charleroi Borough	483-8431
North Franklin Township	228-3330
North Strabane Township	745-8880
Nottingham Township	348-5622
Peters Township	941-4180
Robinson Township	926-8700
Roscoe Borough	938-7109
Smith Township	947-9456
Somerset Township	222-0630
South Franklin Township	225-4828
South Strabane Township	225-9055
Speers Borough	483-5882
Stockdale Borough	938-3770
Twilight Borough	489-1110
Union Township	348-4250
Washington City	223-4200
West Alexander Borough	484-7346
West Bethlehem Township	267-4665
West Brownsville Borough	785-5533
West Finley Township	663-7390
West Middletown Borough	587-3088
West Pike Run Township	938-9194

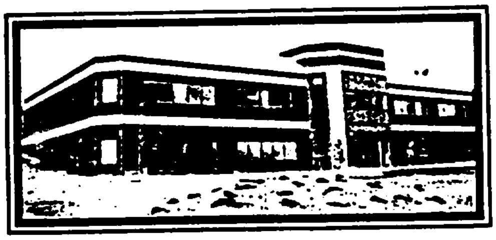
Mitsubishi International Corporation

County Office Telephone Numbers

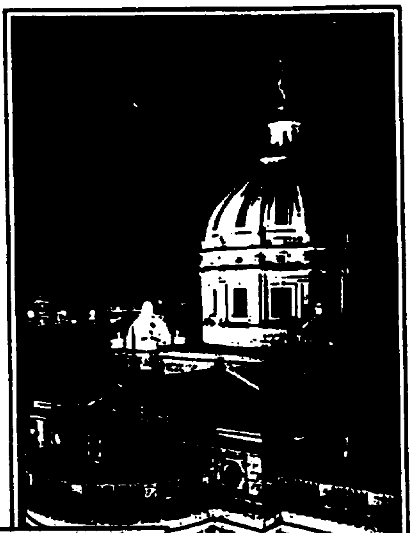
Administration	228-6725
Adult Probation	228-6860
Adult Services	228-6856
Airport	228-5151
Audit Clerk (Orphans' Court)	228-6905
Bridge Department	228-6855
Budget Department	228-6894
Chief Clerk	228-6787
Children & Youth Social Services	228-6884
Clerk of Courts	228-6787
Commissioners	228-6724
Fax	228-6965
Conservation District	228-6774
Contract Manager	228-6729
Controller	228-6800
Cooperative Extension Service	228-6881
Coroner	228-6785
Correction Facility	228-6845
County Authority	228-6734
Courts	228-6797
Court Administrator	228-6797
Data Processing	228-6897
Day Care	228-6969
District Attorney	228-6790
Divorce Court	222-4865
Domestic Relations	228-6756
Drug & Alcohol	228-6746
Economic Development	228-6816
Election/Registration Office	228-6750
Equal Employment Opp. Officer	228-6746
Fair Board	228-9421
Health Center	225-5010
Housekeeping & Maintenance	228-6855
Housing Authority	228-6060
Human Services	228-6836
Industrial Development	228-6875
Jury Commissioners	228-2974
Job Training Program Agency	228-2870 684-8010
Juvenile Court & Probation	228-6794
Law Library	228-6747
Fax	228-6890
Mental Health/Retardation	228-6832
Parks & Recreation	228-6867
Personnel	228-6738
Planning Commission	228-6811
Prothonotary	228-6770
Public Defender	228-6818
Public Safety	228-6733
Publications & Information	228-6811
Purchasing	228-6740
Recorder of Deeds	228-6806
Redevelopment Authority	228-6875
Register of Wills	228-6775
Sheriff	228-6840
Solicitor	228-6727
Tax Assessment	228-6850
Tax Claim Bureau	228-6767
Tourist Promotion Agency	228-8130
Treasurer	228-6780
U. of P. Outreach Office	228-6973
Veterans Affairs	228-6865
Weights & Measures	228-6866



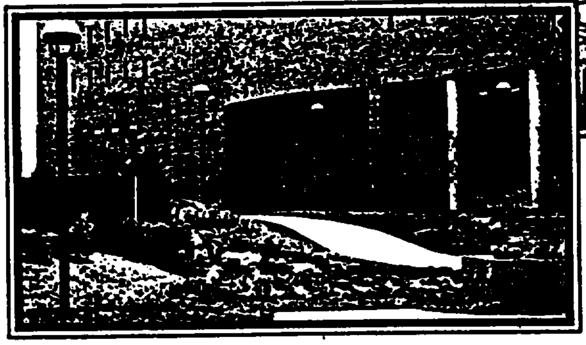
Bailey Engineers, Inc.



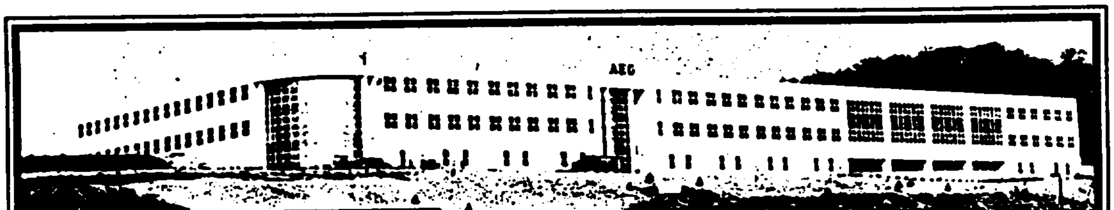
Stevens Painton Corporation



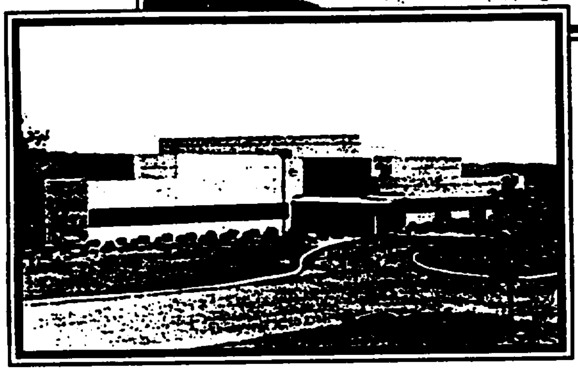
Washington County Courthouse



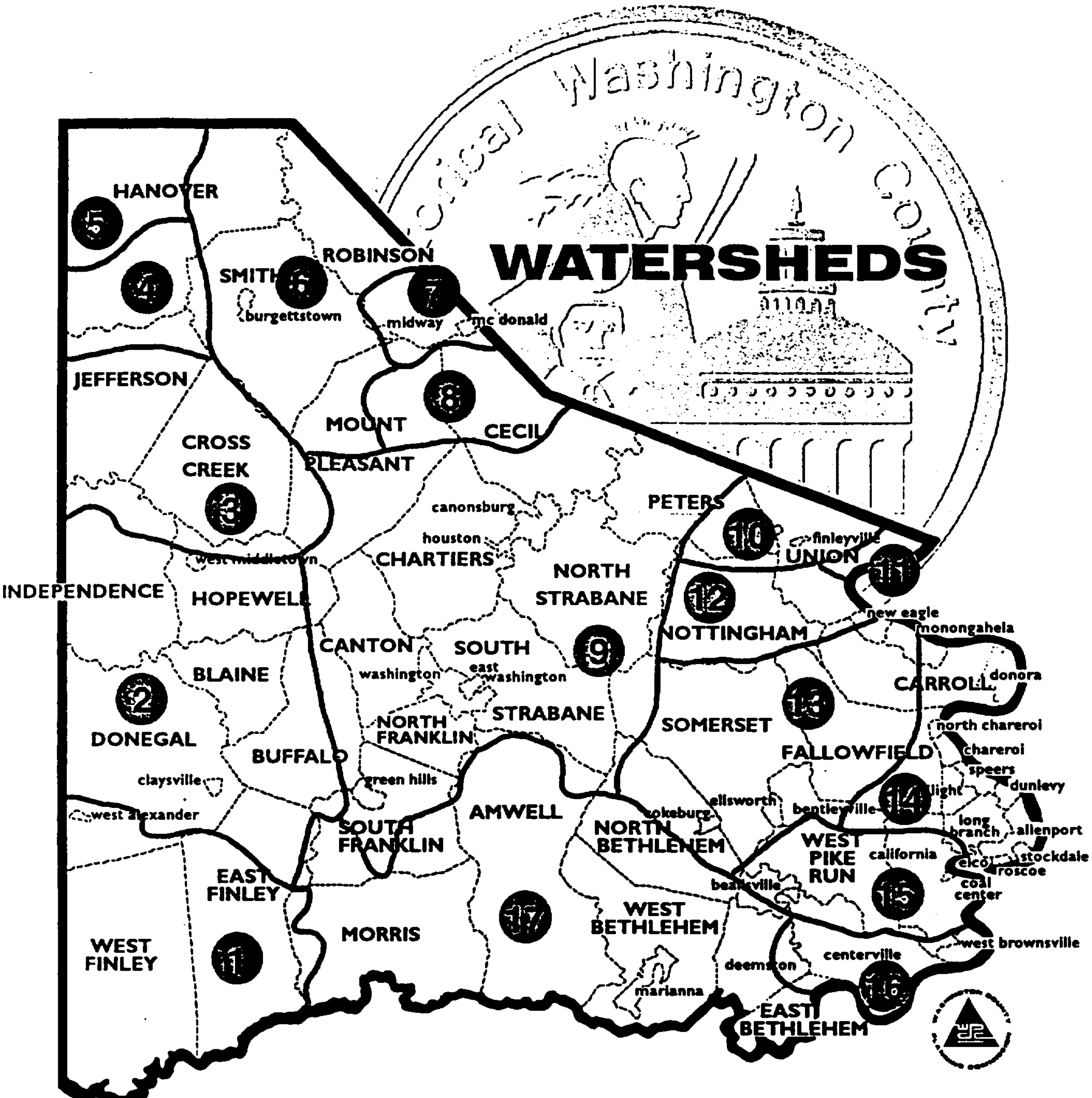
Washington County Correctional Facility



AEG Automation Systems Corporation

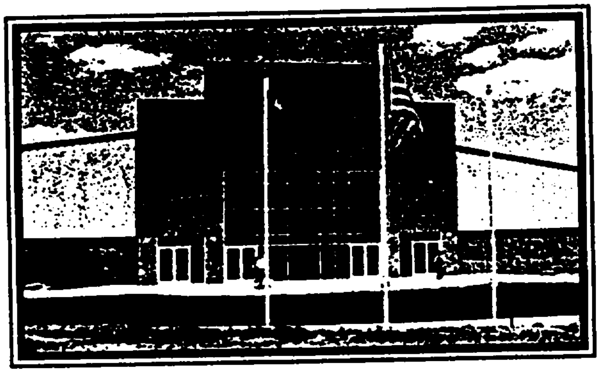


Digital Concepts

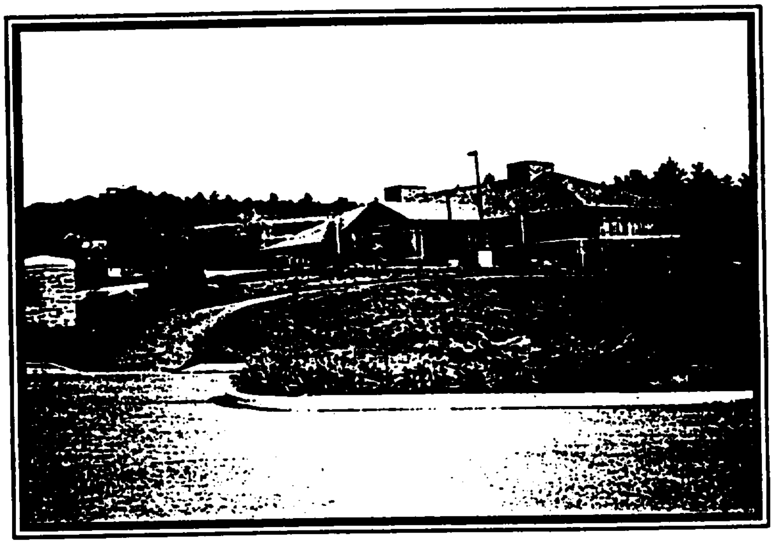


1996

1. Wheeling Creek
2. Buffalo Creek
3. Cross Creek
4. Harmon Creek
5. King's Creek
6. Raccoon Creek
7. Robinson Run
8. Millers Run
9. Charters Creek
10. Peters Creek
11. Houston Run
12. Mingo Creek
13. Pigeon Creek
14. Maple Creek
15. Pike Run
16. Two Mile Run
17. Ten Mile Run



Pittsburgh Penguins
Iceoplex



Southpointe Golf Club
Clubhouse

APPENDIX D

EARTHQUAKE DATA

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* * * * * * * * * * * * * * * * * *  E A R T H Q U A K E   D A T A   B A S E   S Y S T E M  * * * * * * * * * * * * * * * * * *

   FILE CREATED:  20-FEB-1997 16:13:29.30
   Circle Search  Earthquakes=      122
   Latitude:   40.171N  Longitude:    80.275W
   Radius:     200.000 km
   Selected Catalogs:     SRA USHIS   EPB  SESN  NEUS  DNAG   PDE
   Duplicate Eliminator Used: Time separation (sec) =   10.0000  Distance separation (km) =   15.0000
   Acceptable Catalog(s): DNAG  SESN  EPB   USHIS SRA   NEUS  PDE


CATALOG   D A T E     ORIGIN      ***COORDINATES**  DEPTH  pP STN  *****M A G N I T U D E S****  F-E STA  ****INFORMATION****   RADIAL
SOURCE  YEAR  MO DA    TIME        LAT.    LONG.     km       DEV  mb  OBS Ms   OBS CONTRIBUTED  REG      IEMFMDIPF PHENOMENA      DIST
                                                                                      VALUES              NFAPOEDFL  DTSVNWC       km
                                                                                                          TFPS PEDG


USHIS   1776          1400   Z  39.600  -81.900                    |      |      |           | 471 I   6F.......  .......        152
EPB     1823  05 30             41.500  -81.000                    |      |      |3.70MIEPB  | 471     .........  .......        159
SESN    1824  07 15 1620        39.300  -81.500                    |      |      |4.10MISESN | 471     4F.......  .......        142
SRA     1836  07 08          Z  41.500  -81.700                    |      |      |           | 471 I   4........  .......        190
SESN    1853  05 02 1420        38.500  -79.500                    |      |      |4.40MISESN | 492     5F.......  .......        197
SRA     1857  03 01 0140     Z  41.800  -80.600                    |      |      |           | 471 H   4........  .......        182
SRA     1858  04 16 1200     Z  41.700  -81.300                    |      |      |           | 471 H   4........  .......        190
SRA     1867  01 13          Z  41.500  -81.700                    |      |      |           | 471 I   3........  .......        190
SRA     1873  08 17 1400     Z  41.200  -80.500                    |      |      |           | 471 G   3........  .......        115
SRA     1885  01 18 1130     Z  41.300  -81.100                    |      |      |           | 471 H   3........  .......        143
SRA     1885  08 15 0505     Z  41.300  -81.100                    |      |      |           | 471 H   3........  .......        143
SRA     1885  09 26 2030     Z  40.300  -80.100                    |      |      |           | 473 H   3........  .......         20
SRA     1886  05 03 0230     Z  39.500  -82.100                    |      |      |3.40FA     | 471 H   5........  .......        172
SRA     1898  10 23          Z  41.500  -81.700                    |      |      |           | 471 H   3........  .......        190
USHIS   1900  04 09 1400     Z  41.400  -81.900                    |      |      |3.40FABAR  | 471 G   6F.......  .......        193
SESN    1902  06 14 0700        39.400  -81.200                    |      |      |3.10MISESN | 471     4F.......  .......        116
SRA     1906  04 20 1830     Z  41.500  -81.700                    |      |      |           | 471 H   4........  .......        190
EPB     1906  06 27             41.400  -81.600                    |      |      |4.00MLEPB  | 471     .........  .......        176
SRA     1906  06 27 2110     Z  41.400  -81.600                    |      |      |           | 471 G   5........  .......        176
SRA     1907  01 10 1030     Z  40.430  -78.390                    |      |      |           | 473 G   4........  ....N..        162
SRA     1907  04 12 1928     Z  41.500  -81.700                    |      |      |           | 471 H   3........  .......        190
SRA     1907  06 10 1045     Z  40.500  -78.500                    |      |      |           | 473 G   .........  ....N..        155
SRA     1926  11 05 1453     Z  39.100  -82.100                    |      |      |           | 471 G   7........  .......        196
EPB     1926  11 05 1553        39.100  -82.100                    |      |      |5.30MLEPB  | 471     .........  .......        196
USHIS   1926  11 05 1653     Z  39.100  -82.100                    |      |      |3.80FASC   | 471 G   7F.......  .......        196
SRA     1927  01 29          Z  40.900  -81.200                    |      |      |           | 471 H   5........  ....N..        112
SRA     1929  06 10          Z  41.500  -81.700                    |      |      |           | 471 G   3........  .......        190
SRA     1929  09 17 1916     Z  41.600  -81.500                    |      |      |           | 471 G   3........  .......        189
EPB     1930  09 29 2115        40.300  -82.400                    |      |      |3.00MLEPB  | 471     .F.......  .......        181
EPB     1931  03 21 1548        40.300  -82.400                    |      |      |2.40MLEPB  | 471     .F.......  .......        181
EPB     1932  01 21             41.100  -81.600                    |      |      |3.70MLEPB  | 471     .F.......  .......        152
EPB     1933  02 23 0420        40.300  -82.400                    |      |      |3.00MLEPB  | 471     .F.......  .......        181
SRA     1934  11 05 2000     Z  41.900  -80.400                    |      |      |           | 471 G   3........  .......        192
SRA     1935  05 26          Z  41.500  -81.400                    |      |      |           | 471 H   4........  .......        175
SESN    1935  11 01 0830        38.900  -78.900                    |      |      |3.30MISESN | 492     4F.......  .......        183
NEUS    1935  11 01 0830    CH  38.900  -79.900                    |      |      |           | 492     5........  .......        144
```

CATALOG SOURCE	D A T E YEAR	MO	DA	ORIGIN TIME		***COORDINATES** LAT.	LONG.	DEPTH km	pP	STN DEV	*****M A G N I T U D E S**** mb	OBS	Ms	OBS	CONTRIBUTED VALUES	F-E REG	STA	****INFORMATION**** IEMFMDIPF NFAPOEDFL TFPS PEDG	PHENOMENA DTSVNWG	RADIAL DIST km
EPB	1936	08	26	0855		41.400	-80.400								3.00MLEPB	471		.F.......	....	136
SRA	1936	08	26	0900	Z	41.400	-80.400									471	G	3........	....	136
SRA	1936	08	26	0955	Z	41.400	-80.400									471	G	4........	....	136
SRA	1937	03	25	1454	Z	40.900	-78.200									473	G	3........	....	193
NEUS	1938	07	15	2245	CH	40.400	-78.200									473		6........	....	178
EPB	1938	07	15	224547		40.370	-78.230								4.30MLEPB	473		.F.......	....	175
USHIS	1938	07	15	224612	Z	40.370	-78.230								3.30FADG	473	F	6F.......	....	175
EPB	1940	05	31	1600		41.100	-81.520								2.30MLEPB	471		....	....	147
SRA	1940	05	31	1700	Z	41.100	-81.500									471	G	2........	....	146
EPB	1940	06	16	0130		40.930	-82.280								3.00MLEPB	471		.F.......	....	189
SRA	1940	06	16	0230	Z	40.900	-82.300									471	G	4........	....	189
EPB	1940	07	28	0830		40.930	-82.280								2.30MLEPB	471		.F.......	....	189
SRA	1940	07	28	0930	Z	40.900	-82.300									471	G	3........	....	189
EPB	1940	08	15	0935		40.930	-82.280								2.30MLEPB	471		.F.......	....	189
SRA	1940	08	15	1035	Z	40.900	-82.300									471	G	3........	....	189
EPB	1940	08	19	0230		40.930	-82.280								2.30MLEPB	471		.F.......	....	189
SRA	1940	08	19	0330	Z	40.900	-82.300									471	G	3........	....	189
USHIS	1943	03	09	032524.9		41.628	-81.309	7							4.50MnBAS	471	B	6F.......	....	183
EPB	1951	12	03	0702		41.600	-81.400								3.60MLEPB	471		.F.......	....	184
SRA	1951	12	07	2100	Z	41.600	-81.400									471	G	2........	....	184
SRA	1951	12	21	2000	Z	41.600	-81.400									471	G	2........	....	184
DNAG	1952	06	20	093808.6		39.640	-82.020	9							4.10MnEPR	471		....	....	160
SRA	1953	05	07	2332	Z	39.700	-82.200									471	G	4........	....	172
SRA	1955	05	26	1809	Z	41.500	-81.700									471	G	5........	....	190
EPB	1955	05	26	180923		41.480	-81.730								4.00MLEPB	471		.F.......	....	190
EPB	1955	06	29	011533		41.480	-81.730								3.60MLEPB	471		....	....	190
SESN	1957	03	07	210509		39.600	-79.900								2.90MISESN	491		3F.......	....	71
SESN	1957	03	13	210041		39.600	-79.900								2.90MISESN	491		3F.......	....	71
EPB	1958	05	01	224631		41.480	-81.730								4.30MLEPB	471		....	....	190
SESN	1962	09	07	140045.9		39.700	-78.200	38								492		....	....	184
NEUS	1963	10	10	1459	CH	39.800	-78.200								3.60UKEFC	492		....	....	181
SESN	1963	10	10	145952.3		39.655	-78.197	0							3.60MLSESN	492		....	....	186
EPB	1963	10	10	145952.5		39.800	-78.200	15							3.60MLEPB	492		....	....	181
NEUS	1964	02	13	1946	CH	40.400	-78.200								5.20UKEFC	473		....	....	178
SRA	1964	02	13	194640.8		40.377	-77.957	1							3.30Mn	473	A	5........	....N..	198
EPB	1964	02	13	194642		40.400	-78.200								5.20MLEPB	473		....	....	178
NEUS	1965	10	08	0217	CH	40.100	-79.800								3.30UKEFC	473		....	....	41
EPB	1965	10	08	021727		40.080	-79.750								3.30MLEPB	473		....	....	45
DNAG	1966	09	28			39.300	-80.300	0							3.80mbNUT	491		....	....	96
SRA	1966	09	28	205906	Z	39.300	-80.400									491	G	4........	....N..	97
SRA	1969	05	22	145951.6		39.610	-78.245	0							3.10Mn	492	A	....	....N..	184
SRA	1970	05	27	175941.4		39.619	-78.275	0							3.20Mn	492	B	....	....N..	181
SRA	1971	02	18	192948.3		39.649	-78.229	0								492	A	....	....N..	184
PDE	1971	03	05	171910.00E		40.623	-78.167	0								473	006	....	....E..	185
SESN	1972	09	12	151713.7		39.600	-79.900								2.90MISESN	491		3F.......	....	71
DNAG	1974	10	20	151355.6		39.060	-81.610	4							3.80UK DG	471	027	....	....	168
SRA	1976	01	30	185849.1		39.615	-78.252	0							2.80Mn	492	B	....	....N..	183
DNAG	1976	05	06	184608.1		39.600	-79.900	0							3.75MIEPRI	491		....	....	71
SRA	1978	04	26	193023.3		39.700	-78.240	15							3.10Mn	492	B	....	....N..	181
DNAG	1982	02	03	042820.6		40.210	-79.050	2							2.60MnSCP	473	003	....	....	104

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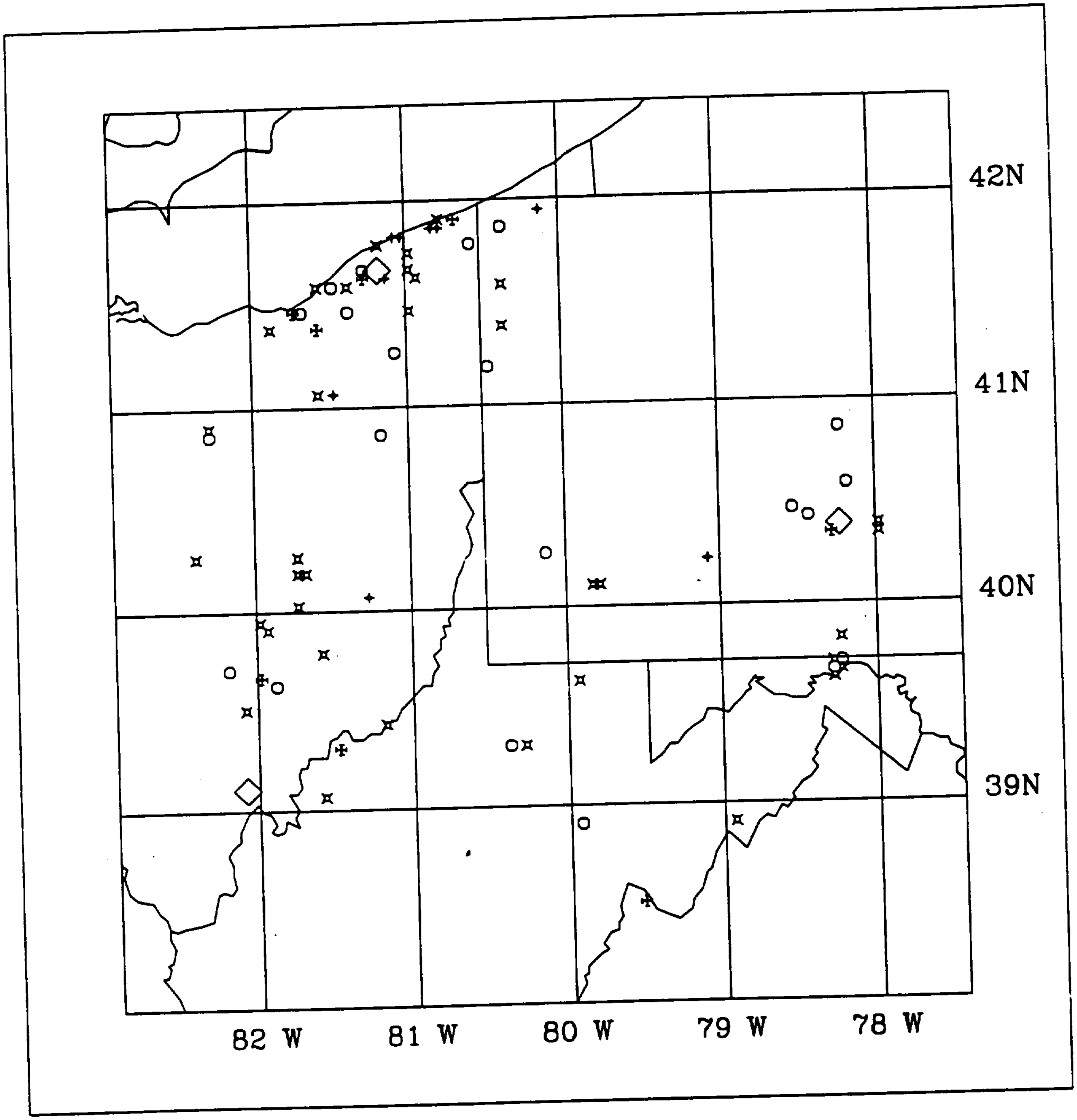
CATALOG   D A T E     ORIGIN      ***COORDINATES**  DEPTH  PP STN   *****M A G N I T U D E S****   F-E STA  ****INFORMATION****   RADIAL
SOURCE  YEAR  MO DA    TIME        LAT.     LONG.    km        DEV  mb  OBS Ms   OBS CONTRIBUTED  REG      IEMFMDIPF PHENOMENA    DIST
                                                                                      VALUES               NFAPOEDFL  DTSVNWG      Km
                                                                                                           TFPS PEDG

DNAG    1982  05 12 182933         40.410  -77.960   0            |      |        |3.00MDSCP  | 473      .........  .......       198
EPB     1983  01 22 074658         41.760  -81.010  10   G        |      |        |3.30MnEPB  | 471 007  .........  .......       186
EPB     1983  11 19 162220         41.830  -81.090  18   G        |      |        |2.50MnEPB  | 471 005  .........  .......       196
DNAG    1985  04 14 113954         41.590  -80.400  18            |      |        |3.20MnEPB  | 471      .........  .......       157
EPB     1986  01 31 164643         41.700  -81.180   5   G        |      |        |5.00mbEPB  | 471 020 5........  .......       186
SRA     1986  02 07 183622.3       41.645  -81.157   6            |      |        |2.50Mn     | 471 B   4........  .......       179
EPB     1987  04 11 214828.8       40.044  -81.326   1   G        |      |        |2.70MnEPB  | 471 009  .........  ....C..        90
EPB     1987  07 13 054918.3       41.931  -80.710   5   G        |      |        |4.10MnEPB  | 471 020 .F.......  .......       198
EPB     1987  07 13 075212.9       41.931  -80.710   5   G        |      |        |3.30MnEPB  | 471 008 .F.......  .......       198
EPB     1987  07 13 130524.1       41.931  -80.710   5   G        |      |        |3.10MnEPB  | 471 009 .F.......  .......       198
PDE     1987  07 14 145110     S&  41.900  -80.800   5   G        |      |        |2.80MnGS   | 471   3 .F.......  .......       196
EPB     1987  07 16 044940.8       41.931  -80.710   5   G        |      |        |3.10MnEPB  | 471 008 .F.......  .......       198
EPB     1987  08 13 075213         41.931  -80.710   5   G        |      |        |3.30MnEPB  | 471 010 .F.......  .......       198
EPB     1987  12 16 192622.6       40.148  -81.700  18   G        |      |        |3.20MnEPB  | 471 006  .........  ....C..       121
EPB     1988  01 22 220709.7       39.940  -82.000   1            |      |        |3.20MnEPB  | 471 007  .........  ....C..       149
EPB     1988  02 20 223310.3       39.940  -82.000   1            |      |        |3.20MnEPB  | 471 004  .........  ....C..       149
EPB     1988  03 19 162910.7       39.940  -82.000   1            |      |        |3.30MnEPB  | 471 010  .........  ....C..       149
EPB     1988  03 31 163012.6       41.630  -80.965   1   G        |      |        |3.20MnEPB  | 471 005  .........  ....?..       172
PDE     1988  05 28 161828.12      39.753  -81.613   0   G    1.20|      |        |3.40MnGS   | 471  27 3F.......  ....E..       123
EPB     1988  06 27 044631.8       41.840  -81.114   0            |      |        |2.70MnEPB  | 471 008  .........  .......       198
EPB     1988  12 25 021134.9       41.831  -81.030   5   G        |      |        |2.50MnEPB  | 471 007  .........  .......       194
EPB     1988  12 28 232824.5       41.636  -81.166   5   G        |      |        |2.80MnEPB  | 471 001  .........  .......       179
EPB     1989  12 31 193736.1       39.874  -81.937   1   G        |      |        |3.20MnEPB  | 471 004  .........  ....C..       145
EPB     1990  03 25 202056.9       39.940  -82.000   1            |      |        |3.20MnEPB  | 471 007  .........  ....C..       149
EPB     1990  04 13 233901.3       40.286  -81.775  18   G        |      |        |3.00MnEPB  | 471 003  .........  ....C..       128
EPB     1990  07 09 010533.8       40.149  -81.750   1   G        |      |        |3.20MnEPB  | 471 005  .........  ....C..       125
EPB     1990  11 07 220449.3       39.988  -81.756   1   G        |      |        |3.60MnEPB  | 471 008  .........  ....C..       127
EPB     1990  12 04 204626.7       39.940  -82.000   0            |      |        |3.80MnEPB  | 471 004  .........  ....C..       149
PDE     1990  12 17 072248.5 CL    41.953  -80.122   5   G        |      |        |2.50MnOTT  | 471   6 3F.......  .......       198
EPB     1991  01 26 032121.7       41.608  -81.593   1            |      |        |3.70MnEPB  | 471 009  .........  .......       194
PDE     1991  04 17 174239.00      40.387  -77.956   0   G    0.31|      |        |2.50MnGS   | 471   6  .........  ....E..       198
EPB     1992  03 15 061356.8       41.814  -81.220   2   G        |      |        |3.70MnEPB  | 471 024  .........  .......       198
EPB     1992  03 15 062807.3       41.814  -81.220   0            |      |        |2.50MnEPB  | 471 002  .........  .......       198
EPB     1992 \03 28 082246.2       41.920  -80.812   5   G        |      |        |3.10MnEPB  | 471 007  .........  .......       199
PDE     1993  10 16 063005.32*     41.698  -81.012   5   G    0.74|      |        |3.40MnGS   | 471  10 4F.......  .......       180
                                                                                  |3.60MnOTT  |
PDE     1995  02 23 093213     O&  41.870  -80.830   5   G        |      |        |2.40MnGS   | 471  11 .F.......  .......       194
                                                                                  |2.90MnOTT  |
```

HDF$:[HDF.PUBLIC]SR151146.DAT

First date: 0, 1776 **Last date:** Feb 23, 1995



MAGNITUDES:

? ○ 1 □ 2 + 3 ¤ 4 ✢ 5 ◇

U. S. Geological Survey, National Earthquake Information Center
Data taken from the Earthquake Data Base System

EARTHQUAKE DATA BASE SYSTEM DOCUMENTATION

Multi-Catalog Historical Earthquake Data Base

Inquires should be directed to:

Mailing Address:

U.S. Geological Survey
National Earthquake Information Center
Denver Federal Center
P.O. Box 25046; Mail Stop 967
Denver, CO 80225-0046

ATTN.: Glen Reagor

The address for Courier Service (Federal Express, DHL, Airborne Express, United Parcel Service, or U.S. Express Mail):

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- FAX (303) 273-8450
- E-MAIL hdf@neis.cr.usgs.gov

GENERAL INFORMATION

The EARTHQUAKE DATA BASE SYSTEM (EDBS) was established to provide earthquake information to the academic community, the private sector, and to governmental agencies. If you use, need, produce, handle, archive, or are concerned with or about earth-science data sets, your participation in the EDBS is solicited.

Please note that government regulations require prepayment on all orders. Telephone requests will be accepted, but data cannot be shipped until payment is received.

The EARTHQUAKE DATA BASE SYSTEM consists of three data bases; this section of the documentation presents information for the Multi-Catalog Historical Earthquake Data Base. For more information about the US or INT Data Bases, contact Glen Reagor (address and telephone number is at the top of this page).

1. HDS - Multi-Catalog Historical Earthquake Data Base.

2. US - United States State Seismicity Files.

3. INT - Earthquake Intensity file

EARTHQUAKE DATA BASE

The current data base was assembled over a period of several decades. Constituent catalogs were in some cases entered manually into the data base from published papers and in other cases entered from computer tapes supplied to the NEIC by representatives of the institutions that compiled the catalogs. Some of the catalogs were provided to the U.S. Geological Survey in computer-readable form by the National Geophysical Data Center of the National Oceanic and Atmospheric Adminstration (NOAA) (Rinehart and others, 1985).

The sources of catalogs in the data base are listed on pages 8-14. If an entry attributed to a source in the data base is not consistent with the entry for the same earthquake given in the source publication or preferred by the source institution, the latter should taken as authoratative. Some catalogs in the data base are updated versions of those described in the cited reference, provided by the authors and prepared using the conventions described in the reference.

The USGS has not been able to determine the sources for some catalogs in the data base. These catalogs are retained in the data base because thaey clearly represent major cataloging efforts, and they may include significant earthquakes that are not included in other catalogs.

The temporal extent of the data base extends from 2000B.C. through the current week of the Preliminary Determination of Epicenters (PDE) program. Each earthquake in the data base is detailed according to source, date, time, latitude, longitude, magnitude, intensity, and seismic-related information. Duplicate entries, two or more records for the same event, may result from searching more than one catalog. For most earthquakes there will be no more than one entry for each cataloging authority. By selecting the desired catalogs or by using the Duplicate Earthquake Eliminator (Search Options), duplicate entries can be mostly eliminated. Caution: peripheral information may vary with each catalog entry. An epicenter with a latitude and longitude of exactly 0.0 degrees usually indicates that the earthquake location was not well enough known that the cataloging authority would assign an epicenter to it. An earthquake is extracted from the data base when it meets all input user-conditions.

The data base is not static; as additions or modifications are made available, new data are added and old data are deleted. The catalogs are not systematically critiqued for erroneous or missing data. The user should be aware that some of the source-institutions for catalogs in the data base may have produced more recent versions of the catalogs than those in the present data base.

Micro-earthquakes having magnitudes below 1.0 are not retained in the data base. Earthquakes with magnitudes less than 2.0 are found in the data base, but in general, the magnitude level of earthquakes in the data base range from 2.5-9.5. Users of micro-earthquake data should contact institutions that operate seismograph networks in their area of interest.

It is ultimately the user's responsibility to assess the accuracy and completeness of a data-set extracted from the data base and to determine if these are sufficient for the purposes to which the data-set would be applied.

AUTOMATED MAP PLOTS

A page-size plot of the data is returned to the user as a part of the completed seismicity search request. Earthquake epicenters are plotted as symbols that vary according to magnitude. In the lower section of the plot, the legend displays the magnitude range of the plotted data. Earthquakes with unknown magnitude values are assigned a symbol corresponding to a magnitude of zero. To avoid overplotting, the map displays only the largest magnitude value at each location. The appearance of the map is data dependent.

SEARCH MODES

The EARTHQUAKE DATA BASE SYSTEM utilizes five (5) search modes to define the data selection method.

(1) Global - A general search method of the data base. This method extracts earthquakes regardless of the earthquake's location. Search Options may be used.

(2) Flinn-Engdahl Number - The globe is broken down into regions based on geographic and political boundaries (Flinn and others, 1974). Each region is assigned a unique number. This search method uses these numbers to extract data from the data base. The EDBS allows a maximum of 20 selected regions per execution sequence.

(3) Rectangle - Selects earthquakes within a specified latitude and longitude geographic grid. EDBS does not search a grid that spans more than 180 degrees of longitude. EDBS, if necessary, will reverse right and left longitude so that the grid spans less than 180 degrees. In other words, EDBS will always search the smaller grid between two longitudes.

(4) Circle - Selects earthquakes that are located within a circle centered at a user-specified location. The fixed selectable radii are 50, 100, 200, 300 km; a variable radius input option is also available.

(5) United States, Alaska, Aleutian Islands Region, Hawaii, Caribbean Island Region, and Selected Border Areas - 50 states plus adjacent border areas of Mexico, Canada, Yukon Territories, and Caribbean Islands Region are searched with the following Flinn-Engdahl Geographic Region Numbers (Flinn and others,1974): 1-3; 5-17; 19-20; 25-46; 85-95; 456-469; 471-514; 516-520; 612-613; 672-676.

(6) U.S. State or United States Search - This search condition produces a list of earthquake that are located with the selected state borders. In some instances where the state border is extremely convoluted, earthquakes located on the boundary between states may be listed that are located in an adjacent state. The user is required to input the 2-letter zip code that represents the selected state. Any of the 50 states may be accessed. If the user inputs "US", then all earthquakes located with the United States except Alaska and Hawaii are extracted from the data base. All options may be used.

SEARCH OPTIONS

The ten (10) search options are used to customize the data output and to select output file formats. The search options can be used either individually or in combinations with other search options.

(1) The output data formats are:

(1) FORMAT 1 (SR.DAT) - See Description of Coded Output (page 8). An example of a SR.DAT listing is shown on page 47.

(2) FORMAT 2 (VX.DAT) - A condensed one-line version of Format 1. The file is designed for computer processing. An example of a VX.DAT listing is shown on page 48.

(3) FORMAT 3 - Both Format 1 (SR.DAT) and Format 2 (VX.DAT) are produced.

(4) FORMAT 4 (STAT.DAT)) - This option produces an magnitude and depth summary output file in chart form. The magnitude and depth increments are on the X-axis and the year increments are on the Y-axis. The largest magnitude value (of the four possible magnitude values) is selected for tabulation. The year is omitted from the year sequence if data are not available. Blank magnitude values and depth values are tabulated under the unknown category. An example of a STAT.DAT listing is shown on page 49.

(5) City Format - This format is produced for athe user who prefers the earthquake location be referenced to the nearest town or locality rather than a location defined by coordinates. This format is generated by a routine that is external to the "Earthquake Data base System". The VX formatted file (produced by the "Earthquake Data Base System") is the input file to the city location program. An example of the format of the City Format is shown on page 50.

(2) Catalog Source - Selects data according to the Catalog Source. Three choices are available (1, 2, or 3):

Enter 1: Displays catalog choices.

Enter 2: The entire data base is searched.

Enter 3: Enter the numeric value of the catalog choices.

(3) Date - Selects data according to the specified input year-to-year range. Selection of data begins with the initial year through the terminal year or the end-of-file.

Month-Day Sub-Option - Selects earthquakes in consecutive order starting with the initial year, month and day and ends with the terminating year, month and day.

(4) Depth - Selects data as defined by the input depth range. If the year is prior to 1964 and the input depth range lies between 0 - 70 km, the earthquake with unknown depths are extracted from the data base. This automatic feature compensates for the lack of depth estimates associated with earthquakes prior to 1964. This feature may be overridden by selecting the "known depth" option.

(5) Magnitude-Intensity Intervals - Selects data according to the input intensity values or magnitude values. An earthquake is extracted from the data base when the intensity or magnitude parameter is within the range of the input values. This option should be bypassed if the user wishes to select individual options of intensity and magnitude; if this option is selected, the individual intensity and magnitude options are bypassed.

(6) Intensity - Selects data according to the input intensity range. See Modified Mercalli Intensity Scale of 1931 on page 33 (Wood and Neumann, 1931).

(7) Magnitude - Selects data according to the specified input magnitude range. Input magnitude cannot be zero. If the year is prior to 1964 and the upper bound of the input magnitude range is greater than or equal to 5.0, the earthquakes with unknown magnitude values are extracted from the data base. This automatic feature compensates for the lack of magnitude estimates associated with earthquakes prior to 1964 and is intended to insure that some large earthquakes are not overlooked in the search by virtue of not having an assigned magnitude. The disadvantage with this feature is that the list will commonly include many shocks whose magnitude, had they been computed, may have been smaller than the specified lower-bound magnitude. This feature may be overridden by selecting the "known magnitude" option.

(8) Moment Tensor/Fault Plane Solution Flagged Data - Earthquakes are extracted from the data base if they have had one of the various types of focal mechanism determined for them and published in the USGS publication Preliminary Determinations of Epicenters (PDE) - Monthly Listing. This option has 4 sub-options: (1.) Moment Tensor only; (2.) Fault Plane Solution only; (3.) Moment Tensor and Fault Plane Solution; (4.) Moment Tensor and/or Fault Plane Solution.

(9) Irregular-Grid Zone - Selects data according to a pre-defined configuration pattern that outlines the irregular grid-shaped area (Godkin and Pulli, 1984). A filename of your choice contain pairs of latitude and longitude that defines an irregular grid pattern. This file is created with a text editor.

NOTE: This option must be used with the Rectangular Grid search mode. The latitiude-longitude grid specified in the mode must enclose the region within the irregular-shaped grid zone. Global search mode is not permitted. Do not use the this option if the grid encloses the North or South Poles.

To create the irregular grid data file:

(A) - Enter the corner points (latitude and longitude) in a continuous clockwise direction. One coordinate pair entry per line. A space, NOT COMMAS, separates latitude and longitude values. A coordinate pair consists of a latitude value, followed by a space, then the longitude value.

(B) - An example of irregular grid file entries:

```
-26.50 28.0
```

-25.00 27.50

-27.0 -26.25

-26.0 28.0

40.00 -179.00

(C) - A minus sign preceding a latitude or longitude value indicates South or West respectively.

(D) - Do not list the starting coordinate pair twice.

(E) - Up to 100 pairs of input coordinates may be used.

Enter the full pathname of the filename that contains the irregular grid data at the program prompt. If this file has not been created when the option is activated, enter a Carriage Return <CR> for the file name and program will terminate.

Example of full pathname:
data$disk:[reagor]filename

(10) Duplicate Earthquake Eliminator - Allows the input of parameters to remove duplicate earthquake solutions from the output file. Duplicate earthquake entries usually arise from earthquakes being listed, perhaps with slightly different epicenters and origin times, in more than one of the searched catalogs. The user specifies how far apart the origin times and epicenters of two listings must be if the listings are to be considered as representing different events. Default values are 10 sec. and 15 km for origin time and epicenter respectively.

In order to eliminate duplicate entries, a list of catalogs is entered in the order of preference. If duplicate earthquakes occur, the program will accept the event for the first-entered catalog. If a list of catalogs is not made, or if the duplicates are not from any of those catalogs that are listed, the first event will be accepted.

DESCRIPTION OF CODED OUTPUT - Format 1 (SR.DAT)

CATALOG SOURCE: Contributing source, or authority. In the following section, the number and abbreviation of each catalog source is enclosed by parenthesis. The catalog abbreviations are listed in alphabetic order.

Catalogs "supplied by NOAA" came to the NEIC from the National Geophysical Data Center of the National Oceanic and Atmospheric Administration (Rinehart and others, 1985).

> (34 = ABE) Catalog of large earthquakes, 1897 - 1980, from Abe (1981, 1982, 1984); Abe and Kanamori (1979); and Abe and Noguchi (1983a,b). Most shocks are of magnitude 6.8 and larger, though some smaller (down to magnitude 6) shocks are cataloged.
>
> (6 = AKAL) Catalog of earthquakes occurring in Alaska, including the Aleutian arc, 1786 - 1981, created by J.N. Taggart of the USGS NEIC.
>
> (32 = AMB) Catalog of earthquakes occurring in the Sudan, 1850 - 1975, from Ambraseys and Adams (1986a).
>
> (27 = ANK) Catalog of earthquakes occurring in Turkey, 11 - 1975, based on a catalog compiled at Kandilli Observatory, Bogazici University, Istanbul. File supplied by NOAA (Rinehart and others, 1985).
>
> (35 = ARAB) Catalog of earthquakes occurring in the Middle East, North Africa, and Spain from the VIIth to the XVIIIth century A.D., compiled by Poirier and Taher (1980) from Arabic documents.
>
> (55 = ARIEH) Catalog of earthquakes in Israel and adjacent areas, compiled by E.J. Arieh, 1903 - 1963. The earthquakes listed in the time interval 1956 - 1962 have magnitudes equal to 3.5 or less. The earthquake locations were based on a three-station solution. This does not indicate that the earthquake did not occur, but the solutions may be suspect. See ISN catalog for additional information.
>
> (3 = BCIS) Catalog of earthquakes listed in the publications of the Bureau Central International Seismologique (BCIS) for 1935, 1950 - 1963. The level of completeness of this catalog is highly uncertain; numerous shocks listed in the publications of the BCIS are not listed in the

present catalog, and there is no duplication of the BCIS listings and ISS (see below) listings from the same time-periods. It is possible that the BCIS listings were originally intended to fill in gaps in the ISS listing. The file was created the earliest years of the data base. The file was supplied by NOAA (Rinehart and others, 1985).

(17 = BDA) Catalog of large earthquakes, 1897 - 1977, compiled by Bath and Duda (1979). File supplied by NOAA (Rinehart and others, 1985).

(9 = BRK) Catalog of California earthquakes, 1910 - 1963, compiled by the University of California at Berkeley. Geographical extent: 35 degrees - 42 degrees North; 116 degrees - 128 degrees West.

(7 = CDMG) Catalog of earthquakes occurring in California, 1735 - 1974, compiled by Real and others (1978) and Toppozada and others (1984) at the California Division of Mines and Geology. This file includes epicenters from catalogs of the Seismological Laboratory of the California Institute of Technology (PAS) and the Seismological Stations of the University of California at Berkeley (BRK).

(57 = CHINA) China Catalog of world-wide earthquakes from 780 B.C. through May 1992, compile by World Data Center D For Seismology, State Seismological Bureau, Beijing, China. Beginning in 1985 the catalog contains only earthquakes with magnitudes 4.0 and greater; data prior to 1985 contains earthquakes that have Ms or mb magnitudes greater than or equal to 4.7.

(40 = DNAG) Catalog of North American earthquakes compiled for the Decade of North American Geology (Engdahl and Rinehart, 1991). The catalog covers the conterminous United States, Alaska (including the Aleutian Islands), Canada, Greenland, Iceland, and Middle America.

(54 = DOYLE) Catalog of earthquakes for the Continent of Australia 1897 - 1966. Compiled by Doyle and others, 1968.

(50 = EC) This catalog lists earthquakes with intensities of IV and larger for the 13 member countries of the European Community plus Austria and Switzerland from 479B.C. through 1983. The data for this catalog were collected by J.M. Van Gils and after his death revised by Dr. Gunter Leydecker of the Federal Institute for Geosciences and Natural Resources, Stilleweg 2, D-3000

Hannover 51, Federal Republic of Germany. The earthquake origin time before 1900 is a mixture of Greenwich Mean Time (GMT) or local time; after 1900, the origin time is stated in GMT now known as UTC. Magnitude values are coded as UNKNOWN due to the fact that no specific coding of the values were given. A general statement suggests that magnitudes for historical earthquakes were macroseismic estimates and, for recent earthquakes, the magnitude values are mostly ML's. For each earthquake, the source national catalog is noted in the Authority Column (see page 17). Each national catalog may contain more information than the summary line presented in the EDBS format.

(37 = EMSC) Catalog of earthquakes occurring in Europe and the Mediterranean region, 1976 - 1985, compiled at the Centre Seismologique Euro-Mediterranean (CSEM), Strasbourg, France.

(20 = EPB) Catalog of Canadian earthquakes, 1568 - 1992, compiled by the Earth Physics Branch (EPB) of Canada, now the Geological Survey of Canada. Also includes U.S. earthquakes occurring near the Canadian border. Only the prime hypocenters (those selected by EPB/GSC as the best solutions for their earthquakes) are entered into the data base; in some cases (indicated in the authority column), these prime hypocenters may have been computed by an institution other than the EPB/GSC. Hypocenters of felt events or events with unknown magnitudes or events with magnitudes greater than 0.0 are found in this catalog.

(24 = EPRI) Catalog of earthquakes of the United States east of the Rock Mountains, 1627 - 1985, compiled by Electric Power Reasearch Institute. This catalog was compiled from various catalogs. The sources from which some of the listings were taken is shown in the authority column.

(12 = EQH) Catalog of earthquakes occurring in the United States and Territories, 1638 - 1969. Catalog supplied by NOAA (Rinehart and others, 1985), (Coffman and others, 1973,1982).

(30 = EUR) Catalog of European earthquakes, 2100B.C. - 1982. This catalog is made up of 7 different sub-catalogs. Each contributing sub-catalog is indicated in the authority column (see page 17) under EUR Catalog. File supplied by NOAA (Rinehart and others, 1985).

(49 = FENN) Fennoscandian Earthquake Catalog, 1375

- 1991, compiled from diskettes prepared at the Institute of Seismology, University of Helsinki, Finland (Ahjos and Uski, 1992). The earthquakes in this catalog may duplicate the events listed in the EUR Catalog. The source reference for each earthquake is listed in the Authority column (page 17) under FENN Catalog.

(36 = GER) Earthquake data file for the Federal Republic of Germany (FRG), 823 - 1992, compiled by (Leydecker, 1986,1988), and (Gruenthal, 1988). A general statement indicates that the file contains earthquakes within the FRG and strong earthquakes outside the FRG that were felt with at least intensity V inside the borders of the FRG. The date and time for events before 1900 is local time; after 1900 time is UTC. The authority column identifies the seismogeographical region associated with the earthquake.

(3 = G-R) Catalog of hypocenters and magnitudes, from Gutenberg and Richter (1954), 1904 - 1952. Catalog supplied by NOAA (Rinehart and others, 1985). Magnitudes revised (Richter, 1958) from original listing. See also GUTE catalog below.

(53 = GOUIN) Catalog of epicenters and magnitudes in Ethiopia and the Horn of Africa (1400 - 1977), from Gouin (1979).

(41 = GREAT) Catalog of great (magnitude 7.9 and larger) earthquakes, 1904 - 1977, from Kanamori (1977).

(47 = GREEK) Catalog of earthquakes in Greece and surrounding area, 550B.C. - 1985, compiled by Papazachos and Papazachos (1986).

(5 = GUTE) Catalog of hypocenters and magnitudes listed in Gutenberg and Richter (1954), 1904 - 1952.

(29 = HVO) Catalog of earthquakes occurring in the Hawaiian Islands, compiled by the United States Geological Survey at the Hawaiian Volcano Observatory (HVO), 1961 - 1976. File supplied by NOAA (Rinehart and others, 1985).

(25 = IGNE) Catalog of Iberia and the Mahgreb, 880B.C. - 1980, Instituto Geografico Nacional de Espana (Mezcua and Martinez-Solares, 1983). Also includes seismicity of the Azores Fracture Zone.

(45 = INDIA) Catalog of earthquakes for India, 1063 - 1984. The Indian earthquake catalog

consists of the combined listings of four catalogs (Tandon. A.N. and Srivastava, H.N., 1974; Chandra, Umesh, 1977; Rao and Rao, 1984; Srivastava, H.N., and Ramachandran, 1983). See the authority column for the catalog identification. The earthquakes that could be identified as duplicates from the four catalogs were eliminated from the final listing. The abbreviations that identify the magnitude source are listed in the publication by Rao and Rao, 1934.

(2 = ISC) Epicenters listed in the International Seismological Centre (ISC) Bulletin tapes, 1964 - December 1991. Only the ISC's hypocenter (prime estimate) is cataloged for inclusion in the data base. Catalog prepared by the International Seismological Centre, Newbury, United Kingdom.

(22 = ISN) Israel Seismic Network Catalog, 1900 - 1993. The catalog was compiled by the Institute for Petroleum Research and Geophysics, Israel. The geographical area is delineated by latitude 27 - 36 degree North, and by longitude 32 - 38 degrees East. (Malitzky, Alona and others, 1993). See the Arieh catalog for supplementary seismic information.

(4 = ISS) Epicenters listed in the International Seismological Summaries, 1913 - 1963 (ISS), from a tape prepared by the International Seismological Centre, Newbury, United Kingdom.

(4 = ISSN) Epicenters listed in the International Seismological Summaries (ISS) , 1918 - 1959. Catalog supplied by NOAA (Rinehart and others, 1985). This file has been modified by NOAA to include magnitudes from various non-ISS sources; other pertinent seismic effects are included.

(44 = ITALY) Catalog of Italian earthquakes, 1000 - 1980; compiled by National Research Council, Project Progetto Finalizzato Geodinamica, Director F. Barberi; "Catalogo Dei Terremoti Italiani Dall'anno 1000 al 1980", Editor D. Postpischi; Bologna 1985.

(43 = JMA) Catalog of felt earthquakes occurring in the Japan region, prepared from a tape compiled by the Japan Meterological Agency (JMA), 416 - 1990. Prior to 1885, the number of strong and damaging earthquakes is sketchy, from 1885 through 1990 the file contains earthquakes that were known to be felt by the JMA network.

(11 = LEE) Catalog of earthquakes occurring in China, 1177B.C. - 1976 (Lee and others, 1976; 1978). Catalog supplied by NOAA (Rinehart and others, 1985).

(56 = LIBYA) Catalog of earthquakes in Libya, 1903 - 1975, Ambraseys, 1982).

(33 = MEAST) Catalog of earthquakes occurring in the Middle East, 1900 - 1983, compiled at NOAA (Riad and Meyers, 1985). This catalog covers more than 20 countries, extending from Libya in the west to Pakistan and Afghanistan in the east, Ethiopia and Somalia in the south, and Turkey in the north. Many of the values of specific types of magnitudes are estimated from values of other types of magnitudes or from intensity observations, using equations derived by Riad and Meyers (1985).

(39 = MED) Earthquake data file of the Mediterranean and surrounding areas, 1901 - 1975. Catalog prepared from a tape compiled at the University of Thessaloniki, Geophysical Laboratory, 1978.

(31 = MOS) Catalog of earthquakes occurring in the USSR, 1950 - 1961. Catalog supplied by NOAA (Rinehart and others, 1985).

(19 = NEUS) Catalog of earthquakes occurring in the northeastern United States, 1534 - 1985. Contains entries of earthquakes occurring in 1534 - 1964 that were compiled by E.F. Chiburis; most of these are listed in Chiburis (1981). Also contains entries supplied by Weston Observatory of Boston College for earthquakes occurring in 1979 - 1985. Weston Observatory-computed hypocenters are not included in the data base if they correspond to shocks that were not felt and were assigned magnitudes of 1.0 or less.

(15 = NEV) Catalog of earthquakes occurring in Nevada, 1852 - 1962; 1970 - 1986. Listings for 1852 - 1962 are from a slightly updated version of the catalog published by Slemmons and others (1965). Listings for 1970 - 1986 are from the Seismological Laboratory of the University of Nevada, Reno.

(21 = NGDC) Catalog of earthquakes occurring in Mid - America (Mexico, Central America, and Caribbean regions), 1900 - 1979, compiled at NOAA (Rinehart and others, 1982).

(59 = NOAA) This catalog is a listing of world-wide historical earthquakes, 2150 B.C. - 1991 (Paula K. Dunbar, Patricia A. Lockridge, and Lowell S. Whiteside, September 1992). The list includes all events that meet at least one of the following criteria:

The following information was taken from the source document, Catalog of Significant Earthquakes, 2150 B.C. - 1991 A.D. The information for the time period after 1991 is taken from the PDE (Preliminary Determination of Epicenters). The file is now (1992 - 1994) updated and maintained by the United States Geological Survey. As it is extremely difficult to code all pertinent information into an earthquake summary line, the user is encouraged to obtain the publication if at all possible.

1. Moderate damage (approximately $1 million or more)

2. Ten or more deaths

3. Magnitude 7.5 or greater

4. Intensity X or greater (for events lacking magnitude)

The location of events prior to 1900 were given a latitude and longitude location based on the city where the damage occurred. Magnitudes are stated as Ms (Surface Wave) or the equivalent derived from intensities for pre-instrumental events.

In the absence of a death toll number, a descriptor (Few = F, S = Some, M = Many) was listed in literary sources. It is not known how the descriptors relate to numbers.

To determine if the damage meets the damage criteria listed below, the dollar estimates at the time of the earthquake are converted to 1990 United States dollar values. Monetary conversion tables for the time of the event were used to convert foriegn currency to dollars.

When possible, a rough estimate of the dollar damage based upon the description provided. in order to choose the damage category. The damage estimate is listed in the following categories:

* U = Damage estimate unknown

* L = LIMITED (corresponding to less than $1

million)

* M = MODERATE (corresponding to $1 to $5 million)

* S = SEVERE (corresponding to $5 to $25 million)

* E = EXTREME (corresponding to $25 million or more)

In the absence of other information, LIMITED is considered synonymous with slight, minor, and light; SEVERE as synonymous with major, extensive, and heavy; and EXTREME as synonymous with catastrophic.

If a tsunami was generated by the earthquake, a "T" appears under the Tsunami Code under the Information column on the printout.

In the source publication, the number of casualities was given; here in the data base, the USGS assigns the number of deaths to a 5 point classification table. The following table illustrates how the alphabetic number corresponds to a casuality number.

* A = 1 - 100

* B = 101 - 1,000

* C = 1,001 - 10,000

* D = 10,000 - 100,000

* E = Greater than 100,000

The alphabetic letters are coded in the AUTHORITY column which is located between the Origin Time column and the Latitude column. The first character of the AUTHORITY is the death toll; the second character is the damage estimate. The explanation of the codes is listed under the AUTHORITY column.

Duplicate earthquake entries have been removed from the file. It is possible that some duplicates exist in the file. If a duplicate earthquake entry is identified, it is removed and the remaining earthquake entry is corrected so that it contains the largest given values for death tolls, damage, intensity, and magnitude.

(S1 = P&S) Catalog of world-wide earthquakes, 1900

- 1989 (Pacheco and Sykes, 1992). This is a seismic moment catalog. The catalog lists earthquakes with Ms magnitudes of 7.0 and larger and with depths less than or equal to 60 km. The selected events were taken from the Abe Catalog (1981, 1984) and from Abe and Noguchi (1983).

(10 = PAS) Catalog of earthquake in California, 1932 - 1986, compiled at the California Institute of Technology at Pasadena (PAS), 1932 - 1985. Geographical extent: 31 degrees - 38 degrees North; 113 degrees - 121 degrees West. File partially supplied by NOAA (Rinehart and others, 1985).

(1 = PDE) Catalog of earthquakes located by the USGS NEIC and its predecessors in the U.S. Coast and Geodetic Survey, the National Oceanic Survey, and the Environmental Research Laboratories of the Department of Commerce. Listings are in most cases the final hypocenters and magnitudes of the USGS NEIC which are listed in the Geological Survey publication, "Preliminary Determination of Epicenters - Monthly Listing". The global catalog includes events occurring from circa 1900 - to six months behind the current month. It is the principal component of the data base. There are gaps in the temporal and geographic coverage of the catalog. To get as complete coverage as possible for a given area, the user should search other catalogs that cover the time and area of interest. Part of the catalog was supplied by NOAA (Rinehart and others, 1985).

> (PDE-W) Weekly PDE file. This file covers the time period following the Monthly data up to four weeks behind the current week. The preliminary Weekly PDE data is replaced by the Monthly PDE data about seven months later.
>
> (PDE-Q) Daily PDE file (QED). This data is extremely preliminary and the parameters of the earthquake are subject to change as more data is used to locate the earthquakes. The daily PDE-Q data covers the time frame following the Weekly PDE data up to seven days behind the current date. This data is replaced by the Weekly PDE data.

(26 = PEK) This catalog contains eight Chinese shocks that occurred in 1959. It dates from the

earliest years of the data base and its significance now is not known. Catalog supplied by NOAA (Rinehart and others, 1985).

(46 = PERU) Catalog of earthquakes occurring in Peru, 1900 - 1984 (Espinosa and others, 1985). This catalog lists instrumentally recorded earthquakes from various sources. Duplicate earthquakes have been deleted.

(33 = ROM) Catalog of earthquakes occurring in Romania, 984 - 1979 (Constantinescu and Marza, 1980).

(60 = ROTHE) World-wide earthquake catalog, 1953 - 1965 (Rothe, 1969). The epicentral coordinates given in this catalog are those recomputed by the ISS in the time period 1953 - 1959; for the period 1960 - 1965 the coordinates are those computed by the Preliminary Determintaion of Epicenters program. If earthquakes have been the subject of special studies, the coordinates proposed by the studies were used. Earthquakes listed in this catalog have magnitudes that are greater than or equal to 5.5. Magnitude estimates represent the average Ms magnitudes computed by different seismograph stations or taken from other seismic networks after standardization as defined and published by Rothe. Depth estimates are also given.

(58 = SAFR) Catalog of South African earthquakes between latitudes 17 and 35 degrees south, and between longitudes 10 and 36 degrees east, 1620 - 1970 (Fernandez and Guzman, 1979).

(61 = SESN) The Southeastern Seismic Network catalog is a compilation of earthquakes which occurred in the states of Florida, Georgia, Alabama, South Carolina, North Carolina, Virginia, southern part of West Virginia, Maryland, Delaware, and the eastern parts of Kentucky and Tennessee, 1698 - 1994. The catalog was prepared at the Virginia Tech Seismology Observatory by Matt Sibol (address: Virgina Tech Seismological Observatory, 4044 Derring Hall, Blacksburg, VA 24061-0420).

(43 = SISRA) Catalog of earthquakes occurring in South America, 1471 - 1981, compiled in the course of the "Programa para la Mitigacion de los Terremotos en la Region Andina", known as project SISRA (Askew and Algermissen, 1985).

(6 = SRA) Catalog of earthquakes occurring in the

eastern, central, and mountain states of the United States, 1534 - 1986 (Stover and others, 1984). An early version of the catalog was developed under the direction of S.T. Algermissen for the lower 48 states; updated and revised files have been published in a series of Miscellaneous Field Studies Maps. The states of Nevada, California, Oregon, Washington, Alaska, and Hawaii are not covered in this catalog.

(23 = SSR) Catalog of earthquakes occurring in the U.S.S.R., 1122 - 1989 (Kondorskaya and Shebalin, 1982). The catalog contains data from the the revised "New Catalog of Strong Earthquakes in the Territory of USSR from Ancient Times through 1977". The IPE in the magnitude authority column identifies this catalog. The remaining part of the catalog is made up from the Annual Book, "Earthquakes in the USSR". The two-letter abbreviation in the authority column identifies the source catalog for each seismic region.

(16 = SYKES) List of hypocenters and magnitudes from papers by Sykes (1963, 1965, 1966, 1977), Sykes and Ewing (1964), and Sykes and Landisman (1964). Catalog supplied by NOAA (Rinehart and others, 1985).

(13 = USE) Catalog of felt earthquakes occurring in the United States and Territories, 1928 - 1972. Catalog supplied by NOAA (Rinehart and others, 1985).

(52 = USHIS) Catalog of principal earthquakes in each of the 50 states in the United States, 1568 - 1989 (Stover, C.W., and Coffman, J. L., 1993). The catalog is a history of earthquakes which have magnitudes greater than or equal to 4.5 and intensity of VI or larger. Exceptions are the State of Alaska and offshore areas of California, Oregon, and Washington where the magnitude range was increased to greater than or equal to 5.5.

(14 = USN) United States Network, 1534 - 1974, catalog supplied by NOAA (Rinehart and others, 1985). This is the original catalog prepared under the the direction of Ted Algermissen. The data file has been partially superceeded by the SRA catalog (compiled by Stover and others, 1984).

(18 = UU) Catalog of earthquakes in and near Utah, 1850 - November 1985, compiled by the University of Utah Seismographic Stations. Shocks through June 1978 are listed by Arabasz and others (1979).

(42 = WCAFR) Catalog of earthquakes occurring in and offshore of West Africa between 5 degrees South and 25 degrees North, 20 degrees West and 27 degrees East, 1615 - 1984 (Ambraseys and Adams, 1936b).

(28 = WDS) Catalog of earthquakes occurring in New Zealand, 1460 - 1977, described by Smith (1976). Catalog supplied by NOAA (Rinehart and others, 1935).

DATE: Year,Month,Day - Year is preceded by a "-" to indicate B.C. date.

ORIGIN TIME: Given in Universal Time Coordinated (UTC)

AUTHORITY: The symbol follows the origin time and refers to the organization that supplied the origin time/coordinate parameters. A single-letter code followed by an ampersand indicates the parameters of the hypocenter were supplied or determined by a computational procedure not normally used by the NEIS.

The authority column has been expanded to include other information than the authority source for the earthquake. Now it is possible for catalogs to have its own set of abbreviations. When referring to the authority column, the user should check the catalog source.

A - Parameters of explosion supplied by U.S. Department of Energy or U.S. Atomic Energy Commission (AEC).

AC - Parameters of the hypocenter supplied by the Alaska Earthquake Information Center (AEIC).

AM - Parameters of the hypocenter supplied by the University of Michigan, Ann Arbor, MI.

B - Parameters of hypocenter supplied by University of California, Berkely, CA.

C - Parameters of hypocenter supplied by the Pacific Geoscience Centre, Sidney, British Columbia, Canada.

CL - Hypocenter parameters supplied

by John Carroll University, Cleveland, OH.

D - Parameters of hypocenter supplied by the Oklahoma Geophysical Observatory, Tulsa, OK.

E - Some or all parameters of explosion (controlled/accidental) supplied by any group or individual other than U.S. Department of Energy or the U.S. Atomic Commission (AEC).

EC Catalog - (AU = Austria), (BE = Belgium), (SW = Switzerland), (GR = Federal Republic of Germany), (SP = Spain), (FR = France), (GB = Great Britain), (GK = Greece), (IR = Ireland), (ITALY = Italy), (NE = Netherlands), (PT = Portugal), (DN = Denmark).

EUR Catalog - (KR = Kirkenes, Norway), (TI = Trieste, Italy; Osservatorio Geofisico Sperimentale), (ZR = Zurich, Switzerland; supplied by D. Mayer-Rosa, ETH-Honggerberg), (FR = Federal Republic of Germany; Bundesanstalt fur Geowissenschaften und Rohstoffe, Hanover; Seismologisches Zentralobservatorium, Grafenberg), (FE = Fennoscandiva; Bath, 1956; Panasenko, 1977), (UP = Uppsala, Sweden; 15 events 1957-1959; precise source unknown), and (BN = supplied by B. Massinon, Laboratorie de Detection et de Geophysique, France).

F - Parameters of hypocenter supplied by the State College of Pennsylvania, University Park, PA.

FENN Catalog - (AJH [AJ] = Ahjos, Finland), (AMB [AM] = Ambraseys, Norway), (ANA [AN] = Ananin and Panasenko, Soviet Union), (BER [BR] = Bergen, Norway), (BKH [BK] = Norsar, North Sea), (BAT [BA] = Bath, Sweden), (COP [CO] = Copenhagen, Denmark), (DOS [DO] = Doss, NW Soviet Union), (DSI [DS] =

Nikonov and Sildvee [referring to Doss], NW Soviet Union), (ERW [ER] = Wahlstrim [referring to Erdmann], Sweden), (EKS [EK] = Ekstrim, Finland), (FOA [FO] = Slunga, et al., Sweden), (GRE [GR] = Gregersen, Denmark), (GUW [GU] = Wahlstrim [referring to Gumaelius], Sweden), (HJE [HJ] = Hjelme, Denmark), (HEL [HE] = Helsinki, Finland), (HOL [HO] = Holmqvist, Holmqvist and Wahlstrim, Sweden), (IGS [IG] = Institute of Geological Sciences, Edinburgh, UK, North Sea), (ISC [IS] = International Seismological Center), (IVO [IV] = Saari, Finland), (KAR [KR] = Karjalainen, Finland), (KAT [KT] = Kataja, Finland), (KIM [KI] = Kim, et al., Sweden), (KJE [KE] = Kjellen, Sweden), (KJW [KW] = Wahlstrim, Sweden), (KOL [KL] = Kolderup, Sweden), (KON [KN] = Kongsberg Seismographic Station, Norway), (KOR [KR] = Korhonen, Finland), (KSI [KS] = Nikonov and Sildvee, NW Soviet Union), (KVA [KV] = Kvale, Norway), (LEH [LE] = Lehman, Denmark), (LIW [LI] = Wahlstrim [referring to Linnarsson], Sweden), (MOS [MO] = World Data Center B, Moscow, NW Soviet Union), (MUW [MU] = Muir Wood and Woo, Norway), (MUI [MI] = Muir Wood et al., Norway), (NAO [NA] = Norsar, Norway), (NOW [NO] = Wahlstrim [referring to Nordenstrim], Sweden), (NSW [NS] = Wahlstrim [referring to Nya Sloertalie Tidning], Sweden), (OPT [OP] = Optun, Norway), (PAN [PA] = Panasenko, NW Soviet Union), (PEN [PE] = Penttila, Finland), (POR [PO] = Porkka [see Penttila], Finland), (REB [RB] = Bath [referring to Renqvist], Sweden and Finland), (REN [RN] = Renqvist, Finland), (SEL [SE] = Sellevol et al., Norway), (SIL [SI] = Nikonov and Sildvee, NW Soviet Union), (SIW [SW] = Wahlstrim [referring to Sioenblaoh], Sweden), (SK [SK] = Siren and Korollef [see Penttila], Finland), (SLU [SL] = Slunga, Sweden), (SVW [SV] = Wahlstrim [referring to Svedmark], Sweden), (TOW [TO] = Wahlstrim [referring to Tirnebohm], Sweden), (UPP [UP] = Uppsala, Sweden), (USGS [GS] = U.S. Geological Survey), (VES [VE] = Vesanen [see Penttila], Finland), (WAH [WA] = Wahlstrim and Ahjos, Sweden and Finland). Information for the three references, IAS, REW, and APA was not provided with the source document. Earthquakes associated with these source documents have a blank in the authority column.

G - Parameters of hypocenter supplied by the U.S. Geological Survey (USGS) for any area other than Island of Hawaii.

GDR Catalog - (AM = Altmark); (BA = Bohemian Massif); (BM = Bavarian Molasse Basin); (BO = Lake of Constance Area); (CS = Central Saxony); (CT = Central Thuringia); (EI = Eifel Mountain Region); (EN = Eastern Netherland Bloc); (EW = Eastern Wuerttemberg); (FA = Frankonian Jura); (HM = Southern Harz Mining District); (HS = Hessian Depression); (HU = Hunsrueck); (HZ = Harz Area); (KR = Krefeld Bloc); (MR = Middle Rhine Area); (MU = Muensterland); (NB = Lower Rhine Area); (ND = Northeastern Germany); (NF = Northern Frankonia); (NW = Northern Black Forest); (NX = Northern Lower Saxony and Holstein); (OR = Upper Rhine Graben); (PS = Pfalz-Saar Area); (RF = Ringkoebing-Fyn High); (RS = Eastern Rhenish Massif); (RU = Ruhr Coal Mining District); (SA = Swabian Jura); (SJ = Swiss Jura); (SM = Saar Mining District); (SW = Southern Black Forest); (SX Souther Lower Saxony); (TI = Texel-Ijsselmeer Bloc); (TW = Teutoburger Wald); (VE = Venn Area); (VG = Vogtland Region); (VO = Vosges Mountain Region); (WD = Northwestern Germany); (WR = Werra Potash Mining District); (= Earthquake cannot be attached to a region).

GL - Parameters of hypocenter supplied by a USGS group located in Golden, CO.

H - Parameters of hypocenter supplied by the USGS Hawaiian Volcano Observatory.

HJ - Parameters of hypocenter supplied by seismograph station HOJ in Jamaica.

HY - Hypocenter estimates furnished by Eric Hjortenberg, Geodetic Institute of Denmark.

I - Parameters of the hypocenter supplied by the International Seismological Centre (ISC), Newbury, United Kingdom.

INDIA Catalog - (CH, Chandra, Umesh, 1977); (RR, Rao and Rao, 1984); (Tandon and Srivastava. 1974); (SR, Srivastava and Ramachandran, 1983).

J - Parameters of hypocenter supplied by St. Louis University, St. Louis, MO..

K - Parameters of hypocenter supplied by the Tennessee Earthquake Information Center (TEIC), Memphis, TN.

L - Parameters of hypocenter supplied by Lamont-Doherty Geological Observatory, Palisades, NY.

LT - Local Time.

M - Hypocenter based on macroseismic information.

NOAA Catalog - (U = Casualities and Damage Unknown); (M = Casualities Unknown, Damage Moderate); (S = Casualities unknown, Damage Severe); (E = Casualities Unknown, Damage Extreme); (FU = Casualities Few, Damage Unknown); (FL = Casualities Few, Damage Limited); (FM =

Casualities Few, Damage Moderate); (FS = Casualities Few, Damage Severe); (SU = Casualities Some, Damage Unknown); (SL = Casualities Some, Damage Limited); (SM = Casualities Some, Damage Moderate); (SS = Casualties Some, Damage Severe); (MU = Casualities Many, Damage Unknown); (ML = Casualities Many, Damage Limited); (MM = Casualities Many, Damage Moderate); (MS = Casualities Many, Damage Severe); (ME = Casualties Many, Damage Extreme); (AU = Casualities 1-100, Damage Unknown); (AL = Casualitites 1-100, Damage Limited); (AM = Casualities 1-100, Damage Moderate); (AS = Casualities 1-100, Damage Severe); (AE = Casualities 1-100, Damage Extreme); (BU = Casualities 101-1000, Damage Unknown); (BL = Casualities 101-1000,Damage Limited); (BM = Casualities 101-1000, Damage Moderate); (BS = Casualities 101-1000, Damage Severe); (BE = Casualities 101-1000, Damage Extreme); (CU = Casualities 1001-10,000, Damage Unknown); (CL = Casualities 1001-10,000, Damage Limited); (CM = Casualities 1001-10,000, Damage Moderate); (CS = Casualitites 1001-10,000, Damage Severe); (CE = Casualities 1001-10,000, Damage Extreme); (DU = Casualities 10,001-100,000, Damage Unknown); (DL = Casualities 10,001-100,000, Damage Limited); (DM = Casualities 10,001-100,000, Damage Moderate); (DS = Casualities 10,001-100,000, Damage Severe); (DE = Casualities 10,001-100,000, Damage Extreme); (EU = Casualities greater than 100,000, Damage Unknomn); (EM = Casualities greater than 100,000, Damage Moderate); (ES = Casualities greater than 100,000, Damage Severe); (EE = Casualities greater than 100,000, Damage Extreme)

O - Parameters of hypocenter supplied by Seismological Service of Canada, Ottawa.

P - Parameters of hypocenter supplied by California Institute of Technology, Pasadena, CA.

G - Parameters of hypocenter supplied by Apia Observatory, Samoa.

R - Parameters of hypocenter supplied by University of Nevada, Reno, NV.

RL - International Seismological Centre (ISC) solution restrained to given location.

S - An NEIS solution based on a local crustal model, or calculated with methods not routinely applied by NEIS.

SSR Catalog - (AL = Altai and Sayany); (AT = Antarctica); (AR = Arctic and Chukota); (BL = Baltic); (BK = Baikal); (CA = Caucasus); (CM = Crimea and Lower Kuban); (CP = Carpathians); (KM = Kamchatatka and Komandors); (KL = Kuril Islands); (MA = Central Asia and Kazakhstan); (NT = Northern Tian-Shan); (NE = Northeast of the USSR); (PR = Primor'e and Amur); (SK = Sakhalin); (TR = Turkmenia (Kopetdag)); and (YA = Yakutia).

T - Parameters of hypocenter supplied 'by Weston Observatory, Weston, MA.

TV - Parameters of hypocenter supplied by the Tennessee Valley Authority in Tennessee.

U - Parameters of hypocenter supplied by University of Utah, Salt Lake City, UT.

V - Parameters of hypocenter supplied by Virginia Polytechnic Institute and State University, Blacksburg, VA.

W - Parameters of hypocenter supplied by University of Washington, Seattle, WA.

X - Time not reported.

Z - Noninstrumental time and location.

** - SSR data file. The two asterisks indicate doubtful data in at least one of the following areas: date, origin time, coordinates.

* - Less reliable hypocenter determination by the PDE using incomplete or less reliable data. Beginning in January 1985, in general, the geometric mean of the semi-major and semi-minor axes of the horizontal 90% confidence ellipse is greater than 8.5 km and less than or equal to 16.0 km.

? - Poor solution - accuracy is considered to be below normal NEIS publication criteria. Beginning in January 1985, in general, the geometric mean of the semi-major and semi-minor axes of the horizontal 90% confidence is greater than 16.0 km. This includes a poor solution computed using data reported by a single network.

% - A non-furnished hypocenter has been computed using data reported by a single network of stations for which the data and/or origin time cannot be confirmed from seismograms available to an NEIS analysts. All other parameters are considered to be consistent with normal NEIS publication criteria.

LATITUDE: Negative value = South.

LONGITUDE: Negative value = West.

DEPTH: Value carried to the whole kilometer.

DEPTH CONTROL:

A = Assigned.

D = Depth restrained based on 2 or more compatible pP phases and/or unidentified secondary arrivals used as pP.

N = Restrained to normal depth (33 km).

G = Restrained by geophysicist.

S = Depth control aided by S-phase data.

% = Questionable value (SSR catalog).

* = Less reliable depth estimate. Accuracy of depth lies between 8.5 km and 16 km based on 90% confidence ellipse.

? = Poor depth estimate; depth accuracy is estimated to be greater than 16 km based on 90% confidence ellipse.

Blank = Good depth estimate and depth unrestrained in contributed hypocenters from other networks. Depth accuracy is estimated to be less than 8.5 km based on 90% confidence ellipse.

pP: Number of contributed pP depth phases and/or unidentified phases used as pP phases in the computed solution.

STN DEV: Standard deviation of the arrival-time residuals for the computed solution.

MAGNITUDES: Magnitude, a logarithmic measure of the "size" of an earthquake, is related to the energy released as seismic waves at the focus of an earthquake. Although the magnitude scale has neither "top" nor "bottom" values, the highest magnitude known was about 9.5, the lowest about -3.0. On this logarithmic scale, a magnitude 6.0 shallow-focus earthquake represents elastic-wave energy about 30 times larger than that generated by a magnitude 5.0 earthquake, 900 times (30x30) larger than that of a magnitude 4.0 shock.

Many factors influence the determination of earthquake magnitude, including focal depth, distance between earthquake focus and observing station, frequency content of the sampled energy, and earthquake radiation pattern.

Magnitude values calculated by the USGS with a brief description of parameters are shown below (see paragraphs under Contributed Magnitudes for appropriate references):

Surface-wave (Ms): Magnitudes are computed for earthquakes that are located at distances between

20 and 160 geocentric degrees from the recieving station, seismic-wave period between 18 and 22 seconds, and depth is less than 50 km (generally Ms magnitudes are not computed for depths greater than 50 km.

Body-wave (mb): Magnitude values are computed based on the seismic-wave period greater than or equal to 0.1 and less than or equal to 3.0, and distance is greater than or equal to 5 degrees.

Moment Magnitude (Mw): The magnitude is computed from the long-period body- and mantle-wave moment tensor inversion method; it is also determined to the product of the area of the earthquake fault, multiplied by the average fault slip over that area and by the shear modulus of the fault rocks. The Mw value is approximately the same as the Ms magnitude value.

Energy Magnitude (Me): These magnitudes are computed from the radiated energy using the method described in Choy and Boatwright (1995). The energy radiated by an earthquake is estimated from the energy spectral density of the broadband P waves (Boatwright and Choy, 1986). The Me can complement moment magnitudes (Mw) in describing the size of an earthquake. Me, being derived from velocity power spectra, is a measure of seismic potential for damage. Mw, being derived from low-frequency asymptote of displacement spectra, is more physically related to the final static displacement of an earthquake.

Local Magnitudes:

Local Magnitude (ML): This magnitude is generally referred to as the true "Richter magnitude" (originally defined for California). The values are computed for distances less than 600 km with depths less than 70 km. These estimates are computed in the western part of the United States as well as world-wide.

Local or Regional Magnitude (Mn or MbLg): This value is calculated for the area east of Rocky Mountains. It is computed from the vertical component 1-second Lg seismic-waves (short-period surface waves).

Other Magnitudes:

Duration Magnitudes (MD): These estimates are derived from the duration or coda length of earthquake vibrations. Duration or coda length magnitude scales normally adjusted to agree with ML or Mn estimates. The MD formulas vary for different geographic regions and for different seismographic instruments.

Felt Area Magnitudes (FA or MI): The estimate is compatible with the mb estmated. It is commonly computed from the felt area for earthquakes occurring before seismic instruments were in general use. The estimates are based on isoseismal maps or defined areas using intensity-attenuation relationships.

Unknown Magnitudes (UK): The computational method was unknown and could not be determined from published sources.

The magnitude section of the earthquake line consist of two parts: magnitude values (mb and MS) determined by the National Earthquake Information Service (NEIS); and the Contributed Magnitude values provided by organizations other than NEIS. The headings listed below contain the given information:

mb = Average NEIS body-wave magnitude.

ObS = Number of mb amplitudes used in the mb magnitude computation.

Ms = Average NEIS surface-wave magnitude (if given, Z = vertical component, H = horizonatal component).

ObS = Number' of amplitudes used in the surface-wave magnitude computation.

CONTRIBUTED MAGNITUDES: Organizations that operate a station network may contribute magnitude values to the NEIS. The value may have been calculated from one station or it may be an average magnitude value from a number of stations in the network. Two magnitude values are possible. The second value is coded on a line immediately beneath the first value. The contributed magnitude field consists of 11 characters: positions 1-4 = magnitude value; positions 5-6 = magnitude scale; and postions 7-11 = organization source; if blank, the catalog listed under catalog source is the source organization.

A number of magnitude scales are defined by source agencies or institutions. The list of magnitude scales in the data base include: (UK = Unknown magnitude scale); (Ms = Surface-wave magnitude; Bath, 1966); (mb = Body-wave magnitude; Gutenberg and Richter, 1956); (ML = Local magnitude; Richter, 1958); (Mn = Nuttli magnitude; Nuttli, 1973); (MD = Coda-length magnitude); (FA or MI = Felt area magnitude; approximately equivalent to an mb value); (mB = Broad-band, body-wave magnitude; Abe (1981, 1982, 1984), Abe and Kanamori, 1979, and Abe and Noguchi (1983a,b); (Mw = Moment magnitude, Hanks and Kanamori, 1979); (Mz = Magnitude based on the cycles/second of the Sg-phase); (MI = Magnitude computed from the epicentral intensity value); and (K = Energy class magnitude value; Kondorskaya and others, 1982).

Flinn-Engdahl Geographic Region Numbers (Header F-E): A number that is assigned to each geographic region on the globe (Flinn and others, 1974).

STA (Header STA): This is a mix of alphabetic and numeric characters. The numeric character indicate number of stations used in the computation. Alphabetic characters recognize the quality indicators for earthquakes from the following sources.

G-R: Three-letter combination (epicenter, origin time, depth):

A = Very accurate.

B = Good.

C = Fair.

D = Poor.

MOS: Two-letter or letter/symbol combination (epicenter, depth):

A = Best accuracy.

B = Very good.

N = Good.

V = Fair.

* = Poor.

PAS: Single-letter designator:

A = Specially investigated.

B = Epicenter probably within 5 km; origin time to nearest second.

C = Epicenter probably within 15 km; origin time to a few seconds.

D = Epicenter not known within 15 km; rough location.

BRK: Single-letter designator:

A = Accurate epicenter.

B = Good.

C = Fair.

D = Poor.

WEL: Single-letter designator:

A = accurate epicenter.

B = Good.

C = Fair.

D = Poor.

SRA: Single-letter designator:

A = Epicenter accuracy estimated to be within 0.0 - 0.1 degrees.

B = Epicenter accuracy estimated to be within 0.1 - 0.2 degrees.

C = Epicenter accuracy estimated to be within 0.2 - 0.5 degrees.

D = Epicenter accuracy estimated to be within 0.5 - 1.0 degrees.

E = Epicenter accuracy estimated to be 1.0 or larger degrees.

F = Noninstrumental epicenter accuracy is estimated to be within 0.0 - 0.5 degrees.

G = Noninstrumental epicenter accuracy is estimated to be within 0.5 - 1.0 degrees.

H = Noninstrumental epicenter accuracy is estimated to be within 1.0 - 2.0 degrees.

I = Noninstrumental epicenter accuracy is estimated to be 2.0 - larger degrees.

EPB: Single-letter designator (1983 - 1984 data):

F = Solution of good quality.

C = Solution of fair quality.

CDMG: Single-letter designator (pre-1900 events only):

A - Epicentral uncertainty probably not more than 15 km, or the fault rupture is identified.

B - Epicentral uncertainty probably not more than 30 km.

C - Epicentral uncertainty probably not more than 60 km.

D - Epicentral uncertainty more than 60 km. ,

E - No epicenter is estimated; the coordinates given are of the reporting locality when only one locality reports the earthquake, or of a convenient intermediate point when the earthquake is reported from more than one locality.

SSR: Three-letter quality code represents the standard error in origin time, coordinates, and magnitude:

A - 1 sec	0.01 deg.	0.1 units
B - 2 sec	0.02 deg.	0.2 units
C - 5 sec	0.05 deg.	0.3 units

D - 10 sec	0.1 deg.	0.5 units
E - 20 sec	0.2 deg.	0.7 units
F - 1 min	0.5 deg.	1.0 units
G - 10 min	1.0 deg.	2.0 units
H - 1 hr	2.0 deg.	
I - 6 hr	5.0 deg.	
J - 1 day		
K - 1 month		
L - 1 year		
M - 10 year		
N - 100 year		

EPRI: Single-letter quality code:

A - +/- = 5 km.
B - +/- = 10 km.
C - +/- = 25 km.
D - +/- = 50 km.
E - +/- = 100 km.

INFORMATION: Dots are coded in place of blanks to aid in the distinction between the columnar values. Read the sub-headers vertically.

Intensity (sub-header INT): The Modified Mercalli Intensity Scale of 1931 is listed on page 36 (Wood and Neumann, 1931): intensity values (1 - 9; X = 10; E = 11; T = 12).

Cultural effects (sub-header EFF): The most severe effect is listed (C = Casualities; D = Damage; F = Felt; H = Heard).

Isoseismal Map (sub-header MAP): Coded to reflect the general publication source.

U = United States Earthquakes.

E = Earthquake Notes.

P = Preliminary Determination of Epicenters (monthly listing).

W = Wellington (New Zealand Seismology Reports, Wellington, N.Z.).

N = Nature Magazine.

S = Bulletin of the Seismological Society of America.

Fault Plane Solution (sub-header FPS): Coded as an "F" to indicate the availability of a fault plane solution in the publication, "Preliminary Determination of Epicenters, Monthly Listing".

Moment Tensor Solution (sub-header MO): Coded as an "G" to indicate the availability of a moment tensor solution in the publication "Preliminary Determination of Epicenters, Monthly Listing" (Sipkin, 1982; Dziewonski, 1980; and Hanks and others, 1979).

ISC Alternate Depth Indicator (sub-header DEP): A "D" in this column indicates that a pP depth is given, but the pP depth is not the adopted depth in the hypocenter solution.

International Data Exchange (sub-header IDE): An "X" in this column identifies the event as a "IDE" earthquake.

Preferred Solution (sub-header PFD): A "P" in this column designates a preferred solution. Earthquake hypocenters which are located within a seismic network, such as Pasadena or Berkeley, or seismic catalogs which have undergone critical review during their compilation will be designated as a preferred solution.

Flag (sub-header FLG): Currently not used.

PHENOMENA (sub-header DTSVNWG):

Diastrophism Code: (sub-header D)

F = Faulting.

U = Uplift.

S = Subsidence.

3 = Uplift and Subsidence.

4 = Uplift and Faulting.

5 = Faulting and Subsidence.

6 = Faulting with Uplift and Subsidence.

7 = Uplift or Subsidence.

8 = Faulting and Uplift or Subsidence.

Tsunami Code: (sub-header T)

T = Tsunami generated.

Q = Questionable Tsunami.

Seicne Code: (sub-header S)

S = Seiche.

Q = Questionable Seiche.

Volcanism Code: (sub-header V)

V = Earthquake associated with volcanism.

Non-Tectonic Code: (sub-header N)

E = Explosion.

I = Collapse.

C = Coal bump or Rock burst in coal mine.

R = Rockburst.

M = Meteoritic.

N = Either known to be or likely to be of non-tectonic origin.

? = Classified as an earthquake, but a non-tectonic origin cannot be ruled out.

V = Reservoir induced earthquake.

Guided Waves in Atmospheric And/Or Ocean Code: (sub-header W)

T = T-wave.

A = Acoustic wave.

G = Gravity wave.

B = Both A and G.

M = T-wave plus and A or G.

Ground, Soil, Water Table Response and Atmospheric Phenomena Code: (sub-header G)

L = Liquefaction.

G = Geyser.

S = Landslides and/or Avalanches.

B = Sand Blows.

C = Ground cracks not known to be an expression of faulting.

V = Lights or other visual phenomena seen.

O = Olfactory (Unusual odors noted).

M = More than one response.

RADIAL DISTANCE: On radius searches, the distance in kilometers between designated input point and earthquake location. The distance value is truncated to the whole kilometer.

Modified Mercalli Intensity Scale of 1931 (Unabridged)
(Wood and Neumann, 1931)

I. Not felt - or, except rarely under especially favorable circumstances. Under certain conditions, at and outside the boundary of the area in which a great shock is felt; sometimes, birds, animals, reported uneasy or disturbed; sometimes dizziness or nausea experienced; sometimes trees, structures, liquids, bodies of water, may sway--doors may swing, very slowly.

II. Felt indoors by few, especially on upper floors, or by sensitive or nervous persons. Also, as in grade I, but often more noticeably: sometimes hanging objects may swing, especially where delicately suspended; sometimes trees, structures, liquids, bodies of water, may sway, doors may swing, very slowly; sometimes birds, animals, reported uneasy or disturbed; sometimes dizziness or nausea experienced.

III. Felt indoors by several, motion usually rapid vibration. Sometimes not recognized to be an earthquake at first. Duration estimated in some cases. Vibration like that due to passing of light or lightly loaded trucks, or heavy trucks some distance away. Hanging objects may swing slightly. Movements may be appreciable on upper levels of tall structures. Rocked standing motor cars slightly.

IV. Felt indoors by many, outdoors by few. Awakened few, especially light sleepers. Frightened no one, unless apprehensive from previous experience. Vibrations like that due to passing of heavy, or heavily loaded trucks. Sensation like heavy body striking building, or falling of heavy objects inside. Rattling of dishes, windows, doors; glassware or crockery clink and clash. Creaking of walls, frame, especially in the upper range of this grade. Hanging objects swung, in numerous instances. Disturbed liquids in open vessels. Rock standing motor cars noticeably.

V. Felt indoors by practically all, outdoors by many or most: outdoors direction estimated. Awakened many, or most. Frightened few--slight excitement, a few ran outdoors. Buildings trembled throughout. Broke dishes, glassware, to some extent. Cracked windows--in some cases, but not generally. Overturned vases, small or unstable objects, in many instances, with occasional fall. Hanging objects, doors, swing generally or considerably. Knocked pictures against walls, or swung them out of place. Opened, or closed, doors, shutters, abruptly. Pendulum clocks stopped, started, or ran fast, or slow. Moved small objects, furnishings, the latter to slight extent. Spilled liquids in small amounts from well-filled open containers. Trees, bushes, shaken slightly.

VI. Felt by all, indoors and outdoors. Frightened many, excitement general, some bushes shaken slightly to moderately. Liquid set in strong motion. Small church bells rang--church, chapel, school, etc. Damage slight in poorly built buildings. Fall of plaster in small amount. Cracked plaster somewhat, especially fine cracks in chimneys in some instances. Broke dishes, glassware in considerable quanity, also some windows. Fall of knickknacks, books, pictures. Overturned furniture in many instances. Moved furnishings of moderately heavy kind.

VII. Frightened all--general alarm, all ran outdoors. Some, or many, found it difficult to stand. Noticed by persons driving motor cars. Trees and bushes shaken moderately to strongly. Waves on ponds, lakes, and running water. Water turbid from mud stirred up. In-caving to some extent of sand or gravel streambanks. Rang large church bells, etc. Suspended objects made to quiver. Damage negligible in buildings of good design and construction, slight to moderate in well-built ordinary buildings, considerable in poorly built or badly designed buildings, adobe houses, old walls (especially where laid up without mortar), spires, etc. Cracked chimneys to considerable extent, walls to some extent. Fall of plaster in considerable to large amount, also some stucco. Broke numerous windows, furniture to some extent. Shook down loosened brickwork and tiles. Broke weak chimneys at the roofline (sometimes damaging roofs). Fall of cornices from towers and high buildings. Dislodged bricks and stones. Overturned heavy furniture, with damage from breaking. Damage considerable to concrete irrigation ditches.

VIII. Fright general--alarm approaches panic. Disturbed persons driving motor cars. Trees shaken strongly--branches, trunks broken off, especially palm trees. Ejected sand and mud in small amounts. Changes: temporary, permanent; in flows of springs and wells; dry wells renewed flow; in temperature of spring and well waters. Damage slight in structures (brick) built especially to withstand earthquakes. Considerable in ordinary substantial buildings, partial collapse: racked, tumbled down, wooden houses in some cases; threw out panel walls in frame structures, broke off decayed piling. Fall of walls. Cracked, broke, solid stone walls seriously. Wet ground to some extent, also ground on steep slopes. Twisting, fall, of chimneys, columns, mouments, also factory stacks, towers. Moved conspicuously, overturned, very heavy furniture.

IX. Panic general. Cracked ground conspicuously. Damage considerable in (masonry) structures built especially to withstand earthquakes: threw out of plum some wood-frame houses built to withstand earthquakes; great in substantial (masonry) buildings, some collapse in large part; or wholly shifted frame buildings off foundations, racked frames; serious to reservoirs; underground pipes sometimes broken.

X. Cracked ground, especially where loose and wet, up to widths of serveral inches; fissures up to a yard in width ran parallel to canal and streambanks. Landslides considerable from riverbanks and steep coasts. Shifted sand and mud horizonatally on beaches and flat land. Changed level of water in wells. Threw water on banks of canals, lakes, rivers, etc. Damage serious to dams, dikes, embankments. Severe to well-built wooden structures and bridges, some destroyed. Developed dangerous cracks in excellent brick walls. Destroyed most masonry and frame structures, also their foundations. Bent railroad rails slightly. Tore apart, or crushed endwise, pipelines buried in earth. Open cracks and broad wavy folds in cement pavements and asphalt road surfaces.

XI. Disturbances in ground many and widespread, varying with ground material. Broad fissures, earth slumps, and land slips in soft, wet ground. Ejected water in large amounts charged with sand and mud. Caused sea waves ("tidal" waves) of significant magnitude. Damage severe to wood-frame structures, especially near shock centers. Great to dams, dikes, embankements, often for long distances. Few, if any, (masonry) structures remained standing. Destroyed large well-built bridges by the wrecking of supporting piers, or pillars. Affected yielding wooden bridges less. Bent railroad rails greatly, and thrust them endwise. Put pipelines buried in earth completely out of service.

XII. Damage total--practically all works of construction damaged greatly or destroyed. Disturbances in ground great and varied, numerous shearing cracks. Landslides, falls of rock of significant character, slumping of riverbanks, etc., numerous and extensive. Wrenched loose, tore off, large rock masses. Fault slips in firm rock, with notable horizontal and vertical offset displacements. Water channels, surface and underground, disturbed and modified greatly. Dammed lakes, produced waterfalls, deflected rivers, etc. Waves seen on ground surfaces (actually seen, probably, in some cases). Distorted lines of sight and level. Threw objects upward into the air.

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APPENDIX E

BORING LOGS

ICF KAISER ENGINEERS

BORING LOG

20152001

PROJECT NAME: Molycorp

PROJECT LOCATION: Washington, Pa.

DRILLING FIRM: Geo Environmental

DRILLING METHOD: Auger/Rock Core

LOGGED BY: Dave Cercone

WATER LEVELS BELOW CASING:
TOC WELL LEVEL
TB-01-1 = 39.11'
TB-01-2 = 61.54'
TB-01-3 = 76.72'
TB-01-4 = 98.62'

NORTHING 12,367.75

EASTING 9,925.52

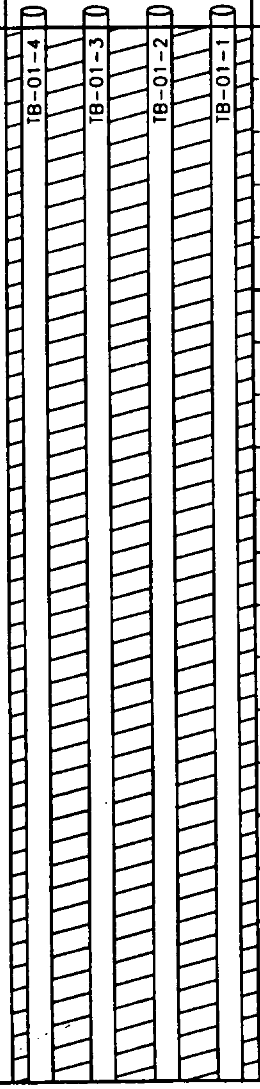
BORING NO. TB-01

G.S. EL. 1121.16

CASING EL.
TB-01-1 1121.55
TB-01-2 1121.23
TB-01-3 1121.13
TB-01-4 1120.93

START DATE: 1-20-97

FINISH DATE: 2-21-97

DEPTH	ELEVATION	RQD	RECOVERY (ft.)	CORE RUN NUMBERS	MATERIAL DESCRIPTION	PIEZOMETER	DEPTH
					0'-11' SILT AND CLAY, Brown, Dry to Damp, Trace Rock Fragments.		
5							5
10							10
					11'-14' SILT AND CLAY, Yellow Brown, Dry-Damp, Trace Rock Fragments.		
		30%	9.6'	RUN #1	14.1'-16.2' MUDSTONE, Grey, Very Soft, Slight-Moderate Weathering, Few Vertical Fractures. Very Broken-Broken.		
15							15
20							20

NOTES:
1. Depths and Elevations in feet unless otherwise noted.

Sheet 1 of 6

6786100300

ICF KAISER ENGINEERS BORING LOG

PROJECT NAME: Molycorp

PROJECT LOCATION: Washington, Pa.

DRILLING FIRM: Geo Environmental

DRILLING METHOD: Auger/Rock Core

LOGGED BY: Dave Cercone

WATER LEVELS BELOW CASING:
TOC WELL LEVEL
TB-01-1 = 39.11'
TB-01-2 = 61.54'
TB-01-3 = 76.72'
TB-01-4 = 98.62'

NORTHING 12,367.75

EASTING 9,925.52

BORING NO. TB-01

G.S. EL. 1121.16

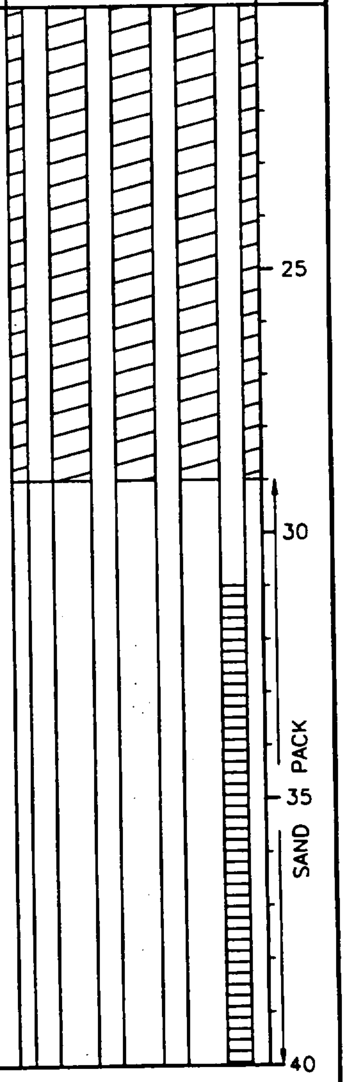
CASING EL.
TB-01-1 1121.55
TB-01-2 1121.23
TB-01-3 1121.13
TB-01-4 1120.93

START DATE: 1-20-97

FINISH DATE: 2-21-97

DEPTH	ELEVATION	RQD	RECOVERY (ft.)	OVM (ppm)	CORE RUN NUMBERS	MATERIAL DESCRIPTION
						16.2'-24.3' SHALE, Dark-Grey-Black Carbonaceous, Soft, Slightly Weathered, Bedding Planes are Weak and Break Readily, Stained Vertical Fractures are Common, Abrupt Contact w/ Grey Mudstone.
25		95%	10.2	0	RUN #2	24.3'-26.7' MUDSTONE, Grey Grading into Grey Sandstone, Very Soft to Soft, Slightly Weathered, Fractured at Sandstone Interface-Oxidized.
30						26.7'-34.0' SANDSTONE, Laminated, Fine Grained (Horsetail Laminations), Horizontal Fractures, Iron-Stained Zones, 7 Zones in Sandstone.
35 40		70%	9.7	0	RUN #3	34.0'-42.1' SANDSTONE, Laminated, Same as Above.

PIEZOMETER



NOTES:
1. Depths and Elevations in feet unless otherwise noted.

ICF KAISER ENGINEERS

BORING LOG

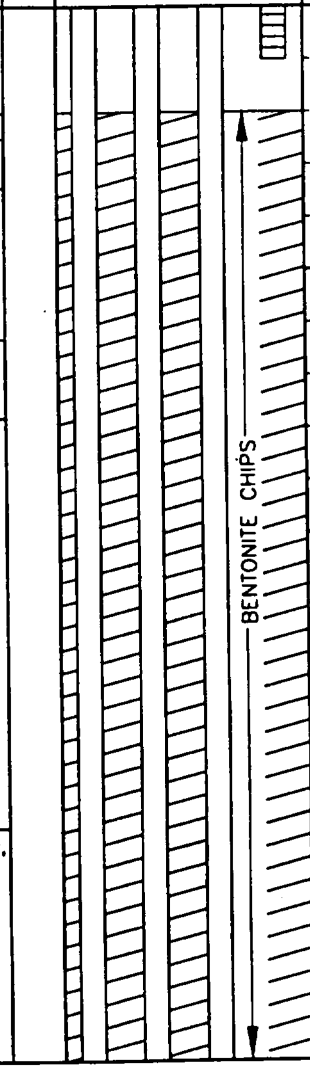
PROJECT NAME: Molycorp
PROJECT LOCATION: Washington, Pa.
DRILLING FIRM: Geo Environmental
DRILLING METHOD: Auger/Rock Core
LOGGED BY: Dave Cercone

WATER LEVELS BELOW CASING:
TOC WELL LEVEL
TB-01-1 = 39.11'
TB-01-2 = 61.54'
TB-01-3 = 76.72'
TB-01-4 = 98.62'
NORTHING 12,367.75
EASTING 9,925.52

BORING NO. TB-01
G.S. EL. 1121.16
CASING EL.
TB-01-1 1121.55
TB-01-2 1121.23
TB-01-3 1121.13
TB-01-4 1120.93
START DATE: 1-20-97
FINISH DATE: 2-21-97

DEPTH	ELEVATION	RQD	RECOVERY (ft.)	OVM (ppm)	CORE RUN NUMBERS	MATERIAL DESCRIPTION	DEPTH
						42.1'-42.6' COAL, Poor Quality.	
						42.6'-43.7' MUDSTONE, Grey.	
		50%	10'	0	RUN #4		
						43.7'-46.3' SHALE, Grey Medium Hard, Slight Weathering, Stained Fractures, Broken.	
45							45
						46.3'-47.8' SHALE/SANDSTONE Grey, Very Fine-Fine Grained, Medium Hard-Hard, Not Weathered, No Fractures, Horsetail Laminates at Contacts w/ Overlying and Underlying Shales.	
						47.8'-55.8' SHALE, Grey-Black, Fissle.	
50							50
		60%	1'	0	RUN #5		
		90%	10'	0	RUN #6		
55							55
						55.8'-62.6' LIMESTONE, Light-Dark Grey, Hard, Micritic, Some Zones Have Laminations, No Fractures.	
60							60

PIEZOMETER



NOTES:
1. Depths and Elevations in feet unless otherwise noted.

ICF KAISER ENGINEERS

BORING LOG

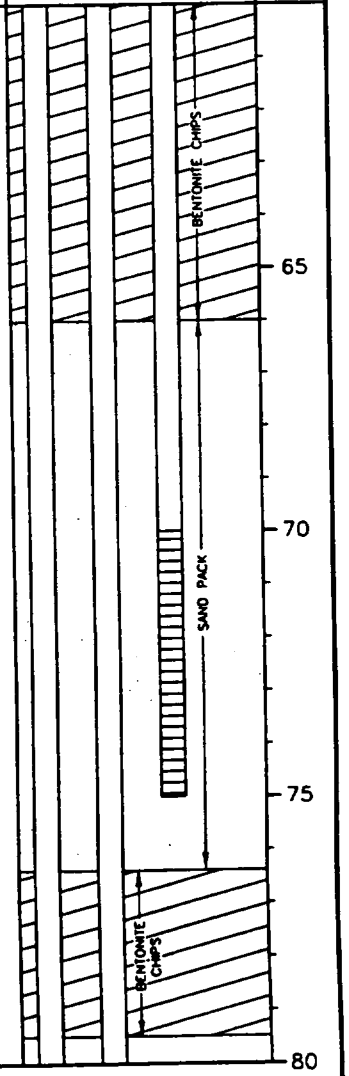
PROJECT NAME: Molycorp
PROJECT LOCATION: Washington, Pa.
DRILLING FIRM: Geo Environmental
DRILLING METHOD: Auger/Rock Core
LOGGED BY: Dave Cercone

WATER LEVELS BELOW CASING:
TOC WELL LEVEL
TB-01-1 = 39.11'
TB-01-2 = 61.54'
TB-01-3 = 76.72'
TB-01-4 = 98.62'
NORTHING 12,367.75
EASTING 9,925.52

BORING NO. TB-01
G.S. EL. 1121.16
CASING EL.
TB-01-1 1121.55
TB-01-2 1121.23
TB-01-3 1121.13
TB-01-4 1120.93
START DATE: 1-20-97
FINISH DATE: 2-21-97

DEPTH	ELEVATION	RQD	RECOVERY (ft.)	OVM (ppm)	CORE RUN NUMBERS	MATERIAL DESCRIPTION
						62.6'-62.9' MUDSTONE, Dark Grey, No Features.
						62.9'-64.1' LIMESTONE, Dark Grey, Soft, Fractured w/ Iron Stains.
		100%	3.5'	0	RUN #7	64.1'-67.6' LIMESTONE, Soft, Medium-Hard.
65						
		95%	6.2'	0	RUN #8	67.6'-70.6' SHALE, Grey, Unfractured, Fissle, Soft-Medium Hard, Sharp Contact.
70						70.6'-71.2' SHALE, Black, Carbonaceous, No Stains or Fractures.
						71.2'-73.0' SANDSTONE, Black/Grey, Hard, No Fractures, Laminated Near Bottom, Sharp Contact.
						73.0'-73.9' SHALE, Black, Carbonaceous, Fractures @ 73.4, Grades into Grey Mudstone From 73.5 to 73.9.
						73.9'-83.9' LIMESTONE, Fractures @ 74 Ft. Thru 75 Ft. and Again @ 79.3 Ft. All Fractures are Stained, Hard.
75		90%	9'		RUN #9	
80						

PIEZOMETER



DEPTH

NOTES:
1. Depths and Elevations in feet unless otherwise noted.

ICF KAISER ENGINEERS

BORING LOG

20152005

PROJECT NAME: Molycorp

PROJECT LOCATION: Washington, Pa.

DRILLING FIRM: Geo Environmental

DRILLING METHOD: Auger/Rock Core

LOGGED BY: Dave Cercone

WATER LEVELS BELOW CASING:
TOC WELL LEVEL
TB-01-1 = 39.11'
TB-01-2 = 61.54'
TB-01-3 = 76.72'
TB-01-4 = 98.62'

NORTHING 12,367.75

EASTING 9,925.52

BORING NO. TB-01

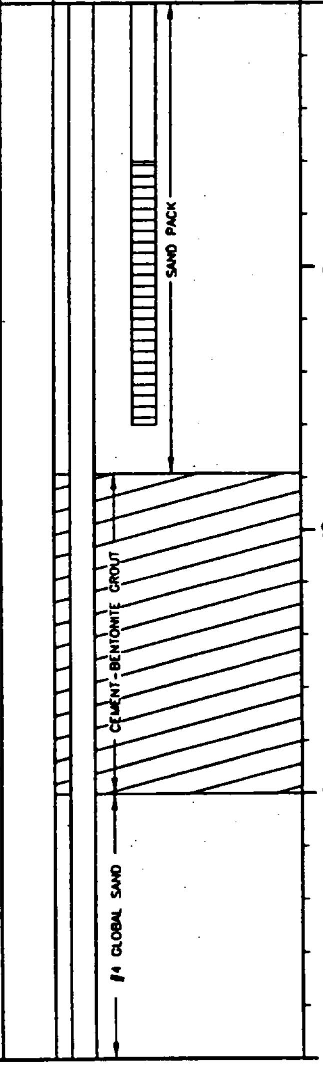
G.S. EL. 1121.16

CASING EL.
TB-01-1 1121.55
TB-01-2 1121.23
TB-01-3 1121.13
TB-01-4 1120.93

START DATE: 1-20-97

FINISH DATE: 2-21-97

DEPTH	ELEVATION	RQD	RECOVERY (ft.)	OVM (ppm)	CORE RUN NUMBERS	MATERIAL DESCRIPTION	PIEZOMETER	DEPTH
						83.9'-84.1' LIMESTONE, Carbonaceous, Gradational Contact w/ Underlying Coal/Carb, Shale.		
		90%	10'		RUN #10	84.1'-85' SHALE, Carbonaceous, Soft, Grades into Coal, Medium Hard.		
85						85'-85.8' COAL, Highly Fractured, Fractures not Stained.		85
						85.8'-87.0' SHALE, Carbonaceous.		
						87.0'-94.5' LIMESTONE, Grey, Fractures are not Open and are not Stained, a well Preserved Closed Fracture @ 91 Ft.		
90								90
		100%	10'		RUN #11			
						94.5'-100.4' SHALE, Grey, Hard, Sandstone Inclusions, No Open Fractures, Mineralized.		
95								95
100								100



NOTES:
1. Depths and Elevations in feet unless otherwise noted.

ICF KAISER ENGINEERS

BORING LOG

20152006

PROJECT NAME: Molycorp

PROJECT LOCATION: Washington, Pa.

DRILLING FIRM: Geo Environmental

DRILLING METHOD: Auger/Rock Core

LOGGED BY: Dave Cercone

WATER LEVELS BELOW CASING:
TOC WELL LEVEL
TB-01-1 = 39.11'
TB-01-2 = 61.54'
TB-01-3 = 76.72'
TB-01-4 = 98.62'

NORTHING 12,367.75

EASTING 9,925.52

BORING NO. TB-01

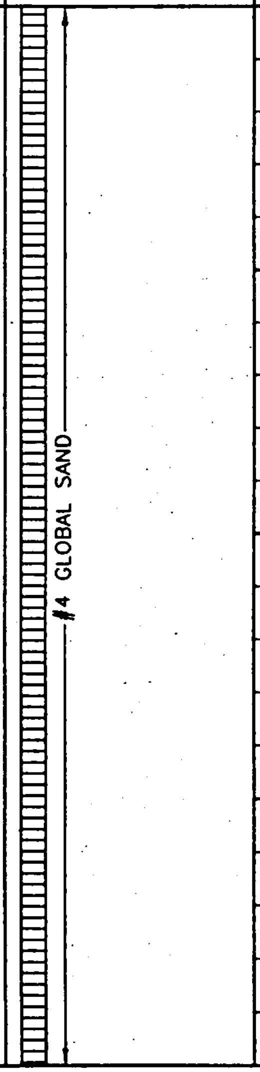
G.S. EL. 1121.16

CASING EL.
TB-01-1 1121.55
TB-01-2 1121.23
TB-01-3 1121.13
TB-01-4 1120.93

START DATE: 1-20-97

FINISH DATE: 2-21-97

DEPTH	ELEVATION	RQD	RECOVERY (ft.)	OVM (ppm)	CORE RUN NUMBERS	MATERIAL DESCRIPTION	PIEZOMETER	DEPTH
						100.4'-101.1' SANDSTONE, Grey, Very Fine Grained, Hard, Lacks Fracture.		
						101.1'-103.9' SHALE, Grey.		
		100%	10'		RUN #12	103.9'-112.8' SHALE, Grey, No Stained Fractures or Open Fractures.		
105								105
110								110
						112.8'-115.0' LIMESTONE, Grey to Black, No Fractures.		
		100%	10'		RUN #13	115.0'-118.9' SHALE, Grey.		
115								115
120						Total Depth, 121 Ft.		120



NOTES:
1. Depths and Elevations in feet unless otherwise noted.

ICF KAISER ENGINEERS

BORING LOG

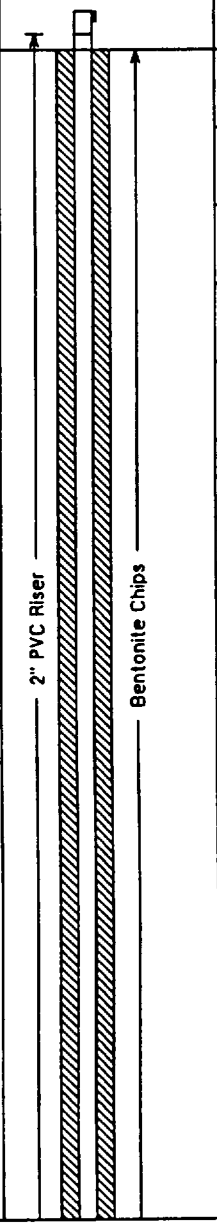
PROJECT NAME Molycorp
PROJECT LOCATION Washington, PA. facility
DRILLING FIRM Geo Environmental
DRILLING METHOD Auger/3" Rock Core/ 6" Hammer
LOGGED BY Dave Cercone

WATER LEVELS RELATIVE TO TOC
DEPTH TO WATER 17.86
17.86

NORTHING 9783.07
EASTING 12655.12

BORING NO. TB-02
G.S. ELEV. 1077.36
CASING ELEV. 1079.07
START DATE 1/29/97
FINISH DATE 1/31/97

DEPTH		RQD (%)	REC. (FT)		CORE RUN NUMBERS	MATERIAL DESCRIPTION		PIEZOMETER	DEPTH
						Augered to 10 feet.			
5						0-10 SILTY CLAY, brown to dark brown, little rock fragments, soft			5
10		70	1.0		Run #1	10-11 LIMESTONE, Hard. 11-12.5 Possible MUDSTONE, very soft, this zone washed out during drilling.			10
		90	2.0		Run #2	12.5-15.4 LIMESTONE, very hard, iron stained, no fractures.			
15									15



NOTES:

1. Depths and Elevations in feet unless otherwise noted

Sheet 1 of 3

ICF KAISER ENGINEERS

BORING LOG

PROJECT NAME Molycorp
PROJECT LOCATION Washington, PA. facility
DRILLING FIRM Geo Environmental
DRILLING METHOD Auger/3" Rock Core/ 6" Hammer
LOGGED BY Dave Cercone

WATER LEVELS RELATIVE TO TOC
DEPTH TO WATER 17.86
17.86

NORTHING 9783.07
EASTING 12655.12

BORING NO. TB-02
G.S. ELEV. 1077.36
CASING ELEV. 1079.07
START DATE 1/29/97
FINISH DATE 1/31/97

DEPTH	RQD (%)	REC. (FT)	CORE RUN NUMBERS
	100	2.5	Run #3
	NA	2.5	Run #4
20	30	2.5	Run #5
	40	2.0	Run #6
25	80	2.3	Run #7
	15	2.0	Run #8
	70	5.0	Run #9
30			

MATERIAL DESCRIPTION

15.4-25 MUDSTONE, Olive grey-grey-grey brown, iron stained, horizontal and vertical fractures from 17.5-25 with iron staining, soft, friable to blocky, badly broken.

25-25.2 SHALE, black, friable, carbonaceous, soft, lacks iron stains.

25.2-26.1 SHALE, dark grey, calcareous.

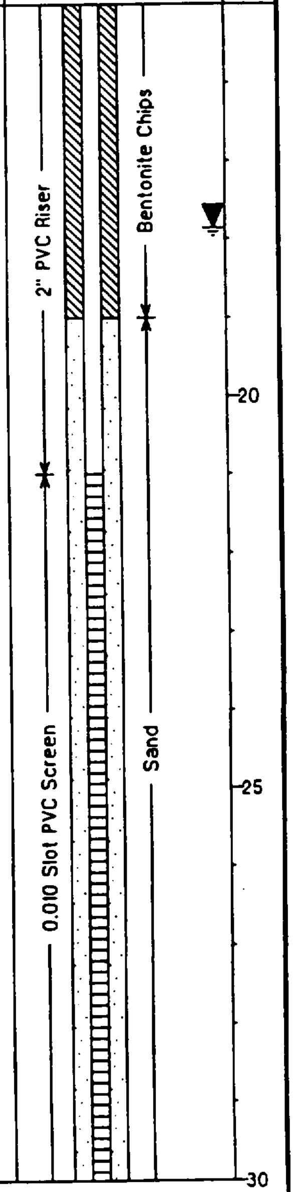
26.1-26.7 MUDSTONE, dark grey to very dark grey, soft

26.7-27.5 LIMESTONE, shaley, dark grey, medium hard, lacks open fractures.

27.5-28 MUDSTONE, grey, medium hard, weathered, closed fractures.

28-34.5 LIMESTONE, grey, hard.

PIEZOMETER



DEPTH

NOTES:

1. Depths and Elevations in feet unless otherwise noted

Sheet 2 of 3

ICF KAISER ENGINEERS

BORING LOG

PROJECT NAME Molycorp
PROJECT LOCATION Washington, PA. facility
DRILLING FIRM Geo Environmental
DRILLING METHOD Auger/3" Rock Core/ 6" Hammer
LOGGED BY Dave Cercone

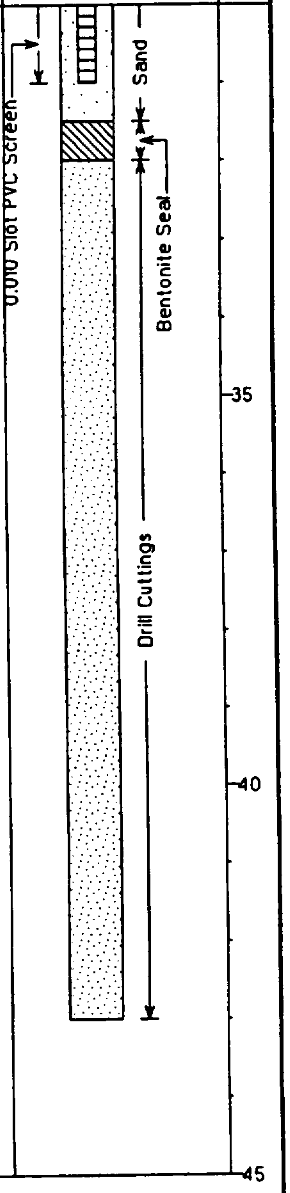
WATER LEVELS RELATIVE TO TOC
DEPTH TO WATER 17.86
17.86

NORTHING 9783.07
EASTING 12655.12

BORING NO. TB-02
G.S. ELEV. 1077.36
CASING ELEV. 1079.07
START DATE 1/29/97
FINISH DATE 1/31/97

DEPTH		RQD (%)	REC. (FT)		CORE RUN NUMBERS	MATERIAL DESCRIPTION
		70	5.0		Run #9	LIMESTONE Same as above.
		40	4.0		Run #10	34.5-35 MUDSTONE, soft, fissile.
35						35-37.3 LIMESTONE, grey, hard, some vertical and horizontal fractures.
						37.3-38 SHALE/MUDSTONE, black, horizontal laminations, soft.
						38-39'SHALE, carbonaceous, fractured.
40		40	4.0		Run #11	39-41 SHALE AND COAL, black, medium hard, carbonaceous, fractured.
						41-43 LIMESTONE, dark grey-black, hard.
45						Total Depth, 43 ft. 3" core extended to total depth while the 6" reaming went to only 35 feet. Interval between 35 to TD filled with drill cuttings.

PIEZOMETER



NOTES:

1. Depths and Elevations in feet unless otherwise noted

ICF KAISER ENGINEERS

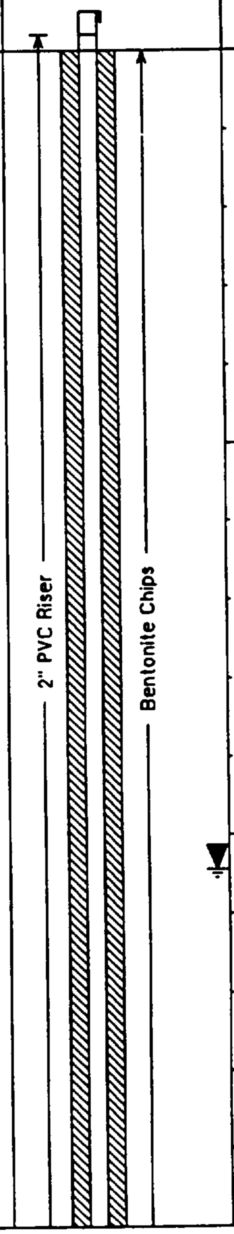
BORING LOG

PROJECT NAME Molycorp
PROJECT LOCATION Washington, PA. facility
DRILLING FIRM Geo Environmental
DRILLING METHOD Auger/3" Rock Core/6" Hammer
LOGGED BY Dave Cercone

WATER LEVELS RELATIVE TO TOC
DEPTH TO WATER 10.44

NORTHING 9871.97
EASTING 11999.30

BORING NO. TB-03
G.S. ELEV. 1122.82
CASING ELEV. 1124.63
START DATE 1/31/97
FINISH DATE 2/6/97

DEPTH	RQD (%)	REC. (FT)	CORE RUN NUMBERS	MATERIAL DESCRIPTION	PIEZOMETER	DEPTH
				Augered to 7.8 feet. 0-2 CLAY, grey/brown, mottled with coarse-fine gravels (limestone fragments), little coarse-fine sand, soft, stiff, moist.		
				2-4 CLAY, yellow brown to grey, trace coarse-fine sand, trace rock fragments, moist.		
5				4-7.8 CLAY, grey/dark grey, trace-some sand, carbonaceous lenses, moist.		5
	90	2.0	Run #1	7.8-8.3 LIMESTONE, grey/brown grey, irregular, very fractured with iron stains, hard. 8.3-9.9 MUDSTONE, grey, soft, stained severely at contact with overlying limestone.		
10	24	2.5	Run #2	9.9-12.1 LIMESTONE, grey/dark grey, iron stained, fractures.		10
	56	2.5	Run #3	12.1-18.5 MUDSTONE, grey, soft, friable, few iron stains at break in core, isolated fractures.		
15						15

NOTES:

1. Depths and Elevations in feet unless otherwise noted

Sheet 1 of 4

BORING LOG

PROJECT NAME Molycorp
PROJECT LOCATION Washington, PA. facility
DRILLING FIRM Geo Environmental
DRILLING METHOD Auger/3" Rock Core/6" Hammer
LOGGED BY Dave Cercone

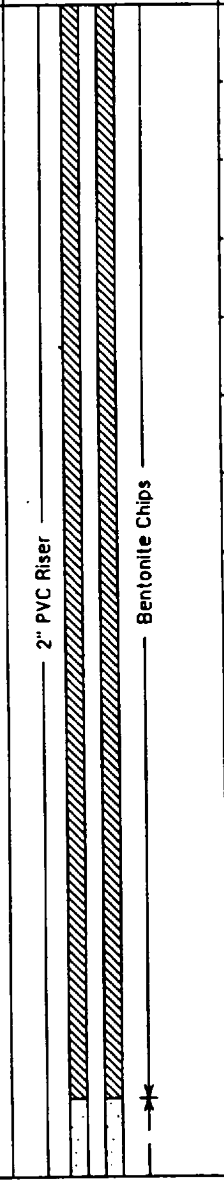
WATER LEVELS RELATIVE TO TOC
DEPTH TO WATER 10.44

NORTHING 9871.97
EASTING 11999.30

BORING NO. TB-03
G.S. ELEV. 1122.82
CASING ELEV. 1124.63
START DATE 1/31/97
FINISH DATE 2/6/97

DEPTH		RQD (%)	REC. (FT)		CORE RUN NUMBERS	MATERIAL DESCRIPTION		DEPTH
		40	2.5		Run #4	MUDSTONE, grey, same as above.		
		60	2.5		Run #5	18.5-19.3 LIMESTONE, grey to dark grey, very fractured, open fractures, iron stained. 19.3-21.2 MUDSTONE, dark grey, soft to friable.		
20		50	2.5		Run #6	21.2-22.8 CLAY SHALE, very dark grey to black, friable, soft, slightly carbonaceous to carbonaceous, slight iron staining on joints/partings.		20
		30	2.5		Run #7	22.8-23.0 COAL, broken, iron stained on joints/partings. 23.0-23.3 MUDSTONE/CLAY SHALE, dark grey to black; soft; friable; iron stained. 23.3-24.0 COAL, broken, iron stained.		
25		0	2.0		Run #8	24.0-24.8 MUDSTONE, grey to dark grey, soft, friable. 24.8-28.0 SHALE, black, fissile, very fractured, stained fractures at 27 feet, other small fractures throughout core, carbonaceous. SHALE (same as above). Abrupt contact with underlying grey shale, siltstone and very fine sandstone.		25
		50	2.5		Run #9	28-29 SHALE, SILTSTONE and SANDSTONE, grey, very fine grained, horizontal, bedding plane fractures.		
		100	2.5		Run #10			
30								30

PIEZOMETER



NOTES:

1. Depths and Elevations in feet unless otherwise noted

ICF KAISER ENGINEERS

BORING LOG

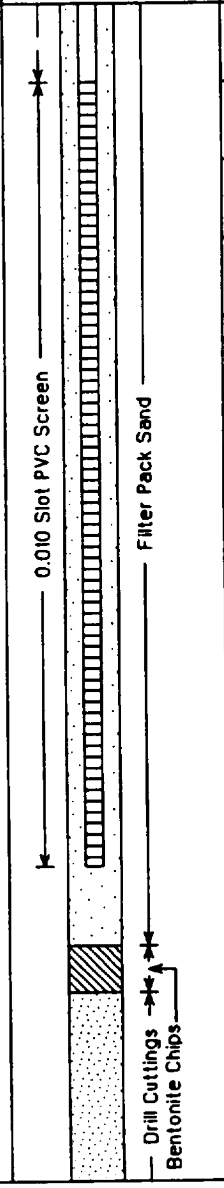
PROJECT NAME Molycorp
PROJECT LOCATION Washington, PA. facility
DRILLING FIRM Geo Environmental
DRILLING METHOD Auger/3" Rock Core/6" Hammer
LOGGED BY Dave Cercone

WATER LEVELS RELATIVE TO TOC
DEPTH TO WATER 10.44
NORTHING 9871.97
EASTING 11999.30

BORING NO. TB-03
G.S. ELEV. 1122.82
CASING ELEV. 1124.63
START DATE 1/31/97
FINISH DATE 2/6/97

DEPTH		RQD (%)	REC. (FT)		CORE RUN NUMBERS	MATERIAL DESCRIPTION		DEPTH
		100	2.5		Run #10	29-30.9 SANDSTONE (same as above), numerous laminated zones, stained horizontal fractures at 29.7 feet and 30.8 feet. 30.9-32.0 SHALE/SILTSTONE, predominates below 30.9 feet.		
		100	2.5		Run #11	32.0-47.5 SANDSTONE, very fine - medium grained, horsetail, laminations throughout. Stained horizontal fractures at 32.5 to 34.0, 34.5 and 44.7.		
35								35
		100	10.0		Run #12			
40								40
		100	5.0		Run #13			
45								45

PIEZOMETER



NOTES:

1. Depths and Elevations in feet unless otherwise noted

ICF KAISER ENGINEERS

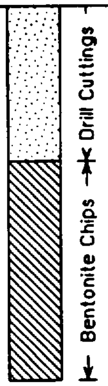
BORING LOG

PROJECT NAME Molycorp
PROJECT LOCATION Washington, PA. facility
DRILLING FIRM Geo Environmental
DRILLING METHOD Auger/3" Rock Core/6" Hammer
LOGGED BY Dave Cercone

WATER LEVELS RELATIVE TO TOC
DEPTH TO WATER 10.44

NORTHING 9871.97
EASTING 11999.30

BORING NO. TB-03
G.S. ELEV. 1122.82
CASING ELEV. 1124.63
START DATE 1/31/97
FINISH DATE 2/6/97

DEPTH		RQD (%)	REC. (FT)		CORE RUN NUMBERS	MATERIAL DESCRIPTION		PIEZOMETER	DEPTH
						Same as above. Grain size increased to medium grained.			
		100	5.0		Run #13	47.5-48 SHALE/COAL, black, carbonaceous, iron stained.			
						48.0-49.3 MUDSTONE/SHALE, grey, vertical fracture at 49 feet, stained, abrupt contact with very soft to medium hard.			
0–						49.3-49.8 SANDSTONE, grey, cross-bedded, hard.			50
						Total Depth, 49.8 feet.			
55–									55
0									60

NOTES:

1. Depths and Elevations in feet unless otherwise noted

ICF KAISER ENGINEERS

BORING LOG

PROJECT NAME Molycorp
PROJECT LOCATION Washington, PA. facility
DRILLING FIRM Geo Environmental
DRILLING METHOD Auger/3" Rock Core/6" Hammer
LOGGED BY Dave Cercone

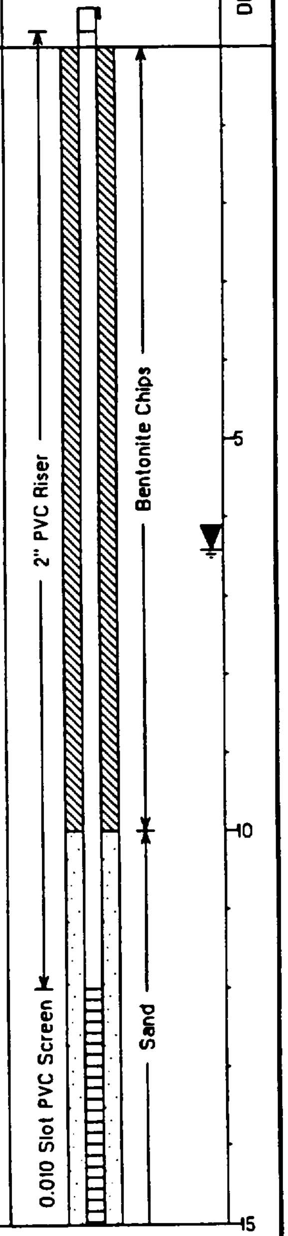
WATER LEVELS RELATIVE TO TOC
DEPTH TO WATER 6.42

NORTHING 10214.40
EASTING 12166.80

BORING NO. TB-04
G.S. ELEV. 1047.36
CASING ELEV. 1049.43
START DATE 2/12/97
FINISH DATE 2/13/97

DEPTH	RQD (%)	REC. (FT)	CORE RUN NUMBERS	MATERIAL DESCRIPTION
				Black to brown FILL, ASH, concrete fragments and crushed limestone.
5	70	5.0	Run #1	3-5.8 LIMESTONE, grey, fractures at 3.5, 4.0 and 5.5 feet.
				5.8-6.2 MUDSTONE
				6.2-8.5 LIMESTONE, grey.
10	60	5.0	Run #2	8.5-11.0 LIMESTONE, hard-medium hard, many stained fractures, muddy lenses.
				11-12.5 MUDSTONE, calcareous, grey, soft, fissile only in a small interval at 12 feet, no stained fractures.
				12.5-13 LIMESTONE, dark grey, hard.
				13-13.5 SHALE/MUDSTONE, grey/black, soft, carbonaceous, no fractures.
15	10	5.0	Run #3	13.5-15.8 SHALE/COAL, carbonaceous, broken.

PIEZOMETER



NOTES:

1. Depths and Elevations in feet unless otherwise noted

Sheet 1 of 3

ICF KAISER ENGINEERS

BORING LOG

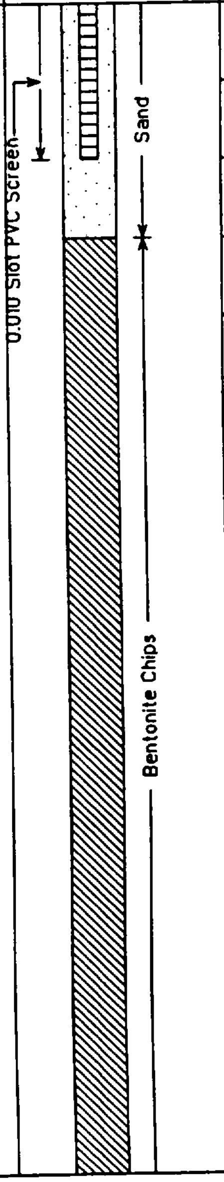
PROJECT NAME Molycorp
PROJECT LOCATION Washington, PA. facility
DRILLING FIRM Geo Environmental
DRILLING METHOD Auger/3" Rock Core/6" Hammer
LOGGED BY Dave Cercone

WATER LEVELS RELATIVE TO TOC
DEPTH TO WATER 6.42

NORTHING 10214.40
EASTING 12166.80

BORING NO. TB-04
G.S. ELEV. 1047.36
CASING ELEV. 1049.43
START DATE 2/12/97
FINISH DATE 2/13/97

DEPTH		RQD (%)	REC. (FT)		CORE RUN NUMBERS	MATERIAL DESCRIPTION		PIEZOMETER	DEPTH
		10	5.0		Run #3	15.8-16.2 MUDSTONE/SHALE, grey. 16.2-17 SHALE, carbonaceous. 17-19 LIMESTONE, dark grey, hard, no fractures in entire core run.			
20		100	5.0		Run #4	19-20.5 LIMESTONE, grey, medium hard, an isolated vertical stained fracture is at 19 feet. Remainder of core run is unfractured. 20.5-24.0 SHALE, calcareous.			20
25		90	5.0		Run #5	SHALE, light grey, medium hard to soft, clayey, siltstone lenses between 28.2 and 28.5 feet. The siltstone has an iron stained lense. 28.2-28.5 SILTSTONE			25
30		100	10.0		Run #6				30



NOTES:

1. Depths and Elevations in feet unless otherwise noted

Sheet 2 of 3

ICF KAISER ENGINEERS

BORING LOG

PROJECT NAME Molycorp
PROJECT LOCATION Washington, PA. facility
DRILLING FIRM Geo Environmental
DRILLING METHOD Auger/3" Rock Core/6" Hammer
LOGGED BY Dave Cercone

WATER LEVELS RELATIVE TO TOC
DEPTH TO WATER 6.42

NORTHING 10214.40
EASTING 12166.80

BORING NO. TB-04
G.S. ELEV. 1047.36
CASING ELEV. 1049.43
START DATE 2/12/97
FINISH DATE 2/13/97

DEPTH		RQD (%)	REC. (FT)		CORE RUN NUMBERS	MATERIAL DESCRIPTION		PIEZOMETER	DEPTH
						28.5-32 SHALE, clayey, light grey, medium hard to soft.		▨	
						32-33.4 SILTSTONE, laminated, micaeous lens.		▨	
35		100	10.0		Run #6	33.4-40 SHALE, grey, same as above interval between 24 and 32 feet, no fractures in entire core run.		▨ Bentonite Chips	35
		100	1.0		Run #7			▨	
40						Total Depth, 40 feet.			40
45									45

NOTES:

1. Depths and Elevations in feet unless otherwise noted

Sheet 3 of 3

ICF KAISER ENGINEERS

BORING LOG

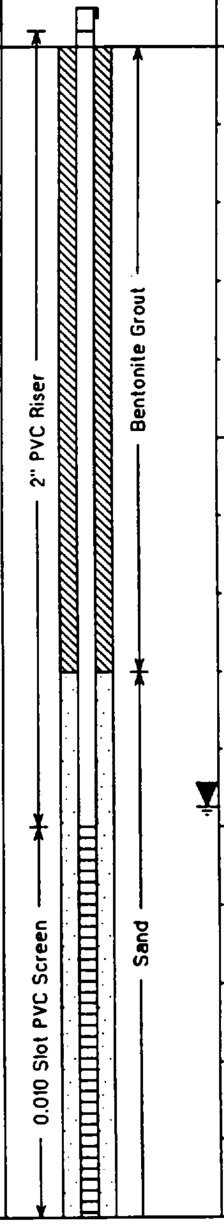
PROJECT NAME Molycorp
PROJECT LOCATION Washington, PA. facility
DRILLING FIRM Geo Environmental
DRILLING METHOD Auger/3" Rock Core/6" Hammer
LOGGED BY George Werkman

WATER LEVELS RELATIVE TO TOC
DEPTH TO WATER 9.75
NORTHING 10139.23
EASTING 11850.27

BORING NO. TB-05
G.S. ELEV. 1049.58
CASING ELEV. 1051.81
START DATE 2/17/97
FINISH DATE 2/18/97

DEPTH	RQD (%)	REC. (FT)	CORE RUN NUMBERS	MATERIAL DESCRIPTION	DEPTH
				0-2 FILL, BLACK ASH, soft.	
				2-4 LIMESTONE, grey.	
	24	3.0	Run #1	4-4.9 LIMESTONE, grey, fractured, 4.6 and 4.75 feet with iron stains, medium hard.	
5				4.9-5.2 SHALE, grey, soft, moderately weathered, fissility.	5
				5.2-7 LIMESTONE, grey, fractured vertically and horizontally from 6.3 to 6.6 feet, slightly broken.	
	40	2.0	Run #2	7-8 SHALE, calcareous, grey, iron stained from 7.6 to 8.0 feet, moderately hard, fractured from 7.9 to 8.1 feet.	
				8-8.6 LIMESTONE, grey, hard.	
	45	6.0	Run #3	8.6-9.0 SHALE, grey, calcareous, moderately hard, fissile.	
				9.0-9.8 LIMESTONE, grey, hard, fracture 9.4 to 9.6 feet, broken.	
10				9.8-10.8 SHALE, grey, moderately hard, slightly broken, fissile.	10
				10.8-12.0 SHALE, carbonaceous, moderately hard, slightly broken, fissile.	
				12-13.1 COAL, hard, very broken.	
				13.1-14.0 MUDSTONE, grey to dark grey, moderately hard.	
				14.0-14.4 LIMESTONE, grey, hard, broken.	
15				14.4-14.8 SHALE, carbonaceous, medium hard, broken.	15

PIEZOMETER



NOTES:

1. Depths and Elevations in feet unless otherwise noted

Sheet 1 of 3

ICF KAISER ENGINEERS

BORING LOG

PROJECT NAME Molycorp
PROJECT LOCATION Washington, PA. facility
DRILLING FIRM Geo Environmental
DRILLING METHOD Auger/3" Rock Core/6" Hammer
LOGGED BY George Werkman

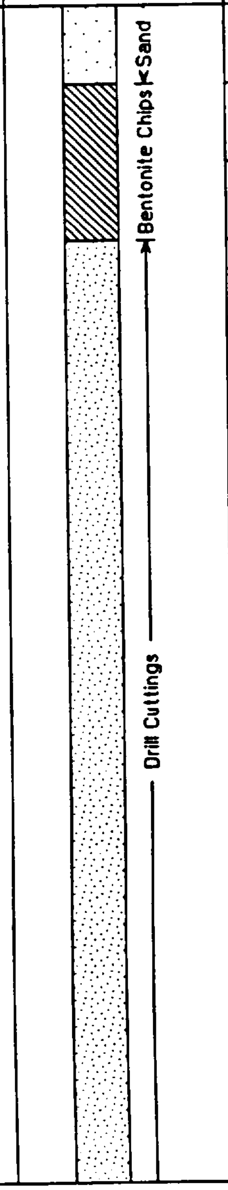
WATER LEVELS RELATIVE TO TOC
DEPTH TO WATER 9.75

NORTHING 10139.23
EASTING 11850.27

BORING NO. TB-05
G.S. ELEV. 1049.58
CASING ELEV. 1051.81
START DATE 2/17/97
FINISH DATE 2/18/97

DEPTH	RQD (%)	REC. (FT)	CORE RUN NUMBERS	MATERIAL DESCRIPTION	DEPTH
				14.8-15.0 MUDSTONE, grey, soft.	
				15.0-15.7 LIMESTONE, grey, medium hard.	
				15.7-15.8 SHALE, grey, fissile, moderately weathered.	
	80	4.0	Run #4	15.8-19.0 LIMESTONE, grey, hard, irregular stains, vertical fractures at 15.8-16.2, 16.4-16.9, 17.0-17.15, and 17.7-18.9.	
				19.0-19.4 LIMESTONE, grey, broken, hard.	
				19.4-20.0 SHALE, grey, fissile, moderately weathered.	
20				20.0-20.8 LIMESTONE, grey, hard, irregular vertical fracture from 20.3 to 20.7.	20
	74	10.0	Run #5	20.8-25 MUDSTONE, clayey, grey, soft-med. hard, unlaminated.	
25				25-25.3 LIMESTONE, grey, iron stained at 25.1, joint fracture at 25.15 and 25.3 feet, hard.	25
				25.3-25.9 CLAY/SHALE, grey, clayey, soft, fissile.	
				25.9-29.0 SANDSTONE, grey to very dark grey, fine, blocky, hard, thinly laminated.	
	85	10.0	Run #6	29-40 SHALE, grey, hard, fissile, no fractures or stains.	
30					30

PIEZOMETER



NOTES:

1. Depths and Elevations in feet unless otherwise noted

Sheet 2 of 3

ICF KAISER ENGINEERS

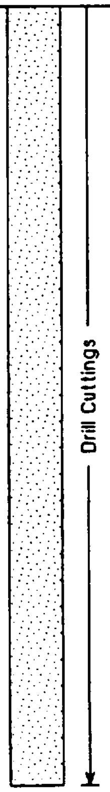
BORING LOG

PROJECT NAME Molycorp
PROJECT LOCATION Washington, PA. facility
DRILLING FIRM Geo Environmental
DRILLING METHOD Auger/3" Rock Core/6" Hammer
LOGGED BY George Werkman

WATER LEVELS RELATIVE TO TOC
DEPTH TO WATER 9.75

NORTHING 10139.23
EASTING 11850.27

BORING NO. TB-05
G.S. ELEV. 1049.58
CASING ELEV. 1051.81
START DATE 2/17/97
FINISH DATE 2/18/97

DEPTH		RQD (%)	REC. (FT)		CORE RUN NUMBERS	MATERIAL DESCRIPTION		PIEZOMETER	DEPTH
		85	10.0		Run #6				
35									35
40						Total Depth, 40.0 feet. 3" core extended to total depth while the 6" reaming went to only 35 feet. Interval between 18 feet to TD filled with drill cuttings.			40
45									45

NOTES:

1. Depths and Elevations in feet unless otherwise noted

Sheet 3 of 3

APPENDIX F

PACKER TEST

APPENDIX F

RESULTS OF THE WATER PRESSURE PERMEABILITY TEST
MOLYCORP
WASHINGTON, PENNSYLVANIA

		L	R	Hg	Hg	Hf	Hp	H			Q	K
Borehole Number	Packer Depth Interval (feet-bgs)[1]	Packer Test Length Interval (feet)	Radius of Borehole (feet)	Depth to Water (feet-bgs)	Head of Water Due to Gravity (feet)[2]	Friction Head Loss (feet)[3]	Pressure Gauge Reading (PSI)[4]	Hg + Hp - Hf (feet)[5]	Duration of Test (minutes)	Volume of Water Used (gallons)	Avg. Flow Rate (gallons/ minute)	Hydraulic Conductivity (ft/day)
TB-01	19.5-24.5	5.58	.25	61.5	22.29*	1.8	5	32.04	6	19.1	3.18	9.99E-07
		5.58	.25	61.5	22.29*	7.8	10	37.59	5	26	5.20	1.39E-06
		5.58	.25	61.5	22.29*	18.0	15	38.94	5	41.1	8.22	2.12E-06
		5.58	.25	61.5	22.29*	10.2	10	35.19	5	35.6	7.12	2.03E-06
		5.58	.25	61.5	22.29*	10.5	7	27.96	5	36	7.20	2.59E-06
	40-45	5.58	.25	61.5	42.79*	.05	10	65.84	5	0	<0.1	<1.53E-08
		5.58	.25	61.5	42.79*	.05	15	77.39	5	0	<0.1	<1.30E-08
		5.58	.25	61.5	42.79*	.05	15	77.39	5	0	<0.1	<1.30E-08
		5.58	.25	61.5	42.79*	.05	30	112.04	5	0	<0.1	<8.97E-09
	62-67	5.58	.25	61.5	61.5	.05	10	84.55	5	0	<0.1	<1.19E-08
		5.58	.25	61.5	61.5	.11	20	107.59	5	.6	.12	1.12E-08
		5.58	.25	61.5	61.5	7.86	30	122.94	11	51.5	4.68	3.83E-07
		5.58	.25	61.5	61.5	16.4	40	137.50	5	35.90	7.18	5.25E-07
		5.58	.25	61.5	61.5	10.5	40	143.40	7	40.0	5.71	4.01E-07
		5.58	.25	61.5	61.5	3.1	20	104.60	4	10.0	2.50	2.40E-07
	72-77	5.58	.25	61.5	61.5	.05	10	84.55	5	0	<0.1	<1.19E-08
		5.58	.25	61.5	61.5	.05	20	107.65	5	0	<0.1	<9.34E-09
		5.58	.25	61.5	61.5	.05	30	130.75	5	.15	<0.1	<7.69E-09

APPENDIX F (Continued)

RESULTS OF THE WATER PRESSURE PERMEABILITY TEST
MOLYCORP
WASHINGTON, PENNSYLVANIA

		L	R	Hg	Hg	Hf	Hp	H			Q	K
Borehole Number	Packer Depth Interval (feet-bgs)[1]	Packer Test Length Interval (feet)	Radius of Borehole (feet)	Depth to Water (feet-bgs)	Head of Water Due to Gravity (feet)[2]	Friction Head Loss (feet)[3]	Pressure Gauge Reading (PSI)[4]	Hg + Hp - Hf (feet)[5]	Duration of Test (minutes)	Volume of Water Used (gallons)	Avg. Flow Rate (gallons/ minute)	Hydraulic Conductivity (ft/day)
TB-01	90-119	5.58	.25	61.5	61.5	.05	30	130.75	5	0	<0.1	<7.69E-09
(cont'd)		5.58	.25	61.5	61.5	.05	20	107.65	5	0	<0.1	<9.34E-09
TB-02	22-27	5.58	.25	14.2	14.2	.42	10	36.88	5	2.90	.58	1.58E-07
		5.58	.25	14.2	14.2	.7	15	48.15	5	5.10	1.02	2.13E-07
		5.58	.25	14.2	14.2	1.2	20	59.20	5	7.40	1.48	2.51E-07
		5.58	.25	14.2	14.2	.95	15	47.90	9	11.20	1.24	2.61E-07
		5.58	.25	14.2	14.2	.5	10	36.80	5	3.60	.72	1.97E-07
	27-32	5.58	.25	14.2	14.2	.05	10	37.25	5	0	<0.1	<2.70E-08
		5.58	.25	14.2	14.2	.05	15	48.8	5	0	<0.1	<2.06E-08
		5.58	.25	14.2	14.2	.05	20	60.35	5	0	<0.1	<1.67E-08
		5.58	.25	14.2	14.2	.05	15	48.8	5	0	<0.1	<2.06E-08
		5.58	.25	14.2	14.2	.05	10	37.25	5	0	<0.1	<2.70E-08
	35-40	5.58	.25	14.2	14.2	.05	35	95	5	0	<0.1	<1.06E-08
		5.58	.25	14.2	14.2	.05	40	106.55	5	0	<0.1	<9.44E-09
		5.58	.25	14.2	14.2	.05	45	118.10	5	.7	.14	1.19E-08
		5.58	.25	14.2	14.2	.05	40	106.55	5	.1	<0.1	<9.44E-09
		5.58	.25	14.2	14.2	.05	35	95.0	5	.2	<0.1	<1.06E-08
TB-03	35-40	5.58	.25	34.5	34.5	37.4	10	20.20	5	57.8	11.56	5.75E-06

APPENDIX F (Continued)

RESULTS OF THE WATER PRESSURE PERMEABILITY TEST
MOLYCORP
WASHINGTON, PENNSYLVANIA

		L	R	Hg	Hg	Hf	Hp	H			Q	K
Borehole Number	Packer Depth Interval (feet-bgs)[1]	Packer Test Length Interval (feet)	Radius of Borehole (feet)	Depth to Water (feet-bgs)	Head of Water Due to Gravity (feet)[2]	Friction Head Loss (feet)[3]	Pressure Gauge Reading (PSI)[4]	Hg + Hp - Hf (feet)[5]	Duration of Test (minutes)	Volume of Water Used (gallons)	Avg. Flow Rate (gallons/ minute)	Hydraulic Conductivity (ft/day)
TB-03 (cont'd)		5.58	.25	34.5	34.5	44.8	15	24.35	5	64.1	12.82	5.29E-06
		5.58	.25	34.5	34.5	30.0	5	16.05	5	51.5	10.82	6.78E-06
		5.58	.25	34.5	34.5	39.1	10	18.50	5	59.3	11.86	6.44E-06
		5.58	.25	34.5	34.5	30.0	5	16.05	5	51.5	10.30	6.45E-06
	42-49.8	5.58	.25	34.5	34.5	2.95	10	54.65	5	13.5	2.70	3.87E-07
		5.58	.25	34.5	34.5	2.60	15	66.55	5	13.0	2.60	3.06E-07
		5.58	.25	34.5	34.5	4.0	20	76.70	5	16.8	3.36	3.43E-07
		5.58	.25	34.5	34.5	3.36	15	65.79	5	14.8	2.96	3.52E-07
		5.58	.25	34.5	34.5	2.80	10	54.80	6	15.45	2.58	3.68E-07
TB-04	8-13	5.58	.25	7.75	9.75**	3.60	10	29.25	6	22.7	3.78	1.30E-06
		5.58	.25	7.75	9.75**	7.45	15	36.95	5	30.6	6.12	1.66E-06
		5.58	.25	7.75	9.75**	8.4	20	47.55	5	39.8	7.96	1.68E-06
		5.58	.25	7.75	9.75**	7.3	15	37.10	5	34.9	6.98	1.89E-06
		5.58	.25	7.75	9.75**	5.0	10	27.85	5	23.2	4.64	1.67E-06
	13-18	5.58	.25	7.75	9.75**	.05	10	32.80	5	0	<0.1	<3.06E-08
		5.58	.25	7.75	9.75**	.05	15	44.35	5	0	<0.1	<2.27E-08
		5.58	.25	7.75	9.75**	.05	20	55.90	5	0	<0.1	<1.80E-08
		5.58	.25	7.75	9.75**	.05	15	44.35	5	0	<0.1	<2.27E-08

APPENDIX F (Continued)

RESULTS OF THE WATER PRESSURE PERMEABILITY TEST
MOLYCORP
WASHINGTON, PENNSYLVANIA

		L	R	Hg	Hg	Hf	Hp	H			Q	K
Borehole Number	Packer Depth Interval (feet-bgs)[1]	Packer Test Length Interval (feet)	Radius of Borehole (feet)	Depth to Water (feet-bgs)	Head of Water Due to Gravity (feet)[2]	Friction Head Loss (feet)[3]	Pressure Gauge Reading (PSI)[4]	Hg + Hp - Hf (feet)[5]	Duration of Test (minutes)	Volume of Water Used (gallons)	Avg. Flow Rate (gallons/ minute)	Hydraulic Conductivity (ft/day)
TB-04		5.58	.25	7.75	9.75**	.05	10	32.80	5	0	<0.1	<3.06E-08
(cont'd)	24-29	5.58	.25	7.75	9.75**	.05	10	32.80	5	0	<0.1	<3.06E-08
		5.58	.25	7.75	9.75**	.05	15	44.35	5	0	<0.1	<2.27E-08
		5.58	.25	7.75	9.75**	.05	20	55.90	5	0	<0.1	<1.80E-08
		5.58	.25	7.75	9.75**	.05	15	44.35	5	0	<0.1	<2.27E-08
		5.58	.25	7.75	9.75**	.05	10	32.80	5	0	<0.1	<3.06E-08
	30-35	5.58	.25	7.75	9.75**	.05	10	32.80	5	0	<0.1	<3.06E-08
		5.58	.25	7.75	9.75**	.05	15	44.35	5	0	<0.1	<2.27E-08
		5.58	.25	7.75	9.75**	.05	20	55.90	5	0	<0.1	<1.80E-08
		5.58	.25	7.75	9.75**	.05	15	44.35	5	0	<0.1	<2.27E-08
		5.58	.25	7.75	9.75**	.05	10	32.80	5	0	<0.1	<3.06E-08
TB-05	9-14	5.58	.25	4.00	6.0**	22.1	10	7.00	5	48.2	9.64	1.38E-05
		5.58	.25	4.00	6.0**	18.5	15	22.15	5	44.8	8.96	4.07E-06
		5.58	.25	4.00	6.0**	22.78	20	29.42	5	48.9	9.78	3.34E-06
		5.58	.25	4.00	6.0**	14.2	15	26.45	5	40.6	8.12	3.09E-06
		5.58	.25	4.00	6.0**	8.8	10	20.30	5	33.0	6.60	3.27E-06
	14-19	5.58	.25	4.00	6.0**	.05	10	29.05	5	0	<0.1	<3.46E-08
		5.58	.25	4.00	6.0**	.05	15	40.60	5	0	<0.1	<2.48E-08

APPENDIX F (Continued)

RESULTS OF THE WATER PRESSURE PERMEABILITY TEST
MOLYCORP
WASHINGTON, PENNSYLVANIA

		L	R	Hg	Hg	Hf	Hp	H			Q	K
Borehole Number	Packer Depth Interval (feet-bgs)[1]	Packer Test Length Interval (feet)	Radius of Borehole (feet)	Depth to Water (feet-bgs)	Head of Water Due to Gravity (feet)[2]	Friction Head Loss (feet)[3]	Pressure Gauge Reading (PSI)[4]	Hg + Hp - Hf (feet)[5]	Duration of Test (minutes)	Volume of Water Used (gallons)	Avg. Flow Rate (gallons/ minute)	Hydraulic Conductivity (ft/day)
TB-05		5.58	.25	4.00	6.0**	4.89	20	47.31	5	23.1	4.62	9.82E-07
(cont'd)		5.58	.25	4.00	6.0**	4.20	15	36.45	5	21.3	4.26	1.18E-06
		5.58	.25	4.00	6.0**	2.41	10	26.69	5	14.1	2.82	1.06E-06
	24-29	5.58	.25	4.00	6.0**	.05	10	29.05	5	0	<0.1	<3.46E-08
		5.58	.25	4.00	6.0**	.05	15	40.60	5	0	<0.1	<2.48E-08
		5.58	.25	4.00	6.0**	.05	20	52.15	5	0	<0.1	<1.93E-08
		5.58	.25	4.00	6.0**	.05	15	40.60	5	0	<0.1	<2.48E-08
		5.58	.25	4.00	6.0**	.05	10	29.05	5	0	<0.1	<3.46E-08

Conversion Values 1 foot = 30.48 centimeters
1 PSI[4]= 2.307 feet of water
1 GPM[6]= 63.09 cubic centimeters per second

L = length of test interval
Q = constant rate of flow into test interval
H = differential head of water at test interval

R = radius of borehole
ln = natural logarithm
K = hydraulic conductivity

Notes:
[1] Feet-bgs = feet below ground surface
[2] Hg = distance from groundwater level to pressure gauge for test interval below water table.
[3] Feet = friction head loss for each incremental flow rate.
[4] PSI = pounds per square inch.
[5] Equivalent head of water above static water level in feet.
[6] GPM = gallons per minute
* Distance from the midpoint of isolated test interval to the elevation of the pressure gauge for test interval above water table.
** Distance from the pressure gauge to depth to water. Pressure gauge was two feet above ground surface.

Packer Test Permeability Calculation Check

Equations

$k = (Q/2\pi LH)\ln(L/r)$ (1)

$H = H_g + H_p - H_f$ (2)

Definitions

k = Permeability (cm/s)
Q = Constant rate of flow into test interval (gpm)
L = Length of test interval (cm)
H = Differential head of water (feet)
r = Radius of borehole (cm)
H_g = Head of water due to gravity (feet)
H_p = Head of water at pressure gauge (feet)
H_f = Head of water due to friction (feet)

ln = Natural log

Conversion factors

1 gpm = 63.09 cm³/s
1 foot = 30.48 cm
1 psi = 70.31 cm = 2.31 feet

1 cm/s = 0.001367017 ft/day

Constants

For all intervals except TB-03 @ 42-49.5

L = 67 in = 170.18 cm
r = 1.5 in = 3.81 cm

$$(1/2\pi L)\ln(L/r) = \frac{\ln(170.18\ \text{cm}/3.81\ \text{cm})}{2\pi(170.18\ \text{cm})} \cdot \frac{63.09\ \text{cm}^3/\text{s}}{1\ \text{gpm}} \cdot \frac{1\ \text{foot}}{30.48\ \text{cm}}$$

= 0.0073545 cm-ft/gpm-s

Equation (1)

$$\text{cm/s}] = \frac{Q\,[\text{gpm}]}{H\,[\text{ft}]} \cdot 0.0073545\ \frac{\text{cm ft}}{\text{gpm s}}$$

For TB-03 @ 42-49.6 interval

L = 93.6 in = 237.74 cm
r = 1.5 in = 3.81 cm

$$(1/2\pi L)\ln(L/r) = \frac{\ln(237.74\ \text{cm}/3.81\ \text{cm})}{2\pi(237.74\ \text{cm})} \cdot \frac{63.09\ \text{cm}^3/\text{s}}{1\ \text{gpm}} \cdot \frac{1\ \text{foot}}{30.48\ \text{cm}}$$

= 0.0057277 cm-ft/gpm-s

$$k\,[\text{cm/s}] = \frac{Q\,[\text{gpm}]}{H\,[\text{ft}]} \cdot 0.0057277\ \frac{\text{cm ft}}{\text{gpm s}}$$

Packer Test Permeability Calculation Check

Boring Number: *TB-01* **Interval:** *19.5-24.5* *feet*

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
5	0	225		3.18
	1	228.2	3.2	
	2	231.4	3.2	
	3	234.4	3	
	4	237.5	3.1	
	5	240.9	3.4	
	6	244.1	3.2	

Calculations

H_g = 19.5 ft + (5.58 ft / 2) = 22.29 ft
H_p = 5 psi (2.31 ft/psi) = 11.55 ft
H_f = 1.8 ft

H = 22.29 ft + 11.55 ft - 1.8 ft = 32.04 ft
k = 3.18 gpm * 0.0073545 cm-ft/gpm-s / 32.04 ft = 0.0007307 cm/s
= 7.31E-04 cm/s = 9.99E-07 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
10	0	252		5.20
	1	257.2	5.2	
	2	262.4	5.2	
	3	267.6	5.2	
	4	272.8	5.2	
	5	278	5.2	

Calculations

H_g = 19.5 ft + (5.58 ft / 2) = 22.29 ft
H_p = 10 psi (2.31 ft/psi) = 23.1 ft
H_f = 7.8 ft

H = 22.29 ft + 23.1 ft - 7.8 ft = 37.59 ft
k = 5.20 gpm * 0.0073545 cm-ft/gpm-s / 37.59 ft = 0.0010173 cm/s
= 1.02E-03 cm/s = 1.39072E-06 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
15	0	428.3		8.22
	1	436.6	8.3	
	2	444.8	8.2	
	3	452.7	7.9	
	4	461	8.3	
	5	469.4	8.4	

Calculations

H_g = 19.5 ft + (5.58 ft / 2) = 22.29 ft
H_p = 15 psi (2.31 ft/psi) = 34.65 ft
H_f = 18.0 ft

H = 22.29 ft + 34.65 ft - 18 ft = 38.94 ft
k = 8.22 gpm * 0.0073545 cm-ft/gpm-s / 38.94 ft = 0.0015524 cm/s
= 1.55E-03 cm/s = 2.12219E-06 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
10	0	477.2		7.12
	1	484.4	7.2	
	2	491.5	7.1	
	3	498.6	7.1	
	4	505.65	7.05	
	5	512.8	7.15	

Calculations

H_g = 19.5 ft + (5.58 ft / 2) = 22.29 ft
H_p = 10 psi (2.31 ft/psi) = 23.1 ft
H_f = 10.2 ft

H = 22.29 ft + 23.1 ft - 10.2 ft = 35.19 ft
k = 7.12 gpm * 0.0073545 cm-ft/gpm-s / 35.19 ft = 0.0014880 cm/s
= 1.49E-03 cm/s = 2.03407E-06 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
7	0	525		7.20
	1	532.5	7.5	
	2	539.8	7.3	
	3	546.9	7.1	
	4	553.8	6.9	
	5	561	7.2	

Calculations

H_g = 19.5 ft + (5.58 ft / 2) = 22.29 ft
H_p = 7 psi (2.31 ft/psi) = 16.17 ft
H_f = 10.5 ft

H = 22.29 ft + 16.17 ft - 10.5 ft = 27.96 ft
k = 7.20 gpm * 0.0073545 cm-ft/gpm-s / 27.96 ft = 0.0018937 cm/s
= 1.89E-03 cm/s = 2.58878E-06 ft/day

Packer Test Permeability Calculation Check

Boring Number: *TB-01* **Interval:** *40-45* *feet*

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
10	0	214.6		<0.1
	1	214.6	0	
	2	214.6	0	
	3	214.6	0	
	4	214.6	0	
	5	214.6	0	

Calculations

H_g = 40 ft + (5.58 ft / 2) = 42.79 ft
H_p = 10 psi (2.31 ft/psi) = 23.1 ft
H_f = 0.05 ft

H = 42.79 ft + 23.1 ft - 0.05 ft = 65.84 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 65.84 ft = 0.0000112 cm/s
= < 1.12E-05 cm/s = < 1.52695E-08 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
15	0	214.8		<0.1
	1	214.85	0.05	
	2	214.9	0.05	
	3	214.9	0	
	4	214.9	0	
	5	214.9	0	

Calculations

H_g = 40 ft + (5.58 ft / 2) = 42.79 ft
H_p = 15 psi (2.31 ft/psi) = 34.65 ft
H_f = 0.05 ft

H = 42.79 ft + 34.65 ft - 0.05 ft = 77.39 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 77.39 ft = 0.0000095 cm/s
= < 9.50E-06 cm/s = < 1.29907E-08 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
15	0	215		<0.1
	1	215	0	
	2	215	0	
	3	215	0	
	4	215	0	
	5	215	0	

Calculations

H_g = 40 ft + (5.58 ft / 2) = 42.79 ft
H_p = 15 psi (2.31 ft/psi) = 34.65 ft
H_f = 0.05 ft

H = 42.79 ft + 34.65 ft - 0.05 ft = 77.39 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 77.39 ft = 0.0000095 cm/s
= < 9.50E-06 cm/s = < 1.29907E-08 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
30	0	215.2		<0.1
	1	215.2	0	
	2	215.2	0	
	3	215.2	0	
	4	215.2	0	
	5	215.2	0	

Calculations

H_g = 40 ft + (5.58 ft / 2) = 42.79 ft
H_p = 30 psi (2.31 ft/psi) = 69.3 ft
H_f = 0.05 ft

H = 42.79 ft + 69.3 ft - 0.05 ft = 112.04 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 112.04 ft = 0.0000066 cm/s
= < 6.56E-06 cm/s = < 8.97319E-09 ft/day

Packer Test Permeability Calculation Check

Boring Number: *TB-01* **Interval:** *62-67* *feet*

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
10	0	10.1		<0.1
	1	10.1	0	
	2	10.1	0	
	3	10.1	0	
	4	10.1	0	
	5	10.1	0	

Calculations

H_s = 61.50 ft (depth to water)
H_p = 10 psi (2.31 ft/psi) = 23.1 ft
H_f = 0.05 ft

H = 61.50 ft + 23.1 ft - 0.05 ft = 84.55 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 84.55 ft = 0.0000087 cm/s
= < 8.70E-06 cm/s = < 1.18908E-08 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
20	0	10.4		0.12
	1	10.6	0.2	
	2	10.7	0.1	
	3	10.8	0.1	
	4	10.9	0.1	
	5	11	0.1	

Calculations

H_s = 61.50 ft (depth to water)
H_p = 20 psi (2.31 ft/psi) = 46.2 ft
H_f = 0.11 ft

H = 61.50 ft + 46.2 ft - 0.11 ft = 107.59 ft
k = 0.12 gpm * 0.0073545 cm-ft/gpm-s / 107.59 ft = 0.0000082 cm/s
= 8.20E-06 cm/s = 1.12134E-08 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
30	0	26		4.68
	1	31	5	
	3	40.2	4.6	
	4	45	4.8	
	5	49.5	4.5	
	6	54	4.5	
	7	58.5	4.5	
	8	63.6	5.1	
	11	77.5	4.6	

Calculations

H_s = 61.50 ft (depth to water)
H_p = 30 psi (2.31 ft/psi) = 69.3 ft
H_f = 7.86 ft

H = 61.50 ft + 69.3 ft - 7.86 ft = 122.94 ft
k = 4.68 gpm * 0.0073545 cm-ft/gpm-s / 122.94 ft = 0.0002801 cm/s
= 2.80E-04 cm/s = 3.82867E-07 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
40	0	100		7.18
	1	107.2	7.2	
	2	114.5	7.3	
	3	121.6	7.1	
	4	128.7	7.1	
	5	135.9	7.2	

Calculations

H_s = 61.50 ft (depth to water)
H_p = 40 psi (2.31 ft/psi) = 92.4 ft
H_f = 16.4 ft

H = 61.50 ft + 92.4 ft - 16.4 ft = 137.50 ft
k = 7.18 gpm * 0.0073545 cm-ft/gpm-s / 137.50 ft = 0.0003840 cm/s
= 3.84E-04 cm/s = 5.24987E-07 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
40	0	150		5.71
	1	155.5	5.5	
	2	161.5	6	
	4	171.2	4.85	
	5	178.5	7.3	
	6	184.3	5.8	
	7	190	5.7	

Calculations

H_s = 61.50 ft (depth to water)
H_p = 40 psi (2.31 ft/psi) = 92.4 ft
H_f = 10.5 ft

H = 61.50 ft + 92.4 ft - 10.5 ft = 143.40 ft
k = 5.71 gpm * 0.0073545 cm-ft/gpm-s / 143.40 ft = 0.0002931 cm/s
= 2.93E-04 cm/s = 4.00626E-07 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
20	0	196		2.50
	1	198.5	2.5	
	2	201	2.5	
	3	203.5	2.5	
	4	206	2.5	

Calculations

H_s = 61.50 ft (depth to water)
H_p = 20 psi (2.31 ft/psi) = 46.2 ft
H_f = 3.1 ft

H = 61.50 ft + 46.2 ft - 3.1 ft = 104.60 ft
k = 2.50 gpm * 0.0073545 cm-ft/gpm-s / 104.60 ft = 0.0001758 cm/s
= 1.76E-04 cm/s = 2.40289E-07 ft/day

Packer Test Permeability Calculation Check

Boring Number: *TB-01* **Interval:** *72-77* *feet*

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
10	0	5.7		<0.1
	1	5.7	0	
	2	5.7	0	
	3	5.7	0	
	5	5.7	0	

Calculations

H_g = 61.50 ft (depth to water)
H_p = 10 psi (2.31 ft/psi) = 23.1 ft
H_f = 0.05 ft

H = 61.50 ft + 23.1 ft - 0.05 ft = 84.55 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 84.55 ft = 0.0000087 cm/s
= < 8.70E-06 cm/s = < 1.18908E-08 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
20	0	6		<0.1
	1	6	0	
	2	6	0	
	3	6	0	
	4	6	0	
	5	6	0	

Calculations

H_g = 61.50 ft (depth to water)
H_p = 20 psi (2.31 ft/psi) = 46.2 ft
H_f = 0.05 ft

H = 61.50 ft + 46.2 ft - 0.05 ft = 107.65 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 107.65 ft = 0.0000068 cm/s
= < 6.83E-06 cm/s = < 9.33926E-09 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
30	0	6.2		<0.1
	1	6.2	0	
	2	6.25	0.05	
	3	6.3	0.05	
	4	6.32	0.02	
	5	6.35	0.03	

Calculations

H_g = 61.50 ft (depth to water)
H_p = 30 psi (2.31 ft/psi) = 69.3 ft
H_f = 0.05 ft

H = 61.50 ft + 69.3 ft - 0.05 ft = 130.75 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 130.75 ft = 0.0000056 cm/s
= < 5.62E-06 cm/s = < 7.68926E-09 ft/day

Boring Number: *TB-01* **Interval:** *90-119* *feet*

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
30	0	391.5		<0.1
	1	391.5	0	
	2	391.5	0	
	3	391.5	0	
	4	391.5	0	
	5	391.5	0	

Calculations

H_g = 61.50 ft (depth to water)
H_p = 30 psi (2.31 ft/psi) = 69.3 ft
H_f = 0.05 ft

H = 61.50 ft + 69.3 ft - 0.05 ft = 130.75 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 130.75 ft = 0.0000056 cm/s
= < 5.62E-06 cm/s = < 7.68926E-09 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
20	0	391.5		<0.1
	1	391.5	0	
	2	391.5	0	
	3	391.5	0	
	4	391.5	0	
	5	391.5	0	

Calculations

H_g = 61.50 ft (depth to water)
H_p = 20 psi (2.31 ft/psi) = 46.2 ft
H_f = 0.05 ft

H = 61.50 ft + 46.2 ft - 0.05 ft = 107.65 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 107.65 ft = 0.0000068 cm/s
= < 6.83E-06 cm/s = < 9.33926E-09 ft/day

Packer Test Permeability Calculation Check

Boring Number: *TB-02* **Interval:** *22-27* *feet*

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
10	0	1217.5		0.58
	1	1218.1	0.6	
	2	1218.6	0.5	
	3	1219.2	0.6	
	4	1219.8	0.6	
	5	1220.4	0.6	

Calculations

H_g = 14.20 ft (depth to water)
H_p = 10 psi (2.31 ft/psi) = 23.1 ft
H_f = 0.42 ft

H = 14.20 ft + 23.1 ft - 0.42 ft = 36.88 ft
k = 0.58 gpm * 0.0073545 cm-ft/gpm-s / 36.88 ft = 0.0001157 cm/s
= 1.16E-04 cm/s = 1.58112E-07 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
15	0	1221.3		1.02
	1	1222.3	1	
	2	1223.3	1	
	3	1224.3	1	
	4	1225.35	1.05	
	5	1226.4	1.05	

Calculations

H_g = 14.20 ft (depth to water)
H_p = 15 psi (2.31 ft/psi) = 34.65 ft
H_f = 0.7 ft

H = 14.20 ft + 34.65 ft - 0.7 ft = 48.15 ft
k = 1.02 gpm * 0.0073545 cm-ft/gpm-s / 48.15 ft = 0.0001558 cm/s
= 1.56E-04 cm/s = 2.12976E-07 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
20	0	1227.5		1.48
	1	1229	1.5	
	2	1230.5	1.5	
	3	1231.9	1.4	
	4	1233.4	1.5	
	5	1234.9	1.5	

Calculations

H_g = 14.20 ft (depth to water)
H_p = 20 psi (2.31 ft/psi) = 46.2 ft
H_f = 1.2 ft

H = 14.20 ft + 46.2 ft - 1.2 ft = 59.20 ft
k = 1.48 gpm * 0.0073545 cm-ft/gpm-s / 59.20 ft = 0.0001839 cm/s
= 1.84E-04 cm/s = 2.51343E-07 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
15	0	1236.1		1.24
	1	1237.5	1.4	
	2	1238.7	1.2	
	3.5	1240.6	1.3	
	4	1241.2	1.2	
	5	1242.6	1.4	
	6	1243.7	1.1	
	7	1244.9	1.2	
	8	1246.1	1.2	
	9	1247.3	1.2	

Calculations

H_g = 14.20 ft (depth to water)
H_p = 15 psi (2.31 ft/psi) = 34.65 ft
H_f = 0.95 ft

H = 14.20 ft + 34.65 ft - 0.95 ft = 47.90 ft
k = 1.24 gpm * 0.0073545 cm-ft/gpm-s / 47.90 ft = 0.0001911 cm/s
= 1.91E-04 cm/s = 2.61196E-07 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
10	0	1248.5		0.72
	1	1249.2	0.7	
	2	1250	0.8	
	3	1250.7	0.7	
	4	1251.4	0.7	
	5	1252.1	0.7	

Calculations

H_g = 14.20 ft (depth to water)
H_p = 10 psi (2.31 ft/psi) = 23.1 ft
H_f = 0.5 ft

H = 14.20 ft + 23.1 ft - 0.5 ft = 36.80 ft
k = 0.72 gpm * 0.0073545 cm-ft/gpm-s / 36.80 ft = 0.0001439 cm/s
= 1.44E-04 cm/s = 1.96703E-07 ft/day

Packer Test Permeability Calculation Check

Boring Number: *TB-02* **Interval:** *27-32* *feet*

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
10	0	1207.1		<0.1
	1	1207.1	0	
	2	1207.1	0	
	3	1207.1	0	
	4	1207.1	0	
	5	1207.1	0	

Calculations

H_g = 14.20 ft (depth to water)
H_p = 10 psi (2.31 ft/psi) = 23.1 ft
H_f = 0.05 ft

H = 14.20 ft + 23.1 ft - 0.05 ft = 37.25 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 37.25 ft = 0.0000197 cm/s
= < 1.97E-05 cm/s = < 2.69898E-08 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
15	0	1207.1		<0.1
	1	1207.1	0	
	2	1207.1	0	
	3	1207.1	0	
	4	1207.1	0	
	5	1207.1	0	

Calculations

H_g = 14.20 ft (depth to water)
H_p = 15 psi (2.31 ft/psi) = 34.65 ft
H_f = 0.05 ft

H = 14.20 ft + 34.65 ft - 0.05 ft = 48.80 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 48.80 ft = 0.0000151 cm/s
= < 1.51E-05 cm/s = < 2.06019E-08 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
20	0	1207.1		<0.1
	1	1207.1	0	
	2	1207.1	0	
	3	1207.1	0	
	4	1207.1	0	
	5	1207.1	0	

Calculations

H_g = 14.20 ft (depth to water)
H_p = 20 psi (2.31 ft/psi) = 46.2 ft
H_f = 0.05 ft

H = 14.20 ft + 46.2 ft - 0.05 ft = 60.35 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 60.35 ft = 0.0000122 cm/s
= < 1.22E-05 cm/s = < 1.6659E-08 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
15	0	1207.1		<0.1
	1	1207.1	0	
	2	1207.1	0	
	3	1207.1	0	
	4	1207.1	0	
	5	1207.1	0	

Calculations

H_g = 14.20 ft (depth to water)
H_p = 15 psi (2.31 ft/psi) = 34.65 ft
H_f = 0.05 ft

H = 14.20 ft + 34.65 ft - 0.05 ft = 48.80 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 48.80 ft = 0.0000151 cm/s
= < 1.51E-05 cm/s = < 2.06019E-08 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
10	0	1207.1		<0.1
	1	1207.1	0	
	2	1207.1	0	
	3	1207.1	0	
	4	1207.1	0	
	5	1207.1	0	

Calculations

H_g = 14.20 ft (depth to water)
H_p = 10 psi (2.31 ft/psi) = 23.1 ft
H_f = 0.05 ft

H = 14.20 ft + 23.1 ft - 0.05 ft = 37.25 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 37.25 ft = 0.0000197 cm/s
= < 1.97E-05 cm/s = < 2.69898E-08 ft/day

Packer Test Permeability Calculation Check

Boring Number: *TB-02* **Interval:** *35-40* *feet*

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
35	0	211.5		<0.1
	1	211.5	0	
	2	211.5	0	
	3	211.5	0	
	4	211.5	0	
	5	211.5	0	

Calculations

H_g = 14.20 ft (depth to water)
H_p = 35 psi (2.31 ft/psi) = 80.85 ft
H_f = 0.05 ft

H = 14.20 ft + 80.85 ft - 0.05 ft = 95.00 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 95.00 ft = 0.0000077 cm/s
= < 7.74E-06 cm/s = < 1.05829E-08 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
40	0	211.5		<0.1
	1	211.5	0	
	2	211.5	0	
	3	211.5	0	
	4	211.5	0	
	5	211.5	0	

Calculations

H_g = 14.20 ft (depth to water)
H_p = 40 psi (2.31 ft/psi) = 92.4 ft
H_f = 0.05 ft

H = 14.20 ft + 92.4 ft - 0.05 ft = 106.55 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 106.55 ft = 0.0000069 cm/s
= < 6.90E-06 cm/s = < 9.43567E-09 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
45	0	211.5		0.14
	1	211.5	0	
	2	211.9	0.4	
	3	212	0.1	
	4	212.1	0.1	
	5	212.2	0.1	

Calculations

H_g = 14.20 ft (depth to water)
H_p = 45 psi (2.31 ft/psi) = 103.95 ft
H_f = 0.05 ft

H = 14.20 ft + 103.95 ft - 0.05 ft = 118.10 ft
k = 0.14 gpm * 0.0073545 cm-ft/gpm-s / 118.10 ft = 0.0000087 cm/s
= 8.72E-06 cm/s = 1.1918E-08 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
40	0	212.2		<0.1
	1	212.2	0	
	2	212.2	0	
	3	212.2	0	
	4	212.3	0.1	
	5	212.3	0	

Calculations

H_g = 14.20 ft (depth to water)
H_p = 40 psi (2.31 ft/psi) = 92.4 ft
H_f = 0.05 ft

H = 14.20 ft + 92.4 ft - 0.05 ft = 106.55 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 106.55 ft = 0.0000069 cm/s
= < 6.90E-06 cm/s = < 9.43567E-09 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
35	0	212.3		<0.1
	1	212.4	0.1	
	2	212.4	0	
	3	212.4	0	
	4	212.5	0.1	
	5	212.5	0	

Calculations

H_g = 14.20 ft (depth to water)
H_p = 35 psi (2.31 ft/psi) = 80.85 ft
H_f = 0.05 ft

H = 14.20 ft + 80.85 ft - 0.05 ft = 95.00 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 95.00 ft = 0.0000077 cm/s
= < 7.74E-06 cm/s = < 1.05829E-08 ft/day

Packer Test Permeability Calculation Check

Boring Number: *TB-03* **Interval:** *35-40* *feet*

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
10	0	365		11.56
	1	376.7	11.7	
	2	388	11.3	
	3	399.9	11.9	
	4	411.4	11.5	
	5	422.8	11.4	

Calculations

H_s = 34.50 ft (depth to water)
H_p = 10 psi (2.31 ft/psi) = 23.1 ft
H_f = 37.4 ft

H = 34.50 ft + 23.1 ft - 37.4 ft = 20.20 ft
k = 11.56 gpm * 0.0073545 cm-ft/gpm-s / 20.20 ft = 0.0042088 cm/s
= 4.21E-03 cm/s = 5.75351E-06 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
15	0	459		12.82
	1	472	13	
	2	484.5	12.5	
	3	497.3	12.8	
	4	510	12.7	
	5	523.1	13.1	

Calculations

H_s = 34.50 ft (depth to water)
H_p = 15 psi (2.31 ft/psi) = 34.65 ft
H_f = 44.8 ft

H = 34.50 ft + 34.65 ft - 44.8 ft = 24.35 ft
k = 12.82 gpm * 0.0073545 cm-ft/gpm-s / 24.35 ft = 0.0038721 cm/s
= 3.87E-03 cm/s = 5.29317E-06 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
5	0	528		10.82
	1	539.5	11.5	
	2	548.8	9.3	
	3	559	10.2	
	4	569.3	10.3	
	5	579.5	10.2	

Calculations

H_s = 34.50 ft (depth to water)
H_p = 5 psi (2.31 ft/psi) = 11.55 ft
H_f = 30 ft

H = 34.50 ft + 11.55 ft - 30 ft = 16.05 ft
k = 10.82 gpm * 0.0073545 cm-ft/gpm-s / 16.05 ft = 0.0049580 cm/s
= 4.96E-03 cm/s = 6.77764E-06 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
10	0	583		11.86
	1	585	2	
	2	607.6	22.6	
	3	618.5	10.9	
	4	630	11.5	
	5	642.3	12.3	

Calculations

H_s = 34.50 ft (depth to water)
H_p = 10 psi (2.31 ft/psi) = 23.1 ft
H_f = 39.1 ft

H = 34.50 ft + 23.1 ft - 39.1 ft = 18.50 ft
k = 11.86 gpm * 0.0073545 cm-ft/gpm-s / 18.50 ft = 0.0047148 cm/s
= 4.71E-03 cm/s = 6.44524E-06 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
5	0	646		10.30
	1	656.6	10.6	
	2	666.8	10.2	
	3	677	10.2	
	4	687.3	10.3	
	5	697.5	10.2	

Calculations

H_s = 34.50 ft (depth to water)
H_p = 5 psi (2.31 ft/psi) = 11.55 ft
H_f = 30 ft

H = 34.50 ft + 11.55 ft - 30 ft = 16.05 ft
k = 10.30 gpm * 0.0073545 cm-ft/gpm-s / 16.05 ft = 0.0047197 cm/s
= 4.72E-03 cm/s = 6.45191E-06 ft/day

Packer Test Permeability Calculation Check

Boring Number: *TB-03* **Interval:** *42-49.8* *feet*

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
10	0	268		2.70
	1	270.8	2.8	
	2	273.5	2.7	
	3	276.3	2.8	
	4	279	2.7	
	5	281.5	2.5	

Calculations

H_g = 34.50 ft (depth to water)
H_p = 10 psi (2.31 ft/psi) = 23.1 ft
H_f = 2.95 ft

H = 34.50 ft + 23.1 ft - 2.95 ft = 54.65 ft
k = 2.70 gpm * 0.0057277 cm-ft/gpm-s / 54.65 ft = 0.0002830 cm/s
= 2.83E-04 cm/s = 3.86837E-07 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
15	0	283		2.60
	1	286	3	
	2	288.4	2.4	
	3	291	2.6	
	4	293.5	2.5	
	5	296	2.5	

Calculations

H_g = 34.50 ft (depth to water)
H_p = 15 psi (2.31 ft/psi) = 34.65 ft
H_f = 2.6 ft

H = 34.50 ft + 34.65 ft - 2.6 ft = 66.55 ft
k = 2.60 gpm * 0.0057277 cm-ft/gpm-s / 66.55 ft = 0.0002238 cm/s
= 2.24E-04 cm/s = 3.059E-07 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
20	0	303.2		3.36
	1	306.8	3.6	
	2	310	3.2	
	3	313.4	3.4	
	4	316.7	3.3	
	5	320	3.3	

Calculations

H_g = 34.50 ft (depth to water)
H_p = 20 psi (2.31 ft/psi) = 46.2 ft
H_f = 4 ft

H = 34.50 ft + 46.2 ft - 4 ft = 76.70 ft
k = 3.36 gpm * 0.0057277 cm-ft/gpm-s / 76.70 ft = 0.0002509 cm/s
= 2.51E-04 cm/s = 3.43004E-07 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
15	0	322		2.96
	1	325	3	
	2	327.9	2.9	
	3	330.9	3	
	4	333.8	2.9	
	5	336.8	3	

Calculations

H_g = 34.50 ft (depth to water)
H_p = 15 psi (2.31 ft/psi) = 34.65 ft
H_f = 3.36 ft

H = 34.50 ft + 34.65 ft - 3.36 ft = 65.79 ft
k = 2.96 gpm * 0.0057277 cm-ft/gpm-s / 65.79 ft = 0.0002577 cm/s
= 2.58E-04 cm/s = 3.52279E-07 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
10	0	338		2.58
	1	340.7	2.7	
	2	343.2	2.5	
	3	345.9	2.7	
	4	348.4	2.5	
	5	350.9	2.5	
	6	353.45	2.55	

Calculations

H_g = 34.50 ft (depth to water)
H_p = 10 psi (2.31 ft/psi) = 23.1 ft
H_f = 2.8 ft

H = 34.50 ft + 23.1 ft - 2.8 ft = 54.80 ft
k = 2.58 gpm * 0.0057277 cm-ft/gpm-s / 54.80 ft = 0.0002691 cm/s
= 2.69E-04 cm/s = 3.67918E-07 ft/day

Packer Test Permeability Calculation Check

Boring Number: *TB-04* **Interval:** *8-13* *feet*

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
10	0	2371.3		3.78
	1	2376.1	4.8	
	2	2380.8	4.7	
	3	2385.2	4.4	
	4	2386.8	1.6	
	5	2389.1	2.3	
	6	2394	4.9	

Calculations

H_g = 9.75 ft*

H_p = 10 psi (2.31 ft/psi) = 23.1 ft

H_f = 3.6 ft

H = 9.75 ft + 23.1 ft - 3.6 ft = 29.25 ft

k = 3.78 gpm * 0.0073545 cm-ft/gpm-s / 29.25 ft = 0.0009513 cm/s

= 9.51E-04 cm/s = 1.30039E-06 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
15	0	2426.2		6.12
	1	2432.6	6.4	
	2	2438.9	6.3	
	3	2445	6.1	
	4	2451	6	
	5	2456.8	5.8	

Calculations

H_g = 9.75 ft*

H_p = 15 psi (2.31 ft/psi) = 34.65 ft

H_f = 7.45 ft

H = 9.75 ft + 34.65 ft - 7.45 ft = 36.95 ft

k = 6.12 gpm * 0.0073545 cm-ft/gpm-s / 36.95 ft = 0.0012181 cm/s

= 1.22E-03 cm/s = 1.66519E-06 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
20	0	2484.2		7.96
	1	2492.4	8.2	
	2	2500.3	7.9	
	3	2508.3	8	
	4	2516.3	8	
	5	2524	7.7	

Calculations

H_g = 9.75 ft*

H_p = 20 psi (2.31 ft/psi) = 46.2 ft

H_f = 8.4 ft

H = 9.75 ft + 46.2 ft - 8.4 ft = 47.55 ft

k = 7.96 gpm * 0.0073545 cm-ft/gpm-s / 47.55 ft = 0.0012312 cm/s

= 1.23E-03 cm/s = 1.68302E-06 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
15	0	2547		6.98
	1	2554.2	7.2	
	2	2561.2	7	
	3	2568.1	7	
	4	2575	6.9	
	5	2581.9	6.9	

Calculations

H_g = 9.75 ft*

H_p = 15 psi (2.31 ft/psi) = 34.65 ft

H_f = 7.3 ft

H = 9.75 ft + 34.65 ft - 7.3 ft = 37.10 ft

k = 6.98 gpm * 0.0073545 cm-ft/gpm-s / 37.10 ft = 0.0013837 cm/s

= 1.38E-03 cm/s = 1.89151E-06 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
10	0	2587		4.64
	1	2591.7	4.7	
	2	2596.3	4.6	
	3	2600.8	4.5	
	4	2605.2	4.4	
	5	2610.2	5	

Calculations

H_g = 9.75 ft*

H_p = 10 psi (2.31 ft/psi) = 23.1 ft

H_f = 5 ft

H = 9.75 ft + 23.1 ft - 5 ft = 27.85 ft

k = 4.64 gpm * 0.0073545 cm-ft/gpm-s / 27.85 ft = 0.0012253 cm/s

= 1.23E-03 cm/s = 1.67502E-06 ft/day

Note

* = 7.75 ft (depth to water from ground surface)

2.00 ft (height to gauge above ground surface)

Packer Test Permeability Calculation Check

Boring Number: *TB-04* **Interval:** *13-18* *feet*

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
10	0	2170.4		<0.1
	1	2170.4	0	
	2	2170.4	0	
	3	2170.4	0	
	4	2170.4	0	
	5	2170.4	0	

Calculations

H_g = 9.75 ft*
H_p = 10 psi (2.31 ft/psi) = 23.1 ft
H_f = 0.05 ft

H = 9.75 ft + 23.1 ft - 0.05 ft = 32.80 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 32.80 ft = 0.0000224 cm/s
= < 2.24E-05 cm/s = < 3.06516E-08 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
15	0	2170.4		<0.1
	1	2170.4	0	
	2	2170.4	0	
	3	2170.4	0	
	4	2170.4	0	
	5	2170.4	0	

Calculations

H_g = 9.75 ft*
H_p = 15 psi (2.31 ft/psi) = 34.65 ft
H_f = 0.05 ft

H = 9.75 ft + 34.65 ft - 0.05 ft = 44.35 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 44.35 ft = 0.0000166 cm/s
= < 1.66E-05 cm/s = 2.2669E-08 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
20	0	2170.4		<0.1
	1	2170.4	0	
	2	2170.4	0	
	3	2170.4	0	
	4	2170.4	0	
	5	2170.4	0	

Calculations

H_g = 9.75 ft*
H_p = 20 psi (2.31 ft/psi) = 46.2 ft
H_f = 0.05 ft

H = 9.75 ft + 46.2 ft - 0.05 ft = 55.90 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 55.90 ft = 0.0000132 cm/s
= < 1.32E-05 cm/s = < 1.79852E-08 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
15	0	2170.4		0.1
	1	2170.4	0	
	2	2170.4	0	
	3	2170.4	0	
	4	2170.4	0	
	5	2170.4	0	

Calculations

H_g = 9.75 ft*
H_p = 15 psi (2.31 ft/psi) = 34.65 ft
H_f = 0.05 ft

H = 9.75 ft + 34.65 ft - 0.05 ft = 44.35 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 44.35 ft = 0.0000166 cm/s
= 1.66E-05 cm/s = 2.2669E-08 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
10	0	2170.4		<0.1
	1	2170.4	0	
	2	2170.4	0	
	3	2170.4	0	
	4	2170.4	0	
	5	2170.4	0	

Calculations

H_g = 9.75 ft*
H_p = 10 psi (2.31 ft/psi) = 23.1 ft
H_f = 0.05 ft

H = 9.75 ft + 23.1 ft - 0.05 ft = 32.80 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 32.80 ft = 0.0000224 cm/s
= < 2.24E-05 cm/s = < 3.06516E-08 ft/day

Note
* = 7.75 ft (depth to water from ground surface)
2.00 ft (height to gauge above ground surface)

Packer Test Permeability Calculation Check

Boring Number: *TB-04* **Interval:** *24-29* *feet*

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
10	0	704.1		<0.1
	1	704.1	0	
	2	704.1	0	
	3	704.1	0	
	4	704.1	0	
	5	704.1	0	

Calculations

H_g = 9.75 ft*
H_p = 10 psi (2.31 ft/psi) = 23.1 ft
H_f = 0.05 ft

H = 9.75 ft + 23.1 ft - 0.05 ft = 32.80 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 32.80 ft = 0.0000224 cm/s
= < 2.24E-05 cm/s = < 3.06516E-08 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
15	0	703.9		<0.1
	1	703.9	0	
	2	703.9	0	
	3	703.9	0	
	4	703.9	0	
	5	703.9	0	

Calculations

H_g = 9.75 ft*
H_p = 15 psi (2.31 ft/psi) = 34.65 ft
H_f = 0.05 ft

H = 9.75 ft + 34.65 ft - 0.05 ft = 44.35 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 44.35 ft = 0.0000166 cm/s
= < 1.66E-05 cm/s = < 2.2669E-08 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
20	0	703.9		<0.1
	1	703.9	0	
	2	703.9	0	
	3	703.9	0	
	4	703.9	0	
	5	703.9	0	

Calculations

H_g = 9.75 ft*
H_p = 20 psi (2.31 ft/psi) = 46.2 ft
H_f = 0.05 ft

H = 9.75 ft + 46.2 ft - 0.05 ft = 55.90 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 55.90 ft = 0.0000132 cm/s
= < 1.32E-05 cm/s = < 1.79852E-08 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
15	0	703.9		<0.1
	1	703.9	0	
	2	703.9	0	
	3	703.9	0	
	4	703.9	0	
	5	703.9	0	

Calculations

H_g = 9.75 ft*
H_p = 15 psi (2.31 ft/psi) = 34.65 ft
H_f = 0.05 ft

H = 9.75 ft + 34.65 ft - 0.05 ft = 44.35 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 44.35 ft = 0.0000166 cm/s
= < 1.66E-05 cm/s = < 2.2669E-08 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
10	0	703.9		<0.1
	1	703.9	0	
	2	703.9	0	
	3	703.9	0	
	4	703.9	0	
	5	703.9	0	

Calculations

H_g = 9.75 ft*
H_p = 10 psi (2.31 ft/psi) = 23.1 ft
H_f = 0.05 ft

H = 9.75 ft + 23.1 ft - 0.05 ft = 32.80 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 32.80 ft = 0.0000224 cm/s
= < 2.24E-05 cm/s = < 3.06516E-08 ft/day

Note
* = 7.75 ft (depth to water from ground surface)
2.00 ft (height to gauge above ground surface)

Packer Test Permeability Calculation Check

Boring Number: *TB-04* **Interval:** *30-35* *feet*

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
10	0	703.3		<0.1
	1	703.3	0	
	2	703.3	0	
	3	703.3	0	
	4	703.3	0	
	5	703.3	0	

Calculations

H_g = 9.75 ft*
H_p = 10 psi (2.31 ft/psi) = 23.1 ft
H_f = 0.05 ft

H = 9.75 ft + 23.1 ft - 0.05 ft = 32.80 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 32.80 ft = 0.0000224 cm/s
= < 2.24E-05 cm/s = < 3.06516E-08 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
15	0	703.3		<0.1
	1	703.3	0	
	2	703.3	0	
	3	703.3	0	
	4	703.3	0	
	5	703.3	0	

Calculations

H_g = 9.75 ft*
H_p = 15 psi (2.31 ft/psi) = 34.65 ft
H_f = 0.05 ft

H = 9.75 ft + 34.65 ft - 0.05 ft = 44.35 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 44.35 ft = 0.0000166 cm/s
= < 1.66E-05 cm/s = < 2.2669E-08 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
20	0	703.3		<0.1
	1	703.3	0	
	2	703.3	0	
	3	703.3	0	
	4	703.3	0	
	5	703.3	0	

Calculations

H_g = 9.75 ft*
H_p = 20 psi (2.31 ft/psi) = 46.2 ft
H_f = 0.05 ft

H = 9.75 ft + 46.2 ft - 0.05 ft = 55.90 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 55.90 ft = 0.0000132 cm/s
= < 1.32E-05 cm/s = < 1.79852E-08 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
15	0	703.4		<0.1
	1	703.4	0	
	2	703.4	0	
	3	703.4	0	
	4	703.4	0	
	5	703.4	0	

Calculations

H_g = 9.75 ft*
H_p = 15 psi (2.31 ft/psi) = 34.65 ft
H_f = 0.05 ft

H = 9.75 ft + 34.65 ft - 0.05 ft = 44.35 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 44.35 ft = 0.0000166 cm/s
= < 1.66E-05 cm/s = < 2.2669E-08 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
10	0	703.4		<0.1
	1	703.4	0	
	2	703.4	0	
	3	703.4	0	
	4	703.4	0	
	5	703.4	0	

Calculations

H_g = 9.75 ft*
H_p = 10 psi (2.31 ft/psi) = 23.1 ft
H_f = 0.05 ft

H = 9.75 ft + 23.1 ft - 0.05 ft = 32.80 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 32.80 ft = 0.0000224 cm/s
= < 2.24E-05 cm/s = < 3.06516E-08 ft/day

Note
* = 7.75 ft (depth to water from ground surface)
2.00 ft (height to gauge above ground surface)

Packer Test Permeability Calculation Check

Boring Number: *TB-05* **Interval:** *9-14* *feet*

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
10	0	2755		9.64
	1	2764.6	9.6	
	2	2774.4	9.8	
	3	2784	9.6	
	4	2793.6	9.6	
	5	2803.2	9.6	

Calculations

H_g = 6.00 ft**
H_p = 10 psi (2.31 ft/psi) = 23.1 ft
H_f = 22.1 ft

H = 6.00 ft + 23.1 ft - 22.1 ft = 7.00 ft
k = 9.64 gpm * 0.0073545 cm-ft/gpm-s / 7.00 ft = 0.0101282 cm/s
= 1.01E-02 cm/s = 1.38454E-05 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
15	0	2903.5		8.96
	1	2912.5	9	
	2	2921.4	8.9	
	3	2930.3	8.9	
	4	2939.2	8.9	
	5	2948.3	9.1	

Calculations

H_g = 6.00 ft**
H_p = 15 psi (2.31 ft/psi) = 34.65 ft
H_f = 18.5 ft

H = 6.00 ft + 34.65 ft - 18.5 ft = 22.15 ft
k = 8.96 gpm * 0.0073545 cm-ft/gpm-s / 22.15 ft = 0.0029750 cm/s
= 2.97E-03 cm/s = 4.00687E-06 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
20	0	2957.9		9.78
	1	2967.8	9.9	
	2	2977.4	9.6	
	3	2987.1	9.7	
	4	2996.9	9.8	
	5	3006.8	9.9	

Calculations

H_g = 6.00 ft**
H_p = 20 psi (2.31 ft/psi) = 46.2 ft
H_f = 22.78 ft

H = 6.00 ft + 46.2 ft - 22.78 ft = 29.42 ft
k = 9.78 gpm * 0.0073545 cm-ft/gpm-s / 29.42 ft = 0.0024448 cm/s
= 2.44E-03 cm/s = 3.34212E-06 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
15	0	3015.3		8.12
	1	3023.5	8.2	
	2	3031.7	8.2	
	3	3039.8	8	
	4	3047.8	8	
	5	3055.9	8.1	

Calculations

H_g = 6.00 ft**
H_p = 15 psi (2.31 ft/psi) = 34.65 ft
H_f = 14.2 ft

H = 6.00 ft + 34.65 ft - 14.2 ft = 26.45 ft
k = 8.12 gpm * 0.0073545 cm-ft/gpm-s / 26.45 ft = 0.0022578 cm/s
= 2.26E-03 cm/s = 3.08643E-06 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
10	0	3062.8		6.60
	1	3069.5	6.7	
	2	3076.2	6.7	
	3	3082.6	6.4	
	4	3089.1	6.5	
	5	3095.8	6.7	

Calculations

H_g = 6.00 ft**
H_p = 10 psi (2.31 ft/psi) = 23.1 ft
H_f = 8.8 ft

H = 6.00 ft + 23.1 ft - 8.8 ft = 20.30 ft
k = 6.60 gpm * 0.0073545 cm-ft/gpm-s / 20.30 ft = 0.0023911 cm/s
= 2.39E-03 cm/s = 3.26869E-06 ft/day

Note
** = 4.00 ft (depth to water from ground surface)
2.00 ft (height to gauge above ground surface)

Packer Test Permeability Calculation Check

Boring Number: *TB-05* **Interval:** *14-19* *feet*

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
10	0	2634.2		<0.1
	1	2634.2	0	
	2	2634.2	0	
	3	2634.2	0	
	4	2634.2	0	
	5	2634.2	0	

Calculations

H_g = 6.00 ft**
H_p = 10 psi (2.31 ft/psi) = 23.1 ft
H_f = 0.05 ft

H = 6.00 ft + 23.1 ft - 0.05 ft = 29.05 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 29.05 ft = 0.0000253 cm/s
= < 2.53E-05 cm/s = < 3.46083E-08 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
15	0	2634.2		<0.1
	1	2634.2	0	
	2	2634.2	0	
	3	2634.2	0	
	4	2634.2	0	
	5	2634.2	0	

Calculations

H_g = 6.00 ft**
H_p = 15 psi (2.31 ft/psi) = 34.65 ft
H_f = 0.05 ft

H = 6.00 ft + 34.65 ft - 0.05 ft = 40.60 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 40.60 ft = 0.0000181 cm/s
= < 1.81E-05 cm/s = < 2.47628E-08 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
20	0	2638.4		4.62
	1	2642.8	4.4	
	2	2647.3	4.5	
	3	2652	4.7	
	4	2656.6	4.6	
	5	2661.5	4.9	

Calculations

H_g = 6.00 ft**
H_p = 20 psi (2.31 ft/psi) = 46.2 ft
H_f = 4.89 ft

H = 6.00 ft + 46.2 ft - 4.89 ft = 47.31 ft
k = 4.62 gpm * 0.0073545 cm-ft/gpm-s / 47.31 ft = 0.0007182 cm/s
= 7.18E-04 cm/s = 9.81783E-07 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
15	0	2673.7		4.26
	1	2677.8	4.1	
	2	2682	4.2	
	3	2686.3	4	
	4	2690.6	4.3	
	5	2695	4.4	

Calculations

H_g = 6.00 ft**
H_p = 15 psi (2.31 ft/psi) = 34.65 ft
H_f = 4.2 ft

H = 6.00 ft + 34.65 ft - 4.2 ft = 36.45 ft
k = 4.26 gpm * 0.0073545 cm-ft/gpm-s / 36.45 ft = 0.0008595 cm/s
= 8.60E-04 cm/s = 1.175E-06 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
10	0	2698		2.82
	1	2700.8	2.8	
	2	2703.5	2.7	
	3	2706.3	2.8	
	4	2709.1	2.8	
	5	2712.1	3	

Calculations

H_g = 6.00 ft**
H_p = 10 psi (2.31 ft/psi) = 23.1 ft
H_f = 2.41 ft

H = 6.00 ft + 23.1 ft - 2.41 ft = 26.69 ft
k = 2.82 gpm * 0.0073545 cm-ft/gpm-s / 26.69 ft = 0.0007771 cm/s
= 7.77E-04 cm/s = 1.06225E-06 ft/day

Note
** = 4.00 ft (depth to water from ground surface)
2.00 ft (height to gauge above ground surface)

Packer Test Permeability Calculation Check

Boring Number: *TB-05* **Interval:** *24-29* *feet*

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
10	0	2632.5		<0.1
	1	2632.5	0	
	2	2632.5	0	
	3	2632.5	0	
	4	2632.5	0	
	5	2632.5	0	

Calculations

H_g = 6.00 ft**
H_p = 10 psi (2.31 ft/psi) = 23.1 ft
H_f = 0.05 ft

H = 6.00 ft + 23.1 ft - 0.05 ft = 29.05 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 29.05 ft = 0.0000253 cm/s
= < 2.53E-05 cm/s = < 3.46083E-08 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
15	0	2632.5		<0.1
	1	2632.5	0	
	2	2632.5	0	
	3	2632.5	0	
	4	2632.5	0	
	5	2632.5	0	

Calculations

H_g = 6.00 ft**
H_p = 15 psi (2.31 ft/psi) = 34.65 ft
H_f = 0.05 ft

H = 6.00 ft + 34.65 ft - 0.05 ft = 40.60 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 40.60 ft = 0.0000181 cm/s
= < 1.81E-05 cm/s = < 2.47628E-08 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
20	0	2632.5		<0.1
	1	2632.5	0	
	2	2632.5	0	
	3	2632.5	0	
	4	2632.5	0	
	5	2632.5	0	

Calculations

H_g = 6.00 ft**
H_p = 20 psi (2.31 ft/psi) = 46.2 ft
H_f = 0.05 ft

H = 6.00 ft + 46.2 ft - 0.05 ft = 52.15 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 52.15 ft = 0.0000141 cm/s
= < 1.41E-05 cm/s = < 1.92784E-08 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
15	0	2632.5		<0.1
	1	2632.5	0	
	2	2632.5	0	
	3	2632.5	0	
	4	2632.5	0	
	5	2632.5	0	

Calculations

H_g = 6.00 ft**
H_p = 15 psi (2.31 ft/psi) = 34.65 ft
H_f = 0.05 ft

H = 6.00 ft + 34.65 ft - 0.05 ft = 40.60 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 40.60 ft = 0.0000181 cm/s
= < 1.81E-05 cm/s = < 2.47628E-08 ft/day

Gage Pressure (psi)	Time (min)	Meter Reading (gallons)	Water Loss (gpm)	Average Water Loss (gpm)
15	0	2632.5		<0.1
	1	2632.5	0	
	2	2632.5	0	
	3	2632.5	0	
	4	2632.5	0	
	5	2632.5	0	

Calculations

H_g = 6.00 ft**
H_p = 10 psi (2.31 ft/psi) = 23.1 ft
H_f = 0.05 ft

H = 6.00 ft + 23.1 ft - 0.05 ft = 29.05 ft
k = 0.10 gpm * 0.0073545 cm-ft/gpm-s / 29.05 ft = 0.0000253 cm/s
= < 2.53E-05 cm/s = < 3.46083E-08 ft/day

Note
** = 4.00 ft (depth to water from ground surface)
2.00 ft (height to gauge above ground surface)

APPENDIX G

NATIONAL CLIMATIC DATA CENTER DATA

NORMALS, MEANS, AND EXTREMES PITTSBURGH, GRTR. PITT. AIRPORT, PENNSYLVANIA

LATITUDE: 40 30 N LONGITUDE: 80 13 W ELEVATION: FT. GRND 1137 BARO 1213 TIME ZONE: EASTERN WBAN: 94823

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
TEMPERATURE F:														
Normals														
-Daily Maximum		33.7	36.9	49.0	60.3	70.6	78.9	82.6	80.8	74.3	62.5	50.4	38.6	59.9
-Daily Minimum		18.5	20.3	29.8	38.8	48.4	56.9	61.6	60.2	53.5	42.3	34.1	24.4	40.7
-Monthly		26.1	28.7	39.4	49.6	59.5	67.9	72.1	70.5	63.9	52.4	42.3	31.5	50.3
Extremes														
-Record Highest	42	69	69	82	89	91	98	103	100	97	87	82	74	103
-Year		1985	1954	1986	1990	1987	1988	1988	1988	1954	1959	1961	1982	JUL 1988
-Record Lowest	42	-22	-12	-1	14	26	34	42	39	31	16	-1	-12	-22
-Year		1994	1979	1980	1982	1970	1972	1963	1982	1959	1965	1958	1989	JAN 1994
NORMAL DEGREE DAYS:														
Heating (base 65 F)		1206	1016	794	462	214	36	6	14	100	400	681	1039	5968
Cooling (base 65 F)		0	0	0	0	44	123	227	184	67	9	0	0	654
% OF POSSIBLE SUNSHINE	42	32	37	43	46	50	56	57	55	55	51	36	29	46
MEAN SKY COVER(tenths)														
Sunrise - Sunset	42	8.1	7.8	7.5	7.2	6.9	6.5	6.4	6.3	6.2	6.3	7.7	8.2	7.1
MEAN NUMBER OF DAYS:														
Sunrise to Sunset														
-Clear	42	2.9	3.2	4.3	4.5	5.3	4.9	5.3	6.4	7.2	7.8	3.8	2.7	58.5
-Partly Cloudy	42	6.0	6.1	6.8	8.3	9.0	11.9	12.9	11.5	10.3	8.8	6.3	5.6	103.6
-Cloudy	42	22.0	18.9	19.9	17.2	16.6	13.2	12.8	13.0	12.5	14.4	19.9	22.6	203.2
Precipitation														
.01 inches or more	42	16.4	13.9	15.7	13.5	12.6	11.5	10.8	9.7	9.5	10.4	13.0	16.3	153.3
Snow,Ice Pellets,Hail														
1.0 inches or more	42	3.6	2.8	2.4	0.5	0.*	0.0	0.0	0.0	0.0	0.1	0.9	2.5	12.9
Thunderstorms	42	0.2	0.4	1.7	3.3	5.2	6.8	6.9	5.6	3.2	1.2	0.6	0.3	35.4
Heavy Fog Visibility														
1/4 mile or less	42	1.3	1.2	1.0	0.8	1.1	1.1	1.6	2.1	2.3	1.8	1.4	1.8	17.6
Temperature F														
-Maximum														
90 and above	35	0.0	0.0	0.0	0.0	0.3	1.9	3.5	1.9	0.5	0.0	0.0	0.0	8.1
32 and below	35	13.8	10.3	3.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	1.2	9.7	38.6
-Minimum														
32 and below	35	27.0	23.9	19.5	8.1	0.8	0.0	0.0	0.0	0.0	4.1	13.9	24.4	121.7
0 and below	35	2.5	1.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.*	0.8	4.8
AV. STATION PRES.(mb)	22	973.5	973.5	971.8	971.2	971.7	972.3	973.4	974.6	975.0	975.2	974.4	974.2	973.4
RELATIVE HUMIDITY (%)														
Hour 01	34	73	71	70	67	73	78	80	82	82	77	75	75	75
Hour 07 (Local Time)	34	76	75	76	73	76	79	83	86	86	82	78	77	79
Hour 13	34	66	62	58	50	52	52	54	56	57	54	62	67	58
Hour 19	34	67	63	59	52	55	57	60	62	66	62	68	70	62
PRECIPITATION (ins):														
Water Equivalent														
-Normal		2.54	2.39	3.41	3.15	3.59	3.71	3.75	3.21	2.97	2.36	2.85	2.92	36.85

-Maximum Monthly	42	6.25	5.98	6.10	7.61	6.56	10.29	8.71	7.86	6.00	8.20	11.05	8.51	11.05
-Year		1978	1956	1967	1964	1989	1989	1992	1987	1990	1954	1985	1990	NOV 1985
-Minimum Monthly	42	0.77	0.51	1.14	0.48	1.21	0.64	1.62	0.78	0.28	0.16	0.90	0.40	0.16
-Year		1981	1969	1969	1971	1965	1992	1989	1957	1985	1963	1976	1955	OCT 1963
-Maximum in 24 hrs	42	1.69	2.30	2.00	2.15	2.44	2.96	2.97	3.06	2.59	3.56	1.97	2.76	3.56
-Year		1986	1975	1964	1964	1971	1987	1971	1956	1990	1954	1985	1990	OCT 1954
Snow,Ice Pellets,Hail														
-Maximum Monthly	42	40.2	24.2	34.1	8.1	3.1	T	T	T	T	8.5	11.0	21.2	40.2
-Year		1978	1972	1993	1987	1966	1990	1991	1994	1989	1993	1958	1974	JAN 1978
-Maximum in 24 hrs	42	14.0	12.3	23.8	7.7	3.1	T	T	T	T	6.6	10.5	12.5	23.8
-Year		1966	1960	1993	1987	1966	1990	1991	1994	1989	1993	1958	1974	MAR 1993
WIND:														
Mean Speed (mph)	42	10.6	10.5	10.7	10.3	8.9	8.0	7.3	6.9	7.4	8.3	9.9	10.3	9.1
Prevailing Direction through 1963		WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW	WSW
Fastest Obs. 1 Min.														
-Direction (!!)	42	23	26	25	27	23	27	25	29	26	25	29	25	26
-Speed (mph)		52	58	48	46	44	40	51	46	36	35	45	48	58
-Year		1978	1967	1954	1974	1988	1957	1956	1963	1990	1986	1969	1968	FEB 1967
Peak Gust														
-Direction (!!)	11	SW	W	W	W	SW	W	W	W	W	SW	W	NE	W
-Speed (mph)	11	51	59	60	60	61	53	83	56	48	49	62	55	83
-Date		1992	1990	1985	1991	1988	1994	1992	1986	1990	1990	1992	1990	JUL 1992

PITTSBURGH, GRTR. PITT. AIRPORT, PENNSYLVANIA

PRECIPITATION (inches)

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1965	3.84	2.98	3.16	1.79	1.21	2.31	1.82	3.26	4.07	2.82	2.35	0.63	30.24
1966	4.52	3.23	1.88	3.73	2.76	1.72	2.70	5.13	1.92	1.38	3.39	1.70	34.06
1967	1.06	2.54	6.10	4.41	5.21	0.90	4.54	2.67	1.61	2.05	3.07	2.22	36.38
1968	2.83	0.79	4.53	2.33	6.36	2.38	2.36	3.97	3.08	2.13	2.07	3.24	36.07
1969	2.02	0.51	1.14	2.91	1.89	3.74	4.52	2.96	0.91	2.59	2.44	3.95	29.58
1970	1.61	1.92	3.35	3.09	4.36	4.61	3.89	1.55	2.77	4.80	2.64	3.29	37.88
1971	2.29	4.04	3.20	0.48	3.87	1.41	6.82	1.23	3.86	0.84	1.94	3.24	33.22
1972	1.84	3.64	3.68	4.37	1.38	5.08	2.98	1.79	5.42	2.15	4.70	3.04	40.07
1973	2.03	1.80	3.86	4.69	5.87	3.12	2.16	3.40	3.56	4.45	2.65	2.15	39.74
1974	3.47	2.10	3.72	3.26	5.35	5.08	3.30	2.93	4.42	1.12	3.06	4.02	41.83
1975	3.34	4.64	4.62	2.27	1.84	4.58	4.38	7.56	5.06	3.46	1.77	2.90	46.42
1976	3.25	1.74	4.45	1.24	1.99	3.37	4.72	1.25	3.30	3.76	0.90	1.81	31.78
1977	2.06	0.87	4.12	3.26	2.57	2.85	3.38	2.66	3.13	2.44	2.59	3.27	33.20
1978	6.25	0.54	1.65	2.25	4.26	4.11	2.15	3.65	2.64	3.42	1.62	5.24	37.78
1979	4.80	3.12	1.32	3.17	4.49	1.73	4.31	6.84	3.60	2.46	2.43	2.29	40.56
1980	1.56	1.32	5.65	2.94	4.32	4.34	6.76	5.10	1.29	2.42	2.38	1.38	39.46
1981	0.77	4.20	2.12	4.92	2.04	8.20	3.82	0.98	4.13	1.82	1.50	3.00	37.50
1982	4.44	1.93	3.52	1.44	3.98	3.05	2.36	1.97	2.80	0.40	3.33	2.79	32.01
1983	1.19	1.58	3.50	4.33	5.24	4.82	3.32	3.13	2.42	3.67	3.94	4.27	41.41
1984	1.40	2.05	2.32	3.72	5.22	1.98	3.01	5.15	0.84	3.45	3.14	3.04	35.32
1985	1.43	1.45	3.37	1.64	5.80	2.26	4.06	2.64	0.28	2.27	11.05	2.26	38.51
1986	2.49	3.43	1.38	1.94	1.67	5.24	5.66	3.04	2.33	2.83	3.92	3.47	37.40
1987	2.23	0.71	2.65	5.30	2.41	6.30	2.42	7.86	3.97	0.92	2.02	2.41	39.20
1988	1.49	3.46	2.56	1.97	2.78	1.26	2.82	2.04	2.34	1.40	2.80	2.17	27.09
1989	1.99	3.42	5.52	1.43	6.56	10.29	1.62	1.12	4.57	2.04	1.56	2.39	42.51
1990	3.30	3.31	1.47	3.48	6.19	4.24	6.59	3.59	6.00	3.51	2.05	8.51	52.24
1991	2.55	1.88	2.92	2.56	3.29	3.82	3.74	1.63	3.45	0.55	1.97	3.66	32.02
1992	2.13	1.73	3.54	2.30	2.31	0.64	8.71	4.77	2.91	1.47	3.31	2.83	36.65
1993	2.99	2.92	4.14	3.66	2.85	3.35	2.85	2.44	3.87	2.77	4.30	2.12	38.26
1994	3.90	2.13	5.00	3.72	2.54	2.91	3.27	7.75	3.59	0.88	3.64	2.01	41.34
Record Mean	2.85	2.46	3.28	3.08	3.38	3.74	3.99	3.25	2.70	2.44	2.48	2.77	36.43

AVERAGE TEMPERATURE (deg. F)

PITTSBURGH, GRTR. PITT. AIRPORT, PENNSYLVANIA

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
1965	28.2	28.4	35.2	49.0	65.9	66.9	69.9	69.1	64.7	48.1	41.3	37.5	50.4
1966	23.1	30.3	40.9	47.9	56.1	70.4	75.6	71.1	61.3	50.8	42.8	31.4	50.1
1967	32.3	25.6	40.2	52.2	54.3	73.0	71.5	68.8	61.1	52.5	36.8	34.8	50.3
1968	23.4	22.2	40.4	51.2	54.7	66.9	72.4	71.8	64.8	52.2	41.3	27.6	49.1
1969	26.7	29.5	34.3	51.7	60.2	69.3	72.7	69.7	63.0	52.9	39.2	26.7	49.7
1970	20.7	27.7	35.5	52.5	63.9	68.2	71.6	71.6	67.8	54.9	42.2	32.1	50.7
1971	23.7	30.4	34.3	46.0	56.6	71.4	70.2	69.6	68.5	59.5	40.4	38.8	50.8
1972	29.6	26.5	36.4	48.5	61.8	63.8	71.2	70.6	65.3	48.4	39.3	37.2	49.9
1973	29.7	28.8	48.3	49.3	56.4	70.9	73.2	73.2	66.5	56.1	44.1	33.3	52.5
1974	34.0	29.9	41.2	51.8	58.3	65.2	73.1	72.8	62.2	52.4	43.9	32.5	51.4
1975	32.6	32.1	36.3	44.3	63.0	67.8	72.8	73.0	58.8	53.3	46.3	32.9	51.1
1976	23.5	37.2	45.2	50.6	55.6	68.4	67.4	65.3	59.9	45.9	33.1	23.9	48.0
1977	11.4	26.9	43.7	50.8	63.0	63.8	71.8	68.1	64.7	50.5	45.6	31.1	49.3
1978	22.6	20.9	36.9	51.0	60.2	69.4	73.0	71.4	66.2	49.1	43.0	32.7	49.7
1979	21.4	18.0	43.1	49.7	59.1	67.7	70.3	69.6	63.4	50.9	44.7	34.6	49.4
1980	26.9	24.2	35.6	48.1	60.3	66.2	75.0	74.5	67.1	49.5	38.6	28.6	49.5
1981	20.5	31.4	35.6	51.9	58.4	68.8	72.1	69.7	61.9	49.4	40.3	29.4	49.1
1982	20.9	28.4	38.4	45.3	64.7	63.7	72.4	68.2	63.4	54.4	44.7	39.9	50.4
1983	30.0	32.6	40.7	47.1	55.8	67.8	73.0	72.8	64.4	53.0	43.5	25.4	50.5
1984	23.2	36.4	32.2	49.2	55.3	69.7	68.5	70.8	61.4	58.3	40.2	39.3	50.4
1985	22.1	27.7	42.1	55.0	60.6	64.2	70.5	69.6	65.3	55.2	47.1	27.4	50.6
1986	28.3	31.3	41.1	53.1	62.0	68.3	73.3	68.6	66.6	54.2	40.4	33.1	51.7
1987	28.0	32.6	41.9	50.0	63.0	70.9	75.7	71.8	65.1	47.8	46.2	35.1	52.3
1988	26.6	29.0	39.3	49.4	61.4	68.5	76.9	75.1	63.5	46.6	44.2	31.9	51.0
1989	35.5	27.8	41.1	47.0	58.0	69.0	74.1	71.6	64.8	53.3	40.6	19.2	50.2
1990	36.8	36.9	44.0	51.3	57.7	68.3	71.7	70.5	63.7	55.0	45.5	38.0	53.3
1991	29.7	35.4	43.0	54.5	68.7	72.6	75.4	74.4	64.6	55.7	41.6	35.3	54.2
1992	30.5	34.3	38.8	51.3	59.1	66.0	72.4	67.9	63.7	50.1	42.9	33.9	50.9
1993	35.1	27.8	37.6	50.0	61.9	68.9	75.7	75.4	63.3	51.7	43.0	31.7	51.8
1994	21.1	29.5	37.8	53.9	56.7	72.9	74.5	70.0	63.8	53.4	47.7	38.2	51.6
Record													
Mean	29.9	31.1	39.9	51.0	61.7	70.1	74.3	72.5	66.2	54.7	43.1	33.3	52.3
Max	37.5	39.3	49.0	61.1	72.3	80.4	84.3	82.4	76.3	64.4	50.9	40.3	61.5
Min	22.3	22.9	30.8	40.8	51.1	59.8	64.2	62.5	56.1	44.9	35.3	26.3	43.1

SNOWFALL (inches) PITTSBURGH, GRTR. PITT. AIRPORT, PENNSYLVANIA

SEASON	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
1965-66	0.0	0.0	0.0	0.2	0.2	1.8	24.6	6.9	8.5	2.7	3.1	0.0	48.0
1966-67	0.0	0.0	0.0	0.0	5.1	7.8	4.5	21.7	20.0	0.5	0.0	0.0	59.6
1967-68	0.0	0.0	0.0	T	10.1	7.9	15.4	6.1	11.0	T	0.0	0.0	50.5
1968-69	0.0	0.0	0.0	T	2.7	13.3	6.5	4.0	3.9	0.0	T	0.0	30.4
1969-70	0.0	0.0	0.0	0.4	7.9	20.6	12.6	13.0	16.1	0.1	0.0	0.0	70.7
1970-71	0.0	0.0	0.0	T	0.1	10.1	12.1	20.6	16.8	0.2	0.0	0.0	59.9
1971-72	0.0	0.0	0.0	0.0	10.5	0.7	4.9	24.2	9.8	1.8	0.0	0.0	51.9
1972-73	0.0	0.0	0.0	1.8	6.1	2.9	3.4	6.1	4.6	1.4	T	0.0	26.3
1973-74	0.0	0.0	0.0	0.0	0.8	4.8	4.9	2.2	2.3	1.6	T	0.0	16.6
1974-75	0.0	0.0	0.0	T	2.6	21.2	10.1	13.9	9.8	1.1	0.0	0.0	58.7
1975-76	0.0	0.0	0.0	0.0	1.9	3.8	21.8	3.3	4.3	0.5	0.0	0.0	35.6
1976-77	0.0	0.0	0.0	T	6.6	7.9	26.5	6.4	0.9	1.3	T	0.0	49.6
1977-78	0.0	0.0	0.0	T	3.3	9.1	40.2	5.4	4.0	0.2	0.0	0.0	62.2
1978-79	0.0	0.0	0.0	0.0	2.3	3.2	18.2	13.7	2.0	1.4	0.0	0.0	40.8
1979-80	0.0	0.0	0.0	T	1.1	1.1	7.8	6.2	7.9	T	0.0	0.0	24.1
1980-81	0.0	0.0	0.0	T	9.7	6.3	12.5	11.9	7.6	T	0.0	0.0	48.0
1981-82	0.0	0.0	0.0	T	0.6	11.5	13.4	3.6	12.2	3.8	0.0	0.0	45.1
1982-83	0.0	0.0	0.0	T	0.1	8.8	3.9	12.0	4.3	1.0	0.0	0.0	30.1
1983-84	0.0	0.0	0.0	0.0	6.1	10.5	10.8	11.4	10.4	T	0.0	0.0	49.2
1984-85	0.0	0.0	0.0	0.0	1.5	4.8	14.6	8.1	0.2	7.2	0.0	0.0	36.4
1985-86	0.0	0.0	0.0	0.0	T	15.3	11.1	12.4	4.8	2.7	0.0	0.0	46.3
1986-87	0.0	0.0	0.0	0.0	1.0	0.9	11.6	1.1	7.3	8.1	0.0	0.0	30.0
1987-88	0.0	0.0	0.0	T	4.1	7.9	5.5	6.9	9.8	0.9	0.0	0.0	35.1
1988-89	0.0	0.0	0.0	0.2	1.1	4.0	4.2	4.1	7.5	0.6	T	0.0	21.7
1989-90	0.0	0.0	T	0.2	1.6	12.5	7.7	2.5	0.6	3.3	0.0	T	28.4
1990-91	0.0	0.0	0.0	0.0	T	4.6	4.8	3.6	4.2	T	0.0	0.0	17.2
1991-92	T	0.0	0.0	0.0	2.1	3.1	12.9	2.4	10.6	2.8	T	0.0	33.9
1992-93	0.0	0.0	0.0	1.3	1.5	14.1	2.1	18.5	34.1	0.5	0.0	0.0	72.1
1993-94	0.0	0.0	0.0	8.5	2.6	10.4	30.1	11.0	13.6	0.6	0.0	0.0	76.8
1994-95	0.0	T	0.0	0.0	0.2	T							
Record Mean	T	T	T	0.4	3.3	8.1	11.7	9.3	8.8	1.7	0.1	T	43.4

REFERENCE NOTES

GENERAL

T - TRACE AMOUNT.

BLANK ENTRIES DENOTE MISSING/UNREPORTED DATA.

# INDICATES A STATION OR INSTRUMENT RELOCATION. SEE STATION LOCATION TABLE ON PAGE 8.

SPECIFIC

PAGE 2

PM - INCLUDES LAST DAY OF PREVIOUS MONTH

ASOS - AUTOMATED SURFACE OBSERVING SYSTEM IN OPERATION DURING THESE MONTHS.

PAGE 3

(a) - LENGTH OF RECORD IN YEARS, ALTHOUGH INDIVIDUAL MONTHS MAY BE MISSING.

0.* OR * - THE VALUE IS BETWEEN 0.0 AND 0.05

NORMALS - BASED ON THE 1961-1990 RECORD PERIOD.

EXTREMES - DATES ARE THE MOST RECENT OCCURRENCE

WIND DIR.- NUMERALS SHOW TENS OF DEGREES CLOCKWISE FROM TRUE NORTH. "00" INDICATES CALM.

RESULTANT DIRECTIONS ARE GIVEN TO WHOLE DEGREES.

BOLD VALUES INDICATE EXTREME VALUES WHICH OCCURRED AFTER THE ASOS SYSTEM WAS COMMISSIONED.

PAGE 4B

RECORD = PERIOD OF RECORD

RECORD MEAN PRECIPITATION IS THE MEAN OF ALL DAILY PRECIPITATION AMOUNTS DURING THE PERIOD OF RECORD.

RECORD MAX(MIN) TEMPERATURE IS THE MEAN OF ALL DAILY MAX(MIN) TEMPERATURES DURING THE PERIOD OF RECORD.

RECORD MEAN TEMPERATURE IS THE SUM OF THE RECORD MAX AND RECORD MIN DIVIDED BY 2.

AVERAGE TEMPERATURE IS THE SUM OF THE MEAN DAILY MAX AND MIN TEMPERATURE DIVIDED BY 2.

EXCEPTIONS

PAGE 3

1. TEMPERATURE DATA MAY BE SUSPECT NOVEMBER 1977 THROUGH JULY 1978 DUE TO INTERMITTENT INSTRUMENT MALFUNCTION.

PAGES 4A, 4B, 6A

RECORD MEANS ARE THROUGH THE CURRENT YEAR,
BEGINNING IN 1875 FOR TEMPERATURE
1872 FOR PRECIPITATION
1953 FOR SNOWFALL

APPENDIX H

SOUND PRESSURE LEVEL TESTING RESULTS

```
File Name.........BIN3
Test Location.....Moly Corp
Employee Name..... Greg Ulanowski
Employee Number...
Department........
Comment Field 1...10124 / 3371
Comment Field 2... Plant area fence
Numeric Code #1...       #2...       #3...       #4...       #5...

METROSONICS db-308 SN 3371 V3.0
REPORT PRINTED 03/04/97 AT 08:32:10

EXCHANGE RATE.....  3dB      FILTER.....A WGHT
DOSE CRITERION.... 90dB      RESPONSE...SLOW
PRE-TEST CALIBRATION TIME.... 2/27/97 AT  7:53:29
PRE-TEST CALIBRATION RANGE...  39.6dB TO 139.6dB
NO POST-TEST CALIBRATION
Calibrator Type & Serial #...____________________________

Calibrator Calibration Date..____________________________

-- OVERALL STATISTICS REPORT --


TEST BEGAN.... 2/27/97 AT  8:20:31
TEST LENGTH...     0 DAYS  7:59:29
TEST ENDED.... 2/27/97 AT 16:20:01
TEST INTERRUPTIONS...1

Lav.............. 69.8dB
SEL..............114.2dB
Lmax............. 97.6dB ON  2/27/97 AT  8:22:26
Lpk..............129.4dB ON  2/27/97 AT 13:49:11
TIME OVER 115dB..  0 DAYS  0:00:00.00

8 HR DOSE (40dB CUTOFF)........  0.93%
8 HR PROJ. DOSE (40dB CUTOFF)..  0.93%
8 HR DOSE (40dB CUTOFF)........  0.93%
8 HR PROJ. DOSE (40dB CUTOFF)..  0.93%
```

```
-- TABULAR TIME HISTORY REPORT --

# OF PERIODS:  480   MODE:  CONTINUOUS
PERIOD LENGTH:  0:01:00
TIME HISTORY CUTOFF:  40dB
Ln(1): 10.0%  Ln(2): 99.9%

DATE:   2/27/97

INT    TIME          Lav     Lmx     Lpk     L1     L2
  1    8:20:31       80.4    96.6    115.0   76     61
  2    8:21:31       81.1    97.6    112.6   78     65
  3    8:22:31       70.1    78.6    115.2   73     60
  4    8:23:31       67.1    71.5    109.9   69     61
  5    8:24:31       66.0    73.6    113.9   68     60
  6    8:25:31       69.1    74.4    111.9   72     63
  7    8:26:31       66.6    74.0     UNR    70     58
  8    8:27:31       68.2    76.9     UNR    72     61
  9    8:28:31       67.8    72.7    114.2   70     60
 10    8:29:31       70.0    73.9    112.6   72     63
 11    8:30:31       63.7    70.6     UNR    65     58
 12    8:31:31       67.0    70.6    108.4   69     64
 13    8:32:31       67.9    75.3    116.4   70     62
 14    8:33:31       70.4    74.3    113.0   72     61
 15    8:34:31       69.5    73.0    114.4   72     64
 16    8:35:31       66.8    70.7     UNR    68     63
 17    8:36:31       69.7    77.8    115.9   72     60
 18    8:37:31       70.7    79.1    120.3   73     63
 19    8:38:31       66.2    70.6    110.8   69     60
 20    8:39:31       67.6    71.9    109.9   70     60
 21    8:40:31       69.3    72.6    113.9   71     65
 22    8:41:31       67.7    71.2    114.4   70     62
 23    8:42:31       67.4    71.8     UNR    69     62
 24    8:43:31       69.2    72.6    111.9   71     63
 25    8:44:31       66.7    72.5    109.9   68     62
 26    8:45:31       66.4    69.4    118.7   68     62
 27    8:46:31       67.2    72.1    110.4   69     59
 28    8:47:31       68.4    72.7    113.6   70     62
 29    8:48:31       67.0    70.7    110.4   69     61
 30    8:49:31       68.0    73.6    117.4   71     63
 31    8:50:31       70.7    75.0    114.4   72     66
 32    8:51:31       68.4    74.2    115.2   70     61
 33    8:52:31       68.4    71.9    110.8   70     62
 34    8:53:31       65.9    72.6    111.2   68     61
 35    8:54:31       70.3    76.0    117.8   73     62
 36    8:55:31       68.2    70.5    108.4   69     64
 37    8:56:31       68.1    71.7    109.4   70     61
 38    8:57:31       67.8    73.9    113.9   70     60
 39    8:58:31       69.2    73.6    114.2   71     64
 40    8:59:31       66.1    72.9    112.3   68     62
 41    9:00:31       65.9    70.5     UNR    68     60
 42    9:01:31       65.7    70.3    107.9   68     60
 43    9:02:31       65.8    70.7    107.9   67     58
 44    9:03:31       67.3    71.8    108.4   69     63
 45    9:04:31       68.3    75.6    117.0   71     64
 46    9:05:31       66.4    71.3    114.7   69     61
```

47	9:06:31	65.1	69.4	109.0	67	60
48	9:07:31	66.3	69.3	107.9	68	60
49	9:08:31	66.9	73.0	UNR	70	60
50	9:09:31	66.1	73.8	113.3	69	60
51	9:10:31	66.7	70.8	109.9	69	60
52	9:11:31	68.4	73.1	113.3	70	63
53	9:12:31	68.6	72.0	110.4	71	63
54	9:13:31	66.9	73.7	113.6	69	62
55	9:14:31	68.7	75.7	112.3	70	62
56	9:15:31	67.3	74.2	110.4	70	60
57	9:16:31	66.6	72.6	110.8	69	60
58	9:17:31	67.6	71.2	112.6	69	62
59	9:18:31	66.2	71.0	UNR	68	60
60	9:19:31	67.9	72.2	111.6	70	63
61	9:20:31	65.5	69.5	109.9	67	62
62	9:21:31	65.6	69.7	UNR	68	58
63	9:22:31	70.1	78.3	110.8	72	61
64	9:23:31	74.0	87.8	119.6	76	64
65	9:24:31	70.9	78.5	118.3	74	62
66	9:25:31	71.7	74.6	112.3	73	68
67	9:26:31	73.5	80.0	116.8	76	67
68	9:27:31	74.5	87.8	117.0	77	62
69	9:28:31	71.4	79.4	123.0	74	63
70	9:29:31	72.7	84.1	119.8	74	66
71	9:30:31	70.8	77.9	118.3	73	64
72	9:31:31	71.0	75.0	115.7	72	65
73	9:32:31	69.9	78.9	112.6	71	65
74	9:33:31	66.8	75.3	110.8	68	62
75	9:34:31	74.8	82.3	122.3	78	67
76	9:35:31	72.9	78.4	119.8	76	64
77	9:36:31	69.8	76.1	118.5	72	62
78	9:37:31	69.6	72.4	112.3	71	65
79	9:38:31	67.8	71.8	109.9	70	60
80	9:39:31	67.1	72.4	UNR	69	63
81	9:40:31	67.7	72.2	115.2	70	62
82	9:41:31	69.6	77.3	113.9	70	63
83	9:42:31	66.3	70.5	111.2	68	61
84	9:43:31	69.5	74.4	109.0	71	66
85	9:44:31	66.6	72.9	110.4	68	61
86	9:45:31	64.9	70.4	109.0	67	60
87	9:46:31	70.2	79.1	117.8	71	63
88	9:47:31	66.8	71.6	115.0	69	60
89	9:48:31	67.7	72.2	115.5	70	61
90	9:49:31	67.1	72.0	111.6	69	61
91	9:50:31	67.3	75.1	116.8	70	60
92	9:51:31	69.0	73.3	111.6	71	62
93	9:52:31	67.4	71.4	114.2	69	62
94	9:53:31	67.2	75.0	111.2	69	59
95	9:54:31	66.0	73.5	112.3	69	61
96	9:55:31	67.0	73.8	116.4	69	59
97	9:56:31	70.4	77.8	118.3	73	62
98	9:57:31	69.0	77.7	116.4	71	63
99	9:58:31	68.8	71.6	109.9	70	64
100	9:59:31	68.0	80.5	121.7	69	60
101	10:00:31	69.7	76.6	119.9	73	61
102	10:01:31	69.0	73.6	111.9	72	61
103	10:02:31	70.5	80.1	110.8	72	64
104	10:03:31	68.7	71.7	112.6	71	64

105	10:04:31	69.9	77.6	116.6	73	63
106	10:05:31	69.6	71.8	113.6	70	65
107	10:06:31	70.5	80.2	120.1	74	64
108	10:07:31	68.1	73.5	115.5	70	62
109	10:08:31	69.6	75.8	116.8	72	63
110	10:09:31	68.3	74.5	112.6	70	63
111	10:10:31	68.9	75.1	113.9	71	64
112	10:11:31	69.0	73.2	115.9	70	63
113	10:12:31	67.7	72.5	111.9	69	62
114	10:13:31	66.5	73.5	115.5	69	59
115	10:14:31	65.1	68.5	109.4	67	61
116	10:15:31	65.1	69.3	107.9	67	62
117	10:16:31	63.6	68.4	111.9	65	58
118	10:17:31	69.7	79.2	111.6	70	61
119	10:18:31	68.1	73.8	110.4	71	60
120	10:19:31	67.9	71.8	112.3	70	61
121	10:20:31	68.4	76.3	115.0	70	61
122	10:21:31	68.7	73.7	114.7	71	64
123	10:22:31	68.0	73.1	115.2	70	63
124	10:23:31	67.2	71.0	110.8	69	61
125	10:24:31	68.0	72.6	113.9	71	61
126	10:25:31	67.6	71.1	113.3	69	64
127	10:26:31	67.9	71.8	113.9	70	63
128	10:27:31	67.0	71.2	113.3	69	62
129	10:28:31	66.6	70.2	109.9	68	62
130	10:29:31	66.3	71.0	UNR	69	61
131	10:30:31	67.2	70.3	113.0	69	62
132	10:31:31	67.5	72.8	115.5	69	63
133	10:32:31	66.8	71.0	112.6	69	61
134	10:33:31	65.7	69.6	UNR	67	61
135	10:34:31	67.7	75.5	UNR	71	61
136	10:35:31	65.6	71.4	UNR	67	60
137	10:36:31	63.5	68.2	UNR	67	58
138	10:37:31	67.8	71.6	UNR	70	60
139	10:38:31	61.8	66.3	109.0	63	55
140	10:39:31	65.4	70.6	110.4	67	59
141	10:40:31	67.3	72.7	UNR	69	58
142	10:41:31	66.6	72.1	UNR	69	59
143	10:42:31	68.0	70.2	UNR	69	63
144	10:43:31	64.8	69.3	UNR	67	61
145	10:44:31	66.9	71.9	UNR	70	61
146	10:45:31	66.0	72.1	UNR	69	59
147	10:46:31	64.7	69.0	UNR	66	60
148	10:47:31	67.9	73.1	UNR	70	62
149	10:48:31	64.5	70.3	UNR	67	59
150	10:49:31	65.8	71.9	UNR	69	60
151	10:50:31	67.3	70.3	UNR	69	62
152	10:51:31	61.5	66.3	UNR	63	57
153	10:52:31	67.5	70.9	UNR	69	58
154	10:53:31	66.4	73.1	UNR	69	58
155	10:54:31	68.2	71.1	UNR	70	62
156	10:55:31	65.3	70.8	UNR	68	59
157	10:56:31	65.7	70.6	109.0	69	59
158	10:57:31	67.8	71.0	UNR	70	60
159	10:58:31	64.2	69.2	UNR	67	58
160	10:59:31	69.4	77.5	UNR	72	61
161	11:00:31	65.3	69.4	UNR	67	59
162	11:01:31	64.6	69.3	UNR	67	60

163	11:02:31	66.7	70.2	UNR	69	59
164	11:03:31	64.7	69.3	UNR	67	58
165	11:04:31	64.9	70.9	UNR	67	59
166	11:05:31	65.8	70.6	111.6	69	60
167	11:06:31	68.6	74.6	116.4	72	61
168	11:07:31	67.7	72.3	119.6	69	60
169	11:08:31	66.6	68.8	UNR	68	60
170	11:09:31	64.0	67.8	108.4	66	58
171	11:10:31	61.4	65.8	UNR	62	57
172	11:11:31	65.8	70.0	UNR	68	57
173	11:12:31	68.3	72.1	UNR	70	63
174	11:13:31	67.0	72.4	UNR	70	59
175	11:14:31	65.7	69.9	107.9	68	61
176	11:15:31	65.1	68.5	UNR	67	60
177	11:16:31	65.1	70.2	UNR	67	60
178	11:17:31	67.5	70.5	UNR	69	63
179	11:18:31	68.3	71.8	UNR	70	64
180	11:19:31	65.4	69.2	108.4	68	61
181	11:20:31	66.5	71.0	UNR	70	59
182	11:21:31	62.6	66.4	UNR	65	56
183	11:22:31	68.6	71.1	UNR	70	65
184	11:23:31	66.1	74.3	110.4	68	61
185	11:24:31	67.9	74.0	113.6	70	63
186	11:25:31	66.8	72.6	UNR	68	62
187	11:26:31	68.3	75.8	114.7	71	62
188	11:27:31	69.3	76.7	107.9	73	58
189	11:28:31	67.8	73.2	111.2	69	62
190	11:29:31	65.1	70.9	113.3	67	61
191	11:30:31	68.5	75.7	112.6	71	63
192	11:31:31	69.9	75.8	114.7	72	64
193	11:32:31	68.2	74.8	113.6	71	61
194	11:33:31	65.7	69.2	107.9	68	61
195	11:34:31	66.3	70.4	109.4	68	62
196	11:35:31	68.1	74.1	116.8	70	62
197	11:36:31	67.2	71.5	115.0	69	62
198	11:37:31	69.0	77.2	113.9	70	62
199	11:38:31	68.2	74.1	111.6	70	63
200	11:39:31	66.4	73.6	114.7	69	60
201	11:40:31	66.0	72.0	113.9	68	59
202	11:41:31	68.1	71.8	113.0	70	61
203	11:42:31	65.6	70.8	113.6	68	60
204	11:43:31	69.2	78.1	115.7	71	63
205	11:44:31	70.2	80.7	117.6	73	62
206	11:45:31	70.3	73.7	116.2	72	64
207	11:46:31	68.1	76.1	116.2	70	63
208	11:47:31	73.3	82.3	125.3	77	65
209	11:48:31	73.9	81.8	122.3	77	68
210	11:49:31	69.9	78.1	117.2	71	64
211	11:50:31	69.3	78.4	116.8	71	63
212	11:51:31	69.7	78.8	115.5	72	63
213	11:52:31	71.8	80.8	122.1	74	63
214	11:53:31	75.0	80.5	121.5	78	67
215	11:54:31	72.2	80.6	120.6	76	65
216	11:55:31	69.0	76.6	119.2	71	63
217	11:56:31	66.5	71.9	114.2	69	62
218	11:57:31	65.7	69.4	110.8	67	62
219	11:58:31	70.0	77.4	120.3	73	63
220	11:59:31	68.2	72.4	116.6	70	63

221	12:00:31	69.8	79.9	122.1	71	61
222	12:01:31	72.6	83.7	125.5	74	65
223	12:02:31	70.9	78.1	122.6	73	64
224	12:03:31	69.9	75.1	116.6	72	63
225	12:04:31	67.4	73.2	113.9	69	61
226	12:05:31	68.8	75.2	114.7	71	62
227	12:06:31	70.5	79.3	118.0	74	61
228	12:07:31	73.7	80.2	123.5	77	66
229	12:08:31	74.0	83.6	121.5	76	64
230	12:09:31	68.0	76.1	120.9	70	63
231	12:10:31	68.8	77.6	119.9	70	65
232	12:11:31	68.4	77.3	116.4	70	63
233	12:12:31	67.3	72.8	115.2	70	63
234	12:13:31	64.2	70.9	111.6	67	59
235	12:14:31	66.4	72.0	109.9	69	60
236	12:15:31	65.9	68.8	109.0	67	63
237	12:16:31	65.7	69.4	UNR	68	62
238	12:17:31	66.6	72.0	113.3	69	59
239	12:18:31	71.2	78.9	118.0	74	63
240	12:19:31	67.9	75.7	116.2	70	61
241	12:20:31	67.4	72.5	117.2	69	63
242	12:21:31	70.1	79.3	121.2	74	60
243	12:22:31	63.9	68.2	111.9	65	60
244	12:23:31	72.1	80.4	119.2	77	62
245	12:24:31	70.0	80.2	116.2	73	61
246	12:25:31	70.2	81.7	119.3	73	61
247	12:26:31	66.8	71.4	110.8	69	60
248	12:27:31	77.9	86.8	124.4	81	63
249	12:28:31	67.9	77.1	115.0	69	61
250	12:29:31	64.9	69.7	114.4	66	61
251	12:30:31	65.8	72.5	114.2	68	59
252	12:31:31	65.1	69.4	110.8	67	57
253	12:32:31	64.8	68.8	UNR	67	60
254	12:33:31	70.6	76.9	117.2	73	64
255	12:34:31	73.3	78.2	117.2	76	65
256	12:35:31	69.0	77.0	118.3	73	60
257	12:36:31	66.4	71.7	118.1	69	61
258	12:37:31	63.8	67.8	110.8	66	59
259	12:38:31	65.2	68.6	108.4	67	60
260	12:39:31	72.8	80.1	120.3	77	60
261	12:40:31	68.6	74.1	114.7	71	61
262	12:41:31	69.5	77.2	116.8	72	63
263	12:42:31	75.9	84.7	123.6	79	66
264	12:43:31	72.8	82.8	120.7	75	64
265	12:44:31	71.5	80.1	120.1	74	63
266	12:45:31	74.9	84.1	121.0	79	65
267	12:46:31	69.2	77.0	119.0	72	61
268	12:47:31	76.2	85.0	123.1	80	66
269	12:48:31	75.9	83.3	121.5	79	66
270	12:49:31	73.9	82.7	120.3	77	66
271	12:50:31	72.1	79.9	122.0	76	64
272	12:51:31	70.6	81.9	120.6	73	61
273	12:52:31	74.8	86.0	125.3	76	63
274	12:53:31	67.6	78.3	112.3	69	61
275	12:54:31	69.8	75.6	117.2	72	65
276	12:55:31	68.6	79.7	118.3	69	60
277	12:56:31	69.9	79.3	120.5	72	64
278	12:57:31	73.3	84.9	124.4	78	61

279	12:58:31	68.6	78.2	116.2	71	60
280	12:59:31	66.7	71.3	113.0	69	62
281	13:00:31	67.8	74.0	113.3	71	60
282	13:01:31	73.1	80.5	122.9	77	61
283	13:02:31	75.1	89.3	125.9	77	61
284	13:03:31	76.4	86.6	124.3	79	66
285	13:04:31	73.8	82.3	122.4	78	61
286	13:05:31	79.7	89.0	124.6	83	68
287	13:06:31	77.3	87.6	123.7	81	66
288	13:07:31	76.1	83.0	122.6	79	64
289	13:08:31	77.4	90.3	126.4	79	66
290	13:09:31	70.2	77.6	120.6	73	63
291	13:10:31	70.6	77.6	117.4	74	61
292	13:11:31	74.4	84.1	122.5	78	61
293	13:12:31	76.7	85.0	125.7	81	63
294	13:13:31	71.2	79.7	118.1	73	63
295	13:14:31	76.3	85.6	122.7	80	67
296	13:15:31	70.1	76.3	115.5	72	65
297	13:16:31	70.7	79.3	120.9	73	62
298	13:17:31	70.7	80.9	120.9	73	62
299	13:18:31	75.5	84.5	123.2	79	66
300	13:19:31	75.2	84.0	122.1	79	66
301	13:20:31	67.8	71.5	111.9	70	63
302	13:21:31	73.6	83.4	123.8	78	61
303	13:22:31	71.7	79.6	119.6	74	64
304	13:23:31	68.6	74.6	116.2	71	62
305	13:24:31	69.7	81.1	118.8	72	61
306	13:25:31	65.9	69.5	108.4	68	61
307	13:26:31	66.1	70.8	UNR	69	62
308	13:27:31	65.4	72.7	113.6	67	59
309	13:28:31	66.3	71.8	115.9	69	60
310	13:29:31	65.6	71.1	112.3	68	58
311	13:30:31	64.6	68.4	UNR	67	59
312	13:31:31	66.8	71.1	UNR	69	60
313	13:32:31	72.2	85.0	120.3	73	64
314	13:33:31	67.6	73.8	112.3	71	60
315	13:34:31	68.0	74.3	113.3	70	62
316	13:35:31	65.3	71.4	108.4	67	60
317	13:36:31	67.0	74.4	UNR	69	60
318	13:37:31	65.7	72.7	112.6	69	59
319	13:38:31	64.3	68.6	109.0	66	58
320	13:39:31	66.4	72.7	111.9	69	61
321	13:40:31	67.9	73.6	115.5	70	61
322	13:41:31	65.3	68.6	107.9	67	61
323	13:42:31	64.1	68.9	UNR	66	59
324	13:43:31	64.7	69.1	108.4	67	60
325	13:44:31	67.8	72.1	111.9	70	61
326	13:45:31	64.3	69.9	UNR	66	60
327	13:46:31	63.8	69.3	111.6	67	59
328	13:47:31	67.7	73.8	113.3	70	60
329	13:48:31	81.0	92.7	129.4	84	64
330	13:49:31	68.9	77.5	118.5	71	61
331	13:50:31	70.5	79.3	122.9	74	64
332	13:51:31	73.0	82.9	122.7	76	64
333	13:52:31	69.0	81.2	119.5	70	62
334	13:53:31	76.3	84.6	123.7	78	66
335	13:54:31	67.6	74.9	117.2	71	59
336	13:55:31	71.9	80.2	118.1	75	64

337	13:56:31	69.6	76.8	116.2	72	61
338	13:57:31	72.0	80.3	119.5	75	62
339	13:58:31	70.0	76.8	117.6	73	63
340	13:59:31	70.9	79.0	114.7	76	62
341	14:00:31	68.8	77.5	109.4	71	59
342	14:01:31	69.1	81.4	118.8	72	60
343	14:02:31	68.9	74.8	113.6	71	63
344	14:03:31	68.8	74.9	110.8	71	64
345	14:04:31	73.1	83.0	119.8	77	62
346	14:05:31	67.8	75.1	111.6	70	60
347	14:06:31	69.4	77.3	115.9	72	61
348	14:07:31	73.3	80.7	123.5	76	65
349	14:08:31	76.9	91.8	127.3	80	64
350	14:09:31	72.3	80.2	120.2	74	64
351	14:10:31	74.1	82.4	120.9	77	64
352	14:11:31	72.7	82.8	119.3	75	63
353	14:12:31	69.0	77.0	116.8	72	62
354	14:13:31	72.6	79.5	119.3	77	62
355	14:14:31	72.3	81.2	121.0	75	63
356	14:15:31	65.1	68.4	UNR	66	61
357	14:16:31	65.9	73.0	UNR	69	58
358	14:17:31	67.9	75.4	110.8	70	61
359	14:18:31	66.1	71.5	113.6	68	61
360	14:19:31	65.6	69.8	107.9	68	60
361	14:20:31	68.0	78.8	117.6	70	58
362	14:21:31	68.8	75.0	111.9	71	62
363	14:22:31	69.7	80.5	121.0	71	60
364	14:23:31	70.7	82.1	119.0	73	62
365	14:24:31	72.0	82.0	122.3	75	63
366	14:25:31	67.7	74.8	113.9	72	60
367	14:26:31	64.4	73.2	114.7	67	58
368	14:27:31	67.5	72.6	112.3	70	60
369	14:28:31	71.1	84.0	123.4	73	64
370	14:29:31	72.6	82.2	121.4	76	64
371	14:30:31	71.7	76.8	118.5	75	65
372	14:31:31	67.4	75.0	115.9	70	60
373	14:32:31	67.0	76.0	111.2	70	60
374	14:33:31	66.3	73.7	111.6	69	60
375	14:34:31	64.5	68.9	UNR	66	60
376	14:35:31	66.7	72.7	114.7	69	60
377	14:36:31	67.9	76.9	114.7	71	59
378	14:37:31	72.4	81.9	122.2	77	64
379	14:38:31	67.7	76.3	119.6	71	60
380	14:39:31	64.2	69.0	111.6	66	60
381	14:40:31	65.2	72.0	116.4	68	60
382	14:41:31	67.6	75.9	UNR	69	61
383	14:42:31	66.7	69.8	UNR	68	61
384	14:43:31	62.9	66.8	UNR	64	58
385	14:44:31	65.0	69.5	111.2	67	59
386	14:45:31	64.0	68.3	109.0	66	57
387	14:46:31	65.6	72.6	111.2	68	58
388	14:47:31	66.2	72.8	110.4	69	60
389	14:48:31	69.3	75.5	114.7	72	62
390	14:49:31	68.8	76.9	116.8	73	59
391	14:50:31	66.9	74.2	114.7	69	61
392	14:51:31	65.8	70.3	111.9	68	61
393	14:52:31	66.2	69.8	107.9	68	60
394	14:53:31	69.3	79.9	119.9	70	63

395	14:54:31	65.4	72.5	UNR	70	57
396	14:55:31	64.9	74.5	UNR	67	58
397	14:56:31	64.2	70.2	109.9	68	58
398	14:57:31	65.1	70.3	111.2	68	58
399	14:58:31	65.7	70.9	115.2	69	58
400	14:59:31	67.9	73.5	114.4	70	60
401	15:00:31	64.4	71.1	109.9	68	58
402	15:01:31	70.5	77.9	121.7	73	61
403	15:02:31	67.8	76.5	118.1	70	61
404	15:03:31	66.7	71.7	113.0	69	59
405	15:04:31	66.7	76.2	114.7	70	58
406	15:05:31	66.8	70.2	109.9	69	61
407	15:06:31	69.5	76.2	114.4	73	62
408	15:07:31	70.5	78.3	117.2	73	61
409	15:08:31	64.9	69.0	107.9	67	61
410	15:09:31	69.5	75.9	117.2	72	61
411	15:10:31	66.1	70.9	113.9	68	61
412	15:11:31	66.6	75.9	117.2	69	59
413	15:12:31	67.9	76.3	113.0	71	61
414	15:13:31	65.7	69.2	UNR	67	60
415	15:14:31	65.4	72.2	UNR	67	60
416	15:15:31	68.1	78.1	UNR	69	60
417	15:16:31	67.6	72.7	114.2	71	61
418	15:17:31	66.8	72.1	115.0	70	61
419	15:18:31	69.7	76.3	120.6	74	62
420	15:19:31	66.0	70.2	UNR	68	61
421	15:20:31	65.5	69.7	UNR	67	62
422	15:21:31	66.3	71.0	UNR	68	61
423	15:22:31	67.5	72.8	107.9	70	62
424	15:23:31	67.3	74.3	110.8	69	61
425	15:24:31	69.2	78.5	119.0	72	62
426	15:25:31	65.4	73.5	UNR	68	58
427	15:26:31	66.3	71.3	109.4	68	61
428	15:27:31	65.5	69.6	107.9	67	60
429	15:28:31	66.9	72.7	117.4	69	61
430	15:29:31	71.4	76.2	117.6	73	66
431	15:30:31	71.6	78.5	116.2	75	62
432	15:31:31	67.4	73.0	112.3	69	62
433	15:32:31	66.4	71.7	111.9	69	60
434	15:33:31	65.9	71.9	108.4	68	61
435	15:34:31	64.8	68.9	109.4	67	60
436	15:35:31	65.4	69.4	109.4	67	61
437	15:36:31	65.5	70.8	112.3	68	60
438	15:37:31	66.1	74.1	113.3	69	60
439	15:38:31	69.2	76.0	115.0	73	62
440	15:39:31	65.7	72.5	110.8	69	58
441	15:40:31	66.4	72.0	110.8	68	59
442	15:41:31	65.3	69.4	108.4	68	59
443	15:42:31	66.2	70.4	UNR	69	60
444	15:43:31	65.7	68.4	110.8	67	62
445	15:44:31	62.7	68.3	UNR	64	58
446	15:45:31	64.1	67.7	UNR	66	60
447	15:46:31	65.3	69.3	110.8	66	62
448	15:47:31	65.9	72.2	111.9	68	60
449	15:48:31	64.2	70.0	UNR	68	56
450	15:49:31	66.1	69.7	111.9	68	62
451	15:50:31	65.3	68.2	UNR	67	61
452	15:51:31	66.0	69.4	107.9	67	61

453	15:52:31	69.5	78.9	111.9	71	61
454	15:53:31	67.3	78.6	115.9	70	59
455	15:54:31	65.4	74.8	112.3	67	58
456	15:55:31	66.3	73.7	111.6	68	62
457	15:56:31	67.1	75.2	113.9	69	61
458	15:57:31	71.1	78.4	111.6	74	62
459	15:58:31	66.7	74.5	114.2	70	58
460	15:59:31	66.1	70.9	110.8	68	60
461	16:00:31	67.3	72.2	110.4	70	61
462	16:01:31	66.6	74.5	111.9	68	60
463	16:02:31	70.1	75.5	115.7	72	64
464	16:03:31	71.2	78.5	117.8	74	64
465	16:04:31	68.0	74.6	112.6	71	62
466	16:05:31	66.7	76.0	UNR	68	60
467	16:06:31	68.6	72.3	114.2	71	61
468	16:07:31	69.8	76.3	119.3	72	63
469	16:08:31	71.6	79.5	117.2	75	62
470	16:09:31	66.1	70.5	107.9	68	61
471	16:10:31	66.3	70.4	UNR	68	60
472	16:11:31	65.7	69.0	UNR	67	62
473	16:12:31	65.9	71.0	111.2	68	61
474	16:13:31	67.0	71.0	110.8	69	61
475	16:14:31	66.5	77.1	114.2	68	61
476	16:15:31	65.9	74.8	110.8	68	61
477	16:16:31	70.0	79.1	117.4	73	61
478	16:17:31	66.0	70.7	112.3	68	61
479	16:18:31	65.1	70.4	107.9	67	61
480	16:19:31	67.1	76.6	117.4	69	61

```
-- AMPLITUDE DISTRIBUTION REPORT --

TOTAL SAMPLES =       460315

dB   SAMPLES                                                    % OF TOTAL
--------------------------------------------------------------------------
55        1 .                                                        0.00
56       47 .                                                        0.01
57      454 .                                                        0.10
58     1075 +                                                        0.23
59     2990 *                                                        0.65
60     8625 **                                                       1.87
61    15608 ***                                                      3.39
62    27072 ******                                                   5.88
63    38094 ********                                                 8.28
64    45582 **********                                               9.90
65    48180 **********                                              10.47
66    51168 ***********                                             11.12
67    49656 ***********                                             10.79
68    44297 **********                                               9.62
69    36055 ********                                                 7.83
70    27303 ******                                                   5.93
71    18023 ****                                                     3.92
72    12524 ***                                                      2.72
73     8610 **                                                       1.87
74     6280 *                                                        1.36
75     4945 *                                                        1.07
76     3749 *                                                        0.81
77     2908 *                                                        0.63
78     2158 +                                                        0.47
79     1543 +                                                        0.34
80     1090 +                                                        0.24
81      800 +                                                        0.17
82      520 +                                                        0.11
83      321 .                                                        0.07
84      210 .                                                        0.05
85      114 .                                                        0.02
86       77 .                                                        0.02
87       45 .                                                        0.01
88       43 .                                                        0.01
89       38 .                                                        0.01
90       26 .                                                        0.01
91       27 .                                                        0.01
92       15 .                                                        0.00
93        6 .                                                        0.00
94       10 .                                                        0.00
95       12 .                                                        0.00
96       11 .                                                        0.00
97        3 .                                                        0.00
```

Ln(0.0) = 97dB
Ln(10.0) = 72dB
Ln(50.0) = 66dB
Ln(99.9) = 57dB

	NO CUTOFF	40.0dB CUTOFF	40.0dB CUTOFF
Leq	69.3dB	69.3dB	69.3dB
Ldod	68.4dB	68.4dB	68.4dB
Losha	68.0dB	68.0dB	68.0dB
Leq(6)	67.7dB	67.7dB	67.7dB

```
File Name.........BIN4
Test Location.....Moly Corp
Employee Name..... Greg Malanowski
Employee Number...
Department........
Comment Field 1...12667 / 3421
Comment Field 2... top of mill
Numeric Code #1...         #2...        #3...        #4...        #5...

METROSONICS db-308 SN 3421 V3.0
REPORT PRINTED 03/04/97 AT 08:32:27

EXCHANGE RATE.....  3dB        FILTER.....A WGHT
DOSE CRITERION.... 90dB        RESPONSE...SLOW
PRE-TEST CALIBRATION TIME.... 2/27/97 AT  7:46:21
PRE-TEST CALIBRATION RANGE...  41.9dB TO 141.9dB
NO POST-TEST CALIBRATION
Calibrator Type & Serial #...______________________________

Calibrator Calibration Date..______________________________

-- OVERALL STATISTICS REPORT --


TEST BEGAN.... 2/27/97 AT  8:42:06
TEST LENGTH...      0 DAYS  8:00:23
TEST ENDED.... 2/27/97 AT 16:42:29
TEST INTERRUPTIONS...1

Lav.............. 62.8dB
SEL..............107.3dB
Lmax............. 93.4dB ON  2/27/97 AT  8:42:08
Lpk..............123.0dB ON  2/27/97 AT  9:28:38
TIME OVER 115dB..  0 DAYS  0:00:00.00

8 HR DOSE (40dB CUTOFF)........  0.18%
8 HR DOSE (40dB CUTOFF)........  0.18%
```

-- TABULAR TIME HISTORY REPORT --

OF PERIODS: 481 MODE: CONTINUOUS
PERIOD LENGTH: 0:01:00
TIME HISTORY CUTOFF: 40dB
Ln(1): 10.0% Ln(2): 99.9%

DATE: 2/27/97

INT	TIME	Lav	Lmx	Lpk	L1	L2
1	8:42:06	76.8	93.4	UNR	70	56
2	8:43:06	61.9	69.3	113.9	64	53
3	8:44:06	67.7	77.9	121.5	72	55
4	8:45:06	60.5	71.4	113.9	63	51
5	8:46:06	58.2	63.1	UNR	60	53
6	8:47:06	63.8	72.2	111.7	67	56
7	8:48:06	57.8	61.6	UNR	59	53
8	8:49:06	60.7	65.0	UNR	62	55
9	8:50:06	62.8	71.2	111.3	65	57
10	8:51:06	62.8	70.6	117.5	66	56
11	8:52:06	63.1	70.9	112.7	65	56
12	8:53:06	65.6	72.5	114.2	69	54
13	8:54:06	59.7	64.9	UNR	61	56
14	8:55:06	59.0	65.1	UNR	61	54
15	8:56:06	57.8	63.9	UNR	60	53
16	8:57:06	58.2	61.6	UNR	59	55
17	8:58:06	58.5	62.9	UNR	61	53
18	8:59:06	55.8	58.7	UNR	57	52
19	9:00:06	57.2	61.5	UNR	58	54
20	9:01:06	58.0	66.7	UNR	59	54
21	9:02:06	56.5	66.9	UNR	57	52
22	9:03:06	59.3	69.1	111.3	61	51
23	9:04:06	61.9	69.7	113.9	65	55
24	9:05:06	56.2	60.7	UNR	58	53
25	9:06:06	66.3	76.7	115.3	71	54
26	9:07:06	63.5	73.7	111.7	68	54
27	9:08:06	63.7	74.0	116.5	68	56
28	9:09:06	59.2	64.5	UNR	61	53
29	9:10:06	64.6	73.9	114.6	68	55
30	9:11:06	60.0	64.8	UNR	62	55
31	9:12:06	66.9	75.2	114.9	71	54
32	9:13:06	60.9	67.0	110.2	64	54
33	9:14:06	58.9	67.2	UNR	60	53
34	9:15:06	56.9	61.7	UNR	59	51
35	9:16:06	66.0	73.6	113.9	70	53
36	9:17:06	60.5	66.3	UNR	63	52
37	9:18:06	55.7	61.9	UNR	58	51
38	9:19:06	57.8	61.1	UNR	59	52
39	9:20:06	62.0	69.2	UNR	64	55
40	9:21:06	59.9	65.5	UNR	62	54
41	9:22:06	56.8	61.1	UNR	58	53
42	9:23:06	56.2	60.1	UNR	58	52
43	9:24:06	66.1	73.9	115.9	70	55
44	9:25:06	68.2	76.5	118.2	71	61
45	9:26:06	71.0	83.3	121.5	74	57
46	9:27:06	70.2	78.9	121.8	74	61

47	9:28:06	71.6	79.7	123.0	76	59
48	9:29:06	69.9	79.5	116.2	74	59
49	9:30:06	69.9	80.5	119.3	74	57
50	9:31:06	62.6	69.9	111.3	66	54
51	9:32:06	69.3	78.4	117.8	74	55
52	9:33:06	63.3	71.5	111.7	67	56
53	9:34:06	64.0	71.8	112.7	67	56
54	9:35:06	62.7	70.0	UNR	66	55
55	9:36:06	59.6	65.5	UNR	61	53
56	9:37:06	60.2	68.6	110.2	63	54
57	9:38:06	58.5	64.1	110.2	61	52
58	9:39:06	59.3	69.6	UNR	61	52
59	9:40:06	61.9	71.8	113.1	66	51
60	9:41:06	61.8	70.9	111.7	65	54
61	9:42:06	58.2	65.7	UNR	60	53
62	9:43:06	56.9	60.6	UNR	59	52
63	9:44:06	61.9	68.9	112.2	66	53
64	9:45:06	59.6	65.9	111.3	62	53
65	9:46:06	60.3	66.8	110.7	64	51
66	9:47:06	55.9	60.3	UNR	58	51
67	9:48:06	66.1	79.9	116.5	69	51
68	9:49:06	66.3	76.5	114.9	70	55
69	9:50:06	59.8	64.7	UNR	62	53
70	9:51:06	56.0	61.5	110.7	57	51
71	9:52:06	58.0	64.3	UNR	60	50
72	9:53:06	55.4	61.3	UNR	57	51
73	9:54:06	55.4	59.8	UNR	57	50
74	9:55:06	56.2	60.9	UNR	57	50
75	9:56:06	61.8	74.8	112.7	63	53
76	9:57:06	63.3	77.0	115.6	59	54
77	9:58:06	71.6	79.7	122.1	76	57
78	9:59:06	57.3	63.6	UNR	60	51
79	10:00:06	61.2	69.0	112.2	66	51
80	10:01:06	58.1	61.3	UNR	59	54
81	10:02:06	63.4	69.7	112.7	66	57
82	10:03:06	62.0	72.1	112.7	66	51
83	10:04:06	64.4	77.9	122.2	68	53
84	10:05:06	59.8	67.5	UNR	62	52
85	10:06:06	58.7	65.5	UNR	61	52
86	10:07:06	61.1	70.7	112.2	63	55
87	10:08:06	63.2	75.7	116.7	63	54
88	10:09:06	62.0	66.4	UNR	64	56
89	10:10:06	57.6	63.0	UNR	60	51
90	10:11:06	58.6	63.5	111.7	61	51
91	10:12:06	57.9	61.7	UNR	60	53
92	10:13:06	54.4	58.1	UNR	55	50
93	10:14:06	55.9	60.4	UNR	58	52
94	10:15:06	58.6	65.2	UNR	62	51
95	10:16:06	58.7	65.1	UNR	61	54
96	10:17:06	57.8	61.8	UNR	60	53
97	10:18:06	59.9	68.2	111.3	63	52
98	10:19:06	63.2	69.7	110.7	66	55
99	10:20:06	60.8	68.3	110.2	64	54
100	10:21:06	58.8	66.6	114.9	60	53
101	10:22:06	55.4	58.9	UNR	57	52
102	10:23:06	56.2	61.6	UNR	58	51
103	10:24:06	56.5	59.7	UNR	58	53
104	10:25:06	54.3	59.4	UNR	55	50

105	10:26:06	56.4	60.1	UNR	58	51
106	10:27:06	55.3	61.9	UNR	57	50
107	10:28:06	54.9	58.4	UNR	57	50
108	10:29:06	58.5	65.6	UNR	61	52
109	10:30:06	55.9	59.5	UNR	57	52
110	10:31:06	55.5	63.9	UNR	58	50
111	10:32:06	54.6	60.1	UNR	56	51
112	10:33:06	55.1	58.9	UNR	58	50
113	10:34:06	55.3	59.3	UNR	57	52
114	10:35:06	59.4	70.1	UNR	62	53
115	10:36:06	54.3	57.7	UNR	56	51
116	10:37:06	53.6	57.1	UNR	55	48
117	10:38:06	52.9	60.6	UNR	56	47
118	10:39:06	53.7	57.7	UNR	55	49
119	10:40:06	53.8	57.9	UNR	55	50
120	10:41:06	56.0	59.2	UNR	57	52
121	10:42:06	56.1	59.6	UNR	58	51
122	10:43:06	54.2	56.9	UNR	55	51
123	10:44:06	54.4	59.1	UNR	56	49
124	10:45:06	52.6	56.1	UNR	55	48
125	10:46:06	52.0	54.3	UNR	53	49
126	10:47:06	53.8	58.4	UNR	55	50
127	10:48:06	53.7	58.0	UNR	55	50
128	10:49:06	54.3	58.0	UNR	56	51
129	10:50:06	52.3	54.7	UNR	54	48
130	10:51:06	53.5	59.3	UNR	55	49
131	10:52:06	53.0	56.1	UNR	54	48
132	10:53:06	61.2	71.9	UNR	65	49
133	10:54:06	60.3	75.5	111.7	60	52
134	10:55:06	54.6	59.0	UNR	56	51
135	10:56:06	56.1	59.5	UNR	58	51
136	10:57:06	55.0	58.0	UNR	56	51
137	10:58:06	55.4	61.3	UNR	59	50
138	10:59:06	57.0	62.8	UNR	58	53
139	11:00:06	56.5	59.6	UNR	58	53
140	11:01:06	56.2	58.3	UNR	57	51
141	11:02:06	53.6	58.5	UNR	55	49
142	11:03:06	55.3	58.8	UNR	57	51
143	11:04:06	57.2	61.1	UNR	60	52
144	11:05:06	56.9	63.7	UNR	61	49
145	11:06:06	55.9	60.4	UNR	58	50
146	11:07:06	58.3	63.6	UNR	60	53
147	11:08:06	55.8	59.5	UNR	57	51
148	11:09:06	51.8	55.1	UNR	53	49
149	11:10:06	54.3	59.1	UNR	57	50
150	11:11:06	56.4	59.0	UNR	57	53
151	11:12:06	55.8	59.2	UNR	57	51
152	11:13:06	57.5	61.1	UNR	59	52
153	11:14:06	55.4	58.8	UNR	57	52
154	11:15:06	55.4	58.4	UNR	57	52
155	11:16:06	56.3	59.5	UNR	58	52
156	11:17:06	56.3	58.9	UNR	58	52
157	11:18:06	55.9	59.7	UNR	57	51
158	11:19:06	56.5	61.9	UNR	58	52
159	11:20:06	54.6	59.5	UNR	58	49
160	11:21:06	57.2	60.5	UNR	59	50
161	11:22:06	60.4	69.5	115.9	63	54
162	11:23:06	57.3	66.0	UNR	59	52

163	11:24:06	54.5	66.6	UNR	55	50
164	11:25:06	56.1	64.8	UNR	57	52
165	11:26:06	57.2	66.5	113.5	61	50
166	11:27:06	53.7	60.5	UNR	55	50
167	11:28:06	57.5	63.1	UNR	60	52
168	11:29:06	62.5	69.7	115.3	66	54
169	11:30:06	63.0	72.0	112.2	67	55
170	11:31:06	58.8	64.4	UNR	61	54
171	11:32:06	56.0	60.3	UNR	58	52
172	11:33:06	57.2	61.3	UNR	59	52
173	11:34:06	60.8	69.1	112.2	65	53
174	11:35:06	59.1	70.8	UNR	58	51
175	11:36:06	57.9	68.7	UNR	58	53
176	11:37:06	55.8	60.1	UNR	57	52
177	11:38:06	54.9	60.8	UNR	56	52
178	11:39:06	59.3	66.9	114.9	63	52
179	11:40:06	54.5	56.5	UNR	55	51
180	11:41:06	57.8	67.3	112.7	59	53
181	11:42:06	67.9	77.4	119.3	71	55
182	11:43:06	61.2	66.8	UNR	64	55
183	11:44:06	64.4	73.6	116.7	68	56
184	11:45:06	65.9	71.0	113.9	68	60
185	11:46:06	69.9	77.6	118.9	73	60
186	11:47:06	65.6	74.3	115.3	70	54
187	11:48:06	64.3	73.1	114.2	68	55
188	11:49:06	62.0	68.9	114.2	65	55
189	11:50:06	60.9	67.4	112.2	64	56
190	11:51:06	59.4	65.4	110.7	62	55
191	11:52:06	69.2	77.5	118.7	72	59
192	11:53:06	64.4	71.0	113.5	66	57
193	11:54:06	62.5	70.0	UNR	66	53
194	11:55:06	64.5	74.4	116.2	68	56
195	11:56:06	61.6	69.2	114.6	66	53
196	11:57:06	64.0	72.9	119.3	66	53
197	11:58:06	63.0	72.6	113.5	68	55
198	11:59:06	67.1	75.4	118.5	71	57
199	12:00:06	60.5	67.8	UNR	63	55
200	12:01:06	60.2	66.2	111.3	63	54
201	12:02:06	60.6	66.9	114.2	63	53
202	12:03:06	63.6	72.4	113.1	68	52
203	12:04:06	65.3	74.9	118.7	67	57
204	12:05:06	63.5	72.2	114.6	66	54
205	12:06:06	58.1	64.3	110.2	60	53
206	12:07:06	57.5	66.7	110.2	61	53
207	12:08:06	63.0	69.2	111.3	66	56
208	12:09:06	60.9	68.0	110.2	63	55
209	12:10:06	58.3	64.7	UNR	61	54
210	12:11:06	59.2	68.9	111.3	59	53
211	12:12:06	54.5	57.9	UNR	55	52
212	12:13:06	55.2	60.4	UNR	57	51
213	12:14:06	58.1	62.7	UNR	60	54
214	12:15:06	56.2	60.8	UNR	57	53
215	12:16:06	60.0	67.6	110.7	64	54
216	12:17:06	61.5	65.1	111.7	63	56
217	12:18:06	63.4	72.8	113.9	67	53
218	12:19:06	64.6	73.3	117.5	68	56
219	12:20:06	65.6	74.5	117.8	70	56
220	12:21:06	59.7	69.6	114.6	63	51

221	12:22:06	54.6	56.5	UNR	55	52
222	12:23:06	55.3	57.9	UNR	56	52
223	12:24:06	53.2	56.1	UNR	54	51
224	12:25:06	63.7	77.7	119.1	66	52
225	12:26:06	62.2	68.5	114.9	66	54
226	12:27:06	62.4	71.3	117.0	65	54
227	12:28:06	59.1	66.3	UNR	61	53
228	12:29:06	55.0	61.3	UNR	57	50
229	12:30:06	55.6	61.4	111.7	57	50
230	12:31:06	56.7	66.4	110.2	58	51
231	12:32:06	59.2	71.9	114.6	60	53
232	12:33:06	59.5	66.5	110.7	62	54
233	12:34:06	61.2	70.0	117.5	64	53
234	12:35:06	64.9	72.5	115.6	69	53
235	12:36:06	56.6	64.5	110.2	59	50
236	12:37:06	55.5	61.6	UNR	58	51
237	12:38:06	60.8	74.1	115.9	62	54
238	12:39:06	69.8	79.1	119.5	74	59
239	12:40:06	65.2	76.2	115.6	70	56
240	12:41:06	65.8	76.5	116.5	68	54
241	12:42:06	58.9	62.8	UNR	61	55
242	12:43:06	60.8	67.5	113.1	63	54
243	12:44:06	64.2	70.0	114.2	67	56
244	12:45:06	69.2	80.1	121.9	73	55
245	12:46:06	74.1	82.9	122.6	77	65
246	12:47:06	68.3	76.2	119.7	71	59
247	12:48:06	68.3	74.5	117.8	72	60
248	12:49:06	68.9	76.9	117.8	72	56
249	12:50:06	62.0	68.7	113.9	65	55
250	12:51:06	66.6	75.4	118.0	69	57
251	12:52:06	59.1	71.2	UNR	60	54
252	12:53:06	65.6	72.8	112.7	68	60
253	12:54:06	59.6	67.1	112.7	64	53
254	12:55:06	68.0	73.1	116.5	71	54
255	12:56:06	67.3	73.6	114.6	71	53
256	12:57:06	67.3	79.7	118.9	70	55
257	12:58:06	61.9	70.7	114.9	65	53
258	12:59:06	57.8	61.7	UNR	59	55
259	13:00:06	58.1	65.2	112.2	61	54
260	13:01:06	58.2	64.0	UNR	61	54
261	13:02:06	60.8	68.4	114.9	63	56
262	13:03:06	60.0	64.9	UNR	61	56
263	13:04:06	68.9	77.8	118.5	73	58
264	13:05:06	68.9	76.1	120.6	72	59
265	13:06:06	65.2	74.0	114.2	68	58
266	13:07:06	62.8	70.8	113.5	67	55
267	13:08:06	60.1	63.9	UNR	62	55
268	13:09:06	58.3	65.9	111.7	60	53
269	13:10:06	60.5	69.4	112.7	64	53
270	13:11:06	63.2	71.3	113.1	66	54
271	13:12:06	67.2	77.1	115.9	72	57
272	13:13:06	69.7	79.9	121.8	73	57
273	13:14:06	63.9	70.1	115.6	66	57
274	13:15:06	65.3	73.5	115.6	69	54
275	13:16:06	64.9	73.9	113.9	69	53
276	13:17:06	59.9	66.0	UNR	62	55
277	13:18:06	66.2	74.0	118.5	71	56
278	13:19:06	61.2	69.1	113.1	64	54

279	13:20:06	56.3	63.6	110.7	58	51
280	13:21:06	58.9	66.7	115.3	63	53
281	13:22:06	65.1	74.4	115.3	69	54
282	13:23:06	58.4	69.1	UNR	60	51
283	13:24:06	56.6	63.0	UNR	60	50
284	13:25:06	57.0	63.0	UNR	59	52
285	13:26:06	58.3	65.4	111.3	62	51
286	13:27:06	54.9	64.0	UNR	58	49
287	13:28:06	56.0	61.7	UNR	59	50
288	13:29:06	59.6	67.7	113.9	61	54
289	13:30:06	60.8	73.3	115.9	64	52
290	13:31:06	57.0	60.4	UNR	58	53
291	13:32:06	55.2	64.3	111.3	58	48
292	13:33:06	55.2	61.2	UNR	58	50
293	13:34:06	58.4	64.7	111.7	60	50
294	13:35:06	55.2	64.6	111.7	60	48
295	13:36:06	54.1	61.9	UNR	56	49
296	13:37:06	53.5	58.9	UNR	56	49
297	13:38:06	56.3	68.3	113.1	58	49
298	13:39:06	62.0	69.5	115.6	67	52
299	13:40:06	59.4	68.5	113.1	63	51
300	13:41:06	56.1	61.9	UNR	58	52
301	13:42:06	60.2	73.8	115.6	60	52
302	13:43:06	64.4	75.5	113.5	68	53
303	13:44:06	62.8	69.6	113.9	66	56
304	13:45:06	60.7	71.4	114.6	63	52
305	13:46:06	65.2	75.3	117.3	69	56
306	13:47:06	61.1	67.0	112.7	64	56
307	13:48:06	65.1	72.9	113.1	69	58
308	13:49:06	65.8	71.8	114.9	68	59
309	13:50:06	63.0	75.9	116.2	65	52
310	13:51:06	62.7	73.5	115.3	67	55
311	13:52:06	65.0	73.9	115.3	69	53
312	13:53:06	56.2	61.7	UNR	60	51
313	13:54:06	60.0	67.5	110.7	64	51
314	13:55:06	68.6	78.6	118.2	72	52
315	13:56:06	65.8	73.8	115.3	70	56
316	13:57:06	64.5	72.6	114.6	67	55
317	13:58:06	65.3	71.2	114.9	68	56
318	13:59:06	62.2	71.3	116.5	66	54
319	14:00:06	57.6	63.8	112.7	61	51
320	14:01:06	60.1	69.3	114.2	63	53
321	14:02:06	61.7	70.2	116.7	65	53
322	14:03:06	61.3	69.1	113.5	65	55
323	14:04:06	59.4	68.3	110.7	62	53
324	14:05:06	55.4	60.6	UNR	56	53
325	14:06:06	64.0	71.0	118.9	67	54
326	14:07:06	60.4	69.1	111.7	63	54
327	14:08:06	67.6	78.4	119.1	71	55
328	14:09:06	63.7	73.5	115.6	67	56
329	14:10:06	61.1	66.3	113.1	63	56
330	14:11:06	62.8	70.3	113.5	65	54
331	14:12:06	63.9	74.9	117.8	67	56
332	14:13:06	63.1	70.8	114.6	67	54
333	14:14:06	59.7	70.2	115.6	62	52
334	14:15:06	59.3	65.9	UNR	61	52
335	14:16:06	59.1	66.3	112.2	63	51
336	14:17:06	60.5	65.5	110.2	63	56

337	14:18:06	60.0	67.6	111.7	63	51
338	14:19:06	61.9	67.1	111.7	64	51
339	14:20:06	61.8	68.2	113.1	63	57
340	14:21:06	62.0	71.2	115.3	65	52
341	14:22:06	61.3	69.9	113.1	65	52
342	14:23:06	59.2	69.3	112.7	63	51
343	14:24:06	52.8	56.4	UNR	54	49
344	14:25:06	53.8	60.8	UNR	57	49
345	14:26:06	59.6	69.3	114.9	62	51
346	14:27:06	62.2	67.6	112.7	65	55
347	14:28:06	59.2	66.2	UNR	62	53
348	14:29:06	60.3	66.1	UNR	62	55
349	14:30:06	60.6	70.7	114.9	62	54
350	14:31:06	57.7	64.7	UNR	61	51
351	14:32:06	55.5	59.1	UNR	57	51
352	14:33:06	59.1	61.6	UNR	60	53
353	14:34:06	57.7	64.3	111.7	60	52
354	14:35:06	56.2	60.9	UNR	58	51
355	14:36:06	60.0	67.8	116.7	62	52
356	14:37:06	58.2	65.2	UNR	60	52
357	14:38:06	58.3	63.4	110.7	61	50
358	14:39:06	57.7	66.4	110.7	63	49
359	14:40:06	62.4	69.7	116.5	65	57
360	14:41:06	63.0	66.5	110.2	64	58
361	14:42:06	63.9	68.6	112.2	65	60
362	14:43:06	62.4	69.7	114.9	64	59
363	14:44:06	61.9	70.4	113.9	65	55
364	14:45:06	63.1	71.3	116.5	65	56
365	14:46:06	61.4	65.6	UNR	62	59
366	14:47:06	62.1	67.1	UNR	63	58
367	14:48:06	61.1	65.1	111.3	62	52
368	14:49:06	60.6	73.6	116.2	63	48
369	14:50:06	57.0	60.8	UNR	59	49
370	14:51:06	53.2	59.5	UNR	57	48
371	14:52:06	55.3	63.8	UNR	58	51
372	14:53:06	55.0	61.2	UNR	57	51
373	14:54:06	57.6	68.4	111.3	61	49
374	14:55:06	54.3	60.3	UNR	56	48
375	14:56:06	51.5	54.0	UNR	52	49
376	14:57:06	55.0	63.1	110.7	59	48
377	14:58:06	54.8	59.5	UNR	57	50
378	14:59:06	58.8	66.5	111.3	62	51
379	15:00:06	60.3	63.2	UNR	62	51
380	15:01:06	60.9	70.8	115.6	63	51
381	15:02:06	56.8	66.1	UNR	59	51
382	15:03:06	60.8	69.9	112.2	65	52
383	15:04:06	64.5	74.3	115.3	70	52
384	15:05:06	59.7	64.0	UNR	62	51
385	15:06:06	64.4	69.4	UNR	67	56
386	15:07:06	60.1	69.1	113.5	64	50
387	15:08:06	61.3	77.3	111.7	57	49
388	15:09:06	53.7	59.5	UNR	55	51
389	15:10:06	55.4	65.0	UNR	59	48
390	15:11:06	51.6	58.4	UNR	53	48
391	15:12:06	52.3	61.2	UNR	55	48
392	15:13:06	50.8	56.5	UNR	52	47
393	15:14:06	55.4	60.9	UNR	59	49
394	15:15:06	62.2	67.5	UNR	64	57

395	15:16:06	62.9	68.7	112.7	65	57
396	15:17:06	61.6	64.7	UNR	62	58
397	15:18:06	61.9	64.4	UNR	63	58
398	15:19:06	61.8	64.7	UNR	63	58
399	15:20:06	63.2	66.5	UNR	64	60
400	15:21:06	62.1	64.9	UNR	63	59
401	15:22:06	62.7	64.7	UNR	63	60
402	15:23:06	62.1	65.7	UNR	63	60
403	15:24:06	64.1	66.7	UNR	65	61
404	15:25:06	62.9	66.4	UNR	63	60
405	15:26:06	62.7	66.3	UNR	63	60
406	15:27:06	62.8	65.5	UNR	64	60
407	15:28:06	62.5	65.3	UNR	63	59
408	15:29:06	62.6	64.4	110.2	63	60
409	15:30:06	61.9	64.9	UNR	64	51
410	15:31:06	53.4	57.8	UNR	55	51
411	15:32:06	66.1	80.6	121.0	70	50
412	15:33:06	58.2	67.6	117.8	62	49
413	15:34:06	64.0	74.8	118.2	68	52
414	15:35:06	58.3	69.2	112.7	60	52
415	15:36:06	62.8	70.1	113.1	63	59
416	15:37:06	61.7	63.9	UNR	62	59
417	15:38:06	62.5	64.0	UNR	63	60
418	15:39:06	62.2	64.4	UNR	63	60
419	15:40:06	63.5	66.3	111.7	64	60
420	15:41:06	63.1	67.5	UNR	64	60
421	15:42:06	63.4	65.3	UNR	64	61
422	15:43:06	63.2	66.1	UNR	64	60
423	15:44:06	62.6	65.9	UNR	64	59
424	15:45:06	62.1	64.1	UNR	62	60
425	15:46:06	61.8	63.7	UNR	62	60
426	15:47:06	62.5	63.9	UNR	63	60
427	15:48:06	62.8	65.4	UNR	63	60
428	15:49:06	63.1	66.8	UNR	64	60
429	15:50:06	61.9	64.3	UNR	63	57
430	15:51:06	62.7	64.8	UNR	63	60
431	15:52:06	63.7	66.5	UNR	64	61
432	15:53:06	64.8	71.3	113.9	66	60
433	15:54:06	63.5	66.1	UNR	64	61
434	15:55:06	63.3	65.9	UNR	64	61
435	15:56:06	62.8	65.1	UNR	64	60
436	15:57:06	62.8	64.8	UNR	63	61
437	15:58:06	60.2	64.8	UNR	63	49
438	15:59:06	63.2	71.6	116.5	67	51
439	16:00:06	64.2	75.2	116.2	69	49
440	16:01:06	61.3	69.4	112.7	65	52
441	16:02:06	57.6	63.9	114.2	60	51
442	16:03:06	55.8	62.9	110.2	59	51
443	16:04:06	52.2	56.3	UNR	53	49
444	16:05:06	54.4	62.0	UNR	57	49
445	16:06:06	56.5	61.2	UNR	59	51
446	16:07:06	58.3	66.8	115.9	62	52
447	16:08:06	55.5	63.7	UNR	58	49
448	16:09:06	61.1	71.7	113.5	62	48
449	16:10:06	61.9	64.3	UNR	62	59
450	16:11:06	61.7	63.9	UNR	62	59
451	16:12:06	62.1	64.3	UNR	63	60
452	16:13:06	62.5	64.8	UNR	63	60

453	16:14:06	65.8	74.6	115.3	67	61
454	16:15:06	64.3	66.1	110.7	65	62
455	16:16:06	65.5	70.1	113.5	67	62
456	16:17:06	65.7	69.3	UNR	67	62
457	16:18:06	65.7	70.4	111.3	67	62
458	16:19:06	65.6	74.1	114.6	68	61
459	16:20:06	65.0	74.1	114.6	66	62
460	16:21:06	63.8	65.7	UNR	64	61
461	16:22:06	63.9	65.6	UNR	64	62
462	16:23:06	63.9	66.8	110.2	65	61
463	16:24:06	65.0	68.0	UNR	65	63
464	16:25:06	65.0	69.1	113.1	66	62
465	16:26:06	64.7	66.5	UNR	65	62
466	16:27:06	64.7	66.8	112.7	65	62
467	16:28:06	65.6	69.1	114.6	67	63
468	16:29:06	64.4	66.8	UNR	65	62
469	16:30:06	65.6	71.0	115.9	67	62
470	16:31:06	64.7	69.0	113.1	66	62
471	16:32:06	64.9	68.1	UNR	66	62
472	16:33:06	65.6	72.9	113.1	67	62
473	16:34:06	64.3	71.8	UNR	64	62
474	16:35:06	65.0	69.1	110.2	66	62
475	16:36:06	64.1	66.2	UNR	65	62
476	16:37:06	65.1	67.9	110.7	66	62
477	16:38:06	64.6	68.3	110.2	65	63
478	16:39:06	63.9	71.5	116.5	67	53
479	16:40:06	65.7	78.3	117.8	67	50
480	16:41:06	72.3	87.6	121.5	74	53
481	16:42:06	63.5	73.1	UNR	66	54

```
-- AMPLITUDE DISTRIBUTION REPORT --

TOTAL SAMPLES =       461172

dB   SAMPLES                                                          % OF TOTAL
--------------------------------------------------------------------------------
47        12 .                                                          0.00
48       768 +                                                          0.17
49      3042 *                                                          0.66
50      7402 **                                                         1.61
51     12387 ***                                                        2.69
52     20037 ****                                                       4.34
53     27742 ******                                                     6.02
54     33664 *******                                                    7.30
55     33943 *******                                                    7.36
56     38908 ********                                                   8.44
57     36593 ********                                                   7.93
58     31269 *******                                                    6.78
59     27687 ******                                                     6.00
60     24970 *****                                                      5.41
61     28005 ******                                                     6.07
62     32682 *******                                                    7.09
63     28269 ******                                                     6.13
64     23263 *****                                                      5.04
65     13918 ***                                                        3.02
66      8895 **                                                         1.93
67      6421 *                                                          1.39
68      5391 *                                                          1.17
69      4042 *                                                          0.88
70      3309 *                                                          0.72
71      2494 *                                                          0.54
72      1777 +                                                          0.39
73      1277 +                                                          0.28
74       980 +                                                          0.21
75       674 +                                                          0.15
76       488 +                                                          0.11
77       325 .                                                          0.07
78       194 .                                                          0.04
79       128 .                                                          0.03
80        70 .                                                          0.02
81        38 .                                                          0.01
82        44 .                                                          0.01
83         9 .                                                          0.00
84         9 .                                                          0.00
85         7 .                                                          0.00
86         7 .                                                          0.00
87         7 .                                                          0.00
88         4 .                                                          0.00
89         3 .                                                          0.00
90         3 .                                                          0.00
91         6 .                                                          0.00
92         6 .                                                          0.00
93         3 .                                                          0.00
```

Ln(0.0) = 93dB
Ln(10.0) = 65dB
Ln(50.0) = 58dB
Ln(99.9) = 48dB

	NO CUTOFF	40.0dB CUTOFF	40.0dB CUTOFF
Leq	62.4dB	62.4dB	62.4dB
Ldod	61.2dB	61.2dB	61.2dB
Losha	60.6dB	60.6dB	60.6dB
Leq(6)	60.2dB	60.2dB	60.2dB

```
File Name.........BIN7
Test Location.....Molycorp
Employee Name.....
Employee Number...
Department........
Comment Field 1...Monitor 12667/3421
Comment Field 2... top of bin
Numeric Code #1...        #2...        #3...        #4...        #5...

METROSONICS db-308 SN 3421 V3.0
REPORT PRINTED 03/04/97 AT 08:33:01

EXCHANGE RATE.....  3dB      FILTER.....A WGHT
DOSE CRITERION.... 90dB      RESPONSE...SLOW
PRE-TEST CALIBRATION TIME.... 2/28/97 AT  8:45:25
PRE-TEST CALIBRATION RANGE...  42.2dB TO 142.2dB
NO POST-TEST CALIBRATION
Calibrator Type & Serial #...______________________________

Calibrator Calibration Date..______________________________

-- OVERALL STATISTICS REPORT --


TEST BEGAN.... 2/28/97 AT  8:47:39
TEST LENGTH...     0 DAYS  8:26:24
TEST ENDED.... 2/28/97 AT 17:14:03
TEST INTERRUPTIONS...1

Lav.............. 55.0dB
SEL.............. 99.7dB
Lmax............. 85.1dB ON  2/28/97 AT 17:13:48
Lpk..............124.1dB ON  2/28/97 AT 17:13:48
TIME OVER 115dB..  0 DAYS  0:00:00.00

8 HR DOSE (40dB CUTOFF)........  0.03%
8 HR DOSE (40dB CUTOFF)........  0.03%
```

-- TABULAR TIME HISTORY REPORT --

OF PERIODS: 507 MODE: CONTINUOUS
PERIOD LENGTH: 0:01:00
TIME HISTORY CUTOFF: 40dB
Ln(1): 10.0% Ln(2): 99.9%

DATE: 2/28/97

INT	TIME	Lav	Lmx	Lpk	L1	L2
1	8:47:39	65.1	81.2	UNR	59	52
2	8:48:39	55.1	58.2	UNR	57	51
3	8:49:39	54.3	57.0	UNR	55	50
4	8:50:39	56.0	58.2	UNR	57	50
5	8:51:39	54.3	56.6	UNR	55	52
6	8:52:39	53.9	55.6	UNR	54	51
7	8:53:39	56.9	59.1	UNR	57	51
8	8:54:39	55.4	58.2	UNR	56	53
9	8:55:39	54.6	56.8	UNR	55	52
10	8:56:39	56.8	59.9	UNR	58	52
11	8:57:39	55.1	58.2	UNR	57	52
12	8:58:39	53.8	56.3	UNR	55	49
13	8:59:39	55.1	57.1	UNR	56	52
14	9:00:39	55.2	57.0	UNR	56	53
15	9:01:39	55.3	58.7	UNR	57	52
16	9:02:39	54.6	57.0	UNR	56	52
17	9:03:39	54.1	56.2	UNR	55	50
18	9:04:39	54.4	56.6	UNR	55	51
19	9:05:39	55.4	58.3	UNR	57	51
20	9:06:39	53.6	57.8	UNR	55	50
21	9:07:39	54.7	56.6	UNR	55	52
22	9:08:39	54.3	56.0	UNR	55	52
23	9:09:39	52.8	55.4	UNR	54	50
24	9:10:39	52.8	55.9	UNR	54	50
25	9:11:39	53.8	55.8	UNR	55	50
26	9:12:39	53.1	56.2	UNR	55	49
27	9:13:39	54.3	56.7	UNR	55	51
28	9:14:39	53.5	56.6	UNR	54	51
29	9:15:39	54.5	57.4	UNR	55	51
30	9:16:39	60.1	75.3	UNR	61	51
31	9:17:39	51.9	55.5	UNR	52	50
32	9:18:39	57.1	65.5	UNR	60	51
33	9:19:39	52.1	55.5	UNR	53	48
34	9:20:39	53.3	55.8	UNR	54	49
35	9:21:39	53.5	57.7	UNR	56	48
36	9:22:39	52.9	55.6	UNR	54	49
37	9:23:39	53.4	56.8	UNR	56	50
38	9:24:39	53.9	57.6	UNR	55	50
39	9:25:39	52.9	57.3	UNR	54	49
40	9:26:39	53.7	57.0	UNR	55	51
41	9:27:39	52.7	55.0	UNR	53	50
42	9:28:39	52.9	55.4	UNR	54	49
43	9:29:39	53.9	56.0	UNR	55	51
44	9:30:39	52.7	54.4	UNR	53	50
45	9:31:39	51.2	53.6	UNR	52	49
46	9:32:39	51.7	54.2	UNR	53	49

47	9:33:39	52.7	55.1	UNR	54	50
48	9:34:39	52.9	54.4	UNR	54	51
49	9:35:39	52.9	54.6	UNR	53	50
50	9:36:39	52.3	54.3	UNR	53	49
51	9:37:39	54.1	57.1	UNR	55	51
52	9:38:39	53.1	56.8	UNR	55	49
53	9:39:39	54.6	56.2	UNR	55	50
54	9:40:39	54.6	57.4	UNR	56	52
55	9:41:39	51.5	54.6	UNR	52	49
56	9:42:39	53.6	56.6	UNR	55	49
57	9:43:39	52.2	54.2	UNR	53	50
58	9:44:39	51.8	54.4	UNR	52	49
59	9:45:39	52.8	55.1	UNR	54	48
60	9:46:39	54.5	58.2	UNR	56	51
61	9:47:39	54.3	58.6	UNR	56	51
62	9:48:39	54.0	56.0	UNR	55	51
63	9:49:39	53.7	56.2	UNR	55	50
64	9:50:39	52.3	55.6	UNR	53	50
65	9:51:39	53.0	55.8	UNR	54	50
66	9:52:39	52.8	56.6	UNR	55	49
67	9:53:39	54.2	56.8	UNR	56	51
68	9:54:39	53.1	56.0	UNR	54	50
69	9:55:39	55.5	58.3	UNR	57	52
70	9:56:39	60.3	65.4	UNR	62	56
71	9:57:39	55.4	59.8	UNR	57	52
72	9:58:39	53.7	56.1	UNR	54	51
73	9:59:39	52.3	54.6	UNR	53	50
74	10:00:39	52.1	53.9	UNR	53	50
75	10:01:39	52.4	55.0	UNR	53	50
76	10:02:39	55.7	61.0	UNR	58	50
77	10:03:39	57.7	61.8	UNR	59	54
78	10:04:39	56.8	60.8	UNR	59	49
79	10:05:39	51.8	54.2	UNR	52	49
80	10:06:39	53.9	58.5	UNR	56	49
81	10:07:39	51.7	57.2	UNR	53	49
82	10:08:39	54.2	58.3	UNR	55	51
83	10:09:39	52.7	55.6	UNR	53	50
84	10:10:39	52.2	54.2	UNR	53	50
85	10:11:39	53.0	55.1	UNR	54	51
86	10:12:39	51.5	53.8	UNR	52	49
87	10:13:39	54.0	56.2	UNR	55	49
88	10:14:39	52.9	55.2	UNR	54	50
89	10:15:39	54.2	58.7	UNR	55	51
90	10:16:39	53.1	55.4	UNR	54	50
91	10:17:39	54.2	56.8	UNR	55	52
92	10:18:39	54.2	56.8	UNR	55	51
93	10:19:39	54.7	57.2	UNR	56	51
94	10:20:39	52.5	57.2	UNR	54	49
95	10:21:39	53.5	57.5	UNR	55	50
96	10:22:39	56.3	58.2	UNR	57	52
97	10:23:39	53.7	55.8	UNR	54	50
98	10:24:39	53.2	57.5	UNR	55	49
99	10:25:39	53.0	55.6	UNR	54	50
100	10:26:39	53.0	56.2	UNR	54	51
101	10:27:39	54.7	57.6	UNR	56	51
102	10:28:39	57.7	61.0	UNR	59	55
103	10:29:39	57.6	61.6	UNR	59	53
104	10:30:39	55.9	59.1	UNR	57	53

105	10:31:39	55.3	62.8	UNR	57	51
106	10:32:39	56.1	61.4	UNR	58	52
107	10:33:39	56.7	62.3	UNR	60	52
108	10:34:39	59.3	64.4	UNR	62	52
109	10:35:39	56.0	60.6	UNR	58	50
110	10:36:39	52.9	58.7	UNR	55	48
111	10:37:39	53.8	58.2	UNR	55	49
112	10:38:39	55.4	60.4	UNR	58	50
113	10:39:39	55.1	59.9	UNR	56	50
114	10:40:39	54.2	59.4	UNR	56	50
115	10:41:39	57.8	61.8	UNR	60	54
116	10:42:39	55.5	57.5	UNR	56	51
117	10:43:39	57.2	59.0	UNR	58	54
118	10:44:39	58.8	62.1	UNR	60	55
119	10:45:39	57.9	61.6	UNR	59	54
120	10:46:39	59.3	62.8	UNR	61	56
121	10:47:39	57.9	60.2	UNR	59	53
122	10:48:39	58.5	61.6	UNR	59	54
123	10:49:39	57.1	59.8	UNR	58	54
124	10:50:39	57.8	59.8	UNR	59	54
125	10:51:39	56.3	59.8	UNR	58	52
126	10:52:39	56.9	60.4	UNR	58	53
127	10:53:39	55.8	59.9	UNR	57	51
128	10:54:39	57.3	60.2	UNR	59	53
129	10:55:39	58.0	59.8	UNR	58	55
130	10:56:39	57.8	61.0	UNR	59	54
131	10:57:39	56.0	58.8	UNR	58	53
132	10:58:39	57.2	59.9	UNR	58	54
133	10:59:39	55.9	61.4	UNR	57	51
134	11:00:39	58.8	62.4	UNR	61	54
135	11:01:39	56.7	59.2	UNR	58	52
136	11:02:39	57.2	59.5	UNR	58	54
137	11:03:39	55.5	59.4	UNR	58	51
138	11:04:39	54.2	57.9	UNR	56	51
139	11:05:39	56.8	62.8	UNR	59	52
140	11:06:39	56.0	59.6	UNR	57	53
141	11:07:39	55.8	61.8	UNR	57	52
142	11:08:39	56.4	61.4	UNR	59	52
143	11:09:39	57.3	61.2	UNR	60	53
144	11:10:39	56.7	60.4	UNR	59	53
145	11:11:39	55.7	60.5	UNR	57	53
146	11:12:39	54.7	60.8	UNR	57	50
147	11:13:39	56.4	62.2	UNR	58	51
148	11:14:39	52.8	56.4	UNR	54	49
149	11:15:39	53.9	56.6	UNR	55	51
150	11:16:39	55.6	58.0	UNR	56	52
151	11:17:39	55.5	59.0	UNR	57	52
152	11:18:39	53.7	56.7	UNR	55	50
153	11:19:39	55.0	58.3	UNR	57	51
154	11:20:39	52.6	55.1	UNR	54	47
155	11:21:39	52.6	56.9	UNR	54	48
156	11:22:39	54.0	57.0	UNR	56	50
157	11:23:39	52.3	56.3	UNR	54	48
158	11:24:39	54.1	56.8	UNR	55	49
159	11:25:39	53.3	55.1	UNR	54	51
160	11:26:39	59.8	64.7	UNR	63	51
161	11:27:39	52.8	57.0	UNR	54	49
162	11:28:39	54.2	56.4	UNR	55	50

163	11:29:39	51.9	55.1	UNR	53	48
164	11:30:39	52.8	56.2	UNR	54	49
165	11:31:39	54.2	58.7	UNR	56	50
166	11:32:39	52.8	55.2	UNR	54	50
167	11:33:39	53.2	55.2	UNR	54	49
168	11:34:39	54.5	57.8	UNR	56	50
169	11:35:39	56.8	59.5	UNR	58	53
170	11:36:39	56.4	58.2	UNR	57	54
171	11:37:39	55.5	59.0	UNR	56	52
172	11:38:39	53.6	56.8	UNR	55	49
173	11:39:39	51.6	56.4	UNR	53	48
174	11:40:39	51.4	55.0	UNR	53	47
175	11:41:39	52.3	60.6	UNR	55	47
176	11:42:39	53.2	57.9	UNR	55	48
177	11:43:39	54.1	57.0	UNR	55	51
178	11:44:39	55.3	58.2	UNR	56	51
179	11:45:39	53.7	57.0	UNR	55	50
180	11:46:39	52.8	55.8	UNR	54	50
181	11:47:39	54.4	59.6	UNR	55	50
182	11:48:39	54.0	58.0	UNR	56	48
183	11:49:39	54.3	59.1	UNR	57	50
184	11:50:39	52.4	55.0	UNR	54	47
185	11:51:39	56.0	60.4	UNR	58	50
186	11:52:39	54.9	58.2	UNR	56	50
187	11:53:39	55.6	59.4	UNR	57	52
188	11:54:39	56.3	58.6	UNR	57	53
189	11:55:39	60.8	65.7	UNR	62	57
190	11:56:39	56.5	61.0	UNR	59	49
191	11:57:39	55.1	58.2	UNR	57	49
192	11:58:39	51.8	56.6	UNR	53	49
193	11:59:39	54.3	60.2	UNR	56	50
194	12:00:39	54.5	57.6	UNR	56	51
195	12:01:39	54.8	58.6	UNR	56	50
196	12:02:39	55.7	60.0	UNR	57	51
197	12:03:39	54.8	57.6	UNR	56	52
198	12:04:39	54.4	58.3	UNR	56	50
199	12:05:39	53.7	55.9	UNR	54	51
200	12:06:39	56.3	59.8	UNR	58	52
201	12:07:39	53.6	56.6	UNR	55	51
202	12:08:39	54.1	55.9	UNR	55	51
203	12:09:39	53.0	55.8	UNR	54	50
204	12:10:39	52.4	55.5	UNR	54	49
205	12:11:39	54.0	56.6	UNR	55	51
206	12:12:39	55.2	59.4	UNR	57	51
207	12:13:39	54.9	57.0	UNR	56	51
208	12:14:39	55.3	58.2	UNR	56	50
209	12:15:39	50.7	55.0	UNR	52	48
210	12:16:39	51.5	54.6	UNR	53	48
211	12:17:39	55.8	59.1	UNR	57	51
212	12:18:39	52.7	56.6	UNR	54	48
213	12:19:39	51.5	53.4	UNR	52	49
214	12:20:39	51.6	53.8	UNR	53	48
215	12:21:39	50.0	52.4	UNR	51	47
216	12:22:39	51.2	53.4	UNR	52	47
217	12:23:39	51.4	53.8	UNR	52	50
218	12:24:39	52.1	55.9	UNR	54	48
219	12:25:39	51.2	54.3	UNR	53	48
220	12:26:39	49.1	51.4	UNR	50	46

221	12:27:39	51.6	55.6	UNR	54	46
222	12:28:39	53.3	58.2	UNR	55	49
223	12:29:39	50.0	51.9	UNR	51	46
224	12:30:39	52.6	57.5	UNR	55	48
225	12:31:39	54.5	59.5	UNR	58	48
226	12:32:39	52.0	56.0	UNR	53	47
227	12:33:39	52.2	54.8	UNR	53	48
228	12:34:39	49.8	53.6	UNR	51	46
229	12:35:39	54.8	59.8	UNR	56	50
230	12:36:39	54.0	56.4	UNR	55	50
231	12:37:39	55.3	57.1	UNR	56	52
232	12:38:39	53.7	56.2	UNR	55	51
233	12:39:39	55.0	58.8	UNR	56	51
234	12:40:39	52.6	56.3	UNR	54	49
235	12:41:39	49.9	53.0	UNR	50	47
236	12:42:39	51.6	55.4	UNR	53	48
237	12:43:39	55.3	59.0	UNR	57	48
238	12:44:39	53.4	58.7	UNR	57	49
239	12:45:39	55.7	60.2	UNR	58	50
240	12:46:39	54.2	58.2	UNR	56	49
241	12:47:39	55.1	60.3	UNR	58	49
242	12:48:39	53.8	59.5	UNR	56	49
243	12:49:39	51.1	56.0	UNR	53	45
244	12:50:39	53.1	57.0	UNR	55	48
245	12:51:39	55.7	67.5	UNR	57	47
246	12:52:39	65.3	73.1	UNR	71	50
247	12:53:39	52.9	55.8	UNR	54	50
248	12:54:39	50.5	53.8	UNR	52	46
249	12:55:39	52.7	55.9	UNR	55	49
250	12:56:39	53.2	56.6	UNR	55	50
251	12:57:39	54.3	57.9	UNR	56	51
252	12:58:39	53.4	57.0	UNR	54	49
253	12:59:39	54.6	58.4	UNR	56	51
254	13:00:39	54.8	59.8	UNR	58	49
255	13:01:39	53.1	56.6	UNR	54	50
256	13:02:39	57.4	61.4	UNR	60	52
257	13:03:39	52.6	56.6	UNR	55	48
258	13:04:39	53.4	57.4	UNR	55	48
259	13:05:39	54.3	58.3	UNR	56	49
260	13:06:39	51.8	55.0	UNR	53	48
261	13:07:39	56.3	60.5	UNR	58	49
262	13:08:39	52.7	56.8	UNR	54	48
263	13:09:39	53.0	56.5	UNR	55	49
264	13:10:39	53.7	58.4	UNR	56	48
265	13:11:39	52.1	56.7	UNR	55	46
266	13:12:39	52.8	55.4	UNR	54	50
267	13:13:39	54.4	59.0	UNR	57	49
268	13:14:39	52.8	56.8	UNR	55	48
269	13:15:39	50.8	54.6	UNR	52	47
270	13:16:39	51.1	58.3	UNR	52	47
271	13:17:39	53.6	59.9	UNR	55	48
272	13:18:39	53.9	58.2	UNR	56	50
273	13:19:39	51.6	57.2	UNR	53	47
274	13:20:39	49.1	52.8	UNR	51	46
275	13:21:39	54.8	58.2	UNR	56	49
276	13:22:39	55.6	59.8	UNR	57	50
277	13:23:39	53.2	57.9	UNR	55	49
278	13:24:39	53.5	59.2	UNR	55	48

279	13:25:39	51.7	54.2	UNR	53	49
280	13:26:39	52.5	55.4	UNR	54	50
281	13:27:39	51.6	55.0	UNR	53	48
282	13:28:39	51.1	55.2	UNR	52	48
283	13:29:39	51.8	55.5	UNR	53	48
284	13:30:39	53.0	58.3	UNR	56	49
285	13:31:39	56.5	59.8	UNR	58	54
286	13:32:39	53.1	57.6	UNR	55	48
287	13:33:39	54.7	57.8	UNR	56	50
288	13:34:39	52.2	56.6	UNR	54	49
289	13:35:39	51.9	54.4	UNR	53	49
290	13:36:39	52.6	55.2	UNR	54	49
291	13:37:39	52.4	56.0	UNR	54	46
292	13:38:39	54.1	57.2	UNR	55	50
293	13:39:39	52.2	57.5	UNR	55	47
294	13:40:39	56.6	59.8	UNR	58	51
295	13:41:39	53.2	58.6	UNR	55	49
296	13:42:39	55.1	59.4	UNR	58	49
297	13:43:39	54.0	58.0	UNR	56	49
298	13:44:39	53.1	58.2	UNR	55	48
299	13:45:39	53.0	56.4	UNR	55	49
300	13:46:39	52.6	56.6	UNR	55	48
301	13:47:39	53.8	57.4	UNR	56	50
302	13:48:39	53.6	57.3	UNR	55	48
303	13:49:39	53.0	55.9	UNR	54	48
304	13:50:39	51.6	55.0	UNR	53	48
305	13:51:39	51.2	54.0	UNR	52	47
306	13:52:39	54.9	59.0	UNR	56	50
307	13:53:39	52.2	55.9	UNR	53	48
308	13:54:39	56.8	62.4	UNR	60	49
309	13:55:39	52.9	55.6	UNR	54	49
310	13:56:39	50.1	53.5	UNR	51	47
311	13:57:39	55.9	60.8	UNR	58	50
312	13:58:39	57.1	59.2	UNR	58	53
313	13:59:39	54.2	56.6	UNR	55	51
314	14:00:39	54.3	57.9	UNR	56	50
315	14:01:39	51.9	56.4	UNR	53	48
316	14:02:39	52.9	56.3	UNR	55	46
317	14:03:39	51.7	55.6	UNR	53	48
318	14:04:39	50.8	54.0	UNR	52	46
319	14:05:39	49.7	51.8	UNR	51	46
320	14:06:39	48.8	51.9	UNR	50	46
321	14:07:39	52.1	59.5	UNR	55	48
322	14:08:39	51.5	54.3	UNR	53	48
323	14:09:39	53.1	56.3	UNR	54	48
324	14:10:39	50.5	53.4	UNR	51	48
325	14:11:39	50.5	52.7	UNR	51	47
326	14:12:39	50.4	58.4	UNR	52	45
327	14:13:39	49.8	52.3	UNR	51	46
328	14:14:39	52.1	55.4	UNR	54	50
329	14:15:39	51.0	53.4	UNR	52	47
330	14:16:39	52.4	56.0	UNR	54	50
331	14:17:39	51.0	55.0	UNR	53	48
332	14:18:39	51.2	53.8	UNR	52	48
333	14:19:39	52.4	55.0	UNR	54	47
334	14:20:39	51.9	55.0	UNR	53	48
335	14:21:39	50.8	54.4	UNR	52	47
336	14:22:39	49.0	52.0	UNR	51	45

337	14:23:39	50.6	53.4	UNR	52	46
338	14:24:39	51.1	54.2	UNR	52	47
339	14:25:39	54.2	57.8	UNR	56	50
340	14:26:39	52.1	53.8	UNR	53	49
341	14:27:39	52.6	55.4	UNR	54	50
342	14:28:39	52.5	55.0	UNR	53	49
343	14:29:39	51.8	55.0	UNR	53	48
344	14:30:39	50.8	53.4	UNR	52	48
345	14:31:39	52.4	56.6	UNR	54	48
346	14:32:39	53.9	56.7	UNR	55	48
347	14:33:39	54.0	56.4	UNR	55	51
348	14:34:39	50.3	53.4	UNR	51	46
349	14:35:39	52.0	55.0	UNR	53	47
350	14:36:39	51.7	54.4	UNR	53	48
351	14:37:39	50.2	53.4	UNR	52	46
352	14:38:39	51.8	55.0	UNR	53	48
353	14:39:39	52.5	55.5	UNR	54	48
354	14:40:39	53.4	56.6	UNR	55	48
355	14:41:39	51.7	55.9	UNR	54	46
356	14:42:39	54.4	58.2	UNR	56	50
357	14:43:39	52.7	58.2	UNR	56	46
358	14:44:39	54.1	58.9	UNR	56	49
359	14:45:39	52.3	61.0	UNR	55	48
360	14:46:39	52.2	56.6	UNR	54	47
361	14:47:39	50.8	55.0	UNR	53	48
362	14:48:39	50.4	54.0	UNR	52	47
363	14:49:39	51.1	54.3	UNR	53	47
364	14:50:39	52.3	56.6	UNR	55	48
365	14:51:39	50.0	54.3	UNR	51	45
366	14:52:39	52.6	56.2	UNR	55	48
367	14:53:39	51.0	54.6	UNR	53	48
368	14:54:39	53.7	58.6	UNR	56	48
369	14:55:39	54.3	60.7	UNR	57	47
370	14:56:39	52.0	55.5	UNR	53	49
371	14:57:39	52.5	55.2	UNR	54	48
372	14:58:39	52.5	55.4	UNR	54	48
373	14:59:39	51.5	55.4	UNR	54	47
374	15:00:39	50.9	55.6	UNR	53	46
375	15:01:39	50.8	54.8	UNR	52	46
376	15:02:39	52.0	55.0	UNR	53	48
377	15:03:39	57.7	65.3	UNR	61	48
378	15:04:39	56.6	60.9	UNR	59	48
379	15:05:39	52.7	55.0	UNR	54	49
380	15:06:39	54.8	59.9	UNR	58	49
381	15:07:39	53.7	59.8	UNR	58	48
382	15:08:39	53.0	55.5	UNR	54	49
383	15:09:39	51.4	55.0	UNR	53	48
384	15:10:39	58.1	65.1	UNR	61	49
385	15:11:39	54.2	60.6	UNR	58	48
386	15:12:39	52.1	55.2	UNR	54	47
387	15:13:39	51.3	54.0	UNR	52	48
388	15:14:39	53.8	58.2	UNR	55	50
389	15:15:39	53.4	56.9	UNR	55	50
390	15:16:39	51.9	54.4	UNR	53	49
391	15:17:39	53.8	60.7	UNR	57	48
392	15:18:39	54.6	59.0	UNR	56	51
393	15:19:39	51.9	56.8	UNR	54	46
394	15:20:39	50.7	53.7	UNR	52	46

395	15:21:39	57.6	62.7	UNR	60	52
396	15:22:39	54.6	59.8	UNR	57	50
397	15:23:39	51.9	54.5	UNR	53	48
398	15:24:39	52.5	56.6	UNR	54	49
399	15:25:39	54.6	57.3	UNR	56	51
400	15:26:39	54.1	56.1	UNR	55	50
401	15:27:39	51.0	54.3	UNR	52	48
402	15:28:39	51.9	53.9	UNR	53	49
403	15:29:39	54.2	56.8	UNR	55	51
404	15:30:39	53.4	58.0	UNR	56	48
405	15:31:39	58.4	65.7	UNR	62	50
406	15:32:39	53.4	57.5	UNR	55	50
407	15:33:39	56.1	63.5	UNR	59	51
408	15:34:39	57.6	63.1	UNR	61	49
409	15:35:39	53.4	55.6	UNR	54	50
410	15:36:39	53.6	55.5	UNR	54	51
411	15:37:39	54.5	58.3	UNR	55	50
412	15:38:39	53.9	57.5	UNR	56	50
413	15:39:39	52.2	55.2	UNR	54	48
414	15:40:39	52.5	56.2	UNR	54	49
415	15:41:39	52.4	54.4	UNR	53	49
416	15:42:39	55.2	59.0	UNR	57	49
417	15:43:39	56.7	59.2	UNR	58	53
418	15:44:39	53.5	55.6	UNR	55	50
419	15:45:39	60.1	73.8	UNR	60	50
420	15:46:39	54.1	58.2	UNR	55	50
421	15:47:39	52.8	55.4	UNR	54	48
422	15:48:39	53.8	56.6	UNR	55	50
423	15:49:39	60.4	64.8	UNR	62	55
424	15:50:39	54.4	58.7	UNR	56	50
425	15:51:39	52.9	57.2	UNR	55	50
426	15:52:39	53.8	57.4	UNR	55	51
427	15:53:39	54.4	58.2	UNR	56	50
428	15:54:39	55.6	58.3	UNR	57	51
429	15:55:39	53.9	58.2	UNR	56	49
430	15:56:39	52.8	56.4	UNR	55	50
431	15:57:39	52.0	54.6	UNR	53	49
432	15:58:39	51.8	55.0	UNR	53	49
433	15:59:39	53.0	55.0	UNR	54	50
434	16:00:39	53.8	59.2	UNR	54	51
435	16:01:39	54.2	60.0	UNR	58	49
436	16:02:39	53.7	55.3	UNR	54	51
437	16:03:39	55.1	57.2	UNR	56	52
438	16:04:39	56.6	59.2	UNR	58	53
439	16:05:39	53.2	55.6	UNR	54	50
440	16:06:39	56.5	59.1	UNR	58	51
441	16:07:39	53.7	57.2	UNR	55	48
442	16:08:39	51.2	53.1	UNR	52	48
443	16:09:39	51.1	53.5	UNR	52	48
444	16:10:39	51.6	55.0	UNR	53	48
445	16:11:39	50.6	54.3	UNR	52	46
446	16:12:39	52.1	55.0	UNR	53	48
447	16:13:39	53.7	59.4	UNR	57	47
448	16:14:39	53.2	59.1	UNR	55	49
449	16:15:39	52.7	55.4	UNR	54	49
450	16:16:39	53.6	58.2	UNR	55	50
451	16:17:39	58.1	62.4	UNR	61	50
452	16:18:39	52.3	55.1	UNR	54	48

453	16:19:39	54.3	58.8	UNR	57	50
454	16:20:39	55.5	59.8	UNR	57	51
455	16:21:39	51.2	54.3	UNR	52	48
456	16:22:39	52.8	56.4	UNR	54	49
457	16:23:39	54.6	61.8	UNR	58	49
458	16:24:39	58.3	64.7	UNR	61	53
459	16:25:39	54.2	57.2	UNR	55	50
460	16:26:39	58.6	62.2	UNR	60	54
461	16:27:39	56.9	61.6	UNR	58	51
462	16:28:39	54.4	57.4	UNR	56	50
463	16:29:39	55.8	58.2	UNR	57	53
464	16:30:39	54.6	57.5	UNR	56	51
465	16:31:39	55.1	59.8	UNR	58	51
466	16:32:39	57.0	60.6	UNR	59	51
467	16:33:39	54.6	56.6	UNR	55	51
468	16:34:39	55.7	59.2	UNR	57	52
469	16:35:39	59.3	61.9	UNR	61	55
470	16:36:39	53.8	60.2	UNR	57	48
471	16:37:39	53.5	57.5	UNR	55	49
472	16:38:39	53.8	56.7	UNR	56	50
473	16:39:39	56.0	59.6	UNR	57	52
474	16:40:39	57.6	64.0	UNR	62	51
475	16:41:39	63.8	67.8	UNR	66	54
476	16:42:39	54.8	56.7	UNR	56	52
477	16:43:39	53.6	56.0	UNR	54	50
478	16:44:39	51.6	53.5	UNR	53	49
479	16:45:39	53.8	56.7	UNR	55	50
480	16:46:39	53.3	55.2	UNR	54	51
481	16:47:39	53.3	56.0	UNR	55	50
482	16:48:39	54.1	56.6	UNR	55	51
483	16:49:39	53.5	56.1	UNR	55	50
484	16:50:39	55.2	57.6	UNR	56	51
485	16:51:39	54.3	56.2	UNR	55	52
486	16:52:39	54.2	56.6	UNR	55	51
487	16:53:39	54.3	57.6	UNR	55	51
488	16:54:39	55.6	58.2	UNR	56	53
489	16:55:39	55.6	58.7	UNR	57	52
490	16:56:39	57.0	59.9	UNR	59	52
491	16:57:39	54.0	55.2	UNR	54	52
492	16:58:39	54.4	58.2	UNR	56	51
493	16:59:39	55.2	59.9	UNR	56	52
494	17:00:39	55.6	58.4	UNR	57	51
495	17:01:39	52.4	55.0	UNR	53	50
496	17:02:39	54.2	56.6	UNR	55	52
497	17:03:39	54.9	57.5	UNR	56	52
498	17:04:39	55.3	60.8	UNR	57	52
499	17:05:39	54.6	58.2	UNR	55	52
500	17:06:39	54.1	56.2	UNR	55	52
501	17:07:39	54.1	61.8	UNR	55	50
502	17:08:39	57.3	69.7	UNR	58	51
503	17:09:39	55.1	57.3	UNR	55	53
504	17:10:39	57.6	70.7	UNR	58	51
505	17:11:39	61.6	71.7	120.2	66	51
506	17:12:39	64.6	73.9	115.2	67	56
507	17:13:39	73.9	85.1	124.1	79	60

```
-- AMPLITUDE DISTRIBUTION REPORT --

TOTAL SAMPLES =       486154
                                                                % OF TOTAL
dB   SAMPLES
--------------------------------------------------------------------------
45        75 .                                                        0.02
46      1018 +                                                        0.21
47      3609 *                                                        0.74
48     10983 **                                                       2.26
49     22342 *****                                                    4.60
50     41572 *********                                                8.55
51     63285 *************                                           13.02
52     67766 **************                                          13.94
53     75794 ****************                                        15.59
54     66195 **************                                          13.62
55     49984 **********                                              10.28
56     32268 *******                                                  6.64
57     20544 ****                                                     4.23
58     14035 ***                                                      2.89
59      7206 *                                                        1.48
60      3575 *                                                        0.74
61      2062 +                                                        0.42
62      1168 +                                                        0.24
63       675 +                                                        0.14
64       428 .                                                        0.09
65       427 .                                                        0.09
66       268 .                                                        0.06
67       200 .                                                        0.04
68       140 .                                                        0.03
69       133 .                                                        0.03
70        66 .                                                        0.01
71        86 .                                                        0.02
72        94 .                                                        0.02
73        35 .                                                        0.01
74        12 .                                                        0.00
75        11 .                                                        0.00
76        18 .                                                        0.00
77        17 .                                                        0.00
78        13 .                                                        0.00
79        11 .                                                        0.00
80        14 .                                                        0.00
81        11 .                                                        0.00
82         4 .                                                        0.00
83         3 .                                                        0.00
84         6 .                                                        0.00
85         1 .                                                        0.00
```

Ln(0.0) = 85dB
Ln(10.0) = 57dB
Ln(50.0) = 53dB
Ln(99.9) = 46dB

	NO CUTOFF	40.0dB CUTOFF	40.0dB CUTOFF
Leq	54.6dB	54.6dB	54.6dB
Ldod	54.0dB	54.0dB	54.0dB
Losha	53.8dB	53.8dB	53.8dB
Leq(6)	53.6dB	53.6dB	53.6dB

```
File Name.........BIN8
Test Location.....Molycorp
Employee Name.....
Employee Number...
Department........
Comment Field 1...Monitor 13072 /3456
Comment Field 2... [illegible] Bin
Numeric Code #1...       #2...        #3...        #4...        #5...

METROSONICS db-308 SN 3456 V3.0
REPORT PRINTED 03/04/97 AT 08:33:16

EXCHANGE RATE.....  3dB      FILTER.....A WGHT
DOSE CRITERION.... 90dB      RESPONSE...SLOW
PRE-TEST CALIBRATION TIME.... 2/28/97 AT  8:30:46
PRE-TEST CALIBRATION RANGE...  40.9dB TO 140.9dB
NO POST-TEST CALIBRATION
Calibrator Type & Serial #...______________________________

Calibrator Calibration Date..______________________________

-- OVERALL STATISTICS REPORT --


TEST BEGAN.... 2/28/97 AT  8:31:24
TEST LENGTH...      0 DAYS  8:48:49
TEST ENDED.... 2/28/97 AT 17:20:13
TEST INTERRUPTIONS...1

Lav.............. 53.4dB
SEL.............. 98.3dB
Lmax............. 78.4dB ON  2/28/97 AT 11:42:17
Lpk..............120.6dB ON  2/28/97 AT 11:42:17
TIME OVER 115dB..  0 DAYS  0:00:00.00

8 HR DOSE (40dB CUTOFF)........  0.02%
8 HR DOSE (40dB CUTOFF)........  0.02%
```

-- TABULAR TIME HISTORY REPORT --

OF PERIODS: 529 MODE: CONTINUOUS
PERIOD LENGTH: 0:01:00
TIME HISTORY CUTOFF: 40dB
Ln(1): 10.0% Ln(2): 99.9%

DATE: 2/28/97

INT	TIME	Lav	Lmx	Lpk	L1	L2
1	8:31:24	54.8	68.2	UNR	54	50
2	8:32:24	56.5	61.9	UNR	57	53
3	8:33:24	54.7	58.6	UNR	56	52
4	8:34:24	53.2	56.6	UNR	54	51
5	8:35:24	53.4	55.1	UNR	54	51
6	8:36:24	52.1	54.7	UNR	53	50
7	8:37:24	52.5	56.5	UNR	53	49
8	8:38:24	52.9	56.3	UNR	55	49
9	8:39:24	53.2	56.1	UNR	54	50
10	8:40:24	52.0	54.3	UNR	53	49
11	8:41:24	52.1	55.0	UNR	53	49
12	8:42:24	51.6	53.7	UNR	52	49
13	8:43:24	51.6	53.7	UNR	52	49
14	8:44:24	52.4	55.7	UNR	54	50
15	8:45:24	51.9	54.5	UNR	53	50
16	8:46:24	52.9	57.0	UNR	56	48
17	8:47:24	53.8	56.9	UNR	54	51
18	8:48:24	53.0	56.9	UNR	54	48
19	8:49:24	53.9	57.0	UNR	55	51
20	8:50:24	51.3	54.5	UNR	52	49
21	8:51:24	53.3	56.1	UNR	54	49
22	8:52:24	52.9	55.4	UNR	54	50
23	8:53:24	53.8	56.5	UNR	54	51
24	8:54:24	54.1	56.3	UNR	55	50
25	8:55:24	51.7	54.6	UNR	53	48
26	8:56:24	58.2	67.5	UNR	63	49
27	8:57:24	53.9	56.0	UNR	55	51
28	8:58:24	53.5	57.3	UNR	55	50
29	8:59:24	54.9	59.7	UNR	57	49
30	9:00:24	58.2	64.1	UNR	61	50
31	9:01:24	57.0	63.3	UNR	59	51
32	9:02:24	54.1	58.0	UNR	55	49
33	9:03:24	54.1	57.5	UNR	56	50
34	9:04:24	53.9	57.3	UNR	55	50
35	9:05:24	54.6	56.9	UNR	55	52
36	9:06:24	54.0	56.3	UNR	55	51
37	9:07:24	52.5	55.7	UNR	54	49
38	9:08:24	51.3	52.5	UNR	51	49
39	9:09:24	53.4	56.0	UNR	55	50
40	9:10:24	53.7	61.1	UNR	56	49
41	9:11:24	52.8	55.7	UNR	54	49
42	9:12:24	52.2	54.4	UNR	53	50
43	9:13:24	53.3	54.9	UNR	54	51
44	9:14:24	53.1	56.1	UNR	54	50
45	9:15:24	51.3	54.6	UNR	53	48
46	9:16:24	53.9	57.2	UNR	56	49

47	9:17:24	50.7	53.8	UNR	52	48
48	9:18:24	55.4	58.2	UNR	56	50
49	9:19:24	52.9	56.5	UNR	54	49
50	9:20:24	52.1	54.4	UNR	53	50
51	9:21:24	53.6	57.1	UNR	55	50
52	9:22:24	54.4	57.8	UNR	56	51
53	9:23:24	52.6	54.9	UNR	54	50
54	9:24:24	52.2	55.7	UNR	53	49
55	9:25:24	53.6	56.9	UNR	55	50
56	9:26:24	52.6	54.8	UNR	54	49
57	9:27:24	53.2	54.3	UNR	53	51
58	9:28:24	53.0	55.7	UNR	54	51
59	9:29:24	54.0	58.6	UNR	56	49
60	9:30:24	53.5	57.7	UNR	55	49
61	9:31:24	53.5	58.1	UNR	55	48
62	9:32:24	52.8	56.2	UNR	55	50
63	9:33:24	53.4	57.3	UNR	54	51
64	9:34:24	51.8	54.9	UNR	53	48
65	9:35:24	53.1	56.4	UNR	54	50
66	9:36:24	52.5	55.0	UNR	53	50
67	9:37:24	53.2	58.1	UNR	55	49
68	9:38:24	53.4	57.3	UNR	56	49
69	9:39:24	52.1	55.0	UNR	53	49
70	9:40:24	52.5	56.9	UNR	54	49
71	9:41:24	53.1	55.7	UNR	54	50
72	9:42:24	52.7	55.1	UNR	53	51
73	9:43:24	53.5	57.6	UNR	56	49
74	9:44:24	53.7	57.6	UNR	55	50
75	9:45:24	56.1	59.3	UNR	57	50
76	9:46:24	54.6	58.3	UNR	56	50
77	9:47:24	52.8	55.6	UNR	54	48
78	9:48:24	52.3	55.5	UNR	53	49
79	9:49:24	52.4	56.0	UNR	54	48
80	9:50:24	52.3	55.0	UNR	53	49
81	9:51:24	54.3	56.9	UNR	56	49
82	9:52:24	52.5	58.1	UNR	56	48
83	9:53:24	55.0	57.7	UNR	56	51
84	9:54:24	60.0	65.8	UNR	64	51
85	9:55:24	59.7	66.0	UNR	64	50
86	9:56:24	53.1	56.9	UNR	54	50
87	9:57:24	52.4	54.9	UNR	53	50
88	9:58:24	52.4	57.2	UNR	54	48
89	9:59:24	52.3	57.3	UNR	54	49
90	10:00:24	52.7	57.3	UNR	55	49
91	10:01:24	57.2	61.5	UNR	58	52
92	10:02:24	56.2	59.3	UNR	57	51
93	10:03:24	51.6	55.4	UNR	53	48
94	10:04:24	51.1	54.1	UNR	52	48
95	10:05:24	53.5	56.9	UNR	56	49
96	10:06:24	53.8	57.6	UNR	56	49
97	10:07:24	53.1	55.8	UNR	54	50
98	10:08:24	53.6	57.9	UNR	55	48
99	10:09:24	53.9	57.1	UNR	55	48
100	10:10:24	51.3	55.4	UNR	52	47
101	10:11:24	51.7	54.3	UNR	53	48
102	10:12:24	52.0	55.5	UNR	54	48
103	10:13:24	51.2	54.9	UNR	53	46
104	10:14:24	51.9	56.9	UNR	54	48

105	10:15:24	53.9	56.5	UNR	55	50
106	10:16:24	52.3	54.9	UNR	53	50
107	10:17:24	53.9	57.8	UNR	56	50
108	10:18:24	51.9	54.5	UNR	53	48
109	10:19:24	53.1	55.8	UNR	54	50
110	10:20:24	53.6	57.4	UNR	56	49
111	10:21:24	51.6	54.5	UNR	53	48
112	10:22:24	49.6	53.8	UNR	51	46
113	10:23:24	52.0	61.4	UNR	53	46
114	10:24:24	49.0	55.6	UNR	50	45
115	10:25:24	51.6	56.9	UNR	53	47
116	10:26:24	54.7	59.1	UNR	57	49
117	10:27:24	52.9	55.7	UNR	54	50
118	10:28:24	52.6	56.4	UNR	54	49
119	10:29:24	52.0	54.3	UNR	53	49
120	10:30:24	52.4	54.9	UNR	54	49
121	10:31:24	52.3	55.3	UNR	53	49
122	10:32:24	53.3	58.7	UNR	56	49
123	10:33:24	57.0	63.0	UNR	61	50
124	10:34:24	50.5	55.1	UNR	52	47
125	10:35:24	52.5	57.6	UNR	54	49
126	10:36:24	52.6	58.2	UNR	55	48
127	10:37:24	51.9	57.2	UNR	53	48
128	10:38:24	53.4	59.0	UNR	56	49
129	10:39:24	54.7	59.1	UNR	56	50
130	10:40:24	54.5	58.9	UNR	57	49
131	10:41:24	53.7	56.9	UNR	55	50
132	10:42:24	54.8	60.9	UNR	57	48
133	10:43:24	54.2	60.1	UNR	57	49
134	10:44:24	53.6	56.9	UNR	55	50
135	10:45:24	54.3	58.1	UNR	56	51
136	10:46:24	55.5	58.3	UNR	57	53
137	10:47:24	52.8	56.1	UNR	54	50
138	10:48:24	53.9	58.6	UNR	56	50
139	10:49:24	52.9	57.3	UNR	54	49
140	10:50:24	52.5	56.9	UNR	54	48
141	10:51:24	53.3	56.9	UNR	54	50
142	10:52:24	54.1	59.6	UNR	56	49
143	10:53:24	54.0	56.3	UNR	55	50
144	10:54:24	54.4	57.8	UNR	55	51
145	10:55:24	52.9	56.9	UNR	54	48
146	10:56:24	59.7	72.6	UNR	60	51
147	10:57:24	56.1	63.7	UNR	59	50
148	10:58:24	53.1	56.9	UNR	55	47
149	10:59:24	53.9	60.1	UNR	55	50
150	11:00:24	52.3	55.8	UNR	53	49
151	11:01:24	52.8	55.4	UNR	54	50
152	11:02:24	51.2	54.2	UNR	53	48
153	11:03:24	52.6	58.3	UNR	55	48
154	11:04:24	53.4	56.1	UNR	54	50
155	11:05:24	52.4	56.2	UNR	54	49
156	11:06:24	52.4	56.3	UNR	54	48
157	11:07:24	55.8	62.4	UNR	59	50
158	11:08:24	55.8	60.1	UNR	57	50
159	11:09:24	53.0	57.3	UNR	54	49
160	11:10:24	53.2	57.8	UNR	55	48
161	11:11:24	52.3	56.9	UNR	54	46
162	11:12:24	52.1	58.0	UNR	54	48

163	11:13:24	54.1	58.9	UNR	56	49
164	11:14:24	52.7	56.2	UNR	54	50
165	11:15:24	53.3	56.7	UNR	55	48
166	11:16:24	52.0	55.4	UNR	53	49
167	11:17:24	52.7	55.4	UNR	54	49
168	11:18:24	53.5	58.9	UNR	55	50
169	11:19:24	51.1	56.0	UNR	52	48
170	11:20:24	53.0	55.4	UNR	54	50
171	11:21:24	53.0	57.6	UNR	55	50
172	11:22:24	51.1	54.5	UNR	52	48
173	11:23:24	53.6	58.1	UNR	56	49
174	11:24:24	58.0	64.2	UNR	61	49
175	11:25:24	52.2	57.3	UNR	55	48
176	11:26:24	52.9	55.3	UNR	54	48
177	11:27:24	50.4	53.3	UNR	52	47
178	11:28:24	51.7	57.1	UNR	54	48
179	11:29:24	52.5	55.6	UNR	53	49
180	11:30:24	52.7	56.1	UNR	54	48
181	11:31:24	51.9	55.1	UNR	53	47
182	11:32:24	53.8	58.2	UNR	56	50
183	11:33:24	54.7	57.8	UNR	56	50
184	11:34:24	55.4	59.1	UNR	57	51
185	11:35:24	55.7	63.3	UNR	59	49
186	11:36:24	52.8	56.2	UNR	54	49
187	11:37:24	52.5	55.3	UNR	53	49
188	11:38:24	54.6	60.7	UNR	58	49
189	11:39:24	52.3	61.8	UNR	54	46
190	11:40:24	52.7	58.8	UNR	55	47
191	11:41:24	63.2	78.4	120.6	63	48
192	11:42:24	53.1	58.1	UNR	55	48
193	11:43:24	53.5	57.4	UNR	55	49
194	11:44:24	56.0	63.1	UNR	59	48
195	11:45:24	56.6	66.5	UNR	60	48
196	11:46:24	55.5	60.9	UNR	57	48
197	11:47:24	64.4	75.7	UNR	69	51
198	11:48:24	54.0	58.5	UNR	55	49
199	11:49:24	56.6	64.2	UNR	59	51
200	11:50:24	53.9	61.8	UNR	56	49
201	11:51:24	54.6	58.1	UNR	56	51
202	11:52:24	54.5	57.0	UNR	55	52
203	11:53:24	61.4	66.9	UNR	64	54
204	11:54:24	58.4	64.6	UNR	62	50
205	11:55:24	53.3	57.6	UNR	55	47
206	11:56:24	50.8	56.5	UNR	52	46
207	11:57:24	52.1	53.9	UNR	53	49
208	11:58:24	52.3	58.3	UNR	53	48
209	11:59:24	54.9	61.1	UNR	57	50
210	12:00:24	54.9	60.2	UNR	57	49
211	12:01:24	53.5	56.2	UNR	54	50
212	12:02:24	52.2	54.9	UNR	53	48
213	12:03:24	52.2	56.0	UNR	54	49
214	12:04:24	52.5	56.1	UNR	54	48
215	12:05:24	52.3	57.2	UNR	54	48
216	12:06:24	53.6	61.2	UNR	56	48
217	12:07:24	54.0	62.9	UNR	56	49
218	12:08:24	51.2	53.7	UNR	53	48
219	12:09:24	50.8	53.7	UNR	52	46
220	12:10:24	52.7	57.3	UNR	55	46

221	12:11:24	52.9	55.8	UNR	54	48
222	12:12:24	54.7	60.1	UNR	57	50
223	12:13:24	51.5	56.1	UNR	52	47
224	12:14:24	50.4	55.7	UNR	51	46
225	12:15:24	53.5	58.5	UNR	55	48
226	12:16:24	51.3	55.7	UNR	53	48
227	12:17:24	51.4	54.2	UNR	52	48
228	12:18:24	53.3	62.6	UNR	55	47
229	12:19:24	55.1	62.1	UNR	58	49
230	12:20:24	52.3	62.4	UNR	53	48
231	12:21:24	52.4	60.8	UNR	55	46
232	12:22:24	51.9	60.1	UNR	52	48
233	12:23:24	51.1	55.3	UNR	52	48
234	12:24:24	50.9	56.9	UNR	53	46
235	12:25:24	49.9	54.7	UNR	52	45
236	12:26:24	50.7	54.7	UNR	52	46
237	12:27:24	50.1	52.2	UNR	50	48
238	12:28:24	52.8	57.5	UNR	55	48
239	12:29:24	50.8	54.0	UNR	51	48
240	12:30:24	50.3	53.7	UNR	52	45
241	12:31:24	49.5	52.1	UNR	50	46
242	12:32:24	49.1	52.2	UNR	50	46
243	12:33:24	51.0	55.1	UNR	53	46
244	12:34:24	50.8	53.3	UNR	51	48
245	12:35:24	51.3	53.7	UNR	52	49
246	12:36:24	50.3	53.3	UNR	52	47
247	12:37:24	51.0	53.7	UNR	52	48
248	12:38:24	49.7	52.9	UNR	51	46
249	12:39:24	48.0	51.0	UNR	49	45
250	12:40:24	49.1	51.9	UNR	50	46
251	12:41:24	51.0	54.7	UNR	53	47
252	12:42:24	51.2	54.1	UNR	52	48
253	12:43:24	50.6	53.7	UNR	52	47
254	12:44:24	50.2	52.6	UNR	51	46
255	12:45:24	49.7	52.5	UNR	51	43
256	12:46:24	49.6	53.4	UNR	52	44
257	12:47:24	48.3	51.4	UNR	50	45
258	12:48:24	50.2	54.9	UNR	53	46
259	12:49:24	51.5	54.1	UNR	53	47
260	12:50:24	63.1	70.5	UNR	68	45
261	12:51:24	51.8	55.3	UNR	54	47
262	12:52:24	50.7	57.4	UNR	52	45
263	12:53:24	49.9	52.9	UNR	51	46
264	12:54:24	49.7	52.1	UNR	51	47
265	12:55:24	51.1	55.1	UNR	53	48
266	12:56:24	49.6	53.7	UNR	51	46
267	12:57:24	51.6	54.9	UNR	53	46
268	12:58:24	52.3	57.0	UNR	53	49
269	12:59:24	50.5	55.8	UNR	52	48
270	13:00:24	52.2	56.1	UNR	54	47
271	13:01:24	48.7	52.7	UNR	50	46
272	13:02:24	48.7	51.1	UNR	49	45
273	13:03:24	50.9	54.5	UNR	52	46
274	13:04:24	49.3	52.7	UNR	51	46
275	13:05:24	52.9	58.5	UNR	56	48
276	13:06:24	54.6	60.1	UNR	57	47
277	13:07:24	49.4	51.7	UNR	50	46
278	13:08:24	49.8	53.3	UNR	51	45

279	13:09:24	54.0	63.1	UNR	56	45
280	13:10:24	50.5	54.9	UNR	53	45
281	13:11:24	51.1	56.2	UNR	54	45
282	13:12:24	51.0	55.4	UNR	53	45
283	13:13:24	48.1	52.5	UNR	49	44
284	13:14:24	48.4	51.7	UNR	50	45
285	13:15:24	50.4	53.7	UNR	51	47
286	13:16:24	51.2	54.9	UNR	53	46
287	13:17:24	49.6	53.3	UNR	51	45
288	13:18:24	47.6	51.4	UNR	49	43
289	13:19:24	48.4	50.9	UNR	49	45
290	13:20:24	51.9	56.5	UNR	54	46
291	13:21:24	52.3	58.2	UNR	55	47
292	13:22:24	51.9	55.5	UNR	54	48
293	13:23:24	50.4	54.9	UNR	51	46
294	13:24:24	52.1	55.7	UNR	54	47
295	13:25:24	53.6	60.9	UNR	56	48
296	13:26:24	49.9	54.2	UNR	51	46
297	13:27:24	49.7	52.7	UNR	51	46
298	13:28:24	49.1	53.7	UNR	50	46
299	13:29:24	51.1	54.6	UNR	53	47
300	13:30:24	50.3	52.7	UNR	51	47
301	13:31:24	48.8	51.9	UNR	50	45
302	13:32:24	50.5	53.4	UNR	52	45
303	13:33:24	50.9	55.3	UNR	53	46
304	13:34:24	50.8	55.3	UNR	53	47
305	13:35:24	50.0	56.2	UNR	52	45
306	13:36:24	50.2	54.1	UNR	51	46
307	13:37:24	49.0	53.7	UNR	52	43
308	13:38:24	50.1	52.7	UNR	52	46
309	13:39:24	48.8	50.7	UNR	50	46
310	13:40:24	51.1	56.2	UNR	53	46
311	13:41:24	50.6	53.7	UNR	52	47
312	13:42:24	47.9	52.1	UNR	49	45
313	13:43:24	48.9	53.4	UNR	51	45
314	13:44:24	47.8	55.7	UNR	48	44
315	13:45:24	49.0	52.1	UNR	51	46
316	13:46:24	46.9	50.9	UNR	48	44
317	13:47:24	50.2	55.7	UNR	52	46
318	13:48:24	50.5	54.3	UNR	52	45
319	13:49:24	51.8	55.7	UNR	53	47
320	13:50:24	53.8	57.3	UNR	55	49
321	13:51:24	49.1	53.8	UNR	50	45
322	13:52:24	53.8	60.9	UNR	58	45
323	13:53:24	52.0	58.7	UNR	56	47
324	13:54:24	49.4	54.1	UNR	51	46
325	13:55:24	51.5	53.9	UNR	52	48
326	13:56:24	52.1	54.1	UNR	53	50
327	13:57:24	52.2	55.9	UNR	53	49
328	13:58:24	50.8	53.3	UNR	52	47
329	13:59:24	49.0	51.9	UNR	50	47
330	14:00:24	50.1	53.7	UNR	52	46
331	14:01:24	51.4	54.1	UNR	52	48
332	14:02:24	49.0	51.7	UNR	50	44
333	14:03:24	49.3	52.9	UNR	51	45
334	14:04:24	47.9	49.8	UNR	49	45
335	14:05:24	50.5	54.3	UNR	52	45
336	14:06:24	49.9	53.7	UNR	52	46

337	14:07:24	50.8	55.7	UNR	52	45
338	14:08:24	50.9	53.3	UNR	52	47
339	14:09:24	56.9	68.3	UNR	62	46
340	14:10:24	49.8	52.9	UNR	51	45
341	14:11:24	50.6	52.5	UNR	51	48
342	14:12:24	56.6	67.1	UNR	62	47
343	14:13:24	49.3	52.9	UNR	51	45
344	14:14:24	51.1	53.7	UNR	52	48
345	14:15:24	49.6	53.4	UNR	51	45
346	14:16:24	51.1	54.3	UNR	53	47
347	14:17:24	49.8	52.3	UNR	51	46
348	14:18:24	48.9	50.6	UNR	50	47
349	14:19:24	49.1	51.4	UNR	50	44
350	14:20:24	49.3	53.7	UNR	51	44
351	14:21:24	49.2	52.5	UNR	50	46
352	14:22:24	49.1	55.3	UNR	51	45
353	14:23:24	49.6	52.6	UNR	51	46
354	14:24:24	51.7	54.6	UNR	53	48
355	14:25:24	53.0	58.3	UNR	56	49
356	14:26:24	50.1	53.7	UNR	51	47
357	14:27:24	50.0	53.3	UNR	51	45
358	14:28:24	50.4	54.1	UNR	51	47
359	14:29:24	48.1	51.1	UNR	50	44
360	14:30:24	50.3	53.3	UNR	51	47
361	14:31:24	50.3	52.9	UNR	51	46
362	14:32:24	50.6	54.2	UNR	53	46
363	14:33:24	50.5	52.6	UNR	51	48
364	14:34:24	48.5	52.1	UNR	50	45
365	14:35:24	50.8	54.1	UNR	52	47
366	14:36:24	50.8	54.5	UNR	52	47
367	14:37:24	50.8	55.1	UNR	53	46
368	14:38:24	50.3	53.7	UNR	52	46
369	14:39:24	50.5	54.9	UNR	52	46
370	14:40:24	51.3	55.7	UNR	53	46
371	14:41:24	50.1	55.3	UNR	52	45
372	14:42:24	49.3	52.6	UNR	51	45
373	14:43:24	49.4	54.1	UNR	53	44
374	14:44:24	49.5	55.1	UNR	52	43
375	14:45:24	49.4	51.7	UNR	50	45
376	14:46:24	47.3	52.5	UNR	50	43
377	14:47:24	48.0	50.9	UNR	49	45
378	14:48:24	49.2	51.7	UNR	50	45
379	14:49:24	48.0	51.5	UNR	50	42
380	14:50:24	51.9	57.0	UNR	54	46
381	14:51:24	49.9	52.7	UNR	51	46
382	14:52:24	52.2	57.0	UNR	54	48
383	14:53:24	52.8	59.7	UNR	55	45
384	14:54:24	50.6	57.3	UNR	53	45
385	14:55:24	49.9	53.7	UNR	51	46
386	14:56:24	50.3	52.7	UNR	51	48
387	14:57:24	49.6	52.5	UNR	50	46
388	14:58:24	49.3	52.5	UNR	50	46
389	14:59:24	50.8	54.2	UNR	52	47
390	15:00:24	51.8	55.2	UNR	53	48
391	15:01:24	51.6	56.1	UNR	53	48
392	15:02:24	56.9	63.9	UNR	59	52
393	15:03:24	50.1	54.1	UNR	52	46
394	15:04:24	51.1	54.1	UNR	52	47

395	15:05:24	51.5	54.3	UNR	53	46
396	15:06:24	52.4	55.1	UNR	54	47
397	15:07:24	49.0	51.9	UNR	50	46
398	15:08:24	53.8	60.1	UNR	57	48
399	15:09:24	56.1	60.5	UNR	58	48
400	15:10:24	52.7	57.3	UNR	54	48
401	15:11:24	52.5	55.7	UNR	54	48
402	15:12:24	53.6	55.7	UNR	54	51
403	15:13:24	54.0	57.5	UNR	56	46
404	15:14:24	51.3	53.7	UNR	52	48
405	15:15:24	50.2	54.3	UNR	51	46
406	15:16:24	53.8	57.7	UNR	55	48
407	15:17:24	51.2	55.7	UNR	54	46
408	15:18:24	51.6	54.1	UNR	53	48
409	15:19:24	55.5	59.4	UNR	58	50
410	15:20:24	57.4	63.1	UNR	60	51
411	15:21:24	50.5	54.7	UNR	52	46
412	15:22:24	50.1	52.9	UNR	52	47
413	15:23:24	52.4	55.0	UNR	53	48
414	15:24:24	53.5	55.8	UNR	55	50
415	15:25:24	52.4	55.0	UNR	53	50
416	15:26:24	52.8	60.1	UNR	56	46
417	15:27:24	52.3	54.6	UNR	53	49
418	15:28:24	51.7	54.1	UNR	53	48
419	15:29:24	58.1	63.9	UNR	61	51
420	15:30:24	56.4	65.7	UNR	62	47
421	15:31:24	53.5	57.7	UNR	55	50
422	15:32:24	57.3	62.2	UNR	60	51
423	15:33:24	54.4	58.9	UNR	56	49
424	15:34:24	51.9	55.3	UNR	53	48
425	15:35:24	51.0	53.0	UNR	51	48
426	15:36:24	51.2	55.1	UNR	52	48
427	15:37:24	51.4	54.1	UNR	52	48
428	15:38:24	51.3	55.3	UNR	53	48
429	15:39:24	50.2	53.1	UNR	51	48
430	15:40:24	54.4	58.3	UNR	56	50
431	15:41:24	53.5	58.9	UNR	55	50
432	15:42:24	53.0	55.3	UNR	54	50
433	15:43:24	54.6	58.1	UNR	56	51
434	15:44:24	53.7	55.8	UNR	54	52
435	15:45:24	52.5	55.1	UNR	53	50
436	15:46:24	50.2	52.9	UNR	51	48
437	15:47:24	55.2	60.5	UNR	58	50
438	15:48:24	55.3	62.1	UNR	59	49
439	15:49:24	52.0	54.9	UNR	53	49
440	15:50:24	53.5	55.7	UNR	54	51
441	15:51:24	54.8	60.1	UNR	57	48
442	15:52:24	53.9	57.3	UNR	56	50
443	15:53:24	52.4	57.0	UNR	54	48
444	15:54:24	51.5	53.3	UNR	52	48
445	15:55:24	52.1	55.7	UNR	54	48
446	15:56:24	52.5	55.8	UNR	54	50
447	15:57:24	52.4	56.9	UNR	55	48
448	15:58:24	54.1	56.9	UNR	56	50
449	15:59:24	57.1	63.6	UNR	61	51
450	16:00:24	53.1	56.5	UNR	55	50
451	16:01:24	54.0	55.7	UNR	54	51
452	16:02:24	53.1	55.3	UNR	54	50

453	16:03:24	52.8	56.3	UNR	54	48
454	16:04:24	51.1	54.1	UNR	52	47
455	16:05:24	51.5	55.7	UNR	53	47
456	16:06:24	50.9	53.3	UNR	52	48
457	16:07:24	51.0	55.7	UNR	54	48
458	16:08:24	52.5	54.6	UNR	53	50
459	16:09:24	50.9	54.1	UNR	52	47
460	16:10:24	52.7	55.7	UNR	54	48
461	16:11:24	50.6	54.5	UNR	53	46
462	16:12:24	52.9	56.2	UNR	54	49
463	16:13:24	52.6	55.3	UNR	54	49
464	16:14:24	53.5	57.5	UNR	55	50
465	16:15:24	56.3	60.9	UNR	59	51
466	16:16:24	53.0	57.5	UNR	54	49
467	16:17:24	52.7	54.9	UNR	53	48
468	16:18:24	54.5	58.6	UNR	55	50
469	16:19:24	51.3	57.5	UNR	53	46
470	16:20:24	53.4	57.8	UNR	55	49
471	16:21:24	53.3	59.2	UNR	56	49
472	16:22:24	57.5	62.6	UNR	59	53
473	16:23:24	53.0	58.5	UNR	55	49
474	16:24:24	56.0	62.5	UNR	59	50
475	16:25:24	53.3	57.7	UNR	55	50
476	16:26:24	52.1	54.9	UNR	53	50
477	16:27:24	53.6	55.4	UNR	54	51
478	16:28:24	52.8	57.9	UNR	53	50
479	16:29:24	54.7	62.3	UNR	56	51
480	16:30:24	51.0	57.5	UNR	52	47
481	16:31:24	52.4	55.7	UNR	54	47
482	16:32:24	51.5	53.7	UNR	52	48
483	16:33:24	52.9	55.3	UNR	54	50
484	16:34:24	52.5	55.3	UNR	54	48
485	16:35:24	52.5	54.9	UNR	53	50
486	16:36:24	51.9	55.7	UNR	53	48
487	16:37:24	53.7	55.7	UNR	54	51
488	16:38:24	54.5	58.5	UNR	56	48
489	16:39:24	62.7	67.2	UNR	65	53
490	16:40:24	54.8	62.1	UNR	57	51
491	16:41:24	52.9	55.4	UNR	54	50
492	16:42:24	52.0	54.6	UNR	53	48
493	16:43:24	53.1	55.9	UNR	54	49
494	16:44:24	53.3	57.3	UNR	54	50
495	16:45:24	51.7	54.1	UNR	53	49
496	16:46:24	51.7	54.6	UNR	52	48
497	16:47:24	51.6	55.3	UNR	53	46
498	16:48:24	51.2	55.0	UNR	52	48
499	16:49:24	52.4	57.0	UNR	54	47
500	16:50:24	52.2	55.3	UNR	53	49
501	16:51:24	50.8	54.2	UNR	52	48
502	16:52:24	52.2	55.3	UNR	54	47
503	16:53:24	53.8	55.7	UNR	54	51
504	16:54:24	54.5	57.8	UNR	56	49
505	16:55:24	52.9	55.3	UNR	54	48
506	16:56:24	53.5	56.9	UNR	55	50
507	16:57:24	52.5	55.4	UNR	54	49
508	16:58:24	51.8	54.9	UNR	54	48
509	16:59:24	50.5	52.5	UNR	51	48
510	17:00:24	52.7	55.7	UNR	53	50

511	17:01:24	52.2	54.9	UNR	53	50
512	17:02:24	52.6	54.1	UNR	53	50
513	17:03:24	51.4	54.1	UNR	52	48
514	17:04:24	51.5	54.5	UNR	53	49
515	17:05:24	52.3	54.1	UNR	53	50
516	17:06:24	56.6	60.7	UNR	59	51
517	17:07:24	56.7	60.7	UNR	59	51
518	17:08:24	53.1	56.1	UNR	55	49
519	17:09:24	52.8	55.7	UNR	53	50
520	17:10:24	53.7	57.3	UNR	56	49
521	17:11:24	53.0	55.6	UNR	54	50
522	17:12:24	52.8	55.7	UNR	54	49
523	17:13:24	52.3	56.0	UNR	54	48
524	17:14:24	54.4	64.2	UNR	57	49
525	17:15:24	52.6	56.9	UNR	54	49
526	17:16:24	53.4	56.1	UNR	54	50
527	17:17:24	62.4	72.6	113.9	67	53
528	17:18:24	61.8	75.3	120.1	64	52
529	17:19:24	62.3	75.1	110.3	62	56

```
-- AMPLITUDE DISTRIBUTION REPORT --


TOTAL SAMPLES =       507674

dB   SAMPLES                                                      % OF TOTAL
____________________________________________________________________________
42        15 .                                                          0.00
43       253 .                                                          0.05
44       959 +                                                          0.19
45      3140 *                                                          0.62
46      9394 **                                                         1.85
47     16990 ***                                                        3.35
48     31620 ******                                                     6.23
49     46351 *********                                                  9.13
50     71979 **************                                            14.18
51     77979 ***************                                           15.36
52     82452 ****************                                          16.24
53     64235 *************                                             12.65
54     43175 *********                                                  8.50
55     23255 *****                                                      4.58
56     14275 ***                                                        2.81
57      6866 *                                                          1.35
58      4542 *                                                          0.89
59      2440 +                                                          0.48
60      2316 +                                                          0.46
61      1481 +                                                          0.29
62      1189 +                                                          0.23
63       899 +                                                          0.18
64       633 +                                                          0.12
65       408 .                                                          0.08
66       224 .                                                          0.04
67       110 .                                                          0.02
68       151 .                                                          0.03
69        94 .                                                          0.02
70        74 .                                                          0.01
71        52 .                                                          0.01
72        40 .                                                          0.01
73        28 .                                                          0.01
74        19 .                                                          0.00
75        20 .                                                          0.00
76         4 .                                                          0.00
77         8 .                                                          0.00
78         4 .                                                          0.00

Ln( 0.0)  =  78dB
Ln(10.0)  =  55dB
Ln(50.0)  =  51dB
Ln(99.9)  =  44dB

               NO         40.0dB      40.0dB
             CUTOFF       CUTOFF      CUTOFF


Leq          53.0dB       53.0dB      53.0dB
Ldod         52.5dB       52.5dB      52.5dB
Losha        52.2dB       52.2dB      52.2dB
Leq(6)       52.1dB       52.1dB      52.1dB
```

```
File Name.........BIN2
Test Location.....Moly Corp
Employee Name..... Greg Malinowski
Employee Number...
Department........
Comment Field 1...13072 /3456
Comment Field 2... Railroad Bed
Numeric Code #1...       #2...       #3...       #4...       #5...

METROSONICS db-308 SN 3456 V3.0
REPORT PRINTED 03/04/97 AT 08:46:55

EXCHANGE RATE.....  3dB      FILTER.....A WGHT
DOSE CRITERION.... 90dB      RESPONSE...SLOW
PRE-TEST CALIBRATION TIME.... 2/27/97 AT  7:47:22
PRE-TEST CALIBRATION RANGE...  40.7dB TO 140.7dB
NO POST-TEST CALIBRATION
Calibrator Type & Serial #...______________________________

Calibrator Calibration Date..______________________________

-- OVERALL STATISTICS REPORT --


TEST BEGAN.... 2/27/97 AT  8:29:50
TEST LENGTH...     0 DAYS  8:01:21
TEST ENDED.... 2/27/97 AT 16:31:34
TEST INTERRUPTIONS...6

Lav.............. 58.6dB
SEL..............103.1dB
Lmax............. 95.4dB ON  2/27/97 AT  8:31:16
Lpk..............134.2dB ON  2/27/97 AT  8:31:16
TIME OVER 115dB..  0 DAYS  0:00:00.00

8 HR DOSE (40dB CUTOFF)........  0.07%
8 HR DOSE (40dB CUTOFF)........  0.07%
```

```
-- TABULAR TIME HISTORY REPORT --


# OF PERIODS:  484   MODE:  CONTINUOUS
PERIOD LENGTH:  0:01:00
TIME HISTORY CUTOFF:  40dB
Ln(1): 10.0%  Ln(2): 99.9%

DATE:   2/27/97

INT    TIME          Lav    Lmx    Lpk     L1    L2
  1   8:29:50       65.9   82.2   UNR     62    50
  2   8:30:50       80.1   95.4  134.2    83    55
  3   8:31:50       56.0   62.5   UNR     58    51
  4   8:32:50       51.1   53.5   UNR     52    48
  5   8:33:50       50.6   53.1   UNR     52    48
  6   8:34:50       51.4   53.5   UNR     52    48
  7   8:35:50       56.3   61.3   UNR     58    49
  8   8:36:50       54.1   59.3   UNR     57    50
  9   8:37:50       50.2   53.3   UNR     51    49
 10   8:38:50       51.9   53.7   UNR     52    49
 11   8:39:50       50.6   52.7   UNR     51    49
 12   8:40:50       51.7   53.5   UNR     52    50
 13   8:41:50       52.9   57.6   UNR     55    48
 14   8:42:50       53.2   57.1   UNR     55    49
 15   8:43:50       51.8   54.7   UNR     53    49
 16   8:44:50       53.5   58.9   UNR     55    49
 17   8:45:50       51.4   52.9   UNR     52    49
 18   8:46:50       51.1   52.5   UNR     51    49
 19   8:47:50       52.8   54.1   UNR     53    51
 20   8:48:50       54.8   59.9   UNR     56    51
 21   8:49:50       54.8   56.7   UNR     55    53
 22   8:50:50       53.8   57.5   UNR     55    50
 23   8:51:50       54.1   59.9   UNR     55    51
 24   8:52:50       53.6   59.3   UNR     55    50
 25   8:53:50       50.4   52.7   UNR     51    48
 26   8:54:50       52.0   54.5   UNR     52    50
 27   8:55:50       51.6   55.5   UNR     52    49
 28   8:56:50       52.5   57.1   UNR     55    48
 29   8:57:50       53.0   55.9   UNR     54    50
 30   8:58:50       50.0   52.3   UNR     50    48
 31   8:59:50       53.9   64.2   UNR     56    49
 32   9:00:50       49.8   53.1   UNR     51    47
 33   9:01:50       51.5   55.1   UNR     52    49
 34   9:02:50       49.6   51.5   UNR     50    47
 35   9:03:50       51.8   55.5   UNR     54    48
 36   9:04:50       51.1   53.5   UNR     52    48
 37   9:05:50       53.0   63.4   UNR     55    48
 38   9:06:50       55.0   58.4   UNR     57    51
 39   9:07:50       52.8   55.7   UNR     54    49
 40   9:08:50       50.9   53.2   UNR     52    49
 41   9:09:50       51.5   53.5   UNR     52    49
 42   9:10:50       53.3   55.5   UNR     54    50
 43   9:11:50       51.1   54.7   UNR     52    48
 44   9:12:50       52.8   57.9   UNR     55    48
 45   9:13:50       52.2   54.5   UNR     53    49
 46   9:14:50       50.5   54.7   UNR     53    48
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47	9:15:50	48.8	50.3	UNR	49	46
48	9:16:50	49.8	53.1	UNR	51	47
49	9:17:50	52.2	57.9	UNR	55	47
50	9:18:50	50.5	53.0	UNR	51	48
51	9:19:50	50.8	52.5	UNR	52	48
52	9:20:50	50.9	53.9	UNR	52	49
53	9:21:50	56.5	61.5	UNR	59	50
54	9:22:50	61.1	70.3	UNR	63	53
55	9:23:50	58.6	63.3	UNR	61	54
56	9:24:50	60.1	65.5	UNR	62	54
57	9:25:50	56.8	59.5	UNR	58	53
58	9:26:50	61.2	70.4	109.5	64	54
59	9:27:50	55.9	61.9	UNR	58	53
60	9:28:50	54.6	57.5	UNR	56	51
61	9:29:50	55.7	66.3	109.0	57	51
62	9:30:50	53.3	57.1	UNR	55	50
63	9:31:50	54.3	57.2	UNR	56	50
64	9:32:50	50.5	52.5	UNR	51	48
65	9:33:50	50.6	54.7	UNR	52	48
66	9:34:50	53.8	57.5	UNR	56	51
67	9:35:50	51.9	55.7	UNR	54	49
68	9:36:50	54.1	61.9	UNR	55	50
69	9:37:50	51.1	55.5	UNR	52	49
70	9:38:50	50.8	52.3	UNR	51	49
71	9:39:50	51.3	53.5	UNR	52	48
72	9:40:50	50.1	53.1	UNR	52	47
73	9:41:50	50.1	53.2	UNR	51	47
74	9:42:50	49.1	51.5	UNR	50	47
75	9:43:50	51.6	53.5	UNR	52	49
76	9:44:50	50.6	53.9	UNR	52	47
77	9:45:50	50.3	53.6	UNR	51	48
78	9:46:50	51.1	54.7	UNR	53	48
79	9:47:50	53.3	59.0	UNR	55	48
80	9:48:50	54.4	66.7	UNR	57	48
81	9:49:50	53.5	59.9	UNR	55	48
82	9:50:50	49.8	55.3	UNR	51	46
83	9:51:50	53.4	67.4	UNR	53	47
84	9:52:50	49.1	53.2	UNR	50	46
85	9:53:50	50.9	53.9	UNR	52	48
86	9:54:50	51.1	54.3	UNR	53	48
87	9:55:50	53.5	57.1	UNR	55	50
88	9:56:50	55.1	66.0	UNR	55	51
89	9:57:50	52.9	62.2	UNR	54	49
90	9:58:50	53.5	57.6	UNR	56	49
91	9:59:50	55.0	62.7	UNR	57	52
92	10:00:50	52.2	54.7	UNR	53	49
93	10:01:50	50.7	55.1	UNR	51	48
94	10:02:50	51.7	53.9	UNR	52	50
95	10:03:50	50.5	52.8	UNR	51	48
96	10:04:50	50.2	52.3	UNR	51	48
97	10:05:50	52.0	56.8	UNR	53	49
98	10:06:50	57.3	63.1	UNR	60	51
99	10:07:50	56.0	62.9	UNR	59	49
100	10:08:50	50.3	53.4	UNR	51	47
101	10:09:50	51.2	55.5	UNR	53	46

DATE: 2/27/97

INT	TIME	Lav	Lmx	Lpk	L1	L2
102	10:10:48	48.5	48.7	UNR	48	48

DATE: 2/27/97

INT	TIME	Lav	Lmx	Lpk	L1	L2
103	10:11:05	46.8	47.5	UNR	47	46

DATE: 2/27/97

INT	TIME	Lav	Lmx	Lpk	L1	L2
104	10:11:07	48.7	52.9	UNR	51	45
105	10:12:07	47.2	49.1	UNR	48	45
106	10:13:07	51.0	55.5	UNR	53	47
107	10:14:07	50.4	55.0	UNR	51	48
108	10:15:07	50.6	54.3	UNR	52	47
109	10:16:07	50.8	53.9	UNR	52	48
110	10:17:07	53.6	58.3	UNR	56	48
111	10:18:07	50.9	55.5	UNR	52	48
112	10:19:07	55.2	60.7	UNR	58	48
113	10:20:07	48.0	49.9	UNR	49	46
114	10:21:07	51.4	56.7	UNR	53	48
115	10:22:07	48.6	50.7	UNR	49	46
116	10:23:07	48.6	58.7	UNR	49	45
117	10:24:07	48.8	51.5	UNR	50	46
118	10:25:07	51.1	65.1	UNR	49	44
119	10:26:07	48.3	56.0	UNR	50	45
120	10:27:07	50.4	55.5	UNR	51	47
121	10:28:07	50.1	53.5	UNR	51	46
122	10:29:07	49.6	52.3	UNR	51	46
123	10:30:07	47.1	49.1	UNR	47	45
124	10:31:07	47.9	50.1	UNR	49	45
125	10:32:07	49.4	60.5	UNR	49	44
126	10:33:07	48.4	51.0	UNR	49	45
127	10:34:07	47.9	50.3	UNR	49	46
128	10:35:07	47.9	51.9	UNR	48	44
129	10:36:07	48.3	53.9	UNR	49	44
130	10:37:07	46.5	51.9	UNR	49	43
131	10:38:07	49.0	53.9	UNR	51	43
132	10:39:07	49.1	52.7	UNR	51	45
133	10:40:07	47.9	51.1	UNR	49	45
134	10:41:07	48.6	51.6	UNR	49	46
135	10:42:07	48.7	51.5	UNR	50	45
136	10:43:07	47.8	53.5	UNR	49	44
137	10:44:07	47.4	51.2	UNR	49	43
138	10:45:07	48.4	59.5	UNR	50	43
139	10:46:07	46.8	49.6	UNR	48	44
140	10:47:07	48.0	50.7	UNR	49	45
141	10:48:07	46.2	50.3	UNR	47	43
142	10:49:07	46.0	49.9	UNR	47	43
143	10:50:07	48.4	51.9	UNR	50	43
144	10:51:07	46.8	49.5	UNR	48	42
145	10:52:07	47.4	51.0	UNR	49	44
146	10:53:07	45.2	47.1	UNR	45	43
147	10:54:07	45.6	47.8	UNR	47	43

148	10:55:07	45.6	47.5	UNR	46	43
149	10:56:07	48.9	54.6	UNR	51	44
150	10:57:07	51.2	57.1	UNR	54	46
151	10:58:07	48.6	52.5	UNR	50	45
152	10:59:07	47.6	50.3	UNR	48	45
153	11:00:07	46.3	48.3	UNR	47	44
154	11:01:07	50.0	53.5	UNR	52	45
155	11:02:07	50.3	53.1	UNR	51	47
156	11:03:07	47.7	50.7	UNR	50	44
157	11:04:07	48.1	51.5	UNR	50	45
158	11:05:07	49.5	53.5	UNR	51	44
159	11:06:07	50.9	55.5	UNR	53	46
160	11:07:07	45.0	49.5	UNR	47	42
161	11:08:07	46.9	49.9	UNR	48	43
162	11:09:07	48.7	50.3	UNR	49	46
163	11:10:07	46.8	50.3	UNR	47	45
164	11:11:07	51.7	60.3	UNR	53	48
165	11:12:07	49.5	52.7	UNR	50	47
166	11:13:07	49.2	55.9	UNR	51	45
167	11:14:07	49.1	57.6	UNR	52	44

DATE: 2/27/97

INT	TIME	Lav	Lmx	Lpk	L1	L2
168	11:14:48	49.0	52.8	UNR	51	45
169	11:15:48	49.1	52.3	UNR	50	46
170	11:16:48	58.9	70.4	110.5	62	46
171	11:17:48	48.0	53.9	UNR	50	45
172	11:18:48	50.5	57.1	UNR	52	45
173	11:19:48	51.1	53.1	UNR	52	48
174	11:20:48	48.9	54.3	UNR	51	45
175	11:21:48	49.7	53.9	UNR	51	47
176	11:22:48	52.9	61.2	UNR	55	48
177	11:23:48	52.6	57.1	UNR	54	49
178	11:24:48	52.7	59.5	UNR	55	49
179	11:25:48	54.8	60.3	UNR	56	51
180	11:26:48	56.7	62.3	UNR	60	50
181	11:27:48	53.6	58.3	UNR	56	50
182	11:28:48	51.3	56.0	UNR	52	49
183	11:29:48	52.0	54.8	UNR	53	48
184	11:30:48	55.1	61.6	UNR	59	50
185	11:31:48	52.5	55.9	UNR	54	49
186	11:32:48	49.5	51.7	UNR	50	47
187	11:33:48	48.8	51.1	UNR	49	47
188	11:34:48	55.0	63.7	UNR	57	48
189	11:35:48	52.3	54.7	UNR	53	50
190	11:36:48	50.8	52.5	UNR	52	48
191	11:37:48	53.5	60.3	UNR	54	51
192	11:38:48	59.1	66.3	UNR	63	53
193	11:39:48	56.4	61.1	UNR	59	51
194	11:40:48	55.3	64.1	UNR	57	51
195	11:41:48	58.9	65.9	109.0	63	51
196	11:42:48	57.1	60.3	UNR	59	52
197	11:43:48	56.5	58.8	UNR	58	52
198	11:44:48	55.2	59.9	UNR	58	51
199	11:45:48	52.4	53.5	UNR	53	51
200	11:46:48	54.9	58.9	UNR	56	52
201	11:47:48	53.2	57.3	UNR	55	49

202	11:48:48	53.4	55.7	UNR	55	50
203	11:49:48	62.2	71.5	UNR	65	51
204	11:50:48	64.2	71.5	UNR	67	53
205	11:51:48	55.4	60.7	UNR	59	49
206	11:52:48	51.2	53.5	UNR	52	49
207	11:53:48	50.2	52.3	UNR	51	47
208	11:54:48	51.9	54.1	UNR	53	49
209	11:55:48	53.1	55.5	UNR	54	50
210	11:56:48	58.2	64.7	109.0	61	49
211	11:57:48	54.6	58.7	UNR	57	51
212	11:58:48	51.2	54.7	UNR	52	49
213	11:59:48	54.6	58.7	UNR	56	51
214	12:00:48	53.3	55.5	UNR	54	50
215	12:01:48	52.3	54.1	UNR	53	50
216	12:02:48	63.9	73.8	UNR	68	51
217	12:03:48	56.3	60.4	UNR	59	52
218	12:04:48	54.6	58.7	UNR	55	49
219	12:05:48	51.5	56.5	UNR	52	49
220	12:06:48	56.5	61.5	UNR	59	51
221	12:07:48	56.7	63.7	UNR	60	51
222	12:08:48	53.9	58.1	UNR	55	50
223	12:09:48	55.7	66.5	111.0	57	51
224	12:10:48	50.7	52.9	UNR	51	48
225	12:11:48	56.1	62.1	UNR	58	49
226	12:12:48	50.4	54.0	UNR	51	48
227	12:13:48	51.8	54.9	UNR	53	48
228	12:14:48	57.7	62.3	UNR	60	51
229	12:15:48	58.0	63.6	UNR	60	53
230	12:16:48	58.1	64.0	UNR	61	54
231	12:17:48	58.5	62.7	UNR	61	53
232	12:18:48	56.9	65.1	UNR	60	51
233	12:19:48	56.5	63.1	UNR	58	52
234	12:20:48	52.2	55.5	UNR	53	49
235	12:21:48	52.9	57.3	UNR	55	48
236	12:22:48	63.0	69.5	UNR	66	53
237	12:23:48	63.3	72.7	112.7	65	57
238	12:24:48	56.3	58.9	UNR	57	52
239	12:25:48	54.9	62.2	UNR	57	50
240	12:26:48	55.9	61.7	UNR	57	52
241	12:27:48	50.4	53.1	UNR	52	46
242	12:28:48	58.2	68.5	110.1	63	49
243	12:29:48	58.3	62.0	UNR	60	54
244	12:30:48	52.0	54.7	UNR	53	49
245	12:31:48	52.3	57.5	UNR	54	49
246	12:32:48	52.8	61.5	UNR	55	48
247	12:33:48	52.2	57.3	UNR	54	48
248	12:34:48	50.4	55.7	UNR	52	47
249	12:35:48	52.4	55.1	UNR	54	49
250	12:36:48	58.6	66.6	UNR	63	53
251	12:37:48	68.9	81.2	117.7	72	55
252	12:38:48	61.8	64.3	UNR	63	57
253	12:39:48	64.3	70.0	111.0	67	57
254	12:40:48	56.8	61.9	UNR	60	53
255	12:41:48	55.9	59.3	UNR	57	53
256	12:42:48	63.4	70.6	109.0	68	54
257	12:43:48	66.4	74.0	114.1	69	60
258	12:44:48	65.1	71.4	111.5	67	60
259	12:45:48	59.5	62.3	UNR	61	56

260	12:46:48	59.6	61.9	UNR	61	55
261	12:47:48	57.8	61.5	UNR	59	53
262	12:48:48	60.5	67.5	UNR	65	53
263	12:49:48	61.4	67.6	UNR	64	53
264	12:50:48	55.0	57.6	UNR	56	52
265	12:51:48	56.3	63.7	UNR	57	53
266	12:52:48	62.9	70.0	UNR	65	56
267	12:53:48	62.9	70.9	UNR	65	53
268	12:54:48	57.3	63.5	UNR	60	52
269	12:55:48	58.0	62.3	UNR	60	53
270	12:56:48	56.5	59.1	UNR	57	54
271	12:57:48	60.3	62.9	UNR	61	57
272	12:58:48	65.0	74.9	112.7	67	55
273	12:59:48	64.1	70.5	109.5	67	57
274	13:00:48	64.9	72.9	113.7	68	56
275	13:01:48	63.7	69.5	UNR	67	54
276	13:02:48	68.3	75.8	115.3	71	61
277	13:03:48	73.6	82.7	118.9	79	59
278	13:04:48	64.8	74.7	112.3	67	58
279	13:05:48	64.4	71.8	112.3	69	54
280	13:06:48	58.9	63.9	UNR	61	54
281	13:07:48	63.8	75.1	110.5	68	54
282	13:08:48	63.1	73.8	111.5	65	54
283	13:09:48	56.7	58.7	UNR	58	53
284	13:10:48	61.1	72.0	112.7	64	52
285	13:11:48	55.1	64.1	UNR	57	50
286	13:12:48	61.0	67.9	UNR	65	50
287	13:13:48	57.6	62.7	UNR	59	53
288	13:14:48	69.7	85.8	116.3	70	58
289	13:15:48	60.6	67.5	UNR	63	53
290	13:16:48	54.7	57.9	UNR	55	52
291	13:17:48	61.7	71.1	UNR	64	52
292	13:18:48	58.4	62.0	UNR	60	55
293	13:19:48	55.4	60.3	UNR	57	52
294	13:20:48	52.2	55.1	UNR	53	49
295	13:21:48	52.1	56.7	UNR	55	46
296	13:22:48	50.1	54.2	UNR	51	47
297	13:23:48	50.0	55.5	UNR	51	47
298	13:24:48	53.5	59.9	UNR	55	47
299	13:25:48	49.0	54.1	UNR	50	46
300	13:26:48	49.7	54.9	UNR	51	46
301	13:27:48	53.2	59.1	UNR	56	48
302	13:28:48	57.0	63.9	UNR	61	49
303	13:29:48	51.6	57.5	UNR	53	47
304	13:30:48	53.2	57.6	UNR	55	49
305	13:31:48	50.8	56.7	UNR	53	47
306	13:32:48	59.2	69.3	109.0	63	48
307	13:33:48	50.1	53.9	UNR	51	48
308	13:34:48	50.2	54.9	UNR	51	47
309	13:35:48	52.4	58.7	UNR	55	47
310	13:36:48	55.0	59.9	UNR	57	51
311	13:37:48	56.5	64.5	110.1	58	49
312	13:38:48	49.9	54.4	UNR	53	46
313	13:39:48	51.6	55.5	UNR	53	49
314	13:40:48	53.7	59.0	UNR	56	48
315	13:41:48	52.1	53.9	UNR	53	48
316	13:42:48	52.0	55.9	UNR	53	49
317	13:43:48	56.1	62.3	UNR	60	50

318	13:44:48	61.2	68.7	109.0	64	54
319	13:45:48	55.0	61.1	UNR	56	52
320	13:46:48	56.6	60.3	UNR	58	53
321	13:47:48	58.4	62.8	UNR	60	55
322	13:48:48	58.2	63.5	UNR	60	52
323	13:49:48	59.4	62.7	UNR	61	55
324	13:50:48	54.8	60.1	UNR	56	52
325	13:51:48	56.6	63.1	UNR	59	52
326	13:52:48	58.6	64.9	UNR	62	51
327	13:53:48	57.7	63.5	109.0	59	54
328	13:54:48	56.0	61.0	UNR	58	51
329	13:55:48	56.9	61.7	UNR	59	52
330	13:56:48	54.6	59.5	UNR	56	49
331	13:57:48	52.5	59.1	UNR	54	48
332	13:58:48	55.5	65.0	UNR	58	51
333	13:59:48	52.7	55.1	UNR	53	51
334	14:00:48	53.6	55.8	UNR	54	51
335	14:01:48	54.9	63.7	UNR	55	50
336	14:02:48	59.5	71.8	109.5	63	49
337	14:03:48	57.9	65.3	UNR	60	54
338	14:04:48	56.5	59.5	UNR	58	52
339	14:05:48	62.9	71.0	113.0	64	55
340	14:06:48	66.2	74.5	112.3	70	54
341	14:07:48	59.9	65.9	UNR	62	56
342	14:08:48	58.6	66.5	UNR	61	54
343	14:09:48	56.3	61.5	UNR	57	52
344	14:10:48	56.6	60.7	UNR	59	52
345	14:11:48	58.8	68.3	UNR	63	50
346	14:12:48	51.2	56.9	UNR	52	48
347	14:13:48	53.6	61.1	UNR	56	48
348	14:14:48	54.9	62.7	UNR	58	50
349	14:15:48	51.3	54.7	UNR	53	48
350	14:16:48	57.4	66.7	UNR	61	50
351	14:17:48	53.9	62.8	UNR	56	49
352	14:18:48	57.8	62.7	UNR	60	53
353	14:19:48	56.4	60.1	UNR	59	53
354	14:20:48	56.4	60.3	UNR	57	53
355	14:21:48	56.8	61.1	UNR	59	51
356	14:22:48	51.1	55.7	UNR	52	48
357	14:23:48	50.5	54.6	UNR	51	48
358	14:24:48	54.8	59.9	UNR	57	49
359	14:25:48	59.2	64.7	UNR	62	52
360	14:26:48	54.0	56.7	UNR	55	50
361	14:27:48	51.0	54.7	UNR	53	48
362	14:28:48	49.8	52.3	UNR	51	46
363	14:29:48	53.6	59.9	UNR	56	48
364	14:30:48	55.2	64.9	UNR	57	48
365	14:31:48	56.7	65.7	UNR	60	50
366	14:32:48	52.3	57.1	UNR	55	47
367	14:33:48	60.7	66.4	UNR	65	52
368	14:34:48	64.1	71.4	114.4	68	53
369	14:35:48	54.9	59.9	UNR	57	49
370	14:36:48	53.8	60.9	UNR	55	49
371	14:37:48	55.7	61.5	UNR	59	50
372	14:38:48	54.2	58.0	UNR	56	49
373	14:39:48	56.9	61.5	UNR	58	53
374	14:40:48	54.9	60.3	UNR	57	50
375	14:41:48	52.6	61.4	UNR	53	49

376	14:42:48	55.5	63.7	UNR	57	50
377	14:43:48	50.6	53.9	UNR	52	48
378	14:44:48	51.3	54.9	UNR	52	49
379	14:45:48	57.2	64.5	UNR	61	48
380	14:46:48	62.0	71.5	UNR	65	52
381	14:47:48	53.8	58.7	UNR	55	50
382	14:48:48	53.3	57.3	UNR	55	48
383	14:49:48	53.4	57.1	UNR	54	50
384	14:50:48	51.4	55.3	UNR	53	48
385	14:51:48	52.8	64.3	UNR	54	47
386	14:52:48	60.4	72.0	112.7	62	50
387	14:53:48	54.4	65.1	UNR	58	48
388	14:54:48	55.6	59.5	UNR	57	52
389	14:55:48	56.6	63.7	UNR	59	50
390	14:56:48	58.7	67.1	UNR	62	48
391	14:57:48	51.8	56.2	UNR	53	49
392	14:58:48	56.5	64.5	UNR	60	51
393	14:59:48	58.2	62.8	UNR	60	53
394	15:00:48	56.1	59.2	UNR	57	52
395	15:01:48	51.5	57.5	UNR	53	49
396	15:02:48	53.6	57.2	UNR	55	50
397	15:03:48	63.6	69.9	110.1	67	55
398	15:04:48	56.9	62.3	UNR	60	51
399	15:05:48	52.8	60.3	UNR	55	47
400	15:06:48	50.5	54.7	UNR	52	47
401	15:07:48	54.4	60.3	UNR	57	50
402	15:08:48	54.5	63.5	UNR	57	47
403	15:09:48	51.8	55.9	UNR	54	47
404	15:10:48	50.2	52.6	UNR	51	47
405	15:11:48	51.0	54.3	UNR	52	46
406	15:12:48	52.9	58.7	UNR	55	48
407	15:13:48	55.9	59.9	UNR	57	53
408	15:14:48	54.7	59.1	UNR	56	52
409	15:15:48	51.4	59.6	UNR	53	47
410	15:16:48	53.4	57.1	UNR	56	48
411	15:17:48	54.4	57.9	UNR	56	51
412	15:18:48	51.3	54.3	UNR	52	48
413	15:19:48	49.2	53.4	UNR	50	46
414	15:20:48	52.7	58.3	UNR	56	46
415	15:21:48	57.9	62.5	UNR	60	52
416	15:22:48	52.2	55.5	UNR	53	48
417	15:23:48	54.9	60.3	UNR	58	48
418	15:24:48	57.8	66.6	UNR	61	51
419	15:25:48	55.8	62.6	UNR	58	49
420	15:26:48	56.6	66.7	UNR	59	52
421	15:27:48	61.7	68.3	111.0	65	54
422	15:28:48	62.6	72.5	UNR	66	52
423	15:29:48	55.6	62.5	UNR	57	50

DATE: 2/27/97

INT	TIME	Lav	Lmx	Lpk	L1	L2
424	15:30:41	58.2	69.9	UNR	59	51
425	15:31:41	58.5	66.5	UNR	62	52
426	15:32:41	56.6	64.0	UNR	57	52
427	15:33:41	59.8	66.1	UNR	62	53
428	15:34:41	59.2	68.7	UNR	61	50
429	15:35:41	57.1	65.0	UNR	61	50

430	15:36:41	53.0	62.7	UNR	54	46
431	15:37:41	50.8	53.9	UNR	52	48
432	15:38:41	52.8	56.9	UNR	54	49
433	15:39:41	55.8	62.5	UNR	57	51
434	15:40:41	51.6	56.7	UNR	54	48
435	15:41:41	52.6	59.6	UNR	54	45
436	15:42:41	49.3	57.0	UNR	49	45
437	15:43:41	53.0	63.9	UNR	55	46
438	15:44:41	49.9	56.7	UNR	52	45
439	15:45:41	55.3	64.7	UNR	57	49
440	15:46:41	54.6	59.4	UNR	56	50
441	15:47:41	54.8	64.9	UNR	56	48
442	15:48:41	56.8	68.8	UNR	58	48
443	15:49:41	55.1	59.9	UNR	58	49
444	15:50:41	52.4	56.3	UNR	54	48
445	15:51:41	51.0	54.0	UNR	52	48
446	15:52:41	52.7	55.5	UNR	54	49
447	15:53:41	55.8	67.4	UNR	58	50
448	15:54:41	50.8	55.7	UNR	53	47
449	15:55:41	51.0	55.3	UNR	53	47
450	15:56:41	52.5	55.1	UNR	54	49
451	15:57:41	58.4	64.7	UNR	61	50
452	15:58:41	51.8	55.8	UNR	53	48
453	15:59:41	54.8	60.4	UNR	58	49
454	16:00:41	52.5	56.4	UNR	54	49
455	16:01:41	52.1	58.4	UNR	54	48
456	16:02:41	54.9	61.8	UNR	57	48
457	16:03:41	60.2	69.6	111.0	62	52
458	16:04:41	54.2	62.0	UNR	56	49
459	16:05:41	52.8	57.1	UNR	55	48
460	16:06:41	51.0	54.3	UNR	52	47
461	16:07:41	50.8	56.7	UNR	53	47
462	16:08:41	55.1	58.1	UNR	57	49
463	16:09:41	51.5	55.0	UNR	52	49
464	16:10:41	53.6	58.9	UNR	56	49
465	16:11:41	52.9	56.7	UNR	54	50
466	16:12:41	52.6	58.1	UNR	54	49
467	16:13:41	54.8	57.9	UNR	56	51
468	16:14:41	54.0	58.7	UNR	56	49
469	16:15:41	58.0	62.7	UNR	59	52
470	16:16:41	55.1	58.9	UNR	57	51
471	16:17:41	55.0	61.9	UNR	57	50
472	16:18:41	52.2	57.5	UNR	53	48
473	16:19:41	50.6	55.9	UNR	52	47
474	16:20:41	49.6	57.6	UNR	52	46
475	16:21:41	52.9	57.6	UNR	56	48
476	16:22:41	54.5	59.9	UNR	57	49
477	16:23:41	57.2	63.1	UNR	60	50
478	16:24:41	57.8	65.9	UNR	62	51
479	16:25:41	50.7	54.7	UNR	52	48
480	16:26:41	56.6	62.1	UNR	58	51
481	16:27:41	58.0	64.8	UNR	60	53
482	16:28:41	54.3	63.1	UNR	55	50
483	16:29:41	55.4	63.1	UNR	58	50
484	16:30:41	52.8	56.1	UNR	54	48

```
-- AMPLITUDE DISTRIBUTION REPORT --


TOTAL SAMPLES =       462105

                                                                  % OF TOTAL
dB   SAMPLES
---------------------------------------------------------------------------
42        36 .                                                        0.01
43       945 +                                                        0.20
44      2823 *                                                        0.61
45      6540 *                                                        1.42
46      9724 **                                                       2.10
47     16585 ****                                                     3.59
48     25689 ******                                                   5.56
49     40338 *********                                                8.73
50     49956 ***********                                             10.81
51     52972 ***********                                             11.46
52     44939 **********                                               9.72
53     42441 *********                                                9.18
54     34885 ********                                                 7.55
55     29649 ******                                                   6.42
56     22045 *****                                                    4.77
57     19025 ****                                                     4.12
58     13479 ***                                                      2.92
59     11648 ***                                                      2.52
60      8058 **                                                       1.74
61      7094 **                                                       1.54
62      5288 *                                                        1.14
63      4177 *                                                        0.90
64      3219 *                                                        0.70
65      2829 *                                                        0.61
66      1980 +                                                        0.43
67      1588 +                                                        0.34
68      1232 +                                                        0.27
69       862 +                                                        0.19
70       487 +                                                        0.11
71       434 .                                                        0.09
72       211 .                                                        0.05
73       208 .                                                        0.05
74       128 .                                                        0.03
75       101 .                                                        0.02
76        71 .                                                        0.02
77        51 .                                                        0.01
78        49 .                                                        0.01
79        61 .                                                        0.01
80        62 .                                                        0.01
81        50 .                                                        0.01
82        32 .                                                        0.01
83        17 .                                                        0.00
84        13 .                                                        0.00
85        16 .                                                        0.00
86        11 .                                                        0.00
87        11 .                                                        0.00
88        13 .                                                        0.00
89        11 .                                                        0.00
90         5 .                                                        0.00
91         4 .                                                        0.00
92         3 .                                                        0.00
```

```
                                                                 % OF TOTAL
dB    SAMPLES
-------------------------------------------------------------------------
93          4 .                                                        0.00
9           4 .                                                        0.00
9           2 .                                                        0.00

Ln( 0.0)  =   95dB
Ln(10.0)  =   59dB
Ln(50.0)  =   52dB
Ln(99.9)  =   43dB

                NO          40.0dB       40.0dB
              CUTOFF        CUTOFF       CUTOFF

Leq           58.2dB        58.2dB       58.2dB
Ldod          55.8dB        55.8dB       55.8dB
Losha         54.9dB        54.9dB       54.9dB
Leq(6)        54.4dB        54.4dB       54.4dB
```

APPENDIX I

SPECIES OF SPECIAL CONCERN

COMMONWEALTH OF PENNSYLVANIA

PENNSYLVANIA GAME COMMISSION

2001 ELMERTON AVENUE
HARRISBURG, PA 17110-9797

ADMINISTRATIVE BUREAUS:

ADMINISTRATION	717-787-5670
AUTOMOTIVE AND PROCUREMENT DIVISION	717-787-6594
LICENSE DIVISION	717-787-2084
PERSONNEL DIVISION	717-787-7836
WILDLIFE MANAGEMENT	717-787-5529
INFORMATION & EDUCATION	717-787-6286
LAW ENFORCEMENT	717-787-5740
LAND MANAGEMENT	717-787-6818
REAL ESTATE DIVISION	717-787-6568
MANAGEMENT INFORMATION SYSTEMS	717-787-4076

October 2, 1996

Mr. William Stanhope
IT Corporation
2790 Mosside Blvd.
Monroeville, PA 15146-2792

Dear Mr. Stanhope:

In response to your request for information services, we are providing the enclosed printouts from the Pennsylvania Fish and Wildlife Data Base.

We have no record of threatened or endangered species occurring on or near your project area.

Additional comments concerning this data search are included on the following page.

Very truly yours,

Calvin W. DuBrock, Director
Bureau of Wildlife Management
Pennsylvania Game Commission

Encl.
CWD:sp

3200-FM-DWW0018 Rev. 3/96

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF DAMS, WATERWAYS AND WETLANDS

For Department Use Only
PNDI Search - Computer ____ Map ____
Reviewer NZ 295
Date 10/9/96 Phone No. ____

SUPPLEMENT NO. 1
PENNSYLVANIA NATURAL DIVERSITY INVENTORY SEARCH FORM

A. This Supplement No. 1 provides the site information necessary to perform a computer search for species of special concern listed under the Endangered Species Act of 1973, the Wild Resources Conservation Act, the Pennsylvania Fish and Boat Code or the Wildlife Code. Records regarding species of special concern are maintained in a computer data base called the "Pennsylvania Natural Diversity Inventory" (PNDI).

B. Complete the information below and mail to the appropriate regional office or the delegated County Conservation District (SEE REVERSE SIDE FOR LIST OF OFFICES AND ADDRESSES).

C. This Supplement No. 1 will be returned to you with information relevant to your project concerning species of special concern. Include it and any correspondence received from the agencies below, with your submission of a Chapter 105 Permit Application for a Water Obstruction and Encroachment Permit and/or a Dam Permit and/or a General Permit Registration.

D. The information in PNDI is routinely updated. Results of this PNDI search are valid for one year.

PROJECT LOCATION:

Washington County
County

Canton Township
Township and/or Municipality

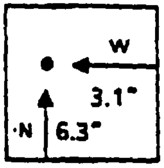
NAME: Bill Stanhope / IT Corp.
ADDRESS: 2790 Mosside Blvd.
Monroeville, PA 15146

PHONE (8:00 AM TO 4:00 PM): (412) 372-7701

1) Name of the United States Geological Survey (U.S.G.S.) 7½ Minute Quadrangle Map where project is located:
Washington West, PA
2) Project size (in acres) <0.25.

3) Indicate location of approximate project center on the U.S.G.S. Quad map by measuring in inches (to nearest one-tenth) from the lower right corner of the full U.S.G.S. Quadrangle map.

- North (Up) ~~7.9~~ inches 8.4
- West (to the left) ~~3.7~~ inches 3.5



N: 6.3"
W: 3.1"
(example, not to scale)

4) Attach an 8½" x 11" photocopy (DO NOT REDUCE) of the section of the U.S.G.S. Quadrangle Map which identifies the project location and outlines the approximate boundaries of the project.

FOR DEPARTMENT USE ONLY

NZ ☒ No known record of habitats for species of special concern has been identified in the area designated above.

☐ No impact to species of special concern. (PNDI staff person ____ on ____).
initials date

☐ Potential impact to species of special concern. Written recommendations on measures necessary to resolve this matter will be provided by:

☐ Dept. of Conservation & Natural Resources
Bureau of Forestry/FAS
P.O. Box 8552
Harrisburg, PA 17105-8552
717-787-3444

☐ Mr. Andrew L. Shiels
PA Fish & Boat Commission
450 Robinson Lane
Bellefonte, PA 16823
814-359-5113

☐ Mr. Denver A. McDowell
PA Game Commission
2001 Elmerton Ave.
Harrisburg, PA 17110-9797
717-783-8743

☐ PNDI Interpretation Requested

Element Occurrence Code ____

APPENDIX J

SEDIMENT AND SURFACE WATER SAMPLING DATA

FLOWERS
CHEMICAL
LABORATORIES
INCORPORATED

481 NEWBURYPORT
P.O. BOX 150-597
ALTAMONTE SPRINGS
FLORIDA 32715-0597
BUS: (407) 339-5984
FAX: (407) 260-6110

CHAIN OF CUSTODY RECORD FOR UNOCAL

Client #3362

Company Name: Molycorp
Address: 300 Caldwell
City: State: Zip Code:
Telephone: FAX #:
Report To: George Davies
Sampler: DP Cercone

Project Name:
UNOCAL Project Manager: John Daniels
AFE #: 854930040
Site #:
QC Data: ☐ Level D (Standard) ☐ Level C ☐ Level B ☐ Level A

Turnaround Time: ☐ 10 Work Days ☐ 5 Work Days ☐ 3 Work Days ☐ 2 Work Days ☐ 1 Work Day ☐ 2-8 Hours

☐ Drinking Water ☐ Waste Water ☐ Other

CODE: ☐ Misc. ☐ Detect. ☐ Eval ☐ Remed. ☐ Demol. ☐ Closure

							PRESERVATIVES															
Client Sample I.D.	Date/Time Sampled	Matrix Desc.	# of Cont.	Cont. Type	Laboratory Sample #	NO. OF CONTAINERS	UNPRESERVED	H_2SO_4	HNO_3	HCl			ANALYSES REQUEST	TAL Metals	Molybdenum	Phenols		Chloride	Sulfate	TDS	TOC	TOX
CHAR-01	1-16 1500	S												✓	✓	✓						
CHAR-01	1500	W			11415									✓	✓	✓		✓	✓	✓	✓	✓
CHAR-02	1400	S												✓	✓	✓						
CHAR-02	1400	W			11416									✓	✓	✓		✓	✓	✓	✓	✓
CHAR-03		–																				
SUGAR-01	1000	S												✓	✓	✓						
SUGAR-01	1000	W			11417									✓	✓	✓		✓	✓	✓	✓	✓
SUGAR-02	1200	S												✓	✓	✓						
SUGAR-02	1200	W			11418									✓	✓	✓		✓	✓	✓	✓	✓
														✓	✓	✓						

Relinquished By: Date: 1/16/97 Time: 1900
Relinquished By: Date: Time:
Relinquished By: Date: Time:

Received By: Date: Time:
Received By: Date: Time:
Received By Lab: Date: 1/17/97 Time: 1010

Were Samples Received in Good Condition? ☑ Yes ☐ No Samples on Ice? ☑ Yes ☐ No Method of Shipment ______ Page __ of __

To be completed upon receipt of report:
1) Were the analyses requested on the Chain of Custody reported? ☐ Yes ☐ No If no, what analyses are still needed? Soil samples not re...
2) Was the report issued within the requested turnaround time? ☐ Yes ☐ No If no, what was the turnaround time? Yes
Approved by: George Davies Signature: George Davies Company: UNOCAL/Molycorp Date: 3-5-97

IEA, Inc.
3000 Weston Parkway
Cary, NC 27513

Phone 919·677·0090
Fax 919·677·0427

IEA
An Aquarion Company

MOLYCORP
Attn: Mr. George Dawes
300 Caldwell Avenue
Washington, PA 15301

February 17, 1997

Dear Mr. Dawes:

Please find enclosed the radiological results of eight (8) water and ten (10) soil samples received at our laboratory on January 17 and 22, 1997. This report contains sections addressing the following information at a minimum:

- case narrative
- sample summary
- report form key
- analytical results (forms I thru VII)

IEA Project #s	1933_082
IEA Work Order #s	97-01-367 & 97-01-443
MOLYCORP PO #	
MOLYCORP Project ID	Hill Area

Copies of this radiological report and supporting data are maintained in our files for a minimum of three years unless special arrangements have been made. Except where specifically indicated, all radiological testing was performed at this laboratory location and no portion of the testing was subcontracted.

We appreciate your selection of our services and welcome any questions or suggestions you may have relative to this report. Please contact your customer service representative at(919) 677-0090 for any additional information. Thank you for utilizing our services. We hope you will consider us for your future analytical needs.

I have reviewed and approved the enclosed data for final release.

Sincerely,

Ross W. Williams

Ross W. Williams, Ph.D.
Technical Supervisor, Radiological Laboratory
IEA-North Carolina

RWW/mevl

IEA
An Aquarion Company

CASE NARRATIVE

Client: MOLYCORP
Order Number: 97-01-367 & 97-01-443
Project Number: 1933_082

Eight (8) water samples and ten (10) soil samples were received on January 17, and January 22, 1996, with the chain-of-custody intact. All of the samples were analyzed for isotopic thorium, isotopic uranium and radium-226. All of the water samples and six of the soil samples were also analyzed for radium-228.

Radium-226 in water was analyzed by the radon emanation method, and Ra-226 in soil was analyzed by gamma spectroscopy using a two-count method for determination of Ra-226 from the Bi-214 (a radon daughter) gamma peak. This two count gamma spectroscopy method corrects for any degassing of radon from the soil which may have occurred prior to the sample being sealed for analysis.

Radium-228 in water was analyzed by proportional counting the beta activity from the Ra-228 daughter, Ac-228. Ra-228 in soil was analyzed by gamma spectroscopy using the gamma peaks from Ac-228.

One method blank was analyzed for each parameter. The activity concentration in the method blanks met the acceptance criteria of less than three times the MDL for all parameters.

One blank spike analysis was performed for each parameter. All blank spike data were within the 80-120% acceptance criteria.

One matrix spike analysis was performed for each parameter. Except for the Ra-228 results, all matrix spike recoveries were within the 80-120% acceptance criteria for water samples. The matrix spike recovery for Ra-228 in sample SUGAR-02 was 126%, which indicates a matrix interference for this sample.

A duplicate sample was analyzed for each parameter. The duplicate analyses data were all within the acceptance criteria of a Duplicate Error Ratio (DER) of less than 1.5. The DER is defined as follows:

$$DER = \frac{|S-D|}{(2\sigma_s + 2\sigma_d)}$$

Where:
S = Original Sample Value
D = Duplicate Value
$2\sigma_s$ = Original Sample Uncertainty
$2\sigma_d$ = Duplicate Sample Uncertainty

Ross W. Williams

Ross W. Williams, Ph. D.
Technical Supervisor, Radiological Laboratory
2/17/97

N:\WP\MOLYCORP_1933_082.wpd

IEA
An Aquarion Company

02/17/97

Environmental Survey

Cover Page

Radiological Data Analysis Package

120 Southcenter Ct., Suite 300
Morrisville, NC 27560
Phone (919) 460-8505
Fax (919) 469-2646

Project Number: 1933_082

Client Sample ID	Lab ID
CHAR-01	9701367-01
CHAR-01	9701367-02
CHAR-02	9701367-03
CHAR-02	9701367-04
SUGAR-01	9701367-05
SUGAR-01	9701367-06
SUGAR-02	9701367-07
SUGAR-02	9701367-08
Pond-01	9701443-09
Pond-01	9701443-10
Pond-02	9701443-11
Pond-02	9701443-12
Blank-20	9701443-13
Blank-Rad20	9701443-14
Rad-01	9701443-15
Rad-02	9701443-16
Rad-03	9701443-17
Rad-04	9701443-18

Comments: ______________________________

Release of the data contained in this package has been authorized by the laboratory manager of the manager's designee, as verified by the following signature.

Manager, Radiological Laboratory

2/17/97
Date

IEA

Project Number: 1933_082

02/17/97

Radiological Analysis Results

Form 1

Client Sample ID	Lab ID	Sample Type	Batch Number	Matrix	Radionuclide	Result	Uncertainty	Q	Units	Analysis Date	Sample Size	MDA
CHAR-01	9701367-01	Reg	97010079	Soil	Th-228	0.46	0.11		pCi/g	02/14/97	1.0150	0.12
CHAR-01	9701367-01	Reg	97010079	Soil	Th-230	0.35	0.08		pCi/g	02/14/97	1.0150	0.04
CHAR-01	9701367-01	Reg	97010079	Soil	Th-232	0.37	0.08		pCi/g	02/14/97	1.0150	0.03
CHAR-01	9701367-01	Reg	97010078	Soil	U-234	0.32	0.06		pCi/g	02/03/97	1.0030	0.03
CHAR-01	9701367-01	Reg	97010078	Soil	U-235	0.02	0.02		pCi/g	02/03/97	1.0030	0.01
CHAR-01	9701367-01	Reg	97010078	Soil	U-238	0.23	0.06		pCi/g	02/03/97	1.0030	0.03
CHAR-01	9701367-01	Reg	97010091	Soil	Ra-226	0.58	0.21		pCi/g	02/03/97	372.9000	0.06
CHAR-01	9701367-01	Reg	97010092	Soil	Ra-228	0.68	0.11		pCi/g	01/28/97	372.9000	0.11
CHAR-01	9701367-02	Reg	97010077	Water	Th-228	-0.21	0.38		pCi/L	01/27/97	0.2500	0.70
CHAR-01	9701367-02	Reg	97010077	Water	Th-230	0.12	0.12		pCi/L	01/27/97	0.2500	0.16
CHAR-01	9701367-02	Reg	97010077	Water	Th-232	-0.03	0.10		pCi/L	01/27/97	0.2500	0.23
CHAR-01	9701367-02	Reg	97010076	Water	U-234	0.27	0.13		pCi/L	01/27/97	0.2500	0.10
CHAR-01	9701367-02	Reg	97010076	Water	U-235	-0.02	0.06		pCi/L	01/27/97	0.2500	0.16
CHAR-01	9701367-02	Reg	97010076	Water	U-238	0.27	0.13		pCi/L	01/27/97	0.2500	0.10
CHAR-01	9701367-02	Reg	97010093	Water	Ra-226	0.09	0.09		pCi/L	02/06/97	0.5000	0.10
CHAR-01	9701367-02	Reg	97010094	Water	Ra-228	0.99	1.14		pCi/L	02/12/97	1.0000	2.55
CHAR-02	9701367-03	Reg	97010079	Soil	Th-228	0.35	0.10		pCi/g	02/04/97	1.0172	0.12
CHAR-02	9701367-03	Reg	97010079	Soil	Th-230	0.39	0.08		pCi/g	02/04/97	1.0172	0.03
CHAR-02	9701367-03	Reg	97010079	Soil	Th-232	0.42	0.08		pCi/g	02/04/97	1.0172	0.04
CHAR-02	9701367-03	Reg	97010078	Soil	U-234	0.35	0.07		pCi/g	02/03/97	1.0612	0.04

Key shall be attached

Comments: ______________________________

MDA mode

IEA
An Aquarion Company

Project Number: 1933_082

IEA Radiological Lab

Radiological Analysis Results

Form I

Client Sample ID	Lab ID	Sample Type	Batch Number	Matrix	Radionuclide	Result	Uncertainty	Q	Units	Analysis Date	Sample Size	MDA
CHAR-02	9701367-03	Reg	97010078	Soil	U-235	0.04	0.03		pCi/g	02/03/97	1.0612	0.03
CHAR-02	9701367-03	Reg	97010078	Soil	U-238	0.32	0.07		pCi/g	02/03/97	1.0612	0.04
CHAR-02	9701367-03	Reg	97010091	Soil	Ra-226	0.76	0.23		pCi/g	02/03/97	411.2000	0.06
CHAR-02	9701367-03	Reg	97010092	Soil	Ra-228	0.94	0.16		pCi/g	01/29/97	411.2000	0.10
CHAR-02	9701367-04	Reg	97010077	Water	Th-228	0.16	0.38		pCi/L	01/27/97	0.2500	0.64
CHAR-02	9701367-04	Reg	97010077	Water	Th-230	0.08	0.19		pCi/L	01/27/97	0.2500	0.34
CHAR-02	9701367-04	Reg	97010077	Water	Th-232	0.20	0.16		pCi/L	01/27/97	0.2500	0.22
CHAR-02	9701367-04	Reg	97010076	Water	U-234	0.25	0.13		pCi/L	01/27/97	0.2500	0.14
CHAR-02	9701367-04	Reg	97010076	Water	U-235	0.05	0.09		pCi/L	01/27/97	0.2500	0.15
CHAR-02	9701367-04	Reg	97010076	Water	U-238	0.18	0.14		pCi/L	01/27/97	0.2500	0.19
CHAR-02	9701367-04	Reg	97010093	Water	Ra-226	-0.03	0.13		pCi/L	02/06/97	0.5000	0.16
CHAR-02	9701367-04	Reg	97010094	Water	Ra-228	2.43	1.15		pCi/L	02/12/97	1.0000	2.20
SUGAR-01	9701367-05	Reg	97010079	Soil	Th-228	0.47	0.11		pCi/g	02/04/97	1.0200	0.13
SUGAR-01	9701367-05	Reg	97010079	Soil	Th-230	0.48	0.09		pCi/g	02/04/97	1.0200	0.05
SUGAR-01	9701367-05	Reg	97010079	Soil	Th-232	0.57	0.10		pCi/g	02/04/97	1.0200	0.04
SUGAR-01	9701367-05	Reg	97010078	Soil	U-234	0.31	0.07		pCi/g	02/03/97	1.0131	0.04
SUGAR-01	9701367-05	Reg	97010078	Soil	U-235	0.00	0.02		pCi/g	02/03/97	1.0131	0.04
SUGAR-01	9701367-05	Reg	97010078	Soil	U-238	0.22	0.06		pCi/g	02/03/97	1.0131	0.05
SUGAR-01	9701367-05	Reg	97010091	Soil	Ra-226	0.65	0.23		pCi/g	02/03/97	340.2000	0.07
SUGAR-01	9701367-05	Reg	97010092	Soil	Ra-228	0.71	0.17		pCi/g	01/29/97	340.2000	0.12

Key shall be attached

Comments:

MDA mode

IEA

Project Number: 1933_082

Radiological Analysis Results

02/17/97

Form I

Client Sample ID	Lab ID	Sample Type	Batch Number	Matrix	Radionuclide	Result	Uncertainty	Q	Units	Analysis Date	Sample Size	MDA
SUGAR-01	9701367-06	Reg	97010077	Water	Th-228	0.23	0.38		pCi/L	01/27/97	0.2500	0.63
SUGAR-01	9701367-06	Reg	97010077	Water	Th-230	0.16	0.15		pCi/L	01/27/97	0.2500	0.23
SUGAR-01	9701367-06	Reg	97010077	Water	Th-232	0.03	0.10		pCi/L	01/27/97	0.2500	0.20
SUGAR-01	9701367-06	Reg	97010076	Water	U-234	0.16	0.16		pCi/L	01/27/97	0.2500	0.25
SUGAR-01	9701367-06	Reg	97010076	Water	U-235	0.04	0.12		pCi/L	01/27/97	0.2500	0.22
SUGAR-01	9701367-06	Reg	97010076	Water	U-238	0.22	0.14		pCi/L	01/27/97	0.2500	0.18
SUGAR-01	9701367-06	Reg	97010093	Water	Ra-226	0.06	0.09		pCi/L	02/06/97	0.5000	0.09
SUGAR-01	9701367-06	Reg	97010094	Water	Ra-228	1.12	1.20		pCi/L	02/12/97	1.0000	2.69
SUGAR-02	9701367-07	Reg	97010079	Soil	Th-228	0.64	0.13		pCi/g	02/04/97	1.0386	0.12
SUGAR-02	9701367-07	Reg	97010079	Soil	Th-230	0.48	0.09		pCi/g	02/04/97	1.0386	0.04
SUGAR-02	9701367-07	Reg	97010079	Soil	Th-232	0.44	0.09		pCi/g	02/04/97	1.0386	0.05
SUGAR-02	9701367-07	Reg	97010078	Soil	U-234	0.37	0.07		pCi/g	02/03/97	1.0036	0.03
SUGAR-02	9701367-07	Reg	97010078	Soil	U-235	0.00	0.02		pCi/g	02/03/97	1.0036	0.04
SUGAR-02	9701367-07	Reg	97010078	Soil	U-238	0.25	0.06		pCi/g	02/03/97	1.0036	0.03
SUGAR-02	9701367-07	Reg	97010091	Soil	Ra-226	0.77	0.26		pCi/g	02/03/97	353.7000	0.07
SUGAR-02	9701367-07	Reg	97010092	Soil	Ra-228	1.06	0.20		pCi/g	01/29/97	353.7000	0.11
SUGAR-02	9701367-08	Reg	97010077	Water	Th-228	-0.02	0.34		pCi/L	01/27/97	0.2500	0.61
SUGAR-02	9701367-08	Reg	97010077	Water	Th-230	0.04	0.17		pCi/L	01/27/97	0.2500	0.31
SUGAR-02	9701367-08	Reg	97010077	Water	Th-232	0.05	0.22		pCi/L	01/27/97	0.2500	0.40
SUGAR-02	9701367-08	Reg	97010076	Water	U-234	0.27	0.16		pCi/L	01/27/97	0.2500	0.20

Key shall be attached

Comments:

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Radiological Analysis Results

Form I

Client Sample ID	Lab ID	Sample Type	Batch Number	Matrix	Radionuclide	Result	Uncertainty	Q	Units	Analysis Date	Sample Size	MDA
SUGAR-02	9701367-08	Reg	97010076	Water	U-235	0.02	0.09		pCi/L	01/27/97	0.2500	0.18
SUGAR-02	9701367-08	Reg	97010076	Water	U-238	0.22	0.14		pCi/L	01/27/97	0.2500	0.18
SUGAR-02	9701367-08	Reg	97010093	Water	Ra-226	0.10	0.08		pCi/L	02/06/97	0.5000	0.08
SUGAR-02	9701367-08	Reg	97010094	Water	Ra-228	2.99	1.29		pCi/L	02/12/97	1.0000	2.48
Pond-01	9701443-09	Reg	97010079	Soil	Th-228	0.68	0.13		pCi/g	02/04/97	1.0288	0.12
Pond-01	9701443-09	Reg	97010079	Soil	Th-230	0.63	0.11		pCi/g	02/04/97	1.0288	0.03
Pond-01	9701443-09	Reg	97010079	Soil	Th-232	0.79	0.12		pCi/g	02/04/97	1.0288	0.04
Pond-01	9701443-09	Reg	97010078	Soil	U-234	0.56	0.10		pCi/g	02/03/97	1.0279	0.05
Pond-01	9701443-09	Reg	97010078	Soil	U-235	0.01	0.03		pCi/g	02/03/97	1.0279	0.06
Pond-01	9701443-09	Reg	97010078	Soil	U-238	0.67	0.11		pCi/g	02/03/97	1.0279	0.06
Pond-01	9701443-09	Reg	97010091	Soil	Ra-226	0.87	0.27		pCi/g	02/04/97	322.3000	0.07
Pond-01	9701443-09	Reg	97010092	Soil	Ra-228	0.79	0.19		pCi/g	01/30/97	322.3000	0.12
Pond-01	9701443-10	Reg	97010077	Water	Th-228	0.05	0.26		pCi/L	01/29/97	0.2500	0.46
Pond-01	9701443-10	Reg	97010077	Water	Th-230	0.35	0.14		pCi/L	01/29/97	0.2500	0.04
Pond-01	9701443-10	Reg	97010077	Water	Th-232	0.07	0.08		pCi/L	01/29/97	0.2500	0.13
Pond-01	9701443-10	Reg	97010076	Water	U-234	2.70	0.41		pCi/L	01/29/97	0.2500	0.20
Pond-01	9701443-10	Reg	97010076	Water	U-235	0.08	0.10		pCi/L	01/29/97	0.2500	0.17
Pond-01	9701443-10	Reg	97010076	Water	U-238	2.38	0.37		pCi/L	01/29/97	0.2500	0.16
Pond-01	9701443-10	Reg	97010093	Water	Ra-226	0.76	0.15		pCi/L	02/06/97	0.5000	0.08
Pond-01	9701443-10	Reg	97010094	Water	Ra-228	3.71	1.41		pCi/L	02/12/97	1.0000	2.53

Key shall be attached

Comments:

MDA mode

IEA

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Radiological Analysis Results

Form I

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Client Sample ID	Lab ID	Sample Type	Batch Number	Matrix	Radionuclide	Result	Uncertainty	Q	Units	Analysis Date	Sample Size	MDA
Pond-02	9701443-11	Reg	97010079	Soil	Th-228	0.91	0.15		pCi/g	02/04/97	1.0406	0.12
Pond-02	9701443-11	Reg	97010079	Soil	Th-230	0.70	0.12		pCi/g	02/04/97	1.0406	0.04
Pond-02	9701443-11	Reg	97010079	Soil	Th-232	0.81	0.13		pCi/g	02/04/97	1.0406	0.06
Pond-02	9701443-11	Reg	97010078	Soil	U-234	1.01	0.13		pCi/g	02/03/97	1.0820	0.04
Pond-02	9701443-11	Reg	97010078	Soil	U-235	0.01	0.03		pCi/g	02/03/97	1.0820	0.06
Pond-02	9701443-11	Reg	97010078	Soil	U-238	1.04	0.13		pCi/g	02/03/97	1.0820	0.05
Pond-02	9701443-11	Reg	97010091	Soil	Ra-226	0.57	0.29		pCi/g	02/03/97	317.8000	0.07
Pond-02	9701443-11	Reg	97010092	Soil	Ra-228	0.76	0.19		pCi/g	01/30/97	317.8000	0.12
Pond-02	9701443-12	Reg	97010077	Water	Th-228	-0.30	0.33		pCi/L	01/29/97	0.2500	0.64
Pond-02	9701443-12	Reg	97010077	Water	Th-230	0.30	0.17		pCi/L	01/29/97	0.2500	0.19
Pond-02	9701443-12	Reg	97010077	Water	Th-232	-0.02	0.11		pCi/L	01/29/97	0.2500	0.24
Pond-02	9701443-12	Reg	97010076	Water	U-234	0.53	0.19		pCi/L	01/29/97	0.2500	0.20
Pond-02	9701443-12	Reg	97010076	Water	U-235	-0.01	0.12		pCi/L	01/29/97	0.2500	0.24
Pond-02	9701443-12	Reg	97010076	Water	U-238	0.58	0.21		pCi/L	01/29/97	0.2500	0.23
Pond-02	9701443-12	Reg	97010093	Water	Ra-226	0.94	0.22		pCi/L	02/06/97	0.5000	0.13
Pond-02	9701443-12	Reg	97010094	Water	Ra-228	0.73	1.42		pCi/L	02/12/97	1.0000	3.33
Blank-20	9701443-13	Reg	97010077	Water	Th-228	-0.28	0.39		pCi/L	01/29/97	0.2500	0.72
Blank-20	9701443-13	Reg	97010077	Water	Th-230	0.54	0.25		pCi/L	01/29/97	0.2500	0.29
Blank-20	9701443-13	Reg	97010077	Water	Th-232	-0.32	0.16		pCi/L	01/29/97	0.2500	0.40
Blank-20	9701443-13	Reg	97010076	Water	U-234	0.16	0.12		pCi/L	01/29/97	0.2500	0.17

Key shall be attached

Comments:

MDA mode

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Radiological Analysis Results

Form I

Client Sample ID	Lab ID	Sample Type	Batch Number	Matrix	Radionuclide	Result	Uncertainty	Q	Units	Analysis Date	Sample Size	MDA
Blank-20	9701443-13	Reg	97010076	Water	U-235	0.03	0.08		pCi/L	01/29/97	0.2500	0.15
Blank-20	9701443-13	Reg	97010076	Water	U-238	0.01	0.10		pCi/L	01/29/97	0.2500	0.20
Blank-20	9701443-13	Reg	97010093	Water	Ra-226	-0.02	0.09		pCi/L	02/06/97	0.5000	0.11
Blank-20	9701443-13	Reg	97010094	Water	Ra-228	2.18	0.94		pCi/L	02/12/97	1.0000	1.72
Blank-Rad20	9701443-14	Reg	97010077	Water	Th-228	-0.06	0.45		pCi/L	01/29/97	0.2500	0.81
Blank-Rad20	9701443-14	Reg	97010077	Water	Th-230	0.50	0.25		pCi/L	01/29/97	0.2500	0.27
Blank-Rad20	9701443-14	Reg	97010077	Water	Th-232	0.06	0.13		pCi/L	01/29/97	0.2500	0.22
Blank-Rad20	9701443-14	Reg	97010076	Water	U-234	-0.01	0.09		pCi/L	01/29/97	0.2500	0.19
Blank-Rad20	9701443-14	Reg	97010076	Water	U-235	0.03	0.07		pCi/L	01/29/97	0.2500	0.13
Blank-Rad20	9701443-14	Reg	97010076	Water	U-238	0.06	0.08		pCi/L	01/29/97	0.2500	0.14
Blank-Rad20	9701443-14	Reg	97010093	Water	Ra-226	-0.02	0.14		pCi/L	02/09/97	0.5000	0.21
Rad-01	9701443-15	Reg	97010079	Soil	Th-228	0.35	0.09		pCi/g	02/04/97	1.0402	0.11
Rad-01	9701443-15	Reg	97010079	Soil	Th-230	0.30	0.07		pCi/g	02/04/97	1.0402	0.03
Rad-01	9701443-15	Reg	97010079	Soil	Th-232	0.34	0.08		pCi/g	02/04/97	1.0402	0.07
Rad-01	9701443-15	Reg	97010078	Soil	U-234	0.36	0.07		pCi/g	02/03/97	1.0230	0.05
Rad-01	9701443-15	Reg	97010078	Soil	U-235	0.03	0.03		pCi/g	02/03/97	1.0230	0.05
Rad-01	9701443-15	Reg	97010078	Soil	U-238	0.35	0.07		pCi/g	02/03/97	1.0230	0.04
Rad-01	9701443-15	Reg	97010091	Soil	Ra-226	2.06	0.45		pCi/g	02/03/97	295.8000	0.08
Rad-02	9701443-16	Reg	97010079	Soil	Th-228	0.16	0.08		pCi/g	02/04/97	1.0235	0.11
Rad-02	9701443-16	Reg	97010079	Soil	Th-230	0.20	0.06		pCi/g	02/04/97	1.0235	0.05

Key shall be attached

Comments: ______________________

MDA mode

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Radiological Analysis Results

Form I

Client Sample ID	Lab ID	Sample Type	Batch Number	Matrix	Radionuclide	Result	Uncertainty	Q	Units	Analysis Date	Sample Size	MDA
Rad-02	9701443-16	Reg	97010079	Soil	Th-232	0.12	0.05		pCi/g	02/04/97	1.0235	0.06
Rad-02	9701443-16	Reg	97010078	Soil	U-234	0.20	0.06		pCi/g	02/03/97	1.0018	0.04
Rad-02	9701443-16	Reg	97010078	Soil	U-235	0.02	0.02		pCi/g	02/03/97	1.0018	0.03
Rad-02	9701443-16	Reg	97010078	Soil	U-238	0.22	0.06		pCi/g	02/03/97	1.0018	0.05
Rad-02	9701443-16	Reg	97010091	Soil	Ra-226	2.15	0.46		pCi/g	02/04/97	302.1000	0.08
Rad-03	9701443-17	Reg	97010079	Soil	Th-228	0.30	0.09		pCi/g	02/04/97	1.0732	0.11
Rad-03	9701443-17	Reg	97010079	Soil	Th-230	0.26	0.06		pCi/g	02/04/97	1.0732	0.05
Rad-03	9701443-17	Reg	97010079	Soil	Th-232	0.21	0.06		pCi/g	02/04/97	1.0732	0.05
Rad-03	9701443-17	Reg	97010078	Soil	U-234	0.25	0.06		pCi/g	02/03/97	1.0004	0.03
Rad-03	9701443-17	Reg	97010078	Soil	U-235	0.00	0.03		pCi/g	02/03/97	1.0004	0.05
Rad-03	9701443-17	Reg	97010078	Soil	U-238	0.26	0.06		pCi/g	02/03/97	1.0004	0.02
Rad-03	9701443-17	Reg	97010091	Soil	Ra-226	3.17	0.51		pCi/g	02/04/97	327.7000	0.07
Rad-04	9701443-18	Reg	97010079	Soil	Th-228	0.17	0.07		pCi/g	02/04/97	1.0461	0.10
Rad-04	9701443-18	Reg	97010079	Soil	Th-230	0.22	0.06		pCi/g	02/04/97	1.0461	0.04
Rad-04	9701443-18	Reg	97010079	Soil	Th-232	0.20	0.05		pCi/g	02/04/97	1.0461	0.04
Rad-04	9701443-18	Reg	97010078	Soil	U-234	0.24	0.07		pCi/g	02/03/97	1.0087	0.07
Rad-04	9701443-18	Reg	97010078	Soil	U-235	0.01	0.03		pCi/g	02/03/97	1.0087	0.06
Rad-04	9701443-18	Reg	97010078	Soil	U-238	0.24	0.07		pCi/g	02/03/97	1.0087	0.08
Rad-04	9701443-18	Reg	97010091	Soil	Ra-226	3.16	0.49		pCi/g	02/04/97	322.4000	0.07

Key shall be attached

Comments:

MDA mode

Project Number: 1933_082

IEA Radiological Lab

QA/QC Results Summary

Form II

Client Sample ID	Lab ID	Sample Type	Batch Number	Matrix	Radionuclide	Result	Uncertainty	Units	Analysis Date	Sample Size	MDA	Inst ID
Blank Spike	N/A	BS	97010077	Water	Th-230	35.79	3.67	pCi/L	01/27/97	0.2500	0.22	3
Blank Spike	N/A	BS	97010079	Soil	Th-230	8.52	0.82	pCi/g	02/04/97	1.0000	0.03	3
Blank Spike	N/A	BS	97010076	Water	U-234	27.17	1.77	pCi/L	01/27/97	0.2500	0.18	3
Blank Spike	N/A	BS	97010078	Soil	U-234	6.91	0.44	pCi/g	02/03/97	1.0000	0.03	3
Blank Spike	N/A	BS	97010076	Water	U-238	27.82	1.81	pCi/L	01/27/97	0.2500	0.29	3
Blank Spike	N/A	BS	97010078	Soil	U-238	6.74	0.44	pCi/g	02/03/97	1.0000	0.03	3
Blank Spike	N/A	BS	97010091	Soil	Ra-226	6.01	0.30	pCi/g	02/04/97	350.0000	0.07	2
Blank Spike	N/A	BS	97010093	Water	Ra-226	137.51	2.13	pCi/L	02/05/97	0.5000	0.21	5
Blank Spike	N/A	BS	97010092	Soil	Ra-228	6.16	0.46	pCi/g	02/04/97	350.0000	0.11	2
Blank Spike	N/A	BS	97010094	Water	Ra-228	115.83	4.98	pCi/L	02/12/97	1.0000	2.00	1
CHAR-01	9701367-02	Dup	97010077	Water	Th-228	-0.18	0.36	pCi/L	01/27/97	0.2500	0.67	3
CHAR-01	9701367-02	Dup	97010077	Water	Th-230	0.07	0.11	pCi/L	01/27/97	0.2500	0.18	3
CHAR-01	9701367-02	Dup	97010077	Water	Th-232	-0.07	0.08	pCi/L	01/27/97	0.2500	0.22	3
CHAR-01	9701367-02	Dup	97010076	Water	U-234	0.39	0.21	pCi/L	01/27/97	0.2500	0.27	3
CHAR-01	9701367-02	Dup	97010076	Water	U-235	0.04	0.12	pCi/L	01/27/97	0.2500	0.22	3
CHAR-01	9701367-02	Dup	97010076	Water	U-238	0.13	0.14	pCi/L	01/27/97	0.2500	0.21	3
CHAR-01	9701367-02	Dup	97010093	Water	Ra-226	0.18	0.28	pCi/L	02/05/97	0.5000	0.27	5
SUGAR-01	9701367-06	Dup	97010094	Water	Ra-228	1.77	1.13	pCi/L	02/12/97	1.0000	2.30	1
Rad-02	9701443-16	Dup	97010079	Soil	Th-228	0.19	0.10	pCi/g	02/04/97	1.0087	0.15	3
Rad-02	9701443-16	Dup	97010079	Soil	Th-230	0.25	0.07	pCi/g	02/04/97	1.0087	0.04	3

Key shall be attached

Comments:

IEA

Project Number: 1933_082

QA/QC Results Summary

Form II

02/17/97

Client Sample ID	Lab ID	Sample Type	Batch Number	Matrix	Radionuclide	Result	Uncertainty	Units	Analysis Date	Sample Size	MDA	Inst ID
Rad-02	9701443-16	Dup	97010079	Soil	Th-232	0.12	0.05	pCi/g	02/04/97	1.0087	0.05	3
Rad-02	9701443-16	Dup	97010078	Soil	U-234	0.20	0.05	pCi/g	02/03/97	1.0082	0.03	3
Rad-02	9701443-16	Dup	97010078	Soil	U-235	0.01	0.02	pCi/g	02/03/97	1.0082	0.05	3
Rad-02	9701443-16	Dup	97010078	Soil	U-238	0.24	0.06	pCi/g	02/03/97	1.0082	0.05	3
Rad-02	9701443-16	Dup	97010091	Soil	Ra-226	3.00	0.49	pCi/g	02/04/97	315.8000	0.07	2
Method Blank	N/A	MB	97010077	Water	Th-228	0.03	0.33	pCi/L	01/27/97	0.2500	0.58	3
Method Blank	N/A	MB	97010079	Soil	Th-228	0.00	0.14	pCi/g	02/04/97	1.0000	0.25	3
Method Blank	N/A	MB	97010077	Water	Th-230	0.14	0.14	pCi/L	01/27/97	0.2500	0.21	3
Method Blank	N/A	MB	97010079	Soil	Th-230	0.04	0.06	pCi/g	02/04/97	1.0000	0.10	3
Method Blank	N/A	MB	97010077	Water	Th-232	0.00	0.10	pCi/L	01/27/97	0.2500	0.21	3
Method Blank	N/A	MB	97010079	Soil	Th-232	0.00	0.03	pCi/g	02/04/97	1.0000	0.07	3
Method Blank	N/A	MB	97010076	Water	U-234	0.02	0.08	pCi/L	01/27/97	0.2500	0.15	3
Method Blank	N/A	MB	97010078	Soil	U-234	0.01	0.02	pCi/g	02/03/97	1.0000	0.02	3
Method Blank	N/A	MB	97010076	Water	U-235	0.06	0.07	pCi/L	01/27/97	0.2500	0.11	3
Method Blank	N/A	MB	97010078	Soil	U-235	0.00	0.02	pCi/g	02/03/97	1.0000	0.03	3
Method Blank	N/A	MB	97010076	Water	U-238	0.02	0.07	pCi/L	01/27/97	0.2500	0.14	3
Method Blank	N/A	MB	97010078	Soil	U-238	0.01	0.02	pCi/g	02/03/97	1.0000	0.04	3
Method Blank	N/A	MB	97010091	Soil	Ra-226	0.00	0.07	pCi/g	02/05/97	350.0000	0.07	2
Method Blank	N/A	MB	97010093	Water	Ra-226	0.01	0.16	pCi/L	02/05/97	0.5000	0.16	5
Method Blank	N/A	MB	97010092	Soil	Ra-228	0.11	0.08	pCi/g	02/05/97	350.0000	0.11	2

Key shall be attached

Comments:

MDA mode

IEA

Project Number: 1933_082

IEA Radiological Lab

QA/QC Results Summary

Form II

02/17/97

Client Sample ID	Lab ID	Sample Type	Batch Number	Matrix	Radionuclide	Result	Uncertainty	Units	Analysis Date	Sample Size	MDA	Inst ID
Method Blank	N/A	MB	97010094	Water	Ra-228	1.56	1.13	pCi/L	02/12/97	1.0000	2.38	1
CHAR-02	9701367-04	MS	97010077	Water	Th-230	33.71	3.89	pCi/L	01/27/97	0.2500	0.48	3
CHAR-02	9701367-04	MS	97010076	Water	U-234	28.62	1.85	pCi/L	01/27/97	0.2500	0.11	3
CHAR-02	9701367-04	MS	97010076	Water	U-238	29.78	1.91	pCi/L	01/27/97	0.2500	0.11	3
CHAR-02	9701367-04	MS	97010093	Water	Ra-226	148.66	1.93	pCi/L	02/05/97	0.5000	0.16	5
SUGAR-02	9701367-08	MS	97010094	Water	Ra-228	133.57	6.09	pCi/L	02/12/97	1.0000	3.02	1
Rad-02	9701443-16	MS	97010079	Soil	Th-230	8.57	0.83	pCi/g	02/04/97	1.0077	0.03	3
Rad-02	9701443-16	MS	97010078	Soil	U-234	6.74	0.46	pCi/g	02/03/97	1.0062	0.04	3
Rad-02	9701443-16	MS	97010078	Soil	U-238	7.03	0.47	pCi/g	02/03/97	1.0062	0.05	3

Key shall be attached

Comments: ______

MDA mode

IEA

Project Number: 1933_082

Method Blank Summary

Form III

02/17/97

Client Sample ID	Batch Number	Matrix	Radionuclide	Result	Uncertainty	Q	Units	Analysis Date	Sample Size	Method Number	Inst ID
Method Blank	97010077	Water	Th-228	0.03	0.33		pCi/L	01/27/97	0.2500	RAS00802	3
Method Blank	97010079	Soil	Th-228	0.00	0.14		pCi/g	02/04/97	1.0000	RAS09100	3
Method Blank	97010077	Water	Th-230	0.14	0.14		pCi/L	01/27/97	0.2500	RAS00802	3
Method Blank	97010079	Soil	Th-230	0.04	0.06		pCi/g	02/04/97	1.0000	RAS09100	3
Method Blank	97010077	Water	Th-232	0.00	0.10		pCi/L	01/27/97	0.2500	RAS00802	3
Method Blank	97010079	Soil	Th-232	0.00	0.03		pCi/g	02/04/97	1.0000	RAS09100	3
Method Blank	97010076	Water	U-234	0.02	0.08		pCi/L	01/27/97	0.2500	RAS02101	3
Method Blank	97010078	Soil	U-234	0.01	0.02		pCi/g	02/03/97	1.0000	RAS09100	3
Method Blank	97010076	Water	U-235	0.06	0.07		pCi/L	01/27/97	0.2500	RAS02101	3
Method Blank	97010078	Soil	U-235	0.00	0.02		pCi/g	02/03/97	1.0000	RAS09100	3
Method Blank	97010076	Water	U-238	0.02	0.07		pCi/L	01/27/97	0.2500	RAS02101	3
Method Blank	97010078	Soil	U-238	0.01	0.02		pCi/g	02/03/97	1.0000	RAS09100	3
Method Blank	97010091	Soil	Ra-226	0.00	0.07	U	pCi/g	02/05/97	350.0000	RAS02300	2
Method Blank	97010093	Water	Ra-226	0.01	0.16		pCi/L	02/05/97	0.5000	RAS01900	5
Method Blank	97010092	Soil	Ra-228	0.11	0.08		pCi/g	02/05/97	350.0000	RAS02800	2
Method Blank	97010094	Water	Ra-228	1.56	1.13		pCi/L	02/12/97	1.0000	RAS08500	1

Key shall be attached

Comments: ______________________________

MDA mode

Project Number: 1933_082

IEA Radiological Lab

Chemical Recovery

Form IV

Client Sample ID	Lab ID	Sample Type	Batch Number	Radionuclide	Chemical Tracer	Tracer Result	Tracer Added	Percent Recovery	Q	Tracer Units	Analysis Date	Inst ID
CHAR-01	9701367-01	Reg	97010079	Th-228	Th-229	2.19	2.43	90.12 %		pCi	02/14/97	3
CHAR-01	9701367-01	Reg	97010079	Th-230	Th-229	2.19	2.43	90.12 %		pCi	02/14/97	3
CHAR-01	9701367-01	Reg	97010079	Th-232	Th-229	2.19	2.43	90.12 %		pCi	02/14/97	3
CHAR-01	9701367-01	Reg	97010078	U-234	U-232	11.84	12.51	94.64 %		pCi	02/03/97	3
CHAR-01	9701367-01	Reg	97010078	U-235	U-232	11.84	12.51	94.64 %		pCi	02/03/97	3
CHAR-01	9701367-01	Reg	97010078	U-238	U-232	11.84	12.51	94.64 %		pCi	02/03/97	3
CHAR-01	9701367-02	Reg	97010077	Th-228	Th-229	6.63	9.85	67.31 %		pCi	01/27/97	3
CHAR-01	9701367-02	Reg	97010077	Th-230	Th-229	6.63	9.85	67.31 %		pCi	01/27/97	3
CHAR-01	9701367-02	Reg	97010077	Th-232	Th-229	6.63	9.85	67.31 %		pCi	01/27/97	3
CHAR-01	9701367-02	Reg	97010076	U-234	U-232	44.27	50.21	88.17 %		pCi	01/27/97	3
CHAR-01	9701367-02	Reg	97010076	U-235	U-232	44.27	50.21	88.17 %		pCi	01/27/97	3
CHAR-01	9701367-02	Reg	97010076	U-238	U-232	44.27	50.21	88.17 %		pCi	01/27/97	3
CHAR-01	9701367-02	Reg	97010093	Ra-226	Ba-133	1123.00	1228.00	91.45 %		pCi	02/06/97	5
CHAR-01	9701367-02	Reg	97010094	Ra-228	Ba-133	962.00	1248.00	77.08 %		pCi	02/12/97	1
CHAR-02	9701367-03	Reg	97010079	Th-228	Th-229	2.30	2.42	95.04 %		pCi	02/04/97	3
CHAR-02	9701367-03	Reg	97010079	Th-230	Th-229	2.30	2.42	95.04 %		pCi	02/04/97	3
CHAR-02	9701367-03	Reg	97010079	Th-232	Th-229	2.30	2.42	95.04 %		pCi	02/04/97	3
CHAR-02	9701367-03	Reg	97010078	U-234	U-232	11.86	11.83	100.25 %		pCi	02/03/97	3
CHAR-02	9701367-03	Reg	97010078	U-235	U-232	11.86	11.83	100.25 %		pCi	02/03/97	3
CHAR-02	9701367-03	Reg	97010078	U-238	U-232	11.86	11.83	100.25 %		pCi	02/03/97	3

Key shall be attached

Comments:

IEA

Project Number: 1933_082

Chemical Recovery

Form IV

02/17/97

Client Sample ID	Lab ID	Sample Type	Batch Number	Radionuclide	Chemical Tracer	Tracer Result	Tracer Added	Percent Recovery	Q	Tracer Units	Analysis Date	Inst ID
CHAR-02	9701367-04	Reg	97010077	Th-228	Th-229	5.71	9.85	57.97 %		pCi	01/27/97	3
CHAR-02	9701367-04	Reg	97010077	Th-230	Th-229	5.71	9.85	57.97 %		pCi	01/27/97	3
CHAR-02	9701367-04	Reg	97010077	Th-232	Th-229	5.71	9.85	57.97 %		pCi	01/27/97	3
CHAR-02	9701367-04	Reg	97010076	U-234	U-232	45.22	50.21	90.06 %		pCi	01/27/97	3
CHAR-02	9701367-04	Reg	97010076	U-235	U-232	45.22	50.21	90.06 %		pCi	01/27/97	3
CHAR-02	9701367-04	Reg	97010076	U-238	U-232	45.22	50.21	90.06 %		pCi	01/27/97	3
CHAR-02	9701367-04	Reg	97010093	Ra-226	Ba-133	1185.00	1276.00	92.87 %		pCi	02/06/97	5
CHAR-02	9701367-04	Reg	97010094	Ra-228	Ba-133	1002.00	1194.00	83.92 %		pCi	02/12/97	1
SUGAR-01	9701367-05	Reg	97010079	Th-228	Th-229	2.28	2.41	94.61 %		pCi	02/04/97	3
SUGAR-01	9701367-05	Reg	97010079	Th-230	Th-229	2.28	2.41	94.61 %		pCi	02/04/97	3
SUGAR-01	9701367-05	Reg	97010079	Th-232	Th-229	2.28	2.41	94.61 %		pCi	02/04/97	3
SUGAR-01	9701367-05	Reg	97010078	U-234	U-232	10.24	12.39	82.65 %		pCi	02/03/97	3
SUGAR-01	9701367-05	Reg	97010078	U-235	U-232	10.24	12.39	82.65 %		pCi	02/03/97	3
SUGAR-01	9701367-05	Reg	97010078	U-238	U-232	10.24	12.39	82.65 %		pCi	02/03/97	3
SUGAR-01	9701367-06	Reg	97010077	Th-228	Th-229	7.01	9.85	71.17 %		pCi	01/27/97	3
SUGAR-01	9701367-06	Reg	97010077	Th-230	Th-229	7.01	9.85	71.17 %		pCi	01/27/97	3
SUGAR-01	9701367-06	Reg	97010077	Th-232	Th-229	7.01	9.85	71.17 %		pCi	01/27/97	3
SUGAR-01	9701367-06	Reg	97010076	U-234	U-232	41.10	50.21	81.86 %		pCi	01/27/97	3
SUGAR-01	9701367-06	Reg	97010076	U-235	U-232	41.10	50.21	81.86 %		pCi	01/27/97	3
SUGAR-01	9701367-06	Reg	97010076	U-238	U-232	41.10	50.21	81.86 %		pCi	01/27/97	3

Key shall be attached

Comments:

IEA
An Aquaterra company

Project Number: 1933_082

IEA Radiological Lab

Chemical Recovery

Form IV

Client Sample ID	Lab ID	Sample Type	Batch Number	Radionuclide	Chemical Tracer	Tracer Result	Tracer Added	Percent Recovery	Q	Tracer Units	Analysis Date	Inst ID
SUGAR-01	9701367-06	Reg	97010093	Ra-226	Ba-133	1094.00	1228.00	89.09 %		pCi	02/06/97	5
SUGAR-01	9701367-06	Reg	97010094	Ra-228	Ba-133	934.60	1194.00	78.27 %		pCi	02/12/97	1
SUGAR-02	9701367-07	Reg	97010079	Th-228	Th-229	1.92	2.37	81.01 %		pCi	02/04/97	3
SUGAR-02	9701367-07	Reg	97010079	Th-230	Th-229	1.92	2.37	81.01 %		pCi	02/04/97	3
SUGAR-02	9701367-07	Reg	97010079	Th-232	Th-229	1.92	2.37	81.01 %		pCi	02/04/97	3
SUGAR-02	9701367-07	Reg	97010078	U-234	U-232	11.90	12.50	95.20 %		pCi	02/03/97	3
SUGAR-02	9701367-07	Reg	97010078	U-235	U-232	11.90	12.50	95.20 %		pCi	02/03/97	3
SUGAR-02	9701367-07	Reg	97010078	U-238	U-232	11.90	12.50	95.20 %		pCi	02/03/97	3
SUGAR-02	9701367-08	Reg	97010077	Th-228	Th-229	6.76	9.85	68.63 %		pCi	01/27/97	3
SUGAR-02	9701367-08	Reg	97010077	Th-230	Th-229	6.76	9.85	68.63 %		pCi	01/27/97	3
SUGAR-02	9701367-08	Reg	97010077	Th-232	Th-229	6.76	9.85	68.63 %		pCi	01/27/97	3
SUGAR-02	9701367-08	Reg	97010076	U-234	U-232	42.36	50.21	84.37 %		pCi	01/27/97	3
SUGAR-02	9701367-08	Reg	97010076	U-235	U-232	42.36	50.21	84.37 %		pCi	01/27/97	3
SUGAR-02	9701367-08	Reg	97010076	U-238	U-232	42.36	50.21	84.37 %		pCi	01/27/97	3
SUGAR-02	9701367-08	Reg	97010093	Ra-226	Ba-133	1130.00	1276.00	88.56 %		pCi	02/06/97	5
SUGAR-02	9701367-08	Reg	97010094	Ra-228	Ba-133	1100.00	1248.00	88.14 %		pCi	02/12/97	1
Pond-01	9701443-09	Reg	97010079	Th-228	Th-229	2.09	2.39	87.45 %		pCi	02/04/97	3
Pond-01	9701443-09	Reg	97010079	Th-230	Th-229	2.09	2.39	87.45 %		pCi	02/04/97	3
Pond-01	9701443-09	Reg	97010079	Th-232	Th-229	2.09	2.39	87.45 %		pCi	02/04/97	3
Pond-01	9701443-09	Reg	97010078	U-234	U-232	9.88	12.21	80.92 %		pCi	02/03/97	3

Key shall be attached
Comments: ____________________

MDA mode

IEA

Project Number: 1933_082

Chemical Recovery

Form IV

02/17/97

Client Sample ID	Lab ID	Sample Type	Batch Number	Radionuclide	Chemical Tracer	Tracer Result	Tracer Added	Percent Recovery	Q	Tracer Units	Analysis Date	Inst ID
Pond-01	9701443-09	Reg	97010078	U-235	U-232	9.88	12.21	80.92 %		pCi	02/03/97	3
Pond-01	9701443-09	Reg	97010078	U-238	U-232	9.88	12.21	80.92 %		pCi	02/03/97	3
Pond-01	9701443-10	Reg	97010077	Th-228	Th-229	8.59	9.85	87.21 %		pCi	01/29/97	3
Pond-01	9701443-10	Reg	97010077	Th-230	Th-229	8.59	9.85	87.21 %		pCi	01/29/97	3
Pond-01	9701443-10	Reg	97010077	Th-232	Th-229	8.59	9.85	87.21 %		pCi	01/29/97	3
Pond-01	9701443-10	Reg	97010076	U-234	U-232	49.33	50.20	98.27 %		pCi	01/29/97	3
Pond-01	9701443-10	Reg	97010076	U-235	U-232	49.33	50.20	98.27 %		pCi	01/29/97	3
Pond-01	9701443-10	Reg	97010076	U-238	U-232	49.33	50.20	98.27 %		pCi	01/29/97	3
Pond-01	9701443-10	Reg	97010093	Ra-226	Ba-133	1124.00	1228.00	91.53 %		pCi	02/06/97	5
Pond-01	9701443-10	Reg	97010094	Ra-228	Ba-133	915.10	1248.00	73.33 %		pCi	02/12/97	1
Pond-02	9701443-11	Reg	97010079	Th-228	Th-229	1.96	2.37	82.70 %		pCi	02/04/97	3
Pond-02	9701443-11	Reg	97010079	Th-230	Th-229	1.96	2.37	82.70 %		pCi	02/04/97	3
Pond-02	9701443-11	Reg	97010079	Th-232	Th-229	1.96	2.37	82.70 %		pCi	02/04/97	3
Pond-02	9701443-11	Reg	97010078	U-234	U-232	10.02	11.60	86.38 %		pCi	02/03/97	3
Pond-02	9701443-11	Reg	97010078	U-235	U-232	10.02	11.60	86.38 %		pCi	02/03/97	3
Pond-02	9701443-11	Reg	97010078	U-238	U-232	10.02	11.60	86.38 %		pCi	02/03/97	3
Pond-02	9701443-12	Reg	97010077	Th-228	Th-229	7.43	9.85	75.43 %		pCi	01/29/97	3
Pond-02	9701443-12	Reg	97010077	Th-230	Th-229	7.43	9.85	75.43 %		pCi	01/29/97	3
Pond-02	9701443-12	Reg	97010077	Th-232	Th-229	7.43	9.85	75.43 %		pCi	01/29/97	3
Pond-02	9701443-12	Reg	97010076	U-234	U-232	49.72	50.20	99.04 %		pCi	01/29/97	3

Key shall be attached

Comments:

IEA

Project Number: 1933_082

IEA Radiological Lab

Chemical Recovery

Form IV

Client Sample ID	Lab ID	Sample Type	Batch Number	Radionuclide	Chemical Tracer	Tracer Result	Tracer Added	Percent Recovery	Q	Tracer Units	Analysis Date	Inst ID
Pond-02	9701443-12	Reg	97010076	U-235	U-232	49.72	50.20	99.04 %		pCi	01/29/97	3
Pond-02	9701443-12	Reg	97010076	U-238	U-232	49.72	50.20	99.04 %		pCi	01/29/97	3
Pond-02	9701443-12	Reg	97010093	Ra-226	Ba-133	1112.00	1276.00	87.15 %		pCi	02/06/97	5
Pond-02	9701443-12	Reg	97010094	Ra-228	Ba-133	544.30	1194.00	45.59 %		pCi	02/12/97	1
Blank-20	9701443-13	Reg	97010077	Th-228	Th-229	7.08	9.85	71.88 %		pCi	01/29/97	3
Blank-20	9701443-13	Reg	97010077	Th-230	Th-229	7.08	9.85	71.88 %		pCi	01/29/97	3
Blank-20	9701443-13	Reg	97010077	Th-232	Th-229	7.08	9.85	71.88 %		pCi	01/29/97	3
Blank-20	9701443-13	Reg	97010076	U-234	U-232	51.90	50.20	103.39 %		pCi	01/29/97	3
Blank-20	9701443-13	Reg	97010076	U-235	U-232	51.90	50.20	103.39 %		pCi	01/29/97	3
Blank-20	9701443-13	Reg	97010076	U-238	U-232	51.90	50.20	103.39 %		pCi	01/29/97	3
Blank-20	9701443-13	Reg	97010093	Ra-226	Ba-133	1013.00	1228.00	82.49 %		pCi	02/06/97	5
Blank-20	9701443-13	Reg	97010094	Ra-228	Ba-133	1016.00	1248.00	81.41 %		pCi	02/12/97	1
Blank-Rad20	9701443-14	Reg	97010077	Th-228	Th-229	5.57	9.85	56.55 %		pCi	01/29/97	3
Blank-Rad20	9701443-14	Reg	97010077	Th-230	Th-229	5.57	9.85	56.55 %		pCi	01/29/97	3
Blank-Rad20	9701443-14	Reg	97010077	Th-232	Th-229	5.57	9.85	56.55 %		pCi	01/29/97	3
Blank-Rad20	9701443-14	Reg	97010076	U-234	U-232	53.89	50.20	107.35 %		pCi	01/29/97	3
Blank-Rad20	9701443-14	Reg	97010076	U-235	U-232	53.89	50.20	107.35 %		pCi	01/29/97	3
Blank-Rad20	9701443-14	Reg	97010076	U-238	U-232	53.89	50.20	107.35 %		pCi	01/29/97	3
Blank-Rad20	9701443-14	Reg	97010093	Ra-226	Ba-133	957.60	1276.00	75.05 %		pCi	02/09/97	5
Rad-01	9701443-15	Reg	97010079	Th-228	Th-229	2.20	2.37	92.83 %		pCi	02/04/97	3

Key shall be attached

Comments:

IEA

Project Number: 1933_082

Chemical Recovery

Form IV

02/17/97

Client Sample ID	Lab ID	Sample Type	Batch Number	Radionuclide	Chemical Tracer	Tracer Result	Tracer Added	Percent Recovery	Q	Tracer Units	Analysis Date	Inst ID
Rad-01	9701443-15	Reg	97010079	Th-230	Th-229	2.20	2.37	92.83 %		pCi	02/04/97	3
Rad-01	9701443-15	Reg	97010079	Th-232	Th-229	2.20	2.37	92.83 %		pCi	02/04/97	3
Rad-01	9701443-15	Reg	97010078	U-234	U-232	10.95	12.27	89.24 %		pCi	02/03/97	3
Rad-01	9701443-15	Reg	97010078	U-235	U-232	10.95	12.27	89.24 %		pCi	02/03/97	3
Rad-01	9701443-15	Reg	97010078	U-238	U-232	10.95	12.27	89.24 %		pCi	02/03/97	3
Rad-02	9701443-16	Reg	97010079	Th-228	Th-229	2.10	2.41	87.14 %		pCi	02/04/97	3
Rad-02	9701443-16	Reg	97010079	Th-230	Th-229	2.10	2.41	87.14 %		pCi	02/04/97	3
Rad-02	9701443-16	Reg	97010079	Th-232	Th-229	2.10	2.41	87.14 %		pCi	02/04/97	3
Rad-02	9701443-16	Reg	97010078	U-234	U-232	11.25	12.53	89.78 %		pCi	02/03/97	3
Rad-02	9701443-16	Reg	97010078	U-235	U-232	11.25	12.53	89.78 %		pCi	02/03/97	3
Rad-02	9701443-16	Reg	97010078	U-238	U-232	11.25	12.53	89.78 %		pCi	02/03/97	3
Rad-03	9701443-17	Reg	97010079	Th-228	Th-229	2.06	2.29	89.96 %		pCi	02/04/97	3
Rad-03	9701443-17	Reg	97010079	Th-230	Th-229	2.06	2.29	89.96 %		pCi	02/04/97	3
Rad-03	9701443-17	Reg	97010079	Th-232	Th-229	2.06	2.29	89.96 %		pCi	02/04/97	3
Rad-03	9701443-17	Reg	97010078	U-234	U-232	11.59	12.54	92.42 %		pCi	02/03/97	3
Rad-03	9701443-17	Reg	97010078	U-235	U-232	11.59	12.54	92.42 %		pCi	02/03/97	3
Rad-03	9701443-17	Reg	97010078	U-238	U-232	11.59	12.54	92.42 %		pCi	02/03/97	3
Rad-04	9701443-18	Reg	97010079	Th-228	Th-229	2.24	2.35	95.32 %		pCi	02/04/97	3
Rad-04	9701443-18	Reg	97010079	Th-230	Th-229	2.24	2.35	95.32 %		pCi	02/04/97	3
Rad-04	9701443-18	Reg	97010079	Th-232	Th-229	2.24	2.35	95.32 %		pCi	02/04/97	3

Key shall be attached

Comments:

IEA

Project Number: 1933_082

IEA Radiological Lab

Chemical Recovery

Form IV

Client Sample ID	Lab ID	Sample Type	Batch Number	Radionuclide	Chemical Tracer	Tracer Result	Tracer Added	Percent Recovery	Q	Tracer Units	Analysis Date	Inst ID
Rad-04	9701443-18	Reg	97010078	U-234	U-232	10.39	12.44	83.52 %		pCi	02/03/97	3
Rad-04	9701443-18	Reg	97010078	U-235	U-232	10.39	12.44	83.52 %		pCi	02/03/97	3
Rad-04	9701443-18	Reg	97010078	U-238	U-232	10.39	12.44	83.52 %		pCi	02/03/97	3
Blank Spike	N/A	BS	97010077	Th-230	Th-229	7.12	9.85	72.28 %		pCi	01/27/97	3
Blank Spike	N/A	BS	97010079	Th-230	Th-229	2.02	2.46	82.11 %		pCi	02/04/97	3
Blank Spike	N/A	BS	97010076	U-234	U-232	50.65	50.21	100.8 %		pCi	01/27/97	3
Blank Spike	N/A	BS	97010078	U-234	U-232	13.07	12.55	104.1 %		pCi	02/03/97	3
Blank Spike	N/A	BS	97010076	U-238	U-232	50.65	50.21	100.8 %		pCi	01/27/97	3
Blank Spike	N/A	BS	97010078	U-238	U-232	13.07	12.55	104.1 %		pCi	02/03/97	3
Blank Spike	N/A	BS	97010093	Ra-226	Ba-133	1093.00	1276.00	85.66 %		pCi	02/05/97	5
Blank Spike	N/A	BS	97010094	Ra-228	Ba-133	1098.00	1194.00	91.96 %		pCi	02/12/97	1
CHAR-01	9701367-02	Dup	97010077	Th-228	Th-229	6.69	9.85	67.92 %		pCi	01/27/97	3
CHAR-01	9701367-02	Dup	97010077	Th-230	Th-229	6.69	9.85	67.92 %		pCi	01/27/97	3
CHAR-01	9701367-02	Dup	97010077	Th-232	Th-229	6.69	9.85	67.92 %		pCi	01/27/97	3
CHAR-01	9701367-02	Dup	97010076	U-234	U-232	39.86	50.21	79.39 %		pCi	01/27/97	3
CHAR-01	9701367-02	Dup	97010076	U-235	U-232	39.86	50.21	79.39 %		pCi	01/27/97	3
CHAR-01	9701367-02	Dup	97010076	U-238	U-232	39.86	50.21	79.39 %		pCi	01/27/97	3
CHAR-01	9701367-02	Dup	97010093	Ra-226	Ba-133	1132.00	1228.00	92.18 %		pCi	02/05/97	5
SUGAR-01	9701367-06	Dup	97010094	Ra-228	Ba-133	968.70	1248.00	77.62 %		pCi	02/12/97	1
Rad-02	9701443-16	Dup	97010079	Th-228	Th-229	1.82	2.44	74.59 %		pCi	02/04/97	3

Key shall be attached

Comments:

MDA mode

IEA
An Aquarion Company

Project Number: 1933_082

Chemical Recovery

Form IV

02/17/97

Client Sample ID	Lab ID	Sample Type	Batch Number	Radionuclide	Chemical Tracer	Tracer Result	Tracer Added	Percent Recovery	Q	Tracer Units	Analysis Date	Inst ID
Rad-02	9701443-16	Dup	97010079	Th-230	Th-229	1.82	2.44	74.59 %		pCi	02/04/97	3
Rad-02	9701443-16	Dup	97010079	Th-232	Th-229	1.82	2.44	74.59 %		pCi	02/04/97	3
Rad-02	9701443-16	Dup	97010078	U-234	U-232	10.82	12.45	86.91 %		pCi	02/03/97	3
Rad-02	9701443-16	Dup	97010078	U-235	U-232	10.82	12.45	86.91 %		pCi	02/03/97	3
Rad-02	9701443-16	Dup	97010078	U-238	U-232	10.82	12.45	86.91 %		pCi	02/03/97	3
Method Blank	N/A	MB	97010077	Th-228	Th-229	6.73	9.85	68.32 %		pCi	01/27/97	3
Method Blank	N/A	MB	97010079	Th-228	Th-229	1.09	2.46	44.31 %		pCi	02/04/97	3
Method Blank	N/A	MB	97010077	Th-230	Th-229	6.73	9.85	68.32 %		pCi	01/27/97	3
Method Blank	N/A	MB	97010079	Th-230	Th-229	1.09	2.46	44.31 %		pCi	02/04/97	3
Method Blank	N/A	MB	97010077	Th-232	Th-229	6.73	9.85	68.32 %		pCi	01/27/97	3
Method Blank	N/A	MB	97010079	Th-232	Th-229	1.09	2.46	44.31 %		pCi	02/04/97	3
Method Blank	N/A	MB	97010076	U-234	U-232	51.75	50.21	103.0 %		pCi	01/27/97	3
Method Blank	N/A	MB	97010078	U-234	U-232	12.77	12.55	101.7 %		pCi	02/03/97	3
Method Blank	N/A	MB	97010076	U-235	U-232	51.75	50.21	103.0 %		pCi	01/27/97	3
Method Blank	N/A	MB	97010078	U-235	U-232	12.77	12.55	101.7 %		pCi	02/03/97	3
Method Blank	N/A	MB	97010076	U-238	U-232	51.75	50.21	103.0 %		pCi	01/27/97	3
Method Blank	N/A	MB	97010078	U-238	U-232	12.77	12.55	101.7 %		pCi	02/03/97	3
Method Blank	N/A	MB	97010093	Ra-226	Ba-133	1072.00	1228.00	87.30 %		pCi	02/05/97	5
Method Blank	N/A	MB	97010094	Ra-228	Ba-133	1050.00	1248.00	84.13 %		pCi	02/12/97	1
CHAR-02	9701367-04	MS	97010077	Th-230	Th-229	6.01	9.85	61.02 %		pCi	01/27/97	3

Key shall be attached

Comments: ____

MDA mode

Project Number: 1933_082

IEA Radiological Lab

Chemical Recovery

Form IV

Client Sample ID	Lab ID	Sample Type	Batch Number	Radionuclide	Chemical Tracer	Tracer Result	Tracer Added	Percent Recovery	Q	Tracer Units	Analysis Date	Inst ID
CHAR-02	9701367-04	MS	97010076	U-234	U-232	48.64	50.21	96.87 %		pCi	01/27/97	3
CHAR-02	9701367-04	MS	97010076	U-238	U-232	48.64	50.21	96.87 %		pCi	01/27/97	3
CHAR-02	9701367-04	MS	97010093	Ra-226	Ba-133	1133.00	1276.00	88.79 %		pCi	02/05/97	5
SUGAR-02	9701367-08	MS	97010094	Ra-228	Ba-133	897.20	1248.00	71.89 %		pCi	02/12/97	1
Rad-02	9701443-16	MS	97010079	Th-230	Th-229	1.98	2.44	81.15 %		pCi	02/04/97	3
Rad-02	9701443-16	MS	97010078	U-234	U-232	11.10	12.47	89.01 %		pCi	02/03/97	3
Rad-02	9701443-16	MS	97010078	U-238	U-232	11.10	12.47	89.01 %		pCi	02/03/97	3

Key shall be attached

Comments: ______

IEA

Project Number: 1933_082

Blank Spike Results Summary

Form V

02/17/97

Client Sample ID	Batch Number	Matrix	Radionuclide	Spike	Result	Spike Value	Percent Recovery	Q	Units	Analysis Date	Method Number
Blank Spike	97010077	Water	Th-230	Th-230	35.79	33.64	106.39%		pCi/L	01/27/97	RAS00802
Blank Spike	97010079	Soil	Th-230	Th-230	8.52	8.41	101.31%		pCi/g	02/04/97	RAS09100
Blank Spike	97010076	Water	U-234	U-234	27.17	26.80	101.38%		pCi/L	01/27/97	RAS02101
Blank Spike	97010078	Soil	U-234	U-234	6.91	6.70	103.13%		pCi/g	02/03/97	RAS09100
Blank Spike	97010076	Water	U-238	U-238	27.82	27.80	100.07%		pCi/L	01/27/97	RAS02101
Blank Spike	97010078	Soil	U-238	U-238	6.74	6.95	96.98%		pCi/g	02/03/97	RAS09100
Blank Spike	97010091	Soil	Ra-226	Ra-226	6.01	6.65	90.38%		pCi/g	02/04/97	RAS02300
Blank Spike	97010093	Water	Ra-226	Ra-226	137.51	145.48	94.52%		pCi/L	02/05/97	RAS01900
Blank Spike	97010092	Soil	Ra-228	Ra-228	6.16	6.05	101.82%		pCi/g	02/04/97	RAS02800
Blank Spike	97010094	Water	Ra-228	Ra-228	115.83	103.13	112.31%		pCi/L	02/12/97	RAS08500

Key shall be attached

Comments:

MDA mode

IEA

Project Number: 1933_082

IEA Radiological Lab

02/17/97

Matrix Spike Results Summary

Form VI

Client Sample ID	Lab ID	Batch Number	Spike	SSR	Sample Result	Spike Added	Percent Recovery	Q	Units	Analysis Date	Inst ID
CHAR-02	9701367-04	97010077	Th-230	33.71	0.08	33.64	99.97 %		pCi/L	01/27/97	3
CHAR-02	9701367-04	97010076	U-234	28.62	0.25	26.80	105.86 %		pCi/L	01/27/97	3
CHAR-02	9701367-04	97010076	U-238	29.78	0.18	27.80	106.47 %		pCi/L	01/27/97	3
CHAR-02	9701367-04	97010093	Ra-226	148.66	-0.03	145.48	102.21 %		pCi/L	02/05/97	5
Rad-02	9701443-16	97010079	Th-230	8.57	0.20	8.35	100.24 %		pCi/g	02/04/97	3
Rad-02	9701443-16	97010078	U-234	6.74	0.20	6.66	98.20 %		pCi/g	02/03/97	3
Rad-02	9701443-16	97010078	U-238	7.03	0.22	6.91	98.55 %		pCi/g	02/03/97	3
SUGAR-02	9701367-08	97010094	Ra-228	133.57	2.99	103.13	126.62 %		pCi/L	02/12/97	1

Key shall be attached

Comments: ______________________

MDA mode

Project Number: 1933_082

02/17/97

Duplicate Results

Form VII

Client Sample ID	Lab ID	Batch Number	Radionuclide	Sample Result	Uncertainty	Dup. Result	Dup. Uncertainty	DER	Q	Units
CHAR-01	9701367-02	97010077	Th-228	-0.21	0.38	-0.18	0.36	0.03		pCi/L
CHAR-01	9701367-02	97010077	Th-230	0.12	0.12	0.07	0.11	0.24		pCi/L
CHAR-01	9701367-02	97010077	Th-232	-0.03	0.10	-0.07	0.08	0.18		pCi/L
CHAR-01	9701367-02	97010076	U-234	0.27	0.13	0.39	0.21	0.34		pCi/L
CHAR-01	9701367-02	97010076	U-235	-0.02	0.06	0.04	0.12	0.31		pCi/L
CHAR-01	9701367-02	97010076	U-238	0.27	0.13	0.13	0.14	0.53		pCi/L
CHAR-01	9701367-02	97010093	Ra-226	0.09	0.09	0.18	0.28	0.24		pCi/L
Rad-02	9701443-16	97010079	Th-228	0.16	0.08	0.19	0.10	0.17		pCi/g
Rad-02	9701443-16	97010079	Th-230	0.20	0.06	0.25	0.07	0.41		pCi/g
Rad-02	9701443-16	97010079	Th-232	0.12	0.05	0.12	0.05	0.05		pCi/g
Rad-02	9701443-16	97010078	U-234	0.20	0.06	0.20	0.05	0.06		pCi/g
Rad-02	9701443-16	97010078	U-235	0.02	0.02	0.01	0.02	0.17		pCi/g
Rad-02	9701443-16	97010078	U-238	0.22	0.06	0.24	0.06	0.20		pCi/g
Rad-02	9701443-16	97010091	Ra-226	2.15	0.46	3.00	0.49	0.89		pCi/g
SUGAR-01	9701367-06	97010094	Ra-228	1.12	1.20	1.77	1.13	0.28		pCi/L

Key shall be attached

Comments:

MDA mode

IEA
An Aquarion Company

IEA RADIOLOGICAL LABORATORY

REPORT FORM KEY

Instrument ID:

#1 - Gas Proportional Counter
#2 - High Purity Germanium Detectors (HPGe)
#3 - Alpha Spectrometry Counter
#4 - Liquid Scintillation Counter
#5 - Lucas Cell Counter
#6 - Sodium Iodide Detector

Sample Type:

REG - Regular Sample
DUP - Duplicate Sample
MS - Matrix Spike
BS - Blank Spike
MB - Method Blank

Units:

pCi/L - Picocuries per Liter
pCi/g - Picocuries per Gram
pCi/ml - Picocuries per Milliliter
pCi/mg - Picocuries per Milligram
pCi/F - Picocuries per Air Filter

Radionuclide:

Ra-226	Radium-226
Ra-228	Radium-228
Sr-90	Strontium-90
H-3	Tritium
Cs-137	Cesium-137
Co-60	Cobalt-60
K-40	Potassium-40
U-234/235/238	Isotopic Uranium
Pu-239/240	Isotopic Plutonium
Tl-208	Thallium-208
Pb-210	Lead-210
Bi-214	Bismuth-214
Th-234	Thorium-234

N.2

IEA Corporation Internal Chain of Custody

Login By: MNS Date Received: 01/17/97 Time Received:

Workorder #	Case #	Department	Location
97-01-367	1933_082		Rad

Storage Return			Removed To/Reason					
Date	Time	By	Date	Time	Frac	Location	Code	By
			1/21/97	0730	All	Sn	TR	MNS

Frac	Matrix	Sample ID
01A	SOIL	CHAR-01
01B	SOIL	CHAR-01
01C	SOIL	CHAR-01
01D	SOIL	CHAR-01
02A	WATER	CHAR-01
02B	WATER	CHAR-01
02C	WATER	CHAR-01
02D	WATER	CHAR-01
03A	SOIL	CHAR-02
03B	SOIL	CHAR-02
03C	SOIL	CHAR-02
03D	SOIL	CHAR-02
04A	WATER	CHAR-02
04B	WATER	CHAR-02
04C	WATER	CHAR-02
04D	WATER	CHAR-02
05A	SOIL	SUGAR-01
05B	SOIL	SUGAR-01
05C	SOIL	SUGAR-01
05D	SOIL	SUGAR-01
06A	WATER	SUGAR-01
06B	WATER	SUGAR-01
06C	WATER	SUGAR-01
06D	WATER	SUGAR-01
07A	SOIL	SUGAR-02

Applicable Codes:

AN=Analyze
TR=Transfer
DI=Dispose
LI=Login
SC=Screen
ST=Storage
DG=Digestion
EX=Extraction
DW=Dry Weight
AT=Autosampler

Verified by: Date: 1/21/97

IEA Corporation

Internal Chain of Custody

Login By: BMS Date Received: 01/17/97 Time Received:

Workorder #	Case #	Department	Location
97-01-367	1933_082		Rad

Storage Return			Removed To/Reason					
Date	Time	By	Date	Time	Frac	Location	Code	By
			1/21/97	0130	All	Sm	TR	nm

Frac	Matrix	Sample ID
07B	SOIL	SUGAR-02
07C	SOIL	SUGAR-02
07D	SOIL	SUGAR-02
08A	WATER	SUGAR-02
08B	WATER	SUGAR-02
08C	WATER	SUGAR-02
08D	WATER	SUGAR-02

Applicable Codes:

AN=Analyze	LI=Login	DG=Digestion	AT=Autosampler
TR=Transfer	SC=Screen	EX=Extraction	
DI=Dispose	ST=Storage	DW=Dry Weight	

Verified by: Date: 1/21/97

IEA
An Aquarion Company

CARY, N.C. 27513
PH# 919-677-00
FAX # 919-677-04

CHAIN O[illegible]DY RECORD

NO. 80009

REGUL[illegible]TION - PLEASE SPECIFY

☐ NPDES ☐ DRINKING W[illegible] ☐ OTHER ____________

☐ STATE CERT. SPECIFY ____________

Page______ of______

COMPANY/LOCATION: Hill Ai[illegible]

PROJECT #:

PROJECT NAME: Unocal

SAMPLERS: (PLEASE PRINT) DRC / SSS

SIGNATURE:

SAMPLE I.D. (26 CHARACTER MAXIMUM)	DATE	TIME			# OF CONTAINERS	[illegible]	ATER	OTHER	Thorium	Radium	Uranium	#
CHAR-01	1/14	1500		✓	2	✓			✓	✓	✓	
CHAR-01		1500			4		✓		✓	✓	✓	
CHAR-02		1400			2	✓			✓	✓	✓	
CHAR-02		1400			4		✓		✓	✓	✓	
~~CHAR-03~~ SUGAR-01		1000			2	✓			✓	✓	✓	
~~CHAR-03~~ SUG[illegible]01		1000			4		✓		✓	✓	✓	
~~CHAR-04~~ SUG[illegible]		1200			2	✓			✓	✓	✓	
~~CHAR-04~~ SUG[illegible]		1200			4		✓		✓	✓	✓	

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY	DATE	TIME

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED FOR LAB BY	DATE	TIME
		200		1/14/91	1320

IEA QUOTE NO.: VS701212

IEA PROJECT NO.: 1933-082

PROJECT MANAGER (PLEASE PRINT):

P.O. NO.:

REMARKS ON SAMPLE RECEI[illegible]

☑ BOTTLE INTACT ☐ CUSTODY SE[illegible]
☐ PRESERVED ☐ SEALS INTAC[illegible]
☑ CHILLED ☐ SEE REMAR[illegible]

IEA REMARKS

RECEIPT TEMPERATURE= 2°C

FIELD REMARKS / COMMENTS

MEVL

IEA Corporation

Internal Chain of Custody

Login By: BMS   Date Received: 01/22/97   Time Received:

Workorder #	Case #	Department	Location
97-01-443	1933_082		Rad

Storage Return			Removed To/Reason					
Date	Time	By	Date	Time	Frac	Location	Code	By
			1/24/97	[illegible]	All	Sr	TR	[illegible]

Frac	Matrix	Sample ID
09A	SOIL	Pond-01
09B	SOIL	Pond-01
09C	SOIL	Pond-01
09D	SOIL	Pond-01
10A	WATER	Pond-01
10B	WATER	Pond-01
10C	WATER	Pond-01
10D	WATER	Pond-01
11A	SOIL	Pond-02
11B	SOIL	Pond-02
11C	SOIL	Pond-02
11D	SOIL	Pond-02
12A	WATER	Pond-02
12B	WATER	Pond-02
12C	WATER	Pond-02
12D	WATER	Pond-02
13A	WATER	Blank-20
13B	WATER	Blank-20
13C	WATER	Blank-20
13D	WATER	Blank-20
14A	WATER	Blank-Rad20
14B	WATER	Blank-Rad20
14C	WATER	Blank-Rad20
14D	WATER	Blank-Rad20
15A	SOIL	Rad-01

Applicable Codes:

AN=Analyze	LI=Login	DG=Digestion	AT=Autosampler
TR=Transfer	SC=Screen	EX=Extraction	
DI=Dispose	ST=Storage	DW=Dry Weight	

Verified by: Date: 1/24/97

IEA Corporation

Internal Chain of Custody

Login By: [illegible]	Date Received: 01/22/97	Time Received:

Workorder #	Case #	Department	Location
97-01-443	1933_082		Rad

Storage Return			Removed To/Reason					
Date	Time	By	Date	Time	Frac	Location	Code	By
[redacted]	[redacted]	[redacted]						

Frac	Matrix	Sample ID
15B	SOIL	Rad-01
15C	SOIL	Rad-01
16A	SOIL	Rad-02
16B	SOIL	Rad-02
16C	SOIL	Rad-02
16D	SOIL	Rad-02 MS/MSD
16E	SOIL	Rad-02 MS/MSD
16F	SOIL	Rad-02 MS/MSD
17A	SOIL	Rad-03
17B	SOIL	Rad-03
17C	SOIL	Rad-03
18A	SOIL	Rad-04
18B	SOIL	Rad-04
18C	SOIL	Rad-04

Applicable Codes:

- AN=Analyze
- TR=Transfer
- DI=Dispose
- LI=Login
- SC=Screen
- ST=Storage
- DG=Digestion
- EX=Extraction
- DW=Dry Weight
- AT=Autosampler

Verified by: Vahid Jailani Date: 1/24/97

IEA
An Aquarion Company

3000 WESTON PKWY.
CARY, N.C. 27513
PH # 919-677-0090
FAX # 919-677-0427

CHAIN OF CUSTODY RECORD

NO. 79971

REGULATORY CLASSIFICATION - PLEASE SPECIFY

☐ NPDES ☐ DRINKING WATER ☐ RCRA ☐ OTHER ____________

☐ STATE CERT. SPECIFY ____________

Page______ of______

COMPANY/LOCATION:

PROJECT #:

PROJECT NAME: Molycorp / Unocal

SAMPLERS: (PLEASE PRINT) Halliday

SIGNATURE: Halliday

SAMPLE I.D. (28 CHARACTER MAXIMUM)	DATE	TIME	COMP	GRAB	# OF CONTAINERS	MATRIX			REQUESTED PARAMETERS											
						SOIL	WATER	OTHER	Thorium	Radium	Uranium		Thorium 232	Radium 226						
POND-01	1 20·97	0835			2	✓			✓	✓	✓									
POND-01		0835			4		✓		✓	✓	✓									
POND-02		0830			2	✓			✓	✓	✓									
POND-02		0830			4		✓		✓	✓	✓									
BLANK-20		1200			4		✓		✓	✓	✓									
BLANK-RAD20		1240			4		✓				✓		✓	✓						
RAD-01		1340			2						✓		✓	✓						
RAD-02		1450			4						✓		✓	✓	MS	MSD				
RAD-03		1600			2						✓		✓	✓						
RAD-04	↓	1610			2						✓		✓	✓						

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED BY	DATE	TIME
L. Halliday	1/21/97	1000	Fed Ex		

RELINQUISHED BY (SIGNATURE)	DATE	TIME	RECEIVED FOR LAB BY	DATE	TIME
			D McCall	1/22/97	1000

IEA QUOTE NO.:

IEA PROJECT NO.: 1433-082

PROJECT MANAGER (PLEASE PRINT): LISA HILL

P.O. NO.:

REMARKS ON SAMPLE RECEIPT

☒ BOTTLE INTACT ☐ CUSTODY SEALS
☐ PRESERVED ☐ SEALS INTACT
☒ CHILLED ☐ SEE REMARKS

IEA REMARKS

RECEIPT TEMPERATURE= 4°C

FIELD REMARKS / COMMENTS

FLOWERS
CHEMICAL
LABORATORIES
INCORPORATED

Received From:
Moly Corp.
300 Caldwell Ave.
Washington,PA 15301

Date Reported : Jan31 1997
Project Number : UNOCAFE888888888
PO Number : N/A
FDHRSDW Number : 83139
FHRS ENVNumber : E83018
FDER COMQAPNum : 86-0008G
LDHH Number : 94-23
NCDEHNR Number : 296
SCDHEC Number : 96019

For: Tot.RCRA Al Be Ca Co Cu Fe K Mg Mn Na Ni Sb Tl V Zn Mo PHE
Date Sampled:Jan16 1997 Date Received:Jan17 1997 Lab Numbers: 5866-5869

REPORT OF ANALYSIS

Parameter	Unit	Method Detection Limit	%ACC	%PRC	5866 CHAR01	5867 CHAR02	5868 SUGAR0 1	5869 SUGAR0 2
Silver	mg/kg	0.0400	75.3	3.82	0.855	2.01	18.3	2.03
Aluminum	mg/kg	0.0500	121.	2.60	863.	315.	249.	987.
Arsenic	mg/kg	0.0200	118.	.740	2.29	12.4	2.00	15.1
Barium	mg/kg	0.0120	98.3	1.19	48.1	38.5	13.0	109.
Beryllium	mg/kg	0.0200	80.1	.030	0.930	1.16	0.692	2.36
Calcium	mg/kg	0.250	120.	.530	571.	9700	1260	11400
Cadmium	mg/kg	0.0100	102.	.470	0.675	1.01	0.630	1.60
Cobalt	mg/kg	0.0200	97.4	.640	3.65	2.87	2.13	14.5
Chromium	mg/kg	0.0400	97.3	.130	4.29	4.54	1.84	14.6
Copper	mg/kg	0.0400	89.9	2.00	5.21	36.9	3.13	15.9
Iron	mg/kg	0.0500	109.	.270	99.3	20500	5610	55900
Mercury	mg/kg	.00100	69.0	.620	<.0010	<.0010	<.0010	<.0010
Potassium	mg/kg	2.50	110.	.800	45.9	868.	221.	871.
Magnesium	mg/kg	.00004	126.	6.00	24.3	1570	361.	1350
Manganese	mg/kg	0.0200	114.	.150	0.911	541.	263.	1390
Sodium	mg/kg	0.500	89.3	.770	157.	395.	125.	339.
Nickel	mg/kg	0.0400	97.1	1.79	5.63	3.97	2.91	21.8
Lead	mg/kg	0.0200	65.6	.780	4.03	6.93	5.19	57.2
Antimony	mg/kg	.00400	93.2	4.91	0.267	0.408	0.234	0.644
Selenium	mg/kg	0.0600	101.	.210	0.859	1.41	0.688	2.34
Thallium	mg/kg	0.0200	105.	2.19	0.662	0.992	0.609	1.57
Vanadium	mg/kg	0.0120	92.0	1.40	4.74	4.68	1.85	18.3
Zinc	mg/kg	0.0200	95.1	2.17	15.4	29.9	13.7	71.5
Molybdenum	mg/kg	0.0200	104.	.290	1.31	2.54	1.22	3.83
Phenols	mg/kg	.00500	74.7	.080	<.0050	1.90	<.0050	0.0313

Data Release Authorization

Sample integrity and reliability certified by Lab personnel prior to analysis. Methods of analysis in accordance with FCL QA and EPA approved methodology. This Report may not be reproduced in part, results relate only to items tested.

Jefferson S. Flowers, Ph.d.
President/Technical Director

Serving Your Analytical and Environmental Needs Since 1957

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FLOWERS
CHEMICAL
LABORATORIES
INCORPORATED

Received From:
Moly Corp.
300 Caldwell Ave.
Washington,PA 15301

Date Reported : Jan31 1997
Project Number : UNOCAFE888888888
PO Number : N/A
FDHRS Number : 83139
FHRS ENVNumber : E83018
FDER COMQAPNum : 86-0008G
LDHH Number : 94-23
NCDEHNR Number : 296
SCDHEC Number : 96019

For: Tot.RCRA Al Be Ca Co Cu Fe K Mg Mn Na Ni Sb Tl V Zn Mo PHE
Date Sampled:Jan16 1997 Date Received:Jan17 1997 Lab Numbers: 5866-5869

REPORT OF INFORMATION

Parameter	Unit	Limit	Expected	Value	Range	Correlation
				5866		
Silver	mg/kg	9.26	1.07	0.855		
Aluminum	mg/kg	24700	4900	863.		
Arsenic	mg/kg	65.4	1.47	2.29		
Barium	mg/kg	10900	138.	48.1		
Beryllium	mg/kg	13.0	0.498	0.930		
Calcium	mg/kg	605000	71300	571.		
Cadmium	mg/kg	617.	38.2	0.675		
Cobalt	mg/kg	2190	252.	3.65		
Chromium	mg/kg	309.	13.3	4.29		
Copper	mg/kg	44500	2820	5.21		
Iron	mg/kg	62000	4380	99.3		
Potassium	mg/kg	1100	155.	45.9		
Magnesium	mg/kg	-	-	24.3		
Manganese	mg/kg	3550	408.	0.911		
Sodium	mg/kg	2320	397.	157.		
Nickel	mg/kg	5670	295.	5.63		
Lead	mg/kg	6840	449.	4.03		
Antimony	mg/kg	884.	25.8	0.267		
Selenium	mg/kg	9.25	0.519	0.859		
Thallium	mg/kg	46.5	2.91	0.662		
Vanadium	mg/kg	-	-	4.74		
Zinc	mg/kg	41200	2540	15.4		
Molybdenum	mg/kg	-	-	1.31		

The above information is intended to highlight exceptional data as compared to the upper control limits (Limit) established for each of the parameters. Range exceedances are flagged by integer values in the Range column. The Expected values are derived from historical data. Expected is computed as either the mean or computed directly from another parameter using linear regression. All known correlation rule exceedances are listed as enumerated rule numbers in the Correlation column. Correlation pair rules are defined on the last page.

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For: Tot.RCRA Al Be Ca Co Cu Fe K Mg Mn Na Ni Sb Tl V Zn Mo PHE
Date Sampled:Jan16 1997 Date Received:Jan17 1997 Lab Numbers: 5866-5869

REPORT OF INFORMATION

Parameter	Unit	Limit	Expected	Value	Range	Correlation
				5867		
Silver	mg/kg	9.26	1.07	2.01		
Aluminum	mg/kg	24700	4900	315.		
Arsenic	mg/kg	65.4	1.47	12.4		
Barium	mg/kg	10900	138.	38.5		
Beryllium	mg/kg	13.0	0.498	1.16		
Calcium	mg/kg	605000	71300	9700		
Cadmium	mg/kg	617.	38.2	1.01		39
Cobalt	mg/kg	2190	252.	2.87		
Chromium	mg/kg	309.	13.3	4.54		
Copper	mg/kg	44500	2820	36.9		
Iron	mg/kg	62000	4380	20500		
Potassium	mg/kg	1100	155.	868.		
Magnesium	mg/kg	-	-	1570		
Manganese	mg/kg	3550	408.	541.		
Sodium	mg/kg	2320	397.	395.		
Nickel	mg/kg	5670	295.	3.97		
Lead	mg/kg	6840	449.	6.93		
Antimony	mg/kg	884.	25.8	0.408		
Selenium	mg/kg	9.25	0.519	1.41		
Thallium	mg/kg	46.5	2.91	0.992		
Vanadium	mg/kg	-	-	4.68		
Zinc	mg/kg	41200	2540	29.9		
Molybdenum	mg/kg	-	-	2.54		
Phenols	mg/kg	1860	93.0	1.90		

The above information is intended to highlight exceptional data as compared to the upper control limits (Limit) established for each of the parameters. Range exceedances are flagged by integer values in the Range column. The Expected values are derived from historical data. Expected is computed as either the mean or computed directly from another parameter using linear regression. All known correlation rule exceedances are listed as enumerated rule numbers in the Correlation column. Correlation pair rules are defined on the last page.

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LDHH Number : 94-23
NCDEHNR Number : 296
SCDHEC Number : 96019

For: Tot.RCRA Al Be Ca Co Cu Fe K Mg Mn Na Ni Sb Tl V Zn Mo PHE
Date Sampled:Jan16 1997 Date Received:Jan17 1997 Lab Numbers: 5866-5869

REPORT OF INFORMATION

Parameter	Unit	Limit	Expected	Value	Range	Correlation
				5868		
Silver	mg/kg	9.26	0.549	18.3	74	74
Aluminum	mg/kg	24700	4900	249.		
Arsenic	mg/kg	65.4	1.47	2.00		
Barium	mg/kg	10900	138.	13.0		
Beryllium	mg/kg	13.0	0.498	0.692		
Calcium	mg/kg	605000	71300	1260		
Cadmium	mg/kg	617.	27.6	0.630		
Cobalt	mg/kg	2190	252.	2.13		
Chromium	mg/kg	309.	13.3	1.84		
Copper	mg/kg	44500	2820	3.13		
Iron	mg/kg	62000	4380	5610		
Potassium	mg/kg	1100	155.	221.		
Magnesium	mg/kg	-	-	361.		
Manganese	mg/kg	3550	408.	263.		
Sodium	mg/kg	2320	397.	125.		
Nickel	mg/kg	5670	295.	2.91		
Lead	mg/kg	6840	449.	5.19		
Antimony	mg/kg	884.	25.8	0.234		
Selenium	mg/kg	9.25	0.519	0.688		
Thallium	mg/kg	46.5	2.91	0.609		
Vanadium	mg/kg	-	-	1.85		
Zinc	mg/kg	41200	2540	13.7		
Molybdenum	mg/kg	-	-	1.22		

The above information is intended to highlight exceptional data as compared to the upper control limits (Limit) established for each of the parameters. Range exceedances are flagged by integer values in the Range column. The Expected values are derived from historical data. Expected is computed as either the mean or computed directly from another parameter using linear regression. All known correlation rule exceedances are listed as enumerated rule numbers in the Correlation column. Correlation pair rules are defined on the last page.

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NCDEHNR Number : 296
SCDHEC Number : 96019

For: Tot.RCRA Al Be Ca Co Cu Fe K Mg Mn Na Ni Sb Tl V Zn Mo PHE
Date Sampled:Jan16 1997 Date Received:Jan17 1997 Lab Numbers: 5866-5869

REPORT OF INFORMATION

Parameter	Unit	Limit	Expected	Value	Range	Correlation
				5869		
Silver	mg/kg	9.26	1.07	2.03		
Aluminum	mg/kg	24700	4900	987.		
Arsenic	mg/kg	65.4	1.47	15.1		
Barium	mg/kg	10900	138.	109.		
Beryllium	mg/kg	13.0	0.498	2.36		
Calcium	mg/kg	605000	71300	11400		
Cadmium	mg/kg	617.	38.2	1.60		39
Cobalt	mg/kg	2190	252.	14.5		
Chromium	mg/kg	309.	13.3	14.6		
Copper	mg/kg	44500	2820	15.9		
Iron	mg/kg	62000	4380	55900		
Potassium	mg/kg	1100	155.	871.		
Magnesium	mg/kg	-	-	1350		
Manganese	mg/kg	3550	408.	1390		
Sodium	mg/kg	2320	397.	339.		
Nickel	mg/kg	5670	295.	21.8		
Lead	mg/kg	6840	449.	57.2		
Antimony	mg/kg	884.	25.8	0.644		
Selenium	mg/kg	9.25	0.519	2.34		
Thallium	mg/kg	46.5	2.91	1.57		
Vanadium	mg/kg	-	-	18.3		
Zinc	mg/kg	41200	2540	71.5		
Molybdenum	mg/kg	-	-	3.83		
Phenols	mg/kg	1860	93.0	0.0313		

The above information is intended to highlight exceptional data as compared to the upper control limits (Limit) established for each of the parameters. Range exceedances are flagged by integer values in the Range column. The Expected values are derived from historical data. Expected is computed as either the mean or computed directly from another parameter using linear regression. All known correlation rule exceedances are listed as enumerated rule numbers in the Correlation column. Correlation pair rules are defined on the last page.

Received From:
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300 Caldwell Ave.
Washington,PA 15301

Date Reported : Jan31 1997
Project Number : UNOCAFE888888888
PO Number : N/A
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For: Tot.RCRA Al Be Ca Co Cu Fe K Mg Mn Na Ni Sb Tl V Zn Mo PHE
Date Sampled:Jan16 1997 Date Received:Jan17 1997 Lab Numbers: 5866-5869

REPORT OF INFORMATION

On this Last Page 5 Correlation Pairs Referenced

39	Arsenic	Cadmium
74	Cadmium	Silver

The above information is intended to highlight exceptional data as compared to the upper control limits (Limit) established for each of the parameters. Range exceedances are flagged by integer values in the Range column. The Expected values are derived from historical data. Expected is computed as either the mean or computed directly from another parameter using linear regression. All known correlation rule exceedances are listed as enumerated rule numbers in the Correlation column. Correlation pair rules are defined on the last page.

3362

FLOWERS CHEMICAL LABORATORIES
ANALYTICAL RESULTS FORM
HRS Number 83139

														QA	Section			
			CHAR-01	CHAR-02	SUGAR-01	SUGAR-02							Method	MDL	%RSD	%Rec	Analys	Date
Parameter	Symbol	Unit	5866	5867	5868	5869												
Silver	•	mg/kg	0.855	2.01	18.3	2.03							EPA272.1	0.04	3.8282931	75.336619	CKN	01-23-97
Aluminum	•	mg/kg	862.97	315.18	248.65	987.25							EPA6010	0.05	2.8059182	121.5	CKN	01-31-97
Arsenic	•	mg/kg	2.2858	12.4173	1.9989	15.0911							EPA206.3	0.02	0.7469477	118.497	CKN	01-23-97
Barium	•	mg/kg	48.121	38.490	13.035	108.504							EPA208.1	0.012	1.1930091	98.304400	CKN	01-23-97
Beryllium	•	mg/kg	0.93049	1.15664	0.69247	2.36279							EPA210.1	0.02	0.0369448	90.1921	CKN	01-23-97
Calcium	•	mg/kg	570.69	9699.0	1261.9	11379.0							EPA6010	0.25	0.5360119	120	CKN	01-21-97
Cadmium	•	mg/kg	0.67480	1.00690	0.63013	1.60064							EPA213.1	0.01	0.4727036	102.1543	CKN	01-23-97
Cobalt	•	mg/kg	3.6513	2.8714	2.1333	14.4646							EPA219.1	0.02	0.6401378	97.4247	CKN	01-23-97
Chromium	•	mg/kg	4.2883	4.53966	1.83651	14.5698							EPA218.1	0.04	0.1368579	97.3257	CKN	01-23-97
Copper	•	mg/kg	5.2130	36.903	3.13108	15.8732							EPA220.1	0.04	2.0014550	99.9117	CKN	01-23-97
Iron	•	mg/kg	99.31	20484	5605.9	55899							EPA6010	0.05	0.2706662	109	CKN	01-21-97
Mercury	•	mg/kg	<0.001	<0.001	<0.001	<0.001							EPA7471	0.001	0.6254104	99.084310	CKN	01-31-97
Potassium	•	mg/kg	45.66031	867.80	221.29	871.06							EPA6010	2.5	0.8016285	110	CKN	01-21-97
Magnesium	•	mg/kg	24.319	1572.0	361.08	1347.15							EPA6010	0.00004	0.0060566	126.5	CKN	01-21-97
Manganese	•	mg/kg	0.91067	541.49	263.44	1390.99							EPA6010	0.02	0.1549834	114.5	CKN	01-21-97
Sodium	•	mg/kg	156.63	395.03	125.32	338.78							EPA6010	0.5	0.7723313	99.35	CKN	01-21-97
Nickel	•	mg/kg	5.6343	3.97363	2.91225	21.784							EPA249.1	0.04	1.7968800	97.1926	CKN	01-23-97
Lead	•	mg/kg	4.0314	6.9319	5.1946	57.193							EPA239.2	0.02	0.7820185	85.606	CKN	01-23-97
Antimony	•	mg/kg	0.26728	0.40918	0.23390	0.64438							EPA204.2	0.004	4.9156492	93.2026	CKN	01-23-97
Selenium	•	mg/kg	0.85906	1.40910	0.66814	2.33868							EPA270.3	0.06	0.2136296	101.4211	CKN	01-23-97
Thallium	•	mg/kg	0.66175	0.99228	0.60949	1.56905							EPA279.2	0.02	2.1935520	105.846	CKN	01-23-97
Vanadium	•	mg/kg	4.7390	4.6839	1.8469	18.2747							EPA286.1	0.012	1.4081559	92.0762	CKN	01-23-97
Zinc	•	mg/kg	15.392	29.854	13.656	71.536							EPA289.1	0.02	2.1796069	95.120266	CKN	01-23-97
Molybdenum	•	mg/kg	1.30520	2.54031	1.21505	3.83360							EPA246.2	0.02	0.2970613	104.3755	CKN	01-23-97
Phenols	•	mg/kg	<0.005	1.90	<0.005	0.0313							EPA420.1	0.005	0.0699722	74.739609	LAM	01-30-97

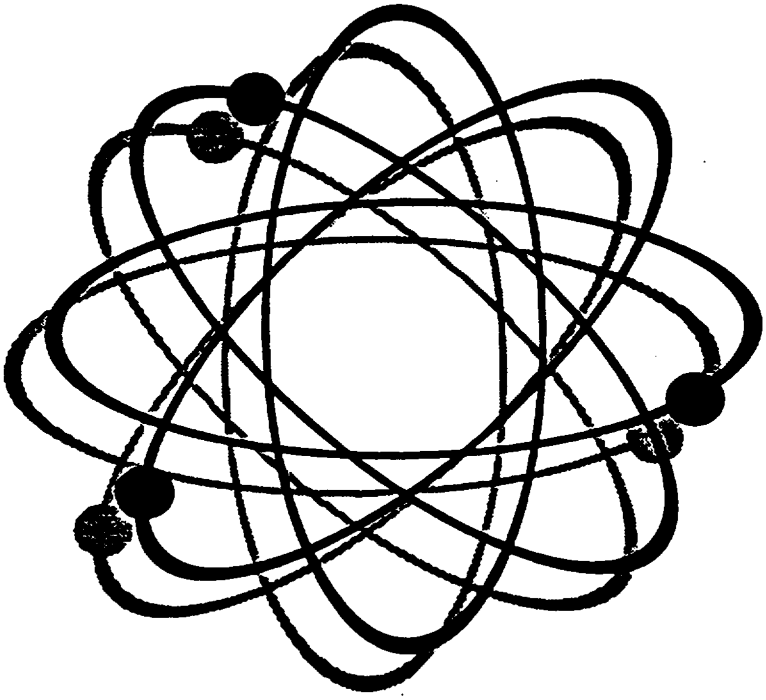
Date Received: 01-17-97 Typed: 01-31-97 Sent: 01-31-97

Project Number	UNOCAFE888888888	
PO Number	N/A	
Date Sampled	1	01-16-97 *
Date Analyzed	0	
Compacted	1	
Format	NormRR	
Unit Cost	Exted	
TolRCRA	$625	4 *
Al	$40	4 *
Be	$40	4 *
Ca	$40	4 *
Co	$40	4 *
Cu	$40	4 *
Fe	$40	4 *
K	$40	4 *
Mg	$40	4 *
Mn	$40	4 *
Na	$40	4 *
Ni	$40	4 *
Sb	$40	4 *
Tl	$40	4 *
V	$40	4 *
Zn	$40	4 *
Mo	$40	4 *
PHE	1800	4 *

Quality Assurance Report

Prepared for: Moly Corp.
Project Number: UNOCAFE888888888
Lab Numbers: 5866 - 5869

Report date: 31-Jan-97



FLOWERS
CHEMICAL
LABORATORIES

FLOWERS CHEMICAL LABORATORIES, INC.

QA Conformance Summary

Client:	Moly Corp.
Project Number:	UNOCAFE888888888
P.O. Number:	N/A
Date Sampled:	16-Jan-97
Lab Numbers:	5866 - 5869

Sample Handling

Sample handling and holding time criteria were met for all samples.
Samples Collected by Submitter

Surrogate Compound Recoveries:

The requested analytes did not require surrogates.

Accuracy / Precision:

The recovery limits were exceeded for 4 compounds in the matrix spike as shown in section 2. This represents a 69.2% success rate.

The recovery limits were exceeded for 4 compounds in the matrix spike duplicate as shown in section 2. This represents a 69.2% success rate.

The RSD was exceeded for 3 compounds as shown in section 2. This represents a 76.9% success rate.

Method Blanks:

No target compounds were found in the method blank in excess of the method limit as shown in section 3.

QCCS Check Sample:

The control limits were exceeded for 2 compounds as shown in section 4. This represents a 84.6% success rate.

Standards Traceability:

The t-test limits were met for all calibration standards as shown in section 5.
The t-test limits were met for all QCCS standards as shown in section 5.
The t-test limits were met for all matrix spike standards as shown in section 5.
There were 16 standard blanks.
The t-test limits were met for all surrogate spike standards as shown in section 5.

FLOWERS CHEMICAL LABORATORIES, INC.

Section 2

Matrix Spike Recovery

Client: Moly Corp.
Project Number: UNOCAFE888888888
P.O. Number: N/A
Date Sampled: 16-Jan-97
Lab Numbers: 5866 - 5869

Analyte	Unit	Analysis Method	Date	Spike Added	Sample Conc.	MS Conc.	MS Rec.	MSD Conc.	MSD Rec.	Acceptable Limits	RSD Rec.	Acceptable Limits
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Silver	mg/k	EPA272.1	01-23-97	0.555	1.03	1.44	75.3%	1.51	86.8%	1.17 - 1.76	0.045	0 - 0.047
Beryllium	mg/k	EPA210.1	01-23-97	0.5	0.007	0.408	80.2%	0.408	80.2%	0.325 - 0.694	0.000	0 - 0.090
Copper	mg/k	EPA220.1	01-23-97	0.1	0.014	0.103	89.9%	0.101	87.6%	0.108 - 0.131	0.002	0 - 0.013
Iron	mg/k	EPA6010	01-21-97	0.2	3.37	3.59	109%	3.60	114%	3.34 - 4.97	0.008	0 - 0.026
Mercury	mg/k	EPA7471	01-31-97	0.002	<0.001	0.001	69.1%	0.001	68.6%	0.001 - 0.003	0.000	0 - 0.000
Potassium	mg/k	EPA6010	01-21-97	0.666	68.9	69.6	110%	70.2	205%	59.8 - 79.7	0.448	0 - 0.093
Magnesium	mg/k	EPA6010	01-21-97	2	9.05	11.6	127%	10.8	88.5%	9.53 - 12.3	0.537	0 - 0.169
Manganese	mg/k	EPA6010	01-21-97	0.2	0.227	0.456	115%	0.457	115%	0.304 - 0.546	0.001	0 - 0.033
Sodium	mg/k	EPA6010	01-21-97	0.2	2.87	3.07	99.4%	3.05	86.0%	2.40 - 3.92	0.019	0 - 0.025
Lead	mg/k	EPA239.2	01-23-97	101.0	77.6	144	65.6%	145	66.9%	164 - 220	0.904	0 - 8.18
Antimony	mg/k	EPA204.2	01-23-97	0.5	0.025	0.491	93.2%	0.519	98.8%	0.373 - 0.617	0.020	.020 - 0.10
Thallium	mg/k	EPA279.2	01-23-97	0.5	0.008	0.537	106%	0.551	109%	0.493 - 0.600	0.010	0 - 0.186
Phenols	mg/k	EPA420.1	01-30-97	0.02	0.001	0.016	74.7%	0.018	83.3%	0.021 - 0.022	0.001	0 - 0.001

FLOWERS CHEMICAL LABORATORIES, INC.

Section 3

Method Blank Report

Client: Moly Corp.
Project Number: UNOCAFE888888888
P.O. Number: N/A
Date Sampled: 16-Jan-97
Lab Numbers: 5866 - 5869

Analyte	Unit	Method	Date	Concentration
Silver	mg/kg	EPA272.1	01-23-97	<0.04
Beryllium	mg/kg	EPA210.1	01-23-97	<0.02
Copper	mg/kg	EPA220.1	01-23-97	<0.04
Iron	mg/kg	EPA6010	01-21-97	<0.05
Mercury	mg/kg	EPA7471	01-31-97	<0.001
Potassium	mg/kg	EPA6010	01-21-97	<2.5
Magnesium	mg/kg	EPA6010	01-21-97	<0.00004
Manganese	mg/kg	EPA6010	01-21-97	<0.02
Sodium	mg/kg	EPA6010	01-21-97	<0.5
Lead	mg/kg	EPA239.2	01-23-97	<0.02
Antimony	mg/kg	EPA204.2	01-23-97	<0.004
Thallium	mg/kg	EPA279.2	01-23-97	<0.02
Phenols	mg/kg	EPA420.1	01-30-97	<0.005

Section 4

QCCS Sample Recovery

Client: Moly Corp.
Project Number: UNOCAFE888888888
P.O. Number: N/A
Date Sampled: 16-Jan-97
Lab Numbers: 5866 - 5869

Analyte	Unit	Method	Date	QCCS Expected	QCCS Measured	Rec. %	Acceptable Limits
Silver	mg/kg	EPA272.1	01-23-97	0.100	0.092	92.1%	0.087 - 0.109
Beryllium	mg/kg	EPA210.1	01-23-97	0.100	0.097	97.3%	0.064 - 0.115
Copper	mg/kg	EPA220.1	01-23-97	0.100	0.093	93.5%	0.098 - 0.100
Iron	mg/kg	EPA6010	01-21-97	1.00	1.05	105%	0.819 - 1.17
Mercury	mg/kg	EPA7471	01-31-97	0.002	0.002	97.4%	0.002 - 0.003
Potassium	mg/kg	EPA6010	01-21-97	1.00	1.04	104%	0.922 - 1.05
Magnesium	mg/kg	EPA6010	01-21-97	1.00	1.06	106%	0.865 - 1.12
Manganese	mg/kg	EPA6010	01-21-97	1.00	1.00	100%	0.718 - 1.28
Sodium	mg/kg	EPA6010	01-21-97	1.00	1.04	104%	0.808 - 1.11
Lead	mg/kg	EPA239.2	01-23-97	0.100	0.095	95.0%	0.092 - 0.116
Antimony	mg/kg	EPA204.2	01-23-97	0.100	0.094	94.4%	0.056 - 0.103
Thallium	mg/kg	EPA279.2	01-23-97	0.100	0.095	94.6%	0.084 - 0.105
Phenols	mg/kg	EPA420.1	01-30-97	0.030	0.032	108%	0.028 - 0.029

Section 5

Standards Traceability

Client:	Moly Corp.
Project Number:	UNOCAFE888888888
P.O. Number:	N/A
Date Sampled:	16-Jan-97
Lab Numbers:	5866 - 5869

Compound Name	Manfacturer Name	Manfacturer Lot #	Rec Lot #	Rec By	Date Recieved	Valid Until	Prep Lot #	Prep By	Date Prepared	Valid Until	t-test	t-test range	Contro Mean	Contro Std	Lot Mean	Lot Std
					Standard				Lot							
Silver	EMS	074-806	100	LSM	04-19-95	10-31-96	104	LSM	08-01-95	08-01-96	2.84	>1.71	0.945	0.074	1.00	0.011
QCCS	EMS	115-716	553	LSM	08-01-96	08-01-97	558	LSM	08-01-96	08-01-97	3.72	>1.70	0.935	0.078	0.997	0.042
Matrix Spike	EMS	074-806	100	LSM	04-19-95	10-31-96	104	LSM	08-01-95	08-01-96	2.84	>1.71	0.945	0.074	1.00	0.011
Barium	EMS	015-747	8	LSM	04-19-95	10-31-96	54	LSM	08-01-95	08-01-96	7.29	>1.70	0.993	0.039	1.01	0.024
QCCS	EMS	115-716	553	LSM	08-01-96	08-01-97	558	LSM	08-01-96	08-01-97	8.72	>1.69	0.983	0.040	1.01	0.037
Matrix Spike	EMS	115-716	553	LSM	08-01-96	08-01-97	558	LSM	08-01-96	08-01-97	8.72	>1.69	0.983	0.040	1.01	0.037
Beryllium	EMS	104-729	9	LSM	04-19-95	10-31-96	56	LSM	08-01-95	08-01-96	3.06	>1.75	1.04	0.076	0.973	0.083
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	4.12	>1.70	1.02	0.093	1.04	0.048
Matrix Spike	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	4.12	>1.70	1.02	0.093	1.04	0.048
Calcium	EMS	036-740	531	LSM	07-15-96	01-01-98	532	LSM	07-16-96	07-16-97	6.73	>1.67	1.05	0.055	1.04	0.093
QCCS	EMS	036-740	531	LSM	07-15-96	01-01-98	532	LSM	07-16-96	07-16-97	6.73	>1.67	1.05	0.055	1.04	0.093
Matrix Spike	EMS	036-740	531	LSM	07-15-96	01-01-98	532	LSM	07-16-96	07-16-97	6.73	>1.67	1.05	0.055	1.04	0.093
Cadmium	EMS	074-799	68	LSM	04-19-95	10-31-96	59	LSM	08-01-95	08-01-96	5.09	>1.68	0.970	0.059	1.02	0.035
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	6.81	>1.65	0.947	0.056	0.925	0.092
Matrix Spike	EMS	074-799	68	LSM	04-19-95	10-31-96	448	LSM	03-28-96	03-28-97	5.99	>1.65	0.953	0.054	0.917	0.053
Chromium	EMS	074-835	70	LSM	04-19-95	10-31-96	61	LSM	08-01-95	08-01-96	6.52	>1.68	0.997	0.050	0.982	0.045
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	7.49	>1.65	1.00	0.058	1.00	0.064
Matrix Spike	EMS	074-835	70	LSM	04-19-95	10-31-96	448	LSM	03-28-96	03-28-97	7.43	>1.65	0.999	0.055	0.983	0.025
Copper																
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	9.30	>1.65	0.980	0.047	0.975	0.026
Matrix Spike	EMS	025-710	72	LSM	04-19-95	10-31-96	448	LSM	03-28-96	03-28-97	8.97	>1.66	0.981	0.047	0.990	0.039
Iron	EMS	074-822	85	LSM	04-19-95	10-31-96	67	LSM	08-01-95	08-01-96	5.31	>1.73	0.983	0.031	1.05	0.055
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	-0.147	±1.99	1.08	0.964	1.02	0.021
Matrix Spike	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	-0.147	±1.99	1.08	0.964	1.02	0.021
Mercury	EMS	124-734	92	LSM	04-19-95	10-31-96	98	LSM	08-01-95	08-01-96	1.37	±2.20	1.00	0.123	1.08	0.067
QCCS	EMS	124-734	92	LSM	04-19-95	10-31-96	228	LSM	09-14-95	09-14-96	1.37	±2.20	1.04	0.837		
Matrix Spike	EMS	124-734	92	LSM	04-19-95	10-31-96	98	LSM	08-01-95	08-01-96	1.37	±2.20	1.00	0.123	1.08	0.067
Potassium	EMS	124-702	533	LSM	07-15-96	01-01-98	534	LSM	07-16-96	07-16-97	5.29	>1.74	1.02	0.050	1.08	0.030
QCCS																
Matrix Spike																

Section 5

Standards Traceability

Client: Moly Corp.
Project Number: UNOCAFE888888888
P.O. Number: N/A
Date Sampled: 16-Jan-97
Lab Numbers: 5866 - 5869

Compound Name	Manfacturer Name	Manfacturer Lot #	Rec Lot #	Rec By	Date Recieved	Valid Until	Prep Lot #	Prep By	Date Prepared	Valid Until	t-test	t-test range	Contro Mean	Contro Std	Lot Mean	Lot Std
					Standard				Lot							
Manganese	EMS	074-825	91	LSM	04-19-95	10-31-96	97	LSM	08-01-95	08-01-96	6.66	>1.69	0.989	0.045	0.953	0.076
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	8.73	>1.67	0.989	0.048	0.989	0.066
Matrix Spike	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	8.73	>1.67	0.989	0.048	0.989	0.066
Sodium	Ultra	IC-0138	586	LSM	08-20-96	08-20-97	600	LSM	10-17-96	10-17-97	5.15	>1.69	1.01	0.067	1.04	0.066
QCCS	Ultra	IC-0138	586	LSM	08-20-96	08-20-97	600	LSM	10-17-96	10-17-97	5.15	>1.69	1.01	0.067	1.04	0.066
Matrix Spike	Ultra	IC-0138	586	LSM	08-20-96	08-20-97	600	LSM	10-17-96	10-17-97	5.15	>1.69	1.01	0.067	1.04	0.066
Nickel	EMS	074-828	95	LSM	04-19-95	10-31-96	100	LSM	08-01-95	08-01-96	1.21	±2.02	0.945	0.165	1.05	0.096
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	4.82	>1.65	0.972	0.091	0.975	0.034
Matrix Spike	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	4.82	>1.65	0.972	0.091	0.975	0.034
Lead	EMS	074-739	87	LSM	04-19-95	10-31-96	69	LSM	08-01-95	08-01-96	5.00	>1.69	1.02	0.072		
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	4.52	>1.69	1.02	0.070	0.978	0.064
Matrix Spike	EMS	074-739	87	LSM	04-19-95	10-31-96	448	LSM	03-28-96	03-28-97	5.00	>1.69	1.02	0.070	0.987	0.031
Antimony																
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97			1.01	0.096	0.938	0.012
Matrix Spike	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97			1.01	0.096	0.938	0.012
Selenium	EMS	074-829	98	LSM	04-19-95	10-31-96	102	LSM	08-01-95	08-01-96	3.46	>1.75	1.06	0.095	1.04	0.069
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	4.49	>1.66	1.01	0.089	1.02	0.029
Matrix Spike	EMS	074-829	98	LSM	04-19-95	10-31-96	102	LSM	08-01-95	08-01-96	3.46	>1.75	1.06	0.095	1.04	0.069
Thallium																
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	2.26	>1.68	1.02	0.096	0.935	0.025
Matrix Spike	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	2.26	>1.68	1.02	0.096	0.935	0.025
Vanadium	EMS	074-814	107	LSM	04-19-95	10-31-96	110	LSM	08-01-95	08-01-96			0.987	0.028	0.974	0.020
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	11.5	>1.69	0.983	0.033	0.964	0.028
Matrix Spike	EMS	074-814	107	LSM	04-19-95	10-31-96	110	LSM	08-01-95	08-01-96			0.987	0.028	0.974	0.020
Zinc	EMS	074-815	108	LSM	04-19-95	10-31-96	111	LSM	08-01-95	08-01-96	6.58	>1.68	0.969	0.045	1.01	0.039
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	7.07	>1.65	0.977	0.048	1.02	0.070
Matrix Spike	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	7.07	>1.65	0.977	0.048	1.02	0.070
Molybdenum	EMS	104-728	94	LSM	04-19-95	10-31-96	99	LSM	08-01-95	08-01-96	-1.24	±2.16	0.978	0.091	0.818	0.358
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	4.01	>1.74	1.01	0.097	1.01	0.065
Matrix Spike	EMS	104-728	94	LSM	04-19-95	10-31-96	448	LSM	03-28-96	03-28-97			1.01	0.097	0.994	0.002
EPA204.2 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						

FLOWERS CHEMICAL LABORATORIES, INC.

Section 5

Standards Traceability

Client:	Moly Corp.
Project Number:	UNOCAFE888888888
P.O. Number:	N/A
Date Sampled:	16-Jan-97
Lab Numbers:	5866 - 5869

Compound Name	Manfacturer Name	Manfacturer Lot #	Rec Lot #	Rec By	Date Recieved	Valid Until	Prep Lot #	Prep By	Date Prepared	Valid Until	t-test	t-test range	Contro Mean	Contro Std	Lot Mean	Lot Std
					Standard				Lot							
EPA208.1 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						
EPA210.1 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						
EPA213.1 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						
EPA218.1 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						
EPA220.1 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						
EPA239.2 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						
EPA246.2 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						
EPA249.1 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						
EPA270.3 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						
EPA272.1 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						
EPA279.2 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						
EPA286.1 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						
EPA289.1 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						
EPA6010 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						
EPA7471 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						

FLOWERS CHEMICAL LABORATORIES

Internal Custody Record   Lab Numbers: 5866 - 5869

Lab # 5866

Container 100887 Jar 250 ml:

Shpped to custome:Check-in Station Tue, 01/14/97 02:05PM
Stainls Stl 4 Shl:Lisa Markle Thu, 01/30/97 10:12AM

Lab # 5867

Container 100889 Jar 250 ml:

Shpped to custome:Check-in Station Tue, 01/14/97 02:05PM
Stainls Stl 4 Shl:Lisa Markle Thu, 01/30/97 10:12AM

Lab # 5868

Container 100883 Jar 250 ml:

Shpped to custome:Check-in Station Tue, 01/14/97 02:05PM
Stainls Stl 4 Shl:Lisa Markle Thu, 01/30/97 10:12AM

Lab # 5869

Container 100884 Jar 250 ml:

Shpped to custome:Check-in Station Tue, 01/14/97 02:05PM
Stainls Stl 4 Shl:Lisa Markle Thu, 01/30/97 10:12AM

Jefferson L. Flowers, Ph.D
Jefferson S. Flowers, Ph.D
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CHEMICAL LABORATORIES INCORPORATED

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ALTAMONTE SPRINGS
FLORIDA 32715-0597
BUS: (407) 339-5984
FAX: (407) 260-6110

CUSTODY RECORD FOR Client #3362

UNOCAL 76

Company Name: MOLYCORN
Address: 300 CALDWELL
City: State: Zip Code:
Telephone: FAX #:
Report To: George Davies
Sampler: DP Cercone

Project Name:
UNOCAL Project Manager: John Daniels
AFE #: 854930040
Site #:
QC Data: ☐ Level D (Standard) ☐ Level C ☐ Level B ☐ Level A

Turnaround Time: ☐ 10 Work Days ☐ 5 Work Days ☐ 3 Work Days ☐ 2 Work Days ☐ 1 Work Day ☐ 2-8 Hours

☐ Drinking Water ☐ Waste Water ☐ Other

CODE: ☐ Misc. ☐ Detect. ☐ Eval. ☐ Remed. ☐ Demol. ☐ Closure

Client Sample I.D.	Date/Time Sampled	Matrix Desc.	# of Cont.	Cont. Type	Laboratory Sample #	NO. OF CONTAINERS	PRESERVATIVES UNPRESERVED	H_2SO_4	HNO_3	HCl			ANALYSES REQUEST	THL Metals	Molybdenum	Phenols		Chloride	Sulfate	TDS	TOC	TOX	
CHAR-01	1-16 1500	S			5866									✓	✓	✓							
CHAR-01	1500	W												✓	✓	✓		✓	✓	✓	✓	✓	
CHAR-02	1400	S			5867									✓	✓	✓							
CHAR-02	1400	W												✓	✓	✓		✓	✓	✓	✓	✓	
CHAR-03	—	—	—	—	—																		
SUGAR-01	1000	S			5868									✓	✓	✓							
SUGAR-01	1000	W												✓	✓	✓		✓	✓	✓	✓	✓	
SUGAR-02	1200	S			5869									✓	✓	✓							
SUGAR-02	1200	W												✓	✓	✓		✓	✓	✓	✓	✓	
														✓	✓	✓							

Relinquished By: Date: 1/16/87 Time: 1900
Relinquished By: Date: Time:
Relinquished By: Date: Time:

Received By: Date: Time:
Received By: Date: Time:
Received By Lab: Date: 1/17/87 Time: 1010

Were Samples Received in Good Condition? ☑ Yes ☐ No Samples on Ice? ☑ Yes ☐ No Method of Shipment ______ Page __ of __

To be completed upon receipt of report:
1) Were the analyses requested on the Chain of Custody reported? ☐ Yes ☐ No If no, what analyses are still needed? ______
2) Was the report issued within the requested turnaround time? ☐ Yes ☐ No If no, what was the turnaround time? ______
Approved by: ______ Signature: ______ Company: ______ Date: ______

SHIP WITH SAMPLES/TO BE RETURNED WITH RESULTS

FLOWERS
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LABORATORIES
INCORPORATED

Received From:
Moly Corp.
300 Caldwell Ave.
Washington,PA 15301

Date Reported : Feb 6 1997
Project Number : UNOCAFE888888888
PO Number : N/A
FDHRSDW Number : 83139
FHRS ENVNumber : E83018
FDER COMQAPNum : 86-0008G
LDHH Number : 94-23
NCDEHNR Number : 296
SCDHEC Number : 96019

For: Tot.RCRA Al Be Ca Co Cu Fe K Mg Mn Na Ni Sb Tl V Zn Mo PHE
Date Sampled:Jan20 1997 Date Received:Jan21 1997 Lab Numbers: 5878-5879

REPORT OF ANALYSIS

Parameter	Unit	Method Detection Limit	%ACC	%PRC	5878 POND01	5879 POND02
Silver	mg/kg	0.0400	134.	.000	2.84	1.17
Aluminum	mg/kg	0.0500	102.	.420	27.4	9510
Arsenic	mg/kg	0.0200	68.0	.000	185.	273.
Barium	mg/kg	0.0400	106.	1.10	147.	163.
Beryllium	mg/kg	0.0200	88.1	1.20	0.758	1.08
Calcium	mg/kg	0.250	101.	.620	8.61	2770
Cadmium	mg/kg	0.0100	85.2	.620	<.0100	<.0100
Cobalt	mg/kg	0.0200	93.7	1.45	12.6	13.7
Chromium	mg/kg	0.0400	83.3	.280	30.3	28.6
Copper	mg/kg	0.0400	82.0	.280	30.9	39.5
Iron	mg/kg	0.0500	101.	.260	52.9	18600
Mercury	mg/kg	.00100	100.	.700	<.0010	<.0010
Potassium	mg/kg	2.50	101.	.160	3.32	1150
Magnesium	mg/kg	.00004	96.6	.310	4.59	1500
Manganese	mg/kg	0.0160	61.0	.250	789.	734.
Sodium	mg/kg	0.500	102.	.670	1.75	323.
Nickel	mg/kg	0.0400	81.5	.280	28.4	30.4
Lead	mg/kg	0.0200	80.6	.280	34.6	42.5
Antimony	mg/kg	.00400			14.4	3.29
Selenium	mg/kg	0.0600	84.2	.520	2.25	4.70
Thallium	mg/kg	0.0400	83.8	.520	3.46	2.16
Vanadium	mg/kg	0.120	82.8	.680	21.2	26.7
Zinc	mg/kg	0.0400	87.3	1.25	148.	171.
Molybdenum	mg/kg	0.0200	81.5	5.49	60.4	177.
Phenols	mg/kg	.00500	74.7	.080	<.0050	0.0126

Data Release Authorization

Sample integrity and reliability certified by Lab personnel prior to analysis. Methods of analysis in accordance with FCL QA and EPA approved methodology. This Report may not be reproduced/in part, results relate only to items tested.

Jefferson S. Flowers, Ph.d.
President/Technical Director

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FLOWERS
CHEMICAL
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Received From:
Moly Corp.
300 Caldwell Ave.
Washington,PA 15301

Date Reported : Feb 6 1997
Project Number : UNOCAFE888888888
PO Number : N/A
FDHRS Number : 83139
FHRS ENVNumber : E83018
FDER COMQAPNum : 86-0008G
LDHH Number : 94-23
NCDEHNR Number : 296
SCDHEC Number : 96019

For: Tot.RCRA Al Be Ca Co Cu Fe K Mg Mn Na Ni Sb Tl V Zn Mo PHE
Date Sampled:Jan20 1997 Date Received:Jan21 1997 Lab Numbers: 5878-5879

REPORT OF INFORMATION

Parameter	Unit	Limit	Expected	Value	Range	Correlation
				5878		
Silver	mg/kg	9.26	1.07	2.84		
Aluminum	mg/kg	24700	4900	27.4		
Arsenic	mg/kg	65.4	7.62	185.	40	
Barium	mg/kg	10900	138.	147.		
Beryllium	mg/kg	13.0	0.498	0.758		
Calcium	mg/kg	605000	71300	8.61		
Cobalt	mg/kg	2190	252.	12.6		
Chromium	mg/kg	309.	13.3	30.3		
Copper	mg/kg	44500	2820	30.9		
Iron	mg/kg	62000	4380	52.9		
Potassium	mg/kg	1100	155.	3.32		
Magnesium	mg/kg	-	-	4.59		
Manganese	mg/kg	3550	408.	789.		
Sodium	mg/kg	2320	397.	1.75		
Nickel	mg/kg	5670	295.	28.4		
Lead	mg/kg	6840	449.	34.6		
Antimony	mg/kg	884.	25.8	14.4		
Selenium	mg/kg	9.25	54.0	2.25		40
Thallium	mg/kg	46.5	2.91	3.46		
Vanadium	mg/kg	-	-	21.2		
Zinc	mg/kg	41200	2540	148.		
Molybdenum	mg/kg	-	-	60.4		

The above information is intended to highlight exceptional data as compared to the upper control limits (Limit) established for each of the parameters. Range exceedances are flagged by integer values in the Range column. The Expected values are derived from historical data. Expected is computed as either the mean or computed directly from another parameter using linear regression. All known correlation rule exceedances are listed as enumerated rule numbers in the Correlation column. Correlation pair rules are defined on the last page.

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Date Reported : Feb 6 1997
Project Number : UNOCAFE888888888
PO Number : N/A
FDHRS Number : 83139
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FDER COMQAPNum : 86-0008G
LDHH Number : 94-23
NCDEHNR Number : 296
SCDHEC Number : 96019

For: Tot.RCRA Al Be Ca Co Cu Fe K Mg Mn Na Ni Sb Tl V Zn Mo PHE
Date Sampled:Jan20 1997 Date Received:Jan21 1997 Lab Numbers: 5878-5879

REPORT OF INFORMATION

Parameter	Unit	Limit	Expected	Value	Range	Correlation
				5879		
Silver	mg/kg	9.26	1.07	1.17		
Aluminum	mg/kg	24700	4900	9510		
Arsenic	mg/kg	65.4	16.0	273.	40	
Barium	mg/kg	10900	138.	163.		
Beryllium	mg/kg	13.0	0.498	1.08		
Calcium	mg/kg	605000	71300	2770		
Cobalt	mg/kg	2190	252.	13.7		
Chromium	mg/kg	309.	13.3	28.6		
Copper	mg/kg	44500	2820	39.5		
Iron	mg/kg	62000	4380	18600		
Potassium	mg/kg	1100	155.	1150	177	
Magnesium	mg/kg	-	-	1500		
Manganese	mg/kg	3550	408.	734.		
Sodium	mg/kg	2320	1280	323.		177
Nickel	mg/kg	5670	295.	30.4		
Lead	mg/kg	6840	449.	42.5		
Antimony	mg/kg	884.	25.8	3.29		
Selenium	mg/kg	9.25	79.7	4.70		40
Thallium	mg/kg	46.5	2.91	2.16		
Vanadium	mg/kg	-	-	26.7		
Zinc	mg/kg	41200	2540	171.		
Molybdenum	mg/kg	-	-	177.		
Phenols	mg/kg	1860	93.0	0.0126		

The above information is intended to highlight exceptional data as compared to the upper control limits (Limit) established for each of the parameters. Range exceedances are flagged by integer values in the Range column. The Expected values are derived from historical data. Expected is computed as either the mean or computed directly from another parameter using linear regression. All known correlation rule exceedances are listed as enumerated rule numbers in the Correlation column. Correlation pair rules are defined on the last page.

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Date Reported : Feb 6 1997
Project Number : UNOCAFE888888888
PO Number : N/A
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SCDHEC Number : 96019

For: Tot.RCRA Al Be Ca Co Cu Fe K Mg Mn Na Ni Sb Tl V Zn Mo PHE
Date Sampled:Jan20 1997 Date Received:Jan21 1997 Lab Numbers: 5878-5879

REPORT OF INFORMATION

On this Last Page 3 Correlation Pairs Referenced

40	Arsenic	Selenium
177	Potassium	Sodium

The above information is intended to highlight exceptional data as compared to the upper control limits (Limit) established for each of the parameters. Range exceedances are flagged by integer values in the Range column. The Expected values are derived from historical data. Expected is computed as either the mean or computed directly from another parameter using linear regression. All known correlation rule exceedances are listed as enumerated rule numbers in the Correlation column. Correlation pair rules are defined on the last page.

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3362

FLOWERS CHEMICAL LABORATORIES

ANALYTICAL RESULTS FORM HRS Number 83139

			pond-01	pond-02									QA	Section				
Parameter	Symbol	Unit	5878	5879									Method	MDL	%RSD	%Rec	Analys	Date
Silver	•	mg/kg	2.84	1.17									EPA6020	0.04	0	134.99	CKN	01-24-97
Aluminum	•	mg/kg	27.4	9510.9									EPA6010	0.05	0.4263060	102.3	LSM	02-05-97
Arsenic	•	mg/kg	185	273									EPA206.3	0.02	0	68	CKN	01-24-97
Barium	•	mg/kg	146.629	163.04									EPA6020	0.04	1.1061946	108.8	CKN	01-24-97
Beryllium	•	mg/kg	0.75843	1.07577									EPA210.1	0.02	1.2095067	88.13	CKN	01-24-97
Calcium	•	mg/kg	8.61	2770.1									EPA6010	0.25	0.6268871	101.12	LSM	02-04-97
Cadmium	•	mg/kg	<0.01	<0.01									EPA213.1	0.01	0.6254104	85.2	CKN	01-24-97
Cobalt	•	mg/kg	12.5562	13.6988									EPA219.1	0.02	1.4537260	93.73	CKN	01-24-97
Chromium	•	mg/kg	30.3	28.6									EPA6020	0.04	0.2825829	83.3	CKN	01-24-97
Copper	•	mg/kg	30.899	39.482									EPA220.1	0.04	0.2850099	82	CKN	01-24-97
Iron	•	mg/kg	52.9	18606									EPA6010	0.05	0.2602811	101.33333	LSM	02-04-97
Mercury	•	mg/kg	<0.001	<0.001									EPA7471	0.001	0.7082393		CKN	01-27-97
Potassium	•	mg/kg	3.32	1147.70									EPA6010	2.5	0.1688846	101.585	LSM	02-04-97
Magnesium	•	mg/kg	4.59	1504.16									EPA6010	0.00004	0.3189029	96.688	LSM	02-04-97
Manganese	•	mg/kg	789.33	733.70									EPA243.1	0.016	0.2583812	61	CKN	01-24-97
Sodium	•	mg/kg	1.75	322.73									EPA6010	0.5	0.6717681	102.81	LSM	02-04-97
Nickel	•	mg/kg	28.371	30.371									EPA249.1	0.04	0.2893588	81.5	CKN	01-24-97
Lead	•	mg/kg	34.551	42.519									EPA6020	0.02	0.2853162	80.6	CKN	01-24-97
Antimony	•	mg/kg	14.3539	3.2928									EPA204.2	0.004	16.261145	66.79	CKN	01-24-97
Selenium	•	mg/kg	2.25000	4.69949									EPA6020	0.08	0.5214824	84.299	CKN	01-24-97
Thallium	•	mg/kg	3.45506	2.15793									EPA279.2	0.04	0.5251962	83.885	CKN	01-24-97
Vanadium	•	mg/kg	21.15169	26.694									EPA286.1	0.12	0.6826104	82.87	CKN	01-24-97
Zinc	•	mg/kg	148.034	171.04									EPA289.1	0.04	1.2552563	87.3	CKN	01-24-97
Molybdenum	•	mg/kg	60.393	177.43									EPA246.2	0.02	5.4922178	81.5	CKN	01-24-97
Phenols	•	mg/kg	<0.005	0.0126									EPA420.1	0.005	0.0889722	74.738609	LAM	01-30-97

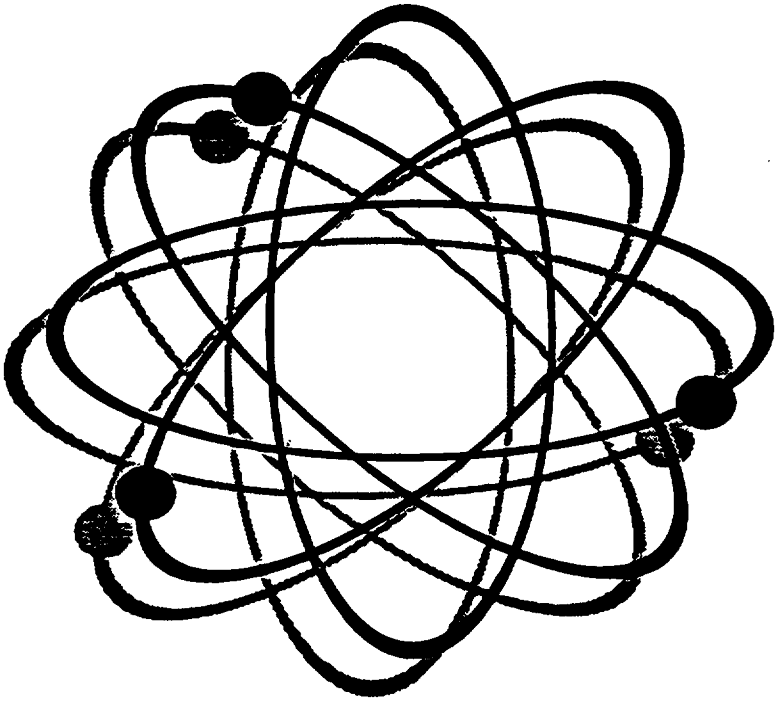
Date Received: 01-21-97 Typed: 02-06-97 Sent: 02-06-97

Project Number	UNOCAFE888888888	
PO Number	N/A	
Date Sampled	1	01-20-97 •
Date Analyzed	0	
Compacted	1	
Format	NormRR	
Unit Cost	Exted	
Tot.RCRA	5625	2 •
Al	540	2 •
Be	540	2 •
Ca	540	2 •
Co	540	2 •
Cu	540	2 •
Fe	540	2 •
K	540	2 •
Mg	540	2 •
Mn	540	2 •
Na	540	2 •
Ni	540	2 •
Sb	540	2 •
Tl	540	2 •
V	540	2 •
Zn	540	2 •
Mo	540	2 •
PHE	1800	2 •

Quality Assurance Report

Prepared for: Moly Corp.
Project Number: UNOCAFE888888888
Lab Numbers: 5878 - 5879

Report date: 6-Feb-97



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FLOWERS CHEMICAL LABORATORIES, INC.

QA Conformance Summary

Client:	Moly Corp.
Project Number:	UNOCAFE888888888
P.O. Number:	N/A
Date Sampled:	20-Jan-97
Lab Numbers:	5878 - 5879

Sample Handling

Sample handling and holding time criteria were met for all samples.
Samples Collected by Submitter

Surrogate Compound Recoveries:

The requested analytes did not require surrogates.

Accuracy / Precision:

The recovery limits were exceeded for 6 compounds in the matrix spike as shown in section 2. This represents a 60.0% success rate.
The recovery limits were exceeded for 6 compounds in the matrix spike duplicate as shown in section 2. This represents a 60.0% success rate.
The RSD was exceeded for 1 compound as shown in section 2. This represents a 93.3% success rate.

Method Blanks:

No target compounds were found in the method blank in excess of the method limit as shown in section 3.

QCCS Check Sample:

The control limits were exceeded for 6 compounds as shown in section 4. This represents a 60.0% success rate.

Standards Traceability:

The t-test limits were met for all calibration standards as shown in section 5.
The t-test limits were met for all QCCS standards as shown in section 5.
The t-test limits were met for all matrix spike standards as shown in section 5.
There were 13 standard blanks.

FLOWERS CHEMICAL LABORATORIES, INC.

Section 2

Matrix Spike Recovery

Client: Moly Corp.
Project Number: UNOCAFE888888888
P.O. Number: N/A
Date Sampled: 20-Jan-97
Lab Numbers: 5878 - 5879

Analyte	Unit	Analysis Method	Date	Spike Added	Sample Conc.	MS Conc.	MS Rec.	MSD Conc.	MSD Rec.	Acceptable Limits	RSD Rec.	Acceptable Limits
Silver	mg/k	EPA6020	01-24-97	280.8	2.84	382	135%	382	135%	113 - 314	0.000	0 - 55.3
Barium	mg/k	EPA6020	01-24-97	280.8	147	447	107%	452	109%	281 - 560	3.97	0 - 119
Beryllium	mg/k	EPA210.1	01-24-97	280.8	0.758	248	88.1%	245	86.9%	181 - 386	2.38	0 - 50.6
Chromium	mg/k	EPA6020	01-24-97	280.8	30.3	264	83.3%	263	83.0%	270 - 336	0.596	0 - 29.9
Copper	mg/k	EPA220.1	01-24-97	280.8	30.9	261	82.0%	262	82.3%	298 - 358	0.596	0 - 35.5
Iron	mg/k	EPA6010	02-04-97	15	52.9	68.1	101%	67.9	100%	63.4 - 94.4	0.141	0 - 1.95
Mercury	mg/k	EPA7471	01-27-97	0.002	<0.001	0.002	99.6%	0.002	100%	0.001 - 0.003	0.000	0 - 0.000
Potassium	mg/k	EPA6010	02-04-97	100	3.32	105	102%	105	101%	88.8 - 118	0.141	0 - 13.9
Magnesium	mg/k	EPA6010	02-04-97	12.5	4.59	16.7	96.7%	16.6	96.2%	14.7 - 19.0	0.042	0 - 1.05
Sodium	mg/k	EPA6010	02-04-97	20	1.75	22.3	103%	22.5	104%	17.0 - 27.7	0.120	0 - 2.50
Lead	mg/k	EPA6020	01-24-97	280.8	34.6	261	80.6%	262	80.9%	129 - 285	0.596	0 - 31.8
Antimony	mg/k	EPA204.2	01-24-97	280.8	14.4	202	66.8%	168	54.7%	210 - 347	24.0	11.1 - 57.6
Selenium	mg/k	EPA6020	01-24-97	280.8	2.25	239	84.3%	238	83.8%	204 - 371	0.993	0 - 26.5
Thallium	mg/k	EPA279.2	01-24-97	561.7	3.46	475	83.9%	472	83.4%	548 - 667	1.99	0 - 209
Phenols	mg/k	EPA420.1	01-30-97	0.02	0.001	0.018	74.7%	0.018	83.3%	0.021 - 0.022	0.003	0 - 0.001

FLOWERS CHEMICAL LABORATORIES, INC.

Section 3

Method Blank Report

Client: Moly Corp.
Project Number: UNOCAFE888888888
P.O. Number: N/A
Date Sampled: 20-Jan-97
Lab Numbers: 5878 - 5879

Analyte	Unit	Method	Date	Concentration
Silver	mg/kg	EPA6020	01-24-97	<0.04
Barium	mg/kg	EPA6020	01-24-97	<0.04
Beryllium	mg/kg	EPA210.1	01-24-97	<0.02
Chromium	mg/kg	EPA6020	01-24-97	<0.04
Copper	mg/kg	EPA220.1	01-24-97	<0.04
Iron	mg/kg	EPA6010	02-04-97	<0.05
Mercury	mg/kg	EPA7471	01-27-97	<0.001
Potassium	mg/kg	EPA6010	02-04-97	<2.5
Magnesium	mg/kg	EPA6010	02-04-97	<0.00004
Sodium	mg/kg	EPA6010	02-04-97	<0.5
Lead	mg/kg	EPA6020	01-24-97	<0.02
Antimony	mg/kg	EPA204.2	01-24-97	<0.004
Selenium	mg/kg	EPA6020	01-24-97	<0.06
Thallium	mg/kg	EPA279.2	01-24-97	<0.04
Phenols	mg/kg	EPA420.1	01-30-97	<0.005

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Section 4

QCCS Sample Recovery

Client: Moly Corp.
Project Number: UNOCAFE888888888
P.O. Number: N/A
Date Sampled: 20-Jan-97
Lab Numbers: 5878 - 5879

Analyte	Unit	Method	Date	QCCS Expected	QCCS Measured	Rec. %	Acceptable Limits
Silver	mg/kg	EPA6020	01-24-97	1.00	1.13	113%	0.748 - 1.09
Barium	mg/kg	EPA6020	01-24-97	1.00	1.08	108%	0.712 - 1.12
Beryllium	mg/kg	EPA210.1	01-24-97	1.00	1.09	109%	0.644 - 1.15
Chromium	mg/kg	EPA6020	01-24-97	1.00	[illegible]	114%	0.839 - 1.05
Copper	mg/kg	EPA220.1	01-24-97	1.00	[illegible]	114%	0.982 - 0.998
Iron	mg/kg	EPA6010	02-04-97	0.150	0.128	85.0%	0.123 - 0.176
Mercury	mg/kg	EPA7471	01-27-97	0.002	0.002	107%	0.002 - 0.003
Potassium	mg/kg	EPA6010	02-04-97	100	100	100%	92.2 - 105
Magnesium	mg/kg	EPA6010	02-04-97	0.015	0.016	104%	0.013 - 0.017
Sodium	mg/kg	EPA6010	02-04-97	100	101	101%	80.8 - 111
Lead	mg/kg	EPA6020	01-24-97	1.00	1.08	108%	0.767 - 1.13
Antimony	mg/kg	EPA204.2	01-24-97	1.00	1.18	118%	0.558 - 1.03
Selenium	mg/kg	EPA6020	01-24-97	1.00	1.06	106%	0.615 - 1.27
Thallium	mg/kg	EPA279.2	01-24-97	2.00	[illegible]	119%	1.68 - 2.10
Phenols	mg/kg	EPA420.1	01-30-97	0.030	0.032	108%	0.028 - 0.029

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Section 5

Standards Traceability

Client: Moly Corp.
Project Number: UNOCAFE888888888
P.O. Number: N/A
Date Sampled: 20-Jan-97
Lab Numbers: 5878 - 5879

Compound Name	Manfacturer Name	Manfacturer Lot #	Rec Lot #	Rec By	Date Recieved	Valid Until	Prep Lot #	Prep By	Date Prepared	Valid Until	t-test	t-test range	Control Mean	Control Std	Lot Mean	Lot Std
					Standard				Lot							
Silver	EMS	074-806	100	LSM	04-19-95	10-31-96	104	LSM	08-01-95	08-01-96	2.84	>1.71	0.945	0.074	1.00	0.011
QCCS	EMS	115-716	553	LSM	08-01-96	08-01-97	558	LSM	08-01-96	08-01-97	3.72	>1.70	0.935	0.078	0.997	0.042
Matrix Spike	EMS	074-806	100	LSM	04-19-95	10-31-96	104	LSM	08-01-95	08-01-96	2.84	>1.71	0.945	0.074	1.00	0.011
Aluminum	EMS	124-743	530	LSM	07-15-96	01-01-98	531	LSM	07-16-96	07-16-97	4.78	>1.69	1.05	0.080	1.03	0.043
QCCS	EMS	115-716	553	LSM	08-01-96	08-01-97	558	LSM	08-01-96	08-01-97	3.47	>1.69	1.05	0.080	0.976	0.040
Matrix Spike	EMS	124-743	530	LSM	07-15-96	01-01-98	531	LSM	07-16-96	07-16-97	4.78	>1.69	1.05	0.080	1.03	0.043
Barium	EMS	015-747	8	LSM	04-19-95	10-31-96	54	LSM	08-01-95	08-01-96	7.29	>1.70	0.993	0.039	1.01	0.024
QCCS	EMS	115-716	553	LSM	08-01-96	08-01-97	558	LSM	08-01-96	08-01-97	8.72	>1.69	0.983	0.040	1.01	0.037
Matrix Spike	EMS	115-716	553	LSM	08-01-96	08-01-97	558	LSM	08-01-96	08-01-97	8.72	>1.69	0.983	0.040	1.01	0.037
Beryllium	EMS	104-729	9	LSM	04-19-95	10-31-96	56	LSM	08-01-95	08-01-96	3.06	>1.75	1.04	0.076	0.973	0.083
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	4.12	>1.70	1.02	0.093	1.04	0.048
Matrix Spike	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	4.12	>1.70	1.02	0.093	1.04	0.048
Calcium	EMS	036-740	531	LSM	07-15-96	01-01-98	532	LSM	07-16-96	07-16-97	6.73	>1.67	1.05	0.055	1.04	0.093
QCCS	EMS	036-740	531	LSM	07-15-96	01-01-98	532	LSM	07-16-96	07-16-97	6.73	>1.67	1.05	0.055	1.04	0.093
Matrix Spike	EMS	036-740	531	LSM	07-15-96	01-01-98	532	LSM	07-16-96	07-16-97	6.73	>1.67	1.05	0.055	1.04	0.093
Cadmium	EMS	074-799	68	LSM	04-19-95	10-31-96	59	LSM	08-01-95	08-01-96	5.09	>1.68	0.970	0.059	1.02	0.035
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	6.81	>1.65	0.947	0.056	0.925	0.092
Matrix Spike	EMS	074-799	68	LSM	04-19-95	10-31-96	448	LSM	03-28-96	03-28-97	5.99	>1.65	0.953	0.054	0.917	0.053
Chromium	EMS	074-835	70	LSM	04-19-95	10-31-96	61	LSM	08-01-95	08-01-96	6.52	>1.68	0.997	0.050	0.982	0.045
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	7.49	>1.65	1.00	0.058	1.00	0.064
Matrix Spike	EMS	074-835	70	LSM	04-19-95	10-31-96	448	LSM	03-28-96	03-28-97	7.43	>1.65	0.999	0.055	0.983	0.025
Copper																
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	9.30	>1.65	0.980	0.047	0.975	0.026
Matrix Spike	EMS	025-710	72	LSM	04-19-95	10-31-96	448	LSM	03-28-96	03-28-97	8.97	>1.66	0.981	0.047	0.990	0.039
Iron	EMS	074-822	85	LSM	04-19-95	10-31-96	67	LSM	08-01-95	08-01-96	5.31	>1.73	0.983	0.031	1.05	0.055
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	-0.147	±1.99	1.08	0.964	1.02	0.021
Matrix Spike	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	-0.147	±1.99	1.08	0.964	1.02	0.021
Mercury	EMS	124-734	92	LSM	04-19-95	10-31-96	98	LSM	08-01-95	08-01-96	1.37	±2.20	1.00	0.123	1.08	0.067
QCCS	EMS	124-734	92	LSM	04-19-95	10-31-96	228	LSM	09-14-95	09-14-96	1.37	±2.20	1.04	0.837		
Matrix Spike	EMS	124-734	92	LSM	04-19-95	10-31-96	98	LSM	08-01-95	08-01-96	1.37	±2.20	1.00	0.123	1.08	0.067

FLOWERS CHEMICAL LABORATORIES,INC.

Section 5

Standards Traceability

Client:	Moly Corp.
Project Number:	UNOCAFE888888888
P.O. Number:	N/A
Date Sampled:	20-Jan-97
Lab Numbers:	5878 - 5879

Compound Name	Manfacturer Name	Manfacturer Lot #	Rec Lot #	Rec By	Date Recieved	Valid Until	Prep Lot #	Prep By	Date Prepared	Valid Until	t-test	t-test range	Contro Mean	Contro Std	Lot Mean	Lot Std
					Standard				Lot							
Potassium	EMS	124-702	533	LSM	07-15-96	01-01-98	534	LSM	07-16-96	07-16-97	5.29	>1.74	1.02	0.050	1.08	0.030
QCCS	EMS	115-716	553	LSM	08-01-96	08-01-97	558	LSM	08-01-96	08-01-97	7.41	>1.74	1.02	0.050	1.04	0.010
Matrix Spike	EMS	115-716	553	LSM	08-01-96	08-01-97	558	LSM	08-01-96	08-01-97	7.41	>1.74	1.02	0.050	1.04	0.010
Magnesium	EMS	056-745	532	LSM	07-15-96	01-01-98	533	LSM	07-16-96	07-16-97	2.27	>1.68	1.02	0.035	1.05	0.181
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97			1.02	0.035	1.14	
Matrix Spike	EMS	056-745	532	LSM	07-15-96	01-01-98	533	LSM	07-16-96	07-16-97			1.02	0.035	1.05	
Manganese	EMS	074-825	91	LSM	04-19-95	10-31-96	97	LSM	08-01-95	08-01-96	6.66	>1.69	0.989	0.045	0.953	0.076
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	8.73	>1.67	0.989	0.048	0.989	0.066
Matrix Spike	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	8.73	>1.67	0.989	0.048	0.989	0.066
Sodium	Ultra	IC-0138	586	LSM	08-20-96	08-20-97	600	LSM	10-17-96	10-17-97	5.15	>1.69	1.01	0.067	1.04	0.066
QCCS	Ultra	IC-0138	586	LSM	08-20-96	08-20-97	600	LSM	10-17-96	10-17-97	5.15	>1.69	1.01	0.067	1.04	0.066
Matrix Spike	Ultra	IC-0138	586	LSM	08-20-96	08-20-97	600	LSM	10-17-96	10-17-97	5.15	>1.69	1.01	0.067	1.04	0.066
Nickel	EMS	074-828	95	LSM	04-19-95	10-31-96	100	LSM	08-01-95	08-01-96	1.21	±2.02	0.945	0.165	1.05	0.096
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	4.82	>1.65	0.972	0.091	0.975	0.034
Matrix Spike	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	4.82	>1.65	0.972	0.091	0.975	0.034
Lead	EMS	074-739	87	LSM	04-19-95	10-31-96	69	LSM	08-01-95	08-01-96	5.00	>1.69	1.02	0.072		
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	4.52	>1.69	1.02	0.070	0.978	0.064
Matrix Spike	EMS	074-739	87	LSM	04-19-95	10-31-96	448	LSM	03-28-96	03-28-97	5.00	>1.69	1.02	0.070	0.987	0.031
Antimony QCCS Matrix Spike	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97			1.01	0.096	0.938	0.012
Selenium	EMS	074-829	98	LSM	04-19-95	10-31-96	102	LSM	08-01-95	08-01-96	3.46	>1.75	1.06	0.095	1.04	0.069
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	4.49	>1.66	1.01	0.089	1.02	0.029
Matrix Spike	EMS	074-829	98	LSM	04-19-95	10-31-96	102	LSM	08-01-95	08-01-96	3.46	>1.75	1.06	0.095	1.04	0.069
Thallium QCCS Matrix Spike	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	2.26	>1.68	1.02	0.096	0.935	0.025
Vanadium	EMS	074-814	107	LSM	04-19-95	10-31-96	110	LSM	08-01-95	08-01-96	11.5	>1.69	0.987	0.028	0.974	0.020
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97			0.983	0.033	0.964	0.028
Matrix Spike	EMS	074-814	107	LSM	04-19-95	10-31-96	110	LSM	08-01-95	08-01-96			0.987	0.028	0.974	0.020
Zinc	EMS	074-815	108	LSM	04-19-95	10-31-96	111	LSM	08-01-95	08-01-96	6.58	>1.68	0.969	0.045	1.01	0.039

FLOWERS CHEMICAL
LABORATORIES,INC.

Section 5

Standards Traceability

Client: Moly Corp.
Project Number: UNOCAFE888888888
P.O. Number: N/A
Date Sampled: 20-Jan-97
Lab Numbers: 5878 - 5879

Compound Name	Manfacturer Name	Manfacturer Lot #	Rec Lot #	Rec By	Date Recieved	Valid Until	Prep Lot #	Prep By	Date Prepared	Valid Until	t-test	t-test range	Contro Mean	Contro Std	Lot Mean	Lot Std
			Standard				Lot									
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	7.07	>1.65	0.977	0.048	1.02	0.070
Matrix Spike	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	7.07	>1.65	0.977	0.048	1.02	0.070
Molybdenum	EMS	104-728	94	LSM	04-19-95	10-31-96	99	LSM	08-01-95	08-01-96	-1.24	±2.16	0.978	0.091	0.818	0.358
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	4.01	>1.74	1.01	0.097	1.01	0.065
Matrix Spike	EMS	104-728	94	LSM	04-19-95	10-31-96	448	LSM	03-28-96	03-28-97			1.01	0.097	0.994	0.002
EPA204.2 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						
EPA210.1 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						
EPA213.1 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						
EPA220.1 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						
EPA243.1 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						
EPA246.2 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						
EPA249.1 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						
EPA279.2 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						
EPA286.1 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						
EPA289.1 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						
EPA6010 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						
EPA6020 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						
EPA7471 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						

FLOWERS CHEMICAL LABORATORIES

Internal Custody Record   Lab Numbers: 5878 - 5879

Lab # 5878

Container 100888 Jar 250 ml:

Shpped to custome:Check-in Station Tue, 01/14/97 02:05PM
Stainls Stl 4 Shl:Lisa Markle Thu, 01/30/97 10:12AM

Lab # 5879

Container 100882 Jar 250 ml:

Shpped to custome:Check-in Station Tue, 01/14/97 02:05PM
Stainls Stl 4 Shl:Lisa Markle Thu, 01/30/97 10:12AM

Jefferson L. Flowers, Ph.D
Jefferson S. Flowers, Ph.D
PO BOX 150597
481 NEWBURYPORT Av.
ALTAMONTE SPRINGS
FLORIDA 32715 - 0597
BUS: (407) 339-5984
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FLOWERS
CHEMICAL LABORATORIES
INCORPORATED

481 NEWBURYPORT
P.O. BOX 150-597
ALTAMONTE SPRINGS
FLORIDA 32715-0597
BUS: (407) 339-5984
FAX: (407) 260-6110

CHAIN OF CUSTODY RECORD FOR

UNOCAL 76

CLIENT #3362

Company Name: Moly Corp Inc
Address:
City: State: Zip Code:
Telephone: FAX #:
Report To: Sampler:

Project Name:
UNOCAL Project Manager: JOHN DANIELS
AFE #: 884930040
Site #:
QC Data: ☐ Level D (Standard) ☐ Level C ☐ Level B ☐ Level A

Turnaround Time: ☐ 10 Work Days ☐ 5 Work Days ☐ 3 Work Days ☐ 2 Work Days ☐ 1 Work Day ☐ 2-8 Hours
☐ Drinking Water ☐ Waste Water ☐ Other
CODE: ☐ Misc. ☐ Detect. ☐ Eval. ☐ Remed. ☐ Demol. ☐ Closure

							PRESERVATIVES																
Client Sample I.D.	Date/Time Sampled	Matrix Desc.	# of Cont.	Cont. Type	Laboratory Sample #	NO. OF CONTAINERS	UNPRESERVED	H_2SO_4	HNO_3	HCl			ANALYSES REQUEST	TAL METALS	MOLYBDENUM	PHENOLS		CHLORIDE	SULFATE	TDS	TOC	TOX	<4°C
POND-01	1-20-97 0835	S	1		5878									✓	✓	✓							
POND-01	↓ 0835	W												✓	✓	✓		✓	✓	✓	✓	✓	
POND-02	↓ 0830	S	1		5879									✓	✓	✓							
POND-02	↓ 0830	W												✓	✓	✓		✓	✓	✓	✓	✓	
BLANK-20	↓ 1200	W												✓	✓	✓		✓	✓	✓	✓	✓	
			RH																				
~~RAD-01~~	RH	~~S~~																					
~~RAD-02~~		~~S~~																					
~~RAD-03~~		~~S~~																					
~~RAD-04~~		~~S~~																					

Relinquished By: Lolin Halliday	Date: 1-20-97 Time: 1930	Received By: FED. EX Date: Time:
Relinquished By:	Date: Time:	Received By: Date: Time:
Relinquished By:	Date: Time:	Received By Lab: Date: 1/21/97 Time: 1043

Were Samples Received in Good Condition? ☑ Yes ☐ No Samples on Ice? ☒ Yes ☐ No Method of Shipment FED EX Page __ of __

To be completed upon receipt of report:
1) Were the analyses requested on the Chain of Custody reported? ☐ Yes ☐ No If no, what analyses are still needed? ______
2) Was the report issued within the requested turnaround time? ☐ Yes ☐ No If no, what was the turnaround time? ______
Approved by: ______ Signature: ______ Company: ______ Date: ______

SHIP WITH SAMPLES/TO BE RETURNED WITH RESULTS

FLOWERS
CHEMICAL LABORATORIES INCORPORATED

Received From:
Moly Corp.
300 Caldwell Ave.
Washington, PA 15301

Date Reported : Mar 4 1997
Project Number : UNOCAFE888888888
PO Number : N/A
FDHRSDW Number : 83139
NYSDOH Number : 11595
FDER COMQAPNum : 86-0008G
LDHH Number : 94-23
NCDEHNR Number : 296
SCDHEC Number : 96019

For: Tot.RCRA Al Be Ca Co Cu Fe K Mg Mn Na Ni Sb Tl V Zn Mo TOX SO4 TOC Cl TDS
Date Sampled:Jan16 1997 Date Received:Jan17 1997 Lab Numbers: 11415-11418

REPORT OF ANALYSIS

Parameter	Unit	Method Detection Limit	%ACC	%PRC	11415 CHAR01	11416 CHAR02	11417 SUGAR0 1	11418 SUGAR0 2
Silver	mg/L	.00020	75.3	3.82	.00226	.00255	.00239	0.0359
Aluminum	mg/L	.00100	99.5	.000	0.305	<.0010	<.0010	<.0010
Arsenic	mg/L	.00010	118.	.740	.00316	.00320	.00259	.00223
Barium	mg/L	.00006	98.3	1.19	0.0842	0.161	0.118	0.111
Beryllium	mg/L	.00010	106.	2.79	.00147	.00158	.00158	.00152
Calcium	mg/L	.00500	90.0	.510	74.0	116.	73.8	78.7
Cadmium	mg/L	.00005	102.	.470	.00226	.00177	.00168	.00170
Cobalt	mg/L	.00010	97.4	.640	.00221	.00270	.00242	.00207
Chromium	mg/L	.00020	97.3	.130	.00689	.00529	.00481	.00414
Copper	mg/L	.00020	89.9	2.00	0.0163	0.0483	0.0104	.00929
Iron	mg/L	.00100	141.	.160	0.952	0.956	0.876	0.587
Mercury	mg/L	.00020	99.5	6.54	.00069	.00083	.00069	.00069
Potassium	mg/L	0.0500	124.	.320	4.55	4.98	3.30	2.79
Magnesium	mg/L	.00004	138.	.500	18.1	17.1	9.89	10.4
Manganese	mg/L	.00004	114.	.150	0.170	0.278	0.158	0.129
Sodium	mg/L	0.0100	88.0	2.04	258.	162.	27.1	28.2
Nickel	mg/L	.00020	97.1	1.79	.00284	.00626	.00354	.00304
Lead	mg/L	.00010	99.6	.770	0.0140	0.0191	.00628	.00467
Antimony	mg/L	.00002			.00130	.00202	.00105	.00098
Selenium	mg/L	.00030	101.	.210	.00394	.00247	.00274	.00297
Thallium	mg/L	.00010	106.	3.47	.00163	.00163	.00164	.00162
Vanadium	mg/L	.00006	100.	1.29	.00384	.00423	.00372	.00275
Zinc	mg/L	.00010	97.6	1.15	0.0313	0.0569	0.0181	0.0127
Molybdenum	mg/L	.00010	101.	.010	0.0888	0.0125	.00676	.00454
Sulfate	mg/L	1.00			58.3	57.6	62.0	56.3
Total_Organic_Carbon	mg/L	1.00	93.3	1.57	7.29	5.83	7.34	5.66

Data Release Authorization

Sample integrity and reliability certified by Lab personnel prior to analysis. Methods of analysis in accordance with FCL QA and EPA approved methodology. This Report may not be reproduced in part, results relate only to items tested.

Jefferson S. Flowers, Ph.d.
President/Technical Director

FLOWERS
CHEMICAL LABORATORIES INCORPORATED

Received From:
Moly Corp.
300 Caldwell Ave.
Washington,PA 15301

Date Reported : Mar 4 1997
Project Number : UNOCAFE888888888
PO Number : N/A
FDHRSDW Number : 83139
NYSDOH Number : 11595
FDER COMQAPNum : 86-0008G
LDHH Number : 94-23
NCDEHNR Number : 296
SCDHEC Number : 96019

For: Tot.RCRA Al Be Ca Co Cu Fe K Mg Mn Na Ni Sb Tl V Zn Mo TOX SO4 TOC Cl TDS
Date Sampled:Jan16 1997 Date Received:Jan17 1997 Lab Numbers: 11415-11418

REPORT OF ANALYSIS

Parameter	Unit	Method Detection Limit	%ACC	%PRC	11415 CHAR01	11416 CHAR02	11417 SUGAR0 1	11418 SUGAR0 2
Chloride	mg/L	0.0100	84.8	.000	151.	266.	49.1	51.4
TDS	mg/L	2.50	114.	2.15	522.	498.	364.	356.
Phenols	mg/L	.00500	92.6	16.9	<.0050	<.0050	<.0050	<.0050
TOX	mg/L	.00100	79.9	.000	0.183	0.165	0.123	0.282

Data Release Authorization

Sample integrity and reliability certified by Lab personnel prior to analysis. Methods of analysis in accordance with FCL QA and EPA approved methodology. This Report may not be reproduced in part, results relate only to items tested.

Jefferson S. Flowers, Ph.d.
President/Technical Director

FLOWERS
CHEMICAL
LABORATORIES
INCORPORATED

Received From:
Moly Corp.
300 Caldwell Ave.
Washington, PA 15301

Date Reported : Mar 4 1997
Project Number : UNOCAFE888888888
PO Number : N/A
FDHRS Number : 83139
FHRS ENVNumber : E83018
FDER COMQAPNum : 86-0008G
LDHH Number : 94-23
NCDEHNR Number : 296
SCDHEC Number : 96019

For: Tot.RCRA Al Be Ca Co Cu Fe K Mg Mn Na Ni Sb Tl V Zn Mo TOX SO4 TOC Cl TDS
Date Sampled:Jan16 1997 Date Received:Jan17 1997 Lab Numbers: 11415-11418

REPORT OF INFORMATION

Parameter	Unit	Limit	Expected	Value	Range	Correlation
				11415		
Silver	mg/L	5.72	0.262	.00226		
Aluminum	mg/L	791.	73.9	0.305		
Arsenic	mg/L	18.2	0.486	.00316		
Barium	mg/L	171.	4.02	0.0842		
Beryllium	mg/L	0.625	0.0249	.00147		
Calcium	mg/L	19300	168.	74.0		
Cadmium	mg/L	76.7	0.839	.00226		
Cobalt	mg/L	13.3	1.09	.00221		
Chromium	mg/L	359.	4.69	.00689		
Copper	mg/L	2810	47.8	0.0163		
Iron	mg/L	2140	53.7	0.952		
Mercury	mg/L	0.497	0.0167	.00069		
Potassium	mg/L	19500	403.	4.55		
Magnesium	mg/L	349.	31.4	18.1		
Manganese	mg/L	67.9	0.750	0.170		
Sodium	mg/L	44600	57.0	258.		211
Nickel	mg/L	57.5	1.13	.00284		
Lead	mg/L	5360	53.7	0.0140		
Antimony	mg/L	5.69	0.270	.00130		
Selenium	mg/L	0.659	0.0226	.00394		
Thallium	mg/L	44.6	1.12	.00163		
Vanadium	mg/L	94.9	8.53	.00384		
Zinc	mg/L	12000	131.	0.0313		
Molybdenum	mg/L	49.5	5.48	0.0888		
Sulfate	mg/L	116000	2080	58.3		
Total_Organic_Carbon	mg/L	2200	103.	7.29		

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Received From:
Moly Corp.
300 Caldwell Ave.
Washington,PA 15301

Date Reported : Mar 4 1997
Project Number : UNOCAFE888888888
PO Number : N/A
FDHRS Number : 83139
FHRS ENVNumber : E83018
FDER COMQAPNum : 86-0008G
LDHH Number : 94-23
NCDEHNR Number : 296
SCDHEC Number : 96019

For: Tot.RCRA Al Be Ca Co Cu Fe K Mg Mn Na Ni Sb Tl V Zn Mo TOX SO4 TOC Cl TDS
Date Sampled:Jan16 1997 Date Received:Jan17 1997 Lab Numbers: 11415-11418

REPORT OF INFORMATION

Parameter	Unit	Limit	Expected	Value	Range	Correlation
				11415		
Chloride	mg/L	4110	183.	151.		
TDS	mg/L	40200	2360	522.		
TOX	mg/L	-	-	0.183		

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For: Tot.RCRA Al Be Ca Co Cu Fe K Mg Mn Na Ni Sb Tl V Zn Mo TOX SO4 TOC Cl TDS
Date Sampled:Jan16 1997 Date Received:Jan17 1997 Lab Numbers: 11415-11418

REPORT OF INFORMATION

Parameter	Unit	Limit	Expected	Value	Range	Correlation
				11416		
Silver	mg/L	5.72	0.262	.00255		
Arsenic	mg/L	18.2	0.486	.00320		
Barium	mg/L	171.	4.02	0.161		
Beryllium	mg/L	0.625	0.0249	.00158		
Calcium	mg/L	19300	168.	116.		
Cadmium	mg/L	76.7	0.839	.00177		
Cobalt	mg/L	13.3	1.09	.00270		
Chromium	mg/L	359.	4.69	.00529		
Copper	mg/L	2810	47.8	0.0483		
Iron	mg/L	2140	53.7	0.956		
Mercury	mg/L	0.497	0.0167	.00083		
Potassium	mg/L	19500	403.	4.98		
Magnesium	mg/L	349.	31.4	17.1		
Manganese	mg/L	67.9	0.750	0.278		
Sodium	mg/L	44600	1090	162.		
Nickel	mg/L	57.5	1.13	.00626		
Lead	mg/L	5360	53.7	0.0191		
Antimony	mg/L	5.69	0.270	.00202		
Selenium	mg/L	0.659	0.0226	.00247		
Thallium	mg/L	44.6	1.12	.00163		
Vanadium	mg/L	94.9	8.53	.00423		
Zinc	mg/L	12000	131.	0.0569		
Molybdenum	mg/L	49.5	5.48	0.0125		
Sulfate	mg/L	116000	2080	57.6		
Total_Organic_Carbon	mg/L	2200	103.	5.83		
Chloride	mg/L	4110	183.	266.		

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FHRS ENVNumber : E83018
FDER COMQAPNum : 86-0008G
LDHH Number : 94-23
NCDEHNR Number : 296
SCDHEC Number : 96019

For: Tot.RCRA Al Be Ca Co Cu Fe K Mg Mn Na Ni Sb Tl V Zn Mo TOX SO4 TOC Cl TDS
Date Sampled:Jan16 1997 Date Received:Jan17 1997 Lab Numbers: 11415-11418

REPORT OF INFORMATION

Parameter	Unit	Limit	Expected	Value	Range	Correlation
				11416		
TDS	mg/L	40200	2360	498.		
TOX	mg/L	-	-	0.165		

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FLOWERS
CHEMICAL LABORATORIES INCORPORATED

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Date Reported : Mar 4 1997
Project Number : UNOCAFE888888888
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FDHRS Number : 83139
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FDER COMQAPNum : 86-0008G
LDHH Number : 94-23
NCDEHNR Number : 296
SCDHEC Number : 96019

For: Tot.RCRA Al Be Ca Co Cu Fe K Mg Mn Na Ni Sb Tl V Zn Mo TOX SO4 TOC Cl TDS
Date Sampled:Jan16 1997 Date Received:Jan17 1997 Lab Numbers: 11415-11418

REPORT OF INFORMATION

Parameter	Unit	Limit	Expected	Value	Range	Correlation
				11417		
Silver	mg/L	5.72	0.262	.00239		
Arsenic	mg/L	18.2	0.486	.00259		
Barium	mg/L	171.	4.02	0.118		
Beryllium	mg/L	0.625	0.0249	.00158		
Calcium	mg/L	19300	168.	73.8		
Cadmium	mg/L	76.7	0.839	.00168		
Cobalt	mg/L	13.3	1.09	.00242		
Chromium	mg/L	359.	4.69	.00481		
Copper	mg/L	2810	47.8	0.0104		
Iron	mg/L	2140	53.7	0.876		
Mercury	mg/L	0.497	0.0167	.00069		
Potassium	mg/L	19500	403.	3.30		
Magnesium	mg/L	349.	31.4	9.89		
Manganese	mg/L	67.9	0.750	0.158		
Sodium	mg/L	44600	1090	27.1		
Nickel	mg/L	57.5	1.13	.00354		
Lead	mg/L	5360	53.7	.00628		
Antimony	mg/L	5.69	0.270	.00105		
Selenium	mg/L	0.659	0.0226	.00274		
Thallium	mg/L	44.6	1.12	.00164		
Vanadium	mg/L	94.9	8.53	.00372		
Zinc	mg/L	12000	131.	0.0181		
Molybdenum	mg/L	49.5	5.48	.00676		
Sulfate	mg/L	116000	2080	62.0		
Total_Organic_Carbon	mg/L	2200	103.	7.34		
Chloride	mg/L	4110	183.	49.1		

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FHRS ENVNumber : E83018
FDER COMQAPNum : 86-0008G
LDHH Number : 94-23
NCDEHNR Number : 296
SCDHEC Number : 96019

For: Tot.RCRA Al Be Ca Co Cu Fe K Mg Mn Na Ni Sb Tl V Zn Mo TOX SO4 TOC Cl TDS
Date Sampled:Jan16 1997 Date Received:Jan17 1997 Lab Numbers: 11415-11418

REPORT OF INFORMATION

Parameter	Unit	Limit	Expected	Value	Range	Correlation
				11417		
TDS	mg/L	40200	2360	364.		
TOX	mg/L	-	-	0.123		

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FDER COMQAPNum : 86-0008G
LDHH Number : 94-23
NCDEHNR Number : 296
SCDHEC Number : 96019

For: Tot.RCRA Al Be Ca Co Cu Fe K Mg Mn Na Ni Sb Tl V Zn Mo TOX SO4 TOC Cl TDS
Date Sampled:Jan16 1997 Date Received:Jan17 1997 Lab Numbers: 11415-11418

REPORT OF INFORMATION

Parameter	Unit	Limit	Expected	Value	Range	Correlation
				11418		
Silver	mg/L	5.72	0.262	0.0359		
Arsenic	mg/L	18.2	0.486	.00223		
Barium	mg/L	171.	4.02	0.111		
Beryllium	mg/L	0.625	0.0249	.00152		
Calcium	mg/L	19300	168.	78.7		
Cadmium	mg/L	76.7	0.839	.00170		
Cobalt	mg/L	13.3	1.09	.00207		
Chromium	mg/L	359.	4.69	.00414		
Copper	mg/L	2810	47.8	.00929		
Iron	mg/L	2140	53.7	0.587		
Mercury	mg/L	0.497	0.0167	.00069		
Potassium	mg/L	19500	403.	2.79		
Magnesium	mg/L	349.	31.4	10.4		
Manganese	mg/L	67.9	0.750	0.129		
Sodium	mg/L	44600	1090	28.2		
Nickel	mg/L	57.5	1.13	.00304		
Lead	mg/L	5360	53.7	.00467		
Antimony	mg/L	5.69	0.270	.00098		
Selenium	mg/L	0.659	0.0226	.00297		
Thallium	mg/L	44.6	1.12	.00162		
Vanadium	mg/L	94.9	8.53	.00275		
Zinc	mg/L	12000	131.	0.0127		
Molybdenum	mg/L	49.5	5.48	.00454		
Sulfate	mg/L	116000	2080	56.3		
Total_Organic_Carbon	mg/L	2200	103.	5.66		
Chloride	mg/L	4110	183.	51.4		

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[illegible]
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FHRS ENVNumber : E83018
FDER COMQAPNum : 86-0008G
LDHH Number : 94-23
NCDEHNR Number : 296
SCDHEC Number : 96019

For: Tot.RCRA Al Be Ca Co Cu Fe K Mg Mn Na Ni Sb Tl V Zn Mo TOX SO4 TOC Cl TDS
Date Sampled:Jan16 1997 Date Received:Jan17 1997 Lab Numbers: 11415-11418

REPORT OF INFORMATION

Parameter	Unit	Limit	Expected	Value	Range	Correlation
				11418		
TDS	mg/L	40200	2360	356.		
TOX	mg/L	-	-	0.282		

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Date Reported : Mar 4 1997
Project Number : UNOCAFE888888888
PO Number : N/A
FDHRS Number : 83139
FHRS ENVNumber : E83018
FDER COMQAPNum : 86-0008G
LDHH Number : 94-23
NCDEHNR Number : 296
SCDHEC Number : 96019

For: Tot.RCRA Al Be Ca Co Cu Fe K Mg Mn Na Ni Sb Tl V Zn Mo TOX SO4 TOC Cl TDS
Date Sampled:Jan16 1997 Date Received:Jan17 1997 Lab Numbers: 11415-11418

REPORT OF INFORMATION

On this Last Page 9 Correlation Pairs Referenced

211	TDS	Sodium

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FLOWERS CHEMICAL LABORATORIES

ANALYTICAL RESULTS FORM HRS Number 83139

			CHAR-01	CHAR-02	SUGAR-01	SUGAR-02							QA Section					
Parameter	Symbol	Unit	11415	11416	11417	11418							Method	MDL	%RSD	%Rec	Analyst	Date
Silver	*	mg/L	0.00228	0.00255	0.00239	0.0359							EPA6020	0.0002	3.826293	75.30661	CKN	01-23-97
Aluminum	*	mg/L	0.305	<0.001	<0.001	<0.001							EPA200.7	0.001	0	99.57	CKN	01-31-97
Arsenic	*	mg/L	0.00316	0.00320	0.00259	0.00223							EPA6020	0.0001	0.7469477	118.497	CKN	01-23-97
Barium	*	mg/L	0.0842	0.161	0.118	0.1109							EPA6020	0.00008	1.193009	98.304400	CKN	01-23-97
Beryllium	*	mg/L	0.00147	0.00158	0.00158	0.00152							EPA6020	0.0001	2.7995225	108.0495	CKN	01-23-97
Calcium	*	mg/L	74.0	116	73.8	78.7							EPA200.7	0.005	0.5170140	90	CKN	01-21-97
Cadmium	*	mg/L	0.00228	0.00177	0.00168	0.00170							EPA6020	0.00005	0.4727036	102.1543	CKN	01-23-97
Cobalt	*	mg/L	0.00221	0.00270	0.00242	0.00207							EPA6020	0.0001	0.6491378	97.4247	CKN	01-23-97
Chromium	*	mg/L	0.00689	0.00529	0.00481	0.00414							EPA6020	0.0002	0.1368579	97.3257	CKN	01-23-97
Copper	*	mg/L	0.0163	0.0483	0.01036	0.00929							EPA6020	0.0002	2.0014550	98.9117	CKN	01-23-97
Iron	*	mg/L	0.952	0.956	0.876	0.587							EPA200.7	0.001	0.1660849	141	CKN	01-24-97
Mercury	*	mg/L	0.000690	0.000829	0.000690	0.000690							EPA245.1	0.0002	6.5432500	99.560462	CKN	01-27-97
Potassium	*	mg/L	4.55	4.98	3.30	2.79							EPA200.7	0.05	0.3278828	124.85	CKN	01-21-97
Magnesium	*	mg/L	18.1	17.1	9.89	10.39							EPA200.7	0.00004	0.6009181	138	CKN	01-21-97
Manganese	*	mg/L	0.170	0.278	0.158	0.129							EPA200.7	0.00004	0.1549834	114.5	CKN	01-21-97
Sodium	*	mg/L	258	162	27.1	28.2							EPA200.7	0.01	2.0442740	88	CKN	01-21-97
Nickel	*	mg/L	0.00284	0.00626	0.00354	0.00304							EPA6020	0.0002	1.7968800	97.1926	CKN	01-23-97
Lead	*	mg/L	0.0140	0.0191	0.00628	0.00467							EPA6020	0.0001	0.7756114	99.602	CKN	01-23-97
Antimony	*	mg/L	0.00130	0.00202	0.001046	0.000984							EPA6020	0.00002			CKN	01-23-97
Selenium	*	mg/L	0.00394	0.00247	0.00274	0.00297							EPA6020	0.0003	0.2136296	101.4211	CKN	01-23-97
Thallium	*	mg/L	0.00163	0.00163	0.00164	0.00162							EPA6020	0.0001	3.4705494	106.1304	CKN	01-23-97
Vanadium	*	mg/L	0.00384	0.00423	0.00372	0.00275							EPA6020	0.00008	1.2989440	100.6476	CKN	01-23-97
Zinc	*	mg/L	0.0313	0.0569	0.0181	0.0127							EPA6020	0.0001	1.1590404	97.6172	CKN	01-23-97
Molybdenum	*	mg/L	0.0888	0.0125	0.00876	0.00454							EPA6020	0.0001	0.0132044	101.7397	CKN	01-23-97
Sulfate	*	mg/L	58.3	57.6	62.0	56.3							EPA375.4	1	33.795893	65.578736	LAM	01-30-97
Total_Organic_Carbon	*	mg/L	7.29	5.83	7.34	5.66							EPA415.1	1	1.5726553	93.333333	TRB	01-22-97
Chloride	*	mg/L	151	266	49.1	51.4							EPA325.2	0.01	0	84.87	TRB	01-29-97
TDS	*	mg/L	522	498	364	356							EPA160.1	2.5	----------	114.00000	YGS	01-21-97
Phenols	*	mg/L	<0.005	<0.005	<0.005	<0.005							EPA420.1	0.005	16.907670	92.653733	LAM	01-30-97
TOX	*	mg/L	0.183	0.165	0.123	0.282							EPA9020B	0.001	0	79.999998	TRB	03-03-97

Date Received: 01-17-97 Typed: 03-04-97 Sent: 03-04-97

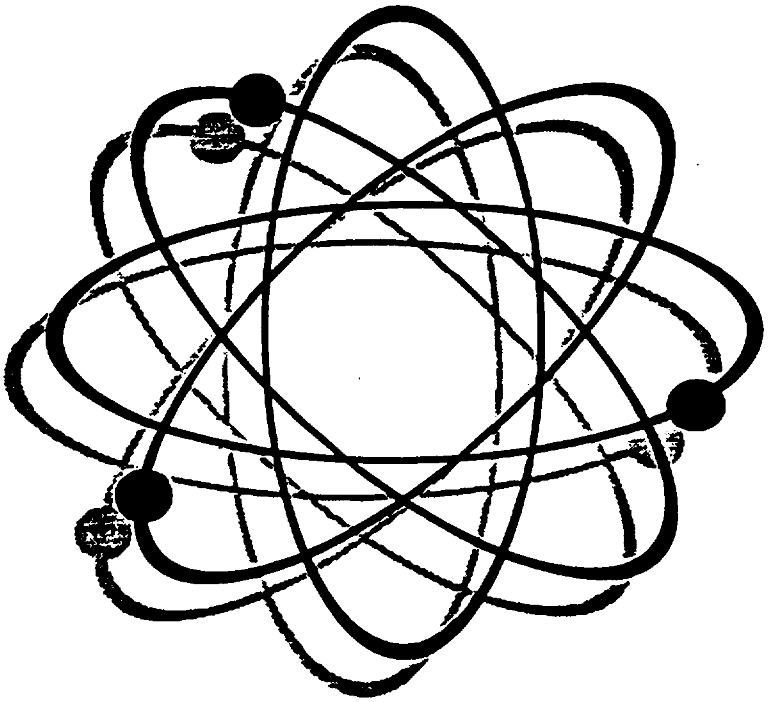
Project Number	UNOCAFE888888888	
PO Number	N/A	
Date Sampled	1	01-16-97 *
Date Analyzed	0	
Compacted	1	
Format	NormRR	
Unit Cost	Exted	
Tot.RCRA	5625	4 *
Al	540	4 *
Be	540	4 *
Ca	540	4 *
Co	540	4 *
Cu	540	4 *
Fe	540	4 *
K	540	4 *
Mg	540	4 *
Mn	540	4 *
Na	540	4 *
Ni	540	4 *
Sb	540	4 *
Tl	540	4 *

Zn	540	4 *
Mo	640	4 *
TOX	7875	4 *
SO4	675	4 *
TOC	1575	4 *
Cl	653	4 *
TDS	450	4 *

Quality Assurance Report

Prepared for: Moly Corp.
Project Number: UNOCAFE888888888
Lab Numbers: 11415 - 11418

Report date: 4-Mar-97



FLOWERS
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FLOWERS CHEMICAL LABORATORIES, INC.

QA Conformance Summary

Client: Moly Corp.
Project Number: UNOCAFE888888888
P.O. Number: N/A
Date Sampled: 16-Jan-97
Lab Numbers: 11415 - 11418

Sample Handling

Sample handling and holding time criteria were met for all samples.
Samples Collected by Submitter.

Surrogate Compound Recoveries:

The requested analytes did not require surrogates.

Accuracy / Precision:

The recovery limits were exceeded for 1 compound in the matrix spike as shown in section 2. This represents a 92.3% success rate.
The recovery limits were exceeded for 1 compound in the matrix spike duplicate as shown in section 2. This represents a 92.3% success rate.
The RSD was exceeded for 1 compound as shown in section 2. This represents a 92.3% success rate.

Method Blanks:

No target compounds were found in the method blank in excess of the method limit as shown in section 3.

QCCS Check Sample:

The control limits were met for all compounds as shown in section 4.

Standards Traceability:

The t-test limits were met for all calibration standards as shown in section 5.
The t-test limits were met for all QCCS standards as shown in section 5.
The t-test limits were met for all matrix spike standards as shown in section 5.
There were 5 standard blanks.
The t-test limits were met for all surrogate spike standards as shown in section 5.

Section 2

Matrix Spike Recovery

Client: Moly Corp.
Project Number: UNOCAFE888888888
P.O. Number: N/A
Date Sampled: 16-Jan-97
Lab Numbers: 11415 - 11418

Analyte	Unit	Analysis Method	Date	Spike Added	Sample Conc.	MS Conc.	MS Rec.	MSD Conc.	MSD Rec.	Acceptable Limits	STD Rec.	Acceptable Limits
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Aluminum	mg/L	EPA200.7	01-31-97	1.111	0.305	1.41	99.6%	1.41	99.6%	1.09 - 1.86	0.000	0 - 0.205
Calcium	mg/L	EPA200.7	01-21-97	1	50.6	51.5	90.0%	51.2	60.0%	37.6 - 61.7	0.212	0 - 0.147
Iron	mg/L	EPA200.7	01-24-97	1.111	0.208	1.77	141%	1.78	141%	0.903 - 1.70	0.002	0 - 0.254
Mercury	mg/L	EPA245.1	01-27-97	0.002	<0.0002	0.002	99.6%	0.002	107%	0.002 - 0.002	0.000	0 - 0.000
Potassium	mg/L	EPA200.7	01-21-97	10	1.04	13.5	125%	13.5	124%	8.01 - 14.9	0.035	0 - 1.97
Magnesium	mg/L	EPA200.7	01-21-97	0.5	9.94	10.6	138%	10.6	126%	7.54 - 12.5	0.042	0 - 0.086
Manganese	mg/L	EPA200.7	01-21-97	0.2	0.227	0.456	115%	0.457	115%	0.343 - 0.521	0.001	0 - 0.027
Sodium	mg/L	EPA200.7	01-21-97	1	7.44	8.32	88.0%	8.13	69.0%	5.40 - 11.4	0.134	0 - 0.243
Sulfate	mg/L	EPA375.4	01-30-97	10	<1	6.56	65.6%	9.65	96.5%	6.37 - 13.9	2.19	0 - 2.86
Total_Organic_Carbon	mg/L	EPA415.1	01-22-97	3	36.2	39.0	93.3%	39.7	117%	21.7 - 52.4	0.495	0 - 0.758
Chloride	mg/L	EPA325.2	01-29-97	10	7.29	15.8	84.9%	15.8	84.9%	10.9 - 21.9	0.000	0 - 2.05
TDS	mg/L	EPA160.1	01-21-97	15	12.1	29.2	114%	29.2	114%	12.3 - 34.3	--------	0 - 3.05
Phenols	mg/L	EPA420.1	01-30-97	0.025	0.000	0.023	92.7%	0.028	112%	0.016 - 0.033	0.003	0 - 0.005

FLOWERS CHEMICAL LABORATORIES, INC.

Section 3

Method Blank Report

Client: Moly Corp.
Project Number: UNOCAFE888888888
P.O. Number: N/A
Date Sampled: 16-Jan-97
Lab Numbers: 11415 - 11418

Analyte	Unit	Method	Date	Concentration
Aluminum	mg/L	EPA200.7	01-31-97	<0.001
Calcium	mg/L	EPA200.7	01-21-97	<0.005
Iron	mg/L	EPA200.7	01-24-97	<0.001
Mercury	mg/L	EPA245.1	01-27-97	<0.0002
Potassium	mg/L	EPA200.7	01-21-97	<0.05
Magnesium	mg/L	EPA200.7	01-21-97	<0.00004
Manganese	mg/L	EPA200.7	01-21-97	<0.00004
Sodium	mg/L	EPA200.7	01-21-97	<0.01
Sulfate	mg/L	EPA375.4	01-30-97	<1
Total_Organic_Carbon	mg/L	EPA415.1	01-22-97	<1
Chloride	mg/L	EPA325.2	01-29-97	0.013
TDS	mg/L	EPA160.1	01-21-97	<2.5
Phenols	mg/L	EPA420.1	01-30-97	<0.005

Section 4

QCCS Sample Recovery

Client: Moly Corp.
Project Number: UNOCAFE888888888
P.O. Number: N/A
Date Sampled: 16-Jan-97
Lab Numbers: 11415 - 11418

Analyte	Unit	Method	Date	QCCS Expected	QCCS Measured	Rec. %	Acceptable Limits
Aluminum	mg/L	EPA200.7	01-31-97	0.500	0.483	96.6%	0.412 - 0.632
Calcium	mg/L	EPA200.7	01-21-97	1.00	1.06	106%	0.907 - 1.20
Iron	mg/L	EPA200.7	01-24-97	1.00	0.992	99.2%	0.863 - 1.11
Mercury	mg/L	EPA245.1	01-27-97	0.002	0.002	103%	0.001 - 0.003
Potassium	mg/L	EPA200.7	01-21-97	1.00	1.02	102%	0.889 - 1.16
Magnesium	mg/L	EPA200.7	01-21-97	1.00	1.08	108%	0.928 - 1.11
Manganese	mg/L	EPA200.7	01-21-97	1.00	1.00	100%	0.860 - 1.10
Sodium	mg/L	EPA200.7	01-21-97	1.00	1.10	110%	0.823 - 1.21
Sulfate	mg/L	EPA375.4	01-30-97	20.0	22.4	112%	14.0 - 23.4
Total_Organic_Carbon	mg/L	EPA415.1	01-22-97	20.0	21.4	107%	15.6 - 25.7
Chloride	mg/L	EPA325.2	01-29-97	50.0	49.3	98.7%	47.0 - 54.9
TDS	mg/L	EPA160.1	01-21-97	15.0	17.3	115%	9.72 - 19.2
Phenols	mg/L	EPA420.1	01-30-97	0.030	0.033	109%	0.022 - 0.038

FLOWERS CHEMICAL LABORATORIES,INC.

Section 5

Standards Traceability

Client: Moly Corp.
Project Number: UNOCAFE888888888
P.O. Number: N/A
Date Sampled: 16-Jan-97
Lab Numbers: 11415 - 11418

Compound Name	Manfacturer Name	Manfacturer Lot #	Rec Lot #	Rec By	Date Recieved	Valid Until	Prep Lot #	Prep By	Date Prepared	Valid Until	t-test	t-test range	Control Mean	Control Std	Lot Mean	Lot Std
			Standard				Lot									
Silver	EMS	074-806	100	LSM	04-19-95	10-31-96	104	LSM	08-01-95	08-01-96	2.84	>1.71	0.945	0.074	1.00	0.011
QCCS	EMS	115-716	553	LSM	08-01-96	08-01-97	558	LSM	08-01-96	08-01-97	3.72	>1.70	0.935	0.078	0.997	0.042
Matrix Spike	EMS	074-806	100	LSM	04-19-95	10-31-96	104	LSM	08-01-95	08-01-96	2.84	>1.71	0.945	0.074	1.00	0.011
Barium	EMS	015-747	8	LSM	04-19-95	10-31-96	54	LSM	08-01-95	08-01-96	7.29	>1.70	0.993	0.039	1.01	0.024
QCCS	EMS	115-716	553	LSM	08-01-96	08-01-97	558	LSM	08-01-96	08-01-97	8.72	>1.69	0.983	0.040	1.01	0.037
Matrix Spike	EMS	115-716	553	LSM	08-01-96	08-01-97	558	LSM	08-01-96	08-01-97	8.72	>1.69	0.983	0.040	1.01	0.037
Beryllium	EMS	104-729	9	LSM	04-19-95	10-31-96	56	LSM	08-01-95	08-01-96	3.06	>1.75	1.04	0.076	0.973	0.083
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	4.12	>1.70	1.02	0.093	1.04	0.048
Matrix Spike	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	4.12	>1.70	1.02	0.093	1.04	0.048
Calcium	EMS	036-740	531	LSM	07-15-96	01-01-98	532	LSM	07-16-96	07-16-97	6.73	>1.67	1.05	0.055	1.04	0.093
QCCS	EMS	036-740	531	LSM	07-15-96	01-01-98	532	LSM	07-16-96	07-16-97	6.73	>1.67	1.05	0.055	1.04	0.093
Matrix Spike	EMS	036-740	531	LSM	07-15-96	01-01-98	532	LSM	07-16-96	07-16-97	6.73	>1.67	1.05	0.055	1.04	0.093
Cadmium	EMS	074-799	68	LSM	04-19-95	10-31-96	59	LSM	08-01-95	08-01-96	5.09	>1.68	0.970	0.059	1.02	0.035
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	6.81	>1.65	0.947	0.056	0.925	0.092
Matrix Spike	EMS	074-799	68	LSM	04-19-95	10-31-96	448	LSM	03-28-96	03-28-97	5.99	>1.65	0.953	0.054	0.917	0.053
Chromium	EMS	074-835	70	LSM	04-19-95	10-31-96	61	LSM	08-01-95	08-01-96	6.52	>1.68	0.997	0.050	0.982	0.045
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	7.49	>1.65	1.00	0.058	1.00	0.064
Matrix Spike	EMS	074-835	70	LSM	04-19-95	10-31-96	448	LSM	03-28-96	03-28-97	7.43	>1.65	0.999	0.055	0.983	0.025
Copper																
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	9.30	>1.65	0.980	0.047	0.975	0.026
Matrix Spike	EMS	025-710	72	LSM	04-19-95	10-31-96	448	LSM	03-28-96	03-28-97	8.97	>1.66	0.981	0.047	0.990	0.039
Iron	EMS	074-822	85	LSM	04-19-95	10-31-96	67	LSM	08-01-95	08-01-96	5.31	>1.73	0.983	0.031	1.05	0.055
QCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	-0.147	±1.99	1.08	0.964	1.02	0.021
Matrix Spike	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	-0.147	±1.99	1.08	0.964	1.02	0.021
Mercury	EMS	124-734	92	LSM	04-19-95	10-31-96	98	LSM	08-01-95	08-01-96	1.37	±2.20	1.00	0.123	1.08	0.067
QCCS	EMS	124-734	92	LSM	04-19-95	10-31-96	228	LSM	09-14-95	09-14-96	1.37	±2.20	1.04	0.807		
Matrix Spike	EMS	124-734	92	LSM	04-19-95	10-31-96	98	LSM	08-01-95	08-01-96	1.37	±2.20	1.00	0.123	1.08	0.067
Potassium	EMS	124-702	533	LSM	07-15-96	01-01-98	534	LSM	07-16-96	07-16-97	5.29	>1.74	1.02	0.050	1.08	0.030
QCCS																
Matrix Spike																

FLOWERS CHEMICAL LABORATORIES, INC.

Section 5

Standards Traceability

Client: Moly Corp.
Project Number: UNOCAFE888888888
P.O. Number: N/A
Date Sampled: 16-Jan-97
Lab Numbers: 11415 - 11418

Compound Name	Manfacturer Name	Manfacturer Lot #	Rec Lot #	Rec By	Date Recieved	Valid Until	Prep Lot #	Prep By	Date Prepared	Valid Until	t-test	t-test range	Control Mean	Control Std	Lot Mean	Lot Std
			Standard				Lot									
Manganese	EMS	074-825	91	LSM	04-19-95	10-31-96	97	LSM	08-01-95	08-01-96	6.66	>1.69	0.989	0.045	0.953	0.076
OCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	8.73	>1.67	0.989	0.048	0.989	0.066
Matrix Spike	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	8.73	>1.67	0.989	0.048	0.989	0.066
Sodium	Ultra	IC-0138	586	LSM	08-20-96	08-20-97	600	LSM	10-17-96	10-17-97	5.15	>1.69	1.01	0.067	1.04	0.066
OCCS	Ultra	IC-0138	586	LSM	08-20-96	08-20-97	600	LSM	10-17-96	10-17-97	5.15	>1.69	1.01	0.067	1.04	0.066
Matrix Spike	Ultra	IC-0138	586	LSM	08-20-96	08-20-97	600	LSM	10-17-96	10-17-97	5.15	>1.69	1.01	0.067	1.04	0.066
Nickel	EMS	074-828	95	LSM	04-19-95	10-31-96	100	LSM	08-01-95	08-01-96	1.21	±2.02	0.945	0.165	1.05	0.096
OCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	4.82	>1.65	0.972	0.091	0.975	0.034
Matrix Spike	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	4.82	>1.65	0.972	0.091	0.975	0.034
Lead	EMS	074-739	87	LSM	04-19-95	10-31-96	69	LSM	08-01-95	08-01-96	5.00	>1.69	1.02	0.072		
OCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	4.52	>1.69	1.02	0.070	0.978	0.064
Matrix Spike	EMS	074-739	87	LSM	04-19-95	10-31-96	448	LSM	03-28-96	03-28-97	5.00	>1.69	1.02	0.070	0.987	0.031
Antimony																
OCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	4.00	>1.68	1.01	0.096	1.02	0.105
Matrix Spike	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	4.00	>1.68	1.01	0.096	1.02	0.105
Selenium	EMS	074-829	98	LSM	04-19-95	10-31-96	102	LSM	08-01-95	08-01-96	3.46	>1.75	1.06	0.095	1.04	0.069
OCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	4.49	>1.66	1.01	0.089	1.02	0.029
Matrix Spike	EMS	074-829	98	LSM	04-19-95	10-31-96	102	LSM	08-01-95	08-01-96	3.46	>1.75	1.06	0.095	1.04	0.069
Thallium																
OCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	2.26	>1.68	1.02	0.096	0.935	0.025
Matrix Spike	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	2.26	>1.68	1.02	0.096	0.935	0.025
Vanadium	EMS	074-814	107	LSM	04-19-95	10-31-96	110	LSM	08-01-95	08-01-96			0.987	0.028	0.974	0.020
OCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	11.5	>1.69	0.983	0.033	0.964	0.028
Matrix Spike	EMS	074-814	107	LSM	04-19-95	10-31-96	110	LSM	08-01-95	08-01-96			0.987	0.028	0.974	0.020
Zinc	EMS	074-815	108	LSM	04-19-95	10-31-96	111	LSM	08-01-95	08-01-96	6.58	>1.68	0.969	0.045	1.01	0.039
OCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	7.07	>1.65	0.977	0.048	1.02	0.070
Matrix Spike	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	7.07	>1.65	0.977	0.048	1.02	0.070
Molybdenum	EMS	104-728	94	LSM	04-19-95	10-31-96	99	LSM	08-01-95	08-01-96	-1.24	±2.16	0.978	0.091	0.818	0.358
OCCS	EMS	026-727	552	LSM	08-01-96	08-01-97	557	LSM	08-01-96	08-01-97	4.01	>1.74	1.01	0.097	1.01	0.065
Matrix Spike	EMS	104-728	94	LSM	04-19-95	10-31-96	448	LSM	03-28-96	03-28-97			1.01	0.097	0.994	0.002
Total_Organic_Carbon	EMS	35068519	308	ALA	10-25-95	12-31-98	305	ALA	10-25-95	04-25-96	5.23	>1.69	0.961	0.080		

Section 5

Standards Traceability

Client:	Moly Corp.
Project Number:	UNOCAFE888888888
P.O. Number:	N/A
Date Sampled:	16-Jan-97
Lab Numbers:	11415 - 11418

Compound Name	Manfacturer Name	Manfacturer Lot #	Rec Lot #	Rec By	Date Recieved	Valid Until	Prep Lot #	Prep By	Date Prepared	Valid Until	t-test	t-test range	Contro Mean	Contro Std	Lot Mean	Lot Std
			Standard				Lot									
OCCS	Fisher	951544	471	RJM	03-07-96	03-31-97	457	TRB	12-20-96	06-20-97	5.23	>1.69	0.961	0.080	0.961	0.059
Matrix Spike	EMS	35068519	308	ALA	10-25-95	12-31-98	305	ALA	10-25-95	04-25-96	5.23	>1.69	0.961	0.080		
Chloride	EMS	33159328	53	ALA	04-08-94	12-31-98	23	ALA	03-31-95	10-30-95	2.25	>1.94	1.08	0.039	0.957	0.046
OCCS	EMS	33159328	53	ALA	04-08-94	12-31-98	178	ALA	09-12-95	03-31-96	2.25	>1.94	1.03	0.058		
Matrix Spike	EMS	33159328	53	ALA	04-08-94	12-31-98	23	ALA	03-31-95	10-30-95	2.25	>1.94	1.08	0.039	0.957	0.046
EPA200.7 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						
EPA245.1 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						
EPA325.2 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						
EPA415.1 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						
EPA6020 Blank	Flowers Chemical Laboratories	Valid	34	JSF	01-01-95	01-01-97	14	JSF	01-01-95	01-01-97						

FLOWERS CHEMICAL LABORATORIES

Internal Custody Record Lab Numbers: 11415 - 11418

Lab # 11415

Container 100871 Plastic Bottle 1 L:

```
Shpped to custome:Check-in Station Tue, 01/14/97 02:05PM
```

Container 100876 Plastic Bottle 1 L:

```
Shpped to custome:Check-in Station Tue, 01/14/97 02:05PM
Stainls Stl 3 Shl:Yanina Shatkhina Tue, 01/21/97 08:40AM
Inorg Mbl Cart 1 :Yanina Shatkhina Tue, 01/21/97 02:38PM
Inorg Mbl Cart 2 :Lisa Markle      Thu, 01/30/97 03:01PM
```

Container 100893 Plastic Bottle 250 ml:

```
Shpped to custome:Check-in Station Tue, 01/14/97 02:05PM
Plastic Metals Ca:Tonjai Belcher   Mon, 01/20/97 09:02AM
Stainls Stl 6 Shl:Tonjai Belcher   Mon, 01/27/97 08:44AM
```

Container 100902 Plastic Bottle 1 L:

```
Shpped to custome:Check-in Station Tue, 01/14/97 02:05PM
Met Mbl Cart 3 Sh:Andrew Harrison  Wed, 01/22/97 08:13AM
```

Lab # 11416

Container 100873 Plastic Bottle 1 L:

```
Shpped to custome:Check-in Station Tue, 01/14/97 02:05PM
```

Container 100874 Plastic Bottle 1 L:

```
Shpped to custome:Check-in Station Tue, 01/14/97 02:05PM
Stainls Stl 3 Shl:Yanina Shatkhina Tue, 01/21/97 08:40AM
Inorg Mbl Cart 2 :Lisa Markle      Thu, 01/30/97 03:01PM
```

Container 100897 Plastic Bottle 250 ml:

```
Shpped to custome:Check-in Station Tue, 01/14/97 02:05PM
Plastic Metals Ca:Tonjai Belcher   Mon, 01/20/97 09:02AM
Stainls Stl 6 Shl:Tonjai Belcher   Mon, 01/27/97 08:44AM
```

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FLOWERS CHEMICAL LABORATORIES

Internal Custody Record   Lab Numbers: 11415 - 11418

Container 100900 Plastic Bottle 1 L:

Shpped to custome:Check-in Station Tue, 01/14/97 02:05PM
Met Mbl Cart 3 Sh:Andrew Harrison Wed, 01/22/97 08:13AM

Lab # 11417

Container 100866 Plastic Bottle 1 L:

Shpped to custome:Check-in Station Tue, 01/14/97 02:05PM

Container 100878 Plastic Bottle 1 L:

Shpped to custome:Check-in Station Tue, 01/14/97 02:05PM
Stainls Stl 3 Shl:Yanina Shatkhina Tue, 01/21/97 08:40AM
Inorg Mbl Cart 1 :Yanina Shatkhina Tue, 01/21/97 02:38PM
Inorg Mbl Cart 2 :Lisa Markle Thu, 01/30/97 03:01PM

Container 100891 Plastic Bottle 250 ml:

Shpped to custome:Check-in Station Tue, 01/14/97 02:05PM
Plastic Metals Ca:Tonjai Belcher Mon, 01/20/97 09:02AM
Stainls Stl 6 Shl:Tonjai Belcher Mon, 01/27/97 08:44AM

Container 100899 Plastic Bottle 1 L:

Shpped to custome:Check-in Station Tue, 01/14/97 02:05PM
Met Mbl Cart 3 Sh:Andrew Harrison Wed, 01/22/97 08:13AM

Lab # 11418

Container 100869 Plastic Bottle 1 L:

Shpped to custome:Check-in Station Tue, 01/14/97 02:05PM

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FLOWERS
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Internal Custody Record   Lab Numbers: 11415 - 11418

Container 100875 Plastic Bottle 1 L:

```
Shpped to custome:Check-in Station Tue, 01/14/97 02:05PM
Stainls Stl 3 Shl:Yanina Shatkhina Tue, 01/21/97 08:40AM
Inorg Mbl Cart 1 :Yanina Shatkhina Tue, 01/21/97 02:38PM
Inorg Mbl Cart 2 :Lisa Markle      Thu, 01/30/97 03:01PM
```

Container 100894 Plastic Bottle 250 ml:

```
Shpped to custome:Check-in Station Tue, 01/14/97 02:05PM
Plastic Metals Ca:Tonjai Belcher   Mon, 01/20/97 09:02AM
Stainls Stl 6 Shl:Tonjai Belcher   Mon, 01/27/97 08:44AM
```

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CHEMICAL LABORATORIES INCORPORATED

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ALTAMONTE SPRINGS
FLORIDA 32715-0597
BUS: (407) 339-5984
FAX: (407) 260-6110

CHAIN OF CUSTODY RECORD FOR UNOCAL

Client #3362

Company Name: MOLYCORP

Address: 300 CALDWELL

City: State: Zip Code:

Telephone: FAX #:

Report To: George Dawes

Sampler: DP Cercone

Project Name:

UNOCAL Project Manager: John Daniels

AFE #: 854930040

Site #:

QC Data: ☐ Level D (Standard) ☐ Level C ☐ Level B ☐ Level A

Turnaround Time: ☐ 10 Work Days ☐ 5 Work Days ☐ 3 Work Days ☐ 2 Work Days ☐ 1 Work Day ☐ 2-8 Hours

CODE: ☐ Misc. ☐ Detect. ☐ Eval. ☐ Remed. ☐ Demol. ☐ Closure

☐ Drinking Water
☐ Waste Water
☐ Other

Client Sample I.D.	Date/Time Sampled	Matrix Desc.	# of Cont.	Cont. Type	Laboratory Sample #	NO. OF CONTAINERS	PRESERVATIVES UNPRESERVED	H$_2$SO$_4$	HNO$_3$	HCl			ANALYSES REQUEST	TAL Metals	Molybdenum	Phenols		Chloride	Sulfate	TDS	TOC	TOX	
CHAR-01	1-16 1500	S												✓	✓	✓							
CHAR-01	1500	W			11415									✓	✓	✓		✓	✓	✓	✓	✓	
CHAR-02	1400	S												✓	✓	✓							
CHAR-02	1400	W			11416									✓	✓	✓		✓	✓	✓	✓	✓	
CHAR-03																							→
SUGAR-01	1000	S												✓	✓	✓							
SUGAR-01	1000	W			11417									✓	✓	✓		✓	✓	✓	✓	✓	
SUGAR-02	1200	S												✓	✓	✓							
SUGAR-02	1200	W			11418									✓	✓	✓		✓	✓	✓	✓	✓	
														✓	✓	✓							

Relinquished By: David Cercone Date: 1/16/97 Time: 1900
Received By: Date: Time:
Relinquished By: Date: Time:
Received By: Date: Time:
Relinquished By: Date: Time:
Received By Lab: Date: 1/17/97 Time: 1010

Were Samples Received In Good Condition? ☑ Yes ☐ No Samples on Ice? ☑ Yes ☐ No Method of Shipment ______ Page __ of __

To be completed upon receipt of report:

1) Were the analyses requested on the Chain of Custody reported? ☐ Yes ☐ No If no, what analyses are still needed? ______
2) Was the report issued within the requested turnaround time? ☐ Yes ☐ No If no, what was the turnaround time? ______

Approved by: ______ Signature: ______ Company: ______ Date: ______

SHIP WITH SAMPLES/TO BE RETURNED WITH RESULTS

APPENDIX K

LEACHATE TESTS

IEA
An Aquarion Co.

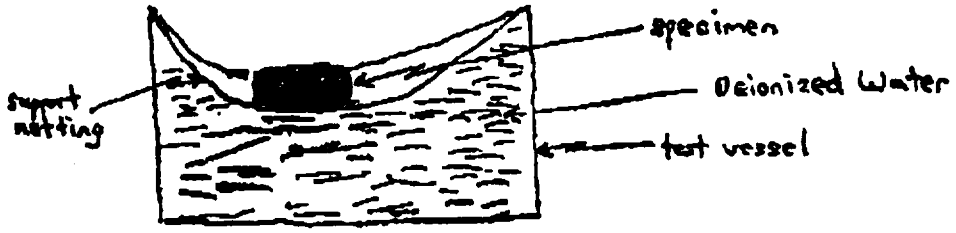
LEACH TEST RESULTS

LEACH TEST IDENTIFICATION NUMBER Client IDs 0944-95 through 0949-95
LABORATORY WHERE TESTS PERFORMED IEA, Inc.
ANALYST Dan Rayno
DATE RESULTS REPORTED 7/11/95

Part B. Description of Leach Test Procedure

Specimen Preparation[1] ______

Diagram of Leach Apparatus:



Leachate Sampling Procedure At the end of each leaching interval, the specimen is rapidly removed from the leachant, rinsed with deionized water and transferred to a new leach test vessel with fresh leachant. The time of this changeover is recorded. The old leach test vessel is rinsed with DI water. The specimen and test vessel rinses are combined with the used leachant for analysis.

Analytical Technique:

Counting Instrumentation Identification and Calibration Initial counting of specimen (Ba) was performed using gamma spectroscopy. Gamma detectors used were Canberra HpGe, 25% efficiency. Energy and efficiency calibration performed for soil counting geometry using std. Co-60, Cs-137, Am-241, Cd-109 and Co-57

Constituent a_1, Analytical Procedure, Standard Deviation of Method Constituent: Th-232. Analytical Procedure: separation by anion-exchange resin and counting by alpha spectrometry. Standard deviation of method: 1.993% at 17 times MDL. Calibration of alpha spectrometers performed with NIST Pu-239 and Am-241.

Constituent a_2, Analytical Procedure, Standard Deviation of Method ______

Constituent a_3, Analytical Procedure, Standard Deviation of Method: ______

[1] If different from "Preparation of Specimen" in Part A.

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Molycorp Leaching Study
Summary of Work

Six specimens were received from Molycorp for leaching following the procedure outlined in ANSI/ANS-16.1-1986, "Measurement of the Leachability of Solidified Low-Level Waste by a Short-Term Test Procedure".

The leaching was initiated on 3/22/95. Prior to leaching, each specimen was counted using gamma spectroscopy and then rinsed in 300 ml of deionized water for 30 seconds. This rinse was reserved for separate analysis. Each specimen was then immersed in a vessel containing 2128 ml of deionized water with an electrical conductivity of less than 5 mho/cm and a temperature of between 17.5 - 27.5 degrees C. The specimen was suspended using teflon netting. The 2128 ml volume used corresponds to a volume to specimen surface area of 10, as specified in the above-cited method.

As requested by Molycorp, six leaching changeouts for each specimen were performed at 48 hours, 5 days, 15 days, 30 days, 45 days and 90 days. The date and time of each changeout was noted and the electrical conductivity and the temperature of the fresh leaching water taken prior to immersing the specimen in it. The volume of the leachant removed after changeout was noted, and rinses of the old leach vessel and the specimen were then combined with its leachant.

After removal from the leaching vessel, each leachant (plus the rinses) was preserved to a pH of less than 2 using 8N HNO_3. Each leachant/rinse was evaporated to dryness and 100 ml of concentrated HNO_3 was added to the residue. The beaker was covered with a watch glass and the residue refluxed at near boiling to dissolve. The solution was cooled and then filtered through glass fiber filter paper and diluted up to 500 ml with deionized water.

Aliquots of 150 ml of this 500 ml stock were taken for analysis. The aliquots were spiked with Th-229 tracer, evaporated to dryness and the thorium separated using anion-exchange resin columns. The separated thorium was precipitation-mounted for alpha spectroscopy counting.

The leached specimens were counted again using gamma spectroscopy. Both gamma counts are reported in the Gamma Spectroscopy Results sheet included in the data package.

The Leach Test Results forms Part A, Part B and Part C are included in the data package. The "Description of Leach Specimen" section of Part A was left blank, since the specimens were prepared at Molycorp.

One Part C form was completed for each specimen. Included in this form are temperature data, leaching interval time, leachant volume, initial specimen activity (blank subtracted), activity of leachant and the fraction of leachant activity to specimen activity.

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Note that all leachant activity was blank subtracted. In some instances, the blank activity was a negative value. In these cases, no blank value was subtracted. Also note that each raw data value for Th-232 was divided by two, since the aliquot volumes were taken from a 0.5 liter volume.

Included in the raw data is the data for a blank spike run for sorption testing. This was done for the longest leach interval (between the 45-day and 90-day changeouts. The recovery for this blank spike was 83.21%.

Don Rayno 7/12/95
Don Rayno
Technical Manager
IEA Radiological Laboratory

IEA
An Aquarion Company

Gamma Spectroscopy Results

IEA ID	Client ID	Gamma Results (before leach)	Gamma Results (after leach)
9503024-01	0944-95	500.90 pCi/g +/- 3.50 pCi/g	497.30 pCi/g +/-3.50 pCi/g
9503024-02	0945-95	398.30 pCi/g +/- 3.20 pCi/g	400.40 pCi/g +/-3.10 pCi/g
9503024-03	0946-95	522.50 pCi/g +/- 3.60 pCi/g	505.0 pCi/g +/-3.50 pCi/g
9503024-04	0947-95	395.00 pCi/g +/- 3.10 pCi/g	385.20 pCi/g +/-4.00 pCi/g
9503024-05	0948-95	558.50 pCi/g +/- 3.70 pCi/g	541.5 pCi/g +/-3.70 pCi/g
9503024-06	0949-95	424.00 pCi/g +/- 3.20 pCi/g	416.40 pCi/g +/-3.20 pCi/g

DATE RESULTS REPORTED 7/11/95

Part C. Experimental Data

Constituent Analyzed Th-232

Free Standing Water in Leach Specimen Container: ____ Yes [✓ No]

If yes, Volume (ml) = ____; Radioactivity (pCi) = ____; and % of A_o = ____

Specimen Rinse Before Initiation of Leaching: *Do not include with results in the table below*

Volume^a (ml) = ____; Radioactivity (pCi) = 0.01; and % of A_o = 3.6×10^{-6} %

Initial Amount in Specimen, A_o (pCi) [after 30-s rinse] = 274,391.17 pCi

Leach Interval (n)	Temp (°C)	Time and Date^b		V_L^c (ml)	$(\Delta t)_n$ (s)	$t=\Sigma(\Delta t)_n$ (s)	A_o Analyzed^d	Blank^d	Corrected Conc.^{d}	a^e_n	a_n/A_o	$[a_n/A_o][1/(\Delta t)_n]$ (fraction/s)	$F=\frac{\Sigma a_n}{A_o}$
		In	Out										
1	21.1°	3/22/95 15:43	3/24/95 15:43	2120	1.73×10^5	2.00 1.73×10^5	274,443.11 pCi	51.94 pCi	274,391.17 pCi	0.13 pCi	4.74×10^{-7}	2.74×10^{-12}	4.74×10^{-7}
2	21.8°	3/24/95 15:43	3/27/95 15:43	2117	2.59×10^5	5.00 4.32×10^5				0.00 pCi	0.00	0.00	4.74×10^{-7}
3	18.4°	3/27/95 15:43	4/6/95 15:43	2112	8.64×10^5	14.98 1.29×10^6				0.04 pCi	1.46×10^{-7}	1.69×10^{-13}	6.20×10^{-7}
4	19.2°	4/6/95 15:43	4/21/95 16:19	2105	1.30×10^6	29.98 2.59×10^6				0.00 pCi	0.00	0.00	6.20×10^{-7}
5	20.3°	4/21/95 16:19	5/5/95 17:02	2097	1.21×10^6	45.98 3.30×10^6				0.03 pCi	1.09×10^{-7}	9.01×10^{-14}	7.29×10^{-7}
6	19.6°	5/5/95 17:02	6/21/95 16:11	2090	4.06×10^6	92.97 7.36×10^6				0.00 pCi	0.00	0.00	7.29×10^{-7}
7					$t_n - t_{n-1}$								
8													
9													
10													

[a] Determined at end of rinse operation.

[b] Date, hour, and minute.

[c] At the end of the leaching interval.

[d] Concentration, show units.

[e] a_n = corrected concentration x V_l x factor to convert to same units as A_o. The value of a_n must include any radioactivity rinsed from the specimen and the leach apparatus at the end of the leaching interval.

ANALYST Don Rayno
DATE RESULTS REPORTED 7/11/95

Part C. Experimental Data

Constituent Analyzed Th-232
Free Standing Water in Leach Specimen Container: ______ Yes [✓ No]
If yes, Volume (ml) = ______; Radioactivity (pCi) = ______; and % of A_o = ______
Specimen Rinse Before Initiation of Leaching: *Do not include with results in the table below*
Volume[a] (ml) = 300 ; Radioactivity (pCi) = 0.30; and % of A_o = 1.38x10^{-4}%
Initial Amount in Specimen, A_o (pCi) [after 30-s rinse] = 216,862.24 pCi

Leach Interval (n)	Temp (°C)	Time and Date[b]		V_L[c] (ml)	$(\Delta t)_n$ (s)	$t=\Sigma(\Delta t)_n$ (s)	A_o Analyzed[d]	Blank[d]	Corrected Conc.[d]	a^e_n	a_n/A_o	$[a_n/A_o][1/(\Delta t)_n]$ (fraction/s)	$F = \frac{\Sigma a_n}{A_o}$
		In	Out										
1	21.1°	3/22/95 13:53	3/24/95 13:53	2122	1.73x10^5	2.00 1.73x10^5	216,914.18pCi	51.94pCi	216,862.24pCi	0.10pCi	4.61x10^{-7}	2.66x10^{-12}	4.61x10^{-7}
2	21.8°	3/24/95 15:53	3/27/95 13:53	2113	2.59x10^5	5.00 4.32x10^5	↓	↓	↓	0.00pCi	0.00	0.00	4.61x10^{-7}
3	18.4°	3/27/95 13:53	4/6/95 15:54	2115	8.64x10^5	14.93 1.29x10^6	↓	↓	↓	0.06pCi	2.77x10^{-7}	3.21x10^{-13}	7.38x10^{-7}
4	19.2°	4/6/95 15:54	4/21/95 16:30	2110	1.29x10^6	29.86 2.58x10^6	↓	↓	↓	0.00pCi	0.00	0.00	7.38x10^{-7}
5	20.3°	4/21/95 16:30	5/5/95 17:14	2100	1.21x10^6	43.86 3.79x10^6	↓	↓	↓	0.04pCi	1.84x10^{-7}	1.52x10^{-13}	9.22x10^{-7}
6	19.6°	5/5/95 17:14	6/21/95 16:28	2099	4.06x10^6	90.85 7.85x10^6	↓	↓	↓	0.07pCi	3.23x10^{-7}	7.96x10^{-14}	1.25x10^{-6}
7													
8													
9													
10													

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[a] Determined at end of rinse operation.

[b] Date, hour, and minute.

[c] At the end of the leaching interval.

[d] Concentration, show units.

[e] a_n = corrected concentration x V_L x factor to convert to same units as A_o. The value of a_n must include any radioactivity rinsed from the specimen and the leach apparatus at the end of the leaching interval.

ANALYST Don Kayne

DATE RESULTS REPORTED 7/11/95

Part C. Experimental Data

Constituent Analyzed Th-232

Free Standing Water in Leach Specimen Container: ____ Yes ✓ No

If yes, Volume (ml) = ____; Radioactivity (pCi) = ____; and % of A_o = ____

Specimen Rinse Before Initiation of Leaching: *Do not include with results in the table below*

Volume[a] (ml) = 300; Radioactivity (pCi) = 0.10; and % of A_o = 3.50×10^{-3}%

Initial Amount in Specimen, A_o (pCi) [after 30-s rinse] = 285,755.56 pCi

Leach Interval (n)	Temp (°C)	Time and Date[b]		V_L[c] (ml)	$(\Delta t)_n$ (s)	$t = \Sigma(\Delta t)_n$ (s)	A_o Analyzed[d]	Blank[d]	Corrected Conc.[d]	a^e_n	a_n/A_o	$[a_n/A_o][1/(\Delta t)_n]$ (fraction/s)	$F = \frac{\Sigma a_n}{A_o}$
		In	Out										
1	21.1°	3/22/95 16:09	3/24/95 16:08	2118	1.73×10^5	2.00 1.73×10^5	285,807.50 pCi	51.94 pCi	285,755.56 pCi	0.26 pCi	9.10×10^{-7}	5.26×10^{-12}	9.10×10^{-7}
2	21.8°	3/24/95 16:08	3/27/95 16:08	2115	2.59×10^5	5.00 4.32×10^5	↓	↓	↓	0.13 pCi	4.55×10^{-7}	1.76×10^{-12}	1.36×10^{-6}
3	18.4°	3/27/95 16:08	4/6/95 16:08	2113	8.64×10^5	14.93 1.29×10^6	↓	↓	↓	0.07 pCi	2.45×10^{-7}	2.84×10^{-13}	1.61×10^{-6}
4	19.2°	4/6/95 16:08	4/21/95 16:44	2112	1.30×10^6	29.98 2.59×10^6	↓	↓	↓	0.00 pCi	0.00	0.00	1.61×10^{-6}
5	20.3°	4/21/95 16:44	5/5/95 17:23	2105	1.21×10^6	41.98 3.80×10^6	↓	↓	↓	0.08 pCi	2.80×10^{-7}	2.31×10^{-13}	1.89×10^{-6}
6	19.6°	5/5/95 17:23	6/21/95 16:24	2105	4.06×10^6	90.97 7.86×10^6	↓	↓	↓	0.29 pCi	1.01×10^{-6}	2.50×10^{-13}	2.90×10^{-6}
7													
8													
9													
10													

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[a] Determined at end of rinse operation.

[b] Date, hour, and minute.

[c] At the end of the leaching interval.

[d] Concentration, show units.

[e] a_n = corrected concentration x V_l x factor to convert to same units as A_o. The value of a_n must include any radioactivity rinsed from the specimen and the leach apparatus at the end of the leaching interval.

DATE RESULTS REPORTED 7/11/95

Part C. Experimental Data

Constituent Analyzed Th-232

Free Standing Water in Leach Specimen Container: ____ Yes ✓ No

If yes, Volume (ml) = ____ ; Radioactivity (pCi) = ____ ; and % of A_o = ____

Specimen Rinse Before Initiation of Leaching: *Do not include with results in the table below*

Volume^a (ml) = 300 ; Radioactivity (pCi) = 0.09 ; and % of A_o = $4.20x10^{-5}$

Initial Amount in Specimen, A_o (pCi) [after 30-s rinse] = 214,156.56 pCi

Leach Interval (n)	Temp (°C)	Time and Date^b		V_L^c (ml)	$(\Delta t)_n$ (s)	$t=\Sigma(\Delta t)_n$ (s)	A_o Analyzed^d	Blank^d	Corrected Conc.^{d}	a_n^e	a_n/A_o	$[a_n/A_o][1/(\Delta t)_n]$ (fraction/s)	$F = \frac{\Sigma a_n}{A_o}$
		In	Out										
1	21.1°	3/22/95 16:14	3/24/95 16:13	2116	$1.73x10^5$	2.00 $1.73x10^5$	214,208.50pCi	51.94pCi	214,156.56pCi	0.11pCi	$5.19x10^{-7}$	$2.97x10^{-12}$	$5.19x10^{-7}$
2	21.8°	3/24/95 16:13	3/27/95 16:13	2120	$2.59x10^5$	5.02 $4.32x10^5$	↓	↓	↓	0.02pCi	$9.39x10^{-8}$	$3.60x10^{-13}$	$6.67x10^{-7}$
3	18.4°	3/27/95 16:13	4/6/95 16:14	2120	$8.64x10^5$	14.93 $1.29x10^6$	↓	↓	↓	0.02pCi	$9.34x10^{-8}$	$1.08x10^{-13}$	$7.00x10^{-7}$
4	19.2°	4/6/95 16:14	4/21/95 16:56	2107	$1.30x10^6$	29.98 $2.59x10^6$	↓	↓	↓	0.00pCi	0.00	0.00	$7.00x10^{-7}$
5	20.3°	4/21/95 16:56	5/5/95 17:30	2101	$1.21x10^6$	42.98 $3.80x10^6$	↓	↓	↓	0.00pCi	0.00	0.00	$7.00x10^{-7}$
6	19.6°	5/8/95 17:30	6/21/95 16:42	2096	$4.06x10^6$	90.97 $7.86x10^6$	↓	↓	↓	0.01pCi	$4.67x10^{-8}$	$1.15x10^{-14}$	$7.47x10^{-7}$
7													
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9													
10													

[a] Determined at end of rinse operation.

[b] Date, hour, and minute.

[c] At the end of the leaching interval.

[d] Concentration, show units.

[e] a_n = corrected concentration x V_l x factor to convert to same units as A_o. The value of a_n must include any radioactivity rinsed from the specimen and the leach apparatus at the end of the leaching interval.

DATE RESULTS REPORTED 7/11/95

Part C. Experimental Data

Constituent Analyzed Th-232

Free Standing Water in Leach Specimen Container: ____ Yes ✓ No

If yes, Volume (ml) = ____: Radioactivity (pCi) = ____: and % of A_o = ____

Specimen Rinse Before Initiation of Leaching: *Do not include with results in the table below*

Volume[a] (ml) = 300 : Radioactivity (pCi) = 0.20: and % of A_o = 6.54x10^{-5}%

Initial Amount in Specimen, A_o (pCi) [after 30-s rinse] = 306,006.06pCi

Leach Interval (n)	Temp (°C)	Time and Date[b]		V_L[c] (ml)	$(\Delta t)_n$ (s)	$t=\Sigma(\Delta t)_n$ (s)	A_o Analyzed[d]	Blank[d]	Corrected Conc.[d]	a_n[e]	a_n/A_o	$[a_n/A_o][1/(\Delta t)_n]$ (fraction/s)	$F=\frac{\Sigma a_n}{A_o}$
		In	Out										
1	21.1°	3/22/95 16:21	3/24/95 16:20	2120	1.73x10^5	2.00 1.73x10^5	306,057.00pCi	51.34pCi	306,006.06pCi	0.06pCi	1.96x10^{-7}	1.13x10^{-12}	1.96x10^{-7}
2	21.8°	3/24/95 16:20	3/27/95 16:24	2119	2.59x10^5	5.00 4.32x10^5				0.00pCi	0.00	0.00	1.96x10^{-7}
3	18.4°	3/27/95 16:20	4/6/95 16:21	2117	8.69x10^5	14.93 1.29x10^6				0.02pCi	6.53x10^{-8}	7.36x10^{-14}	2.61x10^{-7}
4	19.2°	4/6/95 16:21	4/21/95 17:05	2109	1.30x10^6	29.98 2.59x10^6				0.00pCi	0.00	0.00	2.61x10^{-7}
5	20.3°	4/21/95 17:05	5/5/95 17:49	2099	1.21x10^6	43.98 3.80x10^6				0.00pCi	0.00	0.00	2.61x10^{-7}
6	19.6°	5/5/95 17:48	6/21/95 16:53	2101	4.06x10^6	90.97 7.86x10^6				0.02pCi	6.53x10^{-8}	1.61x10^{-14}	3.27x10^{-7}
7													
8													
9													
10													

[a] Determined at end of rinse operation.

[b] Date, hour, and minute.

[c] At the end of the leaching interval.

[d] Concentration, show units.

[e] a_n = corrected concentration x V_L x factor to convert to same units as A_o. The value of a_n must include any radioactivity rinsed from the specimen and the leach apparatus at the end of the leaching interval.

ANALYST Don Kayne
DATE RESULTS REPORTED 7/11/95

Part C. Experimental Data

Constituent Analyzed Th-232
Free Standing Water in Leach Specimen Container: ______ Yes ______ No
If yes, Volume (ml) = ____: Radioactivity (pCi) = ____: and % of A_o = ____
Specimen Rinse Before Initiation of Leaching: *Do not include with results in the table below*
Volume[a] (ml) = 300: Radioactivity (pCi) = 0.07: and % of A_o = 3.01x10⁻³%
Initial Amount in Specimen, A_o (pCi) [after 30-s rinse] = 232,003.26pCi

Leach Interval (n)	Temp (°C)	Time and Date[b]		V_L[c] (ml)	$(\Delta t)_n$ (s)	T $t=\Sigma(\Delta t)_n$ (s)	A_o Analyzed[d]	Blank[d]	Corrected Conc.[d]	a_n[e]	a_n/A_o	$[a_n/A_o][1/(\Delta t)_n]$ (fraction/s)	$F=\frac{\Sigma a_n}{A_o}$
		In	Out										
1	21.1°	3/22/95 16:26	3/24/95 16:26	2117	$1.73x10^5$	2.00 $1.73x10^5$	232,055.20pCi	51.94pCi	232,003.26pCi	0.12pCi	$5.17x10^{-7}$	$2.99 x 10^{-12}$	$5.17x10^{-7}$
2	21.8°	3/24/95 16:26	3/27/95 16:26	2117	$2.59x10^5$	5.00 $4.32x10^5$				0.00pCi	0.00	0.00	$5.17x10^{-7}$
3	18.4°	3/27/95 16:26	4/6/95 16:26	2111	$8.64x10^5$	14.93 $1.29x10^6$				0.07pCi	$3.02x10^{-7}$	$3.49x10^{-13}$	$8.19x10^{-7}$
4	19.2°	4/6/95 16:26	4/21/95 17:16	2112	$1.30x10^6$	29.98 $2.59x10^6$				0.00pCi	0.00	0.00	$8.19x10^{-7}$
5	20.3°	4/21/95 17:16	5/5/95 17:56	2095	$1.21x10^6$	43.98 $3.80x10^6$				0.05pCi	$2.16x10^{-7}$	$1.78 x 10^{-13}$	$1.03x10^{-6}$
6	19.6°	5/5/95 17:56	6/21/95 16:59	2093	$4.06x10^6$	90.97 $7.86x10^6$	↓	↓	↓	0.02pCi	$8.62x10^{-8}$	$2.12 x 10^{-14}$	$1.12x10^{-6}$
7													
8													
9													
10													

[a] Determined at end of rinse operation.
[b] Date, hour, and minute.
[c] At the end of the leaching interval.
[d] Concentration, show units.
[e] a_n = corrected concentration x V_L x factor to convert to same units as A_o.
The value of a_n must include any radioactivity rinsed from the specimen and the leach apparatus at the end of the leaching interval.

Bob,
I thought you
might find this
interesting
reading Ted

APPENDIX L

AIR EMISSIONS CALCULATIONS

Molycorp
Washington, Pa.
Permanent Storage Facility
Estimated Air Emissions from Loading, Unloading, and Spreading Soil

Model Inputs

Soil

M	14	material moisture content (%)
s	20	material silt content (%)
d	110	density of material (lb/ft^3)
CS	27	radionuclide concentration of soil (pCi/g)
Y_{min}	12 5	minimum soil volume/hour (yd^3/hr)
Y_{max}	25	maximum soil volume/hour (yd^3/hr)

Meteorology

U	9 1	Mean wind speed (mph)

Estimated emission rates

Truck loading and unloading (from AP-42, 13 2 4 3, batch drop operations)

	$PM_{2.5}$ Emissions		PM_{10} Emissions		
	Maximum	Minimum	Maximum	Minimum	
k	0.11	0.11	0 35	0.35	particle size multiplier (dimensionless)
E	5.0E-05	5.0E-05	1 6E-04	1.6E-04	emission factor (lb/ton)
er	1.9E-03	9.3E-04	5 9E-03	3.0E-03	average hourly emission rate (lb/hr)

Grader spreading (from AP-42, 11 9.2, grader operation at western surface coal mines)

	$PM_{2.5}$ Emissions		PM_{10} Emissions		
	Maximum	Minimum	Maximum	Minimum	
	8	6	8	6	number passes
	25	18	25	18	length of pass (ft)
	0 038	0 020	0 038	0 020	VMT per load of soil spread
E	2.2E+00	2.2E+00	1.2E+01	1 2E+01	emission factor (lb/VMT)
er	8.4E-02	4.5E-02	4.6E-01	2.5E-01	average hourly emission rate (lb/hr)

Model Results

Modeled air concentrations

Truck loading and unloading

Fenceline				*Worker*				
$PM_{2.5}$ Emissions (1-hour average)		PM_{10} Emissions (Annual Average)		$PM_{2.5}$ Emissions (1-hour average)		PM_{10} Emissions (Annual Average)		
Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	
4,092	4,092	38	38	7,696	7,696	113 ·	113	Modeled dilution factors (µg/m^3)/(lb/hr)
7 6	3 8	0 2	0 1	14 4	7.2	0 7	0 3	Modeled air concentration (µg/m^3)
2.1E-16	1 0E-16	6 1E-18	3 0E-18	3 9E-16	1.9E-16	1 8E-17	9.1E-18	Radionuclide air concentration (µCi/ml)

Grader spreading

Fenceline				*Worker*				
$PM_{2.5}$ Emissions (1-hour average)		PM_{10} Emissions (Annual Average)		$PM_{2.5}$ Emissions (1-hour average)		PM_{10} Emissions (Annual Average)		
Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	Maximum	Minimum	
3,440	3,536	47	45	4,268	5,360	190	155	Modeled dilution factors (µg/m^3)/(lb/hr)
289 0	160 4	21 8	11 4	358 6	243 2	88.2	38 8	Modeled air concentration (µg/m^3)
7 8E-15	4 3E-15	5 9E-16	3 1E-16	9 7E-15	6 6E-15	2 4E-15	1 0E-15	Radionuclide air concentration (µCi/ml)

Molycorp

Washington, Pa.

Permanent Storage Facility

Estimated Air Emissions from Loading, Unloading, and Spreading Soil

Model Results (continued)

Modeled air concentrations

Truck loading and unloading

Option 1 Nearest Neighbor

$PM_{2.5}$ Emissions (1-hour average)		PM_{10} Emissions (Annual Average)	
Maximum	Minimum	Maximum	Minimum
935	935	6	6
1.7	0.9	0.03	0.02
4.7E-17	2.4E-17	9.4E-19	4.7E-19

Option 2 Nearest Neighbor

$PM_{2.5}$ Emissions (1-hour average)		PM_{10} Emissions (Annual Average)	
Maximum	Minimum	Maximum	Minimum
445	445	4	4
0.8	0.4	0.02	0.01
2.2E-17	1.1E-17	6.0E-19	3.0E-19

Option 3 Nearest Neighbor

$PM_{2.5}$ Emissions (1-hour average)		PM_{10} Emissions (Annual Average)		
Maximum	Minimum	Maximum	Minimum	
2,643	2,643	26	26	Modeled dilution factors (μg/m³)/(lb/hr)
4.9	2.5	0.2	0.1	Modeled air concentration (μg/m³)
1.3E-16	6.7E-17	4.2E-18	2.1E-18	Radionuclide air concentration (μCi/ml)

Grader spreading

Option 1 Nearest Neighbor

$PM_{2.5}$ Emissions (1-hour average)		PM_{10} Emissions (Annual Average)	
Maximum	Minimum	Maximum	Minimum
1,137	1,155	5	6
95.6	52.4	2.5	1.5
2.6E-15	1.4E-15	6.9E-17	4.0E-17

Option 2 Nearest Neighbor

$PM_{2.5}$ Emissions (1-hour average)		PM_{10} Emissions (Annual Average)	
Maximum	Minimum	Maximum	Minimum
465	467	4	4
39.1	21.2	1.9	1.0
1.1E-15	5.7E-16	5.0E-17	2.7E-17

Option 3 Nearest Neighbor

$PM_{2.5}$ Emissions (1-hour average)		PM_{10} Emissions (Annual Average)		
Maximum	Minimum	Maximum	Minimum	
2,386	2,638	28	28	Modeled dilution factors (μg/m³)/(lb/hr)
200.5	119.7	12.8	7.0	Modeled air concentration (μg/m³)
5.4E-15	3.2E-15	3.4E-16	1.9E-16	Radionuclide air concentration (μCi/ml)

United States Environmental Protection Agency. 1995. AP-42 (Compilation of Air Pollutant Emission Factors, Volume 1, Fifth Edition, AP-42).

11.9 Western Surface Coal Mining

11.9.1 General[1]

There are 12 major coal fields in the western states (excluding the Pacific Coast and Alaskan fields), as shown in Figure 11.9-1. Together, they account for more than 64 percent of the surface minable coal reserves in the United States.[2] The 12 coal fields have varying characteristics that may influence fugitive dust emission rates from mining operations including overburden and coal seam thicknesses and structure, mining equipment, operating procedures, terrain, vegetation, precipitation and surface moisture, wind speeds, and temperatures. The operations at a typical western surface mine are shown in Figure 11.9-2. All operations that involve movement of soil, coal, or equipment, or exposure of erodible surfaces, generate some amount of fugitive dust.

The initial operation is removal of topsoil and subsoil with large scrapers. The topsoil is carried by the scrapers to cover a previously mined and regraded area as part of the reclamation process or is placed in temporary stockpiles. The exposed overburden, the earth that is between the topsoil and the coal seam, is leveled, drilled, and blasted. Then the overburden material is removed down to the coal seam, usually by a dragline or a shovel and truck operation. It is placed in the adjacent mined cut, forming a spoils pile. The uncovered coal seam is then drilled and blasted. A shovel or front end loader loads the broken coal into haul trucks, and it is taken out of the pit along graded haul roads to the tipple, or truck dump. Raw coal sometimes may be dumped onto a temporary storage pile and later rehandled by a front end loader or bulldozer.

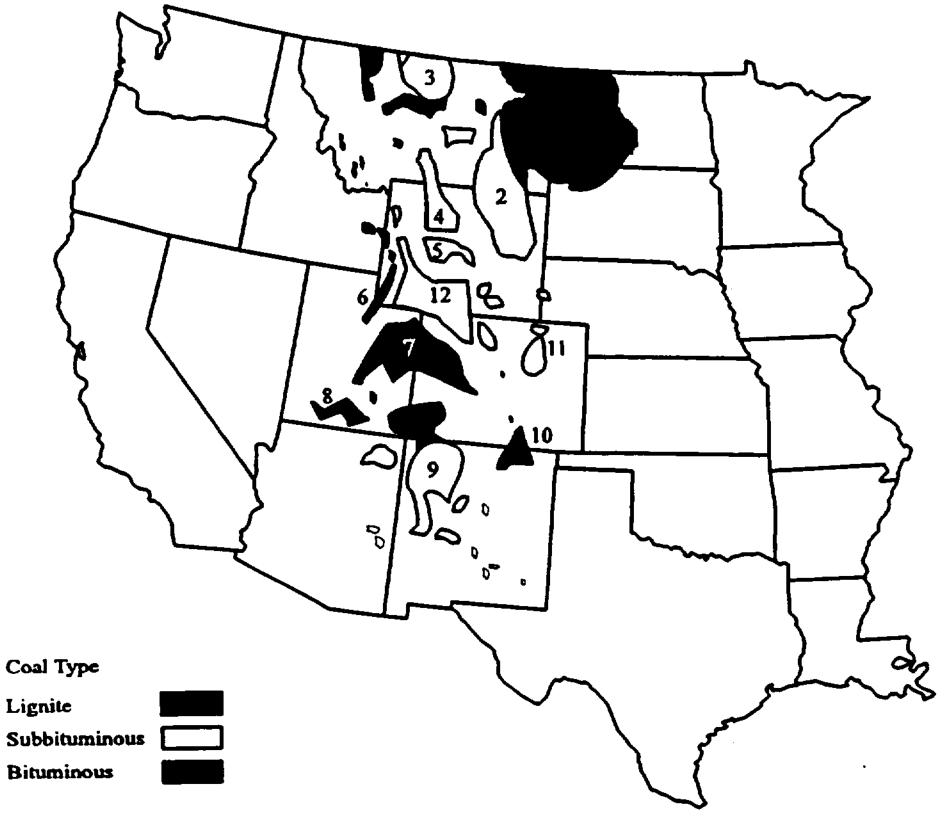
At the tipple, the coal is dumped into a hopper that feeds the primary crusher, then is conveyed through additional coal preparation equipment such as secondary crushers and screens to the storage area. If the mine has open storage piles, the crushed coal passes through a coal stacker onto the pile. The piles, usually worked by bulldozers, are subject to wind erosion. From the storage area, the coal is conveyed to a train loading facility and is put into rail cars. At a captive mine, coal will go from the storage pile to the power plant.

During mine reclamation, which proceeds continuously throughout the life of the mine, overburden spoils piles are smoothed and contoured by bulldozers. Topsoil is placed on the graded spoils, and the land is prepared for revegetation by furrowing, mulching, etc. From the time an area is disturbed until the new vegetation emerges, all disturbed areas are subject to wind erosion.

11.9.2 Emissions

Predictive emission factor equations for open dust sources at western surface coal mines are presented in Tables 11.9-1 and 11.9-2. Each equation is for a single dust-generating activity, such as vehicle traffic on unpaved roads. The predictive equation explains much of the observed variance in emission factors by relating emissions to 3 sets of source parameters: (1) measures of source activity or energy expended (e. g., speed and weight of a vehicle traveling on an unpaved road); (2) properties of the material being disturbed (e. g., suspendable fines in the surface material of an unpaved road); and (3) climate (in this case, mean wind speed).

The equations may be used to estimate particulate emissions generated per unit of source extent (e. g., vehicle distance traveled or mass of material transferred). The equations were



	Coal Field	Strippable Reserves (10^6 tons)
1	Fort Union	23,529
2	Powder River	56,727
3	North Central	All underground
4	Bighorn Basin	All underground
5	Wind River	3
6	Hams Fork	1,000
7	Uinta	308
8	Southwestern Utah	224
9	San Juan River	2,318
10	Raton Mesa	All underground
11	Denver	All underground
12	Green River	2,120

Figure 11.9-1. Coal fields of the western United States.

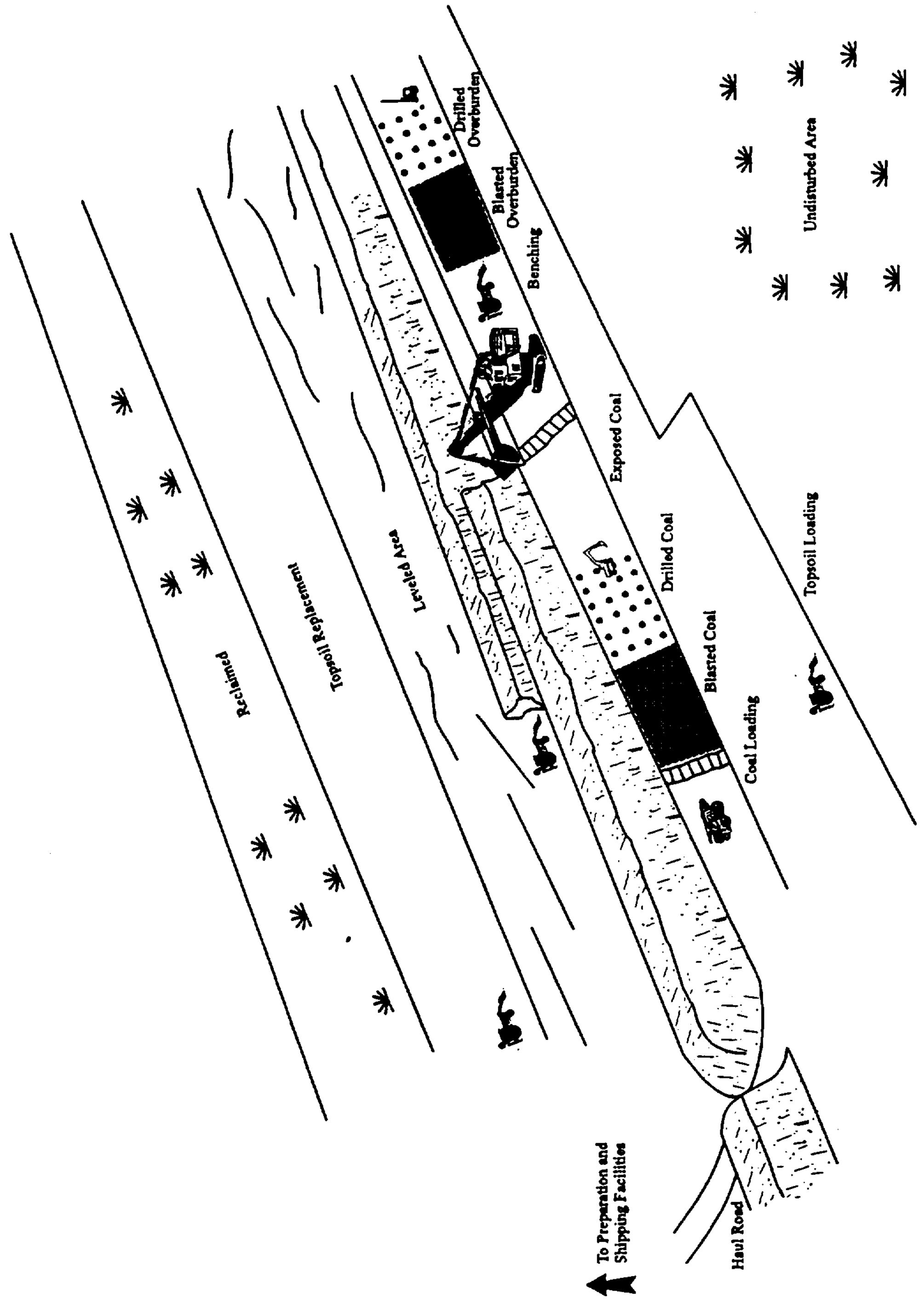


Figure 11.9-2. Operations at typical western surface coal mines.

Table 11.9-1 (Metric Units). EMISSION FACTOR EQUATIONS FOR UNCONTROLLED OPEN DUST SOURCES AT WESTERN SURFACE COAL MINES[a]

Operation	Material	Emissions By Particle Size Range (Aerodymanic Diameter)[b,c]				Units	EMISSION FACTOR RATING
		TSP ≤ 30 µm	≤15 µm	≤10 µm[d]	≤2.5 µm/TSP[e]		
Blasting	Coal or overburden	$0.00022^{1.5}$	ND	0.52[e]	ND	kg/blast	C
Truck loading	Coal	$\frac{0.580}{(M)^{1.2}}$	$\frac{0.0596}{(M)^{0.9}}$	0.75	0.019	kg/Mg	B
Bulldozing	Coal	$\frac{35.6\ (s)^{1.2}}{(M)^{1.4}}$	$\frac{8.44\ (s)^{1.5}}{(M)^{1.4}}$	0.75	0.022	kg/hr	B
	Overburden	$\frac{2.6\ (s)^{1.2}}{(M)^{1.3}}$	$\frac{0.45\ (s)^{1.5}}{(M)^{1.4}}$	0.75	0.105	kg/hr	B
Dragline	Overburden	$\frac{0.0046\ (d)^{1.1}}{(M)^{0.3}}$	$\frac{0.0029\ (d)^{0.7}}{(M)^{0.3}}$	0.75	0.017	kg/m³	B
Scraper (travel mode)		$9.6 \times 10^{-6}\ (s)^{1.3}\ (W)^{2.4}$	$2.2 \times 10^{-6}\ (s)^{1.4}\ (W)^{2.5}$	0.60	0.026	kg/VKT	A
Grading		$0.0034\ (S)^{2.5}$	$0.0056\ (S)^{2.0}$	0.60	0.031	kg/VKT	B
Vehicle traffic (light/medium duty)		$\frac{1.63}{(M)^{4.0}}$	$\frac{1.05}{(M)^{4.3}}$	0.60	0.040	kg/VKT	B
Haul truck		$0.0019\ (w)^{3.4}\ (L)^{0.2}$	$0.0014\ (w)^{3.5}$	0.60	0.017	kg/VKT	A
Active storage pile (wind erosion and maintenance)	Coal	1.8 u	ND	ND	ND	$\frac{kg}{(hectare)(hr)}$	C[f]

[a] Reference 1, except for coal storage pile equation from Reference 4. TSP = total suspended particulate. VKT = vehicle kilometers traveled. ND = no data.

[b] TSP denotes what is measured by a standard high volume sampler (see Section 13.2).

[c] Symbols for equations:

A = horizontal area, with blasting depth ≤21 m. Not for vertical face of a bench.
M = material moisture content (%)

Table 11.9-1 (cont.).

s = material silt content (%)
u = wind speed (m/sec)
d = drop height (m)
W = mean vehicle weight (Mg)
S = mean vehicle speed (kph)
w = mean number of wheels
L = road surface silt loading (g/m^2)

[d] Multiply the $\leq$15 μm equation by this fraction to determine emissions.

[e] Multiply the TSP predictive equation by this fraction to determine emissions in the $\leq$2.5 μm size range.

[f] Rating applicable to Mine Types I, II, and IV (see Tables 11.9-5 and 11.9-6).

Table 11.9-2 (English Units). EMISSION FACTOR EQUATIONS FOR UNCONTROLLED OPEN DUST SOURCES AT WESTERN SURFACE COAL MINES[a]

Operation	Material	Emissions By Particle Size Range (Aerodymanic Diameter)[b,c]				Units	EMISSION FACTOR RATING
		TSP ≤ 30 µm	≤15 µm	≤10 µm[d]	≤2.5 µm/TSP[e]		
Blasting	Coal or overburden	$0.0005A^{1.5}$	ND	0.52[e]	ND	lb/blast	C
Truck loading	Coal	$\frac{1.16}{(M)^{1.2}}$	$\frac{0.119}{(M)^{0.9}}$	0.75	0.019	lb/ton	B
Bulldozing	Coal	$\frac{78.4\ (s)^{1.2}}{(M)^{1.3}}$	$\frac{18.6\ (s)^{1.5}}{(M)^{1.4}}$	0.75	0.022	lb/ton	B
	Overburden	$\frac{5.7\ (s)^{1.2}}{(M)^{1.3}}$	$\frac{1.0\ (c)^{1.5}}{(M)^{1.4}}$	0.75	0.105	lb/ton	B
Dragline	Overburden	$\frac{0.0021\ (d)^{1.1}}{(M)^{0.3}}$	$\frac{0.0021\ (d)^{0.7}}{(M)^{0.3}}$	0.75	0.017	lb/yd³	B
Scraper (travel mode)		$2.7 \times 10^{-5}\ (s)^{1.3}\ (W)^{2.4}$	$6.2 \times 10^{-6}\ (s)^{1.4}\ (W)^{2.5}$	0.60	0.026	lb/VMT	A
Grading		$0.040\ (S)^{2.5}$	$0.051\ (S)^{2.0}$	0.60	0.031	lb/VMT	B
Vehicle traffic (light/medium duty)		$\frac{5.79}{(M)^{4.0}}$	$\frac{3.72}{(M)^{4.3}}$	0.60	0.040	lb/VMT	B
Haul truck		$0.0067\ (w)^{3.4}\ (L)^{0.2}$	$0.0051\ (w)^{3.5}$	0.60	0.017	lb/VMT	A
Active storage pile (wind erosion and maintenance)	Coal	1.6 u	ND	ND	ND	$\frac{\text{lb}}{\text{(acre)(hr)}}$	C[f]

[a] Reference 1, except for coal storage pile equation from Reference 4. TSP = total suspended particulate. VMT = vehicle miles traveled. ND = no data.

[b] TSP denotes what is measured by a standard high volume sampler (see Section 13.2).

[c] Symbols for equations:

A = horizontal area, with blasting depth ≤70 ft. Not for vertical face of a bench.
M = material moisture content (%)

Table 11.9-2 (cont.).

s = material silt content (%)
u = wind speed (m/sec)
d = drop height (ft)
W = mean vehicle weight (tons)
S = mean vehicle speed (mph)
w = mean number of wheels
L = road surface silt loading (g/m^2)

[d] Multiply the ≤15 μm equation by this fraction to determine emissions.

[e] Multiply the TSP predictive equation by this fraction to determine emissions in the ≤2.5 μm size range.

[f] Rating applicable to Mine Types I, II, and IV (see Tables 11.9-5 and 11.9-6).

developed through field sampling of various western surface mine types and are thus applicable to any of the surface coal mines located in the western United States.

In Tables 11.9-1 and 11.9-2, the assigned quality ratings apply within the ranges of source conditions that were tested in developing the equations given in Table 11.9-3. However, the equations should be derated 1 letter value (e. g., A to B) if applied to eastern surface coal mines.

In using the equations to estimate emissions from sources found in a specific western surface mine, it is necessary that reliable values for correction parameters be determined for the specific sources of interest if the assigned quality ranges of the equations are to be applicable. For example, actual silt content of coal or overburden measured at a facility should be used instead of estimated values. In the event that site-specific values for correction parameters cannot be obtained, the appropriate geometric mean values from Table 11.9-3 may be used, but the assigned quality rating of each emission factor equation should be reduced by 1 level (e. g., A to B).

Emission factors for open dust sources not covered in Table 11.9-3 are in Table 11.9-4. These factors were determined through source testing at various western coal mines.

Table 11.9-3 (Metric And English Units). TYPICAL VALUES FOR CORRECTION FACTORS APPLICABLE TO THE PREDICTIVE EMISSION FACTOR EQUATIONS[a]

Source	Correction Factor	Number Of Test Samples	Range	Geometric Mean	Units
Coal loading	Moisture	7	6.6 - 38	17.8	%
Bulldozers					
Coal	Moisture	3	4.0 - 22.0	10.4	%
	Silt	3	6.0 - 11.3	8.6	%
Overburden	Moisture	8	2.2 - 16.8	7.9	%
	Silt	8	3.8 - 15.1	6.9	%
Dragline	Drop distance	19	1.5 - 30	8.6	m
	Drop distance	19	5 - 100	28.1	ft
	Moisture	7	0.2 - 16.3	3.2	%
Scraper	Silt	10	7.2 - 25.2	16.4	%
	Weight	15	33 - 64	48.8	Mg
	Weight	15	36 - 70	53.8	ton
Grader	Speed	7	8.0 - 19.0	11.4	kph
	Speed		5.0 - 11.8	7.1	mph
Light/Medium duty vehicle	Moisture	7	0.9 - 1.70	1.2	%
Haul truck	Wheels	29	6.1 - 10.0	8.1	number
	Silt loading	26	3.8 - 254	40.8	g/m^2
	Silt loading	26	34 - 2270	364	lb/acre

[a] Reference 1.

The factors in Table 11.9-4 for mine locations I through V were developed for specific geographical areas. Tables 11.9-5 and 11.9-6 present characteristics of each of these mines

Table 11.9-4 (English And Metric Units). UNCONTROLLED PARTICULATE EMISSION FACTORS FOR OPEN DUST SOURCES AT WESTERN SURFACE COAL MINES

Source	Material	Mine Location[a]	TSP Emission Factor[b]	Units	EMISSION FACTOR RATING
Drilling	Overburden	Any	1.3 0.59	lb/hole kg/hole	B B
	Coal	V	0.22 0.10	lb/hole kg/hole	E E
Topsoil removal by scraper	Topsoil	Any	0.058 0.029	lb/ton kg/Mg	E E
		IV	0.44 0.22	lb/ton kg/Mg	D D
Overburden replacement	Overburden	Any	0.012 0.0060	lb/ton kg/Mg	C C
Truck loading by power shovel (batch drop)[c]	Overburden	V	0.037 0.018	lb/ton kg/Mg	C C
Train loading (batch or continuous drop)[c]	Coal	Any	0.028 0.014	lb/ton kg/Mg	D D
		III	0.0002 0.0001	lb/ton kg/Mg	D D
Bottom dump truck unloading (batch drop)[c]	Overburden	V	0.002 0.001	lb/ton kg/ton	E E
	Coal	IV	0.027 0.014	lb/ton kg/Mg	E E
		III	0.005 0.002	lb/ton kg/Mg	E E
		II	0.020 0.010	lb/ton kg/Mg	E E

Table 11.9-4 (cont.).

Source	Material	Mine Location[a]	TSP Emission Factor[b]	Units	EMISSION FACTOR RATING
		I	0.014 0.0070	lb/T kg/Mg	D D
		Any	0.066 0.033	lb/T kg/Mg	D D
End dump truck unloading (batch drop)[c]	Coal	V	0.007 0.004	lb/T kg/Mg	E E
Scraper unloading (batch drop)[c]	Topsoil	IV	0.04 0.02	lb/T kg/Mg	C C
Wind erosion of exposed areas	Seeded land, stripped overburden, graded overburden	Any	0.38	$\frac{T}{(acre)(yr)}$	C
			0.85	$\frac{Mg}{(hectare)(yr)}$	C

[a] Roman numerals I through V refer to specific mine locations for which the corresponding emission factors were developed. Tables 11.9-4 and 11.9-5 present characteristics of each of these mines. See text for correct use of these "mine-specific" emission factors. The other factors (from Reference 5 except for overburden drilling from Reference 1) can be applied to any western surface coal mine.

[b] Total suspended particulate (TSP) denotes what is measured by a standard high volume sampler (see Section 13.2).

[c] Predictive emission factor equations, which generally provide more accurate estimates of emissions, are presented is Chapter 13.

(areas). A "mine-specific" emission factor should be used only if the characteristics of the mine for which an emissions estimate is needed are very similar to those of the mine for which the emission factor was developed. The other (nonspecific) emission factors were developed at a variety of mine types and thus are applicable to any western surface coal mine.

As an alternative to the single valued emission factors given in Table 11.9-4 for train or truck loading and for truck or scraper unloading, 2 empirically derived emission factor equations are presented in Section 13.2.4 of this document. Each equation was developed for a source operation (i. e., batch drop and continuous drop, respectively) comprising a single dust-generating mechanism that crosses industry lines.

Because the predictive equations allow emission factor adjustment to specific source conditions, the equations should be used in place of the factors in Table 11.9-4 for the sources identified above if emission estimates for a specific western surface coal mine are needed. However, the generally higher quality ratings assigned to the equations are applicable only if: (1) reliable values of correction parameters have been determined for the specific sources of interest, and (2) the correction parameter values lie within the ranges tested in developing the equations. Table 11.9-3 lists measured properties of aggregate materials that can be used to estimate correction parameter values for the predictive emission factor equations in Chapter 13, in the event that site-specific values are not available. Use of mean correction parameter values from Table 11.9-3 will reduce the quality ratings of the emission factor equations in Chapter 13 by 1 level.

Table 11.9-5 (Metric And English Units). GENERAL CHARACTERISTICS OF SURFACE COAL MINES REFERRED TO IN TABLE 11.9-4[a]

Mine	Location	Type Of Coal Mined	Terrain	Vegetative Cover	Surface Soil Type And Erodibility Index	Mean Wind Speed		Mean Annual Precipitation	
						m/s	mph	cm	in.
I	N.W. Colorado	Subbitum.	Moderately steep	Moderate, sagebrush	Clayey loamy (71)	2.3	5.1	38	15
II	S.W. Wyoming	Subbitum.	Semirugged	Sparse, sagebrush	Arid soil with clay and alkali or carbonate accumulation (86)	6.0	13.4	36	14
III	S.E. Montana	Subbitum.	Gently rolling to semirugged	Sparse, moderate, prairie grassland	Shallow clay loamy deposits on bedrock (47)	4.8	10.7	28 - 41	11 - 16
IV	Central North Dakota	Lignite	Gently rolling	Moderate, prairie grassland	Loamy, loamy to sandy (71)	5.0	11.2	43	17
V	N.E. Wyoming	Subbitum.	Flat to gently rolling	Sparse, sagebrush	Loamy, sandy, clayey, and clay loamy (102)	6.0	13.4	36	14

[a] Reference 4.

Table 11.9-6 (English Units). OPERATING CHARACTERISTICS OF THE COAL MINES REFERRED TO IN TABLE 11.9-4[a]

Parameter	Required Information	Units	Mine				
			I	II	III	IV	V
Production rate	Coal mined	10^6 ton/yr	1.13	5.0	9.5	3.8	12.0[b]
Coal transport	Avg. unit train frequency	per day	NA	NA	2	NA	2
Stratigraphic data	Overburden thickness	ft	21	80	90	65	35
	Overburden density	lb/yd^3	4000	3705	3000	—	—
	Coal seam thicknesses	ft	9,35	15,9	27	2,4,8	70
	Parting thicknesses	ft	50	15	NA	32,16	NA
	Spoils bulking factor	%	22	24	25	20	—
	Active pit depth	ft	52	100	114	80	105
Coal analysis data	Moisture	%	10	18	24	38	30
	Ash	%, wet	8	10	8	7	6
	Sulfur	%, wet	0.46	0.59	0.75	0.65	0.48
	Heat content	Btu/lb	11000	9632	8628	8500	8020
Surface disposition	Total disturbed land	acre	168	1030	2112	1975	217
	Active pit	acre	34	202	87	—	71
	Spoils	acre	57	326	144	—	100
	Reclaimed	acre	100	221	950	—	100
	Barren land	acre	—	30	455	—	—
	Associated disturbances	acre	12	186	476	—	46
Storage	Capacity	ton	NA	NA	—	NA	48000
Blasting	Frequency, total	per week	4	4	3	7	7[b]
	Frequency, overburden	per week	3	0.5	3	NA	7[b]
	Area blasted, coal	ft^2	16000	40000	—	30000	—
	Area blasted, overburden	ft^2	20000	—	—	NA	—

[a] Reference 4. NA = not applicable. Dash = no data.

[b] Estimate.

References For Section 11.9

1. K. Axetell and C. Cowherd, *Improved Emission Factors For Fugitive Dust From Western Surface Coal Mining Sources*, 2 Volumes, EPA Contract No. 68-03-2924, U. S. Environmental Protection Agency, Cincinnati, OH, July 1981.

2. *Reserve Base Of U. S. Coals By Sulfur Content: Part 2, The Western States*, IC8693, Bureau Of Mines, U. S. Department Of The Interior, Washington, DC, 1975.

3. *Bituminous Coal And Lignite Production And Mine Operations - 1978*, DOE/EIA-0118(78), U. S. Department of Energy, Washington, DC, June 1980.

4. K. Axetell, *Survey Of Fugitive Dust From Coal Mines*, EPA-908/1-78-003, U. S. Environmental Protection Agency, Denver, CO, February 1978.

5. D. L. Shearer, *et al.*, *Coal Mining Emission Factor Development And Modeling Study*, Amax Coal Company, Carter Mining Company, Sunoco Energy Development Company, Mobil Oil Corporation, and Atlantic Richfield Company, Denver, CO, July 1981.

United States Environmental Protection Agency. 1995. AP-42 (Compilation of Air Pollutant Emission Factors, Volume 1, Fifth Edition, AP-42).

13.2.3 Heavy Construction Operations

13.2.3.1 General

Heavy construction is a source of dust emissions that may have substantial temporary impact on local air quality. Building and road construction are 2 examples of construction activities with high emissions potential. Emissions during the construction of a building or road can be associated with land clearing, drilling and blasting, ground excavation, cut and fill operations (i.e., earth moving), and construction of a particular facility itself. Dust emissions often vary substantially from day to day, depending on the level of activity, the specific operations, and the prevailing meteorological conditions. A large portion of the emissions results from equipment traffic over temporary roads at the construction site.

The temporary nature of construction differentiates it from other fugitive dust sources as to estimation and control of emissions. Construction consists of a series of different operations, each with its own duration and potential for dust generation. In other words, emissions from any single construction site can be expected (1) to have a definable beginning and an end and (2) to vary substantially over different phases of the construction process. This is in contrast to most other fugitive dust sources, where emissions are either relatively steady or follow a discernable annual cycle. Furthermore, there is often a need to estimate areawide construction emissions, without regard to the actual plans of any individual construction project. For these reasons, following are methods by which either areawide or site-specific emissions may be estimated.

13.2.3.2 Emissions And Correction Parameters

The quantity of dust emissions from construction operations is proportional to the area of land being worked and to the level of construction activity. By analogy to the parameter dependence observed for other similar fugitive dust sources,[1] one can expect emissions from heavy construction operations to be positively correlated with the silt content of the soil (that is, particles smaller than 75 micrometers [μm] in diameter), as well as with the speed and weight of the average vehicle, and to be negatively correlated with the soil moisture content.

13.2.3.3 Emission Factors

Only 1 set of field studies has been performed that attempts to relate the emissions from construction directly to an emission factor.[1-2] Based on field measurements of total suspended particulate (TSP) concentrations surrounding apartment and shopping center construction projects, the approximate emission factors for construction activity operations are:

E = 2.69 megagrams (Mg)/hectare/month of activity
E = 1.2 tons/acre/month of activity

These values are most useful for developing estimates of overall emissions from construction scattered throughout a geographical area. The value is most applicable to construction operations with: (1) medium activity level, (2) moderate silt contents, and (3) semiarid climate. Test data were not sufficient to derive the specific dependence of dust emissions on correction parameters. Because the above emission factor is referenced to TSP, use of this factor to estimate particulate matter (PM) no greater than 10 μm in aerodynamic diameter

(PM-10) emissions will result in conservatively high estimates. Also, because derivation of the factor assumes that construction activity occurs 30 days per month, the above estimate is somewhat conservatively high for TSP as well.

Although the equation above represents a relatively straightforward means of preparing an areawide emission inventory, at least 2 features limit its usefulness for specific construction sites. First, the conservative nature of the emission factor may result in too high an estimate for PM-10 to be of much use for a specific site under consideration. Second, the equation provides neither information about which particular construction activities have the greatest emission potential nor guidance for developing an effective dust control plan.

For these reasons, it is strongly recommended that when emissions are to be estimated for a particular construction site, the construction process be broken down into component operations. (Note that many general contractors typically employ planning and scheduling tools, such as critical path method [CPM], that make use of different sequential operations to allocate resources.) This approach to emission estimation uses a unit or phase method to consider the more basic dust sources of vehicle travel and material handling. That is to say, the construction project is viewed as consisting of several operations, each involving traffic and material movements, and emission factors from other AP-42 sections are used to generate estimates. Table 13.2.3-1 displays the dust sources involved with construction, along with the recommended emission factors.[3]

In addition to the on-site activities shown in Table 13.2.3-1, substantial emissions are possible because of material tracked out from the site and deposited on adjacent paved streets. Because all traffic passing the site (i. e., not just that associated with the construction) can resuspend the deposited material, this "secondary" source of emissions may be far more important than all the dust sources actually within the construction site. Furthermore, this secondary source will be present during all construction operations. Persons developing construction site emission estimates must consider the potential for increased adjacent emissions from off-site paved roadways (see Section 13.2.1, "Paved Roads"). High wind events also can lead to emissions from cleared land and material stockpiles. Section 13.2.5, "Industrial Wind Erosion", presents an estimation methodology that can be used for such sources at construction sites.

13.2.3.4 Control Measures[4]

Because of the relatively short-term nature of construction activities, some control measures are more cost effective than others. Wet suppression and wind speed reduction are 2 common methods used to control open dust sources at construction sites, because a source of water and material for wind barriers tend to be readily available on a construction site. However, several other forms of dust control are available.

Table 13.2.3-2 displays each of the preferred control measures, by dust source.[3-4] Because most of the controls listed in the table modify independent variables in the emission factor models, the effectiveness can be calculated by comparing controlled and uncontrolled emission estimates from Table 13.2.3-1. Additional guidance on controls is provided in the AP-42 sections from which the recommended emission factors were taken, as well as in other documents, such as Reference 4.

Table 13.2.3-1. RECOMMENDED EMISSION FACTORS FOR CONSTRUCTION OPERATIONS[a]

Construction Phase	Dust-generating Activities	Recommended Emission Factor	Comments	Rating Adjustment[b]
I. Demolition and debris removal	1. Demolition of buildings or other (natural) obstacles such as trees, boulders, etc.			
	a. Mechanical dismemberment ("headache ball") of existing structures	NA		—
	b. Implosion of existing structures	NA		—
	c. Drilling and blasting of soil	Drilling factor in Table 11.9-4		-1
		Blasting factor NA	Blasting factor in Tables 11.9-1 and 11.9-2 not considered appropriate for general construction activities	NA
	d. General land clearing	Dozer equation (overburden) in Tables 11.9-1 and 11.9-2		-1/-2[c]
	2. Loading of debris into trucks	Material handling factor in Section 13.2.2		-0/-1[c]
	3. Truck transport of debris	Unpaved road emission factor in Section 13.2.2, or paved road emission factor in Section 13.2.1		-0/-1[c]
	4. Truck unloading of debris	Material handling factor in Section 13.2.2	May occur offsite	-0/-1[c]

Table 13.2.3-1 (cont.).

Construction Phase	Dust-generating Activities	Recommended Emission Factor	Comments	Rating Adjustment[b]
II. Site Preparation (earth moving)	1. Bulldozing	Dozer equation (overburden) in Tables 11.9-1 and 11.9-2		-1/-2[c]
	2. Scrapers unloading topsoil	Scraper unloading factor in Table 11.9-4		-1
	3. Scrapers in travel	Scraper (travel mode) expression in Tables 11.9-1 and 11.9-2		-0/-1[c]
	4. Scrapers removing topsoil	5.7 kg/vehicle kilometer traveled (VKT) (20.2 lb/vehicle mile traveled [VMT])		E[d]
	5. Loading of excavated material into trucks	Material handling factor in Section 13.2.2		-0/-1[c]
	6. Truck dumping of fill material, road base, or other materials	Material handling factor in Section 13.2.2	May occur offsite	-0/-1[c]
	7. Compacting	Dozer equation in Tables 11.9-1 and 11.9-2	Emission factor downgraded because of differences in operating equipment	-1/-2[c]
	8. Motor grading	Grading equation in Tables 11.9-1 and 11.9-2		-1/-2[c]

Table 13.2.3-1 (cont.).

Construction Phase	Dust-generating Activities	Recommended Emission Factor	Comments	Rating Adjustment[b]
III. General Construction	1. Vehicular traffic	Unpaved road emission factor in Section 13.2.2, or paved road emission factor in Section 13.2.1		-0/-1[c] -0/-1[c]
	2. Portable plants			
	a. Crushing	Factors for similar material/operations in Chapter 11 of this document		-1/-2[c]
	b. Screening	Factors for similar material/operations in Chapter 11 of this document		-1/-2[c]
	c. Material transfers	Material handling factor in Section 13.2.2		-0/-1[c]
	3. Other operations	Factors for similar material/operations in Chapter 11 of this document		—

[a] NA = not applicable.

[b] Refers to how many additional letters the emission factor should be downrated (beyond the guidance given in the other sections of AP-42) for application to construction activities. For example, "-2" means that an A-rated factor should be considered of C quality in estimating construction emissions. All emission factors assumed to have site-specific input values; otherwise, additional downgrading of one letter should be employed. Note that no rating can be lower than E.

[c] First value for cases with independent variables within range given in AP-42 section; second value for cases with at least 1 variable outside the range.

[d] Rating for emission factor given. Reference 5.

[e] In the event that individual operations cannot be identified, one may very conservatively overestimate PM-10 emissions by using Equation 1.

Table 13.2.3-2. CONTROL OPTIONS FOR GENERAL CONSTRUCTION OPEN SOURCES OF PM-10

Emission Source	Recommended Control Method(s)
Debris handling	Wind speed reduction Wet suppression[a]
Truck transport[b]	Wet suppression Paving Chemical stabilization[c]
Bulldozers	Wet suppression[d]
Pan scrapers	Wet suppression of travel routes
Cut/fill material handling	Wind speed reduction Wet suppression
Cut/fill haulage	Wet suppression Paving Chemical stabilization
General construction	Wind speed reduction Wet suppression Early paving of permanent roads

[a] Dust control plans should contain precautions against watering programs that confound trackout problems.

[b] Loads could be covered to avoid loss of material in transport, especially if material is transported offsite.

[c] Chemical stabilization usually cost-effective for relatively long-term or semipermanent unpaved roads.

[d] Excavated materials may already be moist and not require additional wetting. Furthermore, most soils are associated with an "optimum moisture" for compaction.

References For Section 13.2.3

1. C. Cowherd, Jr., *et al*, *Development Of Emissions Factors For Fugitive Dust Sources*, EPA-450/3-74-03, U. S. Environmental Protection Agency, Research Triangle Park, NC, June 1974.

2. G. A. Jutze, *et al*, *Investigation Of Fugitive Dust Sources Emissions And Control*, EPA-450/3-74-036a, U. S. Environmental Protection Agency, Research Triangle Park, NC, June 1974.

3. *Background Documentation For AP-42 Section 11.2.4, Heavy Construction Operations*, EPA Contract No. 69-D0-0123, Midwest Research Institute, Kansas City, MO, April 1993.

4. C. Cowherd, *et al*, *Control Of Open Fugitive Dust Sources*, EPA-450/3-88-008, U. S. Environmental Protection Agency, Research Triangle Park, NC, September 1988.

5. M. A. Grelinger, *et al., Gap Filling PM-10 Emission Factors For Open Area Fugitive Dust Sources*, EPA-450/4-88-003, U. S. Environmental Protection Agency, Research Triangle Park, NC, March 1988.

United States Environmental Protection Agency. 1995. AP-42 (Compilation of Air Pollutant Emission Factors, Volume 1, Fifth Edition, AP-42).

13.2.4 Aggregate Handling And Storage Piles

13.2.4.1 General

Inherent in operations that use minerals in aggregate form is the maintenance of outdoor storage piles. Storage piles are usually left uncovered, partially because of the need for frequent material transfer into or out of storage.

Dust emissions occur at several points in the storage cycle, such as material loading onto the pile, disturbances by strong wind currents, and loadout from the pile. The movement of trucks and loading equipment in the storage pile area is also a substantial source of dust.

13.2.4.2 Emissions And Correction Parameters

The quantity of dust emissions from aggregate storage operations varies with the volume of aggregate passing through the storage cycle. Emissions also depend on 3 parameters of the condition of a particular storage pile: age of the pile, moisture content, and proportion of aggregate fines.

When freshly processed aggregate is loaded onto a storage pile, the potential for dust emissions is at a maximum. Fines are easily disaggregated and released to the atmosphere upon exposure to air currents, either from aggregate transfer itself or from high winds. As the aggregate pile weathers, however, potential for dust emissions is greatly reduced. Moisture causes aggregation and cementation of fines to the surfaces of larger particles. Any significant rainfall soaks the interior of the pile, and then the drying process is very slow.

Silt (particles equal to or less than 75 micrometers [µm] in diameter) content is determined by measuring the portion of dry aggregate material that passes through a 200-mesh screen, using ASTM-C-136 method.[1] Table 13.2.4-1 summarizes measured silt and moisture values for industrial aggregate materials.

13.2.4.3 Predictive Emission Factor Equations

Total dust emissions from aggregate storage piles result from several distinct source activities within the storage cycle:

1. Loading of aggregate onto storage piles (batch or continuous drop operations).
2. Equipment traffic in storage area.
3. Wind erosion of pile surfaces and ground areas around piles.
4. Loadout of aggregate for shipment or for return to the process stream (batch or continuous drop operations).

Either adding aggregate material to a storage pile or removing it usually involves dropping the material onto a receiving surface. Truck dumping on the pile or loading out from the pile to a truck with a front-end loader are examples of batch drop operations. Adding material to the pile by a conveyor stacker is an example of a continuous drop operation.

Table 13.2.4-1. TYPICAL SILT AND MOISTURE CONTENTS OF MATERIALS AT VARIOUS INDUSTRIES[a]

Industry	No. Of Facilities	Material	Silt Content (%)			Moisture Content (%)		
			No. Of Samples	Range	Mean	No. Of Samples	Range	Mean
Iron and steel production	9	Pellet ore	13	1.3 - 13	4.3	11	0.64 - 4.0	2.2
		Lump ore	9	2.8 - 19	9.5	6	1.6 - 8.0	5.4
		Coal	12	2.0 - 7.7	4.6	11	2.8 - 11	4.8
		Slag	3	3.0 - 7.3	5.3	3	0.25 - 2.0	0.92
		Flue dust	3	2.7 - 23	13	1	—	7
		Coke breeze	2	4.4 - 5.4	4.9	2	6.4 - 9.2	7.8
		Blended ore	1	—	15	1	—	6.6
		Sinter	1	—	0.7	0	—	—
		Limestone	3	0.4 - 2.3	1.0	2	ND	0.2
Stone quarrying and processing	2	Crushed limestone	2	1.3 - 1.9	1.6	2	0.3 - 1.1	0.7
		Various limestone products	8	0.8 - 14	3.9	8	0.46 - 5.0	2.1
Taconite mining and processing	1	Pellets	9	2.2 - 5.4	3.4	7	0.05 - 2.0	0.9
		Tailings	2	ND	11	1	—	0.4
Western surface coal mining	4	Coal	15	3.4 - 16	6.2	7	2.8 - 20	6.9
		Overburden	15	3.8 - 15	7.5	0	—	—
		Exposed ground	3	5.1 - 21	15	3	0.8 - 6.4	3.4
Coal-fired power plant	1	Coal (as received)	60	0.6 - 4.8	2.2	59	2.7 - 7.4	4.5
Municipal solid waste landfills	4	Sand	1	—	2.6	1	—	7.4
		Slag	2	3.0 - 4.7	3.8	2	2.3 - 4.9	3.6
		Cover	5	5.0 - 16	9.0	5	8.9 - 16	12
		Clay/dirt mix	1	—	9.2	1	—	14
		Clay	2	4.5 - 7.4	6.0	2	8.9 - 11	10
		Fly ash	4	78 - 81	80	4	26 - 29	27
		Misc. fill materials	1	—	12	1	—	11

[a] References 1-10. ND = no data.

The quantity of particulate emissions generated by either type of drop operation, per kilogram (kg) (ton) of material transferred, may be estimated, with a rating of A, using the following empirical expression:[11]

$$E = k(0.0016)\ \frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}\ \text{(kg/megagram [Mg])} \qquad (1)$$

$$E = k(0.0032)\ \frac{\left(\frac{U}{5}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}}\ \text{(pound [lb]/ton)}$$

where:

E = emission factor
k = particle size multiplier (dimensionless)
U = mean wind speed, meters per second (m/s) (miles per hour [mph])
M = material moisture content (%)

The particle size multiplier in the equation, k, varies with aerodynamic particle size range, as follows:

Aerodynamic Particle Size Multiplier (k) For Equation 1				
< 30 μm	< 15 μm	< 10 μm	< 5 μm	< 2.5 μm
0.74	0.48	0.35	0.20	0.11

The equation retains the assigned quality rating if applied within the ranges of source conditions that were tested in developing the equation, as follows. Note that silt content is included, even though silt content does not appear as a correction parameter in the equation. While it is reasonable to expect that silt content and emission factors are interrelated, no significant correlation between the 2 was found during the derivation of the equation, probably because most tests with high silt contents were conducted under lower winds, and vice versa. It is recommended that estimates from the equation be reduced 1 quality rating level if the silt content used in a particular application falls outside the range given:

Ranges Of Source Conditions For Equation 1			
Silt Content (%)	Moisture Content (%)	Wind Speed	
		m/s	mph

0.44 - 19	0.25 - 4.8	0.6 - 6.7	1.3 - 15

To retain the quality rating of the equation when it is applied to a specific facility, reliable correction parameters must be determined for specific sources of interest. The field and laboratory procedures for aggregate sampling are given in Reference 3. In the event that site-specific values for correction parameters cannot be obtained, the appropriate mean from Table 13.2.4-1 may be used, but the quality rating of the equation is reduced by 1 letter.

For emissions from equipment traffic (trucks, front-end loaders, dozers, etc.) traveling between or on piles, it is recommended that the equations for vehicle traffic on unpaved surfaces be used (see Section 13.2.2). For vehicle travel between storage piles, the silt value(s) for the areas among the piles (which may differ from the silt values for the stored materials) should be used.

Worst-case emissions from storage pile areas occur under dry, windy conditions. Worst-case emissions from materials-handling operations may be calculated by substituting into the equation appropriate values for aggregate material moisture content and for anticipated wind speeds during the worst case averaging period, usually 24 hours. The treatment of dry conditions for Section 13.2.2, vehicle traffic, "Unpaved Roads", follows the methodology described in that section centering on parameter p. A separate set of nonclimatic correction parameters and source extent values corresponding to higher than normal storage pile activity also may be justified for the worst-case averaging period.

13.2.4.4 Controls[12-13]

Watering and the use of chemical wetting agents are the principal means for control of aggregate storage pile emissions. Enclosure or covering of inactive piles to reduce wind erosion can also reduce emissions. Watering is useful mainly to reduce emissions from vehicle traffic in the storage pile area. Watering of the storage piles themselves typically has only a very temporary slight effect on total emissions. A much more effective technique is to apply chemical agents (such as surfactants) that permit more extensive wetting. Continuous chemical treating of material loaded onto piles, coupled with watering or treatment of roadways, can reduce total particulate emissions from aggregate storage operations by up to 90 percent.[12]

References For Section 13.2.4

1. C. Cowherd, Jr., *et al.*, *Development Of Emission Factors For Fugitive Dust Sources*, EPA-450/3-74-037, U. S. Environmental Protection Agency, Research Triangle Park, NC, June 1974.

2. R. Bohn, *et al.*, *Fugitive Emissions From Integrated Iron And Steel Plants*, EPA-600/2-78-050, U. S. Environmental Protection Agency, Cincinnati, OH, March 1978.

3. C. Cowherd, Jr., *et al.*, *Iron And Steel Plant Open Dust Source Fugitive Emission Evaluation*, EPA-600/2-79-103, U. S. Environmental Protection Agency, Cincinnati, OH, May 1979.

4. *Evaluation Of Open Dust Sources In The Vicinity Of Buffalo, New York*, EPA Contract No. 68-02-2545, Midwest Research Institute, Kansas City, MO, March 1979.

5. C. Cowherd, Jr., and T. Cuscino, Jr., *Fugitive Emissions Evaluation*, MRI-4343-L, Midwest Research Institute, Kansas City, MO, February 1977.

6. T. Cuscino, Jr., *et al*., *Taconite Mining Fugitive Emissions Study*, Minnesota Pollution Control Agency, Roseville, MN, June 1979.

7. *Improved Emission Factors For Fugitive Dust From Western Surface Coal Mining Sources*, 2 Volumes, EPA Contract No. 68-03-2924, PEDCo Environmental, Kansas City, MO, and Midwest Research Institute, Kansas City, MO, July 1981.

8. *Determination Of Fugitive Coal Dust Emissions From Rotary Railcar Dumping*, TRC, Hartford, CT, May 1984.

9. *PM-10 Emission Inventory Of Landfills In the Lake Calumet Area*, EPA Contract No. 68-02-3891, Midwest Research Institute, Kansas City, MO, September 1987.

10. *Chicago Area Particulate Matter Emission Inventory — Sampling And Analysis*, EPA Contract No. 68-02-4395, Midwest Research Institute, Kansas City, MO, May 1988.

11. *Update Of Fugitive Dust Emission Factors In AP-42 Section 11.2*, EPA Contract No. 68-02-3891, Midwest Research Institute, Kansas City, MO, July 1987.

12. G. A. Jutze, *et al*., *Investigation Of Fugitive Dust Sources Emissions And Control*, EPA-450/3-74-036a, U. S. Environmental Protection Agency, Research Triangle Park, NC, June 1974.

13. C. Cowherd, Jr., *et al*., *Control Of Open Fugitive Dust Sources*, EPA-450/3-88-008, U. S. Environmental Protection Agency, Research Triangle Park, NC, September 1988.

APPENDIX M

SOUND PRESSURE LEVEL CALCULATIONS

ICF KAISER

JOB No. 67861-003
SHEET 1 OF 2

DESIGNED BY DJW DATE 3/17/
CHECKED BY DATE

Like pieces of Equipment : N = No. of pieces

$SPL_2 = 10 \log n + SPL_1$

$= 10 \log(2) + SPL_1$

$= 3.0 + 89$ dB

$= 92.0$ dB

$SPL_2 = 10 \log(4) + SPL_1$

$= 6 + 89$

$= 95$ dB

Sound Pressure Levels @ Distance

$D_1 = 1$ foot

$D_2 = 10, 30 \& 500$ feet.

$SPL_2 = SPL_1 - 20 \log\left(\frac{D_2}{D_1}\right)$

$SPL_2 = 92$ dB $- 20$ dB

$SPL_2 = 72$ dB @ 10 feet

$= 62$ dB @ 30 feet

$= 38$ dB @ 500 feet.

$SPL_2 = SPL_1 - 20 \log\left(\frac{D_2}{D_1}\right)$

$= 75$ dB @ 10 feet

$= 65$ dB @ 30 feet

$= 41$ dB @ 500 feet

ICF KAISER

JOB NO. 67861-003
SHEET 1 OF 2

DESIGNED BY DSW DATE 3/17/
CHECKED BY DATE

Plant Area Fence

$SPL_1 + SPL_2 = 10\log_{10}\left(10^{\frac{SPL_1}{10}} + 10^{\frac{SPL_2}{10}}\right)$

$= 10\log_{10}\left(10^{\frac{69.8}{10}} + 10^{\frac{38}{10}}\right)$

$= 10\log_{10}\left(10^{6.98} + 10^{3.8}\right)$

$= 10\log_{10}(9549926 + 6310)$

$= 10\log_{10}(9556236)$

$SPL_1 - SPL_2$ $= 69.8$ dB

Top of Hill

$SPL_1 + SPL_2 = 10\log_{10}\left(10^{\frac{SPL_1}{10}} + 10^{\frac{SPL_2}{10}}\right)$

$= 10\log_{10}\left(10^{\frac{58.9}{10}} + 10^{\frac{41}{10}}\right)$

$= 10\log_{10}\left(10^{5.89} + 10^{4.1}\right)$

$= 10\log_{10}(776247 - 12589)$

$= 10\log_{10}(788836)$

$= 59$ dB

Railroad Bed

$SPL_1 + SPL_2 = 10\log_{10}\left(10^{\frac{SPL_1}{10}} + 10^{\frac{SPL_2}{10}}\right)$

$= 10\log_{10}\left(10^{5.6} + 10^{3.8}\right)$

$= 10\log_{10}(398107 + 6310)$

$= 10\log_{10}(404417)$

$= 56$ dB

Location/Avg. Measured SPL (dB) - 2 Day Period	Pieces of Equipment @ 89 dB[2]	SPL (dB) 1 foot from Source	SPL (dB) 10 feet from Source	SPL (dB) 30 feet from Source	SPL (dB) 500 feet from Source	Additive SPL (dB) @ Receptor (500 feet)
Plant Area Fence/69.8[1]	2	92	72	62	38	69.8
Top of Hill/58.9	4	95	75	65	41	59
Railroad Bed/56.0	2	92	72	62	38	56

[1] Noise monitor malfuction on second day of testing (2/28/97).

[2] Average noise level of anticipated equipment.

Backhoe SPL (avg.) = 88 dB
Gradeall SPL (avg.) = 94 dB
Truck SPL (avg.) = 85 dB

Notes:

SPL = Sound Pressure Level
dB = Decibel(s)

APPENDIX N

MOLYCORP, INC.
WASHINGTON COUNTY FACILITY RISK ASSESSMENT

RISK ASSESSMENT

References utilized in the risk assessment performed for the Washington decommissioning are:

- 10 CFR 71;
- 10 CFR 20.302;
- SECY 81-576;
- USNRC, 1997;
- USEPA, 1993;
- USEPA, 1988.

This section presents an assessment of the potential radiological consequences (risks) posed by thoriated material at the Molycorp facility in Washington, Pennsylvania, as it is today, and during and following completion of the proposed remediation alternatives. Radiological doses to a maximally exposed hypothetical individual (resident farmer) are estimated at selected times for up to 1000 years from both direct and indirect exposure pathways using the RESRAD dose assessment code. Estimates of radon in growth from the decay of thorium-232 were also made for this same 1000 year period. The Microshield code published by Grove Engineering was used to determine the potential risks imposed by the slag-pile located on the site south of Caldwell Avenue.

The terms resident farmer and industrial worker are referenced in this section. A resident farmer is a hypothetical person who comes to live on the site and builds a home. This person maintains a small farm and obtains drinking water from a well on the facility. Water from this well is used to water crops and livestock. The crops and livestock on the site are consumed by the farmer. The farmer also catches fish in the nearby stream and consumes them. The farmer is assumed to be totally self-sufficient. An industrial worker is defined as a site employee who, depending on his/her job function, spends a percentage of his/her day in-doors and the remainder out-doors. The industrial worker is assumed not to drink water from the site nor consume foodstuffs grown on the site.

The results of these analyses indicate which of the pathways is significant: provide an assessment of the potential radiological consequences if no action is taken to remediate the site: and establish a baseline for the determination of potential exposure scenarios, cleanup criteria, and soil guidelines for decontaminating and decommissioning (D&D) the site.

Potential radiological impacts were estimated using the RESRAD code, developed by the United States Department of Energy (DOE) for assessing the impacts of residual radioactive soil contamination following decontamination of sites in their Formerly Utilized Sites Remedial Action Program (FUSRAP). The volume and concentration of contaminated materials were estimated from site characterization data provided in the Site Characterization Report. Other site specific and locale specific data were obtained from various Molycorp documents and permits, and various departments of the Commonwealth of Pennsylvania.

1.0 ALTERNATIVES CONSIDERED

Molycorp, Inc. is considering three remediation alternatives for the thoriated materials contained on the site at Washington, PA. These alternatives include the following:

1) On-site storage in an engineered cell (three location options)
2) Off-site disposal at an NRC licensed commercial facility
3) No-Action

The present analysis examines the dose impacts/risks associated with the implementation of these alternatives. Each of the alternatives and exposure scenarios are discussed for each area of the property and the thorium slag-pile. The thorium slag pile is treated as a separate case and is discussed in Section 2.2.

1.1 ON-SITE MANAGEMENT ALTERNATIVE

Molycorp is proposing to construct a permanent on-site storage cell (Alternative 1) to store thoriated slag and soil generated during remediation at its Washington and York, Pennsylvania facilities. The following three on-site options are proposed for the permanent cell location:

Option 1: Hilltop Area

Option 2: Open Storage Area

Option 3: Railroad Bed Area

The total estimated volume of thoriated material to be stored in the on-site cell ranges from 50,000 to 62,000 yd^3. A volume of 60,000 yd^3 was used in this analysis.

1.2 OFF-SITE MANAGEMENT ALTERNATIVE

Under the off-site management alternative, radioactive contamination greater than 30 pCi/g would be removed from the facility, packaged, transported, and disposed of at an NRC approved, licensed commercial storage facility. However, Envirocare of Utah, Inc., near Clive, Utah was chosen for use in this risk assessment because of its remote location. The York material, as well as the materials in the rolloffs from previous removal actions, would be included in this alternative. The excavated areas would be returned to grade using clean fill. then seeded and mulched for erosion control.

1.3 NO-ACTION ALTERNATIVE

For the no-action alternative, it is assumed that contamination remains in its current condition without any further action, i.e., all contamination at the site is in its pre-characterization state. This no-action alternative would not comply with NRC's requirements under the Atomic Energy Act nor would it meet the interests of the public, Molycorp, or Commonwealth of Pennsylvania. As stated previously (section 4), this alternative is a baseline to which alternative actions are compared.

2.0 METHODOLOGY

The present dose assessment of the Molycorp facility has been performed based on site conditions as they existed prior to the impoundment removal action in the northwestern portion of the site and the Findlay removal action along the boundary between Molycorp and Findlay's properties in the northern portion of the site.

This risk assessment presents the potential radiological consequences (risks) posed by thoriated material at the Molycorp facility in Washington. Pennsylvania. Three general factors are important in assessing these potential consequences:

1) The time periods considered;
2) The degree of land use control; and
3) The location and class of potential human receptors.

2.1 SECTOR ANALYSIS

Consistent with a recommendation by the NRC, the contaminated portions of the facility were modeled separately rather than as one contiguous 17 acre unit. These portions include:

- the northern sector, consisting of the area adjacent to the Findlay property, the area west of the cooling tower and the impoundment area;
- the southern sector, encompassing those areas south of Caldwell Avenue excluding the thorium slag pile (slag-pile);
- the slag-pile; and
- the area beneath the slag-pile

Gamma-logging and borehole data from the Site Characterization Report were used to methodically review and estimate the depth and extent of contamination in each area. The data was analyzed borehole-by-borehole and sample-by-sample to determine the average concentration, the average depth of contamination, and the area and volume of contamination for material with concentrations greater than background (1-2 pCi/g) and greater than 30 pCi/g. The data are summarized in Table 1. The "Alternative Volume" listed in Table 1 refers to the volume of slag that would remain in place after remediation, i.e. soil and slag with a concentration above 1-2 pCi/g but less than 30 pCi/g. The 30 pCi/g concentration is used as the demarcation value because all areas with concentrations above this value will be removed. ~ Th - 16 pCi/g

In this assessment, three time periods are considered: (1) the present, reflecting the facility as it is today; (2) during the proposed remedial actions; and (3) following the completion of the proposed remedial actions.

The analysis was performed for a 1,000 year period. Where possible, site specific parameters from the Site Characterization Report were used in the calculations. In the absence of site specific data, a parameter

TABLE 1
WASHINGTON SITE AREA SECTOR DATA

Sector	Volume (ft^3)			Area (ft^2)		Average Depth of Contaminated Layer (ft)		Average Concentration (pCi/g)	
	>Bkgd	>30	Alternative Volume (>Bkgd-<30)	>Bkgd	>30	>Bkgd	>30	>Bkgd	>30
NORTHERN SECTOR	5.41E+05	3.96E+05	1.45E+05	6.34E+04	6.34E+04	8.5	4.5	35	61
SOUTHERN SECTOR	4.53E+05	2.13E+05	2.398E+05	6.56E+04	6.56E+04	8.0	5.0	37	81
SLAG PILE	N/A	7.5E+05	N/A	N/A	3.2E+04	N/A	N/A	1250	1250
BENEATH SLAG PILE	2.24E+05	1.6E+05	6.4E+04	3.2E+04	3.2E+04	7.0	5.0	37	81

value was selected from the reference literature based on site specific geologic and hydrologic characteristics (e.g., soil porosity, pH. etc.).

The Molycorp facility has been, and will likely continue to be controlled for use as industrial property in the future. Control of the facility as industrial property restricts access by the general public. General public access is limited by facility fencing. The potential nearest residential receptors are identified as those living in the nearest residential dwelling. Under the above assumptions, facility personnel (industrial workers) would also be evaluated as potential receptors. These potential receptors are used in evaluating the potential radiological consequences under the current conditions, during remediation periods, and post-remediation periods for the facility under controlled land use.

In order to establish a base case for the present analysis, uncontrolled use of the Molycorp facility is evaluated using a hypothetical receptor (resident farmer) for the present and post-remediation time periods. It is assumed that the resident farmer receptor lives on the facility, obtains drinking water from a well on the facility, and obtains all food (meat and produce) from the land of the facility. In effect, the resident farmer is totally self-sufficient. The residential farmer receptor is used in evaluating the maximum potential radiological consequences under the current conditions, during remediation periods and post-remediation periods for the facility under this unlikely, scenario.

RESRAD analysis was performed for each sector for each of two cases, "No-Action" and “Residual (Remediated)", and for two distinct scenarios, "Resident Farmer" and "Industrial" (Table 2). These calculations were based on an average contaminated zone thickness of five (5) feet for concentrations greater than 30 pCi/g. Additionally, it was assumed that all contaminated material with a concentration exceeding 30 pCi/g would be removed and the site returned to grade. The calculations were performed in two stages. Initially, the total volume of unconsolidated material with a concentration exceeding background was used to determine the maximum dose and its time of occurrence for both the resident farmer and industrial scenarios. Calculations for these scenarios were repeated using the alternative volume and the depth of clean fill required to return the site to grade. The subject calculations were repeated for each sector and the area beneath the slag pile.

While results from the No-Action alternative employing the resident farmer scenario were determined, they are significant only as a bounding (worst case scenario) case for the subject analysis. The most plausible

TABLE 2
SUMMARY SITE AREA SECTOR DOSE

SECTOR	RESIDENT FARMER SCENARIO				INDUSTRIAL SCENARIO			
	NO ACTION		RESIDUAL		NO ACTION		RESIDUAL	
	DOSE (mrem/yr)	YEAR	DOSE (mrem/yr)	YEAR	DOSE (mrem/yr)	YEAR	DOSE (mrem/yr)	YEAR
NORTHERN	1.156E+03	100.00	2.499E+02	1000	5.079E+02	100.00	2.562E+00	1000
SOUTHERN	1.221E+03	96.90	2.418E+02	1000	5.367E+02	97.50	2.520E+00	1000
BENEATH SLAG PILE	1.216E+03	95.60	2.418E+02	1000	5.321E+02	97.30	2.520E+00	1000

and appropriate scenario for the Molycorp facility based on its history, present, and projected future use, is the industrial scenario.

2.2 THORIUM SLAG PILE ANALYSIS

The slag pile is a mound of soil and slag covered with clean soil and vegetation. It is about 200 feet long by 70 feet wide and 20 feet high. The slag-pile was modeled as a rectangular volume source using the Microshield-4 code published by Grove Engineering. The area occupied by the pile was estimated to be 32,000 ft^2 with a volume of 270,000 ft^3. A density of 2.85 g/cm^3 was used for the soil/slag mixture (1.6 g/cm^3 for thorium slag) in determining the contribution from each of the constituents of the slag material as detailed in the Site Characterization Report. Based on these parameters and an average pile concentration of 1250 pCi/g, the activity of the slag pile was determined to be 15 curies. This activity is about the same as that reported by RSA (12.7 curies) in its May 1975 site analysis report.

Calculations were performed for receptors located at various distances from the side/center and end/center of the slag pile. The receptor locations ranged from ten feet from the edge of the pile at an elevation of 3.3 feet out to five thousand feet. The purpose of the various receptor orientations was to determine the directional dose-impact of the slag-pile on-site as well as at the site boundary.

2.3 CONTRIBUTION FROM RADON

The release of radon-220 into the atmosphere due to the decay of radium-224 (assumed in secular equilibrium with the thorium-232) is a two-step process. Initially, radium decays to gaseous radon in those grains of slag containing thorium. A portion of the gas remains "fixed" in the grain of the material, i.e., diffusion out of the grain is extremely low with a diffusion coefficient on the order of $1x10^{-22}$ cm^2/sec (see Section 5.1.3 of the Site Characterization Report for details). In the second step, some of the gas does however penetrate the capillaries, microfisures and pores of the slag and enters the air or water in the interstitial pore space of the slag/soil material. The emanation coefficient (E) is defined as a fraction of radon which escapes the mineral grain in which it is formed and is free to diffuse through the bulk medium. The emanation coefficient is therefore the escape to production ratio. That which escapes diffuses into the interstitial spaces of the material very quickly. As the radon diffuses upward towards the surface, the atoms decay. Those surviving reach the surface and escape to the atmosphere.

The thoriated slag from the Washington facility can potentially generate radon gas (radon-220 or thoron) as a result of the decay of thorium. Globally, the mean effective dose equivalent due to radon-220 daughters is estimated to be 20 mrem/yr. RESRAD calculations of radon were performed for the most conservative case: the No-Action Alternative. The radon doses for the southern sector, northern sector, and beneath the slag pile were calculated as 12, 11, and 8 mrem/yr respectively.

2.4 K_d SENSITIVITY ANALYSIS

A sensitivity analysis of the thorium-232 distribution coefficient (K_d) was performed. The distribution coefficient is important because it is an indicator of the rate at which thorium could move in the soil if it were released from the slag. The K_d for thorium-232 may vary over several orders of magnitude depending on soil characteristics and other site specific parameters. Based on the Washington site soil porosity, pH, type, etc. as detailed in the Site Characterization Report and a review of the reference literature (Bases and Sharp, 1983, Isherwood, 1981, and Nuclear Safety Association, 1980) a value of 60,000 cm^3/g was selected as the K_d for thorium for the present analysis.

For the sensitivity analysis, the K_d value was allowed to vary from 60,000 cm^3/g down to 6 cm^3/g and the corresponding dose calculated. Between 60,000 and 600 cm^3/g the dose varied by less than 20%. At 60 cm^3/g the dose decreased by 86%, from 2.56 mrem/yr to 0.28 mrem/yr. The reduction in the dose at 6 cm^3/g was even more dramatic, decreasing by almost 100% (99.94) from a dose of 2.56 mrem/yr to a dose of 1.8E-04 mrem/yr. These results demonstrate that the distribution coefficient may have a significant impact on the dose and should be selected carefully.

Based on the Washington site soil characteristics and the reference data, the site specific K_d is more likely to be in the 6,000 to 60,000 range than the 6-60 cm3/g range. Results of the sensitivity analysis are contained in Table 3.

TABLE 3
DISTRIBUTION COEFFICIENT SENSITIVITY ANALYSIS

Th-232 K_d (cm^3/g)	Radium-228 K_d (cm^3/g)	Maximum Dose (mrem/yr)	Year of Maximum Dose	Case	Scenario	Delta (%)
60,000	70	2.56	1000	Residual	Industrial	
6,000	70	2.51	1000	Residual	Industrial	1.88
600	70	2.06	1000	Residual	Industrial	18.00
60	70	0.28	1000	Residual	Industrial	86.41
6	70	1.77E-04	25	Residual	Industrial	99.94

3.0 RESULTS

Results of the analyses for the alternatives are contained in this section. The results demonstrate that the most significant contribution to the total dose comes from the decay products of thorium-232. Thorium-232 and its decay products are assumed in secular equilibrium for calculations of the total dose.

The slag-pile was treated as a separate case and assessed using the Microshield-4 code. It was assumed that the entire slag-pile would be removed as a first priority, consequently, no other remediation schemes were considered for the slag pile. Section 3.1 contains a detailed discussion of the slag pile analysis and Table 4 contains the results of that analysis.

3.1 SLAG PILE RESULTS

The potential maximum dose to a receptor located at the side/center of the slag-pile is 2.13E-01 mrem/year at a distance of ten feet. The approximate distance to the current fence line is twenty feet. The potential maximum dose is 1.31E-01 mrem/yr at twenty feet. The dose at two hundred feet is 4.49E-03 mrem/yr and at five hundred feet (nearest residence) is 3.07E-04 mrem/yr. The doses at one thousand feet and five thousand feet are 1.26E-05 and 1.46E-14 mrem/yr, respectively.

The potential maximum dose to a receptor located at the end/center orientation of the slag-pile is 4.74E-02 mrem/yr at a distance of ten feet. The maximum doses to receptors at distances of 20 feet, 200 feet, 500 feet, 1,000 feet, and 5,000 feet are 3.48E-02, 7.29E-04, 3.87E-05, 1.32E-06 and 1.07E-15 mrem/yr respectively.

3.2 ON-SITE MANAGEMENT ALTERNATIVE

The risks associated with disposal Option 1 (the Hilltop Area) and Option 3 (Railroad Bed Area) are essentially those posed by normal construction (slips, trips, falls, etc.) because there is no contaminated material in this area to be removed prior to storage cell construction. The primary radiation risks will be those associated with the excavating, hauling and placing (rolling packing, grading, etc.) of the thoriated material. These activities will be performed by workers who are required to be trained in the proper handling of radioactive materials. Additionally, the site specific health and safety plan (HASP) will

TABLE 4
Dosage With Respect to Distance from Slag Pile
(1 meter aboveground)

	End/Center		Side/Center	
Distance (feet)	Dose (mrem/hr)	Dose (mrem/yr)	Dose (mrem/hr)	Dose (mrem/yr)
10	5.412E-06	4.74E-02	2.433E-05	2.13E-01
20	3.970E-06	3.48E-02	1.500E-05	1.31E-01
30	2.895E-06	2.54E-02	1.021E-052	8.94E-02
40	2.102E-06	1.84E-02	7.495E-06	6.57E-02
50	1.544E-06	1.35E-02	5.753E-06	5.04E-02
60	1.154E-06	1.01E-02	4.542E-06	3.98E-02
70	8.806E-07	7.71E-03	3.658E-06	3.20E-02
80	6.846E-07	6.00E-03	2.992E-06	2.62E-02
90	5.415E-07	4.74E-03	2.477E-06	2.17E-02
100	4.350E-07	3.81E-03	2.073E-06	1.82E-02
200	8.319E-08	7.29E-04	5.121E-07	4.49E-03
300	2.598E-08	2.28E-04	1.801E-07	1.58E-03
400	1.009E-08	8.84E-05	7.549E-08	6.61E-04
500	4.421E-09	3.87E-05	3.502E-08	3.07E-04
600	2.083E-09	1.82E-05	1.737E-08	1.52E-04
700	1.031E-09	9.03E-06	8.987E-09	7.87E-05
800	5.295E-10	4.64E-06	4.777E-09	4.18E-05
900	2.796E-10	2.45E-06	2.598E-09	2.28E-05
1000	1.509E-10	1.32E-06	1.442E-09	1.26E-05
2000	5.536E-13	4.85E-09	6.291E-12	5.51E-08
3000	3.018E-15	2.64E-11	3.737E-14	3.27E-10
4000	1.868E-17	1.64E-13	2.488E-16	2.14E-12
5000	1.225E-19	1.07E-15	1.665E-18	1.46E-14

address precautions to ensure that worker exposure is kept to a minimum by strict adherence to as low as reasonably achievable (ALARA) procedures.

Based on a total volume of 60,000 yd^3 of material to be excavated with an average concentration of 80 pCi/g, it is estimated that it would require 4,285 truck loads (assuming 14 yd^3/truck) to remove the material. The activities assumed to effect remediation are: excavating, loading, hauling, unloading, and grading. It is assumed that the excavator will also perform the loading and that the trucker or hauler will also perform unloading. It is assumed that the excavating and loading activities will require 30 minutes each. The hauling, unloading and grading activities will require 15 minutes each. Thus, the total time required from excavation to grading per truck load is 1.75 hours. The total number of hours required to excavate and load is 4,285; to haul and unload is 2,143 hours; and to grade this material is 1,072 hours. The corresponding doses for each activity are presented in Table 5. The risks associated with the implementation of disposal Option 3 are similar to those just discussed.

The risk associated with implementation of disposal Option 2 are also similar to the above with the exception that the direct dose would be greater owing to the fact that a volume of contaminated material, approximately 8,000 yd^3, would first have to be removed in order to construct the cell. Thus the amount of time that the worker is in contact with contaminated material would increase, hence the larger dose. Table 8 lists the potential doses for each activity.

Construction of the cell will involve the installation of a liner system followed by the placement of the thoriated material. The thoriated material will be installed in the cell in a series of lifts (i.e., each layer of waste material will be graded, rolled and compacted to exact specifications) until all of the thoriated material has been placed. After the thoriated material has been placed, a cap will be installed consisting of geosynthetic materials, a "biotic layer", cover soil (clean fill), and topsoil. Finally, the entire cell area will be seeded and mulched. The cap serves multiple functions. It serves to minimize erosion and water infiltration and prevents disturbance by burrowing animals and the inadvertent intruder. By design, the thoriated material will not be closer than three (3) feet from the surface.

Couple this with the fact that one foot of soil normally reduces the dose by a factor of 10, two feet by a factor of 100, etc. (Schaiger, 1974) then one would not expect a receptor standing on or in close proximity to the cell to experience any dose. The dose in μR/hr on the surface of an infinite half space can be

TABLE 5
OPTIONS 1 and 3
(Hilltop and Railroad Areas)

Receptor	Dose from Exposure Pathway (mrem)			Total Dose
	Direct	Inhalation	Soil Ingestion	
Excavator	1205	49.9	2.83	1,258.0
Hauler	603	25.1	1.41	629.1
Grader	327	12.5	0.72	339.9

OPTION 2
(Storage Area)

Receptor	Dose from Exposure Pathway (mrem)			Total Dose
	Direct	Inhalation	Soil Ingestion	
Excavator	1366	56.5	3.20	1,425.7
Hauler	683	28.4	1.60	713.0
Grader	370	14.2	0.82	385.0

estimated as 2.5 times the concentration of radium in pCi/g (Schaiger, 1974). As each foot of soil/slag also attenuates the exposure on the surface by a factor of ten, only the near surface thoriated material contributes significantly to surficial dose.

For the Storage Area option, consider first the exposure at surface "a", as illustrated in Figure 1, which is 2.5 times 81 pCi/g or 203 μR/hr. At surface "b" this exposure is reduced by 10^{10} (a factor of ten for the first foot of thoriated material, 100 for the second foot, 1,000 for the third foot, and so on.) Therefore, the contribution of the exposure at surface "a" by the exposure of surface "b" is 2.03E-10 μR/hr or, for all practical purposes, zero.

The exposure at surface "b" due to the 28 pCi/g is 2.5 times 28 pCi/g or 70 μR/hr. Nearly all of this dose is due to the first two feet of thoriated material, again due to self shielding. This is in addition to the 8 μR/hr background dose in the area. As previously noted, one foot of clean soil placed on top of surface "b" will reduce the contribution to 7 μR/hr, two feet will reduce it to 0.7 μR/hr, and three feet to 0.07 μR/hr. Consequently, an individual standing at the surface of the covered thoriated material will receive only a background dose for a cover of three feet or greater.

In the Railroad Area option, only two feet of 28 pCi/g material covers the 81 pCi/g material (see Figure 2). At surface "a" the exposure due to 81 pCi/g thoriated material is 203 μR/hr (2.5 x 81 pCi/g). At surface "b" this exposure is reduced to 2 μR/hr due to the shielding effect of the two feet of 28 pCi/g material. The exposure at surface "b" from the 28 pCi/g material is 70 μR/hr (2.5 x 28 pCi/g). The total exposure at "b" is then 72 μR/hr (70μR/hr + 2 μR/hr). This will be reduced to 7.2 μR/hr with one foot of soil cover, to 0.72 μR/hr with two feet of soil, and 0.072 μR/hr with three feet of soil. Therefore, a person standing on the surface of the thoriated material with three feet or more of natural soil cover would receive only background exposure.

In both the Railroad Area example and the Storage Area example, only two feet of soil covering has been taken into account for calculations. This conservative approach did not include the biotic material nor the other liners discussed as part of the cap for the proposed cell construction.

STORAGE AREA OPTIONS SCHEMATICS

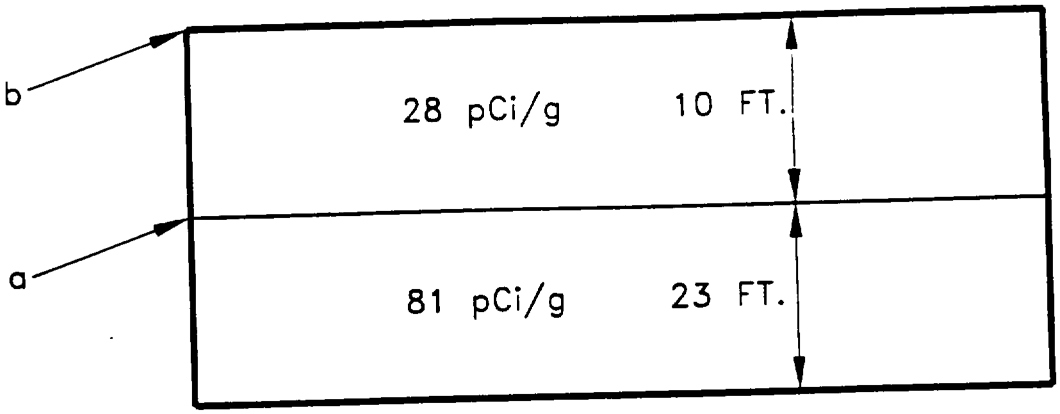


FIGURE 1

Thoriated Material Placement for Open Storage Option

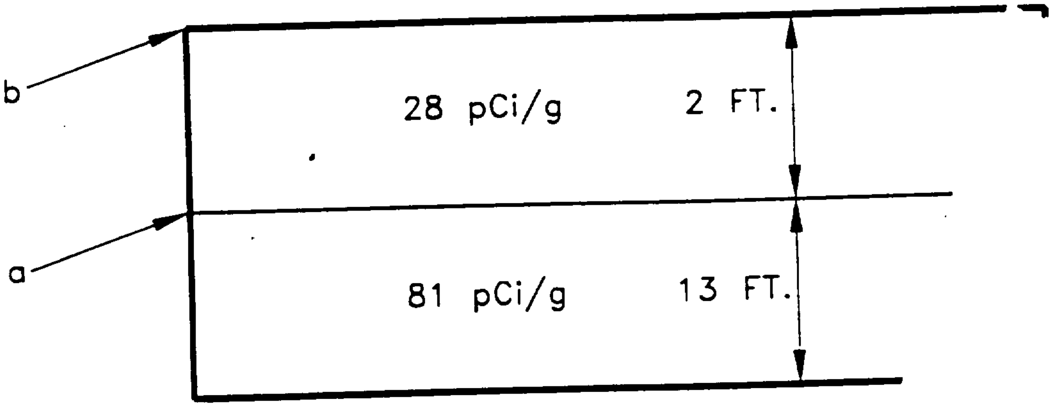


FIGURE 2

Thoriated Material Placement For Railroad Option

The Hill Area option is estimated to have five feet of thoriated material containing 28 pCi/g covering the material containing 81 pCi/g. Total exposure for this option would be greater than that at the surface of the Storage Area option, 0.70 μR/hr, but less than that for the Railroad Area option, 0.72 μR/hr.

During site remediation, controls will be in place to eliminate potential exposures to the casual observer at the fence line and the closest nearby resident. Unlike the thorium slag-pile which is above ground, the thoriated material in question for the majority of the site is below ground. Thus the individual receiving the maximum dose is the occupational worker. Previous analysis has already shown that the hourly dose received by the occupational worker is very small (determined by assuming that the worker is standing on the material). Thus the maximum potential dose(s) received by any casual receptor at the fence line or the closest nearby resident, will be a small fraction of the potential direct dose received by the occupational worker. The subject dose(s) at these locations will be bounded by the dose(s) received by these receptors from the thorium slag-pile.

3.3 DISPOSAL AT AN NRC APPROVED, LICENCED COMMERCIAL FACILITY

The risks associated with this alternative are primarily those incurred by workers as the site is being remediated. Thus, the hours required for excavating and loading the material will be similar to those discussed above. The direct dose to the driver will be bounded by the requirements of 10 CFR 71 which require that the dose at 1 meter from the side center of the truck not exceed 2 mR/hr. The primary exposure pathway will be that from direct exposure to the contaminated material, and the doses realized will be directly reflective of the concentration of material being handled and the length of time that the worker is in contact with the material. For the most part, the radiation risks associated with this alternative will be most similar to those for disposal Options 1 and 3. As previously stated, these activities will be performed by workers who are trained in the proper handling of radioactive materials and the site specific health and safety plan will be in place to ensure that worker exposure(s) are minimized.

3.4 NO-ACTION MANAGEMENT ALTERNATIVE

For the no-action alternative, the maximum annual dose for the resident farmer scenario is about 1.2 rem for each of the sectors and occurs around year 100.* The resident farmer lives on-site in the shadow of the slag pile for this case. The maximum annual dose for the no-action industrial scenario is about

* Two o's 2

530 millirem for each sector and occurs at year 100. For comparison, the maximum dose for the residual or remediated case for the resident farmer scenario is about 250 mrem/yr for each sector and occurs at year 1,000. The maximum dose for the industrial scenario for each sector is about 2.5 mrem/yr and occurs at year 1,000. The summary results for all sectors are presented in Table 2. Detailed results for each sector are presented in Tables 6 to 8.

3.5 TRANSPORTATION RISK ANALYSIS

Transportation risks for the transport of the waste material from the Molycorp site in Washington, PA to the Envirocare facility near Clive, Utah were determined using the RADTRAN-4 Computer code. The analysis was performed under the assumption that the waste material would be contained in B-25 boxes,. It was also assumed that transport would be incident-free (no accidents) using RADTRAN-4 defaults, with the exception that the actual population distribution from Washington, PA to the Envirocare facility was used.

Method

Initially, the Microshield-4 code (MSHLD4) was used to determine the dose to a receptor on the exterior of a B-25 container assuming a 1 pCi/g concentration. This value was subsequently used to determine the source terms for the slag-pile. Washington site and York waste materials (305E-01, 1.92E-02, and 7.31E-03 mrem/hr, respectively).

Next, based on the total volume of waste material associated with the slag-pile, Washington site and York waste materials, the number of waste packages for each source was determined, for input into the code. It was assumed that each package contained 3 yd^3 of waste material. The unit dose in person-rem for each of four receptors was subsequently determined. The "Crew" dose is the collective dose to two drivers. The "Off-Link" dose is the collective dose to the population living along the transportation route. The "On-Line" dose is the collective dose to people in cars traveling near the truck. The "Stops" dose is the collective dose to people who are exposed at truck stops. The Maximum Individual dose is the dose in rem,

TABLE 6
NORTHERN SECTOR

PATHWAY	RESIDENT FARMER SCENARIO				INDUSTRIAL SCENARIO			
	NO ACTION MAX DOSE @ YEAR: 97.8		RESIDUAL MAX DOSE @ YEAR: 1000		NO ACTION MAX DOSE @ YEAR: 100		RESIDUAL MAX DOSE @ YEAR: 1000	
	DOSE (mrem/yr)	%	DOSE (mrem/yr)	%	DOSE (mrem/yr)	%	DOSE (mrem/yr)	%
External Gamma	4.457E+02	38.55	2.562E+00	1.05	4.457E+02	87.77	2.562E+00	100.00
Inhalation (w/o radon)	4.870E+01	4.21	0.000E+00	0.00	4.866E+01	9.58	0.000E+00	0.00
Plant Ingestion	6.247E+02	54.03	2.353E+02	96.05	SUPPRESSED	0.00	SUPPRESSED	0.00
Meat Ingestion	1.306E+01	1.13	3.967E+00	1.62	SUPPRESSED	0.00	SUPPRESSED	0.00
Milk Ingestion	1.028E+01	0.89	3.137E+00	1.28	SUPPRESSED	0.00	SUPPRESSED	0.00
Aquatic Foods	0.000E+00	0.00	0.000E+00	0.00	SUPPRESSED	0.00	SUPPRESSED	0.00
Drinking Water	0.000E+00	0.00	0.000E+00	0.00	0.00E+00	0.00	0.000E+00	0.00
Soil Ingestion	2.723E+00	0.24	0.000E+00	0.00	2.723E+00	0.54	0.000E+00	0.00
Radon	1.094E+01	0.95	0.000E+00	0.00	1.074E+01	2.11	0.000E+00	0.00
TOTAL	1.156E+03	100.00	2.499E+02	100.00	5.079E+02	100.00	2.562E+00	100.00

TABLE 7
SOUTHERN SECTOR

PATHWAY	RESIDENT FARMER SCENARIO				INDUSTRIAL SCENARIO			
	NO ACTION MAX DOSE @ YEAR: 96.9		RESIDUAL MAX DOSE @ YEAR: 1000		NO ACTION MAX DOSE @ YEAR: 97.5		RESIDUAL MAX DOSE @ YEAR: 100	
	DOSE (mrem/yr)	%	DOSE (mrem/yr)	%	DOSE (mrem/yr)	%	DOSE (mrem/yr)	%
External Gamma	4.705E+02	38.54	2.520E+00	1.04	4.705E+02	87.68	2.52E+00	100.00
Inhalation (w/o radon)	5.150E+01	4.22	0.000E+00	0.00	5.150E+01	9.60	0.000E+00	0.00
Plant Ingestion	6.595E+02	54.02	2.323E+02	96.06	SUPPRESSED	0.00	SUPPRESSED	0.00
Meat Ingestion	1.379E+01	1.13	3.915E+00	1.62	SUPPRESSED	0.00	SUPPRESSED	0.00
Milk Ingestion	1.086E+01	0.89	3.096E+00	1.28	SUPPRESSED	0.00	SUPPRESSED	0.00
Aquatic Foods	0.000E+00	0.00	0.000E+00	0.00	SUPPRESSED	0.00	SUPPRESSED	0.00
Drinking Water	0.000E+00	0.00	0.000E+00	0.00	0.00E+00	0.00	0.000E+00	0.00
Soil Ingestion	2.877E+00	0.24	0.000E+00	0.00	2.877E+00	0.54	0.000E+00	0.00
Radon	1.176E+01	0.96	0.000E+00	0.00	1.176E+01	2.19	0.000E+00	0.00
TOTAL	1.221E+03	100.00	2.418E+02	100.00	5.367E+02	100.00	2.520E+00	100.00

TABLE 8
BENEATH SLAG PILE SECTOR

PATHWAY	RESIDENT FARMER SCENARIO				INDUSTRIAL SCENARIO			
	NO ACTION MAX DOSE @ YEAR: 95.9		RESIDUAL MAX DOSE @ YEAR: 1000		NO ACTION MAX DOSE @ YEAR: 97.3		RESIDUAL MAX DOSE @ YEAR: 100	
	DOSE (mrem/yr)	%	DOSE (mrem/yr)	%	DOSE (mrem/yr)	%	DOSE (mrem/yr)	%
External Gamma	4.705E+02	38.69	2.520E+00	1.04	4.705E+02	88.43	2.520E+00	100.00
Inhalation (w/o radon)	5.069+E+01	4.17	0.000E+00	0.00	5.069E+01	9.53	0.000E+00	0.00
Plant Ingestion	6.595E+02	54.22	2.323E+02	96.06	SUPPRESSED	0.00	SUPPRESSED	0.00
Meat Ingestion	1.379E+01	1.13	3.915E+00	1.62	SUPPRESSED	0.00	SUPPRESSED	0.00
Milk Ingestion	1.086E+01	0.89	3.096E+00	1.28	SUPPRESSED	0.00	SUPPRESSED	0.00
Aquatic Foods	0.000E+00	0.00	0.000E+00	0.00	SUPPRESSED	0.00	SUPPRESSED	0.00
Drinking Water	0.000E+00	0.00	0.000E+00	0.00	0.000E+00	0.00	0.000E+00	0.00
Soil Ingestion	2.877E+00	0.24	0.000E+00	0.00	2.877E+00	0.54	0.000E+00	0.00
Radon	8.004E+00	0.66	0.000E+00	0.00	8.004E+00	1.50	0.000E+00	0.00
TOTAL	1.216E+03	100.00	2.418E+02	100.00	5.321E+02	100.00	2.520E+00	100.00

to the highest exposed individual (from Off-Link, On-Line, and Stops). Finally, the total exposure for each dose category was determined by summing the results for the three source terms.

Results

The results demonstrate that the transport of the waste material from Washington, PA to Envirocare will have little radiological impact upon the public. The total collective dose to the crew for the totality of shipment of the 25,000 waste packages is about 25 rem. The occupational limit for workers is 5 rem/yr. On that basis and on the basis of the number of trips that have to be made, and in concert with ALARA principles, many drivers would be used for the transport of the waste material. The total collective dose to a person living along the transport route is 1.38E-01 person-rem. The total collective dose received by a receptor in an automobile traveling alongside the truck is 1.30 person-rem. For the casual observer walking by the truck while it is parked at a truck stop, the total collective dose is about 12 person-rem. Finally, the maximum total individual dose from all sources is 1.07E-05 rem. Details of the calculations are presented in Table 9.

RADTRAN-4 also estimates the radiation exposure of people in the vicinity of an accidental release of radioactive material by assuming that the released material is carried through air. The code employs a simple air dispersion model to determine how much radioactive material is breathed in by people or is deposited on the ground in the surrounding area. The model assumes that all the material carried by the vehicle is available to be released. For example, in the event of a truck accident, the material from all packages would be available for release. The user tells the code what fraction of the material is released. The release fractions used for this analysis are consistent with those used for transporting soil-like material for other RADTRAN analyses. The dose value itself is a function of the probability of occurrence for an accident in one of eight severity categories. That is the dose is not representative of a single accident, but rather a series of accidents of different probability and severity. The dose is an average of the eight accident severity categories.

As can be seen from Table 10, all of the dose is contributed by thorium-232 and thorium-228, (the latter is in secular equilibrium with thorium 232).

TABLE 9
MOLYCORP RADTRAN4 ANALYSIS

Molycorp RADTRAN Analysis

Microshield for B-25, assuming a 1 pCi/g Concentration is 2.44 E-04 mR/hr.

Source	Packages (3 yd^3 per stack)	Concentration (pCi/g)	Dose Rate (mR/hr)		
Washington	15,000	81	1.97E-02		
Washington, Slag pile	3,333	1,250	3.05E-01		
York	1,667	30	7.31E-03		

Unit RADTRAN4 Results
(person-rem)

	Crew (2 persons)	Off-Link	On-Link	Stops	Maximum Individual (rem)
	1.92E-02	1.04E-04	9.83E-04	9.09E-03	8.09E-09

Source	Collective Dose, person-rem				Max. Ind. Dose, rem
Washington	5.67E+00	3.07E-02	2.90E-01	2.69E+00	2.39E-06
Washington, Slag pile	1.95E+01	1.06E-01	9.99E-01	9.24E+00	8.22E-06
York	2.34E-01	1.27E-03	1.20E-02	1.11E-01	9.86E-08
Total	2.54E+01	1.38E-01	1.30E+00	1.20E+01	1.07E-05

TABLE 10

RADTRAN-4 TRANSPORTATION ACCIDENT ANALYSIS

Source Type	Accident Dose, person-rem	Key Radionuclide Contributions
Washington Slag Pile	0.143	Th-228 (13%), Th-232 (87%)
Washington Soil	0.00171	Th-228 (13%), Th-232 (87%)
York Soil	0.0416	Th-228 (13%), Th-232 (87%)

4.0 SUMMARY AND DISCUSSION

In summary, the total effective dose equivalent for the hypothetical maximally exposed person under the no-action alternative (resident farmer scenario) is about 3.6 rem. This is a gross over conservatism that was obtained by adding the maximum exposures from each of the sectors and the slag pile to obtain a total site dose. In actuality, the site dose is most likely similar to that obtained for any one of the area sectors, 1.2 rem/yr.

For the no-action alternative industrial scenario, the total effective dose equivalent is about 1.6 rem for the site dose, using a similar method as that described above. The site dose from any individual sector would be approximately 0.5 rem/yr.

The doses following site remediation for the resident farmer and industrial scenarios are 0.734 rem/yr and 0.0076 rem/yr, respectively.

The resident farmer scenario for the no-action case assumes that a house is built on-site in the shadow of the slag-pile, crops are being raised for consumption by a family that has moved onto the site. Moreover, the family has sunk a well on the edge of the property from which it obtains its drinking water and waters its crops and livestock. This scenario further assumes that the livestock raised on the site is consumed by the family, as well as fish caught from a nearby stream. The total of the exposures associated with each of these assumptions accounts for the dose to the maximally exposed individual for this scenario (i.e., the sum of external and internal exposures). The case at the Washington Facility is that the direct exposure components to the industrial worker receptor is the only one that is truly viable, and even for this most conservative case that value is about 450 mrem/yr.

Finally, the exposure of any nearby residence is so small as not to be detectable by currently available technology and methods.

5.0 ADVANTAGES AND DISADVANTAGES OF EVALUATED ALTERNATIVES

Three alternative disposition methods were investigated leading to the decision to proceed with an on-site storage license application. These alternatives are:

- On-site storage in an engineered storage cell (three proposed locations)
- Disposal at an NRC licensed existing commercial disposal facility
- No-Action

The advantages and disadvantages of these alternatives are briefly described.

5.1 OFF-SITE MANAGEMENT ALTERNATIVE

This alternative consists of removing the material from the site and transporting it off-site for disposal at the Environcare Facility in Clive, Utah or the ChemNuclear Services Facility in Barnwell, SC, or another NRC approved, licensed commercial facility.

Advantages

This alternative has two essential advantages, (1) off-site disposal would satisfy currently accepted NRC requirements and (2) public concern over the ultimate disposition of the thorium bearing material would be alleviated.

Disadvantages

The primary disadvantage of proceeding with this alternative is loss of material control in conjunction with maintained liability of a material in perpetuity.

An additional disadvantage of this alternative is that transport of the material will occur in either trucks or rail cars over long distances (>1,000 miles) on established routes. This transportation creates the potential for off-site releases due to accidents.

5.2 ON-SITE MANAGEMENT ALTERNATIVE

The on-site storage alternative consists of removing the thorium bearing material with a concentration greater than 30 pCi/g from its present locations and placing this material in a Molycorp cell engineered under the provisions of NRC regulations. The proposed action entails storage of the material using one of three location options (Hilltop Area, Open Storage Area, and the Railroad Bed Area) in a cell specifically designed for the thorium-bearing material.

Advantages

The major advantage of this alternative is that Molycorp maintains control of the thoriated material while at the same time protecting the public and the environment. Additionally, any of the proposed cell locations will minimize the distance that material would have to be transported.

Disadvantages

The primary disadvantage of this scenario is restricted use of the cell area devoted to long term storage of the thoriated material.

5.3 NO-ACTION MANAGEMENT ALTERNATIVE

As previously mentioned, the no-action alternative consists of maintaining the current status of site contamination as continued long-term storage with appropriate monitoring and maintenance. The regulators (NRC, DEP, etc.), the public, and Molycorp, Inc. are all in apparent agreement that the no-action alternative is an unacceptable option, and has been considered only to serve as a base case. No advantages or disadvantages are presented.

APPENDIX O

R.S. MEANS HEAVY CONSTRUCTION COST DATA

RSMeans

Heavy Construction Cost Data

11th Annual Edition

1997

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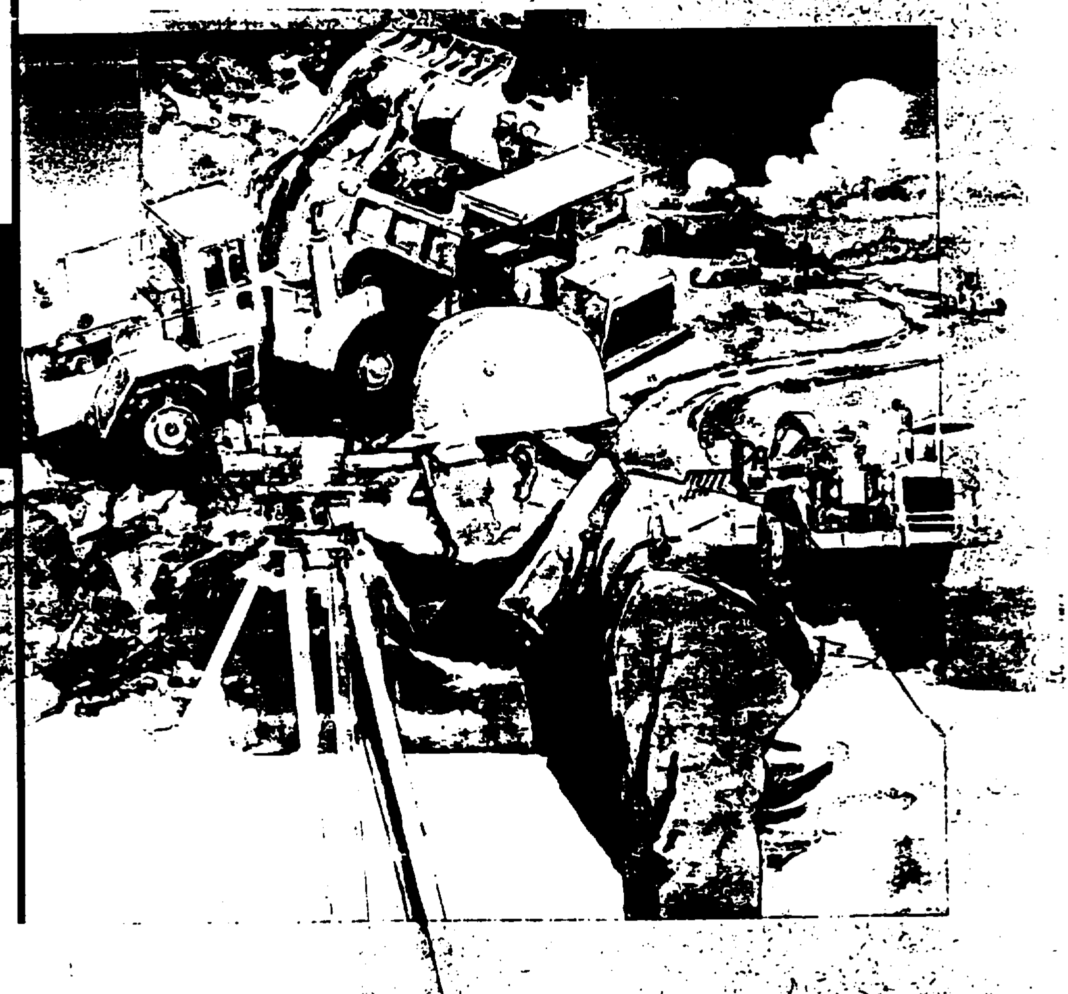

1997

020 750 | Concrete Removal

			CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1997 BARE COSTS				TOTAL INCL O&P
							MAT.	LABOR	EQUIP.	TOTAL	
880	2050	Disposal of decontaminated soil, minimum R020-880				C.Y.					58
	2055	Maximum				↓					100

021 | Site Preparation & Excavation Support

021 100 | Site Clearing

			CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1997 BARE COSTS				TOTAL INCL O&P
							MAT.	LABOR	EQUIP.	TOTAL	
104	0010	**CLEAR AND GRUB** Cut & chip light, trees to 6" diam.	B-7	1	48	Acre		1,050	1,125	2,175	2,900
	0150	Grub stumps and remove	B-30	2	12			278	785	1,063	1,300
	0200	Cut & chip medium, trees to 12" diam.	B-7	.70	68.571			1,475	1,600	3,075	4,125
	0250	Grub stumps and remove	B-30	1	24			555	1,575	2,130	2,575
	0300	Cut & chip heavy, trees to 24" diam.	B-7	.30	160			3,475	3,750	7,225	9,600
	0350	Grub stumps and remove	B-30	.50	48			1,100	3,150	4,250	5,150
	0400	If burning is allowed, reduce cut & chip				↓					40%
	3000	Chipping stumps, to 18" deep, 12" diam.	B-86	20	.400	Ea.		10.70	7.95	18.65	25
	3040	18" diameter		16	.500			13.40	9.90	23.30	31.50
	3080	24" diameter		14	.571			15.30	11.35	26.65	36
	3100	30" diameter		12	.667			17.85	13.25	31.10	42
	3120	36" diameter		10	.800			21.50	15.85	37.35	50.50
	3160	48" diameter	↓	8	1	↓		27	19.85	46.85	63
	5000	Tree thinning, feller buncher, conifer									
	5080	Up to 8" diameter	B-93	240	.033	Ea.		.89	1.47	2.36	2.99
	5120	12" diameter		160	.050			1.34	2.21	3.55	4.48
	5240	Hardwood, up to 4" diameter		240	.033			.89	1.47	2.36	2.99
	5280	8" diameter		180	.044			1.19	1.97	3.16	3.98
	5320	12" diameter	↓	120	.067	↓		1.79	2.95	4.74	5.95
	7000	Tree removal, congested area, aerial lift truck									
	7040	8" diameter	B-85	7	5.714	Ea.		124	115	239	320
	7080	12" diameter		6	6.667			145	134	279	375
	7120	18" diameter		5	8			174	161	335	450
	7160	24" diameter		4	10			218	201	419	560
	7240	36" diameter		3	13.333			290	268	558	750
	7280	48" diameter	↓	2	20	↓		435	400	835	1,125
108	0010	**CLEARING** Brush with brush saw	A-1	.25	32	Acre		650	243	893	1,300
	0100	By hand		.12	66.667			1,350	505	1,855	2,700
	0300	With dozer, ball and chain, light clearing	B-11A	2	8			188	425	613	765
	0400	Medium clearing		1.50	10.667			251	570	821	1,025
	0500	With dozer and brush rake, light	B-11B	1	16			375	1,075	1,450	1,750
	0550	Medium brush to 4" diameter		.60	26.667			625	1,775	2,400	2,925
	0600	Heavy brush to 4" diameter	↓	.40	40	↓		940	2,675	3,615	4,425
	1000	Brush mowing, tractor w/rotary mower, no removal									
	1020	Light density	B-84	2	4	Acre		107	104	211	279
	1040	Medium density		1.50	5.333			143	139	282	370
	1080	Heavy density	↓	1	8	↓		214	208	422	560
116	0010	**FELLING TREES & PILING** With tractor, large tract, firm									
	0020	level terrain, no boulders, less than 12" diam. trees									
	0300	300 HP dozer, up to 400 trees/acre, 0 to 25% hardwoods	B-10M	.75	16	Acre		395	1,475	1,870	2,225
	0340	25% to 50% hardwoods		.60	20			490	1,850	2,340	2,775
	0370	75% to 100% hardwoods		.45	26.667			655	2,475	3,130	3,750
	0400	500 trees/acre, 0% to 25% hardwoods	↓	.60	20	↓		490	1,850	2,340	2,775

021 | Site Preparation & Excavation Support

021 700 | Cofferdams

			CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1997 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P
704	0010	COFFERDAMS Incl. mobilization, temporary sheeting, shore driven	B-40	960	.067	S.F.	10.35	1.75	2	14.10	16.50
	0060	Barge driven	•	550	.116	•	10.30	3.06	3.49	16.85	20.50
	6000	See also div. 021-614									

022 | Earthwork

022 100 | Grading

			CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1997 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P
104	0010	GRADING Site excav. & fill, see div 022-200									
	0020	Fine grading, see div 025-122									

022 200 | Excav./Backfill/Compact.

			CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1997 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P
204	0010	BACKFILL By hand, no compaction, light soil R022-220	1 Clab	14	.571	C.Y.		11.55		11.55	18.35
	0100	Heavy soil		11	.727			14.75		14.75	23.50
	0300	Compaction in 6" layers, hand tamp, add to above		20.60	.388			7.85		7.85	12.50
	0400	Roller compaction operator walking, add	B-10A	100	.120			2.95	.86	3.81	5.50
	0500	Air tamp, add	B-9	190	.211			4.35	.86	5.21	7.85
	0600	Vibrating plate, add	A-1	60	.133			2.70	1.01	3.71	5.40
	0800	Compaction in 12" layers, hand tamp, add to above	1 Clab	34	.235			4.76		4.76	7.55
	0900	Roller compaction operator walking, add	B-10A	150	.080			1.97	.57	2.54	3.67
	1000	Air tamp, add	B-9	285	.140			2.90	.57	3.47	5.25
	1100	Vibrating plate, add	A-1	90	089			1.80	.67	2.47	3.60
208	0010	BACKFILL, STRUCTURAL Dozer or F.E. loader									
	0020	From existing stockpile, no compaction									
	2000	75 H.P., 50' haul, sand & gravel	B-10L	1,100	.011	C.Y.		.27	.26	.53	.70
	2020	Common earth		975	.012			.30	.29	.59	.79
	2040	Clay		850	.014			.35	.34	.69	.91
	2200	150' haul, sand & gravel		550	.022			.54	.52	1.06	1.40
	2220	Common earth		490	.024			.60	.58	1.18	1.57
	2240	Clay		425	.028			.70	.67	1.37	1.81
	2400	300' haul, sand & gravel		370	.032			.80	.77	1.57	2.08
	2420	Common earth		330	.036			.90	.86	1.76	2.33
	2440	Clay		290	.041			1.02	.98	2	2.65
	3000	105 H.P., 50' haul, sand & gravel	B-10W	1,350	.009			.22	.31	.53	.68
	3020	Common earth		1,225	.010			.24	.34	.58	.75
	3040	Clay		1,100	.011			.27	.38	.65	.84
	3200	150' haul, sand & gravel		670	.018			.44	.63	1.07	1.37
	3220	Common earth		610	.020			.48	.69	1.17	1.51
	3240	Clay		550	.022			.54	.76	1.30	1.67
	3300	300' haul, sand & gravel		465	.026			.64	.90	1.54	1.98
	3320	Common earth		415	.029			.71	1.01	1.72	2.21
	3340	Clay		370	.032			.80	1.14	1.94	2.48
	4000	200 H.P., 50' haul, sand & gravel	B-10B	2,500	.005			.12	.34	.46	.56
	4020	Common earth		2,200	.005			.13	.39	.52	.64
	4040	Clay		1,950	.006			.15	.44	.59	.71
	4200	150' haul, sand & gravel		1,225	.010			.24	.70	.94	1.14
	4220	Common earth		1,100	.011			.27	.78	1.05	1.27
	4240	Clay		975	.012			.30	.88	1.18	1.43
	4400	300' haul, sand & gravel		805	.015			.37	1.06	1.43	1.74
	4420	Common earth		735	.016			.40	1.16	1.56	1.90

022 | Earthwork

022 200 | Excav./Backfill/Compact.

			CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1997 BARE COSTS				TOTAL INCL O&P
							MAT.	LABOR	EQUIP.	TOTAL	
208	4440	Clay	B-10B	660	.018	C.Y.		.45	1.29	1.74	2.11
	5000	300 H.P., 50' haul, sand & gravel	B-10M	3,170	.004			.09	.35	.44	.53
	5020	Common earth		2,900	.004			.10	.38	.48	.58
	5040	Clay		2,700	.004			.11	.41	.52	.62
	5200	150' haul, sand & gravel		2,200	.005			.13	.50	.63	.77
	5220	Common earth		1,950	.006			.15	.57	.72	.86
	5240	Clay		1,700	.007			.17	.65	.82	.99
	5400	300' haul, sand & gravel		1,500	.008			.20	.74	.94	1.11
	5420	Common earth		1,350	.009			.22	.82	1.04	1.25
	5440	Clay		1,225	.010			.24	.91	1.15	1.37
	6000	For compaction, see div. 022-226									
	6010	For trench backfill, see div. 022-254 & 258									
216	0011	**BORROW** Bank measure, loaded onto 12 C.Y. hauler, no haul incl.									
	4000	Common earth, shovel, 1 C.Y. bucket	B-12N	840	.019	C.Y.	4.05	.48	.74	5.27	6
	4010	1-1/2 C.Y. bucket	B-12O	1,135	.014		4.05	.36	.79	5.20	5.90
	4020	3 C.Y. bucket	B-12T	1,800	.009		4.05	.23	.68	4.96	5.55
	4030	Front end loader, wheel mounted									
	4050	3/4 C.Y. bucket 	B-10R	550	.022	C.Y.	4.05	.54	.42	5.01	5.75
	4060	1-1/2 C.Y. bucket	B-10S	970	.012		4.05	.30	.32	4.67	5.30
	4070	3 C.Y. bucket	B-10T	1,575	.008		4.05	.19	.27	4.51	5.05
	4080	5 C.Y. bucket	B-10U	2,600	.005		4.05	.11	.34	4.50	5
	5000	Select granular fill, shovel, 1 C.Y. bucket	B-12N	925	.017		5.65	.44	.67	6.76	7.60
	5010	1-1/2 C.Y. bucket	B-12O	1,250	.013		5.65	.32	.72	6.69	7.50
	5020	3 C.Y. bucket	B-12T	1,980	.008		5.65	.20	.62	6.47	7.20
	5030	Front end loader, wheel mounted									
	5050	3/4 C.Y. bucket	B-10R	800	.015	C.Y.	5.65	.37	.29	6.31	7.10
	5060	1-1/2 C.Y. bucket	B-10S	1,065	.011		5.65	.28	.29	6.22	6.95
	5070	3 C.Y. bucket	B-10T	1,735	.007		5.65	.17	.25	6.07	6.75
	5080	5 C.Y. bucket	B-10U	2,850	.004		5.65	.10	.31	6.06	6.70
	6000	Clay, till, or blasted rock, shovel, 1 C.Y. bucket	B-12N	715	.022		4	.57	.87	5.44	6.25
	6010	1-1/2 C.Y. bucket	B-12O	965	.017		4	.42	.93	5.35	6.05
	6020	3 C.Y. bucket	B-12T	1,530	.010		4	.27	.80	5.07	5.70
	6030	Front end loader, wheel mounted									
	6035	3/4 C.Y. bucket	B-10R	465	.026	C.Y.	4	.64	.50	5.14	5.95
	6040	1-1/2 C.Y. bucket	B-10S	825	.015		4	.36	.38	4.74	5.35
	6045	3 C.Y. bucket	B-10T	1,340	.009		4	.22	.32	4.54	5.10
	6050	5 C.Y. bucket	B-10U	2,200	.005		4	.13	.40	4.53	5.05
	6060	Front end loader, track mounted									
	6065	1-1/2 C.Y. bucket	B-10N	715	.017	C.Y.	4	.41	.51	4.92	5.60
	6070	3 C.Y. bucket	B-10P	1,190	.010		4	.25	.69	4.94	5.55
	6075	5 C.Y. bucket	B-10Q	1,835	.007		4	.16	.62	4.78	5.35
	7000	Topsoil or loam from stockpile, shovel, 1 C.Y. bucket	B-12N	840	.019		15.55	.48	.74	16.77	18.65
	7010	1-1/2 C.Y. bucket	B-12O	1,135	.014		15.55	.36	.79	16.70	18.50
	7020	3 C.Y. bucket	B-12T	1,800	.009		15.50	.23	.68	16.41	18.15
	7030	Front end loader, wheel mounted									
	7050	3/4 C.Y. bucket	B-10R	550	.022	C.Y.	15.55	.54	.42	16.51	18.40
	7060	1-1/2 C.Y. bucket	B-10S	970	.012		15.55	.30	.32	16.17	17.90
	7070	3 C.Y. bucket	B-10T	1,575	.008		15.55	.19	.27	16.01	17.70
	7080	5 C.Y. bucket	B-10U	2,600	.005		15.55	.11	.34	16	17.65
	8900	For larger hauling units, deduct from above								30%	
	9000	Hauling only, excavated or borrow material, see div. 022-266									
226	0010	**COMPACTION** R022-220									
	0500	Terra Probe, deep sand, vibrating, 30,000 C.Y., minimum	B-43	1,779	.027	C.Y.		.60	.94	1.54	1.98
	0520	Maximum	•	1,078	.045	•		.99	1.56	2.55	3.26
	0540	Mobilization & demobilization, minimum	B-8	.53	101	Total		2,300	3,500	5,800	7,450

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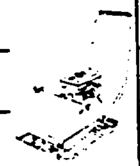
			CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1997 BARE COSTS				TOTAL INCL O&P	
							MAT.	LABOR	EQUIP.	TOTAL		
226	0560	Maximum R022-220	B-8	.48	133	Total		3,025	4,600	7,625	9,775	226
	5000	Riding, vibrating roller, 6" lifts, 2 passes	B-10Y	2,600	.005	C.Y.		.11	.13	.24	.32	
	5020	3 passes		1,735	.007			.17	.20	.37	.48	
	5040	4 passes		1,300	.009			.23	.26	.49	.64	
	5060	12" lifts, 2 passes		5,200	.002			.06	.07	.13	.16	
	5080	3 passes		3,500	.003			.08	.10	.18	.24	
	5100	4 passes		2,600	.005			.11	.13	.24	.32	
	5600	Sheepsfoot or wobbly wheel roller, 6" lifts, 2 passes	B-10G	2,600	.005			.11	.21	.32	.41	
	5620	3 passes		1,735	.007			.17	.32	.49	.61	
	5640	4 passes		1,300	.009			.23	.42	.65	.81	
	5680	12" lifts, 2 passes		5,200	.002			.06	.11	.17	.21	
	5700	3 passes		3,500	.003			.08	.16	.24	.30	
	5720	4 passes		2,600	.005			.11	.21	.32	.41	
	6000	Towed sheepsfoot or wobbly wheel roller, 6" lifts, 2 passes	B-10D	3,000	.004			.10	.32	.42	.51	
	6020	3 passes		2,000	.006			.15	.48	.63	.76	
	6030	4 passes		1,500	.008			.20	.65	.85	1.01	
	6050	12" lifts, 2 passes		6,000	.002			.05	.16	.21	.26	
	6060	3 passes		4,000	.003			.07	.24	.31	.38	
	6070	4 passes		3,000	.004			.10	.32	.42	.51	
	6200	Vibrating roller, 6" lifts, 2 passes	B-10C	2,600	.005			.11	.37	.48	.58	
	6210	3 passes		1,735	.007			.17	.55	.72	.87	
	6220	4 passes		1,300	.009			.23	.73	.96	1.16	
	6250	12" lifts, 2 passes		5,200	.002			.06	.18	.24	.29	
	6260	3 passes		3,465	.003			.09	.28	.37	.43	
	6270	4 passes		2,600	.005			.11	.37	.48	.58	
	7000	Walk behind, vibrating plate 18" wide, 6" lifts, 2 passes	A-1	280	.029			.58	.22	.80	1.16	
	7020	3 passes		185	.043			.88	.33	1.21	1.75	
	7040	4 passes		140	.057			1.16	.43	1.59	2.32	
	7200	12" lifts, 2 passes		560	.014			.29	.11	.40	.58	
	7220	3 passes 		375	.021			.43	.16	.59	.87	
	7240	4 passes		280	.029			.58	.22	.80	1.16	
	7500	Vibrating roller 24" wide, 6" lifts, 2 passes	B-10A	420	.029			.70	.20	.90	1.31	
	7520	3 passes		280	.043			1.06	.31	1.37	1.97	
	7540	4 passes		210	.057			1.41	.41	1.82	2.62	
	7600	12" lifts, 2 passes		840	.014			.35	.10	.45	.65	
	7620	3 passes		560	.021			.53	.15	.68	.99	
	7640	4 passes		420	.029			.70	.20	.90	1.31	
	8000	Rammer tamper, 6" to 11", 4" lifts, 2 passes	A-1	130	.062			1.25	.47	1.72	2.49	
	8050	3 passes		97	.082			1.67	.63	2.30	3.34	
	8100	4 passes		65	.123			2.49	.93	3.42	4.99	
	8200	8" lifts, 2 passes		260	.031			.62	.23	.85	1.25	
	8250	3 passes		195	.041			.83	.31	1.14	1.66	
	8300	4 passes		130	.062			1.25	.47	1.72	2.49	
	8400	13" to 18", 4" lifts, 2 passes		390	.021			.42	.16	.58	.83	
	8450	3 passes		290	.028			.56	.21	.77	1.12	
	8500	4 passes		195	.041			.83	.31	1.14	1.66	
	8600	8" lifts, 2 passes		780	.010			.21	.08	.29	.42	
	8650	3 passes		585	.014			.28	.10	.38	.55	
	8700	4 passes		390	.021			.42	.16	.58	.83	
230	0010	**DRILLING ONLY** 2" hole for rock bolts, average	B-47	395	.061	L.F.		1.38	1.44	2.82	3.74	23
	0800	2-1/2" hole for pre-splitting, average		540	.044			1.01	1.05	2.06	2.74	
	1600	Quarry operations, 2-1/2" to 3-1/2" diameter		715	.034			.76	.79	1.55	2.06	
	1610	6" diameter drill holes	B-47A	1,350	.018			.43	.34	.77	1.04	
234	0010	**DRILLING AND BLASTING** Only, rock, open face, under 1500 C.Y.	B-47	225	.107	C.Y.	1.58	2.42	2.53	6.53	8.30	23
	0100	Over 1500 C.Y.		300	.080		1.58	1.82	1.89	5.29	6.65	

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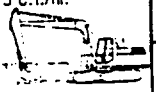
				DAILY	LABOR-		1997 BARE COSTS				TOTAL
			CREW	OUTPUT	HOURS	UNIT	MAT.	LABOR	EQUIP.	TOTAL	INCL O&P
234	0300	Bulk drilling and blasting, can vary greatly, average				C.Y.					3.95
	0500	Pits, average									20
	1300	Deep hole method, up to 1500 C.Y.	B-47	50	.480		1.58	10.90	11.35	23.83	31.50
	1400	Over 1500 C.Y.		66	.364		1.58	8.25	8.60	18.43	24
	1900	Restricted areas, up to 1500 C.Y.		13	1.846		1.58	42	43.50	87.08	115
	2000	Over 1500 C.Y.		20	1.200		1.58	27.50	28.50	57.58	75.50
	2200	Trenches, up to 1500 C.Y.		22	1.091		4.75	25	26	55.75	72.50
	2300	Over 1500 C.Y.		26	.923		4.53	21	22	47.53	62
	2500	Pier holes, up to 1500 C.Y.		22	1.091		1.58	25	26	52.58	69
	2600	Over 1500 C.Y.		31	.774		1.58	17.60	18.35	37.53	49
	2800	Boulders under 1/2 C.Y., loaded on truck, no hauling	B-100	80	.150			3.69	6.15	9.84	12.50
	2900	Drilled, blasted and loaded on truck, no hauling	B-47	30	.800		1.58	18.20	18.95	38.73	51
	3100	Jackhammer operators with foreman compressor, air tools	B-9	1	40	Day		825	164	989	1,475
	3300	Track drill, compressor, operator and foreman	B-47	1	24	•		545	570	1,115	1,475
	3500	Blasting caps				Ea.	3			3	3.30
	3700	Explosives				Lb.	2			2	2.20
	3900	Blasting mats, rent, for first day				Ea.	80			80	88
	4000	Per added day					25			25	27.50
	4200	Preblast survey for 6 room house, individual lot, minimum	A-6	2.40	6.667			162		162	248
	4300	Maximum	•	1.35	11.852			288		288	440
	4500	City block within zone of influence, minimum	A-8	25,200	.001	S.F.		.03		.03	.04
	4600	Maximum	•	15,100	.002	•		.05		.05	.07
	5000	Excavate and load boulders, less than 0.5 C.Y.	B-10T	80	.150	C.Y.		3.69	5.35	9.04	11.55
	5020	0.5 C.Y. to 1 C.Y.	B-10U	100	.120			2.95	8.85	11.80	14.30
	5200	Excavate and load blasted rock, 3 C.Y. power shovel	B-12T	1,530	.010			.27	.80	1.07	1.29
	5400	Haul boulders, 25 Ton off-highway dump, 1 mile round trip	B-34E	330	.024			.52	1.96	2.48	2.94
	5420	2 mile round trip		275	.029			.62	2.35	2.97	3.53
	5440	3 mile round trip		225	.036			.76	2.87	3.63	4.32
	5460	4 mile round trip		200	.040			.85	3.23	4.08	4.86
	5600	Bury boulders on site, less than 0.5 C.Y., 300 H.P. dozer									
	5620	150' haul	B-10M	310	.039	C.Y.		.95	3.58	4.53	5.40
	5640	300' haul		210	.057			1.41	5.30	6.71	7.95
	5800	0.5 to 1 C.Y., 300 H.P. dozer, 150' haul		300	.040			.98	3.70	4.68	5.60
	5820	300' haul		200	.060			1.48	5.55	7.03	8.40
238	0010	**EXCAVATING, BULK BANK MEASURE** Common earth piled R022-240									
	0020	For loading onto trucks, add								15%	15%
	0050	For mobilization and demobilization, see division 022-274 R022-250									
	0100	For hauling, see division 022-266									
	0200	Backhoe, hydraulic, crawler mtd., 1 C.Y. cap. = 75 C.Y./hr.	B-12A	600	.027	C.Y.		.68	.92	1.60	2.04
	0250	1-1/2 C.Y. cap. = 100 C.Y./hr. 	B-12B	800	.020			.51	.89	1.40	1.76
	0260	2 C.Y. cap. = 130 C.Y./hr.	B-12C	1,040	.015			.39	.94	1.33	1.63
	0300	3 C.Y. cap. = 160 C.Y./hr.	B-12D	1,280	.013			.32	1.67	1.99	2.31
	0310	Wheel mounted, 1/2 C.Y. cap. = 30 C.Y./hr.	B-12E	240	.067			1.69	1.39	3.08	4.12
	0360	3/4 C.Y. cap. = 45 C.Y./hr.	B-12F	360	.044			1.13	1.25	2.38	3.10
	0500	Clamshell, 1/2 C.Y. cap. = 20 C.Y./hr.	B-12G	160	.100			2.54	2.95	5.49	7.10
	0550	1 C.Y. cap. = 35 C.Y./hr.	B-12H	280	.057			1.45	1.98	3.43	4.39
	0950	Dragline, 1/2 C.Y. cap. = 30 C.Y./hr.	B-12I	240	.067			1.69	2.03	3.72	4.83
	1001	3/4 C.Y. cap. = 35 C.Y./hr.	-	280	.057			1.45	1.74	3.19	4.14
	1050	1-1/2 C.Y. cap. = 65 C.Y./hr.	B-12P	520	.031			.78	1.52	2.30	2.86
	1100	3 C.Y. cap. = 112 C.Y./hr.	B-12V	900	.018			.45	1.13	1.58	1.94
	1200	Front end loader, track mtd., 1-1/2 C.Y. cap. = 70 C.Y./hr.	B-10N	560	.021			.53	.65	1.18	1.54
	1250	2-1/2 C.Y. cap. = 95 C.Y./hr.	B-10O	760	.016			.39	.65	1.04	1.31
	1300	3 C.Y. cap. = 130 C.Y./hr.	B-10P	1,040	.012			.28	.79	1.07	1.31
	1350	5 C.Y. cap. = 160 C.Y./hr.	B-100	1.620	.007			.18	.70	.88	1.05
	1500	Wheel mounted, 3/4 C.Y. cap. = 45 C.Y./hr.	B-10R	360	.033			.82	.65	1.47	1.98
	1550	1-1/2 C.Y. cap. = 80 C.Y./hr.	B-10S	640	.019			.46	.49	.95	1.24

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			CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1997 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTA INCL O
258	1750	36" deep	A-1	135	.059	L.F.		1.20	.45	1.65	
	2000	Chain trencher, 40 H.P. operator riding									
	2050	6" wide trench and backfill, 12" deep	B-54	1,200	.007	L.F.		.17	.17	.34	
	2100	18" deep		1,000	.008			.21	.21	.42	
	2150	24" deep		975	.008			.21	.21	.42	.5
	2200	36" deep		900	.009			.23	.23	.46	
	2250	48" deep		750	.011			.27	.28	.55	
	2300	60" deep		650	.012			.32	.32	.64	.8
	2400	8" wide trench and backfill, 12" deep		1,000	.008			.21	.21	.42	.54
	2450	18" deep		950	.008			.22	.22	.44	
	2500	24" deep		900	.009			.23	.23	.46	
	2550	36" deep		800	.010			.26	.26	.52	.6
	2600	48" deep		650	.012			.32	.32	.64	
	2700	12" wide trench and backfill, 12" deep		975	.008			.21	.21	.42	
	2750	18" deep		860	.009			.24	.24	.48	.64
	2800	24" deep		800	.010			.26	.26	.52	.6
	2850	36" deep		725	.011			.28	.29	.57	
	3000	16" wide trench and backfill, 12" deep		835	.010			.25	.25	.50	
	3050	18" deep		750	.011			.27	.28	.55	.72
	3100	24" deep		700	.011			.29	.30	.59	
	3200	Compaction with vibratory plate, add								50%	50
	9100	For clay or till, add up to								150%	150%
262	0010	**FILL** Spread dumped material, by dozer, no compaction	B-10B	1,000	.012	C.Y.		.30	.85	1.15	1.
	0100	By hand	1 Clab	12	.667	"		13.50		13.50	21.
	0150	Spread fill, from stockpile with 2-1/2 C.Y. F.E. loader									
	0170	130 H.P., 300' haul	B-10P	600	.020	C.Y.		.49	1.36	1.85	2.2
	0190	With dozer 300 H.P., 300' haul	B-10M	600	.020	"		.49	1.85	2.34	2.
	0400	For compaction of embankment, see div. 022-226									
	0500	Gravel fill, compacted, under floor slabs, 4" deep	B-37	10,000	.005	S.F.	.11	.10	.01	.22	.30
	0600	6" deep		8,600	.006		.17	.12	.02	.31	.
	0700	9" deep		7,200	.007		.28	.14	.02	.44	.
	0800	12" deep		5,000	.008		.40	.17	.02	.59	.74
	1000	Alternate pricing method, 4" deep		120	.400	C.Y.	8.50	8.60	1.18	18.28	24
	1100	6" deep		160	.300		8.50	6.45	.89	15.84	20.5
	1200	9" deep		200	.240		8.50	5.15	.71	14.36	18.2
	1300	12" deep		220	.218		8.50	4.69	.65	13.84	17.40
	1500	For fill under exterior paving, see division 022-308									
266	0011	**HAULING** Excavated or borrow material, highway haulers R022-240									
	0012	bank measure, no loading included									
	0020	6 C.Y. dump truck, 1/4 mile round trip, 5.0 loads/hr.	B-34A	240	.033	C.Y.		.71	1.44	2.15	2.67
	0030	1/2 mile round trip, 4.1 loads/hr.		197	.041			.86	1.75	2.61	3.26
	0040	1 mile round trip, 3.3 loads/hr.		160	.050			1.07	2.16	3.23	4.02
	0100	2 mile round trip, 2.6 loads/hr.		125	.064			1.36	2.76	4.12	5.15
	0150	3 mile round trip, 2.1 loads/hr.		100	.080			1.70	3.46	5.16	6.40
	0200	4 mile round trip, 1.8 loads/hr.		85	.094			2	4.07	6.07	7.55
	0310	12 C.Y. dump truck, 1/4 mile round trip 3.7 loads/hr.	B-34B	356	.022			.48	1.21	1.69	2.07
	0320	1/2 mile round trip, 3.2 loads/hr.		308	.026			.55	1.40	1.95	2.39
	0330	1 mile round trip 2.7 loads/hr.		260	.031			.66	1.66	2.32	2.83
	0400	2 mile round trip, 2.2 loads/hr.		210	.038			.81	2.05	2.86	3.51
	0450	3 mile round trip, 1.9 loads/hr. 		180	.044			.95	2.39	3.34	4.09
	0500	4 mile round trip, 1.6 loads/hr.		150	.053			1.14	2.87	4.01	4.91
	0540	5 mile round trip, 1 load/hr.		98	.082			1.74	4.40	6.14	7.50
	0550	10 mile round trip, 0.75 load/hr.		49	.163			3.48	8.80	12.28	15
	0560	20 mile round trip, 0.5 load/hr.		32	.250			5.30	13.45	18.75	23
	0600	16.5 C.Y. dump trailer, 1 mile round trip, 2.6 loads/hr.	B-34C	340	.024			.50	1.55	2.05	2.47

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				DAILY	LABOR-		1997 BARE COSTS				TOTAL
			CREW	OUTPUT	HOURS	UNIT	MAT.	LABOR	EQUIP.	TOTAL	INCL O&P
266	0700	2 mile round trip, 2.1 loads/hr. R022 -240	B-34C	275	.029	C.Y.		.62	1.91	2.53	3.05
	1000	3 mile round trip, 1.8 loads/hr.		235	.034			.73	2.24	2.97	3.57
	1100	4 mile round trip, 1.6 loads/hr.		210	.038			.81	2.50	3.31	4
	1110	5 mile round trip, 1 load/hr.		132	.061			1.29	3.98	5.27	6.35
	1120	10 mile round trip, .75 load/hr.		100	.080			1.70	5.25	6.95	8.40
	1130	20 mile round trip, .5 load/hr.		66	.121			2.58	7.95	10.53	12.70
	1150	20 C.Y. dump trailer, 1 mile round trip, 2.5 loads/hr.	B-34D	400	.020			.43	1.32	1.75	2.10
	1200	2 mile round trip, 2 loads/hr.		320	.025			.53	1.65	2.18	2.63
	1220	3 mile round trip, 1.7 loads/hr.		270	.030			.63	1.96	2.59	3.12
	1240	4 mile round trip, 1.5 loads/hr.		240	.033			.71	2.20	2.91	3.51
	1245	5 mile round trip, 1.1 load/hr.		[illegible]	.047			.99	3.07	4.06	4.90
	1250	10 mile round trip, .85 load/hr.		136	.059			1.25	3.88	5.13	6.20
	1255	20 mile round trip, .6 load/hr.		96	.083			1.77	5.50	7.27	8.80
	1300	Hauling in medium traffic, add								20%	20%
	1400	Heavy traffic, add								30%	30%
	1600	Grading at dump, or embankment if required, by dozer	B-10B	1,000	.012			.30	.85	1.15	1.40
	1800	Spotter at fill or cut, if required	1 Clab	8	1	Hr.		20.50		20.50	32
	2000	Off highway haulers									
	2010	22 C.Y. rear/bottom dump, 1000' rnd trip, 4.5 loads/hr.	B-34F	800	.010	C.Y.		.21	1.26	1.47	1.71
	2020	1/2 mile round trip, 4.2 loads/hr.		740	.011			.23	1.36	1.59	1.84
	2030	1 mile round trip, 3.9 loads/hr.		685	.012			.25	1.47	1.72	1.99
	2040	2 mile round trip, 3.3 loads/hr.		580	.014			.29	1.73	2.02	2.35
	2050	34 C.Y. rear or bottom dump, 1000' round trip, 4 loads/hr.	B-34G	1,090	.007			.16	1.22	1.38	1.58
	2060	1/2 mile round trip, 3.8 loads/hr.		1,035	.008			.16	1.29	1.45	1.66
	2070	1 mile round trip, 3.5 loads/hr.		950	.008			.18	1.40	1.58	1.82
	2080	2 mile round trip, 3.0 loads/hr.		815	.010			.21	1.63	1.84	2.12
	2090	42 C.Y. rear or bottom bump, 1000' round trip, 3.8 loads/hr.	B-34H	1,275	.006			.13	1.24	1.37	1.58
	2100	1/2 mile round trip, 3.6 loads/hr.		1,210	.007			.14	1.31	1.45	1.66
	2110	1 mile round trip, 3.3 loads/hr.		1,110	.007			.15	1.43	1.58	1.81
	2120	2 mile round trip, 2.8 loads/hr.		940	.009			.18	1.69	1.87	2.13
	2130	60 C.Y. rear or bottom dump, 1000' round trip, 3.6 loads/hr.	B-34J	1,730	.005			.10	1.24	1.34	1.52
	2140	1/2 mile round trip, 3.4 loads/hr.		1,630	.005			.10	1.32	1.42	1.61
	2150	1 mile round trip, 3.1 loads/hr.		1,490	.005			.11	1.44	1.55	1.77
	2160	2 mile round trip, 2.6 loads/hr.		1,250	.006			.14	1.72	1.86	2.10
	3000	Rough terrain or steep grades, add to above								100%	
	4500	Dust control, light	B-59	1	8	Day		170	515	685	825
	4501	Heavy	•	.50	16			340	1,025	1,365	1,650
	4600	Haul road maintenance	B-86A	1	8			214	535	749	920
270	0010	**HORIZONTAL BORING** Casing only, 100' minimum,									
	0020	not incl. jacking pits or dewatering									
	0100	Roadwork, 1/2" thick wall, 24" diameter casing	B-42	10	6.400	L.F.	49.50	146	109	304.50	410
	0200	36" diameter		9.50	6.737		70	154	114	338	450
	0300	48" diameter		9	7.111		110	162	121	393	515
	0500	Railroad work, 24" diameter		7	9.143		49.50	209	155	413.50	560
	0600	36" diameter		6.50	9.846		70	225	167	462	625
	0700	48" diameter		6	10.667		110	244	181	535	715
	0900	For ledge, add								145	175
	1000	Small diameter boring, 3", sandy soil	B-82	1,050	.015		14.75	.35	.04	15.14	16.85
	1040	Rocky soil	•	550	.029		14.75	.67	.08	15.50	17.40
	1100	Prepare jacking pits, incl. mobilization & demobilization, minimum				Ea.				2,650	3,150
	1101	Maximum				•				15,000	18,000
274	0010	**MOBILIZATION OR DEMOBILIZATION** Up to 25 miles R016 -410									
	0020	Dozer or loader, 105 H.P.	B-34K	4	2	Ea.		42.50	198	240.50	284
	0100	300 H.P.		3.80	2.105			45	208	253	298
	0300	Scraper, towed type (incl. tractor), 6 C.Y. capacity		3.50	2.286			48.50	226	274.50	325

023 | Tunneling, Piles & Caissons

023 800 | Caissons

			CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1997 BARE COSTS				TOTAL INCL O&P
							MAT.	LABOR	EQUIP.	TOTAL	
804	2180	9' bell diameter, 48" shaft, 4.48 C.Y. R023 -820	B49	3.30	26.667	Ea.	540	635	730	1,905	2,400
	2200	10' bell diameter, 60" shaft, 5.24 C.Y.		2.80	31.429		600	750	860	2,210	2,800
	2220	12' bell diameter, 72" shaft, 8.74 C.Y.		1.60	55		980	1,300	1,500	3,780	4,800
	2240	14' bell diameter, 84" shaft, 13.6 C.Y.		1	88		1,525	2,100	2,400	6,025	7,650
	2300	Open style, machine drilled, to 50' deep, in soft rocks and									
	2400	medium hard shales, 18" diameter, .065 C.Y./L.F.	B49	50	1.760	V.L.F.	9.90	42	48	99.90	130
	2500	24" diameter, .116 C.Y./L.F.		30	2.933		17.20	70	80.50	167.70	218
	2600	30" diameter, .182 C.Y./L.F.		20	4.400		27	105	121	253	330
	2700	36" diameter, .262 C.Y./L.F.		15	5.867		37.50	140	161	338.50	440
	2800	48" diameter, .465 C.Y./L.F.		10	8.800		65	210	241	516	670
	2900	60" diameter, .727 C.Y./L.F.		7	12.571		101	299	345	745	965
	3000	72" diameter, 1.05 C.Y./L.F.		6	14.667		153	350	400	903	1,175
	3100	84" diameter, 1.43 C.Y./L.F.		5	17.600		205	420	480	1,105	1,425
	3200	For bell excavation and concrete, add									
	3220	4' bell diameter, 24" shaft, .444 C.Y.	B49	10.90	8.073	Ea.	44.50	192	221	457.50	595
	3240	6' bell diameter, 30" shaft, 1.57 C.Y.		3.10	28.387		158	675	780	1,613	2,100
	3260	8' bell diameter, 36" shaft, 3.72 C.Y.		1.30	67.692		355	1,600	1,850	3,805	5,025
	3280	9' bell diameter, 48" shaft, 4.48 C.Y.		1.10	80		460	1,900	2,200	4,560	5,925
	3300	10' bell diameter, 60" shaft, 5.24 C.Y.		.90	97.778		510	2,325	2,675	5,510	7,225
	3320	12' bell diameter, 72" shaft, 8.74 C.Y.		.60	146		835	3,500	4,025	8,360	10,900
	3340	14' bell diameter, 84" shaft, 13.6 C.Y.		.40	220		1,525	5,250	6,025	12,800	16,600
	3600	For rock excavation, sockets, add, minimum		120	.733	C.F.		17.45	20	37.45	50
	3650	Average		95	.926			22	25.50	47.50	63
	3700	Maximum		48	1.833			43.50	50	93.50	125
	3900	For 50' to 100' deep, add				V.L.F.				7%	7%
	4000	For 100' to 150' deep, add								25%	25%
	4100	For 150' to 200' deep, add								30%	30%
	4200	For casings left in place, add				Lb.	.53			.53	.5
	4300	For other than 50 lb. reinf. per C.Y., add or deduct				•	.50			.50	.55
	4400	For steel "I" beam cores, add	B49	8.30	10.602	Ton	695	253	291	1,239	1,475
	4500	Load and haul excess excavation, 2 miles	B-34B	178	.045	C.Y.		.96	2.42	3.38	4.1
	4600	For mobilization, 50 mile radius, rig to 36"	B43	2	24	Ea.		535	840	1,375	1,750
	4650	Rig to 84"	B48	1.75	32			730	1,075	1,805	2,300
	4700	For low headroom, add								50%	
	4750	For difficult access, add								25%	
	5000	Bottom inspection	1 Skwk	1.20	6.667			177		177	282

024 | Railroad & Marine Work

024 520 | Railroad Trackwork

			CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1997 BARE COSTS				TOTAL INCL O&P
							MAT.	LABOR	EQUIP.	TOTAL	
524	0010	RAILROAD Car bumpers, standard R024 -520	B-14	2	24	Ea.	1,300	515	108	1,923	2,375
	0100	Heavy duty		2	24		2,475	515	108	3,098	3,650
	0200	Derails hand throw (sliding)		10	4.800		545	103	21.50	669.50	785
	0300	Hand throw with standard timbers, open stand & target		5.50	8.727		795	188	39.50	1,022.50	1,200
	0400	Resurface and realign existing track		200	.240	L.F.		5.15	1.08	6.23	9.35
	0600	For crushed stone ballast, add		500	.096	•	9.45	2.06	.43	11.94	14.15
	0800	Siding, yard spur, level grade									
	0808	Wood ties and ballast, 80 lb. rail	B-14	57	.842	L.F.	50.50	18.10	3.79	72.39	88
	0809	80 lb. relay rail		57	.842		38	18.10	3.79	59.89	74
	0812	90 lb. rail		57	.842		50.50	18.10	3.79	72.39	88

024 | Railroad & Marine Work

024 520 | Railroad Trackwork

		CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1997 BARE COSTS				TOTAL INCL O&P
						MAT.	LABOR	EQUIP.	TOTAL	
524 0813	90 lb. relay rail R024-520	B-14	57	.842	L.F.	40.50	18.10	3.79	62.39	77
0820	100 lb. rail		57	.842		51	18.10	3.79	72.89	88.50
0822	100 lb. relay rail		57	.842		41	18.10	3.79	62.89	77.50
0830	110 lb. rail		57	.842		53	18.10	3.79	74.89	91
0832	110 lb. relay rail	↓	57	.842	↓	52.50	18.10	3.79	74.39	90
1002	Steel ties in concrete, incl. fasteners & plates									
1003	80 lb. rails	B-14	22	2.182	L.F.	88	47	9.80	144.80	182
1005	80 lb. relay rail		22	2.182		71.50	47	9.80	128.30	163
1012	90 lb. rail		22	2.182		84	47	9.80	140.80	177
1015	90 lb. relay rail		22	2.182		71.50	47	9.80	128.30	163
1020	100 lb. rail		22	2.182		92.50	47	9.80	149.30	187
1025	100 lb. relay rail		22	2.182		72	47	9.80	128.80	164
1030	110 lb. rail		22	2.182		95	47	9.80	151.80	190
1035	110 lb. relay rail		22	2.182	↓	79	47	9.80	135.80	171
1200	Switch timber, for a #8 switch, pressure treated		3.70	12.973	M.B.F.	580	279	58.50	917.50	1,150
1300	Complete set of timbers, 3.7 M.B.F. for #8 switch		1	48	Total	2,300	1,025	216	3,541	4,400
1400	Ties, concrete, 8'-6" long, 30" O.C.		80	.600	Ea.	87.50	12.90	2.70	103.10	119
1600	Wood, pressure treated, 6" x 8" x 8'-6", C.L. lots		90	.533		26.50	11.45	2.40	40.35	50
1700	L.C.L. lots		90	.533		26	11.45	2.40	39.85	49
1900	Heavy duty, 7" x 9" x 8'-6", C.L. lots		70	.686		30	14.75	3.09	47.84	59.50
2000	L.C.L. lots	↓	70	.686	↓	29	14.75	3.09	46.84	58.50
2200	Turnouts, #8, incl. 100 lb. rails, plates, bars, frog, switch pt.									
2300	Timbers and ballast 6" below bottom of tie	B-14	.50	96	Ea.	17,200	2,075	430	19,705	22,600
2400	Wheel stops, fixed		14	3.429	Pr.	420	73.50	15.45	508.95	595
2450	Hinged	↓	14	3.429	•	505	73.50	15.45	593.95	690

024 820 | Dredging

		CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P
824 0010	**DREDGING** Mobilization and demobilization., add to below, minimum	B-8	.53	120	Total		2,750	4,175	6,925	8,850
0100	Maximum	•	.10	640	•		14,500	22,100	36,600	46,900
0300	Barge mounted clamshell excavation into scows,									
0310	Dumped 20 miles at sea, minimum	B-57	310	.155	C.Y.		3.59	3.50	7.09	9.45
0400	Maximum	•	213	.225	•		5.25	5.10	10.35	13.75
0500	Barge mounted dragline or clamshell, hopper dumped,									
0510	pumped 1000' to shore dump, minimum	B-57	340	.141	C.Y.		3.27	3.19	6.46	8.60
0525	All pumping uses 2000 gallons of water per cubic yard									
0600	Maximum	B-57	243	.198	C.Y.		4.58	4.47	9.05	12.05
1000	Hydraulic method, pumped 1000' to shore dump, minimum		460	.104			2.42	2.36	4.78	6.35
1100	Maximum		310	.155			3.59	3.50	7.09	9.45
1400	Into scows dumped 20 miles, minimum		425	.113			2.62	2.55	5.17	6.90
1500	Maximum	↓	243	.198			4.58	4.47	9.05	12.05
1600	For inland rivers and canals in South, deduct				↓				30%	30%

024 840 | Seawall & Bulkheads

		CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P
844 0010	**BULKHEADS** Reinforced concrete, include footing and tie-backs									
0020	Up to 6' high, minimum	C-17C	28	2.964	L.F.	36.50	80	14.45	130.95	183
0060	Maximum		24.25	3.423		43	92.50	16.70	152.20	213
0100	12' high, minimum		20	4.150		81.50	112	20.50	214	290
0160	Maximum	↓	18.50	4.486	↓	89	121	22	232	315
0180	Precast bulkhead, complete, including									
0190	vertical and battered piles, face panels, and cap									
0195	Using 16' vertical piles				L.F.				220	240
0196	Using 20' vertical piles				•				230	250
0200	Steel sheeting, with 4' x 4' x 8" concrete deadmen, @ 10' O.C.									
0210	12' high, shore driven	B-40	27	2.370	L.F.	56	62.50	71	189.50	244
0260	Barge driven	B-76	15	4.800	•	58	126	131	315	420

027 | Sewerage & Drainage

027 150 | Sewage Systems

		CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1997 BARE COSTS				TOTAL INCL O&P
						MAT.	LABOR	EQUIP.	TOTAL	
164 2718	30" diameter, 14 ga.	B-21	15	1.867	Ea.	278	44.50	7.25	329.75	385
2720	36" diameter, 14 ga.		15	1.867		315	44.50	7.25	366.75	425
2722	48" diameter, 12 ga.	↓	12	2.333		570	55.50	9.05	634.55	725
2724	60" diameter, 10 ga.	B-13	10	5.600		1,000	123	53	1,176	1,350
2726	72" diameter, 10 ga.	•	6	9.333		1,325	205	88.50	1,618.50	1,900
2728	Wyes or tees, 12" diameter, 16 ga.	B-20	20	1.200		134	27.50		161.50	191
2730	18" diameter, 16 ga.	•	16	1.500		195	34.50		229.50	270
2732	24" diameter, 14 ga.	B-21	16	1.750		276	41.50	6.80	324.30	380
2734	30" diameter, 14 ga.		14	2		360	47.50	7.75	415.25	485
2736	36" diameter, 14 ga.		14	2		470	47.50	7.75	525.25	605
2738	48" diameter, 12 ga.	↓	12	2.333		745	55.50	9.05	809.55	915
2740	60" diameter, 10 ga.	B-13	10	5.600		1,250	123	53	1,426	1,625
2742	72" diameter, 10 ga.	•	6	9.333		1,725	205	88.50	2,018.50	2,325
2780	End sections, 8" diameter	B-20	24	1		51.50	23		74.50	93
2785	10" diameter		22	1.091		53.50	25		78.50	99
2790	12" diameter	↓	20	1.200		63	27.50		90.50	113
2800	18" diameter	B-21	16	1.750		72.50	41.50	6.80	120.80	152
2810	24" diameter		14	2		104	47.50	7.75	159.25	199
2820	30" diameter		12	2.333		204	55.50	9.05	268.55	320
2825	36" diameter		10	2.800		298	66.50	10.85	375.35	445
2830	48" diameter	↓	8	3.500		660	83	13.60	756.60	870
2835	60" diameter	B-13	6	9.333		1,150	205	88.50	1,443.50	1,675
2840	72" diameter	•	4	14		1,375	310	133	1,818	2,125
2850	Couplings, 12" diameter					8.60			8.60	9.45
2855	18" diameter					14.25			14.25	15.70
2860	24" diameter					23			23	25
2865	30" diameter					32			32	35.50
2870	36" diameter					48.50			48.50	53.50
2875	48" diameter					121			121	133
2880	60" diameter					225			225	247
2885	72" diameter				↓	345			345	380
3000	Corrugated galvinized or alum. oval arch culverts, coated & paved									
3020	17" x 13", 16 ga., 15" equivalent	B-22	200	.150	L.F.	11.95	3.60	.82	16.37	19.65
3040	21" x 15", 16 ga., 18" equivalent		150	.200		21	4.80	1.09	26.89	32
3060	28" x 20", 14 ga., 24" equivalent		125	.240		24	5.75	1.31	31.06	37
3080	35" x 24", 14 ga., 30" equivalent	↓	100	.300		37.50	7.20	1.63	46.33	54.50
3100	42" x 29", 12 ga., 36" equivalent	B-13	100	.560		39.50	12.30	5.30	57.10	68.50
3120	49" x 33", 12 ga., 42" equivalent		90	.622		45.50	13.70	5.90	65.10	78
3140	57" x 38", 12 ga., 48" equivalent	↓	70	.800	↓	52	17.60	7.60	77.20	93.50
3160	Steel, plain oval arch culverts, plain									
3180	17" x 13", 16 ga., 15" equivalent	B-22	225	.133	L.F.	7.85	3.20	.73	11.78	14.50
3200	21" x 15", 16 ga., 18" equivalent		175	.171		12.35	4.11	.93	17.39	21
3220	28" x 20", 14 ga., 24" equivalent		150	.200		14.60	4.80	1.09	20.49	25
3240	35" x 24", 14 ga., 30" equivalent	↓	108	.278		23.50	6.65	1.51	31.66	38
3260	42" x 29", 12 ga., 36" equivalent	B-13	108	.519		36	11.40	4.93	52.33	63
3280	49" x 33", 12 ga., 42" equivalent		92	.609		42.50	13.40	5.80	61.70	74
3300	57" x 38", 12 ga., 48" equivalent		75	.747	↓	53	16.40	7.10	76.50	92.50
3320	End sections, 17" x 13"		22	2.545	Ea.	34	56	24	114	152
3340	42" x 29"	↓	17	3.294	•	172	72.50	31.50	276	340
3350	Multi-plate arch, steel	B-20	1.690	.014	Lb.	.66	.33		.99	1.25
166 0010	**PIPING, DRAINAGE & SEWAGE, PLASTIC**									
0020	Not including excavation & backfill									
1000	Reinforced plastic pipe, general strength, 4" diameter	B-20	190	.126	L.F.	6.55	2.91		9.46	11.80
1010	6" diameter	•	170	.141		11.55	3.25		14.80	17.85
1020	8" diameter	B-21	160	.175		18.45	4.15	.68	23.28	28
1030	10" diameter	↓	140	.200	↓	28	4.74	.78	33.52	39.50

027 | Sewerage & Drainage

027 150 | Sewage Systems

			CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1997 BARE COSTS				TOTAL INCL O&P
							MAT.	LABOR	EQUIP.	TOTAL	
166	1040	12" diameter	B-21	100	.280	L.F.	36.50	6.65	1.09	44.24	51.50
	5000	High strength, 4" diameter	B-20	190	.126		10.65	2.91		13.56	16.30
	5010	6" diameter	•	170	.141		16.15	3.25		19.40	23
	5020	8" diameter	B-21	160	.175		26	4.15	.68	30.83	36
	5030	10" diameter		140	.200		34.50	4.74	.78	40.02	46.50
	5040	12" diameter		100	.280		44	6.65	1.09	51.74	60
	9100	Bends and elbows, general strength, 4" diameter	B-20	19	1.263	Ea.	97	29		126	153
	9130	10" diameter		8	3		260	69		329	395
	9140	12" diameter		6	4		345	92		437	525
	9210	High strength, 4" diameter		19	1.263		126	29		155	185
	9220	6" diameter		12	2		195	46		241	288
	9230	8" diameter		11	2.182		280	50.50		330.50	390
	9240	10" diameter		8	3		340	69		409	480
	9250	12" diameter		6	4		450	92		542	640
	9610	Wyes and tees, general strength, 4" diameter		12	2		82.50	46		128.50	164
	9620	6"		7	3.429		221	79		300	370
	9630	8" diameter		7	3.429		255	79		334	405
	9640	10"		6	4		410	92		502	595
	9650	12" diameter		5	4.800		505	111		616	730
	9710	High strength, 4" diameter		12	2		109	46		155	193
	9720	6" diameter		7	3.429		288	79		367	440
	9730	8" diameter		7	3.429		330	79		409	490
	9740	10" diameter		6	4		530	92		622	730
	9750	12" diameter		5	4.800		645	111		756	880
168	0010	**PIPING, DRAINAGE & SEWAGE, POLYVINYL CHLORIDE**									
	0020	Not including excavation or backfill									
	2000	10' lengths, S.D.R. 35, 4" diameter	B-20	375	.064	L.F.	1.68	1.47		3.15	4.19
	2040	6" diameter		350	.069		3.23	1.58		4.81	6.05
	2080	8" diameter		335	.072		3.50	1.65		5.15	6.45
	2120	10" diameter	B-21	330	.085		3.67	2.01	.33	6.01	7.60
	2160	12" diameter		320	.087		5.05	2.08	.34	7.47	9.20
	2200	15" diameter		190	.147		10.70	3.50	.57	14.77	17.95
	3040	Fittings, bends or elbows, 4" diameter	B-20	19	1.263	Ea.	2.76	29		31.76	49
	3080	6" diameter		15	1.600		11.80	37		48.80	71.50
	3120	Tees, 4" diameter		12	2		2.36	46		48.36	75.50
	3160	5" diameter		10	2.400		11.45	55.50		66.95	101
	3200	Wyes, 4" diameter		12	2		4.49	46		50.49	78
	3240	6" diameter		10	2.400		22	55.50		77.50	113
170	0010	**PIPING, DRAINAGE & SEWAGE, SEWAGE VENT CAST IRON**									
	0020	Not including excavation or backfill									
	2022	Sewage vent cast iron, B & S, 4" diameter	Q-1	44	.364	L.F.	6.10	10.05		16.15	22
	2024	5" diameter	Q-2	62	.387		8.50	11.10		19.60	26.50
	2026	6" diameter	•	59	.407		10.35	11.65		22	29
	2028	8" diameter	Q-3	49	.653		16.60	19.15		35.75	47.50
	2030	10" diameter		45	.711		27.50	21		48.50	62
	2032	12" diameter		39	.821		40	24		64	80.50
	2034	15" diameter		35	.914		61	27		88	109
	2048	For push on joint deduct						25%			
	8001	Fittings, bends and elbows									
	8110	4" diameter	Q-1	13	1.231	Ea.	15.10	34		49.10	68.50
	8112	5" diameter	Q-2	18	1.333		21	38		59	81
	8114	6" diameter	•	17	1.412		26.50	40.50		67	90.50
	8116	8" diameter	Q-3	11	2.909		79	85		164	217
	8118	10" diameter		10	3.200		115	93.50		208.50	270
	8120	12" diameter		9	3.556		156	104		260	330
	8122	15" diameter		7	4.571		500	134		634	755

028 | Site Improvements

028 100 | Irrigation Systems

		CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1997 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P
104 1420	Dual programs, 18 station	1 Skwk	.21	38.095	Ea.	1,200	1,025		2,225	2,900
1430	23 station	↓	.13	61.538	↓	1,400	1,625		3,025	4,150
1435	Backflow preventer, bronze, 0-175 PSI, w/valves, test cocks									
1440	3/4"	1 Skwk	2	4	Ea.	95	106		201	274
1450	1"		2	4		102	106		208	281
1460	1-1/2"		2	4		197	106		303	385
1470	2"	↓	2	4	↓	223	106		329	415
1475	Pressure vacuum breaker, brass, 15-150 PSI									
1480	3/4"	1 Skwk	2	4	Ea.	47.50	106		153.50	222
1490	1"		2	4		88	106		194	266
1500	1-1/2"		2	4		136	106		242	320
1510	2"	↓	2	4	↓	152	106		258	335

028 200 | Fountains

		CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1997 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P
204 0010	**FOUNTAINS** Incl. fiberglass pools, pumps, piping and lights									
0200	4' diameter pool, 18" diameter spray ring	Q-1	2	8	Ea.	750	221		971	1,150
0300	6' diameter pool, 24" diameter spray ring		1.50	10.667		1,325	295		1,620	1,900
0400	7.5' diameter pool, 48" diameter spray ring		1	16		1,925	440		2,365	2,775
0500	Rain curtains, 3' rain bar, 2' x 4' x 1' pool		2	8		655	221		876	1,050
0600	7' rain bar, 2' x 8' x 1' pool	↓	1	16	↓	1,400	440		1,840	2,200

028 300 | Fences & Gates

		CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1997 BARE COSTS MAT.	LABOR	EQUIP.	TOTAL	TOTAL INCL O&P
308 0010	**FENCE, CHAIN LINK INDUSTRIAL**									
0020	6' H, 3 strands barb wire, 2" post @ 10' O.C., set in concrete									
0200	9 ga. wire, galv. steel	B-80	250	.128	L.F.	6.15	2.85	1.85	10.85	13.30
0300	Aluminized steel		250	.128		7.75	2.85	1.85	12.45	15.05
0500	6 ga. wire, galv. steel		250	.128		9.75	2.85	1.85	14.45	17.20
0600	Aluminized steel		250	.128		11.30	2.85	1.85	16	18.90
0800	6 ga. wire, 6' high but omit barbed wire, galv. steel		260	.123		9.25	2.74	1.78	13.77	16.40
0900	Aluminized steel		260	.123	↓	12	2.74	1.78	16.52	19.45
1100	Add for corner posts, 3" diam., galv. steel		40	.800	Ea.	50.50	17.85	11.60	79.95	96.50
1200	Aluminized steel		40	.800		61.50	17.85	11.60	90.95	109
1300	Add for braces, galv. steel		80	.400		13.60	8.90	5.80	28.30	35
1350	Aluminized steel		80	.400		16.80	8.90	5.80	31.50	38.50
1400	Gate for 6' high fence, 1-5/8" frame, 3' wide, galv. steel		10	3.200		71.50	71.50	46.50	189.50	241
1500	Aluminized steel	↓	10	3.200	↓	98.50	71.50	46.50	216.50	270
2000	5'-0" high fence, 9 ga., no barbed wire, 2" line post,									
2010	10' O.C., 1-5/8" top rail									
2100	Galvanized steel	B-80	315	.102	L.F.	5.50	2.26	1.47	9.23	11.20
2200	Aluminized steel		315	.102	"	6.70	2.26	1.47	10.43	12.55
2400	Gate, 4' wide, 5' high, 2" frame, galv. steel		10	3.200	Ea.	93.50	71.50	46.50	211.50	265
2500	Aluminized steel	↓	10	3.200	"	101	71.50	46.50	219	273
2700	Motor operator for gates, not including gates or									
2710	Electrical wiring, for swinging gate 15' wide	B-80	2	16	Opng.	1,400	355	232	1,987	2,350
2800	For swinging gate up to 30' wide (pair)		2	16		2,900	355	232	3,487	4,000
2900	For sliding gate up to 45' long (pair)		2	16	↓	3,075	355	232	3,662	4,175
3100	Overhead slide gate, chain link, 6' high, to 18' wide		38	.842	L.F.	82.50	18.75	12.20	113.45	134
3105	8' high		30	1.067		82.50	24	15.45	121.95	145
3108	10' high		24	1.333		68	29.50	19.30	116.80	143
3110	Cantilever type		48	.667		32	14.85	9.65	56.50	68.50
3120	8' high		24	1.333		50	29.50	19.30	98.80	123
3130	10' high	↓	18	1.778	↓	60	39.50	25.50	125	157
5000	Double swing gates, incl. posts & hardware									
5010	5' high, 12' opening	B-80	3.40	9.412	Opng.	242	210	136	588	740
5020	20' opening		2.80	11.429		315	255	165	735	920
5060	6' high, 12' opening	↓	3.20	10	↓	380	223	145	748	925

028 300 | Fences & Gates

		CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1997 BARE COSTS				TOTAL INCL O&P
						MAT.	LABOR	EQUIP.	TOTAL	
308 5070	20' opening	B-80	2.60	12.308	Opng.	305	274	178	757	960
5080	8' high, 12' opening		1.57	20.382		560	455	295	1,310	1,650
5090	20' opening		1.25	25.600		620	570	370	1,560	1,975
5100	10' high, 12' opening		1.31	24.427		675	545	355	1,575	1,975
5110	20' opening		1.03	31.068		865	695	450	2,010	2,525
5120	12' high, 12' opening		1.05	30.476		865	680	440	1,985	2,475
5130	20' opening		.85	37.647		1,075	840	545	2,460	3,100
5190	For aluminized steel add					20%				
6500	Auger fence post hole, 3' deep, medium soil, by hand	1 Clab	30	.267	Ea.		5.40		5.40	8.55
6510	By machine	B-23	114	.351			7.25	5.40	12.65	17.45
6520	Rock, with jackhammer	B-9	15	2.667			55	10.90	65.90	99.50
6530	With rock drill	B-47	65	.369			8.40	8.75	17.15	23
6580	Line posts, galvanized, 2-1/2" OD, set in conc., 4'	B-80	61	.525		18.80	11.70	7.60	38.10	47
6585	5'		59	.542		20.50	12.10	7.85	40.45	50
6590	6'		57	.561		24.50	12.50	8.15	45.15	55.50
6595	7'		55	.582		27.50	12.95	8.40	48.85	59.50
6600	8'		53	.604		30.50	13.45	8.75	52.70	64
6610	H-beam, 1-7/8", 4'		64	.500		15.75	11.15	7.25	34.15	42.50
6615	5'		62	.516		18	11.50	7.45	36.95	46
6620	6'		60	.533		21	11.90	7.70	40.60	50
6625	7'		58	.552		23	12.30	8	43.30	53.50
6630	8'		56	.571		25	12.75	8.25	46	56.50
6635	Vinyl coated, 2-1/2" OD, set in conc., 4'		61	.525		23	11.70	7.60	42.30	51.50
6640	5'		59	.542		24.50	12.10	7.85	44.45	54.50
6645	6'		57	.561		32	12.50	8.15	52.65	63.50
6650	7'		55	.582		44.50	12.95	8.40	65.85	78.50
6655	8'		53	.604		34.50	13.45	8.75	56.70	68.50
6660	End gate post, steel, 3" OD, set in conc.,4'		53	.604		31	13.45	8.75	53.20	64.50
6665	5'		51	.627		34.50	14	9.10	57.60	70
6670	6'		49	.653		38.50	14.55	9.45	62.50	75
6675	7'		48	.667		43.50	14.85	9.65	68	81.50
6685	Vinyl, 4'		53	.604		48	13.45	8.75	70.20	83.50
6690	5'		51	.627		52	14	9.10	75.10	89
6695	6'		49	.653		62	14.55	9.45	86	101
6705	8'		46	.696		74	15.50	10.05	99.55	117
6710	Corner post, galv. steel, 4" OD, set in conc., 4'		51	.627		48	14	9.10	71.10	85
6715	6'		49	.653		64.50	14.55	9.45	88.50	104
6720	7'		48	.667		81	14.85	9.65	105.50	123
6725	8'		46	.696		68.50	15.50	10.05	94.05	111
6730	Vinyl, 5'		51	.627		82	14	9.10	105.10	123
5735	6'		49	.653		106	14.55	9.45	130	150
6740	7'		48	667		99.50	14.85	9.65	124	144
6745	8'		46	.696		127	15.50	10.05	152.55	174
6935	Fabric, 9 gage., galv., 1.2 oz. coat, 2" chain link, 4'		304	.105	L.F.	2.38	2.35	1.52	6.25	7.95
6940	5'		285	.112		4.47	2.50	1.63	8.60	10.60
6945	6'		266	.120		3.35	2.68	1.74	7.77	9.80
6950	7'		247	.130		5.65	2.89	1.88	10.42	12.75
6955	8'		228	.140		3.35	3.13	2.03	8.51	10.80
6960	9 gage., fused, 4'		304	.105		4.84	2.35	1.52	8.71	10.65
6965	5'		285	.112		7.05	2.50	1.63	11.18	13.45
6970	6'		266	.120		6.55	2.68	1.74	10.97	13.30
6975	7'		247	.130		8.80	2.89	1.88	13.57	16.25
6980	8'		228	.140		8.05	3.13	2.03	13.21	15.95
6985	Barbed wire, galv., cost per strand		2,280	.014		.07	.31	.20	.58	.78
6990	Vinyl coated		2,280	.014		.15	.31	.20	.66	.87
6995	Extension arms, 3 strands		143	.224	Ea.	10.15	4.99	3.24	18.38	22.50

032 | Concrete Reinforcement

		032 200 | Welded Wire Fabric	CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1997 BARE COSTS				TOTAL INCL O&P
							MAT.	LABOR	EQUIP.	TOTAL	
240	0180	Steel fibers, 100 lb. per C.Y., add to concrete				C.Y.	51			51	56
		032 300 | Stressing Tendons									
307	0010	**PRESTRESSING STEEL** Post-tensioned in field									
	0100	Grouted strand, 50' span, 100 kip	C-3	1,200	.053	Lb.	1.81	1.41	.14	3.36	4.54
	0150	300 kip		2,700	.024		1.46	.63	.06	2.15	2.74
	0300	100' span, grouted, 100 kip		1,700	.038		1.20	.99	.10	2.29	3.12
	0350	300 kip		3,200	.020		1.07	.53	.05	1.65	2.13
	0500	200' span, grouted, 100 kip		2,700	.024		1.12	.63	.06	1.81	2.36
	0550	300 kip		3,500	.018		1.03	.48	.05	1.56	2.01
	0800	Grouted bars, 50' span, 42 kip		2,600	.025		1.20	.65	.06	1.91	2.49
	0850	143 kip		3,200	.020		1.03	.53	.05	1.61	2.10
	1000	75' span, grouted, 42 kip		3,200	.020		.98	.53	.05	1.56	2.04
	1050	143 kip	↓	4,200	.015		.92	.40	.04	1.36	1.74
	1200	Ungrouted strand, 50' span, 100 kip	C-4	1,275	.025		1.17	.73	.03	1.93	2.60
	1250	300 kip		1,475	.022		1.18	.63	.03	1.84	2.44
	1400	100' span, ungrouted, 100 kip		1,500	.021		.99	.62	.03	1.64	2.21
	1450	300 kip		1,650	.019		1.01	.56	.02	1.59	2.13
	1600	200' span, ungrouted, 100 kip		1,500	.021		.93	.62	.03	1.58	2.14
	1650	300 kip		1,700	.019		.94	.55	.02	1.51	2.02
	1800	Ungrouted bars, 50' span, 42 kip		1,400	.023		1.06	.66	.03	1.75	2.37
	1850	143 kip		1,700	.019		.99	.55	.02	1.56	2.08
	2000	75' span, ungrouted, 42 kip		1,800	.018		1	.52	.02	1.54	2.03
	2050	143 kip		2,200	.015		.92	.42	.02	1.36	1.77
	2220	Ungrouted single strand, 100' slab, 25 kip		1,200	.027		1.06	.77	.03	1.86	2.57
	2250	35 kip	↓	1,475	.022	↓	.99	.63	.03	1.65	2.23

033 | Cast-In-Place Concrete

		033 100 | Structural Concrete	CREW	DAILY OUTPUT	LABOR-HOURS	UNIT	1997 BARE COSTS				TOTAL INCL O&P
							MAT.	LABOR	EQUIP.	TOTAL	
102	0010	**AGGREGATE** Expanded shale, C.L. lots, 52 lb. per C.F., minimum				Ton	35			35	38.50
	0050	Maximum				•	45			45	49.50
	0100	Lightweight vermiculite or perlite, 4 C.F. bag, C.L. lots				Bag	7.25			7.25	8
	0150	L.C.L. lots				•	7.50			7.50	8.25
	0250	Sand & stone, loaded at pit, crushed bank gravel				Ton	11.50			11.50	12.65
	0350	Sand, washed, for concrete					8			8	8.80
	0400	For plaster or brick					15.75			15.75	17.35
	0450	Stone, 3/4" to 1-1/2"					11.50			11.50	12.65
	0500	3/8" roofing stone & 1/2" pea stone					12			12	13.20
	0550	For trucking 10 miles, add to the above					3.36			3.36	3.70
	0600	30 miles, add to the above				↓	7.60			7.60	8.35
	0850	Sand & stone, loaded at pit, crushed bank gravel				C.Y.	16.10			16.10	17.70
	0950	Sand, washed, for concrete					10.80			10.80	11.90
	1000	For plaster or brick					22.50			22.50	24.50
	1050	Stone, 3/4" to 1-1/2"					17.25			17.25	19
	1100	3/8" roofing stone & 1/2" pea stone					55			55	60.50
	1150	For trucking 10 miles, add to the above					4.70			4.70	5.15
	1200	30 miles, add to the above				↓	10.65			10.65	11.70

APPENDIX P

PERSONAL COMMUNICATIONS

ICF KAISER *Interoffice Correspondence*

DATE: February 14, 1997

TO: Jeanette Duvall

FROM: Daniel J. Rembert

cc: Rachel Skerritt

JOB NUMBER: 67861-003-00

SUBJECT: Phone Conversations for Information

On February 13, 1997, I called Trinity High School (225-5380) to get their enrollment. The enrollment for the school is approximately 1,190. I got this information from Mrs. Brooks, the guidance secretary at the school office.

ICF KAISER *Interoffice Correspondence*

DATE: March 17, 1997

TO: Jeanette Duvall

FROM: Rachel Skerritt

cc:

JOB NUMBER: 67861-003-00

SUBJECT: Phone Conversations for Information

Don Burick from the Pennsylvania Department of Transportation informed me on March, 17, 1997 that a 24-hour count of traffic on the east-bound lanes of I-70 near the Washington Molycorp site is 20,228 and the count on the west-bound lanes is 19,072.

ICF KAISER

Interoffice Correspondence

DATE: February 21, 1997

TO: Jeanette Duvall

FROM: Rachel Skerritt

cc:

JOB NUMBER: 67861-003-00

SUBJECT: Phone Conversations for Information

Patty Copp of the Fish and Boat Commission informed me that the fish normally found in Washington County include bass, pike, trout, muskee, (tiger muskee also), suckers, and walleye. She also said that none of these fish have been documented as being in Chartiers Creek near the Washington Molycorp property.

ICF KAISER

Interoffice Correspondence

DATE: March 5, 1997

TO: Jeanette Duvall

FROM: Rachel Skerritt

cc:

JOB NUMBER: 67861-003-00

SUBJECT: Phone Conversations for Information

Karen Franks of the Washington County Planning Commission informed me that Washington County's current unemployment rate is 4.5%.

ICF KAISER *Interoffice Correspondence*

DATE: February 14, 1997

TO: Jeanette Duvall

FROM: Daniel J. Rembert

cc: Rachel Skerritt

JOB NUMBER: 67861-003-00

SUBJECT: Phone Conversations for Information

On February 13, 1997, I called St. Hilary School (222-8750) to get their enrollment. The enrollment for the school is 63. I got this information from Debbie Harter, a secretary at the school office.

ICF KAISER

Interoffice Correspondence

DATE: February 14, 1997

TO: Jeanette Duvall

FROM: Daniel J. Rembert

cc: Rachel Skerritt

JOB NUMBER: 67861-003-00

SUBJECT: Phone Conversations for Information

On February 13, 1997, I called John F. Kennedy School (225-1680) to get their enrollment. The enrollment for the school is 550. I got this information from Lou, a secretary at the school office.

Newport, T.G., 1973, Summary Ground-Water Resources of Washington County, Pennsylvania. Department of Environmental Resources, Water Resources Report 38, page 23.

Well Location and Spacing

Well spacing is generally not critical when water is being pumped for domestic purposes. Locating an adequate water supply in the Greene Formation can be difficult for the reasons stated in the preceding section. It is possible to develop modest household supplies from the thicker sandstone members where they occur below the water table.

Water Quality

Only two partial chemical analyses of water from the Greene Formation are available – dissolved solids, 411 and 436 mg/l, and iron, 0.81 and 0.93 mg/l. The water is of good quality, but moderately hard.

WASHINGTON FORMATION

Lithology

The Washington Formation consists of alternating beds of shale and sandstone and several coal beds. There are some thin-bedded discontinuous limestone members. The basal member is a dark-colored sandy shale.

Water-Bearing Characteristics

In general the Washington Formation is a poor water bearer. The soft shale that constitutes the major part of the section is a very poor water bearer, although a small amount of water is available from bedding planes. The basal sandy shale yields water in larger quantities where it is not deeply buried.

Well Depths and Yields

Well yields in this formation range from less than 1 to 70 gpm, and the median yield is 2 gpm. Several wells in this formation do not yield water. The yields of wells in the Washington Formation are generally low because of the shale members and the scarcity of fractures. Well depths range from 36 to 304 feet.

Well Locations and Spacing

Small household water supplies can be developed from the sandy units in the Washington Formation. Domestic well location and spacing is generally not critical.

Water Quality

Only one chemical analysis of water from the Washington Formation is available. Dissolved-solids content was 318 mg/l, and iron content was 0.5 mg/l.

ICF KAISER

Interoffice Correspondence

DATE: March 5, 1997

TO: Jeanette Duvall

FROM: Rachel Skerritt

cc:

JOB NUMBER: 67861-003-00

SUBJECT: Phone Conversations for Information

Sam Taylor of Pennsylvania American Water Company informed me that Reservoirs No. 1, No. 2, No. 3, and No. 4, upstream on Chartiers Creek from the Molycorp facility are not in use and in the process of being sold.

ICF KAISER

Interoffice Correspondence

DATE: March 3, 1997

TO: Jeanette Duvall

FROM: Daniel J. Rembert

cc: Rachel Skerritt

JOB NUMBER: 67861-003-00

SUBJECT: Phone Conversation for Information

I called William Kudaroski (571-7717), Operations Manager for Pennsylvania American Water Company, on February 28, 1997 and finally talked to him on March 3, 1997. I asked him about the locations of their pumphouses for the Washington Area. He informed me that the Becks Run intake is taken from the Monogahela River at milepoint 4.5 and the Aldrich intake is taken from the Monogahela River at milepoint 25.5. The address of the Hayes-Mine/Becks Run pumphouse is 380 Becks Run Road in Pittsburgh's South Side and the Aldrich pumphouse address is 60 Elrama Street in Elrama, PA.

ICF KAISER

Interoffice Correspondence

DATE: March 6, 1997

TO: Jeanette Duvall

FROM: Daniel J. Rembert

cc: Rachel Skerritt

JOB NUMBER: 67861-003-00

SUBJECT: Phone Conversation for Information

I called William Kudaroski (571-7717), Operations Manager for Pennsylvania American Water Company, on March 6, 1997, to ask him if they are running at capacity. He informed me that they have a total capacity of about 110 million gallons and the option to purchase about 10 more million off of the city but, they only have been using about 70 million gallons.

ICF KAISER

Interoffice Correspondence

DATE: February 24, 1997

TO: Jeanette Duvall

FROM: Daniel J. Rembert

cc: Rachel Skerritt

JOB NUMBER: 67861-003-00

SUBJECT: Phone Conversations for Information

Gene Wolbert of the PA DEP called me on February 24, 1997, in reference to the letter that was sent to David Plank on February 13, 1997. He informed me that there are no wells, that the DEP is aware of, in the Molycorp and surrounding 2 km diameter area.

ICF KAISER *Interoffice Correspondence*

DATE: March 6, 1997

TO: Jeanette Duvall

FROM: Daniel J. Rembert

cc: Rachel Skerritt

JOB NUMBER: 67861-003-00

SUBJECT: Phone Conversation for Information

I called and talked to Jim Post (222-3272), at the Arden Landfill, to ask him the name of the company that runs the site and if they are at capacity for their disposal cap. He informed me that USA Waste Services, Inc. is the company that is on site. They have enough capacity to be at this site for about 50 or 60 more years.

ICF KAISER *Interoffice Correspondence*

DATE: February 24, 1997

TO: Rachel Skerritt

FROM: Jeanette Duvall

cc:

JOB NUMBER: 67861-003-00

SUBJECT: Phone Conversations for Information

Steve Sproull, a Deputy Wildlife Conservation Officer for the Pennsylvanian Game Commission informed me that the following animals can be found in Washington County - squirrels, chipmunks, rabbits, deer, bear, bobcat, vaious rodents, and various birds. However, these animals have not been documented as being on the Molycorp property.

ICF KAISER *Interoffice Correspondence*

DATE: February 14, 1997

TO: Jeanette Duvall

FROM: Daniel J. Rembert

cc: Rachel Skerritt

JOB NUMBER: 67861-003-00

SUBJECT: Phone Conversations for Information

On February 13, 1997, I called Washington High School (223-5085) to get their enrollment. The enrollment for the school is 547. I got this information from Mrs. Stevens, a secretary at the school office.

ICF KAISER

Interoffice Correspondence

DATE: February 14, 1997

TO: Jeanette Duvall

FROM: Daniel J. Rembert

cc: Rachel Skerritt

JOB NUMBER: 67861-003-00

SUBJECT: Phone Conversations for Information

On February 13, 1997, I called Trinity Middle School (228-2112) to get their enrollment. The enrollment for the school is 965. I got this information from a secretary at the school office.

ICF KAISER *Interoffice Correspondence*

DATE: February 14, 1997

TO: Jeanette Duvall

FROM: Daniel J. Rembert

cc: Rachel Skerritt

JOB NUMBER: 67861-003-00

SUBJECT: Phone Conversations for Information

On February 13, 1997, I called Trinity West Elementary School (222-4730) to get their enrollment. The enrollment for the school is 454. I got this information from a secretary at the school office.

ICF KAISER

Interoffice Correspondence

DATE: February 14, 1997

TO: Jeanette Duvall

FROM: Daniel J. Rembert

cc: Rachel Skerritt

JOB NUMBER: 67861-003-00

SUBJECT: Phone Conversations for Information

On February 13, 1997, I called Washington and Jefferson College (222-4400) to get their enrollment. The enrollment for the school was 1,117 in the fall semester and is 1,077 this semester (spring). I got this information from a secretary at the public information office.