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February 26, 2003

UPS Next Day Air: 1Z 875 261 01 1002 189 8

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c/o Document Control Desk  
Chief of Fuel Cycle Facilities Branch (Mailstop T8-A33)  
Division of Fuel Cycle Safety and Safeguards  
Office of Nuclear Materials Safety and Safeguards  
U. S. Nuclear Regulatory Commission  
11545 Rockville Pike  
Two White Flint North  
Rockville, MD 20852-2738

RE: **Docket No. 40-8903**  
**License No. SUA-1471**  
**Semi-Annual Environmental Monitoring Report**  
**Period – July through December 2002**

Dear Mr. Von Till:

Pursuant to US Nuclear Regulatory Commission Regulation 10 CFR 40.85 and Part 20, Homestake Mining Company of California hereby submits two (2) copies of their semi-annual report for the second half of 2002 (July through December) for the Homestake Grants Reclamation Project.

The content of the attached semi-annual report follows the general format used for previously submitted reports. The 2002 ground water data required under LC 15 of the license (per License Amendment 31) is included in this report.

The second reverse osmosis (RO) unit for expanding the RO water treatment plant to a 600-gpm capacity was completed in early 2002 as stated in the previous semi-annual report. Due to existing evaporation pond storage limitations, the plant was cut back to a one RO unit operating level (300-gpm) in late May. In the latter part of 2002, the plant operating level was increased to an approximate 425-gpm rate. At present we anticipate this will be near optimum with the existing pond storage capacities and associated seasonal forced evaporative spray systems on the ponds.

Any questions or comments regarding this report can be directed to me at my Albuquerque office (505) 828-1621 or at the Grants office (505) 287-4456.

Sincerely,

Enclosures (2)

xc: Mr. Blair Spilzberg, Chief, Decommissioning Branch, w/enclosure  
Mr. Bob Ingersoll, Barrick, SLC, w/enclosure  
Mr. George Hoffman, Hydro Engineering, w/enclosure  
Mr. Mark Purcell, EPA, w/enclosure

nmss01

# **HOMESTAKE MINING COMPANY OF CALIFORNIA GRANTS PROJECT**



## **SEMI-ANNUAL ENVIRONMENTAL MONITORING REPORT**

**JULY – DECEMBER**

**2002**

**State of New Mexico DP-200  
U.S. Nuclear Regulatory Commission License SUA-1471**

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## 1.0 INTRODUCTION

This Semi-Annual Environmental Monitoring Report summarizes effluent monitoring data recorded for Homestake Mining Company of California - Grants Project (Homestake) from July through December 2002. The submittal of this report to the appropriate Nuclear Regulatory Commission (NRC) Regional Office and State of New Mexico within 60 days after January 1, and July 1 for each year of operation is required for all uranium mill facilities pursuant to 10 CFR Part 40.65. The monitoring data and the report format has been selected by Homestake representatives to satisfy the requirements of 10 CFR Part 40.65.

Homestake's monitoring and surveillance program for radioactive effluent releases have been designed to ensure the project compliance with 10 CFR Part 40, and Part 20 U.S. NRC Standards for Protection Against Radiation and closely approximates programs as described in NRC's Regulatory Guide 4.14, Radiological Effluent and Environmental Monitoring at Uranium Mills. Some effluent monitoring activities differ from those presented in the Regulatory Guide 4.14 as required by Homestake's Radioactive Materials License (SUA-1471).

Recontouring reclamation activities began in September 1993 and mill demolition commenced in late October 1993 and was completed December 10, 1995. A mill decommissioning completion report was submitted in February 1996 and approved by the NRC on January 28, 1999. The large tailings pile has been recontoured and covered with interim cover on the top and radon barrier on the outcrops. Bedding and erosion protection was placed on the outcrops. Soil verification of the removal of off-pile contaminated soil is complete; the completion report submitted December 18, 1995 and approved by the NRC on January 29, 1999. In addition, a decommissioning report for the mine ion-exchange (IX) plant was completed and approved on December 22, 1997.

During the reporting period Homestake operated a reverse osmosis water treatment plant as part of the ongoing ground water restoration program at the site. For the operating period from July through December, the RO plant processed an average 303-gpm while producing an average of 242-gpm of product water that was used for re-injection. In late May 2002, operation of the RO plant was cut back to operating one RO unit to address limitations on existing pond storage capacities at the project. During the latter part of 2002 a target throughput rate for the plant was set at 425-gpm, which is being continued for the first quarter 2003.

Homestake's groundwater monitoring program, as outlined in license Condition No. 35, continued as an ongoing program during this period. The requirements set forth in Condition No. 35 include the reporting of both radiological and non-radiological water quality parameters for specified wells, as well as the documentation of water injection and collection volumes of the groundwater cleanup system. The performance review of the corrective action program is submitted annually as a separate document and contains the groundwater monitoring information for January 1 through December 31 of each year. In order to meet NRC's requirement for semi-annual reporting, groundwater-monitoring data for the point-of-compliance (POC) wells and background well P is included in this report. It should be noted that while the POC wells are presently viewed as wells that will eventually be used to demonstrate final groundwater restoration, they are not representative of off-site effluent levels.

## **2.0 ENVIRONMENTAL MONITORING PROGRAMS**

The monitoring requirements for the site are summarized in Tables 1, 2, and 3. Details of the monitoring program are discussed in the following sections:

### **2.1 Air Particulate Monitoring**

Homestake continuously samples total suspended particulate (TSP) at six locations around the reclamation site (see Figure 1). Those locations identified as HMC-1, HMC-2 and HMC-3 are areas at the property boundary expected to have the highest predictable concentrations of airborne radioactive particulate. The predominant wind direction is from the Southwest; accordingly, HMC-1, HMC-2 and HMC-3 are generally located down wind from Homestake's reclamation activities. The location identified at HMC-6 represents background conditions, and is located due west of the large tailings pile at the western most side of the property boundary. Locations HMC-4 and HMC-5 represent the sites of the nearest residences. TSP results for U-nat, Th230 and Ra226 are presented in Attachment 1.

Homestake uses Sierra Instruments Model #305-200 High Volume Air Samplers (or equivalent) to continuously sample the ambient air of the locations shown in Figure 1. The samples are collected on 8-inch by 10-inch Whatman glass fiber filters (or equivalent), which are changed weekly or more frequently as required by dust loading. Energy Laboratories, Inc analyzes the collected samples quarterly for Natural Uranium, Radium-226, and Thorium-230.

### **2.2 Radon Gas Monitoring**

Radon gas concentrations are monitored on a continuous basis at the eight locations identified in Figure 1. The background station for radon gas is HMC #16, located Northwest of the site. Landauer Corporation's track-etch passive radon monitors (PRM), or the equivalent, are used to continuously monitor radon gas at each sampling location. Semi-annually Homestake personnel place new alpha particle sensitive detectors at monitoring locations and the exposed detectors are retrieved and returned to Landauer Corporation for analysis. The technique by which the PRM detectors measure radon gas concentrations consists of exposing an alpha-particle sensitive plastic detector, which is mounted in a plastic container, to ambient air. The decay of radon gas contained in the ambient air causes imprint tracks on the alpha-sensitive detector that can then be counted at a later time. The radon gas concentration can subsequently be calculated by determining the number of tracks per unit area of the detector. A filter is placed over the container opening to inhibit the entrance of any alpha-emitting dust particles. The radon gas concentration results at the eight monitoring sites are presented in Attachment 2.

## **3.0 WATER QUALITY MONITORING**

Table 2 (8-99 as modified by Amendment 34) outlines the ground-water quality sampling wells, frequency of sampling, and parameters monitored. Additionally, the volumes of water injected and recovered as part of the ground-water cleanup program is monitored on a weekly frequency and the values are documented. A performance review report is submitted by March 31 of each year according to License Condition 35E. In order to comply with 10 CFR 40.65, the groundwater

monitoring data for the POC wells and background well P, reported in Tables 2.1.1-2.1.4, is included in this report

The ongoing ground-water restoration program is currently influencing the water quality of the POC wells and therefore the reported levels are not representative of effluent from the site. The concentration levels are therefore not compared to 10 CFR 20 effluent limits. A hydraulic barrier forces the water in the aquifer near these POC wells to move in the direction of the collection wells where the water is withdrawn and treated.

#### **4.0 DIRECT RADIATION**

Gamma exposure rates are continuously monitored through the use of thermo luminescent dosimeters (TLDs) placed at each of the seven locations identified in Figure 1. HMC #16 is considered the background location for direct radiation. Each TLD badge consists of five LiF chips selected for uniform response and placed in a plastic holder. The plastic provides adequate protection from weather for these badges to be used out-of-doors. The TLD's are exchanged semi-annually and analyzed by an approved independent laboratory (currently Landauer Inc.). The integrated levels of direct environmental radiation are recorded for each of the seven locations. The data are reported in Attachment 3.

#### **5.0 SURFACE CONTAMINATION**

The Occupational Monitoring Program requirements for the Grants site are summarized in Table 3. The aspects related to contamination control are discussed briefly below.

##### **5.1 Personnel Skin and Clothing**

The monitoring of personnel for alpha contamination is required as part of all radiation work permits using standard operating procedures. No releases of personnel or clothing above administrative limits were reported during this reporting period.

##### **5.2 Survey of Equipment Prior to Release for Unrestricted Use**

Equipment surveys are required for all equipment that is to be removed from contaminated areas as specified in radiation work permits. Standard Operating Procedures are in place and are used for these surveys. No releases of contaminated material above NRC release criteria were reported.

#### **6.0 LOWER LIMIT OF DETECTION**

Homestake representatives have calculated the Lower Limit of Detection (LLD) for each measurement system, where applicable, to more accurately evaluate concentrations of radioactive material measured in the environment surrounding the mill site. The lower limit of detection is defined in the U.S. Nuclear Regulatory Guide 4.14 as the smallest concentration of radioactive material sampled that has a 95% probability of being detected, with only a 5% probability that a blank sample will yield a response interpreted to mean that radioactive material is present. Since

the LLD is a function of sample volume, counting efficiency, radiochemical yield, etc., it varies for different sampling and analysis procedures.

For the individual measurement systems for which Homestake has calculated LLDs, the following formula was utilized:

$$LLD = \frac{4.66 S_b}{3.7 E 4 V Y \exp(-\lambda \Delta t)}$$

Where:

LLD is the lower limit of detection (microCuries per milliliter);  
S<sub>b</sub> is the standard deviation of the instrument background counting rate (counts per second);  
3.7 E 4 is the number of disintegrations per second per microCurie;  
E is the counting efficiency (counts per disintegration);  
V is the sample volume (milliliters);  
Y is the fractional radiochemical yield (when applicable);  
λ is the radioactive decay constant for the particular radionuclide; and;  
Δt is the elapsed time between sample collection and counting

The value of S<sub>b</sub> used in the calculation of the LLD for a particular measurement system will be based on the actual observed variance of the instrument background counting rate. The laboratory has been instructed to report the LLD for each measurement considering all of the parameters associated with the measurement system and the sample size.

The vendor laboratory that performed the analyses reported herein has documented that the LLD for air and water samples will meet or exceed the requirements in Regulatory Guide 4.14. This assumes a minimum water sample size of 1 liter and an air sample volume of 2 E09 ml. Landauer, Inc reports the LLD for radon-222. The LLDs for the constituents are:

Ra-226, Th-230 in air	1 E-16 μCi/ml
Rn-222 in air	30 pCi(d/l)
U-nat in air	1 E-16 μCi/ml
U-nat in water	2 E-10 μCi/ml
Ra-226, Th-230 in water	2 E-9 μCi/ml
Ra-228 in water	1 E-9 μCi/ml

U-nat is analyzed by a fluorometric method by the current vendor laboratory. In order to determine the LLD, the laboratory has performed the analysis on a blank sample many times and uses the standard deviation of these background measurements to calculate the LLD. This LLD is specified for all analyses as long as the sample size or volume meets the minimum value.

## 7.0 DATA SUMMARY AND CONCLUSIONS

The summaries of Homestake's effluent monitoring program included in this submittal contain data for each of the regulated parameters released to unrestricted areas. The State of New Mexico

discharge permit for Grants, DP-200, dated November 15, 1995, and 10 CFR Part 40.65 requires that Homestake submit its effluent release monitoring data to the State of New Mexico and the NRC within 60 days of the end of the six-month period ending January 1 and July 1 of each year. Homestake is submitting this report to satisfy the regulatory requirements cited above. Included in this report's attachments are summaries of the results of the effluent monitoring activities conducted by Homestake and pertinent to the required monitoring time period.

The data collected in many of Homestake's effluent monitoring programs can be readily compared to 10 CFR Part 20 values. Homestake has not exceeded 10 CFR Part 20 values in any of their effluents monitored during the period covered by this report. This, of course, does not include the ground water values at the POC wells as discussed earlier. The maximum annual effective dose equivalent to the public has been calculated for the year 2002, based upon the environmental monitoring data. The report, Attachment 4, shows that the Total Effective Dose Equivalent (TEDE) to the nearest resident is less than the 100-mrem/year NRC limit.

Vegetation and soil samples are no longer required on an annual basis per Amendment 24 to Source Material License.



**Table 1 - Environmental Monitoring Program Excluding  
Groundwater Monitoring**

TABLE 1 - Environmental Monitoring Program Excluding Groundwater Monitoring

Type of Sample	Number	Locations	Method	Frequency	Analytical Parameters
AIR Particulates	3	HMC1, HMC2, HMC3 at or near the site boundary in sectors that have the highest predicted concentrations of radioactive airborne particulates.	Continuous (High Vol.)	Weekly filter change or more frequently as required. Samples composited and analyzed quarterly.	Natural Uranium, Radium-226, Thorium-230
	2	HMC4, HMC5 at nearest occupied residences	Continuous (High Vol.)	Weekly filter change, or more frequently as required. Samples composited and analyzed quarterly.	Natural Uranium, Radium-226, Thorium-230
	1	HMC6 background location	Continuous (High Vol.)	Weekly filter change, or more frequently as required. Samples composited and analyzed quarterly.	Natural Uranium, Radium-226, Thorium-230
Radon Gas	8	Locations described in Air - Particulates & HMC7 on S boundary & HMC16 as a background	Continuous Track-etch	Semi-Annual	Rn-222
DIRECT RADIATION	7	Locations described in Air - Particulates & HMC-16 as a background	Continuous Track-etch	Semi-Annual	Gamma Exposure Rate

**Table 2 – Groundwater Monitoring Program  
(8-99 as modified by Amendment 34)**

**TABLE 2 – Groundwater Monitoring Program (8-99 as modified by Amendment 34)**

<b>Well Number</b>	<b>Parameters to be Monitored</b>	<b>Frequency of Monitoring</b>
#1 & #2 Deepwells	D	Annually
Broadview Acres Wells 446, SUB1, SUB2, SUB3	G	Annually
Felice Acres Wells 490, 492, 493, 494	G	Annually
Murray Acres Wells 802, 844	G	Annually
Pleasant Valley Wells 688, 846	G	Annually
Regional Wells 920, 942	G	Annually
Site Monitoring Wells F, FB, GH, MO, CW2	G	Annually
Collection System Wells	Total Volume	Monthly
Injection System Wells	Total Volume	Monthly
Reversal Wells B, BA, KZ, DZ*, SO, SP, S1, S2	Water Level	Weekly
Point of Compliance Wells D1, X, S4	B, F	Annually
Background Well P	B	Annually

\* Well DZ replaced well KF by Amendment 34 - License Condition 35 A

B = Water Level, pH, TDS, SO<sub>4</sub>, Cl, HCO<sub>3</sub>, CO<sub>3</sub>, Na, Ca, Mg, K, NO<sub>3</sub>, U, Se, Mo, Ra-226

D = Ca, Mg, K, Na, HCO<sub>3</sub>, CO<sub>3</sub>, Cl, SO<sub>4</sub>, pH, TDS, Al, As, Ba, Cd, Co, Cu, CN, F, Fe, Pb, Mn, Hg, Mo, Ni, NO<sub>3</sub> as N, Se, Ag, Zn, U, Filtered Ra-226

F = V, Ra-228, Th-230

G = Water Level, SO<sub>4</sub>, U, Se, TDS, Mo

**Table 2.1.1 - Water Quality Analyses for Well D1**



### LABORATORY ANALYSIS REPORT

Client: Homestake Mining Company

Sample ID:  
Sample Date/Time:  
Date Received:  
Sample Matrix:  
Laboratory ID:  
Report Date:

D1	D1
05/30/2001 08:50	06/10/2002 10:06
06/11/2001 10:00	06/13/2002 10:00
Liquid, Water	Liquid, Water
01-33453-1	C02060442-001
July 6, 2001	July 15, 2002

Major Ions	Parameter Code	Method	Units	"Lower Limit of Detection"	Results	Results
Calcium	1	EPA 200.7	mg/L	1.0	211	212
Magnesium	2	EPA 200.7	mg/L	1.0	49.1	53.1
Sodium	4	EPA 200.7	mg/L	1.0	329	336
Potassium	3	EPA 200.7	mg/L	1.0	4.2	4.1
Carbonate	6	SM 2320-B	mg/L	1.0	< 1.0	< 1.0
Bicarbonate	5	SM 2320-B	mg/L	1.0	522	542
Sulfate	8	EPA 200.7	mg/L	1.0	769	720
Chloride	7	EPA 200.7	mg/L	0.10	192	196
Nitrate + Nitrite as N	39	EPA 353.2	mg/L	0.10	2.67	2.58

Non-Metals						
Total Dissolved Solids	10	SM 2540-C	mg/L	10	1960	1920
Alkalinity	75	SM 2320-B	mg/L	1.0	428	445
pH	9	SM 4500-H-B	std. units	0.10	7.95	7.93

Trace Metals						
Molybdenum	36	EPA 200.8	mg/L	0.03	0.97	1.05
Selenium	40	EPA 200.8	mg/L	0.005	0.111	0.089
Vanadium	42	EPA 200.8	mg/L	0.01	< 0.01	< 0.01

Radiometric						
Uranium	15	EPA 200.8	mg/L	0.0003	1.34	1.15
*Uranium Precision ±	244				0.003	0.002
Uranium, Rad	113	EPA 200.8	µCi/mL	2.0E-10	9.1E-07	7.8E-07
*Uranium Precision ±	114				1.8E-09	1.6E-09
Radium 226	45	EPA 903.0	pCi/L	0.2	< 0.2	< 0.2
Radium Error Estimate ±	245				0.3	0.2
Radium 226	256	EPA 903.0	µCi/mL	2.0E-10	< 2.0E-10	< 2.0E-10
Radium Error Estimate ±	258				3.0E-10	2.0E-10
Radium 228	57	EPA 904.0	pCi/L	1.0	< 1.0	< 1.0
Radium Error Estimate ±	257				1.0	1.0
Radium 228	359	EPA 904.0	µCi/mL	1.0E-09	< 1.0E-09	< 1.0E-09
Radium Error Estimate ±	360				1.0E-09	1.0E-09
Thorium 230	48	EPA 907.0	pCi/L	0.2	0.5	< 0.2
Thorium Error Estimate ±	248				0.5	0.4
Thorium 230	362	EPA 907.0	µCi/mL	2.0E-10	5.0E-10	< 2.0E-10
Thorium Error Estimate ±	363				5.0E-10	4.0E-10

Quality Assurance Data			Target Range	
Anion	meq		30.2	29.6
Cation	meq		29.1	29.7
SM A/C Balance	%	-5 - +5	-1.95	0.19
Calc TDS	mg/L		1828	1805
TDS A/C Balance	dec %	0.80 - 1.20	1.07	1.06

\*Precision is calculated using standard deviation of mean of replicate analysis multiplied by concentration.

"Lower Limit of Detection" is related to reporting limits suggested by Regulatory Guideline 4.14 in some cases.

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**Table 2.1.2 - Water Quality Analyses for Well S4**



### LABORATORY ANALYSIS REPORT

Client: Homestake Mining Company

Sample ID:  
Sample Date/Time:  
Date/Time Received:  
Sample Matrix:  
Laboratory ID:  
Report Date:

S4	S4
07/23/2001 15:00	07/16/2002 15:38
07/31/2001 10:00	07/18/2002 10:00
Liquid, Water	Liquid, Water
C01080027-004	C02070555-004
September 11, 2001	August 13, 2002

Major Ions	Parameter Code	Method	Units	Lower Limit of Detection	Results	Results
Calcium	1	EPA 200.7	mg/L	1.0	410	366
Magnesium	2	EPA 200.7	mg/L	1.0	86.0	81.6
Sodium	4	EPA 200.7	mg/L	1.0	530	406
Potassium	3	EPA 200.7	mg/L	1.0	6.5	6.4
Carbonate	6	SM 2320-B	mg/L	1.0	< 1.0	< 1.0
Bicarbonate	5	SM 2320-B	mg/L	1.0	426	398
Sulfate	8	EPA 200.7	mg/L	1.0	1700	1530
Chloride	7	EPA 200.7	mg/L	0.10	150	148
Nitrate + Nitrite as N	39	EPA 353.2	mg/L	0.10	< 0.10	< 0.10

<b>Non-Metals</b>						
Total Dissolved Solids	10	SM 2540-C	mg/L	10	3280	3090
Alkalinity	75	SM 2320-B	mg/L	1.0	350	327
pH	9	SM 4500-H-B	std. units	0.01	7.90	8.01

<b>Trace Metals</b>						
Molybdenum	36	EPA 200.8	mg/L	0.03	0.54	0.47
Selenium	40	EPA 200.8	mg/L	0.005	0.013	0.015
Vanadium	42	EPA 200.8	mg/L	0.01	< 0.01	< 0.01

<b>Radiometric</b>						
Uranium	15	EPA 200.8	mg/L	0.0003	2.90	2.20
*Uranium Precision ±	244				0.067	0.099
Uranium, Rad.	113	EPA 200.8	µCi/mL	2.0E-10	2.0E-06	1.5E-06
*Uranium Precision ±	114				4.5E-08	3.4E-08
Radium 226	45	EPA 903.0	pCi/L	0.2	0.7	1.2
Radium Error Estimate	245				0.3	0.2
Radium 226	256	EPA 903.0	µCi/mL	2.0E-10	7.0E-10	1.2E-09
Radium Error Estimate	258				3.0E-10	2.0E-10
Radium 228	57	EPA 904.0	pCi/L	1.0	< 1.0	< 1.0
Radium Error Estimate	257				0.8	1.0
Radium 228	359	EPA 904.0	µCi/mL	1.0E-09	< 1.0E-09	< 1.0E-09
Radium Error Estimate	360				8.0E-10	1.0E-09
Thorium 230	48	EPA 907.0	pCi/L	0.2	< 0.2	< 0.2
Thorium Error Estimate	248				0.1	0.2
Thorium 230	362	EPA 907.0	µCi/mL	2.0E-10	< 2.0E-10	< 2.0E-10
Thorium Error Estimate	363				1.0E-10	2.0E-10

Quality Assurance Data			Target Range	
Anion	meq		46.7	42.6
Cation	meq		50.9	42.9
SM A/C Balance	%	-5 - +5	4.32	0.36
Calc TDS	mg/L		3097	2738
TDS A/C Balance	dec. %	0.80 - 1.20	1.06	1.13

\*Precision is calculated using standard deviation of mean of replicate analysis multiplied by concentration.

"Lower Limit of Detection" is related to reporting limits suggested by Regulatory Guideline 4.14 in some cases.



**Table 2.1.3 - Water Quality Analyses for Well X**



**ENERGY LABORATORIES, INC.**  
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### LABORATORY ANALYSIS REPORT

Client: Homestake Mining Company

Sample ID:  
Sample Date/Time:  
Date/Time Received:  
Sample Matrix:  
Laboratory ID:  
Report Date:  
Revised Report Date:

X	X
07/25/2001 08:18	07/15/2002 14:18
07/31/2001 10:00	07/18/2002 10:00
Liquid, Water	Liquid, Water
C01070307-2	C02070555-002
August 23, 2001	August 13, 2002
	October 10, 2002

Major Ions	Parameter Code	Method	Units	Lower Limit of Detection	Results	Results
Calcium	1	EPA 200.7	mg/L	1.0	57.5	25.6
Magnesium	2	EPA 200.7	mg/L	1.0	16.3	5.4
Sodium	4	EPA 200.7	mg/L	1.0	65.5	14.9
Potassium	3	EPA 200.7	mg/L	1.0	2.5	1.4
Carbonate	6	SM 2320-B	mg/L	1.0	< 1.0	< 1.0
Bicarbonate	5	SM 2320-B	mg/L	1.0	309	101
Sulfate	8	EPA 200.7	mg/L	1.0	61.0	16.0
Chloride	7	EPA 200.7	mg/L	0.10	31.4	15.9
Nitrate + Nitrite as N	39	EPA 353.2	mg/L	0.10	1.12	0.62

Non-Metals						
Total Dissolved Solids	10	SM 2540-C	mg/L	10	417	155
Alkalinity	75	SM 2320-B	mg/L	1.0	253	83.0
pH	9	SM 4500-H-B	std. units	0.01	8.00	7.94

Trace Metals						
Molybdenum	36	EPA 200.8	mg/L	0.03	0.16	0.30
Molybdenum (Recheck)	36	EPA 200.8	mg/L	0.03	0.16	0.30
Selenium	40	EPA 200.8	mg/L	0.005	0.007	< 0.005
Selenium (Recheck)	40	EPA 200.8	mg/L	0.005	0.007	< 0.005
Vanadium	42	EPA 200.8	mg/L	0.01	0.01	0.01

Radiometric						
Uranium	15	EPA 200.8	mg/L	0.0003	0.044	0.009
*Uranium Precision ±	244				0.000	0.000
Uranium, Rad	113	EPA 200.8	µCi/mL	2.0E-10	3.0E-08	6.1E-09
*Uranium Precision ±	114				3.3E-10	6.7E-11
Radium 226	45	EPA 903.0	pCi/L	0.2	0.2	< 0.2
Radium Error Estimate ±	245				0.2	0.2
Radium 226	256	EPA 903.0	µCi/mL	2.0E-10	2.0E-10	2.0E-10
Radium Error Estimate ±	258				2.0E-10	2.0E-10
Radium 228	57	EPA 904.0	pCi/L	1.0	< 1.0	5.4
Radium Error Estimate ±	257				0.8	1.4
Radium 228	359	EPA 904.0	µCi/mL	1.0E-09	< 1.0E-09	5.4E-09
Radium Error Estimate ±	360				8.0E-10	1.4E-09
Radium 228 (Recheck)	57	EPA 904.0	pCi/L	1.0	< 1.0	< 1.0
Radium Error Estimate ±	257				0.8	0.8
Radium 228	359	EPA 904.0	µCi/mL	1.0E-09	< 1.0E-09	< 1.0E-09
Radium Error Estimate ±	360				8.0E-10	8.0E-10
Thorium 230	48	EPA 907.0	pCi/L	0.2	0.2	< 0.2
Thorium Error Estimate ±	248				0.2	0.2
Thorium 230	362	EPA 907.0	µCi/mL	2.0E-10	2.0E-10	< 2.0E-10
Thorium Error Estimate ±	363				2.0E-10	2.0E-10

Quality Assurance Data			Target Range	
Anion	meq		7.33	2.51
Cation	meq		7.15	2.41
SM A/C Balance	%	-5 - +5	-1.30	-2.05
Calc TDS	mg/L		395	133
TDS A/C Balance	dec. %	0.80 - 1.20	1.06	1.16

\*Precision is calculated using standard deviation of mean of replicate analysis multiplied by concentration.

"Lower Limit of Detection" is related to reporting limits suggested by Regulatory Guideline 4.14 in some cases.

**Table 2.1.4 - Water Quality Analyses for Background Well P**



### LABORATORY ANALYSIS REPORT

Client: Homestake Mining Company

Sample ID:

Sample Date/Time:

Date/Time Received:

Sample Matrix:

Laboratory ID:

Report Date:

P	P
07/23/2001 12:02	07/15/2002 14:56
07/31/2001 10:00	07/18/2002 10:00
Liquid, Water	Liquid, Water
C01080046-1	C02070555-001
August 23, 2001	August 13, 2002

Major Ions	Parameter Code	Method	Units	"Lower Limit of Detection"	Results	Results
Calcium	1	EPA 200.7	mg/L	1.0	238	246
Magnesium	2	EPA 200.7	mg/L	1.0	51.2	52.3
Sodium	4	EPA 200.7	mg/L	1.0	239	244
Potassium	3	EPA 200.7	mg/L	1.0	5.0	4.8
Carbonate	6	SM 2320-B	mg/L	1.0	< 1.0	< 1.0
Bicarbonate	5	SM 2320-B	mg/L	1.0	243	242
Sulfate	8	EPA 200.7	mg/L	1.0	983	1010
Chloride	7	EPA 200.7	mg/L	1.0	53.8	57.7
Nitrate + Nitrite as N	39	EPA 353.2	mg/L	0.10	8.40	8.00

#### Non-Metals

Total Dissolved Solids	10	SM 2540-C	mg/L	10	1870	1950
Alkalinity	75	SM 2320-B	mg/L	1.0	199	199
pH	9	SM 4500-H-B	std. units	0.01	7.90	7.99

#### Trace Metals

Molybdenum	36	EPA 200.8	mg/L	0.03	< 0.03	< 0.03
Selenium	40	EPA 200.8	mg/L	0.005	0.170	0.179

#### Radiometric

Uranium	15	EPA 200.8	mg/L	0.0003	0.030	0.027
*Uranium Precision ±	244				0.001	0.001
Uranium, Rad.	113	EPA 200.8	µCi/mL	2.0E-10	2.0E-08	1.8E-08
*Uranium Precision ±	114				4.7E-10	4.2E-10
Radium 226	45	EPA 903.0	pCi/L	0.2	0.4	< 0.2
Radium Error Estimate ±	245				0.3	0.2
Radium 226	256	EPA 903.0	µCi/mL	2.0E-10	4.0E-10	< 2.0E-10
Radium Error Estimate ±	258				3.0E-10	2.0E-10

#### Quality Assurance Data

	Target Range		
Anion	meq	26.6	27.2
Cation	meq	26.7	27.4
SM A/C Balance	%	-5 - +5	0.14
Calc TDS	mg/L	1730	1772
TDS A/C Balance	dec. %	0.80 - 1.20	1.08

\*Precision is calculated using standard deviation of mean of replicate analysis multiplied by concentration.

"Lower Limit of Detection" is related to reporting limits suggested by Regulatory Guideline 4.14 in some cases.

**Table 3 - Occupational Monitoring Program**

**Table 3 - Occupational Monitoring Program**

Type of Sample	Number	Locations	Method	Frequency	Analytical Parameters
Lapel Personal Air Sample	As required by RWP	As required by RWP (2 L/min or eq.)	HP-1	As required by RWP	Alpha, U-Nat
Lapel Personal Air Sampler Calibration	As required by RWP	N/A	HP-1	As required by RWP	Flow rate
Release of Equip.	As required by RWP	Potentially Contaminated Equipment and Materials	HP-4	As required by RWP	Alpha, beta gamma
ALARA	N/A	As required by RPA	HP-6	N/A	As required by RPA
Respiratory Protection	As required by RWP	As required by RWP	HP-7	N/A	N/A
Bioassay	As required by RWP	As required by RWP	HP-8 after mill decommissioning; termination	Baseline, Semi-annual	U-Nat in urine
Instrument Calibration	Variable	Radiation Detection Instruments in use	HP-10	6 months or less	N/A
Personnel Gamma (TLD)	Variable	Personnel	HP-11	Quarterly	Gamma
Personnel Contam.	As required by RWP	As required by RWP	HP-12	As required by RWP	Alpha
Radiation Protection Training	As required	Mill Site taught by RPA (certified individual) subjects as per Reg Guide 8.31	HP-14 for people working with groundwater or physical work with tailings sand/slimes	Initial & annual refresher	Training Class & Written Test

HP-# = Homestake procedure number; RPA = Radiation Protection Administrator; RWP =

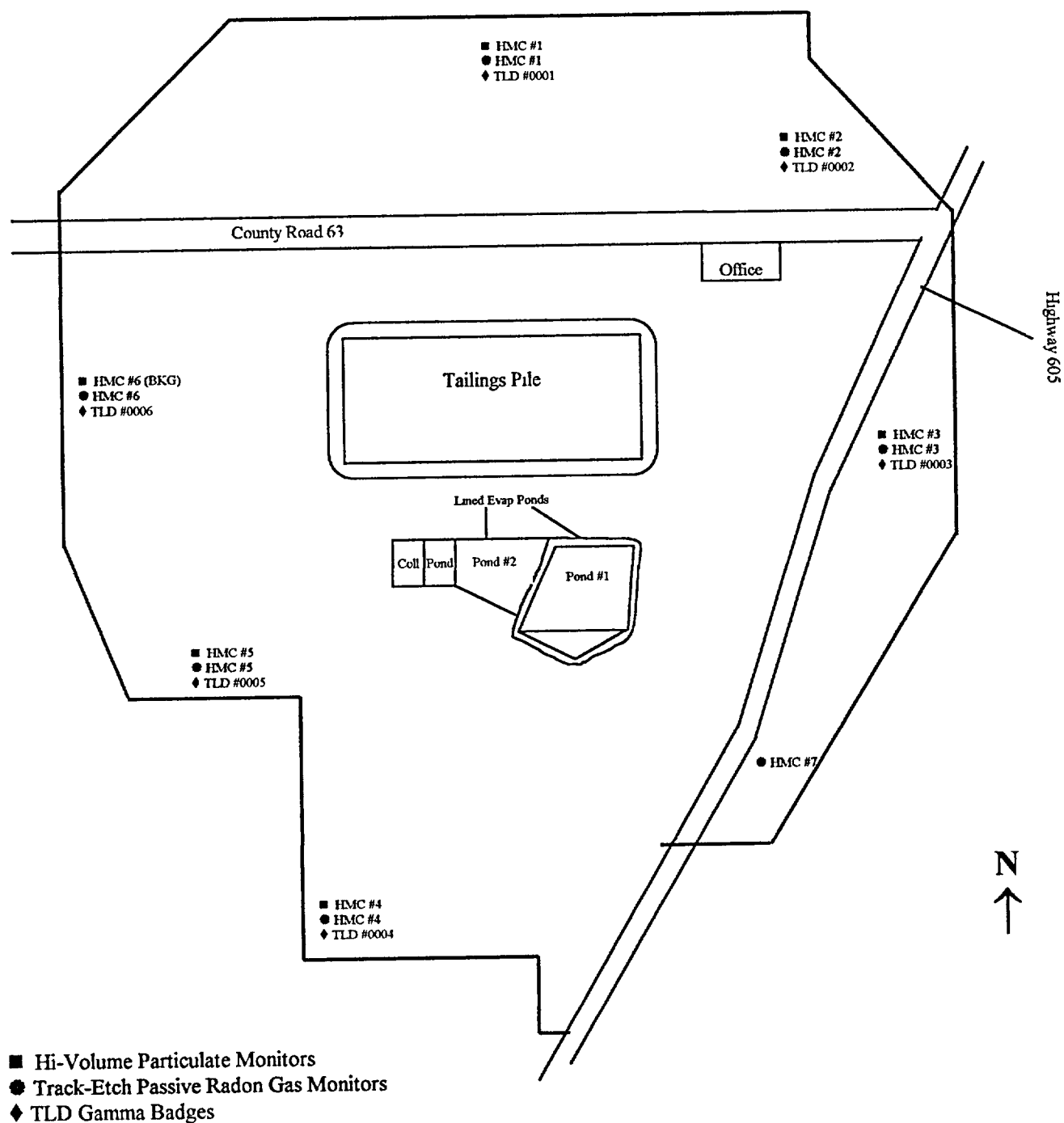
Radiation Work Permit; TLD = Thermoluminescent Dosimeter

**Figure 1 – Monitoring & Sampling Locations**

# HOMESTAKE MINING COMPANY GRANTS PROJECT

## Monitoring & Sampling Locations

- HMC #0016 (BKG)
- ◆ TLD #0016 (BKG)



**FIGURE 1**



**Attachment 1 – High Volume Air Sampling Results**

# HIGH VOLUME AIR SAMPLING REPORT

CLIENT: HOMESTAKE MINING COMPANY • GRANTS, NEW MEXICO

REPORT DATE: January 15, 2003

SAMPLE ID: HMC 1

Quarter/Date Sampled Air Volume	Radionuclide	Concentration $\mu\text{Ci/mL}$	Error Estimate $\mu\text{Ci/mL}$	L.L.D. $\mu\text{Ci/mL}$	Effluent Conc.* $\mu\text{Ci/mL}$	% Effluent Concentration
C02040043-001A First Quarter 2002  Air Volume in mLs 1.44E+11	$^{238}\text{U}$	1.39E-16	N/A	1.00E-16	9.00E-14	1.54E-01
	$^{230}\text{Th}$	2.97E-16	3.15E-17	1.00E-16	2.00E-14	1.48E+00
	$^{226}\text{Ra}$	< 1.00E-16	8.66E-18	1.00E-16	9.00E-13	< 1.11E-02
C02070123-001A Second Quarter 2002  Air Volume in mLs 1.43E+11	$^{238}\text{U}$	9.31E-16	N/A	1.00E-16	9.00E-14	1.03E+00
	$^{230}\text{Th}$	< 1.00E-16	2.11E-17	1.00E-16	2.00E-14	< 5.00E-01
	$^{226}\text{Ra}$	1.51E-16	1.32E-17	1.00E-16	9.00E-13	1.67E-02
C02100040-001A Third Quarter 2002  Air Volume in mLs 1.34E+11	$^{238}\text{U}$	9.74E-16	N/A	1.00E-16	9.00E-14	1.08E+00
	$^{230}\text{Th}$	< 1.00E-16	9.87E-18	1.00E-16	2.00E-14	< 5.00E-01
	$^{226}\text{Ra}$	< 1.00E-16	9.87E-18	1.00E-16	9.00E-13	< 1.11E-02
C03010058-001A Fourth Quarter 2002  Air Volume in mLs 1.47E+11	$^{238}\text{U}$	5.45E-16	N/A	1.00E-16	9.00E-14	6.05E-01
	$^{230}\text{Th}$	< 1.00E-16	5.14E-18	1.00E-16	2.00E-14	< 5.00E-01
	$^{226}\text{Ra}$	< 1.00E-16	6.43E-18	1.00E-16	9.00E-13	< 1.11E-02

N/A not applicable for ICP-MS

LLD = Lower Limit of Detection per Regulatory Guide 4.14

All LLDs were met

\*Effluent Concentrations per 10 CFR Part 20 Appendix B Table 2, Effluent Concentration

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# HIGH VOLUME AIR SAMPLING REPORT

CLIENT: HOMESTAKE MINING COMPANY - GRANTS, NEW MEXICO

REPORT DATE: January 15, 2003

SAMPLE ID: HMC 2

Quarter/Date Sampled Air Volume	Radionuclide	Concentration $\mu\text{Ci/mL}$	Error Estimate $\mu\text{Ci/mL}$	L.L.D. $\mu\text{Ci/mL}$	Effluent Conc.* $\mu\text{Ci/mL}$	% Effluent Concentration
C02040043-002A First Quarter 2002 Air Volume in mLs 1.43E+11	$^{238}\text{U}$	1.86E-16	N/A	1.00E-16	9.00E-14	2.07E-01
	$^{230}\text{Th}$	< 1.00E-16	1.32E-17	1.00E-16	2.00E-14	< 5.00E-01
	$^{226}\text{Ra}$	< 1.00E-16	8.86E-18	1.00E-16	9.00E-13	< 1.11E-02
C02070123-002A Second Quarter 2002 Air Volume in mLs 1.44E+11	$^{238}\text{U}$	1.40E-15	N/A	1.00E-16	9.00E-14	1.56E+00
	$^{230}\text{Th}$	< 1.00E-16	1.84E-17	1.00E-16	2.00E-14	< 5.00E-01
	$^{226}\text{Ra}$	1.40E-16	1.31E-17	1.00E-16	9.00E-13	1.56E-02
C02100040-002A Third Quarter 2002 Air Volume in mLs 1.45E+11	$^{238}\text{U}$	6.90E-16	N/A	1.00E-16	9.00E-14	7.67E-01
	$^{230}\text{Th}$	< 1.00E-16	1.04E-17	1.00E-16	2.00E-14	< 5.00E-01
	$^{226}\text{Ra}$	< 1.00E-16	2.61E-18	1.00E-16	9.00E-13	< 1.11E-02
C03010058-002A Fourth Quarter 2002 Air Volume in mLs 1.48E+11	$^{238}\text{U}$	3.53E-16	N/A	1.00E-16	9.00E-14	3.93E-01
	$^{230}\text{Th}$	< 1.00E-16	5.11E-18	1.00E-16	2.00E-14	< 5.00E-01
	$^{226}\text{Ra}$	< 1.00E-16	5.11E-18	1.00E-16	9.00E-13	< 1.11E-02

N/A not applicable for ICP-MS

LLD = Lower Limit of Detection per Regulatory Guide 4.14

All LLDs were met

\*Effluent Concentrations per 10 CFR Part 20 Appendix B Table 2, Effluent Concentration



### HIGH VOLUME AIR SAMPLING REPORT

CLIENT: HOMESTAKE MINING COMPANY - GRANTS, NEW MEXICO

REPORT DATE: January 15, 2003

SAMPLE ID: HMC 3

Quarter/Date Sampled Air Volume	Radionuclide	Concentration $\mu\text{Ci/mL}$	Error Estimate $\mu\text{Ci/mL}$	L.L.D. $\mu\text{Ci/mL}$	Effluent Conc.* $\mu\text{Ci/mL}$	% Effluent Concentration
C02040043-003A First Quarter 2002 Air Volume in mLs 1.44E+11	$^{235}\text{U}$	1.21E-15	N/A	1.00E-16	9.00E-14	1.35E+00
	$^{230}\text{Th}$	< 1.00E-16	9.19E-18	1.00E-16	2.00E-14	< 5.00E-01
	$^{226}\text{Ra}$	< 1.00E-16	7.48E-18	1.00E-16	9.00E-13	< 1.11E-02
C02070123-003A Second Quarter 2002 Air Volume in mLs 1.46E+11	$^{235}\text{U}$	8.12E-15	N/A	1.00E-16	9.00E-14	9.02E+00
	$^{230}\text{Th}$	< 1.00E-16	1.29E-17	1.00E-16	2.00E-14	< 5.00E-01
	$^{226}\text{Ra}$	< 1.00E-16	2.59E-18	1.00E-16	9.00E-13	< 1.11E-02
C02100040-003A Third Quarter 2002 Air Volume in mLs 1.45E+11	$^{235}\text{U}$	3.94E-15	N/A	1.00E-16	9.00E-14	4.37E+00
	$^{230}\text{Th}$	1.03E-16	1.56E-17	1.00E-16	2.00E-14	5.15E-01
	$^{226}\text{Ra}$	< 1.00E-16	2.61E-18	1.00E-16	9.00E-13	< 1.11E-02
C03010058-003A Fourth Quarter 2002 Air Volume in mLs 1.47E+11	$^{235}\text{U}$	2.41E-15	N/A	1.00E-16	9.00E-14	2.68E+00
	$^{230}\text{Th}$	< 1.00E-16	9.00E-18	1.00E-16	2.00E-14	< 5.00E-01
	$^{226}\text{Ra}$	< 1.00E-16	6.43E-18	1.00E-16	9.00E-13	< 1.11E-02

N/A not applicable for ICP-MS

LLD = Lower Limit of Detection per Regulatory Guide 4.14

All LLDs were met

\*Effluent Concentrations per 10 CFR Part 20 Appendix B Table 2, Effluent Concentration

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# HIGH VOLUME AIR SAMPLING REPORT

CLIENT: HOMESTAKE MINING COMPANY - GRANTS, NEW MEXICO

REPORT DATE: January 15, 2003

SAMPLE ID: HMC 4

Quarter/Date Sampled Air Volume	Radionuclide	Concentration $\mu\text{Ci/mL}$	Error Estimate $\mu\text{Ci/mL}$	L.L.D. $\mu\text{Ci/mL}$	Effluent Conc.* $\mu\text{Ci/mL}$	% Effluent Concentration
C02040043-004A First Quarter 2002  Air Volume in mLs 1.27E+11	$^{238}\text{U}$	3.58E-16	N/A	1.00E-16	9.00E-14	3.98E-01
	$^{230}\text{Th}$	< 1.00E-16	8.93E-18	1.00E-16	2.00E-14	< 5.00E-01
	$^{226}\text{Ra}$	< 1.00E-16	7.14E-18	1.00E-16	9.00E-13	< 1.11E-02
C02070123-004A Second Quarter 2002  Air Volume in mLs 1.45E+11	$^{238}\text{U}$	6.48E-15	N/A	1.00E-16	9.00E-14	7.20E+00
	$^{230}\text{Th}$	< 1.00E-16	1.56E-17	1.00E-16	2.00E-14	< 5.00E-01
	$^{226}\text{Ra}$	< 1.00E-16	2.61E-18	1.00E-16	9.00E-13	< 1.11E-02
C02100040-004A Third Quarter 2002  Air Volume in mLs 1.38E+11	$^{238}\text{U}$	2.74E-15	N/A	1.00E-16	9.00E-14	3.05E+00
	$^{230}\text{Th}$	< 1.00E-16	9.59E-18	1.00E-16	2.00E-14	< 5.00E-01
	$^{226}\text{Ra}$	< 1.00E-16	2.74E-18	1.00E-16	9.00E-13	< 1.11E-02
C03010058-004A Fourth Quarter 2002  Air Volume in mLs 1.46E+11	$^{238}\text{U}$	1.70E-15	N/A	1.00E-16	9.00E-14	1.89E+00
	$^{230}\text{Th}$	< 1.00E-16	6.47E-18	1.00E-16	2.00E-14	< 5.00E-01
	$^{226}\text{Ra}$	< 1.00E-16	5.18E-18	1.00E-16	9.00E-13	< 1.11E-02

N/A not applicable for ICP-MS

LLD = Lower Limit of Detection per Regulatory Guide 4.14

All LLDs were met

\*Effluent Concentrations per 10 CFR Part 20 Appendix B Table 2, Effluent Concentration



### HIGH VOLUME AIR SAMPLING REPORT

CLIENT: HOMESTAKE MINING COMPANY - GRANTS, NEW MEXICO

REPORT DATE: January 15, 2003

SAMPLE ID: HMC 5

Quarter/Date Sampled Air Volume	Radionuclide	Concentration $\mu\text{Ci/mL}$	Error Estimate $\mu\text{Ci/mL}$	L.L.D. $\mu\text{Ci/mL}$	Effluent Conc.* $\mu\text{Ci/mL}$	% Effluent Concentration
C02040043-005A First Quarter 2002 Air Volume in mLs 1.35E+11	$^{235}\text{U}$	5.13E-16	N/A	1.00E-16	9.00E-14	5.70E-01
	$^{230}\text{Th}$	< 1.00E-16	9.80E-18	1.00E-16	2.00E-14	< 5.00E-01
	$^{226}\text{Ra}$	< 1.00E-16	7.98E-18	1.00E-16	9.00E-13	< 1.11E-02
C02070123-005A Second Quarter 2002 Air Volume in mLs 1.30E+11	$^{235}\text{U}$	2.10E-14	N/A	1.00E-16	9.00E-14	2.33E+01
	$^{230}\text{Th}$	1.58E-16	2.76E-17	1.00E-16	2.00E-14	7.92E-01
	$^{226}\text{Ra}$	< 1.00E-16	2.91E-18	1.00E-16	9.00E-13	< 1.11E-02
C02100040-005A Third Quarter 2002 Air Volume in mLs 1.46E+11	$^{235}\text{U}$	5.18E-15	N/A	1.00E-16	9.00E-14	5.76E+00
	$^{230}\text{Th}$	< 1.00E-16	1.29E-17	1.00E-16	2.00E-14	< 5.00E-01
	$^{226}\text{Ra}$	< 1.00E-16	2.59E-18	1.00E-16	9.00E-13	< 1.11E-02
C03010058-005A Fourth Quarter 2002 Air Volume in mLs 1.47E+11	$^{235}\text{U}$	2.24E-15	N/A	1.00E-16	9.00E-14	2.48E+00
	$^{230}\text{Th}$	< 1.00E-16	7.71E-18	1.00E-16	2.00E-14	< 5.00E-01
	$^{226}\text{Ra}$	< 1.00E-16	5.14E-18	1.00E-16	9.00E-13	< 1.11E-02

N/A not applicable for ICP-MS

LLD = Lower Limit of Detection per Regulatory Guide 4.14

All LLDs were met

\*Effluent Concentrations per 10 CFR Part 20 Appendix B Table 2, Effluent Concentration

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# HIGH VOLUME AIR SAMPLING REPORT

CLIENT: HOMESTAKE MINING COMPANY - GRANTS, NEW MEXICO

REPORT DATE: January 15, 2003

SAMPLE ID: HMC 6

Quarter/Date Sampled Air Volume	Radionuclide	Concentration $\mu\text{Ci/mL}$	Error Estimate $\mu\text{Ci/mL}$	L.L.D. $\mu\text{Ci/mL}$	Effluent Conc.* $\mu\text{Ci/mL}$	% Effluent Concentration
C02040043-006A First Quarter 2002 Air Volume in mLs 1.33E+11	$^{238}\text{U}$	1.04E-16	N/A	1.00E-16	9.00E-14	1.15E-01
	$^{230}\text{Th}$	< 1.00E-16	9.95E-18	1.00E-16	2.00E-14	< 5.00E-01
	$^{226}\text{Ra}$	< 1.00E-16	6.82E-18	1.00E-16	9.00E-13	< 1.11E-02
C02070123-006A Second Quarter 2002 Air Volume in mLs 1.37E+11	$^{238}\text{U}$	2.30E-15	N/A	1.00E-16	9.00E-14	2.55E+00
	$^{230}\text{Th}$	< 1.00E-16	1.66E-17	1.00E-16	2.00E-14	< 5.00E-01
	$^{226}\text{Ra}$	< 1.00E-16	2.76E-18	1.00E-16	9.00E-13	< 1.11E-02
C02100040-006A Third Quarter 2002 Air Volume in mLs 1.44E+11	$^{238}\text{U}$	1.18E-15	N/A	1.00E-16	9.00E-14	1.31E+00
	$^{230}\text{Th}$	2.69E-16	3.02E-17	1.00E-16	2.00E-14	1.35E+00
	$^{226}\text{Ra}$	< 1.00E-16	9.19E-18	1.00E-16	9.00E-13	< 1.11E-02
C03010058-006A Fourth Quarter 2002 Air Volume in mLs 1.47E+11	$^{238}\text{U}$	7.54E-16	N/A	1.00E-16	9.00E-14	8.37E-01
	$^{230}\text{Th}$	< 1.00E-16	7.71E-18	1.00E-16	2.00E-14	< 5.00E-01
	$^{226}\text{Ra}$	< 1.00E-16	5.14E-18	1.00E-16	9.00E-13	< 1.11E-02

N/A not applicable for ICP-MS

LLD = Lower Limit of Detection per Regulatory Guide 4.14

All LLDs were met

\*Effluent Concentrations per 10 CFR Part 20 Appendix B Table 2, Effluent Concentration

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### HIGH VOLUME AIR ANALYSIS REPORT

CLIENT:

HOMESTAKE MINING - GRANTS, NEW MEXICO

REPORT DATE:

November 7, 2002

DATE SAMPLED:

3rd Quarter 2002

EPA Method		200.8	903.0		907.0	
Laboratory Number	Sample I.D.	Uranium-nat pCi/filt.	Radium 226 pCi/filt. +/-		Thorium 230 pCi/filt. +/-	
C02100040-001A	HMC 1	131	9.8	1.3	5.7	1.3
C02100040-002A	HMC 2	100	7.9	0.4	7.2	1.5
C02100040-003A	HMC 3	571	5.9	0.4	14.9	2.3
C02100040-004A	HMC 4	379	6.4	0.4	3.6	1.3
C02100040-005A	HMC 5	756	6.2	0.4	7.9	1.9
C02100040-006A	HMC 6	170	9.6	1.3	38.7	4.3
C02100040-007A	HMC 7	<0.4	<0.4	N/A	<0.4	N/A
LLD	pCi/filter	0.4	0.4		0.4	





QUALITY ASSURANCE REPORT  
HOMESTAKE MINING CORPORATION

Laboratory ID Range:  
Sample Matrix:  
Sample Date:  
Date Received:  
Report Date:

C02100040-001A-007A
Air Filter
3rd Quarter 2002
10/01/2002
February 25, 2003

	Method	Relative Percent Difference <sup>1</sup>	Spike Recovery (Percent) <sup>2</sup>	LCS Recovery (Percent)	Method Blank pCi/Filter	Date Analyzed	Analyst
Laboratory #:	C02100919-001A		C02100919-001A				
Uranium:	6020	8.2	104	91	<0.4	10/29/2002	SMD
Laboratory #:	C02090859-061A		C02100040-001A				
Radium 226:	903.0	14.3	101	106	<0.4	10/10/2002	RS
Laboratory #:	C02100484-004A		C02100484-004A				
Thorium 230:	907.0	1.5	95.6	97	<0.4	10/22/2002	PH
Digestion:	SW3050	1.89	Liter		2213	10/02/2002	CS

(1) These values are an assessment of analytical precision. The acceptance range is 0-20% for sample results above 10 times the reporting limit. This range is not applicable to samples with results below 10 times the reporting limit.

(2) These values are an assessment of analytical accuracy. They are a percent recovery of the spike addition. ELI performs a matrix spike on 10 percent of all samples for each analytical method.

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## HIGH VOLUME AIR ANALYSIS REPORT

CLIENT: HOMESTAKE MINING - GRANTS, NEW MEXICO  
REPORT DATE: January 15, 2003  
DATE SAMPLED: 4th Quarter 2002

EPA Method		200.8	903.0		907.0	
Laboratory Number	Sample I.D.	Uranium-nat pCi/filt.	Radium 226 pCi/filt. +/-		Thorium 230 pCi/filt. +/-	
C03010058-001A	HMC 1	80.1	4.5	0.9	1.1	0.8
C03010058-002A	HMC 2	52.3	2.1	0.8	0.9	0.8
C03010058-003A	HMC 3	354	4.2	0.9	3.8	1.3
C03010058-004A	HMC 4	248	2.1	0.8	1.9	0.9
C03010058-005A	HMC 5	329	1.9	0.8	2.6	1.1
C03010058-006A	HMC 6	111	3.0	0.8	2.8	1.1
C03010058-007A	HMC 7	<0.4	<0.4	N/A	<0.4	N/A
LLD	pCi/filter	0.4	0.4		0.4	



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QUALITY ASSURANCE REPORT  
HOMESTAKE MINING CORPORATION

Laboratory ID Range:

C03010058-001A-007A

Sample Matrix:

Air Filter

Sample Date:

4th Quarter 2002

Date Received:

01/03/2003

Report Date:

February 25, 2003

	Method	Relative Percent Difference <sup>1</sup>	Spike Recovery (Percent) <sup>2</sup>	LCS Recovery (Percent)	Method Blank pCi/Filter	Date Analyzed	Analyst
Laboratory #:	C03010058-004A		C03010058-004A				
Uranium:	6020	1.2	120	105	<0.4	01/07/2003	SMD
Laboratory #:	C02120199-002A		C02120199-003A				
Radium 226:	903.0	0.0	71	87	<0.4	01/07/2003	ES
Laboratory #:	C03010058-007A		C03010058-007A				
Thorium 230:	907.0	7.8	102	102	<0.4	01/08/2003	PH
Digestion:	SW3050	Volume 1.89	Units Liter	Batch 2759		01/04/2003	CS

(1) These values are an assessment of analytical precision. The acceptance range is 0-20% for sample results above 10 times the reporting limit. This range is not applicable to samples with results below 10 times the reporting limit.

(2) These values are an assessment of analytical accuracy. They are a percent recovery of the spike addition. ELI performs a matrix spike on 10 percent of all samples for each analytical method.

lmh: r:\reports\clients\2003\homestake\_mining\grants\air\4q2002.xls

## **Attachment 2 - Radon Gas Monitoring Results**

Attachment 2 - Radon Gas Monitoring Results  
Track-Etch Passive Survey

Location	Monitoring Period	Rn Concentration ( $\mu\text{Ci}/\text{ml}$ )	Error Estimate ( $\mu\text{Ci}/\text{ml}$ )	% Limit* (%)	LLD ( $\mu\text{Ci}/\text{ml}$ )
Hi-Vol #1 N Outer Perimeter	6/28/2002 - 12/30/2002	1.5E-09	2.5E-10	15	1.6E-10
Hi-Vol #2 NE Outer Perimeter	6/28/2002 - 12/30/2002	1.3E-09	2.3E-10	13	1.6E-10
Hi-Vol #3 E Outer Perimeter	6/28/2002 - 12/30/2002	1.1E-09	2.1E-10	11	1.6E-10
Hi-Vol #4 S Outer Perimeter	6/28/2002 - 12/30/2002	1.5E-09	2.5E-10	15	1.6E-10
Hi-Vol #5 N of Nearest Residence	6/28/2002 - 12/30/2002	1.3E-09	2.3E-10	13	1.6E-10
Hi-Vol #6 W of Outer Perimeter	6/28/2002 - 12/30/2002	1.2E-09	2.2E-10	12	1.6E-10
HMC #7 S Boundary	6/28/2002 - 12/30/2002	1.1E-09	2.1E-10	11	1.6E-10
HMC #16 Background	6/28/2002 - 12/30/2002	9.0E-10	1.9E-10	9	1.6E-10

\*Limit of  $1\text{E-}8 \mu\text{Ci}/\text{ml}$  for radon-222 with daughters removed as given in 10 CFR20, Appendix B, Table 2

## **Attachment 3 - Environmental Gamma Radiation Results**

Attachment 3 - Environmental Gamma Radiation Results  
TLD Perimeter Survey

Direct Radiation Measurements

Location	Monitoring Period	Exposure Rate (mrem/6 mo)	Error (mrem/6 mo)*
Hi-Vol #1 N Outer Perimeter	07/01/2002 - 12/31/2002	20	2.0
Hi-Vol #2 NE Outer Perimeter	07/01/2002 - 12/31/2002	15	1.5
Hi-Vol #3 E Outer Perimeter	07/01/2002 - 12/31/2002	17	1.7
Hi-Vol #4 S Outer Perimeter	07/01/2002 - 12/31/2002	32	3.1
Hi-Vol #5 N of Nearest Residence	07/01/2002 - 12/31/2002	16	1.6
Hi-Vol #6 W of Outer Perimeter	07/01/2002 - 12/31/2002	15	1.5
#16 Background	07/01/2002 - 12/31/2002	12	1.2

\*Error is 1.96 std. dev.

**Attachment 4 - Annual Effective Dose Equivalent to Individuals  
of the Public**



## Annual Effective Dose Equivalent to Individuals of the Public

### 1.0 Introduction

There were very few activities at the Grants Uranium Mill Site in 2002 other than those associated with the groundwater restoration program. All off-pile tailings were consolidated with the tailings in 1995 and covered with a soil cover. All tailings currently have either an interim or permanent cover.

The 10 CFR 20.1301 radiation dose limit for individual members of the public from NRC-licensed facilities is specified as a total effective dose equivalent (TEDE) of 100 mrem/year. A licensee may request permission from the NRC to operate a facility up to a maximum of 500 mrem/year. Compliance may be demonstrated by calculations or measurements showing that the individual likely to receive the maximum dose from the facility does not exceed the limit, or by comparing the concentrations at the site perimeter to those specified in Table 2 of Appendix B to 10 CFR Part 20. Radiation from external sources for individuals in the unrestricted area may not deliver a dose equivalent of 0.002 rem in any hour or 0.050 rem in one year.

HMC has submitted environmental monitoring reports as required by 10 CFR 40.65 and License No. SUA-1471. The data from these reports along with data from background monitoring stations have been used in this dose assessment.

### 2.0 DOSE ASSESSMENT

The important pathways for assessing the dose to the maximum exposed individual are: inhalation of airborne particulate from the site, exposure to radon generated at the site, and the exposure to direct gamma radiation at the site boundary. The nearest residence is located within 100 yards of the HMC#4 and HMC#5 sampling stations. It is known that the residents have typical lifestyles. Data from the semiannual environmental reports have been used to assess the total effective dose equivalent (TEDE) at both stations.

NUREG/CR-5512 recommends default values for the residential scenario. The values for indoor and outdoor occupancy are 200 effective days/year and 71 effective days/year, respectively. This is equivalent to a 75 percent total occupancy factor. This has been used in this analysis for all pathways.

#### 2.1 Inhalation of Radionuclides

The committed effective dose equivalent from inhalation of particulate was calculated for the four principal long-lived radionuclides, U-238, U-234, Th-230, and Ra-226, using the quarterly environmental monitoring data given in the Semi-Annual Environmental Reports for 2002.

The sampling location HMC#5 is normally chosen as the Nearest Residence Location since the total calculated EDE was higher than at the other possible Nearest Residence Location, HMC#4. However, in 2002, the calculated dose is higher at HMC#4 and thus calculations for both stations are presented below. These stations are located on the

southwestern perimeter of the site near existing residences. The use of these data to predict the dose to the nearest resident is very conservative in that the exposure at the residences should be less than that at the site perimeter.

Committed Effective Dose Equivalent per Unit Intake via Inhalation factors were taken from ICRP 30 tables. The values are given below:

<u>Nuclide</u>	<u>CEDE (mrem/<math>\mu</math>Ci)</u>
U-234	13.2E4
U-238	11.8E4
Th-230	32.6E4
Ra-226	8.6E3

Continuous occupancy at a breathing rate of 20,000 liters/day (Table A-1, NUREG-0859) was assumed. The CEDE was calculated for each of the radionuclides at each station. The CEDE at potential principal residence locations HMC#4 and HMC#5 locations for 100 percent occupancy was calculated to be 2.8 mrem/year and 6.7 mrem/y, respectively while that at the background location (HMC#6) was calculated to be 1.3 mrem/y, for a net CEDE at the potential residence locations, HMC #4 and HMC#5, of 1.5 mrem/y and 5.4 mrem/y. The results from these calculations are shown in Table 2-1, Table 2-2, and Table 2-3. Considering the 75 percent occupancy factor, this results in a net dose equivalent of 1.1mrem/y at HMC #4 and 4.0 mrem/year at HMC #5.

## 2.2 Exposure to Radon

The outdoor radon levels in the Grants Uranium Belt are known to be high and variable, depending on the location relative to mine vents, surface ore deposits, and topographical features. The natural background radon concentrations, arising from the calm winds during the evenings and at times from temperature inversions, generally follow the drainage path of the heavy air. The HMC site is situated at the lowest point in the drainage path for radon generated over a very large area to the North, Northwest, and Lobo Canyon to the East. Therefore the natural background levels at the site are expected to be very high and variable over short periods of time due to being in this drainage path.

The radon data for the two monitoring periods are provided in Attachment 2 of the semi-annual monitoring reports. Monitoring Station 16 has been accepted as the radon background location for the site. The nearest residence exposure was chosen as HMC#4 and HMC#5. The yearly average of the radon concentrations for HMC#4 and HMC #5 were 1.55 pCi/l and 1.3 pCi/l, respectively. The average for the background location is 0.9 pCi/l. This results in net radon concentrations at HMC#4 and HMC#5 of 0.65 pCi/l and 0.4 pCi/l, respectively.

Since the nearest residence locations are within a few hundred feet of Monitoring Stations and within 3500 feet of the major source of radon, the equilibrium should be low. We have selected 20 percent radon daughter equilibrium as an estimate for use in the calculations. NRC uses continuous exposure to 0.1 pCi/l Rn-222 in full equilibrium with the daughter products as being equivalent to a CEDE of 50 mrem/y (10CFR Part 20, Appendix B). With 20 percent equilibrium, the CEDE would be 100 mrem/pCi/l. Considering the 75 percent occupancy factor, the net radon concentration at HMC #4 and

HMC #5 locations results in a calculated CEDE of 49 mrem/y and 30 mrem/y, respectively.

### 2.3 Dose from Exposure to Direct Radiation

An estimate of the dose equivalent from direct exposure to radiation sources at the site is obtained from the environmental TLDs placed at the monitoring stations. HMC#4 and HMC#5 had an exposure of 51 mrem and 34 mrem, respectively, as shown in Attachment 3 at the end of the semiannual reports. The annual exposure at the background location, HMC#16, had an annual exposure of 33 mrem/year. Considering the 75 percent occupancy time, the net annual dose equivalent at HMC#4 and HMC#5 was 13.5 mrem and 0.8 mrem, respectively.

### 2.4 Total Effective Dose Equivalent to the Nearest Resident

The TEDE to the Nearest Resident can be calculated by adding the EDE from inhalation of airborne particulate, the exposure to radon coming from the site, and the dose equivalent from direct gamma radiation. As indicated in the previous sections, HMC #4 had 1.1 mrem/y from airborne particulate, 49 mrem/y from radon, and 13.5 mrem/y from direct gamma radiation for a total TEDE of 64 mrem/y. HMC #5 had 4.0 mrem/y from airborne particulate, 30 mrem/y from radon, and 0.8 mrem/y from direct gamma radiation for a total TEDE of 35 mrem/y. Both of these values are within the 100 mrem/year limit. Therefore the site complies with the 100 mrem/y total effective dose equivalent limit.

Table 2-1 Annual Effective Dose at the Nearest Residence from Airborne Particulate

Year: 2002

STATION: HMC #4 Nearest Residence

AIRBORNE CONCENTRATION					
	U-nat $\mu\text{Ci/ml}$ =====	U-234 $\mu\text{Ci/ml}$ =====	U-238 $\mu\text{Ci/ml}$ =====	Th-230 $\mu\text{Ci/ml}$ =====	Ra-226 $\mu\text{Ci/ml}$ =====
1st qtr	3.58E-16	1.74E-16	1.74E-16	1.00E-16	1.00E-16
2nd qtr	6.48E-15	3.16E-15	3.16E-15	1.58E-16	1.00E-16
3rd qtr	2.74E-15	1.34E-15	1.34E-15	1.00E-16	1.00E-16
4th qtr	1.70E-15	8.29E-16	8.29E-16	1.00E-16	1.00E-16
Average	2.82E-15	1.37E-15	1.37E-15	1.15E-16	1.00E-16
ANNUAL EFFECTIVE DOSE EQUIVALENT					
U-234 mrem =====	U-238 mrem =====	Th-230 mrem =====	Ra-226 mrem =====	TOTAL mrem =====	
1.324	1.184	0.272	0.006	2.8	

Table 2-2 Annual Effective Dose at the Site Background Location from Airborne Particulate

Year:2002

STATION: HMC #6 Background

AIRBORNE CONCENTRATION					
	U-nat $\mu\text{Ci/ml}$ =====	U-234 $\mu\text{Ci/ml}$ =====	U-238 $\mu\text{Ci/ml}$ =====	Th-230 $\mu\text{Ci/ml}$ =====	Ra-226 $\mu\text{Ci/ml}$ =====
1st qtr	1.04E-16	5.07E-17	5.07E-17	1.00E-16	1.00E-16
2nd qtr	2.30E-15	1.12E-15	1.12E-15	1.00E-16	1.00E-16
3rd qtr	1.18E-15	5.75E-16	5.75E-16	2.69E-16	1.00E-16
4th qtr	7.54E-16	3.67E-16	3.67E-16	1.00E-16	1.00E-16
Average	1.08E-15	5.29E-16	5.29E-16	1.42E-16	1.00E-16
ANNUAL EFFECTIVE DOSE EQUIVALENT					
U-234 mrem =====	U-238 mrem =====	Th-230 mrem =====	Ra-226 mrem =====	TOTAL mrem =====	
0.509	0.455	0.339	0.006	1.3	