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24 February 2004

Mr. Bill Von Till, Branch Chief
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 2003

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 2003 (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.

Due to existing evaporation pond storage volume limitations and associated seasonal forced evaporative spray system capacities, the plant was operated at an average rate of 357-gpm during the July – December reporting period.

Thank you for your time and attention on this matter. If you have any questions or require additional information, please contact me in our Grants office at (505) 287-4456 Ext. 17 or via cell phone at (505) 400-2794.

Sincerely yours,

HOMESTAKE MINING COMPANY OF CALIFORNIA
Alan D. Cox

Enclosures (2)

xc: Mr. B. Spitzberg, Chief, Decommissioning Branch, w/enclosure
Mr. R. Chase, Barrick, SLC, w/enclosure
Mr. G. Hoffman, Hydro Engineering, w/enclosure
Mr. M. Purcell, Region VI EPA, w/enclosure

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**HOMESTAKE MINING COMPANY
OF
CALIFORNIA
GRANTS PROJECT**



**SEMI-ANNUAL ENVIRONMENTAL
MONITORING REPORT**

JULY - DECEMBER

2003

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

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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 2003. 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 re-contoured and covered with interim cover on the top and radon barrier on the outcrops. Bedding and erosion protection was placed on the outcrops after placement of the radon barrier. Soil cleanup verification of the off-pile contaminated soil (windblown tailings) 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 357-gpm while producing an average of 261-gpm of product water that was used for re-injection.

Homestake's groundwater monitoring program, as outlined in license Condition No. 35, continued throughout the report 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 monitoring data for the current POC wells are not representative of off-site groundwater quality conditions.

2.0 ENVIRONMENTAL MONITORING PROGRAMS

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

2.1 Air Particulate Monitoring

Homestake continuously samples total suspended particulate 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 as 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 are site proximal to the nearest residences. The results 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 #0016, located Northwest of the site. Landauer Corporation 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 the 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 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 results are presented in Attachment 2.

3.0 WATER QUALITY MONITORING

Table 2 (8-99, as modified by Amendment 34), as attached, outlines the water quality sampling frequency and parameters monitored. In addition, the volumes of water injected and recovered as part of the ground-water cleanup program are monitored on a weekly frequency and the rates documented. A performance review report is submitted by March 31 of each year according to License Condition 35E. The groundwater monitoring data for the POC wells and background well P, as required to comply with 10 CFR 40.65, are reported in Tables 2.1.1-2.1.4. The water quality of the POC wells is currently being restored and therefore the reported levels are not representative of steady state aquifer conditions at the present time. 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. Due to these conditions water level data on these wells are also not reflective of steady state conditions, and therefore are not reported here.

4.0 DIRECT RADIATION

Gamma exposure rates are continuously monitored through the use of optically stimulated luminescence (OSL) dosimeter badges placed at each of the seven locations identified in Figure 1. HMC #0016 is considered the background location for direct radiation. Each OSL badge consists of an aluminum oxide detector within a plastic holder. The plastic provides adequate protection from weather for these badges to be used out-of-doors. The OSL's are exchanged semi-annually and analyzed by an approved independent laboratory (currently Landauer Inc.). Pertinent sample data are reported in Attachment 3.

5.0 SURFACE CONTAMINATION

The Occupational Monitoring Program requirements 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 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 U.S. Nuclear Regulatory Guide 8.30 – Appendix B as the smallest concentration of radioactive material that has a 95% probability of being detected. Radioactive material is “detected” if the value measured on an instrument is high enough to conclude that activity above the system background is probably 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 calculates LLDs, the following formula is utilized:

$$LLD = \frac{3+4.66 S_b}{3.7 E 4 EVY \exp (-\lambda t)}$$

Where:

LLD is the lower limit of detection (microcuries per milliliter);
 S_b 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;
 t is the elapsed time between sample collection and counting

The value of S_b 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 (vendor lab) reports the LLD for radon-222. The LLDs for the constituents are:

Ra-226, Th-230 in air	1 E-16 μ Ci/ml
Rn-222 in air	30 pCi-days/l
U-nat in air	1 E-16 μ Ci/ml
U-rad in water	2 E-10 μ Ci/ml
Ra-226, Th-230 in water	2 E-10 μ Ci/ml

Uranium is analyzed by ICP-MS methods 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. DP-200, dated November 15, 1995, and 10 CFR Part 40.65 requires that Homestake submit 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. The attachments included in this report summarize 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 2003 based upon the environmental monitoring data. The report, Attachment 4, shows that the effective dose equivalent to the nearest resident is within the 100-mrem/year NRC limit.

**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	OSL	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)

Well Number	Parameters to be Monitored	Frequency of Monitoring
#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, KF, SO, SP, S1, S2	Water Level	Weekly
Point of Compliance Wells D1, X, S4	B, F	Annually
Background Well P	B	Annually

B = Water Level, pH, TDS, SO₄, Cl, HCO₃, CO₃, Na, Ca, Mg, K, NO₃, U, Se, Mo, Ra-226

D = Ca, Mg, K, Na, HCO₃, CO₃, Cl, SO₄, pH, TDS, Al, As, Ba, Cd, Co, Cu, CN, F, Fe, Pb, Mn, Hg, Mo, Ni, NO₃ as N, Se, Ag, Zn, U, Filtered Ra-226

F = V, Ra-228, Th-230

G = Water Level, SO₄, 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
06/10/2002 10:06	06/24/2003 10:52
06/13/2002 10:00	06/30/2003 10:00
Liquid, Water	Liquid, Water
C02060442-001	C03061119-001
July 15, 2002	July 23, 2003

Major Ions	Parameter Code	Method	Units	Lower Limit of Detection	Results	Results
Calcium	1	EPA 200.7	mg/L	1.0	212	219
Magnesium	2	EPA 200.7	mg/L	1.0	53.1	52.1
Sodium	4	EPA 200.7	mg/L	1.0	336	330
Potassium	3	EPA 200.7	mg/L	1.0	4.1	4.4
Carbonate	6	SM 2320-B	mg/L	1.0	< 1.0	< 1.0
Bicarbonate	5	SM 2320-B	mg/L	1.0	542	533
Sulfate	8	EPA 200.7	mg/L	1.0	720	730
Chloride	7	EPA 200.7	mg/L	0.10	196	197
Nitrate + Nitrite as N	39	EPA 353.2	mg/L	0.10	2.58	2.60

Non-Metals	Parameter Code	Method	Units	Lower Limit of Detection	Results	Results
Total Dissolved Solids	10	SM 2540-C	mg/L	10	1920	1950
Alkalinity	75	SM 2320-B	mg/L	1.0	445	437
pH	9	SM 4500-H-B	std. units	0.10	7.93	7.76

Trace Metals	Parameter Code	Method	Units	Lower Limit of Detection	Results	Results
Molybdenum	36	EPA 200.8	mg/L	0.03	1.05	0.89
Selenium	40	EPA 200.8	mg/L	0.005	0.089	0.102
Vanadium	42	EPA 200.8	mg/L	0.01	< 0.01	< 0.01

Radiometric	Parameter Code	Method	Units	Lower Limit of Detection	Results	Results
Uranium	15	EPA 200.8	mg/L	0.0003	1.15	1.09
*Uranium Precision ±	244				0.002	0.025
Uranium, Rad.	113	EPA 200.8	µCi/mL	2.0E-10	7.8E-07	7.4E-07
*Uranium Precision ±	114				1.6E-09	1.5E-09
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	< 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	< 0.2	0.3
Thorium Error Estimate ±	248				0.4	0.3
Thorium 230	362	EPA 907.0	µCi/mL	2.0E-10	< 2.0E-10	3.0E-10
Thorium Error Estimate ±	363				4.0E-10	3.0E-10

Quality Assurance Data	Target Range	Results	Results
Anion	meq	29.6	29.7
Cation	meq	29.7	29.8
SM A/C Balance	%	-5 - +5	0.06
Calc TDS	mg/L	1805	1812
TDS A/C Balance	dec. %	0.80 - 1.20	1.06
			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.

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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
07/16/2002 15:38	07/15/2003 12:36
07/18/2002 10:00	07/17/2003 10:00
Liquid, Water	Liquid, Water
C02070555-004	C03070691-002
August 13, 2002	August 14, 2003

Major Ions	Parameter Code	Method	Units	"Lower Limit of Detection"	Results	Results
Calcium	1	EPA 200.7	mg/L	1.0	366	392
Magnesium	2	EPA 200.7	mg/L	1.0	81.6	95.7
Sodium	4	EPA 200.7	mg/L	1.0	406	411
Potassium	3	EPA 200.7	mg/L	1.0	6.4	6.9
Carbonate	6	SM 2320-B	mg/L	1.0	< 1.0	< 1.0
Bicarbonate	5	SM 2320-B	mg/L	1.0	398	393
Sulfate	8	EPA 200.7	mg/L	1.0	1530	1700
Chloride	7	EPA 200.7	mg/L	0.10	148	151
Nitrate + Nitrite as N	39	EPA 353.2	mg/L	0.10	< 0.10	< 0.10

Non-Metals						
Total Dissolved Solids	10	SM 2540-C	mg/L	10	3090	3010
Alkalinity	75	SM 2320-B	mg/L	1.0	327	323
pH	9	SM 4500-H-B	std. units	0.01	8.01	7.80

Trace Metals						
Molybdenum	36	EPA 200.8	mg/L	0.03	0.47	0.33
Selenium	40	EPA 200.8	mg/L	0.005	0.015	0.007
Vanadium	42	EPA 200.8	mg/L	0.01	< 0.01	< 0.01

Radiometric						
Uranium	15	EPA 200.8	mg/L	0.0003	2.20	1.56
*Uranium Precision ±	244				0.099	0.003
Uranium, Rad.	113	EPA 200.8	µCi/mL	2.0E-10	1.5E-06	1.1E-06
*Uranium Precision ±	114				3.4E-08	2.4E-08
Radium 226	45	EPA 903.0	pCi/L	0.2	1.2	0.6
Radium Error Estimate ±	245				0.2	0.3
Radium 226	256	EPA 903.0	µCi/mL	2.0E-10	1.2E-09	6.0E-10
Radium Error Estimate ±	258				2.0E-10	3.0E-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	< 0.2	< 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		42.6	46.2
Cation	meq		42.9	45.6
SM A/C Balance	%	-5 - +5	0.36	-0.58
Calc TDS	mg/L		2738	2955
TDS A/C Balance	dec. %	0.80 - 1.20	1.13	1.02

*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



LABORATORY ANALYSIS REPORT

Client: Homestake Mining Company

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

X	X
07/15/2002 14:18	07/15/2003 10:20
07/18/2002 10:00	07/17/2003 10:00
Liquid, Water	Liquid, Water
C02070555-002	C03070691-003
August 13, 2002	August 14, 2003

Major Ions	Parameter Code	Method	Units	"Lower Limit of Detection"	Results	Results
Calcium	1	EPA 200.7	mg/L	1.0	25.6	51.0
Magnesium	2	EPA 200.7	mg/L	1.0	5.4	8.3
Sodium	4	EPA 200.7	mg/L	1.0	14.9	30.6
Potassium	3	EPA 200.7	mg/L	1.0	1.4	1.9
Carbonate	6	SM 2320-B	mg/L	1.0	< 1.0	< 1.0
Bicarbonate	5	SM 2320-B	mg/L	1.0	101	129
Sulfate	8	EPA 200.7	mg/L	1.0	16.0	73.0
Chloride	7	EPA 200.7	mg/L	0.10	15.9	33.7
Nitrate + Nitrite as N	39	EPA 353.2	mg/L	0.10	0.62	0.80

Non-Metals						
Total Dissolved Solids	10	SM 2540-C	mg/L	10	155	267
Alkalinity	75	SM 2320-B	mg/L	1.0	83.0	106
pH	9	SM 4500-H-B	std. units	0.01	7.94	7.91

Trace Metals						
Molybdenum	36	EPA 200.8	mg/L	0.03	< 0.03	0.13
Selenium	40	EPA 200.8	mg/L	0.005	< 0.005	0.007
Vanadium	42	EPA 200.8	mg/L	0.01	< 0.01	< 0.01

Radiometric						
Uranium	15	EPA 200.8	mg/L	0.0003	0.0090	0.0166
*Uranium Precision ±	244				0.0004	0.00003
Uranium, Rad.	113	EPA 200.8	µCi/mL	2.0E-10	6.1E-09	1.1E-08
*Uranium Precision ±	114				6.7E-11	3.3E-10
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	< 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				0.2	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		2.51	4.68
Cation	meq		2.41	4.62
SM A/C Balance	%	-5 - +5	-2.05	-0.59
Calc TDS	mg/L		133	268
TDS A/C Balance	dec. %	0.80 - 1.20	1.16	1.00

*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 2.1.4 - 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
07/15/2002 14:56	07/15/2003 11:19
07/18/2002 10:00	07/17/2003 10:00
Liquid, Water	Liquid, Water
C02070555-001	C03070691-001
August 13, 2002	August 14, 2003

Major Ions	Parameter Code	Method	Units	"Lower Limit of Detection"	Results	Results
Calcium	1	EPA 200.7	mg/L	1.0	246	259
Magnesium	2	EPA 200.7	mg/L	1.0	52.3	54.3
Sodium	4	EPA 200.7	mg/L	1.0	244	250
Potassium	3	EPA 200.7	mg/L	1.0	4.8	5.5
Carbonate	6	SM 2320-B	mg/L	1.0	< 1.0	< 1.0
Bicarbonate	5	SM 2320-B	mg/L	1.0	242	253
Sulfate	8	EPA 200.7	mg/L	1.0	1010	1070
Chloride	7	EPA 200.7	mg/L	1.0	57.7	54.6
Nitrate + Nitrite as N	39	EPA 353.2	mg/L	0.10	8.00	7.00

Non-Metals						
Total Dissolved Solids	10	SM 2540-C	mg/L	10	1950	1860
Alkalinity	75	SM 2320-B	mg/L	1.0	199	208
pH	9	SM 4500-H-B	std. units	0.01	7.99	7.78

Trace Metals						
Molybdenum	36	EPA 200.8	mg/L	0.03	< 0.03	< 0.03
Selenium	40	EPA 200.8	mg/L	0.005	0.179	0.167

Radiometric						
Uranium	15	EPA 200.8	mg/L	0.0003	0.027	0.0270
*Uranium Precision ±	244				0.001	0.0001
Uranium, Rad.	113	EPA 200.8	µCi/mL	2.0E-10	1.8E-08	1.8E-08
*Uranium Precision ±	114				4.2E-10	4.2E-10
Radium 226	45	EPA 903.0	pCi/L	0.2	< 0.2	0.8
Radium Error Estimate ±	245				0.2	0.4
Radium 226	256	EPA 903.0	µCi/mL	2.0E-10	< 2.0E-10	8.0E-10
Radium Error Estimate ±	258				2.0E-10	4.0E-10

Quality Assurance Data				Target Range	
Anion		meq		27.2	28.5
Cation		meq		27.4	28.5
SM A/C Balance		%	-5 - +5	0.28	-0.04
Calc TDS		mg/L		1772	1852
TDS A/C Balance		dec. %	0.80 - 1.20	1.10	1.00

*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 equivalent)	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 Equipment	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	Annually	N/A
Personnel Gamma (OSL)	Variable	Personnel	HP-11	Quarterly	Gamma
Personnel Contamination	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 (or 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; OSL = Optically Stimulated Luminescence dosimeter

Figure 1 – Monitoring & Sampling Locations

HOMESTAKE MINING COMPANY GRANTS PROJECT Monitoring & Sampling Locations

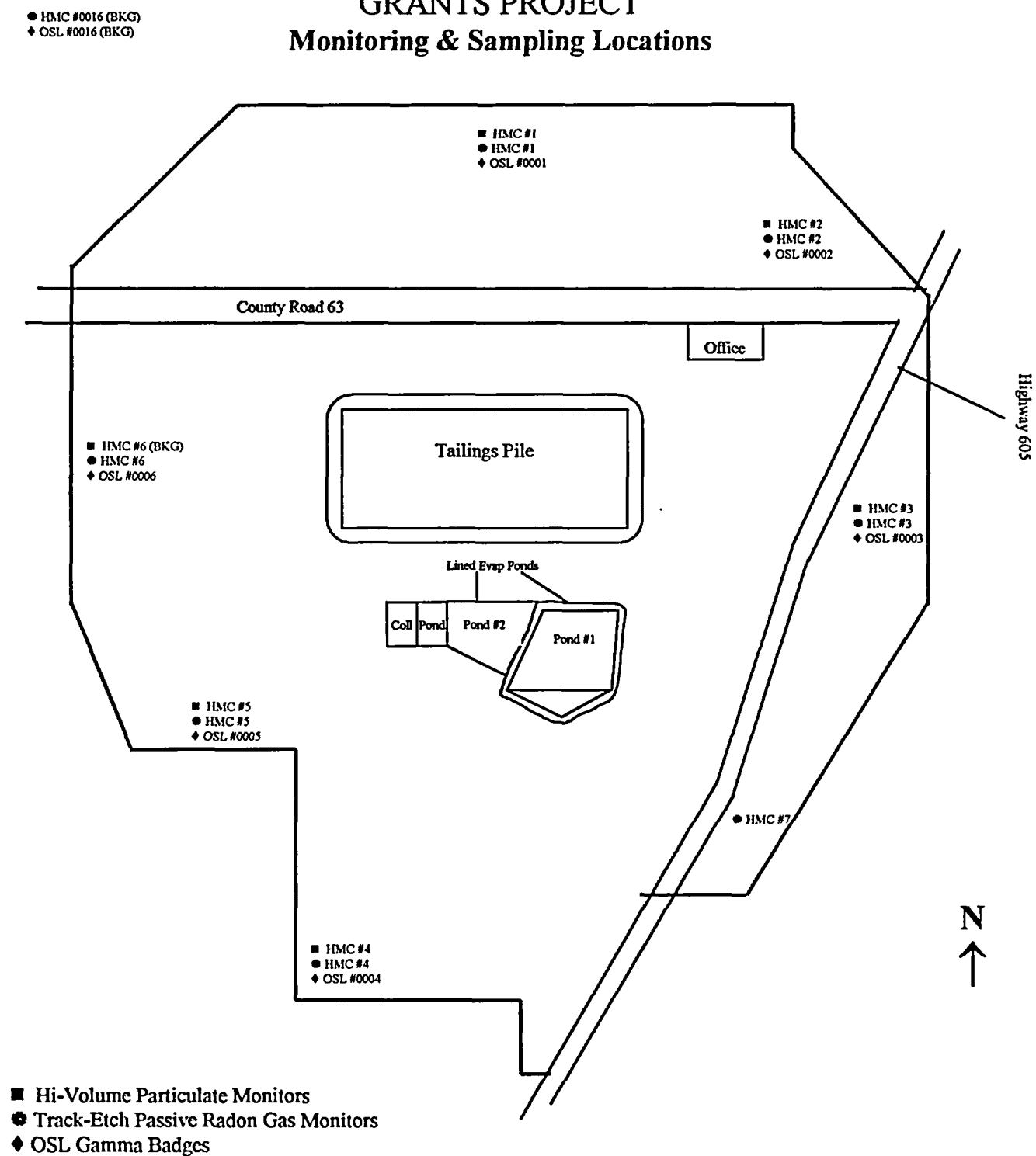


FIGURE 1

Attachment 1 – High Volume Air Sampling Results



HIGH VOLUME AIR ANALYSIS REPORT

CLIENT: HOMESTAKE MINING - GRANTS, NEW MEXICO
REPORT DATE: October 28, 2003
DATE SAMPLED: 3rd Quarter 2003

EPA Method		6020	903.0		907.0	
Laboratory Number	Sample I.D.	Uranium-nat pCi/filt.	Radium 226 pCi/filt.	+/-	Thorium 230 pCi/filt.	+/-
C03100004-001A	HMC 1	256	5.9	1.9	4.0	1.1
C03100004-002A	HMC 2	203	6.0	1.9	4.5	1.1
C03100004-003A	HMC 3	498	5.5	1.9	4.9	1.3
C03100004-004A	HMC 4	800	4.7	1.7	5.7	1.5
C03100004-005A	HMC 5	1036	5.1	1.7	4.9	1.1
C03100004-006A	HMC 6	285	7.0	1.9	3.0	0.9
C03100004-007A	HMC 7	1.2	<0.4	N/A	<0.4	N/A
LLD	pCi/filter	0.4	0.4		0.4	



HIGH VOLUME AIR ANALYSIS REPORT

CLIENT: HOMESTAKE MINING - GRANTS, NEW MEXICO
REPORT DATE: January 7, 2004
DATE SAMPLED: 4th Quarter 2003

EPA Method		6020	903.0		907.0	
Laboratory Number	Sample I.D.	Uranium-nat pCi/filt.	Radium 226 pCi/filt.	+/-	Thorium 230 pCi/filt.	+/-
C03120797-001A	HMC 1	68	5.0	1.4	2.6	0.9
C03120797-002A	HMC 2	69	4.5	1.3	3.0	0.9
C03120797-003A	HMC 3	223	12.2	1.9	8.9	1.7
C03120797-004A	HMC 4	148	4.0	1.3	4.0	1.1
C03120797-005A	HMC 5	317	6.4	1.5	3.8	1.1
C03120797-006A	HMC 6	81	4.7	1.3	4.2	1.3
C03120797-007A	HMC 7	1.2	<0.4	N/A	<0.4	N/A
LLD	pCi/filter	0.4	0.4		0.4	



HIGH VOLUME AIR SAMPLING REPORT

CLIENT: HOMESTAKE MINING COMPANY - GRANTS, NEW MEXICO

REPORT DATE: January 7, 2004

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
C03040034-001A First Quarter 2003 Air Volume in mLs 1.44E+11	^{238}U	1.48E-16	N/A	1.00E-16	9.00E-14	1.64E-01
	^{230}Th	< 1.00E-16	1.31E-17	1.00E-16	2.00E-14	< 5.00E-01
	^{226}Ra	< 1.00E-16	2.63E-18	1.00E-16	9.00E-13	< 1.11E-02
C03061121-001A Second Quarter 2003 Air Volume in mLs 1.44E+11	^{238}U	8.41E-16	N/A	1.00E-16	9.00E-14	9.34E-01
	^{230}Th	1.55E-16	2.10E-17	1.00E-16	2.00E-14	7.74E-01
	^{226}Ra	2.23E-16	1.58E-17	1.00E-16	9.00E-13	2.48E-02
C03100004-001A Third Quarter 2003 Air Volume in mLs 1.43E+11	^{238}U	1.79E-15	N/A	1.00E-16	9.00E-14	1.99E+00
	^{230}Th	< 1.00E-16	7.93E-18	1.00E-16	2.00E-14	< 5.00E-01
	^{226}Ra	< 1.00E-16	1.32E-17	1.00E-16	9.00E-13	< 1.11E-02
C03120797-001A Fourth Quarter 2003 Air Volume in mLs 1.31E+11	^{238}U	5.19E-16	N/A	1.00E-16	9.00E-14	5.77E-01
	^{230}Th	< 1.00E-16	7.21E-18	1.00E-16	2.00E-14	< 5.00E-01
	^{226}Ra	< 1.00E-16	1.01E-17	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 7, 2004

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
C03040034-002A First Quarter 2003 Air Volume in mLs 1.45E+11	^{238}U	2.18E-16	N/A	1.00E-16	9.00E-14	2.42E-01
	^{230}Th	< 1.00E-16	1.30E-17	1.00E-16	2.00E-14	< 5.00E-01
	^{226}Ra	1.21E-16	1.04E-17	1.00E-16	9.00E-13	1.35E-02
C03061121-002A Second Quarter 2003 Air Volume in mLs 1.44E+11	^{238}U	8.48E-16	N/A	1.00E-16	9.00E-14	9.43E-01
	^{230}Th	1.50E-16	1.05E-17	1.00E-16	2.00E-14	7.48E-01
	^{226}Ra	1.97E-16	1.31E-17	1.00E-16	9.00E-13	2.19E-02
C03100004-002A Third Quarter 2003 Air Volume in mLs 1.45E+11	^{238}U	1.40E-15	N/A	1.00E-16	9.00E-14	1.56E+00
	^{230}Th	< 1.00E-16	7.82E-18	1.00E-16	2.00E-14	< 5.00E-01
	^{226}Ra	< 1.00E-16	1.30E-17	1.00E-16	9.00E-13	< 1.11E-02
C03120797-002A Fourth Quarter 2003 Air Volume in mLs 1.31E+11	^{238}U	5.29E-16	N/A	1.00E-16	9.00E-14	5.88E-01
	^{230}Th	< 1.00E-16	7.21E-18	1.00E-16	2.00E-14	< 5.00E-01
	^{226}Ra	< 1.00E-16	1.01E-17	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 7, 2004

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
C03040034-003A First Quarter 2003 Air Volume in mLs 1.46E+11	^{238}U	3.22E-16	N/A	1.00E-16	9.00E-14	3.57E-01
	^{230}Th	< 1.00E-16	7.77E-18	1.00E-16	2.00E-14	< 5.00E-01
	^{226}Ra	< 1.00E-16	6.47E-18	1.00E-16	9.00E-13	< 1.11E-02
C03061121-003A Second Quarter 2003 Air Volume in mLs 1.39E+11	^{238}U	3.22E-15	N/A	1.00E-16	9.00E-14	3.58E+00
	^{230}Th	< 1.00E-16	1.50E-17	1.00E-16	2.00E-14	< 5.00E-01
	^{226}Ra	< 1.00E-16	2.72E-18	1.00E-16	9.00E-13	< 1.11E-02
C03100004-003A Third Quarter 2003 Air Volume in mLs 1.46E+11	^{238}U	3.41E-15	N/A	1.00E-16	9.00E-14	3.79E+00
	^{230}Th	< 1.00E-16	9.06E-18	1.00E-16	2.00E-14	< 5.00E-01
	^{226}Ra	< 1.00E-16	1.29E-17	1.00E-16	9.00E-13	< 1.11E-02
C03120797-003A Fourth Quarter 2003 Air Volume in mLs 1.31E+11	^{238}U	1.70E-15	N/A	1.00E-16	9.00E-14	1.89E+00
	^{230}Th	< 1.00E-16	1.30E-17	1.00E-16	2.00E-14	< 5.00E-01
	^{226}Ra	< 1.00E-16	1.44E-17	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 7, 2004

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
C03040034-004A First Quarter 2003 Air Volume in mLs 1.44E+11	^{238}U	1.77E-16	N/A	1.00E-16	9.00E-14	1.96E-01
	^{230}Th	< 1.00E-16	9.19E-18	1.00E-16	2.00E-14	< 5.00E-01
	^{226}Ra	< 1.00E-16	6.56E-18	1.00E-16	9.00E-13	< 1.11E-02
C03061121-004A Second Quarter 2003 Air Volume in mLs 1.42E+11	^{238}U	1.41E-15	N/A	1.00E-16	9.00E-14	1.57E+00
	^{230}Th	< 1.00E-16	1.46E-17	1.00E-16	2.00E-14	< 5.00E-01
	^{226}Ra	< 1.00E-16	2.66E-18	1.00E-16	9.00E-13	< 1.11E-02
C03100004-004A Third Quarter 2003 Air Volume in mLs 1.43E+11	^{238}U	5.59E-15	N/A	1.00E-16	9.00E-14	6.21E+00
	^{230}Th	< 1.00E-16	1.06E-17	1.00E-16	2.00E-14	< 5.00E-01
	^{226}Ra	< 1.00E-16	1.19E-17	1.00E-16	9.00E-13	< 1.11E-02
C03120797-004A Fourth Quarter 2003 Air Volume in mLs 1.29E+11	^{238}U	1.14E-15	N/A	1.00E-16	9.00E-14	1.27E+00
	^{230}Th	< 1.00E-16	8.79E-18	1.00E-16	2.00E-14	< 5.00E-01
	^{226}Ra	< 1.00E-16	1.03E-17	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 7, 2004

SAMPLE ID: IIMC 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
C03040034-005A First Quarter 2003 Air Volume in mLs 1.45E+11	^{238}U	3.20E-16	N/A	1.00E-16	9.00E-14	3.56E-01
	^{230}Th	< 1.00E-16	9.12E-18	1.00E-16	2.00E-14	< 5.00E-01
	^{226}Ra	< 1.00E-16	2.61E-18	1.00E-16	9.00E-13	< 1.11E-02
C03061121-005A Second Quarter 2003 Air Volume in mLs 1.42E+11	^{238}U	3.34E-15	N/A	1.00E-16	9.00E-14	3.71E+00
	^{230}Th	< 1.00E-16	1.20E-17	1.00E-16	2.00E-14	< 5.00E-01
	^{226}Ra	< 1.00E-16	2.66E-18	1.00E-16	9.00E-13	< 1.11E-02
C03100004-005A Third Quarter 2003 Air Volume in mLs 1.35E+11	^{238}U	7.68E-15	N/A	1.00E-16	9.00E-14	8.53E+00
	^{230}Th	< 1.00E-16	8.40E-18	1.00E-16	2.00E-14	< 5.00E-01
	^{226}Ra	< 1.00E-16	1.26E-17	1.00E-16	9.00E-13	< 1.11E-02
C03120797-005A Fourth Quarter 2003 Air Volume in mLs 1.32E+11	^{238}U	2.40E-15	N/A	1.00E-16	9.00E-14	2.66E+00
	^{230}Th	< 1.00E-16	8.59E-18	1.00E-16	2.00E-14	< 5.00E-01
	^{226}Ra	< 1.00E-16	1.15E-17	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 7, 2004

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
C03040034-006A First Quarter 2003 Air Volume in mLs 1.47E+11	^{238}U	< 1.00E-16	N/A	1.00E-16	9.00E-14	< 1.11E-01
	^{230}Th	< 1.00E-16	9.00E-18	1.00E-16	2.00E-14	< 5.00E-01
	^{226}Ra	< 1.00E-16	6.43E-18	1.00E-16	9.00E-13	< 1.11E-02
C03061121-006A Second Quarter 2003 Air Volume in mLs 1.35E+11	^{238}U	7.35E-16	N/A	1.00E-16	9.00E-14	8.16E-01
	^{230}Th	< 1.00E-16	1.68E-17	1.00E-16	2.00E-14	< 5.00E-01
	^{226}Ra	< 1.00E-16	2.80E-18	1.00E-16	9.00E-13	< 1.11E-02
C03100004-006A Third Quarter 2003 Air Volume in mLs 1.46E+11	^{238}U	1.95E-15	N/A	1.00E-16	9.00E-14	2.17E+00
	^{230}Th	< 1.00E-16	6.47E-18	1.00E-16	2.00E-14	< 5.00E-01
	^{226}Ra	< 1.00E-16	1.29E-17	1.00E-16	9.00E-13	< 1.11E-02
C03120797-006A Fourth Quarter 2003 Air Volume in mLs 1.33E+11	^{238}U	6.11E-16	N/A	1.00E-16	9.00E-14	6.79E-01
	^{230}Th	< 1.00E-16	9.95E-18	1.00E-16	2.00E-14	< 5.00E-01
	^{226}Ra	< 1.00E-16	9.95E-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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QUALITY ASSURANCE REPORT
HOMESTAKE MINING CORPORATION

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

C03100004-001A-007A

Air Filter

3rd Quarter 2003

09/30/2003

October 28, 2003

	Method	Relative Percent Difference ¹	Spike Recovery (Percent) ²	LCS Recovery (Percent)	Method Blank pCi/Filter	Date Analyzed	Analyst
Laboratory #:	C03100128-001A		C03100128-001A				
Uranium:	6020	3.2	128	114	<0.4	10/10/2003	SMD
Laboratory #:	C03100126-001A		C03100126-001A				
Radium 226:	903.0	1.2	151	93	<0.4	10/09/2003	DF
Laboratory #:	C03100073-006A		C03100073-006A				
Thorium 230:	907.0	5.6	92	101	<0.4	10/08/2003	PH
Digestion:	SW3050	Volume 1.89	Units Liter		Batch 4328	10/06/2003	CJS

(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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QUALITY ASSURANCE REPORT
HOMESTAKE MINING CORPORATION

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

C03120797-001A-007A

Air Filter

4th Quarter 2003

12/18/2003

January 7, 2004

	Method	Relative Percent Difference ¹	Spike Recovery (Percent) ²	LCS Recovery (Percent)	Method Blank pCi/Filter	Date Analyzed	Analyst
Laboratory #:	C03120797-006A C03120797-006A						
Uranium:	6020	2.4	102	99	<0.4	12/23/2003	SMD
Laboratory #:	C03110906-005A C03110906-001A						
Radium 226:	903.0	41.7	99	111	<0.4	12/27/2003	DF
Laboratory #:	C03120843-002A C03120843-002A						
Thorium 230:	907.0	6.8	95	96	<0.4	12/27/2003	PH
Digestion:	SW3050	1.89	Liter		4791	12/22/2003	CJS

(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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Attachment 2 - Radon Gas Monitoring Results

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

Location	Monitoring Period	Rn Concentration ($\mu\text{Ci/ml}$)	Error Estimate ($\mu\text{Ci/ml}$)	% Limit* (%)	LLD ($\mu\text{Ci/ml}$)
Hi-Vol #1 N Outer Perimeter	6/30/2003 - 12/31/2003	1.7E-09	4.3E-10	17	1.6E-10
Hi-Vol #2 NE Outer Perimeter	6/30/2003 - 12/31/2003	1.5E-09	3.9E-10	15	1.6E-10
Hi-Vol #3 E Outer Perimeter	6/30/2003 - 12/31/2003	1.1E-09	3.3E-10	11	1.6E-10
Hi-Vol #4 S Outer Perimeter	6/30/2003 - 12/31/2003	2.3E-09	5.0E-10	23	1.6E-10
Hi-Vol #5 N of Nearest Residence	6/30/2003 - 12/31/2003	1.5E-09	3.9E-10	15	1.6E-10
Hi-Vol #6 W of Outer Perimeter	6/30/2003 - 12/31/2003	1.6E-09	4.1E-10	16	1.6E-10
HMC #7 S Boundary	6/30/2003 - 12/31/2003	1.4E-09	3.8E-10	14	1.6E-10
HMC #16 Background	6/30/2003 - 12/31/2003	1.0E-09	3.1E-10	10	1.6E-10

*Limit of 1E-8 $\mu\text{Ci/ml}$ 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
OSL Perimeter Survey

Direct Radiation Measurements

Location	Monitoring Period	Exposure Rate (mrem/6 mo)	Error (mrem/6 mo)*
Hi-Vol #1 N Outer Perimeter	07/01/2003 - 12/31/2003	11	1.1
Hi-Vol #2 NE Outer Perimeter	07/01/2003 - 12/31/2003	25	2.5
Hi-Vol #3 E Outer Perimeter	07/01/2003 - 12/31/2003	29	2.8
Hi-Vol #4 S Outer Perimeter	07/01/2003 - 12/31/2003	24	2.4
Hi-Vol #5 N of Nearest Residence	07/01/2003 - 12/31/2003	18	1.8
Hi-Vol #6 W of Outer Perimeter	07/01/2003 - 12/31/2003	14	1.4
#16 Background	07/01/2003 - 12/31/2003	17	1.7

*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 in 2003 at the Grants Uranium Mill Site 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. The exposure at both sampling stations is considered and the station with the highest exposure is used for calculating the total effective dose equivalent. It is known that the residents have typical lifestyles.

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 2000. The sampling location HMC #5 was chosen as the Nearest Residence Location since the total calculated EDE was higher than at the other possible Nearest Residence Location, HMC#4. 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/μCi)</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 2.1 mrem/year and 3.3 mrem/y, respectively while that at the background location (HMC#6) was calculated to be 1.0 mrem/y, for a net CEDE at the potential residence locations, HMC #4 and HMC#5, of 1.1 mrem/y and 2.3 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 0.8 mrem/y at HMC #4 and 1.7 mrem/year at HMC #5. The location with the highest exposure from all pathways will be chosen for calculating the TEDE to the public.

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 since the total TEDE from all pathways is higher than for HMC#5. The yearly average of the radon concentration for HMC#4 was 1.75 pCi/l while the average for the background location is 0.95 pCi/l. This results in a net radon concentration at the nearest residence of 0.8 pCi/l.

Since the nearest residence is within a few hundred feet of Monitoring Station HMC #4 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 the nearest residence therefore results in a calculated CEDE of 60 mrem/y.

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 Luxel dosimeters placed at the monitoring stations. The Nearest Residence location, HMC#4, was used since the TEDE was higher than the alternative location HMC#5 as shown in Attachment 3 at the end of the semiannual reports. The sum of the net semi-annual dose equivalents for HMC#4 is 13 mrem/y. Considering the 75 percent occupancy time, the dose equivalent to the nearest resident is 10 mrem/year.

2.4 Total Effective Dose Equivalent to the Nearest Resident

The TEDE to the Nearest Resident can be calculated by adding the effective dose equivalent (EDE) from inhalation of airborne particulate, the EDE from the exposure to radon coming from the site, and the dose equivalent from direct gamma radiation. The TEDE is larger for location HMC#4 than for HMC#5. Therefore the TEDE is obtained by summing 0.8 mrem/y from airborne particulate, 60 mrem/y from radon, and 10 mrem/y from direct gamma radiation for a total TEDE of 71 mrem/y. This is within the 100 mrem/year limit.

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

Year: 2003

STATION: HMC #4 Nearest Residence

AIRBORNE CONCENTRATION					
	U-nat μCi/ml =====	U-234 μCi/ml =====	U-238 μCi/ml =====	Th-230 μCi/ml =====	Ra-226 μCi/ml =====
1st qtr	1.77E-16	8.63E-17	8.63E-17	1.00E-16	1.00E-16
2nd qtr	1.41E-15	6.87E-16	6.87E-16	1.58E-16	1.00E-16
3rd qtr	5.59E-15	2.72E-15	2.72E-15	1.00E-16	1.00E-16
4th qtr	1.14E-15	5.56E-16	5.56E-16	1.00E-16	1.00E-16
Average	2.08E-15	1.01E-15	1.01E-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 =====
	0.977	0.873	0.272	0.006	2.1

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

Year: 2003

STATION: HMC #5 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	3.20E-16	1.56E-16	1.56E-16	1.00E-16	1.00E-16
2nd qtr	3.34E-15	1.63E-15	1.63E-15	1.00E-16	1.00E-16
3rd qtr	7.68E-15	3.74E-15	3.74E-15	1.00E-16	1.00E-16
4th qtr	2.40E-15	1.17E-15	1.17E-15	1.00E-16	1.00E-16
Average	----- 3.44E-15	----- 1.67E-15	----- 1.67E-15	----- 1.00E-16	----- 1.00E-16
ANNUAL EFFECTIVE DOSE EQUIVALENT					
	U-234 mrem =====	U-238 mrem =====	Th-230 mrem =====	Ra-226 mrem =====	TOTAL mrem =====
	1.613	1.442	0.238	0.006	3.3

Table 2-3 Annual Effective Dose at the Site Background Location from Airborne Particulate

Year:2003

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	1.00E-16	4.87E-17	4.87E-17	1.00E-16	1.00E-16
2nd qtr	7.35E-16	3.58E-16	3.58E-16	1.00E-16	1.00E-16
3rd qtr	1.95E-15	9.50E-16	9.50E-16	1.00E-16	1.00E-16
4th qtr	6.11E-16	2.98E-16	2.98E-16	1.00E-16	1.00E-16
Average	8.49E-16	4.14E-16	4.14E-16	1.00E-16	1.00E-16

ANNUAL EFFECTIVE DOSE EQUIVALENT

U-234 mrem =====	U-238 mrem =====	Th-230 mrem =====	Ra-226 mrem =====	TOTAL mrem =====
0.399	0.356	0.238	0.006	1.0