

HOMESTAKE MINING COMPANY

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January 23, 1997

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Mr. Joseph Holonich, Chief
U.S. Nuclear Regulatory Commission
High-Level Waste and Uranium
Recovery Projects Branch MSM T7J9
Div. of Waste Management
Rockville, MD 20852

SUBJECT: Docket 40-8903, License SUA-1471
Semi-Annual Environmental Monitoring Reporting Requirements
Request for Amendment of License SUA-1471

Dear Mr. Holonich:

Mr. Louis Carson of NRC Region IV conducted an audit of our Homestake Mining Company's (HMC) Grants Project on January 12-14, 1998. In assessing our response to a violation from a February 13, 1997-audit conducted by Mr. Robert Evans, many questions arose regarding HMC's response. It was finally concluded that confusion exists among everyone involved as to what is expected of HMC regarding this violation. There are several sources that have brought about this confusion, including apparent conflicting license conditions. 1/1

It was suggested by Mr. Carson that Homestake should review the matter in depth and reach agreement with the NRC on the expectations of HMC regarding License Conditions 15 and 35 of license number SUA-1471. Mr. Ken Hooks of your staff has been advised that we intended to document this review and submit our findings to him for possible NRC resolution. NL05

Background

License Condition 15 states:

The results of all effluent and environmental monitoring required by this license

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shall be reported in accordance with 10 CFR 40, Section 40.65, with copies of the report sent to the NRC. Monitoring data shall be reported in the format shown in the attachment to SUA-1471 entitled, "Sample Format for Reporting Monitoring Data." All ground-water data shall be reported as described in License Condition No.35. [Applicable Amendment : 5]

License Condition 35 states:

The licensee shall implement a compliance monitoring program containing the following:

- A. Implement the monitoring program shown in Table 2 as revised by the licensee's August 25, 1997 submittal and Table 3 of the licensee's January 9, 1995, submittal. [Applicable Amendment: 28]
- B. Comply with the following ground-water protection standards at brine evaporation ponds point-of-compliance Wells D1 and BP, at the inactive tailings impoundment point-of-compliance Wells Y and X, and the active tailings impoundment point-of-compliance Wells S4, S3, M5, and DQ with background being recognized in Well P:

chromium = 0.06 mg/l, molybdenum = 0.03 mg/l, selenium = 0.10 mg/l, vanadium = 0.02 mg/l, uranium = 0.04 mg/l, radium-226 and -228 = 5.0 pCi/l, and thorium-230 = 0.30 pCi/l.
- C. Implement the corrective action program described in the September 15, 1989, submittal due to exceeding ground-water protection standards, with the objective of returning the concentrations of chromium, molybdenum, selenium, thorium-230, uranium, and vanadium to the concentration limits specified in 35B above.
- D. Operate the lined evaporation pond and enhanced evaporation system as described in the June 8 and 28, 1990 submittals.
- E. Submit a semi-annual ground-water monitoring report in accordance with the reporting requirements of 10 CFR 40.65. Also, submit by February 28 of each year, a performance review of the corrective action program that details the progress towards attaining ground-water protection standards.

The violation in the April 2, 1997 NRC inspection report indicated that all information was not provided in the Semi-Annual Monitoring Report as required by License Condition No. 15. Specifically, data including error estimates, lower limits of detection, and comparison of the sample results to effluent guideline values were not included in the report. On page 11 of the report, the auditor indicated that "the environmental monitoring program in place at the site consisted of air particulate sampling, radon sampling, and measurement of the ambient gamma exposure rates at six to eight sample stations. Vegetation, soil, surface water, and sediment sampling were no longer required at the site." Note that groundwater monitoring was not included in the auditor's description of the environmental monitoring program. On page 13 of the report, the auditor more carefully defines the omitted data by the phrase, "For example, the error estimates were not provided for the environmental TLDs and the radon measurements. In addition, error estimates, lower limits of detection, and percent of concentration limits were not provided for the air particulate samples."

HMC's May 1, 1997 response to the Statement was "This violation is related to improper format for Attachment 1, Perimeter Particulate Air Sampling, a table of air sampling results in the Semi-Annual Environment report submitted to NRC each year."

The NRC's May 22, 1997 letter indicated that the response was acceptable but noted that "Please note that the first violation was related to your failure to submit all environmental data to the NRC as required by the license, not just your failure to submit the report in a format presented by the license." HMC interpolated this statement to mean that ground-water data which is the subject of the second violation was tied to the first violation because some of the same data was missing from the semi-annual report.

Mr. Louis Carson, the NRC inspector, on January 14, 1997 indicated to HMC staff that the only important constituent in the current environmental monitoring program was groundwater, since it would be easy to demonstrate that perimeter radioactive particulates, radon, and exposure rates were not influenced by the current site operations. He indicated that the groundwater at the location of the point-of-compliance wells should be considered effluent and the data reported accordingly. In addition, he pointed out that much of the groundwater data that HMC currently reports in the Semi-Annual Environmental Report is not required.

In the Semi-Annual Environmental Report for the first half of 1998, HMC presented the radionuclides in air data in the proper format with the exception of uranium which is analyzed by fluorometric analysis. The vendor provided an LLD for all samples which was presented in Section 6.0 of the report. LLDs for Rn-222, and Ra-226, Ra-228, and Th-230 in air and water were also presented in Section 6.0. Comparison to

the effluent guidelines were done for air particulate data. No errors were reported for Rn-222, environmental exposure rates, and radionuclides in water.

Issues

As one looks at all of the information related to this violation, it is apparent that confusion exists, some of which is attributable to the License Conditions Nos. 15 and 35. The last sentence in License Condition 15 states that all groundwater data shall be reported as described in License Condition No. 35. While groundwater data are reported in the Semi-Annual Environmental Reports, HMC did not consider that the format requirements of NRC Regulatory Guide 4.14 Table 3 were required. For example, Table 3 requires all uranium concentration data to be reported in $\mu\text{Ci/ml}$ and compared to 10 CFR Part 20 effluent guidelines while License Condition 35 requires uranium concentrations to be compared to the site standards expressed in mg/l . The 10 CFR Part 20 effluent guidelines for water are expressed in $\mu\text{Ci/ml}$ and are much higher than the current site standards which are based on background levels. The audit report by Mr. Evans appears to support this position in that in describing the environmental monitoring program, groundwater monitoring was noticeably absent from the list of environmental monitoring activities.

A second issue is related to the finding itself. At the closeout from Mr. Evan's audit, it was HMC's understanding that the finding related only to air particulate data. Unfortunately, HMC did not adequately review the basis for the finding that was clearly presented in the backup material. In HMC's response, the belief that this was related only to air particulate data was explicitly stated. NRC's response stated that HMC's response was acceptable although it might be argued that NRC recognized at the time that the finding was broader than just radioactive particulate. HMC interpreted NRC's lead-in cautionary statement as meaning that it was not only a format problem related to air particulate but that the LLD and errors were also not reported.

Suggested Resolution

HMC suggests that the last sentence of License Condition 15 be deleted. A new sentence should be added as follows: "For the purposes of 10 CFR 40.65 reporting ground-water for Table 3 requirements, only ground-water radionuclide data from the point-of-compliance wells and background Well P shall be reported."

In addition, HMC requests that License Condition 35 be amended as follows:

1. The Licensee shall implement a compliance ground-water monitoring program to assess the performance of the ground-water restoration program. This program

is separate from the requirements in License Condition No. 15. The Licensee shall:

- A. Implement the ground-water monitoring program shown in Groundwater Monitoring Program, Table 2 (8/97), as revised by Licensee's August 25, 1997 submittal.
- B. Comply with the following ground-water protection standards at the point-of-compliance Wells D1, BP, S4, S3, M5, X, Y and DQ, with background being recognized in Well P:

molybdenum = 0.03 mg/l, selenium = 0.10 mg/l, vanadium = 0.02 mg/l, uranium = 0.04 mg/l, radium-226 and -228 = 5.0 pCi/l, and thorium 230 = 0.30 pCi/l.
- C. Implement the corrective action program described in the September 15, 1989, submittal due to exceeding ground-water protection standards, with the ground-water restoration program objective of returning the concentrations of, molybdenum, selenium, thorium-230, uranium, and vanadium to site standards concentrations.
- D. Operate the two lined evaporation ponds, pond #1 and pond #2, and the enhanced evaporation systems located in each pond as described in the June 8 and 28, 1990, and July 26, August 16, August 19, September 2 and 15, 1994 submittals.
- E. Submit, by March 31 of each year, a performance review of the corrective action program that details the progress towards attaining the ground-water protection standards.

HMC has obtained the additional groundwater data for the point-of-compliance groundwater monitoring wells and has revised the Semi-Annual Environmental Monitoring Report for the first half of 1997 to include this data. The errors have been added to the presentation of the exposure rate measurements.

The radon-222 measurements are made using Landauer Track-Etch detectors. Track-Etch detectors were not commonly in use in 1980 when Reg. Guide 4.14 was issued. After consulting with the vendor, a precision can be calculated from the error reported for the calibration factor, although this may not truly represent the total error. The vendor also advised us that the precision was 30 pCi(day/liter), or approximately 0.2 pCi/l for a six-month deployment. This LLD complies with the Reg. Guide 4.14. HMC has reported this value as an LLD although it is probably higher than this based on the

reported error in the calibration factor. The limit for Radon-222 will be compared to the 10 CFR 20, Appendix B, Table 2 value of $1\text{E-}8 \mu\text{Ci/ml}$.

Enclosed is the revised Semi-Annual Environmental Report, January-June 1997 that incorporates these changes for your review. HMC believes that this response has addressed all outstanding issues reviewed during the January 12, 1998 NRC inspection and discussed with Mr. Ken Hooks of your office on January 13, 1998. With the suggested License Amendment to License Conditions 15 and 35, the expectations will have been made clear.

With the above changes, then the first sentence in License Condition 35E should be deleted to avoid duplication with License Condition 15, and the words "and Table 3 of the Licensee's January 9, 1995, submittal" be removed from License Condition 35A since this statement is related to the environmental report requirements of License Condition 15.

The reporting requirements for uranium, radium-226, radium-228 and thorium-230 in the Semi-Annual Environmental Monitoring Report are in $\mu\text{Ci/ml}$. The site standards for this project are set on the basis of mg/l for uranium and pCi/l for radium-226, radium-228 and thorium-230. All discussions and comparisons are, therefore, presented relative to the units that the site standards are based on. Therefore, HMC requests that future semi-annual reports use mg/l for uranium and pCi/l for radium-226, radium-228 and thorium-230 rather than $\mu\text{Ci/l}$.

HMC would also like to propose that License Condition No. 35D, be modified by adding the operation of evaporation pond #2 to License Condition No. 35D. This change would allow the deletion of License Condition 39 which was added to the License when permission was granted by the NRC to construct the second evaporation pond.

NRC letter dated March 10, 1995, Subject: "Reduction of Parameters Monitored under Grants Mill Groundwater Corrective Action Program," authorizes the removal of chromium as a monitoring parameter from License Condition No. 35B and C. HMC requests that chromium be removed from License Condition No. 35B and C.

Also, HMC would like to propose, at the suggestion of the past two NRC compliance inspectors, that License Condition No. 14 be reworded as:

Condition No. 14. Any equipment, supplies, or manpower that comes in contact with tailings sand and/or slimes will be monitored using Standard Operating Procedures prior to leaving the radiologically control area.

Mr. Joseph Holonich, Chief January 23, 1998

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We are very anxious for a timely resolution of this issue since we are currently preparing the Semi-Annual Environmental Report for the second half of 1997. Please call me if you need to discuss this or need additional information.

Sincerely,

HOMESTAKE MINING COMPANY



Roy R. Gellan
Corporate Manager, Reclamation

Enclosure

xc: Mr. Ken Hooks, Project Manager
Mr. C. Cain, NRC, Arlington, TX
Mr. Lewis Carson
Mr. Harold Barnes, Director EHSGA, SFO
Mr. George Hoffman, Hydro Engineering
File HMC Grants (2)

**HOMESTAKE MINING COMPANY
OF
CALIFORNIA
GRANTS PROJECT**



**SEMI-ANNUAL ENVIRONMENTAL
REPORT**

**JANUARY – JUNE
1997**

REVISED JANUARY 1998

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

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FIGURES

Figure 1 - Monitoring & Sampling Locations

ATTACHMENTS

- Attachment 1 - Perimeter Particulate Air Sampling
- Attachment 2 - Radon Gas Monitoring Results
- Attachment 3 - Environmental Gamma Radiation

1.0 INTRODUCTION

This Semi-Annual Environmental Monitoring Report summarizes effluent monitoring data recorded for Homestake Mining Company of California - Grants Project (Homestake) from January through June 1997. In some instances, data collected prior to this period is also included in the report because it was not available at the time Homestake submitted their previous semi-annual report. The submittal of this report to the appropriate Nuclear Regulatory Commission (NRC) Regional Office and New Mexico state agency 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 have 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 insure 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 additional effluent monitoring activities that differ from those presented in the Regulatory Guide 4.14 are 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. 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 outcrops. Soil verification of the removal of off-pile contaminated soil is complete, with completion report submitted December 18, 1995. In addition, a decommissioning report for the mine ion-exchange (IX) plant was completed and submitted in March 1997.

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 wells and background well P are included in the semi-annual environmental monitoring report for the first half of the year.

Condition 35A, Table 2, titled *Table 2 - Groundwater Monitoring Program (2-93)* has been modified to reflect current monitoring conditions at the site. The up-dated version of the table, Table 2 (8-97), was submitted to the NRC by letter dated August 25, 1997 to replace the old version of *Table 2 - Groundwater Monitoring Program (2-93)*.

1.5 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 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.

Homestake uses a Sierra Instruments Model #305-200 High Volume Air Sampler (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.

3.0 WATER QUALITY MONITORING

Table 2 (8-97) outlines the sampling frequency 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 February 28 of each year according to License Condition 35E. In order to comply with 10 CFR 40.65, the groundwater monitoring data for the point-of-compliance wells and background P are included in this Semi-Annual Environmental Report.

4.0 DIRECT RADIATION

Gamma exposure rates are continuously monitored through the use of thermoluminescent dosimeters (TLD) at each of the seven locations identified in Figure 1. 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 Eberline Instrument Co.). The integrated levels of direct environmental radiation are recorded for each of the seven locations. HMC #16 is considered the background location for direct radiation.

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 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:

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

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);
$3.7 \text{ E } 4$	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_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. The LLD for radon-222 is reported by Landauer, Inc. The LLDs for the constituents are:

Ra-226, Th-230 in air	1 E-16 $\mu\text{Ci/ml}$
Rn-222 in air	30 pCi(d/l)
U-nat in air	1 E-16 $\mu\text{Ci/ml}$
U-nat in water	2 E-10 $\mu\text{Ci/ml}$
Ra-226, Th-230 in water	2 E-9 $\mu\text{Ci/ml}$
Ra-228 in water	1 E-9 $\mu\text{Ci/ml}$

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 ANNUAL STATUS REPORT FOR TAILINGS AND EVAPORATION POND EMBANKMENTS

License Condition 12 specifies that periodic inspection of the large and small tailings embankments are made and documented. The results of the inspections for 1997 will be included in the second half Semi-Annual Environmental Report.

8.0 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. 10 CFR Part 40.65 requires that Homestake submit its effluent release monitoring data to 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. For some monitoring systems, the data summaries that Homestake is submitting contain data collected prior to the beginning of this six-month

reporting period. Homestake believes that the inclusion of this additional monitoring data is important to more accurately identify any trends regarding effluent levels and demonstrate compliance with all appropriate regulatory requirements. Also, data that was not available for Homestake's previous effluent monitoring report is included in the summaries. 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.

In addition, Table 2, which lists the monitoring requirements for the site has undergone a minor revision, partly to clarify some of the well locations, but mostly to ensure that the monitoring program reflects the current activities at the site. The table, titled *Table 2 - Groundwater Monitoring Program (8-97)* was submitted to the NRC by letter dated August 25, 1997 as a replacement to *Table 2 - Groundwater Monitoring Program (2-93)*. For the purpose of this report, only the ground water monitoring data at the point-of-compliance wells and background well P are considered required to meet 10 CFR 40.65 requirements.

An evaluation of the radiological concentrations in effluent released and a comparison of those values to the licensee's previously reviewed design objectives of the Source Material License is required by 10 CFR Part 40.65 and Part 20 to be included in this submittal.

Homestake representatives have utilized two approaches in this report to demonstrate that the quantities of effluents released satisfy the regulatory standards and meet the criteria of the Radioactive Materials License. The two data evaluation approaches are: 1) comparisons of effluent release values to NRC effluent concentration standards; and 2) graphic demonstrations to show trends. Both evaluation methods indicate that Homestake's releases to unrestricted areas generally are at background levels. It should be noted that most effluent concentrations have substantially decreased from those concentrations that existed during the early reclamation period. This is expected as site reclamation continues and all of the contaminated material has been covered with clean soil. Also, it is demonstrated in this report that the effluents released by Homestake during the period of January 1 through June 31, 1997 do not exceed the allowable effluent release levels pursuant to the requirements of 10 CFR Part 20.

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. Individual effluent monitoring program results are more fully discussed in the following paragraphs.

The airborne radiological particulate concentrations for samples collected at the restricted area boundary of Homestake during the period covered by this report exhibits levels well below 10 CFR Part 20. The average U-Nat concentration, for both quarters, at location HMC-5 (Nearest Resident) for 1997 was 13 percent of effluent concentration standard. The average U-Nat concentration, for both quarters, at the background location (HMC-6) was 1 percent of the effluent standard. Therefore the net U-Nat concentration at the perimeter station considered the Nearest Residence was 12 percent of the concentration standard. Rn-222 concentrations measured at the project boundary, including background contributions of sources unrelated to the Grants project, range from 1.2 to 2.1 pCi/l. Average background during the period was 1.2 pCi/l. The boundary outdoor radon measurements included in this report exhibit levels that are similar to those reported

in Homestake's last effluent monitoring report. In general the air quality monitoring data demonstrates that releases of airborne radioactive particulate and radon gas from the Grants project are quite small and below levels that are allowed under 10 CFR Part 20. It should be noted that radon gas values will vary over a large range due to the topography of the area. Radon gas will concentrate in the valleys, such as the project area.

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

Perimeter TLD exposure rates are presented in Attachment 3. The perimeter Location No. 5 (N. of Nearest Residence) exhibited an exposure rate of $4.59 \mu\text{R/h}$, which is approximately twice as high as the other locations. While this location had previously been slightly elevated relative to the others, the large difference during the October 1996 to April 1997 six-month period led HMC to conduct an investigation. The exposure rates were monitored in and around all of the monitoring stations. It was discovered that on two of the stations, piping with surface contamination was used as legs for the platforms. Contact exposure rates for one leg of Station No. 2 was $60 \mu\text{R/h}$ while one of the legs of Station No. 5 was $400 \mu\text{R/h}$. The contamination legs were replaced and another radiological survey conducted. Measurements indicate that at the TLD location at Station No. 5, a reduction of approximately $2 \mu\text{R/h}$ occurred by replacing the leg. This is equivalent to only 0.4 mrem/week or 25 percent of the approximately 2 mrem/week that Station No. 5 was elevated above the other stations. However, the measured exposure rate at Station No. 5 is now within 1 to 2 $\mu\text{R/h}$ of that at the other stations, indicating that the exposure rates are within 0.4 mrem/week. There were no known activities near any of the monitoring stations during this period that would have affected the exposure rates in the areas. We therefore have assigned a value of 2.9 mrem/week or 37.7 mrem/yr for Station No. 5 for the period October 1996 to April 1997.

TABLES

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 (8-97)

Well Number	Parameters to be Monitored	Frequency of Monitoring
#1 & #2 Deepwell	C	Quarterly
#1 & #2 Deepwell	D	Annually
All Active Injection Wells	Rate & Monthly Total	Monthly
Broadview Acres SUB1, SUB3, 453	A	Semi-Annually
Broadview Acres SUB2	A (except water level)	Semi-Annually
Broadview Acres SUB1, SUB2, SUB3, 434, 446, 453	B (except water level)	Annually
Felice Acres 490, 492, 493, 494	A	Semi-Annually
Felice Acres 490, 492, 493, 494	B	Annually
Murray Acres 802, 844	A	Semi-Annually
Murray Acres 802, 804, 820, 844, V/CW	B(no water level in 804)	Annually
Pleasant Valley 638, 835, 846	A (no water level in 835)	Semi-Annually
Pleasant Valley 688, 835, 846	B (no water level in 835)	Annually
Regional 905, 910, 917, 920, 942	B (except water level)	Annually
Site Monitoring Wells B, CW2, CW3, CW4R, PM, WR7, WR11, X, Y	A	Quarterly
Site Monitoring Wells B, CW2, CW3, CW4R, PM, WR7, WR11, X, Y	B & F	Semi-annually
Secondary Site Monitoring Wells BC, B1, BP, D1, DC, DM, DZ, F, FB, I, K2, KM, KZ, M4, MO, N, O, S, SO, SV, T, W, WR5, WR9	A	Semi-annually
Secondary Site Monitoring Wells GH, CW2-1	Water Level Only	Semi-annually

TABLE 2 – Groundwater Monitoring Program (8-97)

Well Number	Parameters to be Monitored	Frequency of Monitoring
Secondary Site Monitoring Wells BC, B1, BP, CW9, D1, DC, DM, DZ, F, FB, I, K2, KM, KZ, M4, MO, N, ND, O, S, SO, SV, S2, T, W, WR9, WR5	B	Annually
Secondary Site Monitoring Wells 931, 934	B	Semi-Annually
Secondary Site Monitoring Well NC	A B	Quarterly Semi-Annually
Secondary Site Monitoring Wells 929, 933, 945, CW40	B (no water level in 933 or 945)	Semi-Annually
All Active Collection Wells	E	Monthly
All Active Collection Wells	B	Annually
All Active Collection Wells	Collection rate, water level and total volume for week	Weekly
Reversal Wells B, BA, "Z, KF, SO, SP, S1, S2	Water Level	Weekly
E Coll Pond, W Coll Pond	B (W Coll Pond - no water level)	Quarterly
E Coll Pond, W Coll Pond	F	Semi-annually
DQ, M5, S3, S4	S	Quarterly
DQ, M5, S3, S4	F	Semi-annually
Background Wells P, P1, P2	B F	Quarterly Semi-annually
Background Wells DD, Q, R	B & F	Annually

A = Water Level, SO₄, U-Nat, Se, TDS

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

C = SO₄, TDS

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

E = Water Level, SO₄, U-Nat, TDS

F = V, Ra-228, Th-230

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

Table 2.1.1 - Water Quality Analyses for Well DQ



Billings • Casper • Gillet • Rapid City

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Laboratory ID:

Report Date:

Revised Report Date:

DQ/319/

8-6-97/1405

97-47202

09-04-97

January 19, 1998

Major Ions		Units	"Lower Limit of Detection"	Results
Calcium	Ca	mg/L	1.0	570
Magnesium	Mg	mg/L	1.0	388
Sodium	Na	mg/L	1.0	5150
Potassium	K	mg/L	1.0	16.0
Carbonate	CO ₃	mg/L	0.10	0
Bicarbonate	HCO ₃	mg/L	0.10	2380
Sulfate	SO ₄	mg/L	1.0	10100
Chloride	Cl	mg/L	0.10	1550
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	26.1

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	19200
pH	-	std. units	0.10	7.79

Trace Metals				
Molybdenum	Mo	mg/L	0.03	68.40
Selenium	Se	mg/L	0.005	1.95

Radiometric				
Uranium	²³⁸ U	mg/L	0.0003	40.0
*Uranium Precision ±				3.60
Uranium	²³⁵ U	μCi/mL	2.0E-10	2.7E-05
*Uranium Precision ±				2.4E-06
Radium 226	²²⁶ Ra	pCi/L	0.2	0.4
Radium Error Estimate ±				0.3
Radium 226	²²⁶ Ra	μCi/mL	2.0E-10	4.0E-10
Radium Error Estimate ±				3.0E-10

Quality Assurance Data		Target Range	
Anion	meq		294.96
Cation	meq		285.16
WYDEQ A/C Balance	%	-5 - +5	-1.69
Calc TDS	mg/L		19080
TDS A/C Balance	dec. %	0.80 - 1.20	1.01

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample I.D./Date:

DQ/0319/

02-24-97/1035

Laboratory ID:

97-16226

Report Date:

02-09-97

Revised Report Date:

January 19, 1998

Major Ions	Units	Results	"Lower Limit of Detection"
Calcium (Ca)	mg/L	645	1.0
Magnesium (Mg)	mg/L	497	1.0
Sodium (Na)	mg/L	3960	1.0
Potassium (K)	mg/L	11.3	1.0
Carbonate (CO ₃)	mg/L	0	0.10
Bicarbonate (HCO ₃)	mg/L	1910	0.10
Sulfate (SO ₄)	mg/L	7870	1.0
Chloride (Cl)	mg/L	1340	0.10
Nitrite + Nitrate (NO ₂ + NO ₃) as N	mg/L	101	0.10

Non-Metals			
Total Dissolved Solids (TDS) @ 180°C	mg/L	16500	1.0
pH	std. units	7.60	0.10

Trace Metals			
Molybdenum (Mo)	mg/L	3.91	0.03
Selenium (Se)	mg/L	5.23	0.005

Radiometric			
Uranium (U ^{nat})	mg/L	64.5	0.0003
*Uranium Precision ±		5.81	
Uranium (U ^{nat})	µCi/mL	4.4E-05	2.0E-10
*Uranium Precision ±		3.9E-06	
Radium 226 (Ra ²²⁶)	pCi/L	0.9	0.2
Radium Error Estimate ±		0.2	
Radium 226 (Ra ²²⁶)	µCi/mL	9.0E-10	2.0E-10
Radium Error Estimate ±		2.0E-10	

Quality Assurance Data			Target Range
Anion	meq	240.23	
Cation	meq	246.13	
WYDEQ A/C Balance	%	1.21	-5 - +5
Calc TDS	mg/L	15726	
TDS A/C Balance	dec. %	1.05	0.80 - 1.20

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample I.D./Date:

DQ/0319/

05-06-97/10:15

Laboratory ID:

97-27192

Report Date:

06-06-97

Revised Report Date:

January 19, 1998

Major Ions	Units	Results	"Lower Limit of Detection"
Calcium (Ca)	mg/L	535	1.0
Magnesium (Mg)	mg/L	494	1.0
Sodium (Na)	mg/L	4500	1.0
Potassium (K)	mg/L	11.4	1.0
Carbonate (CO ₃)	mg/L	0	0.10
Bicarbonate (HCO ₃)	mg/L	2110	0.10
Sulfate (SO ₄)	mg/L	9580	1.0
Chloride (Cl)	mg/L	1580	0.10
Nitrite + Nitrate (NO ₂ + NO ₃) as N	mg/L	64.8	0.10

Non-Metals			
Total Dissolved Solids (TDS) @ 180°C	mg/L	17500	1.0
pH	std. units	7.67	0.10

Trace Metals			
Chromium (Cr)	mg/L	< 0.05	0.05
Molybdenum (Mo)	mg/L	48.1	0.03
Selenium (Se)	mg/L	3.39	0.005
Vanadium (V)	mg/L	< 0.01	0.01

Radiometric			
Uranium (U ^{nat})	mg/L	49.4	0.0003
*Uranium Precision ±		4.45	
Uranium (U ^{nat})	µCi/mL	3.3E-05	2.0E-10
*Uranium Precision ±		3.0E-06	
Radium 226 (Ra ²²⁶)	pCi/L	< 0.2	0.2
Radium Error Estimate ±		0.2	
Radium 226 (Ra ²²⁶)	µCi/mL	< 2.0E-10	2.0E-10
Radium Error Estimate ±		2.0E-10	
Radium 228 (Ra ²²⁸)	pCi/L	< 1.0	1.0
Radium Error Estimate ±		1.1	
Radium 228 (Ra ²²⁸)	µCi/mL	< 1.0E-09	1.0E-09
Radium Error Estimate ±		1.1E-09	
Thorium 230 (Th ²³⁰)	pCi/L	3.6	0.2
Thorium Error Estimate ±		1.1	
Thorium 230 (Th ²³⁰)	µCi/mL	3.6E-09	2.0E-10
Thorium Error Estimate ±		1.1E-09	

Quality Assurance Data			Target Range
Anion	meq	283.31	
Cation	meq	263.86	
WYDEQ A/C Balance	%	-3.55	-5 - +5
Calc TDS	mg/L	18042	
TDS A/C Balance	dec. %	0.97	0.80 - 1.20

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT HOMESTAKE MINING CO.

Sample ID/Date:

Laboratory ID:

Report Date:

Revised Report Date:

DQ/319/

11-6-97/1230

97-68103

12-12-97

January 19, 1998

Major Ions		Units	"Lower Limit of Detection"	Results
Calcium	Ca	mg/L	1.0	463
Magnesium	Mg	mg/L	1.0	295
Sodium	Na	mg/L	1.0	5300
Potassium	K	mg/L	1.0	19.2
Carbonate	CO ₃	mg/L	0.10	< 0.10
Bicarbonate	HCO ₃	mg/L	0.10	2470
Sulfate	SO ₄	mg/L	1.0	10000
Chloride	Cl	mg/L	0.10	1200
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	23.4

Non-Metals		Units	"Lower Limit of Detection"	Results
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	19700
pH		std. units	0.10	7.86

Trace Metals		Units	"Lower Limit of Detection"	Results
Chromium	Cr	mg/L	0.05	< 0.05
Molybdenum	Mo	mg/L	0.05	64.5
Selenium	Se	mg/L	0.005	1.43
Vanadium	V	mg/L	0.01	0.06

Radiometric		Units	"Lower Limit of Detection"	Results
Uranium	²³⁸ U	mg/L	0.0003	52.3
*Uranium Precision ±				4.71
Uranium	²³⁵ U	μCi/mL	2.0E-10	3.5E-05
*Uranium Precision ±				3.2E-06
Radium 226	²²⁶ Ra	pCi/L	0.2	< 0.2
Radium Error Estimate ±				0.3
Radium 226	²²⁶ Ra	μCi/mL	2.0E-10	< 2.0E-10
Radium Error Estimate ±				3.0E-10
Radium 228	²²⁸ Ra	pCi/L	1.0	< 1.0
Radium Error Estimate ±				1.2
Radium 228	²²⁸ Ra	μCi/mL	1.0E-09	< 1.0E-09
Radium Error Estimate ±				1.2E-09
Thorium 230	²³⁰ Th	pCi/L	0.2	0.7
Thorium Error Estimate ±				0.4
Thorium 230	²³⁰ Th	μCi/mL	2.0E-10	7.0E-10
Thorium Error Estimate ±				4.0E-10

Quality Assurance Data		Target Range	Results
Anion	meq		284.30
Cation	meq		278.66
WYDEQ A/C Balance	%	-5 - +5	-1.00
Calc TDS	mg/L		13616
TDS A/C Balance	dec. %	0.80 - 1.20	1.06

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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Sample ID/Date:

Laboratory ID:

Report Date:

Revised Report Date:

DQ/0319/

9-24-97/1423

97-57203

10-22-97

January 19, 1998

Radiometric		Units	"Lower Limit of Detection"	Results
Thorium 230	²³⁰ Th	pCi/L	0.2	< 0.2
Thorium Error Estimate ±				0.5
Thorium 230	²³⁰ Th	pCi/mL	2.0E-10	< 2.0E-10
Thorium Error Estimate ±				5.0E-10

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Laboratory ID:

Report Date:

Revised Report Date:

DQ/319/ 10-13-97/0948
97-58764
10-28-97
January 19, 1998

Radiometric		Units	"Lower Limit of Detection"	Results
Thorium 230	²³⁰ Th	pCi/L	.2	1.0
Thorium Error Estimate ±				0.5
Thorium 230	²³⁰ Th	μCi/mL	2.0E-10	1.0E-09
Thorium Error Estimate ±				5.0E-10

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Laboratory ID:

Report Date:

Revised Report Date:

DQ/319/

10-29-97/1530

-64731

11-18-97

January 19, 1998

Radiometric		Units	"Lower Limit of Detection"	Results
Thorium 230	²³⁰ Th	pCi/L	0.2	1.2
Thorium Error Estimate ±				0.7
Thorium 230	²³⁰ Th	μCi/mL	2.0E-10	1.2E-09
Thorium Error Estimate ±				7.0E-10

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Laboratory ID:

Report Date:

Revised Report Date:

DQ/319/

12-04-97/1310

97-69649

12-29-97

January 19, 1998

Radiometric		Units	"Lower Limit of Detection"	Results
Thorium 230	²³⁰ Th	pCi/L	0.2	< 0.2
Thorium Error Estimate ±				0.3
Thorium 230	²³⁰ Th	μCi/mL	2.0E-10	< 2.0E-10
Thorium Error Estimate ±				3.0E-10

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

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Table 2.1.2 - Water Quality Analyses for Well M5



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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample I.D./Date:

M-5/0334/

02-27-97/0915

Laboratory ID:

97-16393

Report Date:

03-19-97

Revised Report Date:

January 19, 1998

Major Ions	Units	Results	"Lower Limit of Detection"
Calcium (Ca)	mg/L	199	1.0
Magnesium (Mg)	mg/L	42.8	1.0
Sodium (Na)	mg/L	465	1.0
Potassium (K)	mg/L	3.7	1.0
Carbonate (CO ₃)	mg/L	0	0.10
Bicarbonate (HCO ₃)	mg/L	528	0.10
Sulfate (SO ₄)	mg/L	1010	1.0
Chloride (Cl)	mg/L	188	0.10
Nitrite + Nitrate (NO ₂ + NO ₃) as N	mg/L	4.39	0.10

Non-Metals			
Total Dissolved Solids (TDS) @ 180°C	mg/L	2390	1.0
pH	std. units	7.64	0.10

Trace Metals			
Molybdenum (Mo)	mg/L	4.41	0.03
Selenium (Se)	mg/L	0.387	0.005

Radiometric			
Uranium (U ^{nat})	mg/L	4.95	0.0003
*Uranium Precision ±		0.45	
Uranium (U ^{nat})	μCi/mL	3.4E-06	2.0E-10
*Uranium Precision ±		3.0E-07	
Radium 226 (Ra ²²⁶)	pCi/L	0.6	0.2
Radium Error Estimate ±		0.2	
Radium 226 (Ra ²²⁶)	μCi/mL	6.0E-10	2.0E-10
Radium Error Estimate ±		2.0E-10	

Quality Assurance Data			Target Range
Anion	meq	35.31	
Cation	meq	33.83	
WYDEQ A/C Balance	%	-2.14	-5 - +5
Calc TDS	mg/L	2192	
TDS A/C Balance	dec. %	1.09	0.80 - 1.20

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample I.D./Date:

M-5 HMC/334/

5-7-97/0931

Laboratory ID:

97-27194

Report Date:

06-10-97

Revised Report Date:

January 19, 1998

Major Ions	Units	Results	"Lower Limit of Detection"
Calcium (Ca)	mg/L	223	1.0
Magnesium (Mg)	mg/L	44.4	1.0
Sodium (Na)	mg/L	522	1.0
Potassium (K)	mg/L	4.0	1.0
Carbonate (CO ₃)	mg/L	0	0.10
Bicarbonate (HCO ₃)	mg/L	544	0.10
Sulfate (SO ₄)	mg/L	1100	1.0
Chloride (Cl)	mg/L	204	0.10
Nitrite + Nitrate (NO ₂ + NO ₃) as N	mg/L	4.26	0.10

Non-Metals			
Total Dissolved Solids (TDS) @ 180°C	mg/L	2430	1.0
pH	std. units	7.85	0.10

Trace Metals			
Chromium (Cr)	mg/L	< 0.05	0.05
Molybdenum (Mo)	mg/L	5.0	0.03
Selenium (Se)	mg/L	0.328	0.005
Vanadium (V)	mg/L	< 0.01	0.01

Radiometric			
Uranium (U ²³⁸)	mg/L	4.23	0.0003
*Uranium Precision ±		0.38	
Uranium (U ²³⁵)	µCi/mL	2.9E-06	2.0E-10
*Uranium Precision ±		2.6E-07	
Radium 226 (Ra ²²⁶)	pCi/L	11.6	0.2
Radium Error Estimate ±		1.1	
Radium 226 (Ra ²²⁶)	µCi/mL	1.2E-08	2.0E-10
Radium Error Estimate ±		1.1E-09	
Radium 228 (Ra ²²⁸)	pCi/L	< 1.0	1.0
Radium Error Estimate ±		1.2	
Radium 228 (Ra ²²⁸)	µCi/mL	< 1.0E-09	1.0E-09
Radium Error Estimate ±		1.2E-09	
Thorium 230 (Th ²³⁰)	pCi/L	< 0.2	0.2
Thorium Error Estimate ±		0.3	
Thorium 230 (Th ²³⁰)	µCi/mL	< 2.0E-10	2.0E-10
Thorium Error Estimate ±		3.0E-10	

Quality Assurance Data			Target Range
Anion	meq	37.89	
Cation	meq	37.65	
WYDEQ A/C Balance	%	-0.31	-5 - +5
Calc TDS	mg/L	2388	
TDS A/C Balance	dec. %	1.02	0.80 - 1.20

*precision is calculated using standard deviation of mean *precision is cal *precision is cal *precision is cal *precision is calculated using standard

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample I.D./Date:

M-5/334/

5-7-97/0930

Laboratory ID:

97-27195

Report Date:

06-10-97

Revised Report Date:

January 19, 1998

Major Ions	Units	Results	"Lower Limit of Detection"
Calcium (Ca)	mg/L	220	1.0
Magnesium (Mg)	mg/L	43.8	1.0
Sodium (Na)	mg/L	517	1.0
Potassium (K)	mg/L	3.9	1.0
Carbonate (CO ₃)	mg/L	0	0.10
Bicarbonate (HCO ₃)	mg/L	542	0.10
Sulfate (SO ₄)	mg/L	1080	1.0
Chloride (Cl)	mg/L	200	0.10
Nitrite + Nitrate (NO ₂ + NO ₃) as N	mg/L	4.58	0.10

Non-Metals			
Total Dissolved Solids (TDS) @ 180°C	mg/L	2434	1.0
pH	std. units	7.83	0.10

Trace Metals			
Chromium (Cr)	mg/L	< 0.05	0.05
Molybdenum (Mo)	mg/L	4.97	0.03
Selenium (Se)	mg/L	0.342	0.005
Vanadium (V)	mg/L	< 0.01	0.01

Radiometric			
Uranium (U ²³⁸)	mg/L	4.59	0.0003
*Uranium Precision ±		0.41	
Uranium (U ²³⁵)	μCi/mL	3.1E-06	2.0E-10
*Uranium Precision ±		2.8E-07	
Radium 226 (Ra ²²⁶)	pCi/L	< 0.2	0.2
Radium Error Estimate ±		0.2	
Radium 226 (Ra ²²⁶)	μCi/mL	< 2.0E-10	2.0E-10
Radium Error Estimate ±		2.0E-10	
Radium 228 (Ra ²²⁸)	pCi/L	< 1.0	1.0
Radium Error Estimate ±		1.2	
Radium 228 (Ra ²²⁸)	μCi/mL	< 1.0E-09	1.0E-09
Radium Error Estimate ±		1.2E-09	
Thorium 230 (Th ²³⁰)	pCi/L	< 0.2	0.2
Thorium Error Estimate ±		0.3	
Thorium 230 (Th ²³⁰)	μCi/mL	< 2.0E-10	2.0E-10
Thorium Error Estimate ±		2.0E-10	

Quality Assurance Data			Target Range
Anion	meq	37.35	
Cation	meq	37.23	
WYDEQ A/C Balance	%	-0.16	-5 - +5
Calc TDS	mg/L	2356	
TDS A/C Balance	dec. %	1.03	0.80 - 1.20

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Laboratory ID:

Report Date:

Revised Report Date:

M5/334/

8-11-97/1340

97-47327

08-27-97

January 19, 1998

Major Ions		Units	"Lower Limit of Detection"	Results
Calcium	Ca	mg/L	1.0	208
Magnesium	Mg	mg/L	1.0	41.9
Sodium	Na	mg/L	1.0	522
Potassium	K	mg/L	1.0	4.6
Carbonate	CO ₃	mg/L	0.10	0
Bicarbonate	HCO ₃	mg/L	0.10	536
Sulfate	SO ₄	mg/L	1.0	1100
Chloride	Cl	mg/L	0.10	209
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	4.86

Non-Metals		Units	"Lower Limit of Detection"	Results
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	2480
pH	-	std. units	0.10	7.72

Trace Metals		Units	"Lower Limit of Detection"	Results
Molybdenum	Mo	mg/L	0.03	4.96
Selenium	Se	mg/L	0.005	0.386

Radiometric		Units	"Lower Limit of Detection"	Results
Uranium	Nat U	mg/L	0.0003	4.58
*Uranium Precision ±				0.41
Uranium	Nat U	µCi/mL	2.0E-10	3.1E-06
*Uranium Precision ±				2.8E-07
Radium 226	²²⁶ Ra	pCi/L	0.2	< 0.2
Radium Error Estimate ±				0.3
Radium 226	²²⁶ Ra	µCi/mL	2.0E-10	< 2.0E-10
Radium Error Estimate ±				3.0E-10

Quality Assurance Data		Target Range	Results
Anion	meq		37.94
Cation	meq		36.71
WYDEQ A/C Balance	%	-5 - +5	-1.65
Calc TDS	mg/L		2375
TDS A/C Balance	dec. %	0.80 - 1.20	1.04

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Laboratory ID:

Report Date:

Revised Report Date:

M5/334/

10-30-97/1118

97-64939

12-01-97

January 19, 1998

Major Ions		Units	"Lower Limit of Detection"	Results
Calcium	Ca	mg/L	1.0	232
Magnesium	Mg	mg/L	1.0	48.2
Sodium	Na	mg/L	1.0	543
Potassium	K	mg/L	1.0	4.7
Carbonate	CO ₃	mg/L	0.10	< 0.10
Bicarbonate	HCO ₃	mg/L	0.10	486
Sulfate	SO ₄	mg/L	1.0	1200
Chloride	Cl	mg/L	0.10	203
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	19.3

Non-Metals		Units	"Lower Limit of Detection"	Results
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	2650
pH		std. units	0.10	7.95

Trace Metals		Units	"Lower Limit of Detection"	Results
Chromium	Cr	mg/L	0.05	< 0.05
Molybdenum	Mo	mg/L	0.03	4.24
Selenium	Se	mg/L	0.005	0.600
Vanadium	V	mg/L	0.01	< 0.01

Radiometric		Units	"Lower Limit of Detection"	Results
Uranium	²³⁸ U	mg/L	0.0003	3.88
*Uranium Precision ±				0.35
Uranium	²³⁵ U	µCi/mL	2.0E-10	2.6E-06
*Uranium Precision ±				2.4E-07
Radium 226	²²⁶ Ra	pCi/L	0.2	< 0.2
Radium Error Estimate ±				0.3
Radium 226	²²⁶ Ra	µCi/mL	2.0E-10	< 2.0E-10
Radium Error Estimate ±				3.0E-10
Radium 228	²²⁸ Ra	pCi/L	1.0	< 1.0
Radium Error Estimate ±				1.7
Radium 228	²²⁸ Ra	µCi/mL	1.0E-09	< 1.0E-09
Radium Error Estimate ±				1.7E-09
Thorium 230	²³⁰ Th	pCi/L	0.2	< 0.2
Thorium Error Estimate ±				0.3
Thorium 230	²³⁰ Th	µCi/mL	2.0E-10	< 2.0E-10
Thorium Error Estimate ±				3.0E-10

Quality Assurance Data		Target Range	Results
Anion	meq		40.08
Cation	meq		39.55
WYDEQ A/C Balance	%	-5 - +5	-0.93
Calc TDS	mg/L		2560
TDS A/C Balance	dec. %	0.80 - 1.20	1.04

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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COMPLETE ANALYTICAL SERVICES

Table 2.1.3 - Water Quality Analyses for Well S3



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WATER ANALYSIS REPORT - HOMESTAKE MINING CO..

Sample I.D./Date:

S-3/0335/

02-27-97/1000

Laboratory ID:

97-16394

Report Date:

03-19-97

Revised Report Date:

January 19, 1998

Major Ions	Units	Results	"Lower Limit of Detection"
Calcium (Ca)	mg/L	315	1.0
Magnesium (Mg)	mg/L	73.3	1.0
Sodium (Na)	mg/L	878	1.0
Potassium (K)	mg/L	6.9	1.0
Carbonate (CO ₃)	mg/L	0	0.10
Bicarbonate (HCO ₃)	mg/L	777	0.10
Sulfate (SO ₄)	mg/L	2030	1.0
Chloride (Cl)	mg/L		0.10
Nitrite + Nitrate (NO ₂ + NO ₃) as N	mg/L	3.92	0.10

Non-Metals			
Total Dissolved Solids (TDS) @ 180°C	mg/L	4460	1.0
pH	std. units	7.67	0.10

Trace Metals			
Molybdenum (Mo)	mg/L	6.41	0.03
Selenium (Se)	mg/L	0.699	0.005

Radiometric			
Uranium (U ^{Nat})	mg/L	15.0	0.0003
*Uranium Precision ±		1.35	
Uranium (U ^{Nat})	µCi/mL	1.0E-05	2.0E-10
*Uranium Precision ±		9.2E-07	
Radium 226 (Ra ²²⁶)	pCi/L	0.7	0.2
Radium Error Estimate ±		0.2	
Radium 226 (Ra ²²⁶)	µCi/mL	7.0E-10	2.0E-10
Radium Error Estimate ±		2.0E-10	

Quality Assurance Data			Target Range
Anion	meq	62.58	
Cation	meq	60.21	
WYDEQ A/C Balance	%	-1.93	-5 - +5
Calc TDS	mg/L	3967	
TDS A/C Balance	dec. %	1.12	0.80 - 1.20

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample I.D./Date:

S-3/335/

Laboratory ID:

5-7-97/1015

Report Date:

97-27196

Revised Report Date:

06-10-97

January 19, 1998

Major Ions	Units	Results	"Lower Limit of Detection"
Calcium (Ca)	mg/L	350	1.0
Magnesium (Mg)	mg/L	75.7	1.0
Sodium (Na)	mg/L	965	1.0
Potassium (K)	mg/L	7.3	1.0
Carbonate (CO ₃)	mg/L	0	0.10
Bicarbonate (HCO ₃)	mg/L	816	0.10
Sulfate (SO ₄)	mg/L	2150	1.0
Chloride (Cl)	mg/L	275	0.10
Nitrite + Nitrate (NO ₂ + NO ₃) as N	mg/L	3.71	0.10

Non-Metals			
Total Dissolved Solids (TDS) @ 180°C	mg/L	4443	1.0
pH	std. units	7.89	0.10

Trace Metals			
Chromium (Cr)	mg/L	< 0.05	0.05
Molybdenum (Mo)	mg/L	6.97	0.03
Selenium (Se)	mg/L	0.497	0.005
Vanadium (V)	mg/L	< 0.01	0.01

Radiometric			
Uranium (U ²³⁸)	mg/L	14.6	X03
*Uranium Precision ±		1.31	
Uranium (U ²³⁵)	µCi/mL	9.9E-06	2.0E-10
*Uranium Precision ±		8.9E-07	
Radium 226 (Ra ²²⁶)	pCi/L	0.6	0.2
Radium Error Estimate ±		0.1	
Radium 226 (Ra ²²⁶)	µCi/mL	6.0E-10	2.0E-10
Radium Error Estimate ±		1.0E-10	
Radium 228 (Ra ²²⁸)	pCi/L	< 1.0	1.0
Radium Error Estimate ±		1.3	
Radium 228 (Ra ²²⁸)	µCi/mL	< 1.0E-09	1.0E-09
Radium Error Estimate ±		1.3E-09	
Thorium 230 (Th ²³⁰)	pCi/L	0.6	0.2
Thorium Error Estimate ±		0.2	
Thorium 230 (Th ²³⁰)	µCi/mL	6.0E-10	2.0E-10
Thorium Error Estimate ±		2.0E-10	

Quality Assurance Data			Target Range
Anion	meq	66.18	
Cation	meq	65.95	
WYDEQ A/C Balance	%	-0.17	-5 - +5
Calc TDS	mg/L	4247	
TDS A/C Balance	dec. %	1.05	0.80 - 1.20

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample I.D./Date:

S-3 HMC/335/

Laboratory ID:

S-7-97/1016

Report Date:

97-27197

Revised Report Date:

6-10-97

January 19, 1998

Major ions	Units	Results	"Lower Limit of Detection"
Calcium (Ca)	mg/L	347	1.0
Magnesium (Mg)	mg/L	75.0	1.0
Sodium (Na)	mg/L	958	1.0
Potassium (K)	mg/L	7.3	1.0
Carbonate (CO ₃)	mg/L	0	0.10
Bicarbonate (HCO ₃)	mg/L	804	0.10
Sulfate (SO ₄)	mg/L	2135	1.0
Chloride (Cl)		278	0.10
Nitrite + Nitrate (NO ₂ + NO ₃) as N		3.03	0.10

Non-Metals			
Total Dissolved Solids (TDS) @ 180°C	mg/L	4392	1.0
pH	std. units	7.91	0.10

Trace Metals			
Chromium (Cr)	mg/L	< 0.03	0.03
Molybdenum (Mo)	mg/L	7.0	0.03
Selenium (Se)	mg/L	0.493	0.005
Vanadium (V)	mg/L	< 0.01	0.01

Radiometric			
Uranium (U ²³⁸)	mg/L	14.2	0.0003
*Uranium Precision ±		1.28	
Uranium (U ²³⁵)	µCi/ml	9.6E-06	2.0E-10
*Uranium Precision ±		8.7E-07	
Radium 226 (Ra ²²⁶)	pCi/L	< 0.2	0.2
Radium Error Estimate ±		0.3	
Radium 226 (Ra ²²⁶)	µCi/ml	< 2.0E-10	2.0E-10
Radium Error Estimate ±		3.0E-10	
Radium 228 (Ra ²²⁸)	pCi/L	< 1.0	1.0
Radium Error Estimate ±		1.2	
Radium 228 (Ra ²²⁸)	µCi/ml	< 1.0E-09	1.0E-09
Radium Error Estimate ±		1.2E-09	
Thorium 230 (Th ²³⁰)	pCi/L	< 0.2	0.2
Thorium Error Estimate ±		0.3	
Thorium 230 (Th ²³⁰)	µCi/ml	< 2.0E-10	2.0E-10
Thorium Error Estimate ±		3.0E-10	

Quality Assurance Data			Target Range
Anion	meq	65.71	
Cation	meq	65.44	
WYDEQ A/C Balance	%	-0.20	-5 - +5
Calc TDS	mg/L	4216	
TDS A/C Balance	dec. %	1.04	0.80 - 1.20

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Laboratory ID:

Report Date:

Revised Report Date:

S3/335/

8-11-97/1415

97-47328

08-27-97

January 19, 1998

Major Ions		Units	"Lower Limit of Detection"	Results
Calcium	Ca	mg/L	1.0	293
Magnesium	Mg	mg/L	1.0	66.2
Sodium	Na	mg/L	1.0	896
Potassium	K	mg/L	1.0	7.7
Carbonate	CO ₃	mg/L	0.10	0
Bicarbonate	HCO ₃	mg/L	0.10	822
Sulfate	SO ₄	mg/L	1.0	1950
Chloride	Cl	mg/L	0.10	276
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	2.71

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	4140
pH		std. units	0.10	7.74

Trace Metals				
Molybdenum	Mo	mg/L	0.03	7.30
Selenium	Se	mg/L	0.005	0.285

Radiometric				
Uranium	²³⁸ U	mg/L	0.0003	13.6
*Uranium Precision ±				1.22
Uranium	²³⁵ U	μCi/mL	2.0E-10	9.2E-06
*Uranium Precision ±				8.3E-07
Radium 226	²²⁶ Ra	pCi/L	0.2	0.6
Radium Error Estimate ±				0.2
Radium 226	²²⁶ Ra	μCi/mL	2.0E-10	6.0E-10
Radium Error Estimate ±				2.0E-10

Quality Assurance Data		Target Range	
Anion	meq		62.07
Cation	meq		59.32
WYDEQ A/C Balance	%	-5 - +5	-2.26
Calc TDS	mg/L		3912
TDS A/C Balance	dec. %	0.80 - 1.20	1.06

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Laboratory ID:

Report Date:

Revised Report Date:

S3/335

10-30-97/0945

97-64938

12-01-97

January 19, 1998

Major Ions		Units	"Lower Limit of Detection"	Results
Calcium	Ca	mg/L	1.0	283
Magnesium	Mg	mg/L	1.0	7.4
Sodium	Na	mg/L	1.0	935
Potassium	K	mg/L	1.0	7.6
Carbonate	CO ₃	mg/L	0.10	< 0.10
Bicarbonate	HCO ₃	mg/L	0.10	799
Sulfate	SO ₄	mg/L	1.0	1900
Chloride	Cl	mg/L	0.10	256
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	2.48

Non-Metals		Units	"Lower Limit of Detection"	Results
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	4170
pH		std. units	0.10	7.94

Trace Metals		Units	"Lower Limit of Detection"	Results
Chromium	Cr	mg/L	0.05	< 0.05
Molybdenum	Mo	mg/L	0.03	6.90
Selenium	Se	mg/L	0.005	0.433
Vanadium	V	mg/L	0.01	< 0.01

Radiometric		Units	"Lower Limit of Detection"	Results
Uranium	²³⁸ U	mg/L	0.0003	14.2
*Uranium Precision ±				1.28
Uranium	²³⁵ U	µCi/mL	2.0E-10	9.6E-06
*Uranium Precision ±				8.7E-07
Radium 226	²²⁶ Ra	pCi/L	0.2	< 0.2
Radium Error Estimate ±				0.3
Radium 226	²²⁶ Ra	µCi/mL	2.0E-10	< 2.0E-10
Radium Error Estimate ±				3.0E-10
Radium 228	²²⁸ Ra	pCi/L	1.0	< 1.0
Radium Error Estimate ±				1.7
Radium 228	²²⁸ Ra	µCi/mL	1.0E-09	< 1.0E-09
Radium Error Estimate ±				1.7E-09
Thorium 230	²³⁰ Th	pCi/L	0.2	< 0.2
Thorium Error Estimate ±				0.4
Thorium 230	²³⁰ Th	µCi/mL	2.0E-10	< 2.0E-10
Thorium Error Estimate ±				4.0E-10

Quality Assurance Data		Target Range	Results
Anion	meq		60.14
Cation	meq		60.86
WYDEQ A/C Balance	%	-5 - +5	0.59
Calc TDS	mg/L		3867
TDS A/C Balance	dec. %	0.80 - 1.20	1.08

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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COMPLETE ANALYTICAL SERVICES

Table 2.1.4 - Water Quality Analyses for Well S4



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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample I.D./Date:

S-4/0336/

02-27-97/1035

Laboratory ID:

97-16395

Report Date:

03-19-97

Revised Report Date:

January 19, 1998

Major Ions	Units	Results	"Lower Limit of Detection"
Calcium (Ca)	mg/L	352	1.0
Magnesium (Mg)	mg/L	90.4	1.0
Sodium (Na)	mg/L	466	1.0
Potassium (K)	mg/L	6.3	1.0
Carbonate (CO ₃)	mg/L	0	0.10
Bicarbonate (HCO ₃)	mg/L	472	0.10
Sulfate (SO ₄)	mg/L	1630	1.0
Chloride (Cl)	mg/L	201	0.10
Nitrite + Nitrate (NO ₂ + NO ₃) as N	mg/L	2.46	0.10

Non-Metals			
Total Dissolved Solids (TDS) @ 180°C	mg/L	3390	1.0
pH	std. units	7.65	0.10

Trace Metals			
Molybdenum (Mo)	mg/L	3.55	0.03
Selenium (Se)	mg/L	0.304	0.005

Radiometric			
Uranium (U ^{nat})	mg/L	5.50	0.0003
*Uranium Precision ±		0.50	
Uranium (U ^{nat})	µCi/mL	3.7E-06	2.0E-10
*Uranium Precision ±		3.4E-07	
Radium 226 (Ra ²²⁶)	pCi/L	< 0.2	0.2
Radium Error Estimate ±		0.3	
Radium 226 (Ra ²²⁶)	µCi/mL	< 2.0E-10	2.0E-10
Radium Error Estimate ±		3.0E-10	

Quality Assurance Data			Target Range
Anion	meq	47.53	
Cation	meq	45.56	
WYDEQ A/C Balance	%	-2.12	-5 - +5
Calc TDS	mg/L	2993	
TDS A/C Balance	dec. %	1.13	0.80 - 1.20

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample I.D./Date:

S-4/336/

5-7-97/1123

Laboratory ID:

97-27193

Report Date:

January 19, 1998

Revised Report Date:

January 19, 1998

Major Ions	Units	Results	"Lower Limit of Detection"
Calcium (Ca)	mg/L	441	1.0
Magnesium (Mg)	mg/L	103	1.0
Sodium (Na)	mg/L	603	1.0
Potassium (K)	mg/L	7.0	1.0
Carbonate (CO ₃)	mg/L	0	0.10
Bicarbonate (HCO ₃)	mg/L	553	0.10
Sulfate (SO ₄)	mg/L	1915	1.0
Chloride (Cl)	mg/L	192	0.10
Nitrite + Nitrate (NO ₂ + NO ₃) as N	mg/L	1.98	0.10

Non-Metals			
Total Dissolved Solids (TDS) @ 180°	mg/L	3980	1.0
pH	std. units	7.71	0.10

Trace Metals			
Chromium (Cr)	mg/L	< 0.05	0.05
Molybdenum (Mo)	mg/L	2.25	0.03
Selenium (Se)	mg/L	0.182	0.005
Vanadium (V)	mg/L	< 0.01	0.01

Radiometric			
Uranium (U ²³⁸)	mg/L	6.29	0.0003
*Uranium Precision ±		0.57	
Uranium (U ²³⁵)	µCi/mL	4.3E-06	2.0E-10
*Uranium Precision ±		3.8E-07	
Radium 226 (Ra ²²⁶)	pCi/L	0.9	0.2
Radium Error Estimate ±		0.2	
Radium 226 (Ra ²²⁶)	µCi/mL	9.0E-10	2.0E-10
Radium Error estimate ±		2.0E-10	
Radium 228 (Ra ²²⁸)	pCi/L	< 1.0	1.0
Radium Error Estimate ±		1.3	
Radium 228 (Ra ²²⁸)	µCi/mL	< 1.0E-09	1.0E-09
Radium Error Estimate ±		1.3E-09	
Thorium 230 (Th ²³⁰)	pCi/L	< 0.2	0.2
Thorium Error Estimate ±		0.3	
Thorium 230 (Th ²³⁰)	µCi/mL	< 2.0E-10	2.0E-10
Thorium Error Estimate ±		3.0E-10	

Quality Assurance Data			Target Range
Anion	meq	54.51	
Cation	meq	57.03	
WYDEQ A/C Balance	%	2.26	-5 - +5
Calc TDS	mg/L	3546	
TDS A/C Balance	dec. %	1.12	0.80 - 1.20

*p.recision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Laboratory ID:

Report Date:

Revised Report Date:

S4-336/

08-20-97/1435

97-48186

09-22-97

January 19, 1998

Major Ions		Units	"Lower Limit of Detection"	Results
Calcium	Ca	mg/L	1.0	540
Magnesium	Mg	mg/L	1.0	120
Sodium	Na	mg/L	1.0	696
Potassium	K	mg/L	1.0	7.8
Carbonate	CO ₃	mg/L	0.10	0
Bicarbonate	HCO ₃	mg/L	0.10	623
Sulfate	SO ₄	mg/L	1.0	2470
Chloride	Cl	mg/L	0.10	230
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	0.79

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	4600
pH		std. units	0.10	7.99

Trace Metals				
Molybdenum	Mo	mg/L	0.03	2.10
Selenium	Se	mg/L	0.005	0.099

Radiometric				
Uranium	NatU	mg/L	0.0003	7.53
*Uranium Precision ±				0.68
Uranium	NatU	µCi/mL	2.0E-10	5.1E-06
*Uranium Precision ±				4.6E-07
Radium 226	²²⁶ Ra	pCi/L	0.2	0.7
Radium Error Estimate ±				0.2
Radium 226	²²⁶ Ra	µCi/mL	2.0E-10	7.0E-10
Radium Error Estimate ±				2.0E-10

Quality Assurance Data		Target Range	
Anion	meq		68.21
Cation	meq		67.46
WYDEQ A/C Balance	%	-5 - +5	-0.55
Calc TDS	mg/L		4379
TDS A/C Balance	dec. %	0.80 - 1.20	1.05

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Laboratory ID:

Report Date:

Revised Report Date:

S4/336/

11-6-97/1415

97-68104

12-12-97

January 19, 1998

Major Ions		Units	"Lower Limit of Detection"	Results
Calcium	Ca	mg/L	1.0	504
Magnesium	Mg	mg/L	1.0	143
Sodium	Na	mg/L	1.0	715
Potassium	K	mg/L	1.0	8.7
Carbonate	CO ₃	mg/L	0.10	< 0.10
Bicarbonate	HCO ₃	mg/L	0.10	667
Sulfate	SO ₄	mg/L	1.0	2500
Chloride	Cl	mg/L	0.10	207
Nitrate + Nitrite as N	NO ₃ +NO ₂	mg/L	0.10	0.84

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	4710
pH		std. units	0.10	7.85

Trace Metals				
Chromium	Cr	mg/L	0.05	< 0.05
Molybdenum	Mo	mg/L	0.03	2.72
Selenium	Se	mg/L	0.005	0.104
Vanadium	V	mg/L	0.01	0.02

Radiometric				
Uranium	²³⁸ U	mg/L	0.0003	7.74
*Uranium Precision ±				0.70
Uranium	²³⁵ U	µCi/mL	2.0E-10	5.2E-06
*Uranium Precision ±				4.7E-07
Radium 226	²²⁶ Ra	pCi/L	0.2	0.8
Radium Error Estimate ±				0.2
Radium 226	²²⁶ Ra	µCi/mL	2.0E-10	8.0E-10
Radium Error Estimate ±				2.0E-10
Radium 228	²²⁸ Ra	pCi/L	1.0	< 1.0
Radium Error Estimate ±				1.2
Radium 228	²²⁸ Ra	µCi/mL	1.0E-09	< 1.0E-09
Radium Error Estimate ±				1.2E-09
Thorium 230	²³⁰ Th	pCi/L	0.2	< 0.2
Thorium Error Estimate ±				0.4
Thorium 230	²³⁰ Th	µCi/mL	2.0E-10	< 2.0E-10
Thorium Error Estimate ±				4.0E-10

Quality Assurance Data		Target Range	
Anion	meq		68.91
Cation	meq		68.43
WYDEQ A/C Balance	%	-5 - +5	-0.35
Calc TDS	mg/L		4415
TDS A/C Balance	dec. %	0.80 - 1.20	1.07

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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COMPLETE ANALYTICAL SERVICES

Table 2.1.5 - Water Quality Analyses for Well D1



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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:	DL0737/ 02-03-97/0930
Laboratory ID:	97-15624
Report Date:	02-24-97
Revised Report Date:	January 20, 1998

Major Ions	Units	Results	"Lower Limit of Detection"
Sulfate (SO ₄)	mg/L	1180	1.0

Non-Metals			
Total Dissolved Solids (TDS) @ 180°C	mg/L	2380	1.0

Trace Metals			
Selenium (Se)	mg/L	0.334	0.005

Radiometric			
Uranium (U ²³⁸)	mg/L	1.80	0.0003
*Uranium Precision ±		0.16	
Uranium (U ²³⁵)	μCi/mL	1.2E-06	2.0E-10
*Uranium Precision ±		1.1E-07	

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

D1/737/

Laboratory ID:

8-6-97/1455

Report Date:

97-47201

Revised Report Date:

09-04-97

January 19, 1998

Major Ions		Units	"Lower Limit of Detection"	Results
Calcium	Ca	mg/L	1.0	237
Magnesium	Mg	mg/L	1.0	59.3
Sodium	Na	mg/L	1.0	485
Potassium	K	mg/L	1.0	4.6
Carbonate	CO ₃	mg/L	0.10	0
Bicarbonate	HCO ₃	mg/L	0.10	442
Sulfate	SO ₄	mg/L	1.0	1150
Chloride	Cl	mg/L	0.10	205
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	7.20

Non-Metals		Units	"Lower Limit of Detection"	Results
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	2510
pH		std. units	0.10	7.77

Trace Metals		Units	"Lower Limit of Detection"	Results
Chromium	Cr	mg/L	0.05	< 0.05
Molybdenum	Mo	mg/L	0.03	1.57
Selenium	Se	mg/L	0.005	0.315
Vanadium	V	mg/L	0.01	< 0.01

Radiometric		Units	"Lower Limit of Detection"	Results
Uranium	²³⁸ U	mg/L	0.0003	1.80
*Uranium Precision ±				0.16
Uranium	²³⁵ U	µCi/mL	2.0E-10	1.2E-06
*Uranium Precision ±				1.1E-07
Radium 226	²²⁶ Ra	pCi/L	0.2	< 0.2
Radium Error Estimate ±				0.2
Radium 226	²²⁶ Ra	µCi/mL	2.0E-10	< 2.0E-10
Radium Error Estimate ±				2.0E-10
Radium 228	²²⁸ Ra	pCi/L	1.0	< 1.0
Radium Error Estimate ±				1.6
Radium 228	²²⁸ Ra	µCi/mL	1.0E-09	< 1.0E-09
Radium Error Estimate ±				1.6E-09
Thorium 230	²³⁰ Th	pCi/L	0.2	< 0.2
Thorium Error Estimate ±				0.1
Thorium 230	²³⁰ Th	µCi/mL	2.0E-10	< 2.0E-10
Thorium Error Estimate ±				1.0E-10

Quality Assurance Data		Target Range	Results
Anion	meq		37.49
Cation	meq		38.00
WYDEQ A/C Balance	%	-5 - +5	0.67
Calc TDS	mg/L		2394
TDS A/C Balance	dec. %	0.80 - 1.20	1.05

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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COMPLETE ANALYTICAL SERVICES

Table 2.1.6 - Water Quality Analyses for Well BP



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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:	BP/0738/ 02-03-97/1445
Laboratory ID:	97-15625
Report Date:	02-24-97
Revised Report Date:	January 20, 1998

Major Ions	Units	Results	"Lower Limit of Detection"
Sulfate (SO ₄)	mg/L	1290	1.0

Non-Metals			
Total Dissolved Solids (TDS) @ 180°C	mg/L	2510	1.0

Trace Metals			
Selenium (Se)	mg/L	0.519	0.005

Radiometric			
Uranium (U ^{Nat})	mg/L	2.22	0.0003
*Uranium Precision ±		0.20	
Uranium (U ^{Nat})	µCi/mL	1.5E-06	2.0E-10
*Uranium Precision ±		1.4E-07	

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Laboratory ID:

Report Date:

Revised Report Date:

BP/738/

8-7-97/1405

97-47186

9-04-97

January 19, 1998

Major Ions		Units	"Lower Limit of Detection"	Results
Calcium	Ca	mg/L	1.0	209
Magnesium	Mg	mg/L	1.0	54.2
Sodium	Na	mg/L	1.0	409
Potassium	K	mg/L	1.0	4.3
Carbonate	CO ₃	mg/L	0.10	0
Bicarbonate	HCO ₃	mg/L	0.10	538
Sulfate	SO ₄	mg/L	1.0	869
Chloride	Cl	mg/L	0.10	219
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	1.90

Non-Metals		Units	"Lower Limit of Detection"	Results
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	2120
pH	-	std. units	0.10	7.83

Trace Metals		Units	"Lower Limit of Detection"	Results
Chromium	Cr	mg/L	0.05	< 0.05
Molybdenum	Mo	mg/L	0.03	0.60
Selenium	Se	mg/L	0.005	0.277
Vanadium	V	mg/L	0.01	< 0.01

Radiometric		Units	"Lower Limit of Detection"	Results
Uranium	²³⁸ U	mg/L	0.0003	1.30
*Uranium Precision ±				0.12
Uranium	²³⁵ U	µCi/mL	2.0E-10	8.8E-07
*Uranium Precision ±				7.9E-08
Radium 226	²²⁶ Ra	pCi/L	0.2	0.5
Radium Error Estimate ±				0.3
Radium 226	²²⁶ Ra	µCi/mL	2.0E-10	5.0E-10
Radium Error Estimate ±				3.0E-10
Radium 228	²²⁸ Ra	pCi/L	1.0	< 1.0
Radium Error Estimate ±				1.7
Radium 228	²²⁸ Ra	µCi/mL	1.0E-09	< 1.0E-09
Radium Error Estimate ±				1.7E-09
Thorium 230	²³⁰ Th	pCi/L	0.2	< 0.2
Thorium Error Estimate ±				0.3
Thorium 230	²³⁰ Th	µCi/mL	2.0E-10	< 2.0E-10
Thorium Error Estimate ±				3.0E-10

Quality Assurance Data		Target Range	
Anion	meq		33.23
Cation	meq		32.86
W/DEQ A/C Balance	%	-5 - +5	-0.56
Calc TDS	mg/L		2042
TDS A/C Balance	dec. %	0.80 - 1.20	1.04

*precision is calculated using standard deviation of mean of replicates; analyses multiplied by concentration

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

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COMPLETE ANALYTICAL SERVICES

Table 2.1.7 - Water Quality Analyses for Well Y



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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample I.D./Date:

Y/ 01-10-97/1300
97-11023
02-03-97
January 20, 1998

Laboratory I.D. #:

Report Date:

Revised Report Date:

Major Ions	Units	Results	Lower Limit of Detection"
Sulfate (SO ₄)	mg/L	2000	1.0
Chloride (Cl)	mg/L	367	0.10

Non-Metals	Units	Results	Lower Limit of Detection"
Total Dissolved Solids (TDS) @ 180°C	mg/L	4230	1.0

Trace Metals	Units	Results	Lower Limit of Detection"
Selenium (Se)	mg/L	0.641	0.005
Molybdenum (Mo)	mg/L	11.5	0.03

Radiometric	Units	Results	Lower Limit of Detection"
Uranium (U ^{NaI})	mg/L	7.91	0.0003
*Uranium Precision ±		0.71	
Uranium (U ^{NaI})	μCi/mL	5.4E-06	2.0E-10
*Uranium Precision ±		4.8E-07	

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Y/0126/

02-06-97/1438

Laboratory ID:

97-15627

Report Date:

02-24-97

Revised Report Date:

January 20, 1998

Major Ions	Units	Results	"Lower Limit of Detection"
Sulfate (SO ₄)	mg/L	2130	1.0
Chloride (Cl)	mg/L	405	0.10

Non-Metals			
Total Dissolved Solids (TDS) @ 180°C	mg/L	4360	1.0

Trace Metals			
Selenium (Se)	mg/L	0.712	0.005
Molybdenum (Mo)	mg/L	12.7	0.10

Radlometric			
Uranium (U ^{Nat})	mg/L	10.0	0.0003
*Uranium Precision ±		0.90	
Uranium (U ^{Nat})	μCi/mL	6.8E-06	2.0E-10
*Uranium Precision ±		6.1E-07	

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Y/

02-20-97/1413

Laboratory ID:

97-16190

Report Date:

03-18-97

Revised Report Date:

January 19, 1998

Major Ions	Units	Results	"Lower Limit of Detection"
Sulfate (SO ₄)	mg/L	2120	1.0
Chloride (Cl)	mg/L	372	0.10

Non-Metals	Units	Results	"Lower Limit of Detection"
Total Dissolved Solids (TDS) @ 180°C	mg/L	4390	1.0

Trace Metals	Units	Results	"Lower Limit of Detection"
Molybdenum (Mo)	mg/L	11.8	0.03
Selenium (Se)	mg/L	0.680	0.001

Radiometric	Units	Results	"Lower Limit of Detection"
Uranium (U ^{Nat})	mg/L	8.09	0.0003
*Uranium Precision ±		0.73	
Uranium (U ^{Nat})	μCi/mL	5.5E-06	2.0E-10
*Uranium Precision ±		4.9E-07	

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Y/

03-04-97/1210

Laboratory ID:

97-16487

Report Date:

03-26-97

Revised Report Date:

January 19, 1998

Major Ions	Units	Results	"Lower Limit of Detection"
Sulfate (SO ₄)	mg/L	1940	1.0
Chloride (Cl)	mg/L	394	0.10

Non-Metals			
Total Dissolved Solids (TDS) @ 180°C	mg/L	4330	1.0

Trace Metals			
Molybdenum (Mo)	mg/L	11.6	0.03
Selenium (Se)	mg/L	1.35	0.005

Radiometric			
Uranium (U ^{nat})	mg/L	7.87	0.0003
*Uranium Precision ±		0.71	
Uranium (U ^{nat})	μCi/mL	5.3E-06	2.0E-10
*Uranium Precision ±		4.8E-07	

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Y/

4-15-97/1049

Laboratory ID:

97-22307

Report Date:

05-14-97

Revised Report Date:

January 19, 1998

Major Ions	Units	Results	"Lower Limit of Detection"
Sulfate (SO ₄)	mg/L	2011	1.0
Chloride (Cl)	mg/L	400	1.0

Non-Metals			
Total Dissolved Solids (TDS) @ 130°C	mg/L	4294	1.0

Trace Metals			
Molybdenum (Mo)	mg/L	11.8	0.03
Selenium (Se)	mg/L	0.530	0.005

Radiometric			
Uranium (U ^{Nat})	mg/L	7.5	0.0003
*Uranium Precision ±		0.68	
Uranium (U ^{Nat})	μCi/mL	5.1E-06	2.0E-10
*Uranium Precision ±		4.6E-07	

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Y/126/

4-29-97/1056

Laboratory ID:

97-26751

Report Date:

05-30-97

Revised Report Date:

January 19, 1998

Major Ions	Units	Results	"Lower Limit of Detection"
Calcium (Ca)	mg/L	352	1.0
Magnesium (Mg)	mg/L	79.9	1.0
Sodium (Na)	mg/L	857	1.0
Potassium (K)	mg/L	9.0	1.0
Carbonate (CO ₃)	mg/L	0	0.10
Bicarbonate (HCO ₃)	mg/L	626	0.10
Sulfate (SO ₄)	mg/L	2003	1.0
Chloride (Cl)	mg/L	390	0.10
Nitrite + Nitrate (NO ₂ + NO ₃) as N	mg/L	5.26	0.10

Non-Metals			
Total Dissolved Solids (TDS) @ 180°C	mg/L	4330	1.0
pH	std. units	7.66	0.10

Trace Metals			
Chromium (Cr)	mg/L	< 0.05	0.05
Molybdenum (Mo)	mg/L	12.2	0.03
Seelenium (Se)	mg/L	0.658	0.005
Vanadium (V)	mg/L	< 0.01	0.01

Radiometric			
Uranium (U ²³⁸)	mg/L	7.92	0.0003
*Uranium Precision ±		0.71	
Uranium (U ²³⁵)	µCi/mL	5.4E-06	2.0E-10
*Uranium Precision ±		4.8E-07	
Radium 226 (Ra ²²⁶)	pCi/L	< 0.2	0.2
Radium Precision ±		0.2	
Radium 226 (Ra ²²⁶)	µCi/mL	< 2.0E-10	2.0E-10
Radium Precision ±		2.0E-10	
Radium 228 (Ra ²²⁸)	pCi/L	< 1.0	1.0
Radium Precision ±		1.2	
Radium 228 (Ra ²²⁸)	µCi/mL	< 1.0E-09	1.0E-09
Radium Precision ±		1.2E-09	
Thorium 230 (Th ²³⁰)	pCi/L	< 0.2	0.2
Thorium Precision ±		0.2	
Thorium 230 (Th ²³⁰)	µCi/mL	< 2.0E-10	2.0E-10
Thorium Precision ±		2.0E-10	

Quality Assurance Data			Target Range
Anion	meq	63.35	
Cation	meq	61.75	
WYDEQ A/C Balance	%	-1.28	-5 - +5
Calc TDS	mg/L	4027	
TDS A/C Balance	dec. %	1.08	0.80 - 1.20

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Laboratory ID:

Report Date:

Revised Report Date:

Y/

06-03-97/1214

97-33831

07-02-97

January 19, 1998

Major Ions		Units	"Lower Limit of Detection"	Results
Sulfate	SO ₄	mg/L	1.0	1817
Chloride	Cl	mg/L	0.10	369

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	4270

Trace Metals				
Molybdenum	Mo	mg/L	0.03	11.4
Selenium	Se	mg/L	0.005	0.755

Radiometric				
Uranium	²³⁸ U	mg/L	0.0003	7.120
*Uranium Precision ±				0.641
Uranium	²³⁵ U	μCi/mL	2.0E-10	4.8E-06
*Uranium Precision ±				4.3E-07

*precision : calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Laboratory ID:

Report Date:

Revised Report Date:

Y/ 7-17-97/1250
97-41179
08-21-97
January 19, 1998

Major Ions		Units	"Lower Limit of Detection"	Results
Calcium	Ca	mg/L	1.0	337
Magnesium	Mg	mg/L	1.0	77.8
Sodium	Na	mg/L	1.0	859
Potassium	K	mg/L	1.0	9.6
Carbonate	CO ₃	mg/L	0.10	0
Bicarbonate	HCO ₃	mg/L	0.10	628
Sulfate	SO ₄	mg/L	1.0	1995
Chloride	Cl	mg/L	0.10	430
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	4.81

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	4180
pH	-	std. units	0.10	7.84

Trace Metals				
Molybdenum	Mo	mg/L	0.03	11.80
Selenium	Se	mg/L	0.005	0.740

Radiometric				
Uranium	²³⁸ U	mg/L	0.0003	7.53
*Uranium Precision ±				0.68
Uranium	²³⁵ U	μCi/mL	2.0E-10	5.1E-06
*Uranium Precision ±				4.6E-07
Radium 226	²²⁶ Ra	pCi/L	0.2	< 0.2
Radium Error Estimate ±	-			0.2
Radium 226	²²⁶ Ra	μCi/mL	2.0E-10	< 2.0E-10
Radium Error Estimate ±				2.0E-10

Quality Assurance Data		Target Range	
Anion	meq		64.31
Cation	meq		60.93
WYDEQ A/C Balance	%	-5 - +5	-2.70
Calc TDS	mg/L		4044
TDS A/C Balance	dec. %	0.80 - 1.20	1.03

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Laboratory ID:

Report Date:

Revised Report Date:

Y-0126/ 08-20-97/14:15
97-48192
09-22-97
January 19, 1998

Major Ions		Units	"Lower Limit of Detection"	Results
Sulfate	SO ₄	mg/L	1.0	2020
Chloride	Cl	mg/L	0.10	421

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	4250

Trace Metals				
Molybdenum	Mo	mg/L	0.03	11.7
Selenium	Se	mg/L	0.005	0.537

Radiometric				
Uranium	²³⁸ U	mg/L	0.0003	7.79
*Uranium Precision ±				0.70
Uranium	²³⁵ U	μCi/mL	2.0E-10	5.3E-06
*Uranium Precision ±				4.7E-07

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Laboratory ID:

Report Date:

Revised Report Date:

Y/

9-17-97/1056

97-54913

10-17-97

January 19, 1998

Major Ions		Units	"Lower Limit of Detection"	Results
Sulfate	SO ₄	mg/L	1.0	1980

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	4180

Radiometric				
Uranium	NatU	mg/L	0.0003	7.92
*Uranium Precision ±				0.71
Uranium	NatU	μCi/mL	2.0E-10	5.4E-06
*Uranium Precision ±				4.8E-07

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Laboratory ID:

Report Date:

Revised Report Date:

Y/126/

10-13-97/0900

97-63676

11-24-97

January 19, 1998

Major Ions		Units	"Lower" Limit of Detection	Results
Calcium	Ca	mg/L	1.0	339
Magnesium	Mg	mg/L	1.0	79.1
Sodium	Na	mg/L	1.0	861
Potassium	K	mg/L	1.0	8.5
Carbonate	CO ₃	mg/L	0.10	< 0.10
Bicarbonate	HCO ₃	mg/L	0.10	626
Sulfate	SO ₄	mg/L	1.0	2000
Chloride	Cl	mg/L	0.10	416
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	4.03

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	4230
pH		std. units	0.10	7.91

Trace Metals				
Chromium	Cr	mg/L	0.05	< 0.05
Molybdenum	Mo	mg/L	0.03	12.0
Selenium	Se	mg/L	0.005	0.614
Vanadium	V	mg/L	0.01	< 0.01

Radiometric				
Uranium	²³⁸ U	mg/L	0.0003	8.25
*Uranium Precision ±				0.74
Uranium	²³⁵ U	µCi/mL	2.0E-10	5.6E-06
*Uranium Precision ±				5.0E-07
Radium 226	²²⁶ Ra	pCi/L	0.2	< 0.2
Radium Error Estimate ±				0.2
Radium 226	²²⁶ Ra	µCi/mL	2.0E-10	< 2E-10
Radium Error Estimate ±				2E-10
Radium 228	²²⁸ Ra	pCi/L	1.0	< 1.0
Radium Error Estimate ±				1.6
Radium 228	²²⁸ Ra	µCi/mL	1.0E-09	< 1.0E-09
Radium Error Estimate ±				1.6E-09
Thorium 230	²³⁰ Th	pCi/L	0.2	< 0.2
Thorium Error Estimate ±				0.2
Thorium 230	²³⁰ Th	µCi/mL	2.0E-10	< 2E-10
Thorium Error Estimate ±				2E-10

Quality Assurance Data		Target Range	
Anion	meq		63.94
Cation	meq		61.19
WYDEQ A/C Balance	%	-5 - +5	-2.19
Calc TDS	mg/L		4034
TDS A/C Balance	dec. %	0.80 - 1.20	1.05

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Laboratory ID:

Report Date:

Revised Report Date:

Y/
11-17-97/1453
97-68501
12-17-97
January 19, 1998

Major Ions		Units	"Lower Limit of Detection"	Results
Sulfate	SO ₄	mg/L	1.0	2000
Chloride	Cl	mg/L	0.10	414

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	4270

Trace Metals				
Molybdenum	Mo	mg/L	0.03	13.4
Seelenium	Se	mg/L	0.005	0.469

Radiometric				
Uranium	NatU	mg/L	0.0003	8.641
*Uranium Precision ±				0.78
Uranium	NatU	μCi/mL	2.0E-10	5.8E-06
*Uranium Precision ±				5.3E-07

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

"Lower Limit of Detection" is related to reporting limit; suggested by Regulatory Guide 4.14 in some cases.

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Laboratory ID:

Report Date:

Revised Report Date:

Y/

12-1-97/1344

97-69246

12-16-97

January 19, 1998

Major Ions		Units	"Lower Limit of Detection"	Results
Sulfate	SO ₄	mg/L	1.0	1980
Chloride	Cl	mg/L	0.10	395

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	4280

Trace Metals				
Molybdenum	Mo	mg/L	0.03	12.5
Selenium	Se	mg/L	0.005	0.513

Radiometric				
Uranium	^{Na} U	mg/L	0.0003	9.60
*Uranium Precision ±				0.86
Uranium	^{Na} U	μCi/mL	2.0E-10	6.5E-06
*Uranium Precision ±				5.8E-07

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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Table 2.1.8 - Water Quality Analyses for Well X

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample I.D./Date:

X/

01-10-97/1320

Laboratory I.D. #:

97-11024

Report Date:

02-03-97

Revised Report Date:

January 20, 1998

Major Ions	Units	Results	"Lower Limit of Detection"
Sulfate (SO ₄)	mg/L	732	1.0
Chloride (Cl)	mg/L	207	0.10

Non-Metals			
Total Dissolved Solids (TDS) @ 180 °C	mg/L	1860	1.0

Trace Metals			
Selenium (Se)	mg/L	0.218	0.005
Molybdenum (Mo)	mg/L	1.02	0.03

Radiometric			
Uranium (U ^{Nat})	mg/L	0.64	0.0003
*Uranium Precision ±		0.06	
Uranium (U ^{Nat})	μCi/mL	4.3E-07	2.0E-10
*Uranium Precision ±		3.9E-08	

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

X/0720/

02-06-97/1440

Laboratory ID:

97-15626

Report Date:

02-24-97

Revised Report Date:

January 20, 1998

Major Ions	Units	Results	"Lower Limit of Detection"
Sulfate (SO ₄)	mg/L	780	1.0
Chloride (Cl)	mg/L	217	0.10

Non-Metals			
Total Dissolved Solids (TDS) @ 180°C	mg/L	1980	1.0

Trace Metals			
Selenium (Se)	mg/L	0.171	0.005
Molybdenum (Mo)	mg/L	1.03	0.10

Radiometric			
Uranium (U ^{NaI})	mg/L	0.787	0.0003
*Uranium Precision ±		0.07	
Uranium (U ^{NaI})	μCi/mL	5.3E-07	2.0E-10
*Uranium Precision ±		4.8E-08	

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

X/

02-20-97/1434

Laboratory ID:

97-16189

Report Date:

03-18-97

Revised Report Date:

January 19, 1998

Major Ions	Units	Results	"Lower Limit of Detection"
Sulfate (SO ₄)	mg/L	775	1.0
Chloride (Cl)	mg/L	201	0.10

Non-Metals			
Total Dissolved Solids (TDS) @ 180°C	mg/L	1980	1.0

Trace Metals			
Molybdenum (Mo)	mg/L	1.0	0.03
Selenium (Se)	mg/L	0.159	0.001

Radiometric			
Uranium (U ^{Nat})	mg/L	0.776	0.0003
*Uranium Precision ±		0.07	
Uranium (U ^{Nat})	μCi/mL	5.3E-07	2.0E-10
*Uranium Precision ±		4.7E-08	

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

X/

03-04-97/1215

Laboratory ID:

97-16486

Report Date:

03-26-97

Revised Report Date:

January 19, 1998

Major Ions	Units	Results	"Lower Limit of Detection"
Sulfate (SO ₄)	mg/L	717	1.0
Chloride (Cl)	mg/L	210	0.10

Non-Metals			
Total Dissolved Solids (TDS) @ 180°C	mg/L	2010	1.0

Trace Metals			
Molybdenum (Mo)	mg/L	1.0	0.03
Selenium (Se)	mg/L	0.331	0.005

Radiometric			
Uranium (U ^{Nat})	mg/L	0.892	0.0003
*Uranium Precision ±		0.08	
Uranium (U ^{Nat})	μCi/mL	6.0E-07	2.0E-10
*Uranium Precision ±		5.4E-08	

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:	X/ 4-15-97/111 ^
Laboratory ID:	97-22306
Report Date:	05-14- 7
Revised Report Date:	January 19, 1998

Major Ions	Units	Results	"Lower Limit of Detection"
Sulfate (SO ₄)	mg/L	740	1.0
Chloride (Cl)	mg/L	215	1.0

Non-Metals			
Total Dissolved Solids (TDS) @ 180°C	mg/L	1976	1.0

Trace Metals			
Molybdenum (Mo)	mg/L	1.13	0.03
Selenium (Se)	mg/L	0.146	0.005

Radiometric			
Uranium (U ^{Nat})	mg/L	0.777	0.0003
*Uranium Precision ±		0.07	
Uranium (U ^{Nat})	μCi/mL	5.3E-07	2.0E-10
*Uranium Precision ±		4.7E-08	

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample I.D./Date:

X/720/
4-29-97/1110

Laboratory I.D. #:

97-26750

Report Date:

05-30-97

Revised Report Date:

January 19, 1998

Major Ions	Units	Results	"Lower Limit of Detection"
Calcium (Ca)	mg/L	174	1.0
Magnesium (Mg)	mg/L	47.5	1.0
Sodium (Na)	mg/L	405	1.0
Potassium (K)	mg/L	5.6	1.0
Carbonate (CO ₃)	mg/L	0	0.10
Bicarbonate (HCO ₃)	mg/L	604	0.10
Sulfate (SO ₄)	mg/L	730	1.0
Chloride (Cl)	mg/L	202	0.10
Nitrite + Nitrate (NO ₂ + NO ₃) as N	mg/L	1.95	0.10

Non-Metals			
Total Dissolved Solids (TDS) @ 180°C	mg/L	1990	1.0
pH	std. units	7.62	0.10

Trace Metals			
Chromium (Cr)	mg/L	< 0.05	0.05
Molybdenum (Mo)	mg/L	1.12	0.03
Selenium (Se)	mg/L	0.110	0.005
Vanadium (V)	mg/L	< 0.01	0.01

Radiometric			
Uranium (U ²³⁸)	mg/L	0.913	0.0003
*Uranium Precision ±		0.08	
Uranium (U ²³⁵)	µCi/mL	6.2E-07	2.0E-10
*Uranium Precision ±		5.6E-08	
Radium 226 (Ra ²²⁶)	pCi/L	< 0.2	0.2
Radium Error Estimate ±		0.2	
Radium 226 (Ra ²²⁶)	µCi/mL	< 2.0E-10	2.0E-10
Radium Error Estimate ±		2E-10	
Radium 228 (Ra ²²⁸)	pCi/L	< 1.0	1.0
Radium Error Estimate ±		1.2	
Radium 228 (Ra ²²⁸)	µCi/mL	< 1.0E-09	1.0E-09
Radium Error Estimate ±		1.2E-09	
Thorium 230 (Th ²³⁰)	pCi/L	< 0.2	0.2
Thorium Error Estimate ±		0.3	
Thorium 230 (Th ²³⁰)	µCi/mL	< 2.0E-10	2.0E-10
Thorium Error Estimate ±		3E-10	

Quality Assurance Data			Target Range
Anion	meq	30.94	
Cation	meq	30.41	
WYDEQ A/C Balance	%	-0.86	-5 - +5
Calc TDS	mg/L	1875	
TDS A/C Balance	dec. %	1.06	0.80 - 1.20

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Laboratory ID:

Report Date:

Revised Report Date:

X/
06-03-97/1228
97-33830
06-19-97
January 20, 1998

Major Ions		Units	"Lower Limit of Detection"	Results
Sulfate	SO ₄	mg/L	1.0	687
Chloride	Cl	mg/L	0.10	209

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	1940

Trace Metals				
Molybdenum	Mo	mg/L	0.03	1.17
Selenium	Se	mg/L	0.005	0.107

Radiometric				
Uranium	^{Nat} U	mg/L	0.0003	0.728
*Uranium Precision ±				0.07
Uranium	^{Nat} U	μCi/mL	2.0E-10	8.8E-07
*Uranium Precision ±				4.4E-08

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Laboratory ID:

Report Date:

Revised Report Date:

X/
7-17-97/1245
97-41178
08-21-97
January 19, 1998

Major Ions		Units	"Lower Limit of Detection"	Results
Calcium	Ca	mg/L	1.0	172
Magnesium	Mg	mg/L	1.0	46.9
Sodium	Na	mg/L	1.0	412
Potassium	K	mg/L	1.0	6.2
Carbonate	CO ₃	mg/L	0.10	0
Bicarbonate	HCO ₃	mg/L	0.10	576
Sulfate	SO ₄	mg/L	1.0	761
Chloride	Cl	mg/L	0.10	239
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	1.98

Non-Metals		Units	"Lower Limit of Detection"	Results
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	1920
pH	-	std. units	0.10	7.73

Trace Metals		Units	"Lower Limit of Detection"	Results
Molybdenum	Mo	mg/L	0.03	1.24
Selenium	Se	mg/L	0.005	0.09

Radiometric		Units	"Lower Limit of Detection"	Results
Uranium	²³⁸ U	mg/L	0.0003	0.679
*Uranium Precision ±				0.06
Uranium	²³⁵ U	μCi/mL	2.0E-10	4.6E-07
*Uranium Precision ±				4.1E-08
Radium 226	²²⁶ Ra	pCi/L	0.2	< 0.2
Radium Error Estimate ±	-			0.2
Radium 226	²²⁶ Ra	μCi/mL	2.0E-10	< 2.0E-10
Radium Error Estimate ±	-			2E-10

Quality Assurance Data		Target Range	Results
Anion	meq		32.17
Cation	meq		30.58
WYDEQ A/C Balance	%	-5 - +5	-2.53
Calc TDS	mg/L		1934
TDS A/C Balance	dec. %	0.80 - 1.20	0.99

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Laboratory ID:

Report Date:

Revised Report Date:

X-720/

08-20-97/14:00

97-48191

09-22-97

January 19, 1998

Major Ions		Units	"Lower Limit of Detection"	Results
Sulfate	SO ₄	mg/L	1.0	738
Chloride	Cl	mg/L	1.0	219

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	1910

Trace Metals				
Molybdenum	Mo	mg/L	0.03	1.07
Selenium	Se	mg/L	0.005	0.091

Radiometric				
Uranium	²³⁵ U	mg/L	0.0003	0.781
*Uranium Precision ±				0.07
Uranium	²³⁸ U	μCi/mL	2.0E-10	8.8E-07
*Uranium Precision ±				4.8E-08

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Laboratory ID:
Report Date:
Revised Report Date:

X/ 9-17-97/1050
97-54912
10-17-97
January 19, 1998

Major Ions	Units	"Lower Limit of Detection"	Results
Sulfate	SO ₄	mg/L	1.0
			717

Non-Metals	Units	"Lower Limit of Detection"	Results
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0
			1890

Radiometric	Units	"Lower Limit of Detection"	Results
Uranium	Nat ²³⁸ U	mg/L	0.0003
			0.609
*Uranium Precision ±			0.05
Uranium	Nat ²³⁵ U	μCi/mL	2.0E-10
			4.1E-07
*Uranium Precision ±			3.7E-08

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Laboratory ID:

Report Date:

Revised Report Date:

X/720/

10-13-97/0830

97-63675

11-24-97

January 19, 1998

Major Ions		Units	"Lower Limit of Detection"	Results
Calcium	Ca	mg/L	1.0	178
Magnesium	Mg	mg/L	1.0	50.1
Sodium	Na	mg/L	1.0	387
Potassium	K	mg/L	1.0	5.9
Carbonate	CO ₃	mg/L	0.10	< 0.10
Bicarbonate	HCO ₃	mg/L	0.10	566
Sulfate	SO ₄	mg/L	1.0	743
Chloride	Cl	mg/L	0.10	209
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	1.73

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	1920
pH		std. units	0.10	8.00

Trace Metals				
Chromium	Cr	mg/L	0.05	< 0.05
Molybdenum	Mo	mg/L	0.03	1.01
Selenium	Se	mg/L	0.005	0.085
Vanadium	V	mg/L	0.01	0.06

Radiometric				
Uranium	²³⁸ U	mg/L	0.0003	0.689
*Uranium Precision ±				0.06
Uranium	²³⁵ U	μCi/mL	2.0E-10	8.8E-07
*Uranium Precision ±				4.2E-08
Radium 226	²²⁶ Ra	pCi/L	0.2	< 0.2
Radium Error Estimate ±				0.2
Radium 226	²²⁶ Ra	μCi/mL	2.0E-10	< 2.0E-10
Radium Error Estimate ±				2.0E-10
Radium 228	²²⁸ Ra	pCi/L	1.0	< 1.0
Radium Error Estimate ±				1.6
Radium 228	²²⁸ Ra	μCi/mL	1.0E-09	< 1.0E-09
Radium Error Estimate ±				1.6E-09
Thorium 230	²³⁰ Th	pCi/L	0.2	< 0.2
Thorium Error Estimate ±				0.4
Thorium 230	²³⁰ Th	μCi/mL	2.0E-10	< 2.0E-10
Thorium Error Estimate ±				4E-10

Quality Assurance Data		Target Range	
Anion	meq		30.77
Cation	meq		30.05
WYDEQ A/C Balance	%	-5 - +5	-1.18
Calc TDS	mg/L		1864
TDS A/C Balance	dec. %	0.80 - 1.20	1.03

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Laboratory ID:

Report Date:

Revised Report Date:

X/

11-17-97/1504

97-68500

December 17, 1997

January 19, 1998

Major Ions		Units	"Lower Limit of Detection"	Results
Sulfate	SO ₄	mg/L	1.0	672
Chloride	Cl	mg/L	0.10	206

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	1910

Trace Metals				
Molybdenum	Mo	mg/L	0.03	1.03
Selenium	Se	mg/L	0.005	0.071

Radiometric				
Uranium	NatU	mg/L	0.0003	0.6917
*Uranium Precision ±				0.06
Uranium	NatU	µCi/mL	2.0E-10	4.7E-07
*Uranium Precision ±				4.2E-08

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Laboratory ID:

Report Date:

Revised Report Date:

X/

12-1-97/1400

97-69245

December 16, 1997

January 19, 1998

Major Ions		Units	"Lower Limit of Detection"	Results
Sulfate	SO ₄	mg/L	1.0	710
Chloride	Cl	mg/L	0.10	197

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	1850

Trace Metals				
Molybdenum	Mo	mg/L	0.03	0.95
Selenium	Se	mg/L	0.005	0.077
Vanadium	V	mg/L	0.01	0.05

Radiometric				
Uranium	NatU	mg/L	0.0003	0.686
*Uranium Precision ±				0.06
Uranium	NatU	µCi/mL	2.0E-10	4.6E-07
*Uranium Precision ±				4.0E-08

*Precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

"Lower Limit of Detection" is related to reporting limits suggested by Regulatory Guide 1.14 in some cases.

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Table 2.1.9- Water Quality Analyses for Background Well P



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WATER ANALYSIS REPORT - HOMESTEAK MINING CO.,

Sample I.D. #:

P10501

Laboratory I.D. #:

03-06-97/0855

Report Date:

97-16635

Revised Report Date:

March 26, 1997

January 28, 1998

Major Anions	Units	Results	"Lower Limit of Detection"
Calcium (Ca)	mg/L	211	1.0
Magnesium (Mg)	mg/L	44.4	1.0
Sodium (Na)	mg/L	229	1.0
Potassium (K)	mg/L	4.7	1.0
Carbonate (CO ₃)	mg/L	0	0.10
Bicarbonate (HCO ₃)	mg/L	290	0.10
Sulfate (SO ₄)	mg/L	867	1.0
Chloride (Cl)	mg/L	52.8	0.10
Nitrite + Nitrate (NO ₂ + NO ₃) as N	mg/L	3.04	0.10

Non-Metals			
Total Dissolved Solids (TDS) @ 180°C	mg/L	1670	1.0
pH	sat. units	7.70	0.10

Trace Metals			
Chromium (Cr)	mg/L	< 0.05	0.05
Molybdenum (Mo)	mg/L	< 0.03	0.03
Selenium (Se)	mg/L	0.063	0.005
Vanadium (V)	mg/L	< 0.01	0.01

Radiometric			
Uranium (U ²³⁸)	mg/L	0.044	0.0003
*Uranium Precision ±		0.004	
Uranium (U ²³⁵)	µCi/mL	3.0E-08	2.0E-10
*Uranium Precision ±		2.7E-09	
Radium 226 (Ra ²²⁶)	pCi/L	1.0	0.2
Radium Error Estimate ±		0.2	
Radium 226 (Ra ²²⁶)	µCi/mL	1.0E-09	2.0E-10
Radium Error Estimate ±		2.0E-10	
Radium 228 (Ra ²²⁸)	pCi/L	< 1.0	1.0
Radium Error Estimate ±		1.0	
Radium 228 (Ra ²²⁸)	µCi/mL	< 1.0E-09	1.0E-10
Radium Error Estimate ±		1.0E-10	
Thorium 230 (Th ²³⁰)	pCi/L	< 0.2	0.2
Thorium Error Estimate ±		0.2	
Thorium 230 (Th ²³⁰)	µCi/mL	2.0E-10	2.0E-10
Thorium Error Estimate ±		2.0E-10	

Quality Assurance Data			Target Range
Anion	meq	24.52	
Cation	meq	24.33	
WYTRQ A/C Balance	%	-0.40	-5 - +5
Calc TDS	mg/L	1567	
TDS A/C Balance	dev. %	1.07	(0.80) - 1.20

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

"Lower Limit of Detection" is related to reporting limits suggested by Regulatory Guide 4.14 to mean concs.

pin r:reportclients,97/homestak,03/mar/p10501

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WATER ANALYSIS REPORT - HOMESTAKE MINING CO.

Sample ID/Date:

Laboratory ID:

Report Date:

Revised Report Date:

P/0501/

5-27-97/1000

97-28229

June 26, 1997

January 22, 1998

Major Ions		Units	"Lower Limit of Detection"	Results
Calcium	Ca	mg/L	1.0	230
Magnesium	Mg	mg/L	1.0	44.4
Sodium	Na	mg/L	1.0	232
Potassium	K	mg/L	1.0	4.5
Carbonate	CO ₃	mg/L	0.10	0
Bicarbonate	HCO ₃	mg/L	0.10	300
Sulfate	SO ₄	mg/L	1.0	919
Chloride	Cl	mg/L	0.10	61.8
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	2.85

Non-Metals

Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	1680
pH		std. units	0.10	7.86

Trace Metals

Molybdenum	Mo	mg/L	0.03	< 0.03
Selenium	Se	mg/L	0.005	0.059

Radiometric

Uranium	²³⁸ U	mg/L	0.0003	0.045
*Uranium Precision ±				0.004
Uranium	²³⁵ U	μCi/mL	2.0E-10	3.0E-08
*Uranium Precision ±				2.7E-09
Radium 226	²²⁶ Ra	pCi/L	0.2	1.0
Radium Precision ±				0.2
Radium 228	²²⁸ Ra	μCi/mL	2.0E-10	1.0E-09
Radium Precision ±				2.0E-10

Quality Assurance Data

		Target Range	
Anion	meq		26.01
Cation	meq		25.40
WYDUQ A/C Balance	%	-5 - +5	-1.18
Cal. TDS	mg/L		1654
TDS A/C Balance	dec. %	0.80 - 1.20	1.02

*precision is calculated using standard deviation of mean of replicate analyses multiplied by concentration

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

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COMPLETE ANALYTICAL SERVICES

FIGURES

HOMESTAKE MINING COMPANY

GRANTS PROJECT

MONITORING & SAMPLING LOCATIONS

● HMC # 0016 (BKQ)

◄ TLD # 0016 (BKQ)

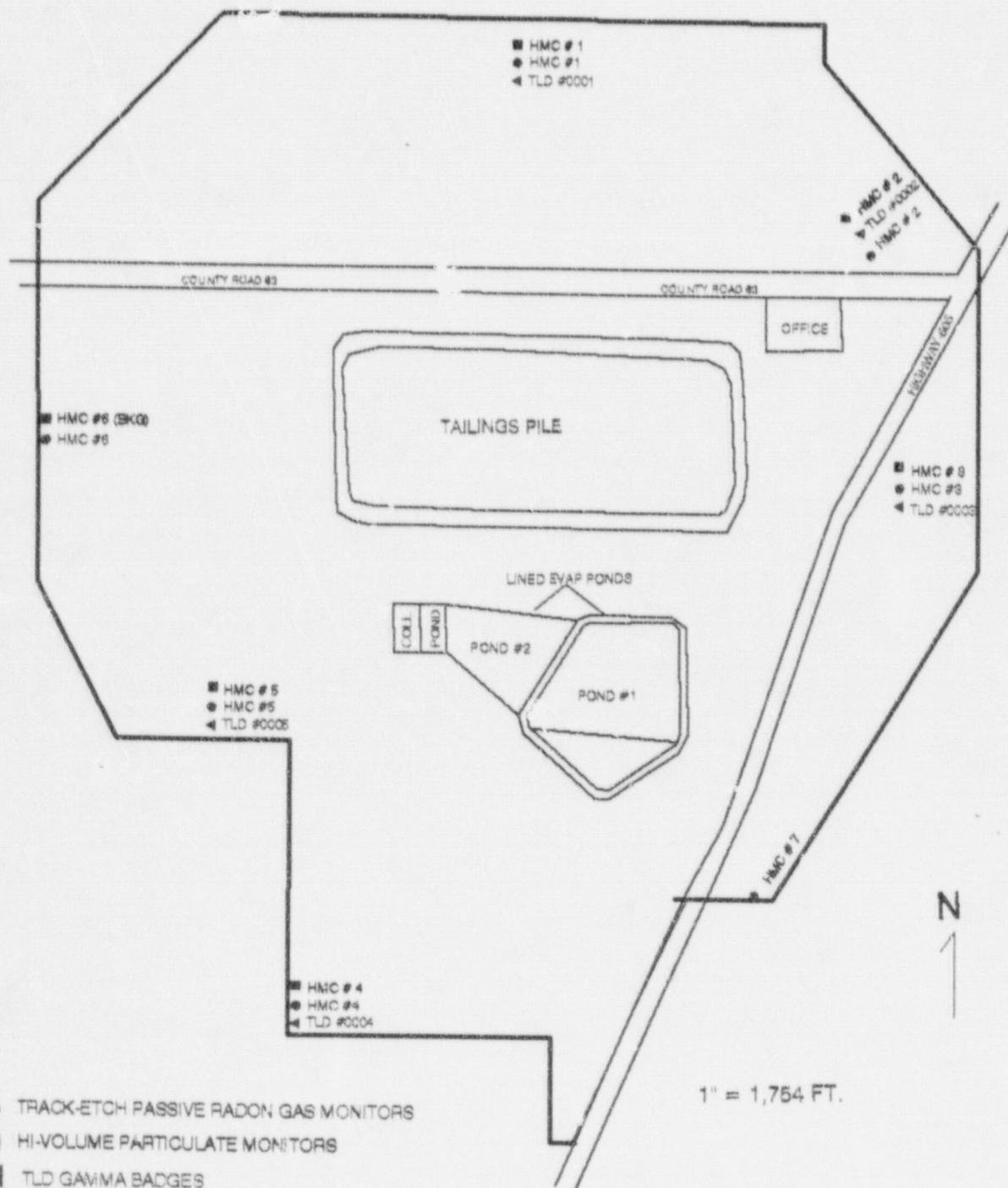


FIGURE 1

ATTACHMENTS

**ENERGY LABORATORIES, INC.**

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2393 SALT CREEK HIGHWAY • CASPER, WY 82601 • FAX (307) 234-1639

Attachment 1

HIGH VOLUME AIR SAMPLING REPORT

CLIENT: HOMESTAKE MINING - GRANTS, NEW MEXICO
P.O. #: 162185
REPORT DATE: July 29, 1997
SAMPLE ID: HMC 1

Quarter/Date Sampled	Air Volume	Radionuclide	Conc. μCi/mL	Error Est. μCi/mL	L.L.D. μCi/mL	Effluent Conc.* μCi/mL	% of Effluent Concentration
97-21611		²³⁸ U	< 1.00E-16	N/A	1.00E-16	9.00E-14	< 1.11E-01
First Quarter 1997		²³⁰ Th	< 1.00E-16	1.18E-17	1.00E-16	2.00E-14	< 5.00E-01
	Air Volume in mLs 1.44E+11	²²⁶ Ra	< 1.00E-16	1.05E-17	1.00E-16	9.00E-13	< 1.11E-02
97-40245		²³⁸ U	1.60E-15	N/A	1.00E-16	9.00E-14	1.77E+00
Second Quarter 1997		²³⁰ Th	< 1.00E-16	1.60E-17	1.00E-16	2.00E-14	< 5.00E-01
	Air Volume in mLs 1.42E+11	²²⁶ Ra	1.12E-16	1.06E-17	1.00E-16	9.00E-13	1.24E-02

N/A not applicable for fluorometric analyses

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

Inh. Air Reports: Clients: 97 Homestake, s: Air 2q97.xls

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P.O. BOX 3258 • CASPER, WY 82602 • PHONE (307) 235-0515
2393 SALT CREEK HIGHWAY • CASPER, WY 82601 • FAX (307) 234-1639

Attachment: 1

HIGH VOLUME AIR SAMPLING REPORT

CLIENT: HOMESTAKE MINING • GRANTS, NEW MEXICO

P.O. #: 162185

REPORT DATE: July 29, 1997

SAMPLE ID: HMC 2

Quarter/Date Sampled	Air Volume	Radionuclide	Conc. μCi/mL	Error Est. μCi/mL	L.L.D. μCi/mL	Effluent Conc.* μCi/mL	% of Effluent Concentration
97-21612 First Quarter 1997	Air Volume in mLs 1.39E+11	²³⁵ U	< 1.00E-16	N/A	1.00E-16	9.00E-14	< 1.11E-01
		²³⁰ Th	< 1.00E-16	1.50E-17	1.00E-16	2.00E-14	< 5.00E-01
		²²⁶ Ra	< 1.00E-16	1.09E-17	1.00E-16	9.00E-13	< 1.11E-02
97-40246 Second Quarter 1997	Air Volume in mLs 1.41E+11	²³⁵ U	1.23E-15	N/A	1.00E-16	9.00E-14	1.37E+00
		²³⁰ Th	< 1.00E-16	1.07E-17	1.00E-16	2.00E-14	< 5.00E-01
		²²⁶ Ra	< 1.00E-16	9.38E-18	1.00E-16	9.00E-13	< 1.11E-02

N/A not applicable for fluorometric analyses

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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Attachment 1

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HIGH VOLUME AIR SAMPLING REPORT

CLIENT: HOMESTAKE MINING - GRANTS, NEW MEXICO

P.O. #: 162185

REPORT DATE: July 29, 1997

SAMPLE ID: HMC 3

Quarter/Date Sampled	Air Volume	Radionuclide	Conc. $\mu\text{Ci/mL}$	Error Est. $\mu\text{Ci/mL}$	L.L.D. $\mu\text{Ci/mL}$	Effluent Conc.* $\mu\text{Ci/mL}$	% of Effluent Concentration
97-21613 First Quarter 1997	Air Volume in mLs 1.41E+11	^{235}U	4.91E-16	N/A	1.00E-16	9.00E-14	5.45E-01
		^{230}Th	< 1.00E-16	1.47E-17	1.00E-16	2.00E-14	< 5.00E-01
		^{226}Ra	< 1.00E-16	1.07E-17	1.00E-16	9.00E-13	< 1.11E-02
97-40247 Second Quarter 1997	Air Volume in mLs 1.30E+11	^{235}U	2.94E-15	N/A	1.00E-16	9.00E-14	3.26E-00
		^{230}Th	< 1.00E-16	1.31E-17	1.00E-16	2.00E-14	< 5.00E-01
		^{226}Ra	< 1.00E-16	1.02E-17	1.00E-16	9.00E-13	< 1.11E-02

N/A not applicable for fluorometric analyses

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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Attachment 1

HIGH VOLUME AIR SAMPLING REPORT

CLIENT: HOMESTAKE MINING - GRANTS, NEW MEXICO

P.O. #: 162185

REPORT DATE: July 29, 1997

SAMPLE ID: HMC 4

Quarter/Date Sampled	Air Volume	Radionuclide	Conc. $\mu\text{Ci/mL}$	Error Est. $\mu\text{Ci/mL}$	L.L.D. $\mu\text{Ci/mL}$	Effluent Conc.* $\mu\text{Ci/mL}$	% of Effluent Concentration
97-21614		^{235}U	1.64E-16	N/A	1.00E-16	9.00E-14	1.82E-01
First Quarter 1997		^{230}Th	< 1.00E-16	1.04E-17	1.00E-16	2.00E-14	< 5.00E-01
	Air Volume in mLs 1.45E+11	^{226}Ra	< 1.00E-16	9.12E-18	1.00E-16	9.00E-13	< 1.11E-02
97-40246		^{235}U	5.74E-15	N/A	1.00E-16	9.00E-14	6.37E-00
Second Quarter 1997		^{230}Th	< 1.00E-16	9.19E-18	1.00E-16	2.00E-14	< 5.00E-01
	Air Volume in mLs 1.44E+11	^{226}Ra	< 1.00E-16	7.88E-18	1.00E-16	9.00E-13	< 1.11E-02

N/A not applicable for fluorometric analyses

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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Attachment 1

HIGH VOLUME AIR SAMPLING REPORT

CLIENT: HOMESTAKE MINING - GRANTS, NEW MEXICO

P.O. #: 162185

REPORT DATE: July 29, 1997

SAMPLE ID: HMC 5

Quarter/Date Sampled	Air Volume	Radionuclide	Conc. $\mu\text{Ci/mL}$	Error Est. $\mu\text{Ci/mL}$	L.L.D. $\mu\text{Ci/mL}$	Effluent Conc.* $\mu\text{Ci/mL}$	% of Effluent Concentration
97-21615		^{235}U	3.28E-16	N/A	1.00E-16	9.00E-14	3.65E-01
First Quarter 1997		^{230}Th	< 1.00E-16	1.14E-17	1.00E-16	2.00E-14	< 5.00E-01
	Air Volume in mLs	^{226}Ra	< 1.00E-16	8.53E-18	1.00E-16	9.00E-13	< 1.11E-02
	1.33E+11						
97-40249		^{235}U	2.33E-14	N/A	1.00E-16	9.00E-14	2.9E-01
Second Quarter 1997		^{230}Th	< 1.00E-16	8.59E-18	1.00E-16	2.00E-14	< 5.00E-01
	Air Volume in mLs	^{226}Ra	< 1.00E-16	7.36E-18	1.00E-16	9.00E-13	< 1.11E-02
	1.54E+11						

N/A not applicable for fluorometric analyses

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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Attachment 1

HIGH VOLUME AIR SAMPLING REPORT

CLIENT: HOMESTAKE MINING - GRANTS, NEW MEXICO

P.O. #: 162185

REPORT DATE: July 29, 1997

SAMPLE ID: HMC 6

Quarter/Date Sampled	Air Volume	Radionuclide	Conc. μCi/mL	Error Est. μCi/mL	L.L.D. μCi/mL	Effluent Conc.* μCi/mL	% of Effluent Concentration
97-21616		²³⁵ U	1.03E-16	N/A	1.00E-16	9.00E-14	1.14E-01
First Quarter 1997		²³⁰ Th	< 1.00E-16	9.00E-18	1.00E-16	2.00E-14	< 5.00E-01
	Air Volume in mLs	²²⁶ Ra	< 1.00E-16	7.71E-18	1.00E-16	9.00E-13	< 1.11E-02
	1.47E+11						
97-40250		²³⁵ U	1.68E-15	N/A	1.00E-16	9.00E-14	1.87E-00
Second Quarter 1997		²³⁰ Th	< 1.00E-16	9.12E-18	1.00E-16	2.00E-14	< 5.00E-01
	Air Volume in mLs	²²⁶ Ra	< 1.00E-16	7.82E-18	1.00E-16	9.00E-13	< 1.11E-02
	1.45E+11						

N/A not applicable for fluorometric analyses

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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Attachment 1

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

Location	Monitoring Period	Ra Concentration ($\mu\text{Ci/ml}$)	Error Estimate ($\mu\text{Ci/ml}$)	% Limit* (%)	LLD ($\mu\text{Ci/ml}$)
Hi-Vol #1 N Outer Perimeter	10/9/96 - 4/1/97	1.7E-09	3.6E-10	17	1.6E-10
Hi-Vol #2 NE Outer Perimeter	10/9/96 - 4/1/97	2.1E-09	3.3E-10	21	1.6E-10
Hi-Vol #3 E Outer Perimeter	10/9/96 - 4/1/97	1.5E-09	3.3E-10	15	1.6E-10
Hi-Vol #4 S Outer Perimeter	10/9/96 - 4/1/97	1.3E-09	3.1E-10	13	1.6E-10
Hi-Vol #5 N of Nearest Residence	10/9/96 - 4/1/97	1.9E-09	3.7E-10	19	1.6E-10
Hi-Vol #6 W of Outer Perimeter	10/9/96 - 4/1/97	1.4E-09	3.2E-10	14	1.6E-10
HMC #7 S Boundary	10/9/96 - 4/1/97	1.5E-09	3.4E-10	15	1.6E-10
HMC #16 Background	10/9/96 - 4/1/97	1.2E-09	2.9E-10	12	1.6E-10

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

Attachment 3 - Environmental Gamma Radiation
TLD Perimeter Survey

Direct Radiation Measurements

Location	Monitoring Period	Exposure Rate (mrem/qr)	Error (mrem/qr)*
Hi-Vol #1 N Outer Perimeter	10/1/96 - 4/4/97	32.2	2.7
Hi-Vol #2 NE Outer Perimeter	10/1/96 - 4/4/97	29.5	9.4
Hi-Vol #3 E Outer Perimeter	10/1/96 - 4/4/97	29.4	8.4
Hi-Vol #4 S Outer Perimeter	10/1/96 - 4/4/97	30.4	3.1
Hi-Vol #5 N of Nearest Residence	10/1/96 - 4/4/97	**37.7	5.9
Hi-Vol #6 W of Outer Perimeter	10/1/96 - 4/4/97	28.5	1.8
#16 Background	10/1/96 - 4/4/97	26.3	1.6

*Error is 1.96 std. dev.

**See Section 8 for explanation