M/045/017

BARRICK

BARRICK RESOURCES (USA), INC.

August 8, 1990

DOGM
MINERALS PROGRAM
FILE COPY

Mr. Donald A. Ostler, P.E.
Executive Secretary
Utah Water Pollution Control Committee
P.O. Box 16690
Salt Lake City, Utah 84116-0690

Dear Mr. Ostler:

SUBJECT: Subsurface Water Quality Sampling
Quality Assurance (QA) and Quality Control (QC) Plan
for Dump Leach Area #3

Enclosed is the Quality Assurance project plan for our Dump Leach Area #3 which incorporates the changes in your July 31, 1990 letter. These changes have also been discussed with Loren Morten of your staff.

Please contact me should additional information be required.

Respectfully,

Glenn M. Eurick
Environmental Affairs Coordinator (USA)

GME/cg

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DAMES & MOORE
QUALITY ASSURANCE PROJECT PLAN

SUBSURFACE WATER QUALITY SAMPLING QUALITY ASSURANCE (QA) AND QUALITY CONTROL (QC) PLAN FOR DUMP LEACH AREA #3, FOR BARRICK MERCUR GOLD MINES, INC.

Approved by Project Quality Assurance Officer: Terry D. Vandell Date: 8/7/90

Terry D. Vandell

DAMES & MOORE JOB NO. 16550-002-031
SALT LAKE CITY, UTAH

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1.0 INTRODUCTION

This "Revised Quality Assurance Plan" presents the basic procedures for water quality investigations as referenced in the January 1990 Dames & Moore report "Ground Water Assessment For Dump Leach Area #3, Barrick Mercur Gold Mine, Utah," with modifications as requested by the State of Utah Department of Health Bureau of Water Pollution Control (BWPC), (March 20, 1990). This QA/QC Plan is to be implemented in accordance with the monitoring requirements as per the State of Utah Department of Health BWPC, Ground Water Quality Discharge Permit for Dump Leach #3 (June 1990).

2.0 PROJECT DESCRIPTION

2.1 PURPOSE

The specific objectives of this QA/QC plan for the subsurface water quality investigations are to:

1. Evaluate background ground water quality at Dump Leach Area #3.
2. Establish ground water protection levels at Dump Leach Area #3.
3. Establish ground water compliance monitoring collection and procedures for Dump Leach Area #3.

The specific activities that will be carried out to achieve the above objectives are:

1. Installation of deep and shallow monitor well(s) at Dump Leach Area #3.
2. Measurement of static ground water levels at all monitor well sites.
3. Completion and evaluation of aquifer pumping tests on all new monitor wells.
4. Collection and analysis of ground water quality samples from the new monitor wells twice per month for one year and on a quarterly basis thereafter, in accordance with this plan. Analytes are presented in Table D-1. Monitor well water quality data reporting frequency will be completed on a monthly basis for one year. A "Background Ground Water Quality Report" will be submitted within 30 days upon completion of the one year accelerated sampling period. Water quality data reports will be submitted to the BWPC on a quarterly basis thereafter and in accordance with the requirements of the Ground Water Quality Discharge Permit for Dump Leach #3.

3.0 PROJECT ORGANIZATION AND RESPONSIBILITY

3.1 ORGANIZATION

The organization for the activity is as follows:

Mr. Glenn M. Eurick
Project Manager (PM)
Barrick

Ms. Terry D. Vandell
Project Quality Assurance
Officer (PQAO)
Dames & Moore

Mr. Ralph R. Sacrison
Project Coordinator (PC)
Barrick

Mr. Loren Morten
Project Manager
State of Utah (UPM)

Mr. Dave P. Beatty
Water Quality Coordinator (WQC)
Barrick

3.2 RESPONSIBILITIES

The PM will have overall responsibility for direction of the project quality control and reporting, and will prepare QA plans for review.

The PM will be responsible for execution of the activity in accordance with the plan. The PM and the PQAO will review all data generated during the first year of the investigation and will be responsible for validating the data. The PM in conjunction with the PQAO, will prepare a data report each month and a final report within 30 days of the one year accelerated sampling period that addresses, for each compliance monitoring well, all of the data and the precision and accuracy of the monitoring data, the arithmetic mean and standard deviation of the required parameters listed in Table D-1, results of performance sample analyses, results of EPA/State audits, and any corrective actions taken pertinent to the project activity.

The PM and the PQAO will 1) review and approve the QA/QC plan, 2) review all quality control data and 3) identify problems and recommend corrective action as necessary. The PQAO will report directly to the PM.

The State of Utah Project Manager will be advised of any proposed changes to be made to this plan, and will advise Dames & Moore and Barrick of any comments or objections to this plan, its implementation or any proposed changes to the plan.

4.0 MONITOR WELL INSTALLATION

Two general types of monitor wells will be installed for this investigation: shallow and deep. Procedures for installing shallow and deep monitor wells will be similar, and will be constructed as presented in Appendix B of the January 1990 Dames & Moore report. Monitoring well construction will conform to the EPA RCRA Ground Water Monitoring Technical Enforcement Guidance Document (1980). Monitor well construction information (as required in the Ground Water Discharge Permit [June 1990]), has and will continue to be submitted to the BWPC.

5.0 ANALYTICAL PARAMETERS AND QA OBJECTIVES

Analytical parameters, their detection limits, methods of analysis and holding times are given in Table D-1. The required analytes (as defined by the BWPC in the Ground Water Quality Discharge Permit for Dump Leach #3) are designated by an asterisk. Specific conductance, temperature and pH will be measured in the field. Sample collection will proceed in the following order:

1. Total Metals
2. Dissolved Metals
3. Cyanides
4. Major Cations/Anions
5. Nitrate, Nitrite and Ammonia

Check analysis for pH and specific conductance will be run in the lab.

Chemical analysis will be performed by Chemtech of Murray, Utah, a laboratory certified by the Utah State Health Laboratory for the required parameters listed in Table D-1. The internal quality assurance program for this project will be in accordance with the State of Utah Department of Health protocol. Laboratory certification will be continuously monitored by Barrick by the Water Quality Coordinator.

Routine analysis of samples will be performed in accordance with standard EPA procedures; special analyses will be performed according to EPA methods for chemical analyses of water and wastes. Specific analytical methodologies and references are listed in Table D-1. These methodologies specify the documentation needed to complete and evaluate the data. They also define acceptable accuracy and precision criteria that must be set for the data to be judged valid. Accuracy is defined by the EPA as the percent recovery of a spiked sample. Laboratory matrix spikes are actual field samples spiked in the laboratory with a representative group from the list of required parameters as per Table D-1. One sample for alternate set of samples will be split for matrix spike analysis.

Precision is defined by the EPA as the relative percent difference of duplicate sample analysis of similar matrix. One duplicate sample will be required for alternate monitor sites on alternate sampling rounds. Only the required parameters as per Table D-1 will be analyzed in the laboratory.

If contaminant concentrations in a trip blank, to be submitted on alternate sampling rounds, are within one order of magnitude of the actual field sample, resampling will be required.

5.1 DATA QUALITY OBJECTIVES

The data collected as part of this investigation is intended for use by the State of Utah Project Manager (the State of Utah Department of Health, BWPC), and by Barrick and its consultants. Laboratory and field procedures have been selected to ensure a high confidence level in the analytical results based on precision, accuracy, representativeness, completeness, and comparability.

The quality control of field data will be managed by field supervisors and the project manager for each type of data as defined in this report. Field data will be compared to other data at the site for reasonableness. The historic data will also be assessed for accuracy during this process to evaluate consistency and compatibility of all data taken at the site. Data will be compared in the same area and/or at similar depths during this study to define if the results are reasonable and consistent. Unreasonable data points will be evaluated by technical personnel who will decide if retesting is required. Table D-1 presents the list of analytes for water quality samples with the laboratory analytical method shown for each analysis.

6.0 SAMPLING PROCEDURES

This section presents the water quality sampling method details for ground water plus water level and flow rate measurement methods.

6.1 GROUND WATER SAMPLING

6.1.1 WATER LEVEL MEASUREMENTS

Static water level measurements are to be made in all monitor wells during this investigation. Ground water level measurements are to be made with electrical resistivity instruments graduated in 0.1 foot increments. Before each measurement, the instrument probe is to be thoroughly washed with distilled water. Measurements are to be made to a standard reference point, usually the

top of the north side of the PVC casing, to the nearest 0.01 foot. Care will be taken to make sure that the water level measurement is reproducible. Ground water level elevation measurements relative to mean sea level will also be reported.

Measurements will be recorded on a standard field log as shown on Figure D-1 and transcribed to the on-site water level records.

6.1.2 CHEMICAL SAMPLES

Ground water samples for laboratory analyses will be collected following well development. Well development will continue until the water removed from the well is reasonably free of sand, silt and clay such that the well can be pumped without pump damage. If possible, the turbidity content should be less than 5 NTU. Field measurements and observation will be recorded in a bound notebook of field logs. Field log forms for MW-10 and MW-11 are shown on Figures D-2 and D-3.

Water level measurements will be made prior to sampling as specified above. The height of the column of water using the water level measurement and total depth of the well will be used to determine three casing volumes for evacuation. Estimated discharge rates and pumping durations to ensure the evacuation of three well casing volumes, without inducing air inflow into the pump, are presented in Table D-2.

Dedicated submersible pumps will be used on each of the deep wells. A stainless steel or teflon bailer, or a peristaltic pump with single-use teflon and silicon tubing may be used on the shallow well to evacuate the three casing volumes. Pumping and/or bailing shall be conducted to ensure that the upper portion (1 to 2 feet) of the static water column is evacuated. Pump discharge will be captured in a calibrated bucket to verify the evacuated volume.

Before purging begins at each well, field instruments for pH, specific conductivity, and temperature will be calibrated according to manufacturer's directions. Orion pH and conductivity meters, or their functional equivalents will be used. Calibration standards for pH will be selected which bracket the sample pH, if possible, and conductivity standards will be selected which are the same order of magnitude as sample conductivity. Instrument calibrations will be checked after sample collection and all calibration procedures will be documented on the sampling field log.

During evacuation of the three casing volumes, pH, conductivity and temperature measurements of ground water will be made at the beginning and just prior to final purging of the last casing volume. Monitor well evacuation will be complete after three casing volumes have been purged.

Ground water samples will be bottled directly from the discharge of the peristaltic pump. Samples for total metals will not be filtered and samples for dissolved trace metals will be filtered in the field immediately upon collection. A 0.45 micron filter will be used for filtering samples for dissolved metals analysis. An in-line, fiberglass pre-filter may also be used for excessively turbid samples. To prevent aeration of sample water, bottles will be filled with the tubing outlet just under the water surface in the bottle. Bottles will be properly labeled prior to filling, and stored on ice immediately after filling. Sample bottles of the appropriate size and with the required preservative, as per the EPA-RCRA Ground-Water Monitoring Enforcement Guidance Document (September 1986), will be obtained from the laboratory.

A dedicated submersible pump will be used for each deep well water evacuation. Pump discharge should be restricted so that drawdown does not exceed the depth to the top of pump. Any sampling equipment contacting water samples will be decontaminated prior to utilization at another site. Decontamination will include cleaning with a nonphosphate detergent/soap mixture, a rinse with 0.1 N HCl acid solution, a rinse with tap water and a final rinse with deionized or distilled water and a thorough air drying.

6.2 SAMPLE HANDLING

Sample containers will be placed out of direct sunlight, preserved, shipped and analyzed within the maximum allowable holding times as specified in Table D-1. Samples will be shipped to the laboratory as soon as possible, the same day as collection and within 2 hours of collection if filtering in the laboratory is required. These methods call for the use of various specific type containers, some predosed with preserving agents, refrigeration and analysis by the laboratory within the maximum holding times, as shown on Table D-1. All sample bottles will be supplied by the laboratory and will be in accordance with EPA guidance (September 1986).

7.0 SAMPLE CUSTODY

7.1 FIELD OPERATIONS

Documentation of field measurements and assuring the integrity of the sample from collection to data reporting are essential parts of the sample collection activity. Documentation of sample possession assures that it will be possible to trace the possession and handling of the samples from the time of collection through analysis and final disposition. This documentation of the history of the sample is referred to as chain-of-custody. The following records and actions will be taken.

1. Sample Labels - Sample labels are necessary to prevent misidentification of samples. The sample label or equivalent shown on Figure D-3 will be completely filled out and attached to each sample bottle before sample collection.

2. Field Sampling and Analysis Record - Pertinent field measurements and observations will be recorded. Equipment used to measure the field parameters shall be calibrated before the collection of each sample. To facilitate these records, the appropriate forms shown on Figures D-1 and D-2 will be filled out for each sample site. Documentation of the sources of buffers, standards, reagents, sample containers, etc., will be recorded on these forms.

3. Chain-of-Custody-Record - To establish the documentation necessary to trace sample possession from the time of collection, the chain-of-custody record as shown on Figure D-4 will be filled out in duplicate with one copy to accompany every sample shipment from the time of collection through receipt by the analytical laboratory. One copy of the form will be retained by the field sampler. The samples will be delivered to the laboratory for analysis as soon as possible, usually within one day after sampling. Maximum holding times are shown on Table D-1. Copies of the form sent to the laboratory with the samples will be returned to Barrick and Dames & Moore with the analytical results and will be included in the monthly and yearly reports.

4. Sample Seals - Will be placed on each sample container (e.g., each ice chest) to verify the integrity of the samples.

7.2 LABORATORY OPERATIONS

The analytical laboratory will acknowledge receipt of the samples by signing and dating in the appropriate box in the form shown on Figure D-4. This form will be returned to Barrick and to Dames & Moore with the analytical results.

The laboratory will maintain internal chain-of-custody control in accordance with protocol as per the Utah Department of Health.

8.0 CALIBRATION PROCEDURES AND FREQUENCY

8.1 GENERAL

Meters used to measure pH and specific conductance will be calibrated as outlined below prior to and during use. Source and identification (Lot No., etc.) of standards used to calibrate will be recorded on the form as presented in Figure D-2.

8.2 FIELD pH

Field pH is to be performed with the following:

Orion, Model SA-250, or equivalent.

This meter has automatic temperature correction.

Follow manufacturer's instructions for operation and standardization of instruments. Perform two-buffer standardization with buffers approximately 3 pH units apart and spanning the anticipated measurement values, if possible. The meter will be standardized prior to each sample collection and checked against the standard after each sample collection. However, if sample pH values vary widely, the meter will be restandardized with a buffer having a pH within 1 or 2 units of that sample.

Notes:

1. If oil gets on the electrodes, the electrodes shall be cleaned with methanol or hydrochloric acid (1 to 9), as necessary.

2. The pH electrode will be stored in pH 7 or pH 4 buffer, depending on the manufacturer's recommendations.

8.3 FIELD SPECIFIC CONDUCTANCE

Field specific conductance measurements are to be done with the following:

Orion, Model 124, or equivalent.

This meter automatically indicates specific conductance corrected to 25°C. Calibration is to be done before each sample measurement as per manufacturer's instructions.

8.4 TEMPERATURE

Temperature will be measured using the internal thermometer function of the pH meter or a good grade mercury-filled thermometer. Temperature should be reported to the nearest 1°C.

8.5 WATER LEVEL METERS

Water level measurements will be made with an electrical interface probe capable of accuracy to within 0.01 feet. This probe will be checked annually against a calibrated tape and will be repaired or recalibrated, if necessary, prior to reuse. Water levels will be recorded in the field on the form shown on Plate 6-1, along with all pertinent observations.

9.0 INTERNAL QUALITY CONTROL CHECKS

9.1 FIELD OPERATIONS

During alternate sampling events, at least one blind field ground water duplicate sample will be prepared and submitted to the laboratory. Splitting of water samples for duplications will be done by pumping waters through a "T" and simultaneously filling sample containers or by filling sample containers from the same stainless steel bucket from which the original sample was obtained.

One field (equipment) blank will also be collected per alternate sampling event. The field blank sample will be prepared by pumping distilled water through the peristaltic pumping system into sample containers or filling sample containers from the stainless steel bucket in the same manner as is done for a typical sample.

A trip blank for each one of the sampling bottles will be included for alternate sampling events. Each of these sample bottles will be prepared by the laboratory (filled with distilled water and appropriate preservatives) and be subjected to the same field conditions and laboratory analytical tests as required for the ground water samples.

9.2 LABORATORY OPERATIONS

The laboratory will conduct quality control checks in accordance with the State of Utah's certification requirements. This quality control check will include running at least 5 percent duplicate and spike samples. The laboratory will summarize the results of these quality control checks and submit them with the analytical results, to be included with each data report submitted to the State.

One ground water sample from alternate sampling events will be designated for laboratory matrix spike duplicate. Field personnel will ensure that sufficient sample material is provided to the laboratory and indicate on the chain-of-custody which sample is designated for the matrix spike.

10.0 DATA MANAGEMENT REDUCTION, VALIDATION AND REPORTING

All field data and chain-of-custody forms generated from sampling will be appropriately identified and included in each water quality data report. Standardized data collection forms will be used by all personnel collecting field data during the project. Standardized data forms will be used for laboratory data during this project. Use of such forms will enable consistent presentation of the data throughout the project.

Validation of all analytical data will be performed. Laboratories will be required to submit results which are supported by sufficient backup data and QA/QC results to enable the reviewer to determine the quality of the data. Validity of all data will be determined based on the precision and accuracy assessments outlined in Section 5.0 of this report. All data will be stored and maintained according to the procedures outlined.

Data will be processed through an orderly, easily traceable and logical sequence. Field data will be assessed for accuracy. Subsequent analysis, interpretation and reporting of results will be conducted by appropriate professional staff, using documents which are initialed and dated whenever necessary. Any calculations will be checked. All assumptions necessary for calculations will be approved by a senior professional within Dames & Moore. No results will be reported without the required supporting documentation and proper review.

11.0 AUDIT PROCEDURES

The PM and the PQAO will monitor and audit performance of the QA procedures outlined in this report. The PM will conduct random field and office audits which will assure that the information being gathered is reliable and of good quality. The PQAO will be a Dames & Moore employee to ensure independent evaluation and compliance with the QA procedures. The PQAO, an employee of the Salt Lake City staff of Dames & Moore, will report to the PM responsible for the project.

11.1 FIELD AUDITS

The PM will conduct unscheduled audits of field activities during each of the sampling events to evaluate the execution of sample identification, sample control, chain-of-custody procedures, field documentation, equipment calibration and sampling operations.

The evaluation is based on the extent to which the applicable standard operating procedures are being followed.

Field documents pertaining to sample identification and control will be examined for completeness and accuracy. Field notebooks will be reviewed to see that all entries are dated and signed and that the contents are legible, written in waterproof ink or pencil and contain accurate and inclusive documentation of

project activities. Because the field notebooks form the basis for reports, they will contain all measurements and observations.

The PM will also check to see that chain-of-custody procedures are being followed and that samples are being kept in secure custody at all times.

The PM will check to see that any field instruments which require calibration are current in their calibration status and that the calibration documents are traceable.

Sampling operations will be evaluated to determine if they are performed as stated in Section 6.0 or directed by the project manager. The proper number of samples will be collected at the assigned locations. The PM and PC will check to determine that the samples are in proper containers and are properly labeled and preserved. The PM and PC will also determine if the required field measurements and quality assurance checks are being performed and documented as directed.

11.2 OFFICE AUDITS

Once a field project has been completed, the individual files will be assembled, organized and securely stored. The documents will be examined to determine that all necessary items such as signatures, dates and project numbers are included. The PM will examine all documents and determine if they have been handled and stored in the proper manner. Such files will be maintained at Barrick Mercur Mine.

The PM will review product quality to assure that the project is being performed in accordance with approved quality assurance procedures. Prior to the production of the draft document, all work products will undergo review by the PQAO. This will include review of calculations, test analysis, graphs, tables, computer input/outputs and any document which involves generating information from the field data. These reviews will be documented.

12.0 CORRECTIVE ACTION

Corrective action will be undertaken if sample collection deficiencies or unreliable analytical results prevent QA objectives for the project from being met. The criteria for acceptable sample collection data are given in Section 5.0 and the laboratory's QA program provides the criteria for acceptable analytical results.

Analytical results supplied by the laboratory will have been subjected to the laboratory's QA plan and will be considered by the PM to be acceptable unless the results significantly contradict prior knowledge of the site conditions. When this situation occurs, the PM will request that the laboratory review the quality control documentation for the sample or analysis in question. Further corrective action will be based on the specific details of the situation.

The principal corrective action that will be required as a result of deficiencies in sample collection is resampling if one or more of the following problems occur:

1. Sample contamination due to sample collection errors which result in a sample unrepresentative of site conditions.
2. Loss of a sample in transit to the laboratory.
3. Violation of holding times for required parameters.
4. If the trip blank shows contaminant concentrations within one-order of magnitude of the original field sample.

Variation between duplicate analyses for trace metals or pH which are outside control limits will be evaluated by the PM, PQAO and by the UPM to determine if resampling may be required. Reanalysis may be substituted for resampling if the holding time has not expired and the sample condition is satisfactory.

A request for corrective action may be initiated by the PM, the PQAO or the UPM.

13.0 QA REPORTS

Water quality data reports will be submitted monthly and QA reports will be prepared quarterly, submitted in conjunction with water quality data reports, to the State of Utah Department of Health, UBWPC. Specifically, QA reports will address the following areas:

- Results of system and/or performance audits of sample collection activities.
- Summary of the laboratory QA report, including notation of QA modifiers.
- Listing and basis for any unacceptable data.
- Significant QA problems and recommended solutions.

The QA report will be prepared by the PQAO and the PM and distributed to the State of Utah UPM. The final report for the project will contain a separate QA section which will summarize the data quality information presented in each of the previous quarterly QA reports.

REFERENCES

Dames & Moore, September 1989. Seepage and Ground Water Assessment For Dump Leach Area #2, Barrick Mercur Gold Mine, Utah, For Barrick Resources (USA), Inc.

Dames & Moore, January 1990. Ground Water Assessment For Dump Leach Area #3, Barrick Mercur Gold Mine, Utah For Barrick Resources (USA), Inc.

State of Utah, Department of Health, March 20, 1990. "Written Notice to Apply For a Ground Water Discharge Permit: Tailings Pond" addressed to Mr. Eurick, signatory Don A. Ostler, Executive Secretary.

State of Utah, Department of Health, June 1990. Ground Water Quality Discharge Permit for Dump Leach #3, for Barick Resources (USA) Inc., Mercur Mine.

U.S. Environmental Protection Agency, September 1986. RCRA Ground-Water Monitoring Technical Enforcement Guidance Document, OSWER-9950.1.

TABLE D-1

WATER SAMPLE ANALYTES

Parameter	Units	Detection Limit	Methodology	Reference (See 1,2,3 and 4 below)	Maximum Holding Time
Major Ions					
* Sodium	mg/l	1.0	AAS	1-273.1	6 months
Phosphate as PO_4-P	mg/l	0.01	Digest Colorimetric	1-365.2	28 days
* Potassium	mg/l	1.0	AAS	1-258.1	6 months
* Calcium	mg/l	1.0	AAS	1-215.1	6 months
* Magnesium	mg/l	1.0	AAS	1-242.1	6 months
* Chloride	mg/l	0.5	Titrimetric	1-325.3	6 months
* Fluoride	mg/l	0.1	Colorimetric	1-340.1	28 days
* Sulfate	mg/l	5	Titrimetric	1-375.4	28 days
* Carbonate as CO_3 at pH 4.5	mg/l	1	Titrimetric	1-310.1;2-404	24 hours
Carbonate Alkalinity as $CaCO_3$ at pH 8.3	mg/l	5	Titrimetric	1-310.1;2-403	14 days
* Bicarbonate Alkalinity as HCO_3 at pH 4.5	mg/l	5	Titrimetric	1-310.1;2-403	14 days
Hardness as $CaCO_3$	mg/l	5	EDTA	1-130.2	48 hours
Hardness (non-carb) as $CaCO_3$	mg/l	5	EDTA	1-130.2	48 hours
Hardness (T) as $CaCO_3$	mg/l	5	EDTA	1-130.2	48 hours
Hydroxide as OH	mg/l	0	Calculation	2-403	48 hours
* Nitrate as N	mg/l	0.1	Colorimetric	2-352.1	24 hours
* Nitrite	Mg/l	0.005	Colorimetric	1-354.1	48 hours
* Total Cations	meq/l	0.1	Calculation	2-104C	-
Total Anions	meq/l	0.1	Calculation	2-104C	-
Difference	%	0.1	Calculation	2-104C	-
Trace Metals (D and T)[a]					
Aluminum	mg/l	0.1	AAS	1-202.1	6 months
* Ammonia as NH^3-N	mg/l	0.2	Electrode	1-350.3	28 days
* Arsenic	mg/l	0.01	Graphite Furnace	1-206.2	6 months
* Barium	mg/l	0.01	AAS	1-208.1	6 months
Boron	mg/l	0.05	Colorimetric	2-404-A	6 months
* Cadmium	mg/l	0.002	Graphite Furnace	1-213.2	6 months
* Chromium	mg/l	0.01	AAS	1-218.2	6 months
Chromium, hexavalent	mg/l	0.01	Colorimetric	1-218.4	24 hours
* Copper	mg/l	0.01	AAS	1-220.1	6 months
Cyanide (Free)	mg/l	0.002	Colorimetric	2-412C(ND)	14 days
* Cyanide (Total)	mg/l	0.002	Colorimetric	4-D2036-082A	14 days
* Cyanide (Weak Acid Dissociable)	mg/l	0.002	Colorimetric	4-D2036-082C	14 days
Gold	mg/l	0.01	AAS	1-231.1	6 months
Iron	mg/l	0.01	AAS	1-236.1	6 months
* Lead	mg/l	0.005	Graphite Furnace	1-239.2	6 months
Manganese	mg/l	0.01	AAS	1-243.1	6 months
* Mercury	mg/l	0.0002	Cold Vapor AAS	1-245.1;3-7470	6 months
* Magnesium	mg/l	0.1	AAS	1-242.1	6 months
* Nickel	mg/l	0.01	AAS	1-249.1	6 months
* Selenium	mg/l	0.002	Graphite Furnace	1-270.2	28 days
Silica as SiO_2	mg/l	0.1	Colorimetric	1-370.1	6 months
* Silver	mg/l	0.01	AAS	1-272.1	6 months
* Thallium	mg/l	0.01	AAS	1-279.1	6 months
* Zinc	mg/l	0.01	AAS	1-289.1	6 months
Other Parameters					
* pH (Field)	units	0.01	Meter	1-150.1;2-423;3-9040	Immediate
* Specific Conductance at 25°C (Field)	mhos/cm	1	Bridge	1-120.1;2-205;3-9050	28 days
* Total Dissolved Solids	mg/l	10	Gravimetric, 180°C	1-160.1;2-209B	7 days
Total Suspended Solids	mg/l	2	Gravimetric, 105°C	1-160.2	7 days
Turbidity	(ntu)units	0.1	Turbidimeter	1-180.1	24 hours
* Temperature (Field)	degrees	0.5	Glass Thermometer		Immediate

References

(1) "Methods for Chemical Analysis of Water and Wastes," EPA-600/4-79-020,EMSL, Cincinnati, March 1983.
(2) "Standard Methods for the Examination of Water and Wastewater," 16th Edition, APHA, 1985.
(3) "Test Methods for Evaluating Solid Waste," EPA Publication SW-846, 3rd Edition.
(4) "American Society of Testing Materials Book of Standards," Part 31.

Notes

Detection limits are limits which are the best achievable with the listed analytical method. Interferences in specific samples may result in a higher detection limit. Detection limits of 0.002 for the cyanides can be achieved by adjusting the sample volume and cell size of the spectrophotometer. A detection limit of 0.01 for nickel can be achieved by concentrating the samples. These methodologies have been approved by EPA.

a All water samples will be analyzed during year 1 for both dissolved (D) metals (0.45u filtered) and for total (T) metals (unfiltered, preparation method 3010 and 3020.

* Background Water Quality Parameters Required by the Ground Water Quality Discharge Permit for Dump Leach Area No. 3, Barrick Resources (USA) Inc.

AAS indicates Atomic Adsorption Spectroscopy
EDTA is Ethylenediamine Tetraacetate used in titrations
(ND) indicates no distillation

TABLE D-2

MONITOR WELL PUMPING PLAN FOR
GROUND WATER QUALITY SAMPLING AT BARRICK MERCUR MINE
DUMP LEACH AREA #3

Well Designation	Estimated Static Water Level (feet Below Measuring Point)	Well Depth (feet)	Pump Intake Depth (feet)	Estimated Pumping Rate (gpm)	Estimated Volume to be Removed (1,2) (gallons)	Estimated Pumping Time Required Prior To Sampling (minutes)
MW-10	721	1025	987	4	930	233
MW-11	733	870	840	3	420	140
MW-12	Dry	433	NA	NA	NA	NA

(1) Volume will vary according to static water level.

(2) Three (3) casing volumes should be removed.

(3) NA = Not Applicable at this time

BARRICK RESOURCES (USA), INC.
MERCUR MINE

ENVIRONMENTAL DEPARTMENT

MONITOR WELL
WATER LEVEL MEASUREMENT LOG

PROJECT:	DUMP LEACH AREA #3			PERSONNEL:	
WELL I.D.	DATE	TIME	REFERENCE POINT	DEPTH TO WATER	OBSERVATIONS
MW-10	___/___/___	___:___	Top of Casing North Edge El. =	_____.___ (Feet)	
MW-11	___/___/___	___:___	Top of Casing North Edge El. =	_____.___ (Feet)	
MW-12	___/___/___	___:___	Top of Casing North Edge El. =	_____.___ (Feet)	
	___/___/___	___:___		_____.___ (Feet)	
	___/___/___	___:___		_____.___ (Feet)	
	___/___/___	___:___		_____.___ (Feet)	
	___/___/___	___:___		_____.___ (Feet)	
	___/___/___	___:___		_____.___ (Feet)	

FIGURE D-1

BARRICK RESOURCES (USA), INC.
MERCUR MINE

ENVIRONMENTAL DEPARTMENT

FIELD LOG
GROUND WATER SAMPLING

Monitor Well I.D.: MW-10

Personnel: _____

Date: ____/____/____

Time Water To Surface: _____:_____

Time Pump On: ____:____

Pumping Rate: _____ gpm Time: ___:___
Pumping Rate: _____ gpm Time: ___:___
Pumping Rate: _____ gpm Time: ___:___
Pumping Rate: _____ gpm Time: ___:___

Time Pump Off: ____:____

Total Pumping Time: _____minutes

Volume Evacuated: _____ gallons

Average Pumping Rate: _____ gpm

Depth To Water: _____ ft.

Well Depth: 1025 ft.
Well Diameter: 5.0 inches

Required Pumping: (1025)-(Depth To Water) = Water Column
(0.13635)*(Water Column)*(7.48 gal/ft3) = Gal./1 Casing Volume
1 Casing Volume * 3 = Volume To Be Evacuated (Gallons)

Calculated Volume To Be Evacuated: _____ gallons
Calculated Total Pumping Time: _____ minutes

Water Appearance (Turbidity, Color, Odor, etc.) _____

pH Meter: Orion, Model SA-250 Serial No.: 7598
pH Calibration Std.: 4.0 Lot No.: _____ Expiration: ____/____/____
pH Calibration Std.: 7.0 Lot No.: 9086 Expiration: March, 1991
pH Calibration Std.: 10.0 Lot No.: 9100 Expiration: April, 1991

Specific Conductance Meter: Orion, Model 124 Serial No.: 9811090
SC Calibration Std.: _____ Lot No.: _____ Expiration: ____/____/____
SC Calibration Std.: _____ Lot No.: _____ Expiration: ____/____/____
SC Calibration Std.: _____ Lot No.: _____ Expiration: ____/____/____

Turbidity Meter: HACH, Model 16800 Serial No.: 1891
Turbidity Calibration Std.: 1.0 ntu Lot No.: 4163 Expiration: N/A
Turbidity Calibration Std.: 10 ntu Lot No.: 4163 Expiration: N/A
Turbidity Calibration Std.: 100 ntu Lot No.: 4163 Expiration: N/A

Total Dissolved Solids Meter: Orion, Model 124 Serial No.: 9811090

Temperature Meter: Orion, Model SA-250 Serial No.: 7598

Field Measurements:

Time	Vol. Evac	pH	Temp. (C)	Cond.	Turbidity	TDS	Comments

Calibration Checks:

pH: Standard: 4.0 Reads As: _____
Standard: 7.0 Reads As: _____
Standard: 10.0 Reads As: _____

SC: Standard: _____ Reads As: _____
Standard: _____ Reads As: _____
Standard: _____ Reads As: _____

Turbidity: Standard: 1.0 Reads As: _____
Standard: 10.0 Reads As: _____
Standard: 100.0 Reads As: _____

FIGURE D-2

BARRICK RESOURCES (USA), INC.
MERCUR MINE

ENVIRONMENTAL DEPARTMENT

FIELD LOG
GROUND WATER SAMPLING

Monitor Well I.D.: MW-11

Personnel: _____

Date: ____/____/____

Time Water To Surface: _____:_____

Time Pump On: ____:____

Pumping Rate: _____ gpm Time: ___:___
Pumping Rate: _____ gpm Time: ___:___
Pumping Rate: _____ gpm Time: ___:___
Pumping Rate: _____ gpm Time: ___:___

Time Pump Off: ____:____

Total Pumping Time: _____minutes

Volume Evacuated: _____ gallons

Average Pumping Rate: _____ gpm

Depth To Water: _____ ft.

Well Depth: 870 ft.
Well Diameter: 5.0 inches

Required Pumping: (870)-(Depth To Water) = Water Column
(0.13635)*(Water Column)*(7.48 gal/ft3) = Gal./1 Casing Volume
1 Casing Volume * 3 = Volume To Be Evacuated (Gallons)

Calculated Volume To Be Evacuated: _____ gallons
Calculated Total Pumping Time: _____ minutes

Water Appearance (Turbidity, Color, Odor, etc.) _____

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pH Meter: Orion, Model SA-250 Serial No.: 7598
pH Calibration Std.: 4.0 Lot No.: _____ Expiration: ___/___/___
pH Calibration Std.: 7.0 Lot No.: 9086 Expiration: March, 1991
pH Calibration Std.: 10.0 Lot No.: 9100 Expiration: April, 1991

Specific Conductance Meter: Orion, Model 124 Serial No.: 9811090
SC Calibration Std.: _____ Lot No.: _____ Expiration: ___/___/___
SC Calibration Std.: _____ Lot No.: _____ Expiration: ___/___/___
SC Calibration Std.: _____ Lot No.: _____ Expiration: ___/___/___

Turbidity Meter: HACH, Model 16800 Serial No.: 1891
Turbidity Calibration Std.: 1.0 ntu Lot No.: 4163 Expiration: N/A
Turbidity Calibration Std.: 10 ntu Lot No.: 4163 Expiration: N/A
Turbidity Calibration Std.: 100 ntu Lot No.: 4163 Expiration: N/A

Total Dissolved Solids Meter: Orion, Model 124 Serial No.: 9811090

Temperature Meter: Orion, Model SA-250 Serial No.: 7598

Field Measurements:

Time	Vol. Evac	pH	Temp. (C)	Cond.	Turbidity	TDS	Comments

Calibration Checks:

pH: Standard: 4.0 Reads As: _____
Standard: 7.0 Reads As: _____
Standard: 10.0 Reads As: _____

SC: Standard: _____ Reads As: _____
Standard: _____ Reads As: _____
Standard: _____ Reads As: _____

Turbidity: Standard: 1.0 Reads As: _____
Standard: 10.0 Reads As: _____
Standard: 100.0 Reads As: _____

FIGURE D-3

Company Name

Sample Description

Parameter

Date and Time

Sampler's Signature

Chemtech
6100 South
Stratler
Murray, UT 84107
(801) 262-7299

Preservative
(circle one)

Acid
Base
Filtered

FIGURE D-4

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OIL, GAS & MINING

CHEMTECH

CHEMICAL AND BACTERIOLOGICAL ANALYSES

6100 S STRATLER
MURRAY, UTAH 84107
(801) 262-7299

				SAMPLERS (Signature)			
Sample Number	Sample Location	Date	Time	Sample Type		Number of Containers	Analysis Required
				Comp.	Grab		

Relinquished by: (Signature)	Received by: (Signature)	Date/Time
Relinquished by: (Signature)	Received by: (Signature)	Date/Time
Relinquished by: (Signature)	Received by: (Signature)	Date/Time

Shipped by: (Signature)	Date/Time	Received for Laboratory by:	Date/Time

Method of Shipment:

FIGURE D-5