Summary of Investigation of Groundwater Conditions at 36-06 KD and 36-07 KD

Ambrosia Lake, McKinley County, New Mexico

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EXECUTIVE SUMMARY

This report presents the results of data collection and analysis of well construction, hydrogeologic conditions, and groundwater quality differences between two Dakota Sandstone (Dakota) wells, 36-06 KD and 36-07 KD. Data were collected and evaluated following the data quality objective goals presented below and in **Table 1**.

1. Evaluate the condition of 36-06 KD and 36-07 KD well casing and screen.
2. Understand the relationship between the screened interval, filter pack interval, and stratigraphy of 36-06 KD and 36-07 KD.
3. Determine whether 36-06 KD and 36-07 KD are hydraulically connected.
4. Characterize incrustation mineralogy.
5. Identify potential sources for water in 36-06 KD and 36-07 KD.

Several lines of evidence were used to evaluate the conditions of the two Dakota wells and whether water from 36-06 KD is representative of the surrounding Dakota aquifer. Geophysical data collected from both wells indicate that the lithology is in agreement between the two locations. Similar well construction allows for sampling of the same saturated zone. A gamma spike within the extended sand pack of 36-06 KD could indicate the presence of radiologically elevated material that may have contributed water to 36-06 KD. The 36-07 KD well construction does not include an extended sand pack, and the gamma log for 36-07 KD did not indicate the presence of elevated radiological material in the upper Dakota.

Downhole camera footage shows a mineral incrustation that covers the screened interval of 36-06 KD. This observation, along with aquifer testing and analytical chemistry data, indicate that well 36-06 KD is not hydraulically connected to the Dakota aquifer and therefore samples from 36-06 KD are not representative of the Dakota aquifer.

Geochemical modeling of mixing scenarios provide insight into the potential sources and conditions that might contribute to the water quality conditions and formation of the incrustations observed in 36-06 KD. Conditions in 36-06 KD appear to be localized, unique, and not representative of Dakota aquifer water levels or chemistry. Further investigation of 36-06 KD is not likely to result in significant changes to the larger conceptual site model and understanding of sources or pathways in the Dakota.

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ACRONYMS AND ABBREVIATIONS

ACL	Alternate Concentration Limit
amsl	above mean sea level
bgs	below ground surface
btoc	below top of casing
CAP	Corrective Action Plan
Century	Century Wireline Services
Dakota	Dakota Sandstone
DQO	data quality objective
DTW	depth-to-water
ft	foot/feet
GPS	Groundwater Protection Standard
H3	H3 Environmental
IAP	Ion Activity Product
INTERA	INTERA Incorporated
L/min	liters per minute
Mancos	Mancos Shale
MDL	method detection limit
mg/L	milligrams per liter
ORP	oxidation-reduction potential
POC	point of compliance
PVC	polyvinyl chloride
Q3	third quarter
RAML	Rio Algom Mining LLC
s.u.	standard pH units
SOP	Standard Operating Procedure
Site	Rio Algom Mining LLC Ambrosia Lake West Facility
SSHASP	Site-Specific Health and Safety Plan
TDS	total dissolved solids
the License	Source Materials License SUA-1473
Westwater	Westwater Member of the Morrison Formation
XRD	x-ray diffraction

1.0 INTRODUCTION

INTERA Incorporated (INTERA) completed a field data collection program at the Rio Algom Mining LLC (RAML) Ambrosia Lake West Facility (Site) to better understand the differences in groundwater conditions between monitoring wells 36-06 KD and 36-07 KD and to determine whether representative groundwater samples can be obtained from 36-06 KD. The data collection effort was driven by the data quality objectives (DQOs) summarized below:

- Goal 1: Evaluate the condition of 36-06 KD and 36-07 KD well casing and screen.
- Goal 2: Understand the relationship between the screened interval, filter pack interval, and stratigraphy of 36-06 KD and 36-07 KD.
- Goal 3: Determine whether 36-06 KD and 36-07 KD are hydraulically connected.
- Goal 4: Characterize incrustation mineralogy.
- Goal 5: Identify potential sources for water in 36-06 KD and 36-07 KD.

This report summarizes the methods and presents the result of the field investigations and data analysis completed to achieve these objectives.

1.1 36-06 KD History

Monitoring well 36-06 KD was installed in 1988 and is part of the Dakota Sandstone (Dakota) monitoring well network (**Figure 1**) defined in Source Materials License SUA-1473 (the License). 36-06 KD is the point of compliance (POC) well for the Dakota (NRC, 2006) and is the nearest Dakota monitoring well to the former unlined Ponds 7 and 8. Groundwater conditions at 36-06 KD include low pH and frequent exceedances of beryllium (2006-Present) and cadmium (2007-2016) relative to the License groundwater protection standards (GPSs). Groundwater quality in 36-06 KD has been attributed to migration of constituents from unlined former evaporation Ponds 7 and 8 (NRC, 2006). 36-06 KD groundwater quality has changed little since well installation, but it has recently become apparent that 36-06 KD is likely not representative of Dakota water quality in general. Measurements of pH in groundwater from 36-06 KD have been acidic since the well was installed in 1988, with the highest measurements recorded at 5.5 standard pH units (s.u.) in 1996-1997 and the lowest pH measurements around 3 s.u. from 2017-2020 (**Figure 2**). Beryllium and cadmium concentrations were highest when the well was initially installed. Concentrations of cadmium have been below the GPS since December 2016. Beryllium concentrations fluctuate and have been greater than the GPS since August 2020. Monitoring well 36-06 KD is slow to recharge (see Section 3.3) and produces groundwater samples that are rust colored.

As part of the *Data Collection Work Plan in Support of Alternate Concentration Limits* (ACLs) (INTERA, 2017), a second monitoring well, 36-07 KD, was installed approximately 20 feet (ft)

from 36-06 KD to confirm whether conditions in 36-06 KD are representative of Dakota groundwater quality in that area. After an eight-quarter stabilization period following the installation of 36-07 KD, there remain significant differences in groundwater quality and elevation between 36-06 KD and 36-07 KD (**Figure 3**). Groundwater collected from 36-07 KD is near-neutral pH and does not contain concentrations of beryllium and cadmium greater than their respective GPSs. The groundwater elevation in 36-07 KD was approximately 10 ft lower than 36-06 KD in December 2021.

36-06 KD was redeveloped on July 29 and August 1, 2020, with the goal of improving communication with the Dakota aquifer and removing sediment from the bottom of the well in advance of aquifer testing that was planned for the third quarter (Q3) 2020. Redevelopment methods included bailing to remove sediment and water from the well, brushing to remove incrustation from the screen, and surging to draw water and sediment into the well. Redevelopment resulted in removal of about 3 ft of sediment from the well, minor incrustation removal, a 10-ft increase in the static water level, and minimal improvement in communication with the aquifer as inferred from continued slow recharge rates after redevelopment. Recharge into the well remained slow after development (Section 3.3), as almost no recharge was observed during subsequent aquifer testing in 2021. Aquifer testing was not performed at 36-06 KD in 2020 due to the insufficient improvement in the recharge rate after redevelopment. The observed changes in water quality and groundwater elevation prompted additional investigation of the condition of well 36-06 KD, resulting in this report.

1.2 Dakota Sandstone Conceptual Site Model

The Dakota overlies the Morrison Formation throughout the San Juan Basin. It consists of a basal section of sandstone and conglomeratic sandstone overlain by a middle section of siltstone, shale, and lenticular sandstone beds, and an upper section of fine-grained sandstone interbedded with shale (INTERA, 2017). The Dakota ranges from 100 to 300 ft thick in the Ambrosia Lake area. Regional groundwater flow is generally down-dip to the north-northeast.

Numerous faults have been mapped in the Ambrosia Lake area (Santos and Thaden, 1966; Thaden et al., 1967), including one fault approximately mapped between Ponds 7 and 8 (**Figure 1**). Faults are generally north-south trending and documented vertical offsets for most faults range from 5 to 85 ft (Santos and Thadden, 1966; Brod and Stone, 1981; Willard Owens Assoc., 1975). There is no evidence that faults strongly influence groundwater flow in the Ambrosia Lake area.

The Dakota outcrops to the southwest of the former mill site and subcrops beneath the alluvium in the vicinity of the former Ponds 7 and 8 (**Figure 1**). Ponds 7 and 8 were in operation from 1961 to 1983 and reclaimed between 1986 and 1994. The Bedrock Corrective Action Plan (CAP) and Alternative Concentration Limit (ACL) Application (AVM and AVA, 2000) identify former Ponds

7 and 8 as the likely source of constituents detected in groundwater at 36-06 KD via drainage into subcrop of the Dakota beneath the alluvium. However, historical monitoring well 1-01 KD was installed near Ponds 7 and 8 over Dakota subcrop (**Figure 1**) and remained dry over its entire period of record (1972-2005). This suggests that the alluvium may not have contributed to the Dakota through the subcrop in the vicinity of 1-01 KD as it never contained groundwater. However, there is some uncertainty as 1-01 KD is slightly upgradient of Ponds 7 and 8 and could remain dry even if the Dakota is receiving seepage closer to Ponds 7 and 8.

2.0 METHODOLOGY

Field activities were conducted as described below and in accordance with INTERA's Site-Specific Health and Safety Plan (SSHASP) and RAML safety protocols. Sampling and analysis procedures are defined by ESP-007 Standard Operating Procedure, Groundwater Sampling, Rev. 48, April 2021 (SOP) (Rio Algom Mining LLC, 2021). Field activities were documented in the field logbook (**Appendix A)** and on field forms (**Appendix B**) when applicable.

2.1 Downhole Camera Inspections (Goal #1)

On May 13, 2021, Century Wireline Services (Century) deployed an optical camera down 36-06 KD and 36-07 KD to provide visual inspections of the monitoring well interiors while they were acquiring the geophysical data in these wells. The dedicated bladder pumps and associated tubing were removed from 36-06 KD and 36-07 KD prior to collecting the optical camera footage. The camera equipment and wireline were decontaminated after use in each monitoring well and were scanned in and out of the Site by H3 Environmental (H3) personnel. Images from the downhole camera inspection are provided on **Figure 4** and **Figure 5** and discussed in Section 3.1.

2.2 Wireline Geophysics (Goal #2)

On May 13, 2021, Century acquired gamma, neutron, density, and electric induction geophysical data at 36-06 KD (**Appendix C: Photograph 1**) and 36-07 KD. The dedicated bladder pumps and associated tubing were removed from 36-06 KD and 36-07 KD prior to collecting the geophysical data. The geophysical tooling and wireline were decontaminated after use in each monitoring well and were scanned in and out of the Site by H3 personnel (**Appendix C: Photograph 2**).

The gamma logs were acquired to compare stratigraphic and lithologic facies elevations between 36-06 KD and 36-07 KD. The neutron logs were collected to evaluate the presence of groundwater within lithologic intervals of the monitoring well boring. The density logs were obtained to assess the monitoring well design and condition of the sand pack at 36-06 KD and 36-07 KD. The electric induction logs were collected to complement the gamma logs for lithologic facies evaluation. Wireline geophysical results are provided in **Figure 6** and **Figure 7** and discussed in Section 3.2.

2.3 Aquifer Test Analysis (Goal #3)

The aquifer test performed under this scope of work included:

- Installing transducers in 36-06 KD and 36-07 KD.
- Verifying transducer readings with manual water level measurements.
- Purging 36-06 KD with the dedicated bladder pump.

- Monitoring groundwater quality parameters of 36-06 KD purge water.
- Allowing for water column recovery in 36-06 KD.
- Retrieving the transducer data and equipment from both wells.

36-06 KD was actively pumped for this aquifer test and the transducer data captured the drawdown and recovery curve for 36-06 KD. 36-07 KD was the observation well for this aquifer test, and the transducer data acquired from 36-07 KD was collected to identify potential responses to pumping at 36-06 KD. All purge water was containerized and placed in on-site open-top frac tanks.

A Grundfos Redi-Flo submersible pump was planned to be used to purge groundwater from 36-06 KD to perform a step and a constant-rate pumping test. Because groundwater recovery rates at 36-06 KD are much lower than the minimum flow requirements of Grundfos Redi-Flo submersible pumps, INTERA staff opted to use the existing dedicated bladder pump at 36-06 KD for the aquifer testing. No step test was performed at 36-06 KD due to the rapid drawdown of the water column under slow pumping conditions.

The aquifer test was attempted on June 8 and 14, 2021, though it was unsuccessful due to mechanical issues in the field. The aquifer test was performed on June 16, 2021. Groundwater from 36-06 KD was pumped until there was insufficient water in the well to fill the bladder pump. Transducers were left in the monitoring wells to continue recording recovery data until they were retrieved on June 28, 2021. Groundwater purged from 36-06 KD was containerized in 5-gallon buckets and then transported and transferred to the open-top frac tank on-site.

The transducers installed in 36-06 KD and in 36-07 KD collected data in 1-minute intervals from June 8 to June 28. The transducer installed in 36-06 KD was attached to the top of the dedicated bladder pump using electrical tape, and the base of the transducer (reference point for measurements) was positioned directly above the top of the pump to avoid potential interference with the intake located at the base of the pump. The transducer installed in 36-07 KD was attached to the bottom of the dedicated bladder pump using electrical tape, and the base of the transducer was installed flush with the base of the pump. Prior to purging 36-06 KD, the transducer installation depths and water column height readings at both wells were verified against the known pump depths and manual depth-to-water (DTW) measurements, respectively.

On June 28, 2021, after allowing 12 days for the water column in 36-06 KD to recover, the transducers were retrieved from 36-06 KD and 36-07 KD and data were downloaded. The rental transducers and associated cable were decontaminated and scanned out by H3 personnel prior to return shipment. The recovery curve data from 36-06 KD was then analyzed in the aquifer test analysis program nSIGHTS (n-dimensional Statistical Inverse Graphical Hydraulic Simulator) to estimate the hydraulic conductivity at 36-06 KD. A summary of regional and site-specific

hydraulic conductivity estimates within the Dakota is provided in **Table 2** and discussed in Section 3.3.

2.4 Geochemical Modeling (Goal #4/5)

Geochemical models were used to identify potential incrustation mineral phases, evaluate potential groundwater mixing scenarios, and model changes to groundwater quality resulting from simulated precipitation of incrustation minerals. Models were run using the "Geochemist's Spreadsheet," "SpecE8," and "React" modules of Geochemist's Workbench 11 and the MINTEQ thermodynamic database.

The approach to geochemical modeling is listed below:

1. Identify and select potential endmember samples for mixing analysis.
2. Model mixing between potential endmember samples.
3. Identify potential incrustation minerals through calculation of saturation indices for endmembers and modeled mixtures.
4. Model changes to groundwater chemistry due to precipitation of potential incrustation minerals on endmembers and modeled mixtures.
5. Compare modeled groundwater samples to measured 36-06 KD groundwater chemistry.

Details about the geochemical modeling process are provided below.

2.4.1 Analytical Data Selection for Modeling

Samples representing potential mixing endmembers were selected for modeling. As a recently installed well in good condition, and solely for the purposes of this investigation, water from 36-07 KD was assumed to be representative of Dakota groundwater near former unlined Ponds 7 and 8. Water from historical Pond 1 and current Cell 1 were selected as proxies for water from former unlined Ponds 7 and 8, as analytical data for former Ponds 7 and 8 have not been identified (**Figure 1**). The historical Pond 1 is contained within the footprint of the existing Cell 1, as the tailings impoundment cell was built from closure of Pond 1. Historical pond water quality from Pond 1 (Bostick, 1985) collected in 1981 was selected as a potential proxy source solution because Ponds 7 and 8 were used as evaporation ponds for decanted solutions from Ponds 1 and 2 (AVM and AHA, 2000), suggesting that water from Ponds 7 and 8 may have been chemically similar to water from Pond 1. The oxidation reduction potential (ORP) for Pond 1 was not defined in Bostick (1985) and was taken from Longmire (1983).

Additionally, a recent sample from open-hole piezometer in Cell 1 (TBH-2Z) was selected as a potential proxy for Pond 7 and Pond 8 water. Of the tailings monitoring locations, TBH-2Z was chosen as a proxy because it has the lowest pH and highest total dissolved solids (TDS)

concentration of the existing tailings monitoring locations. Two samples from 36-06 KD, one pre-redevelopment and the other post-redevelopment, were selected for comparison to the model results. The 36-06 KD samples are not selected as endmembers but are presented for comparison to the results of mixing models.

Analytical data inputs for modeling were limited to parameters which were frequently detected across the sample set used for this evaluation. Parameters which were not detected across the sample set were removed from the data set for modeling, and parameters which were generally detected were retained. Any non-detects remaining in the data set were defined as the method detection limit (MDL). Precipitation models were charge balanced on calcium as needed, based on the assumption that some amount of $CaCO_3$ or $CaSO_4$ is or was present in each unit or source. Saturation index models did not require any charge balance adjustments.

2.4.2 Groundwater Mixing Models

Two simple geochemical models were developed to test a hypothesis that mixing of pond water with Dakota water could produce conditions similar to those observed in 36-06 KD. In this hypothesis, waters from Pond 1 or Cell 1 are potential historical or current tailings source endmembers, respectively, while 36-07 KD reflects Dakota groundwater near Ponds 7 and 8. Geochemical models allow for mixing of Dakota water, represented by 36-07 KD, and two potential tailings sources, represented by either Cell 1 or historical Pond 1 data, followed by precipitation of iron mineral phases. The composition of each groundwater is presented in **Table 3**. Two 36-06 KD samples are presented for comparison: one sample from 2017 collected prior to well redevelopment in 2020, and the sample from June 2021 collected after both well redevelopment and aquifer testing.

Note that the precipitation models and associated tables are intended as a proof of concept to highlight trends in increasing or decreasing pH, alkalinity, and iron concentration as a result of mixing and mineral precipitation. The objective is to determine whether these processes can produce groundwaters more like 36-06 KD, but not to produce the exact values observed at 36-06 KD.

2.4.3 Saturation Indices

As discussed in Section 2.6, sufficient mass of incrustation could not be collected for laboratory x-ray diffraction (XRD) analysis. As a substitute for the results of XRD analysis of incrustation samples, mineral saturation indices were calculated for samples from 36-06 KD, 36-07 KD, and the products of the mixing models to identify which minerals may reasonably be expected to precipitate and encrust the well screen at 36-06 KD and 36-07 KD. Saturation indices are a ratio of the amount of dissolved mineral (the Ion Activity Product [IAP]) over the amount of dissolved mineral expected at equilibrium (the equilibrium constant [K_{sp}]) represented by **Equation 1**.

$$SI = log_{10}(^{IAP}/_{K_{sp}}) \qquad \text{Equation 1}$$

Saturation indices provide a theoretical quantification for whether a mineral is thermodynamically favored to precipitate or dissolve under the given conditions. A saturation index of 0 indicates the mineral and solution are at equilibrium, i.e., the water is saturated with respect to the mineral; negative values indicate the mineral is undersaturated in water and would be expected to dissolve; and positive values indicate the mineral is supersaturated in water and would be expected to precipitate. Note that modeled saturation indices between 1 and -1 may be considered approximately in equilibrium, or saturated, for the purposes of this report due to the inherent uncertainties of geochemical modeling and thermodynamic data. Saturation indices indicate whether a reaction is thermodynamically favored to occur, but do not provide proof that the reaction will occur or that the mineral is present. Kinetic constraints often inhibit mineral precipitation, even when the saturation index indicates mineral supersaturation.

2.4.4 Precipitation Models

Precipitation models are used to determine whether precipitation of scale minerals could be a potential contributor to the geochemical conditions observed at 36-06 KD. Evolution of groundwater quality was modeled by allowing the precipitation of a single supersaturated mineral phase from groundwater or mixing model products and comparing the initial and post-precipitation groundwater quality. Selected mineral phases for precipitation models were identified through the calculation of saturation indices. These models assume precipitation of either ferrihydrite or K-jarosite. Precipitation of these common iron oxide and oxyhydroxide minerals can be responsible for acidifying groundwater through hydrolysis reactions, where reaction between water and iron releases H^+ to solution. Examples of precipitation reactions for these minerals are presented below. Note that each reaction produces several moles of H^+ per mole of iron.

Ferrihydrite: $Fe^{3+} + 3\ H_2O = Fe(OH)_3(s) + 3\ H^+$ Equation 2

K-Jarosite: $3\ Fe^{3+} + 6\ H_2O + K^+ + 2\ SO_4^{2-} = KFe_3(SO_4)_2(OH)_6\ (s) + 6\ H^+$ Equation 3

Hydrolysis reactions are not unique to these iron minerals and could occur during precipitation of many metal oxyhydroxide phases. These particular minerals were selected because they are often supersaturated in these wells, are ubiquitous in both natural and mill/mine settings and are representative of many of the iron minerals that would be expected to precipitate. Ferrihydrite is commonly observed as a precipitant from circum-neutral waters, while K-jarosite is commonly observed as a precipitant from low-pH waters in both natural and anthropogenic sources of acid rock drainage. Precipitation of a number of generally supersaturated iron oxyhydroxide phases were modeled, and the system is largely insensitive to which mineral is selected.

ORP potential is fixed in all precipitation models. Fixing the ORP forces the ORP value to remain oxidizing while running precipitation models without needing to define the array of concurrent oxidation-reduction reactions or buffers that may exist. The tailings sources at Ambrosia Lake are all oxidizing, as are the modeled sample mixtures, so the fixed ORP potential is reflective of the oxidizing conditions observed on site.

2.5 36-06 KD Groundwater Sampling (Goal #5)

A groundwater sample was collected from 36-06 KD after the aquifer test was completed to provide a sample of recently recharged groundwater for comparison of site data to the results of geochemical models. Routine groundwater monitoring samples represent relatively stagnant groundwater in this very slowly recharging well. The sample was collected from 36-06 KD after retrieving the transducer on June 28, 2021. 36-06 KD was sampled per the methods defined in the SOP (RAML, 2021). The 36-06 KD groundwater samples were sent to ACZ Laboratories for wet chemistry, carbonate chemistry, radiochemistry, and metal analysis. See the laboratory report for the complete list of analytes tested for in the 36-06 KD groundwater samples (**Appendix D**).

2.6 Deviations from the Work Plan

INTERA personnel had planned to rent a downhole camera and collect footage in wells 36-06 KD, 36-07 KD, and 36-08 TRA. Well scoping was instead performed by the wireline geophysics contractor during logging of wells 36-06 KD and 36-07 KD.

During the May monthly groundwater sampling event and during the aquifer test associated with this scope of work, INTERA field staff attempted to collect incrustations directly from the bladder pump and by straining purge water; however, there was insufficient accumulation of incrustation mass required for XRD analysis. Calculations of saturation indices were used to identify potential incrustation minerals in lieu of XRD analysis of an incrustation sample as discussed in Section 2.4.3.

3.0 RESULTS

3.1 Downhole Camera Inspections (Goal #1)

Downhole camera inspections within 36-06 KD and 36-07 KD were completed to visually assess the interior condition of the casing and the screened interval of the wells. No structural damage was observed in either well. Within the submerged sections of the wells, 36-07 KD has no apparent fouling or precipitation of incrustations and 36-06 KD is completely coated with incrustations (**Figure 4**). Directly above the water table of 36-07 KD, orange-red staining is present on approximately 10% of the screen (**Figure 5**). Directly above the current water table of 36-06 KD, incrustations are precipitated on 98% of the screened interval and the slotted texture of the screen is not identifiable (**Figure 5**).

3.2 Wireline Geophysics (Goal #2)

Gamma, neutron, density, and electric induction (i.e., resistivity and conductivity) geophysical data were acquired at 36-06 KD and 36-07 KD to assess the hydrogeologic conditions and monitoring well design at both wells. The geophysical logs provided by Century are included as **Appendix E**.

3.2.1 Gamma, Conductivity, and Resistivity

The gamma, conductivity, and resistivity data allow for comparison of the subsurface stratigraphy and lithologic facies at 36-06 KD and 36-07 KD. **Figure 6** shows the 36-07 KD stratigraphy (**Appendix F**) and the gamma, conductivity, and resistivity data for 36-07 KD and 36-06 KD. Each data type (e.g., gamma) from the two monitoring wells are displayed at the same scale. The gamma and conductivity data trend left in coarser-grained lithology (e.g., sandstone) and trend right in finer-grained lithology (e.g., shale). Since resistivity is the reciprocal of conductivity, the resistivity data has the opposite trend of the conductivity data. The 36-06 KD conductivity and resistivity data above 105 ft below ground surface (bgs) are not representative of the formation because permanent steel casing is installed to that depth (**Appendix F**); however, these data confirm the presence of steel casing down to 105 ft bgs at 36-06 KD (**Figure 6**).

The gamma, conductivity, and resistivity data suggest that the stratigraphy is not offset between 36-06 KD and 36-07 KD. Subsurface stratigraphic transitions at 36-06 KD and 36-07 KD are at approximately the same elevation. For example, the top of the Tres Hermanos A (TRA) is at approximately 6,975 ft above mean sea level (amsl) at both well locations, which is identifiable at **Item A** on **Figure 6** in the gamma logs. Although there is some variation in the finer details of these data, the presence and elevations of lithologic facies are in good agreement between the two wells. The largest difference in the data between these two wells is the high gamma peak in 36-06 KD at about 6,905 ft amsl at the top of the Dakota (**Item B**). Although there is a gamma peak in

the 36-07 KD dataset at that same elevation, it is smaller. These small peaks are attributable to lenses of organic material in the upper Dakota, whereas the large gamma peak at 36-06 KD probably is not.

The large gamma peak from 36-06 KD suggests an increased concentration of gamma-emitting elements such as potassium, uranium, and thorium and their daughters in that area. If these elements are present in the formation, it is not clear whether they would be present in the Dakota in solution, as a sorbed phase, or as a solid mineral phase. However, the neutron and density logs are not indicative of a significant water column, suggesting that either (1) they are present in a solid or sorbed phase or (2) any water column in the upper Dakota is thin. Alternatively, the gamma peak could result from material present in the annular space, including naturally occurring radioactive material in the bentonite seal or material introduced into the borehole during well construction.

3.2.2 Neutron and Density

The neutron tool detects hydrogen atoms and can provide information about the moisture content in a lithologic interval, effectively detecting water or hydrated minerals. High hydrogen concentrations will result in low neutron counts and will trend left on the neutron log, while low hydrogen concentrations will result in high neutron counts and trend right. The density tool indicates the apparent density of a material and trends right (low counts per second) in materials with higher density and trends left in materials with lower density. **Figure 7** shows the 36-07 KD stratigraphy, which is the same as at 36-06 KD (see Section 3.2.1), as well as the monitoring well design, DTW, gamma, neutron, and density data for 36-06 KD and 36-07 KD. Each data type (e.g., gamma) from the two monitoring well locations is displayed at the same scale.

In general, the neutron data are in good agreement between the two wells (**Figure 7**). Both neutron curves show a high hydrogen concentration (left peak) at the top of the water column of each well. With two exceptions at 36-07 KD and one at 36-06 KD, the neutron curves show minor variation from ground surface down through the cement, grout, and bentonite seal of the monitoring well design and show most variation within the sand pack intervals of the wells. In 36-07 KD, the uppermost right peak (low hydrogen concentration; **Item C**) is located at the base of the alluvium and correlates with a left peak (low density) in the density curve, which is suggestive of a thin void in the cemented annulus at 36-07 KD. The second right peak in 36-07 KD that is above the sand pack interval coincides with the top of the TRA (**Item D)**. At 36-06 KD, minor variation in the neutron curve (**Item E**) extends about 5 ft below the base of the bentonite seal, which could indicate that the bentonite seal extends down deeper than is reported on the boring log of 36-06 KD (**Appendix F**), there may be a signal from the base of the Mancos Shale (Mancos), or some small amount of water is present. The neutron curves within the sand pack intervals and above the water column at 36-06 KD and 36-07 KD show similar trends, with the lowest hydrogen

concentrations detected from approximately 6,860 to 6,880 ft amsl. There are no peaks in the neutron data that suggest with confidence that there is groundwater present anywhere other than within the observed water columns at both wells. However, there is a small neutron low at the top of the Dakota in 36-07 KD, at roughly the same elevation as the 36-06 KD gamma peak, immediately below that neutron low is a neutron peak, which is also at a similar elevation to the gamma ray spike. Both a neutron low and a neutron high correspond with the gamma ray peak.

The density curve in 36-07 KD identified a void in the cement just below the alluvium and shows little variation below that until the water column is reached, as indicated by **Item C** on **Figure 7**. The density curve in 36-06 KD does not reveal any significant voids in the monitoring well construction but overall shows more apparent density variation than the density log of 36-07 KD. There is a slight decrease in the density co-located with the gamma peak at 36-06 KD, suggesting that whatever is causing the shift in the gamma log has a distinct density value from the lithology above and below. This could be due to material in the annular space or some other structural issue. This observation (a decrease in relative density) is inconsistent with a potential thin saturated zone at this elevation.

3.3 Aquifer Test Analysis (Goal #3)

Transducers were installed in 36-06 KD and 36-07 KD on June 8, 2021, during the first aquifer test attempt. During this event, 4.0 L of groundwater were purged from 36-06 KD in total at an average rate of 0.13 L/min before the bladder in the pump failed, yielding 1.69 ft of drawdown. Due to mechanical issues with the bladder pump at 36-06 KD, INTERA field staff attempted to perform this aquifer test on two occasions before successfully completing this task. The field forms for all three of these events are included in **Appendix C**.

During the second aquifer test attempt on June 14, 2021, approximately 2.5 L of groundwater were purged from 36-06 KD. The water column drawdown from this brief pumping event is shown on **Figure 8.** Prior to pumping, the DTW was measured at 186.37 ft below top of casing (btoc), which is 0.41 ft lower than the initial DTW measurement taken on June 8, 2021. This suggests that 36-06 KD was still recovering after pumping 4.0 L of groundwater 7 days prior.

On June 16, 2021, 36-06 KD was pumped at an average rate of 0.40 L/min. After purging a total of 22.25 L of groundwater, the water column dropped below the transducer located at the top of the bladder pump at 194.6 ft btoc, and shortly thereafter there was insufficient groundwater within the well to continue pumping. The initial DTW prior to the June 16 test was measured at 186.49 ft btoc, which indicates that the water level in 36-06 KD had not fully recovered to the static water level before the June 8 pumping event, but was comparable to the static water level before the June 14 pumping event began (**Figure 8**). The measured DTW at the end of pumping was 195.30 ft btoc, which is 8.81 ft below the initial DTW prior to pumping and represents 22.03 L of purged

water. 36-06 KD produced a measured 22.25 L of total purged groundwater during aquifer testing, suggesting that negligible recovery occurred during pumping.

The time it took for the water column to recover from 195.30 ft btoc to above the depth of the transducer installed at 194.6 ft btoc is represented by the flat line of the transducer data in **Figure 8**. The y-intercept of this flat line is at 0.33 ft instead of 0.0 ft as would be expected. This is due to instrumental drift in the transducer; however, comparison of manual measurements of the DTW taken by INTERA field staff relative to the transducer readings allow us to account for this drift.

The recovery curve of the water column was analyzed in nSIGHTS to yield a hydraulic conductivity at 36-06 KD of 3.86E-06 ft/day. Since the water column in 36-06 KD was purged below the installation depth of the transducer, the hydraulic conductivity estimate is derived from the recovery curve data where the water column is above the height of the transducer (**Figure 8**).

The transducer data from 36-07 KD was assessed to determine if a response to pumping at 36-06 KD, located 20 ft away, was detected. No changes to the water column height in 36-07 KD were identified that are indicative of a response to the 22.25 L of purged groundwater from 36-06 KD (**Figure 9**). The lack of response is most likely due to the relatively small amount of water that could be removed from the well and provides little information on whether these wells would be hydraulically connected if the 36-06 KD well screen was in good condition. However, diurnal pressure responses to atmospheric temperature fluctuations are evident in the 36-07 KD transducer data (**Figure 9**). Unlike 36-07 KD, the water column in 36-06 KD does not appear to show a response to diurnal pressure fluctuations (**Figure 9**). There could be some miniscule fluctuations in the 36-06 KD transducer data that are associated with diurnal pressure variations, but if present, these fluctuations would be orders of magnitude less than what is observed at 36-07 KD. The lack of diurnal variation in 36-06 KD suggests that 36-06 KD has minimal connection to the saturated zone of the Dakota, presumably due to the incrustation on the screen interval and sand pack.

3.4 Geochemical Modeling (Goal #4/5)

Two simple geochemical models were developed to test a conceptual model where mixing of pond water with local Dakota water could produce conditions similar to those observed in 36-06 KD. In this conceptual model, since analytical data from Ponds 7 and 8 have not been identified, historical analytical data for waters from Pond 1 or recent analytical data for waters from Cell 1 are used as potential tailings source endmember proxies for water from Ponds 7 and 8, while 36-07 KD reflects local Dakota groundwater quality near Ponds 7 and 8. Geochemical models allow for mixing of Dakota water and the two potential tailings sources followed by precipitation of iron mineral phases. The composition of each groundwater is presented in **Table 3**. Two 36-06 KD samples are presented for comparison: one sample from 2017 collected prior to well redevelopment in 2020, and the sample from June 2021 collected after both well redevelopment and aquifer testing.

3.4.1 Saturation Indices

As a substitute for the results of XRD analysis of incrustation samples, saturation indices were calculated for samples collected from 36-06 KD (pre- and post-redevelopment), 36-07 KD, Pond 1, Cell 1, and the modeled mixtures (**Table 4; Appendix G**). Saturation indices can be used to identify minerals that may constitute the incrustation in well 36-06 KD. **Table 4** lists all minerals with saturation indices > -3. Supersaturated minerals mostly include iron oxyhydroxides, including hematite, several jarosite phases, maghemite, goethite, ferrihydrite, lepidocrocite, and magnesioferrite. Many of these phases, including goethite and ferrihydrite, are commonly formed in sedimentary environments. K-jarosite is commonly associated with both natural and anthropogenic acid rock drainage, mining, and ore processing. Precipitation of the supersaturated iron minerals identified by calculation of saturation indices would be consistent with the red, rusty appearance of the incrustation minerals.

Redevelopment of 36-06 KD in 2020 resulted in changes to the water chemistry and calculated saturation indices for 36-06 KD samples (**Table 4**). Saturation indices calculated for the post-redevelopment 36-06 KD sample are generally farther from equilibrium, as many supersaturated mineral phases have higher saturation index values than the pre-redevelopment sample collected in 2017.

Sulfate minerals (e.g., gypsum and anhydrite) are approximately saturated in 36-06 KD water both prior to and after redevelopment, suggesting that sulfate minerals could be precipitating so quickly as to reach equilibrium with groundwater and potentially form part of the mineral incrustation at 36-06 KD. Other minerals not listed here, such as carbonate phases, are undersaturated and are not expected to precipitate and form part of the incrustation. This is consistent with the observation that water from 36-06 KD is acidic and has non-detectable alkalinity. Saturation indices for Cell 1 water, all mixtures including a Cell 1 component, and dilute mixtures including a Pond 1 component are similar to those calculated for 36-06 KD. Note that Cell 1 and Pond 1 analytical data are proxies for water from Ponds 7 and 8 as described in Section 2.4.1.

Saturation indices calculated for the 36-07 KD sample are similar to the saturation indices calculated for post-redevelopment 36-06 KD samples (**Table 4**), suggesting that redevelopment may have allowed Dakota water chemically similar to 36-07 KD into the well. Iron oxyhydroxide minerals are strongly supersaturated, while sulfate minerals are approximately saturated or slightly undersaturated. Carbonate minerals are approximately saturated to slightly undersaturated, consistent with the higher alkalinity observed at 36-07 KD.

3.4.2 Precipitation Models

Precipitation of ferrihydrite and K-jarosite was modeled for the 36-07 KD sample (**Table 5**) and mixtures of 36-07 KD water with water from Cell 1 and Pond 1 (**Tables 6** and **7**; **Appendix H**).

Table 8 presents the measured pH of each groundwater sample or mixing model and the modeled pH after simulated precipitation.

Precipitation of ferrihydrite from 36-07 KD (**Table 5**) water changes the pH relatively little, as 36-07 KD water is slightly alkaline and can buffer the pH during mineral precipitation. Modeled precipitation of iron minerals in a pH-buffered groundwater is consistent with the circum-neutral pH and iron mineral staining observed at 36-07 KD. K-jarosite is not supersaturated in 36-07 KD water and does not precipitate.

Without allowing for precipitation of iron minerals, mixing between 36-07 KD and Cell 1 or Pond 1 water will produce a water that is more alkaline and higher in iron than 36-06 KD. By allowing precipitation of iron minerals from the mixed samples, these differences can be resolved. Precipitation of iron phases reduces the buffering capacity of the mixed water, decreasing pH, decreasing alkalinity, and reducing iron concentration to concentrations more similar to those observed in 36-06 KD. Precipitation of ferrihydrite results in lower pH, alkalinity, and iron concentrations than precipitation of K-jarosite, although precipitation of either mineral will cause groundwater quality to trend more towards 36-06 KD water quality.

For samples from 36-06 KD and mixtures including Cell 1 (**Table 6**) or Pond 1 (**Table 7**), pH, alkalinity, and iron concentration decreased proportionally to the amount of mineral precipitated whenever ferrihydrite or K-jarosite are supersaturated. Mixtures of 36-07 KD and Cell 1 (**Table 6**) generally have a higher pH, alkalinity, and iron concentration both before and after mineral precipitation as compared to mixtures of 36-07 KD and Pond 1 (**Table 7**). Regardless of the selection of the tailings source or precipitated mineral, precipitation of iron oxyhydroxide phases will allow mixed waters to trend more towards 36-06 KD water quality.

3.5 36-06 KD Groundwater Sampling (Goal #5)

The post-aquifer test groundwater sample was collected on June 28, 2021, after the well had been pumped dry and allowed to recharge for 12 days. Results are presented in **Appendix D** and are used in geochemical modeling as described above.

4.0 DISCUSSION

This study was undertaken to understand (1) why observed groundwater quality and elevation are different at 36-06 KD and 36-07 KD and (2) whether 36-06 KD is suitable for continued use as a compliance monitoring well based on the DQO's presented in **Table 1**.

4.1 Data Quality Objectives

The DQO goals of this investigation are presented and discussed below.

4.1.1 Goal 1: Condition of 36-06 KD and 36-07 KD Well Casing and Screen

The screened interval in 36-06 KD is completely incrusted with mineral precipitates and has a very low apparent hydraulic conductivity. The incrustations observed in 36-06 KD may extend to the sand pack and likely contribute to the low hydraulic conductivity.

The incrustation of the screen in 36-06 KD is too severe to repair without resorting to aggressive chemical additives. Since the presence of incrustations in a screened interval likely suggest the presence of incrustations in the sand pack (e.g., Houben and Treskatis, 2007), these results suggest that the screened interval and sand pack of 36-06 KD are occluded.

The orange iron staining is beginning to appear on the 36-07 KD well screen above the water column, suggesting that 36-07 KD could have a similar incrustation issue in the future.

4.1.2 Goal 2: Construction and Stratigraphy

The gamma, conductivity, and resistivity data indicate that the subsurface stratigraphy is at the same elevation at both 36-06 KD and 36-07 KD, and that the lithologic character of those stratigraphic units is in good agreement (**Figure 6**). The well log data has not identified any clear water bearing zones above the water table. The most anomalous result from the geophysical data is the large gamma peak located at the Mancos-Dakota contact in 36-06 KD (**Figure 6** and **7**). This anomaly could be caused by detection of radioactive material in the bentonite seal, material introduced into the annular space during well construction, or gamma-emitting elements present within this interval. Gamma-emitting elements could be present in the liquid, sorbed, or solid phase and potentially associated with pond water mixing with the Dakota groundwater. Within 36-06 KD, this interval coincides with a slight decrease in apparent density and little change to the neutron curve relative to the neutron data above that interval (**Figure 7**). A decrease in density could suggest material in the annular space or void space within either the annular space or the formation. The presence of a void space would be consistent with lost circulation of drilling fluids in the upper Dakota during drilling, which is a common occurrence in the Ambrosia Lake valley.

A moist-to-wet interval was found stratigraphically near the 36-06 KD gamma peak during drilling of 36-07 KD, supporting the possibility of gamma emitters in 36-06 KD liquid.

4.1.3 Goal 3: Hydraulic Connection

The mineral incrustation in 36-06 KD limits the connection between 36-06 KD and the Dakota aquifer and prevented effective testing of the hydraulic connection between 36-06 KD and 36-07 KD. The occlusion of the 36-06 KD screen and sand pack is likely the cause for the low hydraulic conductivity at 36-06 KD of 3.86E-06 ft/day. This value is 3 to 7 orders of magnitude less than other site-specific and regional estimates of hydraulic conductivity for the Dakota aquifer (**Table 2**), suggesting that the low conductivity is a function of the well condition rather than the actual conductivity of the Dakota.

Well 36-07 KD, which is only three years old, shows that the groundwater elevation in the Dakota has a very strong diurnal response. The lack of diurnal response to changes in groundwater elevation at 36-06 KD strongly suggests that 36-06 KD is not hydraulically connected to the Dakota.

Given the evidence for occluded porosity and permeability within the well, the relatively low hydraulic conductivity estimate at 36-06 KD, and the lack of diurnal response in the transducer measurements, groundwater in 36-06 KD is not strongly hydraulically connected to the local Dakota formation. That said, it should be noted that due to the well's poor condition, the limited volume of groundwater that could be pumped for the aquifer test resulted in an inconclusive assessment of the hydraulic connection between 36-06 KD and 36-07 KD based on aquifer testing results alone.

4.1.4 Goal 4: Mineralogy

Adequate incrustation sample volume for mineralogical determination could not be collected during the field program. Much of the loose scale appears to have been removed during well redevelopment in 2020, which included a de-scaling of the groundwater sampling pump. Although very little scale was returned during field sampling, the video log of the well shows that the screen is still incrusted.

Calculation of saturation indices shows that the incrustation is likely to be composed of any of several common iron oxyhydroxide minerals, including K-jarosite and/or ferrihydrite. This is consistent with visual observation of the mineral incrustation at both 36-06 KD and 36-07 KD, which is generally a dark red, rusty color, even though the well is constructed of polyvinyl chloride (PVC) and not steel, which would rust.

Lastly, redevelopment of 36-06 KD increased the iron concentration in the well from 1-10 milligrams per liter (mg/L) to 125 mg/L, presumably due to agitation and dissolution of the incrustations (**Table 9**). An increase in dissolved iron is consistent with dissolution of an iron-bearing incrustation mineral.

4.1.5 Goal 5: Potential Sources

Observed groundwater chemistry in 36-06 KD may be the result of mixing of Dakota groundwater (as represented by 36-07 KD) pond water (represented in the model with historical Pond 1 and current Cell 1 water). Mixing of Dakota groundwater with solutions similar to those in historical Pond 1 could acidify the water column and occlude the well screen through precipitation of iron oxyhydroxide minerals.

Mixing 36-07 KD water with acidic pond water can reduce the alkalinity and pH of the mixed water (**Table 6 and 7**). Allowing precipitation of iron minerals from the mixed 36-07 KD – Cell 1 waters further decreases the alkalinity, iron concentration, and pH towards 36-06 KD values. The prediction that iron minerals would likely precipitate and would be an important factor in the acidification of the water column is strong support for a pond water source.

The geochemical models discussed in Section 3.4 also predict the observed incrustation of wells 36-06 KD and 36-07 KD. Based on the modeling, the pH of 36-07 KD is not expected to approach that of 36-06 KD but could develop similar incrustation issues. In contrast to 36-06 KD, **Table 6** demonstrates that precipitation of both the ferrihydrite and K-jarosite in 36-07 KD would cause negligible change to the pH. The pH in 36-07 KD is buffered by the presence of alkalinity (327 mg/L as $CaCO_3$) (**Table 5**), where 36-06 KD has no measurable alkalinity. This allows iron minerals to precipitate in both wells, while 36-07 KD maintains a circum-neutral pH and 36-06 KD is acidified. Lastly, it is important to note that 36-06 KD had a pH of 3.3 when it was installed in 1988 and, with only a few exceptions, pH has generally remained between 3 to 5 ever since. The low pH observed at 36-06 KD does not appear to be caused by gradual acidification of a well, but instead the observed pH is likely representative of one or more groundwater endmembers being intercepted by 36-06 KD.

5.0 CONCEPTUAL MODEL DEVELOPMENT FOR 36-06 KD

The information gathered during this investigation has been used to develop several potential conceptual models that address the hydrologic and geochemical differences between 36-06 KD and 36-07 KD. This section presents potential conceptual models for (1) hydrologic relationship between 36-06 KD and 36-07 KD, (2) potential sources, and (3) potential mixing pathways.

5.1 Hydrologic relationship between 36-06 KD and 36-07 KD

The hydrologic relationship component of the conceptual model addresses the differences in groundwater quality and elevation between wells 36-06 KD and 36-07 KD.

5.1.1 Upper and Lower Dakota Model

The upper and lower Dakota model is most consistent with the observations of this investigation and is currently the model most representative of the hydrologic relationship between 36-06 KD and 36-07 KD.

This model assumes a hydrologically continuous lower Dakota sandstone that is hydraulically separate from an upper Dakota that is, or was, water bearing. Neither of the water bearing Dakota zones would be divided by any hydrologic barriers (e.g., mineralized faults or fractures) or fracture-dominated flow systems. The differences in groundwater elevation between wells 36-06 KD and 36-07 KD would be due to drainage downward through the 36-06 KD annular space from the stratigraphically higher water-bearing zone in the upper Dakota. This model is consistent with the observation of the gamma peak in the upper Dakota at 36-06 KD, observed high groundwater elevation at 36-06 KD, and the intersection of the upper Dakota with the 36-06 KD sand pack. Lost circulation is a common occurrence during drilling through the upper Dakota, suggesting that there may be a pathway (e.g., voids) for water into the well bore. The sand pack and bentonite seal at 36-07 KD are below this upper section of the Dakota, limiting potential flow downward into the screened interval at this location.

However, the geophysical logs did not identify saturation in the upper Dakota, suggesting that drainage was a historical process, is ephemeral, or is caused by a water-bearing zone in the upper Dakota that is undetectable by the methods used in this study.

5.1.2 Fault Separated Aquifers

An alternative conceptual model is two hydrologically distinct and separate aquifers, with one well on each side of a mineralized fracture or other structure. The western side, where 36-06 KD is located, would be affected by pond water through any of the potential pathways discussed in

Section 5.3; the 36-07 KD side would be separated from those sources by an impermeable structure such as a fault.

In such a scenario, an extended aquifer test might be able to detect the effects of a nearby impermeable boundary. Due to the condition of the 36-06 KD well screen and the lack of hydraulic continuity with the Dakota, the aquifer testing results were inconclusive in confirming a nearby groundwater flow boundary. However, the proximity and similar lithology of these monitoring wells makes it unlikely that these wells would be perfectly located on either side of such a very thin, and very low conductivity, fault.

5.1.3 Fault Transport

Another alternative is a situation where 36-06 KD intersects a fracture or fault-controlled flow system transporting low pH, high-iron concentration fluids. Again, the proximity of these wells makes it unlikely that they would alternatively intersect, and not intersect, a fault or fracture pathway. Additionally, no instance of enhanced groundwater transport within faults has been documented at Ambrosia Lake.

5.2 Potential Sources

As discussed in Section 4.1.5, groundwater chemistry in 36-06 KD appears to be the result of mixing of Dakota groundwater (as represented by 36-07 KD) with pond water (represented by Cell 1 or Pond 1, proxies for Ponds 7 and 8 used in the geochemical modeling discussed in Section 3, see **Figure 1**) and precipitation of iron minerals. Mixing with solutions from either historical Pond 1 or the existing Cell 1 could acidify the water column and cause precipitation of iron oxyhydroxide minerals on the well screen, which is consistent with the observed groundwater quality and mineral precipitation at 36-06 KD.

5.3 Potential Mixing Pathways

Potential pathways describe the route that source water may take to reach 36-06 KD and could be consistent with any of the hydrologic models or potential sources discussed in sections 5.1 and 5.2.

5.3.1 Drainage through Annular Space

Drainage of groundwater mixed with pond water from stratigraphically higher water-bearing zones, including upper zones in the Dakota, could be a historical and/or current source of water that slowly trickles down the filter pack in 36-06 KD. Based on the lines of evidence presented below, this model is currently the preferred mixing pathway.

Leakage from the upper Dakota down the annular space of 36-06 KD is one potential mixing pathway that is consistent with geochemical and geophysical observations. Geochemical modeling

demonstrates that such a source, if it exists, could cause precipitation and acidification at 36-06 KD, but not 36-07 KD. This source could be related to the gamma peak at 36-06 KD (Section 5.1.1), which is in contact with the 36-06 KD sand pack interval and could indicate a hydraulic connection with the upper Dakota zone resulting in a downward migration pathway through the sand pack. While the gamma peak in 36-06 KD might indicate the presence of gamma-emitting elements in the upper Dakota (within the sand pack interval of well 36-06 KD but above the sand pack interval of well 36-07 KD), the neutron log does not provide a clear indication of the presence of water in the upper Dakota. However, the increased water levels after redevelopment, and the findings of moist-to-wet conditions in the Dakota at around this level during 36-07 KD drilling, suggest that drainage may be ongoing and contributing water to 36-06 KD directly.

Redevelopment of 36-06 KD in August 2020 caused the water column within 36-06 KD to rise 10-ft for 8 months before declining to pre-redevelopment conditions (**Figure 10**). Simultaneously, the pH rose and ORP decreased, both approaching more typical groundwater values (**Table 9**). These observations would be consistent with clearing a portion of the upper part of the screen, above the lower Dakota water-bearing zone, (**Figure 11**) and allowing water into the well that was previously impeded by the incrustation. Similarly, the eventual decline in water levels would be consistent with the re-incrustation of any previously cleared screen.

An additional condition for water levels to decline is a physical separation of the deeper Dakota groundwater zone from the water trickling down the sand pack from the upper zone. The initial decline in water levels, prior to redevelopment, suggests that not only is the upper-zone groundwater flow into the upper part of the screen very limited, but that it is also blocked from flowing to the lower part of the screen within the sand pack. Without these occlusions, water levels would remain higher. With both the sand pack and the well screen plugged near the top of the screen, water levels in the well would eventually reflect those in the lower Dakota water-bearing zone. Redevelopment could have acted to open the upper pathway more than the lower pathway allowing for water levels in the well to be artificially high compared with the lower Dakota water-bearing zone. In other words, the water level was in balance with the influx of upper Dakota water coming flowing down the sand pack but not in equilibrium with the lower Dakota potentiometric surface, as reflected in nearby well 36-07 KD. Then, over the ensuing 8 months, the incrustations could have re-formed and the upper water flowing down the sand pack was again largely blocked from either flowing into the upper well screen or being hydraulically connected to the deeper sand pack. This would allow for the well water to again become equilibrated with the lower Dakota water-bearing zone, or nearly so. The blockage due to incrustations may not be complete and some upper-zone water may continue to mix with the deeper zone water as suggested by the geochemistry analysis discussed above.

Figure 12 represents a conceptual diagram of the preferred mixing pathway. An additional condition for water levels in well 36-06 KD to decline is occlusion of the sand pack that limits or prevents water flowing from the upper zone to the lower zone outside of the well screen. Redevelopment could have acted to open one or both pathways (sand pack and well screen) allowing for more upper Dakota water to flow into the well resulting in elevated water levels. Over the ensuing 8 months, the incrustations could have re-formed leading to increased blockage of flow into the well from the upper Dakota zone leading to the observed decline in water levels. The higher water levels in well 36-06 KD relative to water levels in well 36-07 KD most likely reflects the very low hydraulic conductivity of the well screen and sand pack in well 36-06 KD due to incrustations. The resulting small inflow rates from the upper zone flowing out of the 36-06 KD well would have a limited effect on water levels in the KD outside the well which would likely be too small to be observed at well 36-07 KD.

5.3.2 Geologic structure

Seepage of pond water from Ponds 7 and 8 mixing with Dakota groundwater through a fault mapped between Ponds 7 and 8 (**Figure 1**) could be a historical pathway. Santos and Thaden (1966) approximated the strike of this fault underneath Ponds 7 and 8 but did not extend it through the area now occupied by 36-06 KD and 36-07 KD. The lack of stratigraphic offset between 36-06 KD and 36-07 KD suggests that a geologic structure is unlikely to be present in the 20 ft that laterally separates the two wells, but this fault could still serve as a downward migration pathway for pond seepage from former Ponds 7 and 8 into the Dakota.

5.3.3 Direct contact

Seepage directly into the Dakota subcrop near former Ponds 7 and 8 could be a historical source of pond water into the Dakota groundwater (AVM and AHA, 2000; Bostick, 1985). However, it is unclear whether the location of the Dakota subcrop relative to former Ponds 7 and 8 allows for this direct contact. Historical monitoring well 1-01 KD (**Figure 1**) was installed over Dakota subcrop near Ponds 7 and 8 and monitored from 1972 to 2005 but remained dry over the entire period. It is possible that the Dakota subcrop was collecting water close to the Ponds, but saturation of the Dakota near Ponds 7 and 8 was never observed in monitoring well 1-01 KD suggesting that drainage into the Dakota subcrop was not a pathway for seepage from Ponds 7 and 8.

6.0 CONCLUSIONS

6.1 Data Quality Objectives

1. Evaluate the condition of 36-06 KD and 36-07 KD well casing and screen: The 36-06 KD well screen is badly incrusted, to the point of blocking the hydraulic connection through the well screen. 36-07 KD has a very slight growth of incrustation that may become more significant in the future.
2. Understand the relationship between the screened interval, filter pack interval, and stratigraphy of 36-06 KD and 36-07 KD: The stratigraphy appears to be consistent between both locations. The extended sand pack in 36-06 KD may allow drainage of higher water bearing zones into the well.
3. Determine whether 36-06 KD and 36-07 KD are hydraulically connected: aquifer testing during this study did not demonstrate a hydraulic connection between 36-06 KD and 36-07 KD, though more advanced testing could provide a more definitive result. The finding for DQO 1 that 36-06 KD is not connected to the Dakota aquifer suggests the well also is not hydraulically connected to 36-07 KD.
4. Characterize incrustation mineralogy: No sample could be collected, but field observation and geochemical modelling suggest that the incrustation is one of several common iron minerals ubiquitous in both natural and mill/mine settings and representative of many of the iron minerals that would be expected to precipitate (see Section 2.4.4).
5. Identify potential sources for water in 36-06 KD and 36-07 KD: 36-06 KD appears to be a mixture of local Dakota groundwater and pond fluids.

6.2 Summary

Monitoring well 36-07 KD was installed adjacent to 36-06 KD to confirm groundwater conditions observed in 36-06 KD. Significant differences in groundwater quality and elevations exist between the two wells. The results of this study demonstrate that the observed stratigraphy in both 36-06 KD and 36-07 KD are similar, and hydrologic and chemical differences in the water in these two wells likely relates to well construction and condition. Unlike well 36-07 KD, well 36-06 KD has limited connection to the Dakota aquifer, as evidenced by the occluded screened interval and lack of diurnal variation in groundwater elevation. Groundwater samples from 36-06 KD are not representative of ambient conditions within the Dakota aquifer. Staining observed in the screen interval above the water table in 36-07 KD may indicate that future incrustation is possible.

Groundwater mixing models can produce chemical conditions similar to that observed in 36-06 KD by mixing Dakota groundwater with tailings water. Observation of precipitation of incrustations in 36-06 KD is consistent with these mixing models.

Conditions in 36-06 KD appear to be localized, unique, and not representative of Dakota aquifer water levels or chemistry. Further investigation of 36-06 KD is not likely to result in significant changes to our current conceptual site model regarding sources or pathways in the Dakota.

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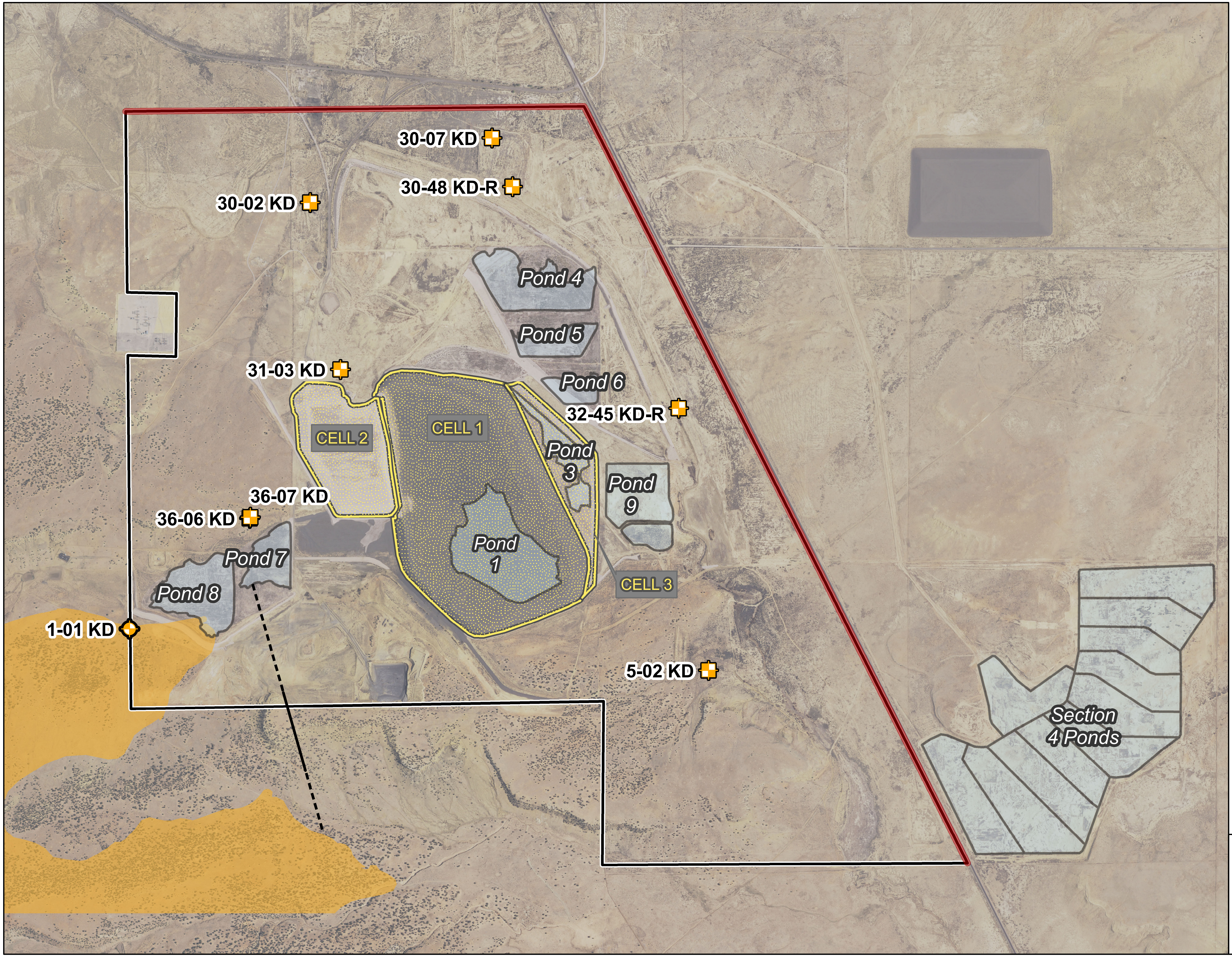
FIGURES



Source(s):
Aerial – NAIP imagery (2018); subcrops digitized from Kerr McGee Resources Corporation, 1979. Ambrosia Lake Uranium District Showing Formation Encountered in Drill Holes Immediately Below the Overburden. March 7, 1979; fault digitized from Santos and Thadden (1966).

Legend

- Dakota Monitoring Well
- Historical Monitoring Location
- Proposed POE
- Proposed LTSM Boundary
- Historical Pond
- Current Tailings Storage Facility Cells

Subcrops

- Dakota Sandstone Subcrop

Fault

- Concealed
- Confirmed

Figure 1
Dakota Monitoring Well Network

Ambrosia Lake
Rio Algom Mining LLC,
Grants, NM

FILE: S:\ABQ\RIO_AmbrosiaLakeClosure\Permit_Closure_Site_Transfer\NRC\Memos\20210108 36 Well Testing\Report\Figures\SummaryInvestigation_wo_historcial_tailings.mxd 3/24/2022

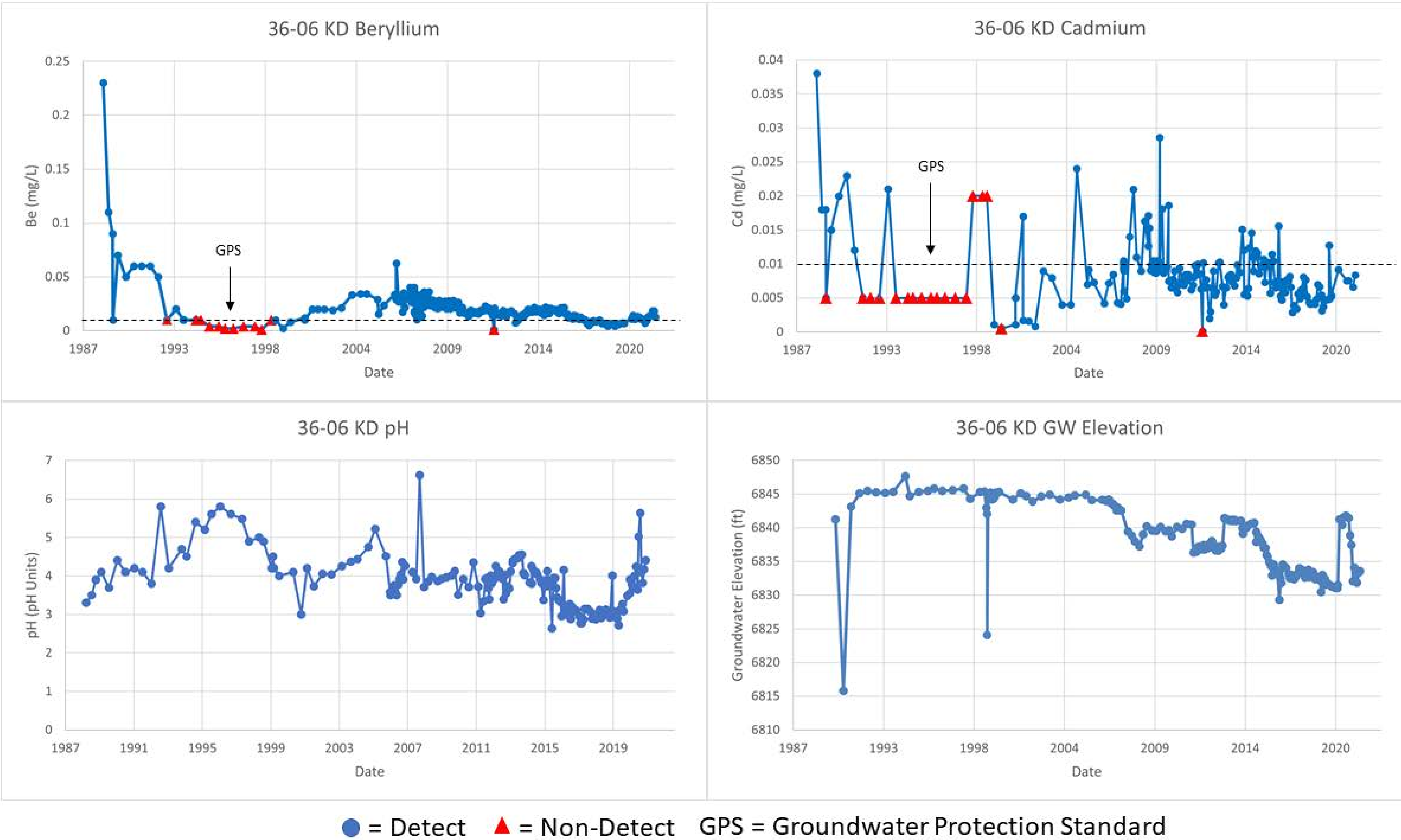


Figure 2
36-06 KD Be, Cd, pH, and GW Elevation Time Series
Ambrosia Lake
Rio Algom Mining LLC, Grants, NM

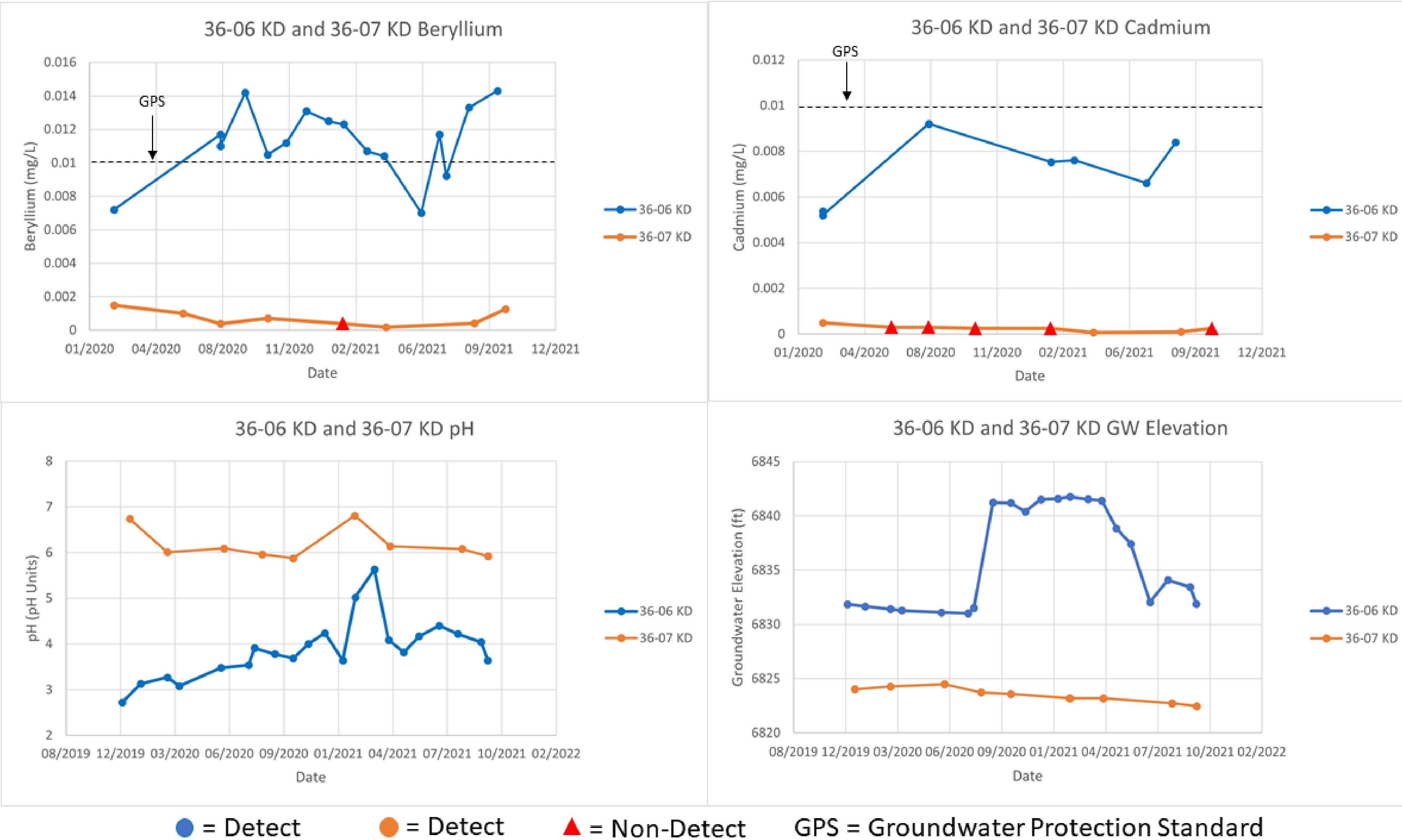


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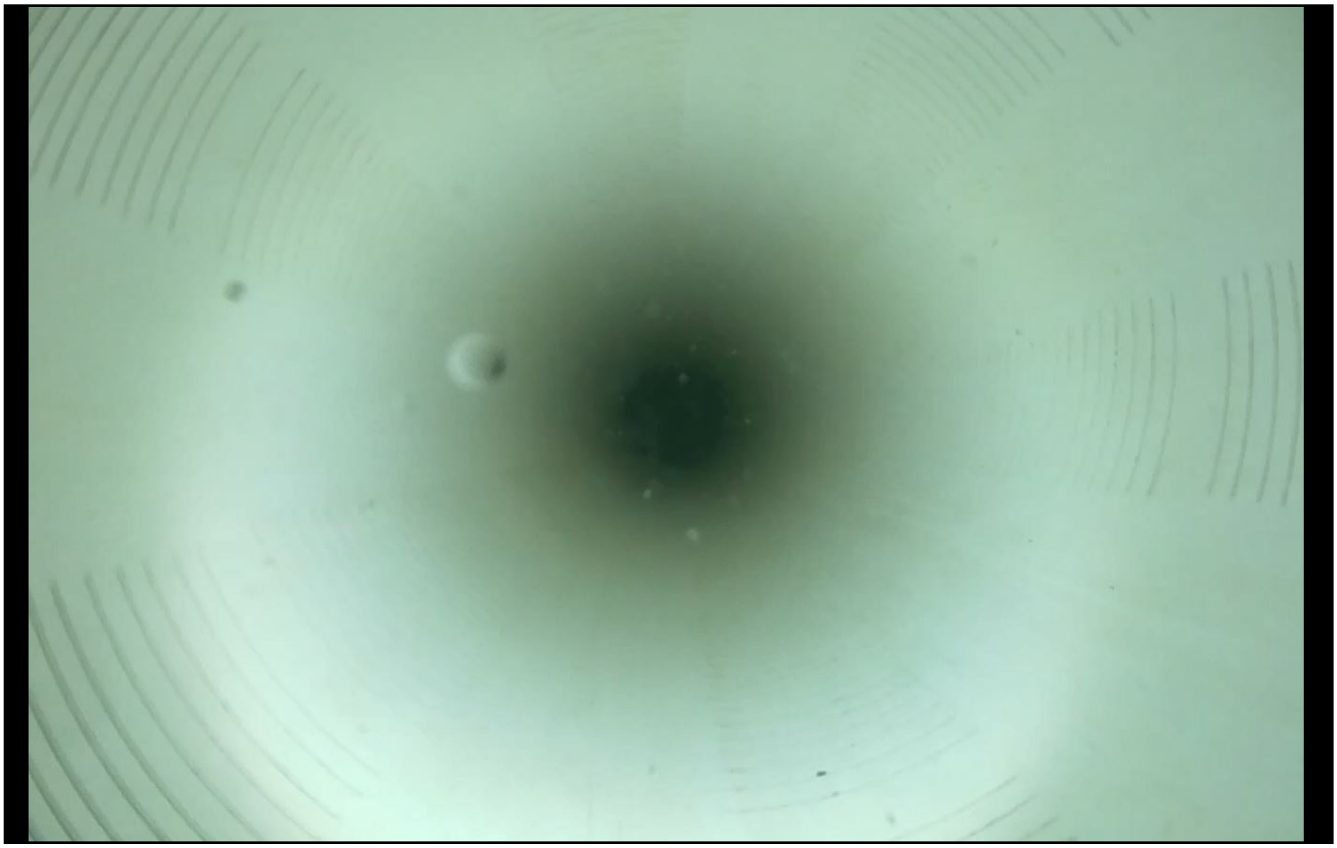
Figure 3
36-06 KD and 36-07 KD Be, Cd, pH, and GW Elevation Time Series for 2019-2021
Ambrosia Lake
Rio Algom Mining LLC, Grants, NM



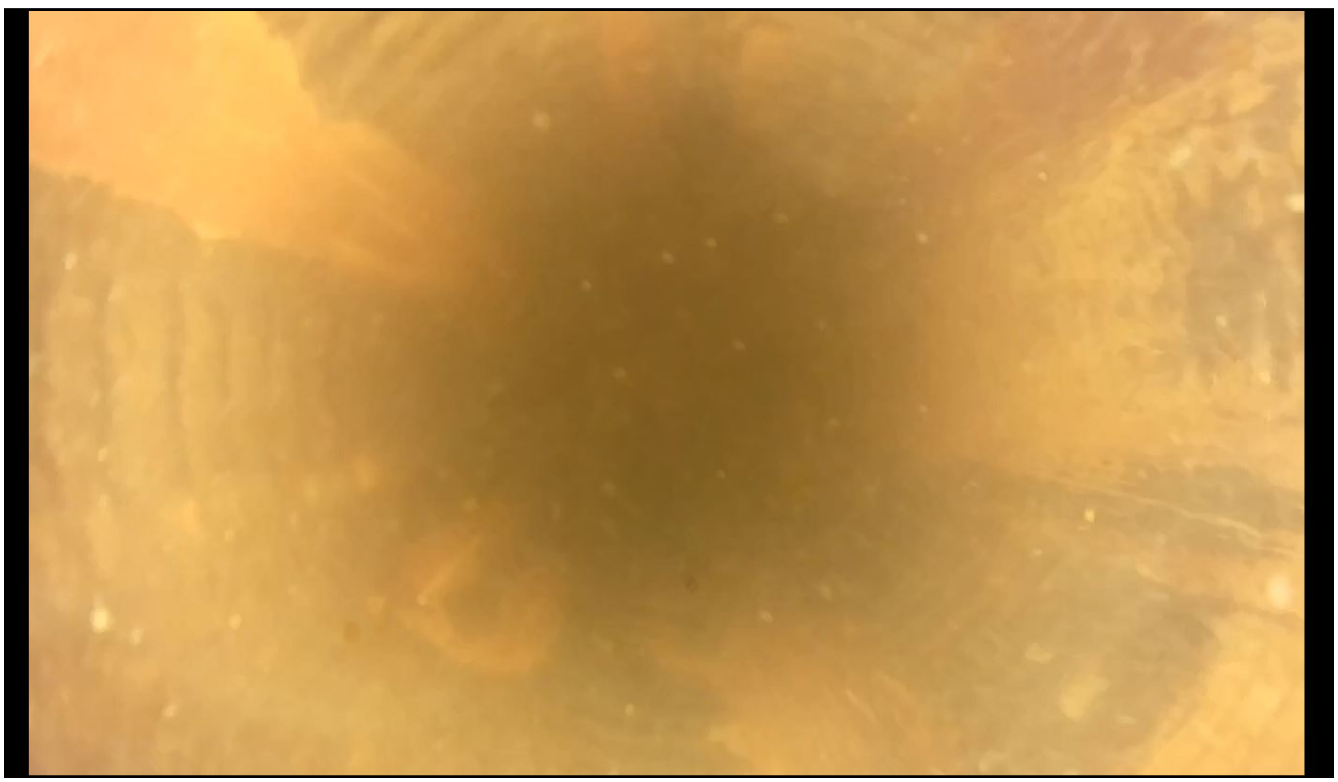
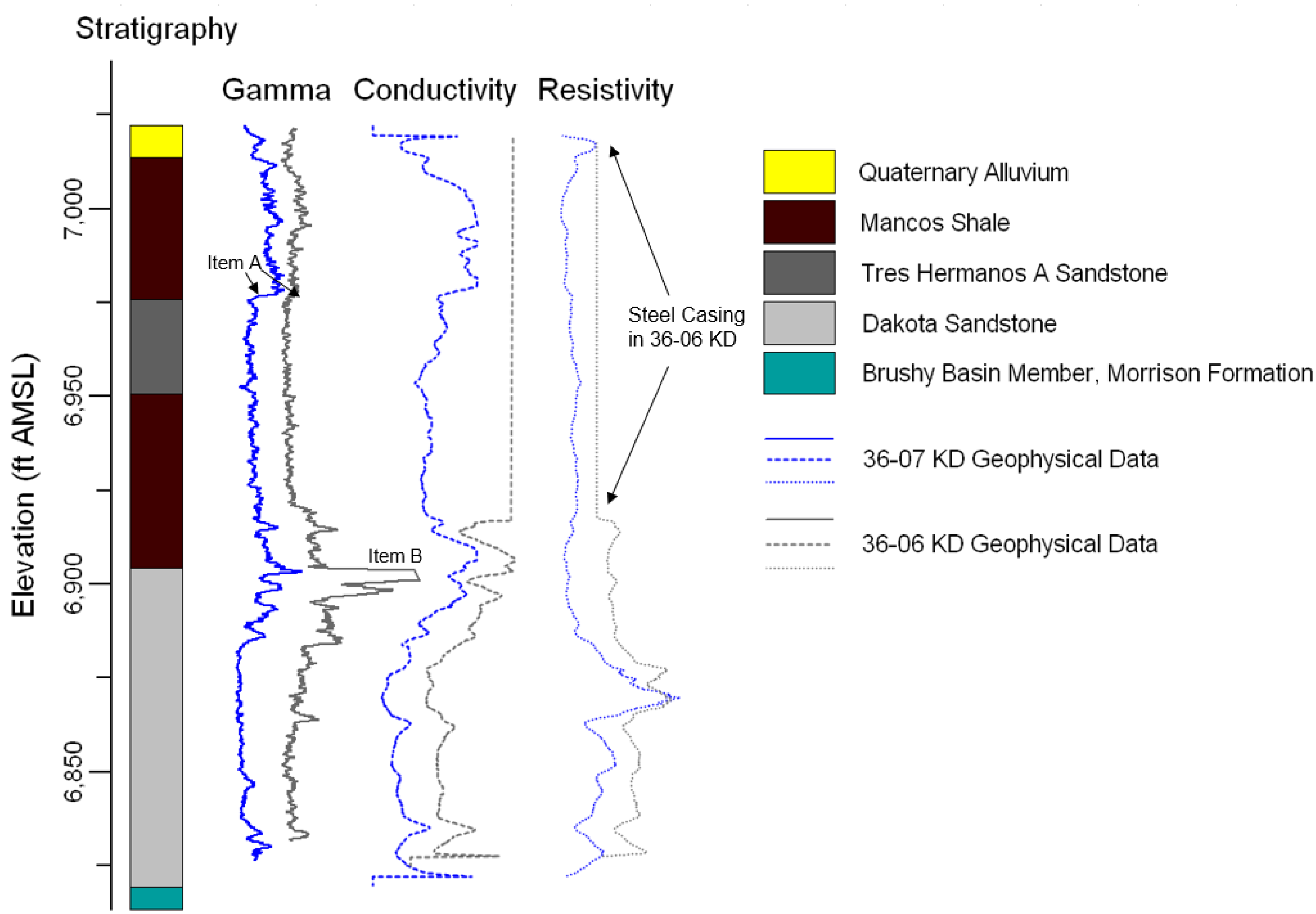


Figure 4
Camera Inspection: Submerged Zones within
36-07 KD and 36-06 KD
Ambrosia Lake
Rio Algom Mining LLC, Grants, NM

Figure 5
Camera Inspection: Above Water Table at 36-07 KD and 36-06 KD
Ambrosia Lake
Rio Algom Mining LLC, Grants, NM



Note: The stratigraphic column shown is from the 36-07 KD boring log.

INTERA

Figure 6
Gamma, Conductivity, & Resistivity Logs at 36-06 KD & 36-07 KD
Ambrosia Lake
Rio Algom Mining LLC, Grants, NM

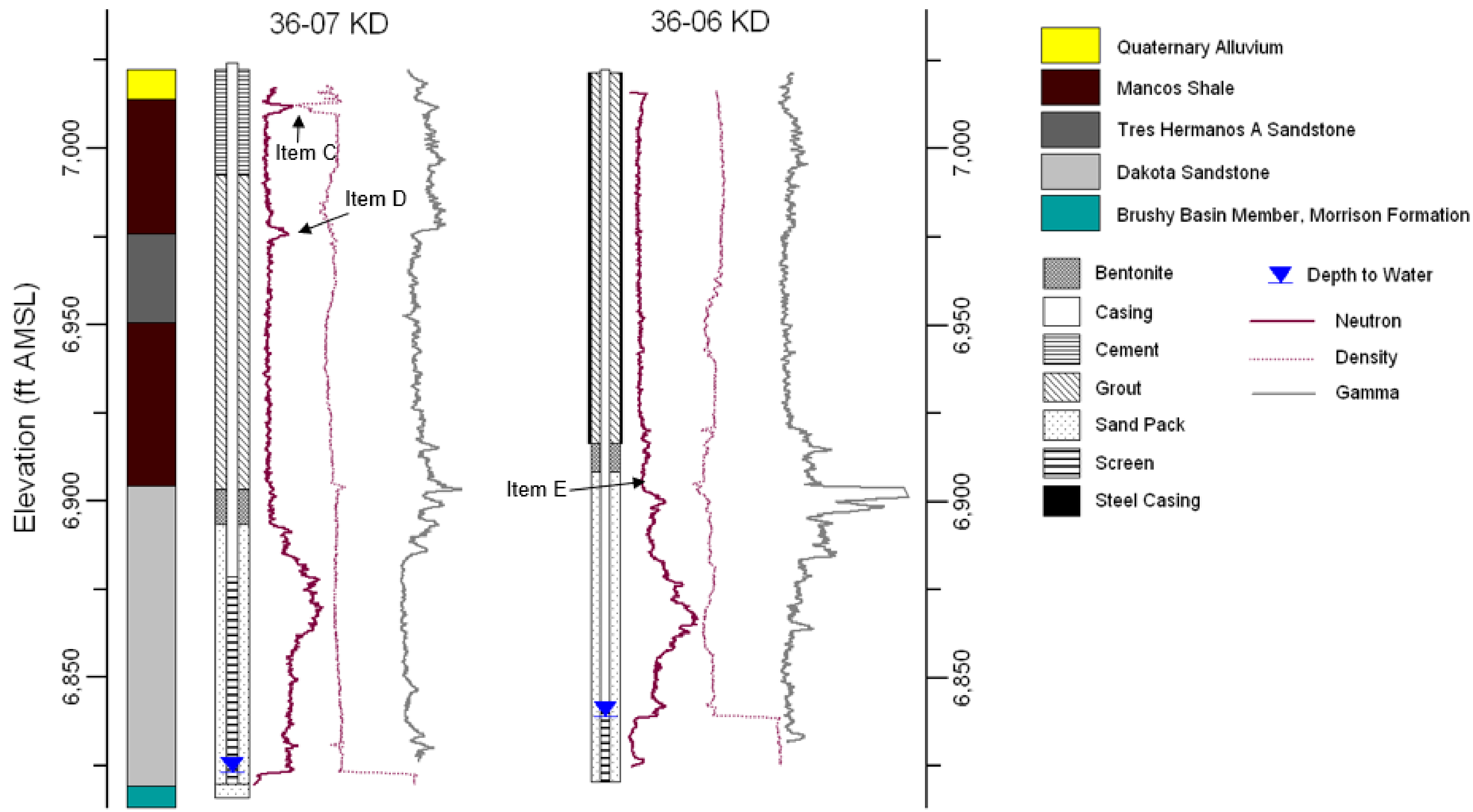
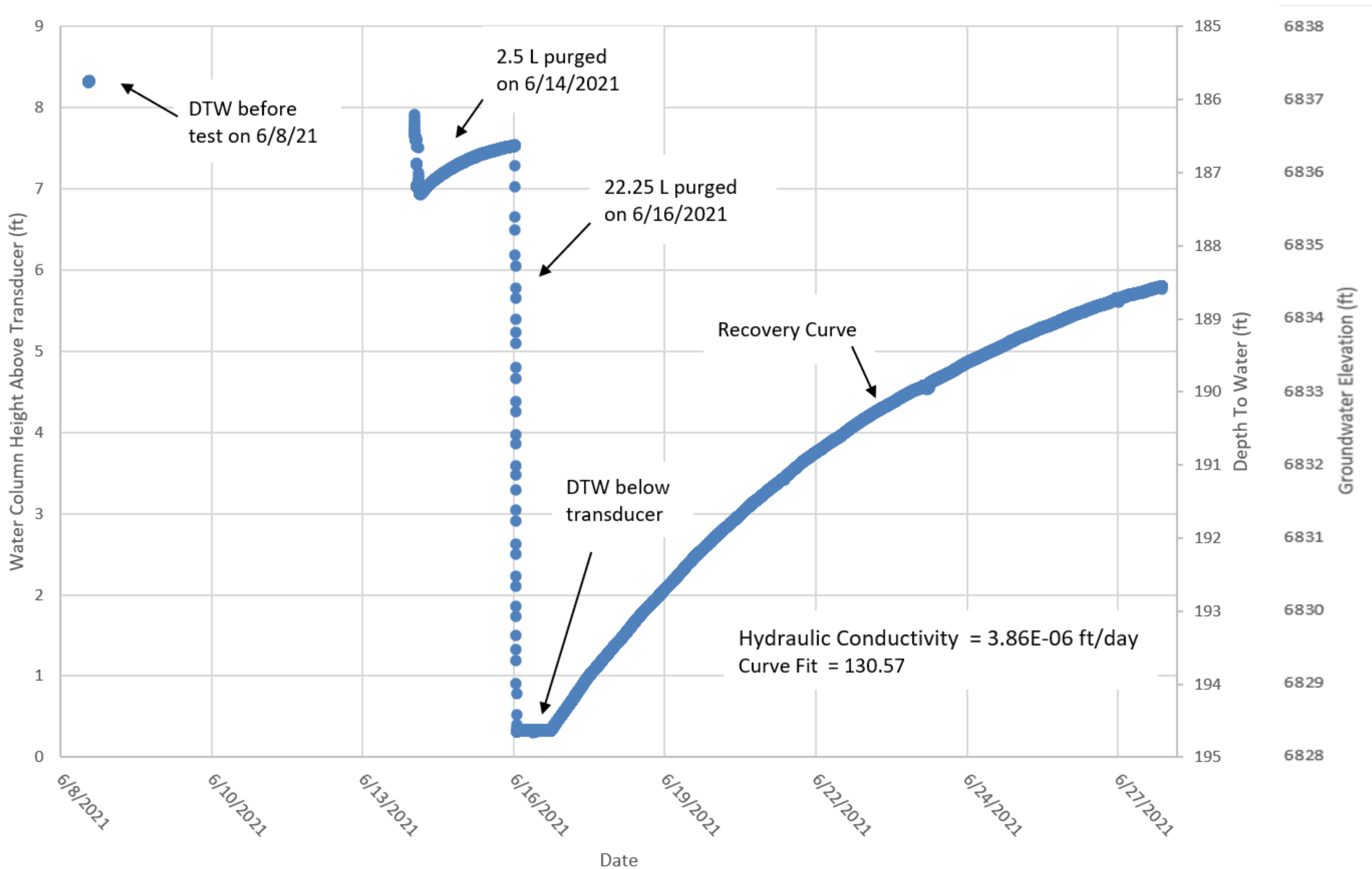
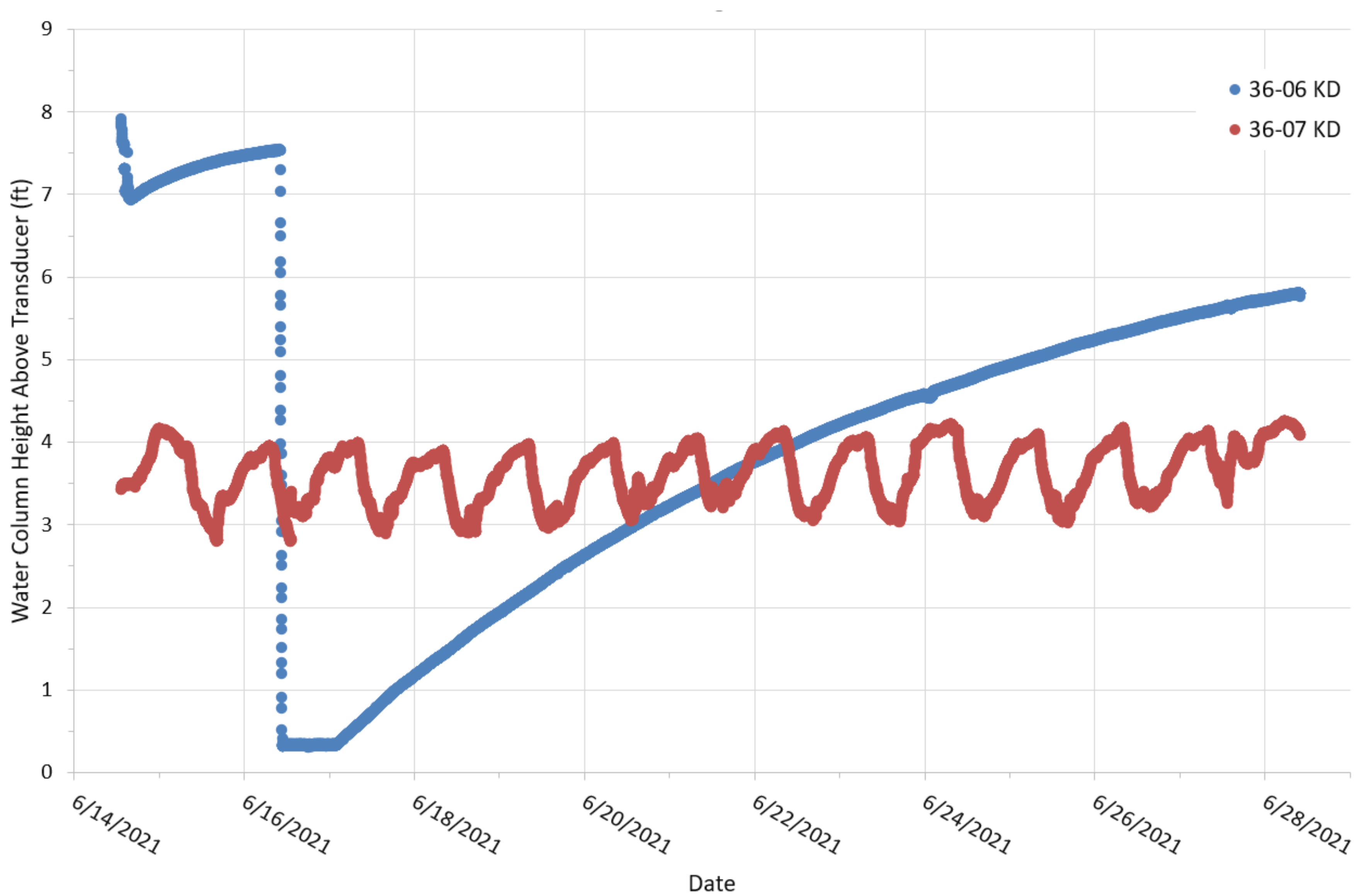


Figure 7
Well Design, Neutron, Density, & Gamma Logs at 36-06 KD & 36-07 KD
Ambrosia Lake
Rio Algom Mining LLC, Grants, NM



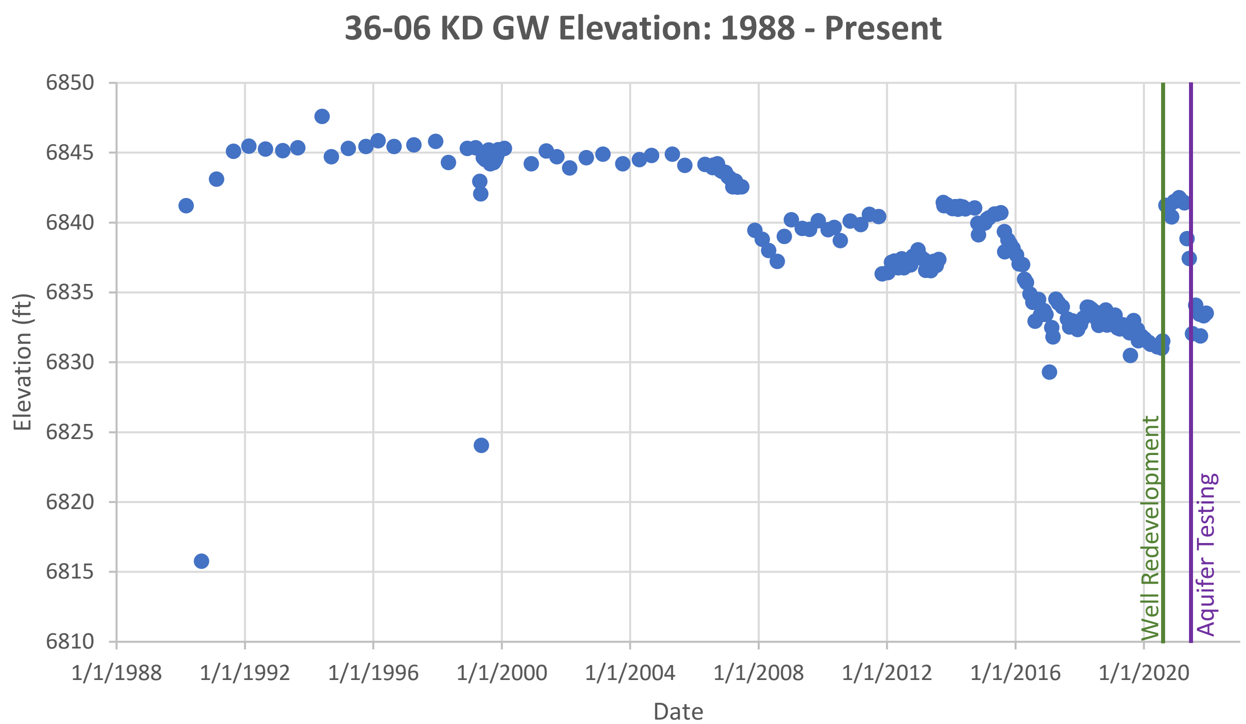
INTERA

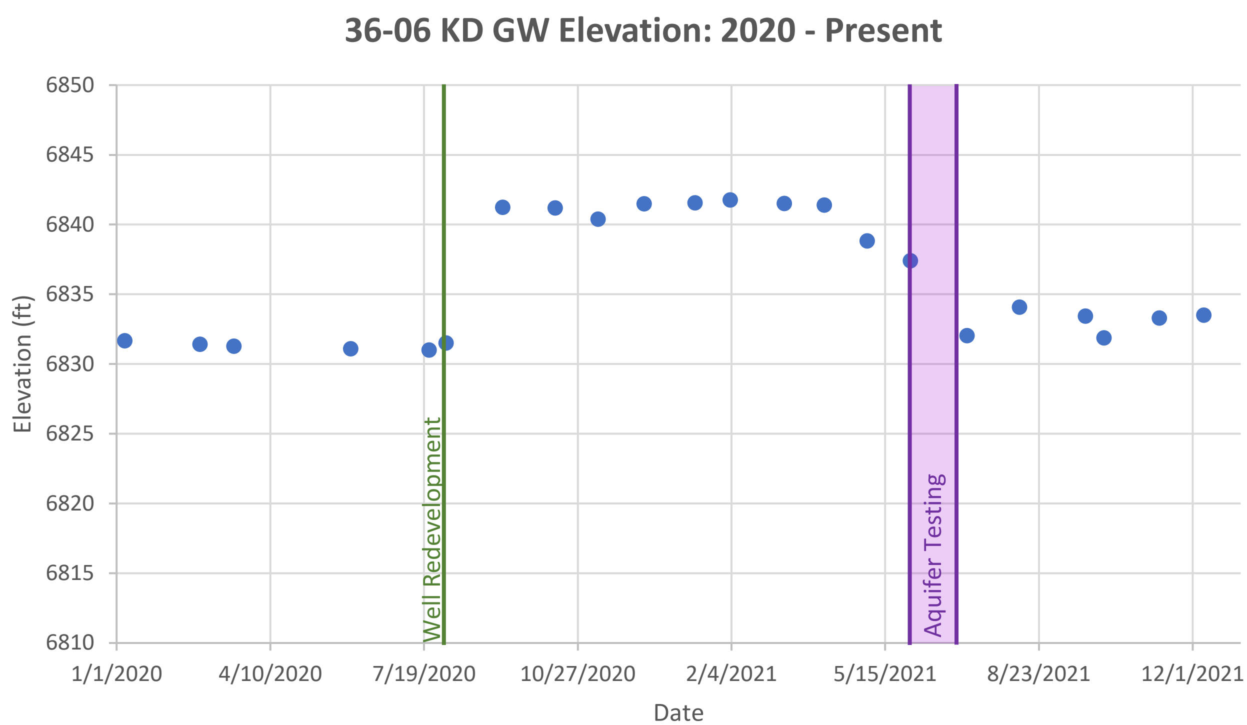
Figure 8
Transducer Data from 36-06 KD
Ambrosia Lake
Rio Algom Mining LLC, Grants, NM



INTERA

Figure 9
Transducer Data from 36-06 KD & 36-07 KD
Ambrosia Lake
Rio Algom Mining LLC, Grants, NM



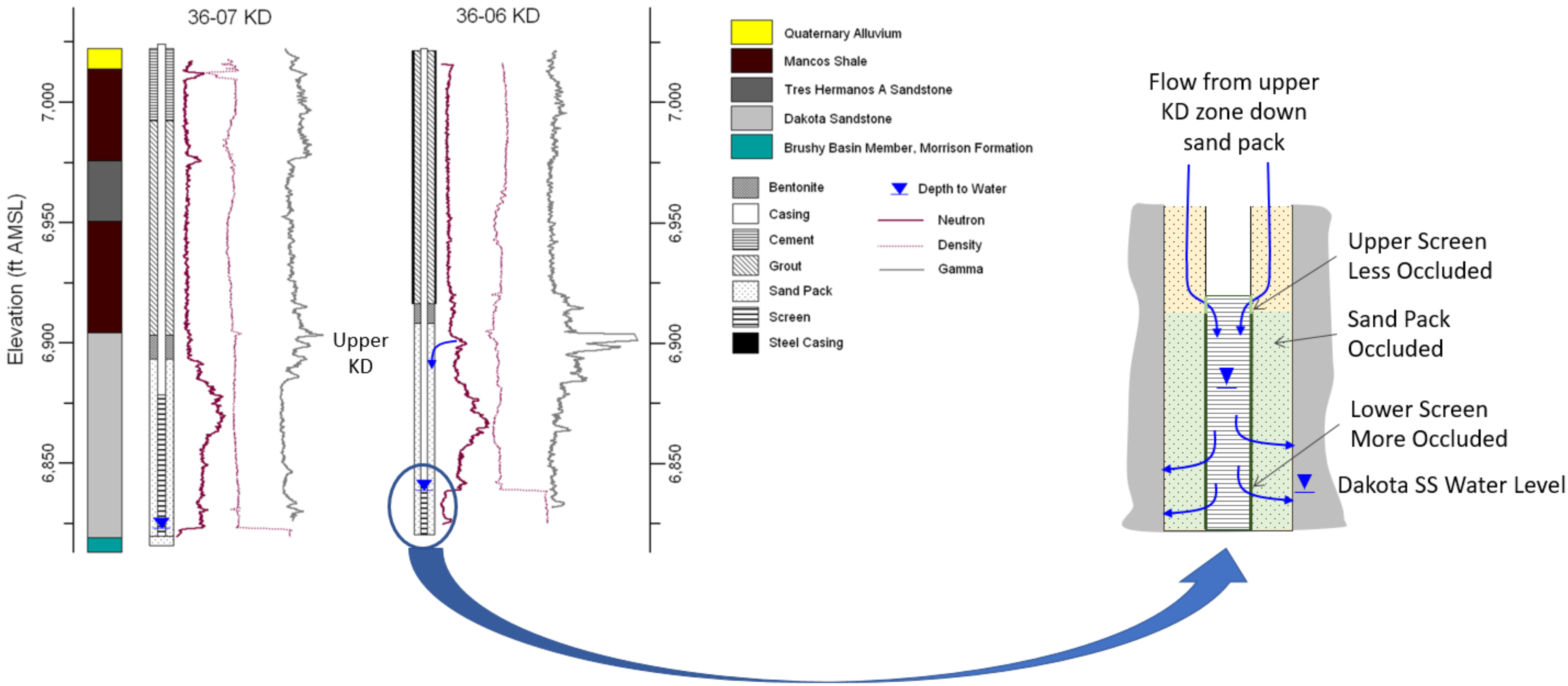


INTERA

Figure 10
36-06 KD Groundwater Elevation History
Ambrosia Lake
Rio Algom Mining LLC, Grants, NM

INTERA

Figure 11
Photograph Taken at ~181.5 ft BTOC (near the top of screen) within 36-06 KD after Redevelopment Efforts on July 29, 2020
Ambrosia Lake
Rio Algom Mining LLC, Grants, NM



The water level in the well will depend on the following:

- The inflow rate from upper KD zone
- The water column thickness in the well
- The water level in the formation, and
- The permeability of the screen and sand pack

INTERA

Figure 12
Conceptual Diagram of Preferred Mixing Pathway for Well 36-06 KD
Ambrosia Lake
Rio Algom Mining LLC, Grants, NM

TABLES

TABLE 1
Data Quality Objectives
Ambrosia Lake; Rio Algom Mining, LLC; Grants, New Mexico

1.0 State the Problem	**Additional information is required to understand why observed groundwater quality and elevation are different at 36-06 KD and 36-07 KD. Monitoring well 36-06 KD is part of the Dakota Sandstone (Dakota) monitoring well network defined by SUA-1473 radioactive materials license at the Ambrosia Lake West Facility (Site). In 2019, monitoring well 36-07 KD was installed about 20 feet (ft) northeast of 36-06 KD to confirm groundwater conditions at 36-06 KD; however, there are significant differences in groundwater quality and elevation at 36-06 KD and 36-07 KD.**				
2.0 Identify the Goals of the Study	Evaluate the condition of the well casing and screen	Understand the relationship between the screened interval, filter pack interval, and stratigraphy.	Determine whether wells 36-06 KD ad 36-07 KD are hydraulically connected	Characterize incrustation mineralogy	Identify potential source terms for water in 36-06 KD and 36-07 KD
3.0 Identify Information Inputs	New downhole camera inspections, previously recorded downhole camera inspections from the 2020 well re-development, well construction logs	New wireline geophysical data, previously collected wireline geophysical data from well installation program, lithologic logs, regional geologic maps	Aquifer test analysis, water level records from sampling program	XRD analysis of 36-06 KD incrustations	Geochemical modeling, historical water levels and chemistry, potential end member water source chemistry, knowledge of historical water management practices
4.0 Define Boundaries of the Study	36-06 KD, 36-07 KD, and 36-08 TRA	36-06 KD and 36-07 KD	36-06 KD and 36-07 KD	36-06 KD	36-06 KD, other nearby wells, historical and existing tailings
5.0 Develop the Analytic Approach	Deploy downhole camera to assess the structural integrity of the well casing and screens of 36-06 KD and 36-07 KD. Estimate the percentage of incrustations present within the screened intervals of 36-06 KD, 36-07 KD, and 36-08 TRA. Downhole camera footage collected in 2020 will be compared to the more recent footage to determine whether significant incrustation growth has occurred in the last year.	Compare subsurface elevations of key stratigraphic intervals between 36-06 KD and 36-07 KD based on gamma logs, lithologic logs, and regional geologic maps. Verify the 36-06 KD monitoring well completion and stratigraphy using the density and gamma logs, respectively. Determine if incrustations are present in the sand pack intervals of both wells by comparing the density logs of 36-06 KD and 36-07 KD. Evaluate the presence of groundwater within the upper Dakota by interpreting the neutron and electric induction logs.	Use transducers to monitor groundwater levels in 36-06 KD and 36-07 KD during the step and constant-rate pumping tests to evaluate hydraulic connection. Step test pumping rates will be informed by drawdown records from the groundwater sampling program. Estimate recovery rates and evaluate the drawdown and recovery data with the aquifer-test analysis program nSIGHTS (n-dimensional Statistical Inverse Graphical Hydraulic Simulator). Determine if a hydraulic connection exists between 36-06 KD and 36-07 KD. Quantify how long it takes for the 36-06 KD and 36-07 KD water levels to recover to 90% of the initial water level after drawdown/purging (e.g., USGS, 2006) to evaluate well adequacy.	Collect incrustations from dedicated bladder pump and analyze via X-ray diffraction (XRD) to determine the mineralogy of the incrustations.	Complete geochemical modelling to evaluate the potential for incrustation precipitation, acidification, and changes to groundwater quality because of mixing between distinct groundwater sources. Potential sources or end members will include historical pond and groundwater chemistry and will be informed by knowledge of historical water management practices.
6.0 Specify Performance or Acceptance Criteria	Conclusions drawn from the downhole camera inspections will be based on visual inspection of the camera footage. Implications of structural damage to the interior of 36-06 KD and/or 36-07 KD, if present, will be determined relative to other data, such as depth interval relative to the stratigraphy. Incrustations are present within the screened interval of 36-06 KD. The higher the percentage of incrustations within a given screened interval, the poorer the connection of that well with the Dakota aquifer. Determining if incrustations are present in 36-07 KD and 36-08 TRA will identify if incrustation precipitation is unique to 36-06 KD. If incrustations are present within a screened interval, incrustations are likely present in the sand pack (e.g., Houben and Treskatis, 2007). Therefore, determining if incrustations are or are not present within 36-07 KD will allow for a meaningful comparison of sand pack bulk density between 36-06 KD and 36-07 KD (see wireline geophysical data DQOs). These results will have implications about the connection of the wells with the Dakota aquifer. Professional judgment will be used in evaluating existing and historical data sources.	Wireline geophysical data is interpretive. Determining if there is variation in the lithologic characteristics of the Dakota relative to the monitoring well completions of 36-06 KD and 36-07 KD will indicate if differences in groundwater conditions should be expected. Because portions of the 36-06 KD boring log have been found to be erroneous, verification of the 36-06 KD monitoring well completion relative to the stratigraphy is critical to understanding the water quality and elevation observations within the well. After visually assessing the degree of incrustation mineralization present in the screened intervals of 36-06 KD and 36-07 KD during the downhole camera inspections, comparing the bulk density of the sand pack interval of 36-06 KD to that of 36-07 KD will aid in determining if groundwater samples collected from these wells are representative of ambient aquifer groundwater composition (e.g., USGS, 2006). Finding out if groundwater is present within the upper Dakota and within the sand pack interval of 36-06 KD using the neutron and electric induction logs will indicate if differences in groundwater conditions between the two wells are the result of groundwater mixing in 36-06 KD. Professional judgment will be used in evaluating existing and historical data sources.	The degree of certainty for drawing conclusions from the pumping tests are affected by the condition of the wells and the local hydraulic conductivity of the aquifer. False negative results (i.e., no apparent hydraulic connection) are possible. A positive result would confirm a hydraulic connection between 36-07 KD and 36-06 KD. According to guidance provided by the USGS (2006), monitoring wells that take more than 24 hours to recover to at least 90% of the initial water level after drawdown/purging should not be sampled. Professional judgment will be used in evaluating existing and historical data sources.	The XRD analysis will be performed by a certified lab working under their own QA/QC program and the collection and shipment of the incrustation sample will meet laboratory requirements. The XRD results will be used to evaluate incrustation precipitation reactions.	Geochemical modelling will be used as a proof-of-concept for potential groundwater mixing at 36-06 KD. This potential explanation to the well discrepancies will be supported if (1) incrustation minerals are supersaturated in modelled fluids and/or (2) groundwater acidification can be modelled by mixing or precipitation reactions. The selection of potential mixing endmembers should be consistent with field observations. Modelling results will be considered with other field observations. Geochemical modelling methods may be changed or omitted if the results of the field work strongly indicate that precipitation and acidification are not the result of groundwater mixing. Professional judgment will be used in evaluating existing and historical data sources.
7.0 Develop Plan for Obtaining Data	Section 3.1 of Workplan (**Attachment 1)**	Section 3.2 of Workplan (**Attachment 1)**	Section 3.3 of Workplan (**Attachment 1)**	Section 3.4 of Workplan (**Attachment 1)**	Section 3.5 of Workplan (**Attachment 1)**

INTERA

TABLE 2
Dakota Sandstone Hydraulic Conductivity
Ambrosia Lake; Rio Algom Mining LLC; Grants, New Mexico

Location	Hydraulic Conductivity (ft/day)
36-06 KD	**3.86E-06**[a]
31-03 KD	2.5[b]
30-48 KD-R	10.3[b]
30-07 KD	0.0053[b]
Regional	0.04-2.8[c]
Regional	1.6[d]
Regional	0.23[e]
Regional	0.4[e]
Regional	0.18-1.67[f]

Notes:

[a] This Study

[b] INTERA (2021b)

[c] Quivira Mining Company/Hydro-Engineering LLC (1989)

[d] Brod (1979)

[e] Four Corners Geological Society (2011)

[f] Berg (1979)

TABLE 3

Analytical Data for Calculation of Saturation Indices, Mixing Models, and Precipitation Models

Ambrosia Lake; Rio Algom Mining LLC; Grants, New Mexico

Location		36-07 KD	36-06 KD	36-06 KD	Cell 1	Pond 1	36-07 KD + Cell 1				36-07 KD + Pond 1				
Date		4/9/2021	2/15/2017	6/28/2021	9/21/2020	11/9/1981	-	-	-	-	-	-	-	-	-
Mixing Ratio		-	-	-	-	-	100:1	50:1	20:1	10:1	200:1	100:1	50:1	20:1	10:1
Sample Description	Units	Recently Installed KD Well	Sampled pre-development	Sampled post-development	Tailings porewater endmember	Historical pond water endmember	Mixtures of 36-07 KD and Cell 1 (TBH-2Z) Tailings Porewater				Mixtures of 36-07 KD and Pond 1 water (collected in 1981)				
Arsenic	mg/kg	0.00338	0.0008864	0.01516	1.655	3.769	0.02003	0.03633	0.08336	0.156	0.02248	0.04139	0.07863	0.186	0.3518
Beryllium	mg/kg	1.70E-04	0.01389	0.01152	0.3127	ND	0.003318	0.006403	0.0153	0.02903	0.0001686	0.000168	0.000166	0.000161	0.000154
Cadmium	mg/kg	6.50E-05	0.004629	0.006508	0.1936	0.04832	0.002014	0.003926	0.009435	0.01794	0.0003098	0.000552	0.001029	0.002406	0.00453
Calcium	mg/kg	646.4	536.7	506.1	399.8	730.6	778	853.9	1073	1412	704.5	709	718.8	746.2	789.3
Magnesium	mg/kg	237.5	351.6	379.1	1200	1928	247.1	256.6	284.1	326.3	246	254.5	271.2	319.4	393.9
Nickel	mg/kg	0.01517	0.1044	0.19	1.191	ND	0.02701	0.03862	0.07208	0.1237	0.01509	0.01502	0.01487	0.01444	0.01377
Potassium	mg/kg	13.99	12.8	12.21	105.5	105.3	14.91	15.82	18.42	22.44	14.45	14.91	15.82	18.42	22.44
Sodium	mg/kg	344.9	545.6	577	1781	1282	359.2	373.5	414.3	477.3	349.5	354.3	363.5	390.3	431.5
Uranium	mg/kg	0.03674	0.5382	0.4505	6.409	3.54	0.101	0.1639	0.3452	0.6251	0.05451	0.0721	0.1068	0.2067	0.3609
Carbonate Ion (CO_3^{2}	mg/kg as $CaCO_3$	322.2	0.9848	0.9846	1.936	1.933	319.2	316	306.85	292.65	320.8	319.2	316	306.85	292.7
Chloride	mg/kg	787.3	1054	1103	2788	2681	807.3	827.1	883.9	971.6	796.8	806.3	825	879	962.4
Sulfate	mg/kg	2178	3142	3535	32623.2	36225	2487.6	2787.9	3657	4995	2352.9	2524.2	2862	3834	5334
pH	s.u.	6.14	2.88	4.49	2.97	1	6.103	6.066	5.952	5.747	4.8	3.264	2.681	2.199	1.912
Iron	mg/kg	5.587	7.189	13.29	4182	3740	47.66	88.89	207.8	391.3	24.53	43.28	80.22	186.7	351.1
Carbonate alkalinity	mg/l as $CaCO_3$	327	1	1	2	2	112.6	106.5	88.75	61.68	9.37	0.28	0.07	0.02	0.01
Eh	mV	207.2	763.4	529.1	474.4	780	254.0	262.8	278.3	304.4	599.0	716.5	737.6	756.6	767.2

Notes

Mixing ratio	Parts 36-07 KD water : parts tailings source water
Non-detected results were defined as the minimum detection limit (MDL)	
mg/l	milligrams per liter
s.u.	standard units
TRA	Tres Hermanos A sandstone member of the Mancos Formation
KD	Dakota Formation
Eh	Oxidation reduction potential normalized to standard hydrogen electrode
ND	No data available
Cell 1	Analytical data are based on results from tailings monitoring location TBH-2Z
Pond 1	Analytical data are presented in Bostick, 1985; Eh is taken from Longmire, 1983.

TABLE 4

Saturation Indices for Monitoring Wells and Modeled Mixtures

Ambrosia Lake; Rio Algom Mining LLC; Grants, New Mexico

Location	36-07 KD	36-06 KD	36-06 KD	Cell 1	Pond 1	36-07 KD + Cell 1				36-07 KD + Pond 1				
Date	4/9/2021	2/15/2017	6/28/2021	9/21/2020	11/9/1981	-	-	-	-	-	-	-	-	-
Mixing Ratio	-	-	-	-	-	100:1	50:1	20:1	10:1	200:1	100:1	50:1	20:1	10:1
Sample Description	Recently Installed KD Well	Sampled pre-development	Sampled post-development	Tailings porewater endmember	Historical pond water endmember	Mixtures of 36-07 KD and Cell 1 (TBH-2Z) Tailings Porewater				Mixtures of 36-07 KD and Pond 1 water (collected in 1981)				
Anhydrite	-0.27	-0.28	-0.27	-0.03	0.01	-0.24	-0.22	-0.17	-0.12	-0.25	-0.24	-0.23	-0.21	-0.19
Aragonite	-0.98	< -3	< -3	< -3	< -3	-1.06	-1.15	-1.40	-1.84	< -3	< -3	< -3	< -3	< -3
$Be(OH)_2$ (alpha)	< -3	< -3	< -3	< -3	< -3	-2.31	-2.04	-1.76	-1.75	< -3	< -3	< -3	< -3	< -3
$Be(OH)_2$ (am)	< -3	< -3	< -3	< -3	< -3	-2.61	-2.34	-2.06	-2.05	< -3	< -3	< -3	< -3	< -3
$Be(OH)_2$ (beta)	< -3	< -3	< -3	< -3	< -3	-1.91	-1.64	-1.36	-1.35	< -3	< -3	< -3	< -3	< -3
$CaCO_3xH_2O$	-2.17	< -3	< -3	< -3	< -3	-2.25	-2.34	-2.59	< -3	< -3	< -3	< -3	< -3	< -3
Calcite	-0.83	< -3	< -3	< -3	< -3	-0.92	-1.00	-1.26	-1.69	< -3	< -3	< -3	< -3	< -3
Dolomite (disordered)	< -3	< -3	< -3	< -3	< -3	< -3	< -3	< -3	< -3	< -3	< -3	< -3	< -3	< -3
Dolomite (ordered)	< -3	< -3	< -3	< -3	< -3	< -3	< -3	< -3	< -3	< -3	< -3	< -3	< -3	< -3
Epsomite	-2.70	-2.46	-2.38	-1.53	-1.59	-2.65	-2.61	-2.50	-2.38	-2.66	-2.64	-2.60	-2.51	-2.40
Fe3(OH)8	< -3	< -3	< -3	< -3	< -3	0.06	0.81	1.37	1.24	-1.42	< -3	< -3	< -3	< -3
$Fe(OH)_{2.7}Cl_{.3}$	4.96	4.07	6.25	3.33	1.49	6.56	6.87	7.14	7.25	7.97	5.82	4.61	3.67	3.12
Ferrihydrite	1.09	-0.81	1.84	-1.66	< -3	2.68	2.97	3.21	3.24	3.70	1.08	-0.30	-1.40	-2.04
Ferrihydrite (aged)	< -3	< -3	< -3	< -3	< -3	< -3	< -3	< -3	< -3	< -3	< -3	< -3	< -3	< -3
Goethite	3.80	1.90	4.55	1.06	-1.36	5.39	5.68	5.92	5.95	6.41	3.79	2.41	1.31	0.67
Gypsum	-0.02	-0.03	-0.02	0.21	0.25	0.01	0.03	0.08	0.13	0.00	0.01	0.02	0.04	0.06
Hematite	10.01	6.19	11.51	4.52	-0.31	13.18	13.76	14.23	14.30	15.22	9.98	7.22	5.02	3.75
H-Jarosite	< -3	< -3	-1.54	< -3	< -3	< -3	< -3	< -3	-2.13	2.45	0.77	-1.00	-2.27	-2.93
K-Jarosite	-2.60	1.67	4.92	1.50	-0.92	2.40	3.49	4.81	5.84	9.31	6.11	3.77	2.08	1.22
Lepidocrocite	2.92	1.02	3.67	0.18	-2.24	4.51	4.80	5.04	5.07	5.53	2.91	1.53	0.43	-0.21
Maghemite	2.20	-1.61	3.70	< -3	< -3	5.38	5.96	6.43	6.50	7.41	2.18	-0.58	-2.78	< -3
Magnesioferrite	1.44	< -3	-0.25	< -3	< -3	4.54	5.04	5.28	4.94	3.98	< -3	< -3	< -3	< -3
Magnesite	-2.04	< -3	< -3	< -3	< -3	-2.11	-2.17	-2.37	-2.74	< -3	< -3	< -3	< -3	< -3
Magnetite	12.87	1.01	11.33	3.29	< -3	16.88	17.63	18.19	18.06	15.41	7.10	3.18	0.05	-1.76
Melanterite	< -3	< -3	< -3	-1.35	< -3	< -3	< -3	-2.96	-2.64	< -3	< -3	< -3	< -3	< -3
Na-Jarosite	< -3	-2.15	1.15	-2.70	< -3	-1.66	-0.58	0.72	1.72	5.25	2.04	-0.31	-2.03	-2.94
$NiCO_3$	-2.91	< -3	< -3	< -3	< -3	-2.74	-2.67	-2.63	-2.82	< -3	< -3	< -3	< -3	< -3
Rutherfordine	< -3	< -3	< -3	< -3	< -3	< -3	< -3	-2.54	-1.67	-2.65	< -3	< -3	< -3	< -3
Siderite	-0.94	< -3	< -3	< -3	< -3	-0.09	0.10	0.22	0.06	< -3	< -3	< -3	< -3	< -3
UO2(OH)2 (beta)	< -3	< -3	< -3	< -3	< -3	< -3	< -3	< -3	-2.64	< -3	< -3	< -3	< -3	< -3
Vaterite	-1.40	< -3	< -3	< -3	< -3	-1.48	-1.57	-1.82	-2.26	< -3	< -3	< -3	< -3	< -3

Notes

Mineral is approximately saturated (SI between 1 and -1)

Mineral is undersaturated (SI < -1)

Mineral is supersaturated (SI > 1)

Mixing ratio — Parts 36-07 KD water : parts tailings source water

TABLE 5
Modeled Precipitation of Ferrihydrite and K-jarosite for 36-07 KD
Ambrosia Lake; Rio Algom Mining LLC; Grants, New Mexico

Location		36-06 KD	36-06 KD	36-07 KD	36-07 KD	36-07 KD
Date		2/15/2017	6/28/2021	4/9/2021	4/9/2021	4/9/2021
Mixing Ratio		-	-	-	-	-
Sample Description		Older KD Well, sampled pre-development	Older KD Well, sampled post-development	Recently Installed KD Well		
Precipitant				No Precipitation	Ferrihydrite	K-Jarosite
Arsenic	mg/kg	0.0008864	0.01516	0.00338	0.003379	DNP
Beryllium	mg/kg	0.01389	0.01152	1.70E-04	1.70E-04	DNP
Cadmium	mg/kg	0.004629	0.006508	6.50E-05	6.50E-05	DNP
Calcium	mg/kg	536.7	506.1	700.2*	698.5	DNP
Magnesium	mg/kg	351.6	379.1	237.5	2.38E+02	DNP
Nickel	mg/kg	0.1044	0.19	0.01517	1.52E-02	DNP
Potassium	mg/kg	12.8	12.21	13.99	13.99	DNP
Sodium	mg/kg	545.6	577	344.9	344.8	DNP
Uranium	mg/kg	0.5382	0.4505	0.03674	0.03674	DNP
Carbonate Ion (CO_3^{2-})	mg/kg as $CaCO_3$	0.9848	0.9846	322.2	322.45	DNP
Chloride	mg/kg	1054	1103	787.3	787.2	DNP
Sulfate	mg/kg	3142	3535	2178	2180.4	DNP
pH	s.u.	2.88	4.49	6.14	6.056	DNP
Iron	mg/kg	7.189	13.29	5.587	0.7992	DNP
Carbonate alkalinity	mg/l as $CaCO_3$	1	1	327	106.18	DNP
Eh	mV	763.4	529.1	207.2	207.2	DNP

Notes

Mixing ratio	Parts 36-07 KD water : parts tailings source water
mg/l	milligrams per liter
s.u.	standard units
KD	Dakota Formation
DNP	Does not precipitate
*	Precip models were charge balanced on Ca. Ca concentrations presented here will differ from those presented in Table 3, which are not charge balanced.

TABLE 6
Modeled Precipitation of Ferrihydrite and K-jarosite for Mixtures of 36-07 KD and Cell 1 Water
Ambrosia Lake; Rio Algom Mining LLC; Grants, New Mexico

Location		**36-06 KD**	**36-06 KD**	**36-07 KD + Cell 1**				**36-07 KD + Cell 1**				**36-07 KD + Cell 1**			
Date		**2/15/2017**	**6/28/2021**	-	-	-	-	-	-	-	-	-	-	-	-
Mixing Ratio		-	-	**100:1**	**50:1**	**20:1**	**10:1**	**100:1**	**50:1**	**20:1**	**10:1**	**100:1**	**50:1**	**20:1**	**10:1**
Sample Description		Older KD Well, sampled pre-development	Older KD Well, sampled post-development	Mixtures of 36-07 KD and Cell 1 (TBH-2Z) Tailings Porewater				Mixtures of 36-07 KD and Cell 1 (TBH-2Z) Tailings Porewater				Mixtures of 36-07 KD and Cell 1 (TBH-2Z) Tailings Porewater			
Precipitant				No Precipitation				Ferrihydrite				K-Jarosite			
Does mineral precipitate, i.e. is mineral supersaturated?				-	-	-	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Arsenic	mg/kg	0.001643	0.02812	0.02003	0.03633	0.08336	0.156	0.02003	0.03633	0.08336	0.156	0.02003	0.03633	0.08337	0.156
Beryllium	mg/kg	0.01389	0.01152	0.003318	0.006403	0.0153	0.02903	0.003318	0.006404	0.0153	0.02903	0.003318	0.006404	0.0153	0.02903
Cadmium	mg/kg	0.004629	0.006508	0.002014	0.003926	0.009435	0.01794	0.002015	0.003926	0.009436	0.01794	0.002015	0.003926	0.009436	0.01794
Calcium	mg/kg	536.7	506.1	778*	853.9*	1073*	1412*	766.7	841.6	1062	1403	770.9	842.7	1059	1400
Magnesium	mg/kg	351.6	379.1	247.1	256.6	284.1	326.3	247.2	256.7	284.1	326.3	247.2	256.7	284.1	326.3
Nickel	mg/kg	0.1044	0.19	0.02701	0.03862	0.07208	0.1237	0.02701	0.03862	0.07208	0.1237	0.02701	0.03862	0.07209	0.1237
Potassium	mg/kg	12.8	12.21	14.91	15.82	18.42	22.44	14.91	15.82	18.42	22.44	10.21	8.435	9.327	14.56
Sodium	mg/kg	545.6	577	359.2	373.5	414.3	477.3	359.3	373.5	414.3	477.3	359.3	373.5	414.3	477.4
Uranium	mg/kg	0.6106	0.511	0.101	0.1639	0.3452	0.6251	0.101	0.1639	0.3452	0.6251	0.101	0.1639	0.3452	0.6252
Carbonate Ion (CO_3^{2}	mg/kg as $CaCO_3$	0.9848	0.9846	319.2	316	306.85	292.65	319.2	316	306.85	292.7	319.2	316	306.85	292.7
Chloride	mg/kg	1054	1103	807.3	827.1	883.9	971.6	807.4	827.1	884	971.7	807.4	827.2	884.1	971.7
Sulfate	mg/kg	3142	3535	2487.6	2787.9	3657	4995	2487.9	2788.2	3657	4995	2464.8	2751.9	3612	4956
pH	s.u.	2.88	4.49	6.103	6.066	5.952	5.747	5.365	5.143	4.901	4.664	5.853	5.631	5.254	4.835
Iron	mg/kg	7.189	13.29	47.66	88.89	207.8	391.3	15.92	54.5	176.1	367.1	27.52	57.27	168.9	357.5
Carbonate alkalinity	mg/kg as $CaCO_3$	1	1	112.6	106.5	88.75	61.68	31.42	19.72	11.5	6.63	77.67	52.47	24.56	9.71
Eh	mV	763.4	529.1	254.0	262.8	278.3	304.4	254.0	262.8	278.3	304.4	254.0	262.8	278.3	304.4

Notes

Mixing ratio	Parts 36-07 KD water : parts tailings source water
mg/l	milligrams per liter
s.u.	standard units
TRA	Tres Hermanos A sandstone member of the Mancos Formation
KD	Dakota Formation
DNP	Does not precipitate
*	Precipitation models were charge balanced on Calcium. Ca concentrations presented here will differ from those presented in Table 3, which are not charge balanced.

TABLE 7

Modeled Precipitation of Ferrihydrite and K-jarosite for Mixtures of 36-07 KD and Pond 1 Water

Ambrosia Lake; Rio Algom Mining LLC; Grants, New Mexico

Location		36-06 KD	36-06 KD	36-07 KD + Pond 1					36-07 KD + Pond 1					36-07 KD + Pond 1				
Date		2/15/2017	6/28/2021	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mixing Ratio		-	-	200:1	100:1	50:1	20:1	10:1	200:1	100:1	50:1	20:1	10:1	200:1	100:1	50:1	20:1	10:1
Sample Description		Older KD Well, sampled pre-development	Older KD Well, sampled post-development	Mixtures of 36-07 KD and Pond 1 water					Mixtures of 36-07 KD and Pond 1 water					Mixtures of 36-07 KD and Pond 1 water				
Precipitant				No Precipitation					Ferrihydrite					K-Jarosite				
Does mineral precipitate, i.e. is mineral supersaturated?				-	-	-	-	-	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Yes
Arsenic	mg/kg	0.001643	0.02812	0.02248	0.04139	0.07863	0.186	0.3518	0.02248	0.04139	DNP	DNP	DNP	0.02248	0.0414	0.07865	0.1861	0.3519
Beryllium	mg/kg	0.01389	0.01152	0.000169	0.000168	0.000166	0.000161	0.000154	0.000169	0.000168	DNP	DNP	DNP	0.000169	0.000168	0.000166	0.000161	0.000154
Cadmium	mg/kg	0.004629	0.006508	0.00031	0.000552	0.001029	0.002406	0.00453	0.00031	0.000552	DNP	DNP	DNP	0.00031	0.000552	0.001029	0.002406	0.004531
Calcium	mg/kg	536.7	506.1	704.5*	709*	718.8*	746.2*	789.3*	703.4	708.1	DNP	DNP	DNP	702.5	707.1	717.3	745.4	788.9
Magnesium	mg/kg	351.6	379.1	246	254.5	271.2	319.4	393.9	246	254.6	DNP	DNP	DNP	246	254.6	271.3	319.5	394
Nickel	mg/kg	0.1044	0.19	0.01509	0.01502	0.01487	0.01444	0.01377	0.01509	0.01502	DNP	DNP	DNP	0.01509	0.01502	0.01487	0.01444	0.01377
Potassium	mg/kg	12.8	12.21	14.45	14.91	15.82	18.42	22.44	14.45	14.91	DNP	DNP	DNP	8.759	5.354	1.76	1.766	4.854
Sodium	mg/kg	545.6	577	349.5	354.3	363.5	390.3	431.5	349.5	354.3	DNP	DNP	DNP	349.6	354.4	363.6	390.4	431.6
Uranium	mg/kg	0.6106	0.511	0.05451	0.0721	0.1068	0.2067	0.3609	0.05451	0.0721	DNP	DNP	DNP	0.05451	0.07211	0.1068	0.2067	0.361
Carbonate Ion (CO_3^{2}	mg/kg as $CaCO_3$	0.9848	0.9846	320.8	319.2	316	306.85	292.7	320.85	319.2	DNP	DNP	DNP	320.85	319.25	316.05	306.9	292.75
Chloride	mg/kg	1054	1103	796.8	806.3	825	879	962.4	796.8	806.3	DNP	DNP	DNP	796.9	806.4	825.2	879.2	962.6
Sulfate	mg/kg	3142	3535	2352.9	2524.2	2862	3834	5334	2352.9	2524.2	DNP	DNP	DNP	2325	2477.4	2793.3	3753	5250
pH	s.u.	2.88	4.49	4.8	3.264	2.681	2.199	1.912	3.689	2.981	DNP	DNP	DNP	4.164	2.926	2.506	2.122	1.869
Iron	mg/kg	7.189	13.29	24.53	43.28	80.22	186.7	351.1	2.694	21.93	DNP	DNP	DNP	0.1327	2.319	19.99	115.4	275.8
Carbonate alkalinity	mg/kg as $CaCO_3$	1	1	9.37	0.28	0.07	0.02	0.01	0.75	0.15	DNP	DNP	DNP	2.22	0.13	0.05	0.02	0.01
Eh	mV	763.4	529.1	599.0	716.5	737.6	756.6	767.2	599.0	716.5	DNP	DNP	DNP	599.0	716.5	737.6	756.6	767.2

Notes

Mixing ratio	Parts 36-07 KD water : parts tailings source water
mg/l	milligrams per liter
s.u.	standard units
KD	Dakota Formation
-	Water quality does not change because mineral is not supersaturated/does not precipitate.
DNP	Does not precipitate
*	Precipitation models were charge balanced on Calcium. Ca concentrations presented here will differ from those presented in Table 3, which are not charge balanced.

TABLE 8
Measured pH and Modeled pH after Simulated Precipitation
Ambrosia Lake; Rio Algom Mining LLC; Grants, New Mexico

Location		36-07 KD	36-06 KD	36-06 KD	36-07 KD + Cell 1				36-07 KD + Pond 1				
Date		**4/9/2021**	**2/15/2017**	**6/28/2021**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Mixing Ratio		**-**	**-**	**-**	**100:1**	**50:1**	**20:1**	**10:1**	**200:1**	**100:1**	**50:1**	**20:1**	**10:1**
Sample Description		Recently Installed KD Well	Sampled pre-development	Sampled post-development	Mixtures of 36-07 KD and TBH-2Z Tailings Porewater				Mixtures of 36-07 KD and Pond 1				
Ferrihydrite	Initial pH	6.140	2.880	4.490	6.103	6.066	5.952	5.747	4.800	3.264	2.681	2.199	1.912
Ferrihydrite	Final pH	6.056	DNP	3.916	5.365	5.143	4.901	4.664	3.689	2.981	DNP	DNP	DNP
K-Jarosite	Initial pH	6.140	2.880	4.490	6.103	6.066	5.952	5.747	4.800	3.264	2.681	2.199	1.912
K-Jarosite	Final pH	DNP	2.855	3.856	5.853	5.631	5.254	4.835	4.164	2.926	2.506	2.122	1.869

Notes

pH (i) Modeled initial pH, pre-precipitation

pH (f) Modeled final pH, post-precipitation

DNP No final pH is calculated because the mineral's saturation index is < 0 and precipitation would not occur

Mixing ratio Parts 36-07 KD water : parts tailings source water

TABLE 9

36-06 KD Groundwater Conditions: Pre- and Post-Redevelopment

Ambrosia Lake; Rio Algom Mining LLC; Grants, New Mexico

Period of Record	Beryllium (mg/L)	Cadmium (mg/L)	Iron (mg/L)	Uranium (mg/L)	ORP (mV)	pH (s.u.)	DTW (ft BTOC)
July 2019 – July 2020 (Pre-Redevelopment)	0.0044 – 0.0072	0.0031 – 0.0054	1.4 – 10.4	0.308 – 0.482	460 – 540	2.7 – 4	~190
August 2020 – December 2020 (Post-Redevelopment)	0.0105 – 0.0142	0.0092	125	0.587	265 – 332	3.69 – 4.24	~180

Notes:

BTOC = below top of casing
DTW = depth to water
ft = foot or feet
mg/L = milligrams per liter
mV = millivolts
ORP = oxidation reduction potential
s.u. = standard units

APPENDIX A

Field Logbook

5/13/21

36-06 KD + 3607 KD
Geophysical Logging

BA

0945 Arrive onsite.

H3 (Tom Bottomly) scan in
Daiman's equipment.

Brian + Scott gather up any
remaining gear.

1015 Head to 36 Pad.

Set up over 36-07 KD to logs

Pulled Pump: No significant encrustations
to sample. (IronScale).

1040 - Start logging. ~~AA~~ $\boxed{\text{36-07 KD}}$ Run#1
- Optical Camera
  - Zeroed at top of casing.
  - Logging downward at ~ 5 ft/min.
  - @ ~37' BTOC upped speed to ~ 8 ft/min.
  - @ 137' BTOC = Top of casing. Some
    rusty color on screen.
  - @ 142' Noticed some potentially very
    faint dripping. Still no indication of
    significant water entry.
  - @ 180' BTOC - Still no indication of
    significant water entry.
  - @ 187' BTOC = looks like old water
    level stain mark.
  - @ 189 Water level. Pretty clear
    water.

5/13/21 Geophysical Logging BA

[Set Camera at bottom of well and set depth to 206.15' BTOC which was gauged during 2021 Q2 Groundwater Monitoring event.]

36-07 KD Run #3 Uphole

- Depth on bottom of well set at 206.15' BTOC.
- Start logging uphole to determine if depth wheel was slipping due to light-weight tooling (camera) going down.

1220 - Reached top of Casing. Depth = ~~~20~~ Depth TOC = ~2'.

note = only about a 2' discrepancy coming uphole.

1230 Setting up to run Induction Tool into the well next. Tool requires air calibration.

1252 36-07 KD Run #4 ~~Downhole~~ Uphole

- Induction Tool. (Induction, Gamma, Res, Conduct)
- Zeroed at Top of Casing.

1252 - Set tool at bottom

1300 Start logging uphole

1308 - Finish logging (Induction)

→ Depth correlated perfectly this run.

1310 Set up to log with Neutron Tool. Sending tool to bottom. Will log uphole.

1450 36-06 KD Run #2 Camera Uphole
- Set camera on bottom of well and set depth to 199' BTOC based on recent gauging data.
- 184' BTOC = Water Level.

Note: Finished logging but No HTML file was saved.

1500 John Meader (BHP) arrive at well Pad to visit. Stayed for 5 minutes.

Set up Induction tool and send it to well bottom. Will log uphole.

36-06 KD Run #3 - Induction Tool; uphole
- zeroed to Top of casing

1534 Finish logging Run #3 (Induction Tool)

Set up to run Neutron Tool. Change tooling.

1542 36-06 KD Run #4 - Neutron Tool
Note: @ 120' BTOC = large gamma kick. This kick was not observed in any of the 36-07 KD logs.
Kick is approx: Gamma = 1300 cps.

1558 Start sending down 4π Tool.

1602 36-06 KD Run #5 4π Tool

10.08.21 AH

$\boxed{\text{36-06KD AquiferTest}}$

0930 AH & Brett on-site

0945 Nizhonabah on-site

WX: clear & smokey

OBJ: · Install a transducer in 36-06KD & 36-07KD
· Use existing bladder pump to purge as much groundwater as possible from 36-06KD
· Collect & decon transducers
· Purge groundwater into 250 gal tote & pump that groundwater into the open top frac tank
· Collect groundwater sample of 06KD if >1.5 casing volumes removed

General Notes:
36-06 KD pump depth: 190-193' btoc(?)
36-06 KD DTW (6.1.21): 183.98' btoc
36-07KD pump depth: 201-204' btoc(?)
36-07KD DTW (5.4.21): 201.5' btoc
36-06KD Pump settings: 10.5/15/20

0950 Tailgate & JRA review

1017 Calibrating YSI

1105 @ 36 pad

6.08.21

36-06KD Aquifer Test

1111 36-06KD DTW = 185.96 ft btoc

1116 36-07KD DTW = 201.77 ft btoc

1126 Pulling bladder pump @ 36-06 KD to install transducer

1146 Taped (electrical) the transducer to the top of the 36-06KD bladder pump

↳ B/c of the transducer cable, the landing plate of -03 is ~2" higher than normal

1200 Taped 2nd transducer @ bottom (even w/ bottom) of 36-07KD bladder pump

↳ 1st live reading = 2.62 ft of water above transducer

1226 1st live reading @ 36-06 KD = 4.94 ft of water above transducer

1242 Double checking cycle times

	Knob set (sec)	Actual (sec)
Fill:	40	45
Discharge:	20	19

6.08.21 AH

36-06KD Aquifer Test

1308 ~~At~~ AH current pumping rate of ~~5770~~ ~~AH~~ 570 mL/4.5 min = 0.126 L/min & water column height above T-ducer ≥ 3.80 ft

~~1328 Water column height above T-ducer >~~ AH

1321 Earlier the pH had crept up to ~140 psi, after lowering it back to 105 psi the 105/40/15 settings were not producing water

1330 Picked up the top plate & shook the well & transducer up & down ~~t~~ AH in case the check ball is stuck

↳ This did not work -> shutting it down & pulling the pump

↳ The bottom of pump is missing 1 of 2 Allen screws

↳ The top of pump (bladder) ~~was~~ had a compression pipe clamp fail, we replaced it

1410 Put pump & transducer back down 36-06 KD

6.08.21 | 36-06 KD Aq Test | AG

1422 After redropping pump & T-Ducer new reading is 3.37 ft above T-Ducer

↳ The measured DTW now is 187.65 ft btoc (~2 in high)

1425 Resume pumping 105/40/15
1434 DTW = 188.00 ft btoc

↳ the YSI got 1/2 full of water & then just air was discharging

↳ stopped went to turn off the compressor & the crimped end of the air hose on GW truck failed

1638 Replacing the 36-06 KD pump

↳ cut 3/4 in of existing water line (Air line fitting ~~fits~~ new pump)

↳ installed the new 3 ft pump

1709 DTW @ 36-06 KD = 188 ft btoc

1712 T-Ducer taped to top of new pump (flush to top) w/ live reading of 3.01 ft above T-Ducer

6.08.21 AH

36-06 KD Aq Test

1713 T-Ducer reading 2.49 ft ~~above~~ water above @ 36-07 KD

Summary: • Installed T-Ducers in 36-06 KD & 36-07 KD
• Purged 4L of gw from 36-06 KD + tubing volume & then bladder failed
• Replaced the entire pump of 36-06 KD
• Left the T-Ducers in both wells

1800 AH & BM off-site

6.14.21 AH

36 Pad Aq Test!

0930 AH & BH on-site

WX: Hot

OBJ: • Lower pump in 36-06KD by ~4 ft
• Perform aquifer test in 36-06KD w/ observation well as 36-07KD

0943 Calibrating YSI

1014 Going to fuel up GWM Truck
↳ Replaced bolts on Air spool

1129 Setting up @ 36-06KD

Initial Measurements

DTW @ 36-06KD = 186.37 ft btometal casing (btomc)
DTW @ 36-07KD = 201.85 ftbtoc
Water column height above T-Ducer @ 36-07KD = 3.42 ft (Located @ bottom of Pump)
Water Column height above T-Ducer @ 36-06KD = 4.55 (Located @ top of pump)

36-06KD bladder pump is 3.16 ft long

186.37 DTW + 4.55 T-Ducer Depth + 3.25 T-Ducer to end pump = 194.17

6.14.21 AU

36 Pad Aq Test

36-06 KD Lowering Pump Notes

- Bottom of pump is currently @ 194 ft btomc
- Measured TD @ 199.1 ft btomc
- Replacing the 6.2 ft of air & water ~~[illegible]~~ w/ 9.2 ft of tubing (3 ft extension -> new bottom of 3.16 ft long pump @ 197.2 ft btomc
- Replacing a 5.65 ft long segment of wire w/ a 9 ft long segment of new wire to allow for the 3 ft tubing-extension

1326 Finished extending pump @ 36-06 KD

↳ Logger depth = 8.02 ft which is 0.47 ft deeper than thought

↳ this level is dropping

1329 Logger depth = 7.94 ft 36-06 KD

↳ The pump was out for a long time, well is probably re-equilibrating

1408 Logger depth = 7.60 ft btomc

↳ Top of pump = 194 ft btomc
intake = 197 ft btomc

6.14.21

AH

36-06 KD Aq Test

1413 Begin pumping 36-06 KD

↳ No water (first 2-3 cycles made water)

↳ Shook pump

1439 Resume pumpig

↳ 2 cycles pumped 300mL (total) & then no more water

↳ Pulled the pump & the bottom check ball was very stuck

Summary:

- Lowered 36-06 KD by 3 ft
- Tried to use new bladder pump, but the bottom check ball kept getting stuck

1552 AH & BM off-site

6/16/21 AH

36-06 KD Aq Test

0900 AH, BH, & CS on-site

WX: Hot

0835: Purge 36-06 KD dry with the bladder pump or bailer (2nd choice) & leave Transducers until next week

0920 Calibrating YSI

0956 Setting up @ 36-06 KD

1013 DTW @ 36-06 KD = 186.49 ft btomc

↳ Initial T-Ducer reading = 7.53 ft above top of pump

1015 Begin pumping 36-06 KD

1111 Pumped 36-06 KD dry after purging 22.25 L

↳ The transducer still read 0.33 ft

1131 verifyed DTW below transducer (located @ top of pump 194 ft btomc)
DTW = 195.30 ft btomc

6.16.21

AH

36 Pad Aquifer Test

Summary: • Purged ~ 22.25L of groundwater from 36-06 KD at which point it pumped dry.
- Final DTW @ 36-06KD = 195.30 ft btomc
- The transducer was at 194 ft btomc but still read 0.33 ft, Brett will come back in a couple days to verify adequate functionality of transducer

Note: Clark is shipping core samples to ATT for analysis. RAD screening was performed 5.21.21 by Clark Short & Tom Bottomly. Activities provided to Will Rawsch (ATT). Will reviewed activities & approved shipment. Clark shipped samples as UN2910

1250 AH & BM off site

6.21.21 BM

36 PAD AQ TEST

0930 Onsite, just BM
- wx: Hot

OBJ: Test transducers, dl data, tag water.

1000 on 3606KD pad. Tag water
DTW at 3606 @ 190.59, wl on tducer
is 3.45. appears working as intended

3607KD also downloaded tducer data

1030 Back @ Trailer, Offsite. Sent
email to Clark Short w/ data dl
for both wells. Plan is to be back
later in week after wells finish
recovering.

BM
6/21/21

6, 28, 21 AH

36 Pad Aq Test

0900 AH & BM on-site

WX: clear, cloudy, & it rained a little bit yesterday

OBJ: • Retreive the transducers (rental) from 36-06 KD & 36-07 KD; decon the transducers; H3 scan out the transducers prior to returning/shiping them.
• sample 36-06 KD for groundwater & incrustation if present
• Have H3 scan out air reel & bring to Abq for service

0930 Calibrating YSI

1000 setting up @ 36-06 KD
↳ DTW = 188.25 ft btoc
↳ T-ducer live reading = 5.80 ft

1028 Begin purging 36-06 KD

1055 GW parameters stabilized
↳ sampled 36-06 KD

6.28.21 AH

3 6 Pad Aq Test

1059 Pump stopped producing GW
↳ DTW = 193.15 ft btoc
intake @ 197 ft btoc
↳ Troubleshooting pump
↳ shook pump, dislodged check ball & finished sampling

1126 Pulling & deconing transducers

1211 Pouring IDW into open-top frac tank

1335 Tom (H3) scanned out both transducers/wire & the air hose
↳ AH & BH off-site to ship 36-06 KD samples & rental Eqp

APPENDIX B

Field Forms

Groundwater Sampling Field Report Form
Rio Algom Mining, LLC Ambrosia Lake Facility, New Mexico

Sample Location: 36-06 KD Date: 6.08.21 Logged by: AH

Sampling Crew: AH & BM Reg No.: Bottle Kit ID:

TD (ft BTOC): 198.99 DTW (ft BTOC): 185.96 Transducer depth: 190 Pump Depth (ft BTOC): 193 Sampled at:

Screened Interval (ft): 181-201 TOS - DTW (ft): # Bottles:

Method: Dedicated bladder Well Diameter (in): 4 Tubing Purge Vol. (L): Meter Model: YSI Pro Plus

Notes: Aquifer Test Reviewed:

Groundwater Quality Indicator Parameters

Time	Water Level (ft BTOC)	Vol. Pumped (gal or L)	Pumping Rate (gal or L / min)	Temp (°C) -	DO (mg/L) +/- 0.3	Spec. Cond. (µS/cm) +/- 3%	pH (s.u.) +/- 0.1	ORP (mV) +/- 10	Turbidity (NTU) +/- 10% if > 10 NTU	~~Notes~~ Pump settings
Start settings 1235										105/40/20
1242	Start pumping									
1247	—	.09	—	15.8	6.49	8031	3.73	352.2	—	
										These settings have
										been discharging 250 ml
1252	—	1.0	—	14.9	3.70	8001	3.79	400.4	—	105/40/10
										→ No gw came out
1255										105/40/15
										→ 120 mL/cycle
1257	—	1.75	—	17.2	3.72	7967	3.82	419.2	—	185 mL cycle
1300	—	2.00	0.126	15.6	4.25	7919	3.79	451.4	—	180 mL cycle
1302	—	—	0.126	—	—	—	—	—	—	120 mL cycle

Groundwater Sampling Field Report Form
Rio Algom Mining, LLC Ambrosia Lake Facility, New Mexico

Sample Location: 36-06 KD Sampler Initials: SH Date: 6.08.2

Time	Water Level (ft BTOC)	Vol. Pumped (gal or L)	Pumping Rate (gal or L / min)	Temp (°C) -	DO (mg/L) +/- 0.3	Spec. Cond. (µS/cm) +/- 3%	pH (s.u.) +/- 0.1	ORP (mV) +/- 10	Turbidity (NTU) +/- 10% if > 10 NTU	Notes
1303	—	—	0.126	17.3	4.27	7795	3.77	450.8	—	50 mL cycle
1304	—	—	0.126	—	—	—	—	—	—	220 mL cycle
1316	—	4.0	—	16.6	2.41	7958	3.98	430.5	—	—
1320										current settings not
										discharging (psi crept
										up earlier)
1321										105/40/20
										→ no water
1324										120/40/20 → no water
1327										120/20/20
1425	Resume pumping									105/40/15 → no water
1434										105/15/20
→ No water pump has a failed bladder										

Diam.	0.25"	1"	2"	4"	5"	6"
L/ft	0.01	0.15	0.62	2.5	3.9	5.6
Gal/ft	0.003	0.04	0.16	0.65	1.0	1.5

Groundwater Sampling Field Report Form

Rio Algom Mining, LLC Ambrosia Lake Facility, New Mexico

Sample Location: 36-06 KD　　Date: 6.14.21　　Logged by: AH

Sampling Crew: AH & BM　　Reg No.: ______　　Bottle Kit ID: ______

TD (ft BTOC): 199.1　　DTW (ft BTOC): 186.37　　Pump Depth (ft BTOC): 197 ft (intake)　　Sampled at: ______

Screened Interval (ft): 181-201　　TOS - DTW (ft): ______　　# Bottles: ______

Method: ______　　Well Diameter (in): 4　　Tubing Purge Vol. (L): ______　　Meter Model: ______

Notes: Aquifer Test　　Reviewed: ______

Groundwater Quality Indicator Parameters

Time	Water Level (ft BTOC)	Vol. Pumped (gal or L)	Pumping Rate (gal or L / min)	Temp (°C) -	DO (mg/L) +/- 0.3	Spec. Cond. (µS/cm) +/- 3%	pH (s.u.) +/- 0.1	ORP (mV) +/- 10	Turbidity (NTU) +/- 10% if > 10 NTU	Notes
1413		Begin pumping								105/40/20
	↳ Flow through half full @ 1425, re set settings to									105/15/20
		↳ Check ball (bottom) kept getting stuck done pumping for today								

Groundwater Sampling Field Report Form
Rio Algom Mining, LLC Ambrosia Lake Facility, New Mexico

Sample Location: ____________ Sampler Initials: ____________ Date: ____________

Time	Water Level (ft BTOC)	Vol. Pumped (gal or L)	Pumping Rate (gal or L / min)	Temp (°C) -	DO (mg/L) +/- 0.3	Spec. Cond. (µS/cm) +/- 3%	pH (s.u.) +/- 0.1	ORP (mV) +/- 10	Turbidity (NTU) +/- 10% if > 10 NTU	Notes

Diam.	0.25"	1"	2"	4"	5"	6"
L/ft	0.01	0.15	0.62	2.5	3.9	5.6
Gal/ft	0.003	0.04	0.16	0.65	1.0	1.5

Groundwater Sampling Field Report Form
Rio Algom Mining, LLC Ambrosia Lake Facility, New Mexico

Sample Location: 36-06 KD Date: 6.16.21 Logged by: AH

Sampling Crew: AH & BM Reg No.: — Bottle Kit ID:

TD (ft BTOC): 199.1 DTW (ft BTOC): 186.49 Pump Depth (ft BTOC): ~~194~~ 197 Sampled at:

Screened Interval (ft): 181-201 TOS - DTW (ft): # Bottles:

Method: Dedicated bladder Well Diameter (in): Tubing Purge Vol. (L): Meter Model:

Notes: Transducer @ 194 ft btoMC → metal casing Reviewed:

Groundwater Quality Indicator Parameters

Time	Water Level (ft BTOC)	Vol. Pumped (gal or L)	Pumping Rate (gal or L / min)	Temp (°C) -	DO (mg/L) +/- 0.3	Spec. Cond. (µS/cm) +/- 3%	pH (s.u.) +/- 0.1	ORP (mV) +/- 10	Turbidity (NTU) +/- 10% if > 10 NTU	Notes
1015	—	Begin pumping								105/15/20
1018	—	.30	—	14.3	7.27	7969	4.05	351.3	—	
1021	—	1.0	—	14.1	5.23	8001	4.29	348.3	—	
1023	—	2.5	—	14.3	2.93	7224	4.32	352.4	—	
1026	—	4.0	—	14.2	1.94	6930	4.33	354.4	—	
1029	—	5.5	—	14.2	1.47	7981	—	—	—	Battery of YSI died
1030	189.6	6.5	—	—	—	—	—	—	—	T-ducer reading = 4.4 ft
1035	190.69	9.5	—	—	—	—	—	—	—	T-ducer reading = 3.32 ft
1039	191.5	11.0	—	—	—	—	—	—	—	T-ducer reading = 2.50
1040	—	—	—	—	—	—	—	—	—	~~Dr~~ Transferred IDW @ 11.5 L
1042	191.95	12.5	—	—	—	—	—	—	—	T-ducer reading = 2.05
1046	192.81	15.0	—	—	—	—	—	—	—	T-ducer reading = 1.19
1049	193.34	16.0	—	—	—	—	—	—	—	T-ducer reading = 0.66
1056	193.69	19.5	—	—	—	—	—	—	—	T-ducer reading = 0.31

Groundwater Sampling Field Report Form
Rio Algom Mining, LLC Ambrosia Lake Facility, New Mexico

Sample Location: 36-06 KD Sampler Initials: AH Date: 6.16.21

Time	Water Level (ft BTOC)	Vol. Pumped (gal or L)	Pumping Rate (gal or L / min)	Temp (°C) -	DO (mg/L) +/- 0.3	Spec. Cond. (µS/cm) +/- 3%	pH (s.u.) +/- 0.1	ORP (mV) +/- 10	Turbidity (NTU) +/- 10% if > 10 NTU	Notes
1108	—	22	—	—	—	—	—	—	—	~~DTW (manual)~~ — ~~AH~~ T-Ducer
1111	—	22.25	—	—	No more water					still reading 0.33 ft
					↳turned off pump					
1131	195.30		manual measurement							

Diam.	0.25"	1"	2"	4"	5"	6"
L/ft	0.01	0.15	0.62	2.5	3.9	5.6
Gal/ft	0.003	0.04	0.16	0.65	1.0	1.5

Groundwater Sampling Field Report Form
Rio Algom Mining, LLC Ambrosia Lake Facility, New Mexico

Sample Location: 36-06 KD Date: 6, 28, 21 Logged by: AH

Sampling Crew: AH & BM Reg No.: Bottle Kit ID: NRC-36-06 KD

TD (ft BTOC): 199.1 DTW (ft BTOC): 188.25 Pump Depth (ft BTOC): 197 Sampled at:

Screened Interval (ft): 181-201 TOS - DTW (ft): 6.75 # Bottles: 6

Method: dedicated bladder Well Diameter (in): 4 Tubing Purge Vol. (L): 1.90 Meter Model: YSI Pro Plus

Notes: 105/15/20 Reviewed:

Groundwater Quality Indicator Parameters

Time	Water Level (ft BTOC)	Vol. Pumped (gal or L)	Pumping Rate (gal or L/ min)	Temp (°C) -	DO (mg/L) +/- 0.3	Spec. Cond. (µS/cm) +/- 3%	pH (s.u.) +/- 0.1	ORP (mV) +/- 10	Turbidity (NTU) +/- 10% if > 10 NTU	Notes
1030	Begin	purging								
1035	—	2.0	0.40	13.9	2.90	64.7	4.48	286.2	—	clear, no odor
1038	—	3.0	0.33	14.0	1.25	725	4.47	289.1	—	" "
1041	—	5.0	0.66	13.9	0.65	6508	4.48	296.7	—	" "
1044	—	7.0	0.66	13.9	0.40	6505	4.49	305.2	—	" "
1047	—	8.5	0.50	14.0	0.30	6499	4.49	304.7	—	" "
1050	—	10.0	0.50	13.9	0.29	6481	4.49	306.7	—	" "
1055	Sampled		36-06 KD							

APPENDIX C

Photograph Log

Photograph 1. Wireline Century Services acquiring geophysical data within monitoring well 36-06 KD.

Photograph 2. H3 staff member scanning out the tooling used for the geophysical data acquisition in monitoring wells 36-06 KD and 36-07 KD.

APPENDIX D

Laboratory Report for 36-06 KD Groundwater Samples

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Analytical Report

August 30, 2021

Report to:	Bill to:
Kent Applegate	Accounts Payable
Rio Algom Mining Company	Rio Algom Mining Company
P.O. Box 218	P.O. Box 218
Grants, NM 87020	Grants, NM 87020

cc: Michaella Gorospe, jcarroll, Jeremy Scott Collyard, Marcus Powell, Clark Short, Angela Persico

Project ID: 4510319940
ACZ Project ID: L66796

Kent Applegate:

Enclosed are the analytical results for sample(s) submitted to ACZ Laboratories, Inc. (ACZ) on June 29, 2021. This project has been assigned to ACZ's project number, L66796. Please reference this number in all future inquiries.

All analyses were performed according to ACZ's Quality Assurance Plan. The enclosed results relate only to the samples received under L66796. Each section of this report has been reviewed and approved by the appropriate Laboratory Supervisor, or a qualified substitute.

Except as noted, the test results for the methods and parameters listed on ACZ's current NELAC certificate letter (#ACZ) meet all requirements of NELAC.

This report shall be used or copied only in its entirety. ACZ is not responsible for the consequences arising from the use of a partial report.

All samples and sub-samples associated with this project will be disposed of after September 29, 2021. If the samples are determined to be hazardous, additional charges apply for disposal (typically $11/sample). If you would like the samples to be held longer than ACZ's stated policy or to be returned, please contact your Project Manager or Customer Service Representative for further details and associated costs. ACZ retains analytical raw data reports for ten years.

If you have any questions or other needs, please contact your Project Manager.

S. Habermehl

Scott Habermehl has reviewed and approved this report.

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Case Narrative

Rio Algom Mining Company

August 30, 2021

Project ID: 4510319940

ACZ Project ID: L66796

Sample Receipt

ACZ Laboratories, Inc. (ACZ) received 1 groundwater sample from Rio Algom Mining Company on June 29, 2021. The sample was received in good condition. Upon receipt, the sample custodian removed the sample from the cooler, inspected the contents, and logged the sample into ACZ's computerized Laboratory Information Management System (LIMS). The sample was assigned ACZ LIMS project number L66796. The custodian verified the sample information entered into the computer against the chain of custody (COC) forms and sample bottle labels.

Holding Times

All analyses were performed within EPA recommended holding times.

Sample Analysis

This sample was analyzed for inorganic, radiochemistry parameters. The individual methods are referenced on both, the ACZ invoice and the analytical reports. The extended qualifier reports may contain footnotes qualifying specific elements due to QC failures. In addition the following has been noted with this specific project:

1. (N1) Applies to: L66796-01/TOTAL DISSOLVED SOLIDS

Oven range is 80 C to 91 C. Over the weekend, the oven had a minor high hit out of range for the temperature. When the oven temperature was checked on Monday 7/6/21, the max temp read at 92.1'C . The WG was removed from the oven on 7/6/21 when the oven was back in range. The WG was examined and there was no splattering of samples.

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Inorganic Analytical Results

Rio Algom Mining Company

Project ID: 4510319940

Sample ID: 36 06 KD

ACZ Sample ID: ***L66796-01***

Date Sampled: *06/28/21 10:55*

Date Received: *06/29/21*

Sample Matrix: *Groundwater*

Metals Analysis

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Antimony, dissolved	M200.8 ICP-MS	5	<0.002	U		mg/L	0.002	0.01	07/14/21 19:41	enb
Arsenic, dissolved	M200.8 ICP-MS	5	0.0154			mg/L	0.001	0.005	07/14/21 19:41	enb
Barium, dissolved	M200.7 ICP	5	<0.035	U		mg/L	0.035	0.175	07/13/21 15:42	kja
Beryllium, dissolved	M200.8 ICP-MS	5	0.0117			mg/L	0.0004	0.00125	07/14/21 19:41	enb
Cadmium, dissolved	M200.8 ICP-MS	5	0.00661			mg/L	0.00025	0.00125	07/14/21 19:41	enb
Calcium, dissolved	M200.7 ICP	5	514			mg/L	0.5	2.5	07/13/21 15:42	kja
Iron, dissolved	M200.7 ICP	5	13.5			mg/L	0.3	0.75	07/13/21 15:42	kja
Lead, dissolved	M200.8 ICP-MS	5	<0.0005	U		mg/L	0.0005	0.0025	07/14/21 19:41	enb
Magnesium, dissolved	M200.7 ICP	5	385			mg/L	1	5	07/13/21 15:42	kja
Molybdenum, dissolved	M200.8 ICP-MS	5	<0.001	U		mg/L	0.001	0.0025	07/14/21 19:41	enb
Nickel, dissolved	M200.8 ICP-MS	5	0.193			mg/L	0.002	0.005	07/14/21 19:41	enb
Potassium, dissolved	M200.7 ICP	5	12.4			mg/L	1	5	07/13/21 15:42	kja
Selenium, dissolved	SM 3114 B, AA-Hydride	1	0.0029	B		mg/L	0.002	0.005	07/07/21 18:09	mlh
Sodium, dissolved	M200.7 ICP	5	586			mg/L	1	5	07/13/21 15:42	kja
Uranium, dissolved	M200.8 ICP-MS	5	0.519			mg/L	0.0005	0.0025	07/14/21 19:41	enb

Wet Chemistry

Parameter	EPA Method	Dilution	Result	Qual	XQ	Units	MDL	PQL	Date	Analyst
Alkalinity as CaCO3	SM2320B - Titration									
Bicarbonate as CaCO3		1	<2	U		mg/L	2	20	07/09/21 0:00	eep
Carbonate as CaCO3		1	<2	U		mg/L	2	20	07/09/21 0:00	eep
Hydroxide as CaCO3		1	<2	U		mg/L	2	20	07/09/21 0:00	eep
Total Alkalinity		1	<2	U	*	mg/L	2	20	07/09/21 0:00	eep
Cation-Anion Balance	Calculation									
Cation-Anion Balance			-12.0			%			08/26/21 0:00	calc
Sum of Anions			107			meq/L			08/26/21 0:00	calc
Sum of Cations			84			meq/L			08/26/21 0:00	calc
Chloride	SM4500Cl-E	20	1120		*	mg/L	10	40	07/17/21 11:58	wtc
Conductivity @25C	SM2510B	1	7710			umhos/cm	1	10	07/09/21 2:28	eep
Cyanide, Total	D7511-09	1	<0.003	U	*	mg/L	0.003	0.01	07/02/21 12:54	md/wtc
Nitrate/Nitrite as N	M353.2 - H2SO4 preserved	1	<0.02	U	*	mg/L	0.02	0.1	07/15/21 1:59	pjb
Residue, Filterable (TDS) @180C	SM2540C	2	6820		*	mg/L	40	80	07/02/21 15:42	emk
Sulfate	D516-02/-07/-11 - TURBIDIMETRIC	120	3590		*	mg/L	120	600	07/20/21 11:09	syw
TDS (calculated)	Calculation		6220			mg/L			08/26/21 0:00	calc
TDS (ratio - measured/calculated)	Calculation		1.10						08/26/21 0:00	calc

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
Lower	Lower Recovery Limit, in % (except for LCSS, mg/Kg)
MDL	Method Detection Limit. Same as Minimum Reporting Limit unless omitted or equal to the PQL (see comment #5). Allows for instrument and annual fluctuations.
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit. Synonymous with the EPA term "minimum level".
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Recovered amount of the true value or spike added, in % (except for LCSS, mg/Kg)
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
Upper	Upper Recovery Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

AS	Analytical Spike (Post Digestion)	*LCSWD*	Laboratory Control Sample - Water Duplicate
ASD	Analytical Spike (Post Digestion) Duplicate	*LFB*	Laboratory Fortified Blank
CCB	Continuing Calibration Blank	*LFM*	Laboratory Fortified Matrix
CCV	Continuing Calibration Verification standard	*LFMD*	Laboratory Fortified Matrix Duplicate
DUP	Sample Duplicate	*LRB*	Laboratory Reagent Blank
ICB	Initial Calibration Blank	*MS*	Matrix Spike
ICV	Initial Calibration Verification standard	*MSD*	Matrix Spike Duplicate
ICSAB	Inter-element Correction Standard - A plus B solutions	*PBS*	Prep Blank - Soil
LCSS	Laboratory Control Sample - Soil	*PBW*	Prep Blank - Water
LCSSD	Laboratory Control Sample - Soil Duplicate	*PQV*	Practical Quantitation Verification standard
LCSW	Laboratory Control Sample - Water	*SDL*	Serial Dilution

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method or calibration procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Spikes/Fortified Matrix	Determines sample matrix interferences, if any.
Standard	Verifies the validity of the calibration.

ACZ Qualifiers (Qual)

B	Analyte concentration detected at a value between MDL and PQL. The associated value is an estimated quantity.
H	Analysis exceeded method hold time. pH is a field test with an immediate hold time.
L	Target analyte response was below the laboratory defined negative threshold.
U	The material was analyzed for, but was not detected above the level of the associated value. The associated value is either the sample quantitation limit or the sample detection limit.

Method References

(1) EPA 600/4-83-020. Methods for Chemical Analysis of Water and Wastes, March 1983.
(2) EPA 600/R-93-100. Methods for the Determination of Inorganic Substances in Environmental Samples, August 1993.
(3) EPA 600/R-94-111. Methods for the Determination of Metals in Environmental Samples - Supplement I, May 1994.
(4) EPA SW-846. Test Methods for Evaluating Solid Waste.
(5) Standard Methods for the Examination of Water and Wastewater.

Comments

(1) QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(2) Soil, Sludge, and Plant matrices for Inorganic analyses are reported on a dry weight basis.
(3) Animal matrices for Inorganic analyses are reported on an "as received" basis.
(4) An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.
(5) If the MDL equals the PQL or the MDL column is omitted, the PQL is the reporting limit.

For a complete list of ACZ's Extended Qualifiers, please click:
https://acz.com/wp-content/uploads/2019/04/Ext-Qual-List.pdf

REP001.03.15.02

Rio Algom Mining Company ACZ Project ID: ***L66796***

NOTE: If the Rec% column is null, the high/low limits are in the same units as the result. If the Rec% column is not null, then the high/low limits are in % Rec.

Alkalinity as CaCO3 SM2320B - Titration

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG522795													
WG522795PBW1	PBW	07/08/21 20:23				2.3	mg/L		-20	20			
WG522795LCSW3	LCSW	07/08/21 20:43	WC210702-1	820.0001		818.4	mg/L	100	90	110			
WG522795LCSW6	LCSW	07/09/21 0:00	WC210702-1	820.0001		822.5	mg/L	100	90	110			
WG522795PBW2	PBW	07/09/21 0:07				U	mg/L		-20	20			
L64837-17DUP	DUP	07/09/21 1:04			U	U	mg/L				0	20	RA
WG522795LCSW9	LCSW	07/09/21 3:06	WC210702-1	820.0001		823	mg/L	100	90	110			
WG522795PBW3	PBW	07/09/21 3:13				U	mg/L		-20	20			
WG522795LCSW12	LCSW	07/09/21 6:27	WC210702-1	820.0001		823.6	mg/L	100	90	110			
WG522795PBW4	PBW	07/09/21 6:34				U	mg/L		-20	20			
WG522795LCSW15	LCSW	07/09/21 10:04	WC210702-1	820.0001		828.4	mg/L	101	90	110			

Antimony, dissolved M200.8 ICP-MS

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG523234													
WG523234ICV	ICV	07/14/21 19:31	MS210630-2	.0201		.01918	mg/L	95	90	110			
WG523234ICB	ICB	07/14/21 19:35				U	mg/L		-0.00088	0.00088			
WG523234LFB	LFB	07/14/21 19:38	MS210702-2	.01		.00971	mg/L	97	85	115			
L66805-01AS	AS	07/14/21 19:48	MS210702-2	.05	U	.04849	mg/L	97	70	130			
L66805-01ASD	ASD	07/14/21 19:51	MS210702-2	.05	U	.05084	mg/L	102	70	130	5	20	

Arsenic, dissolved M200.8 ICP-MS

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG523234													
WG523234ICV	ICV	07/14/21 19:31	MS210630-2	.05		.04724	mg/L	94	90	110			
WG523234ICB	ICB	07/14/21 19:35				U	mg/L		-0.00044	0.00044			
WG523234LFB	LFB	07/14/21 19:38	MS210702-2	.05005		.04922	mg/L	98	85	115			
L66805-01AS	AS	07/14/21 19:48	MS210702-2	.25025	.0519	.29848	mg/L	99	70	130			
L66805-01ASD	ASD	07/14/21 19:51	MS210702-2	.25025	.0519	.30311	mg/L	100	70	130	2	20	

Barium, dissolved M200.7 ICP

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG523102													
WG523102ICV	ICV	07/13/21 15:07	II210628-1	2		1.9678	mg/L	98	95	105			
WG523102ICB	ICB	07/13/21 15:13				U	mg/L		-0.021	0.021			
WG523102LFB	LFB	07/13/21 15:26	II210708-3	.5		.4794	mg/L	96	85	115			
L66786-02AS	AS	07/13/21 15:36	II210708-3	.5	.0071	.481	mg/L	95	85	115			
L66786-02ASD	ASD	07/13/21 15:39	II210708-3	.5	.0071	.4805	mg/L	95	85	115	0	20	

Beryllium, dissolved M200.8 ICP-MS

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG523234													
WG523234ICV	ICV	07/14/21 19:31	MS210630-2	.05		.048336	mg/L	97	90	110			
WG523234ICB	ICB	07/14/21 19:35				U	mg/L		-0.000176	0.000176			
WG523234LFB	LFB	07/14/21 19:38	MS210702-2	.05005		.050059	mg/L	100	85	115			
L66805-01AS	AS	07/14/21 19:48	MS210702-2	.25025	.0382	.281813	mg/L	97	70	130			
L66805-01ASD	ASD	07/14/21 19:51	MS210702-2	.25025	.0382	.274003	mg/L	94	70	130	3	20	

Rio Algom Mining Company ACZ Project ID: **L66796**

NOTE: If the Rec% column is null, the high/low limits are in the same units as the result. If the Rec% column is not null, then the high/low limits are in % Rec.

Cadmium, dissolved M200.8 ICP-MS

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG523234													
WG523234ICV	ICV	07/14/21 19:31	MS210630-2	.05		.049767	mg/L	100	90	110			
WG523234ICB	ICB	07/14/21 19:35				U	mg/L		-0.00011	0.00011			
WG523234LFB	LFB	07/14/21 19:38	MS210702-2	.05005		.050951	mg/L	102	85	115			
L66805-01AS	AS	07/14/21 19:48	MS210702-2	.25025	.000655	.250267	mg/L	100	70	130			
L66805-01ASD	ASD	07/14/21 19:51	MS210702-2	.25025	.000655	.252904	mg/L	101	70	130	1	20	

Calcium, dissolved M200.7 ICP

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG523102													
WG523102ICV	ICV	07/13/21 15:07	II210628-1	100		99.06	mg/L	99	95	105			
WG523102ICB	ICB	07/13/21 15:13				U	mg/L		-0.3	0.3			
WG523102LFB	LFB	07/13/21 15:26	II210708-3	67.99734		67.69	mg/L	100	85	115			
L66786-02AS	AS	07/13/21 15:36	II210708-3	67.99734	2.65	69.36	mg/L	98	85	115			
L66786-02ASD	ASD	07/13/21 15:39	II210708-3	67.99734	2.65	69.58	mg/L	98	85	115	0	20	

Chloride SM4500Cl-E

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG523433													
WG523433ICB	ICB	07/17/21 8:47				U	mg/L		-1.5	1.5			
WG523433ICV	ICV	07/17/21 8:47	WI210503-1	54.89		54.85	mg/L	100	90	110			
WG523433LFB1	LFB	07/17/21 11:22	WI200327-3	30.03		30.34	mg/L	101	90	110			
WG523433LFB2	LFB	07/17/21 11:32	WI200327-3	30.03		30.22	mg/L	101	90	110			
L66799-04AS	AS	07/17/21 12:45	10XCL	30	713	726.51	mg/L	45	90	110			M3

Conductivity @25C SM2510B

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG522795													
WG522795LCSW2	LCSW	07/08/21 20:29	PCN62852	1410		1415	umhos/cm	100	90	110			
WG522795LCSW5	LCSW	07/08/21 23:46	PCN62852	1410		1416	umhos/cm	100	90	110			
L64837-17DUP	DUP	07/09/21 1:04			3990	3960	umhos/cm				1	20	
WG522795LCSW8	LCSW	07/09/21 2:52	PCN62852	1410		1408	umhos/cm	100	90	110			
WG522795LCSW11	LCSW	07/09/21 6:13	PCN62852	1410		1399	umhos/cm	99	90	110			
WG522795LCSW14	LCSW	07/09/21 9:51	PCN62852	1410		1388	umhos/cm	98	90	110			

Cyanide, Total D7511-09

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG522433													
WG522433ICV	ICV	07/02/21 12:22	WI210630-4	.3		.2993	mg/L	100	90	110			
WG522433ICB	ICB	07/02/21 12:24				U	mg/L		-0.003	0.003			
WG522433LFB	LFB	07/02/21 12:30	WI210630-7	.1		.1023	mg/L	102	84	116			
L66741-01AS	AS	07/02/21 12:34	WI210630-7	.1	U	.1034	mg/L	103	84	116			
L66741-01ASD	ASD	07/02/21 12:36	WI210630-7	.1	U	.1036	mg/L	104	84	116	0	20	

Rio Algom Mining Company ACZ Project ID: ***L66796***

NOTE: If the Rec% column is null, the high/low limits are in the same units as the result. If the Rec% column is not null, then the high/low limits are in % Rec.

Iron, dissolved M200.7 ICP

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG523102													
WG523102ICV	ICV	07/13/21 15:07	II210628-1	2		1.928	mg/L	96	95	105			
WG523102ICB	ICB	07/13/21 15:13				U	mg/L		-0.18	0.18			
WG523102LFB	LFB	07/13/21 15:26	II210708-3	1.0001		.967	mg/L	97	85	115			
L66786-02AS	AS	07/13/21 15:36	II210708-3	1.0001	U	.961	mg/L	96	85	115			
L66786-02ASD	ASD	07/13/21 15:39	II210708-3	1.0001	U	.96	mg/L	96	85	115	0	20	

Lead, dissolved M200.8 ICP-MS

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG523234													
WG523234ICV	ICV	07/14/21 19:31	MS210630-2	.05		.04843	mg/L	97	90	110			
WG523234ICB	ICB	07/14/21 19:35				U	mg/L		-0.00022	0.00022			
WG523234LFB	LFB	07/14/21 19:38	MS210702-2	.05005		.04974	mg/L	99	85	115			
L66805-01AS	AS	07/14/21 19:48	MS210702-2	.25025	U	.2418	mg/L	97	70	130			
L66805-01ASD	ASD	07/14/21 19:51	MS210702-2	.25025	U	.24503	mg/L	98	70	130	1	20	

Magnesium, dissolved M200.7 ICP

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG523102													
WG523102ICV	ICV	07/13/21 15:07	II210628-1	100		98.37	mg/L	98	95	105			
WG523102ICB	ICB	07/13/21 15:13				U	mg/L		-0.6	0.6			
WG523102LFB	LFB	07/13/21 15:26	II210708-3	50.00074		48.98	mg/L	98	85	115			
L66786-02AS	AS	07/13/21 15:36	II210708-3	50.00074	.35	48.85	mg/L	97	85	115			
L66786-02ASD	ASD	07/13/21 15:39	II210708-3	50.00074	.35	49.11	mg/L	98	85	115	1	20	

Molybdenum, dissolved M200.8 ICP-MS

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG523234													
WG523234ICV	ICV	07/14/21 19:31	MS210630-2	.01992		.01905	mg/L	96	90	110			
WG523234ICB	ICB	07/14/21 19:35				U	mg/L		-0.00044	0.00044			
WG523234LFB	LFB	07/14/21 19:38	MS210702-2	.0501		.0503	mg/L	100	85	115			
L66805-01AS	AS	07/14/21 19:48	MS210702-2	.2505	U	.25883	mg/L	103	70	130			
L66805-01ASD	ASD	07/14/21 19:51	MS210702-2	.2505	U	.26349	mg/L	105	70	130	2	20	

Nickel, dissolved M200.8 ICP-MS

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG523234													
WG523234ICV	ICV	07/14/21 19:31	MS210630-2	.05		.05008	mg/L	100	90	110			
WG523234ICB	ICB	07/14/21 19:35				U	mg/L		-0.00088	0.00088			
WG523234LFB	LFB	07/14/21 19:38	MS210702-2	.05		.05048	mg/L	101	85	115			
L66805-01AS	AS	07/14/21 19:48	MS210702-2	.25	.836	1.03575	mg/L	80	70	130			
L66805-01ASD	ASD	07/14/21 19:51	MS210702-2	.25	.836	1.03334	mg/L	79	70	130	0	20	

NOTE: If the Rec% column is null, the high/low limits are in the same units as the result. If the Rec% column is not null, then the high/low limits are in % Rec.

Nitrate/Nitrite as N M353.2 - H2SO4 preserved

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG523247													
WG523247ICV	ICV	07/14/21 23:25	WI210603-7	2.416		2.364	mg/L	98	90	110			
WG523247ICB	ICB	07/14/21 23:26				U	mg/L		-0.02	0.02			
WG523251													
WG523251LFB	LFB	07/15/21 1:32	WI210331-13	2		2.046	mg/L	102	90	110			
L66028-06AS	AS	07/15/21 1:54	WI210331-13	2	U	2.086	mg/L	104	90	110			
L66786-01DUP	DUP	07/15/21 1:56			U	U	mg/L				0	20	RA

Potassium, dissolved M200.7 ICP

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG523102													
WG523102ICV	ICV	07/13/21 15:07	II210628-1	20		19.7	mg/L	99	95	105			
WG523102ICB	ICB	07/13/21 15:13				U	mg/L		-0.6	0.6			
WG523102LFB	LFB	07/13/21 15:26	II210708-3	99.99574		97.43	mg/L	97	85	115			
L66786-02AS	AS	07/13/21 15:36	II210708-3	99.99574	.45	96.34	mg/L	96	85	115			
L66786-02ASD	ASD	07/13/21 15:39	II210708-3	99.99574	.45	96.88	mg/L	96	85	115	1	20	

Residue, Filterable (TDS) @180C SM2540C

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG522470													
WG522470PBW	PBW	07/02/21 15:15				U	mg/L		-20	20			
WG522470LCSW	LCSW	07/02/21 15:16	PCN63834	1000		1000	mg/L	100	80	120			
L66883-01DUP	DUP	07/02/21 15:59			40	44	mg/L				10	10	RA

Selenium, dissolved SM 3114 B, AA-Hydride

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG522651													
WG522651ICV	ICV	07/07/21 17:27	SE210408-3	.025		.0263	mg/L	105	90	110			
WG522651ICB	ICB	07/07/21 17:29				U	mg/L		-0.006	0.006			
WG522652													
WG522652LRB	LRB	07/07/21 17:55				U	mg/L		-0.006	0.006			
WG522652LFB	LFB	07/07/21 17:57	SE210601-8	.0225		.0227	mg/L	101	85	115			
L66772-01LFM	LFM	07/07/21 18:01	SE210601-8	.0225	.0059	.026	mg/L	89	85	115			
L66772-01LFMD	LFMD	07/07/21 18:03	SE210601-8	.0225	.0059	.0259	mg/L	89	85	115	0	20	

Sodium, dissolved M200.7 ICP

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG523102													
WG523102ICV	ICV	07/13/21 15:07	II210628-1	100		98.45	mg/L	98	95	105			
WG523102ICB	ICB	07/13/21 15:13				U	mg/L		-0.6	0.6			
WG523102LFB	LFB	07/13/21 15:26	II210708-3	100.0109		97.37	mg/L	97	85	115			
L66786-02AS	AS	07/13/21 15:36	II210708-3	100.0109	10.9	106.4	mg/L	95	85	115			
L66786-02ASD	ASD	07/13/21 15:39	II210708-3	100.0109	10.9	107	mg/L	96	85	115	1	20	

Rio Algom Mining Company ACZ Project ID: ***L66796***

NOTE: If the Rec% column is null, the high/low limits are in the same units as the result. If the Rec% column is not null, then the high/low limits are in % Rec.

Sulfate D516-02/-07/-11 - TURBIDIMETRIC

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG523596													
WG523596ICB	ICB	07/20/21 8:40				U	mg/L		-3	3			
WG523596ICV	ICV	07/20/21 8:40	WI210715-12	20.46		20.8	mg/L	102	90	110			
WG523596LFB	LFB	07/20/21 10:22	WI210105-3	10		9.6	mg/L	96	90	110			
L66842-01AS	AS	07/20/21 10:45	SO4TURB20X	10	768	732.1	mg/L	-359	90	110			M3
L66796-01DUP	DUP	07/20/21 11:09			3590	3605.2	mg/L				0	20	

Uranium, dissolved M200.8 ICP-MS

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Found	Units	Rec%	Lower	Upper	RPD	Limit	Qual
WG523234													
WG523234ICV	ICV	07/14/21 19:31	MS210630-2	.05		.04927	mg/L	99	90	110			
WG523234ICB	ICB	07/14/21 19:35				U	mg/L		-0.00022	0.00022			
WG523234LFB	LFB	07/14/21 19:38	MS210702-2	.05		.04993	mg/L	100	85	115			
L66805-01AS	AS	07/14/21 19:48	MS210702-2	.25	.00096	.26776	mg/L	107	70	130			
L66805-01ASD	ASD	07/14/21 19:51	MS210702-2	.25	.00096	.26797	mg/L	107	70	130	0	20	

ACZ Laboratories, Inc.
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Inorganic Extended Qualifier Report

Rio Algom Mining Company

ACZ Project ID: ***L66796***

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L66796-01	WG523433	Chloride	SM4500Cl-E	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG522433	Cyanide, Total	D7511-09	Q3	Sample received with improper or inadequate chemical preservation.
	WG523251	Nitrate/Nitrite as N	M353.2 - H2SO4 preserved	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG522470	Residue, Filterable (TDS) @180C	SM2540C	N1	See Case Narrative.
			SM2540C	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).
	WG523596	Sulfate	D516-02/-07/-11 - TURBIDIMETRIC	M3	The spike recovery value is unusable since the analyte concentration in the sample is disproportionate to the spike level. The recovery of the associated control sample (LCS or LFB) was acceptable.
	WG522795	Total Alkalinity	SM2320B - Titration	RA	Relative Percent Difference (RPD) was not used for data validation because the concentration of the duplicated sample is too low for accurate evaluation (< 10x MDL).

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RadioChemistry Analytical Results

Rio Algom Mining Company
Project ID: 4510319940
Sample ID: 36 06 KD
Locator:

ACZ Sample ID: ***L66796-01***
Date Sampled: *06/28/21 10:55*
Date Received: *06/29/21*
Sample Matrix: *Groundwater*

GA Dissolved MS, corrected
Calculation
Prep Method:

Parameter	Measure Date	Prep Date	Result	Error(+/-)	LLD	Units	XQ	Analyst
GA Dissolved MS, corrected	08/26/21 9:20		-130			pCi/L		calc

Gross Alpha, dissolved
M9310
Prep Method:

Parameter	Measure Date	Prep Date	Result	Error(+/-)	LLD	Units	XQ	Analyst
Gross Alpha, dissolved	07/13/21 0:14		220	47	150	pCi/L	*	ess

Lead 210, dissolved
EICHROM, OTW01
Prep Method:

Parameter	Measure Date	Prep Date	Result	Error(+/-)	LLD	Units	XQ	Analyst
Lead 210, dissolved	08/05/21 17:21		2	7.9	23	pCi/L	*	cer

Radium 226, dissolved
M903.1
Prep Method:

Parameter	Measure Date	Prep Date	Result	Error(+/-)	LLD	Units	XQ	Analyst
Radium 226, dissolved	07/20/21 0:30		11	0.63	0.25	pCi/L	*	djc

Radium 228, dissolved
M9320
Prep Method:

Parameter	Measure Date	Prep Date	Result	Error(+/-)	LLD	Units	XQ	Analyst
Radium 228, dissolved	08/23/21 14:15		5	3.4	7.5	pCi/L	*	cer

Thorium 230, dissolved
ESM 4506
Prep Method:

Parameter	Measure Date	Prep Date	Result	Error(+/-)	LLD	Units	XQ	Analyst
Thorium 230, dissolved	07/22/21 9:57		4.36	0.97	0.6	pCi/L	*	djc

** Please refer to Qualifier Reports for details.*

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Radiochemistry Reference

Report Header Explanations

Batch	A distinct set of samples analyzed at a specific time
Error(+/-)	Calculated sample specific uncertainty
Found	Value of the QC Type of interest
Limit	Upper limit for RPD, in %.
LCL	Lower Control Limit, in % (except for LCSS, mg/Kg)
LLD	Calculated sample specific Lower Limit of Detection
PCN/SCN	A number assigned to reagents/standards to trace to the manufacturer's certificate of analysis
PQL	Practical Quantitation Limit
QC	True Value of the Control Sample or the amount added to the Spike
Rec	Amount of the true value or spike added recovered, in % (except for LCSS, mg/Kg)
RER	Relative Error Ratio, calculation used for Dup. QC taking into account the error factor.
RPD	Relative Percent Difference, calculation used for Duplicate QC Types
UCL	Upper Control Limit, in % (except for LCSS, mg/Kg)
Sample	Value of the Sample of interest

QC Sample Types

DUP	Sample Duplicate	*MS/MSD*	Matrix Spike/Matrix Spike Duplicate
LCSS	Laboratory Control Sample - Soil	*PBS*	Prep Blank - Soil
LCSW	Laboratory Control Sample - Water	*PBW*	Prep Blank - Water

QC Sample Type Explanations

Blanks	Verifies that there is no or minimal contamination in the prep method procedure.
Control Samples	Verifies the accuracy of the method, including the prep procedure.
Duplicates	Verifies the precision of the instrument and/or method.
Matrix Spikes	Determines sample matrix interferences, if any.

ACZ Qualifiers (Qual)

H	Analysis exceeded method hold time.

Method Prefix Reference

M	EPA methodology, including those under SDWA, CWA, and RCRA
SM	Standard Methods for the Examination of Water and Wastewater.
D	ASTM
RP	DOE
ESM	DOE/ESM

Comments

(1) Solid matrices are reported on a dry weight basis.
(2) Preparation method: "Method" indicates preparation defined in analytical method.
(3) QC results calculated from raw data. Results may vary slightly if the rounded values are used in the calculations.
(4) An asterisk in the "XQ" column indicates there is an extended qualifier and/or certification qualifier associated with the result.

For a complete list of ACZ's Extended Qualifiers, please click:
https://acz.com/wp-content/uploads/2019/04/Ext-Qual-List.pdf

Rio Algom Mining Company ACZ Project ID: ***L66796***

NOTE: If the Rec% column is null, the high/low limits are in the same units as the result. If the Rec% column is not null, then the high/low limits are in % Rec.

Gross Alpha, dissolved — M9310 — **Units:** pCi/L

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Error	LLD	Found	Error	LLD	Rec%	Lower	Upper	RPD/RER	Limit	Qual
WG522671																
WG522671PBW	PBW	07/13/21						.46	0.69	0.8			1.6			
WG522671LCSWA	LCSW	07/13/21	PCN62436	100				110	8.8	1.4	110	67	144			
L65519-10MSA	MS	07/13/21	PCN62436	100	-0.05	0.87	6	90	7.9	3.8	90	67	144			
L65520-10DUP	DUP-RER	07/13/21			6.6	3.4	15	8.9	3.8	7.3				0.45	2	
L65520-10DUP	DUP-RPD	07/13/21			6.6	3.4	15	8.9	3.8	7.3				30	20	RG
L66895-01DUP	DUP-RPD	07/13/21			8.4	3.2	5.5	10	3.8	7.3				17	20	

Lead 210, dissolved — EICHROM, OTW01 — **Units:** pCi/L

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Error	LLD	Found	Error	LLD	Rec%	Lower	Upper	RPD/RER	Limit	Qual
WG522580																
L66766-07DUP	DUP-RER	08/05/21			-5.9	2.3	7.5	-8.4	2.9	9.6				0.68	2	
WG522580PBW	PBW	08/05/21						-.45	1.8	5.5			11			
WG522580LCSW	LCSW	08/05/21	PCN59627	94.04				89	3.6	5.2	95	55	121			
L66766-08MS	MS	08/05/21	PCN59627	188.09	1.8	3.1	9.3	190	6.4	8.1	100	55	121			
L66766-07DUP	DUP-RPD	08/05/21			-5.9	2.3	7.5	-8.4	2.9	9.6				35	20	RG
L66805-01DUP	DUP-RER	08/05/21			6.6	3.6	10	3.6	3.5	10				0.6	2	
L66805-01DUP	DUP-RPD	08/05/21			6.6	3.6	10	3.6	3.5	10				59	20	RG

Radium 226, dissolved — M903.1 — **Units:** pCi/L

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Error	LLD	Found	Error	LLD	Rec%	Lower	Upper	RPD/RER	Limit	Qual
WG522976																
WG522976PBW	PBW	07/20/21						-.03	0.09	0.1			0.2			
WG522976LCSW	LCSW	07/20/21	PCN62879	20				16	0.54	0.1	80	43	148			
L66766-07DUP1	DUP-RPD	07/20/21			0.55	0.16	0.22	.47	0.25	0.27				16	20	
L66766-09MS	MS	07/20/21	PCN62879	40	9	0.46	0.18	39	1.3	0.41	75	43	148			
L66778-01DUP2	DUP-RPD	07/20/21			0.24	0.11	0.32	.18	0.1	0.2				29	20	RG
L66778-01DUP2	DUP-RER	07/20/21			0.24	0.11	0.32	.18	0.1	0.2				0.4	2	

Rio Algom Mining Company ACZ Project ID: ***L66796***

NOTE: If the Rec% column is null, the high/low limits are in the same units as the result. If the Rec% column is not null, then the high/low limits are in % Rec.

Radium 228, dissolved M9320 **Units:** pCi/L

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Error	LLD	Found	Error	LLD	Rec%	Lower	Upper	RPD/RER	Limit	Qual
WG525286																
WG525286PBW	PBW	08/23/21						-.74	0.44	0.49			0.98			
WG525286LCSW	LCSW	08/23/21	PCN63356	9.53				7.4	1.2	0.96	78	47	123			
L66805-07MS	MS	08/23/21	PCN63356	9.53	7.5	1.1	1.7	19	1.5	2	121	47	123			
L66805-08DUP	DUP-RER	08/23/21			1.8	0.93	2	.33	0.66	1.6				1.29	2	
L66805-08DUP	DUP-RPD	08/23/21			1.8	0.93	2	.33	0.66	1.6				138	20	RG
L66805-01DUP	DUP-RPD	08/23/21			23	1.6	1.9	22	3	4.7				4	20	

Thorium 230, dissolved ESM 4506 **Units:** pCi/L

ACZ ID	Type	Analyzed	PCN/SCN	QC	Sample	Error	LLD	Found	Error	LLD	Rec%	Lower	Upper	RPD/RER	Limit	Qual
WG523314																
WG523314PBW	PBW	07/22/21						.229	0.3	0.49			0.98			
WG523314LCSW	LCSW	07/22/21	PCN58726	200				219	27	0.17	110	91	126			
L66766-07DUP	DUP-RPD	07/22/21			0.61	0.28	0.27	1.81	0.51	0.4				99	20	RM
L66766-08MS	MS	07/22/21	PCN58726	200	0.593	0.25	0.17	218	27	0.23	109	91	126			
L66805-03DUP	DUP-RPD	07/22/21			0.225	0.23	0.36	.715	0.29	0.25				104	20	RG
L66805-03DUP	DUP-RER	07/22/21			0.225	0.23	0.36	.715	0.29	0.25				1.32	2	

ACZ ID	WORKNUM	PARAMETER	METHOD	QUAL	DESCRIPTION
L66796-01	WG522671	Gross Alpha, dissolved	M9310	RG	Sample concentration is less than 5x LLD; RPD was not used for data validation. Replicate Error Ratio (RER) is less than 2. Precision judged to be in control.
	WG522580	Lead 210, dissolved	EICHROM, OTW01	D1	Sample required dilution due to matrix.
			EICHROM, OTW01	RG	Sample concentration is less than 5x LLD; RPD was not used for data validation. Replicate Error Ratio (RER) is less than 2. Precision judged to be in control.
	WG522976	Radium 226, dissolved	M903.1	DJ	Sample dilution required due to insufficient sample.
			M903.1	RG	Sample concentration is less than 5x LLD; RPD was not used for data validation. Replicate Error Ratio (RER) is less than 2. Precision judged to be in control.
	WG525286	Radium 228, dissolved	M9320	DJ	Sample dilution required due to insufficient sample.
	WG523314	Thorium 230, dissolved	ESM 4506	RM	For a water matrix, the duplicate precision assessment (RPD or RER) exceeded the control limit. High sediment, turbidity, or presence of an immiscible liquid attributed to non-homogeneity of the sample.

Radiochemistry

The following parameters are not offered for certification or are not covered by NELAC certificate #ACZ.	
Lead 210, dissolved	EICHROM, OTW01
Thorium 230, dissolved	ESM 4506

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

Sample Receipt

Rio Algom Mining Company
4510319940

ACZ Project ID: L66796
Date Received: 06/29/2021 11:15
Received By:
Date Printed: 6/30/2021

Receipt Verification

	YES	NO	NA
1) Is a foreign soil permit included for applicable samples?			X
2) Is the Chain of Custody form or other directive shipping papers present?	X		
3) Does this project require special handling procedures such as CLP protocol?		X	
4) Are any samples NRC licensable material?			X
5) If samples are received past hold time, proceed with requested short hold time analyses?	X		
6) Is the Chain of Custody form complete and accurate?	X		
7) Were any changes made to the Chain of Custody form prior to ACZ receiving the samples?	X		

A change was made in the the sample ID was crossed out and rewritten, a requested analyses was crossed out and a new one was written, something was crossed out in the remarks section section prior to ACZ custody.

A change was made in the the sample ID was crossed out and rewritten, a requested analyses was crossed out and a new one was written, something was crossed out in the remarks section section prior to ACZ custody.

Samples/Containers

	YES	NO	NA
8) Are all containers intact and with no leaks?	X		
9) Are all labels on containers and are they intact and legible?	X		
10) Do the sample labels and Chain of Custody form match for Sample ID, Date, and Time?	X		
11) For preserved bottle types, was the pH checked and within limits? [1]	X		
12) Is there sufficient sample volume to perform all requested work?	X		
13) Is the custody seal intact on all containers?			X
14) Are samples that require zero headspace acceptable?			X
15) Are all sample containers appropriate for analytical requirements?	X		
16) Is there an Hg-1631 trip blank present?			X
17) Is there a VOA trip blank present?			X
18) Were all samples received within hold time?	X		

NA indicates Not Applicable

Chain of Custody Related Remarks

Client Contact Remarks

Shipping Containers

Cooler Id	Temp(°C)	Temp Criteria(°C)	Rad(µR/Hr)	Custody Seal Intact?
7172	5.9	<=6.0	15	Yes

REPAD LPII 2012-03

Rio Algom Mining Company
4510319940

ACZ Project ID:	L66796
Date Received:	06/29/2021 11:15
Received By:	
Date Printed:	6/30/2021

Was ice present in the shipment container(s)?

Yes - Wet ice was present in the shipment container(s).

Client must contact an ACZ Project Manager if analysis should not proceed for samples received outside of their thermal preservation acceptance criteria.

[1] The preservation of the following bottle types is not checked at sample receipt: Orange (oil and grease), Purple (total cyanide), Pink (dissolved cyanide), Brown (arsenic speciation), Sterile (fecal coliform), EDTA (sulfite), HCl preserved vial (organics), Na2S2O3 preserved vial (organics), and HG-1631 (total/dissolved mercury by method 1631).

ACZ Laboratories, Inc. L66796

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Report to:

Name: Kent Applegate	Address: PO BOX 218
Company: RIO ALGOM MINING LLC	Grants NM 87020
E-mail: Kent.kc.applegate@bhpbilliton.com	Telephone: 505 287 8851

Copy of Report to:

Name: See Remarks	E-mail: See Remarks
Company: INTERA INC	Telephone: 505 246 1600

Invoice to:

Name: Kent Applegate	Address: PO BOX 218
Company: RIO ALGOM MINING LLC	Grants NM 87020
E-mail: Kent.kc.applegate@bhpbilliton.com	Telephone: 505 287 8851

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES [X] NO [ ]

If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified

Are samples for SDWA Compliance Monitoring? Yes [ ] No [ ]

If yes, please include state forms. Results will be reported to PQL for Colorado.

Sampler's Name: Mafu **Sampler's Site Information** **State** NM **Zip code** 87020 **Time Zone** MT

***Sampler's Signature:** [signature]

*I attest to the authenticity and validity of this sample. I understand that intentionally mislabeling the time/date/location or tampering with the sample in anyway, is considered fraud and punishable by State Law.

PROJECT INFORMATION — ANALYSES REQUESTED *(attach list or use quote number)*

Quote #: 45026962J3

PO#: RIO.AL.M001.NRC TASK2

Reporting state for compliance testing: NM

Check box if samples include NRC licensed material? [X]

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers	~~KD-NL~~	NRC-KD						
~~30~~36 06KD	6/28/21 10:55	GW	6	X	X						

Matrix: SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

Please CC Report to: cshort@intera.com, apersico@intera.com, Michaella.Gorospe@bhpbilliton.com, jcarrol@intera.com

RAML COC# ~~21-58871~~ 6/28 #21-46

Please refer to ACZ's terms & conditions located on the reverse side of this COC.

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME
Brett [signature]	6/28/21 1330	[signature] 6/29/21	11:15

L66796 Chain of Custod

APPENDIX E

Geophysical Logs, provided by Century

Century WIRELINE SERVICES

GAMMA
GAM-GAMH
36-06KD

COMPANY	INTERA		
WELL	36-06KD		
FIELD	NA		
COUNTY	MCKINLEY		
STATE	NEW MEXICO		

OTHER SERVICES:
NONE
NONE
NONE

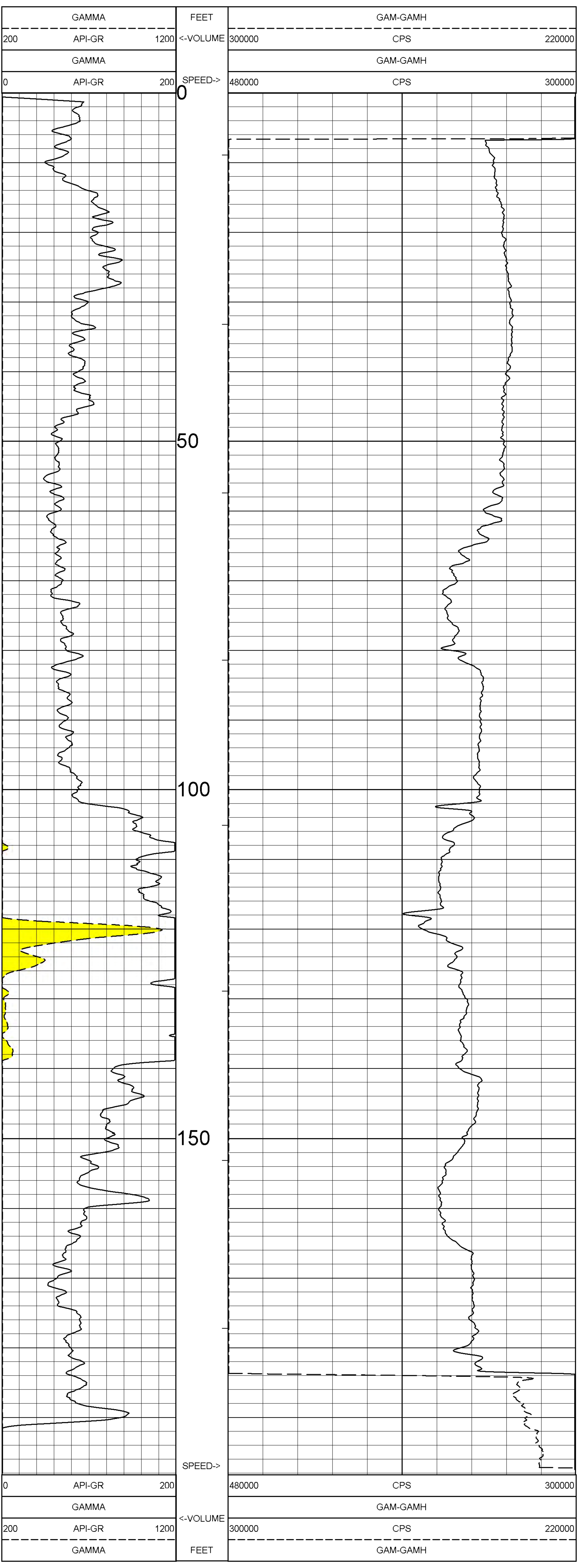
LSD	NA		
SECTION	NA		
TOWNSHIP	NA		
RANGE	NA		
LICENSE NO.	NA		
UNIQUE WELL ID.	NA		
PERMANENT DATUM	GL	ELEVATION KB	NA
LOG MEASURED FROM	TOC	ELEVATION DF	NA
DRL MEASURED FROM	NA	ELEVATION GL	NA
DATE	05/13/21	RIG NUMBER	NA
DEPTH DRILLER	199	LOGGER TD	199
BIT SIZE	4	ARRIVAL TIME	8:00
LOG TOP	0.60	DEPARTURE TIME	NA
LOG BOTTOM	198.10	CIRC STOPPED	NA
CASING OD	4		
CASING DRILLER	199		
CASING TYPE	PVC		
BOREHOLE FLUID	WATER		
RM TEMPERATURE	NA		
MUD RES	NA		
MUD WEIGHT	NA		
WITNESSED BY	BRIAN		
RECORDED BY	D.STEWART		
REMARKS 1	MEASURED FROM TOP OF CASING		
REMARKS 2	:		

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS

10 INCH LOG GRAVEL PACK 36-06KD 05/13/21

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 54
MAGNETIC DECL : 10 ELECT. CUTOFF : 99999 BIT SIZE : 4
PRESENTATION NAME/DATE = INTERA 9068 10-4-13.0 05/13/2021 VERSION = 3.64KF



10 INCH LOG GRAVEL PACK 36-06KD 05/13/21

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 54
MAGNETIC DECL : 10 ELECT. CUTOFF : 99999 BIT SIZE : 4
PRESENTATION NAME/DATE = INTERA 9068 10-4-13.0 05/13/2021 VERSION = 3.64KF

TOOL CALIBRATION 36-06KD 05/13/21 15:26
TOOL 9068C TM VERSION 2002
SERIAL NUMBER 642

	DATE	TIME	SENSOR	STANDARD		RESPONSE	
1	May10,21	12:31:30	GAMMA	Default	[CPS]	Default	[CPS]
	May10,21	12:31:30	GAMMA	Default	[CPS]	Default	[CPS]

TOOL CALIBRATION 36-06KD 05/13/21 15:26
TOOL 9512A TM VERSION 2002
SERIAL NUMBER 2623

	DATE	TIME	SENSOR	STANDARD		RESPONSE	
1	May13,21	12:38:58	GAMMA	1.000	[API-GR]	0.000	[CPS]
	May13,21	12:38:58	GAMMA	340.000	[API-GR]	317.000	[CPS]
2	May13,21	12:43:50	AP-COND	0.000	[MMHO/M]	9831.200	[CPS]
	May13,21	12:43:50	AP-COND	705.000	[MMHO/M]	71925.000	[CPS]
3	May13,21	12:40:43	TEMP	47.000	[DEG_F]	27537.000	[CPS]
	May13,21	12:40:43	TEMP	134.000	[DEG_F]	32362.000	[CPS]
4	May13,21	12:40:36	A	Default	[CPS]		
5	May13,21	12:40:39	B	Default	[CPS]		

TOOL CALIBRATION 36-06KD 05/13/21 15:26
TOOL 9512A TM VERSION 2002
SERIAL NUMBER 2623

	DATE	TIME	SENSOR	STANDARD		RESPONSE	
1	May13,21	12:38:58	GAMMA	1.000	[API-GR]	0.000	[CPS]
	May13,21	12:38:58	GAMMA	340.000	[API-GR]	317.000	[CPS]
2	May13,21	12:43:50	AP-COND	0.000	[MMHO/M]	9831.200	[CPS]
	May13,21	12:43:50	AP-COND	705.000	[MMHO/M]	71925.000	[CPS]
3	May13,21	12:40:43	TEMP	47.000	[DEG_F]	27537.000	[CPS]
	May13,21	12:40:43	TEMP	134.000	[DEG_F]	32362.000	[CPS]
4	May13,21	12:40:36	A	Default	[CPS]		
5	May13,21	12:40:39	B	Default	[CPS]		

Century WIRELINE SERVICES

GAMMA NEUTRON-RES 36-06KD

COMPANY	INTERA		
WELL	36-06KD		
FIELD	NA		
COUNTY	MCKINLEY		
STATE	NEW MEXICO		
LSD	NA		
SECTION	NA		
TOWNSHIP	NA		
RANGE	NA		
LICENSE NO.	NA		
UNIQUE WELL ID.	NA		
PERMANENT DATUM	GL	ELEVATION KB	NA
LOG MEASURED FROM	TOC	ELEVATION DF	NA
DRL MEASURED FROM	NA	ELEVATION GL	NA
DATE	05/13/21	RIG NUMBER	NA
DEPTH DRILLER	199	LOGGER TD	199
BIT SIZE	4	ARRIVAL TIME	8:00
LOG TOP	0.60	DEPARTURE TIME	NA
LOG BOTTOM	198.10	CIRC STOPPED	NA
CASING OD	4		
CASING DRILLER	199		
CASING TYPE	PVC		
BOREHOLE FLUID	WATER		
RM TEMPERATURE	NA		
MUD RES	NA		
MUD WEIGHT	NA		
WITNESSED BY	BRIAN		
RECORDED BY	D.STEWART		
REMARKS 1	MEASURED FROM TOP OF CASING		
REMARKS 2	:		

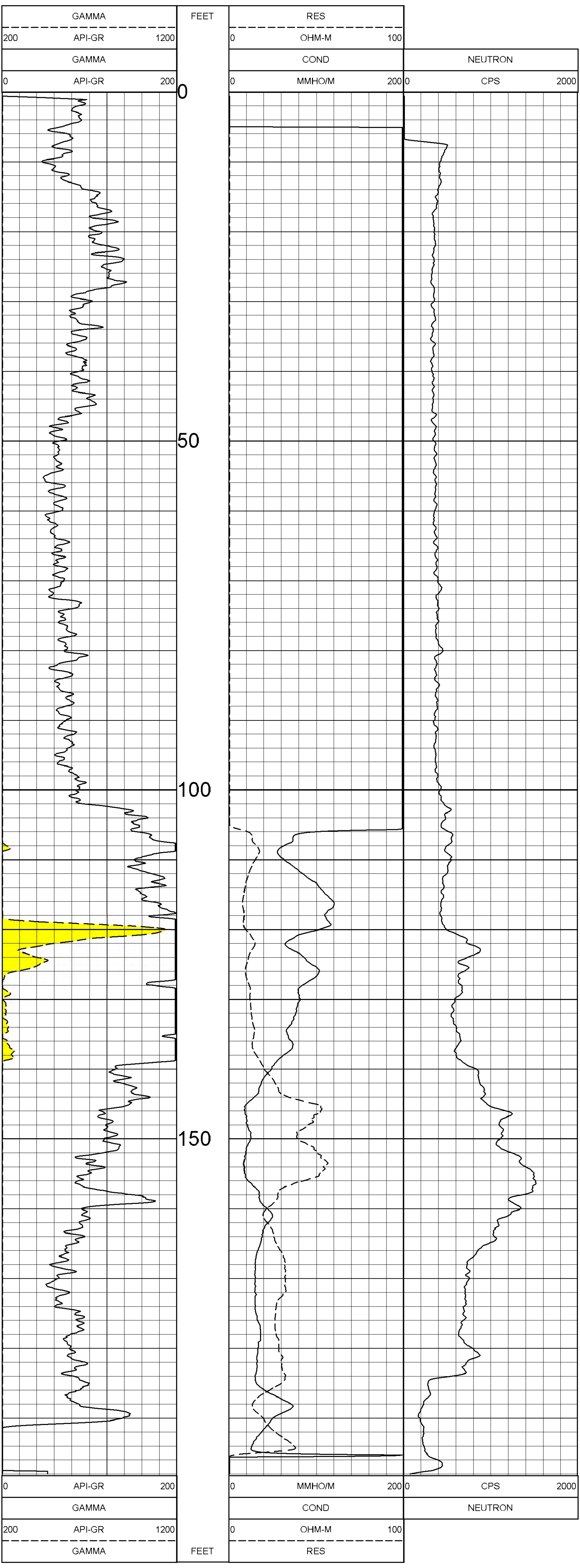
OTHER SERVICES:
NONE
NONE
NONE

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS

10 INCH LOG NEUTRON 36-06KD 05/13/21

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 54
MAGNETIC DECL : 10 ELECT. CUTOFF : 99999 BIT SIZE : 4
PRESENTATION NAME/DATE = INTERA 9067-9512 10-4-13.0 05/13/2021 VERSION = 3.64KF



10 INCH LOG NEUTRON 36-06KD 05/13/21

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 54
MAGNETIC DECL : 10 ELECT. CUTOFF : 99999 BIT SIZE : 4
PRESENTATION NAME/DATE = INTERA 9067-9512 10-4-13.0 05/13/2021 VERSION = 3.64KF

TOOL CALIBRATION 36-06KD 05/13/21 15:26
TOOL 9512A TM VERSION 2002
SERIAL NUMBER 2623

	DATE	TIME	SENSOR	STANDARD		RESPONSE	
1	May13,21	12:38:58	GAMMA	1.000	[API-GR]	0.000	[CPS]
	May13,21	12:38:58	GAMMA	340.000	[API-GR]	317.000	[CPS]
2	May13,21	12:43:50	AP-COND	0.000	[MMHO/M]	9831.200	[CPS]
	May13,21	12:43:50	AP-COND	705.000	[MMHO/M]	71925.000	[CPS]
3	May13,21	12:40:43	TEMP	47.000	[DEG_F]	27537.000	[CPS]
	May13,21	12:40:43	TEMP	134.000	[DEG_F]	32362.000	[CPS]
4	May13,21	12:40:36	A	Default	[CPS]		
5	May13,21	12:40:39	B	Default	[CPS]		

Century WIRELINE SERVICES

GAMMA
GAM-GAMH
36-07KD

COMPANY	INTERA		
WELL	36-07KD		
FIELD	NA		
COUNTY	MCKINLEY		
STATE	NEW MEXICO		
LSD	NA		
SECTION	NA		
TOWNSHIP	NA		
RANGE	NA		
LICENSE NO.	NA		
UNIQUE WELL ID.	NA		
PERMANENT DATUM	GL	ELEVATION KB	NA
LOG MEASURED FROM	TOC	ELEVATION DF	NA
DRL MEASURED FROM	NA	ELEVATION GL	NA
DATE	05/13/21	RIG NUMBER	NA
DEPTH DRILLER	206	LOGGER TD	319
BIT SIZE	5	ARRIVAL TIME	8:00
LOG TOP	0.50	DEPARTURE TIME	NA
LOG BOTTOM	205.20	CIRC STOPPED	NA
CASING OD	5		
CASING DRILLER	206		
CASING TYPE	PVC		
BOREHOLE FLUID	WATER		
RM TEMPERATURE	NA		
MUD RES	NA		
MUD WEIGHT	NA		
WITNESSED BY	BRIAN		
RECORDED BY	D.STEWART		
REMARKS 1	MEASURED FROM TOP OF CASING		
REMARKS 2			

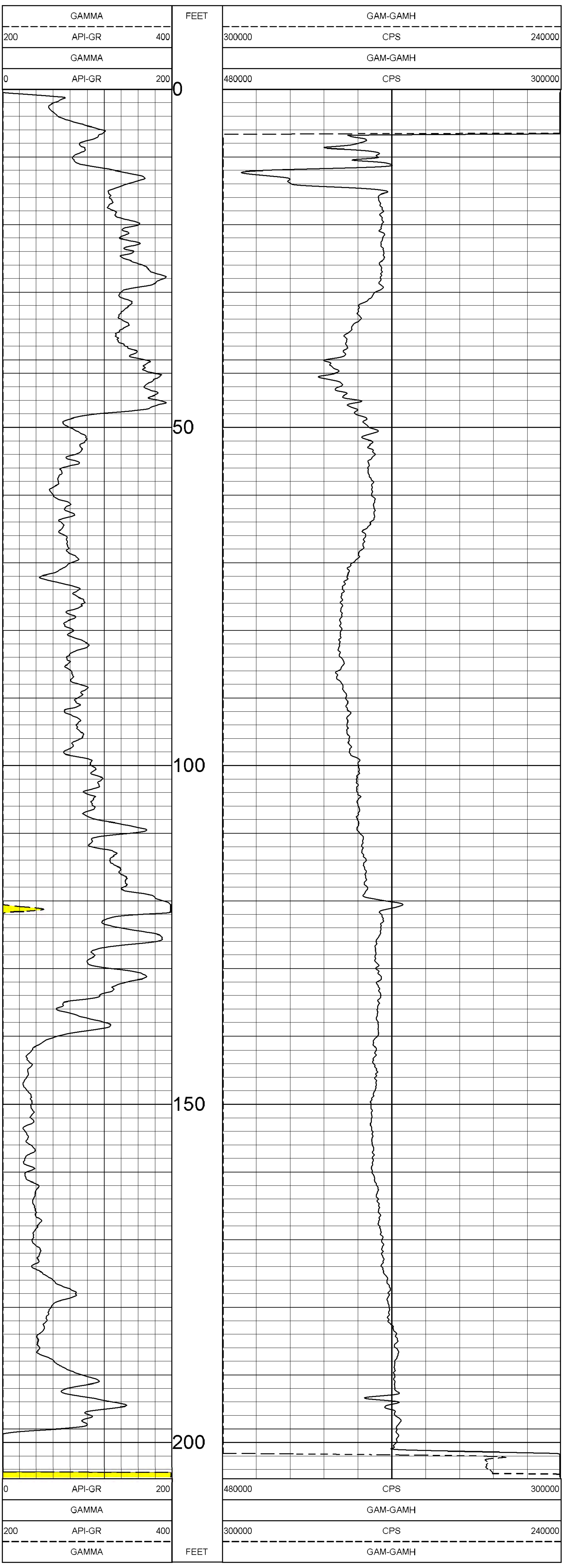
OTHER SERVICES:
NONE
NONE
NONE

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS

10 INCH LOG GRAVEL PACK 36-07KD 05/13/21

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 54
MAGNETIC DECL : 10 ELECT. CUTOFF : 99999 BIT SIZE : 5
PRESENTATION NAME/DATE = INTERA 9068 10-4-13.0 05/14/2021 VERSION = 3.64KF



10 INCH LOG GRAVEL PACK 36-07KD 05/13/21

LOG PARAMETERS

MATRIX DENSITY : 2.65 NEUTRON MATRIX : SANDSTONE MATRIX DELTA T : 54
MAGNETIC DECL : 10 ELECT. CUTOFF : 99999 BIT SIZE : 5
PRESENTATION NAME/DATE = INTERA 9068 10-4-13.0 05/14/2021 VERSION = 3.64KF

TOOL CALIBRATION 36-07KD 05/13/21 12:58
TOOL 9512A TM VERSION 2002
SERIAL NUMBER 2623

	DATE	TIME	SENSOR	STANDARD		RESPONSE	
1	May13,21	12:38:58	GAMMA	1.000	[API-GR]	0.000	[CPS]
	May13,21	12:38:58	GAMMA	340.000	[API-GR]	317.000	[CPS]
2	May13,21	12:43:50	AP-COND	0.000	[MMHO/M]	9831.200	[CPS]
	May13,21	12:43:50	AP-COND	705.000	[MMHO/M]	71925.000	[CPS]
3	May13,21	12:40:43	TEMP	47.000	[DEG_F]	27537.000	[CPS]
	May13,21	12:40:43	TEMP	134.000	[DEG_F]	32362.000	[CPS]
4	May13,21	12:40:36	A	Default	[CPS]		
5	May13,21	12:40:39	B	Default	[CPS]		

Century WIRELINE SERVICES

GAMMA NEUTRON-RES 36-07KD

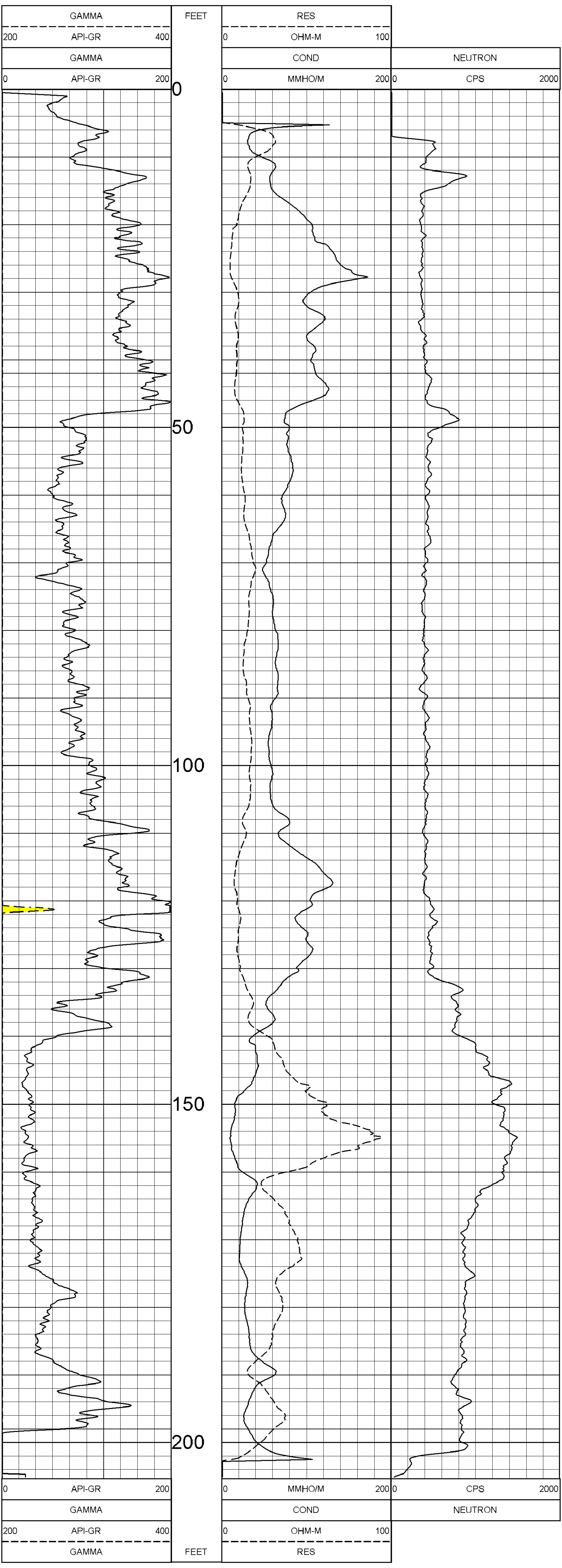
COMPANY	INTERA		
WELL	36-07KD		
FIELD	NA		
COUNTY	MCKINLEY		
STATE	NEW MEXICO		
LSD	NA		
SECTION	NA		
TOWNSHIP	NA		
RANGE	NA		
LICENSE NO.	NA		
UNIQUE WELL ID.	NA		
PERMANENT DATUM	GL	ELEVATION KB	NA
LOG MEASURED FROM	TOC	ELEVATION DF	NA
DRL MEASURED FROM	NA	ELEVATION GL	NA
DATE	05/13/21	RIG NUMBER	NA
DEPTH DRILLER	206	LOGGER TD	319
BIT SIZE	5	ARRIVAL TIME	8:00
LOG TOP	0.50	DEPARTURE TIME	NA
LOG BOTTOM	205.20	CIRC STOPPED	NA
CASING OD	5		
CASING DRILLER	206		
CASING TYPE	PVC		
BOREHOLE FLUID	WATER		
RM TEMPERATURE	NA		
MUD RES	NA		
MUD WEIGHT	NA		
WITNESSED BY	BRIAN		
RECORDED BY	D.STEWART		
REMARKS 1	MEASURED FROM TOP OF CASING		
REMARKS 2	:		

OTHER SERVICES:
NONE
NONE
NONE

10 INCH LOG NEUTRON 36-07KD 05/13/21

LOG PARAMETERS

MATRIX DENSITY : 2.65	NEUTRON MATRIX : SANDSTONE	MATRIX DELTA T : 54
MAGNETIC DECL : 10	ELECT. CUTOFF : 99999	BIT SIZE : 5
PRESENTATION NAME/DATE = INTERA 9067-9512 10-4-13.0 05/14/2021		VERSION = 3.64KF



10 INCH LOG NEUTRON 36-07KD 05/13/21

LOG PARAMETERS

MATRIX DENSITY : 2.65	NEUTRON MATRIX : SANDSTONE	MATRIX DELTA T : 54
MAGNETIC DECL : 10	ELECT. CUTOFF : 99999	BIT SIZE : 5
PRESENTATION NAME/DATE = INTERA 9067-9512 10-4-13.0 05/14/2021		VERSION = 3.64KF

TOOL CALIBRATION 36-07KD 05/13/21 12:58
TOOL 9512A TM VERSION 2002
SERIAL NUMBER 2623

	DATE	TIME	SENSOR	STANDARD		RESPONSE	
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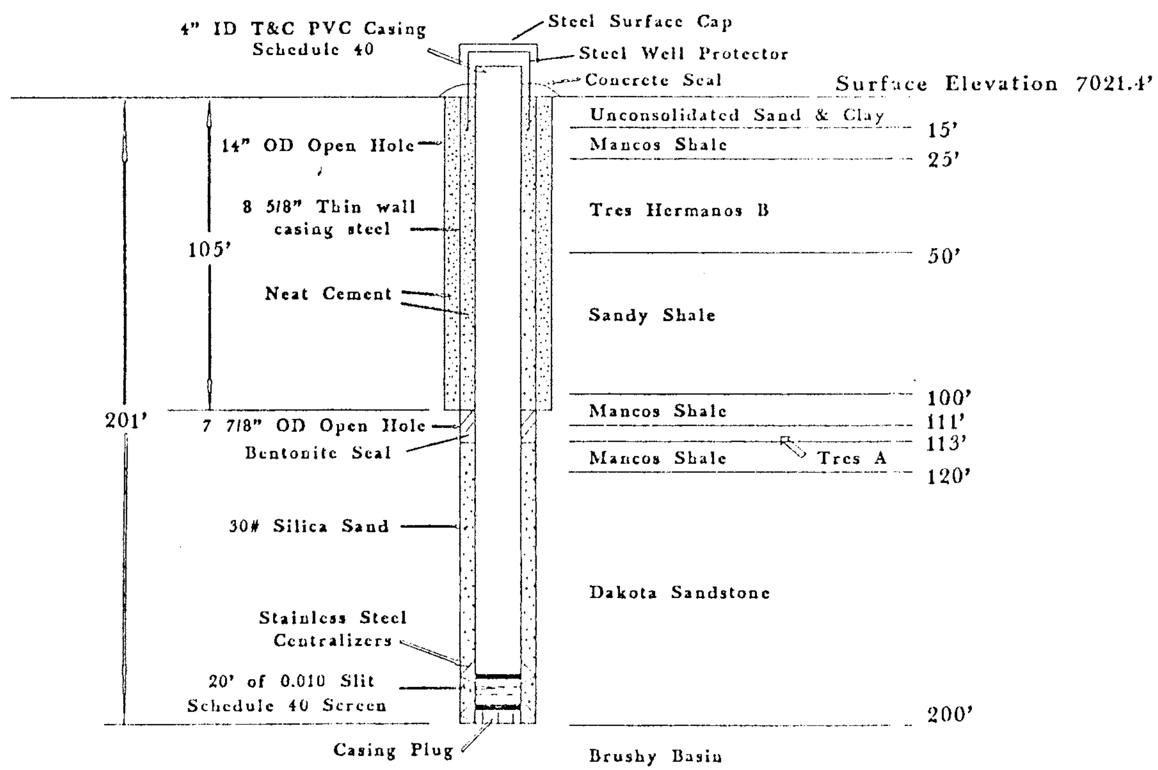
2	May13,21	12:43:50	AP-COND	0.000	[MMHO/M]	9831.200	[CPS]
	May13,21	12:43:50	AP-COND	705.000	[MMHO/M]	71925.000	[CPS]
3	May13,21	12:40:43	TEMP	47.000	[DEG_F]	27537.000	[CPS]
	May13,21	12:40:43	TEMP	134.000	[DEG_F]	32362.000	[CPS]
4	May13,21	12:40:36	A	Default	[CPS]		
5	May13,21	12:40:39	B	Default	[CPS]		

APPENDIX F

Boring Logs

GEOLOGIC FORMATIONS AND WELL PLAN -- 36-06Kd



* No Scale

Completed 10/19/88

Revised June 1972

STATE ENGINEER OFFICE

WELL RECORD

Section 1. GENERAL INFORMATION

(A) Owner of well Quivira Mining Company Owner's Well No. 36-06 Kd
Street or Post Office Address P.O. Box 218
City and State Grants, New Mexico 87020

Well was drilled under Permit No. N/A and is located in the:

a. ____ ¼ SE ¼ SE ¼ NW ¼ of Section 36 Township 14N Range 10W N.M.P.M.

b. Tract No. ____ of Map No. ____ of the ____

c. Lot No. ____ of Block No. ____ of the ____
Subdivision, recorded in McKinley County.

d. X= ____ feet, Y= ____ feet, N.M. Coordinate System ____ Zone in the ____ Grant.

(B) Drilling Contractor Water Well Equipment/Rotary Drilling License No. WD643

Address P.O. Box 129 Grants, New Mexico 87020

Drilling Began 10-16-88 Completed 10-19-88 Type tools tri-cone Size of hole 7-7/8 in.

Elevation of land surface or ____ at well is 7021.4 ft. Total depth of well 201 ft.

Completed well is ☒ shallow ☐ artesian. Depth to water upon completion of well 167.4 ft.

Section 2. PRINCIPAL WATER-BEARING STRATA

Depth in Feet		Thickness in Feet	Description of Water-Bearing Formation	Estimated Yield (gallons per minute)
From	To			
120	200	80	Dakato Sandstone	Less Than 0.5

Section 3. RECORD OF CASING

Diameter (inches)	Pounds per foot	Threads per in.	Depth in Feet		Length (feet)	Type of Shoe	Perforations	
			Top	Bottom			From	To
4.0 I.D.	PVC-SDR40	6			201		181	201
							0.010 Slotted Screen	

Section 4. RECORD OF MUDDING AND CEMENTING

Depth in Feet		Hole Diameter	Sacks of Mud	Cubic Feet of Cement	Method of Placement
From	To				
0	201	7-7/8		17	Trimmy
0	105	14		74	Trimmy

Section 5. PLUGGING RECORD

Plugging Contractor N/A
Address ____
Plugging Method ____
Date Well Plugged ____
Plugging approved by:

____
State Engineer Representative

No.	Depth in Feet		Cubic Feet of Cement
	Top	Bottom	
1			
2			
3			
4			

FOR USE OF STATE ENGINEER ONLY

Date Received

Quad ____ FWL ____ FSL ____

File No. ____ Use ____

Section 6. LOG OF HOLE

Depth in Feet From	Depth in Feet To	Thickness in Feet	Color and Type of Material Encountered
0	15	15	Unconsolidated Sand and Clay
15	25	10	Mancos shale
25	50	25	Tres Hermanos B sandstone
50	100	50	Sandy shale
100	111	11	Mancos shale
111	113	2	Tres Hermanos A sandstone
113	120	7	Mancos shale
120	200	80	Dakota sandstone

Section 7. REMARKS AND ADDITIONAL INFORMATION

Air ligt developed - 50 minutes

The undersigned hereby certifies that, to the best of his knowledge and belief, the foregoing is a true and correct record of the above described hole.

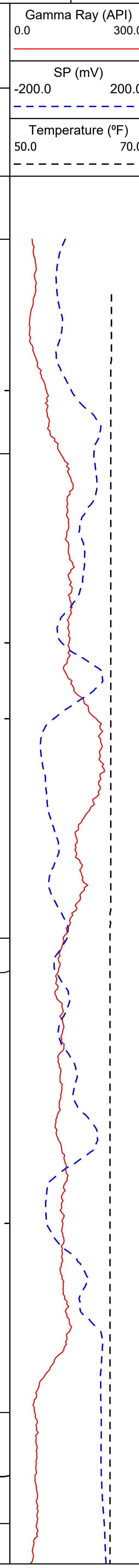
Driller

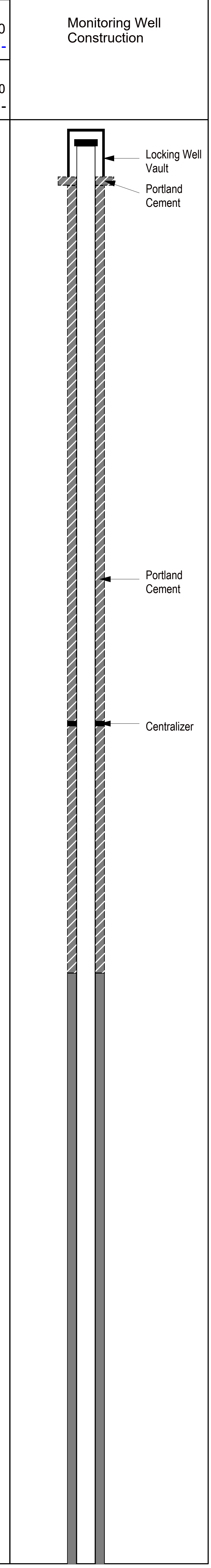
INSTRUCTIONS: This form should be executed in triplicate, preferably typewritten, and submitted to the appropriate district office of the State Engineer. All sections, except Section 5, shall be answered as completely and accurately as possible when any well is drilled, repaired or deepened. When this form is used as a plugging record, only Section 1(a) and Section 5 need be completed.

INTERA GEOSCIENCE & ENGINEERING SOLUTIONS	Boring Log: MW 36-07 KD	Project Name: Alternate Concentration Limits (ACL)	Project #: RIOAL.M001.ACL-FIELD

Date Started:	10/24/2019	Drilling Company:	Yellow Jacket Drilling	Boring Depth/Diam.:	209' bgs/10"
Date Completed:	10/27/2019	Driller:	T. Valentine	TOC Elevation:	7024.69' amsl
Drilling Method:	Air Rotary	Logged By:	A. Hanson	Y (Northing):	1598544.33
Sampling Method:	Cuttings	DTW (Date):	198.41' bgs (12/19/2019)	X (Easting):	2720443.02

Depth (ft)	Lab Sample	Graphic Log	% Recovery	Lithologic Description
0			100	0-6', **Alluvium**, Silty SAND (SM), very fine to fine grained, subrounded, loose, 7.5YR 5/6 (strong brown), moist, no odor, moderate HCL reaction, occasional occurrences of calcite
				6-8.5', Silty SAND (SM), same as above
10			100	8.5-16', **Lower Mancos Shale B**, Silty SHALE, moderately weathered, soft, laminated, horizontal, 7.5YR 4/2 (brown), dry, no odor, no HCL reaction, contains oxidized orangish brown zones, sparse gypsum
			100	16-19', Silty SHALE, same as above
20			70	19-27.7', Silty SHALE, same as above; contains sub horizontal fractures that are infilled with calcite and oxidized to orabgish brown
				27.7-29', Altered CLAY, soft, massive, GLEY 1 7/5G 7/1 (light greenish gray), no odor, dry, no HCl reaction, waxy luster
30			29	29-39', SHALE, moderately weathered, medium hard, 7.5YR 2.5/1 (black), dry, no odor, no HCL reaction, fissile, contains sub horizontal fractures infilled with calcite, oxidized
40			83	39-46.5', SHALE, same as above
				46.5-49', **Tres Hermanos A Sandstone of the Lower Mancos Shale A**, Silty SANDSTONE, hard, very fine grained, subangular, 10YR 6/4 (light yellowish brown), moist, no odor, no HCL reaction, mottled, highly altered to yellowish brown, contains organics, contains sub vertical fractures infilled with gypsum
				49-50.9', Silty SANDSTONE, same as above
50				50.9-59', SANDSTONE, hard, very fine grained, subangular, 10YR 6/4 (light yellowish brown), moist, no odor, no HCL reaction, mottled, highly altered to yellowish orange, abundant organics,





Notes:

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2. Lithology, geophysical data, and lab sample intervals are from the C 36-07 KD 3 core hole.
3. X and Y locations are in New Mexico State Plane Grid (NAD 83 West Zone). All elevations are NAVD 88.

INTERA GEOSCIENCE & ENGINEERING SOLUTIONS	**Boring Log:** MW 36-07 KD	**Project Name:** Alternate Concentration Limits (ACL)	**Project #:** RIOAL.M001.ACL-FIELD

Date Started:	10/24/2019	Drilling Company:	Yellow Jacket Drilling	Boring Depth/Diam.:	209' bgs/10"
Date Completed:	10/27/2019	Driller:	T. Valentine	TOC Elevation:	7024.69' amsl
Drilling Method:	Air Rotary	Logged By:	A. Hanson	Y (Northing):	1598544.33
Sampling Method:	Cuttings	DTW (Date):	198.41' bgs (12/19/2019)	X (Easting):	2720443.02

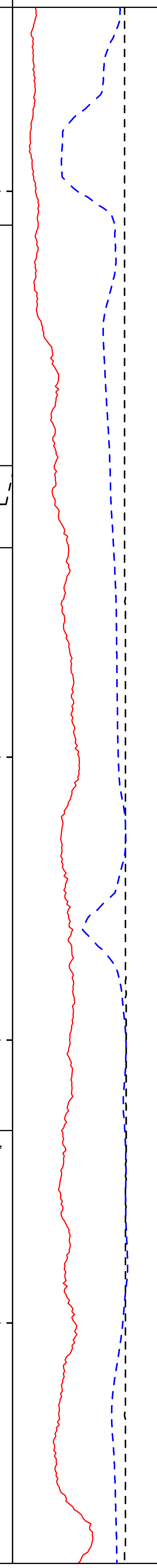
Gamma Ray (API) 0.0 – 300.0

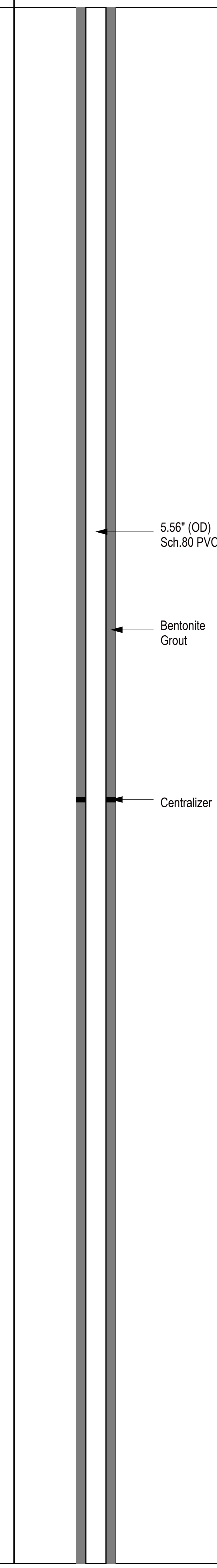
SP (mV) -200.0 – 200.0

Temperature (ºF) 50.0 – 70.0

Monitoring Well Construction

Depth (ft)	% Recovery	Lithologic Description
	98	contains sub vertical fractures infilled with calcite, occurences of shell fragment fossils
		59-60.2', SANDSTONE, same as above
60	94	60.2-68.7', SANDSTONE, hard, fine grained, subrounded, 7.5YR 5/1 (gray), moist, no odor, no HCL reaction, predominantly quartz, abundant organics, contains glauconite, contains burrows, trace pyrite and chalcopyrite; from 68.3-68.7' bgs: SANDSTONE, fine grained, very hard, calcite cemented, contains a 2 mm thick SHALE bed at the bottom
		68.7-69', SANDSTONE, hard, fine grained, subrounded, massive, 7.5YR 5/1 (gray), moist, no odor, no HCL reaction, 97% quartz, trace glauconite, trace mafics
70		69-71.6', SANDSTONE, same as above
	95	71.6-79', **Lower Mancos Shale A**, Silty SANDSTONE and SHALE, hard, fine grained, subrounded, interbedded, 7.5YR 5/1 (gray) and 7.5YR 2.5/1 (black), dry, no odor, weak HCL reaction, contains calcite cemented zones, predominantly quartz, abundant organics, contains burrows, SHALE beds up to 40 mm thick
80	98	79-89', Silty SANDSTONE and SHALE, same as above; SHALE beds up to 50 mm thick
90		89-92.2', Silty SANDSTONE and SHALE, same as above
	96	92.2-99', SILTY SANDSTONE, hard, very fine grained, subangular, 7.5YR 3/1 (very dark gray), dry, no odor, no HCL reaction, mottled, contains shell fragment fossils, predominantly quartz, abundant organics, sparse pyrite and chalcopyrite
100	95	99-109', Silty SANDSTONE, same as above





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3. X and Y locations are in New Mexico State Plane Grid (NAD 83 West Zone). All elevations are NAVD 88.

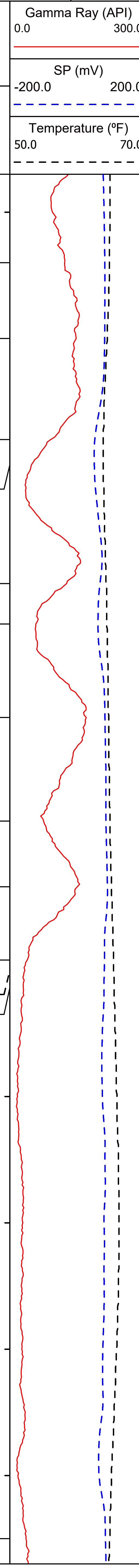
Boring Log:	MW 36-07 KD	Project Name:	Alternate Concentration Limits (ACL)	Project #:	RIOAL.M001.ACL-FIELD

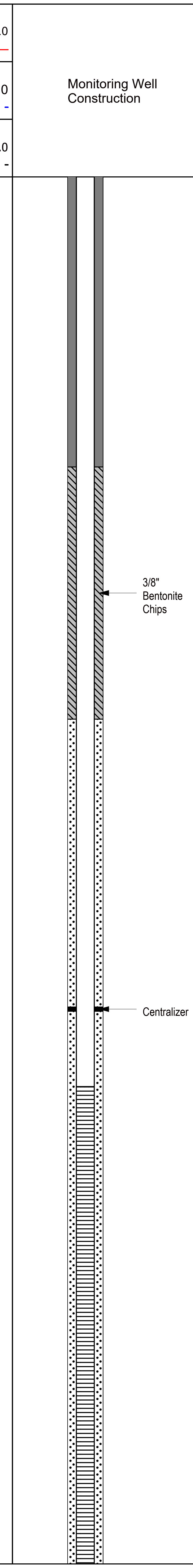
Date Started: 10/24/2019
Date Completed: 10/27/2019
Drilling Method: Air Rotary
Sampling Method: Cuttings

Drilling Company: Yellow Jacket Drilling
Driller: T. Valentine
Logged By: A. Hanson
DTW (Date): 198.41' bgs (12/19/2019)

Boring Depth/Diam.: 209' bgs/10"
TOC Elevation: 7024.69' amsl
Y (Northing): 1598544.33
X (Easting): 2720443.02

Depth (ft)	% Recovery	Lithologic Description
110	100	109-111', Silty SANDSTONE, same as above
		111-114', SILTSTONE, medium hard, laminated, horizontal, 5YR 3/1 (very dark gray), dry, no odor, no HCL reaction, mottled, contains shell fragment fossils, trace pyrite and chalcopyrite
	98	114-118', Clayey SILTSTONE, medium hard, laminated, horizontal, 5YR 2.5/1 (black), dry, no odor, no HCL reaction, fossiliferous, occurrences of pyrite and chalcopyrite
		118-119', **Dakota Sandstone**, SANDSTONE, medium hard, fine grained, subrounded, 7.5YR 4/1 (dark gray), moist, no odor, no HCL reaction, mottled, predominantly quartz, abundant organics, trace pyrite and chalcopyrite
120	100	119-123.7', SANDSTONE, medium hard, fine grained, rounded, 7.5YR 5/1 (gray), moist, no odor, no HCL reaction, contains sub vertical fractures infilled with calcite, 99% quartz, trace glauconite
		123.7-125.3', Clayey SILTSTONE, medium hard, 7.5YR 2.5/1 (black), dry, no odor, no HCL reaction, fissile, sparse pyrite and chalcopyrite
		125.3-129', SANDSTONE, very hard, very fine grained, rounded, massive, 7.5YR 5/1 (gray), moist, no odor, no HCL reaction, contains few 1 mm thick SHALE beds, 99% quartz, trace pyrite and chalcopyrite, sparse organics
130	97	129-133.1', Silty SHALE, medium hard, 7.5YR 2.5/1 (black), dry, no odor, no HCL reaction, mottled, abundant organics, contains shell fragment fossils, occurences of pyrite and chalcopyrite
		133.1-135.7', SANDSTONE, hard, fine grained, rounded, 7.5YR 5/1 (gray), wet, no odor, weak HCL reaction, mottled, predominantly quartz, abundant organics, occurences of pyrite and chalcopyrite
		135.7-138.6', Silty SANDSTONE and SHALE, medium hard, very fine grained, subrounded, 7.5YR 2.5/1 (black), dry, no odor, no HCL reaction, occurrences of pyrite and chalcopyrite
		138.6-139', SANDSTONE, hard, fine grained, rounded, 7.5YR 5/1 (gray), dry, no odor, no HCL reaction, mottled, predominantly quartz, abundant organics
140	100	139-139.7', SANDSTONE, same as above
		139.7-144', SANDSTONE, medium hard, fine grained, rounded, crossbedded, 7.5YR 6/1 (gray), moist, no odor, no HCL reaction, contains sub vertical fractures, occurences of 1 mm thick SHALE beds, 99% quartz
	98	144-149', SANDSTONE, same as above
150	100	149-154', SANDSTONE, same as above; wet
	38	154-159', SANDSTONE, same as above
160		159-161.5', SANDSTONE, same as above
	100	161.5-164', SANDSTONE, hard, fine grained, rounded, 7.5YR 4/1 (dark gray), moist, no odor,





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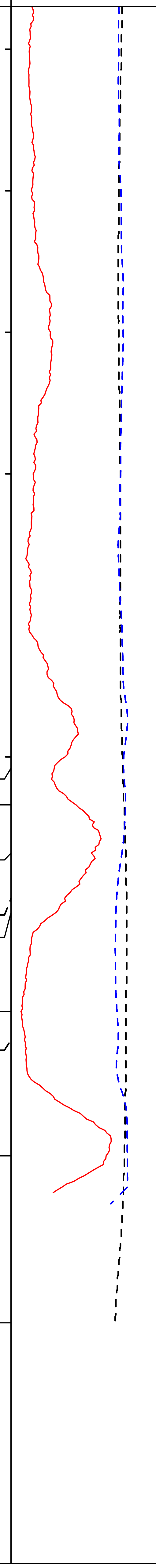
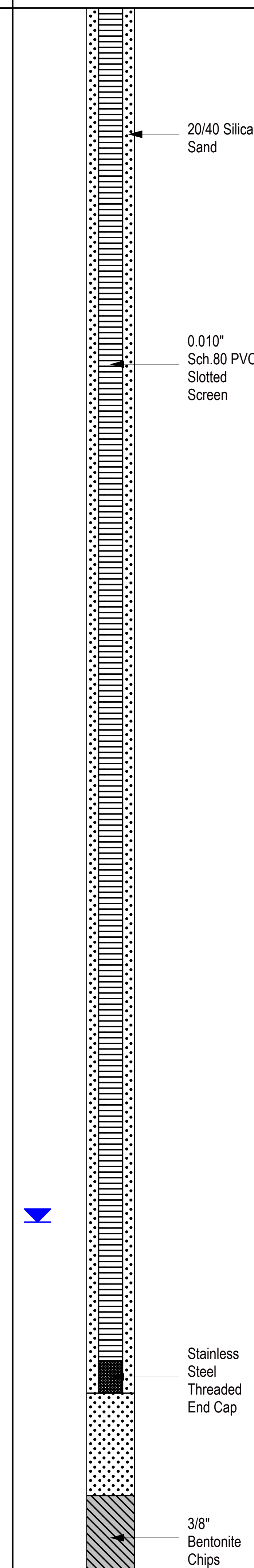
Drilling Method:	Air Rotary	Logged By:	A. Hanson	Y (Northing):	1598544.33
Sampling Method:	Cuttings	DTW (Date):	198.41' bgs (12/19/2019)	X (Easting):	2720443.02

Gamma Ray (API) 0.0 – 300.0; SP (mV) -200.0 – 200.0; Temperature (ºF) 50.0 – 70.0

Monitoring Well Construction

Depth (ft)	Lab Sample	Graphic Log	% Recovery	Lithologic Description
				weak HCL reaction, mottled, predominantly quartz, abundant organics, contains burrows
			64	164-169', SANDSTONE, same as above; dry, contains calcite cemented zones
170			60	169-174', SANDSTONE, same as above; contains pyrite and chalcopyrite
			100	174-179', SANDSTONE, same as above
180			77	179-184', SANDSTONE, same as above; dry until moist at 182' bgs; from 182-186' bgs: less organics
				189-189.4', SANDSTONE, same as above
190				189.4-190.7', SHALE, medium hard, massive, 7.5YR 2.5/1 (black), dry, no odor, no HCL reaction
			100	190.7-192.4', SANDSTONE, medium hard, very fine grained, rounded, 7.5YR 4/1 (dark gray), wet, no odor, no HCL reaction, mottled, contains burrows, predominantly quartz, abundant organics, occurences of pyrite and chalcopyrite
				192.4-194', Silty SANDSTONE, very hard, very fine grained, massive, 7.5YR 6/1 (gray), dry, no odor, no HCL reaction, occurrences of pyrite and chalcopyrite, contains sub vertical fractures infilled with pyrite and chalcopyrite
				194-194.5', Silty SANDSTONE, same as above
			94	194.5-198', SANDSTONE, very hard, very fine grained, rounded, 7.5YR 6/1 (gray), dry, no odor, no HCL reaction,99% quartz, occurrences of organics
				198-199', SANDSTONE, medium hard, fine grained, massive, 7.5YR 6/1 (gray), wet, no odor, no HCL reaction, 99% quartz, occurrences of organics, trace pyrite
200				199-203.1', SANDSTONE, same as above; coarsens downward to coarse grained sand, contains pyrite, occurences of Mudstone clasts (Brushy Basin Mudstone)
			75	203.1-209', **Brushy Basin Mudstone**, MUDSTONE, medium hard, massive, GLEY 1 6/5G 6/1 (greenish gray), dry, no odor, no HCL reaction, waxy luster, contains pyrite at the top up to 1 mm long, contains fractures infilled with calcite
210				Boring terminated at 209' bgs





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APPENDIX G

Saturation Indices

Temperature = 25.0 C   Pressure = 1.013 bars
pH = 2.880   log fO2 = -19.951
Eh = 0.7634 volts   pe = 12.9050
Ionic strength = 0.105211
Charge imbalance = -0.012055 eq/kg (-9.076% error)
Activity of water = 0.998212
Solvent mass = 1.0000 kg
Solution mass = 1.0057 kg
Mineral mass = 0.00000 kg
Solution density = 1.015 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.029890 molal
Dissolved solids = 5654 mg/kg sol'n
Elect. conductivity = 7052.96 uS/cm (or umho/cm)
Hardness = 2787.63 mg/kg sol'n as CaCO3
  carbonate = 0.00 mg/kg sol'n as CaCO3
  non-carbonate = 2787.63 mg/kg sol'n as CaCO3
Carbonate alkalinity= 0.00 mg/kg sol'n as CaCO3
Water type = Na-SO4
Bulk volume = 990. cm3
Fluid volume = 990. cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.7634	12.9050

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02907	1025.	0.7780	-1.6455
Na+	0.02272	519.4	0.7780	-1.7526
SO4--	0.02077	1984.	0.3664	-2.1185
Mg++	0.009457	228.6	0.3664	-2.4603
Ca++	0.008160	325.2	0.3664	-2.5243
CaSO4 (aq)	0.005089	688.9	1.0245	-2.2828
MgSO4 (aq)	0.004685	560.8	1.0245	-2.3188
H+	0.001694	1.698	0.7780	-2.8800
HSO4-	0.001251	120.8	0.7780	-3.0116
NaSO4-	0.0009504	112.5	0.7780	-3.1311
MgCl+	0.0004011	23.83	0.7780	-3.5058
K+	0.0003100	12.05	0.7780	-3.6176
CaCl+	0.0002183	16.40	0.7780	-3.7699
NaCl (aq)	0.0001956	11.37	1.0245	-3.6981
FeSO4+	9.771e-05	14.76	0.7780	-4.1190
KSO4-	1.658e-05	2.228	0.7780	-4.8894
H2CO3* (aq)	1.650e-05	1.017	1.0245	-4.7721
FeOH++	1.108e-05	0.8030	0.3664	-5.3913

Fe(SO4)2-	1.003e-05	2.474	0.7780	-5.1075
Fe+++	5.376e-06	0.2986	0.1045	-6.2505
KCl (aq)	2.669e-06	0.1979	1.0245	-5.5632
Fe++	2.053e-06	0.1140	0.3664	-6.1235
FeSO4 (aq)	1.372e-06	0.2073	1.0245	-5.8521
Ni++	1.155e-06	0.06745	0.3664	-6.3733
Be++	1.061e-06	0.009511	0.3664	-6.4102
FeCl++	1.047e-06	0.09505	0.3664	-6.4161
UO2SO4 (aq)	9.660e-07	0.3517	1.0245	-6.0045
Fe(OH)2+	7.361e-07	0.06577	0.7780	-6.2421
UO2++	6.749e-07	0.1812	0.3664	-6.6068
NiSO4 (aq)	6.276e-07	0.09659	1.0245	-6.1918
UO2(SO4)2--	6.209e-07	0.2853	0.3664	-6.6430
BeSO4 (aq)	4.475e-07	0.04676	1.0245	-6.3387
Be(SO4)2--	2.392e-08	0.004785	0.3664	-8.0572
BeCl+	1.561e-08	0.0006900	0.7780	-7.9157
CdCl+	1.447e-08	0.002127	0.7780	-7.9485
Cd++	1.422e-08	0.001590	0.3664	-8.2830
FeCl+	1.380e-08	0.001253	0.7780	-7.9691
Fe2(OH)2++++	1.281e-08	0.001855	0.0180	-9.6366
UO2Cl+	1.063e-08	0.003230	0.7780	-8.0823
H2AsO4-	9.915e-09	0.001389	0.7780	-8.1127
CdSO4 (aq)	9.077e-09	0.001882	1.0245	-8.0315
HCO3-	7.330e-09	0.0004447	0.7780	-8.2439
NiCl+	4.573e-09	0.0004282	0.7780	-8.4488
Cd(SO4)2--	2.606e-09	0.0007891	0.3664	-9.0200
H3AsO4	1.980e-09	0.0002795	1.0245	-8.6927
UO2OH+	1.353e-09	0.0003863	0.7780	-8.9776
Be(SO4)3----	1.144e-09	0.0003380	0.0180	-10.6857
CdCl2 (aq)	1.036e-09	0.0001888	1.0245	-8.9741
Ni(SO4)2--	4.423e-10	0.0001103	0.3664	-9.7903
MgHCO3+	2.959e-10	2.511e-05	0.7780	-9.6379
CaHCO3+	2.792e-10	2.806e-05	0.7780	-9.6631
NaHCO3 (aq)	4.933e-11	4.120e-06	1.0245	-10.2964
Fe3(OH)4+++++	1.594e-11	3.733e-06	0.0019	-13.5227
UO2Cl2 (aq)	9.809e-12	3.325e-06	1.0245	-10.9978
OH-	9.800e-12	1.657e-07	0.7780	-11.1178
MgOH+	5.539e-12	2.276e-07	0.7780	-11.3655
NiCl2 (aq)	2.724e-12	3.510e-07	1.0245	-11.5543
HAsO4--	1.634e-12	2.274e-07	0.3664	-12.2227
Be(OH)2 (aq)	1.599e-12	6.840e-08	1.0245	-11.7857
(UO2)2OH+++	8.845e-13	4.899e-07	0.1045	-13.0343
Be2OH+++	7.293e-13	2.540e-08	0.1045	-13.1181
UO2CO3 (aq)	6.163e-13	2.023e-07	1.0245	-12.1997
CaOH+	5.846e-13	3.319e-08	0.7780	-12.3421
NiHCO3+	3.828e-13	4.557e-08	0.7780	-12.5261
FeOH+	2.935e-13	2.127e-08	0.7780	-12.6413
Fe(OH)3 (aq)	2.380e-13	2.529e-08	1.0245	-12.6129
(UO2)2(OH)2++	2.296e-13	1.310e-07	0.3664	-13.0751
NaOH (aq)	1.656e-13	6.587e-09	1.0245	-12.7704
UO2(OH)2 (aq)	9.798e-14	2.962e-08	1.0245	-12.9983
FeHCO3+	6.945e-14	8.070e-09	0.7780	-13.2674
NiOH+	5.224e-14	3.933e-09	0.7780	-13.3910
KOH (aq)	3.119e-15	1.740e-10	1.0245	-14.4954

CdHCO3+	1.211e-15	2.088e-10	0.7780	-15.0258
MgCO3 (aq)	6.548e-16	5.490e-11	1.0245	-15.1734
CO3--	5.536e-16	3.303e-11	0.3664	-15.6928
CdOH+	4.057e-16	5.220e-11	0.7780	-15.5008
CaCO3 (aq)	1.795e-16	1.787e-11	1.0245	-15.7353
BeCO3 (aq)	1.384e-16	9.498e-12	1.0245	-15.8484
NaCO3-	8.582e-17	7.083e-12	0.7780	-16.1754
Mg2CO3++	2.586e-17	2.794e-12	0.3664	-17.0233
Fe(OH)4-	4.735e-18	5.833e-13	0.7780	-17.4336
NiCO3 (aq)	3.115e-18	3.677e-13	1.0245	-17.4961
UO2(OH)3-	7.761e-19	2.477e-13	0.7780	-18.2191
Be3(OH)3+++	3.142e-19	2.439e-14	0.1045	-19.4839
CdCO3 (aq)	2.419e-20	4.147e-15	1.0245	-19.6058
Ni(OH)2 (aq)	2.402e-20	2.215e-15	1.0245	-19.6088
(UO2)3(OH)4++	1.708e-20	1.492e-14	0.3664	-20.2034
AsO4---	6.892e-21	9.520e-16	0.1045	-21.1427
UO2(CO3)2--	2.791e-21	1.083e-15	0.3664	-20.9902
(UO2)3(OH)5+	1.364e-21	1.214e-15	0.7780	-20.9742
Fe(OH)2 (aq)	1.350e-21	1.206e-16	1.0245	-20.8591
(UO2)2CO3(OH)3-	9.535e-22	6.173e-16	0.7780	-21.1297
Cd2OH+++	7.893e-23	1.898e-17	0.1045	-23.0838
Cd(OH)2 (aq)	1.482e-23	2.158e-18	1.0245	-22.8186
O2(aq)	1.117e-23	3.553e-19	1.0245	-22.9415
(UO2)3CO3(OH)3+	7.630e-27	6.989e-21	0.7780	-26.2265
UO2(OH)4--	8.833e-28	2.969e-22	0.3664	-27.4899
Ni(OH)3-	2.412e-28	2.632e-23	0.7780	-27.7266
(UO2)4(OH)7+	8.639e-29	1.030e-22	0.7780	-28.1725
Ca2UO2(CO3)3 (aq	6.392e-29	3.370e-23	1.0245	-28.1839
Fe(OH)3-	4.287e-29	4.555e-24	0.7780	-28.4769
UO2(CO3)3----	7.923e-31	3.545e-25	0.0180	-31.8452
CaUO2(CO3)3--	4.231e-31	2.062e-25	0.3664	-30.8095
(UO2)3(OH)7-	1.751e-32	1.618e-26	0.7780	-31.8658
Be5(OH)6++++	1.474e-32	2.156e-27	0.0180	-33.5755
Cd(CO3)2--	9.940e-33	2.297e-27	0.3664	-32.4386
Cd(OH)3-	1.458e-33	2.369e-28	0.7780	-32.9453
Be5(OH)7+++	4.025e-37	6.568e-32	0.1045	-37.3763
Be6(OH)8++++	1.370e-41	2.591e-36	0.0180	-42.6073
Cd(OH)4--	2.409e-44	4.323e-39	0.3664	-44.0541
(UO2)3(CO3)6----	8.851e-57	1.030e-50	0.0001	-59.9772

Mineral saturation states

	log Q/K		log Q/K
Hematite	6.1946s/sat	CdOHCl	-10.5866
Fe(OH)2.7Cl.3	4.0697s/sat	Magnesite	-10.6931
Goethite	1.8969s/sat	NiCO3	-10.8661
K-Jarosite	1.6691s/sat	CdCl2	-10.9153
Lepidocrocite	1.0169s/sat	CaCO3xH2O	-11.0736
Magnetite	1.0095s/sat	Siderite	-11.2264
Gypsum	-0.0344	Ni(OH)2 (c)	-11.4048
Anhydrite	-0.2828	Otavite	-11.9658
Ferrihydrite (ag	-0.3029	Fe(OH)2 (c)	-13.2551
Ferrihydrite	-0.8129	Nesquehonite	-13.4854
Maghemite	-1.6094	Ni(OH)2 (am)	-13.5048

Na-Jarosite	-2.1459	MgCO3:5H2O	-13.6170
Epsomite	-2.4577	Brucite	-13.8018
H-Jarosite	-3.2041	Fe(OH)2 (am)	-13.8551
Mirabilite	-4.5175	Fe2(SO4)3	-15.1223
Halite	-4.9481	Mg(OH)2 (active)	-15.4958
Thenardite	-5.9454	Fe3(OH)8	-15.8128
Melanterite	-6.0385	Cd(OH)2	-16.1686
KCl	-6.1632	Natron	-17.8948
Morenosite	-6.3523	Periclase	-18.2851
Retgersite	-6.4564	Dolomite (ordere	-19.2802
UO2(OH)2 (beta)	-6.4599	Portlandite	-19.4699
Schoepite	-6.8431	Dolomite (disord	-19.8302
Be(OH)2 (beta)	-7.1457	Thermonatrite	-19.8358
FeAsO4:2H2O	-7.1948	Mg2(OH)3Cl:4H2O	-23.9315
Be(OH)2 (alpha)	-7.5457	Artinite	-24.4572
Rutherfordine	-7.8375	As2O5	-24.8731
Be(OH)2 (am)	-7.8457	Lime	-29.4644
Gummite	-8.5194	Cd3OH2(SO4)2	-30.0376
CdSO4:2.67H2O	-8.5306	Ca3(AsO4)2:4H2O	-30.9616
UO3	-8.5476	Ni3(AsO4)2:8H2O	-35.9114
CdSO4:1H2O	-8.6762	Cd3(OH)4SO4	-38.0106
Magnesioferrite	-8.7842	Ni4(OH)6SO4	-42.3362
CdCl2:2.5H2O	-9.6630	Huntite	-42.7084
Calcite	-9.7373	Cd4(OH)6SO4	-46.3752
Aragonite	-9.8810	Cd metal (alpha)	-47.6077
CdCl2:1H2O	-9.8817	Cd metal (gamma)	-47.7110
CdSO4	-10.2293	Hydromagnesite	-60.5512
Vaterite	-10.3037		

Gases	fugacity	log fug.
CO2(g)	0.0004974	-3.303
O2(g)	1.120e-20	-19.951
CH4(g)	2.064e-107	-106.685

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	1.19e-08	1.19e-08	0.00164			
Be++	1.55e-06	1.55e-06	0.0139			
CO3--	1.65e-05	1.65e-05	0.985			
Ca++	0.0135	0.0135	537.			
Cd++	4.14e-08	4.14e-08	0.00463			
Cl-	0.0299	0.0299	1.05e+03			
Fe+++	0.000129	0.000129	7.19			
H+	0.00296	0.00296	2.97			
H2O	55.5	55.5	9.94e+05			
K+	0.000329	0.000329	12.8			
Mg++	0.0145	0.0145	352.			
Na+	0.0239	0.0239	546.			
Ni++	1.79e-06	1.79e-06	0.104			
O2(aq)	-8.60e-07	-8.60e-07	-0.0274			
SO4--	0.0329	0.0329	3.14e+03			
UO2++	2.27e-06	2.27e-06	0.611			

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	1.190e-08	1.190e-08	0.0008863		
Be	1.549e-06	1.549e-06	0.01389		
C	1.650e-05	1.650e-05	0.1971		
Ca	0.01347	0.01347	536.7		
Cd	4.141e-08	4.141e-08	0.004628		
Cl	0.02989	0.02989	1054.		
Fe	0.0001295	0.0001295	7.189		
H	111.0	111.0	1.113e+05		
K	0.0003293	0.0003293	12.80		
Mg	0.01454	0.01454	351.6		
Na	0.02387	0.02387	545.6		
Ni	1.788e-06	1.788e-06	0.1044		
O	55.64	55.64	8.852e+05		
S	0.03289	0.03289	1049.		
U	2.274e-06	2.274e-06	0.5382		

Temperature = 25.0 C Pressure = 1.013 bars
pH = 4.490 log fO2 = -29.354
Eh = 0.5291 volts pe = 8.9442
Ionic strength = 0.112319
Charge imbalance = -0.022291 eq/kg (-15.95% error)
Activity of water = 0.998136
Solvent mass = 1.0000 kg
Solution mass = 1.0062 kg
Mineral mass = 0.00000 kg
Solution density = 1.016 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.031295 molal
Dissolved solids = 6127 mg/kg sol'n
Elect. conductivity = 6948.92 uS/cm (or umho/cm)
Hardness = 2824.30 mg/kg sol'n as CaCO3
carbonate = 0.01 mg/kg sol'n as CaCO3
non-carbonate = 2824.28 mg/kg sol'n as CaCO3
Carbonate alkalinity= 0.01 mg/kg sol'n as CaCO3
Water type = Na-SO4
Bulk volume = 991. cm3
Fluid volume = 991. cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.5291	8.9442

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.03046	1073.	0.7744	-1.6274
SO4--	0.02491	2378.	0.3597	-2.0478
Na+	0.02386	545.3	0.7744	-1.7333
Mg++	0.009714	234.7	0.3597	-2.4567
Ca++	0.007273	289.7	0.3597	-2.5824
MgSO4 (aq)	0.005550	664.0	1.0262	-2.2445
CaSO4 (aq)	0.005231	707.8	1.0262	-2.2702
NaSO4-	0.001175	139.0	0.7744	-3.0411
MgCl+	0.0004236	25.16	0.7744	-3.4841
K+	0.0002931	11.39	0.7744	-3.6440
NaCl (aq)	0.0002129	12.36	1.0262	-3.6607
CaCl+	0.0002001	15.02	0.7744	-3.8098
Fe++	0.0001279	7.096	0.3597	-4.3374
FeSO4 (aq)	9.853e-05	14.88	1.0262	-3.9952
H+	4.179e-05	0.04186	0.7744	-4.4900
HSO4-	3.632e-05	3.504	0.7744	-4.5509
KSO4-	1.845e-05	2.478	0.7744	-4.8451
H2CO3* (aq)	1.619e-05	0.9979	1.0262	-4.7796

Fe(OH)2+	8.208e-06	0.7331	0.7744	-5.1968
FeOH++	3.077e-06	0.2228	0.3597	-5.9560
KCl (aq)	2.614e-06	0.1937	1.0262	-5.5714
Ni++	1.997e-06	0.1165	0.3597	-6.1438
NiSO4 (aq)	1.251e-06	0.1924	1.0262	-5.8916
FeCl+	8.836e-07	0.08018	0.7744	-6.1648
Be++	8.368e-07	0.007495	0.3597	-6.5215
UO2SO4 (aq)	7.810e-07	0.2842	1.0262	-6.0961
FeSO4+	7.729e-07	0.1167	0.7744	-6.2229
UO2(SO4)2--	6.029e-07	0.2769	0.3597	-6.6639
UO2++	4.731e-07	0.1270	0.3597	-6.7691
BeSO4 (aq)	4.069e-07	0.04249	1.0262	-6.3793
HCO3-	2.949e-07	0.01788	0.7744	-6.6414
H2AsO4-	2.013e-07	0.02819	0.7744	-6.8072
Fe(SO4)2-	9.340e-08	0.02302	0.7744	-7.1407
UO2OH+	3.811e-08	0.01087	0.7744	-7.5299
Fe+++	3.751e-08	0.002082	0.1002	-8.4252
Be(SO4)2--	2.613e-08	0.005223	0.3597	-8.0271
CdCl+	1.957e-08	0.002876	0.7744	-7.8194
Cd++	1.871e-08	0.002090	0.3597	-8.1720
CdSO4 (aq)	1.377e-08	0.002853	1.0262	-7.8498
BeCl+	1.265e-08	0.0005591	0.7744	-8.0089
MgHCO3+	1.200e-08	0.001018	0.7744	-8.0318
CaHCO3+	9.826e-09	0.0009873	0.7744	-8.1187
NiCl+	8.125e-09	0.0007604	0.7744	-8.2012
UO2Cl+	7.665e-09	0.002327	0.7744	-8.2265
FeCl++	7.440e-09	0.0006751	0.3597	-8.5725
Cd(SO4)2--	4.749e-09	0.001437	0.3597	-8.7675
NaHCO3 (aq)	2.062e-09	0.0001721	1.0262	-8.6746
Be(OH)2 (aq)	2.049e-09	8.764e-05	1.0262	-8.6771
Be(SO4)3----	1.555e-09	0.0004592	0.0167	-10.5848
CdCl2 (aq)	1.452e-09	0.0002646	1.0262	-8.8267
HAsO4--	1.370e-09	0.0001906	0.3597	-9.3072
Ni(SO4)2--	1.059e-09	0.0002639	0.3597	-9.4194
Fe2(OH)2++++	1.025e-09	0.0001484	0.0167	-10.7659
H3AsO4	9.807e-10	0.0001383	1.0262	-8.9972
FeOH+	7.342e-10	5.316e-05	0.7744	-9.2452
UO2CO3 (aq)	6.907e-10	0.0002266	1.0262	-9.1495
OH-	4.011e-10	6.779e-06	0.7744	-9.5078
MgOH+	2.286e-10	9.386e-06	0.7744	-9.7520
(UO2)2(OH)2++	1.838e-10	0.0001048	0.3597	-10.1799
FeHCO3+	1.707e-10	1.983e-05	0.7744	-9.8787
UO2(OH)2 (aq)	1.117e-10	3.375e-05	1.0262	-9.9408
Fe(OH)3 (aq)	1.074e-10	1.141e-05	1.0262	-9.9576
NiHCO3+	2.612e-11	3.108e-06	0.7744	-10.6941
CaOH+	2.093e-11	1.188e-06	0.7744	-10.7902
Be2OH+++	1.855e-11	6.460e-07	0.1002	-11.7308
(UO2)2OH+++	1.779e-11	9.850e-06	0.1002	-11.7491
Fe3(OH)4+++++	1.476e-11	3.455e-06	0.0017	-13.6067
UO2Cl2 (aq)	7.327e-12	2.483e-06	1.0262	-11.1239
NaOH (aq)	7.041e-12	2.799e-07	1.0262	-11.1411
NiCl2 (aq)	5.014e-12	6.460e-07	1.0262	-11.2886
NiOH+	3.626e-12	2.728e-07	0.7744	-11.5516
MgCO3 (aq)	1.075e-12	9.011e-08	1.0262	-11.9573

CO3--	9.201e-13	5.488e-08	0.3597	-12.4803
CaCO3 (aq)	2.558e-13	2.545e-08	1.0262	-12.5809
BeCO3 (aq)	1.744e-13	1.196e-08	1.0262	-12.7472
NaCO3-	1.471e-13	1.213e-08	0.7744	-12.9436
KOH (aq)	1.194e-13	6.657e-09	1.0262	-12.9118
Fe(OH)4-	8.762e-14	1.079e-08	0.7744	-13.1684
CdHCO3+	6.292e-14	1.084e-08	0.7744	-13.3123
(UO2)3(OH)5+	5.007e-14	4.454e-08	0.7744	-13.4114
(UO2)2CO3(OH)3-	5.001e-14	3.236e-08	0.7744	-13.4120
Mg2CO3++	4.369e-14	4.718e-09	0.3597	-13.8037
UO2(OH)3-	3.626e-14	1.157e-08	0.7744	-13.5516
CdOH+	2.144e-14	2.757e-09	0.7744	-13.7798
(UO2)3(OH)4++	1.561e-14	1.363e-08	0.3597	-14.2506
Be3(OH)3+++	1.026e-14	7.962e-10	0.1002	-14.9880
NiCO3 (aq)	8.604e-15	1.015e-09	1.0262	-14.0541
UO2(CO3)2--	5.208e-15	2.019e-09	0.3597	-14.7275
AsO4---	2.410e-16	3.327e-11	0.1002	-16.6172
Fe(OH)2 (aq)	1.367e-16	1.221e-11	1.0262	-15.8530
Ni(OH)2 (aq)	6.750e-17	6.221e-12	1.0262	-16.1594
CdCO3 (aq)	5.087e-17	8.717e-12	1.0262	-16.2823
(UO2)4(OH)7+	3.621e-18	4.316e-12	0.7744	-17.5522
(UO2)3CO3(OH)3+	2.754e-19	2.521e-13	0.7744	-18.6711
Ca2UO2(CO3)3 (aq	1.459e-19	7.688e-14	1.0262	-18.8247
Cd(OH)2 (aq)	3.171e-20	4.614e-15	1.0262	-19.4876
Cd2OH+++	5.590e-21	1.344e-15	0.1002	-21.2518
UO2(CO3)3----	2.550e-21	1.141e-15	0.0167	-22.3699
UO2(OH)4--	1.705e-21	5.729e-16	0.3597	-21.2124
CaUO2(CO3)3--	1.127e-21	5.488e-16	0.3597	-21.3923
(UO2)3(OH)7-	1.067e-21	9.849e-16	0.7744	-21.0831
Fe(OH)3-	1.779e-22	1.890e-17	0.7744	-21.8608
Ni(OH)3-	2.778e-23	3.030e-18	0.7744	-22.6673
Be5(OH)6++++	2.014e-23	2.944e-18	0.0167	-24.4724
Cd(CO3)2--	3.480e-26	8.039e-21	0.3597	-25.9025
Be5(OH)7+++	2.168e-26	3.536e-21	0.1002	-26.6632
Cd(OH)3-	1.278e-28	2.076e-23	0.7744	-28.0044
Be6(OH)8++++	2.404e-29	4.543e-24	0.0167	-30.3955
O2(aq)	4.407e-33	1.402e-28	1.0262	-32.3446
Cd(OH)4--	8.727e-38	1.565e-32	0.3597	-37.5032
(UO2)3(CO3)6----	6.428e-38	7.475e-32	0.0001	-41.1890

Mineral saturation states

	log Q/K		log Q/K
Hematite	11.5052s/sat	Ni(OH)2 (c)	-7.9554
Magnetite	11.3262s/sat	Fe(OH)2 (c)	-8.2490
Fe(OH)2.7Cl.3	6.2474s/sat	CdSO4:2.67H2O	-8.3489
K-Jarosite	4.9201s/sat	CdSO4:1H2O	-8.4945
Goethite	4.5522s/sat	Otavite	-8.6423
Maghemite	3.7012s/sat	CdOHCl	-8.8475
Lepidocrocite	3.6722s/sat	Fe(OH)2 (am)	-8.8490
Ferrihydrite (ag	2.3524s/sat	CdCl2:2.5H2O	-9.5158
Ferrihydrite	1.8424s/sat	CdCl2:1H2O	-9.7343
Na-Jarosite	1.1508s/sat	CdSO4	-10.0476
Gypsum	-0.0218	Ni(OH)2 (am)	-10.0554

Magnesioferrite	-0.2500	Nesquehonite	-10.2694
Anhydrite	-0.2702	MgCO3:5H2O	-10.4010
H-Jarosite	-1.5367	Brucite	-10.5783
Epsomite	-2.3837	CdCl2	-10.7679
UO2(OH)2 (beta)	-3.4024	Mg(OH)2 (active)	-12.2723
Schoepite	-3.7856	Cd(OH)2	-12.8376
Be(OH)2 (beta)	-4.0371	Dolomite (ordere	-12.9096
Melanterite	-4.1819	Dolomite (disord	-13.4596
Mirabilite	-4.4085	Natron	-14.6440
Be(OH)2 (alpha)	-4.4371	Periclase	-15.0616
Be(OH)2 (am)	-4.7371	Portlandite	-16.3080
Rutherfordine	-4.7873	Thermonatrite	-16.5847
FeAsO4:2H2O	-4.8440	Artinite	-18.0177
Halite	-4.9107	Mg2(OH)3Cl:4H2O	-19.0765
Gummite	-5.4617	Fe2(SO4)3	-19.2593
UO3	-5.4899	Ca3(AsO4)2:4H2O	-22.0849
Fe3(OH)8	-5.4962	As2O5	-25.4821
Thenardite	-5.8361	Ni3(AsO4)2:8H2O	-26.1724
Morenosite	-6.0524	Lime	-26.3025
Retgersite	-6.1565	Cd3OH2(SO4)2	-26.3432
KCl	-6.1714	Huntite	-29.9056
Siderite	-6.2277	Cd3(OH)4SO4	-31.1670
Calcite	-6.5829	Ni4(OH)6SO4	-31.6879
Aragonite	-6.7266	Cd4(OH)6SO4	-36.2006
Vaterite	-7.1493	Cd metal (alpha)	-39.5752
NiCO3	-7.4241	Cd metal (gamma)	-39.6785
Magnesite	-7.4770	Hydromagnesite	-44.4635
CaCO3xH2O	-7.9192		

Gases	fugacity	log fug.
CO2(g)	0.0004889	-3.311
O2(g)	4.426e-30	-29.354
CH4(g)	1.298e-88	-87.887

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	2.04e-07	2.04e-07	0.0281			
Be++	1.29e-06	1.29e-06	0.0115			
CO3--	1.65e-05	1.65e-05	0.985			
Ca++	0.0127	0.0127	506.			
Cd++	5.83e-08	5.83e-08	0.00651			
Cl-	0.0313	0.0313	1.10e+03			
Fe+++	0.000239	0.000239	13.3			
H+	-0.000136	-0.000136	-0.136			
H2O	55.5	55.5	9.94e+05			
K+	0.000314	0.000314	12.2			
Mg++	0.0157	0.0157	379.			
Na+	0.0253	0.0253	577.			
Ni++	3.26e-06	3.26e-06	0.190			
O2(aq)	-5.68e-05	-5.68e-05	-1.81			
SO4--	0.0370	0.0370	3.53e+03			
UO2++	1.90e-06	1.90e-06	0.511			

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	2.036e-07	2.036e-07	0.01516		
Be	1.286e-06	1.286e-06	0.01152		
C	1.651e-05	1.651e-05	0.1971		
Ca	0.01270	0.01270	506.1		
Cd	5.826e-08	5.826e-08	0.006508		
Cl	0.03130	0.03130	1103.		
Fe	0.0002395	0.0002395	13.29		
H	111.0	111.0	1.112e+05		
K	0.0003142	0.0003142	12.21		
Mg	0.01569	0.01569	379.1		
Na	0.02525	0.02525	577.0		
Ni	3.257e-06	3.257e-06	0.1900		
O	55.66	55.66	8.850e+05		
S	0.03702	0.03702	1180.		
U	1.904e-06	1.904e-06	0.4504		

Temperature = 25.0 C   Pressure = 1.013 bars
pH = 6.140   log fO2 = -44.520
Eh = 0.2072 volts   pe = 3.5026
Ionic strength = 0.083710
Charge imbalance = -0.002680 eq/kg (-2.596% error)
Activity of water = 0.998592
Solvent mass = 1.0000 kg
Solution mass = 1.0046 kg
Mineral mass = 0.00000 kg
Solution density = 1.015 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.022307 molal
Dissolved solids = 4544 mg/kg sol'n
Elect. conductivity = 5120.82 uS/cm (or umho/cm)
Hardness = 2591.64 mg/kg sol'n as CaCO3
  carbonate = 118.72 mg/kg sol'n as CaCO3
  non-carbonate = 2472.92 mg/kg sol'n as CaCO3
Carbonate alkalinity= 118.72 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 990. cm3
Fluid volume = 990. cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.2072	3.5026

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02175	767.5	0.7910	-1.7644
Na+	0.01451	332.1	0.7910	-1.9401
SO4--	0.01435	1372.	0.3915	-2.2504
Ca++	0.01061	423.2	0.3915	-2.3816
Mg++	0.006828	165.2	0.3915	-2.5730
CaSO4 (aq)	0.005243	710.6	1.0195	-2.2720
H2CO3* (aq)	0.002896	178.8	1.0195	-2.5298
MgSO4 (aq)	0.002681	321.2	1.0195	-2.5634
HCO3-	0.002292	139.2	0.7910	-2.7416
NaSO4-	0.0004481	53.10	0.7910	-3.4505
K+	0.0003436	13.37	0.7910	-3.5658
MgCl+	0.0002314	13.77	0.7910	-3.7374
CaCl+	0.0002269	17.06	0.7910	-3.7460
CaHCO3+	0.0001213	12.20	0.7910	-4.0181
NaCl (aq)	9.709e-05	5.649	1.0195	-4.0044
MgHCO3+	7.138e-05	6.063	0.7910	-4.2483
Fe++	6.496e-05	3.611	0.3915	-4.5947
FeSO4 (aq)	3.440e-05	5.202	1.0195	-4.4551

KSO4-	1.356e-05	1.825	0.7910	-4.9695
NaHCO3 (aq)	1.024e-05	0.8559	1.0195	-4.9815
KCl (aq)	2.299e-06	0.1706	1.0195	-5.6302
H+	9.158e-07	0.0009189	0.7910	-6.1400
FeHCO3+	7.340e-07	0.08539	0.7910	-6.2361
HSO4-	4.992e-07	0.04824	0.7910	-6.4035
FeCl+	3.490e-07	0.03172	0.7910	-6.5590
CO3--	2.998e-07	0.01791	0.3915	-6.9305
MgCO3 (aq)	2.937e-07	0.02465	1.0195	-6.5238
Ni++	1.679e-07	0.009813	0.3915	-7.1822
Ca2UO2(CO3)3 (aq	1.462e-07	0.07714	1.0195	-6.8268
CaCO3 (aq)	1.450e-07	0.01445	1.0195	-6.8303
NiSO4 (aq)	7.228e-08	0.01114	1.0195	-7.1326
H2AsO4-	3.525e-08	0.004945	0.7910	-7.5547
Fe(OH)2+	3.211e-08	0.002872	0.7910	-7.5952
NaCO3-	3.172e-08	0.002621	0.7910	-7.6005
NiHCO3+	1.858e-08	0.002215	0.7910	-7.8327
FeOH+	1.776e-08	0.001288	0.7910	-7.8523
OH-	1.755e-08	0.0002971	0.7910	-7.8576
Be(OH)2 (aq)	1.489e-08	0.0006378	1.0195	-7.8187
HAsO4--	1.006e-08	0.001401	0.3915	-8.4047
Mg2CO3++	8.333e-09	0.0009012	0.3915	-8.4864
MgOH+	7.651e-09	0.0003147	0.7910	-8.2181
UO2(CO3)2--	5.326e-09	0.002068	0.3915	-8.6809
Be++	2.778e-09	2.492e-05	0.3915	-8.9635
UO2CO3 (aq)	2.182e-09	0.0007170	1.0195	-8.6527
CaOH+	1.454e-09	8.263e-05	0.7910	-8.9392
BeSO4 (aq)	9.284e-10	9.711e-05	1.0195	-9.0239
UO2(CO3)3----	7.170e-10	0.0003212	0.0235	-10.7735
CaUO2(CO3)3--	6.488e-10	0.0003165	0.3915	-9.5952
NiCl+	5.311e-10	4.979e-05	0.7910	-9.3766
NiCO3 (aq)	2.812e-10	3.323e-05	1.0195	-9.5427
FeOH++	2.527e-10	1.833e-05	0.3915	-10.0046
Cd++	2.331e-10	2.608e-05	0.3915	-10.0398
BeCO3 (aq)	2.250e-10	1.546e-05	1.0195	-9.6394
NaOH (aq)	1.968e-10	7.835e-06	1.0195	-9.6977
CdCl+	1.895e-10	2.789e-05	0.7910	-9.8242
CdSO4 (aq)	1.179e-10	2.446e-05	1.0195	-9.9202
Ni(SO4)2--	3.501e-11	8.743e-06	0.3915	-10.8630
Be(SO4)2--	3.412e-11	6.831e-06	0.3915	-10.8743
BeCl+	3.265e-11	1.445e-06	0.7910	-10.5879
Cd(SO4)2--	2.326e-11	7.053e-06	0.3915	-11.0406
Fe(OH)3 (aq)	1.931e-11	2.054e-06	1.0195	-10.7058
UO2OH+	1.476e-11	4.217e-06	0.7910	-10.9328
NiOH+	1.452e-11	1.094e-06	0.7910	-10.9398
CdCl2 (aq)	1.055e-11	1.924e-06	1.0195	-10.9685
CdHCO3+	6.631e-12	1.145e-06	0.7910	-11.2802
KOH (aq)	6.430e-12	3.592e-07	1.0195	-11.1834
UO2SO4 (aq)	4.364e-12	1.590e-06	1.0195	-11.3518
H3AsO4	3.953e-12	5.586e-07	1.0195	-11.3947
UO2++	3.847e-12	1.034e-06	0.3915	-11.8222
UO2(OH)2 (aq)	1.987e-12	6.015e-07	1.0195	-11.6934
UO2(SO4)2--	1.928e-12	8.870e-07	0.3915	-12.1222
Be(SO4)3----	9.871e-13	2.920e-07	0.0235	-13.6347

FeSO4+	9.493e-13	1.436e-07	0.7910	-12.1244
Fe(OH)4-	6.845e-13	8.441e-08	0.7910	-12.2665
CdCO3 (aq)	2.463e-13	4.227e-08	1.0195	-12.6002
NiCl2 (aq)	2.458e-13	3.172e-08	1.0195	-12.6010
Fe(OH)2 (aq)	1.520e-13	1.359e-08	1.0195	-12.8099
(UO2)2CO3(OH)3-	1.214e-13	7.868e-08	0.7910	-13.0176
Fe(SO4)2-	7.195e-14	1.776e-08	0.7910	-13.2448
AsO4---	7.107e-14	9.828e-09	0.1212	-14.0647
Fe+++	6.199e-14	3.446e-09	0.1212	-14.1240
UO2Cl+	4.845e-14	1.473e-08	0.7910	-13.4165
UO2(OH)3-	2.804e-14	8.962e-09	0.7910	-13.6540
CdOH+	1.272e-14	1.638e-09	0.7910	-13.9974
Ni(OH)2 (aq)	1.242e-14	1.147e-09	1.0195	-13.8974
FeCl++	9.974e-15	9.065e-10	0.3915	-14.4084
Be2OH+++	8.949e-15	3.121e-10	0.1212	-14.9646
Cd(CO3)2--	5.452e-17	1.261e-11	0.3915	-16.6707
Be3(OH)3+++	3.573e-17	2.776e-12	0.1212	-17.3633
UO2Cl2 (aq)	3.473e-17	1.179e-11	1.0195	-16.4509
(UO2)2(OH)2++	2.641e-17	1.509e-11	0.3915	-16.9855
Fe(OH)3-	8.597e-18	9.145e-13	0.7910	-17.1675
Fe2(OH)2++++	5.832e-18	8.459e-13	0.0235	-18.8632
Cd(OH)2 (aq)	8.643e-19	1.260e-13	1.0195	-18.0550
Ni(OH)3-	2.222e-19	2.427e-14	0.7910	-18.7550
UO2(OH)4--	5.529e-20	1.861e-14	0.3915	-19.6646
(UO2)2OH+++	5.146e-20	2.853e-14	0.1212	-20.2049
(UO2)3(CO3)6----	4.132e-20	4.813e-14	0.0002	-23.0493
(UO2)3(OH)5+	6.058e-21	5.398e-15	0.7910	-20.3195
Fe3(OH)4+++++	2.773e-22	6.503e-17	0.0028	-24.1025
(UO2)3(OH)4++	3.966e-23	3.467e-17	0.3915	-22.8089
Cd2OH+++	3.795e-23	9.135e-18	0.1212	-23.3371
(UO2)3CO3(OH)3+	5.916e-24	5.425e-18	0.7910	-23.3298
(UO2)3(OH)7-	2.577e-25	2.383e-19	0.7910	-24.6907
Cd(OH)3-	1.514e-25	2.463e-20	0.7910	-24.9216
Be5(OH)6++++	7.046e-26	1.032e-20	0.0235	-26.7811
(UO2)4(OH)7+	7.743e-27	9.243e-21	0.7910	-26.2129
Be5(OH)7+++	3.932e-27	6.424e-22	0.1212	-27.3217
Be6(OH)8++++	6.071e-31	1.149e-25	0.0235	-31.8458
Cd(OH)4--	4.336e-33	7.787e-28	0.3915	-32.7702
O2(aq)	3.027e-48	9.642e-44	1.0195	-47.5107

Mineral saturation states

	log Q/K		log Q/K
Magnetite	12.8721s/sat	Thenardite	-6.4522
Hematite	10.0081s/sat	Na-Jarosite	-6.6566
Fe(OH)2.7Cl.3	4.9630s/sat	Gummite	-7.2146
Goethite	3.8038s/sat	UO3	-7.2428
Lepidocrocite	2.9238s/sat	Morenosite	-7.2920
Maghemite	2.2041s/sat	Brucite	-7.3942
Ferrihydrite (ag	1.6042s/sat	Retgersite	-7.3963
Magnesioferrite	1.4368s/sat	Ni(OH)2 (am)	-7.7934
Ferrihydrite	1.0942s/sat	Huntite	-7.8545
Gypsum	-0.0233	FeAsO4:2H2O	-7.9899
Anhydrite	-0.2720	Mg(OH)2 (active)	-9.0882

Calcite	-0.8323	CdOHCl	-9.2021
Siderite	-0.9351	Artinite	-9.3995
Aragonite	-0.9760	Natron	-9.5057
Vaterite	-1.3987	CdSO4:2.67H2O	-10.4188
Dolomite (ordere	-1.7255	CdSO4:1H2O	-10.5647
Magnesite	-2.0435	H-Jarosite	-10.7871
CaCO3xH2O	-2.1684	Cd(OH)2	-11.4050
Dolomite (disord	-2.2755	Thermonatrite	-11.4482
K-Jarosite	-2.6023	CdCl2:2.5H2O	-11.6571
Epsomite	-2.7012	CdCl2:1H2O	-11.8759
NiCO3	-2.9127	Periclase	-11.8777
Be(OH)2 (beta)	-3.1787	CdSO4	-12.1180
Be(OH)2 (alpha)	-3.5787	Portlandite	-12.8068
Be(OH)2 (am)	-3.8787	CdCl2	-12.9097
Fe3(OH)8	-3.9496	Mg2(OH)3Cl:4H2O	-14.4946
Rutherfordine	-4.2905	Ca3(AsO4)2:4H2O	-16.3767
Melanterite	-4.6403	Hydromagnesite	-19.5445
Nesquehonite	-4.8353	Lime	-22.8015
Otavite	-4.9602	Ni3(AsO4)2:8H2O	-24.1809
MgCO3:5H2O	-4.9665	Ni4(OH)6SO4	-26.1429
Mirabilite	-5.0226	Cd3OH2(SO4)2	-29.0513
UO2(OH)2 (beta)	-5.1550	As2O5	-30.2775
Fe(OH)2 (c)	-5.2059	Cd3(OH)4SO4	-30.3721
Halite	-5.2544	Cd metal (alpha)	-30.5597
Schoepite	-5.5380	Cd metal (gamma)	-30.6630
Ni(OH)2 (c)	-5.6934	Fe2(SO4)3	-31.2649
Fe(OH)2 (am)	-5.8059	Cd4(OH)6SO4	-33.9731
KCl	-6.2302		

Gases	fugacity	log fug.
CO2(g)	0.08687	-1.061
O2(g)	3.020e-45	-44.520
CH4(g)	4.959e-56	-55.305

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	4.53e-08	4.53e-08	0.00627			
Be++	1.89e-08	1.89e-08	0.000169			
CO3--	0.00539	0.00539	322.			
Ca++	0.0162	0.0162	646.			
Cd++	5.81e-10	5.81e-10	6.50e-05			
Cl-	0.0223	0.0223	787.			
Fe+++	0.000100	0.000100	5.59			
H+	0.00819	0.00819	8.22			
H2O	55.5	55.5	9.95e+05			
K+	0.000359	0.000359	14.0			
Mg++	0.00981	0.00981	237.			
Na+	0.0151	0.0151	345.			
Ni++	2.60e-07	2.60e-07	0.0152			
O2(aq)	-2.51e-05	-2.51e-05	-0.800			
SO4--	0.0228	0.0228	2.18e+03			
UO2++	1.55e-07	1.55e-07	0.0417			

Elemental composition	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg
As	4.531e-08	4.531e-08	0.003380		
Be	1.889e-08	1.889e-08	0.0001695		
C	0.005393	0.005393	64.49		
Ca	0.01620	0.01620	646.3		
Cd	5.812e-10	5.812e-10	6.503e-05		
Cl	0.02231	0.02231	787.2		
Fe	0.0001005	0.0001005	5.587		
H	111.0	111.0	1.114e+05		
K	0.0003594	0.0003594	13.99		
Mg	0.009812	0.009812	237.5		
Na	0.01507	0.01507	344.8		
Ni	2.596e-07	2.596e-07	0.01517		
O	55.62	55.62	8.858e+05		
S	0.02277	0.02277	726.8		
U	1.551e-07	1.551e-07	0.03674		

Temperature = 25.0 C Pressure = 1.013 bars
pH = 5.747 log fO2 = -39.517
Eh = 0.3044 volts pe = 5.1465
Ionic strength = 0.133185
Charge imbalance = -0.039291 eq/kg (-25.03% error)
Activity of water = 0.997887
Solvent mass = 11.091 kg
Solution mass = 11.182 kg
Mineral mass = 0.00000 kg
Solution density = 1.017 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.027640 molal
Dissolved solids = 8106 mg/kg sol'n
Elect. conductivity = 7532.43 uS/cm (or umho/cm)
Hardness = 2900.82 mg/kg sol'n as CaCO3
carbonate = 61.20 mg/kg sol'n as CaCO3
non-carbonate = 2839.62 mg/kg sol'n as CaCO3
Carbonate alkalinity= 61.20 mg/kg sol'n as CaCO3
Water type = Na-SO4
Bulk volume = 1.10e+04 cm3
Fluid volume = 1.10e+04 cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.3044	5.1465

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
SO4--	0.03471	3307.	0.3430	-1.9243
Cl-	0.02699	949.2	0.7653	-1.6849
Na+	0.01951	444.8	0.7653	-1.8260
Ca++	0.008102	322.1	0.3430	-2.5561
Mg++	0.007681	185.2	0.3430	-2.5793
CaSO4 (aq)	0.007349	992.4	1.0311	-2.1205
MgSO4 (aq)	0.005534	660.7	1.0311	-2.2437
H2CO3* (aq)	0.003599	221.4	1.0311	-2.4305
Fe++	0.003557	197.0	0.3430	-2.9136
FeSO4 (aq)	0.003457	520.9	1.0311	-2.4480
NaSO4-	0.001276	150.7	0.7653	-3.0103
HCO3-	0.001205	72.93	0.7653	-3.0352
K+	0.0005303	20.57	0.7653	-3.3916
MgCl+	0.0002831	16.78	0.7653	-3.6643
CaCl+	0.0001884	14.12	0.7653	-3.8411
NaCl (aq)	0.0001499	8.688	1.0311	-3.8109
KSO4-	4.435e-05	5.946	0.7653	-4.4693
CaHCO3+	4.266e-05	4.277	0.7653	-4.4862

MgHCO3+	3.698e-05	3.130	0.7653	-4.5482
FeCl+	2.078e-05	1.882	0.7653	-4.7986
FeHCO3+	1.851e-05	2.146	0.7653	-4.8487
Fe(OH)2+	1.147e-05	1.022	0.7653	-5.0568
NaHCO3 (aq)	6.693e-06	0.5577	1.0311	-5.1611
KCl (aq)	4.075e-06	0.3013	1.0311	-5.3766
HSO4-	2.702e-06	0.2601	0.7653	-5.6845
H+	2.339e-06	0.002339	0.7653	-5.7471
H2AsO4-	1.861e-06	0.2602	0.7653	-5.8463
Be++	1.320e-06	0.01180	0.3430	-6.3443
Ni++	1.151e-06	0.06705	0.3430	-6.4035
Ca2UO2(CO3)3 (aq	1.134e-06	0.5964	1.0311	-5.9321
Be(OH)2 (aq)	1.002e-06	0.04275	1.0311	-5.9859
NiSO4 (aq)	9.095e-07	0.1396	1.0311	-6.0279
UO2CO3 (aq)	8.927e-07	0.2922	1.0311	-6.0360
BeSO4 (aq)	8.093e-07	0.08434	1.0311	-6.0786
UO2(CO3)2--	5.177e-07	0.2003	0.3430	-6.7506
FeOH+	3.562e-07	0.02574	0.7653	-6.5645
FeOH++	2.465e-07	0.01781	0.3430	-7.0730
HAsO4--	2.374e-07	0.03295	0.3430	-7.0892
Be(SO4)2--	7.275e-08	0.01451	0.3430	-7.6029
CO3--	7.043e-08	0.004192	0.3430	-7.6170
MgCO3 (aq)	5.889e-08	0.004926	1.0311	-7.2166
NiHCO3+	5.869e-08	0.006970	0.7653	-7.3476
Cd++	4.833e-08	0.005388	0.3430	-7.7806
CdSO4 (aq)	4.485e-08	0.009274	1.0311	-7.3349
CdCl+	4.273e-08	0.006266	0.7653	-7.4855
Cd(SO4)2--	2.165e-08	0.006541	0.3430	-8.1292
UO2(CO3)3----	2.134e-08	0.009526	0.0138	-9.5298
UO2(SO4)2--	1.986e-08	0.009105	0.3430	-8.1667
CaCO3 (aq)	1.974e-08	0.001960	1.0311	-7.6913
BeCO3 (aq)	1.906e-08	0.001305	1.0311	-7.7066
UO2SO4 (aq)	1.838e-08	0.006673	1.0311	-7.7224
BeCl+	1.687e-08	0.0007438	0.7653	-7.8892
UO2OH+	1.240e-08	0.003531	0.7653	-8.0227
UO2++	8.828e-09	0.002364	0.3430	-8.5189
NaCO3-	8.774e-09	0.0007223	0.7653	-8.1730
CaUO2(CO3)3--	8.686e-09	0.004223	0.3430	-8.5259
OH-	7.334e-09	0.0001237	0.7653	-8.2508
(UO2)2CO3(OH)3-	6.902e-09	0.004457	0.7653	-8.2772
Be(SO4)3----	6.633e-09	0.001955	0.0138	-10.0372
FeSO4+	4.392e-09	0.0006618	0.7653	-8.4735
NiCl+	3.960e-09	0.0003699	0.7653	-8.5185
MgOH+	3.151e-09	0.0001292	0.7653	-8.6177
CdCl2 (aq)	2.731e-09	0.0004965	1.0311	-8.5504
Fe(OH)3 (aq)	2.667e-09	0.0002827	1.0311	-8.5606
Mg2CO3++	1.901e-09	0.0002049	0.3430	-9.1857
Ni(SO4)2--	1.078e-09	0.0002682	0.3430	-9.4322
Be2OH+++	8.439e-10	2.933e-05	0.0900	-10.1194
Fe(SO4)2-	7.053e-10	0.0001735	0.7653	-9.2678
UO2(OH)2 (aq)	6.459e-10	0.0001948	1.0311	-9.1765
CdHCO3+	6.332e-10	0.0001089	0.7653	-9.3146
H3AsO4	4.935e-10	6.947e-05	1.0311	-9.2934
CaOH+	4.067e-10	2.303e-05	0.7653	-9.5070

NiCO3 (aq)	3.437e-10	4.047e-05	1.0311	-9.4505
Be3(OH)3+++	2.293e-10	1.775e-05	0.0900	-10.6853
Fe+++	1.764e-10	9.772e-06	0.0900	-10.7992
UO2Cl+	1.209e-10	3.663e-05	0.7653	-10.0338
NaOH (aq)	1.023e-10	4.058e-06	1.0311	-9.9768
Fe(OH)4-	3.997e-11	4.911e-06	0.7653	-10.5145
NiOH+	3.646e-11	2.738e-06	0.7653	-10.5544
FeCl++	2.888e-11	2.616e-06	0.3430	-11.0041
(UO2)2(OH)2++	1.992e-11	1.134e-05	0.3430	-11.1654
CdCO3 (aq)	9.102e-12	1.557e-06	1.0311	-11.0275
Fe2(OH)2++++	7.228e-12	1.045e-06	0.0138	-13.0000
UO2(OH)3-	3.853e-12	1.227e-06	0.7653	-11.5304
KOH (aq)	3.839e-12	2.137e-07	1.0311	-11.4025
NiCl2 (aq)	2.105e-12	2.706e-07	1.0311	-11.6634
Fe(OH)2 (aq)	1.179e-12	1.051e-07	1.0311	-11.9153
CdOH+	9.656e-13	1.239e-07	0.7653	-12.1314
AsO4---	8.008e-13	1.103e-07	0.0900	-13.1421
(UO2)3(OH)5+	5.501e-13	4.884e-07	0.7653	-12.3758
Fe3(OH)4+++++	1.599e-13	3.737e-08	0.0012	-15.7008
(UO2)2OH+++	1.133e-13	6.258e-08	0.0900	-13.9916
UO2Cl2 (aq)	9.953e-14	3.366e-08	1.0311	-12.9887
(UO2)3(CO3)6----	8.398e-14	9.747e-08	0.0001	-17.2585
Ni(OH)2 (aq)	1.206e-14	1.110e-09	1.0311	-13.9052
(UO2)3(OH)4++	9.836e-15	8.567e-09	0.3430	-14.4719
Be5(OH)6++++	6.527e-15	9.523e-10	0.0138	-16.0443
(UO2)3CO3(OH)3+	6.762e-16	6.178e-10	0.7653	-15.2861
Cd(CO3)2--	4.789e-16	1.104e-10	0.3430	-15.7845
(UO2)4(OH)7+	2.312e-16	2.749e-10	0.7653	-15.7523
Be5(OH)7+++	1.168e-16	1.902e-11	0.0900	-16.9781
Fe(OH)3-	2.819e-17	2.988e-12	0.7653	-16.6661
Cd(OH)2 (aq)	2.538e-17	3.686e-12	1.0311	-16.5822
Be6(OH)8++++	3.826e-18	7.216e-13	0.0138	-19.2762
(UO2)3(OH)7-	3.826e-18	3.526e-12	0.7653	-17.5334
UO2(OH)4--	3.393e-18	1.138e-12	0.3430	-17.9342
Cd2OH+++	6.819e-19	1.636e-13	0.0900	-19.2119
Ni(OH)3-	9.124e-20	9.930e-15	0.7653	-19.1560
Cd(OH)3-	1.880e-24	3.047e-19	0.7653	-23.8420
Cd(OH)4--	2.404e-32	4.302e-27	0.3430	-32.0839
O2(aq)	3.014e-43	9.566e-39	1.0311	-42.5075

Mineral saturation states

	log Q/K		log Q/K
Magnetite	18.0583s/sat	Halite	-5.0609
Hematite	14.2995s/sat	Nesquehonite	-5.5291
Fe(OH)2.7Cl.3	7.2500s/sat	MgCO3:5H2O	-5.6609
Maghemite	6.4955s/sat	Ni(OH)2 (c)	-5.7012
Goethite	5.9493s/sat	Thenardite	-5.8981
K-Jarosite	5.8393s/sat	KCl	-5.9766
Lepidocrocite	5.0693s/sat	Morenosite	-6.1894
Magnesioferrite	4.9357s/sat	Retgersite	-6.2934
Ferrihydrite (ag	3.7494s/sat	CdOHCl	-7.2566
Ferrihydrite	3.2394s/sat	Ni(OH)2 (am)	-7.8012
Na-Jarosite	1.7249s/sat	CdSO4:2.67H2O	-7.8343

Fe3(OH)8	1.2355s/sat	CdSO4:1H2O	-7.9797
Gypsum	0.1277s/sat	Brucite	-8.1870
Siderite	0.0594s/sat	CdCl2:2.5H2O	-9.2397
Anhydrite	-0.1205	CdCl2:1H2O	-9.4581
Be(OH)2 (beta)	-1.3459	CdSO4	-9.5327
Rutherfordine	-1.6738	Mg(OH)2 (active)	-9.8810
Calcite	-1.6933	Cd(OH)2	-9.9322
Be(OH)2 (alpha)	-1.7459	Natron	-9.9672
Aragonite	-1.8370	CdCl2	-10.4916
Be(OH)2 (am)	-2.0459	Huntite	-10.7941
H-Jarosite	-2.1271	Artinite	-10.8861
Vaterite	-2.2597	Thermonatrite	-11.9069
Epsomite	-2.3836	Periclase	-12.6702
Melanterite	-2.6354	Portlandite	-13.7678
UO2(OH)2 (beta)	-2.6381	Ca3(AsO4)2:4H2O	-15.0564
Magnesite	-2.7363	Mg2(OH)3Cl:4H2O	-15.6088
NiCO3	-2.8205	Ni3(AsO4)2:8H2O	-20.0023
Schoepite	-3.0214	Cd3OH2(SO4)2	-22.4080
CaCO3xH2O	-3.0297	Hydromagnesite	-23.1100
Dolomite (ordere	-3.2794	Fe2(SO4)3	-23.6370
Otavite	-3.3875	Lime	-23.7622
FeAsO4:2H2O	-3.7431	Cd3(OH)4SO4	-24.8413
Dolomite (disord	-3.8294	Ni4(OH)6SO4	-25.0614
Fe(OH)2 (c)	-4.3113	As2O5	-26.0741
Mirabilite	-4.4715	Cd4(OH)6SO4	-26.9695
Gummite	-4.6974	Cd metal (alpha)	-31.5882
UO3	-4.7256	Cd metal (gamma)	-31.6915
Fe(OH)2 (am)	-4.9113		

Gases	fugacity	log fug.
CO2(g)	0.1093	-0.962
O2(g)	3.041e-40	-39.517
CH4(g)	6.141e-66	-65.212

	In fluid		Sorbed		Kd
Original basis total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4--- 2.33e-05	2.33e-05	0.289			
Be++ 3.60e-05	3.60e-05	0.0290			
CO3-- 0.0545	0.0545	293.			
Ca++ 0.174	0.174	624.			
Cd++ 1.78e-06	1.78e-06	0.0179			
Cl- 0.307	0.307	972.			
Fe+++ 0.0784	0.0784	391.			
H+ 0.0159	0.0159	1.44			
H2O 616.	616.	9.92e+05			
K+ 0.00642	0.00642	22.4			
Mg++ 0.150	0.150	326.			
Na+ 0.232	0.232	477.			
Ni++ 2.36e-05	2.36e-05	0.124			
O2(aq) -0.0196	-0.0196	-56.0			
SO4-- 0.581	0.581	4.99e+03			
UO2++ 2.94e-05	2.94e-05	0.709			

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	2.328e-05	2.328e-05	0.1560		
Be	3.603e-05	3.603e-05	0.02904		
C	0.05451	0.05451	58.55		
Ca	0.1740	0.1740	623.5		
Cd	1.785e-06	1.785e-06	0.01794		
Cl	0.3066	0.3066	972.0		
Fe	0.07837	0.07837	391.4		
H	1231.	1231.	1.110e+05		
K	0.006419	0.006419	22.45		
Mg	0.1501	0.1501	326.4		
Na	0.2322	0.2322	477.5		
Ni	2.357e-05	2.357e-05	0.1237		
O	618.1	618.1	8.845e+05		
S	0.5809	0.5809	1666.		
U	2.938e-05	2.938e-05	0.6253		

Temperature = 25.0 C   Pressure = 1.013 bars
pH = 5.952   log fO2 = -40.460
Eh = 0.2783 volts   pe = 4.7053
Ionic strength = 0.109231
Charge imbalance = -0.021860 eq/kg (-16.68% error)
Activity of water = 0.998224
Solvent mass = 21.194 kg
Solution mass = 21.331 kg
Mineral mass = 0.00000 kg
Solution density = 1.016 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.025099 molal
Dissolved solids = 6410 mg/kg sol'n
Elect. conductivity = 6392.57 uS/cm (or umho/cm)
Hardness = 2753.81 mg/kg sol'n as CaCO3
carbonate = 88.26 mg/kg sol'n as CaCO3
non-carbonate = 2665.55 mg/kg sol'n as CaCO3
Carbonate alkalinity= 88.26 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 2.10e+04 cm3
Fluid volume = 2.10e+04 cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.2783	4.7053

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
SO4--	0.02492	2378.	0.3625	-2.0441
Cl-	0.02450	863.1	0.7759	-1.7210
Na+	0.01716	391.9	0.7759	-1.8758
Ca++	0.009040	360.0	0.3625	-2.4845
Mg++	0.007243	175.0	0.3625	-2.5807
CaSO4 (aq)	0.006614	894.6	1.0255	-2.1686
MgSO4 (aq)	0.004209	503.4	1.0255	-2.3649
H2CO3* (aq)	0.003267	201.4	1.0255	-2.4749
Fe++	0.002080	115.4	0.3625	-3.1227
HCO3-	0.001722	104.4	0.7759	-2.8742
FeSO4 (aq)	0.001630	246.1	1.0255	-2.7768
NaSO4-	0.0008517	100.7	0.7759	-3.1799
K+	0.0004428	17.20	0.7759	-3.4640
MgCl+	0.0002561	15.21	0.7759	-3.7017
CaCl+	0.0002017	15.14	0.7759	-3.8055
NaCl (aq)	0.0001237	7.183	1.0255	-3.8967
CaHCO3+	7.187e-05	7.219	0.7759	-4.2536
MgHCO3+	5.266e-05	4.465	0.7759	-4.3887

KSO4-	2.810e-05	3.774	0.7759	-4.6614
FeHCO3+	1.635e-05	1.898	0.7759	-4.8968
FeCl+	1.166e-05	1.057	0.7759	-5.0436
NaHCO3 (aq)	8.693e-06	0.7256	1.0255	-5.0499
Fe(OH)2+	6.519e-06	0.5820	0.7759	-5.2960
KCl (aq)	3.193e-06	0.2365	1.0255	-5.4849
H+	1.438e-06	0.001440	0.7759	-5.9524
HSO4-	1.260e-06	0.1216	0.7759	-6.0097
Ca2UO2(CO3)3 (aq	1.161e-06	0.6115	1.0255	-5.9244
Be(OH)2 (aq)	9.714e-07	0.04153	1.0255	-6.0017
H2AsO4-	9.361e-07	0.1311	0.7759	-6.1389
Ni++	7.190e-07	0.04194	0.3625	-6.5839
Be++	4.673e-07	0.004185	0.3625	-6.7710
NiSO4 (aq)	4.582e-07	0.07045	1.0255	-6.3281
FeOH+	3.485e-07	0.02523	0.7759	-6.5680
BeSO4 (aq)	2.312e-07	0.02413	1.0255	-6.6252
HAsO4--	1.838e-07	0.02555	0.3625	-7.1764
CO3--	1.549e-07	0.009235	0.3625	-7.2507
UO2(CO3)2--	1.542e-07	0.05977	0.3625	-7.2525
MgCO3 (aq)	1.372e-07	0.01149	1.0255	-6.8517
UO2CO3 (aq)	1.216e-07	0.03988	1.0255	-6.9041
FeOH++	8.375e-08	0.006062	0.3625	-7.5177
NiHCO3+	5.535e-08	0.006584	0.7759	-7.3671
CaCO3 (aq)	5.441e-08	0.005411	1.0255	-7.2534
Cd++	2.888e-08	0.003225	0.3625	-7.9801
CdCl+	2.450e-08	0.003599	0.7759	-7.7211
CdSO4 (aq)	2.162e-08	0.004478	1.0255	-7.6542
NaCO3-	1.794e-08	0.001479	0.7759	-7.8564
BeCO3 (aq)	1.667e-08	0.001143	1.0255	-7.7671
Be(SO4)2--	1.484e-08	0.002965	0.3625	-8.2693
UO2(CO3)3----	1.251e-08	0.005595	0.0173	-9.6654
OH-	1.161e-08	0.0001962	0.7759	-8.0453
Cd(SO4)2--	7.453e-09	0.002255	0.3625	-8.5684
CaUO2(CO3)3--	7.093e-09	0.003454	0.3625	-8.5899
BeCl+	5.730e-09	0.0002532	0.7759	-8.3520
MgOH+	4.973e-09	0.0002042	0.7759	-8.4136
Mg2CO3++	4.154e-09	0.0004484	0.3625	-8.8222
Fe(OH)3 (aq)	2.482e-09	0.0002635	1.0255	-8.5943
NiCl+	2.373e-09	0.0002220	0.7759	-8.7349
CdCl2 (aq)	1.469e-09	0.0002676	1.0255	-8.8220
UO2OH+	1.144e-09	0.0003263	0.7759	-9.0517
Be(SO4)3----	8.695e-10	0.0002568	0.0173	-10.8234
UO2SO4 (aq)	8.174e-10	0.0002973	1.0255	-9.0767
CaOH+	7.592e-10	4.306e-05	0.7759	-9.2298
FeSO4+	7.357e-10	0.0001110	0.7759	-9.2435
UO2(SO4)2--	6.308e-10	0.0002896	0.3625	-9.6408
CdHCO3+	5.714e-10	9.845e-05	0.7759	-9.3532
NiCO3 (aq)	5.302e-10	6.254e-05	1.0255	-9.2646
UO2++	4.868e-10	0.0001306	0.3625	-9.7533
Ni(SO4)2--	3.877e-10	9.662e-05	0.3625	-9.8522
(UO2)2CO3(OH)3-	2.223e-10	0.0001438	0.7759	-9.7633
Be2OH+++	1.675e-10	5.831e-06	0.1020	-10.7674
H3AsO4	1.577e-10	2.224e-05	1.0255	-9.7913
NaOH (aq)	1.472e-10	5.851e-06	1.0255	-9.8211

UO2(OH)2 (aq)	9.752e-11	2.946e-05	1.0255	-10.0000
Fe(SO4)2-	8.965e-11	2.209e-05	0.7759	-10.1576
Fe(OH)4-	5.855e-11	7.206e-06	0.7759	-10.3427
Be3(OH)3+++	4.389e-11	3.404e-06	0.1020	-11.3491
NiOH+	3.810e-11	2.866e-06	0.7759	-10.5293
Fe+++	3.485e-11	1.934e-06	0.1020	-11.4494
CdCO3 (aq)	1.344e-11	2.302e-06	1.0255	-10.8608
UO2Cl+	6.395e-12	1.941e-06	0.7759	-11.3043
FeCl++	5.628e-12	5.105e-07	0.3625	-11.6903
KOH (aq)	5.245e-12	2.924e-07	1.0255	-11.2693
Fe(OH)2 (aq)	1.887e-12	1.685e-07	1.0255	-11.7133
NiCl2 (aq)	1.184e-12	1.524e-07	1.0255	-11.9159
CdOH+	9.655e-13	1.241e-07	0.7759	-12.1254
AsO4---	9.280e-13	1.281e-07	0.1020	-13.0240
UO2(OH)3-	9.159e-13	2.922e-07	0.7759	-12.1483
Fe2(OH)2++++	7.470e-13	1.081e-07	0.0173	-13.8894
(UO2)2(OH)2++	1.649e-13	9.409e-08	0.3625	-13.2233
Ni(OH)2 (aq)	2.063e-14	1.901e-09	1.0255	-13.6746
Fe3(OH)4+++++	8.410e-15	1.969e-09	0.0018	-16.8294
UO2Cl2 (aq)	4.941e-15	1.674e-09	1.0255	-14.2953
(UO2)3(CO3)6----	1.592e-15	1.851e-09	0.0001	-18.7640
Cd(CO3)2--	1.546e-15	3.570e-10	0.3625	-15.2515
(UO2)3(OH)5+	1.144e-15	1.018e-09	0.7759	-15.0516
Be5(OH)6++++	6.570e-16	9.602e-11	0.0173	-16.9451
(UO2)2OH+++	5.451e-16	3.017e-10	0.1020	-16.2550
Fe(OH)3-	7.105e-17	7.544e-12	0.7759	-16.2586
Cd(OH)2 (aq)	4.153e-17	6.041e-12	1.0255	-16.3708
Be5(OH)7+++	2.080e-17	3.391e-12	0.1020	-17.6735
(UO2)3(OH)4++	1.223e-17	1.067e-11	0.3625	-17.3533
(UO2)3CO3(OH)3+	1.269e-18	1.162e-12	0.7759	-18.0067
UO2(OH)4--	1.242e-18	4.171e-13	0.3625	-18.3466
Cd2OH+++	3.854e-19	9.260e-14	0.1020	-19.4056
Be6(OH)8++++	3.714e-19	7.016e-14	0.0173	-20.1928
Ni(OH)3-	2.456e-19	2.678e-14	0.7759	-18.7199
(UO2)4(OH)7+	7.220e-20	8.603e-14	0.7759	-19.2516
(UO2)3(OH)7-	2.051e-20	1.893e-14	0.7759	-19.7983
Cd(OH)3-	4.843e-24	7.863e-19	0.7759	-23.4251
Cd(OH)4--	9.534e-32	1.709e-26	0.3625	-31.4614
O2(aq)	3.455e-44	1.099e-39	1.0255	-43.4506

Mineral saturation states

	log Q/K		log Q/K
Magnetite	18.1923s/sat	MgCO3:5H2O	-5.2953
Hematite	14.2317s/sat	Ni(OH)2 (c)	-5.4706
Fe(OH)2.7Cl.3	7.1439s/sat	Gummite	-5.5210
Maghemite	6.4277s/sat	UO3	-5.5492
Goethite	5.9154s/sat	KCl	-6.0849
Magnesioferrite	5.2773s/sat	Thenardite	-6.1174
Lepidocrocite	5.0354s/sat	Morenosite	-6.4886
K-Jarosite	4.8098s/sat	Retgersite	-6.5927
Ferrihydrite (ag	3.7157s/sat	CdOHCl	-7.2867
Ferrihydrite	3.2057s/sat	Ni(OH)2 (am)	-7.5706
Fe3(OH)8	1.3700s/sat	Brucite	-7.7774

Na-Jarosite	0.7180s/sat	CdSO4:2.67H2O	-8.1533
Siderite	0.2167s/sat	CdSO4:1H2O	-8.2989
Gypsum	0.0798s/sat	Huntite	-9.2614
Anhydrite	-0.1686	Mg(OH)2 (active)	-9.4714
Calcite	-1.2554	CdCl2:2.5H2O	-9.5110
Be(OH)2 (beta)	-1.3617	Natron	-9.6989
Aragonite	-1.3991	Cd(OH)2	-9.7208
Be(OH)2 (alpha)	-1.7617	CdCl2:1H2O	-9.7296
Vaterite	-1.8218	CdSO4	-9.8520
Be(OH)2 (am)	-2.0617	Artinite	-10.1111
Magnesite	-2.3714	CdCl2	-10.7632
Dolomite (ordere	-2.4766	Thermonatrite	-11.6400
Epsomite	-2.5038	Periclase	-12.2607
Rutherfordine	-2.5419	Portlandite	-13.2851
CaCO3xH2O	-2.5916	Ca3(AsO4)2:4H2O	-14.6045
NiCO3	-2.6346	Mg2(OH)3Cl:4H2O	-15.0305
Melanterite	-2.9632	Ni3(AsO4)2:8H2O	-20.3059
Dolomite (disord	-3.0266	Hydromagnesite	-21.2401
Otavite	-3.2208	Cd3OH2(SO4)2	-22.8352
H-Jarosite	-3.2895	Lime	-23.2797
UO2(OH)2 (beta)	-3.4616	Ni4(OH)6SO4	-24.6698
Schoepite	-3.8448	Cd3(OH)4SO4	-24.7378
Fe(OH)2 (c)	-4.1093	Fe2(SO4)3	-25.2968
FeAsO4:2H2O	-4.2749	Cd4(OH)6SO4	-26.6545
Mirabilite	-4.6894	As2O5	-27.0703
Fe(OH)2 (am)	-4.7093	Cd metal (alpha)	-30.9054
Halite	-5.1467	Cd metal (gamma)	-31.0087
Nesquehonite	-5.1637		

Gases	fugacity	log fug.
CO2(g)	0.09861	-1.006
O2(g)	3.467e-41	-40.460
CH4(g)	4.266e-64	-63.370

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	2.37e-05	2.37e-05	0.155			
Be++	3.62e-05	3.62e-05	0.0153			
CO3--	0.109	0.109	307.			
Ca++	0.338	0.338	634.			
Cd++	1.79e-06	1.79e-06	0.00944			
Cl-	0.532	0.532	884.			
Fe+++	0.0794	0.0794	208.			
H+	0.0987	0.0987	4.66			
H2O	1.18e+03	1.18e+03	9.94e+05			
K+	0.0100	0.0100	18.4			
Mg++	0.249	0.249	284.			
Na+	0.384	0.384	414.			
Ni++	2.62e-05	2.62e-05	0.0721			
O2(aq)	-0.0198	-0.0198	-29.7			
SO4--	0.811	0.811	3.65e+03			
UO2++	3.09e-05	3.09e-05	0.392			

Elemental composition	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg
As	2.374e-05	2.374e-05	0.08337		
Be	3.621e-05	3.621e-05	0.01530		
C	0.1090	0.1090	61.38		
Ca	0.3376	0.3376	634.4		
Cd	1.791e-06	1.791e-06	0.009437		
Cl	0.5319	0.5319	884.1		
Fe	0.07937	0.07937	207.8		
H	2353.	2353.	1.112e+05		
K	0.01005	0.01005	18.42		
Mg	0.2493	0.2493	284.1		
Na	0.3844	0.3844	414.4		
Ni	2.619e-05	2.619e-05	0.07209		
O	1180.	1180.	8.851e+05		
S	0.8108	0.8108	1219.		
U	3.094e-05	3.094e-05	0.3452		

Temperature = 25.0 C Pressure = 1.013 bars
pH = 6.066 log fO2 = -41.053
Eh = 0.2628 volts pe = 4.4430
Ionic strength = 0.094047
Charge imbalance = -0.010579 eq/kg (-9.236% error)
Activity of water = 0.998441
Solvent mass = 51.502 kg
Solution mass = 51.777 kg
Mineral mass = 0.00000 kg
Solution density = 1.015 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.023455 molal
Dissolved solids = 5312 mg/kg sol'n
Elect. conductivity = 5644.70 uS/cm (or umho/cm)
Hardness = 2658.39 mg/kg sol'n as CaCO3
carbonate = 106.16 mg/kg sol'n as CaCO3
non-carbonate = 2552.23 mg/kg sol'n as CaCO3
Carbonate alkalinity= 106.16 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 5.10e+04 cm3
Fluid volume = 5.10e+04 cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.2628	4.4430

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02288	807.0	0.7843	-1.7460
SO4--	0.01866	1783.	0.3785	-2.1510
Na+	0.01561	356.9	0.7843	-1.9121
Ca++	0.009864	393.2	0.3785	-2.4279
Mg++	0.006985	168.9	0.3785	-2.5778
CaSO4 (aq)	0.005911	800.4	1.0219	-2.2190
MgSO4 (aq)	0.003325	398.1	1.0219	-2.4689
H2CO3* (aq)	0.003049	188.1	1.0219	-2.5065
HCO3-	0.002058	124.9	0.7843	-2.7919
Fe++	0.0009637	53.54	0.3785	-3.4380
FeSO4 (aq)	0.0006188	93.50	1.0219	-3.1991
NaSO4-	0.0006058	71.74	0.7843	-3.3232
K+	0.0003849	14.97	0.7843	-3.5201
MgCl+	0.0002408	14.32	0.7843	-3.7238
CaCl+	0.0002146	16.12	0.7843	-3.7739
NaCl (aq)	0.0001078	6.265	1.0219	-3.9581
CaHCO3+	9.789e-05	9.844	0.7843	-4.1148
MgHCO3+	6.339e-05	5.380	0.7843	-4.3035

KSO4-	1.910e-05	2.568	0.7843	-4.8244
NaHCO3 (aq)	9.697e-06	0.8103	1.0219	-5.0040
FeHCO3+	9.454e-06	1.099	0.7843	-5.1299
FeCl+	5.267e-06	0.4783	0.7843	-5.3840
Fe(OH)2+	2.883e-06	0.2577	0.7843	-5.6456
KCl (aq)	2.658e-06	0.1971	1.0219	-5.5661
H+	1.094e-06	0.001097	0.7843	-6.0664
HSO4-	7.499e-07	0.07240	0.7843	-6.2305
Ca2UO2(CO3)3 (aq	6.250e-07	0.3296	1.0219	-6.1947
Be(OH)2 (aq)	5.079e-07	0.02174	1.0219	-6.2848
Ni++	4.075e-07	0.02380	0.3785	-6.8118
H2AsO4-	3.909e-07	0.05480	0.7843	-6.5134
CO3--	2.331e-07	0.01391	0.3785	-7.0545
MgCO3 (aq)	2.178e-07	0.01826	1.0219	-6.6526
FeOH+	2.168e-07	0.01571	0.7843	-6.7693
NiSO4 (aq)	2.127e-07	0.03274	1.0219	-6.6629
Be++	1.380e-07	0.001237	0.3785	-7.2821
CaCO3 (aq)	9.772e-08	0.009729	1.0219	-7.0006
HAsO4--	9.659e-08	0.01344	0.3785	-7.4371
BeSO4 (aq)	5.590e-08	0.005842	1.0219	-7.2432
NiHCO3+	3.916e-08	0.004663	0.7843	-7.5127
UO2(CO3)2--	3.888e-08	0.01509	0.3785	-7.8322
FeOH++	2.758e-08	0.001999	0.3785	-7.9813
NaCO3-	2.564e-08	0.002117	0.7843	-7.6966
UO2CO3 (aq)	2.045e-08	0.006712	1.0219	-7.6800
OH-	1.493e-08	0.0002526	0.7843	-7.9313
Cd++	1.315e-08	0.001470	0.3785	-8.3032
CdCl+	1.087e-08	0.001599	0.7843	-8.0691
BeCO3 (aq)	8.101e-09	0.0005562	1.0219	-8.0820
CdSO4 (aq)	8.061e-09	0.001672	1.0219	-8.0842
MgOH+	6.440e-09	0.0002647	0.7843	-8.2966
Mg2CO3++	6.337e-09	0.0006847	0.3785	-8.6201
UO2(CO3)3----	4.355e-09	0.001950	0.0205	-10.0489
CaUO2(CO3)3--	3.200e-09	0.001560	0.3785	-8.9168
Be(SO4)2--	2.678e-09	0.0005357	0.3785	-8.9942
Cd(SO4)2--	2.074e-09	0.0006281	0.3785	-9.1052
BeCl+	1.650e-09	7.296e-05	0.7843	-8.8881
Fe(OH)3 (aq)	1.448e-09	0.0001539	1.0219	-8.8300
NiCl+	1.311e-09	0.0001228	0.7843	-8.9878
CaOH+	1.112e-09	6.316e-05	0.7843	-9.0592
CdCl2 (aq)	6.245e-10	0.0001139	1.0219	-9.1951
NiCO3 (aq)	4.946e-10	5.841e-05	1.0219	-9.2963
CdHCO3+	3.247e-10	5.601e-05	0.7843	-9.5940
NaOH (aq)	1.767e-10	7.029e-06	1.0219	-9.7434
UO2OH+	1.570e-10	4.481e-05	0.7843	-9.9097
FeSO4+	1.505e-10	2.274e-05	0.7843	-9.9280
Ni(SO4)2--	1.343e-10	3.351e-05	0.3785	-10.2939
Be(SO4)3----	1.078e-10	3.187e-05	0.0205	-11.6553
UO2SO4 (aq)	6.838e-11	2.490e-05	1.0219	-10.1556
H3AsO4	5.139e-11	7.255e-06	1.0219	-10.2798
UO2++	4.972e-11	1.336e-05	0.3785	-10.7254
Fe(OH)4-	4.377e-11	5.394e-06	0.7843	-10.4643
UO2(SO4)2--	3.938e-11	1.810e-05	0.3785	-10.8267
NiOH+	2.900e-11	2.184e-06	0.7843	-10.6432

Be2OH+++	1.879e-11	6.546e-07	0.1124	-11.6756
UO2(OH)2 (aq)	1.764e-11	5.335e-06	1.0219	-10.7441
Fe(SO4)2-	1.434e-11	3.536e-06	0.7843	-10.9491
CdCO3 (aq)	1.007e-11	1.727e-06	1.0219	-10.9876
(UO2)2CO3(OH)3-	8.634e-12	5.592e-06	0.7843	-11.1693
Fe+++	8.365e-12	4.647e-07	0.1124	-12.0270
KOH (aq)	6.014e-12	3.356e-07	1.0219	-11.2114
Be3(OH)3+++	2.565e-12	1.991e-07	0.1124	-12.5404
Fe(OH)2 (aq)	1.549e-12	1.384e-07	1.0219	-11.8007
FeCl++	1.346e-12	1.222e-07	0.3785	-12.2929
UO2Cl+	6.370e-13	1.936e-07	0.7843	-12.3014
NiCl2 (aq)	6.264e-13	8.076e-08	1.0219	-12.1937
AsO4---	6.008e-13	8.302e-08	0.1124	-13.1707
CdOH+	5.902e-13	7.597e-08	0.7843	-12.3345
UO2(OH)3-	2.124e-13	6.782e-08	0.7843	-12.7784
Fe2(OH)2++++	7.435e-14	1.078e-08	0.0205	-14.8166
Ni(OH)2 (aq)	2.071e-14	1.910e-09	1.0219	-13.6745
(UO2)2(OH)2++	3.037e-15	1.734e-09	0.3785	-14.9395
Cd(CO3)2--	1.737e-15	4.016e-10	0.3785	-15.1821
UO2Cl2 (aq)	4.713e-16	1.598e-10	1.0219	-15.3173
Fe3(OH)4+++++	3.397e-16	7.959e-11	0.0023	-18.1062
Fe(OH)3-	7.473e-17	7.944e-12	0.7843	-16.2320
Cd(OH)2 (aq)	3.348e-17	4.876e-12	1.0219	-16.4658
(UO2)3(CO3)6----	1.970e-17	2.293e-11	0.0002	-20.5032
Be5(OH)6++++	7.434e-18	1.088e-12	0.0205	-18.8167
(UO2)2OH+++	7.316e-18	4.054e-12	0.1124	-18.0851
(UO2)3(OH)5+	5.101e-18	4.542e-12	0.7843	-17.3978
UO2(OH)4--	3.625e-19	1.219e-13	0.3785	-18.8627
Be5(OH)7+++	3.299e-19	5.386e-14	0.1124	-19.4310
Ni(OH)3-	3.160e-19	3.449e-14	0.7843	-18.6058
Cd2OH+++	1.028e-19	2.471e-14	0.1124	-19.9376
(UO2)3(OH)4++	4.059e-20	3.546e-14	0.3785	-19.8135
(UO2)3CO3(OH)3+	5.258e-21	4.817e-15	0.7843	-20.3847
Be6(OH)8++++	2.190e-21	4.142e-16	0.0205	-22.3475
(UO2)3(OH)7-	1.545e-22	1.428e-16	0.7843	-21.9165
(UO2)4(OH)7+	5.802e-23	6.921e-17	0.7843	-22.3419
Cd(OH)3-	5.004e-24	8.135e-19	0.7843	-23.4061
Cd(OH)4--	1.240e-31	2.226e-26	0.3785	-31.3285
O2(aq)	8.847e-45	2.816e-40	1.0219	-44.0438

Mineral saturation states

	log Q/K		log Q/K
Magnetite	17.6333s/sat	Halite	-5.2081
Hematite	13.7601s/sat	Ni(OH)2 (c)	-5.4705
Fe(OH)2.7Cl.3	6.8666s/sat	KCl	-6.1661
Maghemite	5.9561s/sat	Gummite	-6.2652
Goethite	5.6797s/sat	UO3	-6.2934
Magnesioferrite	5.0366s/sat	Thenardite	-6.2970
Lepidocrocite	4.7997s/sat	Morenosite	-6.8227
K-Jarosite	3.4909s/sat	Retgersite	-6.9269
Ferrihydrite (ag	3.4800s/sat	CdOHCl	-7.5207
Ferrihydrite	2.9700s/sat	Brucite	-7.5465
Fe3(OH)8	0.8114s/sat	Ni(OH)2 (am)	-7.5705

Siderite	0.0975s/sat	Huntite	-8.4113
Gypsum	0.0297s/sat	CdSO4:2.67H2O	-8.5830
Anhydrite	-0.2190	CdSO4:1H2O	-8.7288
Na-Jarosite	-0.5811	Mg(OH)2 (active)	-9.2405
Calcite	-1.0026	Natron	-9.5745
Aragonite	-1.1463	Artinite	-9.6808
Vaterite	-1.5690	Cd(OH)2	-9.8158
Be(OH)2 (beta)	-1.6448	CdCl2:2.5H2O	-9.8838
Dolomite (ordere	-2.0247	CdCl2:1H2O	-10.1025
Be(OH)2 (alpha)	-2.0448	CdSO4	-10.2820
Magnesite	-2.1723	CdCl2	-11.1363
CaCO3xH2O	-2.3388	Thermonatrite	-11.5164
Be(OH)2 (am)	-2.3448	Periclase	-12.0299
Dolomite (disord	-2.5747	Portlandite	-13.0006
Epsomite	-2.6071	Mg2(OH)3Cl:4H2O	-14.7073
NiCO3	-2.6663	Ca3(AsO4)2:4H2O	-14.7279
Rutherfordine	-3.3178	Hydromagnesite	-20.2124
Otavite	-3.3476	Ni3(AsO4)2:8H2O	-21.2823
Melanterite	-3.3848	Lime	-22.9952
Fe(OH)2 (c)	-4.1967	Cd3OH2(SO4)2	-23.7902
UO2(OH)2 (beta)	-4.2057	Ni4(OH)6SO4	-25.0043
Schoepite	-4.5887	Cd3(OH)4SO4	-25.3578
H-Jarosite	-4.6660	Fe2(SO4)3	-26.7728
Fe(OH)2 (am)	-4.7967	Cd4(OH)6SO4	-27.3696
Mirabilite	-4.8680	As2O5	-28.0475
Nesquehonite	-4.9643	Cd metal (alpha)	-30.7039
FeAsO4:2H2O	-4.9990	Cd metal (gamma)	-30.8072
MgCO3:5H2O	-5.0957		

Gases	fugacity	log fug.
CO2(g)	0.09166	-1.038
O2(g)	8.847e-42	-41.053
CH4(g)	6.094e-63	-62.215

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	2.51e-05	2.51e-05	0.0674			
Be++	3.68e-05	3.68e-05	0.00640			
CO3--	0.272	0.272	316.			
Ca++	0.829	0.829	641.			
Cd++	1.81e-06	1.81e-06	0.00393			
Cl-	1.21	1.21	827.			
Fe+++	0.0824	0.0824	88.9			
H+	0.347	0.347	6.75			
H2O	2.86e+03	2.86e+03	9.95e+05			
K+	0.0209	0.0209	15.8			
Mg++	0.547	0.547	257.			
Na+	0.841	0.841	373.			
Ni++	3.41e-05	3.41e-05	0.0386			
O2(aq)	-0.0206	-0.0206	-12.7			
SO4--	1.50	1.50	2.78e+03			
UO2++	3.57e-05	3.57e-05	0.186			

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	2.511e-05	2.511e-05	0.03633		
Be	3.679e-05	3.679e-05	0.006404		
C	0.2725	0.2725	63.20		
Ca	0.8286	0.8286	641.4		
Cd	1.808e-06	1.808e-06	0.003926		
Cl	1.208	1.208	827.1		
Fe	0.08242	0.08242	88.90		
H	5718.	5718.	1.113e+05		
K	0.02095	0.02095	15.82		
Mg	0.5466	0.5466	256.7		
Na	0.8412	0.8412	373.5		
Ni	3.406e-05	3.406e-05	0.03862		
O	2866.	2866.	8.855e+05		
S	1.501	1.501	929.4		
U	3.565e-05	3.565e-05	0.1639		

Temperature = 25.0 C Pressure = 1.013 bars
pH = 6.103 log fO2 = -41.501
Eh = 0.2540 volts pe = 4.2943
Ionic strength = 0.088896
Charge imbalance = -0.006678 eq/kg (-6.132% error)
Activity of water = 0.998516
Solvent mass = 102.02 kg
Solution mass = 102.52 kg
Mineral mass = 0.00000 kg
Solution density = 1.015 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.022887 molal
Dissolved solids = 4932 mg/kg sol'n
Elect. conductivity = 5385.29 uS/cm (or umho/cm)
Hardness = 2625.42 mg/kg sol'n as CaCO3
carbonate = 112.35 mg/kg sol'n as CaCO3
non-carbonate = 2513.07 mg/kg sol'n as CaCO3
Carbonate alkalinity= 112.35 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 1.01e+05 cm3
Fluid volume = 1.01e+05 cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.2540	4.2943

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02232	787.5	0.7876	-1.7550
SO4--	0.01652	1579.	0.3847	-2.1968
Na+	0.01507	344.7	0.7876	-1.9257
Ca++	0.01021	407.2	0.3847	-2.4058
Mg++	0.006904	167.0	0.3847	-2.5758
CaSO4 (aq)	0.005604	759.1	1.0207	-2.2426
MgSO4 (aq)	0.003010	360.5	1.0207	-2.5126
H2CO3* (aq)	0.002974	183.6	1.0207	-2.5177
HCO3-	0.002174	132.0	0.7876	-2.7665
Fe++	0.0005337	29.66	0.3847	-3.6875
NaSO4-	0.0005262	62.34	0.7876	-3.3825
K+	0.0003646	14.18	0.7876	-3.5419
FeSO4 (aq)	0.0003139	47.44	1.0207	-3.4944
MgCl+	0.0002360	14.04	0.7876	-3.7308
CaCl+	0.0002203	16.55	0.7876	-3.7608
CaHCO3+	0.0001088	10.94	0.7876	-4.0672
NaCl (aq)	0.0001024	5.957	1.0207	-3.9807
MgHCO3+	6.726e-05	5.711	0.7876	-4.2759

KSO4-	1.628e-05	2.190	0.7876	-4.8921
NaHCO3 (aq)	9.978e-06	0.8341	1.0207	-4.9921
FeHCO3+	5.621e-06	0.6537	0.7876	-5.3539
FeCl+	2.892e-06	0.2627	0.7876	-5.6425
KCl (aq)	2.478e-06	0.1839	1.0207	-5.5969
Fe(OH)2+	1.359e-06	0.1216	0.7876	-5.9704
H+	1.001e-06	0.001004	0.7876	-6.1031
HSO4-	6.176e-07	0.05966	0.7876	-6.3130
Ca2UO2(CO3)3 (aq	3.944e-07	0.2081	1.0207	-6.3952
Ni++	2.915e-07	0.01703	0.3847	-6.9502
Be(OH)2 (aq)	2.780e-07	0.01190	1.0207	-6.5471
CO3--	2.646e-07	0.01580	0.3847	-6.9923
MgCO3 (aq)	2.528e-07	0.02121	1.0207	-6.5884
H2AsO4-	2.122e-07	0.02976	0.7876	-6.7769
NiSO4 (aq)	1.393e-07	0.02146	1.0207	-6.8470
FeOH+	1.323e-07	0.009592	0.7876	-6.9821
CaCO3 (aq)	1.188e-07	0.01183	1.0207	-6.9163
Be++	6.265e-08	0.0005618	0.3847	-7.6179
HAsO4--	5.637e-08	0.007849	0.3847	-7.6638
NiHCO3+	3.007e-08	0.003583	0.7876	-7.6256
NaCO3-	2.856e-08	0.002359	0.7876	-7.6480
BeSO4 (aq)	2.325e-08	0.002430	1.0207	-7.6248
UO2(CO3)2--	1.887e-08	0.007324	0.3847	-8.1391
OH-	1.619e-08	0.0002739	0.7876	-7.8946
FeOH++	1.181e-08	0.0008558	0.3847	-8.3428
UO2CO3 (aq)	8.750e-09	0.002873	1.0207	-8.0491
Mg2CO3++	7.261e-09	0.0007849	0.3847	-8.5539
MgOH+	7.012e-09	0.0002883	0.7876	-8.2579
Cd++	6.972e-09	0.0007798	0.3847	-8.5715
CdCl+	5.718e-09	0.0008413	0.7876	-8.3465
BeCO3 (aq)	4.320e-09	0.0002967	1.0207	-8.3556
CdSO4 (aq)	3.916e-09	0.0008122	1.0207	-8.3983
UO2(CO3)3----	2.322e-09	0.001040	0.0219	-10.2936
CaUO2(CO3)3--	1.886e-09	0.0009197	0.3847	-9.1394
CaOH+	1.269e-09	7.206e-05	0.7876	-9.0004
Be(SO4)2--	9.846e-10	0.0001971	0.3847	-9.4216
NiCl+	9.301e-10	8.715e-05	0.7876	-9.1352
Cd(SO4)2--	8.907e-10	0.0002699	0.3847	-9.4651
Fe(OH)3 (aq)	7.468e-10	7.941e-05	1.0207	-9.1179
BeCl+	7.427e-10	3.286e-05	0.7876	-9.2329
NiCO3 (aq)	4.155e-10	4.909e-05	1.0207	-9.3725
CdCl2 (aq)	3.234e-10	5.898e-05	1.0207	-9.4814
NaOH (aq)	1.866e-10	7.425e-06	1.0207	-9.7203
CdHCO3+	1.849e-10	3.190e-05	0.7876	-9.8368
Ni(SO4)2--	7.780e-11	1.942e-05	0.3847	-10.5239
UO2OH+	6.301e-11	1.800e-05	0.7876	-10.3043
FeSO4+	5.391e-11	8.149e-06	0.7876	-10.3720
Be(SO4)3----	3.396e-11	1.004e-05	0.0219	-12.1284
H3AsO4	2.577e-11	3.640e-06	1.0207	-10.5800
Fe(OH)4-	2.445e-11	3.013e-06	0.7876	-10.7155
NiOH+	2.285e-11	1.722e-06	0.7876	-10.7448
UO2SO4 (aq)	2.282e-11	8.313e-06	1.0207	-10.6328
UO2++	1.812e-11	4.868e-06	0.3847	-11.1567
UO2(SO4)2--	1.162e-11	5.344e-06	0.3847	-11.3496

UO2(OH)2 (aq)	7.749e-12	2.344e-06	1.0207	-11.1019
CdCO3 (aq)	6.271e-12	1.076e-06	1.0207	-11.1938
KOH (aq)	6.231e-12	3.479e-07	1.0207	-11.1965
Fe(SO4)2-	4.622e-12	1.141e-06	0.7876	-11.4389
Be2OH+++	4.198e-12	1.463e-07	0.1166	-12.3105
Fe+++	3.223e-12	1.791e-07	0.1166	-12.4252
(UO2)2CO3(OH)3-	1.755e-12	1.137e-06	0.7876	-11.8595
Fe(OH)2 (aq)	1.034e-12	9.244e-08	1.0207	-11.9767
FeCl++	5.184e-13	4.710e-08	0.3847	-12.7002
NiCl2 (aq)	4.375e-13	5.642e-08	1.0207	-12.3502
AsO4---	3.739e-13	5.168e-08	0.1166	-13.3607
CdOH+	3.449e-13	4.441e-08	0.7876	-12.5660
Be3(OH)3+++	3.133e-13	2.433e-08	0.1166	-13.4375
UO2Cl+	2.301e-13	6.996e-08	0.7876	-12.7417
UO2(OH)3-	1.010e-13	3.226e-08	0.7876	-13.0995
Ni(OH)2 (aq)	1.785e-14	1.647e-09	1.0207	-13.7394
Fe2(OH)2++++	1.318e-14	1.911e-09	0.0219	-15.5396
Cd(CO3)2--	1.227e-15	2.838e-10	0.3847	-15.3260
(UO2)2(OH)2++	4.856e-16	2.774e-10	0.3847	-15.7286
UO2Cl2 (aq)	1.677e-16	5.688e-11	1.0207	-15.7667
Fe(OH)3-	5.401e-17	5.743e-12	0.7876	-16.3712
Fe3(OH)4+++++	2.748e-17	6.441e-12	0.0026	-19.1539
Cd(OH)2 (aq)	2.140e-17	3.118e-12	1.0207	-16.6606
(UO2)3(CO3)6----	2.041e-18	2.377e-12	0.0002	-21.4239
(UO2)2OH+++	1.053e-18	5.836e-13	0.1166	-18.9111
(UO2)3(OH)5+	3.941e-19	3.510e-13	0.7876	-18.5081
Ni(OH)3-	2.950e-19	3.221e-14	0.7876	-18.6339
Be5(OH)6++++	2.423e-19	3.547e-14	0.0219	-20.2751
UO2(OH)4--	1.853e-19	6.233e-14	0.3847	-19.1470
Cd2OH+++	3.133e-20	7.538e-15	0.1166	-20.4375
Be5(OH)7+++	1.204e-20	1.967e-15	0.1166	-20.8527
(UO2)3(OH)4++	2.847e-21	2.487e-15	0.3847	-20.9605
(UO2)3CO3(OH)3+	3.958e-22	3.628e-16	0.7876	-21.5062
Be6(OH)8++++	3.902e-23	7.382e-18	0.0219	-24.0682
(UO2)3(OH)7-	1.414e-23	1.307e-17	0.7876	-22.9532
Cd(OH)3-	3.464e-24	5.632e-19	0.7876	-23.5642
(UO2)4(OH)7+	1.967e-24	2.347e-18	0.7876	-23.8100
Cd(OH)4--	9.228e-32	1.657e-26	0.3847	-31.4498
O2(aq)	3.158e-45	1.006e-40	1.0207	-44.4917

Mineral saturation states

	log Q/K		log Q/K
Magnetite	16.8813s/sat	FeAsO4:2H2O	-5.5872
Hematite	13.1841s/sat	H-Jarosite	-5.7684
Fe(OH)2.7Cl.3	6.5649s/sat	KCl	-6.1969
Goethite	5.3917s/sat	Thenardite	-6.3700
Maghemite	5.3801s/sat	Gummite	-6.6230
Magnesioferrite	4.5361s/sat	UO3	-6.6512
Lepidocrocite	4.5117s/sat	Morenosite	-7.0067
Ferrihydrite (ag	3.1921s/sat	Retgersite	-7.1109
Ferrihydrite	2.6821s/sat	Brucite	-7.4709
K-Jarosite	2.4033s/sat	Ni(OH)2 (am)	-7.6354
Fe3(OH)8	0.0595s/sat	CdOHCl	-7.7613

Gypsum	0.0061s/sat	Huntite	-8.1343
Siderite	-0.0898	CdSO4:2.67H2O	-8.8970
Anhydrite	-0.2426	CdSO4:1H2O	-9.0429
Calcite	-0.9183	Mg(OH)2 (active)	-9.1649
Aragonite	-1.0620	Natron	-9.5392
Vaterite	-1.4847	Artinite	-9.5409
Na-Jarosite	-1.6604	Cd(OH)2	-10.0106
Dolomite (ordere	-1.8762	CdCl2:2.5H2O	-10.1700
Be(OH)2 (beta)	-1.9071	CdCl2:1H2O	-10.3889
Magnesite	-2.1081	CdSO4	-10.5961
CaCO3xH2O	-2.2544	CdCl2	-11.4226
Be(OH)2 (alpha)	-2.3071	Thermonatrite	-11.4814
Dolomite (disord	-2.4262	Periclase	-11.9544
Be(OH)2 (am)	-2.6071	Portlandite	-12.9050
Epsomite	-2.6506	Mg2(OH)3Cl:4H2O	-14.6018
NiCO3	-2.7425	Ca3(AsO4)2:4H2O	-15.0415
Otavite	-3.5538	Hydromagnesite	-19.8798
Melanterite	-3.6799	Ni3(AsO4)2:8H2O	-22.0773
Rutherfordine	-3.6869	Lime	-22.8996
Fe(OH)2 (c)	-4.3727	Cd3OH2(SO4)2	-24.6132
UO2(OH)2 (beta)	-4.5635	Ni4(OH)6SO4	-25.3831
Nesquehonite	-4.9000	Cd3(OH)4SO4	-26.0615
Mirabilite	-4.9407	Fe2(SO4)3	-27.7066
Schoepite	-4.9465	Cd4(OH)6SO4	-28.2682
Fe(OH)2 (am)	-4.9727	As2O5	-28.6480
MgCO3:5H2O	-5.0313	Cd metal (alpha)	-30.6748
Halite	-5.2307	Cd metal (gamma)	-30.7781
Ni(OH)2 (c)	-5.5354		

Gases	fugacity	log fug.
CO2(g)	0.08931	-1.049
O2(g)	3.154e-42	-41.501
CH4(g)	4.672e-62	-61.331

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	2.74e-05	2.74e-05	0.0371			
Be++	3.77e-05	3.77e-05	0.00332			
CO3--	0.545	0.545	319.			
Ca++	1.65	1.65	644.			
Cd++	1.84e-06	1.84e-06	0.00201			
Cl-	2.33	2.33	807.			
Fe+++	0.0875	0.0875	47.7			
H+	0.761	0.761	7.48			
H2O	5.66e+03	5.66e+03	9.95e+05			
K+	0.0391	0.0391	14.9			
Mg++	1.04	1.04	247.			
Na+	1.60	1.60	359.			
Ni++	4.72e-05	4.72e-05	0.0270			
O2(aq)	-0.0218	-0.0218	-6.82			
SO4--	2.65	2.65	2.48e+03			
UO2++	4.35e-05	4.35e-05	0.115			

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	2.740e-05	2.740e-05	0.02003		
Be	3.774e-05	3.774e-05	0.003318		
C	0.5449	0.5449	63.84		
Ca	1.647	1.647	643.9		
Cd	1.837e-06	1.837e-06	0.002015		
Cl	2.335	2.335	807.4		
Fe	0.08749	0.08749	47.66		
H	1.133e+04	1.133e+04	1.114e+05		
K	0.03910	0.03910	14.91		
Mg	1.042	1.042	247.2		
Na	1.602	1.602	359.3		
Ni	4.717e-05	4.717e-05	0.02701		
O	5675.	5675.	8.856e+05		
S	2.652	2.652	829.3		
U	4.349e-05	4.349e-05	0.1010		

Temperature = 25.0 C Pressure = 1.013 bars
pH = 1.912 log fO2 = -23.567
Eh = 0.7672 volts pe = 12.9690
Ionic strength = 0.131680
Charge imbalance = -0.006408 eq/kg (-3.761% error)
Activity of water = 0.997567
Solvent mass = 11.089 kg
Solution mass = 11.184 kg
Mineral mass = 0.00000 kg
Solution density = 1.017 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.027380 molal
Dissolved solids = 8477 mg/kg sol'n
Elect. conductivity = 12233.80 uS/cm (or umho/cm)
Hardness = 3255.11 mg/kg sol'n as CaCO3
carbonate = 0.01 mg/kg sol'n as CaCO3
non-carbonate = 3255.10 mg/kg sol'n as CaCO3
Carbonate alkalinity= 0.01 mg/kg sol'n as CaCO3
Water type = Mg-SO4
Bulk volume = 1.10e+04 cm3
Fluid volume = 1.10e+04 cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.7672	12.9690

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02658	934.2	0.7659	-1.6914
SO4--	0.02413	2298.	0.3440	-2.0808
Na+	0.01798	409.8	0.7659	-1.8612
H+	0.01599	15.98	0.7659	-1.9120
HSO4-	0.01288	1239.	0.7659	-2.0060
Mg++	0.01061	255.7	0.3440	-2.4378
Ca++	0.009930	394.6	0.3440	-2.4665
CaSO4 (aq)	0.006303	850.8	1.0308	-2.1873
MgSO4 (aq)	0.005348	638.3	1.0308	-2.2587
FeSO4+	0.005198	782.9	0.7659	-2.4000
H2CO3* (aq)	0.004916	302.3	1.0308	-2.2953
NaSO4-	0.0008201	96.80	0.7659	-3.2020
Fe(SO4)2-	0.0005821	143.1	0.7659	-3.3509
K+	0.0005431	21.06	0.7659	-3.3810
MgCl+	0.0003861	22.88	0.7659	-3.5292
Fe+++	0.0002975	16.47	0.0906	-4.5692
CaCl+	0.0002280	17.08	0.7659	-3.7578
NaCl (aq)	0.0001362	7.895	1.0308	-3.8525

Fe++	9.063e-05	5.018	0.3440	-4.5061
FeSO4 (aq)	6.164e-05	9.284	1.0308	-4.1970
FeOH++	6.098e-05	4.405	0.3440	-4.6782
FeCl++	4.818e-05	4.362	0.3440	-4.7805
KSO4-	3.168e-05	4.245	0.7659	-4.6151
KCl (aq)	4.116e-06	0.3043	1.0308	-5.3723
H3AsO4	3.054e-06	0.4298	1.0308	-5.5020
H2AsO4-	1.682e-06	0.2351	0.7659	-5.8900
UO2SO4 (aq)	6.250e-07	0.2269	1.0308	-6.1910
FeCl+	5.228e-07	0.04733	0.7659	-6.3975
UO2(SO4)2--	4.694e-07	0.2151	0.3440	-6.7918
Fe2(OH)2++++	4.398e-07	0.06353	0.0140	-8.2104
UO2++	4.290e-07	0.1149	0.3440	-6.8309
Fe(OH)2+	4.156e-07	0.03703	0.7659	-6.4972
HCO3-	2.403e-07	0.01454	0.7659	-6.7350
Ni++	1.519e-07	0.008845	0.3440	-7.2817
NiSO4 (aq)	8.400e-08	0.01289	1.0308	-7.0626
Cd++	1.454e-08	0.001620	0.3440	-8.3008
CdCl+	1.270e-08	0.001861	0.7659	-8.0122
Be++	1.171e-08	0.0001046	0.3440	-8.3949
CaHCO3+	1.046e-08	0.001048	0.7659	-8.0964
MgHCO3+	1.022e-08	0.0008644	0.7659	-8.1065
CdSO4 (aq)	9.444e-09	0.001952	1.0308	-8.0117
UO2Cl+	5.802e-09	0.001757	0.7659	-8.3523
BeSO4 (aq)	5.024e-09	0.0005234	1.0308	-8.2858
Cd(SO4)2--	3.168e-09	0.0009567	0.3440	-8.9625
NaHCO3 (aq)	1.232e-09	0.0001027	1.0308	-8.8961
CdCl2 (aq)	8.003e-10	0.0001455	1.0308	-9.0836
NiCl+	5.162e-10	4.819e-05	0.7659	-9.4031
Fe3(OH)4+++++	3.505e-10	8.186e-05	0.0013	-12.3516
Be(SO4)2--	3.139e-10	6.260e-05	0.3440	-9.9666
BeCl+	1.478e-10	6.515e-06	0.7659	-9.9463
FeHCO3+	9.436e-11	1.093e-05	0.7659	-10.1410
UO2OH+	8.829e-11	2.513e-05	0.7659	-10.1699
Ni(SO4)2--	6.918e-11	1.721e-05	0.3440	-10.6234
HAsO4--	3.129e-11	4.342e-06	0.3440	-10.9679
Be(SO4)3----	1.978e-11	5.827e-06	0.0140	-12.5575
UO2Cl2 (aq)	4.712e-12	1.593e-06	1.0308	-11.3136
NiHCO3+	1.550e-12	1.840e-07	0.7659	-11.9256
FeOH+	1.330e-12	9.604e-08	0.7659	-11.9921
UO2CO3 (aq)	1.270e-12	4.157e-07	1.0308	-11.8829
OH-	1.071e-12	1.806e-08	0.7659	-12.0860
MgOH+	6.375e-13	2.612e-08	0.7659	-12.3113
NiCl2 (aq)	2.707e-13	3.478e-08	1.0308	-12.5544
CaOH+	7.301e-14	4.132e-09	0.7659	-13.2525
(UO2)2OH+++	3.907e-14	2.158e-08	0.0906	-14.4508
CdHCO3+	3.811e-14	6.554e-09	0.7659	-13.5348
Fe(OH)3 (aq)	1.415e-14	1.499e-09	1.0308	-13.8362
NaOH (aq)	1.379e-14	5.470e-10	1.0308	-13.8472
MgCO3 (aq)	2.381e-15	1.991e-10	1.0308	-14.6100
CO3--	2.049e-15	1.219e-10	0.3440	-15.1519
(UO2)2(OH)2++	1.008e-15	5.739e-10	0.3440	-15.4598
CaCO3 (aq)	7.084e-16	7.030e-11	1.0308	-15.1365
NiOH+	7.049e-16	5.292e-11	0.7659	-15.2677

UO2(OH)2 (aq)	6.728e-16	2.028e-10	1.0308	-15.1589
KOH (aq)	5.752e-16	3.200e-11	1.0308	-15.2270
NaCO3-	2.360e-16	1.942e-11	0.7659	-15.7430
Be(OH)2 (aq)	1.905e-16	8.127e-12	1.0308	-15.7069
Mg2CO3++	1.061e-16	1.143e-11	0.3440	-16.4375
CdOH+	4.256e-17	5.461e-12	0.7659	-16.4869
Be2OH+++	9.701e-18	3.370e-13	0.0906	-18.0558
BeCO3 (aq)	4.951e-18	3.388e-13	1.0308	-17.2922
NiCO3 (aq)	1.328e-18	1.563e-13	1.0308	-17.8636
CdCO3 (aq)	8.019e-20	1.371e-14	1.0308	-19.0827
Fe(OH)4-	3.095e-20	3.801e-15	0.7659	-19.6252
UO2(CO3)2--	2.143e-20	8.286e-15	0.3440	-20.1325
AsO4---	1.537e-20	2.117e-15	0.0906	-20.8559
Fe(OH)2 (aq)	6.437e-22	5.735e-17	1.0308	-21.1782
UO2(OH)3-	5.860e-22	1.865e-16	0.7659	-21.3480
Ni(OH)2 (aq)	3.413e-23	3.138e-18	1.0308	-22.4537
Cd2OH+++	9.014e-24	2.161e-18	0.0906	-24.0877
(UO2)2CO3(OH)3-	1.493e-24	9.640e-19	0.7659	-23.9417
(UO2)3(OH)4++	5.183e-25	4.513e-19	0.3440	-24.7488
Cd(OH)2 (aq)	1.637e-25	2.376e-20	1.0308	-24.7729
(UO2)3(OH)5+	4.247e-27	3.769e-21	0.7659	-26.4878
O2(aq)	2.684e-27	8.515e-23	1.0308	-26.5581
Ca2UO2(CO3)3 (aq	2.077e-27	1.092e-21	1.0308	-26.6695
Be3(OH)3+++	5.010e-28	3.878e-23	0.0906	-28.3428
UO2(CO3)3----	2.553e-29	1.139e-23	0.0140	-30.4465
CaUO2(CO3)3--	1.289e-29	6.266e-24	0.3440	-29.3530
(UO2)3CO3(OH)3+	7.132e-30	6.514e-24	0.7659	-29.2626
Fe(OH)3-	2.247e-30	2.381e-25	0.7659	-29.7642
Cd(CO3)2--	1.227e-31	2.827e-26	0.3440	-31.3746
UO2(OH)4--	7.524e-32	2.522e-26	0.3440	-31.5870
Ni(OH)3-	3.768e-32	4.100e-27	0.7659	-31.5398
(UO2)4(OH)7+	1.858e-36	2.209e-30	0.7659	-35.8467
Cd(OH)3-	1.770e-36	2.868e-31	0.7659	-35.8679
(UO2)3(OH)7-	6.310e-40	5.813e-34	0.7659	-39.3158
Be5(OH)6++++	3.507e-48	5.116e-43	0.0140	-49.3086
Cd(OH)4--	3.300e-48	5.903e-43	0.3440	-47.9449
Be5(OH)7+++	9.226e-54	1.501e-48	0.0906	-54.0776
(UO2)3(CO3)6----	5.843e-54	6.779e-48	0.0001	-57.4040
Be6(OH)8++++	3.909e-61	7.369e-56	0.0140	-62.2616

Mineral saturation states

	log Q/K		log Q/K
Hematite	3.7488s/sat	Be(OH)2 (beta)	-11.0669
Fe(OH)2.7Cl.3	3.1231s/sat	NiCO3	-11.2336
K-Jarosite	1.2157s/sat	Otavite	-11.4427
Goethite	0.6738s/sat	Be(OH)2 (alpha)	-11.4669
Gypsum	0.0606s/sat	CdOHCl	-11.6185
Anhydrite	-0.1873	Fe2(SO4)3	-11.6466
Lepidocrocite	-0.2062	Be(OH)2 (am)	-11.7669
Ferrihydrite (ag	-1.5262	Nesquehonite	-12.9229
Magnetite	-1.7551	MgCO3:5H2O	-13.0550
Ferrihydrite	-2.0362	Magnesioferrite	-13.1437
Epsomite	-2.3996	Fe(OH)2 (c)	-13.5742

H-Jarosite	-2.9264	Fe(OH)2 (am)	-14.1742
Na-Jarosite	-2.9444	Ni(OH)2 (c)	-14.2497
Maghemite	-4.0552	Brucite	-15.7159
Melanterite	-4.3854	Ni(OH)2 (am)	-16.3497
Mirabilite	-4.6997	Mg(OH)2 (active)	-17.4099
Halite	-5.1025	Natron	-17.5738
FeAsO4:2H2O	-5.2272	Dolomite (ordere	-18.1180
KCl	-5.9723	Cd(OH)2	-18.1229
Thenardite	-6.1249	As2O5	-18.4909
Morenosite	-7.2251	Fe3(OH)8	-18.5786
Retgersite	-7.3289	Dolomite (disord	-18.6680
Rutherfordine	-7.5207	Thermonatrite	-19.5122
CdSO4:2.67H2O	-8.5115	Periclase	-20.1989
UO2(OH)2 (beta)	-8.6205	Portlandite	-21.3485
CdSO4:1H2O	-8.6567	Artinite	-25.8087
Schoepite	-9.0040	Mg2(OH)3Cl:4H2O	-26.8383
Siderite	-9.0680	Ca3(AsO4)2:4H2O	-30.2154
Calcite	-9.1385	Lime	-31.3427
Aragonite	-9.2822	Cd3OH2(SO4)2	-31.9523
Vaterite	-9.7049	Ni3(AsO4)2:8H2O	-38.0654
CdCl2:2.5H2O	-9.7732	Huntite	-40.4194
CdCl2:1H2O	-9.9914	Cd3(OH)4SO4	-41.8994
Magnesite	-10.1297	Cd metal (alpha)	-47.7535
CdSO4	-10.2095	Cd metal (gamma)	-47.8568
CaCO3xH2O	-10.4751	Ni4(OH)6SO4	-51.7418
Gummite	-10.6797	Cd4(OH)6SO4	-52.2183
UO3	-10.7079	Hydromagnesite	-60.2129
CdCl2	-11.0248		

Gases	fugacity	log fug.
CO2(g)	0.1492	-0.826
O2(g)	2.707e-24	-23.567
CH4(g)	1.058e-97	-96.976

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	5.25e-05	5.25e-05	0.652			
Be++	1.91e-07	1.91e-07	0.000154			
CO3--	0.0545	0.0545	292.			
Ca++	0.183	0.183	654.			
Cd++	4.51e-07	4.51e-07	0.00453			
Cl-	0.304	0.304	962.			
Fe+++	0.0703	0.0703	351.			
H+	0.427	0.427	38.5			
H2O	616.	616.	9.92e+05			
K+	0.00642	0.00642	22.4			
Mg++	0.181	0.181	394.			
Na+	0.210	0.210	432.			
Ni++	2.62e-06	2.62e-06	0.0138			
O2(aq)	-0.000424	-0.000424	-1.21			
SO4--	0.620	0.620	5.33e+03			
UO2++	1.70e-05	1.70e-05	0.409			

Elemental composition	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg
As	5.251e-05	5.251e-05	0.3518		
Be	1.909e-07	1.909e-07	0.0001538		
C	0.05451	0.05451	58.54		
Ca	0.1825	0.1825	654.1		
Cd	4.507e-07	4.507e-07	0.004530		
Cl	0.3036	0.3036	962.5		
Fe	0.07031	0.07031	351.1		
H	1232.	1232.	1.110e+05		
K	0.006419	0.006419	22.44		
Mg	0.1812	0.1812	393.9		
Na	0.2099	0.2099	431.6		
Ni	2.623e-06	2.623e-06	0.01377		
O	618.2	618.2	8.844e+05		
S	0.6203	0.6203	1778.		
U	1.696e-05	1.696e-05	0.3609		

Temperature = 25.0 C   Pressure = 1.013 bars
pH = 2.199   log fO2 = -23.137
Eh = 0.7566 volts   pe = 12.7901
Ionic strength = 0.108810
Charge imbalance = -0.004638 eq/kg (-3.379% error)
Activity of water = 0.998061
Solvent mass = 21.192 kg
Solution mass = 21.333 kg
Mineral mass = 0.00000 kg
Solution density = 1.016 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.024959 molal
Dissolved solids = 6606 mg/kg sol'n
Elect. conductivity = 8785.49 uS/cm (or umho/cm)
Hardness = 2939.11 mg/kg sol'n as CaCO3
  carbonate = 0.02 mg/kg sol'n as CaCO3
  non-carbonate = 2939.09 mg/kg sol'n as CaCO3
Carbonate alkalinity= 0.02 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 2.10e+04 cm3
Fluid volume = 2.10e+04 cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.7566	12.7901

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02428	855.2	0.7762	-1.7248
SO4--	0.02019	1927.	0.3629	-2.1350
Na+	0.01632	372.6	0.7762	-1.8974
Ca++	0.01011	402.4	0.3629	-2.4356
Mg++	0.008776	211.9	0.3629	-2.4969
H+	0.008157	8.167	0.7762	-2.1985
CaSO4 (aq)	0.006005	812.1	1.0254	-2.2106
HSO4-	0.005800	559.3	0.7762	-2.3466
H2CO3* (aq)	0.005143	316.9	1.0254	-2.2779
MgSO4 (aq)	0.004142	495.3	1.0254	-2.3719
FeSO4+	0.002717	410.0	0.7762	-2.6760
NaSO4-	0.0006571	77.71	0.7762	-3.2924
K+	0.0004479	17.40	0.7762	-3.4589
MgCl+	0.0003079	18.28	0.7762	-3.6217
Fe(SO4)2-	0.0002686	66.16	0.7762	-3.6810
CaCl+	0.0002237	16.78	0.7762	-3.7604
Fe+++	0.0001583	8.781	0.1022	-4.7910
NaCl (aq)	0.0001167	6.773	1.0254	-3.9222

Fe++	7.783e-05	4.318	0.3629	-4.5491
FeOH++	6.712e-05	4.858	0.3629	-4.6133
FeSO4 (aq)	4.955e-05	7.478	1.0254	-4.2940
FeCl++	2.538e-05	2.301	0.3629	-5.0358
KSO4-	2.306e-05	3.096	0.7762	-4.7472
KCl (aq)	3.202e-06	0.2372	1.0254	-5.4837
H2AsO4-	1.278e-06	0.1789	0.7762	-6.0036
H3AsO4	1.222e-06	0.1723	1.0254	-5.9021
Fe(OH)2+	9.212e-07	0.08224	0.7762	-6.1457
Fe2(OH)2++++	4.787e-07	0.06929	0.0173	-8.0807
HCO3-	4.774e-07	0.02894	0.7762	-6.4312
FeCl+	4.327e-07	0.03925	0.7762	-6.4738
UO2SO4 (aq)	3.691e-07	0.1342	1.0254	-6.4220
UO2++	2.706e-07	0.07260	0.3629	-7.0078
UO2(SO4)2--	2.308e-07	0.1060	0.3629	-7.0769
Ni++	1.628e-07	0.009493	0.3629	-7.2286
NiSO4 (aq)	8.424e-08	0.01295	1.0254	-7.0636
CaHCO3+	2.230e-08	0.002240	0.7762	-7.7617
MgHCO3+	1.771e-08	0.001501	0.7762	-7.8618
Be++	1.254e-08	0.0001123	0.3629	-8.3418
Cd++	8.071e-09	0.0009012	0.3629	-8.5333
CdCl+	6.792e-09	0.0009976	0.7762	-8.2780
BeSO4 (aq)	5.039e-09	0.0005260	1.0254	-8.2867
CdSO4 (aq)	4.908e-09	0.001016	1.0254	-8.2982
UO2Cl+	3.528e-09	0.001071	0.7762	-8.5626
NaHCO3 (aq)	2.294e-09	0.0001914	1.0254	-8.6285
Cd(SO4)2--	1.371e-09	0.0004147	0.3629	-9.3032
Fe3(OH)4+++++	7.600e-10	0.0001779	0.0018	-11.8704
NiCl+	5.329e-10	4.985e-05	0.7762	-9.3834
CdCl2 (aq)	4.039e-10	7.356e-05	1.0254	-9.3828
Be(SO4)2--	2.621e-10	5.237e-05	0.3629	-10.0217
FeHCO3+	1.698e-10	1.971e-05	0.7762	-9.8801
BeCl+	1.526e-10	6.740e-06	0.7762	-9.9265
UO2OH+	1.122e-10	3.199e-05	0.7762	-10.0601
Ni(SO4)2--	5.776e-11	1.439e-05	0.3629	-10.6786
HAsO4--	4.417e-11	6.140e-06	0.3629	-10.7951
Be(SO4)3----	1.242e-11	3.666e-06	0.0173	-12.6667
NiHCO3+	3.478e-12	4.137e-07	0.7762	-11.5687
UO2CO3 (aq)	3.309e-12	1.085e-06	1.0254	-11.4695
UO2Cl2 (aq)	2.703e-12	9.153e-07	1.0254	-11.5573
FeOH+	2.300e-12	1.664e-07	0.7762	-11.7484
OH-	2.045e-12	3.455e-08	0.7762	-11.7993
MgOH+	1.062e-12	4.361e-08	0.7762	-12.0837
NiCl2 (aq)	2.636e-13	3.394e-08	1.0254	-12.5682
CaOH+	1.497e-13	8.487e-09	0.7762	-12.9350
Fe(OH)3 (aq)	6.182e-14	6.563e-09	1.0254	-13.1980
CdHCO3+	4.433e-14	7.637e-09	0.7762	-13.4633
(UO2)2OH+++	2.968e-14	1.643e-08	0.1022	-14.5179
NaOH (aq)	2.468e-14	9.806e-10	1.0254	-13.5968
MgCO3 (aq)	8.135e-15	6.814e-10	1.0254	-14.0788
CO3--	7.562e-15	4.508e-10	0.3629	-14.5616
CaCO3 (aq)	2.977e-15	2.960e-10	1.0254	-14.5154
UO2(OH)2 (aq)	1.685e-15	5.090e-10	1.0254	-14.7624
(UO2)2(OH)2++	1.585e-15	9.037e-10	0.3629	-15.2402

NiOH+	1.521e-15	1.144e-10	0.7762	-14.9280
KOH (aq)	9.352e-16	5.213e-11	1.0254	-15.0182
NaCO3-	8.338e-16	6.875e-11	0.7762	-15.1890
Be(OH)2 (aq)	8.104e-16	3.464e-11	1.0254	-15.0804
Mg2CO3++	2.984e-16	3.220e-11	0.3629	-15.9654
CdOH+	4.758e-17	6.117e-12	0.7762	-16.4326
BeCO3 (aq)	2.190e-17	1.501e-12	1.0254	-16.6487
Be2OH+++	2.126e-17	7.398e-13	0.1022	-17.6629
NiCO3 (aq)	5.874e-18	6.927e-13	1.0254	-17.2202
Fe(OH)4-	2.569e-19	3.161e-14	0.7762	-18.7003
UO2(CO3)2--	2.049e-19	7.938e-14	0.3629	-19.1287
CdCO3 (aq)	1.838e-19	3.148e-14	1.0254	-18.7248
AsO4---	3.925e-20	5.417e-15	0.1022	-20.3966
UO2(OH)3-	2.788e-21	8.891e-16	0.7762	-20.6648
Fe(OH)2 (aq)	2.195e-21	1.959e-16	1.0254	-20.6477
Ni(OH)2 (aq)	1.452e-22	1.337e-17	1.0254	-21.8273
(UO2)2CO3(OH)3-	1.840e-23	1.190e-17	0.7762	-22.8451
Cd2OH+++	5.304e-24	1.274e-18	0.1022	-24.2659
(UO2)3(OH)4++	2.030e-24	1.771e-18	0.3629	-24.1327
Cd(OH)2 (aq)	3.607e-25	5.247e-20	1.0254	-24.4319
Ca2UO2(CO3)3 (aq	9.449e-26	4.977e-20	1.0254	-25.0137
(UO2)3(OH)5+	3.350e-26	2.979e-20	0.7762	-25.5850
O2(aq)	7.273e-27	2.312e-22	1.0254	-26.1274
Be3(OH)3+++	4.646e-27	3.603e-22	0.1022	-27.3233
UO2(CO3)3----	8.096e-28	3.620e-22	0.0173	-28.8525
CaUO2(CO3)3--	5.153e-28	2.509e-22	0.3629	-27.7281
(UO2)3CO3(OH)3+	5.850e-29	5.353e-23	0.7762	-28.3429
Fe(OH)3-	1.455e-29	1.545e-24	0.7762	-28.9471
Cd(CO3)2--	1.032e-30	2.383e-25	0.3629	-30.4264
UO2(OH)4--	6.654e-31	2.235e-25	0.3629	-30.6171
Ni(OH)3-	3.044e-31	3.318e-26	0.7762	-30.6266
(UO2)4(OH)7+	3.652e-35	4.351e-29	0.7762	-34.5475
Cd(OH)3-	7.410e-36	1.203e-30	0.7762	-35.2402
(UO2)3(OH)7-	1.864e-38	1.720e-32	0.7762	-37.8397
Be5(OH)6++++	2.741e-46	4.006e-41	0.0173	-47.3228
Cd(OH)4--	2.568e-47	4.603e-42	0.3629	-47.0306
(UO2)3(CO3)6----	3.706e-51	4.308e-45	0.0001	-54.3928
Be5(OH)7+++	1.532e-51	2.498e-46	0.1022	-51.8052
Be6(OH)8++++	1.293e-58	2.442e-53	0.0173	-59.6493

Mineral saturation states

	log Q/K		log Q/K
Hematite	5.0245s/sat	NiCO3	-10.5902
Fe(OH)2.7Cl.3	3.6653s/sat	Be(OH)2 (alpha)	-10.8404
K-Jarosite	2.0841s/sat	Otavite	-11.0848
Goethite	1.3118s/sat	Be(OH)2 (am)	-11.1404
Lepidocrocite	0.4318s/sat	CdCl2	-11.3240
Magnetite	0.0508s/sat	Magnesioferrite	-11.3539
Gypsum	0.0377s/sat	CdOHCl	-11.5977
Anhydrite	-0.2106	Fe2(SO4)3	-12.2527
Ferrihydrite (ag	-0.8880	Nesquehonite	-12.3910
Ferrihydrite	-1.3980	MgCO3:5H2O	-12.5227
Na-Jarosite	-2.0344	Fe(OH)2 (c)	-13.0437

H-Jarosite	-2.2663	Ni(OH)2 (c)	-13.6233
Epsomite	-2.5113	Fe(OH)2 (am)	-13.6437
Maghemite	-2.7795	Brucite	-15.2016
Melanterite	-4.4809	Ni(OH)2 (am)	-15.7233
Mirabilite	-4.8243	Fe3(OH)8	-16.7717
FeAsO4:2H2O	-4.9893	Mg(OH)2 (active)	-16.8956
Halite	-5.1722	Dolomite (ordere	-16.9657
KCl	-6.0837	Natron	-17.0539
Thenardite	-6.2515	Dolomite (disord	-17.5157
Rutherfordine	-7.1073	Cd(OH)2	-17.7819
Morenosite	-7.2246	Thermonatrite	-18.9943
Retgersite	-7.3287	As2O5	-19.2917
UO2(OH)2 (beta)	-8.2240	Periclase	-19.6848
Calcite	-8.5174	Portlandite	-20.7443
Siderite	-8.5206	Artinite	-24.7626
Schoepite	-8.6073	Mg2(OH)3Cl:4H2O	-26.1289
Aragonite	-8.6611	Ca3(AsO4)2:4H2O	-29.2034
CdSO4:2.67H2O	-8.7975	Lime	-30.7387
CdSO4:1H2O	-8.9430	Cd3OH2(SO4)2	-32.1844
Vaterite	-9.0838	Ni3(AsO4)2:8H2O	-36.9858
Magnesite	-9.5985	Huntite	-38.2046
CaCO3xH2O	-9.8537	Cd3(OH)4SO4	-41.5041
CdCl2:2.5H2O	-10.0719	Cd metal (alpha)	-47.6281
Gummite	-10.2834	Cd metal (gamma)	-47.7314
CdCl2:1H2O	-10.2904	Ni4(OH)6SO4	-49.8635
UO3	-10.3116	Cd4(OH)6SO4	-51.4820
Be(OH)2 (beta)	-10.4404	Hydromagnesite	-57.5728
CdSO4	-10.4960		

Gases	fugacity	log fug.
CO2(g)	0.1552	-0.809
O2(g)	7.298e-24	-23.137
CH4(g)	1.516e-98	-97.819

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	5.30e-05	5.30e-05	0.345			
Be++	3.82e-07	3.82e-07	0.000161			
CO3--	0.109	0.109	307.			
Ca++	0.346	0.346	650.			
Cd++	4.57e-07	4.57e-07	0.00241			
Cl-	0.529	0.529	879.			
Fe+++	0.0713	0.0713	187.			
H+	0.510	0.510	24.1			
H2O	1.18e+03	1.18e+03	9.93e+05			
K+	0.0100	0.0100	18.4			
Mg++	0.280	0.280	319.			
Na+	0.362	0.362	390.			
Ni++	5.25e-06	5.25e-06	0.0144			
O2(aq)	-0.000677	-0.000677	-1.02			
SO4--	0.850	0.850	3.83e+03			
UO2++	1.85e-05	1.85e-05	0.235			

Elemental composition	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg
As	5.297e-05	5.297e-05	0.1860		
Be	3.817e-07	3.817e-07	0.0001612		
C	0.1090	0.1090	61.37		
Ca	0.3462	0.3462	650.4		
Cd	4.566e-07	4.566e-07	0.002406		
Cl	0.5289	0.5289	879.0		
Fe	0.07133	0.07133	186.7		
H	2353.	2353.	1.112e+05		
K	0.01005	0.01005	18.42		
Mg	0.2803	0.2803	319.4		
Na	0.3622	0.3622	390.3		
Ni	5.247e-06	5.247e-06	0.01444		
O	1180.	1180.	8.850e+05		
S	0.8503	0.8503	1278.		
U	1.853e-05	1.853e-05	0.2067		

Temperature = 25.0 C   Pressure = 1.013 bars
pH = 2.681   log fO2 = -22.492
Eh =   0.7376 volts   pe = 12.4684
Ionic strength   =   0.093451
Charge imbalance   =   -0.003495 eq/kg (-3.033% error)
Activity of water   =   0.998386
Solvent mass   =   51.500 kg
Solution mass   =   51.779 kg
Mineral mass   =   0.00000 kg
Solution density   =   1.015   g/cm3
Solution viscosity =   0.009   poise
Chlorinity   =   0.023398 molal
Dissolved solids   =   5395 mg/kg sol'n
Elect. conductivity =   6377.17 uS/cm (or umho/cm)
Hardness   =   2734.78 mg/kg sol'n as CaCO3
  carbonate   =   0.07 mg/kg sol'n as CaCO3
  non-carbonate   =   2734.71 mg/kg sol'n as CaCO3
Carbonate alkalinity=   0.07 mg/kg sol'n as CaCO3
Water type   =   Ca-SO4
Bulk volume   =   5.10e+04 cm3
Fluid volume   =   5.10e+04 cm3
Mineral volume   =   0.000 cm3
Inert volume   =   0.000 cm3
Porosity   =   100. %
Permeability   =   98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.7376	12.4684

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02279	803.8	0.7847	-1.7475
SO4--	0.01727	1650.	0.3792	-2.1839
Na+	0.01524	348.6	0.7847	-1.9222
Ca++	0.01030	410.5	0.3792	-2.4084
Mg++	0.007597	183.7	0.3792	-2.5405
CaSO4 (aq)	0.005732	776.2	1.0218	-2.2323
H2CO3* (aq)	0.005289	326.3	1.0218	-2.2673
MgSO4 (aq)	0.003359	402.1	1.0218	-2.4645
H+	0.002655	2.662	0.7847	-2.6812
HSO4-	0.001687	162.9	0.7847	-2.8782
FeSO4+	0.001071	161.9	0.7847	-3.0754
NaSO4-	0.0005485	64.95	0.7847	-3.3661
K+	0.0003863	15.02	0.7847	-3.5184
MgCl+	0.0002614	15.54	0.7847	-3.6880
CaCl+	0.0002236	16.80	0.7847	-3.7559
NaCl (aq)	0.0001050	6.101	1.0218	-3.9696
Fe(SO4)2-	9.462e-05	23.34	0.7847	-4.1293
FeOH++	8.714e-05	6.314	0.3792	-4.4810

Fe++	6.970e-05	3.872	0.3792	-4.5779
Fe+++	6.400e-05	3.555	0.1128	-5.1415
FeSO4 (aq)	4.157e-05	6.281	1.0218	-4.3718
KSO4-	1.777e-05	2.389	0.7847	-4.8556
FeCl++	1.029e-05	0.9340	0.3792	-5.4089
Fe(OH)2+	3.757e-06	0.3358	0.7847	-5.5305
KCl (aq)	2.660e-06	0.1972	1.0218	-5.5658
HCO3-	1.470e-06	0.08923	0.7847	-5.9379
H2AsO4-	7.998e-07	0.1121	0.7847	-6.2023
Fe2(OH)2++++	7.392e-07	0.1071	0.0207	-7.8159
FeCl+	3.801e-07	0.03452	0.7847	-6.5254
H3AsO4	2.554e-07	0.03605	1.0218	-6.5835
UO2SO4 (aq)	1.938e-07	0.07057	1.0218	-6.7033
Ni++	1.711e-07	0.009992	0.3792	-7.1879
UO2++	1.517e-07	0.04075	0.3792	-7.2401
UO2(SO4)2--	1.033e-07	0.04747	0.3792	-7.4072
NiSO4 (aq)	8.296e-08	0.01277	1.0218	-7.0718
CaHCO3+	7.313e-08	0.007353	0.7847	-7.2412
MgHCO3+	4.934e-08	0.004187	0.7847	-7.4121
Be++	1.318e-08	0.0001181	0.3792	-8.3012
NaHCO3 (aq)	6.772e-09	0.0005658	1.0218	-8.1600
BeSO4 (aq)	4.960e-09	0.0005184	1.0218	-8.2952
Fe3(OH)4+++++	4.384e-09	0.001027	0.0023	-10.9904
Cd++	3.571e-09	0.0003993	0.3792	-8.8683
CdCl+	2.948e-09	0.0004335	0.7847	-8.6358
CdSO4 (aq)	2.034e-09	0.0004218	1.0218	-8.6823
UO2Cl+	1.940e-09	0.0005893	0.7847	-8.8176
NiCl+	5.495e-10	5.146e-05	0.7847	-9.3653
FeHCO3+	4.893e-10	5.687e-05	0.7847	-9.4157
Cd(SO4)2--	4.842e-10	0.0001466	0.3792	-9.7362
Be(SO4)2--	2.198e-10	4.398e-05	0.3792	-10.0791
UO2OH+	1.975e-10	5.640e-05	0.7847	-9.8096
CdCl2 (aq)	1.688e-10	3.078e-05	1.0218	-9.7633
BeCl+	1.572e-10	6.954e-06	0.7847	-9.9087
HAsO4--	8.130e-11	1.131e-05	0.3792	-10.5111
Ni(SO4)2--	4.847e-11	1.209e-05	0.3792	-10.7357
UO2CO3 (aq)	1.840e-11	6.040e-06	1.0218	-10.7258
NiHCO3+	1.177e-11	1.401e-06	0.7847	-11.0347
Be(SO4)3----	8.159e-12	2.412e-06	0.0207	-12.7730
FeOH+	6.470e-12	4.688e-07	0.7847	-11.2944
OH-	6.149e-12	1.040e-07	0.7847	-11.3165
MgOH+	2.889e-12	1.187e-07	0.7847	-11.6445
UO2Cl2 (aq)	1.431e-12	4.852e-07	1.0218	-11.8351
Fe(OH)3 (aq)	7.775e-13	8.264e-08	1.0218	-12.1000
CaOH+	4.791e-13	2.720e-08	0.7847	-12.4249
NiCl2 (aq)	2.617e-13	3.374e-08	1.0218	-12.5728
NaOH (aq)	7.112e-14	2.829e-09	1.0218	-13.1387
MgCO3 (aq)	6.986e-14	5.859e-09	1.0218	-13.1464
CO3--	6.848e-14	4.087e-09	0.3792	-13.5856
CdHCO3+	6.312e-14	1.089e-08	0.7847	-13.3051
CaCO3 (aq)	3.009e-14	2.996e-09	1.0218	-13.5122
(UO2)2OH+++	2.804e-14	1.554e-08	0.1128	-14.4998
UO2(OH)2 (aq)	9.152e-15	2.768e-09	1.0218	-14.0291
Be(OH)2 (aq)	8.249e-15	3.530e-10	1.0218	-14.0742

NaCO3-	7.371e-15	6.085e-10	0.7847	-14.2378
NiOH+	5.023e-15	3.782e-10	0.7847	-14.4044
(UO2)2(OH)2++	4.807e-15	2.745e-09	0.3792	-14.7393
KOH (aq)	2.488e-15	1.388e-10	1.0218	-14.5949
Mg2CO3++	2.211e-15	2.388e-10	0.3792	-15.0767
BeCO3 (aq)	2.283e-16	1.567e-11	1.0218	-15.6322
Be2OH+++	7.057e-17	2.459e-12	0.1128	-17.0990
CdOH+	6.614e-17	8.513e-12	0.7847	-16.2848
NiCO3 (aq)	6.126e-17	7.234e-12	1.0218	-16.2035
UO2(CO3)2--	1.028e-17	3.988e-12	0.3792	-17.4091
Fe(OH)4-	9.679e-18	1.193e-12	0.7847	-17.1195
CdCO3 (aq)	8.067e-19	1.383e-13	1.0218	-18.0839
AsO4---	2.078e-19	2.872e-14	0.1128	-19.6299
UO2(OH)3-	4.536e-20	1.448e-14	0.7847	-19.4486
Fe(OH)2 (aq)	1.904e-20	1.702e-15	1.0218	-19.7109
(UO2)2CO3(OH)3-	1.659e-21	1.075e-15	0.7847	-20.8854
Ni(OH)2 (aq)	1.478e-21	1.363e-16	1.0218	-20.8209
Ca2UO2(CO3)3 (aq	5.333e-23	2.812e-17	1.0218	-22.2637
(UO2)3(OH)4++	3.332e-23	2.910e-17	0.3792	-22.8984
Cd2OH+++	3.122e-24	7.509e-19	0.1128	-24.4532
(UO2)3(OH)5+	1.727e-24	1.538e-18	0.7847	-23.8679
Cd(OH)2 (aq)	1.546e-24	2.252e-19	1.0218	-23.8013
UO2(CO3)3----	3.371e-25	1.509e-19	0.0207	-26.1569
CaUO2(CO3)3--	2.605e-25	1.270e-19	0.3792	-25.0053
Be3(OH)3+++	1.565e-25	1.215e-20	0.1128	-25.7532
O2(aq)	3.220e-26	1.025e-21	1.0218	-25.4828
(UO2)3CO3(OH)3+	3.089e-27	2.830e-21	0.7847	-26.6155
Fe(OH)3-	3.783e-28	4.021e-23	0.7847	-27.5274
Cd(CO3)2--	4.089e-29	9.453e-24	0.3792	-28.8095
UO2(OH)4--	3.184e-29	1.071e-23	0.3792	-28.9181
Ni(OH)3-	9.288e-30	1.014e-24	0.7847	-29.1374
(UO2)4(OH)7+	1.019e-32	1.216e-26	0.7847	-32.0970
Cd(OH)3-	9.516e-35	1.547e-29	0.7847	-34.1268
(UO2)3(OH)7-	8.879e-36	8.206e-30	0.7847	-35.1569
Be5(OH)6++++	2.894e-43	4.234e-38	0.0207	-44.2232
Cd(OH)4--	9.702e-46	1.741e-40	0.3792	-45.4343
(UO2)3(CO3)6----	3.602e-46	4.192e-40	0.0002	-49.2340
Be5(OH)7+++	5.308e-48	8.663e-43	0.1128	-48.2227
Be6(OH)8++++	1.384e-54	2.618e-49	0.0207	-55.5435

Mineral saturation states

	log Q/K		log Q/K
Hematite	7.2202s/sat	Be(OH)2 (am)	-10.1342
Fe(OH)2.7Cl.3	4.6116s/sat	Otavite	-10.4439
K-Jarosite	3.7724s/sat	CdCl2:2.5H2O	-10.4520
Magnetite	3.1832s/sat	CdCl2:1H2O	-10.6708
Goethite	2.4097s/sat	CdSO4	-10.8801
Lepidocrocite	1.5297s/sat	Nesquehonite	-11.4582
Ferrihydrite (ag	0.2100s/sat	CdOHCl	-11.4726
Gypsum	0.0163s/sat	MgCO3:5H2O	-11.5896
Anhydrite	-0.2323	CdCl2	-11.7045
Ferrihydrite	-0.3000	Fe(OH)2 (c)	-12.1069
Na-Jarosite	-0.3114	Ni(OH)2 (c)	-12.6169

Maghemite	-0.5838	Fe(OH)2 (am)	-12.7069
H-Jarosite	-1.0011	Fe2(SO4)3	-13.1004
Epsomite	-2.6029	Fe3(OH)8	-13.6388
Melanterite	-4.5577	Brucite	-14.2795
FeAsO4:2H2O	-4.5728	Ni(OH)2 (am)	-14.7169
Mirabilite	-4.9213	Dolomite (ordere	-15.0301
Halite	-5.2196	Dolomite (disord	-15.5801
KCl	-6.1658	Mg(OH)2 (active)	-15.9735
Thenardite	-6.3500	Natron	-16.1260
Rutherfordine	-6.3636	Cd(OH)2	-17.1513
Morenosite	-7.2318	Thermonatrite	-18.0676
Retgersite	-7.3360	Periclase	-18.7629
UO2(OH)2 (beta)	-7.4907	Portlandite	-19.7514
Calcite	-7.5142	As2O5	-20.6549
Siderite	-7.5735	Artinite	-22.9078
Aragonite	-7.6579	Mg2(OH)3Cl:4H2O	-24.7898
Schoepite	-7.8738	Ca3(AsO4)2:4H2O	-27.5878
Vaterite	-8.0806	Lime	-29.7460
Magnesioferrite	-8.2364	Cd3OH2(SO4)2	-32.3218
Magnesite	-8.6661	Huntite	-34.4044
CaCO3xH2O	-8.8504	Ni3(AsO4)2:8H2O	-35.3290
CdSO4:2.67H2O	-9.1811	Cd3(OH)4SO4	-40.6269
CdSO4:1H2O	-9.3269	Ni4(OH)6SO4	-46.8524
Be(OH)2 (beta)	-9.4342	Cd metal (alpha)	-47.3199
Gummite	-9.5502	Cd metal (gamma)	-47.4232
NiCO3	-9.5735	Cd4(OH)6SO4	-49.9742
UO3	-9.5784	Hydromagnesite	-52.9209
Be(OH)2 (alpha)	-9.8342		

Gases	fugacity	log fug.
CO2(g)	0.1590	-0.799
O2(g)	3.220e-23	-22.492
CH4(g)	7.982e-100	-99.098

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	5.43e-05	5.43e-05	0.146			
Be++	9.54e-07	9.54e-07	0.000166			
CO3--	0.272	0.272	316.			
Ca++	0.837	0.837	648.			
Cd++	4.74e-07	4.74e-07	0.00103			
Cl-	1.20	1.20	825.			
Fe+++	0.0744	0.0744	80.2			
H+	0.758	0.758	14.8			
H2O	2.86e+03	2.86e+03	9.95e+05			
K+	0.0209	0.0209	15.8			
Mg++	0.578	0.578	271.			
Na+	0.819	0.819	364.			
Ni++	1.31e-05	1.31e-05	0.0149			
O2(aq)	-0.00144	-0.00144	-0.888			
SO4--	1.54	1.54	2.86e+03			
UO2++	2.32e-05	2.32e-05	0.121			

Elemental composition	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg
As	5.435e-05	5.435e-05	0.07863		
Be	9.541e-07	9.541e-07	0.0001661		
C	0.2725	0.2725	63.20		
Ca	0.8371	0.8371	648.0		
Cd	4.741e-07	4.741e-07	0.001029		
Cl	1.205	1.205	825.0		
Fe	0.07438	0.07438	80.22		
H	5718.	5718.	1.113e+05		
K	0.02095	0.02095	15.82		
Mg	0.5777	0.5777	271.2		
Na	0.8188	0.8188	363.5		
Ni	1.312e-05	1.312e-05	0.01487		
O	2866.	2866.	8.855e+05		
S	1.541	1.541	954.0		
U	2.322e-05	2.322e-05	0.1068		

Temperature = 25.0 C   Pressure = 1.013 bars
pH = 3.264   log fO2 = -21.588
Eh = 0.7165 volts   pe = 12.1114
Ionic strength = 0.088149
Charge imbalance = -0.003070 eq/kg (-2.853% error)
Activity of water = 0.998499
Solvent mass = 102.01 kg
Solution mass = 102.52 kg
Mineral mass = 0.00000 kg
Solution density = 1.015 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.022856 molal
Dissolved solids = 4976 mg/kg sol'n
Elect. conductivity = 5518.20 uS/cm (or umho/cm)
Hardness = 2664.15 mg/kg sol'n as CaCO3
carbonate = 0.28 mg/kg sol'n as CaCO3
non-carbonate = 2663.87 mg/kg sol'n as CaCO3
Carbonate alkalinity= 0.28 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 1.01e+05 cm3
Fluid volume = 1.01e+05 cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.7165	12.1114

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02228	785.9	0.7880	-1.7556
SO4--	0.01618	1547.	0.3857	-2.2048
Na+	0.01488	340.4	0.7880	-1.9309
Ca++	0.01039	414.4	0.3857	-2.3972
Mg++	0.007191	173.9	0.3857	-2.5570
CaSO4 (aq)	0.005613	760.4	1.0205	-2.2420
H2CO3* (aq)	0.005336	329.3	1.0205	-2.2640
MgSO4 (aq)	0.003086	369.6	1.0205	-2.5018
H+	0.0006907	0.6927	0.7880	-3.2642
NaSO4-	0.0005102	60.44	0.7880	-3.3957
FeSO4+	0.0004368	66.03	0.7880	-3.4631
HSO4-	0.0004182	40.39	0.7880	-3.4821
K+	0.0003649	14.20	0.7880	-3.5413
MgCl+	0.0002459	14.63	0.7880	-3.7126
CaCl+	0.0002242	16.85	0.7880	-3.7527
FeOH++	0.0001409	10.22	0.3857	-4.2648
NaCl (aq)	0.0001011	5.879	1.0205	-3.9865
Fe++	6.700e-05	3.723	0.3857	-4.5877

FeSO4 (aq)	3.879e-05	5.863	1.0205	-4.4025
Fe(SO4)2-	3.677e-05	9.073	0.7880	-4.5379
Fe+++	2.647e-05	1.471	0.1172	-5.5083
Fe(OH)2+	2.356e-05	2.107	0.7880	-4.7313
KSO4-	1.600e-05	2.151	0.7880	-4.8994
HCO3-	5.647e-06	0.3429	0.7880	-5.3516
FeCl++	4.265e-06	0.3875	0.3857	-5.7839
KCl (aq)	2.479e-06	0.1839	1.0205	-5.5969
Fe2(OH)2++++	1.869e-06	0.2710	0.0221	-7.3836
H2AsO4-	5.121e-07	0.07182	0.7880	-6.3941
FeCl+	3.632e-07	0.03300	0.7880	-6.5433
CaHCO3+	2.883e-07	0.02900	0.7880	-6.6437
MgHCO3+	1.824e-07	0.01549	0.7880	-6.8423
Ni++	1.744e-07	0.01019	0.3857	-7.1722
UO2SO4 (aq)	1.312e-07	0.04778	1.0205	-6.8734
UO2++	1.058e-07	0.02842	0.3857	-7.3894
NiSO4 (aq)	8.207e-08	0.01264	1.0205	-7.0770
Fe3(OH)4+++++	6.721e-08	0.01575	0.0026	-9.7588
UO2(SO4)2--	6.540e-08	0.03008	0.3857	-7.5982
H3AsO4	4.295e-08	0.006065	1.0205	-7.3583
NaHCO3 (aq)	2.563e-08	0.002143	1.0205	-7.5824
Be++	1.343e-08	0.0001205	0.3857	-8.2857
BeSO4 (aq)	4.906e-09	0.0005129	1.0205	-8.3005
Cd++	1.941e-09	0.0002171	0.3857	-9.1257
FeHCO3+	1.838e-09	0.0002137	0.7880	-8.8392
CdCl+	1.593e-09	0.0002344	0.7880	-8.9012
UO2Cl+	1.344e-09	0.0004086	0.7880	-8.9750
CdSO4 (aq)	1.073e-09	0.0002226	1.0205	-8.9605
NiCl+	5.568e-10	5.217e-05	0.7880	-9.3577
UO2OH+	5.341e-10	0.0001525	0.7880	-9.3759
Cd(SO4)2--	2.391e-10	7.244e-05	0.3857	-10.0353
Be(SO4)2--	2.035e-10	4.072e-05	0.3857	-10.1053
HAsO4--	1.967e-10	2.739e-05	0.3857	-10.1199
UO2CO3 (aq)	1.929e-10	6.335e-05	1.0205	-9.7058
BeCl+	1.593e-10	7.048e-06	0.7880	-9.9012
CdCl2 (aq)	9.003e-11	1.642e-05	1.0205	-10.0368
NiHCO3+	4.686e-11	5.582e-06	0.7880	-10.4327
Ni(SO4)2--	4.488e-11	1.120e-05	0.3857	-10.7618
FeOH+	2.411e-11	1.748e-06	0.7880	-10.7212
OH-	2.344e-11	3.967e-07	0.7880	-10.7335
Fe(OH)3 (aq)	1.877e-11	1.996e-06	1.0205	-10.7177
MgOH+	1.060e-11	4.359e-07	0.7880	-11.0780
Be(SO4)3----	6.841e-12	2.023e-06	0.0221	-12.8201
CaOH+	1.874e-12	1.065e-07	0.7880	-11.8306
MgCO3 (aq)	9.943e-13	8.343e-08	1.0205	-11.9937
CO3--	9.942e-13	5.936e-08	0.3857	-12.4163
UO2Cl2 (aq)	9.787e-13	3.320e-07	1.0205	-12.0005
CaCO3 (aq)	4.566e-13	4.547e-08	1.0205	-12.3317
NaOH (aq)	2.672e-13	1.063e-08	1.0205	-12.5644
NiCl2 (aq)	2.617e-13	3.376e-08	1.0205	-12.5733
CdHCO3+	1.341e-13	2.313e-08	0.7880	-12.9762
Be(OH)2 (aq)	1.255e-13	5.372e-09	1.0205	-12.8926
NaCO3-	1.062e-13	8.773e-09	0.7880	-13.0772
UO2(OH)2 (aq)	9.525e-14	2.882e-08	1.0205	-13.0123

(UO2)2OH+++	5.198e-14	2.881e-08	0.1172	-14.2152
(UO2)2(OH)2++	3.484e-14	1.990e-08	0.3857	-13.8717
Mg2CO3++	2.974e-14	3.215e-09	0.3857	-13.9404
NiOH+	1.985e-14	1.496e-09	0.7880	-13.8056
KOH (aq)	9.044e-15	5.050e-10	1.0205	-14.0348
BeCO3 (aq)	3.498e-15	2.402e-10	1.0205	-14.4474
UO2(CO3)2--	1.563e-15	6.066e-10	0.3857	-15.2198
NiCO3 (aq)	9.391e-16	1.109e-10	1.0205	-15.0185
Fe(OH)4-	8.897e-16	1.097e-10	0.7880	-15.1542
Be2OH+++	2.794e-16	9.740e-12	0.1172	-16.4848
CdOH+	1.394e-16	1.795e-11	0.7880	-15.9591
CdCO3 (aq)	6.595e-18	1.131e-12	1.0205	-17.1720
AsO4---	1.885e-18	2.606e-13	0.1172	-18.6557
UO2(OH)3-	1.797e-18	5.742e-13	0.7880	-17.8488
(UO2)2CO3(OH)3-	6.886e-19	4.461e-13	0.7880	-18.2655
Fe(OH)2 (aq)	2.732e-19	2.443e-14	1.0205	-18.5546
Ca2UO2(CO3)3 (aq	1.284e-19	6.773e-14	1.0205	-18.8827
Ni(OH)2 (aq)	2.249e-20	2.075e-15	1.0205	-19.6391
(UO2)3(OH)4++	2.510e-21	2.194e-15	0.3857	-21.0140
UO2(CO3)3----	7.192e-22	3.221e-16	0.0221	-22.7984
CaUO2(CO3)3--	6.002e-22	2.927e-16	0.3857	-21.6355
(UO2)3(OH)5+	5.046e-22	4.494e-16	0.7880	-21.4005
Cd(OH)2 (aq)	1.255e-23	1.828e-18	1.0205	-22.8926
Be3(OH)3+++	9.412e-24	7.310e-19	0.1172	-23.9574
Cd2OH+++	3.517e-24	8.463e-19	0.1172	-24.3848
(UO2)3CO3(OH)3+	9.090e-25	8.331e-19	0.7880	-24.1449
O2(aq)	2.583e-25	8.225e-21	1.0205	-24.5790
Fe(OH)3-	2.067e-26	2.198e-21	0.7880	-25.7881
Cd(CO3)2--	4.847e-27	1.121e-21	0.3857	-26.7283
UO2(OH)4--	4.770e-27	1.605e-21	0.3857	-26.7353
Ni(OH)3-	5.381e-28	5.875e-23	0.7880	-27.3726
(UO2)4(OH)7+	3.095e-29	3.693e-23	0.7880	-28.6128
(UO2)3(OH)7-	3.802e-32	3.515e-26	0.7880	-31.5235
Cd(OH)3-	2.940e-33	4.781e-28	0.7880	-32.6351
(UO2)3(CO3)6----	1.143e-39	1.331e-33	0.0002	-42.6661
Be5(OH)6++++	1.019e-39	1.491e-34	0.0221	-40.6471
Cd(OH)4--	1.133e-43	2.034e-38	0.3857	-43.3596
Be5(OH)7+++	7.370e-44	1.204e-38	0.1172	-44.0636
Be6(OH)8++++	7.405e-50	1.401e-44	0.0221	-50.7857

Mineral saturation states

	log Q/K		log Q/K
Hematite	9.9845s/sat	Otavite	-9.5320
Magnetite	7.1037s/sat	CdSO4:1H2O	-9.6050
K-Jarosite	6.1053s/sat	Fe3(OH)8	-9.7181
Fe(OH)2.7Cl.3	5.8165s/sat	Nesquehonite	-10.3053
Goethite	3.7919s/sat	MgCO3:5H2O	-10.4366
Lepidocrocite	2.9119s/sat	CdCl2:2.5H2O	-10.7254
Maghemite	2.1805s/sat	CdCl2:1H2O	-10.9443
Na-Jarosite	2.0357s/sat	Fe(OH)2 (c)	-10.9506
Ferrihydrite (ag	1.5923s/sat	CdOHCl	-11.1550
Ferrihydrite	1.0823s/sat	CdSO4	-11.1583
H-Jarosite	0.7718s/sat	Ni(OH)2 (c)	-11.4351

Gypsum	0.0067s/sat	Fe(OH)2 (am)	-11.5506
Anhydrite	-0.2420	CdCl2	-11.9780
Epsomite	-2.6399	Dolomite (ordere	-12.6968
FeAsO4:2H2O	-3.9653	Brucite	-13.1300
Magnesioferrite	-4.3225	Dolomite (disord	-13.2468
Melanterite	-4.5881	Ni(OH)2 (am)	-13.5351
Mirabilite	-4.9591	Fe2(SO4)3	-13.8968
Halite	-5.2365	Mg(OH)2 (active)	-14.8240
Rutherfordine	-5.3436	Natron	-14.9736
KCl	-6.1969	Cd(OH)2	-16.2426
Calcite	-6.3337	Thermonatrite	-16.9158
Thenardite	-6.3883	Periclase	-17.6134
Siderite	-6.4140	Portlandite	-18.5741
UO2(OH)2 (beta)	-6.4739	Artinite	-20.6053
Aragonite	-6.4774	As2O5	-22.2046
Schoepite	-6.8570	Mg2(OH)3Cl:4H2O	-23.0817
Vaterite	-6.9001	Ca3(AsO4)2:4H2O	-25.6055
Morenosite	-7.2366	Lime	-28.5687
Retgersite	-7.3409	Huntite	-29.7655
Magnesite	-7.5134	Cd3OH2(SO4)2	-31.9696
CaCO3xH2O	-7.6698	Ni3(AsO4)2:8H2O	-33.3332
Be(OH)2 (beta)	-8.2526	Cd3(OH)4SO4	-39.0877
NiCO3	-8.3885	Ni4(OH)6SO4	-43.3123
Gummite	-8.5335	Cd metal (alpha)	-46.8632
UO3	-8.5617	Cd metal (gamma)	-46.9665
Be(OH)2 (alpha)	-8.6526	Hydromagnesite	-47.1600
Be(OH)2 (am)	-8.9526	Cd4(OH)6SO4	-47.5263
CdSO4:2.67H2O	-9.4592		

Gases	fugacity	log fug.
CO2(g)	0.1602	-0.795
O2(g)	2.580e-22	-21.588
CH4(g)	1.253e-101	-100.902

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	5.66e-05	5.66e-05	0.0768			
Be++	1.91e-06	1.91e-06	0.000168			
CO3--	0.545	0.545	319.			
Ca++	1.66	1.66	647.			
Cd++	5.04e-07	5.04e-07	0.000552			
Cl-	2.33	2.33	806.			
Fe+++	0.0795	0.0795	43.3			
H+	1.17	1.17	11.5			
H2O	5.66e+03	5.66e+03	9.95e+05			
K+	0.0391	0.0391	14.9			
Mg++	1.07	1.07	255.			
Na+	1.58	1.58	354.			
Ni++	2.62e-05	2.62e-05	0.0150			
O2(aq)	-0.00271	-0.00271	-0.845			
SO4--	2.69	2.69	2.52e+03			
UO2++	3.11e-05	3.11e-05	0.0818			

Elemental composition	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg
As	5.664e-05	5.664e-05	0.04139		
Be	1.908e-06	1.908e-06	0.0001678		
C	0.5450	0.5450	63.84		
Ca	1.656	1.656	647.2		
Cd	5.036e-07	5.036e-07	0.0005521		
Cl	2.332	2.332	806.3		
Fe	0.07946	0.07946	43.28		
H	1.133e+04	1.133e+04	1.113e+05		
K	0.03910	0.03910	14.91		
Mg	1.073	1.073	254.5		
Na	1.580	1.580	354.3		
Ni	2.623e-05	2.623e-05	0.01502		
O	5675.	5675.	8.856e+05		
S	2.690	2.690	841.4		
U	3.105e-05	3.105e-05	0.07210		

Temperature = 25.0 C   Pressure = 1.013 bars
pH = 4.800   log fO2 = -23.389
Eh = 0.5990 volts   pe = 10.1250
Ionic strength = 0.085495
Charge imbalance = -0.002880 eq/kg (-2.762% error)
Activity of water = 0.998548
Solvent mass = 203.04 kg
Solution mass = 204.01 kg
Mineral mass = 0.00000 kg
Solution density = 1.015 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.022583 molal
Dissolved solids = 4770 mg/kg sol'n
Elect. conductivity = 5196.71 uS/cm (or umho/cm)
Hardness = 2627.89 mg/kg sol'n as CaCO3
carbonate = 9.36 mg/kg sol'n as CaCO3
non-carbonate = 2618.53 mg/kg sol'n as CaCO3
Carbonate alkalinity= 9.36 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 2.01e+05 cm3
Fluid volume = 2.01e+05 cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.5990	10.1250

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02202	776.9	0.7898	-1.7597
SO4--	0.01555	1487.	0.3891	-2.2181
Na+	0.01469	336.1	0.7898	-1.9355
Ca++	0.01045	416.9	0.3891	-2.3908
Mg++	0.006987	169.1	0.3891	-2.5657
CaSO4 (aq)	0.005529	749.1	1.0199	-2.2488
H2CO3* (aq)	0.005164	318.8	1.0199	-2.2785
MgSO4 (aq)	0.002936	351.7	1.0199	-2.5237
NaSO4-	0.0004886	57.89	0.7898	-3.4136
K+	0.0003539	13.77	0.7898	-3.5535
Fe(OH)2+	0.0002834	25.34	0.7898	-3.6502
MgCl+	0.0002383	14.17	0.7898	-3.7254
CaCl+	0.0002249	16.91	0.7898	-3.7505
HCO3-	0.0001873	11.37	0.7898	-3.8300
NaCl (aq)	9.914e-05	5.766	1.0199	-3.9952
Fe++	6.567e-05	3.650	0.3891	-4.5926
FeOH++	4.899e-05	3.552	0.3891	-4.7198
FeSO4 (aq)	3.722e-05	5.628	1.0199	-4.4206

H+	2.005e-05	0.02011	0.7898	-4.8003
KSO4-	1.505e-05	2.025	0.7898	-4.9249
HSO4-	1.178e-05	1.138	0.7898	-5.0315
CaHCO3+	9.702e-06	0.9761	0.7898	-5.1156
MgHCO3+	5.932e-06	0.5037	0.7898	-5.3293
FeSO4+	4.314e-06	0.6522	0.7898	-5.4676
KCl (aq)	2.389e-06	0.1773	1.0199	-5.6133
NaHCO3 (aq)	8.435e-07	0.07052	1.0199	-6.0654
FeCl+	3.550e-07	0.03226	0.7898	-6.5523
Fe(SO4)2-	3.522e-07	0.08693	0.7898	-6.5557
H2AsO4-	2.969e-07	0.04164	0.7898	-6.6299
Fe+++	2.647e-07	0.01471	0.1196	-7.4995
Fe2(OH)2++++	2.219e-07	0.03217	0.0229	-8.2937
Ni++	1.753e-07	0.01025	0.3891	-7.1660
UO2CO3 (aq)	9.472e-08	0.03111	1.0199	-7.0150
Fe3(OH)4+++++	9.425e-08	0.02210	0.0027	-9.5878
NiSO4 (aq)	8.079e-08	0.01244	1.0199	-7.0841
FeHCO3+	6.026e-08	0.007009	0.7898	-7.3224
UO2SO4 (aq)	5.468e-08	0.01992	1.0199	-7.2536
UO2++	4.504e-08	0.01210	0.3891	-7.7564
FeCl++	4.273e-08	0.003882	0.3891	-7.7792
UO2(SO4)2--	2.620e-08	0.01205	0.3891	-7.9917
Be++	1.347e-08	0.0001208	0.3891	-8.2807
UO2OH+	7.867e-09	0.002247	0.7898	-8.2067
Fe(OH)3 (aq)	7.780e-09	0.0008275	1.0199	-8.1005
BeSO4 (aq)	4.816e-09	0.0005036	1.0199	-8.3088
HAsO4--	3.894e-09	0.0005422	0.3891	-8.8196
NiHCO3+	1.576e-09	0.0001878	0.7898	-8.9049
CO3--	1.126e-09	6.722e-05	0.3891	-9.3586
MgCO3 (aq)	1.114e-09	9.350e-05	1.0199	-8.9445
Cd++	1.098e-09	0.0001228	0.3891	-9.3695
CdCl+	8.980e-10	0.0001321	0.7898	-9.1492
UO2(CO3)2--	8.683e-10	0.0003371	0.3891	-9.4713
FeOH+	8.177e-10	5.929e-05	0.7898	-9.1899
OH-	8.038e-10	1.361e-05	0.7898	-9.1973
H3AsO4	7.265e-10	0.0001026	1.0199	-9.1302
CdSO4 (aq)	5.941e-10	0.0001233	1.0199	-9.2176
UO2Cl+	5.707e-10	0.0001735	0.7898	-9.3461
NiCl+	5.581e-10	5.230e-05	0.7898	-9.3558
CaCO3 (aq)	5.296e-10	5.275e-05	1.0199	-9.2675
MgOH+	3.565e-10	1.466e-05	0.7898	-9.5505
Be(SO4)2--	1.919e-10	3.842e-05	0.3891	-10.1268
BeCl+	1.593e-10	7.047e-06	0.7898	-9.9004
Be(OH)2 (aq)	1.500e-10	6.424e-06	1.0199	-9.8153
Cd(SO4)2--	1.271e-10	3.853e-05	0.3891	-10.3056
NaCO3-	1.198e-10	9.895e-06	0.7898	-10.0241
Ca2UO2(CO3)3 (aq	8.470e-11	4.470e-05	1.0199	-10.0635
CaOH+	6.522e-11	3.706e-06	0.7898	-10.2881
CdCl2 (aq)	5.041e-11	9.197e-06	1.0199	-10.2889
UO2(OH)2 (aq)	4.836e-11	1.463e-05	1.0199	-10.3070
Ni(SO4)2--	4.244e-11	1.059e-05	0.3891	-10.7822
Mg2CO3++	3.237e-11	3.499e-06	0.3891	-10.8999
Fe(OH)4-	1.264e-11	1.558e-06	0.7898	-11.0008
NaOH (aq)	9.091e-12	3.619e-07	1.0199	-11.0328

(UO2)2(OH)2++	7.527e-12	4.300e-06	0.3891	-11.5333
Be(SO4)3----	6.093e-12	1.802e-06	0.0229	-12.8549
(UO2)2CO3(OH)3-	5.879e-12	3.809e-06	0.7898	-11.3332
BeCO3 (aq)	4.044e-12	2.778e-07	1.0199	-11.3846
CdHCO3+	2.536e-12	4.377e-07	0.7898	-11.6984
NiCO3 (aq)	1.089e-12	1.286e-07	1.0199	-11.9546
NiOH+	6.904e-13	5.203e-08	0.7898	-12.2634
UO2(CO3)3----	4.444e-13	1.990e-07	0.0229	-13.9920
UO2Cl2 (aq)	4.127e-13	1.400e-07	1.0199	-12.3758
CaUO2(CO3)3--	3.865e-13	1.885e-07	0.3891	-12.8228
(UO2)2OH+++	3.231e-13	1.791e-07	0.1196	-13.4130
KOH (aq)	3.024e-13	1.689e-08	1.0199	-12.5109
NiCl2 (aq)	2.606e-13	3.362e-08	1.0199	-12.5755
UO2(OH)3-	3.127e-14	9.993e-09	0.7898	-13.6073
Be2OH+++	9.631e-15	3.358e-10	0.1196	-14.9387
CdCO3 (aq)	4.299e-15	7.377e-10	1.0199	-14.3581
CdOH+	2.727e-15	3.512e-10	0.7898	-14.6668
(UO2)3(OH)5+	1.914e-15	1.705e-09	0.7898	-14.8206
AsO4---	1.268e-15	1.753e-10	0.1196	-15.8193
Fe(OH)2 (aq)	3.193e-16	2.856e-11	1.0199	-15.4872
(UO2)3(OH)4++	2.752e-16	2.405e-10	0.3891	-15.9703
Ni(OH)2 (aq)	2.696e-17	2.488e-12	1.0199	-16.5607
(UO2)3CO3(OH)3+	3.334e-18	3.056e-12	0.7898	-17.5796
Be3(OH)3+++	3.876e-19	3.011e-14	0.1196	-19.3340
(UO2)4(OH)7+	5.955e-20	7.106e-14	0.7898	-19.3276
Cd(OH)2 (aq)	8.459e-21	1.233e-15	1.0199	-20.0641
Cd(CO3)2--	3.575e-21	8.270e-16	0.3891	-20.8566
UO2(OH)4--	2.833e-21	9.533e-16	0.3891	-20.9576
Fe(OH)3-	8.279e-22	8.805e-17	0.7898	-21.1845
(UO2)3(CO3)6----	1.858e-22	2.164e-16	0.0002	-25.4204
(UO2)3(OH)7-	1.703e-22	1.575e-16	0.7898	-21.8713
Cd2OH+++	3.855e-23	9.277e-18	0.1196	-23.3363
Ni(OH)3-	2.210e-23	2.414e-18	0.7898	-22.7580
O2(aq)	4.089e-27	1.302e-22	1.0199	-26.3798
Cd(OH)3-	6.793e-29	1.105e-23	0.7898	-28.2705
Be5(OH)6++++	1.716e-30	2.512e-25	0.0229	-31.4053
Be5(OH)7+++	4.332e-33	7.075e-28	0.1196	-33.2857
Be6(OH)8++++	1.490e-37	2.819e-32	0.0229	-38.4667
Cd(OH)4--	8.936e-38	1.605e-32	0.3891	-37.4588

Mineral saturation states

	log Q/K		log Q/K
Magnetite	15.4056s/sat	Dolomite (disord	-7.1335
Hematite	15.2189s/sat	Morenosite	-7.2436
K-Jarosite	9.3098s/sat	Nesquehonite	-7.2561
Fe(OH)2.7Cl.3	7.9717s/sat	Retgersite	-7.3479
Maghemite	7.4149s/sat	MgCO3:5H2O	-7.3874
Goethite	6.4092s/sat	Fe(OH)2 (c)	-7.8832
Lepidocrocite	5.5292s/sat	Ni(OH)2 (c)	-8.3567
Na-Jarosite	5.2479s/sat	Fe(OH)2 (am)	-8.4832
Ferrihydrite (ag	4.2095s/sat	CdSO4:2.67H2O	-9.7163
Magnesioferrite	3.9756s/sat	CdSO4:1H2O	-9.8621
Ferrihydrite	3.6995s/sat	CdOHCl	-9.8668

H-Jarosite	2.4525s/sat	Brucite	-10.0663
Gypsum	-0.0001	Ni(OH)2 (am)	-10.4567
Anhydrite	-0.2488	CdCl2:2.5H2O	-10.9775
Fe3(OH)8	-1.4161	CdCl2:1H2O	-11.1963
Rutherfordine	-2.6528	CdSO4	-11.4154
Epsomite	-2.6616	Mg(OH)2 (active)	-11.7603
FeAsO4:2H2O	-3.1200	Natron	-11.9249
Calcite	-3.2695	CdCl2	-12.2301
Siderite	-3.3611	Cd(OH)2	-13.4141
Aragonite	-3.4132	Thermonatrite	-13.8672
UO2(OH)2 (beta)	-3.7686	Artinite	-14.4924
Vaterite	-3.8359	Periclase	-14.5498
Schoepite	-4.1516	Portlandite	-15.4954
Magnesite	-4.4642	Huntite	-17.5539
CaCO3xH2O	-4.6057	Fe2(SO4)3	-17.9189
Melanterite	-4.6061	Mg2(OH)3Cl:4H2O	-18.4945
Mirabilite	-4.9814	Ca3(AsO4)2:4H2O	-19.9134
Be(OH)2 (beta)	-5.1753	Lime	-25.4901
Halite	-5.2452	As2O5	-25.7485
NiCO3	-5.3246	Ni3(AsO4)2:8H2O	-27.6417
Be(OH)2 (alpha)	-5.5753	Cd3OH2(SO4)2	-29.6553
Gummite	-5.8282	Hydromagnesite	-31.8996
UO3	-5.8564	Cd3(OH)4SO4	-33.6878
Be(OH)2 (am)	-5.8753	Ni4(OH)6SO4	-34.0841
KCl	-6.2133	Cd4(OH)6SO4	-39.2980
Thenardite	-6.4108	Cd metal (alpha)	-43.1343
Dolomite (ordere	-6.5835	Cd metal (gamma)	-43.2376
Otavite	-6.7181		

Gases	fugacity	log fug.
CO2(g)	0.1549	-0.810
O2(g)	4.081e-24	-23.389
CH4(g)	4.842e-98	-97.315

	In fluid		Sorbed		Kd
Original basis total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	6.12e-05	6.12e-05	0.0417		
Be++	3.82e-06	3.82e-06	0.000169		
CO3--	1.09	1.09	321.		
Ca++	3.29	3.29	647.		
Cd++	5.62e-07	5.62e-07	0.000310		
Cl-	4.59	4.59	797.		
Fe+++	0.0896	0.0896	24.5		
H+	2.00	2.00	9.87		
H2O	1.13e+04	1.13e+04	9.95e+05		
K+	0.0754	0.0754	14.5		
Mg++	2.06	2.06	246.		
Na+	3.10	3.10	350.		
Ni++	5.24e-05	5.24e-05	0.0151		
O2(aq)	-0.00524	-0.00524	-0.823		
SO4--	4.99	4.99	2.35e+03		
UO2++	4.67e-05	4.67e-05	0.0618		

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	6.122e-05	6.122e-05	0.02248		
Be	3.816e-06	3.816e-06	0.0001686		
C	1.090	1.090	64.16		
Ca	3.292	3.292	646.8		
Cd	5.624e-07	5.624e-07	0.0003098		
Cl	4.585	4.585	796.8		
Fe	0.08961	0.08961	24.53		
H	2.254e+04	2.254e+04	1.114e+05		
K	0.07541	0.07541	14.45		
Mg	2.064	2.064	246.0		
Na	3.102	3.102	349.5		
Ni	5.245e-05	5.245e-05	0.01509		
O	1.129e+04	1.129e+04	8.857e+05		
S	4.990	4.990	784.3		
U	4.672e-05	4.672e-05	0.05451		

Temperature = 25.0 C   Pressure = 1.013 bars
pH = 1.000   log fO2 = -26.357
Eh = 0.7800 volts   pe = 13.1856
Ionic strength = 0.510535
Charge imbalance = -0.042940 eq/kg (-5.747% error)
Activity of water = 0.987889
Solvent mass = 1.0000 kg
Solution mass = 1.0494 kg
Mineral mass = 0.00000 kg
Solution density = 1.035 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.079334 molal
Dissolved solids = 47033 mg/kg sol'n
Elect. conductivity = 64828.27 uS/cm (or umho/cm)
Hardness = 9760.03 mg/kg sol'n as CaCO3
carbonate = 0.00 mg/kg sol'n as CaCO3
non-carbonate = 9760.03 mg/kg sol'n as CaCO3
Carbonate alkalinity= 0.00 mg/kg sol'n as CaCO3
Water type = H-HSO4
Bulk volume = 1.01e+03 cm3
Fluid volume = 1.01e+03 cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.7800	13.1856

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
HSO4-	0.2131	1.971e+04	0.7334	-0.8061
H+	0.1364	131.0	0.7334	-1.0000
Cl-	0.07325	2475.	0.7334	-1.2699
SO4--	0.05568	5097.	0.2893	-1.7930
FeSO4+	0.05460	7904.	0.7334	-1.3975
Na+	0.05291	1159.	0.7334	-1.4111
Mg++	0.04526	1049.	0.2893	-1.8829
MgSO4 (aq)	0.03412	3914.	1.1247	-1.4159
Fe(SO4)2-	0.01186	2804.	0.7334	-2.0604
Ca++	0.009551	364.8	0.2893	-2.5586
CaSO4 (aq)	0.009065	1176.	1.1247	-1.9916
NaSO4-	0.004684	531.4	0.7334	-2.4641
MgCl+	0.003818	217.5	0.7334	-2.5528
K+	0.002500	93.14	0.7334	-2.7368
Fe+++	0.002278	121.2	0.0614	-3.8545
NaCl (aq)	0.0009289	51.73	1.1247	-2.9810
FeCl++	0.0007840	68.21	0.2893	-3.6444
CaCl+	0.0005084	36.59	0.7334	-3.4285

FeSO4 (aq)	0.0003450	49.95	1.1247	-3.4111
Fe++	0.0003393	18.06	0.2893	-4.0081
KSO4-	0.0002829	36.44	0.7334	-3.6831
H3AsO4	4.901e-05	6.630	1.1247	-4.2586
FeOH++	4.559e-05	3.165	0.2893	-4.8798
KCl (aq)	4.388e-05	3.118	1.1247	-4.3067
H2CO3* (aq)	3.379e-05	1.997	1.1247	-4.4201
UO2(SO4)2--	8.770e-06	3.862	0.2893	-5.5957
UO2SO4 (aq)	4.637e-06	1.618	1.1247	-5.2827
FeCl+	4.536e-06	0.3947	0.7334	-5.4780
H2AsO4-	3.767e-06	0.5060	0.7334	-5.5586
UO2++	2.129e-06	0.5478	0.2893	-6.2105
Fe2(OH)2++++	3.476e-07	0.04827	0.0070	-8.6136
CdCl+	1.786e-07	0.02516	0.7334	-6.8828
Cd++	8.825e-08	0.009453	0.2893	-7.5929
CdSO4 (aq)	8.571e-08	0.01703	1.1247	-7.0159
Cd(SO4)2--	7.241e-08	0.02101	0.2893	-7.6789
UO2Cl+	6.672e-08	0.01942	0.7334	-7.3104
Fe(OH)2+	3.308e-08	0.002833	0.7334	-7.6151
CdCl2 (aq)	2.608e-08	0.004555	1.1247	-7.5327
HCO3-	2.305e-10	1.340e-05	0.7334	-9.7719
UO2Cl2 (aq)	1.255e-10	4.078e-05	1.1247	-9.8503
UO2OH+	4.665e-11	1.276e-05	0.7334	-10.4658
MgHCO3+	3.516e-11	2.859e-06	0.7334	-10.5886
Fe3(OH)4+++++	3.119e-11	7.002e-06	0.0004	-13.8726
HAsO4--	9.773e-12	1.303e-06	0.2893	-11.5486
CaHCO3+	8.114e-12	7.817e-07	0.7334	-11.2254
NaHCO3 (aq)	2.924e-12	2.341e-07	1.1247	-11.4829
FeOH+	5.300e-13	3.680e-08	0.7334	-12.4104
MgOH+	2.897e-13	1.141e-08	0.7334	-12.6727
FeHCO3+	2.849e-13	3.173e-08	0.7334	-12.6799
OH-	1.356e-13	2.198e-09	0.7334	-13.0023
(UO2)2OH+++	1.218e-13	6.466e-08	0.0614	-14.1263
CaOH+	7.478e-15	4.068e-10	0.7334	-14.2609
NaOH (aq)	4.321e-15	1.647e-10	1.1247	-14.3134
UO2CO3 (aq)	5.464e-16	1.718e-10	1.1247	-15.2114
(UO2)2(OH)2++	3.069e-16	1.679e-10	0.2893	-16.0516
KOH (aq)	2.818e-16	1.507e-11	1.1247	-15.4991
CdHCO3+	1.866e-16	3.084e-11	0.7334	-15.8638
Fe(OH)3 (aq)	1.198e-16	1.220e-11	1.1247	-15.8704
UO2(OH)2 (aq)	3.783e-17	1.096e-11	1.1247	-16.3711
CdOH+	2.751e-17	3.392e-12	0.7334	-16.6952
MgCO3 (aq)	8.808e-19	7.078e-14	1.1247	-18.0041
CO3--	2.741e-19	1.567e-14	0.2893	-19.1008
Mg2CO3++	1.828e-19	1.892e-14	0.2893	-19.2767
NaCO3-	7.811e-20	6.178e-15	0.7334	-19.2419
CaCO3 (aq)	5.906e-20	5.634e-15	1.1247	-19.1776
AsO4---	7.300e-22	9.665e-17	0.0614	-22.3486
CdCO3 (aq)	4.219e-23	6.931e-18	1.1247	-22.3238
Cd2OH+++	4.206e-23	9.691e-18	0.0614	-23.5882
Fe(OH)4-	3.622e-23	4.276e-18	0.7334	-22.5757
Fe(OH)2 (aq)	2.731e-23	2.338e-18	1.1247	-22.5127
UO2(OH)3-	4.553e-24	1.393e-18	0.7334	-23.4764
Cd(OH)2 (aq)	1.126e-26	1.571e-21	1.1247	-25.8975

(UO2)3(OH)4++	9.682e-27	8.102e-21	0.2893	-26.5527
UO2(CO3)2--	1.345e-27	4.999e-22	0.2893	-27.4100
(UO2)3(OH)5+	8.447e-30	7.205e-24	0.7334	-29.2080
(UO2)2CO3(OH)3-	5.444e-30	3.378e-24	0.7334	-29.3987
O2(aq)	3.989e-30	1.216e-25	1.1247	-29.3481
Fe(OH)3-	1.317e-32	1.342e-27	0.7334	-32.0150
(UO2)3CO3(OH)3+	1.085e-34	9.524e-29	0.7334	-34.0992
UO2(OH)4--	8.072e-35	2.600e-29	0.2893	-34.6317
Cd(OH)3-	1.682e-38	2.620e-33	0.7334	-37.9088
Cd(CO3)2--	9.420e-39	2.086e-33	0.2893	-38.5646
Ca2UO2(CO3)3 (aq	7.392e-39	3.735e-33	1.1247	-38.0802
UO2(CO3)3----	3.031e-40	1.300e-34	0.0070	-41.6730
(UO2)4(OH)7+	2.268e-40	2.591e-34	0.7334	-39.7791
CaUO2(CO3)3--	7.363e-41	3.439e-35	0.2893	-40.6716
(UO2)3(OH)7-	1.845e-44	1.634e-38	0.7334	-43.8686
Cd(OH)4--	4.331e-51	7.446e-46	0.2893	-50.9021
(UO2)3(CO3)6----	4.087e-75	4.558e-69	0.0000	-79.2365

Mineral saturation states

	log Q/K		log Q/K
Fe(OH)2.7Cl.3	1.4903s/sat	Calcite	-13.1796
Gypsum	0.2478s/sat	Aragonite	-13.3233
Anhydrite	0.0084s/sat	Magnesite	-13.5238
Hematite	-0.3069	Vaterite	-13.7460
K-Jarosite	-0.9180	CaCO3xH2O	-14.5204
Goethite	-1.3561	Otavite	-14.6838
Epsomite	-1.5865	Fe(OH)2 (c)	-14.9087
Lepidocrocite	-2.2361	Fe(OH)2 (am)	-15.5087
Mirabilite	-3.5541	As2O5	-15.9914
Ferrihydrite (ag	-3.5604	Nesquehonite	-16.3296
Melanterite	-3.6291	MgCO3:5H2O	-16.4702
Ferrihydrite	-4.0704	Brucite	-16.9935
Halite	-4.2310	Magnesioferrite	-18.4728
H-Jarosite	-4.7965	Mg(OH)2 (active)	-18.6875
KCl	-4.9067	Cd(OH)2	-19.2475
Thenardite	-4.9369	Natron	-20.6650
Na-Jarosite	-5.2723	Periclase	-21.4723
FeAsO4:2H2O	-6.0137	Thermonatrite	-22.5653
Magnetite	-7.1411	Portlandite	-23.2732
CdSO4:2.67H2O	-7.5270	Fe3(OH)8	-23.9814
CdSO4:1H2O	-7.6651	Dolomite (ordere	-25.5532
Maghemite	-8.1109	Dolomite (disord	-26.1032
CdCl2:2.5H2O	-8.2329	Mg2(OH)3Cl:4H2O	-28.0728
CdCl2:1H2O	-8.4448	Artinite	-30.4932
CdSO4	-9.2137	Cd3OH2(SO4)2	-31.0853
Fe2(SO4)3	-9.3536	Lime	-33.2632
CdCl2	-9.4739	Ca3(AsO4)2:4H2O	-33.4942
UO2(OH)2 (beta)	-9.8327	Cd3(OH)4SO4	-43.1529
Schoepite	-10.2204	Cd metal (alpha)	-47.4789
Rutherfordine	-10.8492	Cd metal (gamma)	-47.5822
CdOHCl	-11.4054	Cd4(OH)6SO4	-54.5965
Gummite	-11.8876	Huntite	-54.6427
UO3	-11.9158	Hydromagnesite	-75.0838

Siderite -12.5189

Gases	fugacity	log fug.
CO2(g)	0.001130	-2.947
O2(g)	4.391e-27	-26.357
CH4(g)	2.987e-94	-93.525

Original basis	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg	Kd L/kg
AsO4---	5.28e-05	5.28e-05	6.99			
CO3--	3.38e-05	3.38e-05	1.93			
Ca++	0.0191	0.0191	730.			
Cd++	4.51e-07	4.51e-07	0.0483			
Cl-	0.0793	0.0793	2.68e+03			
Fe+++	0.0703	0.0703	3.74e+03			
H+	0.349	0.349	335.			
H2O	55.5	55.5	9.53e+05			
K+	0.00283	0.00283	105.			
Mg++	0.0832	0.0832	1.93e+03			
Na+	0.0585	0.0585	1.28e+03			
O2(aq)	-0.000172	-0.000172	-5.25			
SO4--	0.396	0.396	3.62e+04			
UO2++	1.56e-05	1.56e-05	4.02			

Elemental composition	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg
As	5.278e-05	5.278e-05	3.768		
C	3.379e-05	3.379e-05	0.3868		
Ca	0.01912	0.01912	730.5		
Cd	4.510e-07	4.510e-07	0.04831		
Cl	0.07933	0.07933	2680.		
Fe	0.07026	0.07026	3739.		
H	111.4	111.4	1.070e+05		
K	0.002826	0.002826	105.3		
Mg	0.08320	0.08320	1928.		
Na	0.05853	0.05853	1282.		
O	57.09	57.09	8.705e+05		
S	0.3956	0.3956	1.209e+04		
U	1.560e-05	1.560e-05	3.539		

Temperature = 25.0 C Pressure = 1.013 bars
pH = 2.970 log fO2 = -39.139
Eh = 0.4744 volts pe = 8.0196
Ionic strength = 0.578358
Charge imbalance = -0.398920 eq/kg (-62.65% error)
Activity of water = 0.990997
Solvent mass = 1.0000 kg
Solution mass = 1.0450 kg
Mineral mass = 0.00000 kg
Solution density = 1.033 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.082176 molal
Dissolved solids = 43102 mg/kg sol'n
Elect. conductivity = 26811.25 uS/cm (or umho/cm)
Hardness = 5939.84 mg/kg sol'n as CaCO3
carbonate = 0.00 mg/kg sol'n as CaCO3
non-carbonate = 5939.84 mg/kg sol'n as CaCO3
Carbonate alkalinity= 0.00 mg/kg sol'n as CaCO3
Water type = Na-SO4
Bulk volume = 1.01e+03 cm3
Fluid volume = 1.01e+03 cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.4744	8.0196

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
SO4--	0.2155	1.981e+04	0.2963	-1.1949
Cl-	0.07948	2696.	0.7378	-1.2318
FeSO4 (aq)	0.06252	9087.	1.1424	-1.1462
Na+	0.05910	1300.	0.7378	-1.3604
MgSO4 (aq)	0.03786	4360.	1.1424	-1.3640
NaSO4-	0.02074	2362.	0.7378	-1.8153
Fe++	0.01538	821.8	0.2963	-2.3413
Mg++	0.01256	292.2	0.2963	-2.4292
HSO4-	0.008997	835.7	0.7378	-2.1780
CaSO4 (aq)	0.008149	1062.	1.1424	-2.0311
Ca++	0.002148	82.37	0.2963	-3.1962
K+	0.001921	71.90	0.7378	-2.8484
H+	0.001452	1.401	0.7378	-2.9700
MgCl+	0.001178	67.36	0.7378	-3.0610
NaCl (aq)	0.001122	62.74	1.1424	-2.8922
KSO4-	0.0008619	111.5	0.7378	-3.1966
FeCl+	0.0002285	19.97	0.7378	-3.7731
CaCl+	0.0001271	9.185	0.7378	-4.0280

FeSO4+	6.815e-05	9.906	0.7378	-4.2986
Fe(SO4)2-	5.869e-05	13.93	0.7378	-4.3635
KCl (aq)	3.647e-05	2.602	1.1424	-4.3802
H2CO3* (aq)	3.369e-05	2.000	1.1424	-4.4147
UO2(SO4)2--	2.445e-05	10.81	0.2963	-5.1399
H2AsO4-	2.028e-05	2.735	0.7378	-4.8249
NiSO4 (aq)	1.614e-05	2.390	1.1424	-4.7344
BeSO4 (aq)	1.456e-05	1.464	1.1424	-4.7789
Be(SO4)2--	9.004e-06	1.733	0.2963	-5.5738
Be(SO4)3----	6.827e-06	1.941	0.0077	-7.2786
Be++	5.677e-06	0.04896	0.2963	-5.7741
Ni++	4.883e-06	0.2743	0.2963	-5.8395
UO2SO4 (aq)	3.290e-06	1.152	1.1424	-5.4250
H3AsO4	2.801e-06	0.3804	1.1424	-5.4949
FeOH++	1.320e-06	0.09201	0.2963	-6.4077
Cd(SO4)2--	1.139e-06	0.3318	0.2963	-6.4718
Fe+++	6.835e-07	0.03652	0.0648	-7.3538
UO2++	3.778e-07	0.09761	0.2963	-6.9510
CdSO4 (aq)	3.429e-07	0.06841	1.1424	-6.4070
FeCl++	2.647e-07	0.02312	0.2963	-7.1055
CdCl+	1.987e-07	0.02811	0.7378	-6.8339
BeCl+	1.846e-07	0.007854	0.7378	-6.8658
Ni(SO4)2--	1.315e-07	0.03157	0.2963	-7.4092
Fe(OH)2+	9.129e-08	0.007850	0.7378	-7.1716
Cd++	8.833e-08	0.009500	0.2963	-7.5821
NiCl+	4.273e-08	0.003850	0.7378	-7.5013
CdCl2 (aq)	3.137e-08	0.005502	1.1424	-7.4457
HCO3-	2.166e-08	0.001264	0.7378	-7.7965
UO2Cl+	1.316e-08	0.003847	0.7378	-8.0128
HAsO4--	4.823e-09	0.0006457	0.2963	-8.8449
FeOH+	2.290e-09	0.0001596	0.7378	-8.7723
FeHCO3+	1.243e-09	0.0001390	0.7378	-9.0377
MgHCO3+	9.391e-10	7.668e-05	0.7378	-9.1593
UO2OH+	7.891e-10	0.0002167	0.7378	-9.2349
NaHCO3 (aq)	3.057e-10	2.458e-05	1.1424	-9.4568
Fe2(OH)2++++	2.776e-10	3.871e-05	0.0077	-11.6694
CaHCO3+	1.756e-10	1.699e-05	0.7378	-9.8876
NiCl2 (aq)	5.612e-11	6.960e-06	1.1424	-10.1931
Be2OH+++	2.688e-11	9.010e-07	0.0648	-11.7591
UO2Cl2 (aq)	2.677e-11	8.733e-06	1.1424	-10.5145
OH-	1.262e-11	2.054e-07	0.7378	-11.0309
Be(OH)2 (aq)	9.252e-12	3.809e-07	1.1424	-10.9759
MgOH+	7.664e-12	3.030e-07	0.7378	-11.2476
NiHCO3+	3.865e-12	4.428e-07	0.7378	-11.5449
UO2CO3 (aq)	8.624e-13	2.724e-07	1.1424	-12.0064
NaOH (aq)	4.475e-13	1.713e-08	1.1424	-12.2914
(UO2)2OH+++	3.569e-13	1.903e-07	0.0648	-13.6359
NiOH+	2.299e-13	1.666e-08	0.7378	-12.7704
CaOH+	1.603e-13	8.756e-09	0.7378	-12.9271
(UO2)2(OH)2++	8.678e-14	4.767e-08	0.2963	-13.5898
Fe3(OH)4+++++	6.552e-14	1.477e-08	0.0005	-16.4850
UO2(OH)2 (aq)	5.934e-14	1.726e-08	1.1424	-13.1688
Fe(OH)3 (aq)	3.066e-14	3.136e-09	1.1424	-13.4555
KOH (aq)	2.008e-14	1.078e-09	1.1424	-13.6393

CdHCO3+	1.797e-14	2.982e-09	0.7378	-13.8775
CdOH+	2.624e-15	3.250e-10	0.7378	-14.7130
CO3--	2.360e-15	1.355e-10	0.2963	-15.1554
MgCO3 (aq)	2.174e-15	1.754e-10	1.1424	-14.6048
BeCO3 (aq)	1.851e-15	1.222e-10	1.1424	-14.6748
NaCO3-	7.696e-16	6.112e-11	0.7378	-15.2458
Mg2CO3++	1.272e-16	1.322e-11	0.2963	-16.4237
CaCO3 (aq)	1.181e-16	1.131e-11	1.1424	-15.8698
Be3(OH)3+++	7.473e-17	5.582e-12	0.0648	-17.3150
NiCO3 (aq)	3.291e-17	3.738e-12	1.1424	-16.4249
AsO4---	3.263e-17	4.337e-12	0.0648	-17.6749
Fe(OH)2 (aq)	1.094e-17	9.406e-13	1.1424	-16.9032
Fe(OH)4-	8.762e-19	1.039e-13	0.7378	-18.1895
UO2(OH)3-	6.750e-19	2.074e-13	0.7378	-18.3028
CdCO3 (aq)	3.756e-19	6.196e-14	1.1424	-18.3675
Ni(OH)2 (aq)	1.098e-19	9.747e-15	1.1424	-18.9014
UO2(CO3)2--	1.857e-20	6.929e-15	0.2963	-20.2595
(UO2)3(OH)4++	4.361e-21	3.664e-15	0.2963	-20.8886
Cd2OH+++	3.920e-21	9.071e-16	0.0648	-21.5951
(UO2)2CO3(OH)3-	1.294e-21	8.062e-16	0.7378	-21.0201
(UO2)3(OH)5+	3.626e-22	3.106e-16	0.7378	-21.5726
Cd(OH)2 (aq)	9.959e-23	1.395e-17	1.1424	-21.9440
Fe(OH)3-	4.988e-25	5.101e-20	0.7378	-24.4341
(UO2)3CO3(OH)3+	4.688e-27	4.132e-21	0.7378	-26.4611
Ni(OH)3-	1.584e-27	1.663e-22	0.7378	-26.9323
UO2(OH)4--	1.100e-27	3.559e-22	0.2963	-27.4867
Be5(OH)6++++	1.734e-28	2.440e-23	0.0077	-29.8739
Ca2UO2(CO3)3 (aq	4.816e-29	2.443e-23	1.1424	-28.2595
UO2(CO3)3----	3.434e-29	1.479e-23	0.0077	-30.5771
(UO2)4(OH)7+	1.551e-29	1.780e-23	0.7378	-28.9414
CaUO2(CO3)3--	2.065e-30	9.686e-25	0.2963	-30.2133
Cd(CO3)2--	7.335e-31	1.631e-25	0.2963	-30.6628
Cd(OH)3-	1.407e-32	2.200e-27	0.7378	-31.9839
(UO2)3(OH)7-	6.944e-33	6.174e-27	0.7378	-32.2904
Be5(OH)7+++	3.987e-33	6.261e-28	0.0648	-33.5878
Be6(OH)8++++	1.040e-36	1.892e-31	0.0077	-38.0958
O2(aq)	6.495e-43	1.989e-38	1.1424	-42.1296
Cd(OH)4--	3.330e-43	5.749e-38	0.2963	-43.0058
(UO2)3(CO3)6----	9.307e-54	1.042e-47	0.0000	-57.7851

Mineral saturation states

	log Q/K		log Q/K
Hematite	4.5187s/sat	NiCO3	-9.7949
Fe(OH)2.7Cl.3	3.3251s/sat	Calcite	-9.8718
Magnetite	3.2926s/sat	Fe(OH)2 (am)	-9.8992
K-Jarosite	1.4970s/sat	Aragonite	-10.0155
Goethite	1.0574s/sat	Magnesite	-10.1245
Gypsum	0.2111s/sat	Magnesioferrite	-10.2521
Lepidocrocite	0.1774s/sat	Vaterite	-10.4382
Anhydrite	-0.0311	Ni(OH)2 (c)	-10.6974
Ferrihydrite (ag	-1.1455	Otavite	-10.7275
Melanterite	-1.3547	CaCO3xH2O	-11.2112
Epsomite	-1.5250	Ni(OH)2 (am)	-12.7974

Ferrihydrite	-1.6555	Nesquehonite	-12.9263
Na-Jarosite	-2.6950	MgCO3:5H2O	-13.0642
Mirabilite	-2.8410	Fe3(OH)8	-13.5423
Maghemite	-3.2853	Brucite	-13.5970
Halite	-4.1422	Fe2(SO4)3	-14.5578
Thenardite	-4.2374	Mg(OH)2 (active)	-15.2910
H-Jarosite	-4.2385	Cd(OH)2	-15.2940
FeAsO4:2H2O	-4.8365	Natron	-16.6045
Morenosite	-4.9170	Periclase	-18.0772
KCl	-4.9802	As2O5	-18.4681
Retgersite	-5.0179	Thermonatrite	-18.5172
Be(OH)2 (beta)	-6.3359	Dolomite (ordere	-18.8461
UO2(OH)2 (beta)	-6.6304	Dolomite (disord	-19.3961
Be(OH)2 (alpha)	-6.7359	Portlandite	-19.9681
Siderite	-6.9067	Mg2(OH)3Cl:4H2O	-23.2076
CdSO4:2.67H2O	-6.9144	Artinite	-23.6934
Schoepite	-7.0168	Cd3OH2(SO4)2	-25.9139
Be(OH)2 (am)	-7.0359	Ca3(AsO4)2:4H2O	-26.0542
CdSO4:1H2O	-7.0548	Ni3(AsO4)2:8H2O	-27.3998
Rutherfordine	-7.6442	Lime	-29.9594
CdCl2:2.5H2O	-8.1425	Cd3(OH)4SO4	-34.6369
CdCl2:1H2O	-8.3564	Cd metal (alpha)	-37.1359
CdSO4	-8.6048	Cd metal (gamma)	-37.2392
Gummite	-8.6867	Ni4(OH)6SO4	-38.7565
UO3	-8.7149	Huntite	-41.1372
Fe(OH)2 (c)	-9.2992	Cd4(OH)6SO4	-42.1268
CdOHCl	-9.3851	Hydromagnesite	-58.0849
CdCl2	-9.3869		

Gases	fugacity	log fug.
CO2(g)	0.001141	-2.943
O2(g)	7.261e-40	-39.139
CH4(g)	1.109e-68	-67.955

	In fluid		Sorbed		Kd
Original basis total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	2.31e-05	2.31e-05	3.07		
Be++	3.63e-05	3.63e-05	0.313		
CO3--	3.37e-05	3.37e-05	1.94		
Ca++	0.0104	0.0104	400.		
Cd++	1.80e-06	1.80e-06	0.194		
Cl-	0.0822	0.0822	2.79e+03		
Fe+++	0.0783	0.0783	4.18e+03		
H+	-0.0676	-0.0676	-65.2		
H2O	55.5	55.5	9.58e+05		
K+	0.00282	0.00282	106.		
Mg++	0.0516	0.0516	1.20e+03		
Na+	0.0810	0.0810	1.78e+03		
Ni++	2.12e-05	2.12e-05	1.19		
O2(aq)	-0.0195	-0.0195	-598.		
SO4--	0.355	0.355	3.26e+04		
UO2++	2.81e-05	2.81e-05	7.27		

Elemental composition	In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg

Element	total moles	moles	mg/kg	moles	mg/kg
As	2.309e-05	2.309e-05	1.655		
Be	3.626e-05	3.626e-05	0.3127		
C	3.371e-05	3.371e-05	0.3875		
Ca	0.01042	0.01042	399.8		
Cd	1.800e-06	1.800e-06	0.1936		
Cl	0.08218	0.08218	2788.		
Fe	0.07825	0.07825	4182.		
H	111.0	111.0	1.071e+05		
K	0.002820	0.002820	105.5		
Mg	0.05159	0.05159	1200.		
Na	0.08096	0.08096	1781.		
Ni	2.119e-05	2.119e-05	1.191		
O	56.93	56.93	8.716e+05		
S	0.3549	0.3549	1.089e+04		
U	2.813e-05	2.813e-05	6.408		

APPENDIX H

Precipitation Models

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 2.880 log fO2 = -19.951
Eh = 0.7634 volts pe = 12.9050
Ionic strength = 0.111393
Activity of water = 0.998135
Solvent mass = 1.0000 kg
Solution mass = 1.0059 kg
Mineral mass = 0.00000 kg
Solution density = 1.016 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.029894 molal
Dissolved solids = 5897 mg/kg sol'n
Elect. conductivity = 7218.63 uS/cm (or umho/cm)
Hardness = 3395.03 mg/kg sol'n as CaCO3
carbonate = 0.00 mg/kg sol'n as CaCO3
non-carbonate = 3395.03 mg/kg sol'n as CaCO3
Carbonate alkalinity= 0.00 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 991. cm3
Fluid volume = 991. cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.7634	12.9050

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02897	1021.	0.7749	-1.6489
Na+	0.02280	521.0	0.7749	-1.7529
SO4--	0.01942	1854.	0.3605	-2.1549
Ca++	0.01231	490.7	0.3605	-2.3527
Mg++	0.009767	236.1	0.3605	-2.4533
CaSO4 (aq)	0.006938	939.0	1.0260	-2.1476
MgSO4 (aq)	0.004371	523.1	1.0260	-2.3482
H+	0.001701	1.705	0.7749	-2.8800
HSO4-	0.001155	111.5	0.7749	-3.0480
NaSO4-	0.0008769	103.8	0.7749	-3.1678
MgCl+	0.0004061	24.13	0.7749	-3.5022
CaCl+	0.0003230	24.26	0.7749	-3.6015

K+	0.0003114	12.10	0.7749	-3.6175
NaCl (aq)	0.0001937	11.25	1.0260	-3.7017
FeSO4+	9.672e-05	14.61	0.7749	-4.1252
H2CO3* (aq)	1.650e-05	1.017	1.0260	-4.7714
KSO4-	1.531e-05	2.057	0.7749	-4.9258
FeOH++	1.208e-05	0.8747	0.3605	-5.3611
Fe(SO4)2-	9.133e-06	2.251	0.7749	-5.1502
Fe+++	5.979e-06	0.3320	0.1007	-6.2203
KCl (aq)	2.645e-06	0.1961	1.0260	-5.5664
Fe++	2.238e-06	0.1242	0.3605	-6.0933
FeSO4 (aq)	1.351e-06	0.2040	1.0260	-5.8582
Ni++	1.196e-06	0.06982	0.3605	-6.3653
FeCl++	1.132e-06	0.1028	0.3605	-6.3892
Be++	1.095e-06	0.009810	0.3605	-6.4037
UO2SO4 (aq)	9.522e-07	0.3465	1.0260	-6.0101
Fe(OH)2+	7.922e-07	0.07077	0.7749	-6.2119
UO2++	7.363e-07	0.1977	0.3605	-6.5760
NiSO4 (aq)	5.870e-07	0.09032	1.0260	-6.2202
UO2(SO4)2--	5.728e-07	0.2632	0.3605	-6.6851
BeSO4 (aq)	4.171e-07	0.04357	1.0260	-6.3686
Be(SO4)2--	2.087e-08	0.004173	0.3605	-8.1236
BeCl+	1.578e-08	0.0006977	0.7749	-7.9125
Fe2(OH)2++++	1.571e-08	0.002275	0.0169	-9.5762
Cd++	1.480e-08	0.001653	0.3605	-8.2729
CdCl+	1.476e-08	0.002169	0.7749	-7.9418
FeCl+	1.474e-08	0.001338	0.7749	-7.9422
UO2Cl+	1.137e-08	0.003454	0.7749	-8.0549

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Hematite	6.2550s/sat	Anhydrite	-0.1476
Fe(OH)2.7Cl.3	4.0989s/sat	Ferrihydrite (ag	-0.2727
Goethite	1.9271s/sat	Ferrihydrite	-0.7827
K-Jarosite	1.6868s/sat	Maghemite	-1.5490
Magnetite	1.1001s/sat	Na-Jarosite	-2.1285
Lepidocrocite	1.0471s/sat	Epsomite	-2.4874
Gypsum	0.1008s/sat		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.0004982	-3.303
O2(g)	1.119e-20	-19.951
CH4(g)	2.067e-107	-106.685

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	1.19e-08	1.19e-08	0.00164			
Be++	1.55e-06	1.55e-06	0.0139			
CO3--	1.65e-05	1.65e-05	0.985			
Ca++	0.0196	0.0196	780.			

Cd++	4.14e-08	4.14e-08	0.00463
Cl-	0.0299	0.0299	1.05e+03
Fe+++	0.000129	0.000129	7.19
H+	0.00287	0.00287	2.88
H2O	55.5	55.5	9.94e+05
K+	0.000329	0.000329	12.8
Mg++	0.0145	0.0145	352.
Na+	0.0239	0.0239	546.
Ni++	1.79e-06	1.79e-06	0.104
O2(aq)	-9.01e-07	-9.01e-07	-0.0287
SO4--	0.0329	0.0329	3.14e+03
UO2++	2.27e-06	2.27e-06	0.610

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	1.190e-08	1.190e-08	0.0008862		
Be	1.550e-06	1.550e-06	0.01388		
C	1.651e-05	1.651e-05	0.1971		
Ca	0.01958	0.01958	780.0		
Cd	4.142e-08	4.142e-08	0.004628		
Cl	0.02989	0.02989	1054.		
Fe	0.0001295	0.0001295	7.188		
H	111.0	111.0	1.112e+05		
K	0.0003293	0.0003293	12.80		
Mg	0.01454	0.01454	351.5		
Na	0.02387	0.02387	545.5		
Ni	1.788e-06	1.788e-06	0.1044		
O	55.64	55.64	8.850e+05		
S	0.03289	0.03289	1048.		
U	2.274e-06	2.274e-06	0.5381		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 4.490 log fO2 = -29.354
Eh = 0.5291 volts pe = 8.9442
Ionic strength = 0.122602
Activity of water = 0.997997
Solvent mass = 1.0000 kg
Solution mass = 1.0066 kg
Mineral mass = 0.00000 kg
Solution density = 1.016 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.031303 molal
Dissolved solids = 6573 mg/kg sol'n
Elect. conductivity = 7206.10 uS/cm (or umho/cm)
Hardness = 3939.28 mg/kg sol'n as CaCO3
  carbonate = 0.01 mg/kg sol'n as CaCO3
  non-carbonate = 3939.26 mg/kg sol'n as CaCO3
Carbonate alkalinity= 0.01 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 991. cm3
Fluid volume = 991. cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.5291	8.9442

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.03026	1066.	0.7697	-1.6328
Na+	0.02403	548.7	0.7697	-1.7330
SO4--	0.02205	2104.	0.3509	-2.1114
Ca++	0.01467	584.0	0.3509	-2.2885
Mg++	0.01031	248.9	0.3509	-2.4417
CaSO4 (aq)	0.008869	1199.	1.0286	-2.0399
MgSO4 (aq)	0.004950	591.9	1.0286	-2.2931
NaSO4-	0.001022	120.8	0.7697	-3.1044
MgCl+	0.0004357	25.87	0.7697	-3.4745
CaCl+	0.0003912	29.36	0.7697	-3.5213
K+	0.0002956	11.48	0.7697	-3.6430
NaCl (aq)	0.0002099	12.18	1.0286	-3.6658

Fe++	0.0001371	7.604	0.3509	-4.3179
FeSO4 (aq)	8.880e-05	13.40	1.0286	-4.0393
H+	4.204e-05	0.04210	0.7697	-4.4900
HSO4-	3.156e-05	3.044	0.7697	-4.6145
H2CO3* (aq)	1.618e-05	0.9970	1.0286	-4.7788
KSO4-	1.607e-05	2.158	0.7697	-4.9077
Fe(OH)2+	8.635e-06	0.7709	0.7697	-5.1774
FeOH++	3.298e-06	0.2387	0.3509	-5.9366
KCl (aq)	2.582e-06	0.1912	1.0286	-5.5758
Ni++	2.128e-06	0.1241	0.3509	-6.1269
NiSO4 (aq)	1.120e-06	0.1723	1.0286	-5.9383
FeCl+	9.183e-07	0.08329	0.7697	-6.1507
Be++	8.869e-07	0.007940	0.3509	-6.5070
UO2SO4 (aq)	7.693e-07	0.2798	1.0286	-6.1017
FeSO4+	7.024e-07	0.1060	0.7697	-6.2671
UO2++	5.543e-07	0.1487	0.3509	-6.7111
UO2(SO4)2--	5.269e-07	0.2419	0.3509	-6.7331
BeSO4 (aq)	3.626e-07	0.03785	1.0286	-6.4284
HCO3-	2.973e-07	0.01802	0.7697	-6.6406
H2AsO4-	2.013e-07	0.02818	0.7697	-6.8099
Fe(SO4)2-	7.332e-08	0.01806	0.7697	-7.2485
UO2OH+	4.383e-08	0.01250	0.7697	-7.4719
Fe+++	4.146e-08	0.002300	0.0948	-8.4057
Be(SO4)2--	2.066e-08	0.004127	0.3509	-8.1398
CdCl+	2.041e-08	0.002997	0.7697	-7.8039
Cd++	2.012e-08	0.002247	0.3509	-8.1511
CaHCO3+	1.949e-08	0.001957	0.7697	-7.8239
BeCl+	1.300e-08	0.0005743	0.7697	-7.9998
MgHCO3+	1.252e-08	0.001062	0.7697	-8.0160
CdSO4 (aq)	1.245e-08	0.002578	1.0286	-7.8925

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Hematite	11.5440s/sat	Ferrihydrite	1.8617s/sat
Magnetite	11.3844s/sat	Na-Jarosite	1.0819s/sat
Fe(OH)2.7Cl.3	6.2651s/sat	Gypsum	0.2084s/sat
K-Jarosite	4.8519s/sat	Anhydrite	-0.0399
Goethite	4.5716s/sat	Magnesioferrite	-0.1963
Maghemite	3.7400s/sat	H-Jarosite	-1.6060
Lepidocrocite	3.6916s/sat	Epsomite	-2.4327
Ferrihydrite (ag	2.3717s/sat		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.0004899	-3.310
O2(g)	4.424e-30	-29.354
CH4(g)	1.301e-88	-87.886

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg

AsO4---	2.04e-07	2.04e-07	0.0281
Be++	1.29e-06	1.29e-06	0.0115
CO3--	1.65e-05	1.65e-05	0.984
Ca++	0.0239	0.0239	953.
Cd++	5.83e-08	5.83e-08	0.00651
Cl-	0.0313	0.0313	1.10e+03
Fe+++	0.000240	0.000240	13.3
H+	-0.000141	-0.000141	-0.141
H2O	55.5	55.5	9.93e+05
K+	0.000314	0.000314	12.2
Mg++	0.0157	0.0157	379.
Na+	0.0253	0.0253	577.
Ni++	3.26e-06	3.26e-06	0.190
O2(aq)	-5.67e-05	-5.67e-05	-1.80
SO4--	0.0370	0.0370	3.53e+03
UO2++	1.90e-06	1.90e-06	0.511

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	2.037e-07	2.037e-07	0.01516		
Be	1.286e-06	1.286e-06	0.01152		
C	1.651e-05	1.651e-05	0.1970		
Ca	0.02393	0.02393	952.7		
Cd	5.827e-08	5.827e-08	0.006507		
Cl	0.03130	0.03130	1102.		
Fe	0.0002395	0.0002395	13.29		
H	111.0	111.0	1.112e+05		
K	0.0003142	0.0003142	12.21		
Mg	0.01569	0.01569	379.0		
Na	0.02526	0.02526	576.8		
Ni	3.257e-06	3.257e-06	0.1900		
O	55.66	55.66	8.846e+05		
S	0.03703	0.03703	1180.		
U	1.905e-06	1.905e-06	0.4503		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 3.916 log fO2 = -31.649
Eh = 0.5291 volts pe = 8.9442
Ionic strength = 0.122528
Activity of water = 0.997996
Solvent mass = 1.0000 kg
Solution mass = 1.0066 kg
Mineral mass = 7.8873e-06 kg
Solution density = 1.016 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.031303 molal
Dissolved solids = 6567 mg/kg sol'n
Elect. conductivity = 7240.84 uS/cm (or umho/cm)
Hardness = 3936.20 mg/kg sol'n as CaCO3
carbonate = 0.00 mg/kg sol'n as CaCO3

non-carbonate = 3936.19 mg/kg sol'n as CaCO3
Carbonate alkalinity= 0.00 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 991. cm3
Fluid volume = 991. cm3
Mineral volume = 0.00298 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.5291	8.9442

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

Minerals in system	moles	log moles	grams	volume (cm3)
Ferrihydrite	7.380e-05	-4.132	0.007887	0.002976
(total)			0.007887	0.002976

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.03026	1066.	0.7697	-1.6328
Na+	0.02403	548.8	0.7697	-1.7330
SO4--	0.02201	2101.	0.3510	-2.1121
Ca++	0.01465	583.5	0.3510	-2.2888
Mg++	0.01031	249.0	0.3510	-2.4415
CaSO4 (aq)	0.008850	1197.	1.0286	-2.0408
MgSO4 (aq)	0.004945	591.4	1.0286	-2.2935
NaSO4-	0.001020	120.6	0.7697	-3.1050
MgCl+	0.0004359	25.88	0.7697	-3.4743
CaCl+	0.0003910	29.34	0.7697	-3.5215
K+	0.0002956	11.48	0.7697	-3.6430
NaCl (aq)	0.0002099	12.19	1.0286	-3.6658
H+	0.0001576	0.1578	0.7697	-3.9162
HSO4-	0.0001181	11.39	0.7697	-4.0414
Fe++	9.920e-05	5.503	0.3510	-4.4583
FeSO4 (aq)	6.418e-05	9.686	1.0286	-4.1803
H2CO3* (aq)	1.642e-05	1.012	1.0286	-4.7723
KSO4-	1.605e-05	2.154	0.7697	-4.9083
KCl (aq)	2.582e-06	0.1913	1.0286	-5.5758
Ni++	2.129e-06	0.1241	0.3510	-6.1267
NiSO4 (aq)	1.120e-06	0.1721	1.0286	-5.9387
Be++	8.886e-07	0.007956	0.3510	-6.5060
UO2SO4 (aq)	7.831e-07	0.2848	1.0286	-6.0939
FeCl+	6.647e-07	0.06029	0.7697	-6.2910
FeOH++	6.369e-07	0.04610	0.3510	-6.6507
UO2++	5.650e-07	0.1516	0.3510	-6.7027
UO2(SO4)2--	5.355e-07	0.2459	0.3510	-6.7260

FeSO4+	5.077e-07	0.07662	0.7697	-6.4081
Fe(OH)2+	4.450e-07	0.03973	0.7697	-6.4653
BeSO4 (aq)	3.628e-07	0.03787	1.0286	-6.4281
H2AsO4-	1.997e-07	0.02796	0.7697	-6.8133
HCO3-	8.050e-08	0.004879	0.7697	-7.2079
Fe(SO4)2-	5.291e-08	0.01303	0.7697	-7.3901
Fe+++	3.000e-08	0.001665	0.0948	-8.5460
Be(SO4)2--	2.064e-08	0.004123	0.3510	-8.1401
CdCl+	2.042e-08	0.002999	0.7697	-7.8037
Cd++	2.013e-08	0.002248	0.3510	-8.1509
BeCl+	1.303e-08	0.0005755	0.7697	-7.9988
CdSO4 (aq)	1.244e-08	0.002576	1.0286	-7.8929
UO2OH+	1.192e-08	0.003399	0.7697	-8.0373

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Hematite	7.8206s/sat	Gypsum	0.2074s/sat
Magnetite	6.3731s/sat	Maghemite	0.0166s/sat
Fe(OH)2.7Cl.3	4.5756s/sat	Ferrihydrite	0.0000 sat
Goethite	2.7099s/sat	Anhydrite	-0.0408
Lepidocrocite	1.8299s/sat	Epsomite	-2.4331
K-Jarosite	0.9869s/sat	Na-Jarosite	-2.7831
Ferrihydrite (ag	0.5100s/sat		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.0004972	-3.303
O2(g)	2.242e-32	-31.649
CH4(g)	5.142e-84	-83.289

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	2.04e-07	2.04e-07	0.0281			
Be++	1.29e-06	1.29e-06	0.0115			
CO3--	1.65e-05	1.65e-05	0.984			
Ca++	0.0239	0.0239	951.			
Cd++	5.83e-08	5.83e-08	0.00651			
Cl-	0.0313	0.0313	1.10e+03			
Fe+++	0.000240	0.000166	9.19			
H+	-7.80e-05	0.000143	0.144			
H2O	55.5	55.5	9.93e+05			
K+	0.000314	0.000314	12.2			
Mg++	0.0157	0.0157	379.			
Na+	0.0253	0.0253	577.			
Ni++	3.26e-06	3.26e-06	0.190			
O2(aq)	-4.10e-05	-4.10e-05	-1.30			
SO4--	0.0370	0.0370	3.53e+03			
UO2++	1.90e-06	1.90e-06	0.511			

Elemental composition In fluid Sorbed

	total moles	moles	mg/kg	moles	mg/kg
As	2.037e-07	2.037e-07	0.01516		
Be	1.286e-06	1.286e-06	0.01152		
C	1.651e-05	1.651e-05	0.1970		
Ca	0.02390	0.02390	951.4		
Cd	5.827e-08	5.827e-08	0.006507		
Cl	0.03130	0.03130	1102.		
Fe	0.0002395	0.0001657	9.194		
H	111.0	111.0	1.112e+05		
K	0.0003142	0.0003142	12.21		
Mg	0.01569	0.01569	379.0		
Na	0.02526	0.02526	576.8		
Ni	3.257e-06	3.257e-06	0.1900		
O	55.66	55.66	8.846e+05		
S	0.03703	0.03703	1180.		
U	1.905e-06	1.905e-06	0.4504		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 6.140 log fO2 = -44.520
Eh = 0.2072 volts pe = 3.5026
Ionic strength = 0.085304
Activity of water = 0.998574
Solvent mass = 1.0000 kg
Solution mass = 1.0046 kg
Mineral mass = 0.00000 kg
Solution density = 1.015 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.022307 molal
Dissolved solids = 4597 mg/kg sol'n
Elect. conductivity = 5169.19 uS/cm (or umho/cm)
Hardness = 2726.12 mg/kg sol'n as CaCO3
carbonate = 118.84 mg/kg sol'n as CaCO3
non-carbonate = 2607.28 mg/kg sol'n as CaCO3
Carbonate alkalinity= 118.84 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 990. cm3
Fluid volume = 990. cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.2072	3.5026

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02173	766.8	0.7899	-1.7654
Na+	0.01452	332.4	0.7899	-1.9403
SO4--	0.01409	1348.	0.3894	-2.2606
Ca++	0.01160	462.9	0.3894	-2.3451
Mg++	0.006884	166.6	0.3894	-2.5718
CaSO4 (aq)	0.005569	754.7	1.0198	-2.2457
H2CO3* (aq)	0.002888	178.3	1.0198	-2.5308
MgSO4 (aq)	0.002624	314.4	1.0198	-2.5725
HCO3-	0.002290	139.1	0.7899	-2.7426
NaSO4-	0.0004380	51.90	0.7899	-3.4610
K+	0.0003439	13.39	0.7899	-3.5660
CaCl+	0.0002466	18.54	0.7899	-3.7104

MgCl+	0.0002319	13.79	0.7899	-3.7372
CaHCO3+	0.0001318	13.26	0.7899	-3.9826
NaCl (aq)	9.678e-05	5.630	1.0198	-4.0057
MgHCO3+	7.150e-05	6.073	0.7899	-4.2481
Fe++	6.561e-05	3.647	0.3894	-4.5927
FeSO4 (aq)	3.374e-05	5.102	1.0198	-4.4633
KSO4-	1.326e-05	1.784	0.7899	-4.9799
NaHCO3 (aq)	1.020e-05	0.8530	1.0198	-4.9828
KCl (aq)	2.292e-06	0.1701	1.0198	-5.6313
H+	9.171e-07	0.0009201	0.7899	-6.1400
FeHCO3+	7.366e-07	0.08569	0.7899	-6.2352
HSO4-	4.883e-07	0.04718	0.7899	-6.4137
FeCl+	3.503e-07	0.03183	0.7899	-6.5580
CO3--	3.007e-07	0.01796	0.3894	-6.9315
MgCO3 (aq)	2.937e-07	0.02465	1.0198	-6.5236
Ni++	1.694e-07	0.009897	0.3894	-7.1808
CaCO3 (aq)	1.573e-07	0.01567	1.0198	-6.7948
Ca2UO2(CO3)3 (aq	1.474e-07	0.07778	1.0198	-6.8231
NiSO4 (aq)	7.079e-08	0.01091	1.0198	-7.1415
H2AsO4-	3.522e-08	0.004941	0.7899	-7.5556
Fe(OH)2+	3.230e-08	0.002889	0.7899	-7.5933
NaCO3-	3.166e-08	0.002616	0.7899	-7.6018
NiHCO3+	1.862e-08	0.002219	0.7899	-7.8324
FeOH+	1.787e-08	0.001296	0.7899	-7.8503
OH-	1.757e-08	0.0002975	0.7899	-7.8576
Be(OH)2 (aq)	1.490e-08	0.0006380	1.0198	-7.8184
HAsO4--	1.009e-08	0.001406	0.3894	-8.4056

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Magnetite	12.8780s/sat	Calcite	-0.7968
Hematite	10.0121s/sat	Siderite	-0.9342
Fe(OH)2.7Cl.3	4.9647s/sat	Aragonite	-0.9405
Goethite	3.8057s/sat	Vaterite	-1.3632
Lepidocrocite	2.9257s/sat	Dolomite (ordere	-1.6899
Maghemite	2.2081s/sat	Magnesite	-2.0433
Ferrihydrite (ag	1.6061s/sat	CaCO3xH2O	-2.1329
Magnesioferrite	1.4420s/sat	Dolomite (disord	-2.2399
Ferrihydrite	1.0961s/sat	K-Jarosite	-2.6170
Gypsum	0.0030s/sat	Epsomite	-2.7103
Anhydrite	-0.2457	NiCO3	-2.9124

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.08666	-1.062
O2(g)	3.019e-45	-44.520
CH4(g)	4.948e-56	-55.306

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg

AsO4---	4.53e-08	4.53e-08	0.00627
Be++	1.89e-08	1.89e-08	0.000169
CO3--	0.00539	0.00539	322.
Ca++	0.0176	0.0176	700.
Cd++	5.81e-10	5.81e-10	6.50e-05
Cl-	0.0223	0.0223	787.
Fe+++	0.000100	0.000100	5.59
H+	0.00818	0.00818	8.21
H2O	55.5	55.5	9.95e+05
K+	0.000359	0.000359	14.0
Mg++	0.00981	0.00981	237.
Na+	0.0151	0.0151	345.
Ni++	2.60e-07	2.60e-07	0.0152
O2(aq)	-2.51e-05	-2.51e-05	-0.800
SO4--	0.0228	0.0228	2.18e+03
UO2++	1.55e-07	1.55e-07	0.0417

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	4.531e-08	4.531e-08	0.003379		
Be	1.889e-08	1.889e-08	0.0001695		
C	0.005394	0.005394	64.49		
Ca	0.01755	0.01755	700.2		
Cd	5.812e-10	5.812e-10	6.503e-05		
Cl	0.02231	0.02231	787.2		
Fe	0.0001005	0.0001005	5.586		
H	111.0	111.0	1.114e+05		
K	0.0003595	0.0003595	13.99		
Mg	0.009812	0.009812	237.4		
Na	0.01507	0.01507	344.8		
Ni	2.596e-07	2.596e-07	0.01517		
O	55.62	55.62	8.857e+05		
S	0.02277	0.02277	726.8		
U	1.551e-07	1.551e-07	0.03674		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 6.056 log fO2 = -44.856
Eh = 0.2072 volts pe = 3.5026
Ionic strength = 0.085035
Activity of water = 0.998575
Solvent mass = 1.0000 kg
Solution mass = 1.0046 kg
Mineral mass = 9.2031e-06 kg
Solution density = 1.015 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.022307 molal
Dissolved solids = 4591 mg/kg sol'n
Elect. conductivity = 5158.01 uS/cm (or umho/cm)
Hardness = 2721.86 mg/kg sol'n as CaCO3
carbonate = 106.18 mg/kg sol'n as CaCO3

non-carbonate = 2615.69 mg/kg sol'n as CaCO3
Carbonate alkalinity= 106.18 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 990. cm3
Fluid volume = 990. cm3
Mineral volume = 0.00347 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.2072	3.5026

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

Minerals in system	moles	log moles	grams	volume (cm3)
Ferrihydrite	8.612e-05	-4.065	0.009203	0.003473
(total)			0.009203	0.003473

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02173	766.9	0.7901	-1.7653
Na+	0.01452	332.4	0.7901	-1.9402
SO4--	0.01411	1349.	0.3897	-2.2597
Ca++	0.01157	461.7	0.3897	-2.3458
Mg++	0.006883	166.6	0.3897	-2.5715
CaSO4 (aq)	0.005571	755.0	1.0198	-2.2455
H2CO3* (aq)	0.003146	194.2	1.0198	-2.4937
MgSO4 (aq)	0.002632	315.4	1.0198	-2.5712
HCO3-	0.002055	124.8	0.7901	-2.7895
NaSO4-	0.0004389	52.01	0.7901	-3.4599
K+	0.0003439	13.38	0.7901	-3.5659
CaCl+	0.0002462	18.51	0.7901	-3.7111
MgCl+	0.0002321	13.81	0.7901	-3.7367
CaHCO3+	0.0001180	11.88	0.7901	-4.0302
NaCl (aq)	9.683e-05	5.633	1.0198	-4.0055
MgHCO3+	6.421e-05	5.454	0.7901	-4.2947
KSO4-	1.329e-05	1.788	0.7901	-4.9789
Fe++	9.385e-06	0.5217	0.3897	-5.4368
NaHCO3 (aq)	9.159e-06	0.7659	1.0198	-5.0296
FeSO4 (aq)	4.842e-06	0.7321	1.0198	-5.3065
KCl (aq)	2.293e-06	0.1701	1.0198	-5.6312
H+	1.113e-06	0.001116	0.7901	-6.0560
HSO4-	5.936e-07	0.05736	0.7901	-6.3288
CO3--	2.223e-07	0.01328	0.3897	-7.0624
MgCO3 (aq)	2.174e-07	0.01825	1.0198	-6.6542
Ni++	1.705e-07	0.009964	0.3897	-7.1775
Ca2UO2(CO3)3 (aq	1.444e-07	0.07620	1.0198	-6.8320

CaCO3 (aq)	1.162e-07	0.01157	1.0198	-6.9264
FeHCO3+	9.464e-08	0.01101	0.7901	-7.1262
NiSO4 (aq)	7.149e-08	0.01101	1.0198	-7.1372
FeCl+	5.015e-08	0.004557	0.7901	-7.4021
H2AsO4-	3.666e-08	0.005143	0.7901	-7.5381
NaCO3-	2.343e-08	0.001935	0.7901	-7.7326
NiHCO3+	1.684e-08	0.002007	0.7901	-7.8759
OH-	1.448e-08	0.0002451	0.7901	-7.9416
Be(OH)2 (aq)	1.360e-08	0.0005825	1.0198	-7.8579

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Magnetite	9.6736s/sat	Magnesioferrite	-0.9179
Hematite	7.8199s/sat	Calcite	-0.9284
Fe(OH)2.7Cl.3	3.8938s/sat	Aragonite	-1.0721
Goethite	2.7096s/sat	Vaterite	-1.4948
Lepidocrocite	1.8296s/sat	Siderite	-1.9092
Ferrihydrite (ag	0.5100s/sat	Dolomite (ordere	-1.9521
Maghemite	0.0159s/sat	Magnesite	-2.1739
Gypsum	0.0032s/sat	CaCO3xH2O	-2.2646
Ferrihydrite	0.0000 sat	Dolomite (disord	-2.5021
Anhydrite	-0.2455	Epsomite	-2.7090

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.09438	-1.025
O2(g)	1.393e-45	-44.856
CH4(g)	2.532e-55	-54.597

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	4.53e-08	4.53e-08	0.00627			
Be++	1.89e-08	1.89e-08	0.000169			
CO3--	0.00539	0.00539	322.			
Ca++	0.0175	0.0175	698.			
Cd++	5.81e-10	5.81e-10	6.50e-05			
Cl-	0.0223	0.0223	787.			
Fe+++	0.000100	1.44e-05	0.799			
H+	0.00827	0.00853	8.55			
H2O	55.5	55.5	9.95e+05			
K+	0.000359	0.000359	14.0			
Mg++	0.00981	0.00981	237.			
Na+	0.0151	0.0151	345.			
Ni++	2.60e-07	2.60e-07	0.0152			
O2(aq)	-3.59e-06	-3.59e-06	-0.114			
SO4--	0.0228	0.0228	2.18e+03			
UO2++	1.55e-07	1.55e-07	0.0417			

		In fluid		Sorbed	
Elemental composition	total moles	moles	mg/kg	moles	mg/kg

As	4.531e-08	4.531e-08	0.003379
Be	1.889e-08	1.889e-08	0.0001695
C	0.005394	0.005394	64.49
Ca	0.01751	0.01751	698.5
Cd	5.812e-10	5.812e-10	6.503e-05
Cl	0.02231	0.02231	787.2
Fe	0.0001005	1.438e-05	0.7992
H	111.0	111.0	1.114e+05
K	0.0003595	0.0003595	13.99
Mg	0.009812	0.009812	237.5
Na	0.01507	0.01507	344.8
Ni	2.596e-07	2.596e-07	0.01517
O	55.62	55.62	8.857e+05
S	0.02277	0.02277	726.8
U	1.551e-07	1.551e-07	0.03674

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 5.747 log fO2 = -39.517
Eh = 0.3044 volts pe = 5.1465
Ionic strength = 0.148801
Activity of water = 0.997652
Solvent mass = 11.091 kg
Solution mass = 11.191 kg
Mineral mass = 0.00000 kg
Solution density = 1.017 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.027652 molal
Dissolved solids = 8891 mg/kg sol'n
Elect. conductivity = 7897.11 uS/cm (or umho/cm)
Hardness = 4868.51 mg/kg sol'n as CaCO3
carbonate = 61.68 mg/kg sol'n as CaCO3
non-carbonate = 4806.82 mg/kg sol'n as CaCO3
Carbonate alkalinity= 61.68 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 1.10e+04 cm3
Fluid volume = 1.10e+04 cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.3044	5.1465

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
SO4--	0.02898	2759.	0.3329	-2.0156
Cl-	0.02672	939.0	0.7596	-1.6925
Ca++	0.02044	811.9	0.3329	-2.1672
Na+	0.01975	449.9	0.7596	-1.8239
CaSO4 (aq)	0.01453	1961.	1.0349	-1.8228
Mg++	0.008437	203.3	0.3329	-2.5515
MgSO4 (aq)	0.004765	568.5	1.0349	-2.3070
Fe++	0.003981	220.3	0.3329	-2.8777
H2CO3* (aq)	0.003541	217.7	1.0349	-2.4360
FeSO4 (aq)	0.003033	456.6	1.0349	-2.5033
HCO3-	0.001199	72.49	0.7596	-3.0407
NaSO4-	0.001047	123.5	0.7596	-3.0995

K+	0.0005385	20.87	0.7596	-3.3882
CaCl+	0.0004568	34.19	0.7596	-3.4597
MgCl+	0.0002988	17.70	0.7596	-3.6440
NaCl (aq)	0.0001475	8.541	1.0349	-3.8165
CaHCO3+	0.0001039	10.41	0.7596	-4.1028
MgHCO3+	3.923e-05	3.317	0.7596	-4.5258
KSO4-	3.650e-05	4.890	0.7596	-4.5571
FeCl+	2.234e-05	2.022	0.7596	-4.7702
FeHCO3+	2.000e-05	2.317	0.7596	-4.8183
Fe(OH)2+	1.254e-05	1.117	0.7596	-5.0211
NaHCO3 (aq)	6.616e-06	0.5509	1.0349	-5.1645
KCl (aq)	4.021e-06	0.2971	1.0349	-5.3808
H+	2.357e-06	0.002354	0.7596	-5.7471
HSO4-	2.206e-06	0.2122	0.7596	-5.7758
Ca2UO2(CO3)3 (aq	2.155e-06	1.132	1.0349	-5.6517
H2AsO4-	1.858e-06	0.2595	0.7596	-5.8505
Be++	1.424e-06	0.01272	0.3329	-6.3241
Ni++	1.271e-06	0.07395	0.3329	-6.3735
Be(OH)2 (aq)	1.045e-06	0.04457	1.0349	-5.9659
NiSO4 (aq)	7.870e-07	0.1207	1.0349	-6.0891
BeSO4 (aq)	6.846e-07	0.07130	1.0349	-6.1497
FeOH+	3.898e-07	0.02814	0.7596	-6.5286
UO2CO3 (aq)	2.902e-07	0.09492	1.0349	-6.5225
FeOH++	2.757e-07	0.01991	0.3329	-7.0371
HAsO4--	2.422e-07	0.03360	0.3329	-7.0934
UO2(CO3)2--	1.718e-07	0.06641	0.3329	-7.2427
CO3--	7.164e-08	0.004261	0.3329	-7.6225
NiHCO3+	6.256e-08	0.007423	0.7596	-7.3231
MgCO3 (aq)	6.178e-08	0.005163	1.0349	-7.1943
Cd++	5.482e-08	0.006107	0.3329	-7.7387
Be(SO4)2--	5.157e-08	0.01028	0.3329	-7.7653
CaCO3 (aq)	4.756e-08	0.004718	1.0349	-7.3079
CdCl+	4.657e-08	0.006825	0.7596	-7.4513
CdSO4 (aq)	3.988e-08	0.008240	1.0349	-7.3843
BeCO3 (aq)	1.964e-08	0.001344	1.0349	-7.6920
BeCl+	1.749e-08	0.0007708	0.7596	-7.8766
Cd(SO4)2--	1.613e-08	0.004869	0.3329	-8.2699

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Magnetite	18.1657s/sat	Calcite	-1.3099
Hematite	14.3711s/sat	Be(OH)2 (beta)	-1.3259
Fe(OH)2.7Cl.3	7.2834s/sat	Aragonite	-1.4536
Maghemite	6.5671s/sat	Be(OH)2 (alpha)	-1.7259
Goethite	5.9850s/sat	Vaterite	-1.8763
K-Jarosite	5.7674s/sat	Be(OH)2 (am)	-2.0259
Lepidocrocite	5.1050s/sat	Rutherfordine	-2.1603
Magnesioferrite	5.0351s/sat	H-Jarosite	-2.2025
Ferrihydrite (ag	3.7850s/sat	Epsomite	-2.4477
Ferrihydrite	3.2750s/sat	CaCO3xH2O	-2.6464
Na-Jarosite	1.6517s/sat	Melanterite	-2.6914
Fe3(OH)8	1.3425s/sat	Magnesite	-2.7140

Gypsum	0.4252s/sat	NiCO3	-2.7960
Anhydrite	0.1772s/sat	Dolomite (ordere	-2.8736
Siderite	0.0898s/sat		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.1079	-0.967
O2(g)	3.040e-40	-39.517
CH4(g)	6.067e-66	-65.217

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	2.33e-05	2.33e-05	0.289			
Be++	3.60e-05	3.60e-05	0.0290			
CO3--	0.0545	0.0545	292.			
Ca++	0.394	0.394	1.41e+03			
Cd++	1.79e-06	1.79e-06	0.0179			
Cl-	0.307	0.307	972.			
Fe+++	0.0784	0.0784	391.			
H+	0.0153	0.0153	1.37			
H2O	616.	616.	9.91e+05			
K+	0.00642	0.00642	22.4			
Mg++	0.150	0.150	326.			
Na+	0.232	0.232	477.			
Ni++	2.36e-05	2.36e-05	0.124			
O2(aq)	-0.0196	-0.0196	-55.9			
SO4--	0.581	0.581	4.99e+03			
UO2++	2.94e-05	2.94e-05	0.709			

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	2.329e-05	2.329e-05	0.1560		
Be	3.604e-05	3.604e-05	0.02903		
C	0.05453	0.05453	58.53		
Ca	0.3942	0.3942	1412.		
Cd	1.786e-06	1.786e-06	0.01794		
Cl	0.3067	0.3067	971.6		
Fe	0.07840	0.07840	391.3		
H	1231.	1231.	1.109e+05		
K	0.006422	0.006422	22.44		
Mg	0.1502	0.1502	326.3		
Na	0.2323	0.2323	477.3		
Ni	2.358e-05	2.358e-05	0.1237		
O	618.1	618.1	8.838e+05		
S	0.5811	0.5811	1665.		
U	2.939e-05	2.939e-05	0.6251		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars

pH = 4.664 log fO2 = -43.849
Eh = 0.3044 volts pe = 5.1465
Ionic strength = 0.147651
Activity of water = 0.997658
Solvent mass = 11.091 kg
Solution mass = 11.190 kg
Mineral mass = 0.00051720 kg
Solution density = 1.017 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.027652 molal
Dissolved solids = 8860 mg/kg sol'n
Elect. conductivity = 7862.36 uS/cm (or umho/cm)
Hardness = 4847.76 mg/kg sol'n as CaCO3
carbonate = 6.63 mg/kg sol'n as CaCO3
non-carbonate = 4841.13 mg/kg sol'n as CaCO3
Carbonate alkalinity= 6.63 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 1.10e+04 cm3
Fluid volume = 1.10e+04 cm3
Mineral volume = 0.195 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.6 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.3044	5.1465

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

Minerals in system	moles	log moles	grams	volume (cm3)
Ferrihydrite	0.004840	-2.315	0.5172	0.1952
(total)			0.5172	0.1952

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
SO4--	0.02906	2767.	0.3336	-2.0135
Cl-	0.02673	939.1	0.7600	-1.6923
Ca++	0.02031	806.9	0.3336	-2.1690
Na+	0.01975	450.0	0.7600	-1.8237
CaSO4 (aq)	0.01455	1963.	1.0346	-1.8225
Mg++	0.008437	203.3	0.3336	-2.5506
MgSO4 (aq)	0.004800	572.6	1.0346	-2.3040
H2CO3* (aq)	0.004765	292.9	1.0346	-2.3072
Fe++	0.003740	207.0	0.3336	-2.9039
FeSO4 (aq)	0.002870	432.1	1.0346	-2.5274
NaSO4-	0.001052	124.1	0.7600	-3.0971
K+	0.0005383	20.86	0.7600	-3.3881
CaCl+	0.0004549	34.06	0.7600	-3.4613

MgCl+	0.0002995	17.74	0.7600	-3.6428
NaCl (aq)	0.0001477	8.554	1.0346	-3.8159
HCO3-	0.0001332	8.053	0.7600	-3.9948
KSO4-	3.667e-05	4.912	0.7600	-4.5549
H+	2.851e-05	0.02848	0.7600	-4.6642
HSO4-	2.682e-05	2.580	0.7600	-4.6907
FeCl+	2.104e-05	1.904	0.7600	-4.7962
CaHCO3+	1.149e-05	1.152	0.7600	-5.0587
MgHCO3+	4.366e-06	0.3693	0.7600	-5.4791
KCl (aq)	4.026e-06	0.2975	1.0346	-5.3804
Be++	2.109e-06	0.01883	0.3336	-6.1528
FeHCO3+	2.092e-06	0.2423	0.7600	-5.7987
H2AsO4-	2.071e-06	0.2893	0.7600	-5.8029
Ni++	1.302e-06	0.07575	0.3336	-6.3622
BeSO4 (aq)	1.021e-06	0.1063	1.0346	-5.9763
UO2SO4 (aq)	8.441e-07	0.3063	1.0346	-6.0589
NiSO4 (aq)	8.119e-07	0.1246	1.0346	-6.0757
UO2(SO4)2--	7.664e-07	0.3510	0.3336	-6.5923
NaHCO3 (aq)	7.359e-07	0.06128	1.0346	-6.1184
UO2++	5.135e-07	0.1374	0.3336	-6.7662
UO2CO3 (aq)	4.564e-07	0.1493	1.0346	-6.3258
Fe(OH)2+	8.055e-08	0.007174	0.7600	-7.2131
Be(SO4)2--	7.710e-08	0.01537	0.3336	-7.5897
UO2OH+	5.837e-08	0.01660	0.7600	-7.3530
Cd++	5.484e-08	0.006110	0.3336	-7.7377
CdCl+	4.669e-08	0.006843	0.7600	-7.4499
CdSO4 (aq)	4.019e-08	0.008304	1.0346	-7.3811
FeOH+	3.030e-08	0.002188	0.7600	-7.6378
BeCl+	2.595e-08	0.001144	0.7600	-7.7051
HAsO4--	2.228e-08	0.003091	0.3336	-8.1288
FeOH++	2.140e-08	0.001545	0.3336	-8.1463
Cd(SO4)2--	1.630e-08	0.004919	0.3336	-8.2646
Be(OH)2 (aq)	1.059e-08	0.0004515	1.0346	-7.9605

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Magnetite	9.4236s/sat	Maghemite	0.0171s/sat
Hematite	7.8211s/sat	Ferrihydrite	0.0000 sat
Fe(OH)2.7Cl.3	4.3334s/sat	K-Jarosite	-0.8045
Goethite	2.7100s/sat	Rutherfordine	-1.9636
Lepidocrocite	1.8300s/sat	Siderite	-1.9735
Ferrihydrite (ag	0.5100s/sat	Epsomite	-2.4447
Gypsum	0.4255s/sat	Melanterite	-2.7155
Anhydrite	0.1775s/sat		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.1452	-0.838
O2(g)	1.416e-44	-43.849
CH4(g)	3.760e-57	-56.425

Original basis	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg	Kd L/kg
AsO4---	2.33e-05	2.33e-05	0.289			
Be++	3.60e-05	3.60e-05	0.0290			
CO3--	0.0545	0.0545	292.			
Ca++	0.392	0.392	1.40e+03			
Cd++	1.79e-06	1.79e-06	0.0179			
Cl-	0.307	0.307	972.			
Fe+++	0.0784	0.0736	367.			
H+	0.0200	0.0345	3.10			
H2O	616.	616.	9.91e+05			
K+	0.00642	0.00642	22.4			
Mg++	0.150	0.150	326.			
Na+	0.232	0.232	477.			
Ni++	2.36e-05	2.36e-05	0.124			
O2(aq)	-0.0184	-0.0184	-52.6			
SO4--	0.581	0.581	4.99e+03			
UO2++	2.94e-05	2.94e-05	0.709			

Elemental composition	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg
As	2.329e-05	2.329e-05	0.1560		
Be	3.604e-05	3.604e-05	0.02903		
C	0.05453	0.05453	58.54		
Ca	0.3918	0.3918	1403.		
Cd	1.786e-06	1.786e-06	0.01794		
Cl	0.3067	0.3067	971.7		
Fe	0.07840	0.07356	367.1		
H	1231.	1231.	1.109e+05		
K	0.006422	0.006422	22.44		
Mg	0.1502	0.1502	326.3		
Na	0.2323	0.2323	477.3		
Ni	2.358e-05	2.358e-05	0.1237		
O	618.1	618.1	8.838e+05		
S	0.5811	0.5811	1665.		
U	2.939e-05	2.939e-05	0.6251		

Step #   0   Xi = 0.0000

Temperature = 25.0 C   Pressure = 1.013 bars
pH = 5.952   log fO2 = -40.460
Eh =   0.2783 volts   pe =   4.7053
Ionic strength   =   0.119607
Activity of water   =   0.998087
Solvent mass   =   21.194 kg
Solution mass   =   21.340 kg
Mineral mass   =   0.00000 kg
Solution density   =   1.016   g/cm3
Solution viscosity =   0.009   poise
Chlorinity   =   0.025105 molal
Dissolved solids   =   6848 mg/kg sol'n
Elect. conductivity =   6665.96 uS/cm (or umho/cm)
Hardness   =   3849.39 mg/kg sol'n as CaCO3
  carbonate   =   88.75 mg/kg sol'n as CaCO3
  non-carbonate   =   3760.64 mg/kg sol'n as CaCO3
Carbonate alkalinity=   88.75 mg/kg sol'n as CaCO3
Water type   =   Ca-SO4
Bulk volume   =   2.10e+04 cm3
Fluid volume   =   2.10e+04 cm3
Mineral volume   =   0.000 cm3
Inert volume   =   0.000 cm3
Porosity   =   100. %
Permeability   =   98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.2783	4.7053

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02435	857.4	0.7710	-1.7264
SO4--	0.02216	2114.	0.3533	-2.1063
Na+	0.01727	394.3	0.7710	-1.8757
Ca++	0.01638	652.0	0.3533	-2.2375
CaSO4 (aq)	0.01010	1365.	1.0279	-1.9838
Mg++	0.007684	185.5	0.3533	-2.5662
MgSO4 (aq)	0.003763	449.8	1.0279	-2.4125
H2CO3* (aq)	0.003221	198.4	1.0279	-2.4800
Fe++	0.002234	123.9	0.3533	-3.1028
HCO3-	0.001712	103.8	0.7710	-2.8794
FeSO4 (aq)	0.001476	222.6	1.0279	-2.8190
NaSO4-	0.0007430	87.86	0.7710	-3.2419

K+	0.0004465	17.34	0.7710	-3.4631
CaCl+	0.0003540	26.55	0.7710	-3.5640
MgCl+	0.0002632	15.62	0.7710	-3.6927
CaHCO3+	0.0001262	12.67	0.7710	-4.0118
NaCl (aq)	0.0001219	7.074	1.0279	-3.9021
MgHCO3+	5.416e-05	4.589	0.7710	-4.3793
KSO4-	2.456e-05	3.297	0.7710	-4.7227
FeHCO3+	1.702e-05	1.975	0.7710	-4.8820
FeCl+	1.213e-05	1.100	0.7710	-5.0292
NaHCO3 (aq)	8.573e-06	0.7152	1.0279	-5.0549
Fe(OH)2+	6.866e-06	0.6128	0.7710	-5.2762
KCl (aq)	3.151e-06	0.2333	1.0279	-5.4896
H+	1.447e-06	0.001449	0.7710	-5.9524
Ca2UO2(CO3)3 (aq	1.343e-06	0.7073	1.0279	-5.8599
HSO4-	1.099e-06	0.1060	0.7710	-6.0718
Be(OH)2 (aq)	9.838e-07	0.04204	1.0279	-5.9951
H2AsO4-	9.333e-07	0.1306	0.7710	-6.1429
Ni++	7.650e-07	0.04460	0.3533	-6.5682
Be++	4.869e-07	0.004358	0.3533	-6.7644
NiSO4 (aq)	4.107e-07	0.06314	1.0279	-6.3745
FeOH+	3.671e-07	0.02656	0.7710	-6.5481
BeSO4 (aq)	2.029e-07	0.02118	1.0279	-6.6807
HAsO4--	1.868e-07	0.02596	0.3533	-7.1805
CO3--	1.570e-07	0.009359	0.3533	-7.2558
MgCO3 (aq)	1.399e-07	0.01171	1.0279	-6.8424
CaCO3 (aq)	9.473e-08	0.009417	1.0279	-7.0115
FeOH++	8.994e-08	0.006508	0.3533	-7.4978
UO2(CO3)2--	5.956e-08	0.02307	0.3533	-7.6768
NiHCO3+	5.708e-08	0.006788	0.7710	-7.3564
UO2CO3 (aq)	4.621e-08	0.01515	1.0279	-7.3233
Cd++	3.114e-08	0.003476	0.3533	-7.9585
CdCl+	2.559e-08	0.003757	0.7710	-7.7050
CdSO4 (aq)	1.964e-08	0.004067	1.0279	-7.6948
NaCO3-	1.784e-08	0.001471	0.7710	-7.8615
BeCO3 (aq)	1.669e-08	0.001144	1.0279	-7.7656
OH-	1.168e-08	0.0001973	0.7710	-8.0454
Be(SO4)2--	1.161e-08	0.002319	0.3533	-8.3869

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Magnetite	18.2518s/sat	Anhydrite	0.0162s/sat
Hematite	14.2713s/sat	Calcite	-1.0135
Fe(OH)2.7Cl.3	7.1620s/sat	Aragonite	-1.1572
Maghemite	6.4673s/sat	Be(OH)2 (beta)	-1.3551
Goethite	5.9352s/sat	Vaterite	-1.5799
Magnesioferrite	5.3314s/sat	Be(OH)2 (alpha)	-1.7551
Lepidocrocite	5.0552s/sat	Be(OH)2 (am)	-2.0551
K-Jarosite	4.7456s/sat	Dolomite (ordere	-2.2254
Ferrihydrite (ag	3.7354s/sat	CaCO3xH2O	-2.3499
Ferrihydrite	3.2254s/sat	Magnesite	-2.3621
Fe3(OH)8	1.4292s/sat	Epsomite	-2.5518
Na-Jarosite	0.6531s/sat	NiCO3	-2.6240

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 Gypsum           0.2645s/sat   Dolomite (disord  -2.7754
 Siderite         0.2314s/sat   Rutherfordine     -2.9611
  (only minerals with log Q/K > -3 listed)

 Gases              fugacity     log fug.
-----------------------------------------------
 CO2(g)              0.09746     -1.011
 O2(g)             3.467e-41    -40.460
 CH4(g)            4.218e-64    -63.375

                         In fluid          Sorbed          Kd
 Original basis total moles   moles    mg/kg     moles    mg/kg     L/kg
-------------------------------------------------------------------------------
 AsO4---       2.37e-05   2.37e-05    0.155
 Be++          3.62e-05   3.62e-05   0.0153
 CO3--            0.109      0.109     307.
 Ca++             0.571      0.571 1.07e+03
 Cd++          1.79e-06   1.79e-06  0.00943
 Cl-              0.532      0.532     884.
 Fe+++           0.0794     0.0794     208.
 H+              0.0977     0.0977     4.61
 H2O           1.18e+03   1.18e+03 9.93e+05
 K+              0.0101     0.0101     18.4
 Mg++             0.249      0.249     284.
 Na+              0.385      0.385     414.
 Ni++          2.62e-05   2.62e-05   0.0721
 O2(aq)         -0.0198    -0.0198    -29.7
 SO4--            0.811      0.811 3.65e+03
 UO2++         3.09e-05   3.09e-05    0.392

 Elemental composition          In fluid              Sorbed
             total moles    moles      mg/kg       moles      mg/kg
-------------------------------------------------------------------------------
 As           2.374e-05   2.374e-05    0.08336
 Be           3.622e-05   3.622e-05    0.01530
 C               0.1090      0.1090      61.37
 Ca              0.5714      0.5714      1073.
 Cd           1.791e-06   1.791e-06   0.009435
 Cl              0.5321      0.5321      883.9
 Fe             0.07939     0.07939      207.8
 H                2353.       2353.  1.111e+05
 K              0.01005     0.01005      18.42
 Mg              0.2493      0.2493      284.1
 Na              0.3845      0.3845      414.3
 Ni           2.620e-05   2.620e-05    0.07208
 O                1180.       1180.  8.847e+05
 S               0.8110      0.8110      1219.
 U            3.095e-05   3.095e-05     0.3452


      Step #    0          Xi = 0.0000

      Temperature =  25.0 C     Pressure =  1.013 bars
      pH =  4.901           log fO2 =  -44.668
```

Eh = 0.2783 volts pe = 4.7053
Ionic strength = 0.117976
Activity of water = 0.998096
Solvent mass = 21.193 kg
Solution mass = 21.338 kg
Mineral mass = 0.0012920 kg
Solution density = 1.016 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.025106 molal
Dissolved solids = 6807 mg/kg sol'n
Elect. conductivity = 6606.57 uS/cm (or umho/cm)
Hardness = 3821.66 mg/kg sol'n as CaCO3
carbonate = 11.50 mg/kg sol'n as CaCO3
non-carbonate = 3810.16 mg/kg sol'n as CaCO3
Carbonate alkalinity= 11.50 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 2.10e+04 cm3
Fluid volume = 2.10e+04 cm3
Mineral volume = 0.488 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.6 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.2783	4.7053

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

Minerals in system	moles	log moles	grams	volume (cm3)
Ferrihydrite	0.01209	-1.918	1.292	0.4875
(total)			1.292	0.4875

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02435	857.6	0.7717	-1.7260
SO4--	0.02228	2125.	0.3547	-2.1023
Na+	0.01727	394.4	0.7717	-1.8752
Ca++	0.01619	644.6	0.3547	-2.2408
CaSO4 (aq)	0.01012	1368.	1.0275	-1.9831
Mg++	0.007681	185.5	0.3547	-2.5647
H2CO3* (aq)	0.004886	301.0	1.0275	-2.2992
MgSO4 (aq)	0.003812	455.8	1.0275	-2.4070
Fe++	0.001895	105.1	0.3547	-3.1726
FeSO4 (aq)	0.001269	191.4	1.0275	-2.8849
NaSO4-	0.0007500	88.68	0.7717	-3.2375
K+	0.0004463	17.33	0.7717	-3.4629
CaCl+	0.0003514	26.36	0.7717	-3.5668
MgCl+	0.0002641	15.68	0.7717	-3.6907

HCO3-	0.0002302	13.95	0.7717	-3.7504
NaCl (aq)	0.0001222	7.092	1.0275	-3.9012
KSO4-	2.478e-05	3.326	0.7717	-4.7185
CaHCO3+	1.684e-05	1.691	0.7717	-4.8861
H+	1.629e-05	0.01631	0.7717	-4.9006
HSO4-	1.249e-05	1.204	0.7717	-5.0160
FeCl+	1.033e-05	0.9365	0.7717	-5.0985
MgHCO3+	7.306e-06	0.6192	0.7717	-5.2489
KCl (aq)	3.157e-06	0.2338	1.0275	-5.4889
FeHCO3+	1.948e-06	0.2261	0.7717	-5.8229
Be++	1.157e-06	0.01036	0.3547	-6.3867
NaHCO3 (aq)	1.155e-06	0.09638	1.0275	-5.9255
H2AsO4-	1.099e-06	0.1538	0.7717	-6.0716
Ni++	7.935e-07	0.04627	0.3547	-6.5506
UO2CO3 (aq)	6.383e-07	0.2092	1.0275	-6.1832
BeSO4 (aq)	4.889e-07	0.05102	1.0275	-6.2990
NiSO4 (aq)	4.318e-07	0.06638	1.0275	-6.3529
UO2SO4 (aq)	3.180e-07	0.1156	1.0275	-6.4858
UO2++	2.217e-07	0.05946	0.3547	-7.1043
UO2(SO4)2--	2.198e-07	0.1009	0.3547	-7.1081
Fe(OH)2+	4.600e-08	0.004106	0.7717	-7.4498
UO2OH+	4.550e-08	0.01297	0.7717	-7.4546
Cd++	3.116e-08	0.003478	0.3547	-7.9566
Be(SO4)2--	2.811e-08	0.005616	0.3547	-8.0012
FeOH+	2.771e-08	0.002005	0.7717	-7.6698
CdCl+	2.570e-08	0.003774	0.7717	-7.7026
CdSO4 (aq)	1.992e-08	0.004124	1.0275	-7.6889
HAsO4--	1.946e-08	0.002704	0.3547	-8.1610
Be(OH)2 (aq)	1.850e-08	0.0007904	1.0275	-7.7211
BeCl+	1.380e-08	0.0006095	0.7717	-7.9726

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Magnetite	9.6275s/sat	Maghemite	0.0165s/sat
Hematite	7.8205s/sat	Ferrihydrite	0.0000 sat
Fe(OH)2.7Cl.3	4.2523s/sat	Siderite	-1.7613
Goethite	2.7098s/sat	K-Jarosite	-1.7668
Lepidocrocite	1.8298s/sat	Rutherfordine	-1.8210
Ferrihydrite (ag	0.5100s/sat	Epsomite	-2.5463
Gypsum	0.2653s/sat	UO2(OH)2 (beta)	-2.9164
Anhydrite	0.0169s/sat	Calcite	-2.9397

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.1478	-0.830
O2(g)	2.150e-45	-44.668
CH4(g)	1.662e-55	-54.779

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg

AsO4---	2.37e-05	2.37e-05	0.155
Be++	3.62e-05	3.62e-05	0.0153
CO3--	0.109	0.109	307.
Ca++	0.565	0.565	1.06e+03
Cd++	1.79e-06	1.79e-06	0.00944
Cl-	0.532	0.532	884.
Fe+++	0.0794	0.0673	176.
H+	0.110	0.146	6.89
H2O	1.18e+03	1.18e+03	9.93e+05
K+	0.0101	0.0101	18.4
Mg++	0.249	0.249	284.
Na+	0.385	0.385	414.
Ni++	2.62e-05	2.62e-05	0.0721
O2(aq)	-0.0168	-0.0168	-25.2
SO4--	0.811	0.811	3.65e+03
UO2++	3.09e-05	3.09e-05	0.392

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	2.374e-05	2.374e-05	0.08336		
Be	3.622e-05	3.622e-05	0.01530		
C	0.1090	0.1090	61.37		
Ca	0.5654	0.5654	1062.		
Cd	1.791e-06	1.791e-06	0.009436		
Cl	0.5321	0.5321	884.0		
Fe	0.07939	0.06730	176.1		
H	2353.	2353.	1.111e+05		
K	0.01005	0.01005	18.42		
Mg	0.2493	0.2493	284.1		
Na	0.3845	0.3845	414.3		
Ni	2.620e-05	2.620e-05	0.07208		
O	1180.	1180.	8.847e+05		
S	0.8110	0.8110	1219.		
U	3.095e-05	3.095e-05	0.3452		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 6.066 log fO2 = -41.053
Eh = 0.2628 volts pe = 4.4430
Ionic strength = 0.099751
Activity of water = 0.998372
Solvent mass = 51.502 kg
Solution mass = 51.788 kg
Mineral mass = 0.00000 kg
Solution density = 1.015 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.023458 molal
Dissolved solids = 5524 mg/kg sol'n
Elect. conductivity = 5807.65 uS/cm (or umho/cm)
Hardness = 3188.88 mg/kg sol'n as CaCO3
carbonate = 106.50 mg/kg sol'n as CaCO3
non-carbonate = 3082.37 mg/kg sol'n as CaCO3
Carbonate alkalinity= 106.50 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 5.10e+04 cm3
Fluid volume = 5.10e+04 cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.2628	4.4430

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02281	804.2	0.7810	-1.7492
SO4--	0.01750	1671.	0.3721	-2.1864
Na+	0.01566	358.0	0.7810	-1.9126
Ca++	0.01361	542.7	0.3721	-2.2954
CaSO4 (aq)	0.007384	999.7	1.0232	-2.1218
Mg++	0.007204	174.2	0.3721	-2.5718
MgSO4 (aq)	0.003103	371.5	1.0232	-2.4982
H2CO3* (aq)	0.003021	186.3	1.0232	-2.5099
HCO3-	0.002051	124.5	0.7810	-2.7953
Fe++	0.001001	55.58	0.3721	-3.4290
FeSO4 (aq)	0.0005816	87.86	1.0232	-3.2254
NaSO4-	0.0005602	66.32	0.7810	-3.3590

K+	0.0003864	15.03	0.7810	-3.5203
CaCl+	0.0002902	21.80	0.7810	-3.6446
MgCl+	0.0002434	14.47	0.7810	-3.7210
CaHCO3+	0.0001324	13.31	0.7810	-3.9856
NaCl (aq)	0.0001067	6.202	1.0232	-3.9618
MgHCO3+	6.405e-05	5.435	0.7810	-4.3008
KSO4-	1.768e-05	2.376	0.7810	-4.8600
FeHCO3+	9.619e-06	1.118	0.7810	-5.1242
NaHCO3 (aq)	9.599e-06	0.8019	1.0232	-5.0078
FeCl+	5.359e-06	0.4866	0.7810	-5.3782
Fe(OH)2+	2.956e-06	0.2641	0.7810	-5.6367
KCl (aq)	2.634e-06	0.1953	1.0232	-5.5695
H+	1.099e-06	0.001102	0.7810	-6.0664
HSO4-	6.942e-07	0.06701	0.7810	-6.2659
Ca2UO2(CO3)3 (aq	6.525e-07	0.3441	1.0232	-6.1754
Be(OH)2 (aq)	5.096e-07	0.02180	1.0232	-6.2828
Ni++	4.210e-07	0.02458	0.3721	-6.8051
H2AsO4-	3.900e-07	0.05466	0.7810	-6.5163
CO3--	2.352e-07	0.01404	0.3721	-7.0579
FeOH+	2.223e-07	0.01611	0.7810	-6.7604
MgCO3 (aq)	2.188e-07	0.01835	1.0232	-6.6499
NiSO4 (aq)	1.988e-07	0.03060	1.0232	-6.6915
Be++	1.410e-07	0.001264	0.3721	-7.2801
CaCO3 (aq)	1.314e-07	0.01308	1.0232	-6.8714
HAsO4--	9.759e-08	0.01358	0.3721	-7.4400
BeSO4 (aq)	5.170e-08	0.005403	1.0232	-7.2765
NiHCO3+	3.963e-08	0.004718	0.7810	-7.5093
FeOH++	2.864e-08	0.002075	0.3721	-7.9723
NaCO3-	2.552e-08	0.002106	0.7810	-7.7005
UO2(CO3)2--	2.263e-08	0.008779	0.3721	-8.0746
OH-	1.500e-08	0.0002536	0.7810	-7.9314
Cd++	1.366e-08	0.001527	0.3721	-8.2938
UO2CO3 (aq)	1.177e-08	0.003864	1.0232	-7.9191
CdCl+	1.107e-08	0.001628	0.7810	-8.0630

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Magnetite	17.6602s/sat	Na-Jarosite	-0.6255
Hematite	13.7780s/sat	Calcite	-0.8734
Fe(OH)2.7Cl.3	6.8745s/sat	Aragonite	-1.0171
Maghemite	5.9740s/sat	Vaterite	-1.4398
Goethite	5.6887s/sat	Be(OH)2 (beta)	-1.6428
Magnesioferrite	5.0605s/sat	Dolomite (ordere	-1.8929
Lepidocrocite	4.8087s/sat	Be(OH)2 (alpha)	-2.0428
Ferrihydrite (ag	3.4890s/sat	Magnesite	-2.1696
K-Jarosite	3.4469s/sat	CaCO3xH2O	-2.2096
Ferrihydrite	2.9790s/sat	Be(OH)2 (am)	-2.3428
Fe3(OH)8	0.8382s/sat	Dolomite (disord	-2.4429
Gypsum	0.1268s/sat	Epsomite	-2.6366
Siderite	0.1031s/sat	NiCO3	-2.6630
Anhydrite	-0.1218		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.09096	-1.041
O2(g)	8.846e-42	-41.053
CH4(g)	6.048e-63	-62.218

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	2.51e-05	2.51e-05	0.0674			
Be++	3.68e-05	3.68e-05	0.00640			
CO3--	0.272	0.272	316.			
Ca++	1.10	1.10	854.			
Cd++	1.81e-06	1.81e-06	0.00393			
Cl-	1.21	1.21	827.			
Fe+++	0.0824	0.0824	88.9			
H+	0.345	0.345	6.72			
H2O	2.86e+03	2.86e+03	9.94e+05			
K+	0.0209	0.0209	15.8			
Mg++	0.547	0.547	257.			
Na+	0.841	0.841	373.			
Ni++	3.41e-05	3.41e-05	0.0386			
O2(aq)	-0.0206	-0.0206	-12.7			
SO4--	1.50	1.50	2.78e+03			
UO2++	3.57e-05	3.57e-05	0.186			

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	2.511e-05	2.511e-05	0.03633		
Be	3.680e-05	3.680e-05	0.006403		
C	0.2725	0.2725	63.20		
Ca	1.103	1.103	853.9		
Cd	1.809e-06	1.809e-06	0.003926		
Cl	1.208	1.208	827.1		
Fe	0.08243	0.08243	88.89		
H	5718.	5718.	1.113e+05		
K	0.02095	0.02095	15.82		
Mg	0.5467	0.5467	256.6		
Na	0.8413	0.8413	373.5		
Ni	3.406e-05	3.406e-05	0.03862		
O	2866.	2866.	8.853e+05		
S	1.501	1.501	929.3		
U	3.565e-05	3.565e-05	0.1639		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 5.143 log fO2 = -44.745
Eh = 0.2628 volts pe = 4.4430
Ionic strength = 0.097891
Activity of water = 0.998382

Solvent mass = 51.500 kg
Solution mass = 51.784 kg
Mineral mass = 0.0034089 kg
Solution density = 1.015 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.023459 molal
Dissolved solids = 5480 mg/kg sol'n
Elect. conductivity = 5734.50 uS/cm (or umho/cm)
Hardness = 3158.45 mg/kg sol'n as CaCO3
carbonate = 19.72 mg/kg sol'n as CaCO3
non-carbonate = 3138.73 mg/kg sol'n as CaCO3
Carbonate alkalinity= 19.72 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 5.10e+04 cm3
Fluid volume = 5.10e+04 cm3
Mineral volume = 1.29 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.6 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.2628	4.4430

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

Minerals in system	moles	log moles	grams	volume (cm3)
Ferrihydrite	0.03190	-1.496	3.409	1.286
(total)			3.409	1.286

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02281	804.4	0.7821	-1.7485
SO4--	0.01763	1684.	0.3741	-2.1808
Na+	0.01566	358.0	0.7821	-1.9120
Ca++	0.01340	534.1	0.3741	-2.2999
CaSO4 (aq)	0.007404	1002.	1.0228	-2.1208
Mg++	0.007199	174.1	0.3741	-2.5697
H2CO3* (aq)	0.004857	299.6	1.0228	-2.3039
MgSO4 (aq)	0.003160	378.3	1.0228	-2.4906
Fe++	0.0006135	34.07	0.3741	-3.6392
NaSO4-	0.0005674	67.18	0.7821	-3.3528
HCO3-	0.0003931	23.85	0.7821	-3.5122
K+	0.0003862	15.02	0.7821	-3.5199
FeSO4 (aq)	0.0003632	54.88	1.0228	-3.4300
CaCl+	0.0002873	21.58	0.7821	-3.6485
MgCl+	0.0002446	14.54	0.7821	-3.7183
NaCl (aq)	0.0001071	6.223	1.0228	-3.9605
CaHCO3+	2.510e-05	2.524	0.7821	-4.7071

KSO4-	1.789e-05	2.405	0.7821	-4.8540
MgHCO3+	1.233e-05	1.047	0.7821	-5.0157
H+	9.190e-06	0.009212	0.7821	-5.1434
HSO4-	5.880e-06	0.5677	0.7821	-5.3374
FeCl+	3.304e-06	0.3000	0.7821	-5.5877
KCl (aq)	2.641e-06	0.1958	1.0228	-5.5685
NaHCO3 (aq)	1.845e-06	0.1542	1.0228	-5.7241
FeHCO3+	1.136e-06	0.1320	0.7821	-6.0513
Be++	4.907e-07	0.004398	0.3741	-6.7362
UO2CO3 (aq)	4.818e-07	0.1581	1.0228	-6.3074
H2AsO4-	4.730e-07	0.06630	0.7821	-6.4319
Ni++	4.401e-07	0.02570	0.3741	-6.7835
NiSO4 (aq)	2.118e-07	0.03260	1.0228	-6.6643
BeSO4 (aq)	1.833e-07	0.01915	1.0228	-6.7271
UO2SO4 (aq)	6.617e-08	0.02409	1.0228	-7.1696
UO2++	5.218e-08	0.01401	0.3741	-7.7095
UO2(SO4)2--	3.602e-08	0.01656	0.3741	-7.8704
Fe(OH)2+	2.594e-08	0.002319	0.7821	-7.6927
Be(OH)2 (aq)	2.543e-08	0.001088	1.0228	-7.5848
UO2(CO3)2--	2.110e-08	0.008184	0.3741	-8.1028
UO2OH+	1.950e-08	0.005565	0.7821	-7.8168
FeOH+	1.634e-08	0.001184	0.7821	-7.8935
HAsO4--	1.408e-08	0.001959	0.3741	-8.2784
Ca2UO2(CO3)3 (aq	1.373e-08	0.007239	1.0228	-7.8526
Cd++	1.367e-08	0.001528	0.3741	-8.2912
CdCl+	1.114e-08	0.001638	0.7821	-8.0598

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Magnetite	9.6463s/sat	Anhydrite	-0.1208
Hematite	7.8201s/sat	Siderite	-1.7469
Fe(OH)2.7Cl.3	4.1726s/sat	Rutherfordine	-1.9452
Goethite	2.7097s/sat	Calcite	-2.5179
Lepidocrocite	1.8297s/sat	Epsomite	-2.6290
Ferrihydrite (ag	0.5100s/sat	Aragonite	-2.6616
Gypsum	0.1278s/sat	K-Jarosite	-2.7097
Maghemite	0.0161s/sat	Magnesioferrite	-2.7412
Ferrihydrite	0.0000 sat	Be(OH)2 (beta)	-2.9448

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.1462	-0.835
O2(g)	1.799e-45	-44.745
CH4(g)	2.350e-55	-54.629

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	2.51e-05	2.51e-05	0.0674			
Be++	3.68e-05	3.68e-05	0.00640			
CO3--	0.272	0.272	316.			

Ca++	1.09	1.09	842.
Cd++	1.81e-06	1.81e-06	0.00393
Cl-	1.21	1.21	827.
Fe+++	0.0824	0.0505	54.5
H+	0.377	0.473	9.20
H2O	2.86e+03	2.86e+03	9.95e+05
K+	0.0209	0.0209	15.8
Mg++	0.547	0.547	257.
Na+	0.841	0.841	373.
Ni++	3.41e-05	3.41e-05	0.0386
O2(aq)	-0.0126	-0.0126	-7.81
SO4--	1.50	1.50	2.78e+03
UO2++	3.57e-05	3.57e-05	0.186

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	2.511e-05	2.511e-05	0.03633		
Be	3.680e-05	3.680e-05	0.006404		
C	0.2725	0.2725	63.20		
Ca	1.087	1.087	841.6		
Cd	1.809e-06	1.809e-06	0.003926		
Cl	1.208	1.208	827.1		
Fe	0.08243	0.05053	54.50		
H	5718.	5718.	1.113e+05		
K	0.02095	0.02095	15.82		
Mg	0.5467	0.5467	256.7		
Na	0.8413	0.8413	373.5		
Ni	3.406e-05	3.406e-05	0.03862		
O	2866.	2866.	8.853e+05		
S	1.501	1.501	929.4		
U	3.565e-05	3.565e-05	0.1639		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 6.103 log fO2 = -41.501
Eh = 0.2540 volts pe = 4.2943
Ionic strength = 0.092672
Activity of water = 0.998472
Solvent mass = 102.02 kg
Solution mass = 102.53 kg
Mineral mass = 0.00000 kg
Solution density = 1.015 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.022888 molal
Dissolved solids = 5066 mg/kg sol'n
Elect. conductivity = 5496.36 uS/cm (or umho/cm)
Hardness = 2960.40 mg/kg sol'n as CaCO3
carbonate = 112.60 mg/kg sol'n as CaCO3
non-carbonate = 2847.81 mg/kg sol'n as CaCO3
Carbonate alkalinity= 112.60 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 1.01e+05 cm3
Fluid volume = 1.01e+05 cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.2540	4.2943

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02228	785.7	0.7852	-1.7572
SO4--	0.01583	1513.	0.3801	-2.2206
Na+	0.01510	345.3	0.7852	-1.9262
Ca++	0.01263	503.7	0.3801	-2.3187
Mg++	0.007043	170.4	0.3801	-2.5724
CaSO4 (aq)	0.006478	877.4	1.0216	-2.1793
H2CO3* (aq)	0.002956	182.4	1.0216	-2.5201
MgSO4 (aq)	0.002869	343.6	1.0216	-2.5330
HCO3-	0.002169	131.7	0.7852	-2.7688
Fe++	0.0005470	30.39	0.3801	-3.6821
NaSO4-	0.0004991	59.12	0.7852	-3.4068
K+	0.0003654	14.22	0.7852	-3.5422

FeSO4 (aq)	0.0003006	45.43	1.0216	-3.5128
CaCl+	0.0002686	20.19	0.7852	-3.6759
MgCl+	0.0002374	14.12	0.7852	-3.7296
CaHCO3+	0.0001326	13.34	0.7852	-3.9824
NaCl (aq)	0.0001017	5.914	1.0216	-3.9834
MgHCO3+	6.763e-05	5.742	0.7852	-4.2749
KSO4-	1.545e-05	2.077	0.7852	-4.9161
NaHCO3 (aq)	9.904e-06	0.8278	1.0216	-4.9949
FeHCO3+	5.678e-06	0.6602	0.7852	-5.3509
FeCl+	2.922e-06	0.2654	0.7852	-5.6394
KCl (aq)	2.462e-06	0.1826	1.0216	-5.5994
Fe(OH)2+	1.380e-06	0.1234	0.7852	-5.9650
H+	1.005e-06	0.001007	0.7852	-6.1031
HSO4-	5.864e-07	0.05664	0.7852	-6.3368
Ca2UO2(CO3)3 (aq	4.037e-07	0.2130	1.0216	-6.3846
Ni++	2.977e-07	0.01739	0.3801	-6.9463
Be(OH)2 (aq)	2.784e-07	0.01192	1.0216	-6.5460
CO3--	2.664e-07	0.01590	0.3801	-6.9946
MgCO3 (aq)	2.532e-07	0.02124	1.0216	-6.5873
H2AsO4-	2.118e-07	0.02971	0.7852	-6.7790
CaCO3 (aq)	1.443e-07	0.01437	1.0216	-6.8315
FeOH+	1.344e-07	0.009740	0.7852	-6.9767
NiSO4 (aq)	1.330e-07	0.02048	1.0216	-6.8670
Be++	6.357e-08	0.0005700	0.3801	-7.6169
HAsO4--	5.678e-08	0.007905	0.3801	-7.6659
NiHCO3+	3.027e-08	0.003606	0.7852	-7.6240
NaCO3-	2.846e-08	0.002350	0.7852	-7.6508
BeSO4 (aq)	2.204e-08	0.002304	1.0216	-7.6475
OH-	1.623e-08	0.0002747	0.7852	-7.8946
UO2(CO3)2--	1.317e-08	0.005112	0.3801	-8.3004
FeOH++	1.210e-08	0.0008769	0.3801	-8.3374

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Magnetite	16.8974s/sat	Calcite	-0.8335
Hematite	13.1948s/sat	Aragonite	-0.9772
Fe(OH)2.7Cl.3	6.5695s/sat	Vaterite	-1.3999
Goethite	5.3971s/sat	Na-Jarosite	-1.6924
Maghemite	5.3908s/sat	Dolomite (ordere	-1.7903
Magnesioferrite	4.5502s/sat	Be(OH)2 (beta)	-1.9060
Lepidocrocite	4.5171s/sat	Magnesite	-2.1070
Ferrihydrite (ag	3.1974s/sat	CaCO3xH2O	-2.1697
Ferrihydrite	2.6874s/sat	Be(OH)2 (alpha)	-2.3060
K-Jarosite	2.3715s/sat	Dolomite (disord	-2.3403
Fe3(OH)8	0.0755s/sat	Be(OH)2 (am)	-2.6060
Gypsum	0.0694s/sat	Epsomite	-2.6711
Siderite	-0.0868	NiCO3	-2.7410
Anhydrite	-0.1793		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.

CO2(g)	0.08883	-1.051
O2(g)	3.154e-42	-41.501
CH4(g)	4.647e-62	-61.333

Original basis	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg	Kd L/kg
AsO4---	2.74e-05	2.74e-05	0.0371			
Be++	3.77e-05	3.77e-05	0.00332			
CO3--	0.545	0.545	319.			
Ca++	1.99	1.99	778.			
Cd++	1.84e-06	1.84e-06	0.00201			
Cl-	2.33	2.33	807.			
Fe+++	0.0875	0.0875	47.7			
H+	0.759	0.759	7.46			
H2O	5.66e+03	5.66e+03	9.95e+05			
K+	0.0391	0.0391	14.9			
Mg++	1.04	1.04	247.			
Na+	1.60	1.60	359.			
Ni++	4.72e-05	4.72e-05	0.0270			
O2(aq)	-0.0218	-0.0218	-6.82			
SO4--	2.65	2.65	2.48e+03			
UO2++	4.35e-05	4.35e-05	0.115			

Elemental composition	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg
As	2.741e-05	2.741e-05	0.02003		
Be	3.775e-05	3.775e-05	0.003318		
C	0.5450	0.5450	63.84		
Ca	1.990	1.990	778.0		
Cd	1.838e-06	1.838e-06	0.002014		
Cl	2.335	2.335	807.3		
Fe	0.08750	0.08750	47.66		
H	1.133e+04	1.133e+04	1.113e+05		
K	0.03911	0.03911	14.91		
Mg	1.042	1.042	247.1		
Na	1.602	1.602	359.2		
Ni	4.717e-05	4.717e-05	0.02701		
O	5675.	5675.	8.855e+05		
S	2.652	2.652	829.2		
U	4.349e-05	4.349e-05	0.1010		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 5.365 log fO2 = -44.453
Eh = 0.2540 volts pe = 4.2943
Ionic strength = 0.090925
Activity of water = 0.998481
Solvent mass = 102.01 kg
Solution mass = 102.53 kg
Mineral mass = 0.0062269 kg

Solution density = 1.015 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.022889 molal
Dissolved solids = 5025 mg/kg sol'n
Elect. conductivity = 5425.71 uS/cm (or umho/cm)
Hardness = 2932.25 mg/kg sol'n as CaCO3
carbonate = 31.42 mg/kg sol'n as CaCO3
non-carbonate = 2900.82 mg/kg sol'n as CaCO3
Carbonate alkalinity= 31.42 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 1.01e+05 cm3
Fluid volume = 1.01e+05 cm3
Mineral volume = 2.35 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.6 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.2540	4.2943

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

Minerals in system	moles	log moles	grams	volume (cm3)
Ferrihydrite	0.05827	-1.235	6.227	2.350
(total)			6.227	2.350

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02228	785.9	0.7863	-1.7565
SO4--	0.01595	1524.	0.3822	-2.2150
Na+	0.01510	345.3	0.7863	-1.9256
Ca++	0.01243	495.6	0.3822	-2.3233
Mg++	0.007038	170.2	0.3822	-2.5703
CaSO4 (aq)	0.006495	879.9	1.0212	-2.1783
H2CO3* (aq)	0.004657	287.4	1.0212	-2.3228
MgSO4 (aq)	0.002922	349.9	1.0212	-2.5252
HCO3-	0.0006238	37.87	0.7863	-3.3094
NaSO4-	0.0005057	59.90	0.7863	-3.4005
K+	0.0003652	14.21	0.7863	-3.5418
CaCl+	0.0002658	19.98	0.7863	-3.6799
MgCl+	0.0002386	14.19	0.7863	-3.7268
Fe++	0.0001827	10.15	0.3822	-4.1560
FeSO4 (aq)	0.0001023	15.46	1.0212	-3.9810
NaCl (aq)	0.0001020	5.934	1.0212	-3.9821
CaHCO3+	3.774e-05	3.797	0.7863	-4.5276
MgHCO3+	1.955e-05	1.660	0.7863	-4.8133
KSO4-	1.564e-05	2.104	0.7863	-4.9101
H+	5.485e-06	0.005501	0.7863	-5.3652

HSO4-	3.244e-06	0.3133	0.7863	-5.5933
NaHCO3 (aq)	2.858e-06	0.2389	1.0212	-5.5348
KCl (aq)	2.469e-06	0.1832	1.0212	-5.5984
FeCl+	9.815e-07	0.08916	0.7863	-6.1126
FeHCO3+	5.485e-07	0.06377	0.7863	-6.3653
Ni++	3.107e-07	0.01815	0.3822	-6.9253
UO2CO3 (aq)	2.971e-07	0.09756	1.0212	-6.5180
H2AsO4-	2.560e-07	0.03590	0.7863	-6.6962
Be++	2.417e-07	0.002167	0.3822	-7.0345
NiSO4 (aq)	1.415e-07	0.02178	1.0212	-6.8403
BeSO4 (aq)	8.540e-08	0.008928	1.0212	-7.0595
Ca2UO2(CO3)3 (aq	5.374e-08	0.02835	1.0212	-7.2606
Be(OH)2 (aq)	3.561e-08	0.001524	1.0212	-7.4394
UO2(CO3)2--	3.380e-08	0.01312	0.3822	-7.8887
Fe(OH)2+	1.548e-08	0.001384	0.7863	-7.9146
UO2SO4 (aq)	1.419e-08	0.005167	1.0212	-7.8391
CO3--	1.395e-08	0.0008331	0.3822	-8.2730
MgCO3 (aq)	1.341e-08	0.001125	1.0212	-7.8636
HAsO4--	1.250e-08	0.001740	0.3822	-8.3210
UO2++	1.183e-08	0.003177	0.3822	-8.3449

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Magnetite	9.5729s/sat	Anhydrite	-0.1783
Hematite	7.8200s/sat	Siderite	-1.8390
Fe(OH)2.7Cl.3	4.1037s/sat	Calcite	-2.1166
Goethite	2.7097s/sat	Rutherfordine	-2.1558
Lepidocrocite	1.8297s/sat	Aragonite	-2.2603
Ferrihydrite (ag	0.5100s/sat	Magnesioferrite	-2.2982
Gypsum	0.0704s/sat	Epsomite	-2.6634
Maghemite	0.0160s/sat	Vaterite	-2.6830
Ferrihydrite	0.0000 sat	Be(OH)2 (beta)	-2.7994

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.1399	-0.854
O2(g)	3.528e-45	-44.453
CH4(g)	5.852e-56	-55.233

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	2.74e-05	2.74e-05	0.0371			
Be++	3.77e-05	3.77e-05	0.00332			
CO3--	0.545	0.545	319.			
Ca++	1.96	1.96	767.			
Cd++	1.84e-06	1.84e-06	0.00201			
Cl-	2.33	2.33	807.			
Fe+++	0.0875	0.0292	15.9			
H+	0.817	0.992	9.75			
H2O	5.66e+03	5.66e+03	9.95e+05			

K+	0.0391	0.0391	14.9
Mg++	1.04	1.04	247.
Na+	1.60	1.60	359.
Ni++	4.72e-05	4.72e-05	0.0270
O2(aq)	-0.00731	-0.00731	-2.28
SO4--	2.65	2.65	2.48e+03
UO2++	4.35e-05	4.35e-05	0.115

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	2.741e-05	2.741e-05	0.02003		
Be	3.775e-05	3.775e-05	0.003318		
C	0.5450	0.5450	63.84		
Ca	1.961	1.961	766.7		
Cd	1.838e-06	1.838e-06	0.002015		
Cl	2.335	2.335	807.4		
Fe	0.08750	0.02923	15.92		
H	1.133e+04	1.133e+04	1.113e+05		
K	0.03911	0.03911	14.91		
Mg	1.042	1.042	247.2		
Na	1.602	1.602	359.3		
Ni	4.717e-05	4.717e-05	0.02701		
O	5675.	5675.	8.856e+05		
S	2.652	2.652	829.3		
U	4.349e-05	4.349e-05	0.1010		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 1.912 log fO2 = -23.568
Eh = 0.7672 volts pe = 12.9690
Ionic strength = 0.135200
Activity of water = 0.997525
Solvent mass = 11.089 kg
Solution mass = 11.185 kg
Mineral mass = 0.00000 kg
Solution density = 1.017 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.027382 molal
Dissolved solids = 8611 mg/kg sol'n
Elect. conductivity = 12331.68 uS/cm (or umho/cm)
Hardness = 3592.61 mg/kg sol'n as CaCO3
carbonate = 0.01 mg/kg sol'n as CaCO3
non-carbonate = 3592.59 mg/kg sol'n as CaCO3
Carbonate alkalinity= 0.01 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 1.10e+04 cm3
Fluid volume = 1.10e+04 cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.7672	12.9690

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02653	932.4	0.7645	-1.6929
SO4--	0.02357	2245.	0.3416	-2.0941
Na+	0.01800	410.3	0.7645	-1.8613
H+	0.01602	16.00	0.7645	-1.9120
HSO4-	0.01251	1204.	0.7645	-2.0193
Ca++	0.01216	483.2	0.3416	-2.3816
Mg++	0.01074	258.9	0.3416	-2.4354
CaSO4 (aq)	0.007427	1002.	1.0316	-2.1157
MgSO4 (aq)	0.005211	621.9	1.0316	-2.2695
FeSO4+	0.005196	782.5	0.7645	-2.4010
H2CO3* (aq)	0.004916	302.3	1.0316	-2.2949
NaSO4-	0.0007965	94.01	0.7645	-3.2154

Fe(SO4)2-	0.0005643	138.7	0.7645	-3.3651
K+	0.0005440	21.09	0.7645	-3.3810
MgCl+	0.0003875	22.96	0.7645	-3.5284
Fe+++	0.0003110	17.22	0.0892	-4.5569
CaCl+	0.0002768	20.73	0.7645	-3.6745
NaCl (aq)	0.0001356	7.856	1.0316	-3.8543
Fe++	9.390e-05	5.199	0.3416	-4.4938
FeOH++	6.318e-05	4.564	0.3416	-4.6659
FeSO4 (aq)	6.145e-05	9.255	1.0316	-4.1979
FeCl++	4.974e-05	4.502	0.3416	-4.7698
KSO4-	3.078e-05	4.124	0.7645	-4.6284
KCl (aq)	4.098e-06	0.3029	1.0316	-5.3739
H3AsO4	3.051e-06	0.4293	1.0316	-5.5020
H2AsO4-	1.685e-06	0.2354	0.7645	-5.8900
UO2SO4 (aq)	6.224e-07	0.2259	1.0316	-6.1924
FeCl+	5.369e-07	0.04859	0.7645	-6.3868
Fe2(OH)2++++	4.789e-07	0.06918	0.0136	-8.1858
UO2(SO4)2--	4.571e-07	0.2094	0.3416	-6.8066
UO2++	4.440e-07	0.1189	0.3416	-6.8191
Fe(OH)2+	4.282e-07	0.03815	0.7645	-6.4849
HCO3-	2.410e-07	0.01458	0.7645	-6.7346
Ni++	1.540e-07	0.008965	0.3416	-7.2789
NiSO4 (aq)	8.193e-08	0.01257	1.0316	-7.0730
Cd++	1.478e-08	0.001647	0.3416	-8.2967
CdCl+	1.279e-08	0.001875	0.7645	-8.0096
CaHCO3+	1.275e-08	0.001278	0.7645	-8.0111
Be++	1.185e-08	0.0001059	0.3416	-8.3926
MgHCO3+	1.030e-08	0.0008714	0.7645	-8.1037

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Hematite	3.7733s/sat	Ferrihydrite (ag	-1.5140
Fe(OH)2.7Cl.3	3.1349s/sat	Magnetite	-1.7183
K-Jarosite	1.2260s/sat	Ferrihydrite	-2.0240
Goethite	0.6861s/sat	Epsomite	-2.4106
Gypsum	0.1322s/sat	H-Jarosite	-2.9162
Anhydrite	-0.1157	Na-Jarosite	-2.9344
Lepidocrocite	-0.1939		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.1493	-0.826
O2(g)	2.707e-24	-23.568
CH4(g)	1.059e-97	-96.975

Original basis	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg	Kd L/kg
AsO4---	5.25e-05	5.25e-05	0.652			
Be++	1.91e-07	1.91e-07	0.000154			
CO3--	0.0545	0.0545	292.			

Ca++	0.220	0.220	789.
Cd++	4.51e-07	4.51e-07	0.00453
Cl-	0.304	0.304	962.
Fe+++	0.0703	0.0703	351.
H+	0.423	0.423	38.1
H2O	616.	616.	9.91e+05
K+	0.00642	0.00642	22.4
Mg++	0.181	0.181	394.
Na+	0.210	0.210	432.
Ni++	2.62e-06	2.62e-06	0.0138
O2(aq)	-0.000432	-0.000432	-1.24
SO4--	0.620	0.620	5.33e+03
UO2++	1.70e-05	1.70e-05	0.409

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	5.252e-05	5.252e-05	0.3518		
Be	1.909e-07	1.909e-07	0.0001538		
C	0.05452	0.05452	58.54		
Ca	0.2203	0.2203	789.3		
Cd	4.508e-07	4.508e-07	0.004530		
Cl	0.3036	0.3036	962.4		
Fe	0.07032	0.07032	351.1		
H	1232.	1232.	1.110e+05		
K	0.006420	0.006420	22.44		
Mg	0.1812	0.1812	393.9		
Na	0.2100	0.2100	431.5		
Ni	2.623e-06	2.623e-06	0.01377		
O	618.2	618.2	8.842e+05		
S	0.6203	0.6203	1778.		
U	1.696e-05	1.696e-05	0.3609		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 2.199 log fO2 = -23.137
Eh = 0.7566 volts pe = 12.7901
Ionic strength = 0.111389
Activity of water = 0.998030
Solvent mass = 21.192 kg
Solution mass = 21.335 kg
Mineral mass = 0.00000 kg
Solution density = 1.016 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.024960 molal
Dissolved solids = 6702 mg/kg sol'n
Elect. conductivity = 8859.85 uS/cm (or umho/cm)
Hardness = 3178.33 mg/kg sol'n as CaCO3
carbonate = 0.02 mg/kg sol'n as CaCO3
non-carbonate = 3178.30 mg/kg sol'n as CaCO3
Carbonate alkalinity= 0.02 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 2.10e+04 cm3
Fluid volume = 2.10e+04 cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.7566	12.7901

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02425	853.9	0.7749	-1.7261
SO4--	0.01976	1885.	0.3605	-2.1474
Na+	0.01634	373.0	0.7749	-1.8976
Ca++	0.01175	467.7	0.3605	-2.3731
Mg++	0.008876	214.3	0.3605	-2.4949
H+	0.008171	8.180	0.7749	-2.1985
CaSO4 (aq)	0.006736	910.9	1.0260	-2.1605
HSO4-	0.005647	544.4	0.7749	-2.3590
H2CO3* (aq)	0.005143	316.9	1.0260	-2.2776
MgSO4 (aq)	0.004042	483.3	1.0260	-2.3823
FeSO4+	0.002713	409.4	0.7749	-2.6773
NaSO4-	0.0006394	75.61	0.7749	-3.3050

K+	0.0004485	17.42	0.7749	-3.4590
MgCl+	0.0003089	18.34	0.7749	-3.6210
Fe(SO4)2-	0.0002607	64.20	0.7749	-3.6947
CaCl+	0.0002580	19.35	0.7749	-3.6992
Fe+++	0.0001648	9.142	0.1007	-4.7800
NaCl (aq)	0.0001162	6.744	1.0260	-3.9238
Fe++	8.037e-05	4.458	0.3605	-4.5380
FeOH++	6.931e-05	5.016	0.3605	-4.6023
FeSO4 (aq)	4.937e-05	7.450	1.0260	-4.2954
FeCl++	2.612e-05	2.369	0.3605	-5.0261
KSO4-	2.245e-05	3.013	0.7749	-4.7596
KCl (aq)	3.190e-06	0.2362	1.0260	-5.4851
H2AsO4-	1.279e-06	0.1791	0.7749	-6.0038
H3AsO4	1.220e-06	0.1721	1.0260	-5.9023
Fe(OH)2+	9.465e-07	0.08448	0.7749	-6.1346
Fe2(OH)2++++	5.173e-07	0.07487	0.0169	-8.0586
HCO3-	4.785e-07	0.02900	0.7749	-6.4309
FeCl+	4.433e-07	0.04020	0.7749	-6.4641
UO2SO4 (aq)	3.670e-07	0.1334	1.0260	-6.4242
UO2++	2.789e-07	0.07480	0.3605	-6.9976
UO2(SO4)2--	2.247e-07	0.1031	0.3605	-7.0916
Ni++	1.647e-07	0.009608	0.3605	-7.2263
NiSO4 (aq)	8.227e-08	0.01265	1.0260	-7.0736
CaHCO3+	2.582e-08	0.002592	0.7749	-7.6989
MgHCO3+	1.784e-08	0.001512	0.7749	-7.8595
Be++	1.268e-08	0.0001135	0.3605	-8.3400

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Hematite	5.0466s/sat	Anhydrite	-0.1605
Fe(OH)2.7Cl.3	3.6759s/sat	Ferrihydrite (ag	-0.8770
K-Jarosite	2.0923s/sat	Ferrihydrite	-1.3870
Goethite	1.3229s/sat	Na-Jarosite	-2.0263
Lepidocrocite	0.4429s/sat	H-Jarosite	-2.2580
Gypsum	0.0878s/sat	Epsomite	-2.5218
Magnetite	0.0839s/sat	Maghemite	-2.7574

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.1553	-0.809
O2(g)	7.297e-24	-23.137
CH4(g)	1.517e-98	-97.819

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	5.30e-05	5.30e-05	0.345			
Be++	3.82e-07	3.82e-07	0.000161			
CO3--	0.109	0.109	307.			
Ca++	0.397	0.397	746.			
Cd++	4.57e-07	4.57e-07	0.00241			

Cl-	0.529	0.529	879.
Fe+++	0.0713	0.0713	187.
H+	0.507	0.507	23.9
H2O	1.18e+03	1.18e+03	9.93e+05
K+	0.0100	0.0100	18.4
Mg++	0.280	0.280	319.
Na+	0.362	0.362	390.
Ni++	5.25e-06	5.25e-06	0.0144
O2(aq)	-0.000690	-0.000690	-1.03
SO4--	0.850	0.850	3.83e+03
UO2++	1.85e-05	1.85e-05	0.234

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	5.298e-05	5.298e-05	0.1860		
Be	3.817e-07	3.817e-07	0.0001612		
C	0.1090	0.1090	61.37		
Ca	0.3972	0.3972	746.2		
Cd	4.566e-07	4.566e-07	0.002406		
Cl	0.5290	0.5290	879.0		
Fe	0.07133	0.07133	186.7		
H	2353.	2353.	1.112e+05		
K	0.01005	0.01005	18.42		
Mg	0.2803	0.2803	319.4		
Na	0.3622	0.3622	390.3		
Ni	5.247e-06	5.247e-06	0.01444		
O	1180.	1180.	8.850e+05		
S	0.8504	0.8504	1278.		
U	1.853e-05	1.853e-05	0.2067		

Step #   0   Xi = 0.0000

Temperature = 25.0 C   Pressure = 1.013 bars
pH = 2.681   log fO2 = -22.492
Eh =   0.7376 volts   pe = 12.4684
Ionic strength   =   0.095424
Activity of water   =   0.998363
Solvent mass   =   51.500 kg
Solution mass   =   51.783 kg
Mineral mass   =   0.00000 kg
Solution density   =   1.015   g/cm3
Solution viscosity =   0.009   poise
Chlorinity   =   0.023399 molal
Dissolved solids   =   5465 mg/kg sol'n
Elect. conductivity =   6435.33 uS/cm (or umho/cm)
Hardness   =   2911.67 mg/kg sol'n as CaCO3
  carbonate   =   0.07 mg/kg sol'n as CaCO3
  non-carbonate   =   2911.60 mg/kg sol'n as CaCO3
Carbonate alkalinity=   0.07 mg/kg sol'n as CaCO3
Water type   =   Ca-SO4
Bulk volume   =   5.10e+04 cm3
Fluid volume   =   5.10e+04 cm3
Mineral volume   =   0.000 cm3
Inert volume   =   0.000 cm3
Porosity   =   100. %
Permeability   =   98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.7376	12.4684

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02277	802.8	0.7835	-1.7486
SO4--	0.01692	1616.	0.3769	-2.1954
Na+	0.01526	348.9	0.7835	-1.9224
Ca++	0.01156	460.7	0.3769	-2.3609
Mg++	0.007673	185.5	0.3769	-2.5388
CaSO4 (aq)	0.006225	842.9	1.0222	-2.1963
H2CO3* (aq)	0.005289	326.3	1.0222	-2.2671
MgSO4 (aq)	0.003282	393.0	1.0222	-2.4743
H+	0.002659	2.666	0.7835	-2.6812
HSO4-	0.001645	158.8	0.7835	-2.8897
FeSO4+	0.001067	161.2	0.7835	-3.0777
NaSO4-	0.0005347	63.31	0.7835	-3.3778

K+	0.0003868	15.04	0.7835	-3.5185
MgCl+	0.0002621	15.58	0.7835	-3.6874
CaCl+	0.0002492	18.72	0.7835	-3.7095
NaCl (aq)	0.0001046	6.079	1.0222	-3.9710
Fe(SO4)2-	9.180e-05	22.64	0.7835	-4.1431
FeOH++	8.955e-05	6.488	0.3769	-4.4717
Fe++	7.163e-05	3.979	0.3769	-4.5687
Fe+++	6.627e-05	3.681	0.1113	-5.1322
FeSO4 (aq)	4.134e-05	6.245	1.0222	-4.3741
KSO4-	1.733e-05	2.329	0.7835	-4.8672
FeCl++	1.054e-05	0.9573	0.3769	-5.4008
Fe(OH)2+	3.843e-06	0.3435	0.7835	-5.5212
KCl (aq)	2.651e-06	0.1965	1.0222	-5.5671
HCO3-	1.473e-06	0.08940	0.7835	-5.9377
H2AsO4-	8.002e-07	0.1122	0.7835	-6.2027
Fe2(OH)2++++	7.901e-07	0.1145	0.0202	-7.7975
FeCl+	3.879e-07	0.03522	0.7835	-6.5173
H3AsO4	2.550e-07	0.03600	1.0222	-6.5839
UO2SO4 (aq)	1.925e-07	0.07009	1.0222	-6.7060
Ni++	1.730e-07	0.01010	0.3769	-7.1859
UO2++	1.557e-07	0.04182	0.3769	-7.2314
UO2(SO4)2--	1.005e-07	0.04621	0.3769	-7.4215
CaHCO3+	8.175e-08	0.008219	0.7835	-7.1935
NiSO4 (aq)	8.113e-08	0.01249	1.0222	-7.0813
MgHCO3+	4.963e-08	0.004212	0.7835	-7.4102
Be++	1.331e-08	0.0001193	0.3769	-8.2998

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Hematite	7.2386s/sat	Gypsum	0.0523s/sat
Fe(OH)2.7Cl.3	4.6205s/sat	Anhydrite	-0.1963
K-Jarosite	3.7769s/sat	Ferrihydrite	-0.2908
Magnetite	3.2108s/sat	Na-Jarosite	-0.3070
Goethite	2.4190s/sat	Maghemite	-0.5654
Lepidocrocite	1.5390s/sat	H-Jarosite	-0.9965
Ferrihydrite (ag	0.2192s/sat	Epsomite	-2.6127

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.1591	-0.798
O2(g)	3.219e-23	-22.492
CH4(g)	7.986e-100	-99.098

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	5.43e-05	5.43e-05	0.146			
Be++	9.54e-07	9.54e-07	0.000166			
CO3--	0.272	0.272	316.			
Ca++	0.929	0.929	719.			
Cd++	4.74e-07	4.74e-07	0.00103			

Cl-	1.21	1.21	825.
Fe+++	0.0744	0.0744	80.2
H+	0.756	0.756	14.7
H2O	2.86e+03	2.86e+03	9.95e+05
K+	0.0209	0.0209	15.8
Mg++	0.578	0.578	271.
Na+	0.819	0.819	364.
Ni++	1.31e-05	1.31e-05	0.0149
O2(aq)	-0.00146	-0.00146	-0.902
SO4--	1.54	1.54	2.86e+03
UO2++	2.32e-05	2.32e-05	0.121

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	5.435e-05	5.435e-05	0.07863		
Be	9.541e-07	9.541e-07	0.0001660		
C	0.2725	0.2725	63.20		
Ca	0.9287	0.9287	718.8		
Cd	4.741e-07	4.741e-07	0.001029		
Cl	1.205	1.205	825.0		
Fe	0.07438	0.07438	80.22		
H	5718.	5718.	1.113e+05		
K	0.02095	0.02095	15.82		
Mg	0.5777	0.5777	271.2		
Na	0.8188	0.8188	363.5		
Ni	1.312e-05	1.312e-05	0.01487		
O	2866.	2866.	8.854e+05		
S	1.541	1.541	954.0		
U	2.323e-05	2.323e-05	0.1068		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 3.264 log fO2 = -21.588
Eh = 0.7165 volts pe = 12.1114
Ionic strength = 0.089896
Activity of water = 0.998478
Solvent mass = 102.01 kg
Solution mass = 102.53 kg
Mineral mass = 0.00000 kg
Solution density = 1.015 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.022857 molal
Dissolved solids = 5037 mg/kg sol'n
Elect. conductivity = 5570.05 uS/cm (or umho/cm)
Hardness = 2818.41 mg/kg sol'n as CaCO3
carbonate = 0.28 mg/kg sol'n as CaCO3
non-carbonate = 2818.13 mg/kg sol'n as CaCO3
Carbonate alkalinity= 0.28 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 1.01e+05 cm3
Fluid volume = 1.01e+05 cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.7165	12.1114

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02226	785.1	0.7869	-1.7566
SO4--	0.01587	1517.	0.3835	-2.2158
Na+	0.01489	340.6	0.7869	-1.9311
Ca++	0.01151	458.9	0.3835	-2.3553
Mg++	0.007258	175.6	0.3835	-2.5555
CaSO4 (aq)	0.006025	816.1	1.0209	-2.2111
H2CO3* (aq)	0.005336	329.3	1.0209	-2.2638
MgSO4 (aq)	0.003018	361.5	1.0209	-2.5113
H+	0.0006917	0.6936	0.7869	-3.2642
NaSO4-	0.0004979	58.98	0.7869	-3.4069
FeSO4+	0.0004328	65.42	0.7869	-3.4677
HSO4-	0.0004083	39.44	0.7869	-3.4931

K+	0.0003653	14.21	0.7869	-3.5415
CaCl+	0.0002467	18.54	0.7869	-3.7119
MgCl+	0.0002466	14.66	0.7869	-3.7121
FeOH++	0.0001438	10.43	0.3835	-4.2584
NaCl (aq)	0.0001008	5.859	1.0209	-3.9877
Fe++	6.838e-05	3.800	0.3835	-4.5813
FeSO4 (aq)	3.836e-05	5.798	1.0209	-4.4071
Fe(SO4)2-	3.553e-05	8.765	0.7869	-4.5535
Fe+++	2.721e-05	1.512	0.1157	-5.5019
Fe(OH)2+	2.394e-05	2.141	0.7869	-4.7249
KSO4-	1.561e-05	2.100	0.7869	-4.9106
HCO3-	5.658e-06	0.3435	0.7869	-5.3514
FeCl++	4.342e-06	0.3944	0.3835	-5.7786
KCl (aq)	2.471e-06	0.1833	1.0209	-5.5981
Fe2(OH)2++++	1.969e-06	0.2855	0.0216	-7.3709
H2AsO4-	5.122e-07	0.07182	0.7869	-6.3946
FeCl+	3.682e-07	0.03345	0.7869	-6.5380
CaHCO3+	3.180e-07	0.03199	0.7869	-6.6016
MgHCO3+	1.834e-07	0.01557	0.7869	-6.8406
Ni++	1.762e-07	0.01029	0.3835	-7.1703
UO2SO4 (aq)	1.302e-07	0.04743	1.0209	-6.8763
UO2++	1.084e-07	0.02912	0.3835	-7.3813
NiSO4 (aq)	8.034e-08	0.01237	1.0209	-7.0861
Fe3(OH)4+++++	7.277e-08	0.01706	0.0025	-9.7398
UO2(SO4)2--	6.371e-08	0.02929	0.3835	-7.6121
H3AsO4	4.287e-08	0.006055	1.0209	-7.3588
NaHCO3 (aq)	2.562e-08	0.002141	1.0209	-7.5824
Be++	1.355e-08	0.0001215	0.3835	-8.2843

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Hematite	9.9972s/sat	Na-Jarosite	2.0326s/sat
Magnetite	7.1228s/sat	Ferrihydrite (ag	1.5986s/sat
K-Jarosite	6.1022s/sat	Ferrihydrite	1.0886s/sat
Fe(OH)2.7Cl.3	5.8226s/sat	H-Jarosite	0.7689s/sat
Goethite	3.7983s/sat	Gypsum	0.0376s/sat
Lepidocrocite	2.9183s/sat	Anhydrite	-0.2111
Maghemite	2.1932s/sat	Epsomite	-2.6494

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.1603	-0.795
O2(g)	2.580e-22	-21.588
CH4(g)	1.253e-101	-100.902

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	5.66e-05	5.66e-05	0.0767			
Be++	1.91e-06	1.91e-06	0.000168			
CO3--	0.545	0.545	319.			

Ca++	1.81	1.81	709.
Cd++	5.04e-07	5.04e-07	0.000552
Cl-	2.33	2.33	806.
Fe+++	0.0795	0.0795	43.3
H+	1.17	1.17	11.5
H2O	5.66e+03	5.66e+03	9.95e+05
K+	0.0391	0.0391	14.9
Mg++	1.07	1.07	255.
Na+	1.58	1.58	354.
Ni++	2.62e-05	2.62e-05	0.0150
O2(aq)	-0.00273	-0.00273	-0.853
SO4--	2.69	2.69	2.52e+03
UO2++	3.11e-05	3.11e-05	0.0818

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	5.665e-05	5.665e-05	0.04139		
Be	1.909e-06	1.909e-06	0.0001678		
C	0.5450	0.5450	63.84		
Ca	1.814	1.814	709.0		
Cd	5.036e-07	5.036e-07	0.0005521		
Cl	2.332	2.332	806.3		
Fe	0.07946	0.07946	43.28		
H	1.133e+04	1.133e+04	1.113e+05		
K	0.03911	0.03911	14.91		
Mg	1.073	1.073	254.5		
Na	1.580	1.580	354.3		
Ni	2.623e-05	2.623e-05	0.01502		
O	5675.	5675.	8.856e+05		
S	2.691	2.691	841.4		
U	3.106e-05	3.106e-05	0.07210		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 2.981 log fO2 = -22.720
Eh = 0.7165 volts pe = 12.1114
Ionic strength = 0.089804
Activity of water = 0.998470
Solvent mass = 102.01 kg
Solution mass = 102.53 kg
Mineral mass = 0.0041900 kg
Solution density = 1.015 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.022858 molal
Dissolved solids = 5014 mg/kg sol'n
Elect. conductivity = 5782.39 uS/cm (or umho/cm)
Hardness = 2816.26 mg/kg sol'n as CaCO3
  carbonate = 0.15 mg/kg sol'n as CaCO3
  non-carbonate = 2816.11 mg/kg sol'n as CaCO3
Carbonate alkalinity= 0.15 mg/kg sol'n as CaCO3
Water type = Ca-SO4

Bulk volume = 1.01e+05 cm3
Fluid volume = 1.01e+05 cm3
Mineral volume = 1.58 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.6 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.7165	12.1114

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

Minerals in system	moles	log moles	grams	volume (cm3)
Ferrihydrite	0.03921	-1.407	4.190	1.581
(total)			4.190	1.581

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02226	785.1	0.7870	-1.7566
SO4--	0.01577	1508.	0.3836	-2.2182
Na+	0.01489	340.7	0.7870	-1.9310
Ca++	0.01151	459.2	0.3836	-2.3549
Mg++	0.007269	175.8	0.3836	-2.5547
CaSO4 (aq)	0.005996	812.2	1.0209	-2.2132
H2CO3* (aq)	0.005339	329.5	1.0209	-2.2636
MgSO4 (aq)	0.003007	360.1	1.0209	-2.5129
H+	0.001326	1.330	0.7870	-2.9814
HSO4-	0.0007786	75.20	0.7870	-3.2127
NaSO4-	0.0004952	58.66	0.7870	-3.4093
K+	0.0003653	14.21	0.7870	-3.5413
FeSO4+	0.0002476	37.42	0.7870	-3.7103
MgCl+	0.0002471	14.69	0.7870	-3.7112
CaCl+	0.0002469	18.56	0.7870	-3.7115
NaCl (aq)	0.0001008	5.861	1.0209	-3.9876
FeOH++	4.313e-05	3.126	0.3836	-4.7814
Fe++	3.933e-05	2.185	0.3836	-4.8215
FeSO4 (aq)	2.194e-05	3.317	1.0209	-4.6497
Fe(SO4)2-	2.021e-05	4.985	0.7870	-4.7986
Fe+++	1.564e-05	0.8691	0.1158	-5.7421
KSO4-	1.553e-05	2.088	0.7870	-4.9129
Fe(OH)2+	3.744e-06	0.3348	0.7870	-5.5307
HCO3-	2.951e-06	0.1792	0.7870	-5.6340
FeCl++	2.498e-06	0.2269	0.3836	-6.0186
KCl (aq)	2.472e-06	0.1834	1.0209	-5.5979
H2AsO4-	4.784e-07	0.06708	0.7870	-6.4243
FeCl+	2.118e-07	0.01924	0.7870	-6.7780
Fe2(OH)2++++	1.769e-07	0.02565	0.0216	-8.4168
Ni++	1.765e-07	0.01031	0.3836	-7.1694

CaHCO3+	1.660e-07	0.01670	0.7870	-6.8838
UO2SO4 (aq)	1.303e-07	0.04747	1.0209	-6.8760
UO2++	1.090e-07	0.02929	0.3836	-7.3786
MgHCO3+	9.587e-08	0.008139	0.7870	-7.1224
NiSO4 (aq)	8.005e-08	0.01233	1.0209	-7.0877
H3AsO4	7.681e-08	0.01085	1.0209	-7.1056
UO2(SO4)2--	6.337e-08	0.02914	0.3836	-7.6143
Be++	1.357e-08	0.0001217	0.3836	-8.2835
NaHCO3 (aq)	1.337e-08	0.001117	1.0209	-7.8649

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Hematite	7.8200s/sat	Gypsum	0.0355s/sat
Fe(OH)2.7Cl.3	4.8188s/sat	Maghemite	0.0160s/sat
Magnetite	4.1398s/sat	Ferrihydrite	0.0000 sat
K-Jarosite	3.6801s/sat	Anhydrite	-0.2132
Goethite	2.7097s/sat	Na-Jarosite	-0.3896
Lepidocrocite	1.8297s/sat	H-Jarosite	-1.3706
Ferrihydrite (ag	0.5100s/sat	Epsomite	-2.6511

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.1604	-0.795
O2(g)	1.907e-23	-22.720
CH4(g)	2.296e-99	-98.639

Original basis	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg	Kd L/kg
AsO4---	5.66e-05	5.66e-05	0.0768			
Be++	1.91e-06	1.91e-06	0.000168			
CO3--	0.545	0.545	319.			
Ca++	1.81	1.81	708.			
Cd++	5.04e-07	5.04e-07	0.000552			
Cl-	2.33	2.33	806.			
Fe+++	0.0795	0.0403	21.9			
H+	1.18	1.29	12.7			
H2O	5.66e+03	5.66e+03	9.95e+05			
K+	0.0391	0.0391	14.9			
Mg++	1.07	1.07	255.			
Na+	1.58	1.58	354.			
Ni++	2.62e-05	2.62e-05	0.0150			
O2(aq)	-0.00157	-0.00157	-0.489			
SO4--	2.69	2.69	2.52e+03			
UO2++	3.11e-05	3.11e-05	0.0818			

Elemental composition	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg
As	5.665e-05	5.665e-05	0.04139		
Be	1.909e-06	1.909e-06	0.0001678		

C	0.5450	0.5450	63.84
Ca	1.811	1.811	708.1
Cd	5.036e-07	5.036e-07	0.0005521
Cl	2.332	2.332	806.3
Fe	0.07946	0.04026	21.93
H	1.133e+04	1.133e+04	1.113e+05
K	0.03911	0.03911	14.91
Mg	1.073	1.073	254.6
Na	1.580	1.580	354.3
Ni	2.623e-05	2.623e-05	0.01502
O	5675.	5675.	8.856e+05
S	2.691	2.691	841.4
U	3.106e-05	3.106e-05	0.07210

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 4.800 log fO2 = -23.389
Eh = 0.5990 volts pe = 10.1250
Ionic strength = 0.087138
Activity of water = 0.998529
Solvent mass = 203.04 kg
Solution mass = 204.02 kg
Mineral mass = 0.00000 kg
Solution density = 1.015 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.022584 molal
Dissolved solids = 4827 mg/kg sol'n
Elect. conductivity = 5245.75 uS/cm (or umho/cm)
Hardness = 2772.02 mg/kg sol'n as CaCO3
carbonate = 9.37 mg/kg sol'n as CaCO3
non-carbonate = 2762.65 mg/kg sol'n as CaCO3
Carbonate alkalinity= 9.37 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 2.01e+05 cm3
Fluid volume = 2.01e+05 cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.5990	10.1250

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02200	776.1	0.7887	-1.7607
SO4--	0.01526	1459.	0.3870	-2.2288
Na+	0.01470	336.3	0.7887	-1.9357
Ca++	0.01150	458.9	0.3870	-2.3515
Mg++	0.007050	170.6	0.3870	-2.5642
CaSO4 (aq)	0.005902	799.6	1.0203	-2.2203
H2CO3* (aq)	0.005163	318.7	1.0203	-2.2784
MgSO4 (aq)	0.002873	344.1	1.0203	-2.5330
NaSO4-	0.0004770	56.51	0.7887	-3.4246
K+	0.0003543	13.79	0.7887	-3.5537
Fe(OH)2+	0.0002837	25.37	0.7887	-3.6502
CaCl+	0.0002460	18.49	0.7887	-3.7122

MgCl+	0.0002389	14.21	0.7887	-3.7249
HCO3-	0.0001876	11.39	0.7887	-3.8299
NaCl (aq)	9.882e-05	5.747	1.0203	-3.9965
Fe++	6.604e-05	3.670	0.3870	-4.5926
FeOH++	4.926e-05	3.572	0.3870	-4.7198
FeSO4 (aq)	3.630e-05	5.488	1.0203	-4.4314
H+	2.008e-05	0.02014	0.7887	-4.8003
KSO4-	1.470e-05	1.977	0.7887	-4.9358
HSO4-	1.150e-05	1.111	0.7887	-5.0422
CaHCO3+	1.064e-05	1.070	0.7887	-5.0763
MgHCO3+	5.961e-06	0.5062	0.7887	-5.3278
FeSO4+	4.215e-06	0.6371	0.7887	-5.4783
KCl (aq)	2.382e-06	0.1767	1.0203	-5.6144
NaHCO3 (aq)	8.429e-07	0.07046	1.0203	-6.0655
FeCl+	3.547e-07	0.03222	0.7887	-6.5533
Fe(SO4)2-	3.357e-07	0.08284	0.7887	-6.5771
H2AsO4-	2.969e-07	0.04164	0.7887	-6.6305
Fe+++	2.681e-07	0.01490	0.1181	-7.4995
Fe2(OH)2++++	2.268e-07	0.03289	0.0224	-8.2937
Ni++	1.770e-07	0.01034	0.3870	-7.1643
Fe3(OH)4+++++	9.757e-08	0.02287	0.0026	-9.5878
UO2CO3 (aq)	9.563e-08	0.03141	1.0203	-7.0107
NiSO4 (aq)	7.910e-08	0.01218	1.0203	-7.0931
FeHCO3+	6.036e-08	0.007020	0.7887	-7.3223
UO2SO4 (aq)	5.384e-08	0.01962	1.0203	-7.2601
UO2++	4.573e-08	0.01229	0.3870	-7.7521
FeCl++	4.287e-08	0.003895	0.3870	-7.7802
UO2(SO4)2--	2.531e-08	0.01164	0.3870	-8.0090
Be++	1.358e-08	0.0001218	0.3870	-8.2794

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Magnetite	15.4056s/sat	Magnesioferrite	3.9771s/sat
Hematite	15.2189s/sat	Ferrihydrite	3.6995s/sat
K-Jarosite	9.2882s/sat	H-Jarosite	2.4309s/sat
Fe(OH)2.7Cl.3	7.9714s/sat	Gypsum	0.0284s/sat
Maghemite	7.4149s/sat	Anhydrite	-0.2203
Goethite	6.4092s/sat	Fe3(OH)8	-1.4162
Lepidocrocite	5.5292s/sat	Rutherfordine	-2.6485
Na-Jarosite	5.2261s/sat	Epsomite	-2.6710
Ferrihydrite (ag	4.2095s/sat		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.1550	-0.810
O2(g)	4.081e-24	-23.389
CH4(g)	4.843e-98	-97.315

	In fluid		Sorbed		Kd
Original basis total moles	moles	mg/kg	moles	mg/kg	L/kg

AsO4---	6.12e-05	6.12e-05	0.0417
Be++	3.82e-06	3.82e-06	0.000169
CO3--	1.09	1.09	321.
Ca++	3.59	3.59	705.
Cd++	5.62e-07	5.62e-07	0.000310
Cl-	4.59	4.59	797.
Fe+++	0.0896	0.0896	24.5
H+	2.00	2.00	9.87
H2O	1.13e+04	1.13e+04	9.95e+05
K+	0.0754	0.0754	14.5
Mg++	2.06	2.06	246.
Na+	3.10	3.10	350.
Ni++	5.24e-05	5.24e-05	0.0151
O2(aq)	-0.00522	-0.00522	-0.818
SO4--	4.99	4.99	2.35e+03
UO2++	4.67e-05	4.67e-05	0.0618

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	6.122e-05	6.122e-05	0.02248		
Be	3.816e-06	3.816e-06	0.0001686		
C	1.090	1.090	64.16		
Ca	3.586	3.586	704.5		
Cd	5.624e-07	5.624e-07	0.0003098		
Cl	4.585	4.585	796.8		
Fe	0.08962	0.08962	24.53		
H	2.254e+04	2.254e+04	1.114e+05		
K	0.07541	0.07541	14.45		
Mg	2.064	2.064	246.0		
Na	3.102	3.102	349.5		
Ni	5.245e-05	5.245e-05	0.01509		
O	1.129e+04	1.129e+04	8.857e+05		
S	4.990	4.990	784.3		
U	4.672e-05	4.672e-05	0.05451		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 3.689 log fO2 = -27.833
Eh = 0.5990 volts pe = 10.1250
Ionic strength = 0.086759
Activity of water = 0.998530
Solvent mass = 203.04 kg
Solution mass = 204.02 kg
Mineral mass = 0.0085254 kg
Solution density = 1.015 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.022584 molal
Dissolved solids = 4795 mg/kg sol'n
Elect. conductivity = 5315.36 uS/cm (or umho/cm)
Hardness = 2769.21 mg/kg sol'n as CaCO3
carbonate = 0.75 mg/kg sol'n as CaCO3

non-carbonate = 2768.46 mg/kg sol'n as CaCO3
Carbonate alkalinity= 0.75 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 2.01e+05 cm3
Fluid volume = 2.01e+05 cm3
Mineral volume = 3.22 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.6 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.5990	10.1250

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

Minerals in system	moles	log moles	grams	volume (cm3)
Ferrihydrite	0.07977	-1.098	8.525	3.217
(total)			8.525	3.217

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02200	776.1	0.7890	-1.7606
SO4--	0.01517	1450.	0.3874	-2.2307
Na+	0.01470	336.4	0.7890	-1.9355
Ca++	0.01150	458.8	0.3874	-2.3510
Mg++	0.007060	170.8	0.3874	-2.5630
CaSO4 (aq)	0.005883	797.1	1.0202	-2.2217
H2CO3* (aq)	0.005352	330.3	1.0202	-2.2628
MgSO4 (aq)	0.002868	343.6	1.0202	-2.5338
NaSO4-	0.0004750	56.28	0.7890	-3.4263
K+	0.0003544	13.79	0.7890	-3.5535
H+	0.0002591	0.2599	0.7890	-3.6894
CaCl+	0.0002463	18.51	0.7890	-3.7116
MgCl+	0.0002395	14.25	0.7890	-3.7236
HSO4-	0.0001478	14.28	0.7890	-3.9333
NaCl (aq)	9.890e-05	5.753	1.0202	-3.9961
Fe++	2.834e-05	1.575	0.3874	-4.9594
FeSO4 (aq)	1.553e-05	2.348	1.0202	-4.8002
HCO3-	1.506e-05	0.9143	0.7890	-4.9252
KSO4-	1.464e-05	1.969	0.7890	-4.9375
KCl (aq)	2.384e-06	0.1769	1.0202	-5.6141
FeSO4+	1.802e-06	0.2725	0.7890	-5.8471
FeOH++	1.638e-06	0.1187	0.3874	-6.1976
CaHCO3+	8.548e-07	0.08600	0.7890	-6.1711
Fe(OH)2+	7.314e-07	0.06541	0.7890	-6.2388
MgHCO3+	4.797e-07	0.04074	0.7890	-6.4219
H2AsO4-	2.920e-07	0.04096	0.7890	-6.6375
Ni++	1.782e-07	0.01041	0.3874	-7.1609

FeCl+	1.524e-07	0.01385	0.7890	-6.9200
Fe(SO4)2-	1.429e-07	0.03527	0.7890	-6.9479
Fe+++	1.149e-07	0.006384	0.1184	-7.8664
UO2SO4 (aq)	9.781e-08	0.03563	1.0202	-7.0010
UO2++	8.333e-08	0.02239	0.3874	-7.4910
NiSO4 (aq)	7.938e-08	0.01223	1.0202	-7.0916
NaHCO3 (aq)	6.771e-08	0.005661	1.0202	-7.1606
UO2(SO4)2--	4.572e-08	0.02103	0.3874	-7.7517
FeCl++	1.840e-08	0.001672	0.3874	-8.1469
Be++	1.370e-08	0.0001229	0.3874	-8.2749

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Hematite	7.8199s/sat	Gypsum	0.0270s/sat
Magnetite	5.4179s/sat	Maghemite	0.0159s/sat
Fe(OH)2.7Cl.3	4.6052s/sat	Ferrihydrite	0.0000 sat
Goethite	2.7096s/sat	Anhydrite	-0.2217
Lepidocrocite	1.8296s/sat	Na-Jarosite	-2.5434
K-Jarosite	1.5187s/sat	Epsomite	-2.6717
Ferrihydrite (ag	0.5100s/sat		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.1606	-0.794
O2(g)	1.470e-28	-27.833
CH4(g)	3.871e-89	-88.412

Original basis	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg	Kd L/kg
AsO4---	6.12e-05	6.12e-05	0.0417			
Be++	3.82e-06	3.82e-06	0.000169			
CO3--	1.09	1.09	321.			
Ca++	3.58	3.58	703.			
Cd++	5.62e-07	5.62e-07	0.000310			
Cl-	4.59	4.59	797.			
Fe+++	0.0896	0.00984	2.69			
H+	2.01	2.25	11.1			
H2O	1.13e+04	1.13e+04	9.95e+05			
K+	0.0754	0.0754	14.5			
Mg++	2.06	2.06	246.			
Na+	3.10	3.10	350.			
Ni++	5.24e-05	5.24e-05	0.0151			
O2(aq)	-0.00223	-0.00223	-0.351			
SO4--	4.99	4.99	2.35e+03			
UO2++	4.67e-05	4.67e-05	0.0618			

Elemental composition	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg
As	6.122e-05	6.122e-05	0.02248		

Be	3.816e-06	3.816e-06	0.0001686
C	1.090	1.090	64.17
Ca	3.580	3.580	703.4
Cd	5.624e-07	5.624e-07	0.0003098
Cl	4.585	4.585	796.8
Fe	0.08962	0.009842	2.694
H	2.254e+04	2.254e+04	1.114e+05
K	0.07541	0.07541	14.45
Mg	2.064	2.064	246.0
Na	3.102	3.102	349.5
Ni	5.245e-05	5.245e-05	0.01509
O	1.129e+04	1.129e+04	8.857e+05
S	4.990	4.990	784.3
U	4.672e-05	4.672e-05	0.05451

Step #   0   Xi = 0.0000

Temperature = 25.0 C   Pressure = 1.013 bars
pH = 1.000   log fO2 = -26.358
Eh =   0.7800 volts   pe = 13.1856
Ionic strength   =   0.530938
Activity of water   =   0.987628
Solvent mass   =   1.0000 kg
Solution mass   =   1.0505 kg
Mineral mass   =   0.00000 kg
Solution density   =   1.035   g/cm3
Solution viscosity =   0.009   poise
Chlorinity   =   0.079381 molal
Dissolved solids   =   48030 mg/kg sol'n
Elect. conductivity =   64975.59 uS/cm (or umho/cm)
Hardness   =   12322.25 mg/kg sol'n as CaCO3
  carbonate   =   0.00 mg/kg sol'n as CaCO3
  non-carbonate   =   12322.25 mg/kg sol'n as CaCO3
Carbonate alkalinity=   0.00 mg/kg sol'n as CaCO3
Water type   =   H-HSO4
Bulk volume   =   1.01e+03 cm3
Fluid volume   =   1.01e+03 cm3
Mineral volume   =   0.000 cm3
Inert volume   =   0.000 cm3
Porosity   =   100. %
Permeability   =   98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.7800	13.1856

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
HSO4-	0.2048	1.892e+04	0.7346	-0.8227
H+	0.1361	130.6	0.7346	-1.0000
Cl-	0.07250	2447.	0.7346	-1.2736
FeSO4+	0.05491	7941.	0.7346	-1.3943
SO4--	0.05324	4869.	0.2911	-1.8096
Na+	0.05311	1162.	0.7346	-1.4088
Mg++	0.04598	1064.	0.2911	-1.8734
MgSO4 (aq)	0.03341	3829.	1.1300	-1.4230
Ca++	0.02341	893.3	0.2911	-2.1664
CaSO4 (aq)	0.02142	2776.	1.1300	-1.6161
Fe(SO4)2-	0.01148	2710.	0.7346	-2.0740
NaSO4-	0.004524	512.8	0.7346	-2.4784

MgCl+	0.003863	219.8	0.7346	-2.5470
K+	0.002511	93.47	0.7346	-2.7341
Fe+++	0.002350	124.9	0.0623	-3.8347
CaCl+	0.001241	89.26	0.7346	-3.0401
NaCl (aq)	0.0009215	51.27	1.1300	-2.9824
FeCl++	0.0008083	70.25	0.2911	-3.6283
Fe++	0.0003529	18.76	0.2911	-3.9883
FeSO4 (aq)	0.0003459	50.02	1.1300	-3.4079
KSO4-	0.0002735	35.19	0.7346	-3.6971
H3AsO4	4.903e-05	6.625	1.1300	-4.2564
FeOH++	4.741e-05	3.288	0.2911	-4.8601
KCl (aq)	4.356e-05	3.092	1.1300	-4.3078
H2CO3* (aq)	3.381e-05	1.996	1.1300	-4.4178
UO2(SO4)2--	8.575e-06	3.773	0.2911	-5.6027
UO2SO4 (aq)	4.719e-06	1.645	1.1300	-5.2730
FeCl+	4.699e-06	0.4084	0.7346	-5.4619
H2AsO4-	3.780e-06	0.5072	0.7346	-5.5564
UO2++	2.248e-06	0.5778	0.2911	-6.1842
Fe2(OH)2++++	3.711e-07	0.05147	0.0072	-8.5742
CdCl+	1.818e-07	0.02559	0.7346	-6.8743
Cd++	9.021e-08	0.009653	0.2911	-7.5806
CdSO4 (aq)	8.446e-08	0.01676	1.1300	-7.0203
UO2Cl+	7.017e-08	0.02041	0.7346	-7.2878
Cd(SO4)2--	6.855e-08	0.01987	0.2911	-7.6999
Fe(OH)2+	3.455e-08	0.002956	0.7346	-7.5955
CdCl2 (aq)	2.624e-08	0.004579	1.1300	-7.5279

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Fe(OH)2.7Cl.3	1.5086s/sat	K-Jarosite	-0.8899
Gypsum	0.6231s/sat	Goethite	-1.3365
Anhydrite	0.3839s/sat	Epsomite	-1.5944
Hematite	-0.2676	Lepidocrocite	-2.2165

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.001137	-2.944
O2(g)	4.388e-27	-26.358
CH4(g)	3.005e-94	-93.522

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	5.28e-05	5.28e-05	6.98			
CO3--	3.38e-05	3.38e-05	1.93			
Ca++	0.0461	0.0461	1.76e+03			
Cd++	4.51e-07	4.51e-07	0.0483			
Cl-	0.0794	0.0794	2.68e+03			
Fe+++	0.0703	0.0703	3.74e+03			
H+	0.340	0.340	327.			
H2O	55.5	55.5	9.52e+05			

K+	0.00283	0.00283	105.
Mg++	0.0833	0.0833	1.93e+03
Na+	0.0586	0.0586	1.28e+03
O2(aq)	-0.000176	-0.000176	-5.36
SO4--	0.396	0.396	3.62e+04
UO2++	1.56e-05	1.56e-05	4.01

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	5.281e-05	5.281e-05	3.767		
C	3.381e-05	3.381e-05	0.3866		
Ca	0.04607	0.04607	1758.		
Cd	4.513e-07	4.513e-07	0.04829		
Cl	0.07938	0.07938	2679.		
Fe	0.07030	0.07030	3738.		
H	111.4	111.4	1.068e+05		
K	0.002828	0.002828	105.3		
Mg	0.08325	0.08325	1927.		
Na	0.05856	0.05856	1282.		
O	57.09	57.09	8.696e+05		
S	0.3959	0.3959	1.208e+04		
U	1.561e-05	1.561e-05	3.538		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 2.970 log fO2 = -39.140
Eh = 0.4744 volts pe = 8.0196
Ionic strength = 0.547861
Activity of water = 0.989289
Solvent mass = 1.0000 kg
Solution mass = 1.0537 kg
Mineral mass = 0.00000 kg
Solution density = 1.037 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.082558 molal
Dissolved solids = 50991 mg/kg sol'n
Elect. conductivity = 24509.69 uS/cm (or umho/cm)
Hardness = 26021.02 mg/kg sol'n as CaCO3
carbonate = 0.00 mg/kg sol'n as CaCO3
non-carbonate = 26021.02 mg/kg sol'n as CaCO3
Carbonate alkalinity= 0.00 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 1.02e+03 cm3
Fluid volume = 1.02e+03 cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.4744	8.0196

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
CaSO4 (aq)	0.1438	1.858e+04	1.1345	-0.7874
SO4--	0.1120	1.021e+04	0.2929	-1.4843
Cl-	0.07512	2527.	0.7356	-1.2576
Ca++	0.07418	2822.	0.2929	-1.6631
Na+	0.06789	1481.	0.7356	-1.3015
FeSO4 (aq)	0.05277	7608.	1.1345	-1.2228
MgSO4 (aq)	0.03038	3471.	1.1345	-1.4626
Fe++	0.02540	1346.	0.2929	-2.1285
Mg++	0.01973	455.1	0.2929	-2.2383
NaSO4-	0.01223	1382.	0.7356	-2.0458
HSO4-	0.004634	426.9	0.7356	-2.4674
CaCl+	0.004099	293.8	0.7356	-2.5206

K+	0.002269	84.22	0.7356	-2.7774
MgCl+	0.001728	97.98	0.7356	-2.8959
H+	0.001457	1.393	0.7356	-2.9700
NaCl (aq)	0.001219	67.62	1.1345	-2.8591
KSO4-	0.0005228	67.06	0.7356	-3.4150
FeCl+	0.0003526	30.55	0.7356	-3.5861
FeSO4+	5.729e-05	8.260	0.7356	-4.3752
KCl (aq)	4.076e-05	2.884	1.1345	-4.3350
H2CO3* (aq)	3.384e-05	1.992	1.1345	-4.4158
Fe(SO4)2-	2.534e-05	5.963	0.7356	-4.7295
UO2(SO4)2--	2.139e-05	9.382	0.2929	-5.2031
H2AsO4-	2.037e-05	2.724	0.7356	-4.8244
BeSO4 (aq)	1.631e-05	1.626	1.1345	-4.7329
NiSO4 (aq)	1.330e-05	1.953	1.1345	-4.8215
Be++	1.244e-05	0.1064	0.2929	-5.4386
Ni++	7.874e-06	0.4387	0.2929	-5.6371
UO2SO4 (aq)	5.577e-06	1.938	1.1345	-5.1988
Be(SO4)2--	5.202e-06	0.9930	0.2929	-5.8172
H3AsO4	2.824e-06	0.3804	1.1345	-5.4944
FeOH++	2.176e-06	0.1505	0.2929	-6.1956
Be(SO4)3----	2.099e-06	0.5919	0.0074	-7.8115
UO2++	1.253e-06	0.3212	0.2929	-6.4353
Fe+++	1.146e-06	0.06073	0.0631	-7.1409
Cd(SO4)2--	6.987e-07	0.2019	0.2929	-6.6891
CdCl+	4.318e-07	0.06059	0.7356	-6.4980
FeCl++	4.119e-07	0.03569	0.2929	-6.9185
CdSO4 (aq)	4.078e-07	0.08068	1.1345	-6.3348
BeCl+	3.777e-07	0.01594	0.7356	-6.5561
Cd++	2.055e-07	0.02193	0.2929	-7.2204
Fe(OH)2+	1.490e-07	0.01270	0.7356	-6.9603
CdCl2 (aq)	6.450e-08	0.01122	1.1345	-7.1356
NiCl+	6.436e-08	0.005751	0.7356	-7.3247
Ni(SO4)2--	5.592e-08	0.01331	0.2929	-7.7858
UO2Cl+	4.078e-08	0.01182	0.7356	-7.5229
HCO3-	2.166e-08	0.001255	0.7356	-7.7976

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Hematite	4.9421s/sat	Lepidocrocite	0.3887s/sat
Magnetite	3.9282s/sat	Ferrihydrite (ag	-0.9350
Fe(OH)2.7Cl.3	3.5282s/sat	Melanterite	-1.4365
K-Jarosite	1.6231s/sat	Ferrihydrite	-1.4450
Gypsum	1.4533s/sat	Epsomite	-1.6288
Goethite	1.2687s/sat	Na-Jarosite	-2.5810
Anhydrite	1.2126s/sat	Maghemite	-2.8619

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.001140	-2.943
O2(g)	7.236e-40	-39.140
CH4(g)	1.112e-68	-67.954

Original basis	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg	Kd L/kg
AsO4---	2.32e-05	2.32e-05	3.06			
Be++	3.64e-05	3.64e-05	0.312			
CO3--	3.39e-05	3.39e-05	1.93			
Ca++	0.222	0.222	8.45e+03			
Cd++	1.81e-06	1.81e-06	0.193			
Cl-	0.0826	0.0826	2.78e+03			
Fe+++	0.0786	0.0786	4.17e+03			
H+	-0.0723	-0.0723	-69.2			
H2O	55.5	55.5	9.50e+05			
K+	0.00283	0.00283	105.			
Mg++	0.0518	0.0518	1.20e+03			
Na+	0.0813	0.0813	1.77e+03			
Ni++	2.13e-05	2.13e-05	1.19			
O2(aq)	-0.0196	-0.0196	-596.			
SO4--	0.357	0.357	3.25e+04			
UO2++	2.83e-05	2.83e-05	7.24			

Elemental composition	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg
As	2.320e-05	2.320e-05	1.649		
Be	3.642e-05	3.642e-05	0.3115		
C	3.387e-05	3.387e-05	0.3861		
Ca	0.2221	0.2221	8448.		
Cd	1.808e-06	1.808e-06	0.1929		
Cl	0.08256	0.08256	2778.		
Fe	0.07862	0.07862	4167.		
H	111.0	111.0	1.062e+05		
K	0.002833	0.002833	105.1		
Mg	0.05183	0.05183	1196.		
Na	0.08134	0.08134	1775.		
Ni	2.129e-05	2.129e-05	1.186		
O	56.94	56.94	8.645e+05		
S	0.3565	0.3565	1.085e+04		
U	2.827e-05	2.827e-05	6.385		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 2.880 log fO2 = -19.951
Eh = 0.7634 volts pe = 12.9050
Ionic strength = 0.111393
Activity of water = 0.998135
Solvent mass = 1.0000 kg
Solution mass = 1.0059 kg
Mineral mass = 0.00000 kg
Solution density = 1.016 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.029894 molal
Dissolved solids = 5897 mg/kg sol'n
Elect. conductivity = 7218.63 uS/cm (or umho/cm)
Hardness = 3395.03 mg/kg sol'n as CaCO3
carbonate = 0.00 mg/kg sol'n as CaCO3
non-carbonate = 3395.03 mg/kg sol'n as CaCO3
Carbonate alkalinity= 0.00 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 991. cm3
Fluid volume = 991. cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.7634	12.9050

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02897	1021.	0.7749	-1.6489
Na+	0.02280	521.0	0.7749	-1.7529
SO4--	0.01942	1854.	0.3605	-2.1549
Ca++	0.01231	490.7	0.3605	-2.3527
Mg++	0.009767	236.1	0.3605	-2.4533
CaSO4 (aq)	0.006938	939.0	1.0260	-2.1476
MgSO4 (aq)	0.004371	523.1	1.0260	-2.3482
H+	0.001701	1.705	0.7749	-2.8800
HSO4-	0.001155	111.5	0.7749	-3.0480
NaSO4-	0.0008769	103.8	0.7749	-3.1678
MgCl+	0.0004061	24.13	0.7749	-3.5022
CaCl+	0.0003230	24.26	0.7749	-3.6015

K+	0.0003114	12.10	0.7749	-3.6175
NaCl (aq)	0.0001937	11.25	1.0260	-3.7017
FeSO4+	9.672e-05	14.61	0.7749	-4.1252
H2CO3* (aq)	1.650e-05	1.017	1.0260	-4.7714
KSO4-	1.531e-05	2.057	0.7749	-4.9258
FeOH++	1.208e-05	0.8747	0.3605	-5.3611
Fe(SO4)2-	9.133e-06	2.251	0.7749	-5.1502
Fe+++	5.979e-06	0.3320	0.1007	-6.2203
KCl (aq)	2.645e-06	0.1961	1.0260	-5.5664
Fe++	2.238e-06	0.1242	0.3605	-6.0933
FeSO4 (aq)	1.351e-06	0.2040	1.0260	-5.8582
Ni++	1.196e-06	0.06982	0.3605	-6.3653
FeCl++	1.132e-06	0.1028	0.3605	-6.3892
Be++	1.095e-06	0.009810	0.3605	-6.4037
UO2SO4 (aq)	9.522e-07	0.3465	1.0260	-6.0101
Fe(OH)2+	7.922e-07	0.07077	0.7749	-6.2119
UO2++	7.363e-07	0.1977	0.3605	-6.5760
NiSO4 (aq)	5.870e-07	0.09032	1.0260	-6.2202
UO2(SO4)2--	5.728e-07	0.2632	0.3605	-6.6851
BeSO4 (aq)	4.171e-07	0.04357	1.0260	-6.3686
Be(SO4)2--	2.087e-08	0.004173	0.3605	-8.1236
BeCl+	1.578e-08	0.0006977	0.7749	-7.9125
Fe2(OH)2++++	1.571e-08	0.002275	0.0169	-9.5762
Cd++	1.480e-08	0.001653	0.3605	-8.2729
CdCl+	1.476e-08	0.002169	0.7749	-7.9418
FeCl+	1.474e-08	0.001338	0.7749	-7.9422
UO2Cl+	1.137e-08	0.003454	0.7749	-8.0549

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Hematite	6.2550s/sat	Anhydrite	-0.1476
Fe(OH)2.7Cl.3	4.0989s/sat	Ferrihydrite (ag	-0.2727
Goethite	1.9271s/sat	Ferrihydrite	-0.7827
K-Jarosite	1.6868s/sat	Maghemite	-1.5490
Magnetite	1.1001s/sat	Na-Jarosite	-2.1285
Lepidocrocite	1.0471s/sat	Epsomite	-2.4874
Gypsum	0.1008s/sat		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.0004982	-3.303
O2(g)	1.119e-20	-19.951
CH4(g)	2.067e-107	-106.685

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	1.19e-08	1.19e-08	0.00164			
Be++	1.55e-06	1.55e-06	0.0139			
CO3--	1.65e-05	1.65e-05	0.985			
Ca++	0.0196	0.0196	780.			

Cd++	4.14e-08	4.14e-08	0.00463
Cl-	0.0299	0.0299	1.05e+03
Fe+++	0.000129	0.000129	7.19
H+	0.00287	0.00287	2.88
H2O	55.5	55.5	9.94e+05
K+	0.000329	0.000329	12.8
Mg++	0.0145	0.0145	352.
Na+	0.0239	0.0239	546.
Ni++	1.79e-06	1.79e-06	0.104
O2(aq)	-9.01e-07	-9.01e-07	-0.0287
SO4--	0.0329	0.0329	3.14e+03
UO2++	2.27e-06	2.27e-06	0.610

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	1.190e-08	1.190e-08	0.0008862		
Be	1.550e-06	1.550e-06	0.01388		
C	1.651e-05	1.651e-05	0.1971		
Ca	0.01958	0.01958	780.0		
Cd	4.142e-08	4.142e-08	0.004628		
Cl	0.02989	0.02989	1054.		
Fe	0.0001295	0.0001295	7.188		
H	111.0	111.0	1.112e+05		
K	0.0003293	0.0003293	12.80		
Mg	0.01454	0.01454	351.5		
Na	0.02387	0.02387	545.5		
Ni	1.788e-06	1.788e-06	0.1044		
O	55.64	55.64	8.850e+05		
S	0.03289	0.03289	1048.		
U	2.274e-06	2.274e-06	0.5381		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 2.855 log fO2 = -20.051
Eh = 0.7634 volts pe = 12.9050
Ionic strength = 0.111340
Activity of water = 0.998135
Solvent mass = 1.0000 kg
Solution mass = 1.0059 kg
Mineral mass = 1.4801e-05 kg
Solution density = 1.016 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.029895 molal
Dissolved solids = 5885 mg/kg sol'n
Elect. conductivity = 7249.48 uS/cm (or umho/cm)
Hardness = 3394.96 mg/kg sol'n as CaCO3
carbonate = 0.00 mg/kg sol'n as CaCO3
non-carbonate = 3394.96 mg/kg sol'n as CaCO3
Carbonate alkalinity= 0.00 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 991. cm3

Fluid volume = 991. cm3
Mineral volume = 0.00559 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.7634	12.9050

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

Minerals in system	moles	log moles	grams	volume (cm3)
K-Jarosite	2.955e-05	-4.529	0.01480	0.005585
(total)			0.01480	0.005585

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02897	1021.	0.7749	-1.6488
Na+	0.02280	521.1	0.7749	-1.7528
SO4--	0.01938	1851.	0.3606	-2.1556
Ca++	0.01232	490.9	0.3606	-2.3524
Mg++	0.009771	236.2	0.3606	-2.4531
CaSO4 (aq)	0.006932	938.2	1.0260	-2.1480
MgSO4 (aq)	0.004367	522.6	1.0260	-2.3487
H+	0.001802	1.806	0.7749	-2.8549
HSO4-	0.001222	117.9	0.7749	-3.0236
NaSO4-	0.0008756	103.6	0.7749	-3.1684
MgCl+	0.0004063	24.14	0.7749	-3.5019
CaCl+	0.0003232	24.27	0.7749	-3.6012
K+	0.0002834	11.02	0.7749	-3.6583
NaCl (aq)	0.0001937	11.26	1.0260	-3.7017
FeSO4+	3.067e-05	4.632	0.7749	-4.6240
H2CO3* (aq)	1.650e-05	1.017	1.0260	-4.7714
KSO4-	1.392e-05	1.870	0.7749	-4.9672
FeOH++	3.620e-06	0.2622	0.3606	-5.8843
Fe(SO4)2-	2.892e-06	0.7128	0.7749	-5.6496
KCl (aq)	2.408e-06	0.1785	1.0260	-5.6071
Fe+++	1.899e-06	0.1054	0.1007	-6.7184
Ni++	1.197e-06	0.06985	0.3606	-6.3650
Be++	1.095e-06	0.009814	0.3606	-6.4034
UO2SO4 (aq)	9.522e-07	0.3465	1.0260	-6.0102
UO2++	7.374e-07	0.1979	0.3606	-6.5753
Fe++	7.106e-07	0.03945	0.3606	-6.5914
NiSO4 (aq)	5.865e-07	0.09024	1.0260	-6.2206
UO2(SO4)2--	5.718e-07	0.2627	0.3606	-6.6858
FeSO4 (aq)	4.284e-07	0.06469	1.0260	-6.3570
BeSO4 (aq)	4.167e-07	0.04353	1.0260	-6.3691
FeCl++	3.596e-07	0.03264	0.3606	-6.8872

Fe(OH)2+	2.242e-07	0.02003	0.7749	-6.7602
Be(SO4)2--	2.081e-08	0.004162	0.3606	-8.1247
BeCl+	1.579e-08	0.0006981	0.7749	-7.9123
Cd++	1.480e-08	0.001654	0.3606	-8.2727
CdCl+	1.476e-08	0.002170	0.7749	-7.9415
UO2Cl+	1.139e-08	0.003459	0.7749	-8.0542

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Hematite	5.1084s/sat	Anhydrite	-0.1480
Fe(OH)2.7Cl.3	3.5331s/sat	Magnetite	-0.5948
Goethite	1.3538s/sat	Ferrihydrite (ag	-0.8460
Lepidocrocite	0.4738s/sat	Ferrihydrite	-1.3560
Gypsum	0.1004s/sat	Epsomite	-2.4879
K-Jarosite	0.0000 sat	Maghemite	-2.6956

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.0004982	-3.303
O2(g)	8.887e-21	-20.051
CH4(g)	3.280e-107	-106.484

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	1.19e-08	1.19e-08	0.00164			
Be++	1.55e-06	1.55e-06	0.0139			
CO3--	1.65e-05	1.65e-05	0.985			
Ca++	0.0196	0.0196	780.			
Cd++	4.14e-08	4.14e-08	0.00463			
Cl-	0.0299	0.0299	1.05e+03			
Fe+++	0.000129	4.08e-05	2.27			
H+	0.00287	0.00305	3.06			
H2O	55.5	55.5	9.94e+05			
K+	0.000329	0.000300	11.7			
Mg++	0.0145	0.0145	352.			
Na+	0.0239	0.0239	546.			
Ni++	1.79e-06	1.79e-06	0.104			
O2(aq)	-2.86e-07	-2.86e-07	-0.00910			
SO4--	0.0329	0.0328	3.14e+03			
UO2++	2.27e-06	2.27e-06	0.610			

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	1.190e-08	1.190e-08	0.0008862		
Be	1.550e-06	1.550e-06	0.01388		
C	1.651e-05	1.651e-05	0.1971		
Ca	0.01958	0.01958	780.0		
Cd	4.142e-08	4.142e-08	0.004628		
Cl	0.02989	0.02989	1054.		

Fe	0.0001295	4.081e-05	2.266
H	111.0	111.0	1.112e+05
K	0.0003293	0.0002998	11.65
Mg	0.01454	0.01454	351.5
Na	0.02387	0.02387	545.5
Ni	1.788e-06	1.788e-06	0.1044
O	55.64	55.64	8.850e+05
S	0.03289	0.03283	1047.
U	2.274e-06	2.274e-06	0.5381

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 4.490 log fO2 = -29.354
Eh = 0.5291 volts pe = 8.9442
Ionic strength = 0.122602
Activity of water = 0.997997
Solvent mass = 1.0000 kg
Solution mass = 1.0066 kg
Mineral mass = 0.00000 kg
Solution density = 1.016 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.031303 molal
Dissolved solids = 6573 mg/kg sol'n
Elect. conductivity = 7206.10 uS/cm (or umho/cm)
Hardness = 3939.28 mg/kg sol'n as CaCO3
carbonate = 0.01 mg/kg sol'n as CaCO3
non-carbonate = 3939.26 mg/kg sol'n as CaCO3
Carbonate alkalinity= 0.01 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 991. cm3
Fluid volume = 991. cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.5291	8.9442

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.03026	1066.	0.7697	-1.6328
Na+	0.02403	548.7	0.7697	-1.7330
SO4--	0.02205	2104.	0.3509	-2.1114
Ca++	0.01467	584.0	0.3509	-2.2885
Mg++	0.01031	248.9	0.3509	-2.4417
CaSO4 (aq)	0.008869	1199.	1.0286	-2.0399
MgSO4 (aq)	0.004950	591.9	1.0286	-2.2931
NaSO4-	0.001022	120.8	0.7697	-3.1044
MgCl+	0.0004357	25.87	0.7697	-3.4745
CaCl+	0.0003912	29.36	0.7697	-3.5213
K+	0.0002956	11.48	0.7697	-3.6430
NaCl (aq)	0.0002099	12.18	1.0286	-3.6658

Fe++	0.0001371	7.604	0.3509	-4.3179
FeSO4 (aq)	8.880e-05	13.40	1.0286	-4.0393
H+	4.204e-05	0.04210	0.7697	-4.4900
HSO4-	3.156e-05	3.044	0.7697	-4.6145
H2CO3* (aq)	1.618e-05	0.9970	1.0286	-4.7788
KSO4-	1.607e-05	2.158	0.7697	-4.9077
Fe(OH)2+	8.635e-06	0.7709	0.7697	-5.1774
FeOH++	3.298e-06	0.2387	0.3509	-5.9366
KCl (aq)	2.582e-06	0.1912	1.0286	-5.5758
Ni++	2.128e-06	0.1241	0.3509	-6.1269
NiSO4 (aq)	1.120e-06	0.1723	1.0286	-5.9383
FeCl+	9.183e-07	0.08329	0.7697	-6.1507
Be++	8.869e-07	0.007940	0.3509	-6.5070
UO2SO4 (aq)	7.693e-07	0.2798	1.0286	-6.1017
FeSO4+	7.024e-07	0.1060	0.7697	-6.2671
UO2++	5.543e-07	0.1487	0.3509	-6.7111
UO2(SO4)2--	5.269e-07	0.2419	0.3509	-6.7331
BeSO4 (aq)	3.626e-07	0.03785	1.0286	-6.4284
HCO3-	2.973e-07	0.01802	0.7697	-6.6406
H2AsO4-	2.013e-07	0.02818	0.7697	-6.8099
Fe(SO4)2-	7.332e-08	0.01806	0.7697	-7.2485
UO2OH+	4.383e-08	0.01250	0.7697	-7.4719
Fe+++	4.146e-08	0.002300	0.0948	-8.4057
Be(SO4)2--	2.066e-08	0.004127	0.3509	-8.1398
CdCl+	2.041e-08	0.002997	0.7697	-7.8039
Cd++	2.012e-08	0.002247	0.3509	-8.1511
CaHCO3+	1.949e-08	0.001957	0.7697	-7.8239
BeCl+	1.300e-08	0.0005743	0.7697	-7.9998
MgHCO3+	1.252e-08	0.001062	0.7697	-8.0160
CdSO4 (aq)	1.245e-08	0.002578	1.0286	-7.8925

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Hematite	11.5440s/sat	Ferrihydrite	1.8617s/sat
Magnetite	11.3844s/sat	Na-Jarosite	1.0819s/sat
Fe(OH)2.7Cl.3	6.2651s/sat	Gypsum	0.2084s/sat
K-Jarosite	4.8519s/sat	Anhydrite	-0.0399
Goethite	4.5716s/sat	Magnesioferrite	-0.1963
Maghemite	3.7400s/sat	H-Jarosite	-1.6060
Lepidocrocite	3.6916s/sat	Epsomite	-2.4327
Ferrihydrite (ag	2.3717s/sat		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.0004899	-3.310
O2(g)	4.424e-30	-29.354
CH4(g)	1.301e-88	-87.886

	In fluid		Sorbed		Kd
Original basis total moles	moles	mg/kg	moles	mg/kg	L/kg

AsO4---	2.04e-07	2.04e-07	0.0281
Be++	1.29e-06	1.29e-06	0.0115
CO3--	1.65e-05	1.65e-05	0.984
Ca++	0.0239	0.0239	953.
Cd++	5.83e-08	5.83e-08	0.00651
Cl-	0.0313	0.0313	1.10e+03
Fe+++	0.000240	0.000240	13.3
H+	-0.000141	-0.000141	-0.141
H2O	55.5	55.5	9.93e+05
K+	0.000314	0.000314	12.2
Mg++	0.0157	0.0157	379.
Na+	0.0253	0.0253	577.
Ni++	3.26e-06	3.26e-06	0.190
O2(aq)	-5.67e-05	-5.67e-05	-1.80
SO4--	0.0370	0.0370	3.53e+03
UO2++	1.90e-06	1.90e-06	0.511

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	2.037e-07	2.037e-07	0.01516		
Be	1.286e-06	1.286e-06	0.01152		
C	1.651e-05	1.651e-05	0.1970		
Ca	0.02393	0.02393	952.7		
Cd	5.827e-08	5.827e-08	0.006507		
Cl	0.03130	0.03130	1102.		
Fe	0.0002395	0.0002395	13.29		
H	111.0	111.0	1.112e+05		
K	0.0003142	0.0003142	12.21		
Mg	0.01569	0.01569	379.0		
Na	0.02526	0.02526	576.8		
Ni	3.257e-06	3.257e-06	0.1900		
O	55.66	55.66	8.846e+05		
S	0.03703	0.03703	1180.		
U	1.905e-06	1.905e-06	0.4503		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 3.856 log fO2 = -31.892
Eh = 0.5291 volts pe = 8.9442
Ionic strength = 0.122342
Activity of water = 0.997998
Solvent mass = 1.0000 kg
Solution mass = 1.0066 kg
Mineral mass = 2.1968e-05 kg
Solution density = 1.016 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.031303 molal
Dissolved solids = 6553 mg/kg sol'n
Elect. conductivity = 7239.47 uS/cm (or umho/cm)
Hardness = 3933.42 mg/kg sol'n as CaCO3
carbonate = 0.00 mg/kg sol'n as CaCO3

non-carbonate = 3933.41 mg/kg sol'n as CaCO3
Carbonate alkalinity= 0.00 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 991. cm3
Fluid volume = 991. cm3
Mineral volume = 0.00829 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.5291	8.9442

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

Minerals in system	moles	log moles	grams	volume (cm3)
K-Jarosite	4.386e-05	-4.358	0.02197	0.008290
(total)			0.02197	0.008290

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.03026	1066.	0.7698	-1.6327
Na+	0.02403	548.8	0.7698	-1.7329
SO4--	0.02196	2096.	0.3511	-2.1129
Ca++	0.01465	583.2	0.3511	-2.2889
Mg++	0.01031	249.1	0.3511	-2.4411
CaSO4 (aq)	0.008830	1194.	1.0286	-2.0418
MgSO4 (aq)	0.004940	590.8	1.0286	-2.2940
NaSO4-	0.001018	120.4	0.7698	-3.1058
MgCl+	0.0004363	25.91	0.7698	-3.4738
CaCl+	0.0003909	29.33	0.7698	-3.5216
K+	0.0002544	9.881	0.7698	-3.7082
NaCl (aq)	0.0002100	12.19	1.0286	-3.6656
H+	0.0001812	0.1814	0.7698	-3.8555
HSO4-	0.0001355	13.07	0.7698	-3.9816
Fe++	6.472e-05	3.591	0.3511	-4.6435
FeSO4 (aq)	4.181e-05	6.310	1.0286	-4.3665
H2CO3* (aq)	1.643e-05	1.013	1.0286	-4.7720
KSO4-	1.378e-05	1.850	0.7698	-4.9744
KCl (aq)	2.223e-06	0.1646	1.0286	-5.6409
Ni++	2.130e-06	0.1242	0.3511	-6.1262
NiSO4 (aq)	1.118e-06	0.1720	1.0286	-5.9392
Be++	8.891e-07	0.007960	0.3511	-6.5056
UO2SO4 (aq)	7.839e-07	0.2851	1.0286	-6.0935
UO2++	5.665e-07	0.1520	0.3511	-6.7014
UO2(SO4)2--	5.347e-07	0.2455	0.3511	-6.7264
FeCl+	4.339e-07	0.03935	0.7698	-6.4763
BeSO4 (aq)	3.624e-07	0.03783	1.0286	-6.4285

FeOH++	3.614e-07	0.02615	0.3511	-6.8966
FeSO4+	3.307e-07	0.04991	0.7698	-6.5942
Fe(OH)2+	2.196e-07	0.01961	0.7698	-6.7720
H2AsO4-	1.992e-07	0.02789	0.7698	-6.8143
HCO3-	7.004e-08	0.004246	0.7698	-7.2683
Fe(SO4)2-	3.439e-08	0.008473	0.7698	-7.5772
Be(SO4)2--	2.056e-08	0.004109	0.3511	-8.1415
CdCl+	2.044e-08	0.003002	0.7698	-7.8032
Cd++	2.014e-08	0.002249	0.3511	-8.1505
Fe+++	1.957e-08	0.001085	0.0949	-8.7313
BeCl+	1.304e-08	0.0005761	0.7698	-7.9983
CdSO4 (aq)	1.243e-08	0.002573	1.0286	-7.8935
UO2OH+	1.040e-08	0.002965	0.7698	-8.0967

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Hematite	7.0860s/sat	Ferrihydrite (ag	0.1427s/sat
Magnetite	5.3318s/sat	K-Jarosite	0.0000 sat
Fe(OH)2.7Cl.3	4.2265s/sat	Anhydrite	-0.0418
Goethite	2.3425s/sat	Ferrihydrite	-0.3673
Lepidocrocite	1.4625s/sat	Maghemite	-0.7180
Gypsum	0.2065s/sat	Epsomite	-2.4336

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.0004976	-3.303
O2(g)	1.282e-32	-31.892
CH4(g)	1.574e-83	-82.803

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	2.04e-07	2.04e-07	0.0281			
Be++	1.29e-06	1.29e-06	0.0115			
CO3--	1.65e-05	1.65e-05	0.984			
Ca++	0.0239	0.0239	950.			
Cd++	5.83e-08	5.83e-08	0.00651			
Cl-	0.0313	0.0313	1.10e+03			
Fe+++	0.000240	0.000108	5.99			
H+	-2.09e-05	0.000242	0.243			
H2O	55.5	55.5	9.93e+05			
K+	0.000314	0.000270	10.5			
Mg++	0.0157	0.0157	379.			
Na+	0.0253	0.0253	577.			
Ni++	3.26e-06	3.26e-06	0.190			
O2(aq)	-2.67e-05	-2.67e-05	-0.850			
SO4--	0.0370	0.0369	3.53e+03			
UO2++	1.90e-06	1.90e-06	0.511			

Elemental composition In fluid Sorbed
total moles moles mg/kg moles mg/kg

As	2.037e-07	2.037e-07	0.01516
Be	1.286e-06	1.286e-06	0.01152
C	1.651e-05	1.651e-05	0.1970
Ca	0.02387	0.02387	950.3
Cd	5.827e-08	5.827e-08	0.006507
Cl	0.03130	0.03130	1103.
Fe	0.0002395	0.0001079	5.988
H	111.0	111.0	1.112e+05
K	0.0003142	0.0002704	10.50
Mg	0.01569	0.01569	379.0
Na	0.02526	0.02526	576.9
Ni	3.257e-06	3.257e-06	0.1900
O	55.66	55.66	8.846e+05
S	0.03703	0.03694	1177.
U	1.905e-06	1.905e-06	0.4504

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 6.140 log fO2 = -44.520
Eh = 0.2072 volts pe = 3.5026
Ionic strength = 0.085304
Activity of water = 0.998574
Solvent mass = 1.0000 kg
Solution mass = 1.0046 kg
Mineral mass = 0.00000 kg
Solution density = 1.015 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.022307 molal
Dissolved solids = 4597 mg/kg sol'n
Elect. conductivity = 5169.19 uS/cm (or umho/cm)
Hardness = 2726.12 mg/kg sol'n as CaCO3
carbonate = 118.84 mg/kg sol'n as CaCO3
non-carbonate = 2607.28 mg/kg sol'n as CaCO3
Carbonate alkalinity= 118.84 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 990. cm3
Fluid volume = 990. cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.2072	3.5026

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02173	766.8	0.7899	-1.7654
Na+	0.01452	332.4	0.7899	-1.9403
SO4--	0.01409	1348.	0.3894	-2.2606
Ca++	0.01160	462.9	0.3894	-2.3451
Mg++	0.006884	166.6	0.3894	-2.5718
CaSO4 (aq)	0.005569	754.7	1.0198	-2.2457
H2CO3* (aq)	0.002888	178.3	1.0198	-2.5308
MgSO4 (aq)	0.002624	314.4	1.0198	-2.5725
HCO3-	0.002290	139.1	0.7899	-2.7426
NaSO4-	0.0004380	51.90	0.7899	-3.4610
K+	0.0003439	13.39	0.7899	-3.5660
CaCl+	0.0002466	18.54	0.7899	-3.7104

MgCl+	0.0002319	13.79	0.7899	-3.7372
CaHCO3+	0.0001318	13.26	0.7899	-3.9826
NaCl (aq)	9.678e-05	5.630	1.0198	-4.0057
MgHCO3+	7.150e-05	6.073	0.7899	-4.2481
Fe++	6.561e-05	3.647	0.3894	-4.5927
FeSO4 (aq)	3.374e-05	5.102	1.0198	-4.4633
KSO4-	1.326e-05	1.784	0.7899	-4.9799
NaHCO3 (aq)	1.020e-05	0.8530	1.0198	-4.9828
KCl (aq)	2.292e-06	0.1701	1.0198	-5.6313
H+	9.171e-07	0.0009201	0.7899	-6.1400
FeHCO3+	7.366e-07	0.08569	0.7899	-6.2352
HSO4-	4.883e-07	0.04718	0.7899	-6.4137
FeCl+	3.503e-07	0.03183	0.7899	-6.5580
CO3--	3.007e-07	0.01796	0.3894	-6.9315
MgCO3 (aq)	2.937e-07	0.02465	1.0198	-6.5236
Ni++	1.694e-07	0.009897	0.3894	-7.1808
CaCO3 (aq)	1.573e-07	0.01567	1.0198	-6.7948
Ca2UO2(CO3)3 (aq	1.474e-07	0.07778	1.0198	-6.8231
NiSO4 (aq)	7.079e-08	0.01091	1.0198	-7.1415
H2AsO4-	3.522e-08	0.004941	0.7899	-7.5556
Fe(OH)2+	3.230e-08	0.002889	0.7899	-7.5933
NaCO3-	3.166e-08	0.002616	0.7899	-7.6018
NiHCO3+	1.862e-08	0.002219	0.7899	-7.8324
FeOH+	1.787e-08	0.001296	0.7899	-7.8503
OH-	1.757e-08	0.0002975	0.7899	-7.8576
Be(OH)2 (aq)	1.490e-08	0.0006380	1.0198	-7.8184
HAsO4--	1.009e-08	0.001406	0.3894	-8.4056

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Magnetite	12.8780s/sat	Calcite	-0.7968
Hematite	10.0121s/sat	Siderite	-0.9342
Fe(OH)2.7Cl.3	4.9647s/sat	Aragonite	-0.9405
Goethite	3.8057s/sat	Vaterite	-1.3632
Lepidocrocite	2.9257s/sat	Dolomite (ordere	-1.6899
Maghemite	2.2081s/sat	Magnesite	-2.0433
Ferrihydrite (ag	1.6061s/sat	CaCO3xH2O	-2.1329
Magnesioferrite	1.4420s/sat	Dolomite (disord	-2.2399
Ferrihydrite	1.0961s/sat	K-Jarosite	-2.6170
Gypsum	0.0030s/sat	Epsomite	-2.7103
Anhydrite	-0.2457	NiCO3	-2.9124

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.08666	-1.062
O2(g)	3.019e-45	-44.520
CH4(g)	4.948e-56	-55.306

Original basis	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg	Kd L/kg

AsO4---	4.53e-08	4.53e-08	0.00627
Be++	1.89e-08	1.89e-08	0.000169
CO3--	0.00539	0.00539	322.
Ca++	0.0176	0.0176	700.
Cd++	5.81e-10	5.81e-10	6.50e-05
Cl-	0.0223	0.0223	787.
Fe+++	0.000100	0.000100	5.59
H+	0.00818	0.00818	8.21
H2O	55.5	55.5	9.95e+05
K+	0.000359	0.000359	14.0
Mg++	0.00981	0.00981	237.
Na+	0.0151	0.0151	345.
Ni++	2.60e-07	2.60e-07	0.0152
O2(aq)	-2.51e-05	-2.51e-05	-0.800
SO4--	0.0228	0.0228	2.18e+03
UO2++	1.55e-07	1.55e-07	0.0417

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	4.531e-08	4.531e-08	0.003379		
Be	1.889e-08	1.889e-08	0.0001695		
C	0.005394	0.005394	64.49		
Ca	0.01755	0.01755	700.2		
Cd	5.812e-10	5.812e-10	6.503e-05		
Cl	0.02231	0.02231	787.2		
Fe	0.0001005	0.0001005	5.586		
H	111.0	111.0	1.114e+05		
K	0.0003595	0.0003595	13.99		
Mg	0.009812	0.009812	237.4		
Na	0.01507	0.01507	344.8		
Ni	2.596e-07	2.596e-07	0.01517		
O	55.62	55.62	8.857e+05		
S	0.02277	0.02277	726.8		
U	1.551e-07	1.551e-07	0.03674		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 5.747 log fO2 = -39.517
Eh = 0.3044 volts pe = 5.1465
Ionic strength = 0.148801
Activity of water = 0.997652
Solvent mass = 11.091 kg
Solution mass = 11.191 kg
Mineral mass = 0.00000 kg
Solution density = 1.017 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.027652 molal
Dissolved solids = 8891 mg/kg sol'n
Elect. conductivity = 7897.11 uS/cm (or umho/cm)
Hardness = 4868.51 mg/kg sol'n as CaCO3
carbonate = 61.68 mg/kg sol'n as CaCO3
non-carbonate = 4806.82 mg/kg sol'n as CaCO3
Carbonate alkalinity= 61.68 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 1.10e+04 cm3
Fluid volume = 1.10e+04 cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.3044	5.1465

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
SO4--	0.02898	2759.	0.3329	-2.0156
Cl-	0.02672	939.0	0.7596	-1.6925
Ca++	0.02044	811.9	0.3329	-2.1672
Na+	0.01975	449.9	0.7596	-1.8239
CaSO4 (aq)	0.01453	1961.	1.0349	-1.8228
Mg++	0.008437	203.3	0.3329	-2.5515
MgSO4 (aq)	0.004765	568.5	1.0349	-2.3070
Fe++	0.003981	220.3	0.3329	-2.8777
H2CO3* (aq)	0.003541	217.7	1.0349	-2.4360
FeSO4 (aq)	0.003033	456.6	1.0349	-2.5033
HCO3-	0.001199	72.49	0.7596	-3.0407
NaSO4-	0.001047	123.5	0.7596	-3.0995

K+	0.0005385	20.87	0.7596	-3.3882
CaCl+	0.0004568	34.19	0.7596	-3.4597
MgCl+	0.0002988	17.70	0.7596	-3.6440
NaCl (aq)	0.0001475	8.541	1.0349	-3.8165
CaHCO3+	0.0001039	10.41	0.7596	-4.1028
MgHCO3+	3.923e-05	3.317	0.7596	-4.5258
KSO4-	3.650e-05	4.890	0.7596	-4.5571
FeCl+	2.234e-05	2.022	0.7596	-4.7702
FeHCO3+	2.000e-05	2.317	0.7596	-4.8183
Fe(OH)2+	1.254e-05	1.117	0.7596	-5.0211
NaHCO3 (aq)	6.616e-06	0.5509	1.0349	-5.1645
KCl (aq)	4.021e-06	0.2971	1.0349	-5.3808
H+	2.357e-06	0.002354	0.7596	-5.7471
HSO4-	2.206e-06	0.2122	0.7596	-5.7758
Ca2UO2(CO3)3 (aq	2.155e-06	1.132	1.0349	-5.6517
H2AsO4-	1.858e-06	0.2595	0.7596	-5.8505
Be++	1.424e-06	0.01272	0.3329	-6.3241
Ni++	1.271e-06	0.07395	0.3329	-6.3735
Be(OH)2 (aq)	1.045e-06	0.04457	1.0349	-5.9659
NiSO4 (aq)	7.870e-07	0.1207	1.0349	-6.0891
BeSO4 (aq)	6.846e-07	0.07130	1.0349	-6.1497
FeOH+	3.898e-07	0.02814	0.7596	-6.5286
UO2CO3 (aq)	2.902e-07	0.09492	1.0349	-6.5225
FeOH++	2.757e-07	0.01991	0.3329	-7.0371
HAsO4--	2.422e-07	0.03360	0.3329	-7.0934
UO2(CO3)2--	1.718e-07	0.06641	0.3329	-7.2427
CO3--	7.164e-08	0.004261	0.3329	-7.6225
NiHCO3+	6.256e-08	0.007423	0.7596	-7.3231
MgCO3 (aq)	6.178e-08	0.005163	1.0349	-7.1943
Cd++	5.482e-08	0.006107	0.3329	-7.7387
Be(SO4)2--	5.157e-08	0.01028	0.3329	-7.7653
CaCO3 (aq)	4.756e-08	0.004718	1.0349	-7.3079
CdCl+	4.657e-08	0.006825	0.7596	-7.4513
CdSO4 (aq)	3.988e-08	0.008240	1.0349	-7.3843
BeCO3 (aq)	1.964e-08	0.001344	1.0349	-7.6920
BeCl+	1.749e-08	0.0007708	0.7596	-7.8766
Cd(SO4)2--	1.613e-08	0.004869	0.3329	-8.2699

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Magnetite	18.1657s/sat	Calcite	-1.3099
Hematite	14.3711s/sat	Be(OH)2 (beta)	-1.3259
Fe(OH)2.7Cl.3	7.2834s/sat	Aragonite	-1.4536
Maghemite	6.5671s/sat	Be(OH)2 (alpha)	-1.7259
Goethite	5.9850s/sat	Vaterite	-1.8763
K-Jarosite	5.7674s/sat	Be(OH)2 (am)	-2.0259
Lepidocrocite	5.1050s/sat	Rutherfordine	-2.1603
Magnesioferrite	5.0351s/sat	H-Jarosite	-2.2025
Ferrihydrite (ag	3.7850s/sat	Epsomite	-2.4477
Ferrihydrite	3.2750s/sat	CaCO3xH2O	-2.6464
Na-Jarosite	1.6517s/sat	Melanterite	-2.6914
Fe3(OH)8	1.3425s/sat	Magnesite	-2.7140

Gypsum	0.4252s/sat	NiCO3	-2.7960
Anhydrite	0.1772s/sat	Dolomite (ordere	-2.8736
Siderite	0.0898s/sat		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.1079	-0.967
O2(g)	3.040e-40	-39.517
CH4(g)	6.067e-66	-65.217

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	2.33e-05	2.33e-05	0.289			
Be++	3.60e-05	3.60e-05	0.0290			
CO3--	0.0545	0.0545	292.			
Ca++	0.394	0.394	1.41e+03			
Cd++	1.79e-06	1.79e-06	0.0179			
Cl-	0.307	0.307	972.			
Fe+++	0.0784	0.0784	391.			
H+	0.0153	0.0153	1.37			
H2O	616.	616.	9.91e+05			
K+	0.00642	0.00642	22.4			
Mg++	0.150	0.150	326.			
Na+	0.232	0.232	477.			
Ni++	2.36e-05	2.36e-05	0.124			
O2(aq)	-0.0196	-0.0196	-55.9			
SO4--	0.581	0.581	4.99e+03			
UO2++	2.94e-05	2.94e-05	0.709			

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	2.329e-05	2.329e-05	0.1560		
Be	3.604e-05	3.604e-05	0.02903		
C	0.05453	0.05453	58.53		
Ca	0.3942	0.3942	1412.		
Cd	1.786e-06	1.786e-06	0.01794		
Cl	0.3067	0.3067	971.6		
Fe	0.07840	0.07840	391.3		
H	1231.	1231.	1.109e+05		
K	0.006422	0.006422	22.44		
Mg	0.1502	0.1502	326.3		
Na	0.2323	0.2323	477.3		
Ni	2.358e-05	2.358e-05	0.1237		
O	618.1	618.1	8.838e+05		
S	0.5811	0.5811	1665.		
U	2.939e-05	2.939e-05	0.6251		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars

pH = 4.835   log fO2 = -43.164
Eh = 0.3044 volts   pe = 5.1465
Ionic strength = 0.146976
Activity of water = 0.997670
Solvent mass = 11.091 kg
Solution mass = 11.189 kg
Mineral mass = 0.0011293 kg
Solution density = 1.017 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.027652 molal
Dissolved solids = 8801 mg/kg sol'n
Elect. conductivity = 7825.88 uS/cm (or umho/cm)
Hardness = 4839.43 mg/kg sol'n as CaCO3
carbonate = 9.71 mg/kg sol'n as CaCO3
non-carbonate = 4829.72 mg/kg sol'n as CaCO3
Carbonate alkalinity= 9.71 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 1.10e+04 cm3
Fluid volume = 1.10e+04 cm3
Mineral volume = 0.426 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.6 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.3044	5.1465

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

Minerals in system	moles	log moles	grams	volume (cm3)
K-Jarosite	0.002255	-2.647	1.129	0.4262
(total)			1.129	0.4262

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
SO4--	0.02885	2747.	0.3340	-2.0160
Cl-	0.02673	939.2	0.7602	-1.6921
Ca++	0.02030	806.4	0.3340	-2.1688
Na+	0.01975	450.1	0.7602	-1.8234
CaSO4 (aq)	0.01447	1953.	1.0344	-1.8248
Mg++	0.008449	203.6	0.3340	-2.5494
MgSO4 (aq)	0.004785	570.9	1.0344	-2.3054
H2CO3* (aq)	0.004694	288.6	1.0344	-2.3137
Fe++	0.003648	201.9	0.3340	-2.9142
FeSO4 (aq)	0.002787	419.6	1.0344	-2.5402
NaSO4-	0.001046	123.5	0.7602	-3.0994
CaCl+	0.0004551	34.07	0.7602	-3.4609
K+	0.0003494	13.54	0.7602	-3.5757

MgCl+	0.0003003	17.79	0.7602	-3.6416
HCO3-	0.0001945	11.77	0.7602	-3.8301
NaCl (aq)	0.0001478	8.563	1.0344	-3.8156
KSO4-	2.366e-05	3.170	0.7602	-4.7450
FeCl+	2.055e-05	1.860	0.7602	-4.8063
H+	1.921e-05	0.01919	0.7602	-4.8355
HSO4-	1.797e-05	1.729	0.7602	-4.8646
CaHCO3+	1.680e-05	1.683	0.7602	-4.8937
MgHCO3+	6.396e-06	0.5409	0.7602	-5.3132
FeHCO3+	2.985e-06	0.3458	0.7602	-5.6441
KCl (aq)	2.615e-06	0.1932	1.0344	-5.5678
Be++	2.104e-06	0.01879	0.3340	-6.1533
H2AsO4-	2.063e-06	0.2882	0.7602	-5.8046
Ni++	1.302e-06	0.07576	0.3340	-6.3616
NaHCO3 (aq)	1.076e-06	0.08962	1.0344	-5.9534
BeSO4 (aq)	1.014e-06	0.1056	1.0344	-5.9793
UO2CO3 (aq)	8.170e-07	0.2673	1.0344	-6.0731
NiSO4 (aq)	8.084e-07	0.1240	1.0344	-6.0777
UO2SO4 (aq)	6.928e-07	0.2514	1.0344	-6.1447
UO2(SO4)2--	6.245e-07	0.2861	0.3340	-6.6807
UO2++	4.234e-07	0.1133	0.3340	-6.8495
Fe(OH)2+	1.731e-07	0.01542	0.7602	-6.8808
Be(SO4)2--	7.602e-08	0.01516	0.3340	-7.5953
UO2OH+	7.146e-08	0.02033	0.7602	-7.2650
Cd++	5.493e-08	0.006120	0.3340	-7.7364
CdCl+	4.683e-08	0.006863	0.7602	-7.4485
FeOH+	4.389e-08	0.003169	0.7602	-7.4767
CdSO4 (aq)	4.008e-08	0.008281	1.0344	-7.3824
HAsO4--	3.290e-08	0.004563	0.3340	-7.9591
FeOH++	3.098e-08	0.002237	0.3340	-7.9852
BeCl+	2.592e-08	0.001142	0.7602	-7.7054
Be(OH)2 (aq)	2.328e-08	0.0009927	1.0344	-7.6184
Cd(SO4)2--	1.614e-08	0.004871	0.3340	-8.2684
NiHCO3+	1.043e-08	0.001238	0.7602	-8.1006

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Magnetite	10.7634s/sat	Anhydrite	0.1752s/sat
Hematite	8.8284s/sat	K-Jarosite	0.0000 sat
Fe(OH)2.7Cl.3	4.7857s/sat	Siderite	-1.6476
Goethite	3.2137s/sat	Rutherfordine	-1.7109
Lepidocrocite	2.3337s/sat	Magnesioferrite	-2.3287
Maghemite	1.0244s/sat	Epsomite	-2.4460
Ferrihydrite (ag	1.0137s/sat	Melanterite	-2.7283
Ferrihydrite	0.5037s/sat	UO2(OH)2 (beta)	-2.7922
Gypsum	0.4232s/sat	Be(OH)2 (beta)	-2.9784

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.1430	-0.845
O2(g)	6.861e-44	-43.164

CH4(g)	1.578e-58	-57.802

Original basis	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg	Kd L/kg
AsO4---	2.33e-05	2.33e-05	0.289			
Be++	3.60e-05	3.60e-05	0.0290			
CO3--	0.0545	0.0545	292.			
Ca++	0.391	0.391	1.40e+03			
Cd++	1.79e-06	1.79e-06	0.0179			
Cl-	0.307	0.307	972.			
Fe+++	0.0784	0.0716	358.			
H+	0.0219	0.0354	3.19			
H2O	616.	616.	9.91e+05			
K+	0.00642	0.00417	14.6			
Mg++	0.150	0.150	326.			
Na+	0.232	0.232	477.			
Ni++	2.36e-05	2.36e-05	0.124			
O2(aq)	-0.0179	-0.0179	-51.2			
SO4--	0.581	0.577	4.95e+03			
UO2++	2.94e-05	2.94e-05	0.709			

Elemental composition	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg
As	2.329e-05	2.329e-05	0.1560		
Be	3.604e-05	3.604e-05	0.02903		
C	0.05453	0.05453	58.54		
Ca	0.3908	0.3908	1400.		
Cd	1.786e-06	1.786e-06	0.01794		
Cl	0.3067	0.3067	971.7		
Fe	0.07840	0.07164	357.5		
H	1231.	1231.	1.109e+05		
K	0.006422	0.004167	14.56		
Mg	0.1502	0.1502	326.3		
Na	0.2323	0.2323	477.4		
Ni	2.358e-05	2.358e-05	0.1237		
O	618.1	618.1	8.838e+05		
S	0.5811	0.5766	1652.		
U	2.939e-05	2.939e-05	0.6252		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 5.952 log fO2 = -40.460
Eh = 0.2783 volts pe = 4.7053
Ionic strength = 0.119607
Activity of water = 0.998087
Solvent mass = 21.194 kg
Solution mass = 21.340 kg
Mineral mass = 0.00000 kg
Solution density = 1.016 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.025105 molal
Dissolved solids = 6848 mg/kg sol'n
Elect. conductivity = 6665.96 uS/cm (or umho/cm)
Hardness = 3849.39 mg/kg sol'n as CaCO3
carbonate = 88.75 mg/kg sol'n as CaCO3
non-carbonate = 3760.64 mg/kg sol'n as CaCO3
Carbonate alkalinity= 88.75 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 2.10e+04 cm3
Fluid volume = 2.10e+04 cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.2783	4.7053

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02435	857.4	0.7710	-1.7264
SO4--	0.02216	2114.	0.3533	-2.1063
Na+	0.01727	394.3	0.7710	-1.8757
Ca++	0.01638	652.0	0.3533	-2.2375
CaSO4 (aq)	0.01010	1365.	1.0279	-1.9838
Mg++	0.007684	185.5	0.3533	-2.5662
MgSO4 (aq)	0.003763	449.8	1.0279	-2.4125
H2CO3* (aq)	0.003221	198.4	1.0279	-2.4800
Fe++	0.002234	123.9	0.3533	-3.1028
HCO3-	0.001712	103.8	0.7710	-2.8794
FeSO4 (aq)	0.001476	222.6	1.0279	-2.8190
NaSO4-	0.0007430	87.86	0.7710	-3.2419

K+	0.0004465	17.34	0.7710	-3.4631
CaCl+	0.0003540	26.55	0.7710	-3.5640
MgCl+	0.0002632	15.62	0.7710	-3.6927
CaHCO3+	0.0001262	12.67	0.7710	-4.0118
NaCl (aq)	0.0001219	7.074	1.0279	-3.9021
MgHCO3+	5.416e-05	4.589	0.7710	-4.3793
KSO4-	2.456e-05	3.297	0.7710	-4.7227
FeHCO3+	1.702e-05	1.975	0.7710	-4.8820
FeCl+	1.213e-05	1.100	0.7710	-5.0292
NaHCO3 (aq)	8.573e-06	0.7152	1.0279	-5.0549
Fe(OH)2+	6.866e-06	0.6128	0.7710	-5.2762
KCl (aq)	3.151e-06	0.2333	1.0279	-5.4896
H+	1.447e-06	0.001449	0.7710	-5.9524
Ca2UO2(CO3)3 (aq	1.343e-06	0.7073	1.0279	-5.8599
HSO4-	1.099e-06	0.1060	0.7710	-6.0718
Be(OH)2 (aq)	9.838e-07	0.04204	1.0279	-5.9951
H2AsO4-	9.333e-07	0.1306	0.7710	-6.1429
Ni++	7.650e-07	0.04460	0.3533	-6.5682
Be++	4.869e-07	0.004358	0.3533	-6.7644
NiSO4 (aq)	4.107e-07	0.06314	1.0279	-6.3745
FeOH+	3.671e-07	0.02656	0.7710	-6.5481
BeSO4 (aq)	2.029e-07	0.02118	1.0279	-6.6807
HAsO4--	1.868e-07	0.02596	0.3533	-7.1805
CO3--	1.570e-07	0.009359	0.3533	-7.2558
MgCO3 (aq)	1.399e-07	0.01171	1.0279	-6.8424
CaCO3 (aq)	9.473e-08	0.009417	1.0279	-7.0115
FeOH++	8.994e-08	0.006508	0.3533	-7.4978
UO2(CO3)2--	5.956e-08	0.02307	0.3533	-7.6768
NiHCO3+	5.708e-08	0.006788	0.7710	-7.3564
UO2CO3 (aq)	4.621e-08	0.01515	1.0279	-7.3233
Cd++	3.114e-08	0.003476	0.3533	-7.9585
CdCl+	2.559e-08	0.003757	0.7710	-7.7050
CdSO4 (aq)	1.964e-08	0.004067	1.0279	-7.6948
NaCO3-	1.784e-08	0.001471	0.7710	-7.8615
BeCO3 (aq)	1.669e-08	0.001144	1.0279	-7.7656
OH-	1.168e-08	0.0001973	0.7710	-8.0454
Be(SO4)2--	1.161e-08	0.002319	0.3533	-8.3869

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Magnetite	18.2518s/sat	Anhydrite	0.0162s/sat
Hematite	14.2713s/sat	Calcite	-1.0135
Fe(OH)2.7Cl.3	7.1620s/sat	Aragonite	-1.1572
Maghemite	6.4673s/sat	Be(OH)2 (beta)	-1.3551
Goethite	5.9352s/sat	Vaterite	-1.5799
Magnesioferrite	5.3314s/sat	Be(OH)2 (alpha)	-1.7551
Lepidocrocite	5.0552s/sat	Be(OH)2 (am)	-2.0551
K-Jarosite	4.7456s/sat	Dolomite (ordere	-2.2254
Ferrihydrite (ag	3.7354s/sat	CaCO3xH2O	-2.3499
Ferrihydrite	3.2254s/sat	Magnesite	-2.3621
Fe3(OH)8	1.4292s/sat	Epsomite	-2.5518
Na-Jarosite	0.6531s/sat	NiCO3	-2.6240

Gypsum 0.2645s/sat Dolomite (disord -2.7754
Siderite 0.2314s/sat Rutherfordine -2.9611
(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.09746	-1.011
O2(g)	3.467e-41	-40.460
CH4(g)	4.218e-64	-63.375

Original basis	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg	Kd L/kg
AsO4---	2.37e-05	2.37e-05	0.155			
Be++	3.62e-05	3.62e-05	0.0153			
CO3--	0.109	0.109	307.			
Ca++	0.571	0.571	1.07e+03			
Cd++	1.79e-06	1.79e-06	0.00943			
Cl-	0.532	0.532	884.			
Fe+++	0.0794	0.0794	208.			
H+	0.0977	0.0977	4.61			
H2O	1.18e+03	1.18e+03	9.93e+05			
K+	0.0101	0.0101	18.4			
Mg++	0.249	0.249	284.			
Na+	0.385	0.385	414.			
Ni++	2.62e-05	2.62e-05	0.0721			
O2(aq)	-0.0198	-0.0198	-29.7			
SO4--	0.811	0.811	3.65e+03			
UO2++	3.09e-05	3.09e-05	0.392			

Elemental composition	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg
As	2.374e-05	2.374e-05	0.08336		
Be	3.622e-05	3.622e-05	0.01530		
C	0.1090	0.1090	61.37		
Ca	0.5714	0.5714	1073.		
Cd	1.791e-06	1.791e-06	0.009435		
Cl	0.5321	0.5321	883.9		
Fe	0.07939	0.07939	207.8		
H	2353.	2353.	1.111e+05		
K	0.01005	0.01005	18.42		
Mg	0.2493	0.2493	284.1		
Na	0.3845	0.3845	414.3		
Ni	2.620e-05	2.620e-05	0.07208		
O	1180.	1180.	8.847e+05		
S	0.8110	0.8110	1219.		
U	3.095e-05	3.095e-05	0.3452		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 5.254 log fO2 = -43.254

Eh = 0.2783 volts pe = 4.7053
Ionic strength = 0.117353
Activity of water = 0.998108
Solvent mass = 21.193 kg
Solution mass = 21.337 kg
Mineral mass = 0.0024842 kg
Solution density = 1.016 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.025105 molal
Dissolved solids = 6744 mg/kg sol'n
Elect. conductivity = 6570.22 uS/cm (or umho/cm)
Hardness = 3815.33 mg/kg sol'n as CaCO3
carbonate = 24.56 mg/kg sol'n as CaCO3
non-carbonate = 3790.77 mg/kg sol'n as CaCO3
Carbonate alkalinity= 24.56 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 2.10e+04 cm3
Fluid volume = 2.10e+04 cm3
Mineral volume = 0.937 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.5 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.2783	4.7053

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

Minerals in system	moles	log moles	grams	volume (cm3)
K-Jarosite	0.004960	-2.304	2.484	0.9374
(total)			2.484	0.9374

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02435	857.6	0.7720	-1.7258
SO4--	0.02201	2100.	0.3552	-2.1069
Na+	0.01728	394.5	0.7720	-1.8749
Ca++	0.01620	644.7	0.3552	-2.2401
CaSO4 (aq)	0.01003	1356.	1.0274	-1.9870
Mg++	0.007697	185.9	0.3552	-2.5632
H2CO3* (aq)	0.004597	283.2	1.0274	-2.3258
MgSO4 (aq)	0.003787	452.7	1.0274	-2.4100
Fe++	0.001821	101.0	0.3552	-3.1891
FeSO4 (aq)	0.001209	182.4	1.0274	-2.9060
NaSO4-	0.0007423	87.78	0.7720	-3.2418
HCO3-	0.0004884	29.60	0.7720	-3.4236
CaCl+	0.0003520	26.40	0.7720	-3.5659
MgCl+	0.0002651	15.74	0.7720	-3.6890

K+	0.0002261	8.783	0.7720	-3.7580
NaCl (aq)	0.0001223	7.102	1.0274	-3.9007
CaHCO3+	3.579e-05	3.594	0.7720	-4.5586
MgHCO3+	1.556e-05	1.319	0.7720	-4.9204
KSO4-	1.242e-05	1.668	0.7720	-5.0182
FeCl+	9.941e-06	0.9015	0.7720	-5.1149
H+	7.217e-06	0.007225	0.7720	-5.2540
HSO4-	5.475e-06	0.5279	0.7720	-5.3740
FeHCO3+	3.979e-06	0.4619	0.7720	-5.5126
NaHCO3 (aq)	2.454e-06	0.2048	1.0274	-5.5984
KCl (aq)	1.601e-06	0.1186	1.0274	-5.7838
Be++	1.110e-06	0.009936	0.3552	-6.4042
H2AsO4-	1.076e-06	0.1507	0.7720	-6.0804
UO2CO3 (aq)	1.005e-06	0.3294	1.0274	-5.9862
Ni++	7.901e-07	0.04608	0.3552	-6.5518
BeSO4 (aq)	4.648e-07	0.04850	1.0274	-6.3210
NiSO4 (aq)	4.262e-07	0.06552	1.0274	-6.3587
Fe(OH)2+	2.254e-07	0.02012	0.7720	-6.7594
UO2SO4 (aq)	1.034e-07	0.03760	1.0274	-6.9737
Ca2UO2(CO3)3 (aq	9.442e-08	0.04973	1.0274	-7.0132
Be(OH)2 (aq)	9.047e-08	0.003866	1.0274	-7.0317
UO2(CO3)2--	7.365e-08	0.02853	0.3552	-7.5824
UO2++	7.275e-08	0.01951	0.3552	-7.5877
UO2(SO4)2--	7.062e-08	0.03242	0.3552	-7.6006
FeOH+	6.018e-08	0.004355	0.7720	-7.3329
HAsO4--	4.297e-08	0.005972	0.3552	-7.8164
UO2OH+	3.372e-08	0.009614	0.7720	-7.5844
Cd++	3.122e-08	0.003485	0.3552	-7.9551
Be(SO4)2--	2.640e-08	0.005274	0.3552	-8.0279
CdCl+	2.579e-08	0.003788	0.7720	-7.7009
CdSO4 (aq)	1.978e-08	0.004096	1.0274	-7.6919
NiHCO3+	1.691e-08	0.002011	0.7720	-7.8843
FeOH++	1.468e-08	0.001063	0.3552	-8.2826
BeCl+	1.326e-08	0.0005855	0.7720	-7.9900

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Magnetite	12.4054s/sat	Magnesioferrite	-0.4256
Hematite	9.9080s/sat	Siderite	-1.0976
Fe(OH)2.7Cl.3	5.1901s/sat	Rutherfordine	-1.6240
Goethite	3.7536s/sat	Calcite	-2.2587
Lepidocrocite	2.8736s/sat	Be(OH)2 (beta)	-2.3917
Maghemite	2.1040s/sat	Aragonite	-2.4024
Ferrihydrite (ag	1.5538s/sat	Epsomite	-2.5493
Ferrihydrite	1.0438s/sat	UO2(OH)2 (beta)	-2.6928
Gypsum	0.2614s/sat	Be(OH)2 (alpha)	-2.7917
Anhydrite	0.0130s/sat	Vaterite	-2.8251
K-Jarosite	0.0000 sat		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.

CO2(g)	0.1390	-0.857
O2(g)	5.575e-44	-43.254
CH4(g)	2.326e-58	-57.633

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	2.37e-05	2.37e-05	0.155			
Be++	3.62e-05	3.62e-05	0.0153			
CO3--	0.109	0.109	307.			
Ca++	0.564	0.564	1.06e+03			
Cd++	1.79e-06	1.79e-06	0.00944			
Cl-	0.532	0.532	884.			
Fe+++	0.0794	0.0645	169.			
H+	0.112	0.142	6.72			
H2O	1.18e+03	1.18e+03	9.93e+05			
K+	0.0101	0.00509	9.33			
Mg++	0.249	0.249	284.			
Na+	0.385	0.385	414.			
Ni++	2.62e-05	2.62e-05	0.0721			
O2(aq)	-0.0161	-0.0161	-24.2			
SO4--	0.811	0.801	3.61e+03			
UO2++	3.09e-05	3.09e-05	0.392			

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	2.374e-05	2.374e-05	0.08337		
Be	3.622e-05	3.622e-05	0.01530		
C	0.1090	0.1090	61.37		
Ca	0.5640	0.5640	1059.		
Cd	1.791e-06	1.791e-06	0.009436		
Cl	0.5321	0.5321	884.1		
Fe	0.07939	0.06451	168.9		
H	2353.	2353.	1.111e+05		
K	0.01005	0.005090	9.327		
Mg	0.2493	0.2493	284.1		
Na	0.3845	0.3845	414.3		
Ni	2.620e-05	2.620e-05	0.07209		
O	1180.	1180.	8.848e+05		
S	0.8110	0.8010	1204.		
U	3.095e-05	3.095e-05	0.3452		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 6.066 log fO2 = -41.053
Eh = 0.2628 volts pe = 4.4430
Ionic strength = 0.099751
Activity of water = 0.998372
Solvent mass = 51.502 kg
Solution mass = 51.788 kg
Mineral mass = 0.00000 kg
Solution density = 1.015 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.023458 molal
Dissolved solids = 5524 mg/kg sol'n
Elect. conductivity = 5807.65 uS/cm (or umho/cm)
Hardness = 3188.88 mg/kg sol'n as CaCO3
carbonate = 106.50 mg/kg sol'n as CaCO3
non-carbonate = 3082.37 mg/kg sol'n as CaCO3
Carbonate alkalinity= 106.50 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 5.10e+04 cm3
Fluid volume = 5.10e+04 cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.2628	4.4430

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02281	804.2	0.7810	-1.7492
SO4--	0.01750	1671.	0.3721	-2.1864
Na+	0.01566	358.0	0.7810	-1.9126
Ca++	0.01361	542.7	0.3721	-2.2954
CaSO4 (aq)	0.007384	999.7	1.0232	-2.1218
Mg++	0.007204	174.2	0.3721	-2.5718
MgSO4 (aq)	0.003103	371.5	1.0232	-2.4982
H2CO3* (aq)	0.003021	186.3	1.0232	-2.5099
HCO3-	0.002051	124.5	0.7810	-2.7953
Fe++	0.001001	55.58	0.3721	-3.4290
FeSO4 (aq)	0.0005816	87.86	1.0232	-3.2254
NaSO4-	0.0005602	66.32	0.7810	-3.3590

K+	0.0003864	15.03	0.7810	-3.5203
CaCl+	0.0002902	21.80	0.7810	-3.6446
MgCl+	0.0002434	14.47	0.7810	-3.7210
CaHCO3+	0.0001324	13.31	0.7810	-3.9856
NaCl (aq)	0.0001067	6.202	1.0232	-3.9618
MgHCO3+	6.405e-05	5.435	0.7810	-4.3008
KSO4-	1.768e-05	2.376	0.7810	-4.8600
FeHCO3+	9.619e-06	1.118	0.7810	-5.1242
NaHCO3 (aq)	9.599e-06	0.8019	1.0232	-5.0078
FeCl+	5.359e-06	0.4866	0.7810	-5.3782
Fe(OH)2+	2.956e-06	0.2641	0.7810	-5.6367
KCl (aq)	2.634e-06	0.1953	1.0232	-5.5695
H+	1.099e-06	0.001102	0.7810	-6.0664
HSO4-	6.942e-07	0.06701	0.7810	-6.2659
Ca2UO2(CO3)3 (aq	6.525e-07	0.3441	1.0232	-6.1754
Be(OH)2 (aq)	5.096e-07	0.02180	1.0232	-6.2828
Ni++	4.210e-07	0.02458	0.3721	-6.8051
H2AsO4-	3.900e-07	0.05466	0.7810	-6.5163
CO3--	2.352e-07	0.01404	0.3721	-7.0579
FeOH+	2.223e-07	0.01611	0.7810	-6.7604
MgCO3 (aq)	2.188e-07	0.01835	1.0232	-6.6499
NiSO4 (aq)	1.988e-07	0.03060	1.0232	-6.6915
Be++	1.410e-07	0.001264	0.3721	-7.2801
CaCO3 (aq)	1.314e-07	0.01308	1.0232	-6.8714
HAsO4--	9.759e-08	0.01358	0.3721	-7.4400
BeSO4 (aq)	5.170e-08	0.005403	1.0232	-7.2765
NiHCO3+	3.963e-08	0.004718	0.7810	-7.5093
FeOH++	2.864e-08	0.002075	0.3721	-7.9723
NaCO3-	2.552e-08	0.002106	0.7810	-7.7005
UO2(CO3)2--	2.263e-08	0.008779	0.3721	-8.0746
OH-	1.500e-08	0.0002536	0.7810	-7.9314
Cd++	1.366e-08	0.001527	0.3721	-8.2938
UO2CO3 (aq)	1.177e-08	0.003864	1.0232	-7.9191
CdCl+	1.107e-08	0.001628	0.7810	-8.0630

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Magnetite	17.6602s/sat	Na-Jarosite	-0.6255
Hematite	13.7780s/sat	Calcite	-0.8734
Fe(OH)2.7Cl.3	6.8745s/sat	Aragonite	-1.0171
Maghemite	5.9740s/sat	Vaterite	-1.4398
Goethite	5.6887s/sat	Be(OH)2 (beta)	-1.6428
Magnesioferrite	5.0605s/sat	Dolomite (ordere	-1.8929
Lepidocrocite	4.8087s/sat	Be(OH)2 (alpha)	-2.0428
Ferrihydrite (ag	3.4890s/sat	Magnesite	-2.1696
K-Jarosite	3.4469s/sat	CaCO3xH2O	-2.2096
Ferrihydrite	2.9790s/sat	Be(OH)2 (am)	-2.3428
Fe3(OH)8	0.8382s/sat	Dolomite (disord	-2.4429
Gypsum	0.1268s/sat	Epsomite	-2.6366
Siderite	0.1031s/sat	NiCO3	-2.6630
Anhydrite	-0.1218		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.09096	-1.041
O2(g)	8.846e-42	-41.053
CH4(g)	6.048e-63	-62.218

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	2.51e-05	2.51e-05	0.0674			
Be++	3.68e-05	3.68e-05	0.00640			
CO3--	0.272	0.272	316.			
Ca++	1.10	1.10	854.			
Cd++	1.81e-06	1.81e-06	0.00393			
Cl-	1.21	1.21	827.			
Fe+++	0.0824	0.0824	88.9			
H+	0.345	0.345	6.72			
H2O	2.86e+03	2.86e+03	9.94e+05			
K+	0.0209	0.0209	15.8			
Mg++	0.547	0.547	257.			
Na+	0.841	0.841	373.			
Ni++	3.41e-05	3.41e-05	0.0386			
O2(aq)	-0.0206	-0.0206	-12.7			
SO4--	1.50	1.50	2.78e+03			
UO2++	3.57e-05	3.57e-05	0.186			

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	2.511e-05	2.511e-05	0.03633		
Be	3.680e-05	3.680e-05	0.006403		
C	0.2725	0.2725	63.20		
Ca	1.103	1.103	853.9		
Cd	1.809e-06	1.809e-06	0.003926		
Cl	1.208	1.208	827.1		
Fe	0.08243	0.08243	88.89		
H	5718.	5718.	1.113e+05		
K	0.02095	0.02095	15.82		
Mg	0.5467	0.5467	256.6		
Na	0.8413	0.8413	373.5		
Ni	3.406e-05	3.406e-05	0.03862		
O	2866.	2866.	8.853e+05		
S	1.501	1.501	929.3		
U	3.565e-05	3.565e-05	0.1639		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 5.631 log fO2 = -42.794
Eh = 0.2628 volts pe = 4.4430
Ionic strength = 0.097837
Activity of water = 0.998390

Solvent mass = 51.501 kg
Solution mass = 51.783 kg
Mineral mass = 0.0048968 kg
Solution density = 1.015 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.023459 molal
Dissolved solids = 5439 mg/kg sol'n
Elect. conductivity = 5723.32 uS/cm (or umho/cm)
Hardness = 3161.00 mg/kg sol'n as CaCO3
carbonate = 52.47 mg/kg sol'n as CaCO3
non-carbonate = 3108.53 mg/kg sol'n as CaCO3
Carbonate alkalinity= 52.47 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 5.10e+04 cm3
Fluid volume = 5.10e+04 cm3
Mineral volume = 1.85 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.6 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.2628	4.4430

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

Minerals in system	moles	log moles	grams	volume (cm3)
K-Jarosite	0.009778	-2.010	4.897	1.848
(total)			4.897	1.848

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02281	804.4	0.7821	-1.7486
SO4--	0.01737	1659.	0.3742	-2.1872
Na+	0.01566	358.1	0.7821	-1.9118
Ca++	0.01346	536.4	0.3742	-2.2980
CaSO4 (aq)	0.007328	992.2	1.0228	-2.1252
Mg++	0.007216	174.5	0.3742	-2.5686
H2CO3* (aq)	0.004150	256.0	1.0228	-2.3722
MgSO4 (aq)	0.003122	373.7	1.0228	-2.4958
HCO3-	0.001033	62.66	0.7821	-3.0928
Fe++	0.0006467	35.92	0.3742	-3.6162
NaSO4-	0.0005593	66.23	0.7821	-3.3591
FeSO4 (aq)	0.0003774	57.01	1.0228	-3.4135
CaCl+	0.0002885	21.67	0.7821	-3.6466
MgCl+	0.0002452	14.58	0.7821	-3.7172
K+	0.0002061	8.014	0.7821	-3.7927
NaCl (aq)	0.0001071	6.226	1.0228	-3.9604
CaHCO3+	6.622e-05	6.658	0.7821	-4.2857

MgHCO3+	3.248e-05	2.756	0.7821	-4.5952
KSO4-	9.408e-06	1.265	0.7821	-5.1332
NaHCO3 (aq)	4.849e-06	0.4051	1.0228	-5.3046
FeCl+	3.483e-06	0.3163	0.7821	-5.5648
FeHCO3+	3.146e-06	0.3657	0.7821	-5.6090
H+	2.989e-06	0.002997	0.7821	-5.6312
HSO4-	1.885e-06	0.1820	0.7821	-5.8315
KCl (aq)	1.409e-06	0.1045	1.0228	-5.8413
H2AsO4-	4.466e-07	0.06260	0.7821	-6.4568
Ni++	4.335e-07	0.02531	0.3742	-6.7899
Ca2UO2(CO3)3 (aq	3.932e-07	0.2074	1.0228	-6.3956
Be++	3.765e-07	0.003374	0.3742	-6.8512
Fe(OH)2+	2.585e-07	0.02310	0.7821	-6.6943
UO2CO3 (aq)	2.098e-07	0.06885	1.0228	-6.6685
NiSO4 (aq)	2.056e-07	0.03165	1.0228	-6.6771
Be(OH)2 (aq)	1.845e-07	0.007893	1.0228	-6.7243
BeSO4 (aq)	1.386e-07	0.01448	1.0228	-6.8484
UO2(CO3)2--	7.416e-08	0.02877	0.3742	-7.5568
FeOH+	5.296e-08	0.003837	0.7821	-7.3828
CO3--	4.329e-08	0.002584	0.3742	-7.7906
HAsO4--	4.086e-08	0.005686	0.3742	-7.8157
MgCO3 (aq)	4.081e-08	0.003422	1.0228	-7.3795
CaCO3 (aq)	2.418e-08	0.002407	1.0228	-7.6068
NiHCO3+	2.066e-08	0.002460	0.7821	-7.7917
Cd++	1.369e-08	0.001531	0.3742	-8.2904
CdCl+	1.116e-08	0.001641	0.7821	-8.0590

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Magnetite	13.6170s/sat	Siderite	-0.8168
Hematite	10.7924s/sat	Calcite	-1.6088
Fe(OH)2.7Cl.3	5.5125s/sat	Aragonite	-1.7525
Goethite	4.1959s/sat	Be(OH)2 (beta)	-2.0843
Lepidocrocite	3.3159s/sat	Vaterite	-2.1752
Maghemite	2.9884s/sat	Rutherfordine	-2.3063
Ferrihydrite (ag	1.9962s/sat	Be(OH)2 (alpha)	-2.4843
Ferrihydrite	1.4862s/sat	Epsomite	-2.6342
Magnesioferrite	1.2077s/sat	Be(OH)2 (am)	-2.7843
Gypsum	0.1234s/sat	Magnesite	-2.8992
K-Jarosite	0.0000 sat	CaCO3xH2O	-2.9450
Anhydrite	-0.1252		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.1249	-0.903
O2(g)	1.607e-43	-42.794
CH4(g)	2.517e-59	-58.599

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg

AsO4---	2.51e-05	2.51e-05	0.0674
Be++	3.68e-05	3.68e-05	0.00640
CO3--	0.272	0.272	316.
Ca++	1.09	1.09	843.
Cd++	1.81e-06	1.81e-06	0.00393
Cl-	1.21	1.21	827.
Fe+++	0.0824	0.0531	57.3
H+	0.375	0.433	8.43
H2O	2.86e+03	2.86e+03	9.95e+05
K+	0.0209	0.0112	8.43
Mg++	0.547	0.547	257.
Na+	0.841	0.841	373.
Ni++	3.41e-05	3.41e-05	0.0386
O2(aq)	-0.0133	-0.0133	-8.20
SO4--	1.50	1.48	2.75e+03
UO2++	3.57e-05	3.57e-05	0.186

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	2.511e-05	2.511e-05	0.03633		
Be	3.680e-05	3.680e-05	0.006404		
C	0.2725	0.2725	63.20		
Ca	1.089	1.089	842.7		
Cd	1.809e-06	1.809e-06	0.003926		
Cl	1.208	1.208	827.2		
Fe	0.08243	0.05310	57.27		
H	5718.	5718.	1.113e+05		
K	0.02095	0.01117	8.435		
Mg	0.5467	0.5467	256.7		
Na	0.8413	0.8413	373.5		
Ni	3.406e-05	3.406e-05	0.03862		
O	2866.	2865.	8.854e+05		
S	1.501	1.481	917.3		
U	3.565e-05	3.565e-05	0.1639		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 6.103 log fO2 = -41.501
Eh = 0.2540 volts pe = 4.2943
Ionic strength = 0.092672
Activity of water = 0.998472
Solvent mass = 102.02 kg
Solution mass = 102.53 kg
Mineral mass = 0.00000 kg
Solution density = 1.015 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.022888 molal
Dissolved solids = 5066 mg/kg sol'n
Elect. conductivity = 5496.36 uS/cm (or umho/cm)
Hardness = 2960.40 mg/kg sol'n as CaCO3
carbonate = 112.60 mg/kg sol'n as CaCO3
non-carbonate = 2847.81 mg/kg sol'n as CaCO3
Carbonate alkalinity= 112.60 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 1.01e+05 cm3
Fluid volume = 1.01e+05 cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.2540	4.2943

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02228	785.7	0.7852	-1.7572
SO4--	0.01583	1513.	0.3801	-2.2206
Na+	0.01510	345.3	0.7852	-1.9262
Ca++	0.01263	503.7	0.3801	-2.3187
Mg++	0.007043	170.4	0.3801	-2.5724
CaSO4 (aq)	0.006478	877.4	1.0216	-2.1793
H2CO3* (aq)	0.002956	182.4	1.0216	-2.5201
MgSO4 (aq)	0.002869	343.6	1.0216	-2.5330
HCO3-	0.002169	131.7	0.7852	-2.7688
Fe++	0.0005470	30.39	0.3801	-3.6821
NaSO4-	0.0004991	59.12	0.7852	-3.4068
K+	0.0003654	14.22	0.7852	-3.5422

FeSO4 (aq)	0.0003006	45.43	1.0216	-3.5128
CaCl+	0.0002686	20.19	0.7852	-3.6759
MgCl+	0.0002374	14.12	0.7852	-3.7296
CaHCO3+	0.0001326	13.34	0.7852	-3.9824
NaCl (aq)	0.0001017	5.914	1.0216	-3.9834
MgHCO3+	6.763e-05	5.742	0.7852	-4.2749
KSO4-	1.545e-05	2.077	0.7852	-4.9161
NaHCO3 (aq)	9.904e-06	0.8278	1.0216	-4.9949
FeHCO3+	5.678e-06	0.6602	0.7852	-5.3509
FeCl+	2.922e-06	0.2654	0.7852	-5.6394
KCl (aq)	2.462e-06	0.1826	1.0216	-5.5994
Fe(OH)2+	1.380e-06	0.1234	0.7852	-5.9650
H+	1.005e-06	0.001007	0.7852	-6.1031
HSO4-	5.864e-07	0.05664	0.7852	-6.3368
Ca2UO2(CO3)3 (aq	4.037e-07	0.2130	1.0216	-6.3846
Ni++	2.977e-07	0.01739	0.3801	-6.9463
Be(OH)2 (aq)	2.784e-07	0.01192	1.0216	-6.5460
CO3--	2.664e-07	0.01590	0.3801	-6.9946
MgCO3 (aq)	2.532e-07	0.02124	1.0216	-6.5873
H2AsO4-	2.118e-07	0.02971	0.7852	-6.7790
CaCO3 (aq)	1.443e-07	0.01437	1.0216	-6.8315
FeOH+	1.344e-07	0.009740	0.7852	-6.9767
NiSO4 (aq)	1.330e-07	0.02048	1.0216	-6.8670
Be++	6.357e-08	0.0005700	0.3801	-7.6169
HAsO4--	5.678e-08	0.007905	0.3801	-7.6659
NiHCO3+	3.027e-08	0.003606	0.7852	-7.6240
NaCO3-	2.846e-08	0.002350	0.7852	-7.6508
BeSO4 (aq)	2.204e-08	0.002304	1.0216	-7.6475
OH-	1.623e-08	0.0002747	0.7852	-7.8946
UO2(CO3)2--	1.317e-08	0.005112	0.3801	-8.3004
FeOH++	1.210e-08	0.0008769	0.3801	-8.3374

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Magnetite	16.8974s/sat	Calcite	-0.8335
Hematite	13.1948s/sat	Aragonite	-0.9772
Fe(OH)2.7Cl.3	6.5695s/sat	Vaterite	-1.3999
Goethite	5.3971s/sat	Na-Jarosite	-1.6924
Maghemite	5.3908s/sat	Dolomite (ordere	-1.7903
Magnesioferrite	4.5502s/sat	Be(OH)2 (beta)	-1.9060
Lepidocrocite	4.5171s/sat	Magnesite	-2.1070
Ferrihydrite (ag	3.1974s/sat	CaCO3xH2O	-2.1697
Ferrihydrite	2.6874s/sat	Be(OH)2 (alpha)	-2.3060
K-Jarosite	2.3715s/sat	Dolomite (disord	-2.3403
Fe3(OH)8	0.0755s/sat	Be(OH)2 (am)	-2.6060
Gypsum	0.0694s/sat	Epsomite	-2.6711
Siderite	-0.0868	NiCO3	-2.7410
Anhydrite	-0.1793		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.

CO2(g)	0.08883	-1.051
O2(g)	3.154e-42	-41.501
CH4(g)	4.647e-62	-61.333

Original basis	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg	Kd L/kg
AsO4---	2.74e-05	2.74e-05	0.0371			
Be++	3.77e-05	3.77e-05	0.00332			
CO3--	0.545	0.545	319.			
Ca++	1.99	1.99	778.			
Cd++	1.84e-06	1.84e-06	0.00201			
Cl-	2.33	2.33	807.			
Fe+++	0.0875	0.0875	47.7			
H+	0.759	0.759	7.46			
H2O	5.66e+03	5.66e+03	9.95e+05			
K+	0.0391	0.0391	14.9			
Mg++	1.04	1.04	247.			
Na+	1.60	1.60	359.			
Ni++	4.72e-05	4.72e-05	0.0270			
O2(aq)	-0.0218	-0.0218	-6.82			
SO4--	2.65	2.65	2.48e+03			
UO2++	4.35e-05	4.35e-05	0.115			

Elemental composition	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg
As	2.741e-05	2.741e-05	0.02003		
Be	3.775e-05	3.775e-05	0.003318		
C	0.5450	0.5450	63.84		
Ca	1.990	1.990	778.0		
Cd	1.838e-06	1.838e-06	0.002014		
Cl	2.335	2.335	807.3		
Fe	0.08750	0.08750	47.66		
H	1.133e+04	1.133e+04	1.113e+05		
K	0.03911	0.03911	14.91		
Mg	1.042	1.042	247.1		
Na	1.602	1.602	359.2		
Ni	4.717e-05	4.717e-05	0.02701		
O	5675.	5675.	8.855e+05		
S	2.652	2.652	829.2		
U	4.349e-05	4.349e-05	0.1010		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 5.853 log fO2 = -42.500
Eh = 0.2540 volts pe = 4.2943
Ionic strength = 0.091434
Activity of water = 0.998483
Solvent mass = 102.01 kg
Solution mass = 102.53 kg
Mineral mass = 0.0061716 kg

Solution density = 1.015 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.022889 molal
Dissolved solids = 5012 mg/kg sol'n
Elect. conductivity = 5441.14 uS/cm (or umho/cm)
Hardness = 2942.62 mg/kg sol'n as CaCO3
carbonate = 77.67 mg/kg sol'n as CaCO3
non-carbonate = 2864.95 mg/kg sol'n as CaCO3
Carbonate alkalinity= 77.67 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 1.01e+05 cm3
Fluid volume = 1.01e+05 cm3
Mineral volume = 2.33 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.6 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.2540	4.2943

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

Minerals in system	moles	log moles	grams	volume (cm3)
K-Jarosite	0.01232	-1.909	6.172	2.329
(total)			6.172	2.329

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02228	785.8	0.7860	-1.7567
SO4--	0.01574	1505.	0.3816	-2.2213
Na+	0.01510	345.4	0.7860	-1.9257
Ca++	0.01253	499.6	0.3816	-2.3205
Mg++	0.007051	170.6	0.3816	-2.5702
CaSO4 (aq)	0.006442	872.7	1.0213	-2.1818
H2CO3* (aq)	0.003676	226.9	1.0213	-2.4255
MgSO4 (aq)	0.002880	345.0	1.0213	-2.5314
HCO3-	0.001516	92.02	0.7860	-2.9240
NaSO4-	0.0004985	59.05	0.7860	-3.4069
Fe++	0.0003166	17.59	0.3816	-3.9180
CaCl+	0.0002675	20.10	0.7860	-3.6773
K+	0.0002503	9.738	0.7860	-3.7062
MgCl+	0.0002386	14.19	0.7860	-3.7269
FeSO4 (aq)	0.0001744	26.36	1.0213	-3.7492
NaCl (aq)	0.0001020	5.929	1.0213	-3.9824
CaHCO3+	9.229e-05	9.283	0.7860	-4.1395
MgHCO3+	4.751e-05	4.033	0.7860	-4.4279
KSO4-	1.057e-05	1.421	0.7860	-5.0807
NaHCO3 (aq)	6.939e-06	0.5800	1.0213	-5.1496

FeHCO3+	2.305e-06	0.2681	0.7860	-5.7419
H+	1.784e-06	0.001789	0.7860	-5.8533
FeCl+	1.698e-06	0.1542	0.7860	-5.8747
KCl (aq)	1.690e-06	0.1254	1.0213	-5.7629
HSO4-	1.040e-06	0.1004	0.7860	-6.0876
Ca2UO2(CO3)3 (aq	3.578e-07	0.1887	1.0213	-6.4373
Ni++	3.036e-07	0.01773	0.3816	-6.9362
Fe(OH)2+	2.536e-07	0.02268	0.7860	-6.7004
H2AsO4-	2.335e-07	0.03274	0.7860	-6.7363
Be(OH)2 (aq)	1.844e-07	0.007895	1.0213	-6.7251
NiSO4 (aq)	1.360e-07	0.02094	1.0213	-6.8574
Be++	1.325e-07	0.001188	0.3816	-7.2963
CO3--	1.044e-07	0.006235	0.3816	-7.3996
MgCO3 (aq)	1.002e-07	0.008404	1.0213	-6.9901
CaCO3 (aq)	5.655e-08	0.005632	1.0213	-7.2384
BeSO4 (aq)	4.606e-08	0.004815	1.0213	-7.3275
FeOH+	4.388e-08	0.003181	0.7860	-7.4624
HAsO4--	3.510e-08	0.004887	0.3816	-7.8731
UO2CO3 (aq)	3.498e-08	0.01149	1.0213	-7.4470
UO2(CO3)2--	2.979e-08	0.01156	0.3816	-7.9443
NiHCO3+	2.165e-08	0.002580	0.7860	-7.7691
NaCO3-	1.120e-08	0.0009251	0.7860	-8.0553

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Magnetite	14.1914s/sat	Siderite	-0.7276
Hematite	11.2243s/sat	Calcite	-1.2404
Fe(OH)2.7Cl.3	5.6594s/sat	Aragonite	-1.3841
Goethite	4.4118s/sat	Vaterite	-1.8068
Lepidocrocite	3.5318s/sat	Be(OH)2 (beta)	-2.0851
Maghemite	3.4203s/sat	Be(OH)2 (alpha)	-2.4851
Ferrihydrite (ag	2.2122s/sat	Magnesite	-2.5098
Magnesioferrite	2.0823s/sat	CaCO3xH2O	-2.5766
Ferrihydrite	1.7022s/sat	Dolomite (ordere	-2.6000
Gypsum	0.0669s/sat	Fe3(OH)8	-2.6304
K-Jarosite	0.0000 sat	Epsomite	-2.6696
Anhydrite	-0.1818	Be(OH)2 (am)	-2.7851

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.1105	-0.957
O2(g)	3.160e-43	-42.500
CH4(g)	5.759e-60	-59.240

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	2.74e-05	2.74e-05	0.0371			
Be++	3.77e-05	3.77e-05	0.00332			
CO3--	0.545	0.545	319.			
Ca++	1.97	1.97	771.			

Cd++	1.84e-06	1.84e-06	0.00201
Cl-	2.33	2.33	807.
Fe+++	0.0875	0.0505	27.5
H+	0.796	0.870	8.55
H2O	5.66e+03	5.66e+03	9.95e+05
K+	0.0391	0.0268	10.2
Mg++	1.04	1.04	247.
Na+	1.60	1.60	359.
Ni++	4.72e-05	4.72e-05	0.0270
O2(aq)	-0.0126	-0.0126	-3.94
SO4--	2.65	2.63	2.46e+03
UO2++	4.35e-05	4.35e-05	0.115

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	2.741e-05	2.741e-05	0.02003		
Be	3.775e-05	3.775e-05	0.003318		
C	0.5450	0.5450	63.84		
Ca	1.972	1.972	770.9		
Cd	1.838e-06	1.838e-06	0.002015		
Cl	2.335	2.335	807.4		
Fe	0.08750	0.05053	27.52		
H	1.133e+04	1.133e+04	1.113e+05		
K	0.03911	0.02678	10.21		
Mg	1.042	1.042	247.2		
Na	1.602	1.602	359.3		
Ni	4.717e-05	4.717e-05	0.02701		
O	5675.	5675.	8.855e+05		
S	2.652	2.627	821.6		
U	4.349e-05	4.349e-05	0.1010		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 1.912 log fO2 = -23.568
Eh = 0.7672 volts pe = 12.9690
Ionic strength = 0.135200
Activity of water = 0.997525
Solvent mass = 11.089 kg
Solution mass = 11.185 kg
Mineral mass = 0.00000 kg
Solution density = 1.017 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.027382 molal
Dissolved solids = 8611 mg/kg sol'n
Elect. conductivity = 12331.68 uS/cm (or umho/cm)
Hardness = 3592.61 mg/kg sol'n as CaCO3
carbonate = 0.01 mg/kg sol'n as CaCO3
non-carbonate = 3592.59 mg/kg sol'n as CaCO3
Carbonate alkalinity= 0.01 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 1.10e+04 cm3
Fluid volume = 1.10e+04 cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.7672	12.9690

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02653	932.4	0.7645	-1.6929
SO4--	0.02357	2245.	0.3416	-2.0941
Na+	0.01800	410.3	0.7645	-1.8613
H+	0.01602	16.00	0.7645	-1.9120
HSO4-	0.01251	1204.	0.7645	-2.0193
Ca++	0.01216	483.2	0.3416	-2.3816
Mg++	0.01074	258.9	0.3416	-2.4354
CaSO4 (aq)	0.007427	1002.	1.0316	-2.1157
MgSO4 (aq)	0.005211	621.9	1.0316	-2.2695
FeSO4+	0.005196	782.5	0.7645	-2.4010
H2CO3* (aq)	0.004916	302.3	1.0316	-2.2949
NaSO4-	0.0007965	94.01	0.7645	-3.2154

```
 Fe(SO4)2-          0.0005643       138.7      0.7645      -3.3651
 K+                 0.0005440        21.09     0.7645      -3.3810
 MgCl+              0.0003875        22.96     0.7645      -3.5284
 Fe+++              0.0003110        17.22     0.0892      -4.5569
 CaCl+              0.0002768        20.73     0.7645      -3.6745
 NaCl (aq)          0.0001356        7.856     1.0316      -3.8543
 Fe++               9.390e-05        5.199     0.3416      -4.4938
 FeOH++             6.318e-05        4.564     0.3416      -4.6659
 FeSO4 (aq)         6.145e-05        9.255     1.0316      -4.1979
 FeCl++             4.974e-05        4.502     0.3416      -4.7698
 KSO4-              3.078e-05        4.124     0.7645      -4.6284
 KCl (aq)           4.098e-06       0.3029     1.0316      -5.3739
 H3AsO4             3.051e-06       0.4293     1.0316      -5.5020
 H2AsO4-            1.685e-06       0.2354     0.7645      -5.8900
 UO2SO4 (aq)        6.224e-07       0.2259     1.0316      -6.1924
 FeCl+              5.369e-07      0.04859     0.7645      -6.3868
 Fe2(OH)2++++       4.789e-07      0.06918     0.0136      -8.1858
 UO2(SO4)2--        4.571e-07       0.2094     0.3416      -6.8066
 UO2++              4.440e-07       0.1189     0.3416      -6.8191
 Fe(OH)2+           4.282e-07      0.03815     0.7645      -6.4849
 HCO3-              2.410e-07      0.01458     0.7645      -6.7346
 Ni++               1.540e-07     0.008965     0.3416      -7.2789
 NiSO4 (aq)         8.193e-08      0.01257     1.0316      -7.0730
 Cd++               1.478e-08     0.001647     0.3416      -8.2967
 CdCl+              1.279e-08     0.001875     0.7645      -8.0096
 CaHCO3+            1.275e-08     0.001278     0.7645      -8.0111
 Be++               1.185e-08    0.0001059     0.3416      -8.3926
 MgHCO3+            1.030e-08    0.0008714     0.7645      -8.1037
  (only species > 1e-8 molal listed)

Mineral saturation states
                    log Q/K                        log Q/K
----------------------------------------------------------------
 Hematite          3.7733s/sat   Ferrihydrite (ag  -1.5140
 Fe(OH)2.7Cl.3     3.1349s/sat   Magnetite          -1.7183
 K-Jarosite        1.2260s/sat   Ferrihydrite       -2.0240
 Goethite          0.6861s/sat   Epsomite           -2.4106
 Gypsum            0.1322s/sat   H-Jarosite         -2.9162
 Anhydrite        -0.1157        Na-Jarosite        -2.9344
 Lepidocrocite    -0.1939
  (only minerals with log Q/K > -3 listed)

Gases             fugacity      log fug.
-----------------------------------------------
 CO2(g)               0.1493      -0.826
 O2(g)             2.707e-24     -23.568
 CH4(g)            1.059e-97     -96.975

                          In fluid            Sorbed           Kd
Original basis total moles   moles      mg/kg      moles     mg/kg      L/kg
-------------------------------------------------------------------------------
 AsO4---        5.25e-05   5.25e-05     0.652
 Be++          1.91e-07   1.91e-07  0.000154
 CO3--           0.0545     0.0545      292.
```

Ca++	0.220	0.220	789.
Cd++	4.51e-07	4.51e-07	0.00453
Cl-	0.304	0.304	962.
Fe+++	0.0703	0.0703	351.
H+	0.423	0.423	38.1
H2O	616.	616.	9.91e+05
K+	0.00642	0.00642	22.4
Mg++	0.181	0.181	394.
Na+	0.210	0.210	432.
Ni++	2.62e-06	2.62e-06	0.0138
O2(aq)	-0.000432	-0.000432	-1.24
SO4--	0.620	0.620	5.33e+03
UO2++	1.70e-05	1.70e-05	0.409

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	5.252e-05	5.252e-05	0.3518		
Be	1.909e-07	1.909e-07	0.0001538		
C	0.05452	0.05452	58.54		
Ca	0.2203	0.2203	789.3		
Cd	4.508e-07	4.508e-07	0.004530		
Cl	0.3036	0.3036	962.4		
Fe	0.07032	0.07032	351.1		
H	1232.	1232.	1.110e+05		
K	0.006420	0.006420	22.44		
Mg	0.1812	0.1812	393.9		
Na	0.2100	0.2100	431.5		
Ni	2.623e-06	2.623e-06	0.01377		
O	618.2	618.2	8.842e+05		
S	0.6203	0.6203	1778.		
U	1.696e-05	1.696e-05	0.3609		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 1.869 log fO2 = -23.738
Eh = 0.7672 volts pe = 12.9690
Ionic strength = 0.134745
Activity of water = 0.997517
Solvent mass = 11.089 kg
Solution mass = 11.183 kg
Mineral mass = 0.0025199 kg
Solution density = 1.017 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.027383 molal
Dissolved solids = 8435 mg/kg sol'n
Elect. conductivity = 12841.59 uS/cm (or umho/cm)
Hardness = 3591.82 mg/kg sol'n as CaCO3
  carbonate = 0.01 mg/kg sol'n as CaCO3
  non-carbonate = 3591.81 mg/kg sol'n as CaCO3
Carbonate alkalinity= 0.01 mg/kg sol'n as CaCO3
Water type = Ca-SO4

Bulk volume	=	1.10e+04 cm3
Fluid volume	=	1.10e+04 cm3
Mineral volume	=	0.951 cm3
Inert volume	=	0.000 cm3
Porosity	=	100. %
Permeability	=	98.4 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.7672	12.9690

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

Minerals in system	moles	log moles	grams	volume (cm3)
K-Jarosite	0.005032	-2.298	2.520	0.9509
(total)			2.520	0.9509

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02654	932.9	0.7647	-1.6927
SO4--	0.02316	2206.	0.3419	-2.1014
Na+	0.01801	410.7	0.7647	-1.8609
H+	0.01766	17.65	0.7647	-1.8694
HSO4-	0.01357	1306.	0.7647	-1.9839
Ca++	0.01222	485.8	0.3419	-2.3790
Mg++	0.01080	260.3	0.3419	-2.4328
CaSO4 (aq)	0.007348	992.0	1.0315	-2.1203
MgSO4 (aq)	0.005156	615.4	1.0315	-2.2742
H2CO3* (aq)	0.004916	302.4	1.0315	-2.2949
FeSO4+	0.004086	615.4	0.7647	-2.5053
NaSO4-	0.0007839	92.54	0.7647	-3.2223
Fe(SO4)2-	0.0004364	107.3	0.7647	-3.4767
MgCl+	0.0003900	23.11	0.7647	-3.5255
CaCl+	0.0002785	20.86	0.7647	-3.6716
Fe+++	0.0002482	13.75	0.0894	-4.6539
NaCl (aq)	0.0001358	7.871	1.0315	-3.8536
K+	0.0001177	4.565	0.7647	-4.0456
Fe++	7.503e-05	4.155	0.3419	-4.5909
FeSO4 (aq)	4.834e-05	7.281	1.0315	-4.3022
FeOH++	4.577e-05	3.306	0.3419	-4.8056
FeCl++	3.977e-05	3.600	0.3419	-4.8666
KSO4-	6.550e-06	0.8779	0.7647	-5.3003
H3AsO4	3.156e-06	0.4442	1.0315	-5.4873
H2AsO4-	1.580e-06	0.2208	0.7647	-5.9179
KCl (aq)	8.877e-07	0.06563	1.0315	-6.0383
UO2SO4 (aq)	6.228e-07	0.2261	1.0315	-6.1922
UO2++	4.513e-07	0.1208	0.3419	-6.8116
UO2(SO4)2--	4.493e-07	0.2059	0.3419	-6.8136
FeCl+	4.295e-07	0.03889	0.7647	-6.4835

```
 Fe(OH)2+          2.814e-07     0.02507     0.7647      -6.6672
 Fe2(OH)2++++      2.508e-07     0.03624     0.0137      -8.4651
 HCO3-             2.184e-07     0.01321     0.7647      -6.7773
 Ni++              1.549e-07     0.009016    0.3419      -7.2761
 NiSO4 (aq)        8.110e-08     0.01245     1.0315      -7.0775
 Cd++              1.487e-08     0.001657    0.3419      -8.2939
 CdCl+             1.288e-08     0.001889    0.7647      -8.0065
 Be++              1.192e-08     0.0001065   0.3419      -8.3900
 CaHCO3+           1.163e-08     0.001165    0.7647      -8.0511
  (only species > 1e-8 molal listed)

 Mineral saturation states
                 log Q/K                    log Q/K
----------------------------------------------------------------
 Hematite          3.3235s/sat   Lepidocrocite     -0.4188
 Fe(OH)2.7Cl.3     2.9228s/sat   Ferrihydrite (ag  -1.7389
 Goethite          0.4612s/sat   Ferrihydrite      -2.2489
 Gypsum            0.1275s/sat   Magnetite         -2.3504
 K-Jarosite        0.0000 sat    Epsomite          -2.4153
 Anhydrite        -0.1203
  (only minerals with log Q/K > -3 listed)

 Gases            fugacity     log fug.
-----------------------------------------------
 CO2(g)              0.1493     -0.826
 O2(g)            1.828e-24    -23.738
 CH4(g)           2.322e-97    -96.634

                          In fluid           Sorbed          Kd
 Original basis total moles   moles     mg/kg      moles    mg/kg      L/kg
--------------------------------------------------------------------------------
 AsO4---        5.25e-05   5.25e-05     0.652
 Be++           1.91e-07   1.91e-07  0.000154
 CO3--            0.0545     0.0545      293.
 Ca++              0.220      0.220      789.
 Cd++           4.51e-07   4.51e-07   0.00453
 Cl-               0.304      0.304      963.
 Fe+++            0.0703     0.0552      276.
 H+                0.423      0.454      40.9
 H2O                616.       616.  9.92e+05
 K+              0.00642    0.00139      4.85
 Mg++              0.181      0.181      394.
 Na+               0.210      0.210      432.
 Ni++           2.62e-06   2.62e-06    0.0138
 O2(aq)        -0.000343  -0.000343    -0.982
 SO4--             0.620      0.610  5.24e+03
 UO2++          1.70e-05   1.70e-05     0.410

 Elemental composition          In fluid              Sorbed
              total moles    moles      mg/kg       moles      mg/kg
--------------------------------------------------------------------------------
 As           5.252e-05    5.252e-05     0.3519
 Be           1.909e-07    1.909e-07   0.0001538
 C             0.05452      0.05452      58.55
```

Ca	0.2201	0.2201	788.9
Cd	4.508e-07	4.508e-07	0.004531
Cl	0.3036	0.3036	962.6
Fe	0.07032	0.05522	275.8
H	1232.	1231.	1.110e+05
K	0.006420	0.001388	4.854
Mg	0.1812	0.1812	394.0
Na	0.2100	0.2100	431.6
Ni	2.623e-06	2.623e-06	0.01377
O	618.2	618.1	8.843e+05
S	0.6203	0.6102	1750.
U	1.696e-05	1.696e-05	0.3610

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 2.199 log fO2 = -23.137
Eh = 0.7566 volts pe = 12.7901
Ionic strength = 0.111389
Activity of water = 0.998030
Solvent mass = 21.192 kg
Solution mass = 21.335 kg
Mineral mass = 0.00000 kg
Solution density = 1.016 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.024960 molal
Dissolved solids = 6702 mg/kg sol'n
Elect. conductivity = 8859.85 uS/cm (or umho/cm)
Hardness = 3178.33 mg/kg sol'n as CaCO3
carbonate = 0.02 mg/kg sol'n as CaCO3
non-carbonate = 3178.30 mg/kg sol'n as CaCO3
Carbonate alkalinity= 0.02 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 2.10e+04 cm3
Fluid volume = 2.10e+04 cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.7566	12.7901

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02425	853.9	0.7749	-1.7261
SO4--	0.01976	1885.	0.3605	-2.1474
Na+	0.01634	373.0	0.7749	-1.8976
Ca++	0.01175	467.7	0.3605	-2.3731
Mg++	0.008876	214.3	0.3605	-2.4949
H+	0.008171	8.180	0.7749	-2.1985
CaSO4 (aq)	0.006736	910.9	1.0260	-2.1605
HSO4-	0.005647	544.4	0.7749	-2.3590
H2CO3* (aq)	0.005143	316.9	1.0260	-2.2776
MgSO4 (aq)	0.004042	483.3	1.0260	-2.3823
FeSO4+	0.002713	409.4	0.7749	-2.6773
NaSO4-	0.0006394	75.61	0.7749	-3.3050

K+	0.0004485	17.42	0.7749	-3.4590
MgCl+	0.0003089	18.34	0.7749	-3.6210
Fe(SO4)2-	0.0002607	64.20	0.7749	-3.6947
CaCl+	0.0002580	19.35	0.7749	-3.6992
Fe+++	0.0001648	9.142	0.1007	-4.7800
NaCl (aq)	0.0001162	6.744	1.0260	-3.9238
Fe++	8.037e-05	4.458	0.3605	-4.5380
FeOH++	6.931e-05	5.016	0.3605	-4.6023
FeSO4 (aq)	4.937e-05	7.450	1.0260	-4.2954
FeCl++	2.612e-05	2.369	0.3605	-5.0261
KSO4-	2.245e-05	3.013	0.7749	-4.7596
KCl (aq)	3.190e-06	0.2362	1.0260	-5.4851
H2AsO4-	1.279e-06	0.1791	0.7749	-6.0038
H3AsO4	1.220e-06	0.1721	1.0260	-5.9023
Fe(OH)2+	9.465e-07	0.08448	0.7749	-6.1346
Fe2(OH)2++++	5.173e-07	0.07487	0.0169	-8.0586
HCO3-	4.785e-07	0.02900	0.7749	-6.4309
FeCl+	4.433e-07	0.04020	0.7749	-6.4641
UO2SO4 (aq)	3.670e-07	0.1334	1.0260	-6.4242
UO2++	2.789e-07	0.07480	0.3605	-6.9976
UO2(SO4)2--	2.247e-07	0.1031	0.3605	-7.0916
Ni++	1.647e-07	0.009608	0.3605	-7.2263
NiSO4 (aq)	8.227e-08	0.01265	1.0260	-7.0736
CaHCO3+	2.582e-08	0.002592	0.7749	-7.6989
MgHCO3+	1.784e-08	0.001512	0.7749	-7.8595
Be++	1.268e-08	0.0001135	0.3605	-8.3400

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Hematite	5.0466s/sat	Anhydrite	-0.1605
Fe(OH)2.7Cl.3	3.6759s/sat	Ferrihydrite (ag	-0.8770
K-Jarosite	2.0923s/sat	Ferrihydrite	-1.3870
Goethite	1.3229s/sat	Na-Jarosite	-2.0263
Lepidocrocite	0.4429s/sat	H-Jarosite	-2.2580
Gypsum	0.0878s/sat	Epsomite	-2.5218
Magnetite	0.0839s/sat	Maghemite	-2.7574

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.1553	-0.809
O2(g)	7.297e-24	-23.137
CH4(g)	1.517e-98	-97.819

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	5.30e-05	5.30e-05	0.345			
Be++	3.82e-07	3.82e-07	0.000161			
CO3--	0.109	0.109	307.			
Ca++	0.397	0.397	746.			
Cd++	4.57e-07	4.57e-07	0.00241			

Cl-	0.529	0.529	879.
Fe+++	0.0713	0.0713	187.
H+	0.507	0.507	23.9
H2O	1.18e+03	1.18e+03	9.93e+05
K+	0.0100	0.0100	18.4
Mg++	0.280	0.280	319.
Na+	0.362	0.362	390.
Ni++	5.25e-06	5.25e-06	0.0144
O2(aq)	-0.000690	-0.000690	-1.03
SO4--	0.850	0.850	3.83e+03
UO2++	1.85e-05	1.85e-05	0.234

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	5.298e-05	5.298e-05	0.1860		
Be	3.817e-07	3.817e-07	0.0001612		
C	0.1090	0.1090	61.37		
Ca	0.3972	0.3972	746.2		
Cd	4.566e-07	4.566e-07	0.002406		
Cl	0.5290	0.5290	879.0		
Fe	0.07133	0.07133	186.7		
H	2353.	2353.	1.112e+05		
K	0.01005	0.01005	18.42		
Mg	0.2803	0.2803	319.4		
Na	0.3622	0.3622	390.3		
Ni	5.247e-06	5.247e-06	0.01444		
O	1180.	1180.	8.850e+05		
S	0.8504	0.8504	1278.		
U	1.853e-05	1.853e-05	0.2067		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 2.122 log fO2 = -23.444
Eh = 0.7566 volts pe = 12.7901
Ionic strength = 0.110882
Activity of water = 0.998023
Solvent mass = 21.191 kg
Solution mass = 21.330 kg
Mineral mass = 0.0045498 kg
Solution density = 1.016 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.024961 molal
Dissolved solids = 6534 mg/kg sol'n
Elect. conductivity = 9346.90 uS/cm (or umho/cm)
Hardness = 3176.59 mg/kg sol'n as CaCO3
carbonate = 0.02 mg/kg sol'n as CaCO3
non-carbonate = 3176.57 mg/kg sol'n as CaCO3
Carbonate alkalinity= 0.02 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 2.10e+04 cm3
Fluid volume = 2.10e+04 cm3

Mineral volume = 1.72 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.4 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.7566	12.7901

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

Minerals in system	moles	log moles	grams	volume (cm3)
K-Jarosite	0.009085	-2.042	4.550	1.717
(total)			4.550	1.717

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02426	854.4	0.7751	-1.7258
SO4--	0.01936	1848.	0.3610	-2.1556
Na+	0.01635	373.4	0.7751	-1.8972
Ca++	0.01181	470.2	0.3610	-2.3703
H+	0.009747	9.760	0.7751	-2.1218
Mg++	0.008923	215.5	0.3610	-2.4920
CaSO4 (aq)	0.006652	899.6	1.0259	-2.1660
HSO4-	0.006609	637.3	0.7751	-2.2905
H2CO3* (aq)	0.005144	317.0	1.0259	-2.2776
MgSO4 (aq)	0.003993	477.5	1.0259	-2.3876
FeSO4+	0.001682	253.9	0.7751	-2.8848
NaSO4-	0.0006278	74.25	0.7751	-3.3128
MgCl+	0.0003111	18.47	0.7751	-3.6178
CaCl+	0.0002597	19.49	0.7751	-3.6961
Fe(SO4)2-	0.0001586	39.06	0.7751	-3.9104
NaCl (aq)	0.0001164	6.758	1.0259	-3.9230
Fe+++	0.0001039	5.764	0.1010	-4.9791
Fe++	5.074e-05	2.815	0.3610	-4.7372
K+	4.304e-05	1.672	0.7751	-4.4767
FeOH++	3.667e-05	2.654	0.3610	-4.8782
FeSO4 (aq)	3.062e-05	4.622	1.0259	-4.5028
FeCl++	1.650e-05	1.497	0.3610	-5.2249
KSO4-	2.113e-06	0.2838	0.7751	-5.7857
H3AsO4	1.331e-06	0.1877	1.0259	-5.8647
H2AsO4-	1.169e-06	0.1636	0.7751	-6.0429
Fe(OH)2+	4.200e-07	0.03750	0.7751	-6.4873
HCO3-	4.008e-07	0.02430	0.7751	-6.5077
UO2SO4 (aq)	3.668e-07	0.1334	1.0259	-6.4245
KCl (aq)	3.065e-07	0.02270	1.0259	-6.5025
UO2++	2.837e-07	0.07611	0.3610	-6.9896
FeCl+	2.803e-07	0.02543	0.7751	-6.6630
UO2(SO4)2--	2.200e-07	0.1010	0.3610	-7.1001

Ni++	1.657e-07	0.009666	0.3610	-7.2231
Fe2(OH)2++++	1.444e-07	0.02091	0.0170	-8.6105
NiSO4 (aq)	8.131e-08	0.01250	1.0259	-7.0788
CaHCO3+	2.176e-08	0.002186	0.7751	-7.7729
MgHCO3+	1.504e-08	0.001275	0.7751	-7.9334
Be++	1.275e-08	0.0001141	0.3610	-8.3371

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Hematite	4.1877s/sat	Anhydrite	-0.1660
Fe(OH)2.7Cl.3	3.2696s/sat	Magnetite	-1.1276
Goethite	0.8934s/sat	Ferrihydrite (ag	-1.3064
Gypsum	0.0823s/sat	Ferrihydrite	-1.8164
Lepidocrocite	0.0134s/sat	Epsomite	-2.5272
K-Jarosite	0.0000 sat		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.1553	-0.809
O2(g)	3.599e-24	-23.444
CH4(g)	6.236e-98	-97.205

Original basis	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg	Kd L/kg
AsO4---	5.30e-05	5.30e-05	0.345			
Be++	3.82e-07	3.82e-07	0.000161			
CO3--	0.109	0.109	307.			
Ca++	0.397	0.397	745.			
Cd++	4.57e-07	4.57e-07	0.00241			
Cl-	0.529	0.529	879.			
Fe+++	0.0713	0.0441	115.			
H+	0.508	0.562	26.6			
H2O	1.18e+03	1.18e+03	9.93e+05			
K+	0.0100	0.000963	1.77			
Mg++	0.280	0.280	319.			
Na+	0.362	0.362	390.			
Ni++	5.25e-06	5.25e-06	0.0144			
O2(aq)	-0.000433	-0.000433	-0.649			
SO4--	0.850	0.832	3.75e+03			
UO2++	1.85e-05	1.85e-05	0.235			

Elemental composition	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg
As	5.298e-05	5.298e-05	0.1861		
Be	3.817e-07	3.817e-07	0.0001613		
C	0.1090	0.1090	61.38		
Ca	0.3967	0.3967	745.4		
Cd	4.566e-07	4.566e-07	0.002406		
Cl	0.5290	0.5290	879.2		

Fe	0.07133	0.04408	115.4
H	2353.	2353.	1.112e+05
K	0.01005	0.0009634	1.766
Mg	0.2803	0.2803	319.5
Na	0.3622	0.3622	390.4
Ni	5.247e-06	5.247e-06	0.01444
O	1180.	1180.	8.850e+05
S	0.8504	0.8322	1251.
U	1.853e-05	1.853e-05	0.2067

Step #   0   Xi = 0.0000

Temperature = 25.0 C   Pressure = 1.013 bars
pH = 2.681   log fO2 = -22.492
Eh =   0.7376 volts   pe = 12.4684
Ionic strength   =   0.095424
Activity of water   =   0.998363
Solvent mass   =   51.500 kg
Solution mass   =   51.783 kg
Mineral mass   =   0.00000 kg
Solution density   =   1.015   g/cm3
Solution viscosity =   0.009   poise
Chlorinity   =   0.023399 molal
Dissolved solids   =   5465 mg/kg sol'n
Elect. conductivity =   6435.33 uS/cm (or umho/cm)
Hardness   =   2911.67 mg/kg sol'n as CaCO3
  carbonate   =   0.07 mg/kg sol'n as CaCO3
  non-carbonate   =   2911.60 mg/kg sol'n as CaCO3
Carbonate alkalinity=   0.07 mg/kg sol'n as CaCO3
Water type   =   Ca-SO4
Bulk volume   =   5.10e+04 cm3
Fluid volume   =   5.10e+04 cm3
Mineral volume   =   0.000 cm3
Inert volume   =   0.000 cm3
Porosity   =   100. %
Permeability   =   98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.7376	12.4684

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02277	802.8	0.7835	-1.7486
SO4--	0.01692	1616.	0.3769	-2.1954
Na+	0.01526	348.9	0.7835	-1.9224
Ca++	0.01156	460.7	0.3769	-2.3609
Mg++	0.007673	185.5	0.3769	-2.5388
CaSO4 (aq)	0.006225	842.9	1.0222	-2.1963
H2CO3* (aq)	0.005289	326.3	1.0222	-2.2671
MgSO4 (aq)	0.003282	393.0	1.0222	-2.4743
H+	0.002659	2.666	0.7835	-2.6812
HSO4-	0.001645	158.8	0.7835	-2.8897
FeSO4+	0.001067	161.2	0.7835	-3.0777
NaSO4-	0.0005347	63.31	0.7835	-3.3778

K+	0.0003868	15.04	0.7835	-3.5185
MgCl+	0.0002621	15.58	0.7835	-3.6874
CaCl+	0.0002492	18.72	0.7835	-3.7095
NaCl (aq)	0.0001046	6.079	1.0222	-3.9710
Fe(SO4)2-	9.180e-05	22.64	0.7835	-4.1431
FeOH++	8.955e-05	6.488	0.3769	-4.4717
Fe++	7.163e-05	3.979	0.3769	-4.5687
Fe+++	6.627e-05	3.681	0.1113	-5.1322
FeSO4 (aq)	4.134e-05	6.245	1.0222	-4.3741
KSO4-	1.733e-05	2.329	0.7835	-4.8672
FeCl++	1.054e-05	0.9573	0.3769	-5.4008
Fe(OH)2+	3.843e-06	0.3435	0.7835	-5.5212
KCl (aq)	2.651e-06	0.1965	1.0222	-5.5671
HCO3-	1.473e-06	0.08940	0.7835	-5.9377
H2AsO4-	8.002e-07	0.1122	0.7835	-6.2027
Fe2(OH)2++++	7.901e-07	0.1145	0.0202	-7.7975
FeCl+	3.879e-07	0.03522	0.7835	-6.5173
H3AsO4	2.550e-07	0.03600	1.0222	-6.5839
UO2SO4 (aq)	1.925e-07	0.07009	1.0222	-6.7060
Ni++	1.730e-07	0.01010	0.3769	-7.1859
UO2++	1.557e-07	0.04182	0.3769	-7.2314
UO2(SO4)2--	1.005e-07	0.04621	0.3769	-7.4215
CaHCO3+	8.175e-08	0.008219	0.7835	-7.1935
NiSO4 (aq)	8.113e-08	0.01249	1.0222	-7.0813
MgHCO3+	4.963e-08	0.004212	0.7835	-7.4102
Be++	1.331e-08	0.0001193	0.3769	-8.2998

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Hematite	7.2386s/sat	Gypsum	0.0523s/sat
Fe(OH)2.7Cl.3	4.6205s/sat	Anhydrite	-0.1963
K-Jarosite	3.7769s/sat	Ferrihydrite	-0.2908
Magnetite	3.2108s/sat	Na-Jarosite	-0.3070
Goethite	2.4190s/sat	Maghemite	-0.5654
Lepidocrocite	1.5390s/sat	H-Jarosite	-0.9965
Ferrihydrite (ag	0.2192s/sat	Epsomite	-2.6127

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.1591	-0.798
O2(g)	3.219e-23	-22.492
CH4(g)	7.986e-100	-99.098

Original basis	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg	Kd L/kg
AsO4---	5.43e-05	5.43e-05	0.146			
Be++	9.54e-07	9.54e-07	0.000166			
CO3--	0.272	0.272	316.			
Ca++	0.929	0.929	719.			
Cd++	4.74e-07	4.74e-07	0.00103			

Cl-	1.21	1.21	825.
Fe+++	0.0744	0.0744	80.2
H+	0.756	0.756	14.7
H2O	2.86e+03	2.86e+03	9.95e+05
K+	0.0209	0.0209	15.8
Mg++	0.578	0.578	271.
Na+	0.819	0.819	364.
Ni++	1.31e-05	1.31e-05	0.0149
O2(aq)	-0.00146	-0.00146	-0.902
SO4--	1.54	1.54	2.86e+03
UO2++	2.32e-05	2.32e-05	0.121

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	5.435e-05	5.435e-05	0.07863		
Be	9.541e-07	9.541e-07	0.0001660		
C	0.2725	0.2725	63.20		
Ca	0.9287	0.9287	718.8		
Cd	4.741e-07	4.741e-07	0.001029		
Cl	1.205	1.205	825.0		
Fe	0.07438	0.07438	80.22		
H	5718.	5718.	1.113e+05		
K	0.02095	0.02095	15.82		
Mg	0.5777	0.5777	271.2		
Na	0.8188	0.8188	363.5		
Ni	1.312e-05	1.312e-05	0.01487		
O	2866.	2866.	8.854e+05		
S	1.541	1.541	954.0		
U	2.323e-05	2.323e-05	0.1068		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 2.506 log fO2 = -23.193
Eh = 0.7376 volts pe = 12.4684
Ionic strength = 0.094794
Activity of water = 0.998359
Solvent mass = 51.498 kg
Solution mass = 51.773 kg
Mineral mass = 0.0093232 kg
Solution density = 1.015 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.023400 molal
Dissolved solids = 5322 mg/kg sol'n
Elect. conductivity = 6837.85 uS/cm (or umho/cm)
Hardness = 2908.01 mg/kg sol'n as CaCO3
 carbonate = 0.05 mg/kg sol'n as CaCO3
 non-carbonate = 2907.96 mg/kg sol'n as CaCO3
Carbonate alkalinity= 0.05 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 5.10e+04 cm3
Fluid volume = 5.10e+04 cm3

Mineral volume = 3.52 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.5 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.7376	12.4684

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

Minerals in system	moles	log moles	grams	volume (cm3)
K-Jarosite	0.01862	-1.730	9.323	3.518
(total)			9.323	3.518

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02278	803.2	0.7839	-1.7482
SO4--	0.01655	1581.	0.3776	-2.2042
Na+	0.01527	349.2	0.7839	-1.9219
Ca++	0.01160	462.6	0.3776	-2.3584
Mg++	0.007713	186.5	0.3776	-2.5357
CaSO4 (aq)	0.006137	831.1	1.0221	-2.2025
H2CO3* (aq)	0.005290	326.3	1.0221	-2.2671
H+	0.003978	3.988	0.7839	-2.5060
MgSO4 (aq)	0.003241	388.0	1.0221	-2.4799
HSO4-	0.002412	232.9	0.7839	-2.7233
NaSO4-	0.0005244	62.10	0.7839	-3.3861
FeSO4+	0.0002718	41.07	0.7839	-3.6715
MgCl+	0.0002641	15.70	0.7839	-3.6840
CaCl+	0.0002507	18.83	0.7839	-3.7066
NaCl (aq)	0.0001048	6.092	1.0221	-3.9701
K+	4.306e-05	1.675	0.7839	-4.4717
Fe(SO4)2-	2.291e-05	5.651	0.7839	-4.7457
Fe++	1.859e-05	1.032	0.3776	-5.1538
Fe+++	1.715e-05	0.9529	0.1118	-5.7173
FeOH++	1.552e-05	1.125	0.3776	-5.2320
FeSO4 (aq)	1.053e-05	1.592	1.0221	-4.9679
FeCl++	2.738e-06	0.2486	0.3776	-5.9856
KSO4-	1.891e-06	0.2542	0.7839	-5.8291
HCO3-	9.838e-07	0.05971	0.7839	-6.1128
H2AsO4-	7.144e-07	0.1001	0.7839	-6.2518
Fe(OH)2+	4.457e-07	0.03984	0.7839	-6.4567
H3AsO4	3.409e-07	0.04813	1.0221	-6.4579
KCl (aq)	2.955e-07	0.02192	1.0221	-6.5199
UO2SO4 (aq)	1.923e-07	0.07001	1.0221	-6.7066
Ni++	1.740e-07	0.01016	0.3776	-7.1825
UO2++	1.584e-07	0.04254	0.3776	-7.2233
FeCl+	1.009e-07	0.009160	0.7839	-7.1020

UO2(SO4)2--	9.820e-08	0.04514	0.3776	-7.4308
NiSO4 (aq)	8.014e-08	0.01234	1.0221	-7.0867
CaHCO3+	5.491e-08	0.005521	0.7839	-7.3661
MgHCO3+	3.338e-08	0.002833	0.7839	-7.5823
Fe2(OH)2++++	2.365e-08	0.003428	0.0203	-9.3180
Be++	1.337e-08	0.0001199	0.3776	-8.2967

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Hematite	5.0175s/sat	K-Jarosite	0.0000 sat
Fe(OH)2.7Cl.3	3.5626s/sat	Anhydrite	-0.2025
Goethite	1.3084s/sat	Ferrihydrite (ag	-0.8913
Lepidocrocite	0.4284s/sat	Ferrihydrite	-1.4013
Magnetite	0.0543s/sat	Epsomite	-2.6184
Gypsum	0.0460s/sat	Maghemite	-2.7865

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.1591	-0.798
O2(g)	6.414e-24	-23.193
CH4(g)	2.012e-98	-97.696

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	5.43e-05	5.43e-05	0.146			
Be++	9.54e-07	9.54e-07	0.000166			
CO3--	0.272	0.272	316.			
Ca++	0.927	0.927	717.			
Cd++	4.74e-07	4.74e-07	0.00103			
Cl-	1.21	1.21	825.			
Fe+++	0.0744	0.0185	20.0			
H+	0.760	0.872	17.0			
H2O	2.86e+03	2.86e+03	9.95e+05			
K+	0.0209	0.00233	1.76			
Mg++	0.578	0.578	271.			
Na+	0.819	0.819	364.			
Ni++	1.31e-05	1.31e-05	0.0149			
O2(aq)	-0.000376	-0.000376	-0.233			
SO4--	1.54	1.50	2.79e+03			
UO2++	2.32e-05	2.32e-05	0.121			

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	5.435e-05	5.435e-05	0.07865		
Be	9.541e-07	9.541e-07	0.0001661		
C	0.2725	0.2725	63.21		
Ca	0.9265	0.9265	717.3		
Cd	4.741e-07	4.741e-07	0.001029		
Cl	1.205	1.205	825.2		

Fe	0.07438	0.01853	19.99
H	5718.	5718.	1.113e+05
K	0.02095	0.002330	1.760
Mg	0.5777	0.5777	271.3
Na	0.8188	0.8188	363.6
Ni	1.312e-05	1.312e-05	0.01487
O	2866.	2865.	8.855e+05
S	1.541	1.503	931.1
U	2.323e-05	2.323e-05	0.1068

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 3.264 log fO2 = -21.588
Eh = 0.7165 volts pe = 12.1114
Ionic strength = 0.089896
Activity of water = 0.998478
Solvent mass = 102.01 kg
Solution mass = 102.53 kg
Mineral mass = 0.00000 kg
Solution density = 1.015 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.022857 molal
Dissolved solids = 5037 mg/kg sol'n
Elect. conductivity = 5570.05 uS/cm (or umho/cm)
Hardness = 2818.41 mg/kg sol'n as CaCO3
carbonate = 0.28 mg/kg sol'n as CaCO3
non-carbonate = 2818.13 mg/kg sol'n as CaCO3
Carbonate alkalinity= 0.28 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 1.01e+05 cm3
Fluid volume = 1.01e+05 cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.7165	12.1114

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02226	785.1	0.7869	-1.7566
SO4--	0.01587	1517.	0.3835	-2.2158
Na+	0.01489	340.6	0.7869	-1.9311
Ca++	0.01151	458.9	0.3835	-2.3553
Mg++	0.007258	175.6	0.3835	-2.5555
CaSO4 (aq)	0.006025	816.1	1.0209	-2.2111
H2CO3* (aq)	0.005336	329.3	1.0209	-2.2638
MgSO4 (aq)	0.003018	361.5	1.0209	-2.5113
H+	0.0006917	0.6936	0.7869	-3.2642
NaSO4-	0.0004979	58.98	0.7869	-3.4069
FeSO4+	0.0004328	65.42	0.7869	-3.4677
HSO4-	0.0004083	39.44	0.7869	-3.4931

K+	0.0003653	14.21	0.7869	-3.5415
CaCl+	0.0002467	18.54	0.7869	-3.7119
MgCl+	0.0002466	14.66	0.7869	-3.7121
FeOH++	0.0001438	10.43	0.3835	-4.2584
NaCl (aq)	0.0001008	5.859	1.0209	-3.9877
Fe++	6.838e-05	3.800	0.3835	-4.5813
FeSO4 (aq)	3.836e-05	5.798	1.0209	-4.4071
Fe(SO4)2-	3.553e-05	8.765	0.7869	-4.5535
Fe+++	2.721e-05	1.512	0.1157	-5.5019
Fe(OH)2+	2.394e-05	2.141	0.7869	-4.7249
KSO4-	1.561e-05	2.100	0.7869	-4.9106
HCO3-	5.658e-06	0.3435	0.7869	-5.3514
FeCl++	4.342e-06	0.3944	0.3835	-5.7786
KCl (aq)	2.471e-06	0.1833	1.0209	-5.5981
Fe2(OH)2++++	1.969e-06	0.2855	0.0216	-7.3709
H2AsO4-	5.122e-07	0.07182	0.7869	-6.3946
FeCl+	3.682e-07	0.03345	0.7869	-6.5380
CaHCO3+	3.180e-07	0.03199	0.7869	-6.6016
MgHCO3+	1.834e-07	0.01557	0.7869	-6.8406
Ni++	1.762e-07	0.01029	0.3835	-7.1703
UO2SO4 (aq)	1.302e-07	0.04743	1.0209	-6.8763
UO2++	1.084e-07	0.02912	0.3835	-7.3813
NiSO4 (aq)	8.034e-08	0.01237	1.0209	-7.0861
Fe3(OH)4+++++	7.277e-08	0.01706	0.0025	-9.7398
UO2(SO4)2--	6.371e-08	0.02929	0.3835	-7.6121
H3AsO4	4.287e-08	0.006055	1.0209	-7.3588
NaHCO3 (aq)	2.562e-08	0.002141	1.0209	-7.5824
Be++	1.355e-08	0.0001215	0.3835	-8.2843

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Hematite	9.9972s/sat	Na-Jarosite	2.0326s/sat
Magnetite	7.1228s/sat	Ferrihydrite (ag	1.5986s/sat
K-Jarosite	6.1022s/sat	Ferrihydrite	1.0886s/sat
Fe(OH)2.7Cl.3	5.8226s/sat	H-Jarosite	0.7689s/sat
Goethite	3.7983s/sat	Gypsum	0.0376s/sat
Lepidocrocite	2.9183s/sat	Anhydrite	-0.2111
Maghemite	2.1932s/sat	Epsomite	-2.6494

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.1603	-0.795
O2(g)	2.580e-22	-21.588
CH4(g)	1.253e-101	-100.902

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	5.66e-05	5.66e-05	0.0767			
Be++	1.91e-06	1.91e-06	0.000168			
CO3--	0.545	0.545	319.			

Ca++	1.81	1.81	709.
Cd++	5.04e-07	5.04e-07	0.000552
Cl-	2.33	2.33	806.
Fe+++	0.0795	0.0795	43.3
H+	1.17	1.17	11.5
H2O	5.66e+03	5.66e+03	9.95e+05
K+	0.0391	0.0391	14.9
Mg++	1.07	1.07	255.
Na+	1.58	1.58	354.
Ni++	2.62e-05	2.62e-05	0.0150
O2(aq)	-0.00273	-0.00273	-0.853
SO4--	2.69	2.69	2.52e+03
UO2++	3.11e-05	3.11e-05	0.0818

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	5.665e-05	5.665e-05	0.04139		
Be	1.909e-06	1.909e-06	0.0001678		
C	0.5450	0.5450	63.84		
Ca	1.814	1.814	709.0		
Cd	5.036e-07	5.036e-07	0.0005521		
Cl	2.332	2.332	806.3		
Fe	0.07946	0.07946	43.28		
H	1.133e+04	1.133e+04	1.113e+05		
K	0.03911	0.03911	14.91		
Mg	1.073	1.073	254.5		
Na	1.580	1.580	354.3		
Ni	2.623e-05	2.623e-05	0.01502		
O	5675.	5675.	8.856e+05		
S	2.691	2.691	841.4		
U	3.106e-05	3.106e-05	0.07210		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 2.926 log fO2 = -22.942
Eh = 0.7165 volts pe = 12.1114
Ionic strength = 0.089112
Activity of water = 0.998479
Solvent mass = 102.01 kg
Solution mass = 102.52 kg
Mineral mass = 0.012555 kg
Solution density = 1.015 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.022858 molal
Dissolved solids = 4937 mg/kg sol'n
Elect. conductivity = 5808.72 uS/cm (or umho/cm)
Hardness = 2813.76 mg/kg sol'n as CaCO3
carbonate = 0.13 mg/kg sol'n as CaCO3
non-carbonate = 2813.63 mg/kg sol'n as CaCO3
Carbonate alkalinity= 0.13 mg/kg sol'n as CaCO3
Water type = Ca-SO4

Bulk volume = 1.01e+05 cm3
Fluid volume = 1.01e+05 cm3
Mineral volume = 4.74 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.5 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.7165	12.1114

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

Minerals in system	moles	log moles	grams	volume (cm3)
K-Jarosite	0.02507	-1.601	12.55	4.738
(total)			12.55	4.738

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02226	785.3	0.7874	-1.7563
SO4--	0.01555	1486.	0.3844	-2.2235
Na+	0.01490	340.9	0.7874	-1.9306
Ca++	0.01153	460.0	0.3844	-2.3532
Mg++	0.007289	176.3	0.3844	-2.5525
CaSO4 (aq)	0.005948	805.7	1.0207	-2.2167
H2CO3* (aq)	0.005339	329.5	1.0207	-2.2636
MgSO4 (aq)	0.002986	357.6	1.0207	-2.5160
H+	0.001506	1.511	0.7874	-2.9259
HSO4-	0.0008736	84.38	0.7874	-3.1625
NaSO4-	0.0004894	57.98	0.7874	-3.4141
MgCl+	0.0002483	14.77	0.7874	-3.7088
CaCl+	0.0002479	18.63	0.7874	-3.7095
K+	0.0001312	5.105	0.7874	-3.9859
NaCl (aq)	0.0001010	5.872	1.0207	-3.9869
FeSO4+	2.656e-05	4.014	0.7874	-4.6796
KSO4-	5.510e-06	0.7410	0.7874	-5.3627
Fe++	4.262e-06	0.2369	0.3844	-5.7855
FeOH++	4.114e-06	0.2982	0.3844	-5.8009
HCO3-	2.596e-06	0.1576	0.7874	-5.6895
FeSO4 (aq)	2.355e-06	0.3560	1.0207	-5.6190
Fe(SO4)2-	2.141e-06	0.5283	0.7874	-5.7732
Fe+++	1.690e-06	0.09394	0.1164	-6.7061
KCl (aq)	8.891e-07	0.06596	1.0207	-6.0421
H2AsO4-	4.695e-07	0.06584	0.7874	-6.4322
Fe(OH)2+	3.148e-07	0.02815	0.7874	-6.6057
FeCl++	2.709e-07	0.02461	0.3844	-6.9824
Ni++	1.770e-07	0.01034	0.3844	-7.1671
CaHCO3+	1.466e-07	0.01475	0.7874	-6.9376
UO2SO4 (aq)	1.303e-07	0.04745	1.0207	-6.8763

UO2++	1.101e-07	0.02957	0.3844	-7.3736
H3AsO4	8.571e-08	0.01211	1.0207	-7.0580
MgHCO3+	8.473e-08	0.007195	0.7874	-7.1757
NiSO4 (aq)	7.952e-08	0.01225	1.0207	-7.0906
UO2(SO4)2--	6.243e-08	0.02871	0.3844	-7.6198
FeCl+	2.301e-08	0.002091	0.7874	-7.7418
Be++	1.361e-08	0.0001220	0.3844	-8.2814
NaHCO3 (aq)	1.178e-08	0.0009846	1.0207	-7.9200

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Hematite	5.5590s/sat	K-Jarosite	0.0000 sat
Fe(OH)2.7Cl.3	3.7051s/sat	Anhydrite	-0.2167
Goethite	1.5792s/sat	Ferrihydrite (ag	-0.6205
Magnetite	0.8038s/sat	Ferrihydrite	-1.1305
Lepidocrocite	0.6992s/sat	Maghemite	-2.2450
Gypsum	0.0319s/sat	Epsomite	-2.6542

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.1603	-0.795
O2(g)	1.144e-23	-22.942
CH4(g)	6.379e-99	-98.195

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	5.66e-05	5.66e-05	0.0768			
Be++	1.91e-06	1.91e-06	0.000168			
CO3--	0.545	0.545	319.			
Ca++	1.81	1.81	707.			
Cd++	5.04e-07	5.04e-07	0.000552			
Cl-	2.33	2.33	806.			
Fe+++	0.0795	0.00426	2.32			
H+	1.18	1.33	13.1			
H2O	5.66e+03	5.66e+03	9.95e+05			
K+	0.0391	0.0140	5.35			
Mg++	1.07	1.07	255.			
Na+	1.58	1.58	354.			
Ni++	2.62e-05	2.62e-05	0.0150			
O2(aq)	-0.000169	-0.000169	-0.0529			
SO4--	2.69	2.64	2.47e+03			
UO2++	3.11e-05	3.11e-05	0.0818			

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	5.665e-05	5.665e-05	0.04140		
Be	1.909e-06	1.909e-06	0.0001678		
C	0.5450	0.5450	63.85		
Ca	1.809	1.809	707.1		

Cd	5.036e-07	5.036e-07	0.0005522
Cl	2.332	2.332	806.4
Fe	0.07946	0.004257	2.319
H	1.133e+04	1.133e+04	1.114e+05
K	0.03911	0.01404	5.354
Mg	1.073	1.073	254.6
Na	1.580	1.580	354.4
Ni	2.623e-05	2.623e-05	0.01502
O	5675.	5675.	8.856e+05
S	2.691	2.640	825.8
U	3.106e-05	3.106e-05	0.07211

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 4.800 log fO2 = -23.389
Eh = 0.5990 volts pe = 10.1250
Ionic strength = 0.087138
Activity of water = 0.998529
Solvent mass = 203.04 kg
Solution mass = 204.02 kg
Mineral mass = 0.00000 kg
Solution density = 1.015 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.022584 molal
Dissolved solids = 4827 mg/kg sol'n
Elect. conductivity = 5245.75 uS/cm (or umho/cm)
Hardness = 2772.02 mg/kg sol'n as CaCO3
carbonate = 9.37 mg/kg sol'n as CaCO3
non-carbonate = 2762.65 mg/kg sol'n as CaCO3
Carbonate alkalinity= 9.37 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 2.01e+05 cm3
Fluid volume = 2.01e+05 cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.5990	10.1250

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02200	776.1	0.7887	-1.7607
SO4--	0.01526	1459.	0.3870	-2.2288
Na+	0.01470	336.3	0.7887	-1.9357
Ca++	0.01150	458.9	0.3870	-2.3515
Mg++	0.007050	170.6	0.3870	-2.5642
CaSO4 (aq)	0.005902	799.6	1.0203	-2.2203
H2CO3* (aq)	0.005163	318.7	1.0203	-2.2784
MgSO4 (aq)	0.002873	344.1	1.0203	-2.5330
NaSO4-	0.0004770	56.51	0.7887	-3.4246
K+	0.0003543	13.79	0.7887	-3.5537
Fe(OH)2+	0.0002837	25.37	0.7887	-3.6502
CaCl+	0.0002460	18.49	0.7887	-3.7122

MgCl+	0.0002389	14.21	0.7887	-3.7249
HCO3-	0.0001876	11.39	0.7887	-3.8299
NaCl (aq)	9.882e-05	5.747	1.0203	-3.9965
Fe++	6.604e-05	3.670	0.3870	-4.5926
FeOH++	4.926e-05	3.572	0.3870	-4.7198
FeSO4 (aq)	3.630e-05	5.488	1.0203	-4.4314
H+	2.008e-05	0.02014	0.7887	-4.8003
KSO4-	1.470e-05	1.977	0.7887	-4.9358
HSO4-	1.150e-05	1.111	0.7887	-5.0422
CaHCO3+	1.064e-05	1.070	0.7887	-5.0763
MgHCO3+	5.961e-06	0.5062	0.7887	-5.3278
FeSO4+	4.215e-06	0.6371	0.7887	-5.4783
KCl (aq)	2.382e-06	0.1767	1.0203	-5.6144
NaHCO3 (aq)	8.429e-07	0.07046	1.0203	-6.0655
FeCl+	3.547e-07	0.03222	0.7887	-6.5533
Fe(SO4)2-	3.357e-07	0.08284	0.7887	-6.5771
H2AsO4-	2.969e-07	0.04164	0.7887	-6.6305
Fe+++	2.681e-07	0.01490	0.1181	-7.4995
Fe2(OH)2++++	2.268e-07	0.03289	0.0224	-8.2937
Ni++	1.770e-07	0.01034	0.3870	-7.1643
Fe3(OH)4+++++	9.757e-08	0.02287	0.0026	-9.5878
UO2CO3 (aq)	9.563e-08	0.03141	1.0203	-7.0107
NiSO4 (aq)	7.910e-08	0.01218	1.0203	-7.0931
FeHCO3+	6.036e-08	0.007020	0.7887	-7.3223
UO2SO4 (aq)	5.384e-08	0.01962	1.0203	-7.2601
UO2++	4.573e-08	0.01229	0.3870	-7.7521
FeCl++	4.287e-08	0.003895	0.3870	-7.7802
UO2(SO4)2--	2.531e-08	0.01164	0.3870	-8.0090
Be++	1.358e-08	0.0001218	0.3870	-8.2794

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Magnetite	15.4056s/sat	Magnesioferrite	3.9771s/sat
Hematite	15.2189s/sat	Ferrihydrite	3.6995s/sat
K-Jarosite	9.2882s/sat	H-Jarosite	2.4309s/sat
Fe(OH)2.7Cl.3	7.9714s/sat	Gypsum	0.0284s/sat
Maghemite	7.4149s/sat	Anhydrite	-0.2203
Goethite	6.4092s/sat	Fe3(OH)8	-1.4162
Lepidocrocite	5.5292s/sat	Rutherfordine	-2.6485
Na-Jarosite	5.2261s/sat	Epsomite	-2.6710
Ferrihydrite (ag	4.2095s/sat		

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.1550	-0.810
O2(g)	4.081e-24	-23.389
CH4(g)	4.843e-98	-97.315

	In fluid		Sorbed		Kd
Original basis total moles	moles	mg/kg	moles	mg/kg	L/kg

AsO4---	6.12e-05	6.12e-05	0.0417
Be++	3.82e-06	3.82e-06	0.000169
CO3--	1.09	1.09	321.
Ca++	3.59	3.59	705.
Cd++	5.62e-07	5.62e-07	0.000310
Cl-	4.59	4.59	797.
Fe+++	0.0896	0.0896	24.5
H+	2.00	2.00	9.87
H2O	1.13e+04	1.13e+04	9.95e+05
K+	0.0754	0.0754	14.5
Mg++	2.06	2.06	246.
Na+	3.10	3.10	350.
Ni++	5.24e-05	5.24e-05	0.0151
O2(aq)	-0.00522	-0.00522	-0.818
SO4--	4.99	4.99	2.35e+03
UO2++	4.67e-05	4.67e-05	0.0618

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	6.122e-05	6.122e-05	0.02248		
Be	3.816e-06	3.816e-06	0.0001686		
C	1.090	1.090	64.16		
Ca	3.586	3.586	704.5		
Cd	5.624e-07	5.624e-07	0.0003098		
Cl	4.585	4.585	796.8		
Fe	0.08962	0.08962	24.53		
H	2.254e+04	2.254e+04	1.114e+05		
K	0.07541	0.07541	14.45		
Mg	2.064	2.064	246.0		
Na	3.102	3.102	349.5		
Ni	5.245e-05	5.245e-05	0.01509		
O	1.129e+04	1.129e+04	8.857e+05		
S	4.990	4.990	784.3		
U	4.672e-05	4.672e-05	0.05451		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 4.164 log fO2 = -25.936
Eh = 0.5990 volts pe = 10.1250
Ionic strength = 0.086278
Activity of water = 0.998541
Solvent mass = 203.04 kg
Solution mass = 204.01 kg
Mineral mass = 0.014879 kg
Solution density = 1.015 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.022584 molal
Dissolved solids = 4757 mg/kg sol'n
Elect. conductivity = 5234.55 uS/cm (or umho/cm)
Hardness = 2767.20 mg/kg sol'n as CaCO3
carbonate = 2.22 mg/kg sol'n as CaCO3

non-carbonate = 2764.98 mg/kg sol'n as CaCO3
Carbonate alkalinity= 2.22 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 2.01e+05 cm3
Fluid volume = 2.01e+05 cm3
Mineral volume = 5.61 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.6 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.5990	10.1250

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

Minerals in system	moles	log moles	grams	volume (cm3)
K-Jarosite	0.02971	-1.527	14.88	5.615
(total)			14.88	5.615

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
Cl-	0.02200	776.1	0.7893	-1.7604
SO4--	0.01504	1438.	0.3881	-2.2338
Na+	0.01471	336.5	0.7893	-1.9353
Ca++	0.01151	459.0	0.3881	-2.3501
Mg++	0.007069	171.0	0.3881	-2.5617
CaSO4 (aq)	0.005855	793.3	1.0201	-2.2238
H2CO3* (aq)	0.005319	328.4	1.0201	-2.2655
MgSO4 (aq)	0.002857	342.2	1.0201	-2.5355
NaSO4-	0.0004718	55.90	0.7893	-3.4290
CaCl+	0.0002468	18.55	0.7893	-3.7105
MgCl+	0.0002402	14.29	0.7893	-3.7222
K+	0.0002148	8.360	0.7893	-3.7707
NaCl (aq)	9.901e-05	5.759	1.0201	-3.9957
H+	8.691e-05	0.08718	0.7893	-4.1637
HSO4-	4.923e-05	4.756	0.7893	-4.4105
HCO3-	4.458e-05	2.707	0.7893	-4.4536
KSO4-	8.810e-06	1.185	0.7893	-5.1578
CaHCO3+	2.536e-06	0.2552	0.7893	-5.6986
KCl (aq)	1.446e-06	0.1073	1.0201	-5.8311
MgHCO3+	1.425e-06	0.1210	0.7893	-5.9491
Fe++	1.179e-06	0.06551	0.3881	-6.3397
FeSO4 (aq)	6.425e-07	0.09714	1.0201	-6.1835
H2AsO4-	2.975e-07	0.04172	0.7893	-6.6293
Fe(OH)2+	2.705e-07	0.02419	0.7893	-6.6706
FeOH++	2.030e-07	0.01472	0.3881	-7.1036
NaHCO3 (aq)	2.007e-07	0.01678	1.0201	-6.6888
Ni++	1.783e-07	0.01042	0.3881	-7.1599

UO2SO4 (aq)	9.340e-08	0.03403	1.0201	-7.0210
UO2++	7.998e-08	0.02150	0.3881	-7.5081
NiSO4 (aq)	7.902e-08	0.01217	1.0201	-7.0937
FeSO4+	7.453e-08	0.01127	0.7893	-7.2304
UO2(SO4)2--	4.328e-08	0.01991	0.3881	-7.7748
Be++	1.372e-08	0.0001230	0.3881	-8.2738

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Hematite	7.9048s/sat	Maghemite	0.1008s/sat
Magnetite	5.0710s/sat	Ferrihydrite	0.0425s/sat
Fe(OH)2.7Cl.3	4.5054s/sat	Gypsum	0.0249s/sat
Goethite	2.7521s/sat	K-Jarosite	0.0000 sat
Lepidocrocite	1.8721s/sat	Anhydrite	-0.2238
Ferrihydrite (ag	0.5525s/sat	Epsomite	-2.6734

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.1596	-0.797
O2(g)	1.159e-26	-25.936
CH4(g)	6.181e-93	-92.209

Original basis	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg	Kd L/kg
AsO4---	6.12e-05	6.12e-05	0.0417			
Be++	3.82e-06	3.82e-06	0.000169			
CO3--	1.09	1.09	321.			
Ca++	3.58	3.58	703.			
Cd++	5.62e-07	5.62e-07	0.000310			
Cl-	4.59	4.59	797.			
Fe+++	0.0896	0.000485	0.133			
H+	2.02	2.20	10.9			
H2O	1.13e+04	1.13e+04	9.95e+05			
K+	0.0754	0.0457	8.76			
Mg++	2.06	2.06	246.			
Na+	3.10	3.10	350.			
Ni++	5.24e-05	5.24e-05	0.0151			
O2(aq)	-9.28e-05	-9.28e-05	-0.0146			
SO4--	4.99	4.93	2.32e+03			
UO2++	4.67e-05	4.67e-05	0.0618			

Elemental composition	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg
As	6.122e-05	6.122e-05	0.02248		
Be	3.816e-06	3.816e-06	0.0001686		
C	1.090	1.090	64.17		
Ca	3.576	3.576	702.5		
Cd	5.624e-07	5.624e-07	0.0003099		
Cl	4.585	4.585	796.9		

Fe	0.08962	0.0004847	0.1327
H	2.254e+04	2.254e+04	1.114e+05
K	0.07541	0.04570	8.759
Mg	2.064	2.064	246.0
Na	3.102	3.102	349.6
Ni	5.245e-05	5.245e-05	0.01509
O	1.129e+04	1.129e+04	8.857e+05
S	4.990	4.931	775.0
U	4.672e-05	4.672e-05	0.05451

Step #   0   Xi = 0.0000

Temperature = 25.0 C   Pressure = 1.013 bars
pH = 1.000   log fO2 = -26.358
Eh =   0.7800 volts   pe = 13.1856
Ionic strength   =   0.530938
Activity of water   =   0.987628
Solvent mass   =   1.0000 kg
Solution mass   =   1.0505 kg
Mineral mass   =   0.00000 kg
Solution density   =   1.035   g/cm3
Solution viscosity =   0.009   poise
Chlorinity   =   0.079381 molal
Dissolved solids   =   48030 mg/kg sol'n
Elect. conductivity =   64975.59 uS/cm (or umho/cm)
Hardness   =   12322.25 mg/kg sol'n as CaCO3
  carbonate   =   0.00 mg/kg sol'n as CaCO3
  non-carbonate   =   12322.25 mg/kg sol'n as CaCO3
Carbonate alkalinity=   0.00 mg/kg sol'n as CaCO3
Water type   =   H-HSO4
Bulk volume   =   1.01e+03 cm3
Fluid volume   =   1.01e+03 cm3
Mineral volume   =   0.000 cm3
Inert volume   =   0.000 cm3
Porosity   =   100. %
Permeability   =   98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.7800	13.1856

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
HSO4-	0.2048	1.892e+04	0.7346	-0.8227
H+	0.1361	130.6	0.7346	-1.0000
Cl-	0.07250	2447.	0.7346	-1.2736
FeSO4+	0.05491	7941.	0.7346	-1.3943
SO4--	0.05324	4869.	0.2911	-1.8096
Na+	0.05311	1162.	0.7346	-1.4088
Mg++	0.04598	1064.	0.2911	-1.8734
MgSO4 (aq)	0.03341	3829.	1.1300	-1.4230
Ca++	0.02341	893.3	0.2911	-2.1664
CaSO4 (aq)	0.02142	2776.	1.1300	-1.6161
Fe(SO4)2-	0.01148	2710.	0.7346	-2.0740
NaSO4-	0.004524	512.8	0.7346	-2.4784

MgCl+	0.003863	219.8	0.7346	-2.5470
K+	0.002511	93.47	0.7346	-2.7341
Fe+++	0.002350	124.9	0.0623	-3.8347
CaCl+	0.001241	89.26	0.7346	-3.0401
NaCl (aq)	0.0009215	51.27	1.1300	-2.9824
FeCl++	0.0008083	70.25	0.2911	-3.6283
Fe++	0.0003529	18.76	0.2911	-3.9883
FeSO4 (aq)	0.0003459	50.02	1.1300	-3.4079
KSO4-	0.0002735	35.19	0.7346	-3.6971
H3AsO4	4.903e-05	6.625	1.1300	-4.2564
FeOH++	4.741e-05	3.288	0.2911	-4.8601
KCl (aq)	4.356e-05	3.092	1.1300	-4.3078
H2CO3* (aq)	3.381e-05	1.996	1.1300	-4.4178
UO2(SO4)2--	8.575e-06	3.773	0.2911	-5.6027
UO2SO4 (aq)	4.719e-06	1.645	1.1300	-5.2730
FeCl+	4.699e-06	0.4084	0.7346	-5.4619
H2AsO4-	3.780e-06	0.5072	0.7346	-5.5564
UO2++	2.248e-06	0.5778	0.2911	-6.1842
Fe2(OH)2++++	3.711e-07	0.05147	0.0072	-8.5742
CdCl+	1.818e-07	0.02559	0.7346	-6.8743
Cd++	9.021e-08	0.009653	0.2911	-7.5806
CdSO4 (aq)	8.446e-08	0.01676	1.1300	-7.0203
UO2Cl+	7.017e-08	0.02041	0.7346	-7.2878
Cd(SO4)2--	6.855e-08	0.01987	0.2911	-7.6999
Fe(OH)2+	3.455e-08	0.002956	0.7346	-7.5955
CdCl2 (aq)	2.624e-08	0.004579	1.1300	-7.5279

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Fe(OH)2.7Cl.3	1.5086s/sat	K-Jarosite	-0.8899
Gypsum	0.6231s/sat	Goethite	-1.3365
Anhydrite	0.3839s/sat	Epsomite	-1.5944
Hematite	-0.2676	Lepidocrocite	-2.2165

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.001137	-2.944
O2(g)	4.388e-27	-26.358
CH4(g)	3.005e-94	-93.522

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	5.28e-05	5.28e-05	6.98			
CO3--	3.38e-05	3.38e-05	1.93			
Ca++	0.0461	0.0461	1.76e+03			
Cd++	4.51e-07	4.51e-07	0.0483			
Cl-	0.0794	0.0794	2.68e+03			
Fe+++	0.0703	0.0703	3.74e+03			
H+	0.340	0.340	327.			
H2O	55.5	55.5	9.52e+05			

K+	0.00283	0.00283	105.
Mg++	0.0833	0.0833	1.93e+03
Na+	0.0586	0.0586	1.28e+03
O2(aq)	-0.000176	-0.000176	-5.36
SO4--	0.396	0.396	3.62e+04
UO2++	1.56e-05	1.56e-05	4.01

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	5.281e-05	5.281e-05	3.767		
C	3.381e-05	3.381e-05	0.3866		
Ca	0.04607	0.04607	1758.		
Cd	4.513e-07	4.513e-07	0.04829		
Cl	0.07938	0.07938	2679.		
Fe	0.07030	0.07030	3738.		
H	111.4	111.4	1.068e+05		
K	0.002828	0.002828	105.3		
Mg	0.08325	0.08325	1927.		
Na	0.05856	0.05856	1282.		
O	57.09	57.09	8.696e+05		
S	0.3959	0.3959	1.208e+04		
U	1.561e-05	1.561e-05	3.538		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 2.970 log fO2 = -39.140
Eh = 0.4744 volts pe = 8.0196
Ionic strength = 0.547861
Activity of water = 0.989289
Solvent mass = 1.0000 kg
Solution mass = 1.0537 kg
Mineral mass = 0.00000 kg
Solution density = 1.037 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.082558 molal
Dissolved solids = 50991 mg/kg sol'n
Elect. conductivity = 24509.69 uS/cm (or umho/cm)
Hardness = 26021.02 mg/kg sol'n as CaCO3
 carbonate = 0.00 mg/kg sol'n as CaCO3
 non-carbonate = 26021.02 mg/kg sol'n as CaCO3
Carbonate alkalinity= 0.00 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 1.02e+03 cm3
Fluid volume = 1.02e+03 cm3
Mineral volume = 0.000 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.7 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.4744	8.0196

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

No minerals in system.

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
CaSO4 (aq)	0.1438	1.858e+04	1.1345	-0.7874
SO4--	0.1120	1.021e+04	0.2929	-1.4843
Cl-	0.07512	2527.	0.7356	-1.2576
Ca++	0.07418	2822.	0.2929	-1.6631
Na+	0.06789	1481.	0.7356	-1.3015
FeSO4 (aq)	0.05277	7608.	1.1345	-1.2228
MgSO4 (aq)	0.03038	3471.	1.1345	-1.4626
Fe++	0.02540	1346.	0.2929	-2.1285
Mg++	0.01973	455.1	0.2929	-2.2383
NaSO4-	0.01223	1382.	0.7356	-2.0458
HSO4-	0.004634	426.9	0.7356	-2.4674
CaCl+	0.004099	293.8	0.7356	-2.5206

K+	0.002269	84.22	0.7356	-2.7774
MgCl+	0.001728	97.98	0.7356	-2.8959
H+	0.001457	1.393	0.7356	-2.9700
NaCl (aq)	0.001219	67.62	1.1345	-2.8591
KSO4-	0.0005228	67.06	0.7356	-3.4150
FeCl+	0.0003526	30.55	0.7356	-3.5861
FeSO4+	5.729e-05	8.260	0.7356	-4.3752
KCl (aq)	4.076e-05	2.884	1.1345	-4.3350
H2CO3* (aq)	3.384e-05	1.992	1.1345	-4.4158
Fe(SO4)2-	2.534e-05	5.963	0.7356	-4.7295
UO2(SO4)2--	2.139e-05	9.382	0.2929	-5.2031
H2AsO4-	2.037e-05	2.724	0.7356	-4.8244
BeSO4 (aq)	1.631e-05	1.626	1.1345	-4.7329
NiSO4 (aq)	1.330e-05	1.953	1.1345	-4.8215
Be++	1.244e-05	0.1064	0.2929	-5.4386
Ni++	7.874e-06	0.4387	0.2929	-5.6371
UO2SO4 (aq)	5.577e-06	1.938	1.1345	-5.1988
Be(SO4)2--	5.202e-06	0.9930	0.2929	-5.8172
H3AsO4	2.824e-06	0.3804	1.1345	-5.4944
FeOH++	2.176e-06	0.1505	0.2929	-6.1956
Be(SO4)3----	2.099e-06	0.5919	0.0074	-7.8115
UO2++	1.253e-06	0.3212	0.2929	-6.4353
Fe+++	1.146e-06	0.06073	0.0631	-7.1409
Cd(SO4)2--	6.987e-07	0.2019	0.2929	-6.6891
CdCl+	4.318e-07	0.06059	0.7356	-6.4980
FeCl++	4.119e-07	0.03569	0.2929	-6.9185
CdSO4 (aq)	4.078e-07	0.08068	1.1345	-6.3348
BeCl+	3.777e-07	0.01594	0.7356	-6.5561
Cd++	2.055e-07	0.02193	0.2929	-7.2204
Fe(OH)2+	1.490e-07	0.01270	0.7356	-6.9603
CdCl2 (aq)	6.450e-08	0.01122	1.1345	-7.1356
NiCl+	6.436e-08	0.005751	0.7356	-7.3247
Ni(SO4)2--	5.592e-08	0.01331	0.2929	-7.7858
UO2Cl+	4.078e-08	0.01182	0.7356	-7.5229
HCO3-	2.166e-08	0.001255	0.7356	-7.7976

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Hematite	4.9421s/sat	Lepidocrocite	0.3887s/sat
Magnetite	3.9282s/sat	Ferrihydrite (ag	-0.9350
Fe(OH)2.7Cl.3	3.5282s/sat	Melanterite	-1.4365
K-Jarosite	1.6231s/sat	Ferrihydrite	-1.4450
Gypsum	1.4533s/sat	Epsomite	-1.6288
Goethite	1.2687s/sat	Na-Jarosite	-2.5810
Anhydrite	1.2126s/sat	Maghemite	-2.8619

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.001140	-2.943
O2(g)	7.236e-40	-39.140
CH4(g)	1.112e-68	-67.954

Original basis	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg	Kd L/kg
AsO4---	2.32e-05	2.32e-05	3.06			
Be++	3.64e-05	3.64e-05	0.312			
CO3--	3.39e-05	3.39e-05	1.93			
Ca++	0.222	0.222	8.45e+03			
Cd++	1.81e-06	1.81e-06	0.193			
Cl-	0.0826	0.0826	2.78e+03			
Fe+++	0.0786	0.0786	4.17e+03			
H+	-0.0723	-0.0723	-69.2			
H2O	55.5	55.5	9.50e+05			
K+	0.00283	0.00283	105.			
Mg++	0.0518	0.0518	1.20e+03			
Na+	0.0813	0.0813	1.77e+03			
Ni++	2.13e-05	2.13e-05	1.19			
O2(aq)	-0.0196	-0.0196	-596.			
SO4--	0.357	0.357	3.25e+04			
UO2++	2.83e-05	2.83e-05	7.24			

Elemental composition	total moles	In fluid moles	In fluid mg/kg	Sorbed moles	Sorbed mg/kg
As	2.320e-05	2.320e-05	1.649		
Be	3.642e-05	3.642e-05	0.3115		
C	3.387e-05	3.387e-05	0.3861		
Ca	0.2221	0.2221	8448.		
Cd	1.808e-06	1.808e-06	0.1929		
Cl	0.08256	0.08256	2778.		
Fe	0.07862	0.07862	4167.		
H	111.0	111.0	1.062e+05		
K	0.002833	0.002833	105.1		
Mg	0.05183	0.05183	1196.		
Na	0.08134	0.08134	1775.		
Ni	2.129e-05	2.129e-05	1.186		
O	56.94	56.94	8.645e+05		
S	0.3565	0.3565	1.085e+04		
U	2.827e-05	2.827e-05	6.385		

Step # 0 Xi = 0.0000

Temperature = 25.0 C Pressure = 1.013 bars
pH = 2.728 log fO2 = -40.110
Eh = 0.4744 volts pe = 8.0196
Ionic strength = 0.546795
Activity of water = 0.989305
Solvent mass = 0.99992 kg
Solution mass = 1.0533 kg
Mineral mass = 0.00037188 kg
Solution density = 1.037 g/cm3
Solution viscosity = 0.009 poise
Chlorinity = 0.082565 molal

Dissolved solids = 50692 mg/kg sol'n
Elect. conductivity = 24825.57 uS/cm (or umho/cm)
Hardness = 25925.66 mg/kg sol'n as CaCO3
carbonate = 0.00 mg/kg sol'n as CaCO3
non-carbonate = 25925.66 mg/kg sol'n as CaCO3
Carbonate alkalinity= 0.00 mg/kg sol'n as CaCO3
Water type = Ca-SO4
Bulk volume = 1.02e+03 cm3
Fluid volume = 1.02e+03 cm3
Mineral volume = 0.140 cm3
Inert volume = 0.000 cm3
Porosity = 100. %
Permeability = 98.2 cm2

Nernst redox couples	Eh (volts)	pe
e- + H+ + .25*O2(aq) = .5*H2O	0.4744	8.0196

Reactants	moles remaining	moles reacted	grams reacted	cm3 reacted
e-	-- fixed Eh buffer --			

Minerals in system	moles	log moles	grams	volume (cm3)
K-Jarosite	0.0007426	-3.129	0.3719	0.1403
(total)			0.3719	0.1403

Aqueous species	molality	mg/kg sol'n	act. coef.	log act.
CaSO4 (aq)	0.1425	1.842e+04	1.1342	-0.7915
SO4--	0.1106	1.009e+04	0.2927	-1.4897
Cl-	0.07512	2528.	0.7356	-1.2576
Ca++	0.07442	2832.	0.2927	-1.6618
Na+	0.06802	1485.	0.7356	-1.3007
FeSO4 (aq)	0.05107	7365.	1.1342	-1.2371
MgSO4 (aq)	0.03023	3454.	1.1342	-1.4650
Fe++	0.02489	1320.	0.2927	-2.1374
Mg++	0.01987	458.7	0.2927	-2.2352
NaSO4-	0.01210	1368.	0.7356	-2.0505
HSO4-	0.007998	737.0	0.7356	-2.2304
CaCl+	0.004111	294.7	0.7356	-2.5195
H+	0.002546	2.436	0.7356	-2.7276
MgCl+	0.001740	98.71	0.7356	-2.8929
K+	0.001679	62.31	0.7356	-2.9084
NaCl (aq)	0.001222	67.78	1.1342	-2.8584
KSO4-	0.0003819	49.00	0.7356	-3.5515
FeCl+	0.0003454	29.94	0.7356	-3.5951
FeSO4+	5.544e-05	7.995	0.7356	-4.3896
H2CO3* (aq)	3.386e-05	1.993	1.1342	-4.4157
KCl (aq)	3.015e-05	2.134	1.1342	-4.4661
Fe(SO4)2-	2.421e-05	5.700	0.7356	-4.7493
UO2(SO4)2--	2.132e-05	9.352	0.2927	-5.2048

H2AsO4-	1.867e-05	2.498	0.7356	-4.8622
BeSO4 (aq)	1.629e-05	1.624	1.1342	-4.7335
NiSO4 (aq)	1.324e-05	1.945	1.1342	-4.8236
Be++	1.258e-05	0.1076	0.2927	-5.4338
Ni++	7.938e-06	0.4424	0.2927	-5.6338
UO2SO4 (aq)	5.627e-06	1.955	1.1342	-5.1951
Be(SO4)2--	5.132e-06	0.9799	0.2927	-5.8232
H3AsO4	4.524e-06	0.6096	1.1342	-5.2898
Be(SO4)3----	2.047e-06	0.5775	0.0073	-7.8230
UO2++	1.280e-06	0.3282	0.2927	-6.4262
FeOH++	1.221e-06	0.08442	0.2927	-6.4469
Fe+++	1.123e-06	0.05956	0.0630	-7.1499
Cd(SO4)2--	6.901e-07	0.1995	0.2927	-6.6946
CdCl+	4.371e-07	0.06135	0.7356	-6.4928
CdSO4 (aq)	4.078e-07	0.08070	1.1342	-6.3349
FeCl++	4.037e-07	0.03499	0.2927	-6.9275
BeCl+	3.819e-07	0.01612	0.7356	-6.5514
Cd++	2.082e-07	0.02221	0.2927	-7.2151
CdCl2 (aq)	6.530e-08	0.01136	1.1342	-7.1304
NiCl+	6.485e-08	0.005797	0.7356	-7.3215
Ni(SO4)2--	5.498e-08	0.01309	0.2927	-7.7933
Fe(OH)2+	4.779e-08	0.004077	0.7356	-7.4540
UO2Cl+	4.165e-08	0.01208	0.7356	-7.5138
HCO3-	1.240e-08	0.0007183	0.7356	-8.0399

(only species > 1e-8 molal listed)

Mineral saturation states

	log Q/K		log Q/K
Hematite	3.4697s/sat	K-Jarosite	0.0000 sat
Fe(OH)2.7Cl.3	2.8647s/sat	Lepidocrocite	-0.3475
Magnetite	1.9620s/sat	Melanterite	-1.4508
Gypsum	1.4491s/sat	Epsomite	-1.6311
Anhydrite	1.2085s/sat	Ferrihydrite (ag	-1.6711
Goethite	0.5325s/sat	Ferrihydrite	-2.1811

(only minerals with log Q/K > -3 listed)

Gases	fugacity	log fug.
CO2(g)	0.001140	-2.943
O2(g)	7.759e-41	-40.110
CH4(g)	9.676e-67	-66.014

		In fluid		Sorbed		Kd
Original basis	total moles	moles	mg/kg	moles	mg/kg	L/kg
AsO4---	2.32e-05	2.32e-05	3.06			
Be++	3.64e-05	3.64e-05	0.312			
CO3--	3.39e-05	3.39e-05	1.93			
Ca++	0.221	0.221	8.41e+03			
Cd++	1.81e-06	1.81e-06	0.193			
Cl-	0.0826	0.0826	2.78e+03			
Fe+++	0.0786	0.0764	4.05e+03			
H+	-0.0701	-0.0656	-62.8			

H2O	55.5	55.5	9.50e+05
K+	0.00283	0.00209	77.6
Mg++	0.0518	0.0518	1.20e+03
Na+	0.0813	0.0813	1.78e+03
Ni++	2.13e-05	2.13e-05	1.19
O2(aq)	-0.0191	-0.0191	-580.
SO4--	0.357	0.355	3.24e+04
UO2++	2.83e-05	2.83e-05	7.25

Elemental composition		In fluid		Sorbed	
	total moles	moles	mg/kg	moles	mg/kg
As	2.320e-05	2.320e-05	1.650		
Be	3.642e-05	3.642e-05	0.3116		
C	3.387e-05	3.387e-05	0.3862		
Ca	0.2210	0.2210	8409.		
Cd	1.808e-06	1.808e-06	0.1930		
Cl	0.08256	0.08256	2779.		
Fe	0.07862	0.07639	4050.		
H	111.0	111.0	1.062e+05		
K	0.002833	0.002090	77.60		
Mg	0.05183	0.05183	1196.		
Na	0.08134	0.08134	1775.		
Ni	2.129e-05	2.129e-05	1.187		
O	56.94	56.92	8.647e+05		
S	0.3565	0.3550	1.081e+04		
U	2.827e-05	2.827e-05	6.387		