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June 15, 2000

U.S. Nuclear Regulatory Commission
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Subject: *Southwest Alluvium Groundwater Geochemistry Report* and Request to Temporarily Shut Down the Southwest Alluvium Corrective Action System United Nuclear Corporation Church Rock Site, Gallup, New Mexico

Dear Messrs. Essig and Lyssy:

Enclosed is a copy of the above-referenced report, which was requested in the March 3, 2000, meeting in Santa Fe, New Mexico. The report includes a request to temporarily shut down the Southwest Alluvium corrective action system. The purpose of the temporary shutdown is to demonstrate the viability of natural attenuation in lieu of pumping to prevent migration of hazardous constituents. Earth Tech, Inc., on behalf of United Nuclear Corporation, requests your timely response to this request.

Please contact me at (303) 804-2367 or <suzie_dupont@earthtech.com> if you need additional information or copies.

Respectfully,
Earth Tech, Inc.

Suzie du Pont
Project Manager

Enclosures

cc: Roy Blickwedel, General Electric Corporation
Larry Bush, United Nuclear Corporation
Ken Hooks, NRC Project Manager
George Padilla, Navajo Superfund
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SOUTHWEST ALLUVIUM GROUNDWATER GEOCHEMISTRY REPORT

Church Rock Site,
Gallup, New Mexico

Prepared for:

UNC Mining and Milling
A Division of United Nuclear Corporation
Gallup, New Mexico

Prepared by:

Earth Tech, Inc.
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LIST OF ABBREVIATIONS AND ACRONYMS

ACL	alternate concentration limit
ANP	acid neutralization potential
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
Earth Tech	Earth Tech, Inc.
EPA	U.S. Environmental Protection Agency
gpm	gallons per minute
IC	Institutional Controls
MCL	maximum contaminant level
mg/L	milligrams per liter
MNA	monitored natural attenuation
NRC	Nuclear Regulatory Commission
pCi/L	picoCuries per liter
ROD	Record of Decision
TDS	total dissolved solids
TI	Technical Impracticability
United Nuclear	United Nuclear Corporation

1.0 INTRODUCTION

Earth Tech, Inc. (Earth Tech), on behalf of United Nuclear Corporation (United Nuclear), is providing this report on Southwest Alluvium geochemical processes as part of the ongoing discussions concerning closure of United Nuclear's Church Rock site. This information, which provides an evaluation of the Southwest Alluvium similar to the Zone 1 presentation, was requested in the March 3, 2000, meeting in Santa Fe, New Mexico. The information provides technical documentation of the geochemical conditions in the Southwest Alluvium that limit the effectiveness of the ongoing corrective action system and proposes a solution for closure of the system operating in the Southwest Alluvium.

This report:

- Summarizes current exceedances of the site water quality standards;
- Evaluates geochemical conditions and predicts future exceedances;
- Defines the extent of seepage impacts; and
- Proposes a solution for attaining completion of the Southwest Alluvium Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Corrective Action.

1.1 CURRENT STATUS

Accomplishments for Southwest Alluvium include:

- United Nuclear completed 10 years of active remediation, including remediating the source by completing tailings reclamation which prevents infiltration of precipitation.
- The U.S. Environmental Protection Agency (EPA) issued the *Five-Year Review Report* in September 1998 which recognized that the cleanup standards cannot be achieved in a reasonable timeframe. The report also recognized that Extraction Well 801 met the decommissioning criteria specified in the Record of Decision (ROD).
- Extraction Well 801 was turned off in July 1999 with agency approval.
- The alternate concentration limit (ACL) and Technical Impracticability (TI) waiver process was initiated to complete the remedial action process under CERCLA and in accordance with the *Five-Year Review Report*.

Like Zone 1, the ACL or TI process is considered to be the acceptable route for completing the Southwest Alluvium remedial action. However, because of the hydrogeological and geochemical conditions in the Southwest Alluvium, United Nuclear cannot implement the standard ACL process outlined in the ACL guidance documents. Therefore, United Nuclear is presenting this report to document the hydrogeological and geochemical conditions that prevent use of the standard ACL process and to propose a hybrid remedy that can attain compliance with the CERCLA ROD. The hybrid remedy is a combination of:

- Monitored natural attenuation (MNA) - for neutralization and on-site constituent removal;
- TI - for the natural geochemical conditions that prevent sulfate and total dissolved solids (TDS) concentrations from meeting the water quality standards; and
- Institutional Controls (IC) – for supporting the TI waiver process for sulfate and TDS and providing an added measure of protection of human health and the environment.

1.2 SITE OVERVIEW

The information and evaluation provided in this report are based on Southwest Alluvium water quality data collected since 1989 as part of the approved performance monitoring program (United Nuclear, 1989a and 1989b). Figure 1 shows the locations of monitoring wells that are sampled quarterly as part of this program. These groundwater data have been provided to the regulatory agencies on a regular basis in annual reports (Canonie Environmental Services Corp. 1989 through 1992a, 1993a, and 1995; Smith Technology Corporation 1995 and 1996; Rust Environment & Infrastructure 1997; and Earth Tech 1998 and 1999) and in electronic database format. This report also incorporates historic monitoring data collected prior to initiation of the performance monitoring program and included in the electronic database.

Groundwater in the Southwest Alluvium in the vicinity of the Church Rock tailings impoundment was created by mine water that was discharged to Pipeline Arroyo. This mine water percolated into the alluvium and created a temporary saturation in the vicinity of the tailings impoundment. The temporary saturation created by the mine water discharge is the recognized background water for the Southwest Alluvium (EPA 1988). This temporary saturation has been draining out since the mine water discharge ceased in 1986, resulting in a

total loss of saturation at the northern property boundary (Wells 639, 642, 644, 645) and on the flanks of the alluvial valley (Wells EPA 22A, 29 A and EPA 27), and an average loss in saturation of 31 percent further to the south.

The background water in the Southwest Alluvium was impacted by acidic seepage from the tailings impoundment located on the eastern side Pipeline Arroyo (Figure 1). The acidic seepage contained elevated concentrations of metals, radionuclides, and major ions such as sulfate and chloride. However, the impact of the seepage was mitigated because the alluvium has a high neutralization capacity. As the seepage percolated into and through the alluvium, it was neutralized and concentrations of most constituents were reduced to below the cleanup standards established for the site.

Although the impacts from the tailings seepage were minimal and almost indistinguishable from background, United Nuclear was required to install and operate a series of extraction wells to create a hydraulic barrier to flow near the south end of the tailings impoundment. The Southwest Alluvium extraction system consists of four pumping wells (Wells 801, 802, 803 and 808) located upgradient from the Section 2/3 property boundary. The pumping wells are identified by red diamonds on Figure 1. The wells began operating in November 1989 and, with the exception of Well 801, are currently operating. Well 801 met the decommissioning criteria and was shut off in July 1999 with agency approval.

Table 1 lists the exceedances of standards as of the third quarter 1999, and Figure 2 illustrates the approximate extent of seepage-impacted water. Currently only two constituents, sulfate and TDS, exceed the standards in the Southwest Alluvium outside United Nuclear's property boundary in Sections 3 and 10. Sulfate and TDS, although nonhazardous and also present in concentrations exceeding the groundwater quality standards in the background water, are considered constituents of concern for the Southwest Alluvium. They are the only constituents, aside from erratic exceedances of the lead-210 standard, that have ever been observed in concentrations exceeding the standards outside the property boundary.

Table 1 lists four other constituents that also exceed the standards, but these exceedances are either within the property boundary (chloride, manganese and chloroform) or are erratic and unrelated to seepage impacts (lead-210). The exceedances of chloride, manganese and chloroform are limited to localized areas immediately adjacent to the tailings impoundment and have never been detected in concentrations exceeding the standards outside the property boundary, either before or after remediation began. As has been discussed in previous documents (e.g., Canonie Environmental Services Corp. 1993b and 1995), the lead-210 exceedances are related to analytical issues rather than seepage.

Chloride exceeds the standards only in Well 509 D, which is located along the western side of the Central Cell of the tailings impoundment. Figure 3 shows the chloride concentration trend at Well 509 D. As indicated, the chloride concentration has been increasing since before pumping began 1989 but has been stable since 1997. The increase in concentration was probably related to a decrease in the flow in the alluvium after the mine water discharge ceased. Because chloride is a conservative constituent and moves concurrent with groundwater flow, the stability of the chloride concentrations after 1997 indicates that the hydrologic system has stabilized. That is, a mixing zone between seepage from the tailings and background water in the alluvium has been reestablished. Because chloride exceeds the standards well inside the property boundary and concentrations are either stable or declining in the remaining on-site monitoring wells, chloride is not considered a constituent of concern for the Southwest Alluvium.

Manganese exceeds the standard only at on-site Well 801. Figure 4 shows the time-series manganese concentrations for this well, which exhibits a clear declining trend. The linear projection of the manganese concentration trend, also plotted on Figure 4, indicates that the standard will be met in about seven years. Because manganese is a secondary drinking water standard, it exceeds the standard in only one well, and the concentration is decreasing, it is not considered a constituent of concern for the Southwest Alluvium.

Chloroform exceeds the Nuclear Regulatory Commission (NRC) standard in on-site Wells 632, 801 and 802. Figure 5 provides the time-series chloroform data for these wells. Where detected, chloroform has remained at fairly stable concentrations near the site standard and well below the

EPA's maximum contaminant level (MCL) of 0.100 milligram per liter (mg/L) (100 micrograms per liter). Chloroform concentrations in the Southwest Alluvium are over an order of magnitude less than the MCL. Because chloroform has been detected in very low concentrations only immediately adjacent to the tailings impoundment and within the property boundary, it is not considered a constituent of concern for the Southwest Alluvium.

Figure 6 shows the exceedances of lead-210 for the past three years. Only four samples, one from each of four wells, had lead-210 concentrations that exceeded the standard during this time. These exceedances are sporadic and have occurred throughout the alluvium both upgradient and downgradient and at similar concentrations in both impacted and background water. Similar sporadic exceedances have also been observed in Zone 1 and Zone 3. Analytical precision and the fact that the standard is also the laboratory reporting limit are the most likely causes of the exceedances. Because the sporadic detections of lead-210 are unrelated to seepage impacts, it is not considered a constituent of concern for the Southwest Alluvium.

2.0 SOUTHWEST ALLUVIUM GEOCHEMISTRY

This section presents an overview of the Southwest Alluvium geochemistry that is the basis for predicting future concentrations of constituents of concern. The conceptual geochemical model developed to understand the evolution of the Southwest Alluvium water chemistry is also discussed. The section on the evolution of the water chemistry includes a discussion of the extent of seepage impacts and the effectiveness of the active remediation system that is currently operating to control the seepage.

2.1 GEOCHEMICAL AREAS

To better understand current groundwater quality and to predict future conditions, a conceptual geochemical model of constituents in the Southwest Alluvium groundwater was developed. The model was built upon the observed evolution of groundwater geochemistry along flow paths from the tailings impoundment to the leading edge of the seepage-impacted groundwater.

Unlike Zone 1, the Southwest Alluvium has only two geochemical areas, as shown on Figure 2 and listed in Table 2:

- Transition (shown in blue)
- Background (shown in white)

The Transition area is where the water has been impacted by seepage and is most similar to the Transition 2 area defined for Zone 1 because it has near neutral pH values and bicarbonate concentrations typically above 1,000 mg/L. Unlike the Zone 1 Transition 2 area, in the Southwest Alluvium this area has isolated exceedances of manganese, chloroform, and chloride. The Background area is the water beyond the seepage-impacted area and has near neutral pH, bicarbonate concentrations in the hundreds of milligrams per liter, and low concentrations of metals. The sulfate standard is consistently exceeded in both areas.

The overall chemical evolution in this groundwater system was brought about by neutralization of acidic seepage via reaction with the alluvium, which, as documented in previous reports

(Canonie Environmental Services Corp. 1988 and 1992b) has a very high neutralization capacity. Figure 7 illustrates this neutralization capacity using the empirical data collected as part of the 1988 investigation (Canonie Environmental Services Corp. 1988) to evaluate the evolution of groundwater chemistry in the Southwest Alluvium. Two soil borings, T1-A and T2-A, were drilled through the South Cell of the tailings impoundment and into the underlying alluvium. Figure 2 shows the locations of the two borings. Soil samples were collected and analyzed for a variety of parameters, including soil pH and acid neutralization potential (ANP).

The top graph on Figure 7 presents the soil pH versus depth for both boreholes. The graph shows that, although the tailings have a pH of 3, the underlying alluvium very quickly neutralizes the seepage, so that within six feet beneath the tailings the soil pH of the alluvium is near neutral. The bottom graph on Figure 7 presents the ANP data from Boring T1-A. As shown, the ANP is almost used up in the upper few feet of alluvium immediately beneath the tailings but is back to higher levels within six feet beneath the contact. The ability of the alluvium to neutralize the acidic seepage is demonstrated by the water quality data which, unlike in Zone 1 and Zone 3, has always had near-neutral pH and by minor occurrences of detectable metals that have been limited to wells located immediately adjacent to the tailings impoundment.

2.2 EXTENT OF SEEPAGE IMPACTS

The extent of seepage impacts was estimated by reviewing the water quality data from the monitoring wells to identify patterns in constituent concentrations or concentration trends that could be used to delineate seepage-impacted and background water. The water quality data used included historical data collected prior to the start of the corrective action program in 1989. The historical data were helpful in identifying the range of background water quality that evolved as the mine water discharge percolated through the alluvium and for recognizing the movement of seepage-impacted water over time.

Figure 2 shows the wells that were used in this water quality evaluation. The water quality data review consisted of four primary steps:

- Identify the wells known to be impacted or unimpacted based on the constituents known to be associated with tailings seepage;
- Prepare Stiff diagrams to identify water types and delineate seepage-impacted and background water;
- Prepare a matrix of the constituent concentration patterns for each well to provide a basis for delineating seepage impacts at wells over time; and
- Graph constituents to identify trends and whether seepage impacts are evident.

2.2.1 Initial Delineation of Impacted versus Unimpacted Wells

Evaluation of the time-series monitoring well water quality data indicates four wells that are clearly seepage impacted. As shown on Figure 8, these wells, 801 802, 803, and 632, all have high bicarbonate (greater than 1,000 mg/L) and high chloride (typically greater than 150 mg/L). Chloroform, which is associated only with the main part of the seepage, is reported in detectable concentrations only at Wells 801, 802 and 632. In contrast, the unimpacted wells (627, EPA 25, EPA 27 and GW-4) typically have lower concentrations of bicarbonate (in the range of 500 mg/L to 900 mg/L) and lower concentrations of chloride (less than 150 mg/L).

Delineating wells that have been partially impacted required a more detailed review of the data. Stiff diagrams were selected for the first step in the more detailed review to identify differences in the general patterns or trends in the major constituent concentrations between impacted and unimpacted water.

2.2.2 Stiff Diagrams

Stiff diagrams were plotted for several different sampling events over time for each well. Review of these diagrams identified several constituent concentrations and concentration trends that were helpful in further delineating seepage impacts.

Figure 9 presents the Stiff diagrams for unimpacted wells (Wells 627, EPA 27, EPA 25 and GW-4) and the four seepage-impacted wells (Wells 801, 802, 803 and 632). As shown, the unimpacted background water (Wells 627, EPA 25, EPA 27, GW-4) is a predominantly calcium-

sulfate type. The variability in the background water evident from the Stiff diagrams has been documented in previous reports (Canonie Environmental Services Corp. 1988, 1992a and 1993b; NRC 1996). This variability is caused by the transient conditions of saturation resulting from discharge of mine water to the arroyo. The mine water first saturated the alluvium and then has been draining out since the discharge ceased. As a result, the extent of saturation and the groundwater flow paths have changed constantly.

The Stiff diagrams for Wells 801, 802, 803 and 632 indicate that the acidic seepage results in a magnesium-sulfate water with higher bicarbonate and calcium concentrations than the background water. These wells also had chloride concentrations that were typically greater than 150 mg/L as compared to the unimpacted wells, where chloride concentrations were typically 120 mg/L or less.

The Stiff diagrams also showed when seepage impacts became evident in a well and when water quality has improved. For example, Figure 10 presents Stiff diagrams of Wells GW-2 and GW-1 water over time. As shown, initially the water in Well GW-2 was a calcium-sulfate type similar to the water in Well GW-4 or EPA 25. However, the water quality in this well changed over time from a calcium-sulfate type to a magnesium-sulfate type. Correspondingly, the bicarbonate concentrations increased from about 800 mg/L to almost 2,000 mg/L and chloride increased from about 60 mg/L to almost 200 mg/L. Because of the neutralization capacity of the alluvium, the pH remained near neutral and no metals or radionuclides have been detected above the standards.

A similar pattern is evident for Well GW-1 where initially the water was a calcium-sulfate type and then changed to a calcium-magnesium-sulfate type as the seepage-impacts became evident. However, since 1997 the water quality in this well has been improving as indicated by return of the water quality to a calcium-sulfate type. Correspondingly, bicarbonate concentrations decreased from over 2,000 mg/L to about 800 mg/L and chloride concentrations have decreased from over 200 mg/L to about 125 mg/L.

2.2.3 Matrix of Patterns

Based on review of the Stiff diagrams, a pattern of constituent concentrations and concentration trends indicative of seepage impacts was identified that helped differentiate the partially impacted wells. Table 3 lists these constituent concentrations and also identifies how the water quality at each of the wells fits the different patterns. The constituent concentrations and concentration trends listed in Table 3 that were selected for use in the evaluation are discussed below.

Chloride: Chloride was present in the acid seepage in high concentrations. Chloride is a nonreactive constituent that moves with the plume and therefore provides clear evidence of plume migration. A chloride level of 150 mg/L was chosen to distinguish the plume from background concentrations which are typically between 60 and 120 mg/L.

Bicarbonate: Bicarbonate concentrations greater than 1,000 mg/L indicate that low pH tailings seepage has migrated through the alluvium and been neutralized. The neutralization process occurs within a few feet of the alluvium/tailings contact, as discussed in Section 2.1 and illustrated on Figure 7. The neutralization results principally from the following reaction:

$$CaCO_3 + H^+ \longrightarrow Ca^{2+} + HCO_3 \qquad (1)$$

The result is an increase in calcium and bicarbonate concentrations. In the unimpacted areas, the background water has reached approximate equilibrium conditions with carbonate minerals, and bicarbonate concentrations range from approximately 500 mg/L to 900 mg/L.

Calcium-to-Magnesium Ratio: Calcium and magnesium are fairly stable within the Southwest Alluvium background water. Neutralization of acidic seepage results in increases in both calcium and magnesium, probably due to acid dissolution of calcite, dolomite and silicate minerals (including clays). However, the calcium concentration in the alluvial water is more or less fixed by the presence of two calcium-bearing phases, calcite and gypsum. As a result, as seepage mixes with background water, the magnesium concentration increases relative to

calcium and the calcium-to-magnesium ratio drops. A calcium-to-magnesium ratio of less than 1.5 was found to be typical for the seepage-impacted water.

Water Type: As illustrated by the Stiff diagrams on Figures 9 and 10, a magnesium-sulfate water type indicates impacts from acidic seepage. Therefore, the presence (or absence) of this water type was included as a pattern in the matrix.

Metals: Metals have exceeded the standards only in localized areas immediately adjacent to the tailings impoundment, and therefore, are an indication of seepage impacts.

Chloroform: Chloroform is detectable only within the seepage front because it is present in low concentrations and dissipates rapidly.

These parameters were evaluated to determine if monitoring wells were background or impacted. In Table 3, white or no color indicates wells with unimpacted background water quality. Blue indicates mild groundwater impact, such as chloride or bicarbonate concentrations greater than background. Pink indicates seepage impacts with exceedance of a groundwater standard. Parameters for Well GW-1 are shown in white but grouped with the mildly impacted wells. This representation is used because, although the current water quality is unimpacted (i.e., white), it was previously impacted as indicated by historical chloride and bicarbonate concentrations greater than 200 mg/L and 1,000 mg/L, respectively.

The extent of seepage impacts shown in blue on Figure 2 was based on the matrix analysis presented in Table 3. As of 1989, seepage impacts were evident at the property boundary as indicated by the water quality in Wells GW-1, GW-2 and GW-3. The seepage has continued to migrate downgradient and, as indicated in Table 3, has impacted the water quality at Well 624. This well has exhibited increasing trends in chloride and bicarbonate concentrations. However, water quality is improving at Wells GW-1, GW-2, and GW-3. Additionally, increases in chloride and bicarbonate are the only seepage impacts evident in the downgradient areas because the natural neutralization process attenuates the metals and radionuclides within close proximity to the tailings impoundment.

2.2.4 Graphs of Water Quality

Figures 11 and 12 present graphs of water quality for two sets of mildly seepage-impacted wells to illustrate the change in water quality as the seepage migrated in the alluvium. Figure 11 shows that concentrations of chloride and bicarbonate in Wells 509 D, GW-1 and GW-3 were originally much lower in the three wells. Then, as the seepage migrated into these areas, the chloride and bicarbonate concentrations increased. Based on the historical data shown for Wells GW-1 and GW-3, changes in water quality first became evident between 1980 and 1981, approximately three years after tailings were first discharged to the South Cell of the impoundment. These wells are located approximately 800 feet from the impoundment, so the travel rate was about 270 feet per year.

Recently the water quality in Wells GW-1 and GW-3 has been improving, as indicated by the declining trend in both chloride and bicarbonate concentrations. The water quality at Well GW-1 is approaching the pre-impacted conditions, which is why it is shown in white in Table 3.

Figure 12 shows that chloride and bicarbonate concentrations in Wells 624 and EPA 25 have increased since 1989. At Well 624, chloride and bicarbonate exceeded the concentrations indicative of seepage impacts (150 mg/L chloride and 1,000 mg/L bicarbonate) in 1996. The concentrations appear to be stabilizing. For Well EPA 25, chloride and bicarbonate have approached the concentrations indicative of seepage. However, the concentrations have stabilized for the past two years, indicating that seepage impacts, if they are the cause of the increased concentrations at this well, are limited. That is why the extent of seepage impacts shown on Figure 2 approaches but does not include Well EPA 25.

2.3 REMEDIAL ACTION SYSTEM

United Nuclear began operating a corrective action pumping system in 1989 to create a hydraulic barrier to groundwater flow in the alluvium. This system consists of four extraction wells (801, 802, 803 and 808), shown on Figure 2. However, as documented in the Annual Review Reports, 99 percent of the mass removed by these wells over the past ten years consists of sulfate and TDS. These constituents are nonhazardous and are also present in concentrations exceeding the standards in the background water.

The water level, water quality and pumping data indicate that the system was ineffective in controlling migration of the seepage. This is because there has been a large volume of groundwater flow through the alluvium and only part has been removed by pumping. Instead, source treatment (placement of the reclamation cover) and natural processes (i.e., neutralization by the alluvium, discussed in Section 2.1, Geochemical Areas) have been effective in reducing constituent concentrations.

To illustrate the greater effect of the natural drainage in controlling the hydraulic system, Figure 13 shows the change in saturated thickness over time in the monitoring wells. This includes the wells located outside the influence of pumping (Wells GW-4 and 509 D) and Wells 804 through 807, which were installed to monitor the hydraulic affect of the pumping wells.

Review of the figure shows that all the wells exhibit a steady and parallel decline in saturated thickness. Wells such as GW-1, GW-4 and 509 D that had data for the period prior to cessation of the mine water discharge exhibit a steady decline both prior to and after pumping started. If the pumping had had an effect in controlling the natural system, a deflection in the slope of the plotted lines would be expected. However, no deflection in the slopes of the lines is evident.

The localized effect of the pumping is evident from the fluctuations in the saturated thickness at Wells 804 through 807. These fluctuations were in response to reductions in pumping rates during the winter months to ensure that the evaporation pond storage capacity was not exceeded. Even with these seasonal fluctuations the decline in saturated thickness parallels the decline in the other monitoring wells. Although the pumping wells have a localized effect on the alluvial groundwater flow, they clearly cannot compete with the greater effect of the draining of the temporary saturation. This draining process will continue regardless of whether or not the pumping wells are operated.

Another way to evaluate the relative hydraulic effect of the pumping wells and the natural drainage is to estimate the flux of the alluvial water exiting the property boundary at Section 3

and compare this to the pumping rate. The flux was calculated based on Darcy's Law: Q = KiA where:

Q = Flux in gallons per minute

K = hydraulic conductivity in centimeters per second

i = hydraulic gradient

A = cross sectional area in square feet

The flux was calculated for a cross section drawn through Well GW-2 perpendicular to the axis of the alluvial valley. The location of the cross section (A-A') is shown on Figure 2.

Table 4 provides the values used in calculating the flux. As shown, the cross-sectional area of 10,395 square feet was estimated using the third quarter 1999 water level data for Wells GW-1, GW-2 and GW-3 and the approximate limit of saturated alluvium shown on Figure 2. The hydraulic conductivity value was from the aquifer test of Well 802, which was documented in the 1989 Annual Review (Canonie Environmental Services Corp. 1989). The hydraulic gradient was calculated from the water levels measured at Wells GW-2 and 627.

Using these input values, the flux from the property boundary was estimated to be 25 gallons per minute (gpm). This flux rate is considered to be conservative because it is based on the recent saturated thickness data. Considering that the saturated thickness at the GW wells has declined by about 12 feet since 1989, the flux would have been even higher in previous years. To illustrate this difference, the flux rate based on the October 1989 data is also shown in Table 4. The greater cross-sectional area for groundwater flow results in an estimated flux rate of 52 gpm in 1989.

Table 4 also lists the annual pumping rate for the Southwest Alluvium extraction wells. These values were compared to the estimated flux rates for each year since 1990. Figure 14 presents these data. The annualized flux rates on the figure were estimated by incrementally reducing the flux rate each year from the 52 gpm calculated for 1989 to the 25 gpm calculated for 1999. The flux rates were reduced by equal increments because the rate of water level decline has been very

consistent over this time period. As shown, the flux rate has exceeded the pumping rate throughout the ten-year corrective action period by 30 percent or more.

Based on this evaluation of the effect of the natural drainage on the alluvial groundwater system, groundwater pumping has not contained the migration of seepage-impacted water and will not do so in the future. As discussed in Section 2.3.4, seepage impacts were evident at the property boundary (Wells GW-1 and GW-3) in approximately 1980 or 1981, nine years prior to turning on the pumping wells. Yet the only seepage impacts evident in these downgradient wells have been elevated concentrations of chloride, bicarbonate and sulfate. No hazardous constituents migrated from the vicinity of the tailings impoundment because the alluvium neutralized the acid seepage and these constituents were attenuated. Continuing to operate the pumping wells will not improve the water quality or control the migration of hazardous constituents, whereas natural neutralization processes in the alluvium are much more effective.

3.0 FATE OF CONSTITUENTS OF CONCERN

This section discusses the fate of the constituents of concern, sulfate and TDS, that exceed the standards outside the property boundary in Section 1. The discussion focuses on assessing the dominant geochemical mechanisms controlling the migration of the two constituents. Both empirical and modeled data were used to identify the mechanisms and illustrate how they function in the different geochemical areas in the Southwest Alluvium water.

3.1 SULFATE

Figure 15 illustrates temporal sulfate concentration trends for the monitoring wells. The figure shows that the groundwater standard for sulfate is exceeded in wells in the seepage-impacted areas and in background wells.

The occurrence of sulfate above the groundwater standard in background wells indicates a postmining-pretailings source of sulfate, such as dissolution of a naturally occurring mineral. Gypsum ($CaSO_4 \cdot 2H_2O$) is ubiquitous in arid environments such as the Church Rock site. As the background mine water migrated through the alluvium, gypsum dissolved, resulting in calcium-sulfate rich water. This is the source of sulfate in the postmining-pretailings background water. A second source of sulfate in the impacted part of the Southwest Alluvium was the acidic plume. Sulfate in the plume originated primarily from sulfuric acid used in the milling process.

To evaluate the controls on sulfate concentration in Southwest Alluvium, water quality data were evaluated using the geochemical model, MINTEQA2 (Allison and others 1991). Median concentrations for 1998-1999 at each well were used as input to the model. Calculation file 1 in Appendix A provides details of the modeling, including input parameters, model runs, and results.

Figure 16 illustrates the model results. This figure shows the modeled gypsum saturation indices for groundwater at each well. The indices (indicated by red diamonds) are all slightly above and very close to the zero line within the zone where gypsum saturation occurs. The indices

demonstrate that water in the Southwest Alluvium is near equilibrium with gypsum. The fact that the indices are close to the zero line shows that gypsum precipitation and/or dissolution are important controls on the Southwest Alluvium sulfate concentrations. If this were not the case, the saturation indices would be scattered rather than nearly parallel to the zero saturation index line.

The saturation indices for the Background area wells (627, EPA 25, EPA 27 and GW-4) are also above the zero line, indicating that gypsum dissolution has occurred. This confirms dissolution of gypsum as the likely mechanism for the presence of sulfate in background groundwater at concentrations above the standard.

Reaction 2 shows the equation for the formation (or dissolution) of gypsum ($CaSO_4 \cdot 2H_2O$):

$$\mathbf{Ca^{2+} + SO_4^{2-} + 2H_2O \longleftrightarrow CaSO_4 \cdot 2H_2O} \qquad \mathbf{(2)}$$

The reaction indicates that an increase in the calcium concentration would result in a reduction in the sulfate concentration. The additional calcium would move the reaction toward the right, resulting in precipitation of gypsum. However, calcium concentrations are relatively stable within individual wells, as illustrated by the time-series graphs of calcium on Figure 17.

As dictated by the Phase Rule, calcium concentrations are essentially fixed by the presence of two calcium-bearing minerals, gypsum and calcite, in the Southwest Alluvium. As shown on Figure 18, calcite is also slightly saturated in Southwest Alluvium wells. Because of the Phase Rule, calcium concentrations cannot increase and, therefore, sulfate concentrations are similarly stable. Therefore, the Corrective Action Program is not and will not be an effective means to reduce sulfate concentrations because they are controlled purely by natural geochemical processes.

3.2 TOTAL DISSOLVED SOLIDS

As shown in Table 1, TDS concentrations are exceeded in several of the Southwest Alluvium wells, including Background area Well 627. These exceedances are related to the presence of elevated concentrations of sulfate in the water. Figure 19 illustrates the contribution of major ions to TDS and shows that sulfate contributes more than 50 percent of the TDS. Because sulfate contributes more to TDS than all other ions combined, TDS concentrations are determined primarily by the concentrations of sulfate in the water. As discussed above, sulfate is expected to remain at concentrations that will cause TDS to exceed the standards both within the seepage-impacted area and in the unimpacted water.

4.0 SUMMARY AND RECOMMENDATIONS

The evaluation of Southwest Alluvium water geochemistry demonstrates the following:

- Sulfate and TDS are the only remaining constituents of concern. The high neutralization capacity of the alluvium has neutralized the acidic seepage and naturally reduced all radionuclides and metals (except manganese) to meet the water quality standards.
- Chloroform, chloride, and manganese water quality standards are exceeded only at localized wells near the tailings and have never been exceeded off-site and changes in their concentrations have been independent of the corrective action.
- Sulfate will continue to exceed the water quality standards both in the seepage-impacted area and in the Background area.
- The majority of TDS is composed of sulfate; therefore, TDS concentrations mimic sulfate.
- Seepage impacts were evident in wells downgradient of the pumping wells ten years before the extraction system was installed and began operating. However, impacts in the downgradient areas are limited to chloride and bicarbonate.
- Pumping has removed about one-third of the water that flows through the Southwest Alluvium at the Section 2/3 boundary. The remainder has migrated downgradient.
- The lack of groundwater containment by pumping means that hazardous constituents, in addition to sulfate and TDS, should be strongly evident in downgradient wells. The lack of these hazardous constituents demonstrates that natural attenuation is controlling the extent of seepage impacts.

Considering the Southwest Alluvium geochemical conditions documented in this report, United Nuclear advocates the following approach for terminating the CERCLA Correction Action Program in the Southwest Alluvium:

1. Monitored Natural Attenuation

- To account for source treatment (tailings reclamation was completed in 1996) and
- To account for natural attenuation which:
  - Mitigates the migration of hazardous constituents – acidic pH is neutralized, causing metals and radionuclide precipitation, and

- Stabilizes the plume – equilibrium conditions maintain sulfate at its current or lower concentrations.

2. Technical Impracticability Waiver

- To account for the natural geochemical conditions which prevent attaining standards for sulfate and TDS (gypsum equilibrium).

3. Institutional Controls

- To support MNA and TI and
- To provide an added level of protection of human health and the environment.

The administrative process for implementing this combined approach includes input from all four agencies involved at this site. To handle the MNA and TI processes, United Nuclear would submit a TI Waiver to the EPA and an ACL application to the NRC. The ACL application is addressed in Appendix A to 10 Code of Federal Regulations Part 40. The Navajo Superfund would provide concurrence on IC and the submittals provided to EPA and NRC. New Mexico Environment Department would provide concurrence on the overall approach as well as the submittals provided to EPA and NRC. Final concurrence for the combined approach would be obtained from the Department of Energy prior to site transfer for long-term care.

To gain regulatory acceptance of the proposed remedy, UNC requests a test period to temporarily shut off the extraction wells. The purpose of the test period is to demonstrate that the natural system, not pumping, is controlling migration of the seepage and that there will be no adverse impacts to water quality. The wells would be shut off for a period of one to two years and water level and water quality would continue to be monitored bimonthly. The pumping wells would be maintained in an operational condition so they could be turned on at any time, if necessary.

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TABLES

TABLE 1
SOUTHWEST ALLUVIUM EXCEEDANCES OF STANDARDS
THIRD QUARTER 1999[1]

Well Number	Lab TDS (mg/L)	Sulfate (mg/L)	Chloride (mg/L)	Manganese (mg/L)	Chloroform (mg/L)	Lead-210 (pCi/L)	Location With Respect to Property Boundary	
							Inside	Outside
NRC Standard	NA	2125	NA	NA	0.001	1		
EPA Standard	4800	2125	250	2.6	NA	NA		
509 D	6620	3000	312	0.56	-0.001	-1	X	
624	5020	2070	181	0.02	-0.001	-1		X
627	5320	2620	67.7	0.08	-0.001	3		X
632	6140	2830	244	0.72	0.0018	2.9	X	
801	7950	4240	220	12.60	0.0035	-1	X	
802	7350	3160	207	1.13	0.0014	-1	X	
803	6910	3100	178	1.55	-0.001	-1	X	
EPA 23	4640	2300	86	2.33	-0.001	-1	X	
EPA 25	4040	1740	84	0.30	-0.001	-1		X
EPA 28	5390	3010	106	0.26	-0.001	-1		X
GW-1	4190	1900	125	0.02	-0.001	-1	X	
GW-2	5530	2660	166	0.40	-0.001	-1	X	
GW-3	4610	1830	126	1.69	-0.001	-1	X	
GW-4 (dry)	--	--	--	--	--	--	X	
EPA 27 (dry)	--	--	--	--	--	--		X
29 A (dry)	--	--	--	--	--	--	X	
639 (dry)	--	--	--	--	--	--	X	
642 (dry)	--	--	--	--	--	--	X	
644 (dry)	--	--	--	--	--	--	X	
645 (dry)	--	--	--	--	--	--	X	

Notes:
[1] Data for Well 803 from second quarter, 1999
TDS = total dissolved solids
mg/L = milligrams per liter
pCi/L = picoCuries per liter
"-" (minus sign) indicates that the constituent concentration is less than the laboratory reporting limit.

NA = not applicable
Shading indicates concentration exceeds the site cleanup standard.
-- = no data available

TABLE 2
SOUTHWEST ALLUVIUM GEOCHEMICAL AREAS

Well Number	Field pH (SU)	Bicarbonate (mg/L)	Chloride (mg/L)	Manganese (mg/L)	Chloroform (mg/L)	Sulfate (mg/L)
NRC Standard	NA	NA	NA	NA	0.001	2125
EPA Standard	NA	NA	250	2.6	NA	2125
Transition Area						
801	6.5	1,420	220	12.60	0.0035	4,240
802	6.5	2,120	207	1.13	0.0014	3,160
632	6.3	1,910	244	0.72	0.0018	2,830
803	6.5	1,960	178	2.33	-0.001	3,100
509 D	6.5	1,540	312	0.56	-0.001	3,000
GW-2	6.4	1,410	162	0.34	-0.001	2,500
GW-3	6.7	1,170	126	1.69	-0.001	1,830
EPA 23	6.7	1,120	86	0.30	-0.001	2,300
624	6.7	1,070	181	0.02	-0.001	2,070
GW-1	6.7	770	125	0.02	-0.001	1,900
EPA 28	6.9	557	106	0.40	-0.001	3,010
Background Area						
627	7	594	67.7	0.08	-0.001	2,620
EPA 27 (dry)	7.5	31	123	0.02	-0.001	1,790
EPA 25	6.8	941	84	0.26	-0.001	1,740
GW-4 (dry)	7.2	644	50.1	0.10	-0.001	1,620

Notes:
SU = Standard pH units
mg/L = milligrams per liter
NA = not applicable
Blue lettering indicates near neutral to neutral field pH.
dry = well no longer has sufficient water to sample.

"-" (minus sign) indicates that the constituent concentration is less than the laboratory reporting limit.
indicates concentration exceeds the site cleanup standard.

C1

TABLE 3
CONSTITUENT CONCENTRATION PATTERNS FOR
EVALUATING SOUTHWEST ALLUVIUM SEEPAGE IMPACTS

	Well	Current Constituent Concentrations						Time Period Impacts First Detected	Recent Trend In Water Quality	Remarks
		Chloride > 150 mg/L	Bicarbonate > 1,000 mg/L	Ca/Mg Ratio < 1.5	Mg-SO_4 Water Type	Metals Exceed Standards	Chloroform Detected			
Background	GW-4									Well dry as of April 1999.
	627									
	EPA 27									Well dry as of July 1997.
	EPA 25									
Impacted	GW-1							1980	improving	Water returning to pre-impacted quality
	EPA 28							Pre-1989		Completed 12 feet into Mancos Shale. Well installed in 1989, historical impacts estimated from nearby wells
	GW-3							1981	improving	
	624							Oct-96	degrading	
	GW-2							1981	improving	
	803							Pre-1989		Well installed in 1989, historical impacts estimated from nearby wells
	EPA 23							Pre-1989		Well installed in 1989, historical impacts estimated from nearby wells
	509 D							1982 - 1988		
	802							Pre-1989		Well installed in 1989, historical impacts estimated from nearby wells
	632							Pre-1989		Well installed in 1989, historical impacts estimated from nearby wells
	801					Mn		Pre-1989	improving	Well installed in 1989, historical impacts estimated from nearby wells

Notes:
= mildly impacted (chloride and/or bicarbonate only; no groundwater quality standards exceeded).
= groundwater standard exceeded.
> = greater than
< = less than
mg/L = milligrams per liter
Ca = calcium
Mg = magnesium
Mn = manganese
SO4 = sulfate
Based on July 1999 data unless dry; Well 803 data from April 1999.

TABLE 4
SOUTHWEST ALLUVIUM GROUNDWATER FLUX CALCULATIONS

Area of 1999 Saturated Cross Section (A):

From	To	Area (ft^2)
West side	GW-3	1,155
GW-3	GW-2	2,700
GW-2	GW-1	4,640
GW-1	East Side	1,900
		10,395

1999 Saturated Thickness:

Well	Thickness (ft)
GW-3	7
GW-2	38
GW-1	20

Area of 1989 Saturated Cross Section (A):

From	To	Area (ft^2)
West side	GW-3	2,970
GW-3	GW-2	4,080
GW-2	GW-1	6,480
GW-1	East Side	2,945
		16,475

1989 Saturated Thickness:

Well	Thickness (ft)
GW-3	18
GW-2	50
GW-1	31

Hydraulic Gradient (i):

Distance from GW-2 to Well 627 = 2,550 ft

Difference in water level elevation, 4th Quarter 1989 = 6870.10 - 6846.80 = 23.3 ft

i (1989) = 23.3/2,550 = 0.009 ft/ft

Difference in water level elevation, 3rd Quarter 1999 = 6857.98 - 6839.22 = 18.76 ft

i (1999) = 18.76/2,550 = 0.007 ft/ft

Hydraulic Conductivity (K):

Data from Well 802 pumping test (Canonie Environmental Services Corp. 1989)

K = 1.8E-02 cm/sec at Well 632

K = 2.9E-02 cm/sec at Well 804

Average K = 2.4E-02 cm/sec

Flux (Q): Q = K x i x Area

25 gpm in 1999; 52 gpm in 1989

Pumping Well Annual Rates:

Year	Rate (gpm)	Year	Rate (gpm)		
1990	14.3	1995	25.6	**Average:**	23.8
1991	25.6	1996	24.5		
1992	30.3	1997	20.3		
1993	32.1	1998	19.3		
1994	28.8	1999	16.8		

FIGURES

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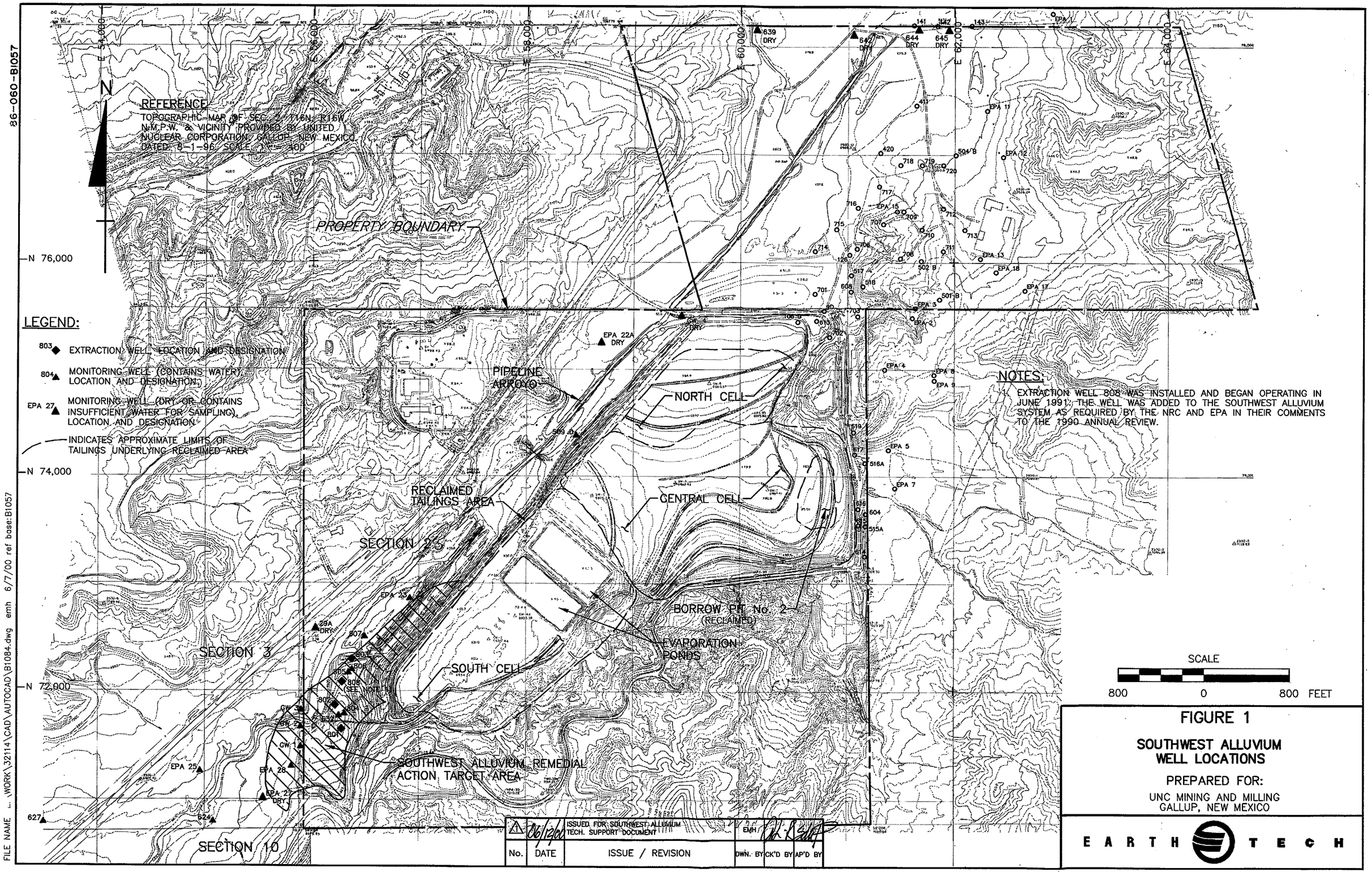

NOTES:

1. EXTRACTION WELL 808 WAS INSTALLED AND BEGAN OPERATING IN JUNE 1991. THE WELL WAS ADDED TO THE SOUTHWEST ALLUVIUM SYSTEM AS REQUIRED BY THE NRC AND EPA IN THEIR COMMENTS TO THE 1990 ANNUAL REVIEW.

No.	DATE	ISSUE / REVISION	DWN. BY	CK'D BY	AP'D BY
1	06/12/00	ISSUED FOR SOUTHWEST ALLUVIUM TECH. SUPPORT DOCUMENT	EMH		

FIGURE 1

SOUTHWEST ALLUVIUM WELL LOCATIONS

PREPARED FOR:

UNC MINING AND MILLING
GALLUP, NEW MEXICO

EARTH TECH

FILE NAME ...\WORK\32114\CAD\AUTOCAD\B1084.dwg emh 6/7/00 ref base:B1057

1

86-060-B1060

N

N 74,000

N 72,000

E 54,000

E 56,000

PROPERTY BOUNDARY

APPROXIMATE LIMIT OF SATURATED ALLUVIUM

CENTRAL CELL

509 D

T1-A

T2-A

EVAPORATION PONDS

SECTION 2

RECLAIMED TAILINGS AREA

SOUTH CELL

SECTION 3

DIRECTION OF ALLUVIAL WATER FLOW

29 A

807

803

806

805

808

802

804

801

A

A'

GW 3

GW 2

GW 1

EPA 28

EPA 25

EPA 27 (DR4)

PIPELINE ARROYO

APPROXIMATE EXTENT OF ALLUVIUM

627

624

SECTION 10

NOTES:

1. WELL 808 INSTALLED JUNE 1991 IN ACCORDANCE WITH AMENDMENT 12 OF THE NRC LICENSE.
2. CROSS SECTION A-A' USED FOR FLUX CALCULATION.

LEGEND:

- 624 — MONITORING WELL
- 632 — POINT OF COMPLIANCE MONITORING WELL
- T1-A — SOIL BORING
- 801 — SOUTHWEST ALLUVIUM EXTRACTION WELL
- 804 — SOUTHWEST ALLUVIUM OBSERVATION WELL
- APPROXIMATE AREA IMPACTED BY TAILINGS SEEPAGE

C3

SCALE

400 0 400 FEET

FIGURE 2

APPROXIMATE CURRENT EXTENT OF SEEPAGE IMPACTS IN SOUTHWEST ALLUVIUM

PREPARED FOR:

UNC MINING AND MILLING
GALLUP, NEW MEXICO

EARTH TECH

REFERENCE:
TOPOGRAPHIC MAP OF SEC. 2, T16N, R16W N.M.P.M. & VICINITY PROVIDED BY UNITED NUCLEAR CORPORATION, GALLUP, N.M. DATED: 8-1-96. SCALE: 1" = 400'.

No.	DATE	ISSUE / REVISION	DWN. BY	CK'D BY	AP'D BY
1	06/12/00	ISSUED FOR SOUTHWEST ALLUVIUM TECH. SUPPORT DOCUMENT	EMH		

FILE NAME L:\WORK\32114\CAD\AUTOCAD\B1119.dwg emh 6/7/00 ref base:B1060

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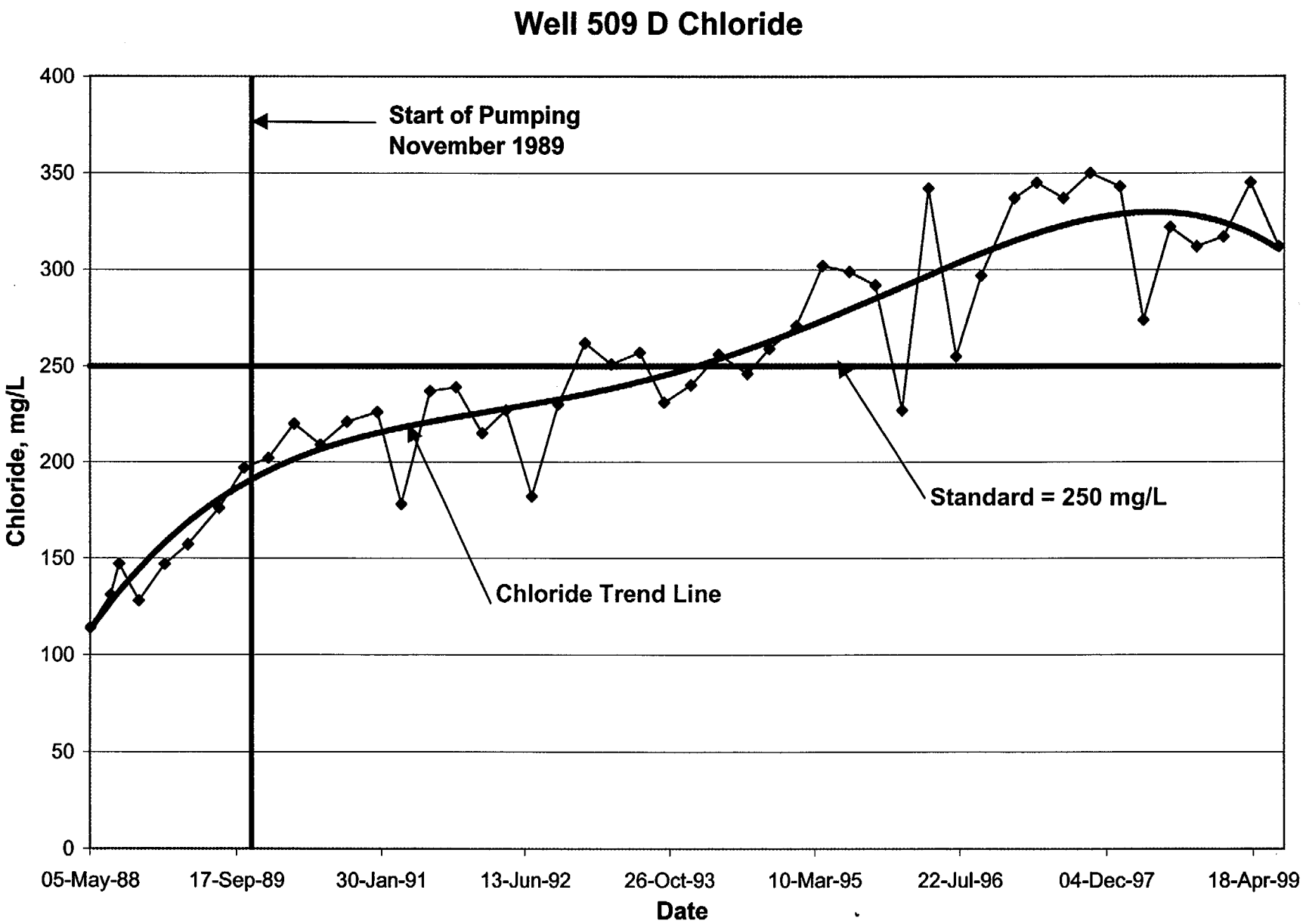

L:\Work\32114\Product\SWA GW Geochem\Figures\ Figure 3 Chart 2\Figure 3 Chart 2

FIGURE 3

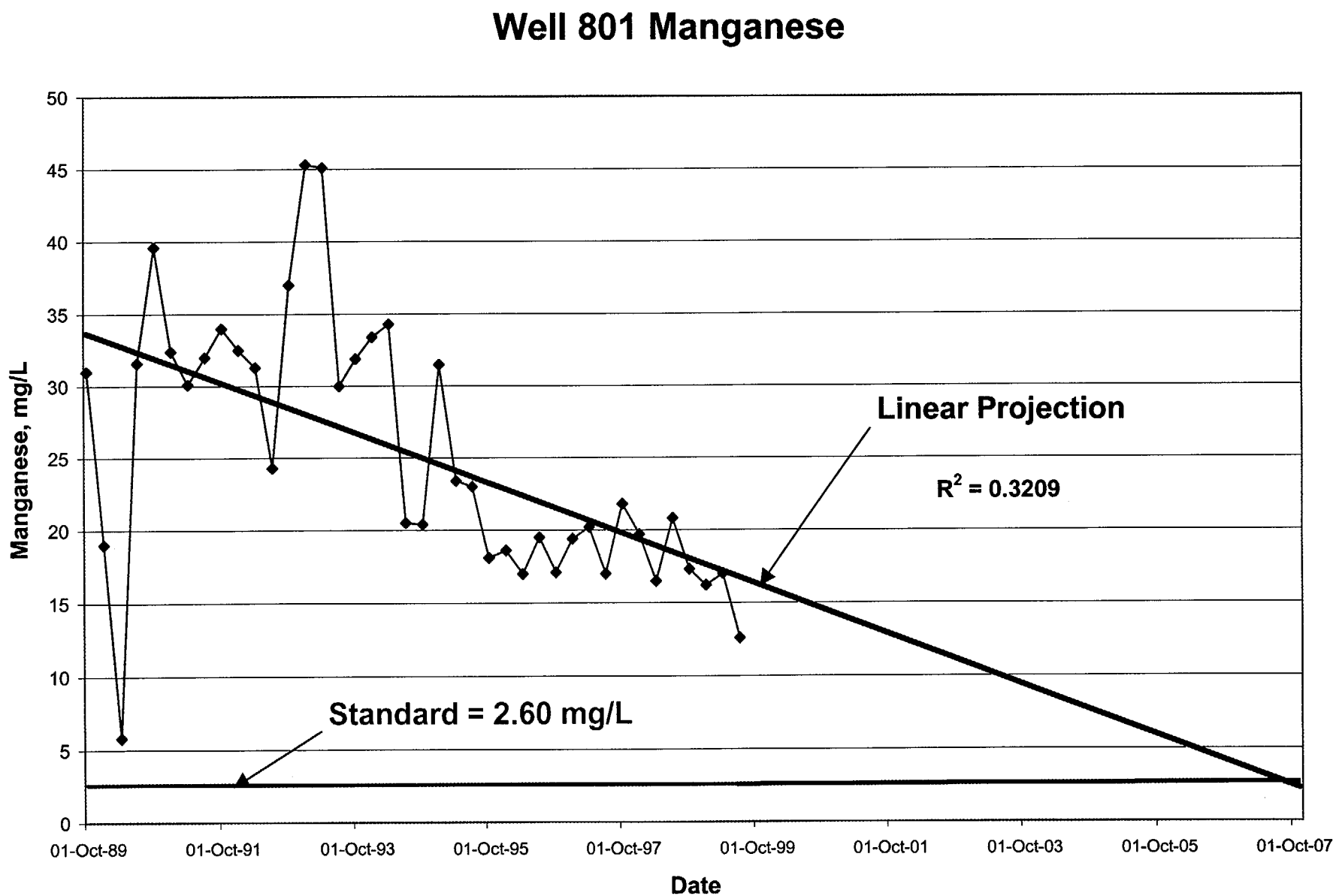

FIGURE 4

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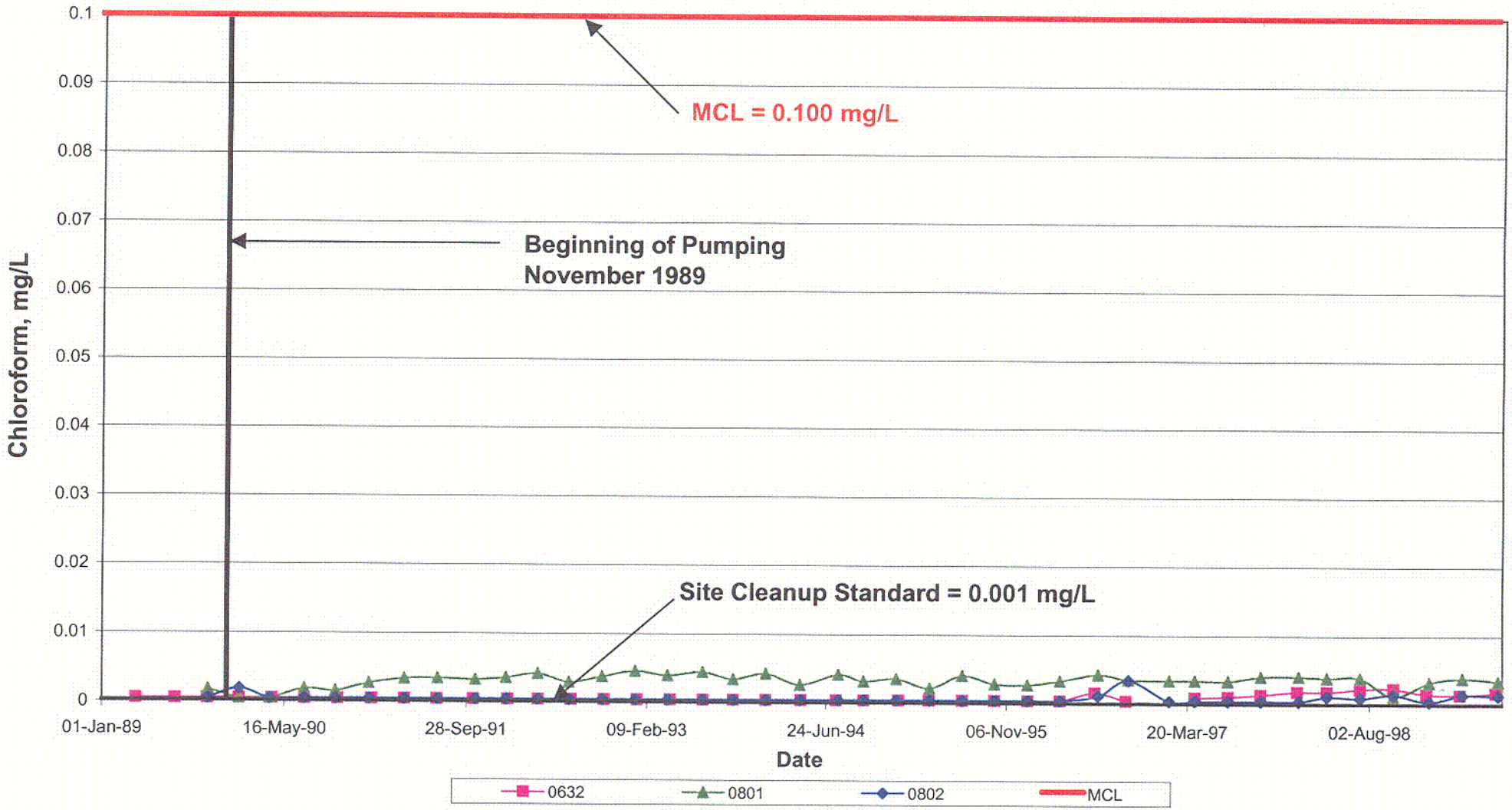
Southwest Alluvium Chloroform Exceedances



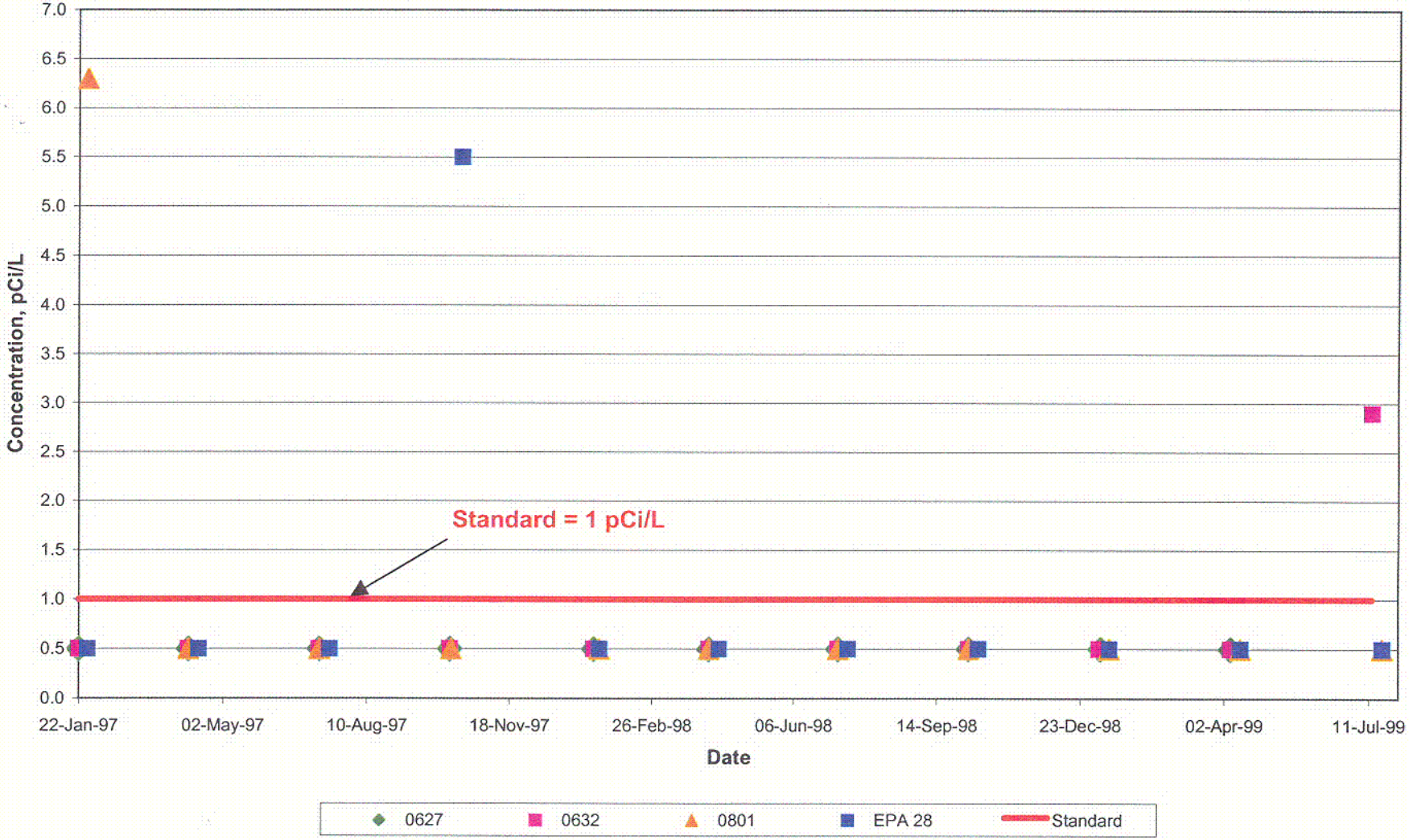
Note: Nondetect concentrations shown as one-half the laboratory reporting limit of 0.001 mg/L.

C4

FIGURE 5

L:\Work\32114\Product\SWA GW Geochem\Figures\ Figure 5 Chart 1\Figure 5 Chart 1

Southwest Alluvium Lead-210 Exceedances

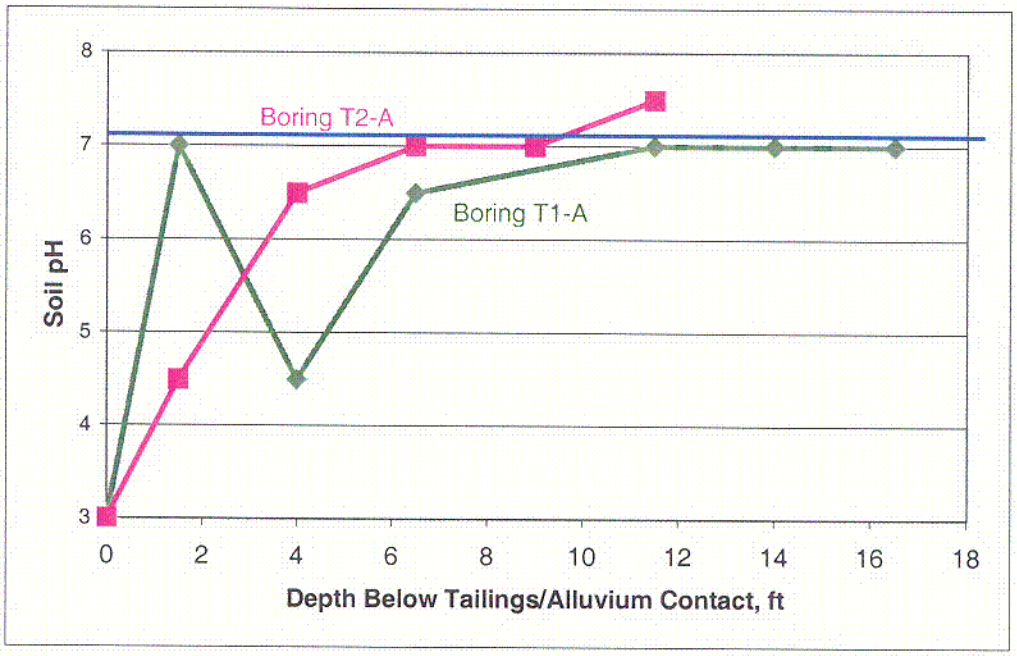


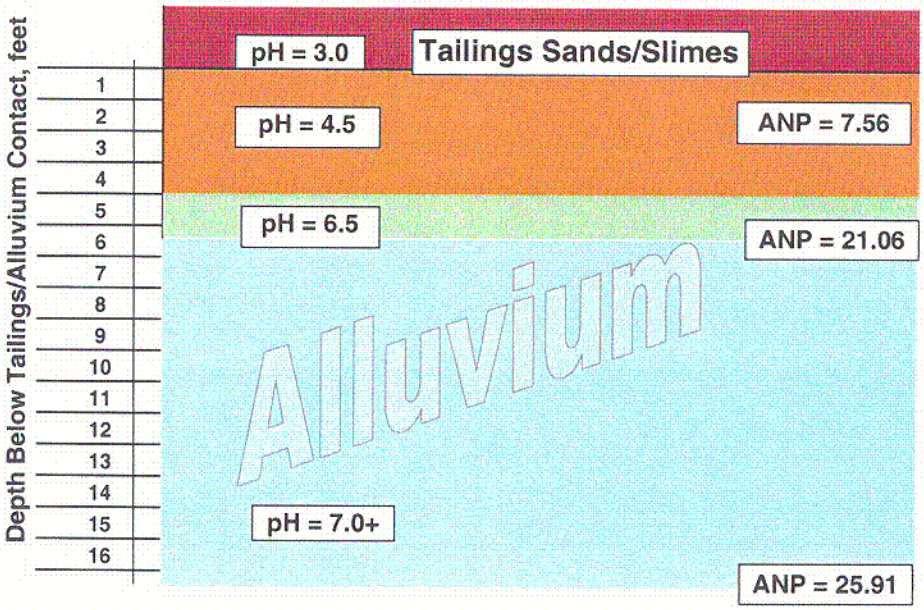
Note: Nondetect concentrations shown as one-half the laboratory reporting limit of 1 pCi/L

C5

FIGURE 6

L:\Work\32114\Work\Engineering\ACLs Background\NMED PRESENTATION\Southwest Alluvium\SWA Tech Support Document\Figures\Figure 6 Chart 1\Figure 6 Chart 1



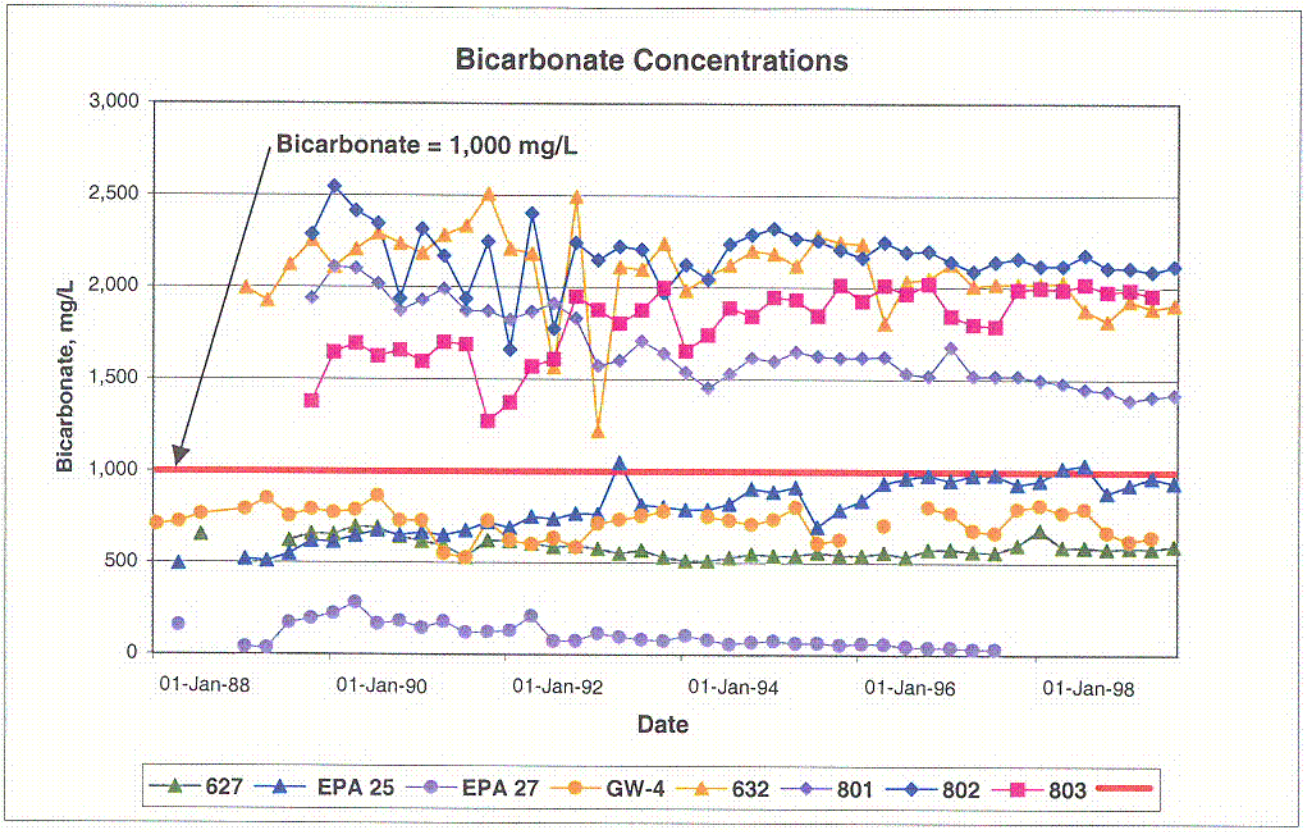


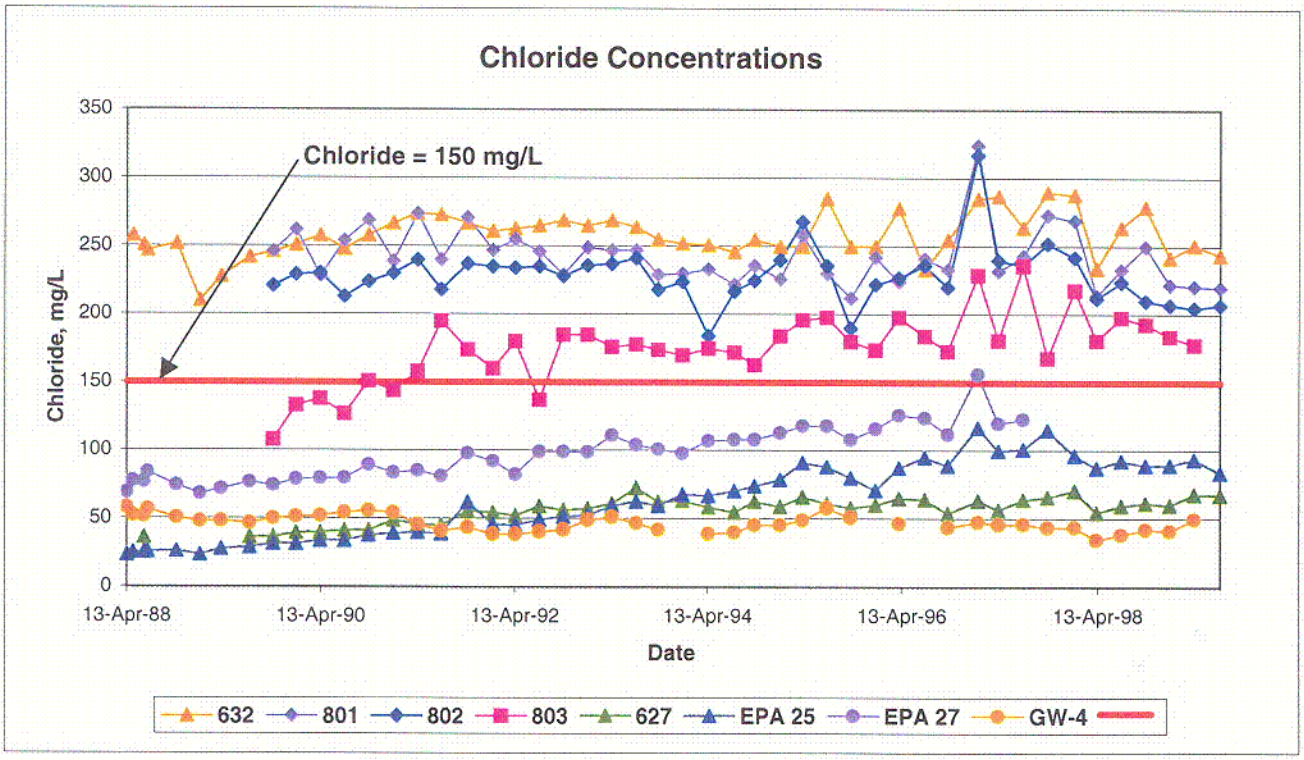
Neutralization Capacity of the Alluvium

C6

L:\Work\32114\Product\SWA GW Geochem\Figures\ Figures for SWA Tech Support.xls\Figure 7

FIGURE 7





Bicarbonate and Chloride Concentrations in Some Southwest Alluvium Wells

C7

FIGURE 8

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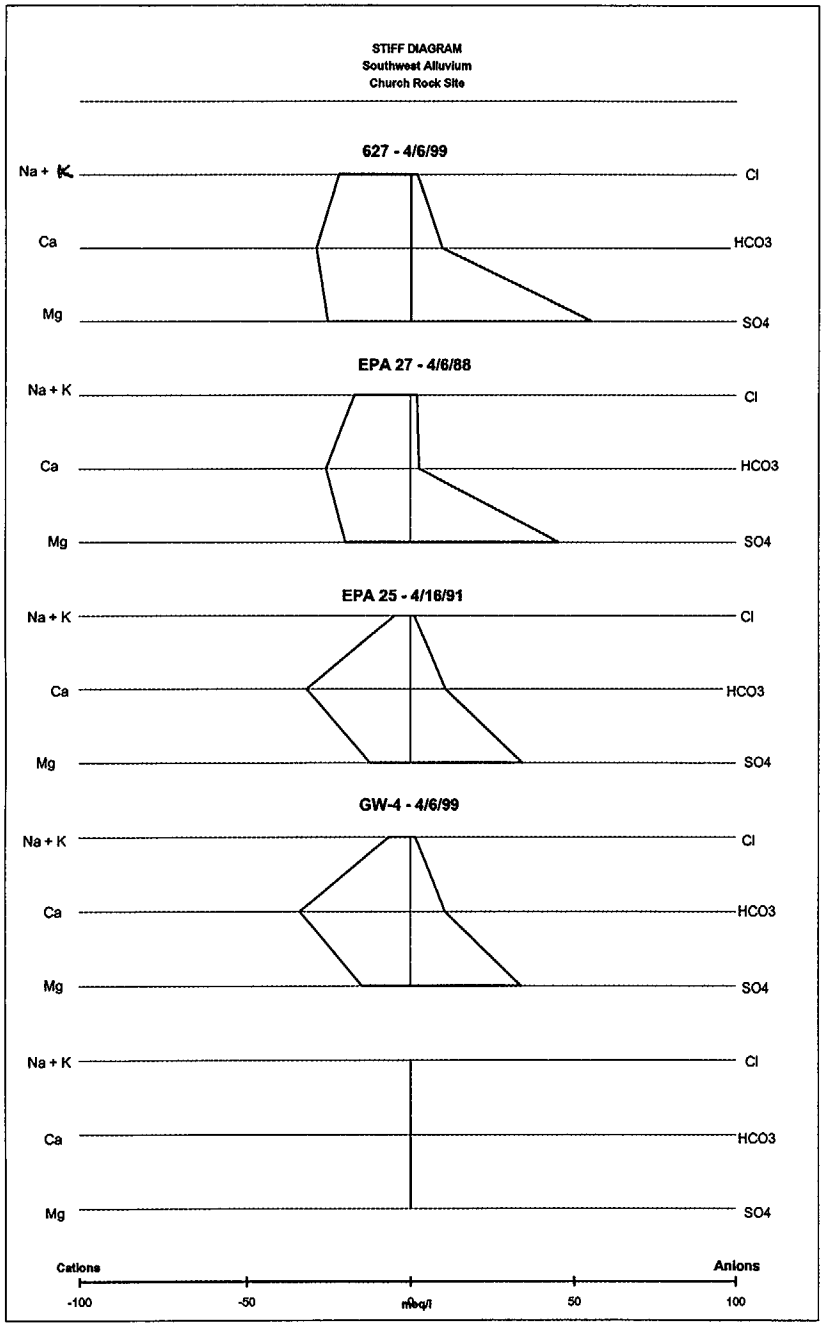
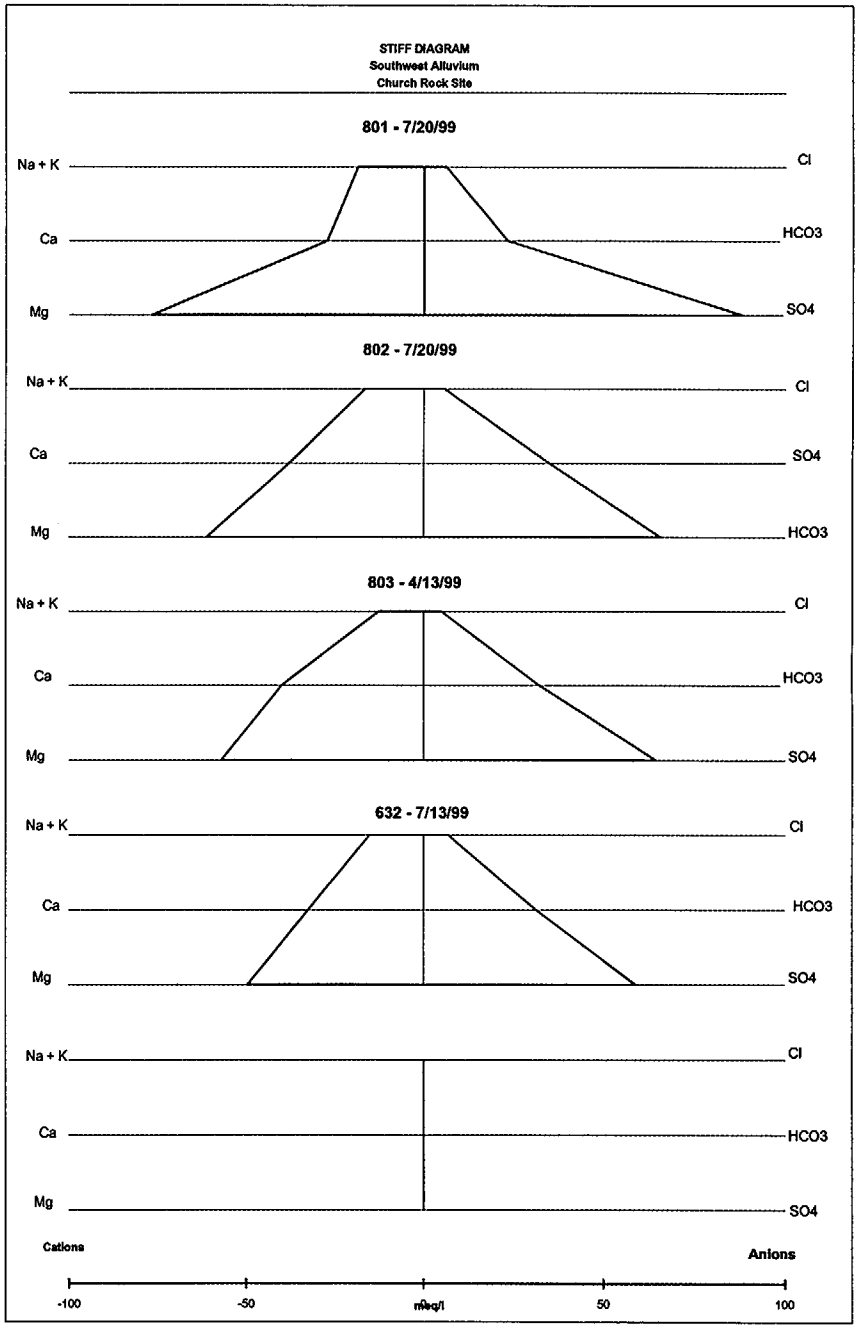


Background Water



Seepage-Impacted Water

Stiff Diagrams of Background and Seepage-Impacted Water

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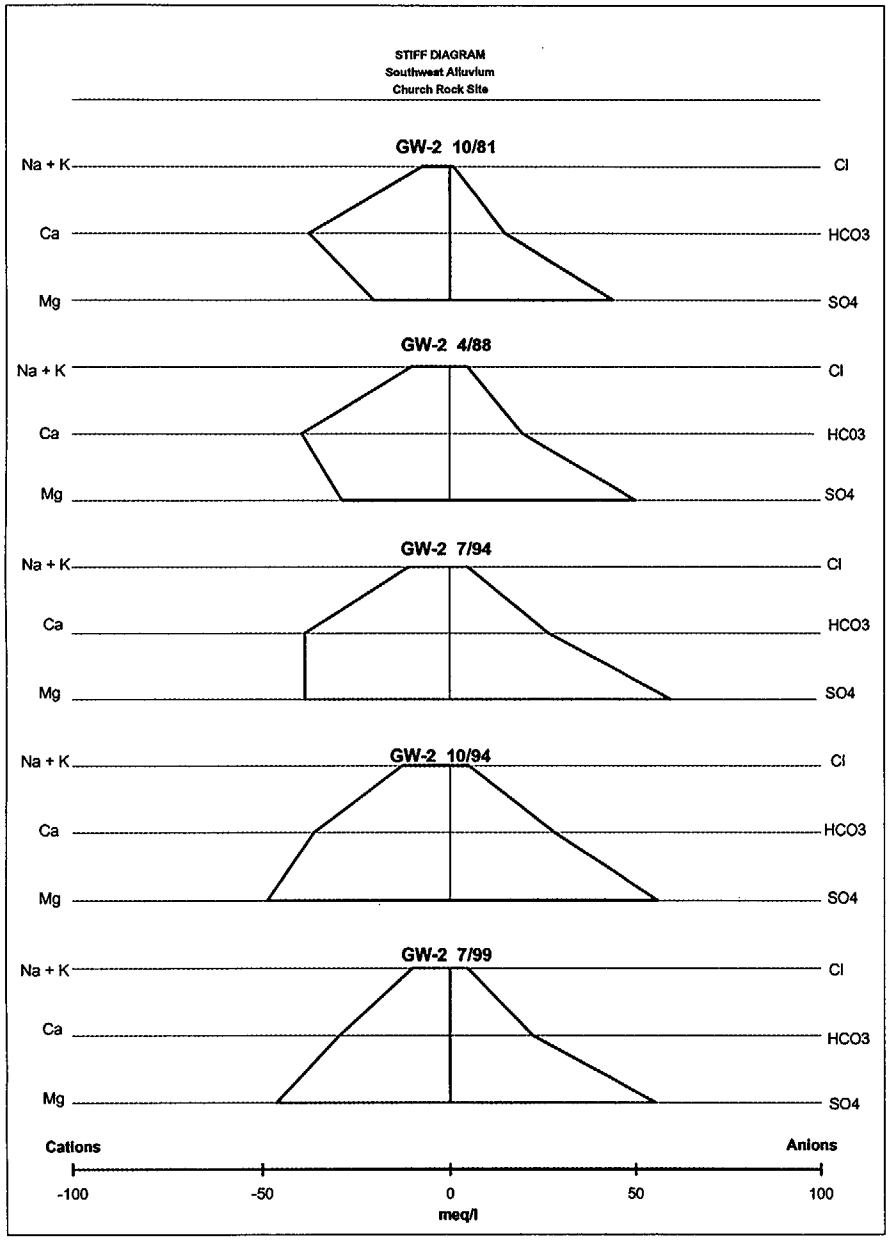
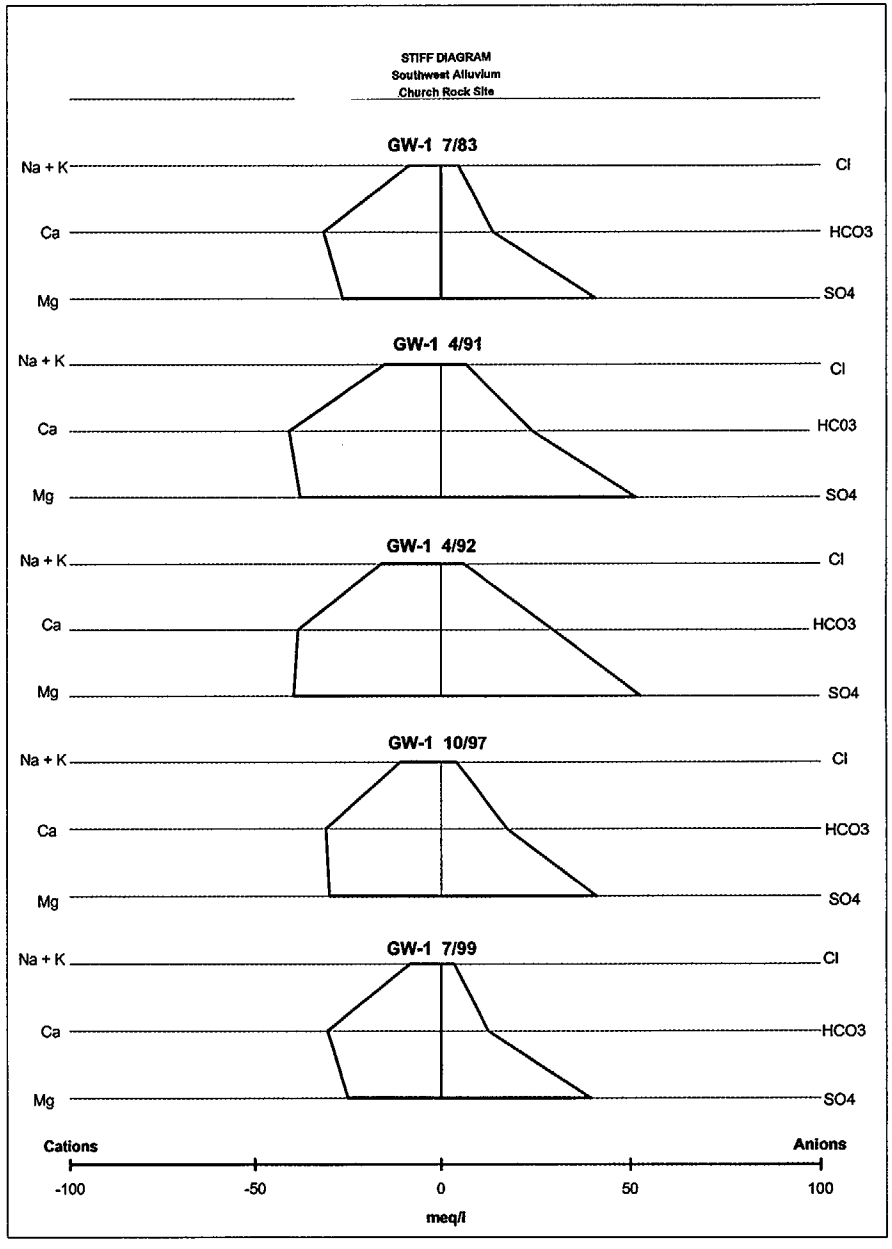
FIGURE 9



Well GW-2

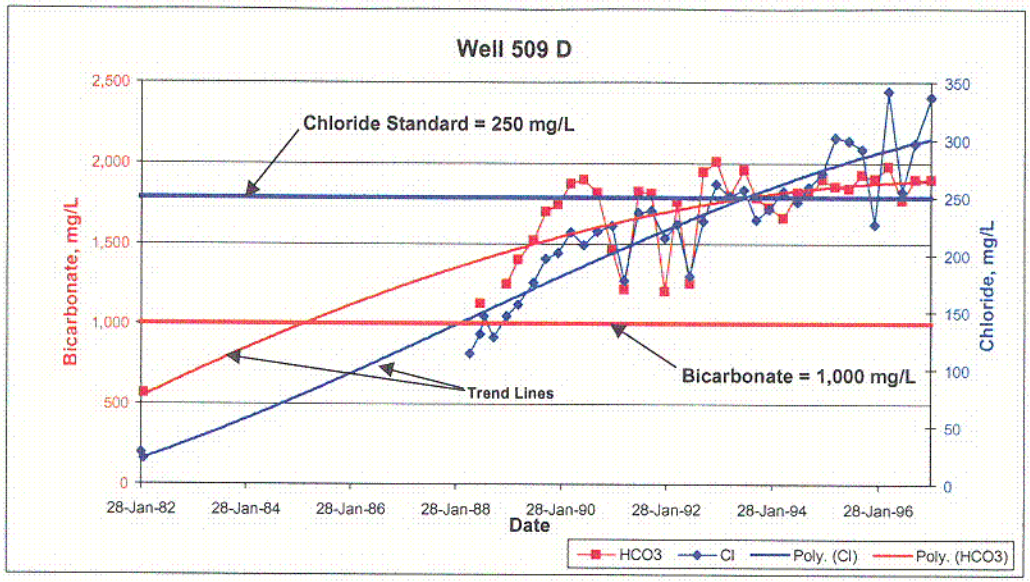


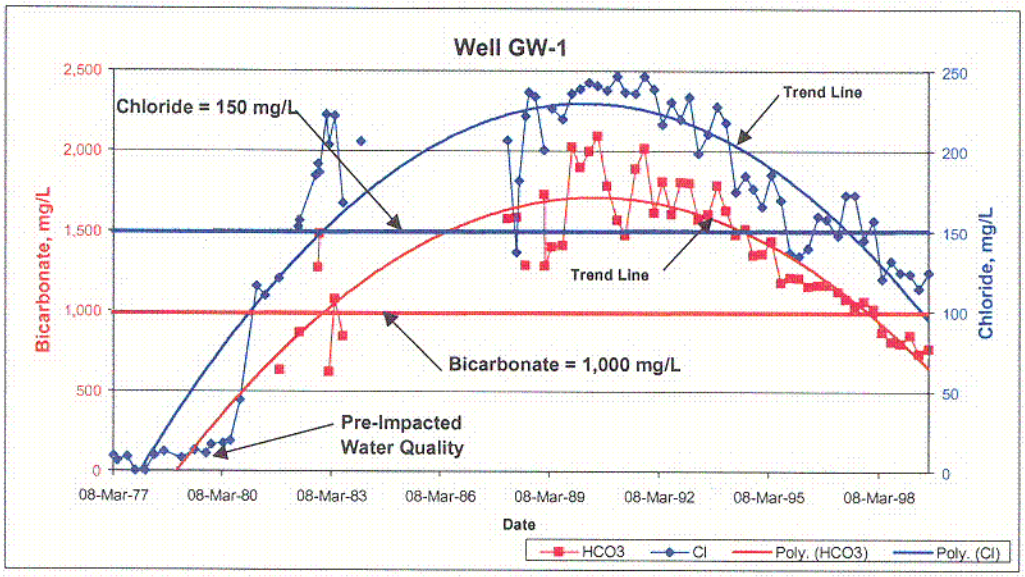
Well GW-1

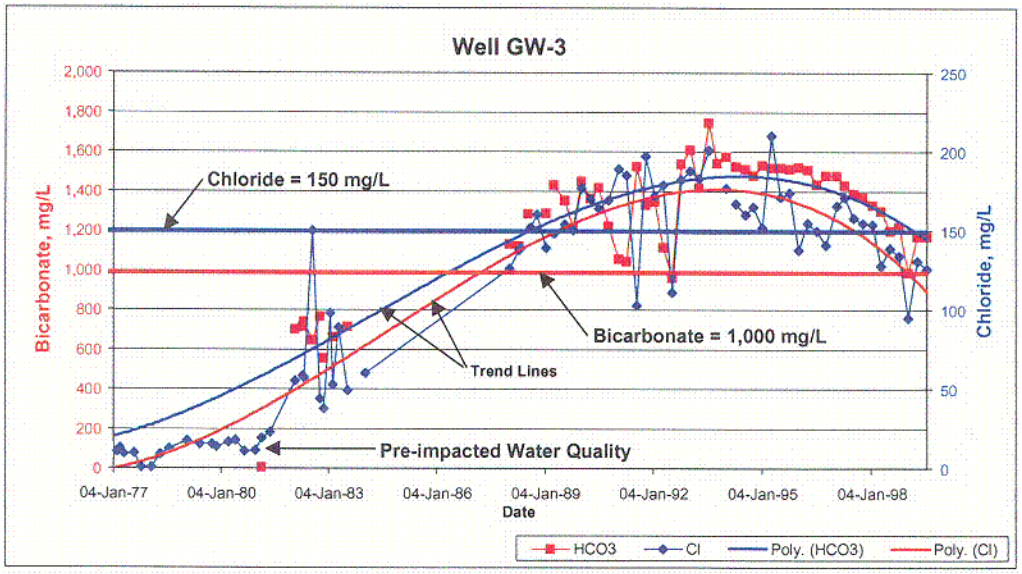
Change In Water Type Over Time

L:\Work\32114\Product\SWA GW Geochem\Figures\ Figures for SWA Tech Support\Figure 10

FIGURE 10





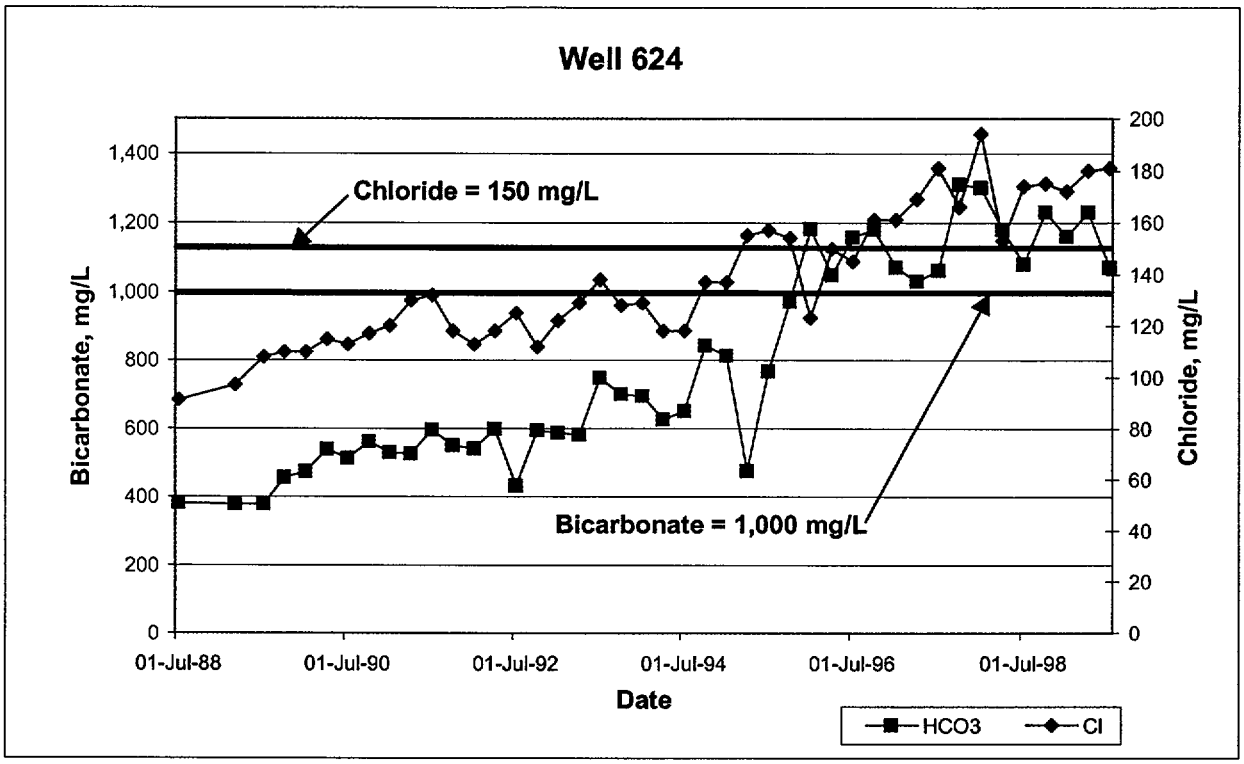


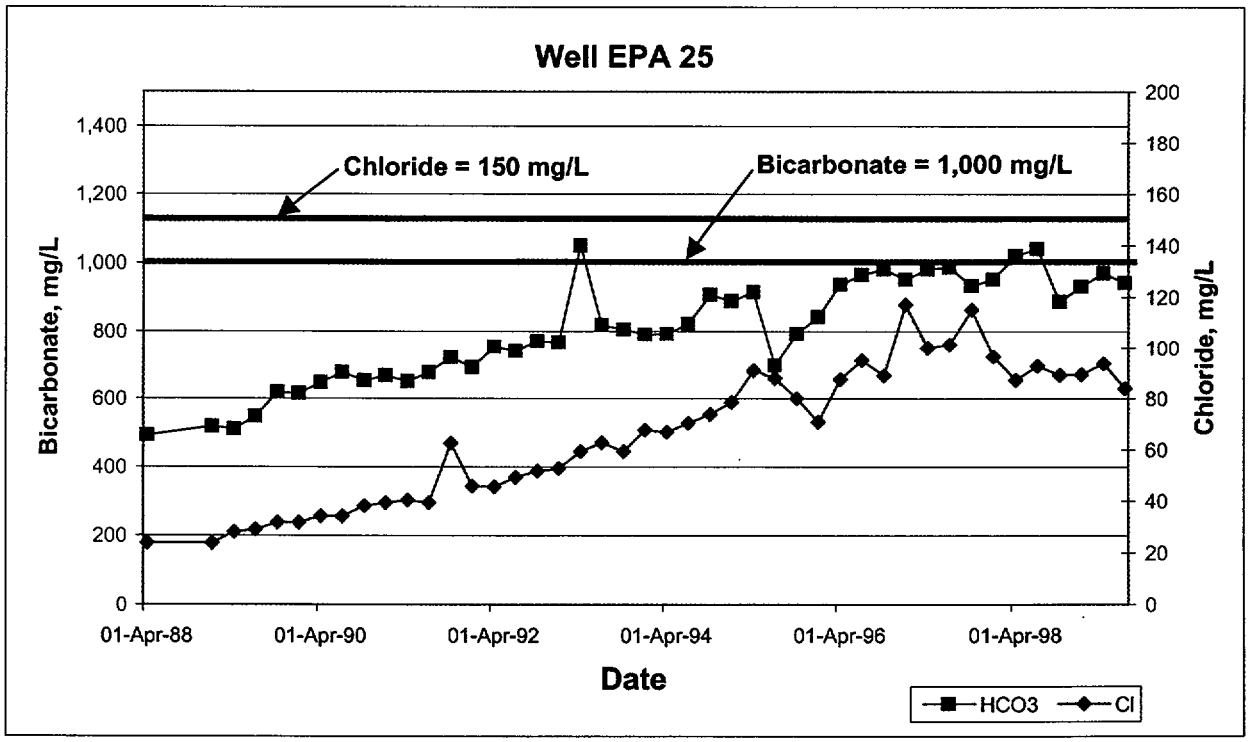
Chloride and Bicarbonate Trends In Wells 509 D, GW-1 and GW-3

C8

FIGURE 11

L:\Work\32114\Product\SWA GW Geochem\Figures\ Figures for SWA Tech Support\Figure 11

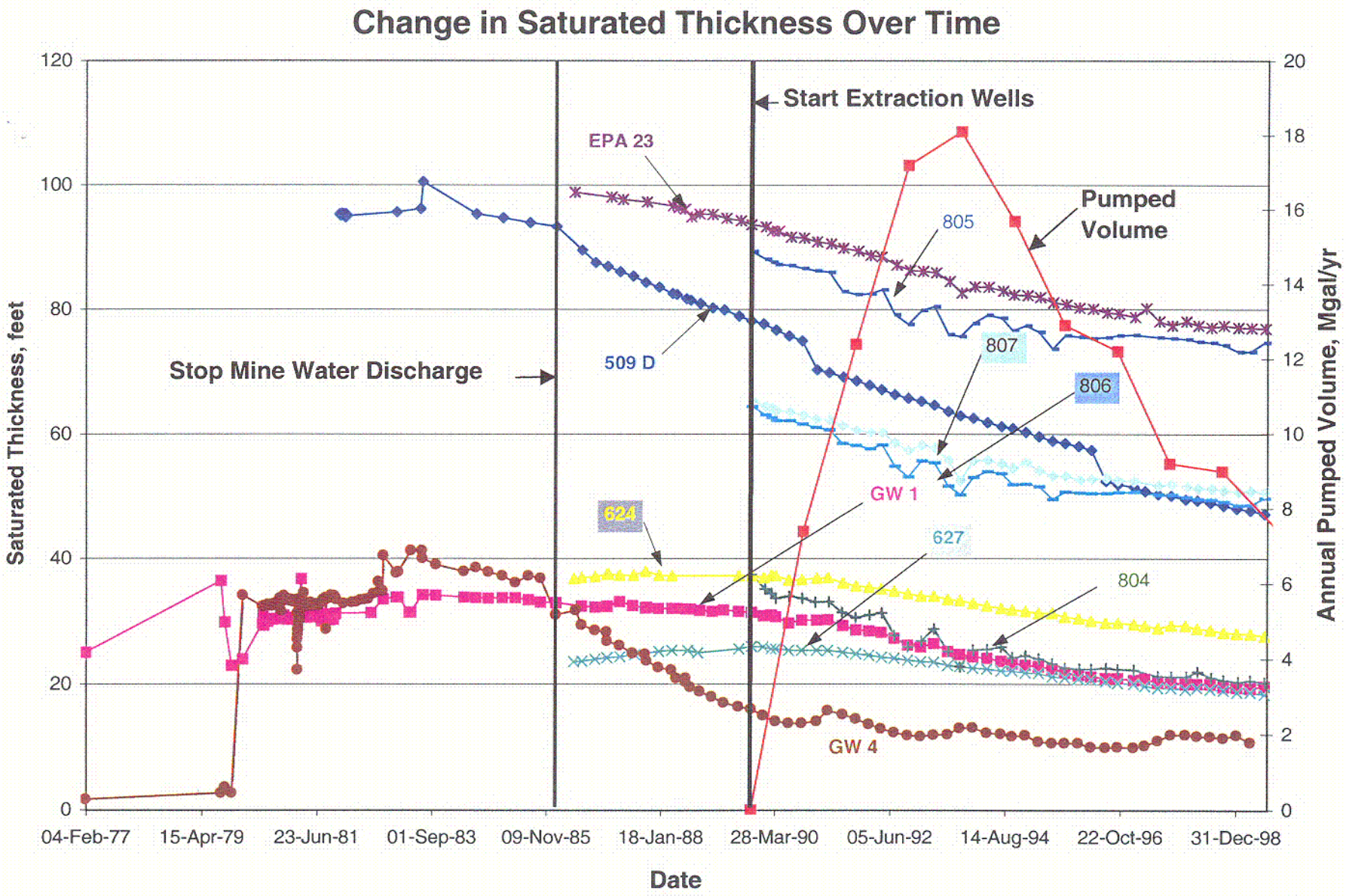




Chloride and Bicarbonate Trends In Wells 624 and EPA 25

L:\Work\32114\Product\SWA GW Geochem\Figures\ Figures for SWA Tech Support\Figure 12

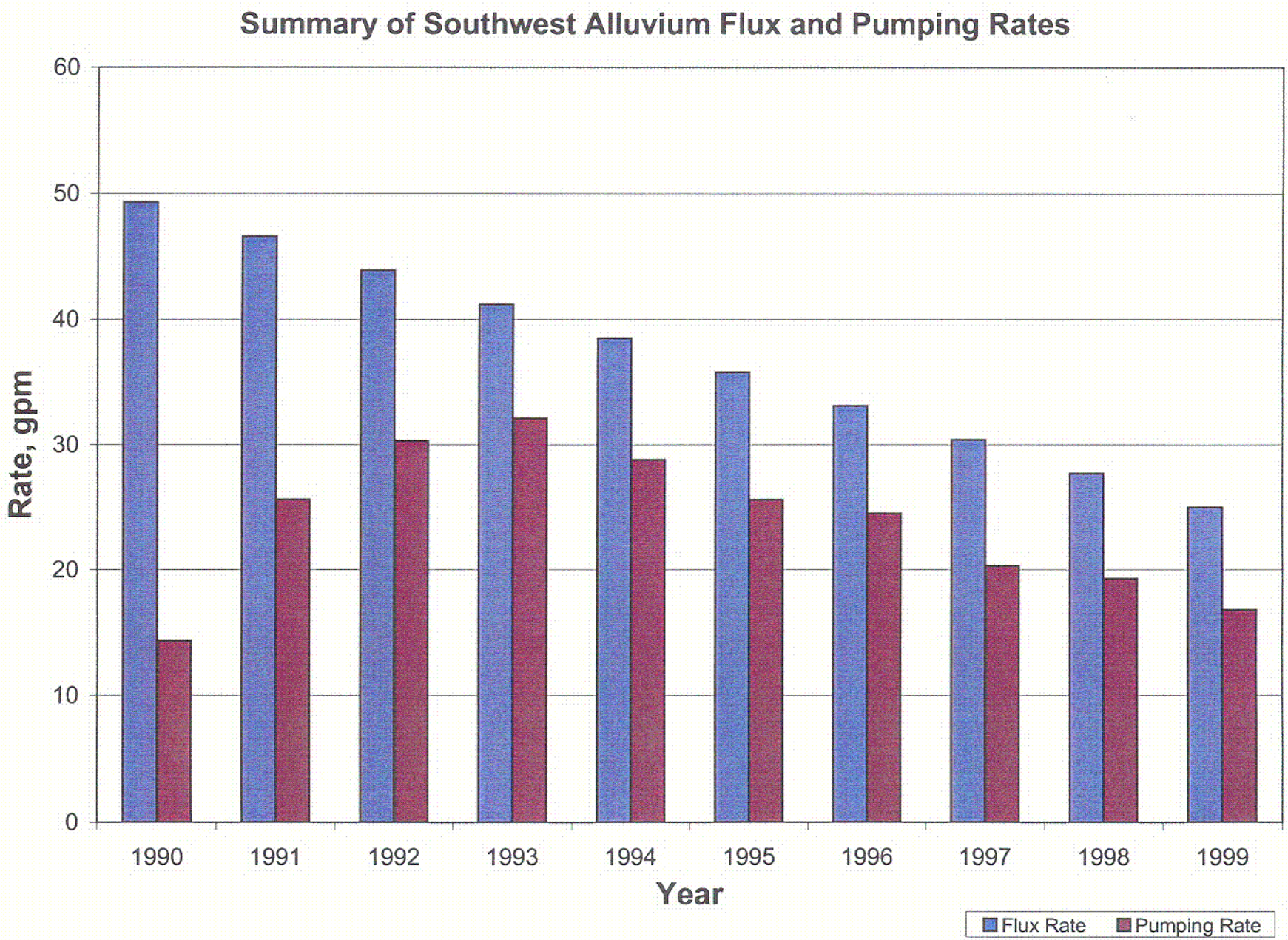
FIGURE 12



C9

FIGURE 13

L:\Work\32114\Product\SWA GW Geochem\Figures\ Figure 13 Chart 1\Figure 13 Chart 1



C10

FIGURE 14

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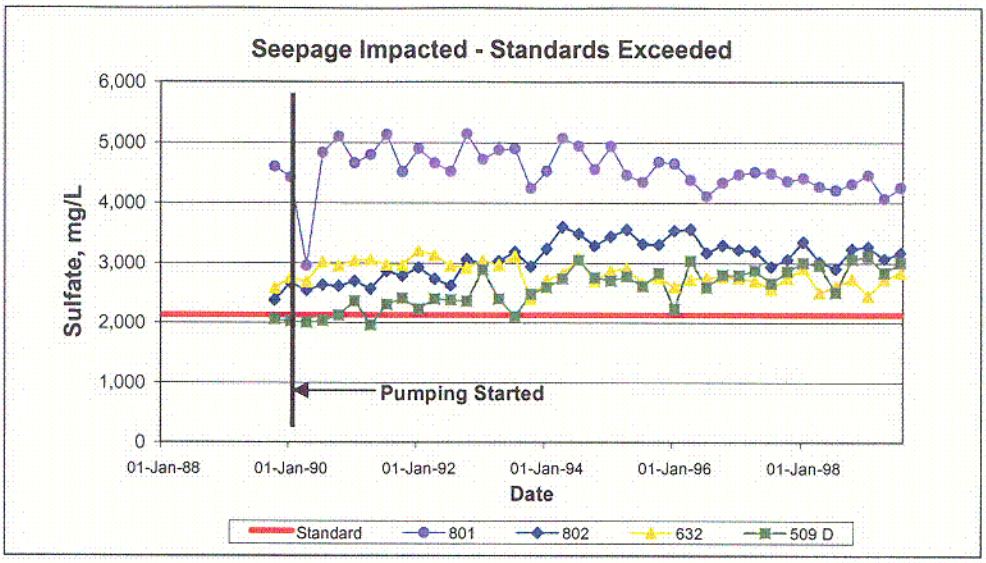
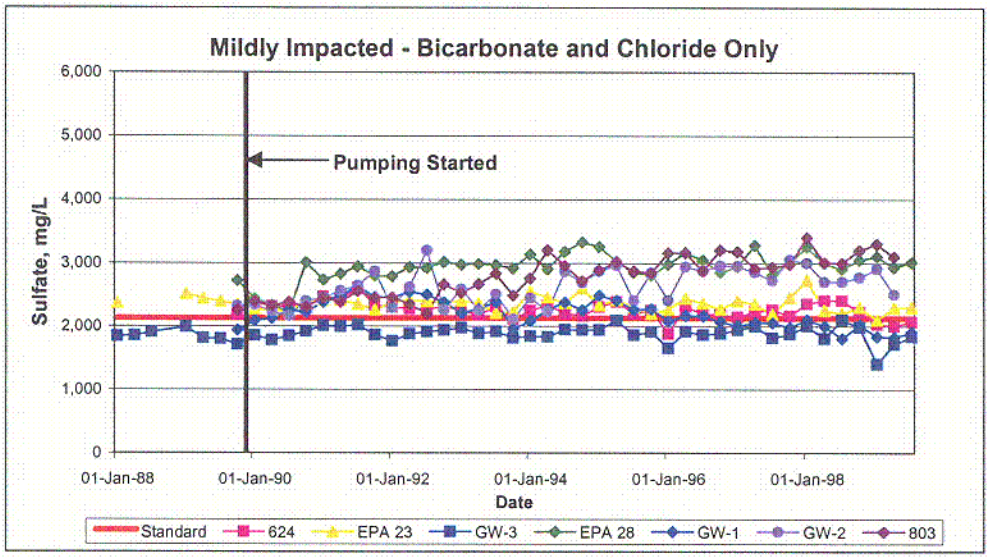
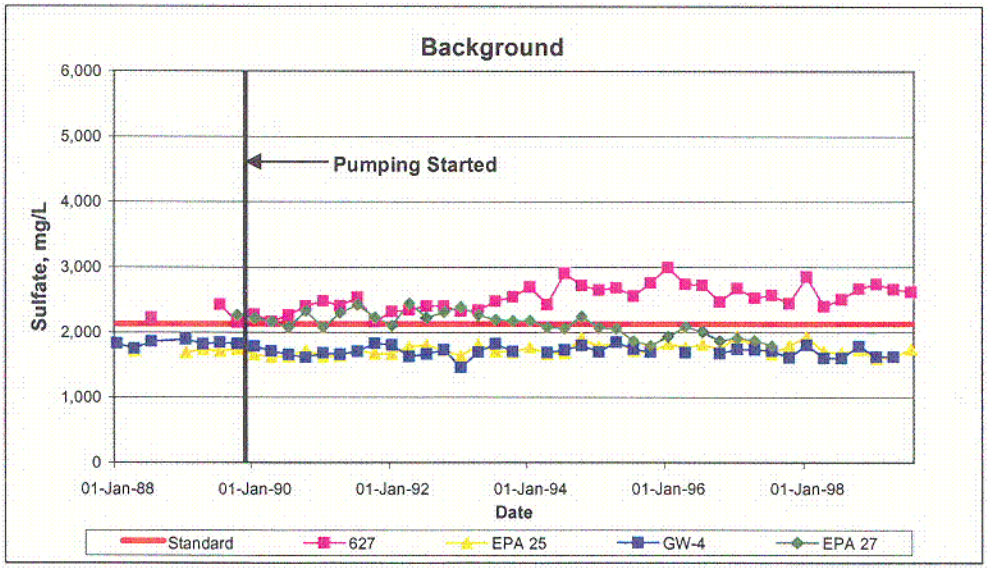




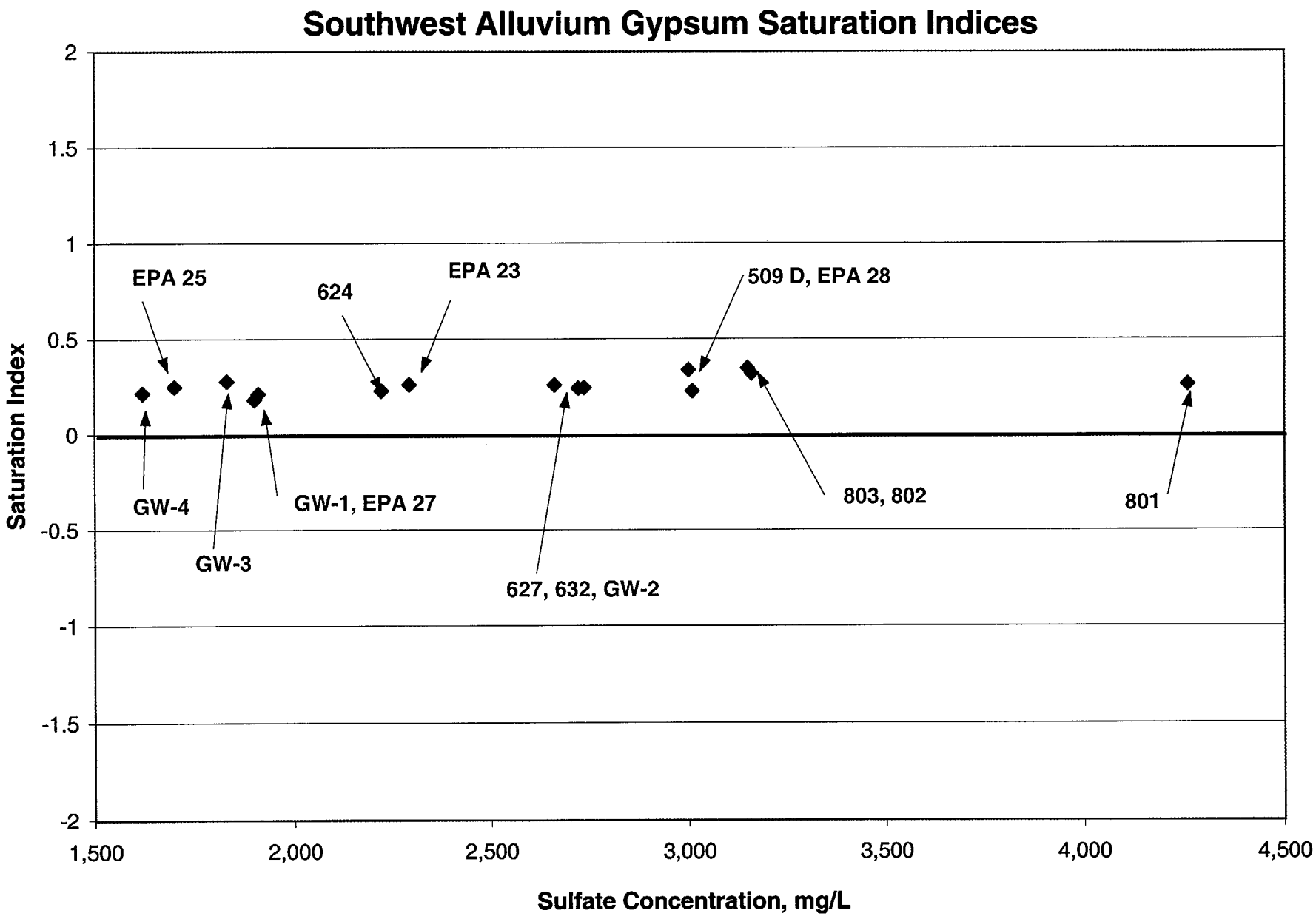


Southwest Alluvium Sulfate

C11

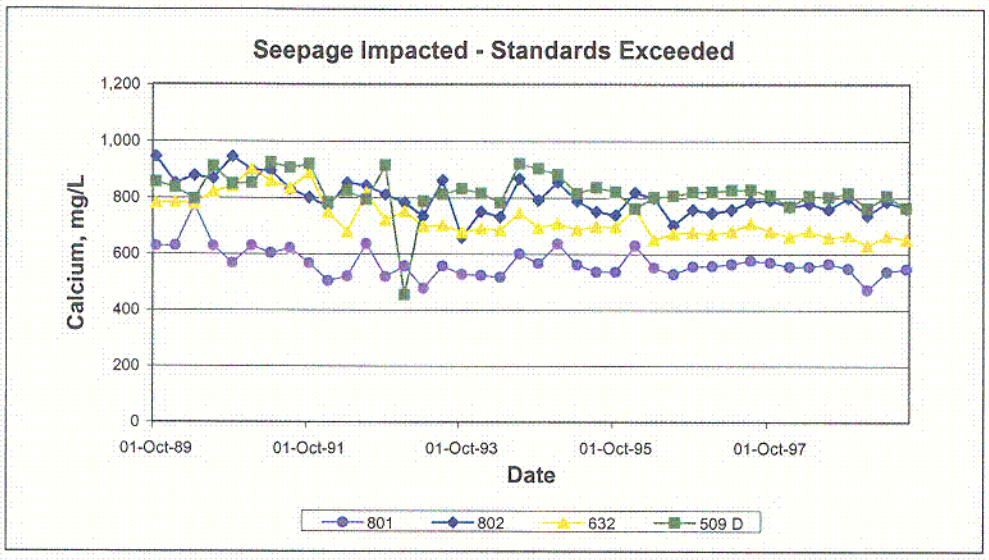
L:\Work\32114\Product\SWA GW Geochem\Figures\ Figure 15 and 17\Figure 15

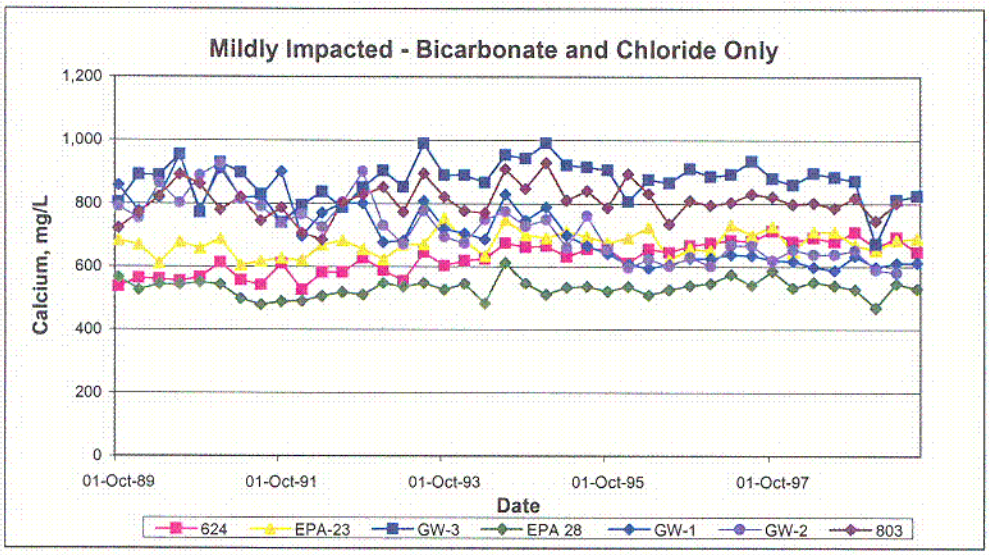
FIGURE 15

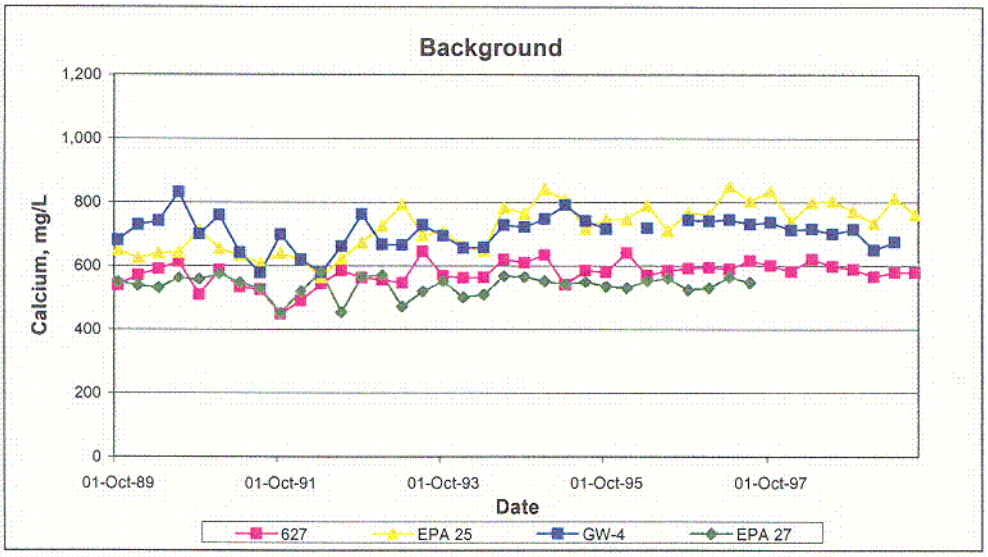


L:\Work\32114\Product\SWA GW Geochem\Figures\ Figure 16 Chart 1026\Figure 16 Chart 1026

FIGURE 16







Southwest Alluvium Calcium

C12

FIGURE 17

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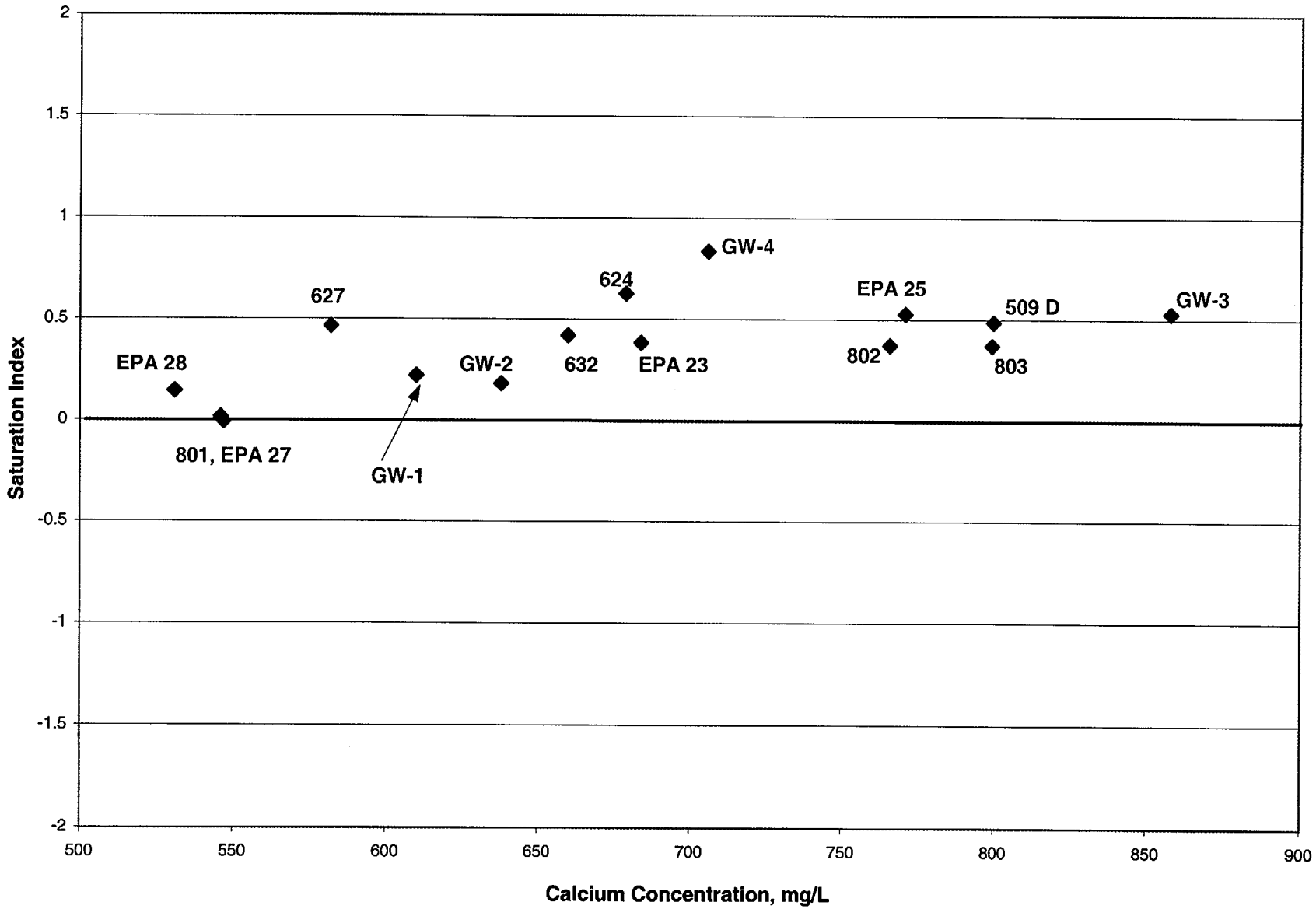
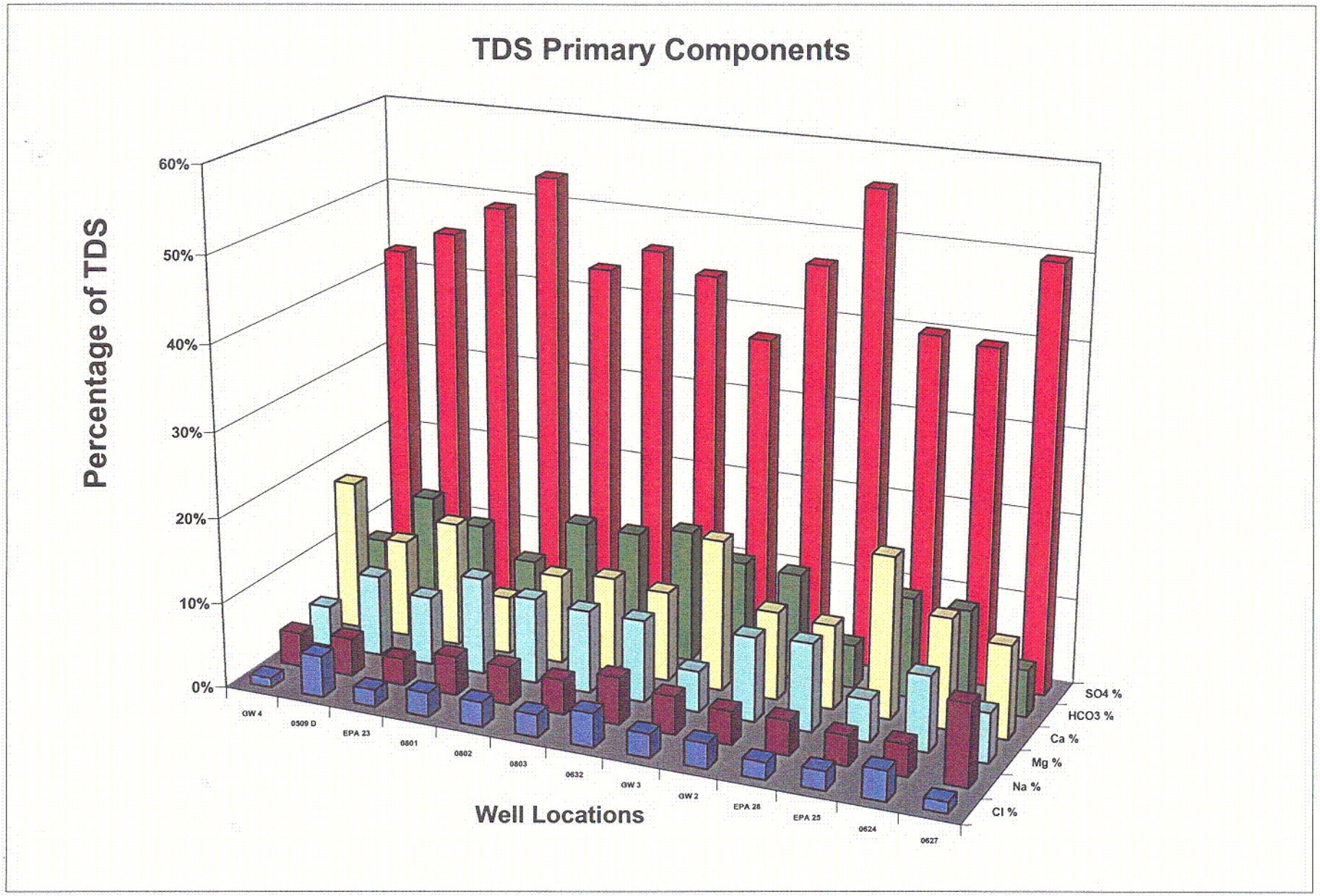
Southwest Alluvium Calcite Saturation Indices



L:\Work\32114\Product\SWA GW Geochem\Figures\ Figure 18 Chart 2\Figure 18 Chart 2

FIGURE 18



C13

FIGURE 19

L:\Work\32114\Product\SWA GW Geochem\Figures\ Figure 19 Chart 1\Figure 19 Chart 1

APPENDIX A

SULFATE MODELING CALCULATION FILE

EARTH TECH

By:	ALR	**Date:**	6/5/00	**Subject:**	Southwest Alluvium Groundwater	**Sheet No:**	1 of 6
Chkd By:		**Date:**			Modeled SO4 Concentrations	**Project No:**	32114
					UNC Church Rock Site		

Purpose: Develop explanation of controls on sulfate concentrations in Southwest Alluvium.

Method: 1. Use MINTEQA2 equilibrium geochemical model (Allison and others 1991) and Southwest Alluvium water quality data to determine likely mechanisms controlling sulfate concentrations.

2. Model equilibrium conditions for water at Southwest Alluvium wells. For MINTEQA2 model input, use median concentrations for 1998-1999 (Worksheet titled " 98-99 stats", pgs. 2-3), input fixed median pH, and no precipitation allowed. For EPA 27, median concentrations for 1996-1997 were used because the water level at this well dropped to the point it could not be sampled after July 1997. Printouts of the model runs are included at the end of this calculation file. They are arranged by well in numerical order.

Results: The results of modeling are summarized in the Worksheet titled " Modeling Results", pg. 4. The modeled gypsum saturation indices vs sulfate are graphed on the Worksheet titled "gypsum saturation", pg. 5, and the modeled calcite saturation indices vs calcium are graphed on the Worksheet titled "calcite saturation", pg. 6. The results show that gypsum is slightly supersaturated for all wells including the unimpacted background wells 627, EPA 25 , EPA 27 and GW-4. This indicates that sulfate is near equilibrium with gypsum. Calcite is also slightly supersaturated for all wells except for EPA 27, which is almost exactly at saturation (SI = -0.007 compared to SI = 0 at equilibrium).

Gypsum is composed of calcium, sulfate and water. Therefore, gypsum formation is constrained by the concentrations of both calcium and sulfate. As indicated on the Worksheet titled "gypsum saturation", median sulfate concentrations (1998-1999) range from approximately 1,600 to 4,300 mg/L. The wide range of sulfate concentrations reflects contributions from background (postmining-pretailings) water and tailings seepage. The range of median calcium concentrations, 531 to 858 mg/L (see "Modeling Results", pg. 4) is much smaller. This relatively narrow range of calcium concentrations results from calcium being constrained by the presence of two calcium-bearing minerals in the formation, gypsum and calcite. Therefore, the control of sulfate concentrations by gypsum saturation is limited because calcium concentrations are limited by the co-occurrence of gypsum and calcite.

Reference:

Allison, Jerry D., Brown, David S., and Novo-Gradac, Kevin J. 1991. MINTEQA2/PRODEFA2, A Geochemical Assessment Model for Environmental Systems: Version 3.0 User's Manual. Environmental Research laboratory, Office of Research and Development, U.S. Environmental Protection Agency, Athens, Georgia

Statistical Data for Southwest Alluvium Wells: 1998 through 1999 (1996-1997 for EPA 27)

	Field pH	Ca	Mg	Na	K	HCO3	SO4	Cl	NH4	NO3	Al	Mn
509D												
Average	6.56	788	619	311	18.5	1871	2919	318	11.81	38.18	-0.10	0.86
Median	6.60	800	610	310	17.3	1910	3000	317	12.90	42.30	-0.10	0.83
Minimum	6.40	761	548	289	16.1	1540	2500	274	7.32	9.53	-0.10	0.56
Maximum	6.70	815	689	353	25.1	1970	3100	345	17.60	47.30	-0.10	1.20
632												
Average	6.57	658	588	369	9.47	1926	2674	257	0.21	6.59	-0.10	0.71
Median	6.60	660	594	383	8.60	1910	2720	251	0.21	6.37	-0.10	0.72
Minimum	6.30	629	559	331	8.10	1820	2440	234	0.10	5.00	-0.10	0.66
Maximum	6.70	681	602	401	14.30	2030	2900	288	0.27	7.95	-0.10	0.75
801												
Average	6.44	538	914	385	14.3	1441	4273	233	20.99	6.26	-0.10	17.16
Median	6.50	546	915	397	14.3	1440	4260	222	20.40	6.37	-0.10	17.00
Minimum	6.20	470	858	347	13.0	1390	4060	214	19.70	4.86	-0.10	12.60
Maximum	6.60	563	969	414	15.5	1500	4450	269	23.20	7.42	-0.10	20.80
802												
Average	6.50	768	727	342	7.44	2121	3139	215	1.25	85.23	-0.10	1.25
Median	6.50	766	726	348	7.20	2120	3160	210	1.23	86.20	-0.10	1.20
Minimum	6.20	734	686	298	6.60	2090	2900	205	1.13	76.20	-0.10	1.13
Maximum	6.80	796	757	370	9.80	2180	3350	242	1.49	90.80	-0.10	1.48
803												
Average	6.46	792	667	295	12.05	4962	3168	192	0.67	40.95	-0.10	1.50
Median	6.47	800	662	299	11.90	1995	3150	189	0.68	39.25	-0.10	1.50
Minimum	6.30	745	642	272	11.50	1960	3000	178	0.56	35.80	-0.10	1.42
Maximum	6.60	818	695	310	13.00	19810	3400	218	0.77	51.80	-0.10	1.59
GW-2												
Average	6.45	625	585	243	9.97	1502	2762	172	0.06	9.30	-0.10	0.33
Median	6.48	638	589	248	9.90	1500	2735	171	0.07	8.85	-0.10	0.34
Minimum	6.10	580	552	217	9.60	1410	2500	162	-0.05	6.12	-0.10	0.30
Maximum	6.70	653	602	271	10.70	1640	3000	188	0.16	16.00	-0.10	0.38
EPA-23												
Average	6.66	680	393	149	10.53	1139	2310	88	2.29	43.39	-0.10	3.25
Median	6.70	684	390	145	10.50	1140	2290	91	2.32	49.30	-0.10	2.96
Minimum	6.60	647	369	134	9.60	1050	2100	71	1.41	1.93	-0.10	2.33
Maximum	6.70	711	424	170	12.00	1190	2730	99	3.05	61.60	-0.10	4.63
EPA-25												
Average	6.78	774	209	150	8.3	963	1714	90	0.06	75.17	-0.10	0.46
Median	6.80	771	210	155	8.3	952	1700	90	0.07	75.30	-0.10	0.36
Minimum	6.50	733	196	137	7.8	886	1600	84	-0.05	69.70	-0.10	0.30
Maximum	6.90	813	226	158	9.0	1040	1930	96	0.19	78.50	-0.10	0.76
EPA-27												
Average	7.73	544	125	333	15.94	44	1923	125	0.06	126.71	-0.10	0.01
Median	7.70	547	127	332	16.30	40	1910	123	0.07	123.00	-0.10	-0.01
Minimum	7.10	524	111	317	14.10	31	1790	112	-0.05	113.00	-0.10	-0.01
Maximum	8.40	564	135	348	16.80	62	2080	156	0.18	143.00	-0.10	0.08

Statistical Data for Southwest Alluvium Wells: 1998 through 1999 (1996-1997 for EPA 27)												
	Field pH	Ca	Mg	Na	K	HCO3	SO4	Cl	NH4	NO3	Al	Mn
GW-1												
Average	6.72	607	314	216	5.79	838	1924	128	0.35	99.07	-0.10	0.03
Median	6.70	610	317	220	5.40	815	1900	125	0.37	95.90	-0.10	0.03
Minimum	6.60	587	264	183	4.20	738	1800	115	0.06	82.40	-0.10	0.02
Maximum	6.80	632	349	251	9.70	1020	2100	157	0.71	122.00	-0.10	0.07
GW-3												
Average	6.71	830	250	219	8.5	1197	1831	130	0.14	128.99	-0.10	1.74
Median	6.70	858	265	234	8.1	1200	1830	131	0.11	119.00	-0.10	1.76
Minimum	6.60	671	193	163	6.7	987	1400	95	0.06	85.90	-0.10	1.41
Maximum	6.80	895	276	246	12.3	1330	2100	154	0.28	220.00	-0.10	2.00
EPA-28												
Average	6.87	526	535	222	12.90	541	3033	105	0.05	43.70	-0.10	0.27
Median	6.90	531	543	224	12.80	539	3010	104	0.08	43.70	-0.10	0.30
Minimum	6.70	468	504	204	11.90	533	2900	95	-0.05	39.50	-0.10	0.18
Maximum	7.00	549	556	235	15.00	557	3250	121	0.16	51.40	-0.10	0.32
624												
Average	6.92	679	443	199	6.0	1179	2210	176	0.06	95.76	-0.10	0.04
Median	6.90	679	442	197	5.4	1180	2220	175	0.08	94.50	-0.10	0.02
Minimum	6.70	646	423	188	4.4	1070	2000	153	-0.05	88.70	-0.10	0.02
Maximum	7.20	708	464	216	10.8	1300	2400	194	0.18	101.00	-0.10	0.11
627												
Average	7.17	588	294	518	5.39	600	2634	63	0.28	127.00	-0.10	0.33
Median	7.10	582	289	509	4.70	588	2660	62	0.17	131.00	-0.10	0.14
Minimum	6.90	566	284	498	3.90	579	2400	55	-0.05	107.00	-0.10	0.08
Maximum	7.70	621	309	545	10.60	682	2850	71	1.28	142.00	-0.10	1.47
GW-4												
Average	7.18	694	188	157	11.8	721	1670	42	0.16	94.70	-0.10	0.11
Median	7.20	706	189	158	11.7	724	1620	42	0.18	97.80	-0.10	0.10
Minimum	7.00	650	179	146	11.3	622	1600	35	-0.05	75.70	-0.10	0.04
Maximum	7.30	715	198	165	13.0	817	1800	50	0.28	105.00	-0.10	0.21

Source of data: derived from Southwest Alluvium database

SOUTHWEST ALLUVIUM MODELING

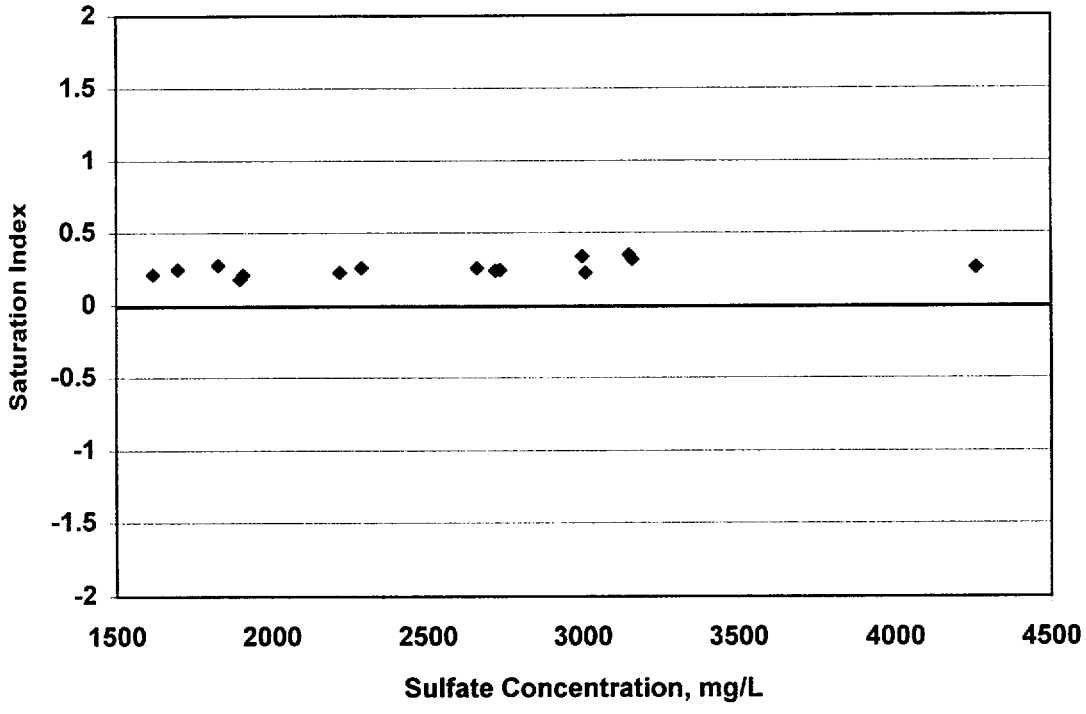
(1998 - 1999 median data)

Minteqa2 File	Well	Precipitated Minerals Saturation Indices			Modeled Median Concentrations											
		Gypsum	Calcite	Rhodocrosite	pH	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	HCO3 mg/L	SO4 mg/L	Cl mg/L	NH4 mg/L	NO3 mg/L	Al mg/L	Mn mg/L
509-med1	509D	0.337	0.488	-0.716	6.60	800	610	310	17	1910	3000	317	12.90	42.30	-0.1	0.83
632-med1	632	0.242	0.421	-0.758	6.60	660	594	383	9	1910	2720	251	0.21	6.37	-0.1	0.72
801-med1	801	0.261	0.017	0.317	6.50	546	915	397	14	1440	4260	222	20.40	6.37	-0.1	17
802-med1	802	0.319	0.374	-0.634	6.50	766	726	348	7	2120	3160	210	1.23	86.20	-0.1	1.2
803-med1	803	0.348	0.372	-0.556	6.47	800	662	299	12	1995	3150	189	0.68	39.25	-0.1	1.495
Gw2-med1	GW-2	0.245	0.182	-1.344	6.48	638	589	248	10	1500	2735	171	0.07	8.85	-0.1	0.335
E23-med1	EPA-23	0.262	0.384	-0.171	6.70	684	390	145	11	1140	2290	91	2.32	49.30	-0.1	2.96
E25-med1	EPA-25	0.250	0.529	-0.955	6.80	771	210	155	8	952	1700	90	0.07	75.3	-0.1	0.36
E27-med1	EPA-27	0.213	-0.007	na	7.70	547	127	332	16	40	1910	123	0.07	123	-0.1	-0.01
Gw1-med1	GW-1	0.181	0.222	na	6.70	610	317	220	5	815	1900	125	0.37	95.9	-0.1	0.03
Gw3-med1	GW-3	0.279	0.531	-0.349	6.70	858	265	234	8	1200	1830	131	0.11	119	-0.1	1.76
E28-med1	EPA-28	0.227	0.145	-1.291	6.90	531	543	224	13	539	3010	104	0.08	43.7	-0.1	0.3
624-med1	624	0.229	0.628	na	6.90	679	442	197	5	1180	2220	175	0.08	94.5	-0.1	0.02
627-med1	627	0.259	0.467	-1.487	7.10	582	289	509	5	588	2660	62	0.17	131.00	-0.1	0.14
Gw4-med1	GW-4	0.216	0.836	-1.209	7.20	706	189	158	12	724	1620	42	0.18	97.8	-0.1	0.1

Southwest Alluvium Modeling
(1998 - 1999 median data)

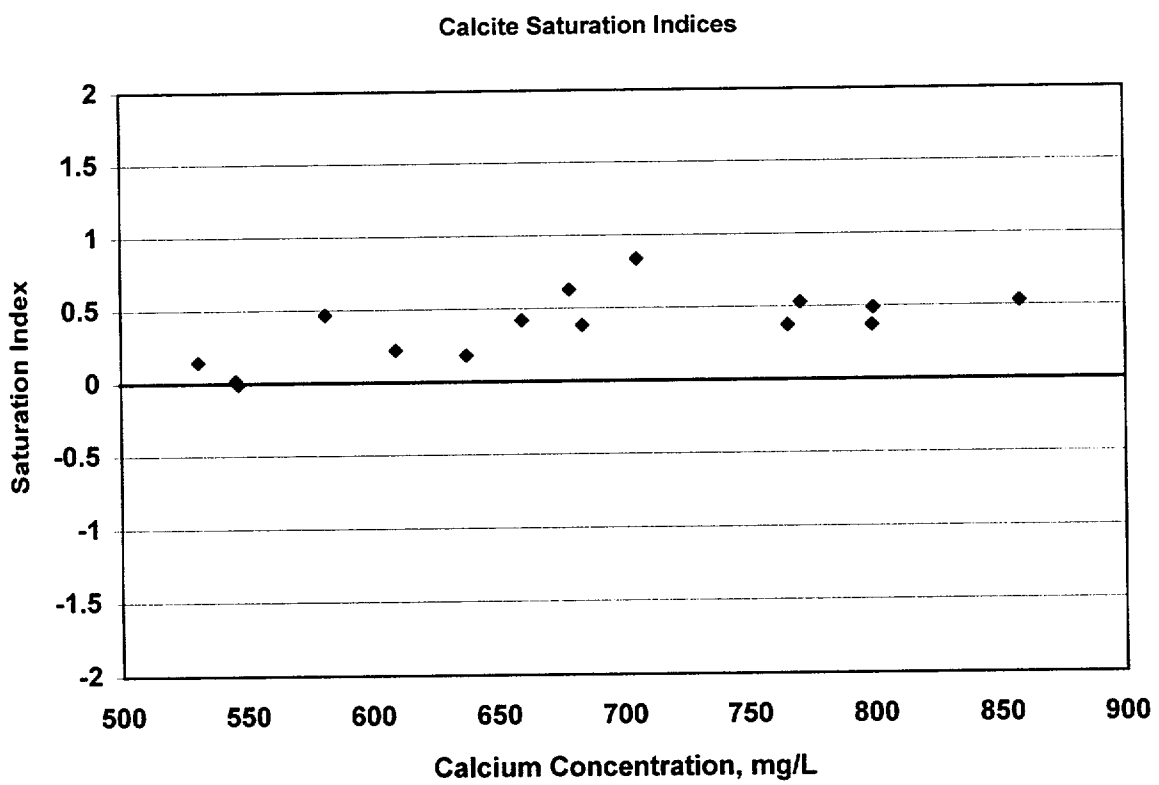
Well	SO4	Gypsum
	mg/L	SI
509D	3000	0.337
632	2720	0.242
801	4260	0.261
802	3160	0.319
803	3150	0.348
GW-2	2735	0.245
EPA-23	2290	0.262
EPA-25	1700	0.250
EPA-27	1910	0.213
GW-1	1900	0.181
GW-3	1830	0.279
EPA-28	3010	0.227
624	2220	0.229
627	2660	0.259
GW-4	1620	0.216

Gypsum Saturation Indices



Southwest Alluvium Modeling
(1998 - 1999 median data)

Well	Calcium	Calcite
	mg/L	SI
509D	800	0.488
632	660	0.421
801	546	0.017
802	766	0.374
803	800	0.372
GW-2	638	0.182
EPA-23	684	0.324
EPA-25	771	0.629
EPA-27	547	-0.007
GW-1	610	0.222
GW-3	858	0.531
EPA-28	531	0.145
624	679	0.628
627	582	0.467
GW-4	706	0.836



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Southwest Alluvium well 509d, median '98-99 values
determine saturation indices
16.00 MG/L   0.000  0.00000E-01
0 0 1 0 3 0 0 0 1 1 0 0 0
0   0   0
    330  0.000E-01   -6.60 y                    /H+1
    150  8.000E+02   -1.70 y                    /Ca+2
    460  6.100E+02   -1.60 y                    /Mg+2
    500  3.100E+02   -1.87 y                    /Na+1
    410  1.730E+01   -3.35 y                    /K+1
    140  1.878E+03   -1.50 y                    /CO3-2
    732  3.000E+03   -1.51 y                    /SO4-2
    180  3.170E+02   -2.05 y                    /Cl-1
    492  1.870E+02   -2.52 y                    /NO3-1
    490  1.700E+01   -3.03 y                    /NH4+1
    470  8.000E-01   -4.84 y                    /Mn+2

  3   1
    330     6.6000     0.0000                   /H+1
```

PART 1 of OUTPUT FILE

PC MINTEQA2 v3.10 DATE OF CALCULATIONS: 18-JAN-** TIME: 7:47: 2

Southwest Alluvium well 509d, median '98-99 values
determine saturation indices

Temperature (Celsius): 16.00
Units of concentration: MG/L
Ionic strength to be computed.
If specified, carbonate concentration represents total inorganic carbon.
Do not automatically terminate if charge imbalance exceeds 30%
Precipitation is allowed only for those solids specified as ALLOWED
in the input file (if any).
The maximum number of iterations is: 200
The method used to compute activity coefficients is: Davies equation
Intermediate output file

330	0.000E-01	-6.60	y
150	8.000E+02	-1.70	y
460	6.100E+02	-1.60	y
500	3.100E+02	-1.87	y
410	1.730E+01	-3.35	y
140	1.878E+03	-1.50	y
732	3.000E+03	-1.51	y
180	3.170E+02	-2.05	y
492	1.870E+02	-2.52	y
490	1.700E+01	-3.03	y
470	8.000E-01	-4.84	y

H2O has been inserted as a COMPONENT
3 1
330 6.6000 0.0000

INPUT DATA BEFORE TYPE MODIFICATIONS

ID	NAME	ACTIVITY GUESS	LOG GUESS	ANAL TOTAL
330	H+1	2.512E-07	-6.600	0.000E-01
150	Ca+2	1.995E-02	-1.700	8.000E+02
460	Mg+2	2.512E-02	-1.600	6.100E+02
500	Na+1	1.349E-02	-1.870	3.100E+02
410	K+1	4.467E-04	-3.350	1.730E+01
140	CO3-2	3.162E-02	-1.500	1.878E+03
732	SO4-2	3.090E-02	-1.510	3.000E+03
180	Cl-1	8.913E-03	-2.050	3.170E+02
492	NO3-1	3.020E-03	-2.520	1.870E+02
490	NH4+1	9.333E-04	-3.030	1.700E+01
470	Mn+2	1.445E-05	-4.840	8.000E-01
2	H2O	1.000E+00	0.000	0.000E-01

Charge Balance: UNSPECIATED

Sum of CATIONS= 1.058E-01 Sum of ANIONS = 1.380E-01

PERCENT DIFFERENCE = 1.323E+01 (ANIONS - CATIONS)/(ANIONS + CATIONS)

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|  IMPROVED ACTIVITY GUESSES PRIOR TO FIRST ITERATION: |
|       CO3-2        Log activity guess:    -5.50      |
|       SO4-2        Log activity guess:    -1.50      |
|       Mn+2         Log activity guess:    -4.83      |
|                                                      |
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PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY	RESIDUAL
0	NH4+1	9.492E-04	3.633E-04	-3.03000	3.632E-04
1	NH4+1	9.492E-04	2.500E-05	-3.08945	2.490E-05
2	NH4+1	9.492E-04	2.462E-04	-3.07020	2.461E-04
3	NH4+1	9.492E-04	3.502E-05	-3.16117	3.492E-05
4	NH4+1	9.492E-04	2.142E-06	-3.17381	2.047E-06
5	NH4+1	9.492E-04	1.142E-07	-3.17460	1.928E-08

ID	NAME	ANAL MOL	CALC MOL	LOG ACTVTY	GAMMA	DIFF FXN
470	Mn+2	1.467E-05	9.956E-06	-5.46846	0.341544	5.819E-10
150	Ca+2	2.010E-02	1.372E-02	-2.32925	0.341544	7.843E-07
460	Mg+2	2.527E-02	1.758E-02	-2.22159	0.341544	1.016E-06
500	Na+1	1.358E-02	1.311E-02	-1.99919	0.764472	1.974E-07
410	K+1	4.456E-04	4.289E-04	-3.48427	0.764472	6.525E-09
140	CO3-2	3.152E-02	7.181E-06	-5.61039	0.341544	2.964E-07
732	SO4-2	3.145E-02	1.908E-02	-2.18590	0.341544	1.060E-06
180	Cl-1	9.006E-03	9.006E-03	-2.16212	0.764472	1.319E-07
492	NO3-1	3.038E-03	3.038E-03	-2.63411	0.764472	4.448E-08
490	NH4+1	9.492E-04	8.750E-04	-3.17464	0.764472	1.389E-08
2	H2O	0.000E-01	-5.184E-08	-0.00100	1.000000	0.000E-01
330	H+1	0.000E-01	3.286E-07	-6.60000	0.764472	0.000E-01

Type I - COMPONENTS AS SPECIES IN SOLUTION

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
330	H+1	3.286E-07	2.512E-07	-6.60000	0.76447	0.117
150	Ca+2	1.372E-02	4.685E-03	-2.32925	0.34154	0.467
460	Mg+2	1.758E-02	6.004E-03	-2.22159	0.34154	0.467
500	Na+1	1.311E-02	1.002E-02	-1.99919	0.76447	0.117
410	K+1	4.289E-04	3.279E-04	-3.48427	0.76447	0.117
140	CO3-2	7.181E-06	2.453E-06	-5.61039	0.34154	0.467
732	SO4-2	1.908E-02	6.518E-03	-2.18590	0.34154	0.467
180	Cl-1	9.006E-03	6.885E-03	-2.16212	0.76447	0.117
492	NO3-1	3.038E-03	2.322E-03	-2.63411	0.76447	0.117
490	NH4+1	8.750E-04	6.689E-04	-3.17464	0.76447	0.117
470	Mn+2	9.956E-06	3.400E-06	-5.46846	0.34154	0.467

Type II - OTHER SPECIES IN SOLUTION OR ADSORBED

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
3301401	H2CO3 AQ	8.115E-03	8.354E-03	-2.07813	1.02942	16.720
3307320	HSO4 -	1.625E-07	1.242E-07	-6.90574	0.76447	1.997
3300020	OH-	2.589E-08	1.979E-08	-7.70345	0.76447	-14.186

3304900	NH3 AQ	7.653E-07	7.879E-07	-6.10355	1.02942	-9.542
4907320	NH4SO4 -	7.347E-05	5.616E-05	-4.25054	0.76447	1.227
4603300	MgOH +	2.287E-08	1.748E-08	-7.75739	0.76447	-12.018
4601400	MgCO3 AQ	1.189E-05	1.224E-05	-4.91229	1.02942	2.907
4601401	MgHCO3 +	1.402E-03	1.072E-03	-2.96997	0.76447	11.579
4607320	MgSO4 AQ	6.281E-03	6.465E-03	-2.18941	1.02942	2.205
1503300	CaOH +	2.863E-09	2.189E-09	-8.65985	0.76447	-12.813
1501400	CaHCO3 +	7.785E-04	5.951E-04	-3.22538	0.76447	11.431
1501401	CaCO3 AQ	1.331E-05	1.371E-05	-4.86310	1.02942	3.064
1507320	CaSO4 AQ	5.594E-03	5.759E-03	-2.23968	1.02942	2.263
5001400	NaCO3 -	3.730E-07	2.852E-07	-6.54488	0.76447	1.181
5001401	NaHCO3 AQ	7.208E-05	7.420E-05	-4.12958	1.02942	10.067
5007320	NaSO4 -	4.036E-04	3.086E-04	-3.51064	0.76447	0.791
4107320	KSO4 -	1.671E-05	1.277E-05	-4.89368	0.76447	0.893
4701800	MnCl +	1.239E-07	9.471E-08	-7.02358	0.76447	0.724
4701801	MnCl2 AQ	1.721E-10	1.771E-10	-9.75171	1.02942	0.028
4701802	MnCl3 -	7.191E-13	5.498E-13	-12.25983	0.76447	-0.188
4703300	MnOH +	2.131E-10	1.629E-10	-9.78796	0.76447	-10.802
4703301	Mn(OH)3 -1	4.417E-21	3.377E-21	-20.47147	0.76447	-34.683
4707320	MnSO4 AQ	3.496E-06	3.599E-06	-5.44387	1.02942	2.198
4704920	Mn(NO3)2AQ	7.240E-11	7.453E-11	-10.12764	1.02942	0.596
4701400	MnHCO3 +	1.091E-06	8.340E-07	-6.07885	0.76447	11.717
3301400	HCO3 -	2.112E-02	1.615E-02	-1.79196	0.76447	10.535

Type III - SPECIES WITH FIXED ACTIVITY

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
2	H2O	-5.184E-08	-7.285	0.001	0.000
330	H+1	-3.960E-02	-1.402	6.600	0.000

Type VI - EXCLUDED SPECIES (not included in mole balance)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
3301403	CO2 (g)	2.305E-01	-0.637	18.172	-0.530

PERCENTAGE DISTRIBUTION OF COMPONENTS AMONG
TYPE I and TYPE II (dissolved and adsorbed) species

```
Mn+2                    67.9     PERCENT BOUND IN SPECIES #    470   Mn+2
              23.8    PERCENT BOUND IN SPECIES #4707320   MnSO4 AQ
               7.4    PERCENT BOUND IN SPECIES #4701400   MnHCO3 +

Ca+2                    68.2     PERCENT BOUND IN SPECIES #    150   Ca+2
               3.9    PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
              27.8    PERCENT BOUND IN SPECIES #1507320   CaSO4 AQ

Mg+2                    69.6     PERCENT BOUND IN SPECIES #    460   Mg+2
               5.5    PERCENT BOUND IN SPECIES #4601401   MgHCO3 +
              24.9    PERCENT BOUND IN SPECIES #4607320   MgSO4 AQ

Na+1                    96.5     PERCENT BOUND IN SPECIES #    500   Na+1
               3.0    PERCENT BOUND IN SPECIES #5007320   NaSO4 -

K+1                     96.3     PERCENT BOUND IN SPECIES #    410   K+1
               3.7    PERCENT BOUND IN SPECIES #4107320   KSO4 -

CO3-2                   25.7     PERCENT BOUND IN SPECIES #3301401   H2CO3
AQ
               4.4    PERCENT BOUND IN SPECIES #4601401   MgHCO3 +
               2.5    PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
              67.0    PERCENT BOUND IN SPECIES #3301400   HCO3 -

SO4-2                   60.7     PERCENT BOUND IN SPECIES #    732   SO4-2
              20.0    PERCENT BOUND IN SPECIES #4607320   MgSO4 AQ
              17.8    PERCENT BOUND IN SPECIES #1507320   CaSO4 AQ
               1.3    PERCENT BOUND IN SPECIES #5007320   NaSO4 -

Cl-1                   100.0     PERCENT BOUND IN SPECIES #    180   Cl-1

NO3-1                  100.0     PERCENT BOUND IN SPECIES #    492   NO3-1

NH4+1                   92.2     PERCENT BOUND IN SPECIES #    490   NH4+1
               7.7    PERCENT BOUND IN SPECIES #4907320   NH4SO4 -

H2O                     50.0     PERCENT BOUND IN SPECIES #3300020   OH-
              44.1    PERCENT BOUND IN SPECIES #4603300   MgOH +
               5.5    PERCENT BOUND IN SPECIES #1503300   CaOH +

H+1                     41.0     PERCENT BOUND IN SPECIES #3301401   H2CO3
AQ
               3.5    PERCENT BOUND IN SPECIES #4601401   MgHCO3 +
               2.0    PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
              53.3    PERCENT BOUND IN SPECIES #3301400   HCO3 -
```

---------- EQUILIBRATED MASS DISTRIBUTION ----------

IDX	NAME	DISSOLVED MOL/KG	DISSOLVED PERCENT	SORBED MOL/KG	SORBED PERCENT	PRECIPITATED MOL/KG	PRECIPITATED PERCENT
470	Mn+2	1.467E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
150	Ca+2	2.010E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	2.527E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	1.358E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	4.456E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
140	CO3-2	3.152E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
732	SO4-2	3.146E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
180	Cl-1	9.006E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
492	NO3-1	3.038E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
490	NH4+1	9.492E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
2	H2O	5.184E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
330	H+1	3.960E-02	100.0	0.000E-01	0.0	0.000E-01	0.0

Charge Balance: SPECIATED

Sum of CATIONS = 7.920E-02 Sum of ANIONS 7.184E-02

PERCENT DIFFERENCE = 4.876E+00 (ANIONS - CATIONS)/(ANIONS + CATIONS)

EQUILIBRIUM IONIC STRENGTH (m) = 1.259E-01

EQUILIBRIUM pH = 6.600

DATE ID NUMBER: ******
TIME ID NUMBER: 7470578

Saturation indices and stoichiometry of all minerals

ID #	NAME	Sat. Index	Stoichiometry in [brackets]							
6015000	ANHYDRITE	0.036	[1.000]	150	[1.000]	732				
5015000	ARAGONITE	0.318	[1.000]	150	[1.000]	140				
5046000	ARTINITE	-7.114	[-2.000]	330	[2.000]	460	[1.000]	140		
			[5.000]	2						
2046000	BRUCITE	-6.405	[1.000]	460	[2.000]	2	[-2.000]	330		
5015001	CALCITE	0.488	[1.000]	150	[1.000]	140				
5015002	DOLOMITE	1.039	[1.000]	150	[1.000]	460	[2.000]	140		
6046000	EPSOMITE	-2.210	[1.000]	460	[1.000]	732	[7.000]	2		
6015001	GYPSUM	0.337	[1.000]	150	[1.000]	732	[2.000]	2		
4150000	HALITE	-5.722	[1.000]	500	[1.000]	180				
5015003	HUNTITE	-2.055	[3.000]	460	[1.000]	150	[4.000]	140		
5046001	HYDRMAGNESIT	-12.781	[5.000]	460	[4.000]	140	[-2.000]	330		
			[6.000]	2						
5046002	MAGNESITE	0.056	[1.000]	460	[1.000]	140				
6050001	MIRABILITE	-4.647	[2.000]	500	[1.000]	732	[10.000]	2		
3050000	NATRON	-7.949	[2.000]	500	[1.000]	140	[10.000]	2		
5046003	NESQUEHONITE	-2.346	[1.000]	460	[1.000]	140	[3.000]	2		
6050002	THENARDITE	-6.018	[2.000]	500	[1.000]	732				
5050001	THERMONATR	-9.799	[2.000]	500	[1.000]	140	[1.000]	2		
2047003	PYROCROITE	-7.874	[-2.000]	330	[1.000]	470	[2.000]	2		
5047000	RHODOCHROSIT	-0.716	[1.000]	470	[1.000]	140				
4147000	MNCL2, 4H2O	-12.110	[1.000]	470	[2.000]	180	[4.000]	2		
6047000	MNSO4	-10.677	[1.000]	470	[1.000]	732				
2015000	LIME	-22.983	[-2.000]	330	[1.000]	150	[1.000]	2		
2015001	PORTLANDITE	-12.506	[-2.000]	330	[1.000]	150	[2.000]	2		
2046001	PERICLASE	-11.357	[-2.000]	330	[1.000]	460	[1.000]	2		

```
Southwest Alluvium well 624, median '98-'99 concentrations
Fixed pH, no precip - determine SI
16.00 MG/L   0.000  0.00000E-01
0 0 1 0 3 0 0 0 1 1 0 0 0
0   0   0
    330  0.000E-01   -6.90 y                    /H+1
    150  6.790E+02   -1.77 y                    /Ca+2
    460  4.420E+02   -1.74 y                    /Mg+2
    500  1.970E+02   -2.07 y                    /Na+1
    410  5.400E+00   -3.86 y                    /K+1
    140  1.160E+03   -1.71 y                    /CO3-2
    732  2.220E+03   -1.64 y                    /SO4-2
    180  1.750E+02   -2.31 y                    /Cl-1
    490  1.300E-01   -5.14 y                    /NH4+1
    492  4.190E+02   -2.17 y                    /NO3-1

  3   1
    330     6.9000     0.0000                   /H+1
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PART 1 of OUTPUT FILE

PC MINTEQA2 v3.10 DATE OF CALCULATIONS: 18-JAN-** TIME: 7:52:34

Southwest Alluvium well 624, median '98-'99 concentrations
Fixed pH, no precip - determine SI

Temperature (Celsius): 16.00
Units of concentration: MG/L
Ionic strength to be computed.
If specified, carbonate concentration represents total inorganic carbon.
Do not automatically terminate if charge imbalance exceeds 30%
Precipitation is allowed only for those solids specified as ALLOWED
in the input file (if any).
The maximum number of iterations is: 200
The method used to compute activity coefficients is: Davies equation
Intermediate output file

330	0.000E-01	-6.90	y
150	6.790E+02	-1.77	y
460	4.420E+02	-1.74	y
500	1.970E+02	-2.07	y
410	5.400E+00	-3.86	y
140	1.160E+03	-1.71	y
732	2.220E+03	-1.64	y
180	1.750E+02	-2.31	y
490	1.300E-01	-5.14	y
492	4.190E+02	-2.17	y

H2O has been inserted as a COMPONENT
3 1
330 6.9000 0.0000

INPUT DATA BEFORE TYPE MODIFICATIONS

ID	NAME	ACTIVITY GUESS	LOG GUESS	ANAL TOTAL
330	H+1	1.259E-07	-6.900	0.000E-01
150	Ca+2	1.698E-02	-1.770	6.790E+02
460	Mg+2	1.820E-02	-1.740	4.420E+02
500	Na+1	8.511E-03	-2.070	1.970E+02
410	K+1	1.380E-04	-3.860	5.400E+00
140	CO3-2	1.950E-02	-1.710	1.160E+03
732	SO4-2	2.291E-02	-1.640	2.220E+03
180	Cl-1	4.898E-03	-2.310	1.750E+02
490	NH4+1	7.244E-06	-5.140	1.300E-01
492	NO3-1	6.761E-03	-2.170	4.190E+02
2	H2O	1.000E+00	0.000	0.000E-01

Charge Balance: UNSPECIATED

Sum of CATIONS= 7.938E-02 Sum of ANIONS = 9.709E-02

PERCENT DIFFERENCE = 1.004E+01 (ANIONS - CATIONS)/(ANIONS + CATIONS)

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|  IMPROVED ACTIVITY GUESSES PRIOR TO FIRST ITERATION: |
|       CO3-2       Log activity guess:    -5.33       |
|       SO4-2       Log activity guess:    -1.63       |
|                                                      |
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PC MINTEQA2 v3.10 DATE OF CALCULATIONS: 18-JAN-** TIME: 7:52:35

PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY	RESIDUAL
0	NH4+1	7.245E-06	2.184E-06	-5.14000	2.184E-06
1	NH4+1	7.245E-06	1.264E-07	-5.19164	1.257E-07
2	NH4+1	7.245E-06	1.740E-06	-5.17747	1.740E-06
3	NH4+1	7.245E-06	2.343E-07	-5.26511	2.336E-07
4	NH4+1	7.245E-06	1.598E-08	-5.27680	1.525E-08
5	NH4+1	7.245E-06	1.086E-09	-5.27761	3.613E-10

ID	NAME	ANAL MOL	CALC MOL	LOG ACTVTY	GAMMA	DIFF FXN
492	NO3-1	6.794E-03	6.794E-03	-2.27608	0.779510	1.202E-07
150	Ca+2	1.703E-02	1.210E-02	-2.34997	0.369221	8.437E-07
460	Mg+2	1.828E-02	1.324E-02	-2.31071	0.369221	9.308E-07
500	Na+1	8.615E-03	8.370E-03	-2.18548	0.779510	1.517E-07
410	K+1	1.388E-04	1.346E-04	-3.97928	0.779510	2.457E-09
140	CO3-2	1.943E-02	9.625E-06	-5.44930	0.369221	2.752E-07
732	SO4-2	2.323E-02	1.443E-02	-2.27359	0.369221	9.818E-07
180	Cl-1	4.962E-03	4.962E-03	-2.41248	0.779510	8.783E-08
490	NH4+1	7.245E-06	6.769E-06	-5.27767	0.779510	1.280E-10
2	H2O	0.000E-01	-9.251E-08	-0.00073	1.000000	0.000E-01
330	H+1	0.000E-01	1.615E-07	-6.90000	0.779510	0.000E-01

Type I - COMPONENTS AS SPECIES IN SOLUTION

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
330	H+1	1.615E-07	1.259E-07	-6.90000	0.77951	0.108
150	Ca+2	1.210E-02	4.467E-03	-2.34997	0.36922	0.433
460	Mg+2	1.324E-02	4.890E-03	-2.31071	0.36922	0.433
500	Na+1	8.370E-03	6.524E-03	-2.18548	0.77951	0.108
410	K+1	1.346E-04	1.049E-04	-3.97928	0.77951	0.108
140	CO3-2	9.625E-06	3.554E-06	-5.44930	0.36922	0.433
732	SO4-2	1.443E-02	5.326E-03	-2.27359	0.36922	0.433
180	Cl-1	4.962E-03	3.868E-03	-2.41248	0.77951	0.108
490	NH4+1	6.769E-06	5.276E-06	-5.27767	0.77951	0.108
492	NO3-1	6.794E-03	5.296E-03	-2.27608	0.77951	0.108

Type II - OTHER SPECIES IN SOLUTION OR ADSORBED

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
3301401	H2CO3 AQ	2.973E-03	3.041E-03	-2.51704	1.02282	16.722
3307320	HSO4 -	6.528E-08	5.088E-08	-7.29343	0.77951	1.988
3300020	OH-	5.070E-08	3.952E-08	-7.40318	0.77951	-14.194
3304900	NH3 AQ	1.212E-08	1.240E-08	-7.90658	1.02282	-9.539
4907320	NH4SO4 -	4.644E-07	3.620E-07	-6.44126	0.77951	1.218

4603300	MgOH +	3.647E-08	2.843E-08	-7.54623	0.77951	-12.027
4601400	MgCO3 AQ	1.412E-05	1.444E-05	-4.84031	1.02282	2.910
4601401	MgHCO3 +	8.132E-04	6.339E-04	-3.19799	0.77951	11.570
4607320	MgSO4 AQ	4.207E-03	4.303E-03	-2.36621	1.02282	2.208
1503300	CaOH +	5.344E-09	4.166E-09	-8.38030	0.77951	-12.821
1501400	CaHCO3 +	5.286E-04	4.121E-04	-3.38502	0.77951	11.422
1501401	CaCO3 AQ	1.851E-05	1.893E-05	-4.72274	1.02282	3.067
1507320	CaSO4 AQ	4.386E-03	4.486E-03	-2.34810	1.02282	2.266
5001400	NaCO3 -	3.452E-07	2.691E-07	-6.57008	0.77951	1.173
5001401	NaHCO3 AQ	3.431E-05	3.509E-05	-4.45478	1.02282	10.070
5007320	NaSO4 -	2.106E-04	1.642E-04	-3.78462	0.77951	0.783
4107320	KSO4 -	4.284E-06	3.339E-06	-5.47637	0.77951	0.885
3301400	HCO3 -	1.504E-02	1.173E-02	-1.93087	0.77951	10.527

Type III - SPECIES WITH FIXED ACTIVITY

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
2	H2O	-9.251E-08	-7.034	0.001	0.000
330	H+1	-2.236E-02	-1.650	6.900	0.000

Type VI - EXCLUDED SPECIES (not included in mole balance)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
3301403	CO2 (g)	8.385E-02	-1.076	18.172	-0.530

PERCENTAGE DISTRIBUTION OF COMPONENTS AMONG
TYPE I and TYPE II (dissolved and adsorbed) species

NO3-1		100.0	PERCENT BOUND IN SPECIES # 492	NO3-1
Ca+2		71.0	PERCENT BOUND IN SPECIES # 150	Ca+2
	3.1	PERCENT BOUND IN SPECIES #1501400	CaHCO3 +	
	25.8	PERCENT BOUND IN SPECIES #1507320	CaSO4 AQ	
Mg+2		72.5	PERCENT BOUND IN SPECIES # 460	Mg+2
	4.4	PERCENT BOUND IN SPECIES #4601401	MgHCO3 +	
	23.0	PERCENT BOUND IN SPECIES #4607320	MgSO4 AQ	
Na+1		97.2	PERCENT BOUND IN SPECIES # 500	Na+1
	2.4	PERCENT BOUND IN SPECIES #5007320	NaSO4 -	
K+1		96.9	PERCENT BOUND IN SPECIES # 410	K+1
	3.1	PERCENT BOUND IN SPECIES #4107320	KSO4 -	
CO3-2		15.3	PERCENT BOUND IN SPECIES #3301401	H2CO3
AQ				
	4.2	PERCENT BOUND IN SPECIES #4601401	MgHCO3 +	
	2.7	PERCENT BOUND IN SPECIES #1501400	CaHCO3 +	
	77.4	PERCENT BOUND IN SPECIES #3301400	HCO3 -	
SO4-2		62.1	PERCENT BOUND IN SPECIES # 732	SO4-2
	18.1	PERCENT BOUND IN SPECIES #4607320	MgSO4 AQ	
	18.9	PERCENT BOUND IN SPECIES #1507320	CaSO4 AQ	
Cl-1		100.0	PERCENT BOUND IN SPECIES # 180	Cl-1
NH4+1		93.4	PERCENT BOUND IN SPECIES # 490	NH4+1
	6.4	PERCENT BOUND IN SPECIES #4907320	NH4SO4 -	
H2O		54.8	PERCENT BOUND IN SPECIES #3300020	OH-
	39.4	PERCENT BOUND IN SPECIES #4603300	MgOH +	
	5.8	PERCENT BOUND IN SPECIES #1503300	CaOH +	
H+1		26.6	PERCENT BOUND IN SPECIES #3301401	H2CO3
AQ				
	3.6	PERCENT BOUND IN SPECIES #4601401	MgHCO3 +	
	2.4	PERCENT BOUND IN SPECIES #1501400	CaHCO3 +	
	67.3	PERCENT BOUND IN SPECIES #3301400	HCO3 -	

---------- EQUILIBRATED MASS DISTRIBUTION ----------

IDX	NAME	DISSOLVED MOL/KG	DISSOLVED PERCENT	SORBED MOL/KG	SORBED PERCENT	PRECIPITATED MOL/KG	PRECIPITATED PERCENT
492	NO3-1	6.794E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
150	Ca+2	1.703E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	1.828E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	8.615E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	1.388E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
140	CO3-2	1.943E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
732	SO4-2	2.323E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
180	Cl-1	4.962E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
490	NH4+1	7.245E-06	100.0	0.000E-01	0.0	0.000E-01	0.0
2	H2O	9.251E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
330	H+1	2.236E-02	100.0	0.000E-01	0.0	0.000E-01	0.0

Charge Balance: SPECIATED

Sum of CATIONS = 6.054E-02 Sum of ANIONS 5.588E-02

PERCENT DIFFERENCE = 3.997E+00 (ANIONS - CATIONS)/(ANIONS + CATIONS)

EQUILIBRIUM IONIC STRENGTH (m) = 9.798E-02

EQUILIBRIUM pH = 6.900

DATE ID NUMBER: ******
TIME ID NUMBER: 7523720

Saturation indices and stoichiometry of all minerals

ID #	NAME	Sat. Index	Stoichiometry in [brackets]							
6015000	ANHYDRITE	-0.073	[1.000]	150	[1.000]	732				
5015000	ARAGONITE	0.459	[1.000]	150	[1.000]	140				
5046000	ARTINITE	-6.530	[-2.000]	330	[2.000]	460	[1.000]	140		
			[5.000]	2						
2046000	BRUCITE	-5.894	[1.000]	460	[2.000]	2	[-2.000]	330		
5015001	CALCITE	0.628	[1.000]	150	[1.000]	140				
5015002	DOLOMITE	1.252	[1.000]	150	[1.000]	460	[2.000]	140		
6046000	EPSOMITE	-2.385	[1.000]	460	[1.000]	732	[7.000]	2		
6015001	GYPSUM	0.229	[1.000]	150	[1.000]	732	[2.000]	2		
4150000	HALITE	-6.159	[1.000]	500	[1.000]	180				
5015003	HUNTITE	-1.699	[3.000]	460	[1.000]	150	[4.000]	140		
5046001	HYDRMAGNESIT	-11.980	[5.000]	460	[4.000]	140	[-2.000]	330		
			[6.000]	2						
5046002	MAGNESITE	0.128	[1.000]	460	[1.000]	140				
6050001	MIRABILITE	-5.105	[2.000]	500	[1.000]	732	[10.000]	2		
3050000	NATRON	-8.157	[2.000]	500	[1.000]	140	[10.000]	2		
5046003	NESQUEHONITE	-2.273	[1.000]	460	[1.000]	140	[3.000]	2		
6050002	THENARDITE	-6.479	[2.000]	500	[1.000]	732				
5050001	THERMONATR	-10.010	[2.000]	500	[1.000]	140	[1.000]	2		
2015000	LIME	-22.403	[-2.000]	330	[1.000]	150	[1.000]	2		
2015001	PORTLANDITE	-11.927	[-2.000]	330	[1.000]	150	[2.000]	2		
2046001	PERICLASE	-10.846	[-2.000]	330	[1.000]	460	[1.000]	2		

```
Southwest Alluvium well 627 - '98-'99 median concentrations
Fixed pH, no precip - determine SI
16.00 MG/L   0.000  0.00000E-01
0 0 1 0 3 0 0 0 1 1 0 0 0
0   0   0
    330  0.000E-01   -7.10 y                    /H+1
    150  5.820E+02   -1.84 y                    /Ca+2
    460  2.890E+02   -1.92 y                    /Mg+2
    500  5.090E+02   -1.65 y                    /Na+1
    410  4.700E+00   -3.92 y                    /K+1
    140  5.780E+02   -2.02 y                    /CO3-2
    732  2.660E+03   -1.56 y                    /SO4-2
    180  6.150E+01   -2.76 y                    /Cl-1
    490  2.600E-01   -4.84 y                    /NH4+1
    492  5.800E+02   -2.03 y                    /NO3-1
    470  1.000E-01   -5.74 y                    /Mn+2

  3   1
    330     7.1000     0.0000                   /H+1
```

PART 1 of OUTPUT FILE

PC MINTEQA2 v3.10 DATE OF CALCULATIONS: 18-JAN-** TIME: 7:52:59

Southwest Alluvium well 627 - '98-'99 median concentrations
Fixed pH, no precip - determine SI

Temperature (Celsius): 16.00
Units of concentration: MG/L
Ionic strength to be computed.
If specified, carbonate concentration represents total inorganic carbon.
Do not automatically terminate if charge imbalance exceeds 30%
Precipitation is allowed only for those solids specified as ALLOWED
in the input file (if any).
The maximum number of iterations is: 200
The method used to compute activity coefficients is: Davies equation
Intermediate output file

330	0.000E-01	-7.10	y
150	5.820E+02	-1.84	y
460	2.890E+02	-1.92	y
500	5.090E+02	-1.65	y
410	4.700E+00	-3.92	y
140	5.780E+02	-2.02	y
732	2.660E+03	-1.56	y
180	6.150E+01	-2.76	y
490	2.600E-01	-4.84	y
492	5.800E+02	-2.03	y
470	1.000E-01	-5.74	y

H2O has been inserted as a COMPONENT
3 1
330 7.1000 0.0000

INPUT DATA BEFORE TYPE MODIFICATIONS

ID	NAME	ACTIVITY GUESS	LOG GUESS	ANAL TOTAL
330	H+1	7.943E-08	-7.100	0.000E-01
150	Ca+2	1.445E-02	-1.840	5.820E+02
460	Mg+2	1.202E-02	-1.920	2.890E+02
500	Na+1	2.239E-02	-1.650	5.090E+02
410	K+1	1.202E-04	-3.920	4.700E+00
140	CO3-2	9.550E-03	-2.020	5.780E+02
732	SO4-2	2.754E-02	-1.560	2.660E+03
180	Cl-1	1.738E-03	-2.760	6.150E+01
490	NH4+1	1.445E-05	-4.840	2.600E-01
492	NO3-1	9.333E-03	-2.030	5.800E+02
470	Mn+2	1.820E-06	-5.740	1.000E-01
2	H2O	1.000E+00	0.000	0.000E-01

Charge Balance: UNSPECIATED

Sum of CATIONS= 7.549E-02 Sum of ANIONS = 8.619E-02

PERCENT DIFFERENCE = 6.615E+00 (ANIONS - CATIONS)/(ANIONS + CATIONS)

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-------------------------------------------------------
|  IMPROVED ACTIVITY GUESSES PRIOR TO FIRST ITERATION: |
|       CO3-2       Log activity guess:    -5.40       |
|       SO4-2       Log activity guess:    -1.56       |
|       Mn+2        Log activity guess:    -5.74       |
|                                                      |
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PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY	RESIDUAL
0	NO3-1	9.404E-03	-7.106E-05	-2.03000	7.012E-05
1	NH4+1	1.449E-05	3.406E-07	-4.90768	3.392E-07
2	NO3-1	9.404E-03	2.250E-03	-2.02671	2.248E-03
3	NO3-1	9.404E-03	2.884E-04	-2.11986	2.874E-04
4	NO3-1	9.404E-03	1.496E-05	-2.13298	1.402E-05
5	SO4-2	2.784E-02	4.055E-06	-2.15083	1.271E-06

ID	NAME	ANAL MOL	CALC MOL	LOG ACTVTY	GAMMA	DIFF FXN
470	Mn+2	1.830E-06	1.247E-06	-6.33214	0.373303	2.818E-11
150	Ca+2	1.460E-02	9.657E-03	-2.44311	0.373303	2.158E-07
460	Mg+2	1.195E-02	8.181E-03	-2.51513	0.373303	1.841E-07
500	Na+1	2.226E-02	2.149E-02	-1.77472	0.781655	1.276E-07
410	K+1	1.208E-04	1.159E-04	-4.04275	0.781655	6.946E-10
140	CO3-2	9.683E-03	8.138E-06	-5.51743	0.373303	4.785E-08
732	SO4-2	2.784E-02	1.893E-02	-2.15088	0.373303	4.262E-07
180	Cl-1	1.744E-03	1.744E-03	-2.86547	0.781655	1.002E-08
490	NH4+1	1.449E-05	1.325E-05	-4.98488	0.781655	8.301E-11
492	NO3-1	9.404E-03	9.404E-03	-2.13369	0.781655	5.405E-08
2	H2O	0.000E-01	-1.230E-07	-0.00072	1.000000	0.000E-01
330	H+1	0.000E-01	1.016E-07	-7.10000	0.781655	0.000E-01

Type I - COMPONENTS AS SPECIES IN SOLUTION

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
330	H+1	1.016E-07	7.943E-08	-7.10000	0.78166	0.107
150	Ca+2	9.657E-03	3.605E-03	-2.44311	0.37330	0.428
460	Mg+2	8.181E-03	3.054E-03	-2.51513	0.37330	0.428
500	Na+1	2.149E-02	1.680E-02	-1.77472	0.78166	0.107
410	K+1	1.159E-04	9.062E-05	-4.04275	0.78166	0.107
140	CO3-2	8.138E-06	3.038E-06	-5.51743	0.37330	0.428
732	SO4-2	1.893E-02	7.065E-03	-2.15088	0.37330	0.428
180	Cl-1	1.744E-03	1.363E-03	-2.86547	0.78166	0.107
490	NH4+1	1.325E-05	1.035E-05	-4.98488	0.78166	0.107
492	NO3-1	9.404E-03	7.350E-03	-2.13369	0.78166	0.107
470	Mn+2	1.247E-06	4.654E-07	-6.33214	0.37330	0.428

Type II - OTHER SPECIES IN SOLUTION OR ADSORBED

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
3301401	H2CO3 AQ	1.012E-03	1.035E-03	-2.98516	1.02202	16.723
3307320	HSO4 -	5.448E-08	4.259E-08	-7.37072	0.78166	1.987
3300020	OH-	8.013E-08	6.264E-08	-7.20317	0.78166	-14.195

3304900	NH3 AQ	3.774E-08	3.857E-08	-7.41379	1.02202	-9.538
4907320	NH4SO4 -	1.206E-06	9.424E-07	-6.02576	0.78166	1.217
4603300	MgOH +	3.600E-08	2.814E-08	-7.55064	0.78166	-12.028
4601400	MgCO3 AQ	7.545E-06	7.712E-06	-5.11285	1.02202	2.910
4601401	MgHCO3 +	2.732E-04	2.135E-04	-3.67053	0.78166	11.569
4607320	MgSO4 AQ	3.488E-03	3.565E-03	-2.44792	1.02202	2.209
1503300	CaOH +	6.816E-09	5.328E-09	-8.27343	0.78166	-12.823
1501400	CaHCO3 +	2.295E-04	1.794E-04	-3.74628	0.78166	11.421
1501401	CaCO3 AQ	1.278E-05	1.306E-05	-4.88400	1.02202	3.067
1507320	CaSO4 AQ	4.699E-03	4.803E-03	-2.31853	1.02202	2.266
5001400	NaCO3 -	7.578E-07	5.923E-07	-6.22744	0.78166	1.172
5001401	NaHCO3 AQ	4.769E-05	4.874E-05	-4.31214	1.02202	10.071
5007320	NaSO4 -	7.175E-04	5.609E-04	-3.25115	0.78166	0.781
4107320	KSO4 -	4.896E-06	3.827E-06	-5.41714	0.78166	0.883
4701800	MnCl +	3.284E-09	2.567E-09	-8.59061	0.78166	0.714
4701801	MnCl2 AQ	9.300E-13	9.504E-13	-12.02208	1.02202	0.032
4701802	MnCl3 -	7.472E-16	5.841E-16	-15.23355	0.78166	-0.198
4703300	MnOH +	9.029E-11	7.057E-11	-10.15136	0.78166	-10.812
4703301	Mn(OH)3 -1	1.874E-20	1.465E-20	-19.83430	0.78166	-34.693
4707320	MnSO4 AQ	5.224E-07	5.339E-07	-6.27253	1.02202	2.201
4704920	Mn(NO3)2AQ	1.000E-10	1.022E-10	-9.99048	1.02202	0.600
4701400	MnHCO3 +	5.720E-08	4.471E-08	-7.34957	0.78166	11.707
3301400	HCO3 -	8.091E-03	6.324E-03	-2.19899	0.78166	10.525

Type III - SPECIES WITH FIXED ACTIVITY

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
2	H2O	-1.230E-07	-6.910	0.001	0.000
330	H+1	-1.067E-02	-1.972	7.100	0.000

Type VI - EXCLUDED SPECIES (not included in mole balance)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
3301403	CO2 (g)	2.854E-02	-1.545	18.172	-0.530

PERCENTAGE DISTRIBUTION OF COMPONENTS AMONG
TYPE I and TYPE II (dissolved and adsorbed) species

```
Mn+2                    68.1     PERCENT BOUND IN SPECIES #    470   Mn+2
          28.5     PERCENT BOUND IN SPECIES #4707320   MnSO4 AQ
           3.1     PERCENT BOUND IN SPECIES #4701400   MnHCO3 +

Ca+2                    66.2     PERCENT BOUND IN SPECIES #    150   Ca+2
           1.6     PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
          32.2     PERCENT BOUND IN SPECIES #1507320   CaSO4 AQ

Mg+2                    68.5     PERCENT BOUND IN SPECIES #    460   Mg+2
           2.3     PERCENT BOUND IN SPECIES #4601401   MgHCO3 +
          29.2     PERCENT BOUND IN SPECIES #4607320   MgSO4 AQ

Na+1                    96.6     PERCENT BOUND IN SPECIES #    500   Na+1
           3.2     PERCENT BOUND IN SPECIES #5007320   NaSO4 -

K+1                     95.9     PERCENT BOUND IN SPECIES #    410   K+1
           4.1     PERCENT BOUND IN SPECIES #4107320   KSO4 -

CO3-2                   10.5     PERCENT BOUND IN SPECIES #3301401   H2CO3
AQ
           2.8     PERCENT BOUND IN SPECIES #4601401   MgHCO3 +
           2.4     PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
          83.6     PERCENT BOUND IN SPECIES #3301400   HCO3 -

SO4-2                   68.0     PERCENT BOUND IN SPECIES #    732   SO4-2
          12.5     PERCENT BOUND IN SPECIES #4607320   MgSO4 AQ
          16.9     PERCENT BOUND IN SPECIES #1507320   CaSO4 AQ
           2.6     PERCENT BOUND IN SPECIES #5007320   NaSO4 -

Cl-1                   100.0     PERCENT BOUND IN SPECIES #    180   Cl-1

NH4+1                   91.4     PERCENT BOUND IN SPECIES #    490   NH4+1
           8.3     PERCENT BOUND IN SPECIES #4907320   NH4SO4 -

NO3-1                  100.0     PERCENT BOUND IN SPECIES #    492   NO3-1

H2O                     65.1     PERCENT BOUND IN SPECIES #3300020   OH-
          29.3     PERCENT BOUND IN SPECIES #4603300   MgOH +
           5.5     PERCENT BOUND IN SPECIES #1503300   CaOH +

H+1                     19.0     PERCENT BOUND IN SPECIES #3301401   H2CO3
AQ
           2.6     PERCENT BOUND IN SPECIES #4601401   MgHCO3 +
           2.2     PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
          75.9     PERCENT BOUND IN SPECIES #3301400   HCO3 -
```

---------- EQUILIBRATED MASS DISTRIBUTION ----------

IDX	NAME	DISSOLVED MOL/KG	DISSOLVED PERCENT	SORBED MOL/KG	SORBED PERCENT	PRECIPITATED MOL/KG	PRECIPITATED PERCENT
470	Mn+2	1.830E-06	100.0	0.000E-01	0.0	0.000E-01	0.0
150	Ca+2	1.460E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	1.195E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	2.226E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	1.208E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
140	CO3-2	9.683E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
732	SO4-2	2.784E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
180	Cl-1	1.744E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
490	NH4+1	1.449E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
492	NO3-1	9.404E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
2	H2O	1.230E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
330	H+1	1.067E-02	100.0	0.000E-01	0.0	0.000E-01	0.0

Charge Balance: SPECIATED

Sum of CATIONS = 5.780E-02 Sum of ANIONS 5.783E-02

PERCENT DIFFERENCE = 2.524E-02 (ANIONS - CATIONS)/(ANIONS + CATIONS)

EQUILIBRIUM IONIC STRENGTH (m) = 9.459E-02

EQUILIBRIUM pH = 7.100

DATE ID NUMBER: ******
TIME ID NUMBER: 7530258

Saturation indices and stoichiometry of all minerals

ID #	NAME	Sat. Index	Stoichiometry in [brackets]							
6015000	ANHYDRITE	-0.043	[1.000]	150	[1.000]	732				
5015000	ARAGONITE	0.298	[1.000]	150	[1.000]	140				
5046000	ARTINITE	-6.607	[-2.000]	330	[2.000]	460	[1.000]	140		
			[5.000]	2						
2046000	BRUCITE	-5.698	[1.000]	460	[2.000]	2	[-2.000]	330		
5015001	CALCITE	0.467	[1.000]	150	[1.000]	140				
5015002	DOLOMITE	0.818	[1.000]	150	[1.[illegible]0]	460	[2.000]	140		
6046000	EPSOMITE	-2.467	[1.000]	460	[1.[illegible]]	732	[7.000]	2		
6015001	GYPSUM	0.259	[1.000]	150	[1.[illegible]0]	732	[2.000]	2		
4150000	HALITE	-6.201	[1.000]	500	[1.000]	180				
5015003	HUNTITE	-2.678	[3.000]	460	[1.000]	150	[4.000]	140		
5046001	HYDRMAGNESIT	-12.875	[5.000]	460	[4.000]	140	[-2.000]	330		
			[6.000]	2						
5046002	MAGNESITE	-0.144	[1.000]	460	[1.000]	140				
6050001	MIRABILITE	-4.160	[2.000]	500	[1.000]	732	[10.000]	2		
3050000	NATRON	-7.404	[2.000]	500	[1.000]	140	[10.000]	2		
5046003	NESQUEHONITE	-2.[illegible]6	[1.000]	460	[1.000]	140	[3.000]	2		
6050002	THENARDITE	-5.[illegible]4	[2.000]	500	[1.000]	732				
5050001	THERMONATR	-9.[illegible]57	[2.000]	500	[1.000]	140	[1.000]	2		
2047003	PYROCROITE	-7.737	[-2.000]	330	[1.000]	470	[2.000]	2		
5047000	RHODOCHROSIT	-1.487	[1.000]	470	[1.000]	140				
4147000	MNCL2, 4H2O	-14.379	[1.000]	470	[2.000]	180	[4.000]	2		
6047000	MNSO4	-11.505	[1.000]	470	[1.000]	732				
2015000	LIME	-22.096	[-2.000]	330	[1.000]	150	[1.000]	2		
2015001	PORTLANDITE	-11.620	[-2.000]	330	[1.000]	150	[2.000]	2		
2046001	PERICLASE	-10.650	[-2.000]	330	[1.000]	460	[1.000]	2		

```
Southwest Alluvium well 632, median concentrations '98-99
fixed pH, no precip, determine SI
16.00 MG/L   0.000  0.00000E-01
0 0 1 0 3 0 0 0 1 1 0 0 0
0   0   0
    330  0.000E-01   -6.60 y                    /H+1
    150  6.600E+02   -1.78 y                    /Ca+2
    460  5.940E+02   -1.65 y                    /Mg+2
    500  3.830E+02   -1.78 y                    /Na+1
    410  8.600E+00   -3.66 y                    /K+1
    140  1.878E+03   -1.50 y                    /CO3-2
    732  2.720E+03   -1.55 y                    /SO4-2
    180  2.510E+02   -2.15 y                    /Cl-1
    490  2.600E-01   -4.84 y                    /NH4+1
    492  2.800E+01   -3.35 y                    /NO3-1
    470  7.000E-01   -4.89 y                    /Mn+2

  3   1
    330     6.6000     0.0000                   /H+1
```

PART 1 of OUTPUT FILE

PC MINTEQA2 v3.10 DATE OF CALCULATIONS: 18-JAN-** TIME: 7:47:29

Southwest Alluvium well 632, median concentrations '98-99
fixed pH, no precip, determine SI

Temperature (Celsius): 16.00
Units of concentration: MG/L
Ionic strength to be computed.
If specified, carbonate concentration represents total inorganic carbon.
Do not automatically terminate if charge imbalance exceeds 30%
Precipitation is allowed only for those solids specified as ALLOWED
in the input file (if any).
The maximum number of iterations is: 200
The method used to compute activity coefficients is: Davies equation
Intermediate output file

330	0.000E-01	-6.60	y
150	6.600E+02	-1.78	y
460	5.940E+02	-1.65	y
500	3.830E+02	-1.78	y
410	8.600E+00	-3.66	y
140	1.878E+03	-1.50	y
732	2.720E+03	-1.55	y
180	2.510E+02	-2.15	y
490	2.600E-01	-4.84	y
492	2.800E+01	-3.35	y
470	7.000E-01	-4.89	y

H2O has been inserted as a COMPONENT
3 1
330 6.6000 0.0000

INPUT DATA BEFORE TYPE MODIFICATIONS

ID	NAME	ACTIVITY GUESS	LOG GUESS	ANAL TOTAL
330	H+1	2.512E-07	-6.600	0.000E-01
150	Ca+2	1.660E-02	-1.780	6.600E+02
460	Mg+2	2.239E-02	-1.650	5.940E+02
500	Na+1	1.660E-02	-1.780	3.830E+02
410	K+1	2.188E-04	-3.660	8.600E+00
140	CO3-2	3.162E-02	-1.500	1.878E+03
732	SO4-2	2.818E-02	-1.550	2.720E+03
180	Cl-1	7.079E-03	-2.150	2.510E+02
490	NH4+1	1.445E-05	-4.840	2.600E-01
492	NO3-1	4.467E-04	-3.350	2.800E+01
470	Mn+2	1.288E-05	-4.890	7.000E-01
2	H2O	1.000E+00	0.000	0.000E-01

Charge Balance: UNSPECIATED

Sum of CATIONS= 9.937E-02 Sum of ANIONS = 1.276E-01

PERCENT DIFFERENCE = 1.243E+01 (ANIONS - CATIONS)/(ANIONS + CATIONS)

```
-----------------------------------------------------
| IMPROVED ACTIVITY GUESSES PRIOR TO FIRST ITERATION: |
|      CO3-2        Log activity guess:    -5.50      |
|      SO4-2        Log activity guess:    -1.55      |
|      Mn+2         Log activity guess:    -4.89      |
|                                                     |
-----------------------------------------------------
```

PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY	RESIDUAL
0	NO3-1	4.545E-04	-7.859E-06	-3.35000	7.813E-06
1	NH4+1	1.451E-05	3.498E-07	-4.89815	3.484E-07
2	NO3-1	4.545E-04	1.166E-04	-3.34243	1.166E-04
3	NO3-1	4.545E-04	1.462E-05	-3.44161	1.457E-05
4	NO3-1	4.545E-04	9.871E-07	-3.45536	9.415E-07
5	NO3-1	4.545E-04	6.591E-08	-3.45630	2.045E-08

ID	NAME	ANAL MOL	CALC MOL	LOG ACTVTY	GAMMA	DIFF FXN
470	Mn+2	1.283E-05	8.769E-06	-5.51284	0.350119	6.161E-10
150	Ca+2	1.658E-02	1.140E-02	-2.39896	0.350119	7.841E-07
460	Mg+2	2.459E-02	1.721E-02	-2.21989	0.350119	1.197E-06
500	Na+1	1.677E-02	1.621E-02	-1.90423	0.769226	2.919E-07
410	K+1	2.214E-04	2.135E-04	-3.78447	0.769226	3.882E-09
140	CO3-2	3.150E-02	7.050E-06	-5.60763	0.350119	3.571E-07
732	SO4-2	2.850E-02	1.756E-02	-2.21135	0.350119	1.177E-06
180	Cl-1	7.126E-03	7.126E-03	-2.26108	0.769226	1.250E-07
490	NH4+1	1.451E-05	1.343E-05	-4.98578	0.769226	2.542E-10
492	NO3-1	4.545E-04	4.546E-04	-3.45636	0.769226	7.971E-09
2	H2O	0.000E-01	-5.117E-08	-0.00093	1.000000	0.000E-01
330	H+1	0.000E-01	3.265E-07	-6.60000	0.769226	0.000E-01

Type I - COMPONENTS AS SPECIES IN SOLUTION

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
330	H+1	3.265E-07	2.512E-07	-6.60000	0.76923	0.114
150	Ca+2	1.140E-02	3.991E-03	-2.39896	0.35012	0.456
460	Mg+2	1.721E-02	6.027E-03	-2.21989	0.35012	0.456
500	Na+1	1.621E-02	1.247E-02	-1.90423	0.76923	0.114
410	K+1	2.135E-04	1.643E-04	-3.78447	0.76923	0.114
140	CO3-2	7.050E-06	2.468E-06	-5.60763	0.35012	0.456
732	SO4-2	1.756E-02	6.147E-03	-2.21135	0.35012	0.456
180	Cl-1	7.126E-03	5.482E-03	-2.26108	0.76923	0.114
490	NH4+1	1.343E-05	1.033E-05	-4.98578	0.76923	0.114
492	NO3-1	4.546E-04	3.497E-04	-3.45636	0.76923	0.114
470	Mn+2	8.769E-06	3.070E-06	-5.51284	0.35012	0.456

Type II - OTHER SPECIES IN SOLUTION OR ADSORBED

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
3301401	H2CO3 AQ	8.185E-03	8.407E-03	-2.07536	1.02712	16.721
3307320	HSO4 -	1.523E-07	1.172E-07	-6.93119	0.76923	1.994
3300020	OH-	2.574E-08	1.980E-08	-7.70338	0.76923	-14.189

3304900	NH3 AQ	1.185E-08	1.217E-08	-7.91469	1.02712	-9.541
4907320	NH4SO4 -	1.064E-06	8.182E-07	-6.08713	0.76923	1.224
4603300	MgOH +	2.282E-08	1.755E-08	-7.75561	0.76923	-12.021
4601400	MgCO3 AQ	1.204E-05	1.236E-05	-4.90781	1.02712	2.908
4601401	MgHCO3 +	1.408E-03	1.083E-03	-2.96549	0.76923	11.576
4607320	MgSO4 AQ	5.960E-03	6.121E-03	-2.21315	1.02712	2.206
1503300	CaOH +	2.424E-09	1.864E-09	-8.72949	0.76923	-12.816
1501400	CaHCO3 +	6.632E-04	5.101E-04	-3.29232	0.76923	11.428
1501401	CaCO3 AQ	1.144E-05	1.175E-05	-4.93005	1.02712	3.065
1507320	CaSO4 AQ	4.503E-03	4.625E-03	-2.33484	1.02712	2.264
5001400	NaCO3 -	4.643E-07	3.572E-07	-6.44715	0.76923	1.179
5001401	NaHCO3 AQ	9.047E-05	9.293E-05	-4.03185	1.02712	10.068
5007320	NaSO4 -	4.708E-04	3.621E-04	-3.44113	0.76923	0.788
4107320	KSO4 -	7.846E-06	6.035E-06	-5.21932	0.76923	0.890
4701800	MnCl +	8.852E-08	6.809E-08	-7.16692	0.76923	0.721
4701801	MnCl2 AQ	9.871E-11	1.014E-10	-9.99400	1.02712	0.029
4701802	MnCl3 -	3.257E-13	2.506E-13	-12.60108	0.76923	-0.191
4703300	MnOH +	1.913E-10	1.471E-10	-9.83227	0.76923	-10.805
4703301	Mn(OH)3 -1	3.966E-21	3.050E-21	-20.51563	0.76923	-34.686
4707320	MnSO4 AQ	2.983E-06	3.064E-06	-5.51370	1.02712	2.199
4704920	Mn(NO3)2AQ	1.485E-12	1.526E-12	-11.81654	1.02712	0.597
4701400	MnHCO3 +	9.851E-07	7.578E-07	-6.12047	0.76923	11.714
3301400	HCO3 -	2.112E-02	1.625E-02	-1.78919	0.76923	10.532

Type III - SPECIES WITH FIXED ACTIVITY

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
2	H2O	-5.117E-08	-7.291	0.001	0.000
330	H+1	-3.966E-02	-1.402	6.600	0.000

Type VI - EXCLUDED SPECIES (not included in mole balance)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
3301403	CO2 (g)	2.320E-01	-0.635	18.172	-0.530

PERCENTAGE DISTRIBUTION OF COMPONENTS AMONG
TYPE I and TYPE II (dissolved and adsorbed) species

```
Mn+2                    68.4     PERCENT BOUND IN SPECIES #    470   Mn+2
              23.3    PERCENT BOUND IN SPECIES #4707320   MnSO4 AQ
               7.7    PERCENT BOUND IN SPECIES #4701400   MnHCO3 +

Ca+2                    68.8     PERCENT BOUND IN SPECIES #    150   Ca+2
               4.0    PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
              27.2    PERCENT BOUND IN SPECIES #1507320   CaSO4 AQ

Mg+2                    70.0     PERCENT BOUND IN SPECIES #    460   Mg+2
               5.7    PERCENT BOUND IN SPECIES #4601401   MgHCO3 +
              24.2    PERCENT BOUND IN SPECIES #4607320   MgSO4 AQ

Na+1                    96.7     PERCENT BOUND IN SPECIES #    500   Na+1
               2.8    PERCENT BOUND IN SPECIES #5007320   NaSO4 -

K+1                     96.5     PERCENT BOUND IN SPECIES #    410   K+1
               3.5    PERCENT BOUND IN SPECIES #4107320   KSO4 -

CO3-2                   26.0     PERCENT BOUND IN SPECIES #3301401   H2CO3
AQ
               4.5    PERCENT BOUND IN SPECIES #4601401   MgHCO3 +
               2.1    PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
              67.1    PERCENT BOUND IN SPECIES #3301400   HCO3 -

SO4-2                   61.6     PERCENT BOUND IN SPECIES #    732   SO4-2
              20.9    PERCENT BOUND IN SPECIES #4607320   MgSO4 AQ
              15.8    PERCENT BOUND IN SPECIES #1507320   CaSO4 AQ
               1.7    PERCENT BOUND IN SPECIES #5007320   NaSO4 -

Cl-1                   100.0     PERCENT BOUND IN SPECIES #    180   Cl-1

NH4+1                   92.6     PERCENT BOUND IN SPECIES #    490   NH4+1
               7.3    PERCENT BOUND IN SPECIES #4907320   NH4SO4 -

NO3-1                  100.0     PERCENT BOUND IN SPECIES #    492   NO3-1

H2O                     50.3     PERCENT BOUND IN SPECIES #3300020   OH-
              44.6    PERCENT BOUND IN SPECIES #4603300   MgOH +
               4.7    PERCENT BOUND IN SPECIES #1503300   CaOH +

H+1                     41.3     PERCENT BOUND IN SPECIES #3301401   H2CO3
AQ
               3.5    PERCENT BOUND IN SPECIES #4601401   MgHCO3 +
               1.7    PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
              53.3    PERCENT BOUND IN SPECIES #3301400   HCO3 -
```

---------- EQUILIBRATED MASS DISTRIBUTION ----------

IDX	NAME	DISSOLVED MOL/KG	DISSOLVED PERCENT	SORBED MOL/KG	SORBED PERCENT	PRECIPITATED MOL/KG	PRECIPITATED PERCENT
470	Mn+2	1.283E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
150	Ca+2	1.658E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	2.459E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	1.677E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	2.214E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
140	CO3-2	3.150E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
732	SO4-2	2.850E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
180	Cl-1	7.126E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
490	NH4+1	1.451E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
492	NO3-1	4.546E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
2	H2O	5.117E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
330	H+1	3.966E-02	100.0	0.000E-01	0.0	0.000E-01	0.0

Charge Balance: SPECIATED

Sum of CATIONS = 7.575E-02 Sum of ANIONS 6.431E-02

PERCENT DIFFERENCE = 8.167E+00 (ANIONS - CATIONS)/(ANIONS + CATIONS)

EQUILIBRIUM IONIC STRENGTH (m) = 1.162E-01

EQUILIBRIUM pH = 6.600

DATE ID NUMBER: ******
TIME ID NUMBER: 7473220

Saturation indices and stoichiometry of all minerals

ID #	NAME	Sat. Index	Stoichiometry in [brackets]							
6015000	ANHYDRITE	-0.059	[1.000]	150	[1.000]	732				
5015000	ARAGONITE	0.251	[1.000]	150	[1.000]	140				
5046000	ARTINITE	-7.108	[-2.000]	330	[2.000]	460	[1.000]	140		
			[5.000]	2						
2046000	BRUCITE	-6.403	[1.000]	460	[2.000]	2	[-2.000]	330		
5015001	CALCITE	0.421	[1.000]	150	[1.000]	140				
5015002	DOLOMITE	0.977	[1.000]	150	[1.000]	460	[2.000]	140		
6046000	EPSOMITE	-2.233	[1.000]	460	[1.000]	732	[7.000]	2		
6015001	GYPSUM	0.242	[1.000]	150	[1.000]	732	[2.000]	2		
4150000	HALITE	-5.726	[1.000]	500	[1.000]	180				
5015003	HUNTITE	-2.109	[3.000]	460	[1.000]	150	[4.000]	140		
5046001	HYDRMAGNESIT	-12.761	[5.000]	460	[4.000]	140	[-2.000]	330		
			[6.000]	2						
5046002	MAGNESITE	0.061	[1.000]	460	[1.000]	140				
6050001	MIRABILITE	-4.482	[2.000]	500	[1.000]	732	[10.000]	2		
3050000	NATRON	-7.755	[2.000]	500	[1.000]	140	[10.000]	2		
5046003	NESQUEHONITE	-2.341	[1.000]	460	[1.000]	140	[3.000]	2		
6050002	THENARDITE	-5.854	[2.000]	500	[1.000]	732				
5050001	THERMONATR	-9.606	[2.000]	500	[1.000]	140	[1.000]	2		
2047003	PYROCROITE	-7.918	[-2.000]	330	[1.000]	470	[2.000]	2		
5047000	RHODOCHROSIT	-0.758	[1.000]	470	[1.000]	140				
4147000	MNCL2, 4H2O	-12.352	[1.000]	470	[2.000]	180	[4.000]	2		
6047000	MNSO4	-10.746	[1.000]	470	[1.000]	732				
2015000	LIME	-23.052	[-2.000]	330	[1.000]	150	[1.000]	2		
2015001	PORTLANDITE	-12.576	[-2.000]	330	[1.000]	150	[2.000]	2		
2046001	PERICLASE	-11.355	[-2.000]	330	[1.000]	460	[1.000]	2		

```
Southwest Alluvium well 801, median '98-99 concentrations
fixed pH and no precip to determine SI
16.00 MG/L   0.000  0.00000E-01
0 0 1 0 3 0 0 0 1 1 0 0 0
0   0   0
    330  0.000E-01   -6.50 y                    /H+1
    150  5.460E+02   -1.87 y                    /Ca+2
    460  9.150E+02   -1.42 y                    /Mg+2
    500  3.970E+02   -1.76 y                    /Na+1
    410  1.430E+01   -3.44 y                    /K+1
    140  1.416E+03   -1.63 y                    /CO3-2
    732  4.260E+03   -1.35 y                    /SO4-2
    180  2.220E+02   -2.20 y                    /Cl-1
    490  2.600E+01   -2.84 y                    /NH4+1
    492  2.800E+01   -3.35 y                    /NO3-1
    470  1.700E+01   -3.51 y                    /Mn+2

  3   1
    330     6.5000     0.0000                   /H+1
```

PART 1 of OUTPUT FILE

PC MINTEQA2 v3.10 DATE OF CALCULATIONS: 18-JAN-** TIME: 7:47:56

Southwest Alluvium well 801, median '98-99 concentrations
fixed pH and no precip to determine SI

Temperature (Celsius): 16.00
Units of concentration: MG/L
Ionic strength to be computed.
If specified, carbonate concentration represents total inorganic carbon.
Do not automatically terminate if charge imbalance exceeds 30%
Precipitation is allowed only for those solids specified as ALLOWED
in the input file (if any).
The maximum number of iterations is: 200
The method used to compute activity coefficients is: Davies equation
Intermediate output file

330	0.000E-01	-6.50	y
150	5.460E+02	-1.87	y
460	9.150E+02	-1.42	y
500	3.970E+02	-1.76	y
410	1.430E+01	-3.44	y
140	1.416E+03	-1.63	y
732	4.260E+03	-1.35	y
180	2.220E+02	-2.20	y
490	2.600E+01	-2.84	y
492	2.800E+01	-3.35	y
470	1.700E+01	-3.51	y

H2O has been inserted as a COMPONENT
3 1
330 6.5000 0.0000

INPUT DATA BEFORE TYPE MODIFICATIONS

ID	NAME	ACTIVITY GUESS	LOG GUESS	ANAL TOTAL
330	H+1	3.162E-07	-6.500	0.000E-01
150	Ca+2	1.349E-02	-1.870	5.460E+02
460	Mg+2	3.802E-02	-1.420	9.150E+02
500	Na+1	1.738E-02	-1.760	3.970E+02
410	K+1	3.631E-04	-3.440	1.430E+01
140	CO3-2	2.344E-02	-1.630	1.416E+03
732	SO4-2	4.467E-02	-1.350	4.260E+03
180	Cl-1	6.310E-03	-2.200	2.220E+02
490	NH4+1	1.445E-03	-2.840	2.600E+01
492	NO3-1	4.467E-04	-3.350	2.800E+01
470	Mn+2	3.090E-04	-3.510	1.700E+01
2	H2O	1.000E+00	0.000	0.000E-01

Charge Balance: UNSPECIATED

Sum of CATIONS= 1.232E-01 Sum of ANIONS = 1.437E-01

PERCENT DIFFERENCE = 7.699E+00 (ANIONS - CATIONS)/(ANIONS + CATIONS)

```
-------------------------------------------------------
|  IMPROVED ACTIVITY GUESSES PRIOR TO FIRST ITERATION: |
|       CO3-2        Log activity guess:    -5.76      |
|       SO4-2        Log activity guess:    -1.35      |
|       Mn+2         Log activity guess:    -3.51      |
|                                                      |
-------------------------------------------------------
```

PC MINTEQA2 v3.10 DATE OF CALCULATIONS: 18-JAN-** TIME: 7:47:57

PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY	RESIDUAL
0	NO3-1	4.551E-04	-8.462E-06	-3.35000	8.417E-06
1	NH4+1	1.453E-03	7.490E-05	-2.92679	7.476E-05
2	NO3-1	4.551E-04	1.228E-04	-3.34185	1.228E-04
3	NO3-1	4.551E-04	1.726E-05	-3.44561	1.722E-05
4	NO3-1	4.551E-04	1.050E-06	-3.46178	1.005E-06
5	SO4-2	4.470E-02	1.052E-05	-2.04701	6.047E-06

ID	NAME	ANAL MOL	CALC MOL	LOG ACTVTY	GAMMA	DIFF FXN
470	Mn+2	3.119E-04	2.018E-04	-4.17890	0.328157	9.567E-09
150	Ca+2	1.373E-02	8.712E-03	-2.54382	0.328157	4.047E-07
460	Mg+2	3.793E-02	2.487E-02	-2.08819	0.328157	1.169E-06
500	Na+1	1.741E-02	1.664E-02	-1.89992	0.756868	2.114E-07
410	K+1	3.686E-04	3.498E-04	-3.57711	0.756868	4.501E-09
140	CO3-2	2.378E-02	4.147E-06	-5.86622	0.328157	1.645E-07
732	SO4-2	4.470E-02	2.734E-02	-2.04708	0.328157	1.259E-06
180	Cl-1	6.311E-03	6.310E-03	-2.32097	0.756868	7.707E-08
490	NH4+1	1.453E-03	1.301E-03	-3.00656	0.756868	1.773E-08
492	NO3-1	4.551E-04	4.552E-04	-3.46282	0.756868	5.558E-09
2	H2O	0.000E-01	-5.044E-08	-0.00108	1.000000	0.000E-01
330	H+1	0.000E-01	4.178E-07	-6.50000	0.756868	0.000E-01

Type I - COMPONENTS AS SPECIES IN SOLUTION

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
330	H+1	4.178E-07	3.162E-07	-6.50000	0.75687	0.121
150	Ca+2	8.712E-03	2.859E-03	-2.54382	0.32816	0.484
460	Mg+2	2.487E-02	8.162E-03	-2.08819	0.32816	0.484
500	Na+1	1.664E-02	1.259E-02	-1.89992	0.75687	0.121
410	K+1	3.498E-04	2.648E-04	-3.57711	0.75687	0.121
140	CO3-2	4.147E-06	1.361E-06	-5.86622	0.32816	0.484
732	SO4-2	2.734E-02	8.973E-03	-2.04708	0.32816	0.484
180	Cl-1	6.310E-03	4.776E-03	-2.32097	0.75687	0.121
490	NH4+1	1.301E-03	9.850E-04	-3.00656	0.75687	0.121
492	NO3-1	4.552E-04	3.445E-04	-3.46282	0.75687	0.121
470	Mn+2	2.018E-04	6.624E-05	-4.17890	0.32816	0.484

Type II - OTHER SPECIES IN SOLUTION OR ADSORBED

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
3301401	H2CO3 AQ	7.107E-03	7.346E-03	-2.13395	1.03360	16.718
3307320	HSO4 -	2.845E-07	2.153E-07	-6.66691	0.75687	2.001
3300020	OH-	2.077E-08	1.572E-08	-7.80353	0.75687	-14.181

3304900	NH3 AQ	8.916E-07	9.216E-07	-6.03547	1.03360	-9.543
4907320	NH4SO4 -	1.504E-04	1.139E-04	-3.94363	0.75687	1.231
4603300	MgOH +	2.494E-08	1.888E-08	-7.72407	0.75687	-12.014
4601400	MgCO3 AQ	8.932E-06	9.232E-06	-5.03471	1.03360	2.905
4601401	MgHCO3 +	1.345E-03	1.018E-03	-2.99239	0.75687	11.583
4607320	MgSO4 AQ	1.171E-02	1.210E-02	-1.91718	1.03360	2.204
1503300	CaOH +	1.401E-09	1.060E-09	-8.97451	0.75687	-12.809
1501400	CaHCO3 +	3.351E-04	2.536E-04	-3.59578	0.75687	11.435
1501401	CaCO3 AQ	4.489E-06	4.640E-06	-5.33350	1.03360	3.062
1507320	CaSO4 AQ	4.680E-03	4.837E-03	-2.31543	1.03360	2.261
5001400	NaCO3 -	2.628E-07	1.989E-07	-6.70143	0.75687	1.186
5001401	NaHCO3 AQ	6.303E-05	6.514E-05	-4.18613	1.03360	10.066
5007320	NaSO4 -	7.054E-04	5.339E-04	-3.27254	0.75687	0.795
4107320	KSO4 -	1.876E-05	1.420E-05	-4.84769	0.75687	0.897
4701800	MnCl +	1.691E-06	1.280E-06	-5.89287	0.75687	0.728
4701801	MnCl2 AQ	1.606E-09	1.660E-09	-8.77984	1.03360	0.027
4701802	MnCl3 -	4.722E-12	3.574E-12	-11.44682	0.75687	-0.184
4703300	MnOH +	3.330E-09	2.521E-09	-8.59848	0.75687	-10.798
4703301	Mn(OH)3 -1	4.353E-20	3.295E-20	-19.48215	0.75687	-34.679
4707320	MnSO4 AQ	9.336E-05	9.650E-05	-4.01548	1.03360	2.196
4704920	Mn(NO3)2AQ	3.091E-11	3.195E-11	-10.49551	1.03360	0.595
4701400	MnHCO3 +	1.499E-05	1.135E-05	-4.94512	0.75687	11.721
3301400	HCO3 -	1.490E-02	1.128E-02	-1.94779	0.75687	10.539

Type III - SPECIES WITH FIXED ACTIVITY

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
2	H2O	-5.044E-08	-7.297	0.001	0.000
330	H+1	-3.087E-02	-1.510	6.500	0.000

Type VI - EXCLUDED SPECIES (not included in mole balance)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
3301403	CO2 (g)	2.027E-01	-0.693	18.172	-0.530

PERCENTAGE DISTRIBUTION OF COMPONENTS AMONG
TYPE I and TYPE II (dissolved and adsorbed) species

```
Mn+2                    64.7     PERCENT BOUND IN SPECIES #    470   Mn+2
          29.9     PERCENT BOUND IN SPECIES #4707320   MnSO4 AQ
           4.8     PERCENT BOUND IN SPECIES #4701400   MnHCO3 +

Ca+2                    63.4     PERCENT BOUND IN SPECIES #    150   Ca+2
           2.4     PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
          34.1     PERCENT BOUND IN SPECIES #1507320   CaSO4 AQ

Mg+2                    65.6     PERCENT BOUND IN SPECIES #    460   Mg+2
           3.5     PERCENT BOUND IN SPECIES #4601401   MgHCO3 +
          30.9     PERCENT BOUND IN SPECIES #4607320   MgSO4 AQ

Na+1                    95.6     PERCENT BOUND IN SPECIES #    500   Na+1
           4.1     PERCENT BOUND IN SPECIES #5007320   NaSO4 -

K+1                     94.9     PERCENT BOUND IN SPECIES #    410   K+1
           5.1     PERCENT BOUND IN SPECIES #4107320   KSO4 -

CO3-2                   29.9     PERCENT BOUND IN SPECIES #3301401   H2CO3
AQ
           5.7     PERCENT BOUND IN SPECIES #4601401   MgHCO3 +
           1.4     PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
          62.7     PERCENT BOUND IN SPECIES #3301400   HCO3 -

SO4-2                   61.2     PERCENT BOUND IN SPECIES #    732   SO4-2
          26.2     PERCENT BOUND IN SPECIES #4607320   MgSO4 AQ
          10.5     PERCENT BOUND IN SPECIES #1507320   CaSO4 AQ
           1.6     PERCENT BOUND IN SPECIES #5007320   NaSO4 -

Cl-1                   100.0     PERCENT BOUND IN SPECIES #    180   Cl-1

NH4+1                   89.6     PERCENT BOUND IN SPECIES #    490   NH4+1
          10.4     PERCENT BOUND IN SPECIES #4907320   NH4SO4 -

NO3-1                  100.0     PERCENT BOUND IN SPECIES #    492   NO3-1

H2O                     41.2     PERCENT BOUND IN SPECIES #3300020   OH-
          49.4     PERCENT BOUND IN SPECIES #4603300   MgOH +
           2.8     PERCENT BOUND IN SPECIES #1503300   CaOH +
           6.6     PERCENT BOUND IN SPECIES #4703300   MnOH +

H+1                     46.0     PERCENT BOUND IN SPECIES #3301401   H2CO3
AQ
           4.4     PERCENT BOUND IN SPECIES #4601401   MgHCO3 +
           1.1     PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
          48.3     PERCENT BOUND IN SPECIES #3301400   HCO3 -
```

---------- EQUILIBRATED MASS DISTRIBUTION ----------

IDX	NAME	DISSOLVED MOL/KG	DISSOLVED PERCENT	SORBED MOL/KG	SORBED PERCENT	PRECIPITATED MOL/KG	PRECIPITATED PERCENT
470	Mn+2	3.119E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
150	Ca+2	1.373E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	3.793E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	1.741E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	3.686E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
140	CO3-2	2.378E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
732	SO4-2	4.470E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
180	Cl-1	6.311E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
490	NH4+1	1.453E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
492	NO3-1	4.552E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
2	H2O	5.044E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
330	H+1	3.087E-02	100.0	0.000E-01	0.0	0.000E-01	0.0

Charge Balance: SPECIATED

Sum of CATIONS = 8.756E-02 Sum of ANIONS 7.723E-02

PERCENT DIFFERENCE = 6.265E+00 (ANIONS - CATIONS)/(ANIONS + CATIONS)

EQUILIBRIUM IONIC STRENGTH (m) = 1.435E-01

EQUILIBRIUM pH = 6.500

DATE ID NUMBER: ******
TIME ID NUMBER: 7475923

Saturation indices and stoichiometry of all minerals

ID #	NAME	Sat. Index	Stoichiometry in [brackets]							
6015000	ANHYDRITE	-0.040	[1.000]	150	[1.000]	732				
5015000	ARAGONITE	-0.152	[1.000]	150	[1.000]	140				
5046000	ARTINITE	-7.304	[-2.000]	330	[2.000]	460	[1.000]	140		
			[5.000]	2						
2046000	BRUCITE	-6.472	[1.000]	460	[2.000]	2	[-2.000]	330		
5015001	CALCITE	0.017	[1.000]	150	[1.000]	140				
5015002	DOLOMITE	0.446	[1.000]	150	[1.000]	460	[2.000]	140		
6046000	EPSOMITE	-1.939	[1.000]	460	[1.000]	732	[7.000]	2		
6015001	GYPSUM	0.261	[1.000]	150	[1.000]	732	[2.000]	2		
4150000	HALITE	-5.782	[1.000]	500	[1.000]	180				
5015003	HUNTITE	-2.893	[3.000]	460	[1.000]	150	[4.000]	140		
5046001	HYDRMAGNESIT	-13.337	[5.000]	460	[4.000]	140	[-2.000]	330		
			[6.000]	2						
5046002	MAGNESITE	-0.066	[1.000]	460	[1.000]	140				
6050001	MIRABILITE	-4.311	[2.000]	500	[1.000]	732	[10.000]	2		
3050000	NATRON	-8.007	[2.000]	500	[1.000]	140	[10.000]	2		
5046003	NESQUEHONITE	-2.469	[1.000]	460	[1.000]	140	[3.000]	2		
6050002	THENARDITE	-5.681	[2.000]	500	[1.000]	732				
5050001	THERMONATR	-9.856	[2.000]	500	[1.000]	140	[1.000]	2		
2047003	PYROCROITE	-6.784	[-2.000]	330	[1.000]	470	[2.000]	2		
5047000	RHODOCHROSIT	0.317	[1.000]	470	[1.000]	140				
4147000	MNCL2, 4H2O	-11.139	[1.000]	470	[2.000]	180	[4.000]	2		
6047000	MNSO4	-9.248	[1.000]	470	[1.000]	732				
2015000	LIME	-23.397	[-2.000]	330	[1.000]	150	[1.000]	2		
2015001	PORTLANDITE	-12.921	[-2.000]	330	[1.000]	150	[2.000]	2		
2046001	PERICLASE	-11.424	[-2.000]	330	[1.000]	460	[1.000]	2		

```
Southwest Alluvium well 802, median '98-99 concentrations
Fixed pH, no precip, determine SI
16.00 MG/L   0.000  0.00000E-01
0 0 1 0 3 0 0 0 1 1 0 0 0
0   0   0
    330  0.000E-01   -6.50 y                    /H+1
    150  7.660E+02   -1.72 y                    /Ca+2
    460  7.260E+02   -1.52 y                    /Mg+2
    500  3.480E+02   -1.82 y                    /Na+1
    410  7.200E+00   -3.73 y                    /K+1
    140  2.084E+03   -1.46 y                    /CO3-2
    732  3.160E+03   -1.48 y                    /SO4-2
    180  2.100E+02   -2.23 y                    /Cl-1
    490  1.500E+00   -4.08 y                    /NH4+1
    492  3.820E+02   -2.21 y                    /NO3-1
    470  1.200E+00   -4.66 y                    /Mn+2

  3   1
    330     6.5000     0.0000                   /H+1
```

PART 1 of OUTPUT FILE

PC MINTEQA2 v3.10 DATE OF CALCULATIONS: 18-JAN-** TIME: 7:48:52

Southwest Alluvium well 802, median '98-99 concentrations
Fixed pH, no precip, determine SI

Temperature (Celsius): 16.00
Units of concentration: MG/L
Ionic strength to be computed.
If specified, carbonate concentration represents total inorganic carbon.
Do not automatically terminate if charge imbalance exceeds 30%
Precipitation is allowed only for those solids specified as ALLOWED
in the input file (if any).
The maximum number of iterations is: 200
The method used to compute activity coefficients is: Davies equation
Intermediate output file

330	0.000E-01	-6.50	y
150	7.660E+02	-1.72	y
460	7.260E+02	-1.52	y
500	3.480E+02	-1.82	y
410	7.200E+00	-3.73	y
140	2.084E+03	-1.46	y
732	3.160E+03	-1.48	y
180	2.100E+02	-2.23	y
490	1.500E+00	-4.08	y
492	3.820E+02	-2.21	y
470	1.200E+00	-4.66	y

H2O has been inserted as a COMPONENT
3 1
330 6.5000 0.0000

INPUT DATA BEFORE TYPE MODIFICATIONS

ID	NAME	ACTIVITY GUESS	LOG GUESS	ANAL TOTAL
330	H+1	3.162E-07	-6.500	0.000E-01
150	Ca+2	1.905E-02	-1.720	7.660E+02
460	Mg+2	3.020E-02	-1.520	7.260E+02
500	Na+1	1.514E-02	-1.820	3.480E+02
410	K+1	1.862E-04	-3.730	7.200E+00
140	CO3-2	3.467E-02	-1.460	2.084E+03
732	SO4-2	3.311E-02	-1.480	3.160E+03
180	Cl-1	5.888E-03	-2.230	2.100E+02
490	NH4+1	8.318E-05	-4.080	1.500E+00
492	NO3-1	6.166E-03	-2.210	3.820E+02
470	Mn+2	2.188E-05	-4.660	1.200E+00
2	H2O	1.000E+00	0.000	0.000E-01

Charge Balance: UNSPECIATED

Sum of CATIONS= 1.143E-01 Sum of ANIONS = 1.485E-01

PERCENT DIFFERENCE = 1.302E+01 (ANIONS - CATIONS)/(ANIONS + CATIONS)

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-----------------------------------------------------
| IMPROVED ACTIVITY GUESSES PRIOR TO FIRST ITERATION: |
|      CO3-2        Log activity guess:    -5.59     |
|      SO4-2        Log activity guess:    -1.48     |
|      Mn+2         Log activity guess:    -4.66     |
|                                                    |
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PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY	RESIDUAL
0	NO3-1	6.209E-03	-4.256E-05	-2.21000	4.194E-05
1	NH4+1	8.380E-05	2.566E-06	-4.14479	2.558E-06
2	NO3-1	6.209E-03	1.672E-03	-2.20701	1.671E-03
3	NO3-1	6.209E-03	2.051E-04	-2.31059	2.044E-04
4	NO3-1	6.209E-03	1.305E-05	-2.32470	1.242E-05
5	NO3-1	6.209E-03	7.910E-07	-2.32562	1.701E-07

ID	NAME	ANAL MOL	CALC MOL	LOG ACTVTY	GAMMA	DIFF FXN
470	Mn+2	2.201E-05	1.497E-05	-5.29952	0.335224	9.345E-10
150	Ca+2	1.926E-02	1.314E-02	-2.35620	0.335224	8.027E-07
460	Mg+2	3.009E-02	2.091E-02	-2.15423	0.335224	1.292E-06
500	Na+1	1.525E-02	1.471E-02	-1.95108	0.760911	2.375E-07
410	K+1	1.856E-04	1.785E-04	-3.86711	0.760911	2.912E-09
140	CO3-2	3.500E-02	5.999E-06	-5.69661	0.335224	3.154E-07
732	SO4-2	3.315E-02	1.984E-02	-2.17706	0.335224	1.172E-06
180	Cl-1	5.969E-03	5.969E-03	-2.34275	0.760911	9.366E-08
490	NH4+1	8.380E-05	7.714E-05	-4.23140	0.760911	1.314E-09
492	NO3-1	6.209E-03	6.209E-03	-2.32567	0.760911	9.741E-08
2	H2O	0.000E-01	-4.437E-08	-0.00107	1.000000	0.000E-01
330	H+1	0.000E-01	4.156E-07	-6.50000	0.760911	0.000E-01

Type I - COMPONENTS AS SPECIES IN SOLUTION

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
330	H+1	4.156E-07	3.162E-07	-6.50000	0.76091	0.119
150	Ca+2	1.314E-02	4.403E-03	-2.35620	0.33522	0.475
460	Mg+2	2.091E-02	7.011E-03	-2.15423	0.33522	0.475
500	Na+1	1.471E-02	1.119E-02	-1.95108	0.76091	0.119
410	K+1	1.785E-04	1.358E-04	-3.86711	0.76091	0.119
140	CO3-2	5.999E-06	2.011E-06	-5.69661	0.33522	0.475
732	SO4-2	1.984E-02	6.652E-03	-2.17706	0.33522	0.475
180	Cl-1	5.969E-03	4.542E-03	-2.34275	0.76091	0.119
490	NH4+1	7.714E-05	5.869E-05	-4.23140	0.76091	0.119
492	NO3-1	6.209E-03	4.724E-03	-2.32567	0.76091	0.119
470	Mn+2	1.497E-05	5.017E-06	-5.29952	0.33522	0.475

Type II - OTHER SPECIES IN SOLUTION OR ADSORBED

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
3301401	H2CO3 AQ	1.053E-02	1.086E-02	-1.96435	1.03129	16.719
3307320	HSO4 -	2.098E-07	1.596E-07	-6.79690	0.76091	1.999
3300020	OH-	2.066E-08	1.572E-08	-7.80353	0.76091	-14.184

3304900	NH3 AQ	5.325E-08	5.491E-08	-7.26031	1.03129	-9.542
4907320	NH4SO4 -	6.610E-06	5.030E-06	-5.29846	0.76091	1.229
4603300	MgOH +	2.131E-08	1.621E-08	-7.79010	0.76091	-12.016
4601400	MgCO3 AQ	1.136E-05	1.172E-05	-4.93115	1.03129	2.906
4601401	MgHCO3 +	1.698E-03	1.292E-03	-2.88883	0.76091	11.581
4607320	MgSO4 AQ	7.472E-03	7.705E-03	-2.11321	1.03129	2.205
1503300	CaOH +	2.147E-09	1.634E-09	-8.78688	0.76091	-12.811
1501400	CaHCO3 +	7.588E-04	5.774E-04	-3.23856	0.76091	11.433
1501401	CaCO3 AQ	1.024E-05	1.056E-05	-4.97628	1.03129	3.063
1507320	CaSO4 AQ	5.356E-03	5.523E-03	-2.25780	1.03129	2.262
5001400	NaCO3 -	3.433E-07	2.612E-07	-6.58299	0.76091	1.183
5001401	NaHCO3 AQ	8.297E-05	8.557E-05	-4.06770	1.03129	10.067
5007320	NaSO4 -	4.623E-04	3.518E-04	-3.45370	0.76091	0.793
4107320	KSO4 -	7.096E-06	5.399E-06	-5.26768	0.76091	0.895
4701800	MnCl +	1.212E-07	9.220E-08	-7.03527	0.76091	0.726
4701801	MnCl2 AQ	1.103E-10	1.138E-10	-9.94403	1.03129	0.028
4701802	MnCl3 -	3.061E-13	2.329E-13	-12.63278	0.76091	-0.186
4703300	MnOH +	2.509E-10	1.909E-10	-9.71909	0.76091	-10.800
4703301	Mn(OH)3 -1	3.280E-21	2.496E-21	-20.60274	0.76091	-34.681
4707320	MnSO4 AQ	5.254E-06	5.419E-06	-5.26609	1.03129	2.197
4704920	Mn(NO3)2AQ	4.414E-10	4.552E-10	-9.34183	1.03129	0.596
4701400	MnHCO3 +	1.669E-06	1.270E-06	-5.89614	0.76091	11.719
3301400	HCO3 -	2.190E-02	1.667E-02	-1.77818	0.76091	10.537

Type III - SPECIES WITH FIXED ACTIVITY

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
2	H2O	-4.437E-08	-7.353	0.001	0.000
330	H+1	-4.550E-02	-1.342	6.500	0.000

Type VI - EXCLUDED SPECIES (not included in mole balance)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
3301403	CO2 (g)	2.996E-01	-0.523	18.172	-0.530

PERCENTAGE DISTRIBUTION OF COMPONENTS AMONG
TYPE I and TYPE II (dissolved and adsorbed) species

```
Mn+2                    68.0     PERCENT BOUND IN SPECIES #    470   Mn+2
              23.9    PERCENT BOUND IN SPECIES #4707320   MnSO4 AQ
               7.6    PERCENT BOUND IN SPECIES #4701400   MnHCO3 +

Ca+2                    68.2     PERCENT BOUND IN SPECIES #    150   Ca+2
               3.9    PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
              27.8    PERCENT BOUND IN SPECIES #1507320   CaSO4 AQ

Mg+2                    69.5     PERCENT BOUND IN SPECIES #    460   Mg+2
               5.6    PERCENT BOUND IN SPECIES #4601401   MgHCO3 +
              24.8    PERCENT BOUND IN SPECIES #4607320   MgSO4 AQ

Na+1                    96.4     PERCENT BOUND IN SPECIES #    500   Na+1
               3.0    PERCENT BOUND IN SPECIES #5007320   NaSO4 -

K+1                     96.2     PERCENT BOUND IN SPECIES #    410   K+1
               3.8    PERCENT BOUND IN SPECIES #4107320   KSO4 -

CO3-2                   30.1     PERCENT BOUND IN SPECIES #3301401   H2CO3
AQ
               4.9    PERCENT BOUND IN SPECIES #4601401   MgHCO3 +
               2.2    PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
              62.6    PERCENT BOUND IN SPECIES #3301400   HCO3 -

SO4-2                   59.9     PERCENT BOUND IN SPECIES #    732   SO4-2
              22.5    PERCENT BOUND IN SPECIES #4607320   MgSO4 AQ
              16.2    PERCENT BOUND IN SPECIES #1507320   CaSO4 AQ
               1.4    PERCENT BOUND IN SPECIES #5007320   NaSO4 -

Cl-1                   100.0     PERCENT BOUND IN SPECIES #    180   Cl-1

NH4+1                   92.0     PERCENT BOUND IN SPECIES #    490   NH4+1
               7.9    PERCENT BOUND IN SPECIES #4907320   NH4SO4 -

NO3-1                  100.0     PERCENT BOUND IN SPECIES #    492   NO3-1

H2O                     46.6     PERCENT BOUND IN SPECIES #3300020   OH-
              48.0    PERCENT BOUND IN SPECIES #4603300   MgOH +
               4.8    PERCENT BOUND IN SPECIES #1503300   CaOH +

H+1                     46.3     PERCENT BOUND IN SPECIES #3301401   H2CO3
AQ
               3.7    PERCENT BOUND IN SPECIES #4601401   MgHCO3 +
               1.7    PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
              48.1    PERCENT BOUND IN SPECIES #3301400   HCO3 -
```

---------- EQUILIBRATED MASS DISTRIBUTION ----------

IDX	NAME	DISSOLVED MOL/KG	DISSOLVED PERCENT	SORBED MOL/KG	SORBED PERCENT	PRECIPITATED MOL/KG	PRECIPITATED PERCENT
470	Mn+2	2.201E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
150	Ca+2	1.926E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	3.009E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	1.525E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	1.856E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
140	CO3-2	3.500E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
732	SO4-2	3.315E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
180	Cl-1	5.969E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
490	NH4+1	8.380E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
492	NO3-1	6.209E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
2	H2O	4.437E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
330	H+1	4.550E-02	100.0	0.000E-01	0.0	0.000E-01	0.0

Charge Balance: SPECIATED

Sum of CATIONS = 8.555E-02 Sum of ANIONS 7.425E-02

PERCENT DIFFERENCE = 7.070E+00 (ANIONS - CATIONS)/(ANIONS + CATIONS)

EQUILIBRIUM IONIC STRENGTH (m) = 1.338E-01

EQUILIBRIUM pH = 6.500

DATE ID NUMBER: ******
TIME ID NUMBER: 7485580

Saturation indices and stoichiometry of all minerals

ID #	NAME	Sat. Index	Stoichiometry in [brackets]							
6015000	ANHYDRITE	0.018	[1.000]	150	[1.000]	732				
5015000	ARAGONITE	0.205	[1.000]	150	[1.000]	140				
5046000	ARTINITE	-7.266	[-2.000]	330	[2.000]	460	[1.000]	140		
			[5.000]	2						
2046000	BRUCITE	-6.538	[1.000]	460	[2.000]	2	[-2.000]	330		
5015001	CALCITE	0.374	[1.000]	150	[1.000]	140				
5015002	DOLOMITE	0.907	[1.000]	150	[1.000]	460	[2.000]	140		
6046000	EPSOMITE	-2.134	[1.000]	460	[1.000]	732	[7.000]	2		
6015001	GYPSUM	0.319	[1.000]	150	[1.000]	732	[2.000]	2		
4150000	HALITE	-5.855	[1.000]	500	[1.000]	180				
5015003	HUNTITE	-2.225	[3.000]	460	[1.000]	150	[4.000]	140		
5046001	HYDRMAGNESIT	-12.989	[5.000]	460	[4.000]	140	[-2.000]	330		
			[6.000]	2						
5046002	MAGNESITE	0.037	[1.000]	460	[1.000]	140				
6050001	MIRABILITE	-4.543	[2.000]	500	[1.000]	732	[10.000]	2		
3050000	NATRON	-7.939	[2.000]	500	[1.000]	140	[10.000]	2		
5046003	NESQUEHONITE	-2.365	[1.000]	460	[1.000]	140	[3.000]	2		
6050002	THENARDITE	-5.913	[2.000]	500	[1.000]	732				
5050001	THERMONATR	-9.789	[2.000]	500	[1.000]	140	[1.000]	2		
2047003	PYROCROITE	-7.905	[-2.000]	330	[1.000]	470	[2.000]	2		
5047000	RHODOCHROSIT	-0.634	[1.000]	470	[1.000]	140				
4147000	MNCL2, 4H2O	-12.303	[1.000]	470	[2.000]	180	[4.000]	2		
6047000	MNSO4	-10.499	[1.000]	470	[1.000]	732				
2015000	LIME	-23.210	[-2.000]	330	[1.000]	150	[1.000]	2		
2015001	PORTLANDITE	-12.734	[-2.000]	330	[1.000]	150	[2.000]	2		
2046001	PERICLASE	-11.490	[-2.000]	330	[1.000]	460	[1.000]	2		

```
Southwest Alluvium well 803, median concentrations for '98-99
Fixed pH, no precip, determine SI
16.00 MG/L   0.000  0.00000E-01
0 0 1 0 3 0 0 0 1 1 0 0 0
0   0   0
    330  0.000E-01   -6.50 y                    /H+1
    150  7.995E+02   -1.70 y                    /Ca+2
    460  6.620E+02   -1.56 y                    /Mg+2
    500  2.990E+02   -1.89 y                    /Na+1
    410  1.190E+01   -3.52 y                    /K+1
    140  1.961E+03   -1.49 y                    /CO3-2
    732  3.150E+03   -1.48 y                    /SO4-2
    180  1.885E+02   -2.27 y                    /Cl-1
    490  9.000E-01   -4.30 y                    /NH4+1
    492  1.740E+02   -2.55 y                    /NO3-1
    470  1.500E+00   -4.56 y                    /Mn+2

  3   1
    330     6.5000     0.0000                   /H+1
```

PART 1 of OUTPUT FILE

PC MINTEQA2 v3.10 DATE OF CALCULATIONS: 18-JAN-** TIME: 7:49:18

Southwest Alluvium well 803, median concentrations for '98-99
Fixed pH, no precip, determine SI

Temperature (Celsius): 16.00
Units of concentration: MG/L
Ionic strength to be computed.
If specified, carbonate concentration represents total inorganic carbon.
Do not automatically terminate if charge imbalance exceeds 30%
Precipitation is allowed only for those solids specified as ALLOWED
in the input file (if any).
The maximum number of iterations is: 200
The method used to compute activity coefficients is: Davies equation
Intermediate output file

330	0.000E-01	-6.50	y
150	7.995E+02	-1.70	y
460	6.620E+02	-1.56	y
500	2.990E+02	-1.89	y
410	1.190E+01	-3.52	y
140	1.961E+03	-1.49	y
732	3.150E+03	-1.48	y
180	1.885E+02	-2.27	y
490	9.000E-01	-4.30	y
492	1.740E+02	-2.55	y
470	1.500E+00	-4.56	y

H2O has been inserted as a COMPONENT
3 1
330 6.5000 0.0000

INPUT DATA BEFORE TYPE MODIFICATIONS

ID	NAME	ACTIVITY GUESS	LOG GUESS	ANAL TOTAL
330	H+1	3.162E-07	-6.500	0.000E-01
150	Ca+2	1.995E-02	-1.700	7.995E+02
460	Mg+2	2.754E-02	-1.560	6.620E+02
500	Na+1	1.288E-02	-1.890	2.990E+02
410	K+1	3.020E-04	-3.520	1.190E+01
140	CO3-2	3.236E-02	-1.490	1.961E+03
732	SO4-2	3.311E-02	-1.480	3.150E+03
180	Cl-1	5.370E-03	-2.270	1.885E+02
490	NH4+1	5.012E-05	-4.300	9.000E-01
492	NO3-1	2.818E-03	-2.550	1.740E+02
470	Mn+2	2.754E-05	-4.560	1.500E+00
2	H2O	1.000E+00	0.000	0.000E-01

Charge Balance: UNSPECIATED

Sum of CATIONS= 1.086E-01 Sum of ANIONS = 1.401E-01

PERCENT DIFFERENCE = 1.268E+01 (ANIONS - CATIONS)/(ANIONS + CATIONS)

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|  IMPROVED ACTIVITY GUESSES PRIOR TO FIRST ITERATION: |
|       CO3-2        Log activity guess:    -5.62      |
|       SO4-2        Log activity guess:    -1.48      |
|       Mn+2         Log activity guess:    -4.56      |
|                                                      |
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PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY	RESIDUAL
0	NO3-1	2.827E-03	-8.334E-06	-2.55000	8.051E-06
1	NH4+1	5.026E-05	1.575E-06	-4.36719	1.570E-06
2	NO3-1	2.827E-03	7.434E-04	-2.54872	7.430E-04
3	NO3-1	2.827E-03	9.575E-05	-2.65011	9.546E-05
4	NO3-1	2.827E-03	6.537E-06	-2.66458	6.254E-06
5	NO3-1	2.827E-03	4.391E-07	-2.66558	1.564E-07

ID	NAME	ANAL MOL	CALC MOL	LOG ACTVTY	GAMMA	DIFF FXN
470	Mn+2	2.750E-05	1.862E-05	-5.19789	0.340589	1.477E-09
150	Ca+2	2.009E-02	1.360E-02	-2.33437	0.340589	1.057E-06
460	Mg+2	2.743E-02	1.894E-02	-2.19030	0.340589	1.488E-06
500	Na+1	1.310E-02	1.263E-02	-2.01557	0.763937	2.595E-07
410	K+1	3.066E-04	2.946E-04	-3.64764	0.763937	6.116E-09
140	CO3-2	3.292E-02	5.583E-06	-5.72089	0.340589	3.801E-07
732	SO4-2	3.303E-02	1.986E-02	-2.16970	0.340589	1.498E-06
180	Cl-1	5.356E-03	5.356E-03	-2.38813	0.763937	1.068E-07
490	NH4+1	5.026E-05	4.620E-05	-4.45230	0.763937	1.002E-09
492	NO3-1	2.827E-03	2.827E-03	-2.66565	0.763937	5.639E-08
2	H2O	0.000E-01	-4.268E-08	-0.00100	1.000000	0.000E-01
330	H+1	0.000E-01	4.139E-07	-6.50000	0.763937	0.000E-01

Type I - COMPONENTS AS SPECIES IN SOLUTION

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
330	H+1	4.139E-07	3.162E-07	-6.50000	0.76394	0.117
150	Ca+2	1.360E-02	4.631E-03	-2.33437	0.34059	0.468
460	Mg+2	1.894E-02	6.452E-03	-2.19030	0.34059	0.468
500	Na+1	1.263E-02	9.648E-03	-2.01557	0.76394	0.117
410	K+1	2.946E-04	2.251E-04	-3.64764	0.76394	0.117
140	CO3-2	5.583E-06	1.902E-06	-5.72089	0.34059	0.468
732	SO4-2	1.986E-02	6.766E-03	-2.16970	0.34059	0.468
180	Cl-1	5.356E-03	4.091E-03	-2.38813	0.76394	0.117
490	NH4+1	4.620E-05	3.529E-05	-4.45230	0.76394	0.117
492	NO3-1	2.827E-03	2.159E-03	-2.66565	0.76394	0.117
470	Mn+2	1.862E-05	6.340E-06	-5.19789	0.34059	0.468

Type II - OTHER SPECIES IN SOLUTION OR ADSORBED

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
3301401	H2CO3 AQ	9.969E-03	1.027E-02	-1.98863	1.02969	16.720
3307320	HSO4 -	2.125E-07	1.624E-07	-6.78954	0.76394	1.997
3300020	OH-	2.058E-08	1.572E-08	-7.80345	0.76394	-14.186

3304900	NH3 AQ	3.207E-08	3.302E-08	-7.48121	1.02969	-9.542
4907320	NH4SO4 -	4.027E-06	3.076E-06	-5.51200	0.76394	1.227
4603300	MgOH +	1.954E-08	1.492E-08	-7.82610	0.76394	-12.018
4601400	MgCO3 AQ	9.904E-06	1.020E-05	-4.99150	1.02969	2.907
4601401	MgHCO3 +	1.472E-03	1.124E-03	-2.94918	0.76394	11.579
4607320	MgSO4 AQ	7.004E-03	7.212E-03	-2.14192	1.02969	2.205
1503300	CaOH +	2.249E-09	1.718E-09	-8.76497	0.76394	-12.813
1501400	CaHCO3 +	7.515E-04	5.741E-04	-3.24100	0.76394	11.431
1501401	CaCO3 AQ	1.020E-05	1.050E-05	-4.97873	1.02969	3.064
1507320	CaSO4 AQ	5.737E-03	5.907E-03	-2.22861	1.02969	2.263
5001400	NaCO3 -	2.787E-07	2.129E-07	-6.67175	0.76394	1.182
5001401	NaHCO3 AQ	6.774E-05	6.975E-05	-4.15646	1.02969	10.067
5007320	NaSO4 -	4.038E-04	3.084E-04	-3.51082	0.76394	0.791
4107320	KSO4 -	1.192E-05	9.102E-06	-5.04085	0.76394	0.893
4701800	MnCl +	1.374E-07	1.049E-07	-6.97902	0.76394	0.724
4701801	MnCl2 AQ	1.133E-10	1.166E-10	-9.93314	1.02969	0.028
4701802	MnCl3 -	2.816E-13	2.151E-13	-12.66727	0.76394	-0.188
4703300	MnOH +	3.159E-10	2.413E-10	-9.61739	0.76394	-10.802
4703301	Mn(OH)3 -1	4.131E-21	3.156E-21	-20.50089	0.76394	-34.683
4707320	MnSO4 AQ	6.764E-06	6.965E-06	-5.15710	1.02969	2.198
4704920	Mn(NO3)2AQ	1.167E-10	1.202E-10	-9.92016	1.02969	0.596
4701400	MnHCO3 +	1.987E-06	1.518E-06	-5.81878	0.76394	11.717
3301400	HCO3 -	2.063E-02	1.576E-02	-1.80246	0.76394	10.535

Type III - SPECIES WITH FIXED ACTIVITY

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
2	H2O	-4.268E-08	-7.370	0.001	0.000
330	H+1	-4.286E-02	-1.368	6.500	0.000

Type VI - EXCLUDED SPECIES (not included in mole balance)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
3301403	CO2 (g)	2.833E-01	-0.548	18.172	-0.530

PERCENTAGE DISTRIBUTION OF COMPONENTS AMONG
TYPE I and TYPE II (dissolved and adsorbed) species

Mn+2	67.7	PERCENT BOUND IN SPECIES #	470	Mn+2
	24.6	PERCENT BOUND IN SPECIES #4707320	MnSO4 AQ	
	7.2	PERCENT BOUND IN SPECIES #4701400	MnHCO3 +	
Ca+2	67.7	PERCENT BOUND IN SPECIES #	150	Ca+2
	3.7	PERCENT BOUND IN SPECIES #1501400	CaHCO3 +	
	28.6	PERCENT BOUND IN SPECIES #1507320	CaSO4 AQ	
Mg+2	69.1	PERCENT BOUND IN SPECIES #	460	Mg+2
	5.4	PERCENT BOUND IN SPECIES #4601401	MgHCO3 +	
	25.5	PERCENT BOUND IN SPECIES #4607320	MgSO4 AQ	
Na+1	96.4	PERCENT BOUND IN SPECIES #	500	Na+1
	3.1	PERCENT BOUND IN SPECIES #5007320	NaSO4 -	
K+1	96.1	PERCENT BOUND IN SPECIES #	410	K+1
	3.9	PERCENT BOUND IN SPECIES #4107320	KSO4 -	
CO3-2	30.3	PERCENT BOUND IN SPECIES #3301401		H2CO3
AQ				
	4.5	PERCENT BOUND IN SPECIES #4601401	MgHCO3 +	
	2.3	PERCENT BOUND IN SPECIES #1501400	CaHCO3 +	
	62.7	PERCENT BOUND IN SPECIES #3301400	HCO3 -	
SO4-2	60.1	PERCENT BOUND IN SPECIES #	732	SO4-2
	21.2	PERCENT BOUND IN SPECIES #4607320	MgSO4 AQ	
	17.4	PERCENT BOUND IN SPECIES #1507320	CaSO4 AQ	
	1.2	PERCENT BOUND IN SPECIES #5007320	NaSO4 -	
Cl-1	100.0	PERCENT BOUND IN SPECIES #	180	Cl-1
NH4+1	91.9	PERCENT BOUND IN SPECIES #	490	NH4+1
	8.0	PERCENT BOUND IN SPECIES #4907320	NH4SO4 -	
NO3-1	100.0	PERCENT BOUND IN SPECIES #	492	NO3-1
H2O	48.2	PERCENT BOUND IN SPECIES #3300020		OH-
	45.8	PERCENT BOUND IN SPECIES #4603300	MgOH +	
	5.3	PERCENT BOUND IN SPECIES #1503300	CaOH +	
H+1	46.5	PERCENT BOUND IN SPECIES #3301401		H2CO3
AQ				
	3.4	PERCENT BOUND IN SPECIES #4601401	MgHCO3 +	
	1.8	PERCENT BOUND IN SPECIES #1501400	CaHCO3 +	
	48.1	PERCENT BOUND IN SPECIES #3301400	HCO3 -	

---------- EQUILIBRATED MASS DISTRIBUTION ----------

IDX	NAME	DISSOLVED MOL/KG	DISSOLVED PERCENT	SORBED MOL/KG	SORBED PERCENT	PRECIPITATED MOL/KG	PRECIPITATED PERCENT
470	Mn+2	2.750E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
150	Ca+2	2.009E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	2.743E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	1.310E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	3.066E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
140	CO3-2	3.292E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
732	SO4-2	3.303E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
180	Cl-1	5.356E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
490	NH4+1	5.026E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
492	NO3-1	2.827E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
2	H2O	4.268E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
330	H+1	4.286E-02	100.0	0.000E-01	0.0	0.000E-01	0.0

Charge Balance: SPECIATED

Sum of CATIONS = 8.031E-02 Sum of ANIONS 6.897E-02

PERCENT DIFFERENCE = 7.596E+00 (ANIONS - CATIONS)/(ANIONS + CATIONS)

EQUILIBRIUM IONIC STRENGTH (m) = 1.271E-01

EQUILIBRIUM pH = 6.500

DATE ID NUMBER: ******
TIME ID NUMBER: 7492194

Saturation indices and stoichiometry of all minerals

ID #	NAME	Sat. Index	Stoichiometry in [brackets]							
6015000	ANHYDRITE	0.047	[1.000]	150	[1.000]	732				
5015000	ARAGONITE	0.203	[1.000]	150	[1.000]	140				
5046000	ARTINITE	-7.362	[-2.000]	330	[2.000]	460	[1.000]	140		
			[5.000]	2						
2046000	BRUCITE	-6.574	[1.000]	460	[2.000]	2	[-2.000]	330		
5015001	CALCITE	0.372	[1.000]	150	[1.000]	140				
5015002	DOLOMITE	0.844	[1.000]	150	[1.000]	460	[2.000]	140		
6046000	EPSOMITE	-2.163	[1.000]	460	[1.000]	732	[7.000]	2		
6015001	GYPSUM	0.348	[1.000]	150	[1.000]	732	[2.000]	2		
4150000	HALITE	-5.965	[1.000]	500	[1.000]	180				
5015003	HUNTITE	-2.409	[3.000]	460	[1.000]	150	[4.000]	140		
5046001	HYDRMAGNESIT	-13.266	[5.000]	460	[4.000]	140	[-2.000]	330		
			[6.000]	2						
5046002	MAGNESITE	-0.023	[1.000]	460	[1.000]	140				
6050001	MIRABILITE	-4.664	[2.000]	500	[1.000]	732	[10.000]	2		
3050000	NATRON	-8.092	[2.000]	500	[1.000]	140	[10.000]	2		
5046003	NESQUEHONITE	-2.425	[1.000]	460	[1.000]	140	[3.000]	2		
6050002	THENARDITE	-6.035	[2.000]	500	[1.000]	732				
5050001	THERMONATR	-9.942	[2.000]	500	[1.000]	140	[1.000]	2		
2047003	PYROCROITE	-7.803	[-2.000]	330	[1.000]	470	[2.000]	2		
5047000	RHODOCHROSIT	-0.556	[1.000]	470	[1.000]	140				
4147000	MNCL2, 4H2O	-12.292	[1.000]	470	[2.000]	180	[4.000]	2		
6047000	MNSO4	-10.390	[1.000]	470	[1.000]	732				
2015000	LIME	-23.188	[-2.000]	330	[1.000]	150	[1.000]	2		
2015001	PORTLANDITE	-12.712	[-2.000]	330	[1.000]	150	[2.000]	2		
2046001	PERICLASE	-11.526	[-2.000]	330	[1.000]	460	[1.000]	2		

```
Southwest Alluvium well EPA-23, median '98-'98 concentrations
Fixed pH, no precip - determine SI
16.00 MG/L   0.000  0.00000E-01
0 0 1 0 3 0 0 0 1 1 0 0 0
0   0   0
    330  0.000E-01   -6.70 y                    /H+1
    150  6.840E+02   -1.77 y                    /Ca+2
    460  3.900E+02   -1.79 y                    /Mg+2
    500  1.450E+02   -2.20 y                    /Na+1
    410  1.050E+01   -3.57 y                    /K+1
    140  1.121E+03   -1.73 y                    /CO3-2
    732  2.290E+03   -1.62 y                    /SO4-2
    180  9.080E+01   -2.59 y                    /Cl-1
    490  3.000E+00   -3.78 y                    /NH4+1
    492  2.180E+02   -2.45 y                    /NO3-1
    470  3.000E+00   -4.26 y                    /Mn+2

  3   1
    330     6.7000     0.0000                   /H+1
```

PART 1 of OUTPUT FILE

PC MINTEQA2 v3.10 DATE OF CALCULATIONS: 18-JAN-** TIME: 7:50:13

Southwest Alluvium well EPA-23, median '98-'98 concentrations
Fixed pH, no precip - determine SI

Temperature (Celsius): 16.00
Units of concentration: MG/L
Ionic strength to be computed.
If specified, carbonate concentration represents total inorganic carbon.
Do not automatically terminate if charge imbalance exceeds 30%
Precipitation is allowed only for those solids specified as ALLOWED
in the input file (if any).
The maximum number of iterations is: 200
The method used to compute activity coefficients is: Davies equation
Intermediate output file

330	0.000E-01	-6.70	y
150	6.840E+02	-1.77	y
460	3.900E+02	-1.79	y
500	1.450E+02	-2.20	y
410	1.050E+01	-3.57	y
140	1.121E+03	-1.73	y
732	2.290E+03	-1.62	y
180	9.080E+01	-2.59	y
490	3.000E+00	-3.78	y
492	2.180E+02	-2.45	y
470	3.000E+00	-4.26	y

H2O has been inserted as a COMPONENT
3 1
330 6.7000 0.0000

INPUT DATA BEFORE TYPE MODIFICATIONS

ID	NAME	ACTIVITY GUESS	LOG GUESS	ANAL TOTAL
330	H+1	1.995E-07	-6.700	0.000E-01
150	Ca+2	1.698E-02	-1.770	6.840E+02
460	Mg+2	1.622E-02	-1.790	3.900E+02
500	Na+1	6.310E-03	-2.200	1.450E+02
410	K+1	2.692E-04	-3.570	1.050E+01
140	CO3-2	1.862E-02	-1.730	1.121E+03
732	SO4-2	2.399E-02	-1.620	2.290E+03
180	Cl-1	2.570E-03	-2.590	9.080E+01
490	NH4+1	1.660E-04	-3.780	3.000E+00
492	NO3-1	3.548E-03	-2.450	2.180E+02
470	Mn+2	5.495E-05	-4.260	3.000E+00
2	H2O	1.000E+00	0.000	0.000E-01

Charge Balance: UNSPECIATED

Sum of CATIONS= 7.343E-02 Sum of ANIONS = 9.157E-02

PERCENT DIFFERENCE = 1.099E+01 (ANIONS - CATIONS)/(ANIONS + CATIONS)

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| IMPROVED ACTIVITY GUESSES PRIOR TO FIRST ITERATION: |
|      CO3-2        Log activity guess:    -5.59      |
|      SO4-2        Log activity guess:    -1.62      |
|      Mn+2         Log activity guess:    -4.26      |
|                                                     |
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PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY	RESIDUAL
0	NO3-1	3.533E-03	1.478E-05	-2.45000	1.442E-05
1	NH4+1	1.671E-04	2.905E-06	-3.83177	2.889E-06
2	NO3-1	3.533E-03	8.231E-04	-2.45181	8.227E-04
3	NO3-1	3.533E-03	1.110E-04	-2.54276	1.107E-04
4	NO3-1	3.533E-03	8.580E-06	-2.55620	8.226E-06
5	NO3-1	3.533E-03	6.936E-07	-2.55725	3.402E-07

ID	NAME	ANAL MOL	CALC MOL	LOG ACTVTY	GAMMA	DIFF FXN
470	Mn+2	5.488E-05	3.857E-05	-4.83589	0.378308	3.860E-09
150	Ca+2	1.715E-02	1.193E-02	-2.34557	0.378308	1.177E-06
460	Mg+2	1.612E-02	1.148E-02	-2.36228	0.378308	1.141E-06
500	Na+1	6.339E-03	6.151E-03	-2.31662	0.784262	1.582E-07
410	K+1	2.699E-04	2.610E-04	-3.68889	0.784262	6.767E-09
140	CO3-2	1.877E-02	5.306E-06	-5.69742	0.378308	3.356E-07
732	SO4-2	2.396E-02	1.503E-02	-2.24526	0.378308	1.454E-06
180	Cl-1	2.574E-03	2.574E-03	-2.69496	0.784262	6.453E-08
490	NH4+1	1.671E-04	1.556E-04	-3.91361	0.784262	4.186E-09
492	NO3-1	3.533E-03	3.533E-03	-2.55734	0.784262	8.859E-08
2	H2O	0.000E-01	-5.662E-08	-0.00066	1.000000	0.000E-01
330	H+1	0.000E-01	2.544E-07	-6.70000	0.784262	0.000E-01

Type I - COMPONENTS AS SPECIES IN SOLUTION

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
330	H+1	2.544E-07	1.995E-07	-6.70000	0.78426	0.106
150	Ca+2	1.193E-02	4.513E-03	-2.34557	0.37831	0.422
460	Mg+2	1.148E-02	4.342E-03	-2.36228	0.37831	0.422
500	Na+1	6.151E-03	4.824E-03	-2.31662	0.78426	0.106
410	K+1	2.610E-04	2.047E-04	-3.68889	0.78426	0.106
140	CO3-2	5.306E-06	2.007E-06	-5.69742	0.37831	0.422
732	SO4-2	1.503E-02	5.685E-03	-2.24526	0.37831	0.422
180	Cl-1	2.574E-03	2.019E-03	-2.69496	0.78426	0.106
490	NH4+1	1.556E-04	1.220E-04	-3.91361	0.78426	0.106
492	NO3-1	3.533E-03	2.771E-03	-2.55734	0.78426	0.106
470	Mn+2	3.857E-05	1.459E-05	-4.83589	0.37831	0.422

Type II - OTHER SPECIES IN SOLUTION OR ADSORBED

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
3301401	H2CO3 AQ	4.225E-03	4.314E-03	-2.36516	1.02109	16.723
3307320	HSO4 -	1.098E-07	8.608E-08	-7.06510	0.78426	1.986
3300020	OH-	3.180E-08	2.494E-08	-7.60311	0.78426	-14.197

3304900	NH3 AQ	1.772E-07	1.809E-07	-6.74252	1.02109	-9.538
4907320	NH4SO4 -	1.139E-05	8.936E-06	-5.04887	0.78426	1.216
4603300	MgOH +	2.031E-08	1.593E-08	-7.79773	0.78426	-12.029
4601400	MgCO3 AQ	7.095E-06	7.244E-06	-5.14001	1.02109	2.911
4601401	MgHCO3 +	6.425E-04	5.039E-04	-3.29769	0.78426	11.568
4607320	MgSO4 AQ	3.995E-03	4.079E-03	-2.38946	1.02109	2.209
1503300	CaOH +	3.386E-09	2.656E-09	-8.57582	0.78426	-12.824
1501400	CaHCO3 +	4.751E-04	3.726E-04	-3.42873	0.78426	11.420
1501401	CaCO3 AQ	1.058E-05	1.080E-05	-4.96646	1.02109	3.067
1507320	CaSO4 AQ	4.738E-03	4.838E-03	-2.31536	1.02109	2.266
5001400	NaCO3 -	1.433E-07	1.124E-07	-6.94934	0.78426	1.170
5001401	NaHCO3 AQ	2.275E-05	2.322E-05	-4.63404	1.02109	10.071
5007320	NaSO4 -	1.652E-04	1.296E-04	-3.88743	0.78426	0.780
4107320	KSO4 -	8.869E-06	6.956E-06	-5.15766	0.78426	0.882
4701800	MnCl +	1.519E-07	1.192E-07	-6.92385	0.78426	0.713
4701801	MnCl2 AQ	6.399E-11	6.534E-11	-10.18481	1.02109	0.032
4701802	MnCl3 -	7.582E-14	5.946E-14	-13.22578	0.78426	-0.199
4703300	MnOH +	1.123E-09	8.810E-10	-9.05504	0.78426	-10.813
4703301	Mn(OH)3 -1	3.696E-20	2.898E-20	-19.53786	0.78426	-34.694
4707320	MnSO4 AQ	1.319E-05	1.347E-05	-4.87065	1.02109	2.201
4704920	Mn(NO3)2AQ	4.461E-10	4.555E-10	-9.34153	1.02109	0.600
4701400	MnHCO3 +	2.966E-06	2.326E-06	-5.63331	0.78426	11.706
3301400	HCO3 -	1.338E-02	1.050E-02	-1.97899	0.78426	10.524

Type III - SPECIES WITH FIXED ACTIVITY

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
2	H2O	-5.662E-08	-7.247	0.001	0.000
330	H+1	-2.298E-02	-1.639	6.700	0.000

Type VI - EXCLUDED SPECIES (not included in mole balance)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
3301403	CO2 (g)	1.189E-01	-0.925	18.172	-0.530

PERCENTAGE DISTRIBUTION OF COMPONENTS AMONG
TYPE I and TYPE II (dissolved and adsorbed) species

Mn+2	70.3	PERCENT BOUND IN SPECIES #	470	Mn+2
	24.0	PERCENT BOUND IN SPECIES #4707320	MnSO4 AQ	
	5.4	PERCENT BOUND IN SPECIES #4701400	MnHCO3 +	
Ca+2	69.5	PERCENT BOUND IN SPECIES #	150	Ca+2
	2.8	PERCENT BOUND IN SPECIES #1501400	CaHCO3 +	
	27.6	PERCENT BOUND IN SPECIES #1507320	CaSO4 AQ	
Mg+2	71.2	PERCENT BOUND IN SPECIES #	460	Mg+2
	4.0	PERCENT BOUND IN SPECIES #4601401	MgHCO3 +	
	24.8	PERCENT BOUND IN SPECIES #4607320	MgSO4 AQ	
Na+1	97.0	PERCENT BOUND IN SPECIES #	500	Na+1
	2.6	PERCENT BOUND IN SPECIES #5007320	NaSO4 -	
K+1	96.7	PERCENT BOUND IN SPECIES #	410	K+1
	3.3	PERCENT BOUND IN SPECIES #4107320	KSO4 -	
CO3-2	22.5	PERCENT BOUND IN SPECIES #3301401	H2CO3	
AQ	3.4	PERCENT BOUND IN SPECIES #4601401	MgHCO3 +	
	2.5	PERCENT BOUND IN SPECIES #1501400	CaHCO3 +	
	71.3	PERCENT BOUND IN SPECIES #3301400	HCO3 -	
SO4-2	62.7	PERCENT BOUND IN SPECIES #	732	SO4-2
	16.7	PERCENT BOUND IN SPECIES #4607320	MgSO4 AQ	
	19.8	PERCENT BOUND IN SPECIES #1507320	CaSO4 AQ	
Cl-1	100.0	PERCENT BOUND IN SPECIES #	180	Cl-1
NH4+1	93.1	PERCENT BOUND IN SPECIES #	490	NH4+1
	6.8	PERCENT BOUND IN SPECIES #4907320	NH4SO4 -	
NO3-1	100.0	PERCENT BOUND IN SPECIES #	492	NO3-1
H2O	56.2	PERCENT BOUND IN SPECIES #3300020	OH-	
	35.9	PERCENT BOUND IN SPECIES #4603300	MgOH +	
	6.0	PERCENT BOUND IN SPECIES #1503300	CaOH +	
	2.0	PERCENT BOUND IN SPECIES #4703300	MnOH +	
H+1	36.8	PERCENT BOUND IN SPECIES #3301401	H2CO3	
AQ	2.8	PERCENT BOUND IN SPECIES #4601401	MgHCO3 +	
	2.1	PERCENT BOUND IN SPECIES #1501400	CaHCO3 +	
	58.2	PERCENT BOUND IN SPECIES #3301400	HCO3 -	

---------- EQUILIBRATED MASS DISTRIBUTION ----------

IDX	NAME	DISSOLVED MOL/KG	DISSOLVED PERCENT	SORBED MOL/KG	SORBED PERCENT	PRECIPITATED MOL/KG	PRECIPITATED PERCENT
470	Mn+2	5.488E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
150	Ca+2	1.715E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	1.612E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	6.339E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	2.699E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
140	CO3-2	1.877E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
732	SO4-2	2.396E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
180	Cl-1	2.574E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
490	NH4+1	1.671E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
492	NO3-1	3.533E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
2	H2O	5.662E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
330	H+1	2.298E-02	100.0	0.000E-01	0.0	0.000E-01	0.0

Charge Balance: SPECIATED

Sum of CATIONS = 5.458E-02 Sum of ANIONS 4.974E-02

PERCENT DIFFERENCE = 4.636E+00 (ANIONS - CATIONS)/(ANIONS + CATIONS)

EQUILIBRIUM IONIC STRENGTH (m) = 9.063E-02

EQUILIBRIUM pH = 6.700

DATE ID NUMBER: ******
TIME ID NUMBER: 7501720

Saturation indices and stoichiometry of all minerals

ID #	NAME	Sat. Index	Stoichiometry in [brackets]							
6015000	ANHYDRITE	-0.040	[1.000]	150	[1.000]	732				
5015000	ARAGONITE	0.215	[1.000]	150	[1.000]	140				
5046000	ARTINITE	-7.281	[-2.000]	330	[2.000]	460	[1.000]	140		
			[5.000]	2						
2046000	BRUCITE	-6.345	[1.000]	460	[2.000]	2	[-2.000]	330		
5015001	CALCITE	0.384	[1.000]	150	[1.000]	140				
5015002	DOLOMITE	0.708	[1.000]	150	[1.000]	460	[2.000]	140		
6046000	EPSOMITE	-2.408	[1.000]	460	[1.000]	732	[7.000]	2		
6015001	GYPSUM	0.262	[1.000]	150	[1.000]	732	[2.000]	2		
4150000	HALITE	-6.573	[1.000]	500	[1.000]	180				
5015003	HUNTITE	-2.842	[3.000]	460	[1.000]	150	[4.000]	140		
5046001	HYDRMAGNESIT	-13.630	[5.000]	460	[4.000]	140	[-2.000]	330		
			[6.000]	2						
5046002	MAGNESITE	-0.171	[1.000]	460	[1.000]	140				
6050001	MIRABILITE	-5.338	[2.000]	500	[1.000]	732	[10.000]	2		
3050000	NATRON	-8.667	[2.000]	500	[1.000]	140	[10.000]	2		
5046003	NESQUEHONITE	-2.573	[1.000]	460	[1.000]	140	[3.000]	2		
6050002	THENARDITE	-6.713	[2.000]	500	[1.000]	732				
5050001	THERMONATR	-10.520	[2.000]	500	[1.000]	140	[1.000]	2		
2047003	PYROCROITE	-7.041	[-2.000]	330	[1.000]	470	[2.000]	2		
5047000	RHODOCHROSIT	-0.171	[1.000]	470	[1.000]	140				
4147000	MNCL2, 4H2O	-12.542	[1.000]	470	[2.000]	180	[4.000]	2		
6047000	MNSO4	-10.103	[1.000]	470	[1.000]	732				
2015000	LIME	-22.799	[-2.000]	330	[1.000]	150	[1.000]	2		
2015001	PORTLANDITE	-12.322	[-2.000]	330	[1.000]	150	[2.000]	2		
2046001	PERICLASE	-11.297	[-2.000]	330	[1.000]	460	[1.000]	2		

Southwest Alluvium well EPA-25, median '98-99 concentrations

```
16.00 MG/L   0.000  0.00000E-01
0 0 1 0 3 0 0 0 1 1 0 0 0
0   0   0
    330  0.000E-01   -6.80 y                    /H+1
    150  7.710E+02   -1.72 y                    /Ca+2
    460  2.100E+02   -2.06 y                    /Mg+2
    500  1.550E+02   -2.17 y                    /Na+1
    410  8.300E+00   -3.67 y                    /K+1
    140  9.360E+02   -1.81 y                    /CO3-2
    732  1.700E+03   -1.75 y                    /SO4-2
    180  8.950E+01   -2.60 y                    /Cl-1
    490  1.300E-01   -5.14 y                    /NH4+1
    492  3.330E+02   -2.27 y                    /NO3-1
    470  4.000E-01   -5.14 y                    /Mn+2

  3   1
    330     6.8000     0.0000                   /H+1
```

PART 1 of OUTPUT FILE

PC MINTEQA2 v3.10 DATE OF CALCULATIONS: 18-JAN-** TIME: 7:50:40

Southwest Alluvium well EPA-25, median '98-99 concentrations

Temperature (Celsius): 16.00
Units of concentration: MG/L
Ionic strength to be computed.
If specified, carbonate concentration represents total inorganic carbon.
Do not automatically terminate if charge imbalance exceeds 30%
Precipitation is allowed only for those solids specified as ALLOWED
in the input file (if any).
The maximum number of iterations is: 200
The method used to compute activity coefficients is: Davies equation
Intermediate output file

330	0.000E-01	-6.80	y
150	7.710E+02	-1.72	y
460	2.100E+02	-2.06	y
500	1.550E+02	-2.17	y
410	8.300E+00	-3.67	y
140	9.360E+02	-1.81	y
732	1.700E+03	-1.75	y
180	8.950E+01	-2.60	y
490	1.300E-01	-5.14	y
492	3.330E+02	-2.27	y
470	4.000E-01	-5.14	y

H2O has been inserted as a COMPONENT
3 1
330 6.8000 0.0000

INPUT DATA BEFORE TYPE MODIFICATIONS

ID	NAME	ACTIVITY GUESS	LOG GUESS	ANAL TOTAL
330	H+1	1.585E-07	-6.800	0.000E-01
150	Ca+2	1.905E-02	-1.720	7.710E+02
460	Mg+2	8.710E-03	-2.060	2.100E+02
500	Na+1	6.761E-03	-2.170	1.550E+02
410	K+1	2.138E-04	-3.670	8.300E+00
140	CO3-2	1.549E-02	-1.810	9.360E+02
732	SO4-2	1.778E-02	-1.750	1.700E+03
180	Cl-1	2.512E-03	-2.600	8.950E+01
490	NH4+1	7.244E-06	-5.140	1.300E-01
492	NO3-1	5.370E-03	-2.270	3.330E+02
470	Mn+2	7.244E-06	-5.140	4.000E-01
2	H2O	1.000E+00	0.000	0.000E-01

Charge Balance: UNSPECIATED

Sum of CATIONS= 6.299E-02 Sum of ANIONS = 7.480E-02

PERCENT DIFFERENCE = 8.570E+00 (ANIONS - CATIONS)/(ANIONS + CATIONS)

```
-------------------------------------------------------
|  IMPROVED ACTIVITY GUESSES PRIOR TO FIRST ITERATION: |
|       CO3-2        Log activity guess:    -5.55      |
|       SO4-2        Log activity guess:    -1.75      |
|       Mn+2         Log activity guess:    -5.14      |
|                                                      |
-------------------------------------------------------
```

PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY	RESIDUAL
0	NO3-1	5.393E-03	-2.289E-05	-2.27000	2.235E-05
1	NH4+1	7.237E-06	7.896E-08	-5.18135	7.824E-08
2	NO3-1	5.393E-03	1.208E-03	-2.26815	1.207E-03
3	NO3-1	5.393E-03	1.451E-04	-2.35591	1.445E-04
4	NO3-1	5.393E-03	1.064E-05	-2.36743	1.010E-05
5	NO3-1	5.393E-03	8.307E-07	-2.36829	2.913E-07

ID	NAME	ANAL MOL	CALC MOL	LOG ACTVTY	GAMMA	DIFF FXN
470	Mn+2	7.312E-06	5.392E-06	-5.66907	0.397330	3.793E-10
150	Ca+2	1.932E-02	1.416E-02	-2.24969	0.397330	9.842E-07
460	Mg+2	8.674E-03	6.482E-03	-2.58913	0.397330	4.532E-07
500	Na+1	6.771E-03	6.610E-03	-2.28001	0.793940	1.182E-07
410	K+1	2.132E-04	2.077E-04	-3.78285	0.793940	3.738E-09
140	CO3-2	1.566E-02	5.660E-06	-5.64807	0.397330	2.094E-07
732	SO4-2	1.777E-02	1.115E-02	-2.35342	0.397330	7.592E-07
180	Cl-1	2.535E-03	2.535E-03	-2.69621	0.793940	4.445E-08
490	NH4+1	7.237E-06	6.837E-06	-5.26535	0.793940	1.267E-10
492	NO3-1	5.393E-03	5.393E-03	-2.36836	0.793940	9.457E-08
2	H2O	0.000E-01	-6.000E-08	-0.00056	1.000000	0.000E-01
330	H+1	0.000E-01	1.996E-07	-6.80000	0.793940	0.000E-01

Type I - COMPONENTS AS SPECIES IN SOLUTION

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
330	H+1	1.996E-07	1.585E-07	-6.80000	0.79394	0.100
150	Ca+2	1.416E-02	5.627E-03	-2.24969	0.39733	0.401
460	Mg+2	6.482E-03	2.576E-03	-2.58913	0.39733	0.401
500	Na+1	6.610E-03	5.248E-03	-2.28001	0.79394	0.100
410	K+1	2.077E-04	1.649E-04	-3.78285	0.79394	0.100
140	CO3-2	5.660E-06	2.249E-06	-5.64807	0.39733	0.401
732	SO4-2	1.115E-02	4.432E-03	-2.35342	0.39733	0.401
180	Cl-1	2.535E-03	2.013E-03	-2.69621	0.79394	0.100
490	NH4+1	6.837E-06	5.428E-06	-5.26535	0.79394	0.100
492	NO3-1	5.393E-03	4.282E-03	-2.36836	0.79394	0.100
470	Mn+2	5.392E-06	2.143E-06	-5.66907	0.39733	0.401

Type II - OTHER SPECIES IN SOLUTION OR ADSORBED

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
3301401	H2CO3 AQ	2.995E-03	3.049E-03	-2.51581	1.01798	16.725
3307320	HSO4 -	6.714E-08	5.330E-08	-7.27325	0.79394	1.980
3300020	OH-	3.955E-08	3.140E-08	-7.50302	0.79394	-14.202

3304900	NH3 AQ	9.954E-09	1.013E-08	-7.99426	1.01798	-9.537
4907320	NH4SO4 -	3.903E-07	3.099E-07	-6.50876	0.79394	1.210
4603300	MgOH +	1.499E-08	1.190E-08	-7.92449	0.79394	-12.035
4601400	MgCO3 AQ	4.729E-06	4.814E-06	-5.31750	1.01798	2.912
4601401	MgHCO3 +	3.350E-04	2.660E-04	-3.57518	0.79394	11.562
4607320	MgSO4 AQ	1.853E-03	1.886E-03	-2.72446	1.01798	2.210
1503300	CaOH +	5.252E-09	4.170E-09	-8.37985	0.79394	-12.829
1501400	CaHCO3 +	5.209E-04	4.135E-04	-3.38350	0.79394	11.414
1501401	CaCO3 AQ	1.483E-05	1.509E-05	-4.82122	1.01798	3.069
1507320	CaSO4 AQ	4.620E-03	4.703E-03	-2.32764	1.01798	2.268
5001400	NaCO3 -	1.725E-07	1.370E-07	-6.86338	0.79394	1.165
5001401	NaHCO3 AQ	2.209E-05	2.249E-05	-4.64808	1.01798	10.072
5007320	NaSO4 -	1.384E-04	1.099E-04	-3.95898	0.79394	0.775
4107320	KSO4 -	5.501E-06	4.367E-06	-5.35977	0.79394	0.877
4701800	MnCl +	2.198E-08	1.745E-08	-7.75828	0.79394	0.707
4701801	MnCl2 AQ	9.371E-12	9.539E-12	-11.02049	1.01798	0.033
4701802	MnCl3 -	1.090E-14	8.656E-15	-14.06270	0.79394	-0.205
4703300	MnOH +	2.052E-10	1.629E-10	-9.78813	0.79394	-10.818
4703301	Mn(OH)3 -1	1.070E-20	8.496E-21	-20.07077	0.79394	-34.700
4707320	MnSO4 AQ	1.514E-06	1.542E-06	-5.81200	1.01798	2.203
4704920	Mn(NO3)2AQ	1.569E-10	1.597E-10	-9.79675	1.01798	0.601
4701400	MnHCO3 +	3.829E-07	3.040E-07	-6.51714	0.79394	11.700
3301400	HCO3 -	1.176E-02	9.340E-03	-2.02964	0.79394	10.519

Type III - SPECIES WITH FIXED ACTIVITY

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
2	H2O	-6.000E-08	-7.222	0.001	0.000
330	H+1	-1.863E-02	-1.730	6.800	0.000

Type VI - EXCLUDED SPECIES (not included in mole balance)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
3301403	CO2 (g)	8.406E-02	-1.075	18.172	-0.530

PERCENTAGE DISTRIBUTION OF COMPONENTS AMONG
TYPE I and TYPE II (dissolved and adsorbed) species

Mn+2		73.7	PERCENT BOUND IN SPECIES # 470	Mn+2
	20.7	PERCENT BOUND IN SPECIES #4707320	MnSO4 AQ	
	5.2	PERCENT BOUND IN SPECIES #4701400	MnHCO3 +	
Ca+2		73.3	PERCENT BOUND IN SPECIES # 150	Ca+2
	2.7	PERCENT BOUND IN SPECIES #1501400	CaHCO3 +	
	23.9	PERCENT BOUND IN SPECIES #1507320	CaSO4 AQ	
Mg+2		74.7	PERCENT BOUND IN SPECIES # 460	Mg+2
	3.9	PERCENT BOUND IN SPECIES #4601401	MgHCO3 +	
	21.4	PERCENT BOUND IN SPECIES #4607320	MgSO4 AQ	
Na+1		97.6	PERCENT BOUND IN SPECIES # 500	Na+1
	2.0	PERCENT BOUND IN SPECIES #5007320	NaSO4 -	
K+1		97.4	PERCENT BOUND IN SPECIES # 410	K+1
	2.6	PERCENT BOUND IN SPECIES #4107320	KSO4 -	
CO3-2		19.1	PERCENT BOUND IN SPECIES #3301401	H2CO3
AQ				
	2.1	PERCENT BOUND IN SPECIES #4601401	MgHCO3 +	
	3.3	PERCENT BOUND IN SPECIES #1501400	CaHCO3 +	
	75.1	PERCENT BOUND IN SPECIES #3301400	HCO3 -	
SO4-2		62.8	PERCENT BOUND IN SPECIES # 732	SO4-2
	10.4	PERCENT BOUND IN SPECIES #4607320	MgSO4 AQ	
	26.0	PERCENT BOUND IN SPECIES #1507320	CaSO4 AQ	
Cl-1		100.0	PERCENT BOUND IN SPECIES # 180	Cl-1
NH4+1		94.5	PERCENT BOUND IN SPECIES # 490	NH4+1
	5.4	PERCENT BOUND IN SPECIES #4907320	NH4SO4 -	
NO3-1		100.0	PERCENT BOUND IN SPECIES # 492	NO3-1
H2O		65.9	PERCENT BOUND IN SPECIES #3300020	OH-
	25.0	PERCENT BOUND IN SPECIES #4603300	MgOH +	
	8.8	PERCENT BOUND IN SPECIES #1503300	CaOH +	
H+1		32.2	PERCENT BOUND IN SPECIES #3301401	H2CO3
AQ				
	1.8	PERCENT BOUND IN SPECIES #4601401	MgHCO3 +	
	2.8	PERCENT BOUND IN SPECIES #1501400	CaHCO3 +	
	63.1	PERCENT BOUND IN SPECIES #3301400	HCO3 -	

---------- EQUILIBRATED MASS DISTRIBUTION ----------

IDX	NAME	DISSOLVED MOL/KG	DISSOLVED PERCENT	SORBED MOL/KG	SORBED PERCENT	PRECIPITATED MOL/KG	PRECIPITATED PERCENT
470	Mn+2	7.312E-06	100.0	0.000E-01	0.0	0.000E-01	0.0
150	Ca+2	1.932E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	8.675E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	6.771E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	2.132E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
140	CO3-2	1.566E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
732	SO4-2	1.777E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
180	Cl-1	2.535E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
490	NH4+1	7.237E-06	100.0	0.000E-01	0.0	0.000E-01	0.0
492	NO3-1	5.393E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
2	H2O	6.000E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
330	H+1	1.863E-02	100.0	0.000E-01	0.0	0.000E-01	0.0

Charge Balance: SPECIATED

Sum of CATIONS = 4.898E-02 Sum of ANIONS 4.216E-02

PERCENT DIFFERENCE = 7.489E+00 (ANIONS - CATIONS)/(ANIONS + CATIONS)

EQUILIBRIUM IONIC STRENGTH (m) = 7.738E-02

EQUILIBRIUM pH = 6.800

DATE ID NUMBER: ******
TIME ID NUMBER: 7504367

Saturation indices and stoichiometry of all minerals

ID #	NAME	Sat. Index	Stoichiometry in [brackets]							
6015000	ANHYDRITE	-0.052	[1.000]	150	[1.000]	732				
5015000	ARAGONITE	0.360	[1.000]	150	[1.000]	140				
5046000	ARTINITE	-7.485	[-2.000]	330	[2.000]	460	[1.000]	140		
			[5.000]	2						
2046000	BRUCITE	-6.372	[1.000]	460	[2.000]	2	[-2.000]	330		
5015001	CALCITE	0.529	[1.000]	150	[1.000]	140				
5015002	DOLOMITE	0.676	[1.000]	150	[1.000]	460	[2.000]	140		
6046000	EPSOMITE	-2.742	[1.000]	460	[1.000]	732	[7.000]	2		
6015001	GYPSUM	0.250	[1.000]	150	[1.000]	732	[2.000]	2		
4150000	HALITE	-6.537	[1.000]	500	[1.000]	180				
5015003	HUNTITE	-3.229	[3.000]	460	[1.000]	150	[4.000]	140		
5046001	HYDRMAGNESIT	-14.366	[5.000]	460	[4.000]	140	[-2.000]	330		
			[6.000]	2						
5046002	MAGNESITE	-0.349	[1.000]	460	[1.000]	140				
6050001	MIRABILITE	-5.372	[2.000]	500	[1.000]	732	[10.000]	2		
3050000	NATRON	-8.544	[2.000]	500	[1.000]	140	[10.000]	2		
5046003	NESQUEHONITE	-2.750	[1.000]	460	[1.000]	140	[3.000]	2		
6050002	THENARDITE	-6.747	[2.000]	500	[1.000]	732				
5050001	THERMONATR	-10.398	[2.000]	500	[1.000]	140	[1.000]	2		
2047003	PYROCROITE	-7.674	[-2.000]	330	[1.000]	470	[2.000]	2		
5047000	RHODOCHROSIT	-0.955	[1.000]	470	[1.000]	140				
4147000	MNCL2, 4H2O	-13.377	[1.000]	470	[2.000]	180	[4.000]	2		
6047000	MNSO4	-11.045	[1.000]	470	[1.000]	732				
2015000	LIME	-22.503	[-2.000]	330	[1.000]	150	[1.000]	2		
2015001	PORTLANDITE	-12.026	[-2.000]	330	[1.000]	150	[2.000]	2		
2046001	PERICLASE	-11.324	[-2.000]	330	[1.000]	460	[1.000]	2		

Southwest Alluvium Well EPA 27, 1996-1997 median concentrations

```
16.00 MG/L   0.000  0.00000E-01
0 0 1 0 3 0 0 0 1 1 0 0 0
0   0   0
    330  0.000E-01   -7.70 y                    /H+1
    150  5.470E+02   -1.72 y                    /Ca+2
    460  1.270E+02   -2.06 y                    /Mg+2
    500  3.320E+02   -2.17 y                    /Na+1
    410  1.630E+01   -3.67 y                    /K+1
    140  3.970E+01   -1.81 y                    /CO3-2
    732  1.910E+03   -1.75 y                    /SO4-2
    180  1.230E+02   -2.60 y                    /Cl-1
    490  7.000E-02   -5.14 y                    /NH4+1
    492  1.230E+02   -2.27 y                    /NO3-1

  3   1
    330     7.7000     0.0000                   /H+1
```

PART 1 of OUTPUT FILE

PC MINTEQA2 v3.10 DATE OF CALCULATIONS: 9-JUN-** TIME: 7:31:24

Southwest Alluvium Well EPA 27, 1996-1997 median concentrations

---

Temperature (Celsius): 16.00
Units of concentration: MG/L
Ionic strength to be computed.
If specified, carbonate concentration represents total inorganic carbon.
Do not automatically terminate if charge imbalance exceeds 30%
Precipitation is allowed only for those solids specified as ALLOWED
in the input file (if any).
The maximum number of iterations is: 200
The method used to compute activity coefficients is: Davies equation
Intermediate output file

330	0.000E-01	-7.70	y
150	5.470E+02	-1.72	y
460	1.270E+02	-2.06	y
500	3.320E+02	-2.17	y
410	1.630E+01	-3.67	y
140	3.970E+01	-1.81	y
732	1.910E+03	-1.75	y
180	1.230E+02	-2.60	y
490	7.000E-02	-5.14	y
492	1.230E+02	-2.27	y

H2O has been inserted as a COMPONENT
3 1
330 7.7000 0.0000

INPUT DATA BEFORE TYPE MODIFICATIONS

ID	NAME	ACTIVITY GUESS	LOG GUESS	ANAL TOTAL
330	H+1	1.995E-08	-7.700	0.000E-01
150	Ca+2	1.905E-02	-1.720	5.470E+02
460	Mg+2	8.710E-03	-2.060	1.270E+02
500	Na+1	6.761E-03	-2.170	3.320E+02
410	K+1	2.138E-04	-3.670	1.630E+01
140	CO3-2	1.549E-02	-1.810	3.970E+01
732	SO4-2	1.778E-02	-1.750	1.910E+03
180	Cl-1	2.512E-03	-2.600	1.230E+02
490	NH4+1	7.244E-06	-5.140	7.000E-02
492	NO3-1	5.370E-03	-2.270	1.230E+02
2	H2O	1.000E+00	0.000	0.000E-01

Charge Balance: UNSPECIATED

Sum of CATIONS= 5.277E-02 Sum of ANIONS = 4.669E-02

PERCENT DIFFERENCE = 6.115E+00 (ANIONS - CATIONS)/(ANIONS + CATIONS)

```
-----------------------------------------------------
| IMPROVED ACTIVITY GUESSES PRIOR TO FIRST ITERATION: |
|      CO3-2       Log activity guess:    -5.91      |
|      SO4-2       Log activity guess:    -1.70      |
|                                                     |
-----------------------------------------------------
```

PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY	RESIDUAL
0	NH4+1	3.893E-06	5.320E-06	-5.14000	5.320E-06
1	NH4+1	3.893E-06	3.543E-07	-5.44158	3.540E-07
2	NH4+1	3.893E-06	8.111E-07	-5.46109	8.107E-07
3	NH4+1	3.893E-06	1.203E-07	-5.52905	1.199E-07
4	NH4+1	3.893E-06	4.504E-09	-5.53947	4.115E-09

ID	NAME	ANAL MOL	CALC MOL	LOG ACTVTY	GAMMA	DIFF FXN
492	NO3-1	1.990E-03	1.990E-03	-2.79525	0.805146	-1.076E-10
150	Ca+2	1.369E-02	9.408E-03	-2.40299	0.420242	6.718E-08
460	Mg+2	5.241E-03	3.744E-03	-2.80322	0.420242	2.492E-08
500	Na+1	1.449E-02	1.410E-02	-1.94494	0.805146	7.371E-10
410	K+1	4.182E-04	4.042E-04	-3.48754	0.805146	3.178E-11
140	CO3-2	6.637E-04	2.214E-06	-6.03130	0.420242	9.262E-11
732	SO4-2	1.995E-02	1.380E-02	-2.23659	0.420242	9.338E-08
180	Cl-1	3.481E-03	3.481E-03	-2.55247	0.805146	-1.882E-10
490	NH4+1	3.893E-06	3.583E-06	-5.53985	0.805146	7.431E-13
2	H2O	0.000E-01	-4.105E-07	-0.00044	1.000000	0.000E-01
330	H+1	0.000E-01	2.478E-08	-7.70000	0.805146	0.000E-01

Type I - COMPONENTS AS SPECIES IN SOLUTION

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
330	H+1	2.478E-08	1.995E-08	-7.70000	0.80515	0.094
150	Ca+2	9.408E-03	3.954E-03	-2.40299	0.42024	0.377
460	Mg+2	3.744E-03	1.573E-03	-2.80322	0.42024	0.377
500	Na+1	1.410E-02	1.135E-02	-1.94494	0.80515	0.094
410	K+1	4.042E-04	3.254E-04	-3.48754	0.80515	0.094
140	CO3-2	2.214E-06	9.305E-07	-6.03130	0.42024	0.377
732	SO4-2	1.380E-02	5.800E-03	-2.23659	0.42024	0.377
180	Cl-1	3.481E-03	2.802E-03	-2.55247	0.80515	0.094
490	NH4+1	3.583E-06	2.885E-06	-5.53985	0.80515	0.094
492	NO3-1	1.990E-03	1.602E-03	-2.79525	0.80515	0.094

Type II - OTHER SPECIES IN SOLUTION OR ADSORBED

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
3301401	H2CO3 AQ	1.970E-05	2.000E-05	-4.69904	1.01494	16.726
3307320	HSO4 -	1.091E-08	8.782E-09	-8.05643	0.80515	1.974
3300020	OH-	3.099E-07	2.495E-07	-6.60289	0.80515	-14.208
3304900	NH3 AQ	4.215E-08	4.278E-08	-7.36876	1.01494	-9.535
4907320	NH4SO4 -	2.677E-07	2.156E-07	-6.66644	0.80515	1.204
4603300	MgOH +	7.172E-08	5.775E-08	-7.23846	0.80515	-12.041

4601400	MgCO3 AQ	1.199E-06	1.217E-06	-5.91483	1.01494	2.913
4601401	MgHCO3 +	1.051E-05	8.462E-06	-5.07251	0.80515	11.556
4607320	MgSO4 AQ	1.485E-03	1.508E-03	-2.82173	1.01494	2.212
1503300	CaOH +	2.891E-08	2.328E-08	-7.63303	0.80515	-12.835
1501400	CaHCO3 +	1.880E-05	1.513E-05	-4.82003	0.80515	11.408
1501401	CaCO3 AQ	4.323E-06	4.388E-06	-5.35775	1.01494	3.070
1507320	CaSO4 AQ	4.260E-03	4.324E-03	-2.36411	1.01494	2.269
5001400	NaCO3 -	1.523E-07	1.226E-07	-6.91154	0.80515	1.159
5001401	NaHCO3 AQ	2.496E-06	2.534E-06	-5.59625	1.01494	10.074
5007320	NaSO4 -	3.864E-04	3.111E-04	-3.50709	0.80515	0.769
4107320	KSO4 -	1.401E-05	1.128E-05	-4.94763	0.80515	0.871
3301400	HCO3 -	6.043E-04	4.866E-04	-3.31287	0.80515	10.513

Type III - SPECIES WITH FIXED ACTIVITY

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
2	H2O	-4.105E-07	-6.387	0.000	0.000
330	H+1	-6.751E-04	-3.171	7.700	0.000

Type VI - EXCLUDED SPECIES (not included in mole balance)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
3301403	CO2 (g)	5.511E-04	-3.259	18.172	-0.530

PERCENTAGE DISTRIBUTION OF COMPONENTS AMONG
TYPE I and TYPE II (dissolved and adsorbed) species

NO3-1		100.0	PERCENT BOUND IN SPECIES # 492	NO3-1
Ca+2		68.7	PERCENT BOUND IN SPECIES # 150	Ca+2
	31.1	PERCENT BOUND IN SPECIES #1507320	CaSO4 AQ	
Mg+2		71.4	PERCENT BOUND IN SPECIES # 460	Mg+2
	28.3	PERCENT BOUND IN SPECIES #4607320	MgSO4 AQ	
Na+1		97.3	PERCENT BOUND IN SPECIES # 500	Na+1
	2.7	PERCENT BOUND IN SPECIES #5007320	NaSO4 -	
K+1		96.6	PERCENT BOUND IN SPECIES # 410	K+1
	3.4	PERCENT BOUND IN SPECIES #4107320	KSO4 -	
CO3-2		3.0	PERCENT BOUND IN SPECIES #3301401	H2CO3
AQ				
	1.6	PERCENT BOUND IN SPECIES #4601401	MgHCO3 +	
	2.8	PERCENT BOUND IN SPECIES #1501400	CaHCO3 +	
	91.1	PERCENT BOUND IN SPECIES #3301400	HCO3 -	
SO4-2		69.2	PERCENT BOUND IN SPECIES # 732	SO4-2
	7.4	PERCENT BOUND IN SPECIES #4607320	MgSO4 AQ	
	21.4	PERCENT BOUND IN SPECIES #1507320	CaSO4 AQ	
	1.9	PERCENT BOUND IN SPECIES #5007320	NaSO4 -	
Cl-1		100.0	PERCENT BOUND IN SPECIES # 180	Cl-1
NH4+1		92.0	PERCENT BOUND IN SPECIES # 490	NH4+1
	1.1	PERCENT BOUND IN SPECIES #3304900	NH3 AQ	
	6.9	PERCENT BOUND IN SPECIES #4907320	NH4SO4 -	
H2O		75.5	PERCENT BOUND IN SPECIES #3300020	OH-
	17.5	PERCENT BOUND IN SPECIES #4603300	MgOH +	
	7.0	PERCENT BOUND IN SPECIES #1503300	CaOH +	
H+1		5.8	PERCENT BOUND IN SPECIES #3301401	H2CO3
AQ				
	1.6	PERCENT BOUND IN SPECIES #4601401	MgHCO3 +	
	2.8	PERCENT BOUND IN SPECIES #1501400	CaHCO3 +	
	89.5	PERCENT BOUND IN SPECIES #3301400	HCO3 -	

---------- EQUILIBRATED MASS DISTRIBUTION ----------

IDX	NAME	DISSOLVED MOL/KG	DISSOLVED PERCENT	SORBED MOL/KG	SORBED PERCENT	PRECIPITATED MOL/KG	PRECIPITATED PERCENT
492	NO3-1	1.990E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
150	Ca+2	1.369E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	5.241E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	1.449E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	4.182E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
140	CO3-2	6.637E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
732	SO4-2	1.995E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
180	Cl-1	3.481E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
490	NH4+1	3.893E-06	100.0	0.000E-01	0.0	0.000E-01	0.0
2	H2O	4.105E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
330	H+1	6.751E-04	100.0	0.000E-01	0.0	0.000E-01	0.0

Charge Balance: SPECIATED

Sum of CATIONS = 4.084E-02 Sum of ANIONS 3.408E-02

PERCENT DIFFERENCE = 9.019E+00 (ANIONS - CATIONS)/(ANIONS + CATIONS)

EQUILIBRIUM IONIC STRENGTH (m) = 6.442E-02

EQUILIBRIUM pH = 7.700

DATE ID NUMBER: ******
TIME ID NUMBER: 7312694

PC MINTEQA2 v3.10 DATE OF CALCULATIONS: 9-JUN-** TIME: 7:31:27

Saturation indices and stoichiometry of all minerals

ID #	NAME	Sat. Index	Stoichiometry in [brackets]							
6015000	ANHYDRITE	-0.089	[1.000]	150	[1.000]	732				
5015000	ARAGONITE	-0.176	[1.000]	150	[1.000]	140				
5046000	ARTINITE	-6.496	[-2.000]	330	[2.000]	460	[1.000]	140		
			[5.000]	2						
2046000	BRUCITE	-4.786	[1.000]	460	[2.000]	2	[-2.000]	330		
5015001	CALCITE	-0.007	[1.000]	150	[1.000]	140				
5015002	DOLOMITE	-0.458	[1.000]	150	[1.000]	460	[2.000]	140		
6046000	EPSOMITE	-2.839	[1.000]	460	[1.000]	732	[7.000]	2		
6015001	GYPSUM	0.213	[1.000]	150	[1.000]	732	[2.000]	2		
4150000	HALITE	-6.058	[1.000]	500	[1.000]	180				
5015003	HUNTITE	-5.558	[3.000]	460	[1.000]	150	[4.000]	140		
5046001	HYDRMAGNESIT	-15.169	[5.000]	460	[4.000]	140	[-2.000]	330		
			[6.000]	2						
5046002	MAGNESITE	-0.946	[1.000]	460	[1.000]	140				
6050001	MIRABILITE	-4.584	[2.000]	500	[1.000]	732	[10.000]	2		
3050000	NATRON	-8.255	[2.000]	500	[1.000]	140	[10.000]	2		
5046003	NESQUEHONITE	-3.347	[1.000]	460	[1.000]	140	[3.000]	2		
6050002	THENARDITE	-5.961	[2.000]	500	[1.000]	732				
5050001	THERMONATR	-10.111	[2.000]	500	[1.000]	140	[1.000]	2		
2015000	LIME	-20.856	[-2.000]	330	[1.000]	150	[1.000]	2		
2015001	PORTLANDITE	-10.379	[-2.000]	330	[1.000]	150	[2.000]	2		
2046001	PERICLASE	-9.738	[-2.000]	330	[1.000]	460	[1.000]	2		

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Southwest Alluvium well EPA-28, median concentrations '98-'99
Fixed pH, no precip - determine SI
16.00 MG/L   0.000  0.00000E-01
0 0 1 0 3 0 0 0 1 1 0 0 0
0   0   0
    330  0.000E-01   -6.90 y                    /H+1
    150  5.310E+02   -1.88 y                    /Ca+2
    460  5.430E+02   -1.65 y                    /Mg+2
    500  2.240E+02   -2.01 y                    /Na+1
    410  1.280E+01   -3.48 y                    /K+1
    140  5.300E+02   -2.05 y                    /CO3-2
    732  3.010E+03   -1.50 y                    /SO4-2
    180  1.040E+02   -2.53 y                    /Cl-1
    490  1.300E-01   -5.14 y                    /NH4+1
    492  1.930E+02   -2.51 y                    /NO3-1
    470  3.000E-01   -5.26 y                    /Mn+2

  3   1
    330     6.9000     0.0000                   /H+1
```

PART 1 of OUTPUT FILE

PC MINTEQA2 v3.10 DATE OF CALCULATIONS: 18-JAN-** TIME: 7:52: 6

Southwest Alluvium well EPA-28, median concentrations '98-'99
Fixed pH, no precip - determine SI

Temperature (Celsius): 16.00
Units of concentration: MG/L
Ionic strength to be computed.
If specified, carbonate concentration represents total inorganic carbon.
Do not automatically terminate if charge imbalance exceeds 30%
Precipitation is allowed only for those solids specified as ALLOWED
in the input file (if any).
The maximum number of iterations is: 200
The method used to compute activity coefficients is: Davies equation
Intermediate output file

330	0.000E-01	-6.90	y
150	5.310E+02	-1.88	y
460	5.430E+02	-1.65	y
500	2.240E+02	-2.01	y
410	1.280E+01	-3.48	y
140	5.300E+02	-2.05	y
732	3.010E+03	-1.50	y
180	1.040E+02	-2.53	y
490	1.300E-01	-5.14	y
492	1.930E+02	-2.51	y
470	3.000E-01	-5.26	y

H2O has been inserted as a COMPONENT
3 1
330 6.9000 0.0000

INPUT DATA BEFORE TYPE MODIFICATIONS

ID	NAME	ACTIVITY GUESS	LOG GUESS	ANAL TOTAL
330	H+1	1.259E-07	-6.900	0.000E-01
150	Ca+2	1.318E-02	-1.880	5.310E+02
460	Mg+2	2.239E-02	-1.650	5.430E+02
500	Na+1	9.772E-03	-2.010	2.240E+02
410	K+1	3.311E-04	-3.480	1.280E+01
140	CO3-2	8.913E-03	-2.050	5.300E+02
732	SO4-2	3.162E-02	-1.500	3.010E+03
180	Cl-1	2.951E-03	-2.530	1.040E+02
490	NH4+1	7.244E-06	-5.140	1.300E-01
492	NO3-1	3.090E-03	-2.510	1.930E+02
470	Mn+2	5.495E-06	-5.260	3.000E-01
2	H2O	1.000E+00	0.000	0.000E-01

Charge Balance: UNSPECIATED

Sum of CATIONS= 8.168E-02 Sum of ANIONS = 8.683E-02

PERCENT DIFFERENCE = 3.056E+00 (ANIONS - CATIONS)/(ANIONS + CATIONS)

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| IMPROVED ACTIVITY GUESSES PRIOR TO FIRST ITERATION: |
|      CO3-2        Log activity guess:    -5.67      |
|      SO4-2        Log activity guess:    -1.50      |
|      Mn+2         Log activity guess:    -5.26      |
|                                                     |
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PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY	RESIDUAL
0	NO3-1	3.129E-03	-3.847E-05	-2.51000	3.816E-05
1	NH4+1	7.244E-06	2.140E-07	-5.21035	2.133E-07
2	NO3-1	3.129E-03	7.429E-04	-2.50463	7.425E-04
3	NO3-1	3.129E-03	1.107E-04	-2.59715	1.104E-04
4	NO3-1	3.129E-03	8.804E-06	-2.61225	8.491E-06
5	NO3-1	3.129E-03	6.995E-07	-2.61347	3.866E-07

ID	NAME	ANAL MOL	CALC MOL	LOG ACTVTY	GAMMA	DIFF FXN
470	Mn+2	5.489E-06	3.731E-06	-5.86401	0.366597	4.542E-10
150	Ca+2	1.332E-02	8.772E-03	-2.49273	0.366597	1.056E-06
460	Mg+2	2.245E-02	1.533E-02	-2.25026	0.366597	1.858E-06
500	Na+1	9.794E-03	9.447E-03	-2.13364	0.778121	3.036E-07
410	K+1	3.290E-04	3.152E-04	-3.61041	0.778121	1.022E-08
140	CO3-2	8.878E-03	4.428E-06	-5.78961	0.366597	2.204E-07
732	SO4-2	3.150E-02	2.010E-02	-2.13260	0.366597	2.409E-06
180	Cl-1	2.949E-03	2.949E-03	-2.63932	0.778121	9.160E-08
490	NH4+1	7.244E-06	6.605E-06	-5.28905	0.778121	2.246E-10
492	NO3-1	3.129E-03	3.129E-03	-2.61357	0.778121	9.720E-08
2	H2O	0.000E-01	-9.681E-08	-0.00068	1.000000	0.000E-01
330	H+1	0.000E-01	1.618E-07	-6.90000	0.778121	0.000E-01

Type I - COMPONENTS AS SPECIES IN SOLUTION

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
330	H+1	1.618E-07	1.259E-07	-6.90000	0.77812	0.109
150	Ca+2	8.772E-03	3.216E-03	-2.49273	0.36660	0.436
460	Mg+2	1.533E-02	5.620E-03	-2.25026	0.36660	0.436
500	Na+1	9.447E-03	7.351E-03	-2.13364	0.77812	0.109
410	K+1	3.152E-04	2.452E-04	-3.61041	0.77812	0.109
140	CO3-2	4.428E-06	1.623E-06	-5.78961	0.36660	0.436
732	SO4-2	2.010E-02	7.369E-03	-2.13260	0.36660	0.436
180	Cl-1	2.949E-03	2.294E-03	-2.63932	0.77812	0.109
490	NH4+1	6.605E-06	5.140E-06	-5.28905	0.77812	0.109
492	NO3-1	3.129E-03	2.435E-03	-2.61357	0.77812	0.109
470	Mn+2	3.731E-06	1.368E-06	-5.86401	0.36660	0.436

Type II - OTHER SPECIES IN SOLUTION OR ADSORBED

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
3301401	H2CO3 AQ	1.357E-03	1.389E-03	-2.85734	1.02335	16.722
3307320	HSO4 -	9.047E-08	7.040E-08	-7.15244	0.77812	1.989
3300020	OH-	5.079E-08	3.952E-08	-7.40313	0.77812	-14.193

3304900	NH3 AQ	1.180E-08	1.208E-08	-7.91796	1.02335	-9.539
4907320	NH4SO4 -	6.270E-07	4.879E-07	-6.31165	0.77812	1.219
4603300	MgOH +	4.200E-08	3.268E-08	-7.48573	0.77812	-12.026
4601400	MgCO3 AQ	7.410E-06	7.583E-06	-5.12016	1.02335	2.910
4601401	MgHCO3 +	4.277E-04	3.328E-04	-3.47784	0.77812	11.571
4607320	MgSO4 AQ	6.687E-03	6.843E-03	-2.16477	1.02335	2.208
1503300	CaOH +	3.854E-09	2.999E-09	-8.52301	0.77812	-12.821
1501400	CaHCO3 +	1.741E-04	1.355E-04	-3.86808	0.77812	11.423
1501401	CaCO3 AQ	6.084E-06	6.226E-06	-5.20580	1.02335	3.067
1507320	CaSO4 AQ	4.366E-03	4.468E-03	-2.34987	1.02335	2.265
5001400	NaCO3 -	1.780E-07	1.385E-07	-6.85854	0.77812	1.174
5001401	NaHCO3 AQ	1.765E-05	1.806E-05	-4.74325	1.02335	10.070
5007320	NaSO4 -	3.290E-04	2.560E-04	-3.59179	0.77812	0.783
4107320	KSO4 -	1.388E-05	1.080E-05	-4.96651	0.77812	0.885
4701800	MnCl +	1.632E-08	1.270E-08	-7.89632	0.77812	0.716
4701801	MnCl2 AQ	7.733E-12	7.913E-12	-11.10164	1.02335	0.031
4701802	MnCl3 -	1.052E-14	8.185E-15	-14.08696	0.77812	-0.196
4703300	MnOH +	1.682E-10	1.309E-10	-9.88319	0.77812	-10.810
4703301	Mn(OH)3 -1	1.390E-20	1.081E-20	-19.96605	0.77812	-34.691
4707320	MnSO4 AQ	1.599E-06	1.636E-06	-5.78611	1.02335	2.200
4704920	Mn(NO3)2AQ	3.220E-11	3.295E-11	-10.48210	1.02335	0.599
4701400	MnHCO3 +	1.430E-07	1.113E-07	-6.95361	0.77812	11.709
3301400	HCO3 -	6.883E-03	5.356E-03	-2.27117	0.77812	10.527

Type III - SPECIES WITH FIXED ACTIVITY

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
2	H2O	-9.681E-08	-7.014	0.001	0.000
330	H+1	-1.022E-02	-1.991	6.900	0.000

Type VI - EXCLUDED SPECIES (not included in mole balance)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
3301403	CO2 (g)	3.830E-02	-1.417	18.172	-0.530

PERCENTAGE DISTRIBUTION OF COMPONENTS AMONG
TYPE I and TYPE II (dissolved and adsorbed) species

```
Mn+2                    68.0     PERCENT BOUND IN SPECIES #    470   Mn+2
          29.1     PERCENT BOUND IN SPECIES #4707320   MnSO4 AQ
           2.6     PERCENT BOUND IN SPECIES #4701400   MnHCO3 +

Ca+2                    65.9     PERCENT BOUND IN SPECIES #    150   Ca+2
           1.3     PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
          32.8     PERCENT BOUND IN SPECIES #1507320   CaSO4 AQ

Mg+2                    68.3     PERCENT BOUND IN SPECIES #    460   Mg+2
           1.9     PERCENT BOUND IN SPECIES #4601401   MgHCO3 +
          29.8     PERCENT BOUND IN SPECIES #4607320   MgSO4 AQ

Na+1                    96.5     PERCENT BOUND IN SPECIES #    500   Na+1
           3.4     PERCENT BOUND IN SPECIES #5007320   NaSO4 -

K+1                     95.8     PERCENT BOUND IN SPECIES #    410   K+1
           4.2     PERCENT BOUND IN SPECIES #4107320   KSO4 -

CO3-2                   15.3     PERCENT BOUND IN SPECIES #3301401   H2CO3
AQ
           4.8     PERCENT BOUND IN SPECIES #4601401   MgHCO3 +
           2.0     PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
          77.5     PERCENT BOUND IN SPECIES #3301400   HCO3 -

SO4-2                   63.8     PERCENT BOUND IN SPECIES #    732   SO4-2
          21.2     PERCENT BOUND IN SPECIES #4607320   MgSO4 AQ
          13.9     PERCENT BOUND IN SPECIES #1507320   CaSO4 AQ
           1.0     PERCENT BOUND IN SPECIES #5007320   NaSO4 -

Cl-1                   100.0     PERCENT BOUND IN SPECIES #    180   Cl-1

NH4+1                   91.2     PERCENT BOUND IN SPECIES #    490   NH4+1
           8.7     PERCENT BOUND IN SPECIES #4907320   NH4SO4 -

NO3-1                  100.0     PERCENT BOUND IN SPECIES #    492   NO3-1

H2O                     52.5     PERCENT BOUND IN SPECIES #3300020   OH-
          43.4     PERCENT BOUND IN SPECIES #4603300   MgOH +
           4.0     PERCENT BOUND IN SPECIES #1503300   CaOH +

H+1                     26.6     PERCENT BOUND IN SPECIES #3301401   H2CO3
AQ
           4.2     PERCENT BOUND IN SPECIES #4601401   MgHCO3 +
           1.7     PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
          67.4     PERCENT BOUND IN SPECIES #3301400   HCO3 -
```

---------- EQUILIBRATED MASS DISTRIBUTION ----------

IDX	NAME	DISSOLVED MOL/KG	DISSOLVED PERCENT	SORBED MOL/KG	SORBED PERCENT	PRECIPITATED MOL/KG	PRECIPITATED PERCENT
470	Mn+2	5.489E-06	100.0	0.000E-01	0.0	0.000E-01	0.0
150	Ca+2	1.332E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	2.245E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	9.794E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	3.291E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
140	CO3-2	8.878E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
732	SO4-2	3.150E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
180	Cl-1	2.949E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
490	NH4+1	7.244E-06	100.0	0.000E-01	0.0	0.000E-01	0.0
492	NO3-1	3.129E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
2	H2O	9.681E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
330	H+1	1.022E-02	100.0	0.000E-01	0.0	0.000E-01	0.0

Charge Balance: SPECIATED

Sum of CATIONS = 5.858E-02 Sum of ANIONS 5.351E-02

PERCENT DIFFERENCE = 4.521E+00 (ANIONS - CATIONS)/(ANIONS + CATIONS)

EQUILIBRIUM IONIC STRENGTH (m) = 1.002E-01

EQUILIBRIUM pH = 6.900

DATE ID NUMBER: ******
TIME ID NUMBER: 7520974

Saturation indices and stoichiometry of all minerals

ID #	NAME	Sat. Index	Stoichiometry in [brackets]							
6015000	ANHYDRITE	-0.074	[1.000]	150	[1.000]	732				
5015000	ARAGONITE	-0.024	[1.000]	150	[1.000]	140				
5046000	ARTINITE	-6.749	[-2.000]	330	[2.000]	460	[1.000]	140		
			[5.000]	2						
2046000	BRUCITE	-5.833	[1.000]	460	[2.000]	2	[-2.000]	330		
5015001	CALCITE	0.145	[1.000]	150	[1.000]	140				
5015002	DOLOMITE	0.489	[1.000]	150	[1.000]	460	[2.000]	140		
6046000	EPSOMITE	-2.183	[1.000]	460	[1.000]	732	[7.000]	2		
6015001	GYPSUM	0.227	[1.000]	150	[1.000]	732	[2.000]	2		
4150000	HALITE	-6.334	[1.000]	500	[1.000]	180				
5015003	HUNTITE	-3.022	[3.000]	460	[1.000]	150	[4.000]	140		
5046001	HYDRMAGNESIT	-13.039	[5.000]	460	[4.000]	140	[-2.000]	330		
			[6.000]	2						
5046002	MAGNESITE	-0.152	[1.000]	460	[1.000]	140				
6050001	MIRABILITE	-4.860	[2.000]	500	[1.000]	732	[10.000]	2		
3050000	NATRON	-8.394	[2.000]	500	[1.000]	140	[10.000]	2		
5046003	NESQUEHONITE	-2.553	[1.000]	460	[1.000]	140	[3.000]	2		
6050002	THENARDITE	-6.234	[2.000]	500	[1.000]	732				
5050001	THERMONATR	-10.246	[2.000]	500	[1.000]	140	[1.000]	2		
2047003	PYROCROITE	-7.669	[-2.000]	330	[1.000]	470	[2.000]	2		
5047000	RHODOCHROSIT	-1.291	[1.000]	470	[1.000]	140				
4147000	MNCL2, 4H2O	-13.459	[1.000]	470	[2.000]	180	[4.000]	2		
6047000	MNSO4	-11.019	[1.000]	470	[1.000]	732				
2015000	LIME	-22.546	[-2.000]	330	[1.000]	150	[1.000]	2		
2015001	PORTLANDITE	-12.069	[-2.000]	330	[1.000]	150	[2.000]	2		
2046001	PERICLASE	-10.785	[-2.000]	330	[1.000]	460	[1.000]	2		

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Southwest Alluvium well GW-1, median '98-99 concentrations
Fixed pH, no precip - determine SI
16.00 MG/L   0.000  0.00000E-01
0 0 1 0 3 0 0 0 1 1 0 0 0
0   0   0
    330  0.000E-01   -6.70 y                    /H+1
    150  6.100E+02   -1.82 y                    /Ca+2
    460  3.170E+02   -1.88 y                    /Mg+2
    500  2.200E+02   -2.02 y                    /Na+1
    410  5.400E+00   -3.86 y                    /K+1
    140  8.010E+02   -1.87 y                    /CO3-2
    732  1.900E+03   -1.70 y                    /SO4-2
    180  1.250E+02   -2.45 y                    /Cl-1
    490  5.000E-01   -4.56 y                    /NH4+1
    492  4.240E+02   -2.17 y                    /NO3-1

  3   1
    330     6.7000     0.0000                   /H+1
```

PART 1 of OUTPUT FILE

PC MINTEQA2 v3.10 DATE OF CALCULATIONS: 18-JAN-** TIME: 7:51: 9

Southwest Alluvium well GW-1, median '98-99 concentrations
Fixed pH, no precip - determine SI

Temperature (Celsius): 16.00
Units of concentration: MG/L
Ionic strength to be computed.
If specified, carbonate concentration represents total inorganic carbon.
Do not automatically terminate if charge imbalance exceeds 30%
Precipitation is allowed only for those solids specified as ALLOWED
in the input file (if any).
The maximum number of iterations is: 200
The method used to compute activity coefficients is: Davies equation
Intermediate output file

330	0.000E-01	-6.70	y
150	6.100E+02	-1.82	y
460	3.170E+02	-1.88	y
500	2.200E+02	-2.02	y
410	5.400E+00	-3.86	y
140	8.010E+02	-1.87	y
732	1.900E+03	-1.70	y
180	1.250E+02	-2.45	y
490	5.000E-01	-4.56	y
492	4.240E+02	-2.17	y

H2O has been inserted as a COMPONENT
3 1
330 6.7000 0.0000

INPUT DATA BEFORE TYPE MODIFICATIONS

ID	NAME	ACTIVITY GUESS	LOG GUESS	ANAL TOTAL
330	H+1	1.995E-07	-6.700	0.000E-01
150	Ca+2	1.514E-02	-1.820	6.100E+02
460	Mg+2	1.318E-02	-1.880	3.170E+02
500	Na+1	9.550E-03	-2.020	2.200E+02
410	K+1	1.380E-04	-3.860	5.400E+00
140	CO3-2	1.349E-02	-1.870	8.010E+02
732	SO4-2	1.995E-02	-1.700	1.900E+03
180	Cl-1	3.548E-03	-2.450	1.250E+02
490	NH4+1	2.754E-05	-4.560	5.000E-01
492	NO3-1	6.761E-03	-2.170	4.240E+02
2	H2O	1.000E+00	0.000	0.000E-01

Charge Balance: UNSPECIATED

Sum of CATIONS= 6.655E-02 Sum of ANIONS = 7.696E-02

PERCENT DIFFERENCE = 7.255E+00 (ANIONS - CATIONS)/(ANIONS + CATIONS)

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| IMPROVED ACTIVITY GUESSES PRIOR TO FIRST ITERATION: |
|      CO3-2        Log activity guess:    -5.74     |
|      SO4-2        Log activity guess:    -1.70     |
|                                                     |
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PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY	RESIDUAL
0	NH4+1	2.784E-05	6.791E-06	-4.56000	6.788E-06
1	NH4+1	2.784E-05	3.315E-07	-4.60177	3.287E-07
2	NH4+1	2.784E-05	6.297E-06	-4.59001	6.293E-06
3	NH4+1	2.784E-05	8.515E-07	-4.67283	8.488E-07
4	NH4+1	2.784E-05	5.709E-08	-4.68395	5.431E-08
5	NH4+1	2.784E-05	3.786E-09	-4.68471	1.002E-09

ID	NAME	ANAL MOL	CALC MOL	LOG ACTVTY	GAMMA	DIFF FXN
492	NO3-1	6.868E-03	6.869E-03	-2.26528	0.790411	1.074E-07
150	Ca+2	1.529E-02	1.102E-02	-2.36648	0.390313	6.798E-07
460	Mg+2	1.310E-02	9.666E-03	-2.42335	0.390313	5.998E-07
500	Na+1	9.612E-03	9.367E-03	-2.13052	0.790411	1.499E-07
410	K+1	1.387E-04	1.347E-04	-3.97269	0.790411	2.170E-09
140	CO3-2	1.341E-02	3.712E-06	-5.83893	0.390313	1.498E-07
732	SO4-2	1.987E-02	1.268E-02	-2.30554	0.390313	7.708E-07
180	Cl-1	3.541E-03	3.541E-03	-2.55297	0.790411	5.540E-08
490	NH4+1	2.784E-05	2.614E-05	-4.68476	0.790411	4.350E-10
2	H2O	0.000E-01	-5.227E-08	-0.00060	1.000000	0.000E-01
330	H+1	0.000E-01	2.524E-07	-6.70000	0.790411	0.000E-01

Type I - COMPONENTS AS SPECIES IN SOLUTION

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
330	H+1	2.524E-07	1.995E-07	-6.70000	0.79041	0.102
150	Ca+2	1.102E-02	4.301E-03	-2.36648	0.39031	0.409
460	Mg+2	9.666E-03	3.773E-03	-2.42335	0.39031	0.409
500	Na+1	9.367E-03	7.404E-03	-2.13052	0.79041	0.102
410	K+1	1.347E-04	1.065E-04	-3.97269	0.79041	0.102
140	CO3-2	3.712E-06	1.449E-06	-5.83893	0.39031	0.409
732	SO4-2	1.268E-02	4.948E-03	-2.30554	0.39031	0.409
180	Cl-1	3.541E-03	2.799E-03	-2.55297	0.79041	0.102
490	NH4+1	2.614E-05	2.067E-05	-4.68476	0.79041	0.102
492	NO3-1	6.869E-03	5.429E-03	-2.26528	0.79041	0.102

Type II - OTHER SPECIES IN SOLUTION OR ADSORBED

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
3301401	H2CO3 AQ	3.056E-03	3.114E-03	-2.50667	1.01905	16.724
3307320	HSO4 -	9.479E-08	7.492E-08	-7.12538	0.79041	1.982
3300020	OH-	3.156E-08	2.494E-08	-7.60306	0.79041	-14.200
3304900	NH3 AQ	3.007E-08	3.064E-08	-7.51367	1.01905	-9.537
4907320	NH4SO4 -	1.667E-06	1.317E-06	-5.88031	0.79041	1.212

4603300	MgOH +	1.751E-08	1.384E-08	-7.85875	0.79041	-12.033
4601400	MgCO3 AQ	4.459E-06	4.544E-06	-5.34258	1.01905	2.912
4601401	MgHCO3 +	3.998E-04	3.160E-04	-3.50026	0.79041	11.564
4607320	MgSO4 AQ	3.027E-03	3.085E-03	-2.51081	1.01905	2.210
1503300	CaOH +	3.202E-09	2.531E-09	-8.59668	0.79041	-12.827
1501400	CaHCO3 +	3.243E-04	2.564E-04	-3.59115	0.79041	11.416
1501401	CaCO3 AQ	7.293E-06	7.432E-06	-5.12888	1.01905	3.068
1507320	CaSO4 AQ	3.938E-03	4.013E-03	-2.39656	1.01905	2.267
5001400	NaCO3 -	1.575E-07	1.245E-07	-6.90475	0.79041	1.167
5001401	NaHCO3 AQ	2.525E-05	2.574E-05	-4.58946	1.01905	10.072
5007320	NaSO4 -	2.190E-04	1.731E-04	-3.76162	0.79041	0.777
4107320	KSO4 -	3.985E-06	3.150E-06	-5.50174	0.79041	0.879
3301400	HCO3 -	9.586E-03	7.577E-03	-2.12050	0.79041	10.521

Type III - SPECIES WITH FIXED ACTIVITY

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
2	H2O	-5.227E-08	-7.282	0.001	0.000
330	H+1	-1.645E-02	-1.784	6.700	0.000

Type VI - EXCLUDED SPECIES (not included in mole balance)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
3301403	CO2 (g)	8.585E-02	-1.066	18.172	-0.530

PERCENTAGE DISTRIBUTION OF COMPONENTS AMONG
TYPE I and TYPE II (dissolved and adsorbed) species

NO3-1		100.0	PERCENT BOUND IN SPECIES # 492	NO3-1
Ca+2		72.1	PERCENT BOUND IN SPECIES # 150	Ca+2
	2.1	PERCENT BOUND IN SPECIES #1501400	CaHCO3 +	
	25.8	PERCENT BOUND IN SPECIES #1507320	CaSO4 AQ	
Mg+2		73.8	PERCENT BOUND IN SPECIES # 460	Mg+2
	3.1	PERCENT BOUND IN SPECIES #4601401	MgHCO3 +	
	23.1	PERCENT BOUND IN SPECIES #4607320	MgSO4 AQ	
Na+1		97.5	PERCENT BOUND IN SPECIES # 500	Na+1
	2.3	PERCENT BOUND IN SPECIES #5007320	NaSO4 -	
K+1		97.1	PERCENT BOUND IN SPECIES # 410	K+1
	2.9	PERCENT BOUND IN SPECIES #4107320	KSO4 -	
CO3-2		22.8	PERCENT BOUND IN SPECIES #3301401	H2CO3
AQ				
	3.0	PERCENT BOUND IN SPECIES #4601401	MgHCO3 +	
	2.4	PERCENT BOUND IN SPECIES #1501400	CaHCO3 +	
	71.5	PERCENT BOUND IN SPECIES #3301400	HCO3 -	
SO4-2		63.8	PERCENT BOUND IN SPECIES # 732	SO4-2
	15.2	PERCENT BOUND IN SPECIES #4607320	MgSO4 AQ	
	19.8	PERCENT BOUND IN SPECIES #1507320	CaSO4 AQ	
	1.1	PERCENT BOUND IN SPECIES #5007320	NaSO4 -	
Cl-1		100.0	PERCENT BOUND IN SPECIES # 180	Cl-1
NH4+1		93.9	PERCENT BOUND IN SPECIES # 490	NH4+1
	6.0	PERCENT BOUND IN SPECIES #4907320	NH4SO4 -	
H2O		60.4	PERCENT BOUND IN SPECIES #3300020	OH-
	33.5	PERCENT BOUND IN SPECIES #4603300	MgOH +	
	6.1	PERCENT BOUND IN SPECIES #1503300	CaOH +	
H+1		37.2	PERCENT BOUND IN SPECIES #3301401	H2CO3
AQ				
	2.4	PERCENT BOUND IN SPECIES #4601401	MgHCO3 +	
	2.0	PERCENT BOUND IN SPECIES #1501400	CaHCO3 +	
	58.3	PERCENT BOUND IN SPECIES #3301400	HCO3 -	

---------- EQUILIBRATED MASS DISTRIBUTION ----------

IDX	NAME	DISSOLVED MOL/KG	DISSOLVED PERCENT	SORBED MOL/KG	SORBED PERCENT	PRECIPITATED MOL/KG	PRECIPITATED PERCENT
492	NO3-1	6.869E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
150	Ca+2	1.529E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	1.310E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	9.612E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	1.387E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
140	CO3-2	1.341E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
732	SO4-2	1.987E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
180	Cl-1	3.541E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
490	NH4+1	2.784E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
2	H2O	5.227E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
330	H+1	1.645E-02	100.0	0.000E-01	0.0	0.000E-01	0.0

Charge Balance: SPECIATED

Sum of CATIONS = 5.162E-02 Sum of ANIONS 4.558E-02

PERCENT DIFFERENCE = 6.210E+00 (ANIONS - CATIONS)/(ANIONS + CATIONS)

EQUILIBRIUM IONIC STRENGTH (m) = 8.196E-02

EQUILIBRIUM pH = 6.700

DATE ID NUMBER: ******
TIME ID NUMBER: 7511234

PC MINTEQA2 v3.10 DATE OF CALCULATIONS: 18-JAN-** TIME: 7:51:12

Saturation indices and stoichiometry of all minerals

ID #	NAME	Sat. Index	Stoichiometry in [brackets]							
6015000	ANHYDRITE	-0.121	[1.000]	150	[1.000]	732				
5015000	ARAGONITE	0.053	[1.000]	150	[1.000]	140				
5046000	ARTINITE	-7.544	[-2.000]	330	[2.000]	460	[1.000]	140		
			[5.000]	2						
2046000	BRUCITE	-6.406	[1.000]	460	[2.000]	2	[-2.000]	330		
5015001	CALCITE	0.222	[1.000]	150	[1.000]	140				
5015002	DOLOMITE	0.343	[1.000]	150	[1.000]	460	[2.000]	140		
6046000	EPSOMITE	-2.529	[1.000]	460	[1.000]	732	[7.000]	2		
6015001	GYPSUM	0.181	[1.000]	150	[1.000]	732	[2.000]	2		
4150000	HALITE	-6.245	[1.000]	500	[1.000]	180				
5015003	HUNTITE	-3.612	[3.000]	460	[1.000]	150	[4.000]	140		
5046001	HYDRMAGNESIT	-14.501	[5.000]	460	[4.000]	140	[-2.000]	330		
			[6.000]	2						
5046002	MAGNESITE	-0.374	[1.000]	460	[1.000]	140				
6050001	MIRABILITE	-5.025	[2.000]	500	[1.000]	732	[10.000]	2		
3050000	NATRON	-8.436	[2.000]	500	[1.000]	140	[10.000]	2		
5046003	NESQUEHONITE	-2.775	[1.000]	460	[1.000]	140	[3.000]	2		
6050002	THENARDITE	-6.401	[2.000]	500	[1.000]	732				
5050001	THERMONATR	-10.290	[2.000]	500	[1.000]	140	[1.000]	2		
2015000	LIME	-22.820	[-2.000]	330	[1.000]	150	[1.000]	2		
2015001	PORTLANDITE	-12.343	[-2.000]	330	[1.000]	150	[2.000]	2		
2046001	PERICLASE	-11.358	[-2.000]	330	[1.000]	460	[1.000]	2		

```
Southwest Alluvium well GW-2, '98-'99 median concentrations
Fixed pH, no precip - determine SI
16.00 MG/L   0.000  0.00000E-01
0 0 1 0 3 0 0 0 1 1 0 0 0
0   0   0
    330  0.000E-01   -6.50 y                    /H+1
    150  6.380E+02   -1.80 y                    /Ca+2
    460  5.890E+02   -1.62 y                    /Mg+2
    500  2.480E+02   -1.97 y                    /Na+1
    410  9.900E+00   -1.63 y                    /K+1
    140  1.475E+03   -1.61 y                    /CO3-2
    732  2.735E+03   -1.55 y                    /SO4-2
    180  1.710E+02   -2.32 y                    /Cl-1
    490  1.300E-01   -5.14 y                    /NH4+1
    492  3.900E+01   -3.20 y                    /NO3-1
    470  3.000E-01   -5.26 y                    /Mn+2

  3   1
    330     6.5000     0.0000                   /H+1
```

PART 1 of OUTPUT FILE

PC MINTEQA2 v3.10 DATE OF CALCULATIONS: 18-JAN-** TIME: 7:49:47

Southwest Alluvium well GW-2, '98-'99 median concentrations
Fixed pH, no precip - determine SI

Temperature (Celsius): 16.00
Units of concentration: MG/L
Ionic strength to be computed.
If specified, carbonate concentration represents total inorganic carbon.
Do not automatically terminate if charge imbalance exceeds 30%
Precipitation is allowed only for those solids specified as ALLOWED
in the input file (if any).
The maximum number of iterations is: 200
The method used to compute activity coefficients is: Davies equation
Intermediate output file

330	0.000E-01	-6.50	y
150	6.380E+02	-1.80	y
460	5.890E+02	-1.62	y
500	2.480E+02	-1.97	y
410	9.900E+00	-1.63	y
140	1.475E+03	-1.61	y
732	2.735E+03	-1.55	y
180	1.710E+02	-2.32	y
490	1.300E-01	-5.14	y
492	3.900E+01	-3.20	y
470	3.000E-01	-5.26	y

H2O has been inserted as a COMPONENT
3 1
330 6.5000 0.0000

INPUT DATA BEFORE TYPE MODIFICATIONS

ID	NAME	ACTIVITY GUESS	LOG GUESS	ANAL TOTAL
330	H+1	3.162E-07	-6.500	0.000E-01
150	Ca+2	1.585E-02	-1.800	6.380E+02
460	Mg+2	2.399E-02	-1.620	5.890E+02
500	Na+1	1.072E-02	-1.970	2.480E+02
410	K+1	2.344E-02	-1.630	9.900E+00
140	CO3-2	2.455E-02	-1.610	1.475E+03
732	SO4-2	2.818E-02	-1.550	2.735E+03
180	Cl-1	4.786E-03	-2.320	1.710E+02
490	NH4+1	7.244E-06	-5.140	1.300E-01
492	NO3-1	6.310E-04	-3.200	3.900E+01
470	Mn+2	5.495E-06	-5.260	3.000E-01
2	H2O	1.000E+00	0.000	0.000E-01

Charge Balance: UNSPECIATED

Sum of CATIONS= 9.189E-02 Sum of ANIONS = 1.122E-01

PERCENT DIFFERENCE = 9.958E+00 (ANIONS - CATIONS)/(ANIONS + CATIONS)

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-----------------------------------------------------
| IMPROVED ACTIVITY GUESSES PRIOR TO FIRST ITERATION: |
|      CO3-2       Log activity guess:    -5.74      |
|      SO4-2       Log activity guess:    -1.54      |
|      Mn+2        Log activity guess:    -5.26      |
|                                                    |
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PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY	RESIDUAL
0	NO3-1	6.327E-04	-1.762E-06	-3.20000	1.698E-06
1	NH4+1	7.250E-06	1.801E-07	-5.20401	1.794E-07
2	NO3-1	6.327E-04	1.566E-04	-3.19879	1.565E-04
3	NO3-1	6.327E-04	2.106E-05	-3.29484	2.099E-05
4	NO3-1	6.327E-04	1.653E-06	-3.30906	1.590E-06
5	NO3-1	6.327E-04	1.356E-07	-3.31019	7.231E-08

ID	NAME	ANAL MOL	CALC MOL	LOG ACTVTY	GAMMA	DIFF FXN
470	Mn+2	5.493E-06	3.794E-06	-5.86695	0.358079	4.218E-10
150	Ca+2	1.601E-02	1.098E-02	-2.40543	0.358079	1.201E-06
460	Mg+2	2.437E-02	1.711E-02	-2.21286	0.358079	1.887E-06
500	Na+1	1.085E-02	1.050E-02	-2.09048	0.773561	3.016E-07
410	K+1	2.547E-04	2.455E-04	-3.72151	0.773561	7.117E-09
140	CO3-2	2.473E-02	4.043E-06	-5.83931	0.358079	4.081E-07
732	SO4-2	2.864E-02	1.756E-02	-2.20143	0.358079	1.877E-06
180	Cl-1	4.852E-03	4.852E-03	-2.42558	0.773561	1.356E-07
490	NH4+1	7.250E-06	6.702E-06	-5.28530	0.773561	2.024E-10
492	NO3-1	6.327E-04	6.327E-04	-3.31028	0.773561	1.768E-08
2	H2O	0.000E-01	-4.061E-08	-0.00082	1.000000	0.000E-01
330	H+1	0.000E-01	4.088E-07	-6.50000	0.773561	0.000E-01

Type I - COMPONENTS AS SPECIES IN SOLUTION

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
330	H+1	4.088E-07	3.162E-07	-6.50000	0.77356	0.112
150	Ca+2	1.098E-02	3.932E-03	-2.40543	0.35808	0.446
460	Mg+2	1.711E-02	6.125E-03	-2.21286	0.35808	0.446
500	Na+1	1.050E-02	8.119E-03	-2.09048	0.77356	0.112
410	K+1	2.455E-04	1.899E-04	-3.72151	0.77356	0.112
140	CO3-2	4.043E-06	1.448E-06	-5.83931	0.35808	0.446
732	SO4-2	1.756E-02	6.289E-03	-2.20143	0.35808	0.446
180	Cl-1	4.852E-03	3.753E-03	-2.42558	0.77356	0.112
490	NH4+1	6.702E-06	5.184E-06	-5.28530	0.77356	0.112
492	NO3-1	6.327E-04	4.895E-04	-3.31028	0.77356	0.112
470	Mn+2	3.794E-06	1.358E-06	-5.86695	0.35808	0.446

Type II - OTHER SPECIES IN SOLUTION OR ADSORBED

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
3301401	H2CO3 AQ	7.623E-03	7.815E-03	-2.10705	1.02520	16.721
3307320	HSO4 -	1.951E-07	1.509E-07	-6.82126	0.77356	1.992
3300020	OH-	2.033E-08	1.573E-08	-7.80327	0.77356	-14.191

3304900	NH3 AQ	4.731E-09	4.851E-09	-8.31421	1.02520	-9.540
4907320	NH4SO4 -	5.430E-07	4.200E-07	-6.37672	0.77356	1.222
4603300	MgOH +	1.832E-08	1.418E-08	-7.84847	0.77356	-12.023
4601400	MgCO3 AQ	7.190E-06	7.371E-06	-5.13247	1.02520	2.909
4601401	MgHCO3 +	1.050E-03	8.125E-04	-3.09015	0.77356	11.574
4607320	MgSO4 AQ	6.208E-03	6.365E-03	-2.19620	1.02520	2.207
1503300	CaOH +	1.887E-09	1.459E-09	-8.83584	0.77356	-12.818
1501400	CaHCO3 +	4.798E-04	3.711E-04	-3.43048	0.77356	11.426
1501401	CaCO3 AQ	6.622E-06	6.789E-06	-5.16820	1.02520	3.066
1507320	CaSO4 AQ	4.548E-03	4.662E-03	-2.33139	1.02520	2.265
5001400	NaCO3 -	1.764E-07	1.364E-07	-6.86508	0.77356	1.176
5001401	NaHCO3 AQ	4.359E-05	4.469E-05	-4.34979	1.02520	10.069
5007320	NaSO4 -	3.119E-04	2.413E-04	-3.61746	0.77356	0.786
4107320	KSO4 -	9.227E-06	7.138E-06	-5.14644	0.77356	0.888
4701800	MnCl +	2.667E-08	2.063E-08	-7.68554	0.77356	0.719
4701801	MnCl2 AQ	2.052E-11	2.103E-11	-10.67712	1.02520	0.030
4701802	MnCl3 -	4.601E-14	3.559E-14	-13.44870	0.77356	-0.193
4703300	MnOH +	6.687E-11	5.173E-11	-10.28627	0.77356	-10.807
4703301	Mn(OH)3 -1	8.752E-22	6.770E-22	-21.16940	0.77356	-34.688
4707320	MnSO4 AQ	1.353E-06	1.387E-06	-5.85789	1.02520	2.200
4704920	Mn(NO3)2AQ	1.290E-12	1.323E-12	-11.87849	1.02520	0.598
4701400	MnHCO3 +	3.201E-07	2.476E-07	-6.60627	0.77356	11.712
3301400	HCO3 -	1.551E-02	1.200E-02	-1.92088	0.77356	10.530

Type III - SPECIES WITH FIXED ACTIVITY

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
2	H2O	-4.061E-08	-7.391	0.001	0.000
330	H+1	-3.233E-02	-1.490	6.500	0.000

Type VI - EXCLUDED SPECIES (not included in mole balance)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
3301403	CO2 (g)	2.156E-01	-0.666	18.172	-0.530

PERCENTAGE DISTRIBUTION OF COMPONENTS AMONG
TYPE I and TYPE II (dissolved and adsorbed) species

```
Mn+2                    69.1     PERCENT BOUND IN SPECIES #    470   Mn+2
              24.6    PERCENT BOUND IN SPECIES #4707320   MnSO4 AQ
               5.8    PERCENT BOUND IN SPECIES #4701400   MnHCO3 +

Ca+2                    68.6     PERCENT BOUND IN SPECIES #    150   Ca+2
               3.0    PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
              28.4    PERCENT BOUND IN SPECIES #1507320   CaSO4 AQ

Mg+2                    70.2     PERCENT BOUND IN SPECIES #    460   Mg+2
               4.3    PERCENT BOUND IN SPECIES #4601401   MgHCO3 +
              25.5    PERCENT BOUND IN SPECIES #4607320   MgSO4 AQ

Na+1                    96.7     PERCENT BOUND IN SPECIES #    500   Na+1
               2.9    PERCENT BOUND IN SPECIES #5007320   NaSO4 -

K+1                     96.4     PERCENT BOUND IN SPECIES #    410   K+1
               3.6    PERCENT BOUND IN SPECIES #4107320   KSO4 -

CO3-2                   30.8     PERCENT BOUND IN SPECIES #3301401   H2CO3
AQ
               4.2    PERCENT BOUND IN SPECIES #4601401   MgHCO3 +
               1.9    PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
              62.7    PERCENT BOUND IN SPECIES #3301400   HCO3 -

SO4-2                   61.3     PERCENT BOUND IN SPECIES #    732   SO4-2
              21.7    PERCENT BOUND IN SPECIES #4607320   MgSO4 AQ
              15.9    PERCENT BOUND IN SPECIES #1507320   CaSO4 AQ
               1.1    PERCENT BOUND IN SPECIES #5007320   NaSO4 -

Cl-1                   100.0     PERCENT BOUND IN SPECIES #    180   Cl-1

NH4+1                   92.4     PERCENT BOUND IN SPECIES #    490   NH4+1
               7.5    PERCENT BOUND IN SPECIES #4907320   NH4SO4 -

NO3-1                  100.0     PERCENT BOUND IN SPECIES #    492   NO3-1

H2O                     50.1     PERCENT BOUND IN SPECIES #3300020   OH-
              45.1    PERCENT BOUND IN SPECIES #4603300   MgOH +
               4.6    PERCENT BOUND IN SPECIES #1503300   CaOH +

H+1                     47.2     PERCENT BOUND IN SPECIES #3301401   H2CO3
AQ
               3.2    PERCENT BOUND IN SPECIES #4601401   MgHCO3 +
               1.5    PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
              48.0    PERCENT BOUND IN SPECIES #3301400   HCO3 -
```

---------- EQUILIBRATED MASS DISTRIBUTION ----------

IDX	NAME	DISSOLVED MOL/KG	DISSOLVED PERCENT	SORBED MOL/KG	SORBED PERCENT	PRECIPITATED MOL/KG	PRECIPITATED PERCENT
470	Mn+2	5.494E-06	100.0	0.000E-01	0.0	0.000E-01	0.0
150	Ca+2	1.601E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	2.437E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	1.085E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	2.547E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
140	CO3-2	2.473E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
732	SO4-2	2.864E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
180	Cl-1	4.852E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
490	NH4+1	7.250E-06	100.0	0.000E-01	0.0	0.000E-01	0.0
492	NO3-1	6.327E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
2	H2O	4.061E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
330	H+1	3.233E-02	100.0	0.000E-01	0.0	0.000E-01	0.0

Charge Balance: SPECIATED

Sum of CATIONS = 6.846E-02 Sum of ANIONS 5.645E-02

PERCENT DIFFERENCE = 9.613E+00 (ANIONS - CATIONS)/(ANIONS + CATIONS)

EQUILIBRIUM IONIC STRENGTH (m) = 1.081E-01

EQUILIBRIUM pH = 6.500

DATE ID NUMBER: ******
TIME ID NUMBER: 7495039

Saturation indices and stoichiometry of all minerals

ID #	NAME	Sat. Index	Stoichiometry in [brackets]							
6015000	ANHYDRITE	-0.056	[1.000]	150	[1.000]	732				
5015000	ARAGONITE	0.013	[1.000]	150	[1.000]	140				
5046000	ARTINITE	-7.525	[-2.000]	330	[2.000]	460	[1.000]	140		
			[5.000]	2						
2046000	BRUCITE	-6.596	[1.000]	460	[2.000]	2	[-2.000]	330		
5015001	CALCITE	0.182	[1.000]	150	[1.000]	140				
5015002	DOLOMITE	0.514	[1.000]	150	[1.000]	460	[2.000]	140		
6046000	EPSOMITE	-2.216	[1.000]	460	[1.000]	732	[7.000]	2		
6015001	GYPSUM	0.245	[1.000]	150	[1.000]	732	[2.000]	2		
4150000	HALITE	-6.077	[1.000]	500	[1.000]	180				
5015003	HUNTITE	-3.021	[3.000]	460	[1.000]	150	[4.000]	140		
5046001	HYDRMAGNESIT	-13.852	[5.000]	460	[4.000]	140	[-2.000]	330		
			[6.000]	2						
5046002	MAGNESITE	-0.164	[1.000]	460	[1.000]	140				
6050001	MIRABILITE	-4.843	[2.000]	500	[1.000]	732	[10.000]	2		
3050000	NATRON	-8.358	[2.000]	500	[1.000]	140	[10.000]	2		
5046003	NESQUEHONITE	-2.566	[1.000]	460	[1.000]	140	[3.000]	2		
6050002	THENARDITE	-6.216	[2.000]	500	[1.000]	732				
5050001	THERMONATR	-10.210	[2.000]	500	[1.000]	140	[1.000]	2		
2047003	PYROCROITE	-8.472	[-2.000]	330	[1.000]	470	[2.000]	2		
5047000	RHODOCHROSIT	-1.344	[1.000]	470	[1.000]	140				
4147000	MNCL2, 4H2O	-13.035	[1.000]	470	[2.000]	180	[4.000]	2		
6047000	MNSO4	-11.091	[1.000]	470	[1.000]	732				
2015000	LIME	-23.259	[-2.000]	330	[1.000]	150	[1.000]	2		
2015001	PORTLANDITE	-12.782	[-2.000]	330	[1.000]	150	[2.000]	2		
2046001	PERICLASE	-11.548	[-2.000]	330	[1.000]	460	[1.000]	2		

```
Southwest Alluvium well GW-3, median '98-'99 concentrations
Fixed pH, no precip - determine SI
16.00 MG/L   0.000  0.00000E-01
0 0 1 0 3 0 0 0 1 1 0 0 0
0   0   0
    330  0.000E-01   -6.70 y                    /H+1
    150  8.580E+02   -1.67 y                    /Ca+2
    460  2.650E+02   -1.96 y                    /Mg+2
    500  2.340E+02   -1.99 y                    /Na+1
    410  8.100E+00   -3.68 y                    /K+1
    140  1.180E+03   -1.71 y                    /CO3-2
    732  1.830E+03   -1.72 y                    /SO4-2
    180  1.310E+02   -2.43 y                    /Cl-1
    490  1.300E-01   -5.14 y                    /NH4+1
    492  5.270E+02   -2.07 y                    /NO3-1
    470  1.800E+00   -4.48 y                    /Mn+2

  3   1
    330     6.7000     0.0000                   /H+1
```

PART 1 of OUTPUT FILE

PC MINTEQA2 v3.10 DATE OF CALCULATIONS: 18-JAN-** TIME: 7:51:39

Southwest Alluvium well GW-3, median '98-'99 concentrations
Fixed pH, no precip - determine SI

Temperature (Celsius): 16.00
Units of concentration: MG/L
Ionic strength to be computed.
If specified, carbonate concentration represents total inorganic carbon.
Do not automatically terminate if charge imbalance exceeds 30%
Precipitation is allowed only for those solids specified as ALLOWED
in the input file (if any).
The maximum number of iterations is: 200
The method used to compute activity coefficients is: Davies equation
Intermediate output file

330	0.000E-01	-6.70	y
150	8.580E+02	-1.67	y
460	2.650E+02	-1.96	y
500	2.340E+02	-1.99	y
410	8.100E+00	-3.68	y
140	1.180E+03	-1.71	y
732	1.830E+03	-1.72	y
180	1.310E+02	-2.43	y
490	1.300E-01	-5.14	y
492	5.270E+02	-2.07	y
470	1.800E+00	-4.48	y

H2O has been inserted as a COMPONENT
3 1
330 6.7000 0.0000

INPUT DATA BEFORE TYPE MODIFICATIONS

ID	NAME	ACTIVITY GUESS	LOG GUESS	ANAL TOTAL
330	H+1	1.995E-07	-6.700	0.000E-01
150	Ca+2	2.138E-02	-1.670	8.580E+02
460	Mg+2	1.096E-02	-1.960	2.650E+02
500	Na+1	1.023E-02	-1.990	2.340E+02
410	K+1	2.089E-04	-3.680	8.100E+00
140	CO3-2	1.950E-02	-1.710	1.180E+03
732	SO4-2	1.905E-02	-1.720	1.830E+03
180	Cl-1	3.715E-03	-2.430	1.310E+02
490	NH4+1	7.244E-06	-5.140	1.300E-01
492	NO3-1	8.511E-03	-2.070	5.270E+02
470	Mn+2	3.311E-05	-4.480	1.800E+00
2	H2O	1.000E+00	0.000	0.000E-01

Charge Balance: UNSPECIATED

Sum of CATIONS= 7.545E-02 Sum of ANIONS = 9.008E-02

PERCENT DIFFERENCE = 8.834E+00 (ANIONS - CATIONS)/(ANIONS + CATIONS)

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-----------------------------------------------------
| IMPROVED ACTIVITY GUESSES PRIOR TO FIRST ITERATION: |
|      CO3-2        Log activity guess:    -5.57      |
|      SO4-2        Log activity guess:    -1.72      |
|      Mn+2         Log activity guess:    -4.48      |
|                                                     |
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PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY	RESIDUAL
0	NO3-1	8.542E-03	-3.094E-05	-2.07000	3.008E-05
1	NH4+1	7.243E-06	8.896E-08	-5.18194	8.823E-08
2	NO3-1	8.542E-03	2.047E-03	-2.06842	2.046E-03
3	NO3-1	8.542E-03	2.273E-04	-2.16171	2.264E-04
4	NO3-1	8.542E-03	1.634E-05	-2.17312	1.549E-05
5	NO3-1	8.542E-03	1.260E-06	-2.17395	4.053E-07

ID	NAME	ANAL MOL	CALC MOL	LOG ACTVTY	GAMMA	DIFF FXN
470	Mn+2	3.293E-05	2.432E-05	-5.03636	0.378119	1.577E-09
150	Ca+2	2.152E-02	1.590E-02	-2.22096	0.378119	1.016E-06
460	Mg+2	1.096E-02	8.228E-03	-2.50707	0.378119	5.295E-07
500	Na+1	1.023E-02	9.981E-03	-2.10640	0.784164	1.643E-07
410	K+1	2.082E-04	2.028E-04	-3.79849	0.784164	3.360E-09
140	CO3-2	1.976E-02	5.590E-06	-5.67493	0.378119	2.270E-07
732	SO4-2	1.915E-02	1.175E-02	-2.35220	0.378119	7.317E-07
180	Cl-1	3.714E-03	3.714E-03	-2.53579	0.784164	5.994E-08
490	NH4+1	7.243E-06	6.844E-06	-5.27030	0.784164	1.168E-10
492	NO3-1	8.542E-03	8.542E-03	-2.17401	0.784164	1.379E-07
2	H2O	0.000E-01	-5.158E-08	-0.00070	1.000000	0.000E-01
330	H+1	0.000E-01	2.544E-07	-6.70000	0.784164	0.000E-01

Type I - COMPONENTS AS SPECIES IN SOLUTION

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
330	H+1	2.544E-07	1.995E-07	-6.70000	0.78416	0.106
150	Ca+2	1.590E-02	6.012E-03	-2.22096	0.37812	0.422
460	Mg+2	8.228E-03	3.111E-03	-2.50707	0.37812	0.422
500	Na+1	9.981E-03	7.827E-03	-2.10640	0.78416	0.106
410	K+1	2.028E-04	1.590E-04	-3.79849	0.78416	0.106
140	CO3-2	5.590E-06	2.114E-06	-5.67493	0.37812	0.422
732	SO4-2	1.175E-02	4.444E-03	-2.35220	0.37812	0.422
180	Cl-1	3.714E-03	2.912E-03	-2.53579	0.78416	0.106
490	NH4+1	6.844E-06	5.367E-06	-5.27030	0.78416	0.106
492	NO3-1	8.542E-03	6.699E-03	-2.17401	0.78416	0.106
470	Mn+2	2.432E-05	9.197E-06	-5.03636	0.37812	0.422

Type II - OTHER SPECIES IN SOLUTION OR ADSORBED

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
3301401	H2CO3 AQ	4.449E-03	4.543E-03	-2.34267	1.02112	16.723
3307320	HSO4 -	8.581E-08	6.729E-08	-7.17204	0.78416	1.986
3300020	OH-	3.180E-08	2.494E-08	-7.60315	0.78416	-14.197

3304900	NH3 AQ	7.793E-09	7.958E-09	-8.09921	1.02112	-9.538
4907320	NH4SO4 -	3.918E-07	3.073E-07	-6.51250	0.78416	1.216
4603300	MgOH +	1.456E-08	1.141E-08	-7.94256	0.78416	-12.029
4601400	MgCO3 AQ	5.353E-06	5.466E-06	-5.26231	1.02112	2.911
4601401	MgHCO3 +	4.848E-04	3.802E-04	-3.41999	0.78416	11.568
4607320	MgSO4 AQ	2.237E-03	2.285E-03	-2.64119	1.02112	2.209
1503300	CaOH +	4.512E-09	3.538E-09	-8.45125	0.78416	-12.824
1501400	CaHCO3 +	6.668E-04	5.228E-04	-3.28163	0.78416	11.420
1501401	CaCO3 AQ	1.484E-05	1.516E-05	-4.81935	1.02112	3.067
1507320	CaSO4 AQ	4.934E-03	5.039E-03	-2.29769	1.02112	2.266
5001400	NaCO3 -	2.449E-07	1.920E-07	-6.71663	0.78416	1.170
5001401	NaHCO3 AQ	3.887E-05	3.969E-05	-4.40133	1.02112	10.071
5007320	NaSO4 -	2.096E-04	1.644E-04	-3.78415	0.78416	0.780
4107320	KSO4 -	5.388E-06	4.225E-06	-5.37420	0.78416	0.882
4701800	MnCl +	1.382E-07	1.084E-07	-6.96515	0.78416	0.713
4701801	MnCl2 AQ	8.394E-11	8.571E-11	-10.06695	1.02112	0.032
4701802	MnCl3 -	1.435E-13	1.125E-13	-12.94874	0.78416	-0.199
4703300	MnOH +	7.080E-10	5.552E-10	-9.25556	0.78416	-10.813
4703301	Mn(OH)3 -1	2.329E-20	1.826E-20	-19.73845	0.78416	-34.694
4707320	MnSO4 AQ	6.499E-06	6.636E-06	-5.17806	1.02112	2.201
4704920	Mn(NO3)2AQ	1.643E-09	1.677E-09	-8.77535	1.02112	0.600
4701400	MnHCO3 +	1.969E-06	1.544E-06	-5.81129	0.78416	11.706
3301400	HCO3 -	1.410E-02	1.105E-02	-1.95650	0.78416	10.524

Type III - SPECIES WITH FIXED ACTIVITY

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
2	H2O	-5.158E-08	-7.288	0.001	0.000
330	H+1	-2.419E-02	-1.616	6.700	0.000

Type VI - EXCLUDED SPECIES (not included in mole balance)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
3301403	CO2 (g)	1.253E-01	-0.902	18.172	-0.530

PERCENTAGE DISTRIBUTION OF COMPONENTS AMONG
TYPE I and TYPE II (dissolved and adsorbed) species

```
Mn+2                    73.9     PERCENT BOUND IN SPECIES #    470   Mn+2
          19.7     PERCENT BOUND IN SPECIES #4707320   MnSO4 AQ
           6.0     PERCENT BOUND IN SPECIES #4701400   MnHCO3 +

Ca+2                    73.9     PERCENT BOUND IN SPECIES #    150   Ca+2
           3.1     PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
          22.9     PERCENT BOUND IN SPECIES #1507320   CaSO4 AQ

Mg+2                    75.1     PERCENT BOUND IN SPECIES #    460   Mg+2
           4.4     PERCENT BOUND IN SPECIES #4601401   MgHCO3 +
          20.4     PERCENT BOUND IN SPECIES #4607320   MgSO4 AQ

Na+1                    97.6     PERCENT BOUND IN SPECIES #    500   Na+1
           2.0     PERCENT BOUND IN SPECIES #5007320   NaSO4 -

K+1                     97.4     PERCENT BOUND IN SPECIES #    410   K+1
           2.6     PERCENT BOUND IN SPECIES #4107320   KSO4 -

CO3-2                   22.5     PERCENT BOUND IN SPECIES #3301401   H2CO3
AQ
           2.5     PERCENT BOUND IN SPECIES #4601401   MgHCO3 +
           3.4     PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
          71.3     PERCENT BOUND IN SPECIES #3301400   HCO3 -

SO4-2                   61.4     PERCENT BOUND IN SPECIES #    732   SO4-2
          11.7     PERCENT BOUND IN SPECIES #4607320   MgSO4 AQ
          25.8     PERCENT BOUND IN SPECIES #1507320   CaSO4 AQ
           1.1     PERCENT BOUND IN SPECIES #5007320   NaSO4 -

Cl-1                   100.0     PERCENT BOUND IN SPECIES #    180   Cl-1

NH4+1                   94.5     PERCENT BOUND IN SPECIES #    490   NH4+1
           5.4     PERCENT BOUND IN SPECIES #4907320   NH4SO4 -

NO3-1                  100.0     PERCENT BOUND IN SPECIES #    492   NO3-1

H2O                     61.7     PERCENT BOUND IN SPECIES #3300020   OH-
          28.2     PERCENT BOUND IN SPECIES #4603300   MgOH +
           8.7     PERCENT BOUND IN SPECIES #1503300   CaOH +
           1.4     PERCENT BOUND IN SPECIES #4703300   MnOH +

H+1                     36.8     PERCENT BOUND IN SPECIES #3301401   H2CO3
AQ
           2.0     PERCENT BOUND IN SPECIES #4601401   MgHCO3 +
           2.8     PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
          58.3     PERCENT BOUND IN SPECIES #3301400   HCO3 -
```

---------- EQUILIBRATED MASS DISTRIBUTION ----------

IDX	NAME	DISSOLVED MOL/KG	DISSOLVED PERCENT	SORBED MOL/KG	SORBED PERCENT	PRECIPITATED MOL/KG	PRECIPITATED PERCENT
470	Mn+2	3.293E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
150	Ca+2	2.152E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	1.096E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	1.023E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	2.082E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
140	CO3-2	1.976E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
732	SO4-2	1.915E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
180	Cl-1	3.714E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
490	NH4+1	7.243E-06	100.0	0.000E-01	0.0	0.000E-01	0.0
492	NO3-1	8.542E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
2	H2O	5.158E-08	100.0	0.000E-01	0.0	0.000E-01	0.0
330	H+1	2.419E-02	100.0	0.000E-01	0.0	0.000E-01	0.0

Charge Balance: SPECIATED

Sum of CATIONS = 5.965E-02 Sum of ANIONS 5.009E-02

PERCENT DIFFERENCE = 8.716E+00 (ANIONS - CATIONS)/(ANIONS + CATIONS)

EQUILIBRIUM IONIC STRENGTH (m) = 9.078E-02

EQUILIBRIUM pH = 6.700

DATE ID NUMBER: ******
TIME ID NUMBER: 7514288

Saturation indices and stoichiometry of all minerals

ID #	NAME	Sat. Index	Stoichiometry in [brackets]							
6015000	ANHYDRITE	-0.022	[1.000]	150	[1.000]	732				
5015000	ARAGONITE	0.362	[1.000]	150	[1.000]	140				
5046000	ARTINITE	-7.548	[-2.000]	330	[2.000]	460	[1.000]	140		
			[5.000]	2						
2046000	BRUCITE	-6.490	[1.000]	460	[2.000]	2	[-2.000]	330		
5015001	CALCITE	0.531	[1.000]	150	[1.000]	140				
5015002	DOLOMITE	0.733	[1.000]	150	[1.000]	460	[2.000]	140		
6046000	EPSOMITE	-2.660	[1.000]	460	[1.000]	732	[7.000]	2		
6015001	GYPSUM	0.279	[1.000]	150	[1.000]	732	[2.000]	2		
4150000	HALITE	-6.203	[1.000]	500	[1.000]	180				
5015003	HUNTITE	-3.062	[3.000]	460	[1.000]	150	[4.000]	140		
5046001	HYDRMAGNESIT	-14.264	[5.000]	460	[4.000]	140	[-2.000]	330		
			[6.000]	2						
5046002	MAGNESITE	-0.294	[1.000]	460	[1.000]	140				
6050001	MIRABILITE	-5.025	[2.000]	500	[1.000]	732	[10.000]	2		
3050000	NATRON	-8.224	[2.000]	500	[1.000]	140	[10.000]	2		
5046003	NESQUEHONITE	-2.695	[1.000]	460	[1.000]	140	[3.000]	2		
6050002	THENARDITE	-6.399	[2.000]	500	[1.000]	732				
5050001	THERMONATR	-10.077	[2.000]	500	[1.000]	140	[1.000]	2		
2047003	PYROCROITE	-7.241	[-2.000]	330	[1.000]	470	[2.000]	2		
5047000	RHODOCHROSIT	-0.349	[1.000]	470	[1.000]	140				
4147000	MNCL2, 4H2O	-12.424	[1.000]	470	[2.000]	180	[4.000]	2		
6047000	MNSO4	-10.411	[1.000]	470	[1.000]	732				
2015000	LIME	-22.674	[-2.000]	330	[1.000]	150	[1.000]	2		
2015001	PORTLANDITE	-12.198	[-2.000]	330	[1.000]	150	[2.000]	2		
2046001	PERICLASE	-11.442	[-2.000]	330	[1.000]	460	[1.000]	2		

Southwest Alluvium well GW-4, median '98-'99 comcentrations

```
16.00 MG/L    0.000  0.00000E-01
0 0 1 0 3 0 0 0 1 1 0 0 0
0    0    0
    330  0.000E-01   -7.20 y                    /H+1
    150  7.060E+02   -1.75 y                    /Ca+2
    460  1.890E+02   -2.11 y                    /Mg+2
    500  1.575E+02   -2.16 y                    /Na+1
    410  1.170E+01   -3.52 y                    /K+1
    140  7.112E+02   -1.93 y                    /CO3-2
    732  1.620E+03   -1.77 y                    /SO4-2
    180  4.190E+01   -2.93 y                    /Cl-1
    490  2.600E-01   -4.84 y                    /NH4+1
    492  4.330E+02   -2.16 y                    /NO3-1
    470  1.000E-01   -5.74 y                    /Mn+2

  3   1
    330     7.2000     0.0000                   /H+1
```

PART 1 of OUTPUT FILE

PC MINTEQA2 v3.10 DATE OF CALCULATIONS: 18-JAN-** TIME: 7:53:24

Southwest Alluvium well GW-4, median '98-'99 comcentrations

Temperature (Celsius): 16.00
Units of concentration: MG/L
Ionic strength to be computed.
If specified, carbonate concentration represents total inorganic carbon.
Do not automatically terminate if charge imbalance exceeds 30%
Precipitation is allowed only for those solids specified as ALLOWED
in the input file (if any).
The maximum number of iterations is: 200
The method used to compute activity coefficients is: Davies equation
Intermediate output file

330	0.000E-01	-7.20	y
150	7.060E+02	-1.75	y
460	1.890E+02	-2.11	y
500	1.575E+02	-2.16	y
410	1.170E+01	-3.52	y
140	7.112E+02	-1.93	y
732	1.620E+03	-1.77	y
180	4.190E+01	-2.93	y
490	2.600E-01	-4.84	y
492	4.330E+02	-2.16	y
470	1.000E-01	-5.74	y

H2O has been inserted as a COMPONENT

3 1

330 7.2000 0.0000

INPUT DATA BEFORE TYPE MODIFICATIONS

ID	NAME	ACTIVITY GUESS	LOG GUESS	ANAL TOTAL
330	H+1	6.310E-08	-7.200	0.000E-01
150	Ca+2	1.778E-02	-1.750	7.060E+02
460	Mg+2	7.762E-03	-2.110	1.890E+02
500	Na+1	6.918E-03	-2.160	1.575E+02
410	K+1	3.020E-04	-3.520	1.170E+01
140	CO3-2	1.175E-02	-1.930	7.112E+02
732	SO4-2	1.698E-02	-1.770	1.620E+03
180	Cl-1	1.175E-03	-2.930	4.190E+01
490	NH4+1	1.445E-05	-4.840	2.600E-01
492	NO3-1	6.918E-03	-2.160	4.330E+02
470	Mn+2	1.820E-06	-5.740	1.000E-01
2	H2O	1.000E+00	0.000	0.000E-01

Charge Balance: UNSPECIATED

Sum of CATIONS= 5.817E-02 Sum of ANIONS = 6.585E-02

PERCENT DIFFERENCE = 6.193E+00 (ANIONS - CATIONS)/(ANIONS + CATIONS)

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| IMPROVED ACTIVITY GUESSES PRIOR TO FIRST ITERATION: |
|      CO3-2        Log activity guess:    -5.20      |
|      SO4-2        Log activity guess:    -1.77      |
|      Mn+2         Log activity guess:    -5.74      |
|                                                     |
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PARAMETERS OF THE COMPONENT MOST OUT OF BALANCE:

ITER	NAME	TOTAL MOL	DIFF FXN	LOG ACTVTY	RESIDUAL
0	NO3-1	7.010E-03	-9.214E-05	-2.16000	9.144E-05
1	NH4+1	1.447E-05	1.453E-07	-4.88103	1.438E-07
2	NO3-1	7.010E-03	1.532E-03	-2.15425	1.531E-03
3	NO3-1	7.010E-03	1.848E-04	-2.24009	1.841E-04
4	NO3-1	7.010E-03	1.239E-05	-2.25139	1.169E-05
5	NO3-1	7.010E-03	8.673E-07	-2.25216	1.662E-07

ID	NAME	ANAL MOL	CALC MOL	LOG ACTVTY	GAMMA	DIFF FXN
470	Mn+2	1.827E-06	1.355E-06	-6.25990	0.405650	7.500E-11
150	Ca+2	1.768E-02	1.296E-02	-2.27929	0.405650	7.097E-07
460	Mg+2	7.804E-03	5.841E-03	-2.62537	0.405650	3.217E-07
500	Na+1	6.877E-03	6.718E-03	-2.27070	0.798064	9.475E-08
410	K+1	3.004E-04	2.927E-04	-3.63153	0.798064	4.153E-09
140	CO3-2	1.190E-02	1.203E-05	-5.31157	0.405650	1.466E-07
732	SO4-2	1.693E-02	1.082E-02	-2.35779	0.405650	5.826E-07
180	Cl-1	1.186E-03	1.186E-03	-3.02371	0.798064	1.640E-08
490	NH4+1	1.447E-05	1.365E-05	-4.96289	0.798064	1.992E-10
492	NO3-1	7.010E-03	7.011E-03	-2.25221	0.798064	9.692E-08
2	H2O	0.000E-01	-1.457E-07	-0.00051	1.000000	0.000E-01
330	H+1	0.000E-01	7.906E-08	-7.20000	0.798064	0.000E-01

Type I - COMPONENTS AS SPECIES IN SOLUTION

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
330	H+1	7.906E-08	6.310E-08	-7.20000	0.79806	0.098
150	Ca+2	1.296E-02	5.257E-03	-2.27929	0.40565	0.392
460	Mg+2	5.841E-03	2.369E-03	-2.62537	0.40565	0.392
500	Na+1	6.718E-03	5.362E-03	-2.27070	0.79806	0.098
410	K+1	2.927E-04	2.336E-04	-3.63153	0.79806	0.098
140	CO3-2	1.203E-05	4.880E-06	-5.31157	0.40565	0.392
732	SO4-2	1.082E-02	4.387E-03	-2.35779	0.40565	0.392
180	Cl-1	1.186E-03	9.469E-04	-3.02371	0.79806	0.098
490	NH4+1	1.365E-05	1.089E-05	-4.96289	0.79806	0.098
492	NO3-1	7.011E-03	5.595E-03	-2.25221	0.79806	0.098
470	Mn+2	1.355E-06	5.497E-07	-6.25990	0.40565	0.392

Type II - OTHER SPECIES IN SOLUTION OR ADSORBED

ID	NAME	CALC MOL	ACTIVITY	LOG ACTVTY	GAMMA	NEW LOGK
3301401	H2CO3 AQ	1.031E-03	1.049E-03	-2.97931	1.01680	16.725
3307320	HSO4 -	2.632E-08	2.101E-08	-7.67763	0.79806	1.978
3300020	OH-	9.885E-08	7.889E-08	-7.10297	0.79806	-14.204

3304900	NH3 AQ	5.023E-08	5.107E-08	-7.29180	1.01680	-9.536
4907320	NH4SO4 -	7.714E-07	6.156E-07	-6.21068	0.79806	1.208
4603300	MgOH +	3.446E-08	2.750E-08	-7.56068	0.79806	-12.037
4601400	MgCO3 AQ	9.452E-06	9.611E-06	-5.01725	1.01680	2.912
4601401	MgHCO3 +	2.649E-04	2.114E-04	-3.67493	0.79806	11.560
4607320	MgSO4 AQ	1.689E-03	1.718E-03	-2.76508	1.01680	2.211
1503300	CaOH +	1.226E-08	9.786E-09	-8.00941	0.79806	-12.832
1501400	CaHCO3 +	4.182E-04	3.337E-04	-3.47661	0.79806	11.412
1501401	CaCO3 AQ	3.009E-05	3.060E-05	-4.51433	1.01680	3.069
1507320	CaSO4 AQ	4.277E-03	4.349E-03	-2.36162	1.01680	2.268
5001400	NaCO3 -	3.805E-07	3.037E-07	-6.51757	0.79806	1.163
5001401	NaHCO3 AQ	1.952E-05	1.985E-05	-4.70227	1.01680	10.073
5007320	NaSO4 -	1.393E-04	1.112E-04	-3.95404	0.79806	0.772
4107320	KSO4 -	7.676E-06	6.126E-06	-5.21282	0.79806	0.874
4701800	MnCl +	2.638E-09	2.106E-09	-8.67662	0.79806	0.705
4701801	MnCl2 AQ	5.326E-13	5.416E-13	-12.26633	1.01680	0.034
4701802	MnCl3 -	2.897E-16	2.312E-16	-15.63604	0.79806	-0.207
4703300	MnOH +	1.315E-10	1.050E-10	-9.97892	0.79806	-10.821
4703301	Mn(OH)3 -1	4.330E-20	3.456E-20	-19.46145	0.79806	-34.702
4707320	MnSO4 AQ	3.851E-07	3.916E-07	-6.40720	1.01680	2.203
4704920	Mn(NO3)2AQ	6.878E-11	6.994E-11	-10.15529	1.01680	0.602
4701400	MnHCO3 +	8.443E-08	6.738E-08	-7.17148	0.79806	11.698
3301400	HCO3 -	1.011E-02	8.070E-03	-2.09314	0.79806	10.516

Type III - SPECIES WITH FIXED ACTIVITY

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
2	H2O	-1.457E-07	-6.837	0.001	0.000
330	H+1	-1.288E-02	-1.890	7.200	0.000

Type VI - EXCLUDED SPECIES (not included in mole balance)

ID	NAME	CALC MOL	LOG MOL	NEW LOGK	DH
3301403	CO2 (g)	2.891E-02	-1.539	18.172	-0.530

PERCENTAGE DISTRIBUTION OF COMPONENTS AMONG
TYPE I and TYPE II (dissolved and adsorbed) species

```
Mn+2                    74.2     PERCENT BOUND IN SPECIES #    470   Mn+2
          21.1     PERCENT BOUND IN SPECIES #4707320   MnSO4 AQ
           4.6     PERCENT BOUND IN SPECIES #4701400   MnHCO3 +

Ca+2                    73.3     PERCENT BOUND IN SPECIES #    150   Ca+2
           2.4     PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
          24.2     PERCENT BOUND IN SPECIES #1507320   CaSO4 AQ

Mg+2                    74.8     PERCENT BOUND IN SPECIES #    460   Mg+2
           3.4     PERCENT BOUND IN SPECIES #4601401   MgHCO3 +
          21.6     PERCENT BOUND IN SPECIES #4607320   MgSO4 AQ

Na+1                    97.7     PERCENT BOUND IN SPECIES #    500   Na+1
           2.0     PERCENT BOUND IN SPECIES #5007320   NaSO4 -

K+1                     97.4     PERCENT BOUND IN SPECIES #    410   K+1
           2.6     PERCENT BOUND IN SPECIES #4107320   KSO4 -

CO3-2                    8.7     PERCENT BOUND IN SPECIES #3301401   H2CO3
AQ
           2.2     PERCENT BOUND IN SPECIES #4601401   MgHCO3 +
           3.5     PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
          85.0     PERCENT BOUND IN SPECIES #3301400   HCO3 -

SO4-2                   63.9     PERCENT BOUND IN SPECIES #    732   SO4-2
          10.0     PERCENT BOUND IN SPECIES #4607320   MgSO4 AQ
          25.3     PERCENT BOUND IN SPECIES #1507320   CaSO4 AQ

Cl-1                   100.0     PERCENT BOUND IN SPECIES #    180   Cl-1

NH4+1                   94.3     PERCENT BOUND IN SPECIES #    490   NH4+1
           5.3     PERCENT BOUND IN SPECIES #4907320   NH4SO4 -

NO3-1                  100.0     PERCENT BOUND IN SPECIES #    492   NO3-1

H2O                     67.8     PERCENT BOUND IN SPECIES #3300020   OH-
          23.6     PERCENT BOUND IN SPECIES #4603300   MgOH +
           8.4     PERCENT BOUND IN SPECIES #1503300   CaOH +

H+1                     16.0     PERCENT BOUND IN SPECIES #3301401   H2CO3
AQ
           2.1     PERCENT BOUND IN SPECIES #4601401   MgHCO3 +
           3.2     PERCENT BOUND IN SPECIES #1501400   CaHCO3 +
          78.5     PERCENT BOUND IN SPECIES #3301400   HCO3 -
```

---------- EQUILIBRATED MASS DISTRIBUTION ----------

IDX	NAME	DISSOLVED MOL/KG	DISSOLVED PERCENT	SORBED MOL/KG	SORBED PERCENT	PRECIPITATED MOL/KG	PRECIPITATED PERCENT
470	Mn+2	1.827E-06	100.0	0.000E-01	0.0	0.000E-01	0.0
150	Ca+2	1.768E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
460	Mg+2	7.804E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
500	Na+1	6.878E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
410	K+1	3.004E-04	100.0	0.000E-01	0.0	0.000E-01	0.0
140	CO3-2	1.190E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
732	SO4-2	1.693E-02	100.0	0.000E-01	0.0	0.000E-01	0.0
180	Cl-1	1.186E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
490	NH4+1	1.447E-05	100.0	0.000E-01	0.0	0.000E-01	0.0
492	NO3-1	7.011E-03	100.0	0.000E-01	0.0	0.000E-01	0.0
2	H2O	1.457E-07	100.0	0.000E-01	0.0	0.000E-01	0.0
330	H+1	1.288E-02	100.0	0.000E-01	0.0	0.000E-01	0.0

Charge Balance: SPECIATED

Sum of CATIONS = 4.531E-02 Sum of ANIONS 4.011E-02

PERCENT DIFFERENCE = 6.084E+00 (ANIONS - CATIONS)/(ANIONS + CATIONS)

EQUILIBRIUM IONIC STRENGTH (m) = 7.234E-02

EQUILIBRIUM pH = 7.200

DATE ID NUMBER: ******
TIME ID NUMBER: 7532735

Saturation indices and stoichiometry of all minerals

ID #	NAME	Sat. Index	Stoichiometry in [brackets]							
6015000	ANHYDRITE	-0.086	[1.000]	150	[1.000]	732				
5015000	ARAGONITE	0.667	[1.000]	150	[1.000]	140				
5046000	ARTINITE	-6.421	[-2.000]	330	[2.000]	460	[1.000]	140		
			[5.000]	2						
2046000	BRUCITE	-5.608	[1.000]	460	[2.000]	2	[-2.000]	330		
5015001	CALCITE	0.836	[1.000]	150	[1.000]	140				
5015002	DOLOMITE	1.283	[1.000]	150	[1.000]	460	[2.000]	140		
6046000	EPSOMITE	-2.782	[1.000]	460	[1.000]	732	[7.000]	2		
6015001	GYPSUM	0.216	[1.000]	150	[1.000]	732	[2.000]	2		
4150000	HALITE	-6.855	[1.000]	500	[1.000]	180				
5015003	HUNTITE	-2.021	[3.000]	460	[1.000]	150	[4.000]	140		
5046001	HYDRMAGNESIT	-12.401	[5.000]	460	[4.000]	140	[-2.000]	330		
			[6.000]	2						
5046002	MAGNESITE	-0.049	[1.000]	460	[1.000]	140				
6050001	MIRABILITE	-5.357	[2.000]	500	[1.000]	732	[10.000]	2		
3050000	NATRON	-8.188	[2.000]	500	[1.000]	140	[10.000]	2		
5046003	NESQUEHONITE	-2.450	[1.000]	460	[1.000]	140	[3.000]	2		
6050002	THENARDITE	-6.733	[2.000]	500	[1.000]	732				
5050001	THERMONATR	-10.042	[2.000]	500	[1.000]	140	[1.000]	2		
2047003	PYROCROITE	-7.464	[-2.000]	330	[1.000]	470	[2.000]	2		
5047000	RHODOCHROSIT	-1.209	[1.000]	470	[1.000]	140				
4147000	MNCL2, 4H2O	-14.623	[1.000]	470	[2.000]	180	[4.000]	2		
6047000	MNSO4	-11.640	[1.000]	470	[1.000]	732				
2015000	LIME	-21.732	[-2.000]	330	[1.000]	150	[1.000]	2		
2015001	PORTLANDITE	-11.255	[-2.000]	330	[1.000]	150	[2.000]	2		
2046001	PERICLASE	-10.560	[-2.000]	330	[1.000]	460	[1.000]	2		