556699

Sandia National Laboratories
Waste Isolation Pilot Plant

Determination of pC_{H+} Correction Factors in Brines

Work Carried Out under the Analysis Plan for Determination of pC_{H+} Correction Factors in Brines, AP 157, Rev. 0

To be included in the AP-157 records package

WIPP:1.4.2.2:TD:QA-L:RECERT:556532

APPROVAL PAGE

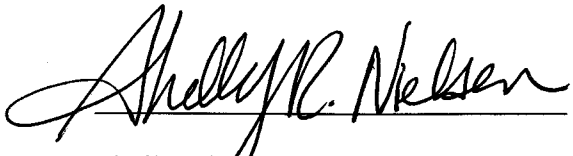
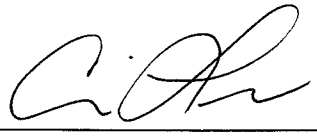
Author:		12/1/2011
	Gregory T. Roselle, Org. 6212	Date
Technical Reviewer:		12/1/2011
	Je-Hun Jang, Org. 6212	Date
QA Reviewer:		12-1-11
	Shelly Nielsen, Org. 6210	Date
Management Reviewer:		12/1/2011 CDL 12/1/11
	Christi Leigh, Org. 6212	Date

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 Introduction

This report documents the derivation of pH correction factors that will be used to determine the hydrogen ion (H^+) concentration in the high ionic strength brines used in geochemical studies in support of the Waste Isolation Pilot Plant (WIPP). The H^+ concentration is a critical parameter used for calculating geochemical equilibria in electrolyte solutions, especially the high ionic strength brines relevant to the WIPP geochemistry model. The H^+ concentration is typically determined via pH measurements in the solutions of interest. However, the measurement of pH in high ionic strength solutions using standard National Bureau of Standards (NBS) operational methods (Bates, 1973) does not provide an accurate measure of the H^+ concentration due to a number of factors (see discussions in Knauss et al., 1990; and Rai et al., 1995). The most significant factor of concern for WIPP studies are the potentially large liquid-junction potentials and the formation of species such as HSO_4^- and $H_2B_4O_7$ that can consume H^+ during electrode standardization (Rai et al., 1995).

In the commonly used combination pH electrodes, the liquid-junction potential arises from differences in ionic diffusivity between the reference electrode solution (typically 3 M KCl) and the sample solution. The measurement of pH using combination electrodes assumes that the liquid-junction potential of the cell in the electrode remains constant between the pH standardization buffer solutions and the samples to be measured. This assumption is valid as long as the ionic strength of the unknown solutions are not significantly higher than the standard buffer solutions (i.e. <0.1 m). However, in higher ionic strength brines pH measurement with a combination electrode is affected because the liquid-junction potential can no longer be assumed as constant between the standard buffer solutions and the samples.

Due to these difficulties it is necessary to correct the measured pH values in brines in order to gain an accurate measure of the hydrogen ion concentration (pC_{H+}). Rai et al. (1995) proposed a relatively simple procedure for estimating pC_{H+} in concentrated brines using commercially available combination glass electrodes. They showed that this procedure gave reliable results (± 0.05 pC_{H+}) units over a wide range of ionic strengths and pC_{H+} values. Rai et al. (1995) show that the H^+ concentration in unknown samples of a given electrolyte (e.g. NaCl) at a fixed molarity can be estimated using the following relation:

$$pC_{H+} = pH_{obs} + A \quad (1)$$

where pH_{obs} is the measured pH reading of the unknown sample with a calibrated combination glass electrode, and A is defined as:

$$A = \log \gamma_{H+} + (F/2.303RT)\Delta E_j \quad (2)$$

where γ_{H+} is the molarity-scale activity coefficient of H^+, and ΔE_j is the difference in liquid-junction potential between the standards and solutions. Although neither term on the right-hand side of Eq. (2) can be independently measured, the combination of the two is measurable. Thus, the constant A can be obtained empirically through a modified Gran titration.

The objective of this work is to derive the pC_{H+} correction factors (A) for a broad range of WIPP-relevant brines. These brines include simple single electrolyte brines (e.g. NaCl, Na_2SO_4, or $MgCl_2$), two electrolyte brines (e.g. NaCl + $MgCl_2$), simplified multi-component brines, and full-strength WIPP brines (GWB and ERDA-6). This report also addresses whether the same correction factors (A) can be used for combination glass electrodes from different manufacturers or if each brand of electrode requires a unique value for A. Finally, the correction factors derived in this study are compared to other correction factors in the published literature.

Once the correction factors are determined they will be used to calculate the pC_{H+} in experimental solutions based on observed pH readings. These pC_{H+} values can then be used in other analyses to derive thermodynamic properties needed for WIPP geochemical modeling. Therefore, this study is considered a compliance decision analysis.

2 *Approach*

2.1 General Procedure

The purpose of this report is not to provide a detailed discussion of the methods used to generate the data required for derivation of the pC_{H+} correction factors. However, a brief description of the method is provided here for reference. The experimental data used in this report are collected under Test Plans TP 06-02, *Iron and Lead Corrosion in WIPP-Relevant Conditions* (Wall and Enos, 2006); TP 08-02, *Iron, Lead, Sulfide and EDTA Solubilities* (Ismail

et al., 2008); and TP 10-01, *Experimental Study of Thermodynamic Parameters of Borate in WIPP Relevant Brines at Sandia National Laboratories Carlsbad Facility* (Xiong, 2010).

The modified Gran titration method involves titrating stock electrolyte solutions of known concentration with standard solutions of HCl or NaOH and recording the changes in measured pH as a function of the amount of titrant (HCl or NaOH) added. All stock solutions are prepared with DI water and reagent grade salts. Titrant solutions are either commercially purchased solutions or carefully prepared in the laboratory and then standardized using accepted methods. All solution preparations are recorded in scientific notebooks. Table 1 lists the solutions and titrants used for this analysis.

Table 1 Solutions Used in Titrations

Solution	Titrant	
	HCl	NaOH
0.1 m to 5.14 m NaCl	0.01 M; 0.1 M; 1.0 M	--
0.1 m to 1.0 m Na_2SO_4	0.1 M	--
0.01 m to 2.0 m $MgCl_2$	0.01 M; 0.1 M	--
mixed NaCl - $MgCl_2$	0.01 M	--
mixed NaCl - Na_2SO_4	0.1 M	--
Simplified ERDA-6	0.01 M	1.0 M
Simplified GWB	0.01 M	--
ERDA-6	1.0 M	1.0 M
GWB	1.0 M	--

Once the solutions have been prepared the modified Gran titration can be conducted either by hand or using an auto titrator (both methods have been used in this exercise). The titration proceeds by adding a known amount of electrolyte solution to a titration vessel and then adding a known amount of titrant to the solution. A fresh aliquot of titrant (acid or base) is added to the

titration vessel when the measured pH stabilizes to within 0.05 pH units. After each addition of titrant, the stabilized pH value and the incremental and total volume of titrant added are recorded. These data are then recorded in scientific notebooks.

The data used in this analysis was collected by numerous researchers including: Caitlin Allen, Haoran Deng, Je-Hun Jang, Martin Nemer, Gregory Roselle, Rachael Roselle and Yongliang Xiong.

2.2 Data Analysis

Rewriting Eq. (1) as a logarithmic expression yields:

$$- \log (C_{H+}) = - \log (H^{+}_{obs}) + A \tag{3}$$

Rearranging Eq. (3) and taking the antilog of the result gives the equation:

$$H^{+}_{obs} = 10^{A} C_{H+} \tag{4}$$

The pC_{H+} correction factor, A, can then be obtained from the Gran titration data by plotting the moles of added free H^+ per liter ($H^{+}_{free,add}$) against the H^{+}_{obs} (i.e., 10^{-pHobs}). The logarithm of the slope of this curve is the correction factor A needed to convert the measured pH reading to pC_{H+}.

It is important to note that the moles of added free H^+ per liter must be calculated from the titration data. In addition, the method of calculation will differ depending on the particular electrolytes that are present in the brine of interest. The details for the calculation of $H^{+}_{free,add}$ are discussed below for each of the major electrolytes used in this study.

NaCl Brines – In brines containing only NaCl there are no other species (e.g. SO_4^{2-} or $B_4O_7^{2-}$) that can consume added H^+ during an acid titration. Thus, the amount of acid added during titration should correspond to the free H^+ added ($H^{+}_{free,add}$). The free H^+ added in moles per liter can then be determined with the following formula:

$$H^{+}_{free,add} = \frac{V_{add}N}{V_i+V_{add}} \tag{5}$$

where V_i is the volume of brine added to the titration vessel (ml), V_{add} is the volume of standardized acid addition (ml), and N is the normality of the standardized HCl solution.

A plot of H^+_{obs} versus $H^+_{free,add}$ should result in a linear trend. However, the presence of small amounts of impurities such as soluble bicarbonate may consume minor amounts of H^+ at the beginning of a titration resulting in non-linear behavior at low values of $H^+_{free,add}$. These portions of the plots should not be used in determining the slope of the data trend.

Na_2SO_4 Brines – In brines containing Na_2SO_4 the addition of HCl results in the formation of bisulfate ions (HSO_4^-). The concentration of HSO_4^- that is formed is dependent on the total sulfate concentration of the brine and the amount of acid added. If the total sulfate concentration is large relative to the amount of added H^+ (via the acid), the formation of HSO_4^- will not significantly alter the total sulfate concentration of the brine and the A factor will remain constant throughout the titration. In contrast, because the amount of added acid (H^+) is small relative to the total sulfate concentration, bisulfate formation can consume a significant quantity of added H^+ and it becomes necessary to account for bisulfate formation when determining the correct value of $H^+_{free,add}$. In this case the amount of free H^+ added to solution is calculated using the equation:

$$H^+_{free,add} = \frac{H^+_{add}}{1+K_{app}\,[SO_4^{2-}]} \tag{6}$$

where H^+_{add} is calculated according to Eq. (5) for borate-free brines or Eq. (8) for borate-containing brines, $[SO_4^{2-}]$ is the molar free sulfate concentration of the brine and K_{app} is the apparent molar equilibrium constant for the bisulfate formation reaction:

$$H^+ + SO_4^{2-} = HSO_4^- \tag{7}$$

K_{app} is determined for the Na_2SO_4 concentration of interest using the Pitzer thermodynamic model. The method used to calculate K_{app} is discussed in Section 2.3.

Borate Brines – As with sulfate brines, the addition of acid to brines containing borate will result in significant consumption of added H^+ due to the formation of $H_2B_4O_7$. Here again the consumption of added HCl by borate complexes must be accounted for when calculating $H^+_{free,add}$. Because the formation of borate species is rather complex the "K_{app}" method used for sulfate brines is not practical and an empirical approach is used. In this case the equivalence point for $H_2B_4O_7$ formation must be determined in a separate titration using the same volume of brine and standardized acid concentration as will be used in the Gran titration. This is done by

adding an indicator solution (e.g. methyl orange) to the brine and titrating acid into the brine until a color change of the indicator is observed. In some cases the equivalence point was determined empirically based on a visual estimate of the inflection point in a plot of solution pH versus amount of acid added. The equivalence point occurs at a pH of approximately 5 for ERDA-6 brines and 3 for GWB brines. From this equivalence point determination the volume of acid required to reach the equivalence point is used to calculate $H^+_{free,add}$ as follows:

$$H^+_{free,add} = \frac{(V_{add} - V_{eq})\,N}{V_i + V_{add}} \tag{8}$$

where V_{eq} is the volume (ml) of acid added to reach the equivalence point and all other variables are as defined for Eq. (5).

NaOH Titrations – Rai et al. (1995) showed that the correction factor A can also be determined using modified Gran titrations with NaOH as the titrant. When NaOH is used as a titrant a different formulation must be used to calculate $H^+_{free,add}$ that accounts for the dissociation of water. The amount of NaOH added during the titration is converted to $H^+_{free,add}$ through the equation:

$$H^+_{free,add} = \frac{K_w}{OH^-_{add}} \tag{9}$$

where K_w is concentration-dependent dissociation constant of water and OH^-_{add} is determined by:

$$OH^-_{add} = \frac{V_{add}N}{V_i + V_{add}} \tag{10}$$

where V_i is the volume of brine added to the titration vessel (ml), V_{add} is the volume of standardized base addition (ml), and N is the normality of the standardized NaOH solution. K_w is determined for the brine concentration of interest using the Pitzer thermodynamic model. The method used to calculate K_w is discussed in Section 2.3.

It should be noted that the presence of OH^- consuming species in brines for which A is to be determined using base titrations will require special consideration similar to sulfate and borate for acid titrations. For WIPP-relevant brines (especially GWB) the presence of significant quantities of magnesium will result in precipitation of $Mg(OH)_2$, which must be accounted for if base titrations are used.

2.3 Calculation of Equilibrium Constants

The determination of $H^+_{free,add}$ for acid titrations in brines containing sulfate and for all titrations using NaOH requires the calculation of appropriate equilibrium constants. This includes the equilibrium constant for bisulfate formation via the reaction given in Eq. (7) and the dissociation constant of water, both of which are dependent on the composition of the brine. The Pitzer thermodynamic model is used to calculate these constants for each brine of interest with the EQ3/6 version 8.0a geochemical modeling program. The bulk composition of each brine is input into EQ3, which then calculates the equilibrium distribution of the various chemical species in the brine. The needed equilibrium constants are then calculated from the results using the following relations for bisulfate formation and water dissociation, respectively:

$$K_{app} = \frac{[HSO_4^-]}{[H^+]\,[SO_4^{2-}]} \tag{11}$$

$$K_w = [H^+]\,[OH^-] \tag{12}$$

where the values in brackets are the molar concentrations of the indicated species. Table 2 lists the calculated values for K_{app} and K_w calculated for each of the brines of interest. It should be noted that the EQ3 program reports the concentration data for each species in units of mole per kilogram water (molal). However, the Gran titration method requires the use of molar (mole/L) values for calculating the equilibrium constants. In order to calculate the appropriate K_{app} and K_w values the molar to molal ratio (M/m) reported by EQ3 for each brine is used to convert the concentrations of the species of interest from molal to molar. The value of M/m is also given in Table 2 for each brine.

Table 2 Calculated Equilibrium Constants Used in Data Analysis

Brine	M/m	Kapp	Kw
0.1 m Na_2SO_4	0.996	17.765	--
1.0 m Na_2SO_4	0.952	3.430	--
0.01 m Na_2SO_4 + 0.15 m NaCl	0.997	24.182	--
0.1 m Na_2SO_4 + 0.15 m NaCl	0.993	14.577	--
0.5 m Na_2SO_4 + 0.15 m NaCl	0.973	5.642	--
1.0 m Na_2SO_4 + 0.15 m NaCl	0.949	3.505	--
1.5 m Na_2SO_4 + 0.15 m NaCl	0.927	2.882	--
1.8 m Na_2SO_4 + 0.15 m NaCl	0.914	2.779	--
Simplified ERDA-6	0.896	12.675	3.58E-15
Simplified GWB	0.899	6.835	--
ERDA-6	0.892	12.777	3.48E-15
GWB	0.876	9.044	--

3 Results and Discussion

A broad range of solutions that have compositions relevant to the WIPP geochemistry investigations were titrated with HCl and NaOH to estimate the value of the correction factor A so that pC_{H+} values can be calculated from observed pH measurements. Table 1 lists the different solutions and titrants used in this study. The titrations were performed by a number of different researchers using combination pH electrodes from a variety of manufacturers. Table 3 lists the details of the different electrodes used in this study. The study used a number of electrodes from different manufacturers to determine if the correction factor A is electrode-dependent. All pH electrodes used in the study were of the Ag/AgCl type with the exception of

the Ross Sureflow Combination pH electrode, which uses a Pt wire with a proprietary redox solution.

In the sections that follow the results of the titration studies are discussed based on brine type. The brines have been divided into four different types: pure NaCl brines; Na_2SO_4 brines that may also include sodium chloride; $MgCl_2$ brines that may also include sodium chloride; and complex brines (e.g. GWB, ERDA-6). The data for each of these brines is reported in molar concentrations. However, some of the brines were prepared on a molal basis. Because the Gran titration method requires data analysis on a molar basis the concentrations of the molal brines are converted to a molar basis using the brine density according to the formula:

$$[M] = \frac{[m]\,\rho}{1+[m]\,M.W.} \tag{13}$$

where [M] is the molar concentration (moles/L), [m] the molal concentration (moles/kg), ρ the solution density (kg/L), and M.W. the molecular weight of the solute (kg/mol). Brine densities were either measured directly on the brines of interest (and are recorded in the relevant scientific notebook) or calculated based on the data of Connaughton et al. (1986). For some brines the densities were not measured and/or it is not possible to calculate them using the data of Connaughton et al. (1986). In this case the molar to molal (M/m) ratio was calculated using EQ3, which also calculates brine densities based on the input bulk composition.

Table 3 Electrodes Used in Titrations

Manufacturer	Model	Type
Mettler-Toledo	DG-111-SC	Ag/AgCl
Thermo Electron Corp.	Ross Sureflow Combination pH	Pt wire
Corning	Semi-Micro Combo	Ag/AgCl
Fisher Scientific	Orion Ross Semi-Micro	Ag/AgCl
Fisher Scientific	Accumet Semi-Micro	Ag/AgCl

All of the EQ3/6 input and output (I/O) files and the Excel spreadsheets that are used in the data analysis are archived in library LIBAP157_FILES, class AP157, in the CMS.

3.1 NaCl Brines

Five different groups of pure NaCl brines were titrated with HCl each using a different pH electrode. These brines ranged in composition from 0.01 M to 5.35 M NaCl. Multiple replicates of each brine titration were conducted. The details of each titration are presented in Appendix A. For each titration of a particular brine composition a value of the pC_{H+} correction factor can be determined. The correction factor data for pure NaCl brines are summarized in Table 4. The values of the correction factor A are plotted as a function of the brine molar ionic strength for each titration data set in Figure 1. From this plot it can be seen that the data define a consistent linear trend. Also shown on the plot is a fit to all of the NaCl titration data. Based on this data it seems clear that the value of the correction factor A is independent of the manufacturer of the pH electrode.

Table 4 Summary of Correction Factors for NaCl Titrations

Corning Semi-Micro Combo		Fisher Accumet Semi-Micro		Mettler Toledo DG-111-SC		Orion Ross Semi-Micro		Ross Sureflow Combination	
NaCl (M)	A	NaCl (M)	A	NaCl (M)	A	NaCl (M)	A	NaCl (M)	A
0.100	-0.052	0.030	0.007	0.10	-0.096	0.01	-0.020	0.05	-0.062
0.100	-0.056	0.030	-0.032	0.10	-0.076	0.01	-0.025	0.05	-0.062
0.985	0.044	0.332	-0.017	1.02	0.009	0.10	-0.029	0.10	-0.064
0.985	0.047	0.332	-0.038	1.02	0.030	0.10	-0.028	0.10	-0.062
2.823	0.373	1.001	0.000	1.02	0.000	0.10	-0.027	0.10	-0.064
2.823	0.377	1.001	0.062	1.02	-0.013	0.20	-0.060	0.98	0.045
4.628	0.738	2.885	0.348	2.085	0.202	0.50	0.023	0.98	0.052
4.628	0.741	2.885	0.415	2.085	0.198	0.49	0.017	1.92	0.215
--	--	5.3495	0.983	3.20	0.390	1.02	0.103	1.92	0.215
--	--	5.3495	0.951	4.52	0.685	1.02	0.101	2.82	0.376
--	--	5.3495	0.983	4.52	0.700	--	--	2.82	0.377

Correction factors A are determined from the plots of H^+_{obs} versus H^+_{added} shown in Appendix A.

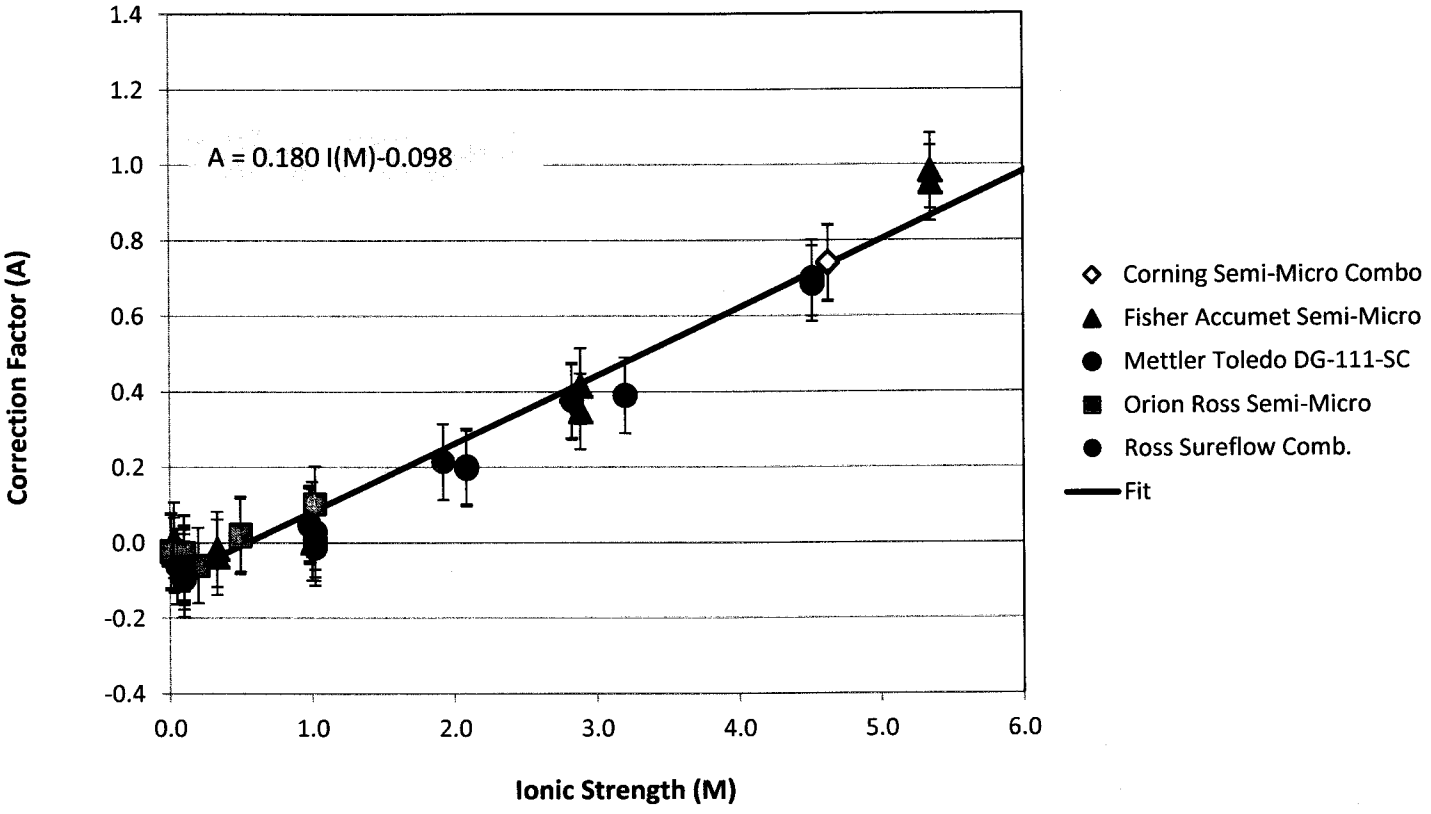


Figure 1 Plot of correction factor A as a function of molar ionic strength for pure NaCl brines. Symbols indicate the pH electrode used in the titrations. Equation is a linear fit to all plotted data as shown by the black line. Error bars represent ± 0.1 pH units.

3.2 $MgCl_2$ Brines

A single group of pure $MgCl_2$ brines were titrated with HCl each using a Fisher Accumet Semi-Micro pH electrode. These brines ranged in composition from 0.01 M to 1.9 M $MgCl_2$. Two additional groups of $MgCl_2$ plus NaCl brines were also titrated. These brines ranged from 0.5 M to 1.9 M $MgCl_2$ and 0.5 M to 4.5 M NaCl each using a different pH electrode. Multiple replicates of each brine titration were conducted. The details of each titration are presented in Appendix B. For each titration of a particular brine composition a value of the pC_{H+} correction factor can be determined. The correction factor data for the pure $MgCl_2$ and mixed $MgCl_2$-NaCl brines are summarized in Table 5. The values of the correction factor A are plotted as a function of the brine molar ionic strength for each titration data set in Figure 2. From this plot it can be

seen that the pure $MgCl_2$ brine data define a consistent linear trend. However, the mixed $MgCl_2$-NaCl brine data do not plot on this trend and will be evaluated with other more complex mixed brines (see Section 3.4). A linear fit to the pure $MgCl_2$ titration data is shown in Figure 2.

Table 5 Summary of Correction Factors for $MgCl_2$ Titrations

Fisher Accumet Semi-Micro				Orion Ross Semi-Micro			
$MgCl_2$ (M)	NaCl (M)	I (M)	A	$MgCl_2$ (M)	NaCl (M)	I (M)	A
0.01	--	0.03	-0.038	0.45	4.46	5.80	1.083
0.01	--	0.03	-0.021	0.73	3.18	5.36	0.923
0.10	--	0.31	-0.062	1.13	2.72	6.11	1.068
0.10	--	0.31	-0.065	1.37	1.83	5.95	0.997
0.48	--	1.44	0.063	1.60	1.38	6.19	1.071
0.48	--	1.44	0.024	1.86	0.46	6.03	0.975
0.90	--	2.71	0.270	Mettler Toledo DG-111-SC			
1.30	--	3.91	0.390	0.99	3.58	6.55	1.190
1.30	--	3.91	0.471	0.99	3.58	6.55	1.188
1.92	--	5.75	0.757	0.99	3.58	6.55	1.235
1.92	--	5.75	0.790	--	--	--	--
Correction factors A are determined from the plots of H^+_{obs} versus H^+_{added} shown in Appendix C.							

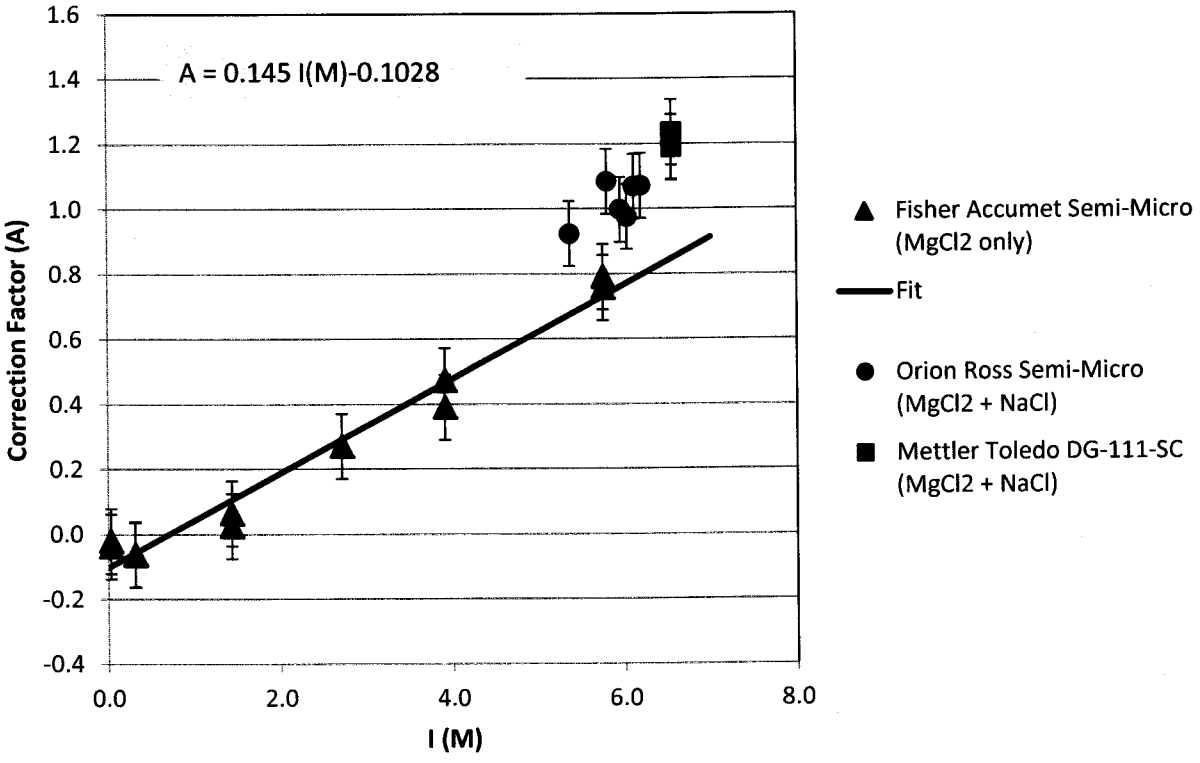


Figure 2 Plot of correction factor A as a function of molar ionic strength for pure $MgCl_2$ and mixed $MgCl_2$-NaCl brines. Symbols indicate the pH electrode used in the titrations. Equation is a linear fit to pure $MgCl_2$ as shown by the black line. Error bars represent ± 0.1 pH units.

3.3 Na_2SO_4 Brines

Two sets of Na_2SO_4 based brines were titrated with HCl each using a Corning Semi-Micro Combo pH electrode. The first set of brines consisted of pure Na_2SO_4 brines, whereas the second set also contained 0.15 m NaCl. The Na_2SO_4 concentration of these brines ranged from 0.01 M to 1.65 M Na_2SO_4. Multiple replicates of each brine titration were conducted. The details of each titration are presented in Appendix C. For each titration of a particular brine composition a value of the pC_{H+} correction factor can be determined. The correction factor data for the pure Na_2SO_4 and mixed Na_2SO_4-NaCl brines are summarized in Table 6. The values of

the correction factor A are plotted as a function of the brine molar ionic strength for each titration data set in Figure 3. From this plot it can be seen that the pure Na_2SO_4 data differ from the NaCl and $MgCl_2$ titrations in that they do not form a linear trend. This observation was also made by Rai et al. (1995). The data are well described by a second order polynomial equation as is shown in Figure 3.

Table 6 Summary of Correction Factors for Na_2SO_4 Titrations

Corning Semi-Micro Combo			
Na_2SO_4 (M)	NaCl (M)	I (M)	A
0.01	0.15	0.18	-0.063
0.01	0.15	0.18	-0.042
0.10	0.15	0.45	-0.090
0.10	0.15	0.45	-0.091
0.49	0.15	1.61	-0.255
0.49	0.15	1.61	-0.248
0.95	0.14	2.99	-0.300
0.95	0.14	2.99	-0.299
1.39	0.14	4.31	-0.287
1.39	0.14	4.31	-0.284
1.65	0.14	5.10	-0.167
1.65	0.14	5.10	-0.192
0.10	--	0.30	-0.092
0.95	--	2.86	-0.316
0.95	--	2.86	-0.379
Correction factors A are determined from the plots of H^+_{obs} versus H^+_{added} shown in Appendix B.			

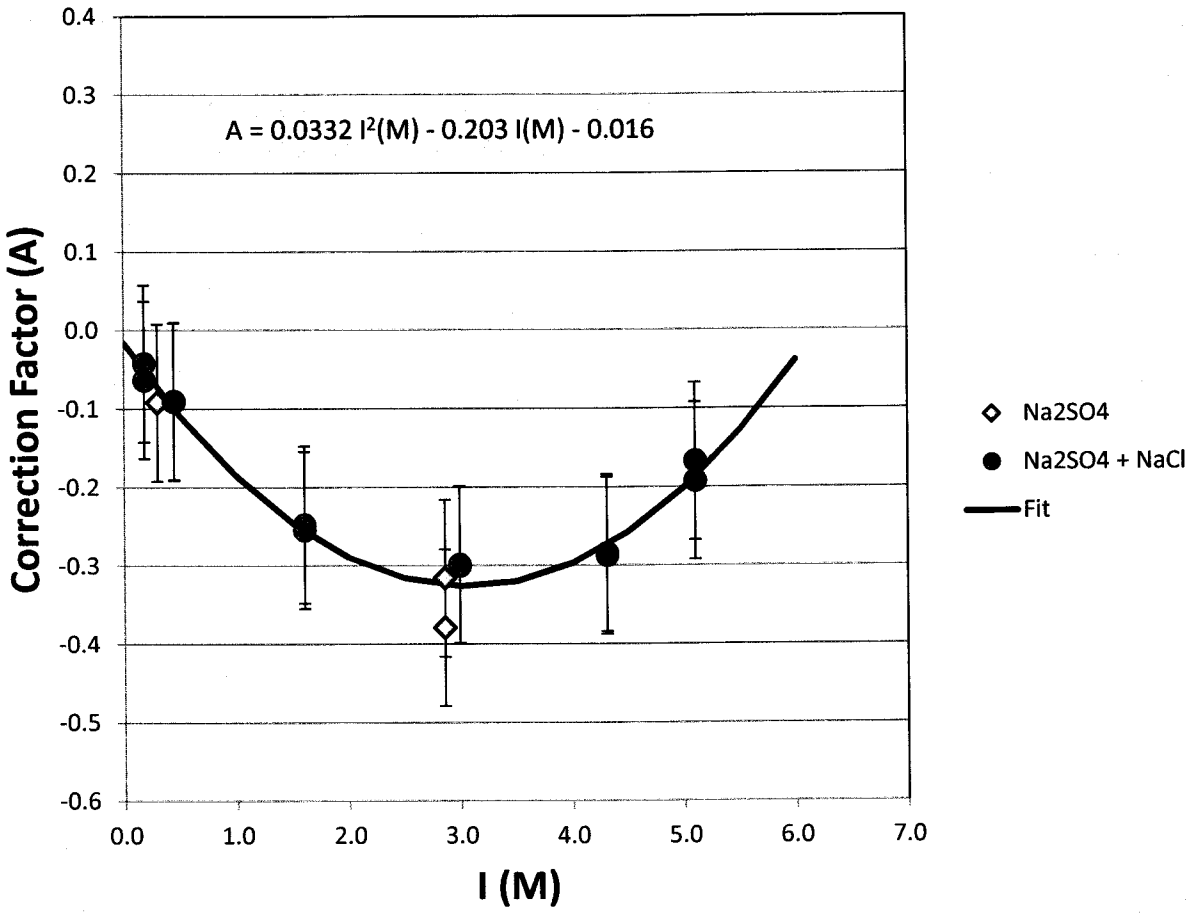


Figure 3 Plot of correction factor A as a function of molar ionic strength for pure Na_2SO_4 and mixed Na_2SO_4-NaCl brines. Equation is a second order polynomial fit to both data sets as shown by the black line. Error bars represent ± 0.1 pH units.

3.4 Complex Brines

The final sets of brines investigated are termed complex brines. This includes simplified versions of GWB and ERDA-6 as well as full strength GWB and ERDA-6. Both of the GWB-based brines were titrated using HCl and the ERDA-6 based brines were titrated using HCl and NaOH. The composition of each of these brines is given in Table 7. Both GWB and ERDA-6 contain sulfate and borate species and must be analyzed using the additional methods described in Section 2.2 and 2.3, which take into account the consumption of added H^+ by these species (see Appendix D for V_{eq} values used in the analysis). Two different pH electrodes were used in these titrations and multiple replicates of each brine titration were conducted. The details of each

titration are presented in Appendix D. For each titration of a particular brine composition a value of the pC_{H+} correction factor can be determined. The correction factor data for the complex brines are summarized in Table 8. The values of the correction factor A are plotted as a function of the brine molar ionic strength for each titration data set in Figure 4. Also plotted in this figure are the data for the mixed $MgCl_2$-NaCl brines reported in Table 5. Because these brines are all relatively high ionic strength they tend to cluster at the high end of the plot. However, there is some indication that they may be part of a linear trend. As a comparison the linear trend fit to the pure NaCl data is plotted in Figure 4 as well. It can be seen that the complex brine data agree quite well with this trend.

Table 7 Molar Composition of Complex Brines

Chemical Species	Simplified GWB (M)	Simplified ERDA-6 (M)	GWB[a] (M)	ERDA-6[a] (M)
Na^+	2.84	4.92	3.53	4.85
K^+	--	--	0.467	9.70×10^{-2}
Li^+	--	--	4.48×10^{-3}	--
Ca^{2+}	--	--	1.38×10^{-2}	1.20×10^{-2}
Mg^{2+}	0.944	--	1.02	1.90×10^{-2}
Cl^-	4.73	4.56	5.61	4.64
Br^-	--	--	2.66×10^{-2}	1.10×10^{-2}
SO_4^{2-}	0.157	0.179	0.178	0.167
$B_4O_7^{2-}$	--	--	3.95×10^{-2}	1.57×10^{-2}

[a] Compositions from Xiong (2008)

Table 8 Summary of Correction Factors for Complex Brine Titrations

Brine	pH electrode[a]	Titrant	I (M)	A
Simplified ERDA-6	A	HCl	5.099	0.771
	A	HCl	5.099	0.772
	A	HCl	5.099	0.773
	A	NaOH	5.099	0.840
	A	NaOH	5.099	0.880
	A	NaOH	5.099	0.916
Simplified GWB	A	HCl	6.143	0.848
	A	HCl	6.143	0.877
	A	HCl	6.143	0.845
ERDA-6	A	HCl	5.183	1.010
	A	HCl	5.183	1.001
	A	HCl	5.183	1.011
	A	NaOH	5.183	0.779
	A	NaOH	5.183	0.961
	A	NaOH	5.183	0.982
	B	HCl	5.183	1.115
	B	HCl	5.183	1.122
	B	HCl	5.183	1.142
	B	NaOH	5.183	0.932
	B	NaOH	5.183	0.888
	B	NaOH	5.183	0.861
GWB	A	HCl	7.322	1.204
	A	HCl	7.322	1.208
	A	HCl	7.322	1.181
	B	HCl	7.322	1.221
	B	HCl	7.322	1.257
	B	HCl	7.322	1.226

Correction factors A are determined from the plots of H^+_{obs} versus H^+_{added} shown in Appendix D.
[a]pH electrodes are A: Mettler Toledo DG-111-SC
B: Orion Ross Semi-Micro

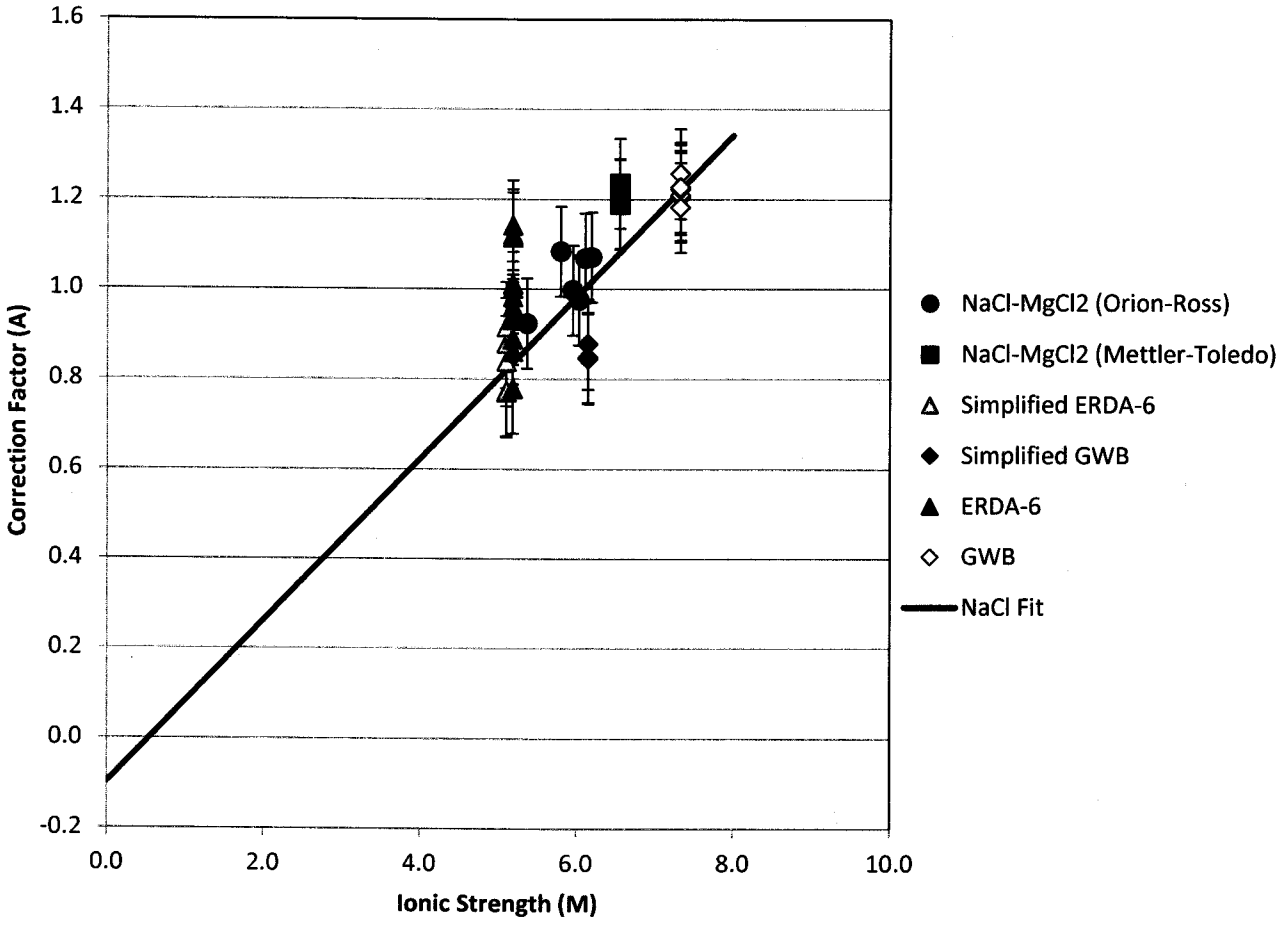


Figure 4 Plot of correction factor A as a function of molar ionic strength for complex brines and mixed $MgCl_2$-NaCl brines. Red circles indicate the Orion-Ross data from Table 5 and the blue squares show the Mettler-Toledo data from Table 5. The linear fit to the pure NaCl data from Figure 1 is shown by the black line. Error bars represent ± 0.1 pH units.

3.5 Compilation of Titration Results

The ultimate goal of this report is to produce a set of empirical correction factors that can be used to convert observed pH readings in experimental brines into pC_{H+} values required for data analysis. Although values of the correction factor A could be provided for individual brine types it would be more practical if a unified expression could be derived that covers multiple brine types. Based on the observation in Figure 4 that the A values for the complex brines plot on the

same trend as the pure NaCl values (when plotted in terms of ionic strength) it may be possible to derive a generic expression for A as a function of ionic strength. To this end all of the NaCl, $MgCl_2$ and complex brine data are plotted together as a function of ionic strength in Figure 5. The data for brines dominated by Na_2SO_4 have been excluded because of their pronounced non-linear behavior.

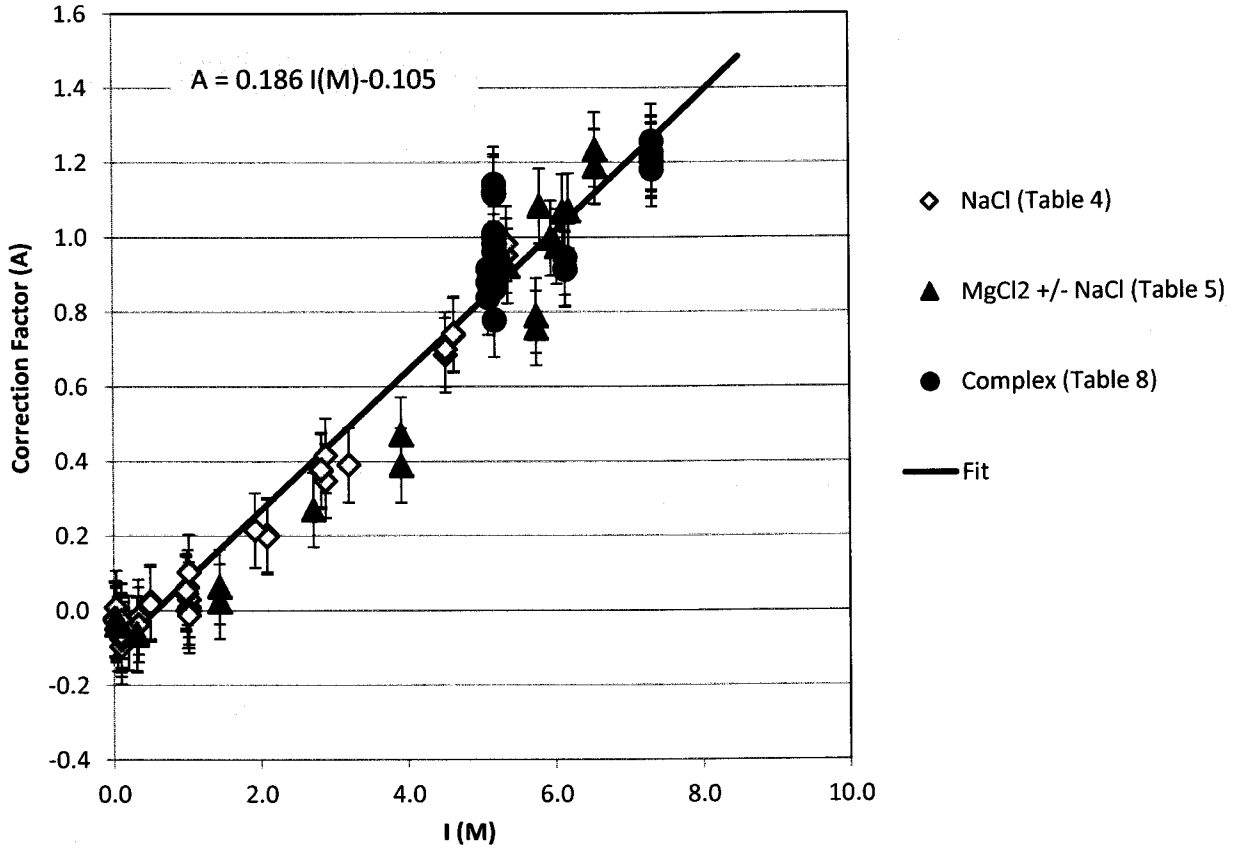


Figure 5 Plot of correction factor A as a function of molar ionic strength for all brines in this study with the exception of Na_2SO_4 dominated brines. Equation (as shown by the black line) is a linear fit to all data. Error bars represent ± 0.1 pH units.

The plot in Figure 5 clearly shows that the titration data for the NaCl brines, $MgCl_2$ (± NaCl) brines and complex brines form a well-defined linear trend. The black line on Figure 5

represents a linear fit to all brine data. The fit is represented by the equation shown in the box on the figure.

3.6 Comparisons to Other Studies

Numerous other studies in the literature have documented pC_{H+} correction factors as well. The correction factor A values from these studies can be compared to the values documented in this report in order to provide confidence in the data. Rai et al. (1995) determined correction factors for NaCl, Na_2SO_4, and mixed NaCl-Na_2SO_4 solutions. They provided a linear relationship for calculating A as a function of molality for pure NaCl solutions and a second-order polynomial relationship for calculating A in pure Na_2SO_4 solutions. The mixed NaCl-Na_2SO_4 investigated by Rai et al. (1995) gave results similar to the pure NaCl system because the concentration of Na_2SO_4 in their mixed brines was very low. Nemer et al. (2011) published their own fits to the Mettler Toledo DG-111-SC and Fisher Accumet data from Table 1. In their study the Mettler Toledo data were fit using a third order polynomial and the Fisher data were fit with a linear expression, both in terms of molal NaCl concentration. Although these data are also included in the fit obtained in the current study they were only a small part of the overall data set and are shown here for comparison. Altmaier et al. (2003) published second-order polynomial equations for calculating the correction factor A as a function of molality for both pure NaCl and $MgCl_2$ solutions. Additional data on correction factors for pure $MgCl_2$ brines were provided by Hansen (2001). Finally the Los Alamos National Laboratory – Carlsbad Actinide Chemistry and Repository Science Program has published individual correction factor determinations for 5 M NaCl, 3.7 M $MgCl_2$, ERDA-6 and GWB brines (Borkowski, 2011).

A comparison of the current study with the other published results cited above for the NaCl dominated brines (including the complex brines) is shown in Figure 6. The expressions presented by Rai et al. (1995), Nemer et al. (2011) and Altmaier et al. (2003) were given in terms of molal concentration of NaCl. Thus, a conversion from molal to molar was necessary. This was done for each expression by calculating the value of A for a given molal NaCl concentration and then converting the molal concentration to molar units using the data of Connaughton et al. (1986). Then the calculated value of A was plotted against the equivalent molar concentration. From Figure 6 it can be seen that all of the expressions or single values for the correction factor A agree to within 0.1 pH units from the values from the current study.

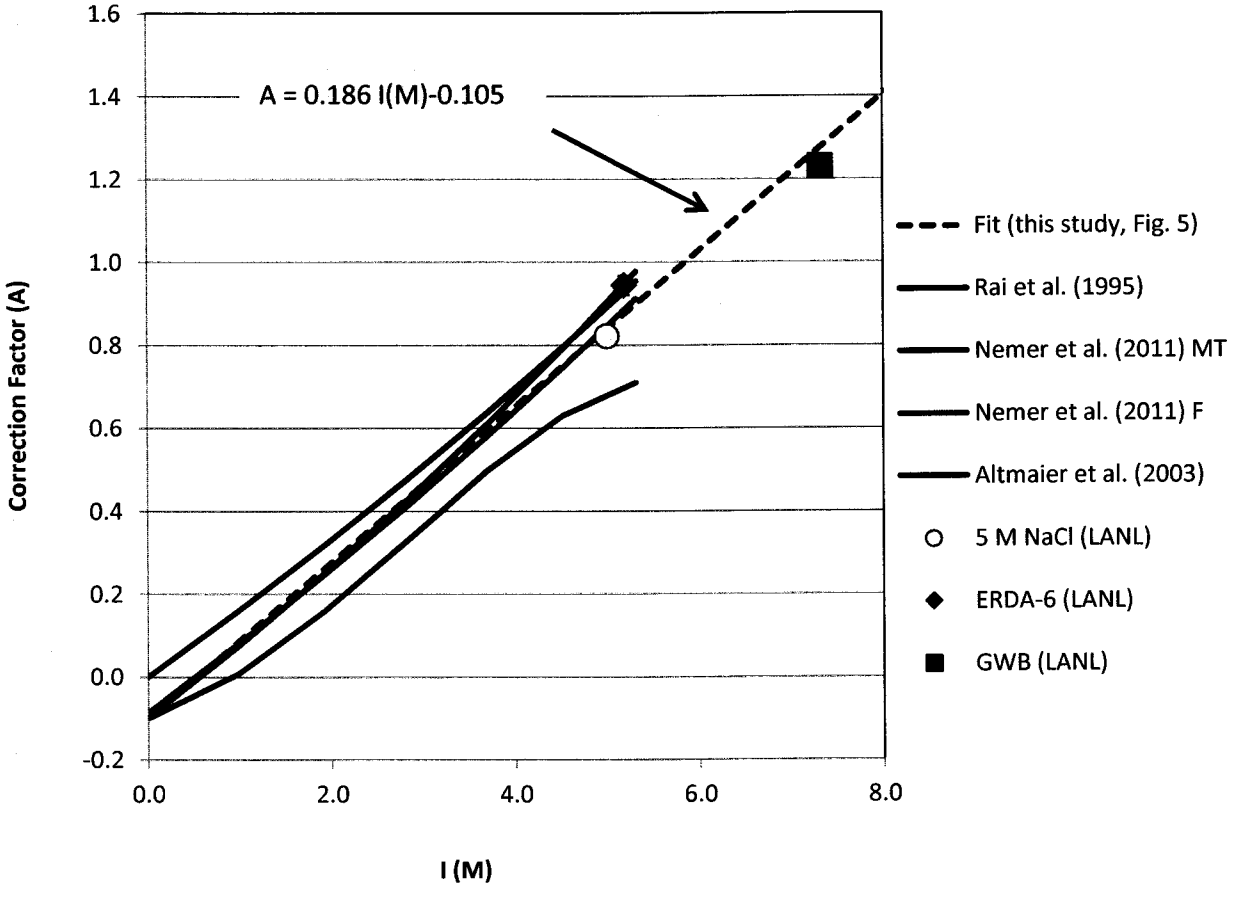


Figure 6 Comparison of various published correction factor data sets for NaCl-dominated brines against the expression determined in this study.

The correction factor data from the current study for $MgCl_2$ brines is compared to other published values in Figure 7. The data of Altmaier et al. (2003) required conversion from molal to molar units and this was done using the same method discussed above for the NaCl-dominated brines. The data of Hansen (2001) and LANL (Borkowski, 2011) was already given in molar units. Figure 7 shows that the published studies agree quite well with each other. However, the expression derived from the current study (black line) differs significantly especially at higher ionic strengths. As a comparison the fit of the NaCl-dominated brines (blue dashed line) is plotted as well. It is clear from the plot that the published $MgCl_2$ data agree quite well with the NaCl expression from this study. Thus, this expression may be a better choice for determining values of A for $MgCl_2$ brines over that given in Section 3.2.

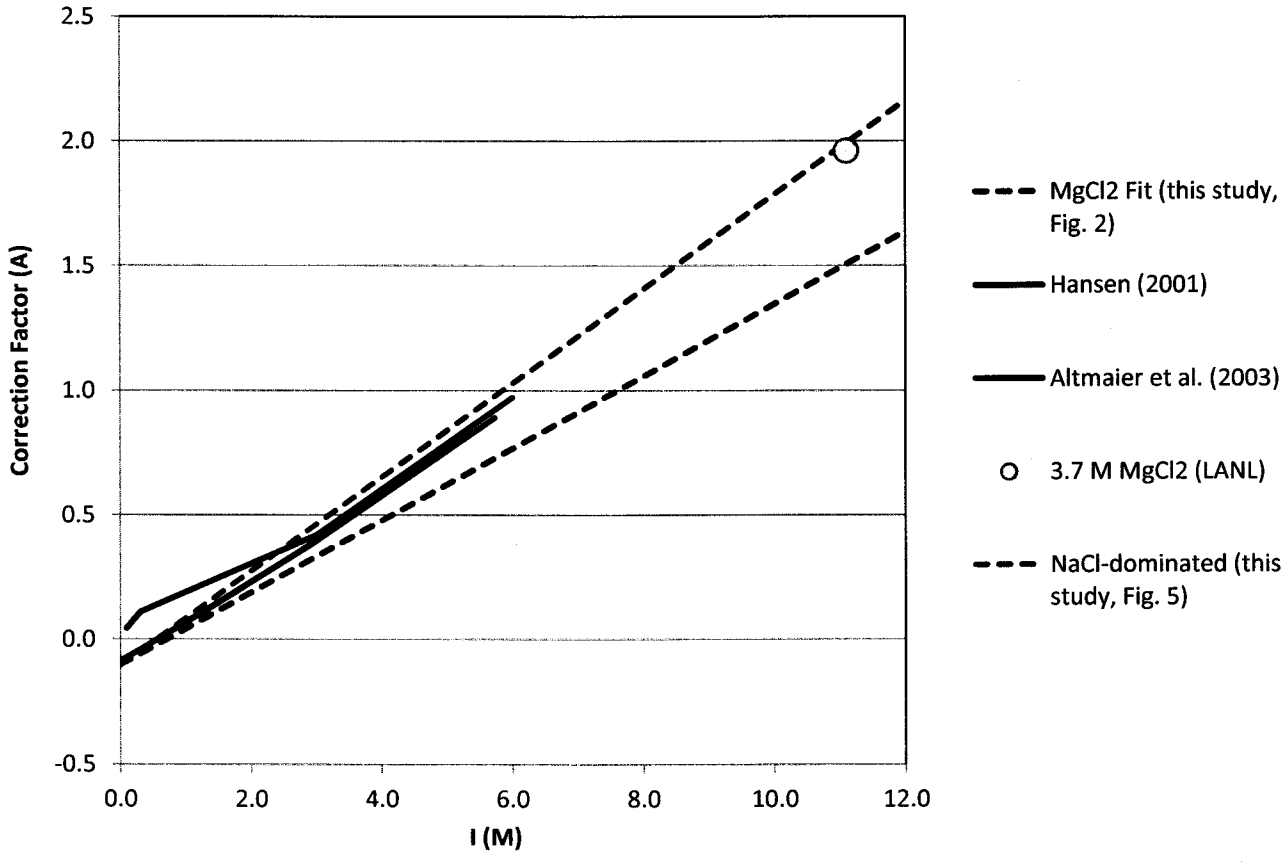


Figure 7 Comparison of various published correction factor data sets for $MgCl_2$ brines against the expression determined in this study (black dotted line). Also shown is the fit for NaCl-dominated brines from the current study (blue dotted line).

Finally, the correction factor data Na_2SO_4 dominated brines is compared to values in Rai et al. (1995). A review of the Rai et al. (1995) highlighted several mistakes that had to be corrected before this comparison could be made. First, in accounting for the consumption of H^+ by bisulfate formation (see Sections 2.2 and 2.3) Rai et al. (1995) calculated the value of K_{app} using the molal concentrations. The Gran titration method as used by Rai et al. (1995) and the current study requires the calculation of K_{app} using molar values. Secondly, Rai et al. (1995) incorrectly used the molal concentration of SO_4^- in Eq. (6) instead of the molar concentration. Finally, the expression given for calculating the value of A does not match the data presented in Rai et al. (1995), as shown below. In order to make the comparison with the current study, the data of Rai

et al. (1995) was reevaluated by calculating appropriate values of K_{app} and applying them with the correct concentration data in Eq. (6). As with the other published studies the Rai et al. (1995) expression was in terms of molal concentrations, which required the brine data to be converted to molar units as discussed above for NaCl. The recalculated Rai et al. (1995) data are given in Table 9.

Table 9 Summary of Corrected Rai et al. (1995) Na_2SO_4 data

Na_2SO_4 (molal)	Correction Factor A (Rai et al. (1995))	Correction Factor A (recalculated)
0.05	0.07	0.08
0.05	0.19	-0.15
0.10	-0.10	-0.07
0.10	-0.25	-0.21
0.50	-0.25	-0.20
0.50	-0.35	-0.30
1.00	-0.31	-0.27
1.50	-0.32	-0.29
2.00	-0.29	-0.25
2.00	-0.35	-0.20

The recalculated Rai et al. (1995) data are plotted against the fit for the data from the current study in Figure 8. The two data sets are in excellent agreement. Also shown in this figure is the expression given in Rai et al. (1995) meant to describe their data. It is clear that there must be an error in this expression.

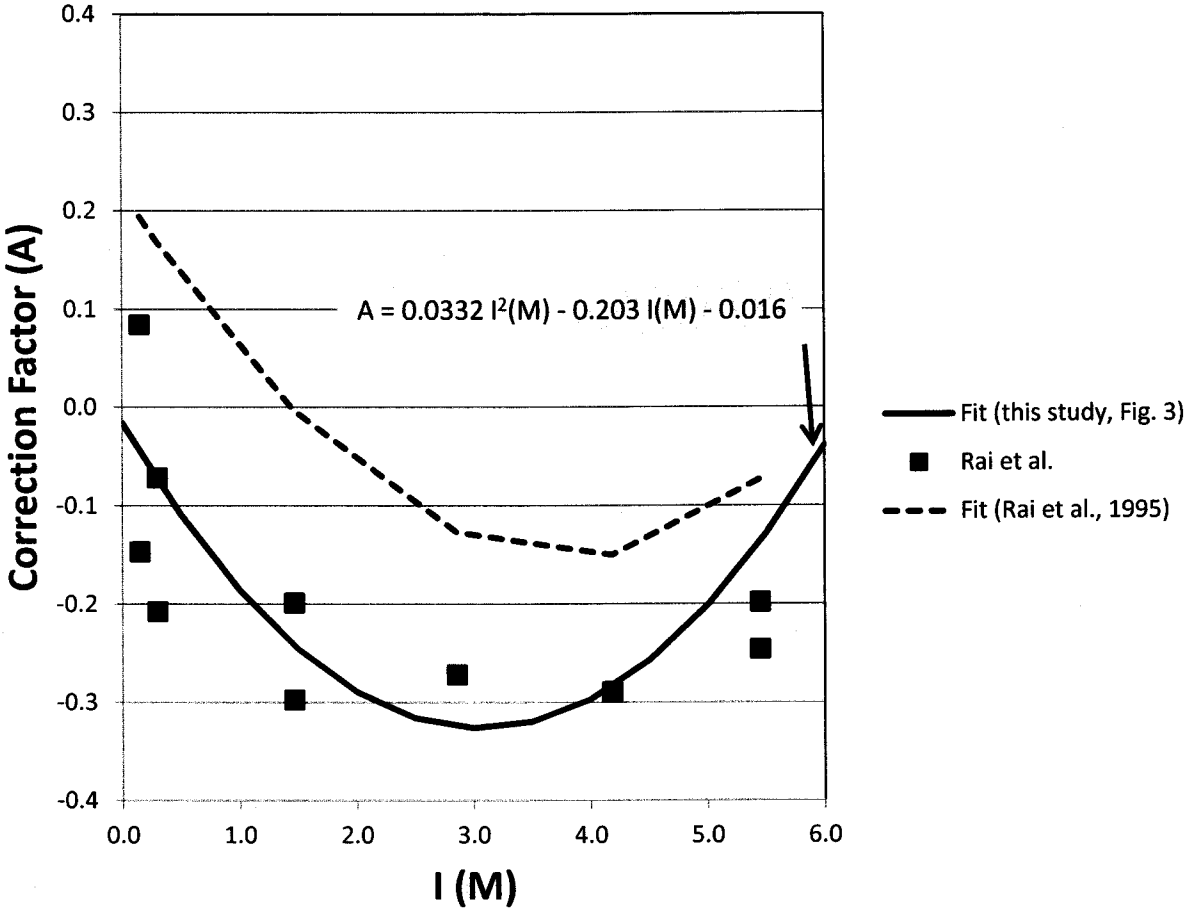


Figure 8 Comparison of corrected Rai et al. (1995) data set for Na_2SO_4 brines against the expression determined in this study (black line). Also shown is the original fit from the Rai et al. (1995) study (dotted line).

4 *Summary*

The purpose of this report is to document the derivation of pH correction factors that will be used to determine the H^+ concentration (pC_{H+}) in the high ionic strength brines used in geochemical studies in support of the Waste Isolation Pilot Plant (WIPP). The H^+ concentration is a critical parameter used for calculating geochemical equilibria in electrolyte solutions, especially the high ionic strength brines relevant to the WIPP geochemistry model. The correction factors are derived empirically using a Gran titration method to determine the change in observed pH in the brine as a function of added H^+ usually in the form of HCl or NaOH. For this analysis a number of different brine types were evaluated. They include pure NaCl brines,

pure Na_2SO_4 brines, pure $MgCl_2$ brines, mixed NaCl-Na_2SO_4 brines, mixed NaCl-$MgCl_2$ brines and more complex brines such as simplified GWB, simplified ERDA-6, full GWB and full ERDA-6.

Based on the analysis presented in the preceding sections the brines can be put into two groups. The first group consists of NaCl-dominated brines that include pure NaCl brines (Table 4), $MgCl_2$ brines (Table 5) and the complex brines (Table 8). The second group is the Na_2SO_4-dominated brines (Table 6). For each of these groups an expression for calculating the appropriate value of the correction factor A is given by:

$$A_{NaCl} (\pm 0.47) = 0.186\ I_M - 0.105 \quad (14)$$

$$A_{Na2SO4} (\pm 0.09) = 0.0332\ I^2_M - 0.203\ I_M - 0.016 \quad (15)$$

where A_{NaCl} is the correction factor for NaCl-dominated brines (including $MgCl_2$ and complex brines), A_{Na2SO4} is the correction factor for Na_2SO_4 dominated brines and I_M is molar ionic strength of the solution. These expressions are valid for all makes of pH electrodes evaluated. The use of electrodes of a different type or manufacturer should be tested against these expressions.

5 *References*

Altmaier, M., Metz, V., Neck, V., Müller, R. and Fanghänel, T. (2003) Solid-liquid equilibria of $Mg(OH)_2$(cr) and $Mg_2(OH)_3Cl{\cdot}4H_2O$(cr) in the system Mg-Na-H-OH-Cl-H_2O at 25°C. *Geochimica et Cosmochimica Acta*, v. 67, pp. 3595-3601.

Bates, R.G. (1973) *Determination of pH: Theory and Practice*. 2nd Ed. New York, NY: Wiley Interscience.

Borkowski, M. (2011) *Determination of Hydrogen Ion Concentration in Brine, ACP-EXP-010, Rev 2*. Carlsbad, NM: Los Alamos National Laboratory.

Connaughton, L.M., Hershey, J.P. and Millero, F.J. (1986) PVT properties of concentrated aqueous electrolytes: V. Densities and apparent molal volumes of the four major sea salts from dilute solution to saturation and from 0 to 100°C. *Journal of Solution Chemistry*, v. 15, pp. 989-1002.

Hansen, D.J. (2001) *Determining aluminum solubilities as part of cement degradation studies in support of the Waste Isolation Pilot Plant*. SAND2001-2144P, Albuquerque, NM: Sandia National Laboratories.

Ismail, A.E., Nemer, M.B., Roselle, G.T. and Xiong, Y. (2008) *Iron, Lead, Sulfide, and EDTA Solubilities, TP 08-02, Rev 0*. ERMS 548467. Carlsbad, NM: Sandia National Laboratories.

Knauss, K.G., Wolery, T.J., and Jackson, K.J. (1990) A new approach to measuring pH in brines and other concentrated electrolytes. *Geochimica et Cosmochimica Acta*, v. 54, pp. 1519-1523.

Nemer, M.B., Xiong, Y., Ismail, A.E. and Jang, J.-H. (2011) Solubility of $Fe_2(OH)_3Cl$ (pure-iron end-member of hibbingite) in NaCl and Na_2SO_4 brines. *Chemical Geology*, v. 280, pp. 26-32.

Rai, D., Felmy, A.R., Juracich, S.P., and Rao, F. (1995) *Estimating the hydrogen ion concentration in concentrated NaCl and Na_2SO_4 electrolytes*. SAND94-1949, Albuquerque, NM: Sandia National Laboratories.

Wall, N.A. and Enos, D. (2006) *Iron and Lead Corrosion in WIPP-Relevant Conditions, TP 06-02, Rev 1*. ERMS 543238. Carlsbad, NM: Sandia National Laboratories.

Xiong, Y. (2008) *Preparing Synthetic Brines for Geochemical Experiments, SP 20-4, Rev. 2*. Carlsbad, NM: Sandia National Laboratories.

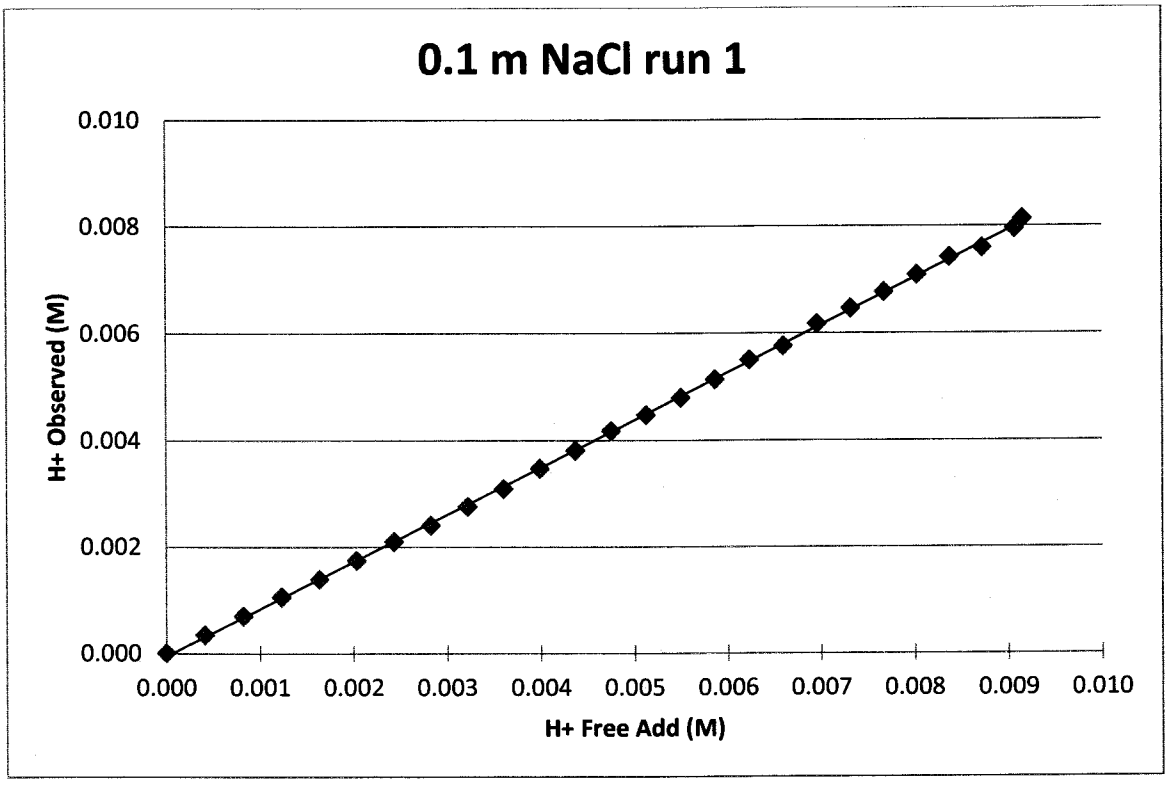
Xiong, Y. (2010) *Experimental Study of Thermodynamic Parameters of Borate in WIPP Relevant Brines at Sandia National Laboratories Carlsbad Facility, TP 10-01, Rev. 0*. ERMS 553558. Carlsbad, NM: Sandia National Laboratories.

Appendix A

Titration Data for NaCl Solutions

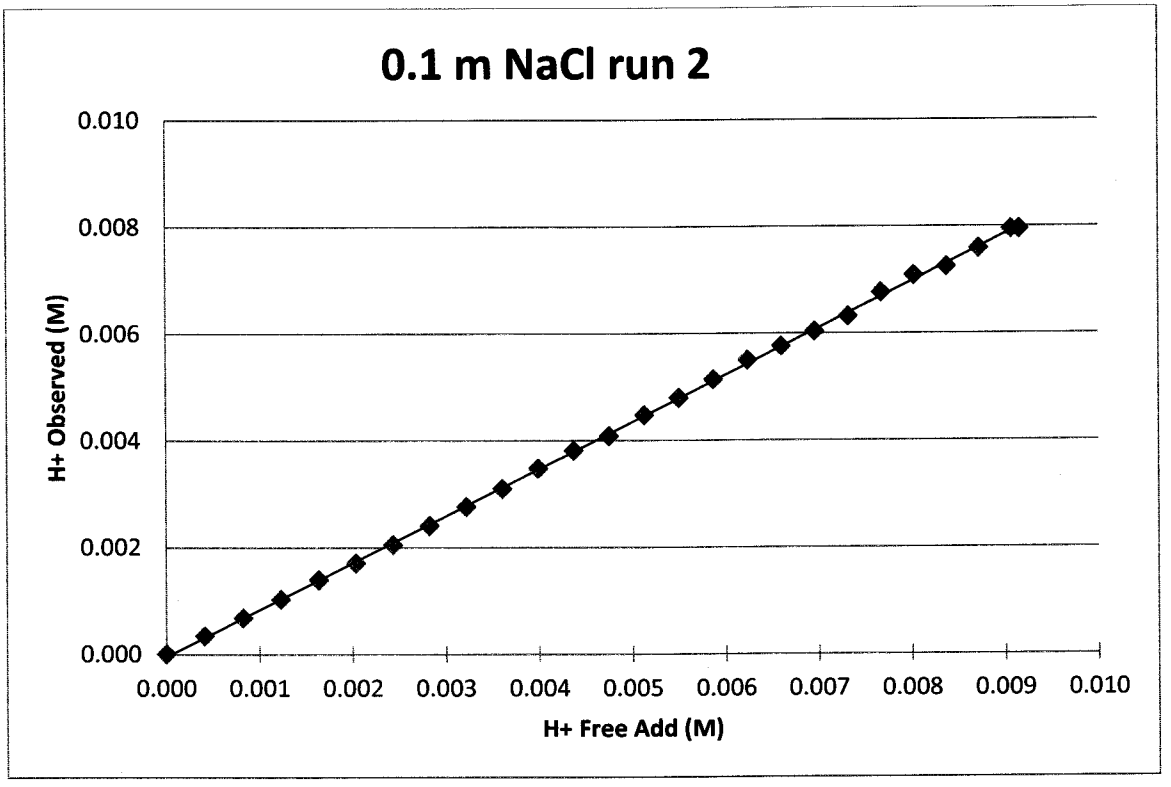
Type:	0.1 m NaCl with 0.1 M HCl
SN Reference	WIPP-Solubility-13 p. 14
Solution Reference:	WIPP-Solubility-8 p. 76
Brine Volume:	50.0 mL
pH Probe:	Corning Semi-Micro Combo
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.000	5.69	2.042E-06	0.000E+00
0.208	3.47	3.388E-04	4.143E-04
0.416	3.16	6.918E-04	8.251E-04
0.623	2.98	1.047E-03	1.231E-03
0.831	2.86	1.380E-03	1.635E-03
1.039	2.76	1.738E-03	2.036E-03
1.247	2.68	2.089E-03	2.433E-03
1.454	2.62	2.399E-03	2.826E-03
1.662	2.56	2.754E-03	3.217E-03
1.870	2.51	3.090E-03	3.605E-03
2.078	2.46	3.467E-03	3.990E-03
2.285	2.42	3.802E-03	4.370E-03
2.493	2.38	4.169E-03	4.749E-03
2.701	2.35	4.467E-03	5.125E-03
2.909	2.32	4.786E-03	5.498E-03
3.116	2.29	5.129E-03	5.866E-03
3.324	2.26	5.495E-03	6.234E-03
3.532	2.24	5.754E-03	6.598E-03
3.740	2.21	6.166E-03	6.959E-03
3.947	2.19	6.457E-03	7.316E-03
4.155	2.17	6.761E-03	7.672E-03
4.363	2.15	7.079E-03	8.026E-03
4.571	2.13	7.413E-03	8.376E-03
4.778	2.12	7.586E-03	8.722E-03
4.986	2.10	7.943E-03	9.068E-03
5.038	2.09	8.128E-03	9.154E-03



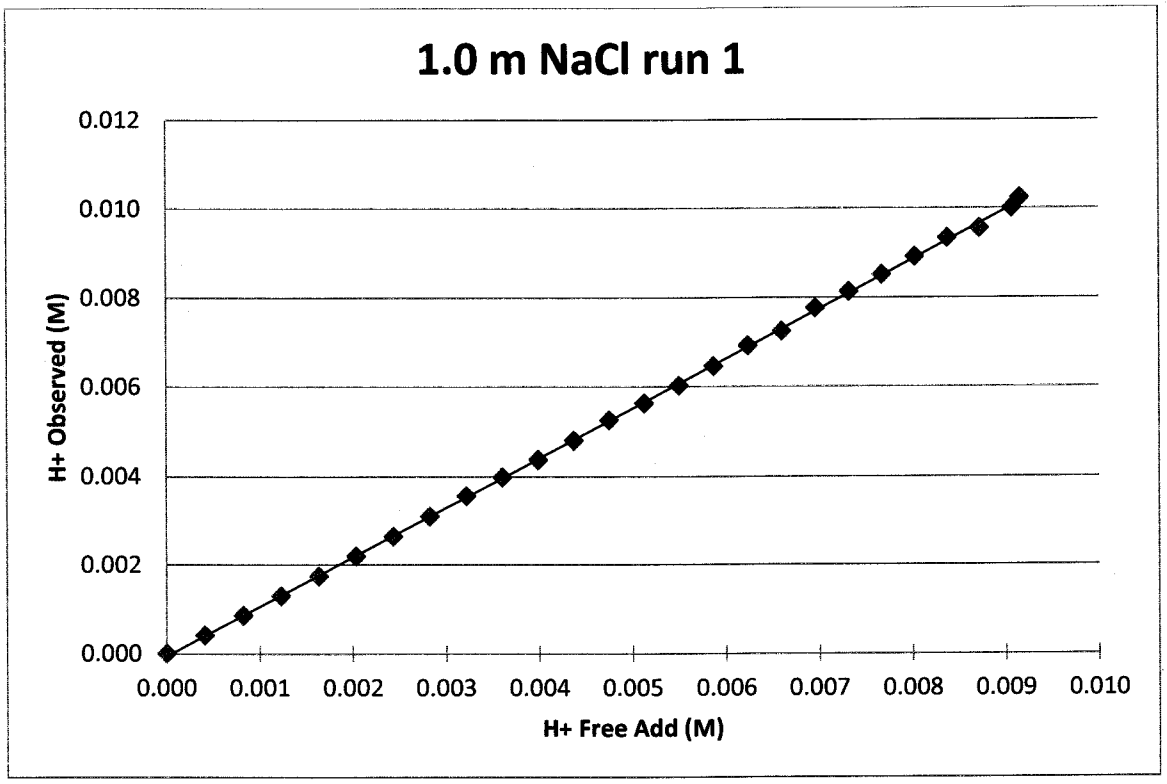
Type:	0.1 m NaCl with 0.1 M HCl
SN Reference	WIPP-Solubility-13 p. 14
Solution Reference:	WIPP-Solubility-8 p. 76
Brine Volume:	50.0 mL
pH Probe:	Corning Semi-Micro Combo
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.000	5.66	2.188E-06	0.000E+00
0.208	3.47	3.388E-04	4.143E-04
0.416	3.17	6.761E-04	8.251E-04
0.623	2.99	1.023E-03	1.231E-03
0.831	2.86	1.380E-03	1.635E-03
1.039	2.77	1.698E-03	2.036E-03
1.247	2.69	2.042E-03	2.433E-03
1.454	2.62	2.399E-03	2.826E-03
1.662	2.56	2.754E-03	3.217E-03
1.870	2.51	3.090E-03	3.605E-03
2.078	2.46	3.467E-03	3.990E-03
2.285	2.42	3.802E-03	4.370E-03
2.493	2.39	4.074E-03	4.749E-03
2.701	2.35	4.467E-03	5.125E-03
2.909	2.32	4.786E-03	5.498E-03
3.116	2.29	5.129E-03	5.866E-03
3.324	2.26	5.495E-03	6.234E-03
3.532	2.24	5.754E-03	6.598E-03
3.740	2.22	6.026E-03	6.959E-03
3.947	2.20	6.310E-03	7.316E-03
4.155	2.17	6.761E-03	7.672E-03
4.363	2.15	7.079E-03	8.026E-03
4.571	2.14	7.244E-03	8.376E-03
4.778	2.12	7.586E-03	8.722E-03
4.986	2.10	7.943E-03	9.068E-03
5.038	2.10	7.943E-03	9.154E-03



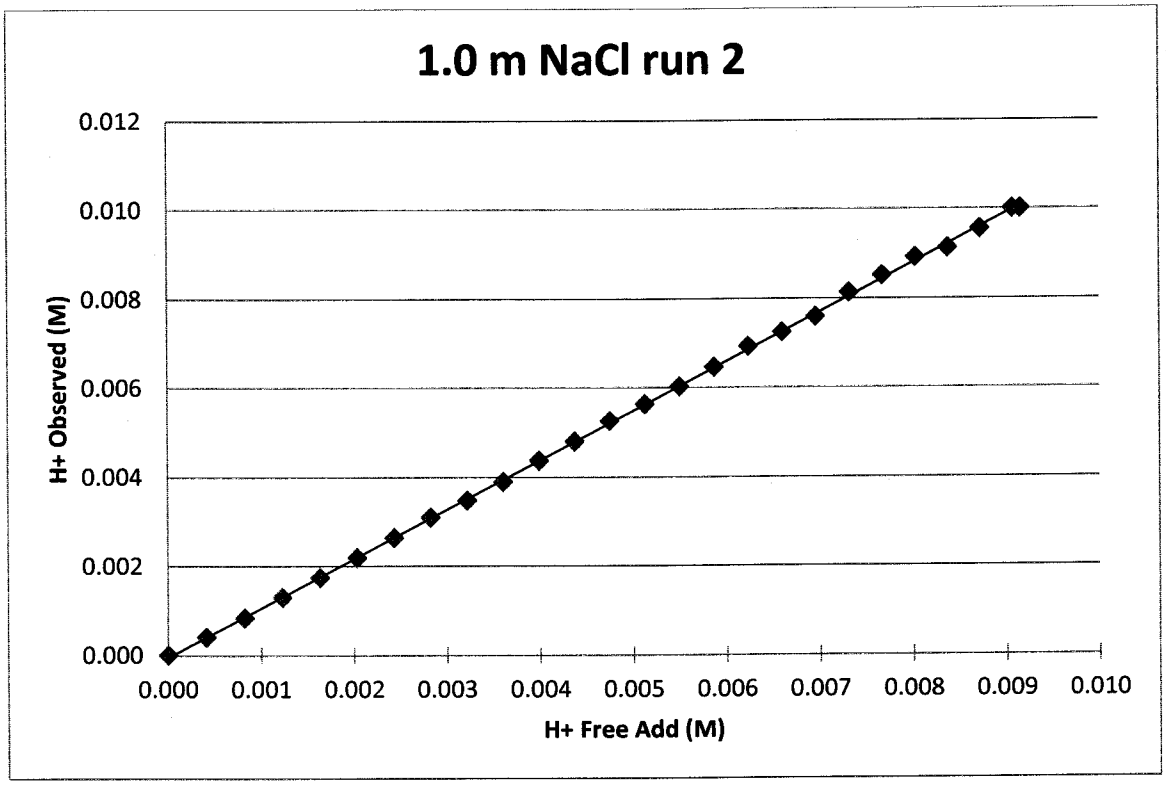
Type:	0.95 m NaCl with 0.1 M HCl
SN Reference	WIPP-Solubility-13 p. 14
Solution Reference:	WIPP-Solubility-8 p. 64 (see also WIPP-Solubility-8 Supplemental Binder 1, tab 11/9/10)
Brine Volume:	50.0 mL
pH Probe:	Corning Semi-Micro Combo
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.000	5.82	1.514E-06	0.000E+00
0.208	3.39	4.074E-04	4.143E-04
0.416	3.07	8.511E-04	8.251E-04
0.623	2.89	1.288E-03	1.231E-03
0.831	2.76	1.738E-03	1.635E-03
1.039	2.66	2.188E-03	2.036E-03
1.247	2.58	2.630E-03	2.433E-03
1.454	2.51	3.090E-03	2.826E-03
1.662	2.45	3.548E-03	3.217E-03
1.870	2.40	3.981E-03	3.605E-03
2.078	2.36	4.365E-03	3.990E-03
2.285	2.32	4.786E-03	4.370E-03
2.493	2.28	5.248E-03	4.749E-03
2.701	2.25	5.623E-03	5.125E-03
2.909	2.22	6.026E-03	5.498E-03
3.116	2.19	6.457E-03	5.866E-03
3.324	2.16	6.918E-03	6.234E-03
3.532	2.14	7.244E-03	6.598E-03
3.740	2.11	7.762E-03	6.959E-03
3.947	2.09	8.128E-03	7.316E-03
4.155	2.07	8.511E-03	7.672E-03
4.363	2.05	8.913E-03	8.026E-03
4.571	2.03	9.333E-03	8.376E-03
4.778	2.02	9.550E-03	8.722E-03
4.986	2.00	1.000E-02	9.068E-03
5.038	1.99	1.023E-02	9.154E-03



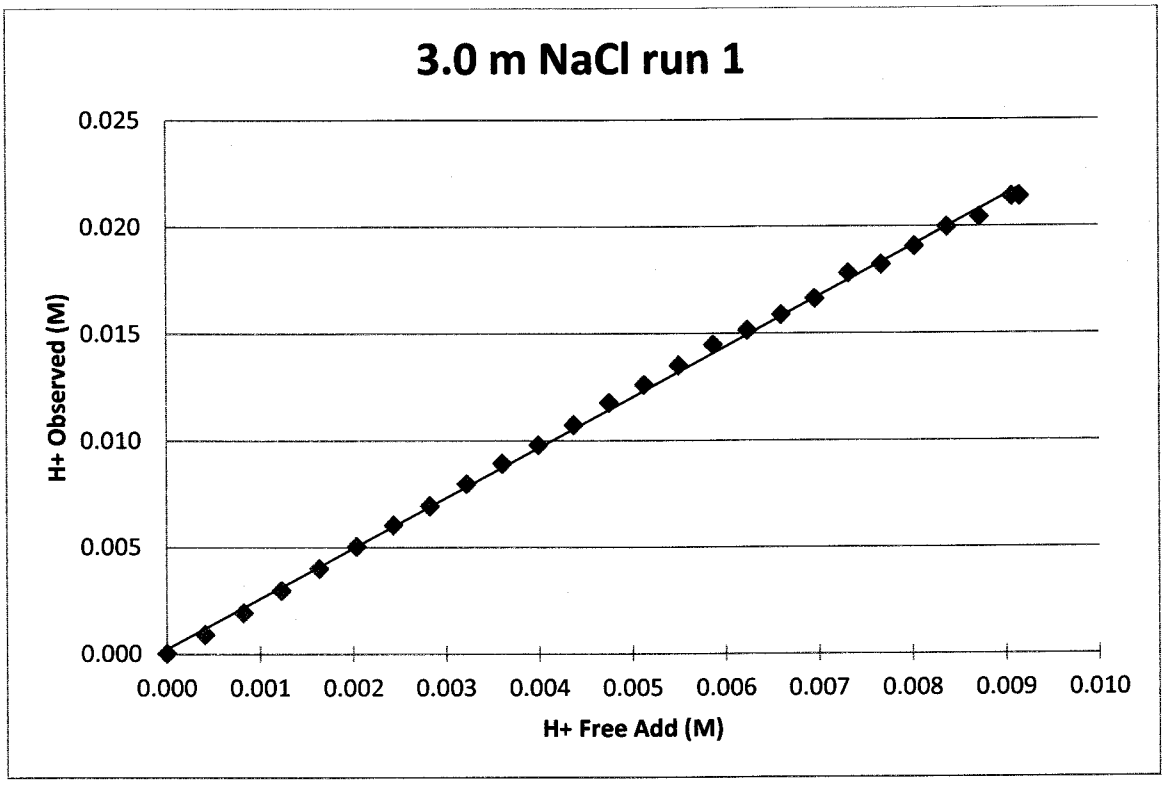
Type:	0.95 m NaCl with 0.1 M HCl
SN Reference	WIPP-Solubility-13 p. 14
Solution Reference:	WIPP-Solubility-8 p. 64 (see also WIPP-Solubility-8 Supplemental Binder 1, tab 11/9/10)
Brine Volume:	50.0 mL
pH Probe:	Corning Semi-Micro Combo
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.000	6.08	8.318E-07	0.000E+00
0.208	3.40	3.981E-04	4.143E-04
0.416	3.08	8.318E-04	8.251E-04
0.623	2.89	1.288E-03	1.231E-03
0.831	2.76	1.738E-03	1.635E-03
1.039	2.66	2.188E-03	2.036E-03
1.247	2.58	2.630E-03	2.433E-03
1.454	2.51	3.090E-03	2.826E-03
1.662	2.46	3.467E-03	3.217E-03
1.870	2.41	3.890E-03	3.605E-03
2.078	2.36	4.365E-03	3.990E-03
2.285	2.32	4.786E-03	4.370E-03
2.493	2.28	5.248E-03	4.749E-03
2.701	2.25	5.623E-03	5.125E-03
2.909	2.22	6.026E-03	5.498E-03
3.116	2.19	6.457E-03	5.866E-03
3.324	2.16	6.918E-03	6.234E-03
3.532	2.14	7.244E-03	6.598E-03
3.740	2.12	7.586E-03	6.959E-03
3.947	2.09	8.128E-03	7.316E-03
4.155	2.07	8.511E-03	7.672E-03
4.363	2.05	8.913E-03	8.026E-03
4.571	2.04	9.120E-03	8.376E-03
4.778	2.02	9.550E-03	8.722E-03
4.986	2.00	1.000E-02	9.068E-03
5.038	2.00	1.000E-02	9.154E-03



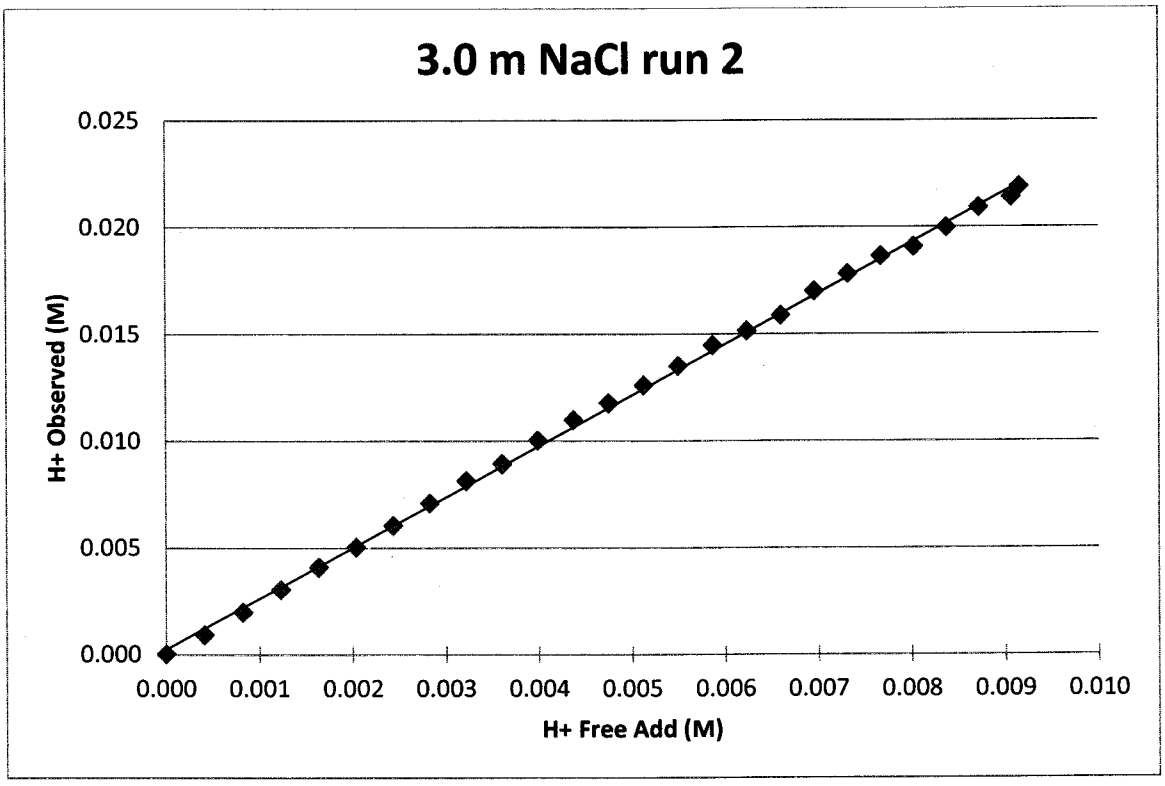
Type:	3.0 m NaCl with 0.1 M HCl
SN Reference	WIPP-Solubility-13 p. 15-16
Solution Reference:	WIPP-Solubility-8 p. 76
Brine Volume:	50.0 mL
pH Probe:	Corning Semi-Micro Combo
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.000	5.87	1.349E-06	0.000E+00
0.208	3.05	8.913E-04	4.143E-04
0.416	2.72	1.905E-03	8.251E-04
0.623	2.53	2.951E-03	1.231E-03
0.831	2.40	3.981E-03	1.635E-03
1.039	2.30	5.012E-03	2.036E-03
1.247	2.22	6.026E-03	2.433E-03
1.454	2.16	6.918E-03	2.826E-03
1.662	2.10	7.943E-03	3.217E-03
1.870	2.05	8.913E-03	3.605E-03
2.078	2.01	9.772E-03	3.990E-03
2.285	1.97	1.072E-02	4.370E-03
2.493	1.93	1.175E-02	4.749E-03
2.701	1.90	1.259E-02	5.125E-03
2.909	1.87	1.349E-02	5.498E-03
3.116	1.84	1.445E-02	5.866E-03
3.324	1.82	1.514E-02	6.234E-03
3.532	1.80	1.585E-02	6.598E-03
3.740	1.78	1.660E-02	6.959E-03
3.947	1.75	1.778E-02	7.316E-03
4.155	1.74	1.820E-02	7.672E-03
4.363	1.72	1.905E-02	8.026E-03
4.571	1.70	1.995E-02	8.376E-03
4.778	1.69	2.042E-02	8.722E-03
4.986	1.67	2.138E-02	9.068E-03
5.038	1.67	2.138E-02	9.154E-03



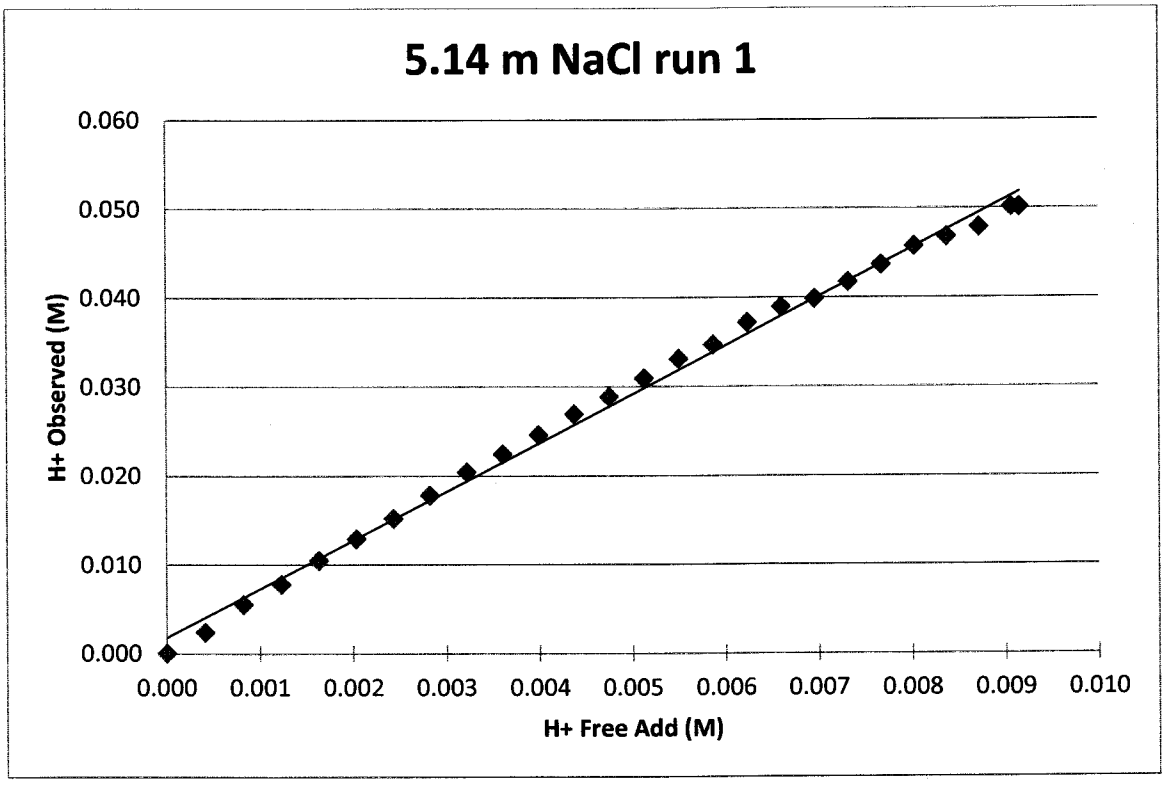
Type:	3.0 m NaCl with 0.1 M HCl
SN Reference	WIPP-Solubility-13 p. 15-16
Solution Reference:	WIPP-Solubility-8 p. 76
Brine Volume:	50.0 mL
pH Probe:	Corning Semi-Micro Combo
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.000	5.92	1.202E-06	0.000E+00
0.208	3.05	8.913E-04	4.143E-04
0.416	2.71	1.950E-03	8.251E-04
0.623	2.52	3.020E-03	1.231E-03
0.831	2.39	4.074E-03	1.635E-03
1.039	2.30	5.012E-03	2.036E-03
1.247	2.22	6.026E-03	2.433E-03
1.454	2.15	7.079E-03	2.826E-03
1.662	2.09	8.128E-03	3.217E-03
1.870	2.05	8.913E-03	3.605E-03
2.078	2.00	1.000E-02	3.990E-03
2.285	1.96	1.096E-02	4.370E-03
2.493	1.93	1.175E-02	4.749E-03
2.701	1.90	1.259E-02	5.125E-03
2.909	1.87	1.349E-02	5.498E-03
3.116	1.84	1.445E-02	5.866E-03
3.324	1.82	1.514E-02	6.234E-03
3.532	1.80	1.585E-02	6.598E-03
3.740	1.77	1.698E-02	6.959E-03
3.947	1.75	1.778E-02	7.316E-03
4.155	1.73	1.862E-02	7.672E-03
4.363	1.72	1.905E-02	8.026E-03
4.571	1.70	1.995E-02	8.376E-03
4.778	1.68	2.089E-02	8.722E-03
4.986	1.67	2.138E-02	9.068E-03
5.038	1.66	2.188E-02	9.154E-03



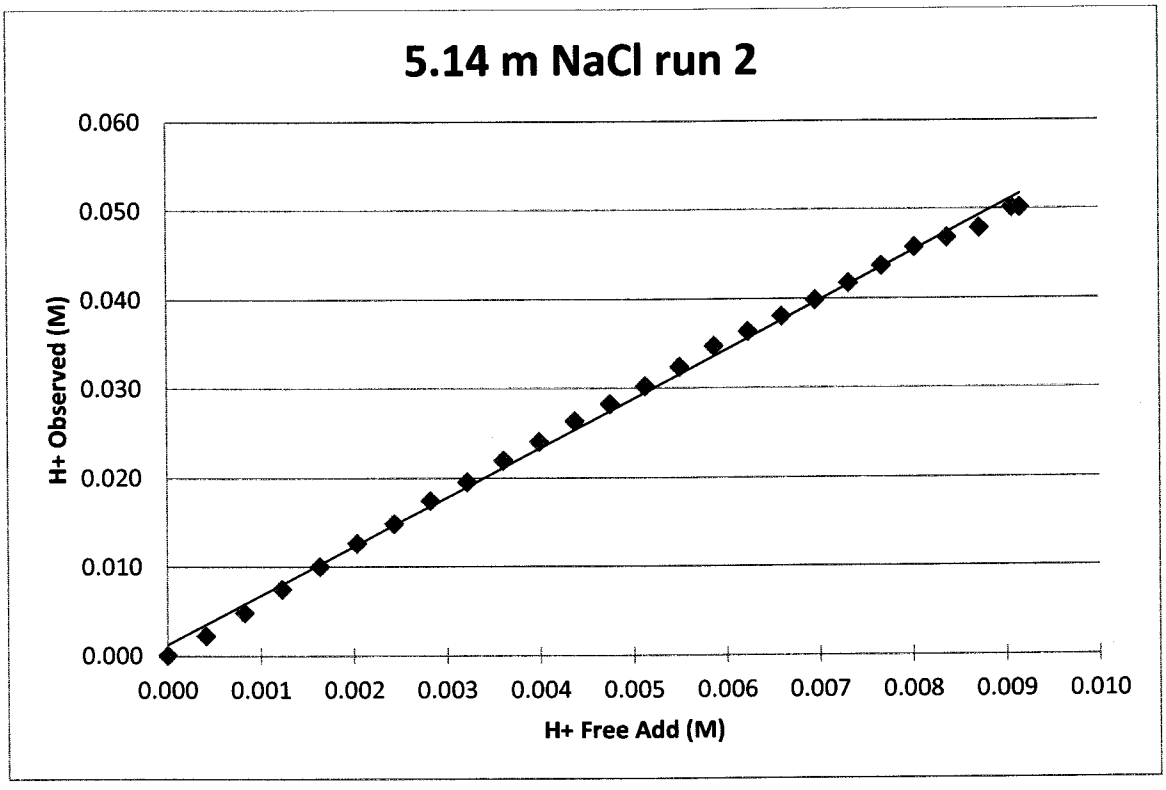
Type:	5.14 m NaCl with 0.1 M HCl
SN Reference	WIPP-Solubility-13 p. 15-16
Solution Reference:	WIPP-Solubility-8 p. 64
Brine Volume:	50.0 mL
pH Probe:	Corning Semi-Micro Combo
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.000	5.51	3.090E-06	0.000E+00
0.208	2.63	2.344E-03	4.143E-04
0.416	2.26	5.495E-03	8.251E-04
0.623	2.11	7.762E-03	1.231E-03
0.831	1.98	1.047E-02	1.635E-03
1.039	1.89	1.288E-02	2.036E-03
1.247	1.82	1.514E-02	2.433E-03
1.454	1.75	1.778E-02	2.826E-03
1.662	1.69	2.042E-02	3.217E-03
1.870	1.65	2.239E-02	3.605E-03
2.078	1.61	2.455E-02	3.990E-03
2.285	1.57	2.692E-02	4.370E-03
2.493	1.54	2.884E-02	4.749E-03
2.701	1.51	3.090E-02	5.125E-03
2.909	1.48	3.311E-02	5.498E-03
3.116	1.46	3.467E-02	5.866E-03
3.324	1.43	3.715E-02	6.234E-03
3.532	1.41	3.890E-02	6.598E-03
3.740	1.40	3.981E-02	6.959E-03
3.947	1.38	4.169E-02	7.316E-03
4.155	1.36	4.365E-02	7.672E-03
4.363	1.34	4.571E-02	8.026E-03
4.571	1.33	4.677E-02	8.376E-03
4.778	1.32	4.786E-02	8.722E-03
4.986	1.30	5.012E-02	9.068E-03
5.038	1.30	5.012E-02	9.154E-03



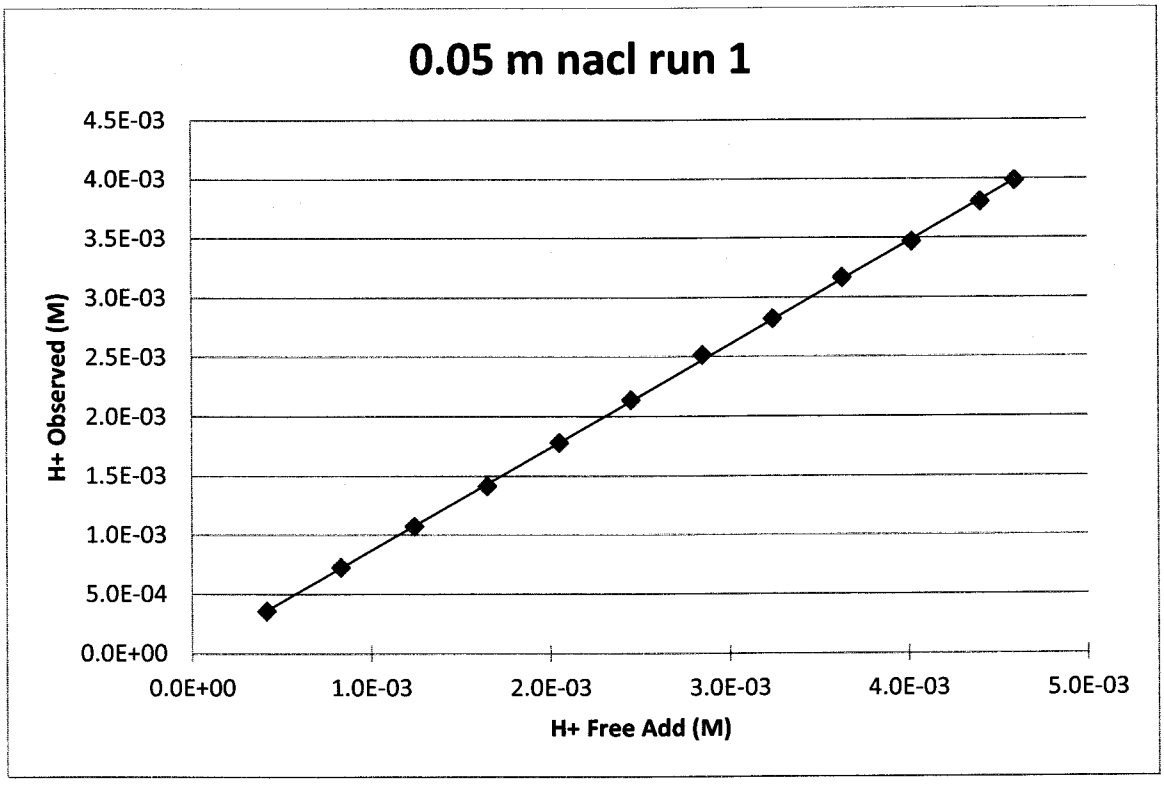
Type:	5.14 m NaCl with 0.1 M HCl
SN Reference	WIPP-Solubility-13 p. 15-16
Solution Reference:	WIPP-Solubility-8 p. 64
Brine Volume:	50.0 mL
pH Probe:	Corning Semi-Micro Combo
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.000	5.49	3.236E-06	0.000E+00
0.208	2.66	2.188E-03	4.143E-04
0.416	2.32	4.786E-03	8.251E-04
0.623	2.13	7.413E-03	1.231E-03
0.831	2.00	1.000E-02	1.635E-03
1.039	1.90	1.259E-02	2.036E-03
1.247	1.83	1.479E-02	2.433E-03
1.454	1.76	1.738E-02	2.826E-03
1.662	1.71	1.950E-02	3.217E-03
1.870	1.66	2.188E-02	3.605E-03
2.078	1.62	2.399E-02	3.990E-03
2.285	1.58	2.630E-02	4.370E-03
2.493	1.55	2.818E-02	4.749E-03
2.701	1.52	3.020E-02	5.125E-03
2.909	1.49	3.236E-02	5.498E-03
3.116	1.46	3.467E-02	5.866E-03
3.324	1.44	3.631E-02	6.234E-03
3.532	1.42	3.802E-02	6.598E-03
3.740	1.40	3.981E-02	6.959E-03
3.947	1.38	4.169E-02	7.316E-03
4.155	1.36	4.365E-02	7.672E-03
4.363	1.34	4.571E-02	8.026E-03
4.571	1.33	4.677E-02	8.376E-03
4.778	1.32	4.786E-02	8.722E-03
4.986	1.30	5.012E-02	9.068E-03
5.038	1.30	5.012E-02	9.154E-03



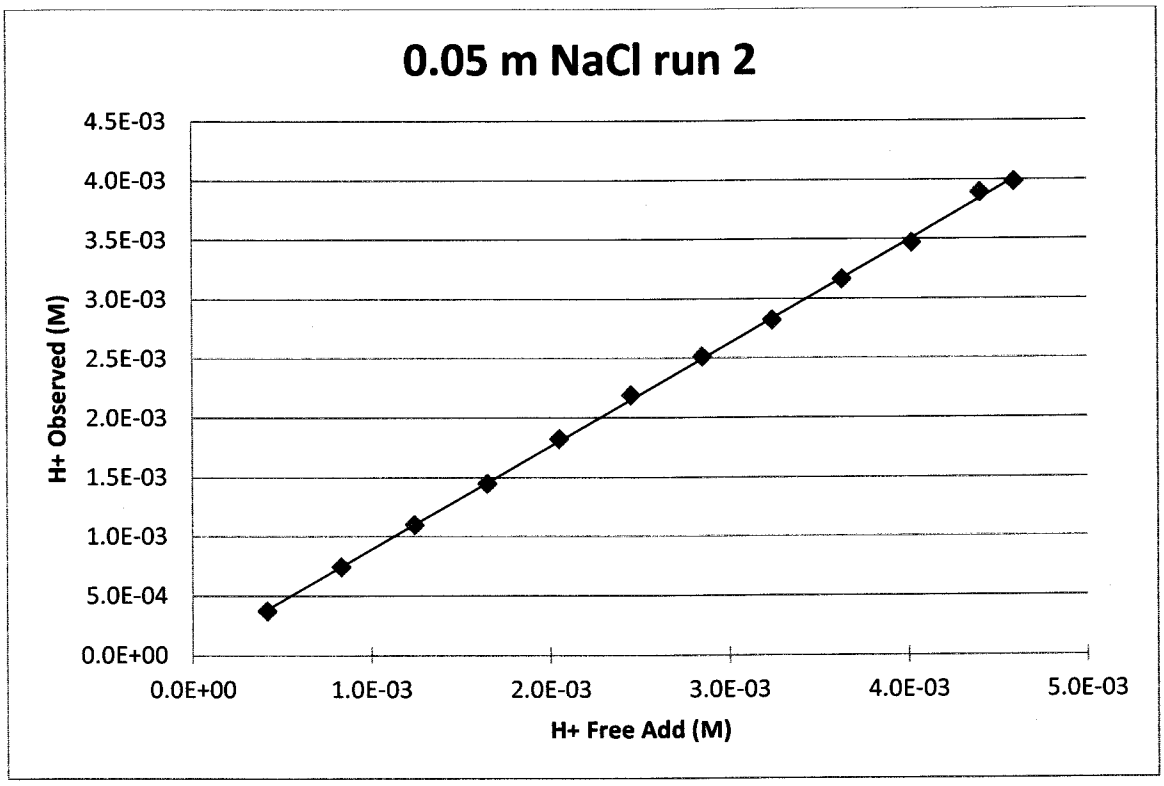
Type:	0.05 m NaCl with 0.1 M HCl
SN Reference	WIPP-Solubility-8 p. 75-77
Solution Reference:	WIPP-Solubility-8 p. 75-77
Brine Volume:	50.0 mL
pH Probe:	Ross Sure-Flow Combination
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.000	5.74	1.820E-06	0.000E+00
0.209	3.45	3.548E-04	3.932E-04
0.419	3.14	7.244E-04	7.849E-04
0.628	2.97	1.072E-03	1.172E-03
0.838	2.85	1.413E-03	1.557E-03
1.047	2.75	1.778E-03	1.937E-03
1.256	2.67	2.138E-03	2.314E-03
1.466	2.60	2.512E-03	2.690E-03
1.675	2.55	2.818E-03	3.062E-03
1.884	2.50	3.162E-03	3.430E-03
2.094	2.46	3.467E-03	3.797E-03
2.303	2.42	3.802E-03	4.159E-03
2.408	2.40	3.981E-03	4.340E-03



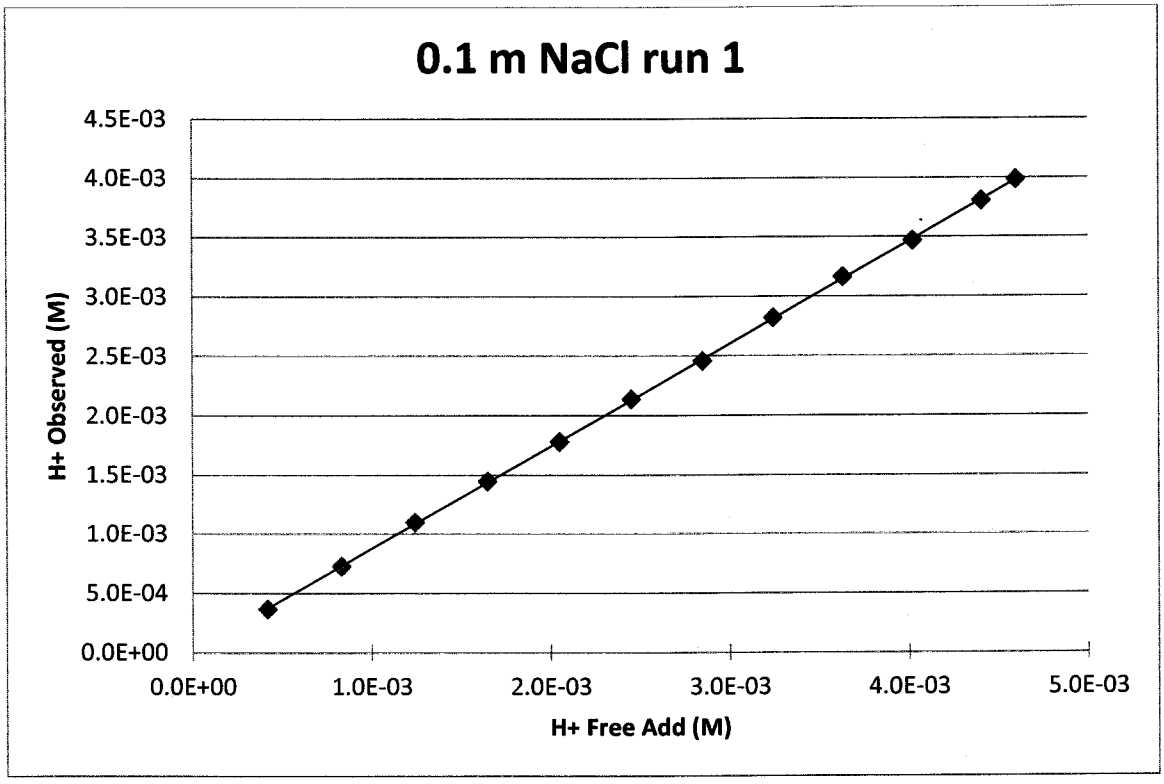
Type:	0.05 m NaCl with 0.1 M HCl
SN Reference	WIPP-Solubility-8 p. 75-77
Solution Reference:	WIPP-Solubility-8 p. 75-77
Brine Volume:	50.0 mL
pH Probe:	Ross Sure-Flow Combination
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.000	5.67	2.138E-06	0.000E+00
0.209	3.43	3.715E-04	4.163E-04
0.419	3.13	7.413E-04	8.310E-04
0.628	2.96	1.096E-03	1.240E-03
0.838	2.84	1.445E-03	1.648E-03
1.047	2.74	1.820E-03	2.051E-03
1.256	2.66	2.188E-03	2.450E-03
1.466	2.60	2.512E-03	2.848E-03
1.675	2.55	2.818E-03	3.241E-03
1.884	2.50	3.162E-03	3.631E-03
2.094	2.46	3.467E-03	4.020E-03
2.303	2.41	3.890E-03	4.403E-03
2.408	2.40	3.981E-03	4.595E-03



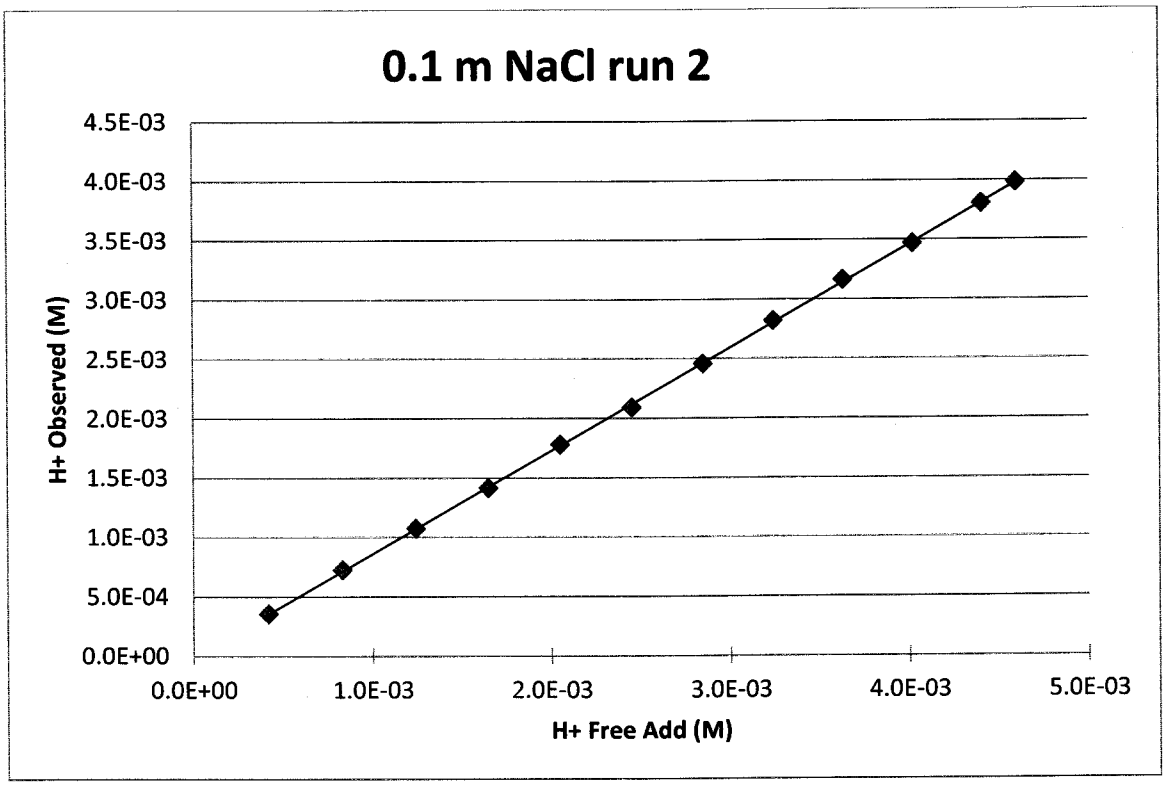
Type:	0.1 m NaCl with 0.1 M HCl
SN Reference	WIPP-Solubility-8 p. 75-77
Solution Reference:	WIPP-Solubility-8 p. 75-77
Brine Volume:	50.0 mL
pH Probe:	Ross Sure-Flow Combination
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.000	5.79	1.622E-06	0.000E+00
0.209	3.44	3.631E-04	4.163E-04
0.419	3.14	7.244E-04	8.310E-04
0.628	2.96	1.096E-03	1.240E-03
0.838	2.84	1.445E-03	1.648E-03
1.047	2.75	1.778E-03	2.051E-03
1.256	2.67	2.138E-03	2.450E-03
1.466	2.61	2.455E-03	2.848E-03
1.675	2.55	2.818E-03	3.241E-03
1.884	2.50	3.162E-03	3.631E-03
2.094	2.46	3.467E-03	4.020E-03
2.303	2.42	3.802E-03	4.403E-03
2.408	2.40	3.981E-03	4.595E-03



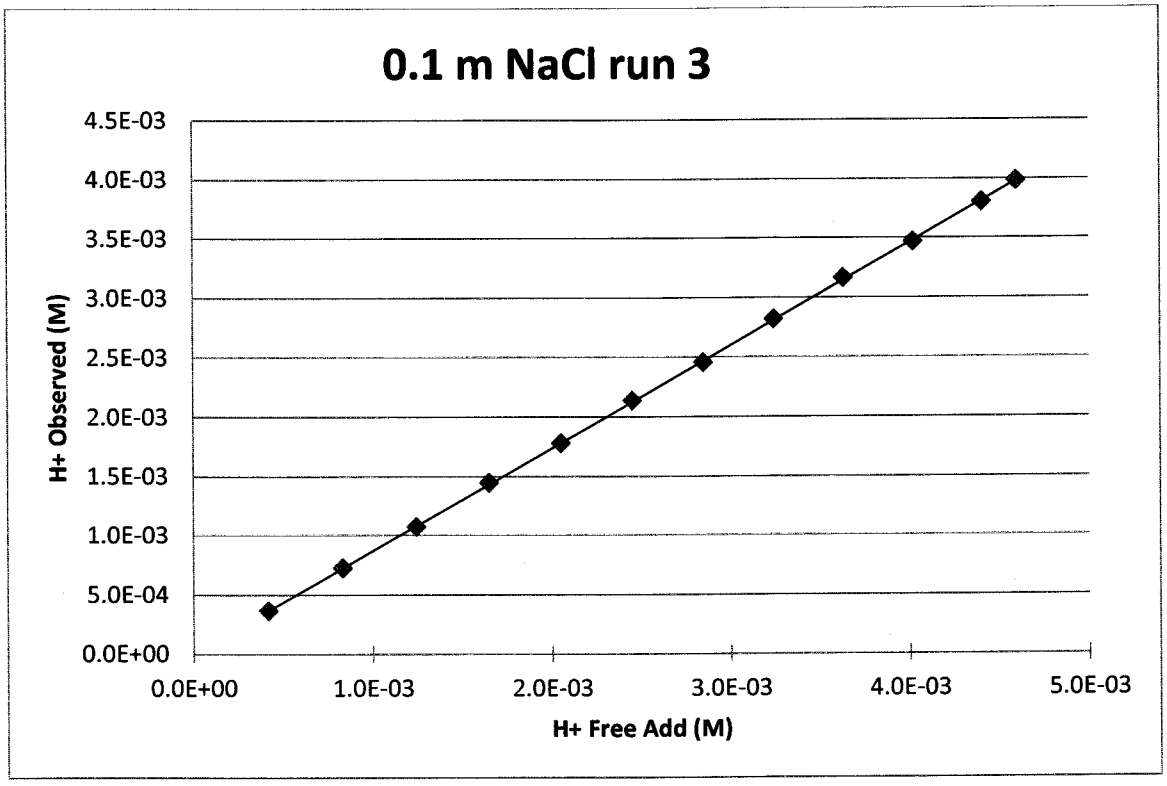
Type:	0.1 m NaCl with 0.1 M HCl
SN Reference	WIPP-Solubility-8 p. 75-77
Solution Reference:	WIPP-Solubility-8 p. 75-77
Brine Volume:	50.0 mL
pH Probe:	Ross Sure-Flow Combination
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.000	5.86	1.380E-06	0.000E+00
0.209	3.45	3.548E-04	4.163E-04
0.419	3.14	7.244E-04	8.310E-04
0.628	2.97	1.072E-03	1.240E-03
0.838	2.85	1.413E-03	1.648E-03
1.047	2.75	1.778E-03	2.051E-03
1.256	2.68	2.089E-03	2.450E-03
1.466	2.61	2.455E-03	2.848E-03
1.675	2.55	2.818E-03	3.241E-03
1.884	2.50	3.162E-03	3.631E-03
2.094	2.46	3.467E-03	4.020E-03
2.303	2.42	3.802E-03	4.403E-03
2.408	2.40	3.981E-03	4.595E-03



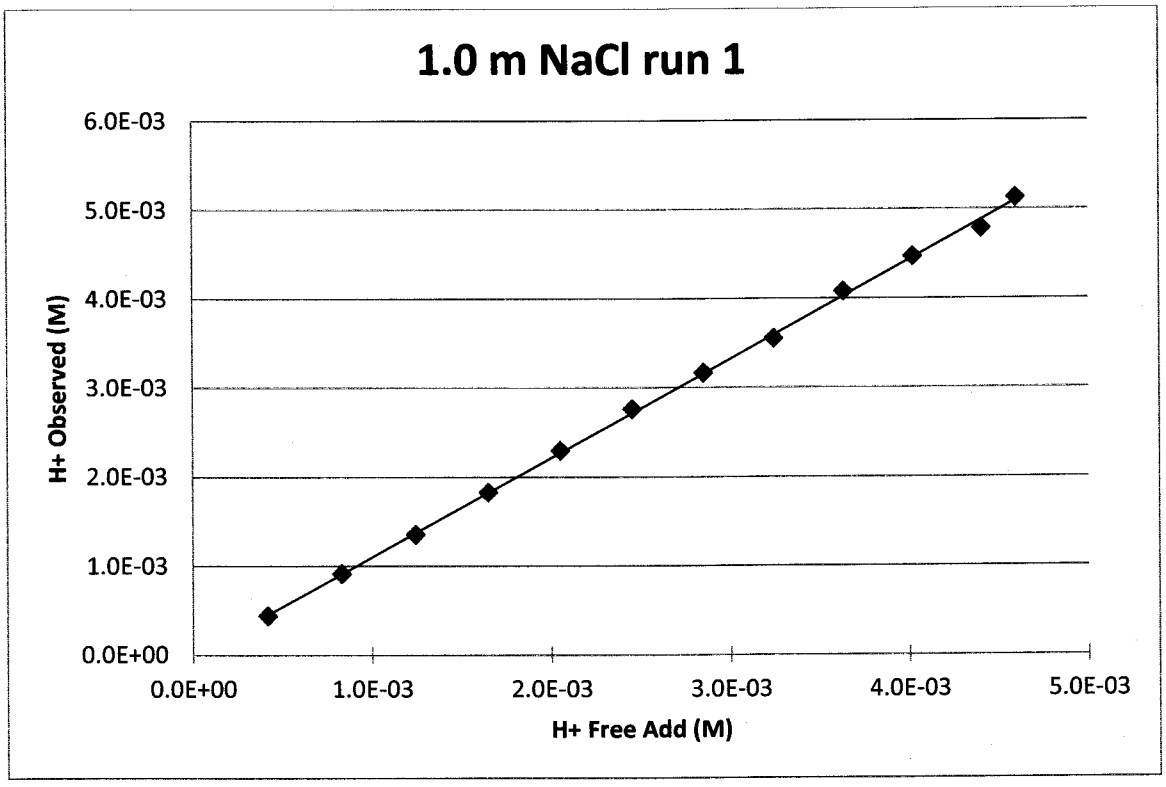
Type:	0.1 m NaCl with 0.1 M HCl
SN Reference	WIPP-Solubility-8 p. 75-77
Solution Reference:	WIPP-Solubility-8 p. 75-77
Brine Volume:	50.0 mL
pH Probe:	Ross Sure-Flow Combination
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.000	5.79	1.622E-06	0.000E+00
0.209	3.44	3.631E-04	4.163E-04
0.419	3.14	7.244E-04	8.310E-04
0.628	2.97	1.072E-03	1.240E-03
0.838	2.84	1.445E-03	1.648E-03
1.047	2.75	1.778E-03	2.051E-03
1.256	2.67	2.138E-03	2.450E-03
1.466	2.61	2.455E-03	2.848E-03
1.675	2.55	2.818E-03	3.241E-03
1.884	2.50	3.162E-03	3.631E-03
2.094	2.46	3.467E-03	4.020E-03
2.303	2.42	3.802E-03	4.403E-03
2.408	2.40	3.981E-03	4.595E-03



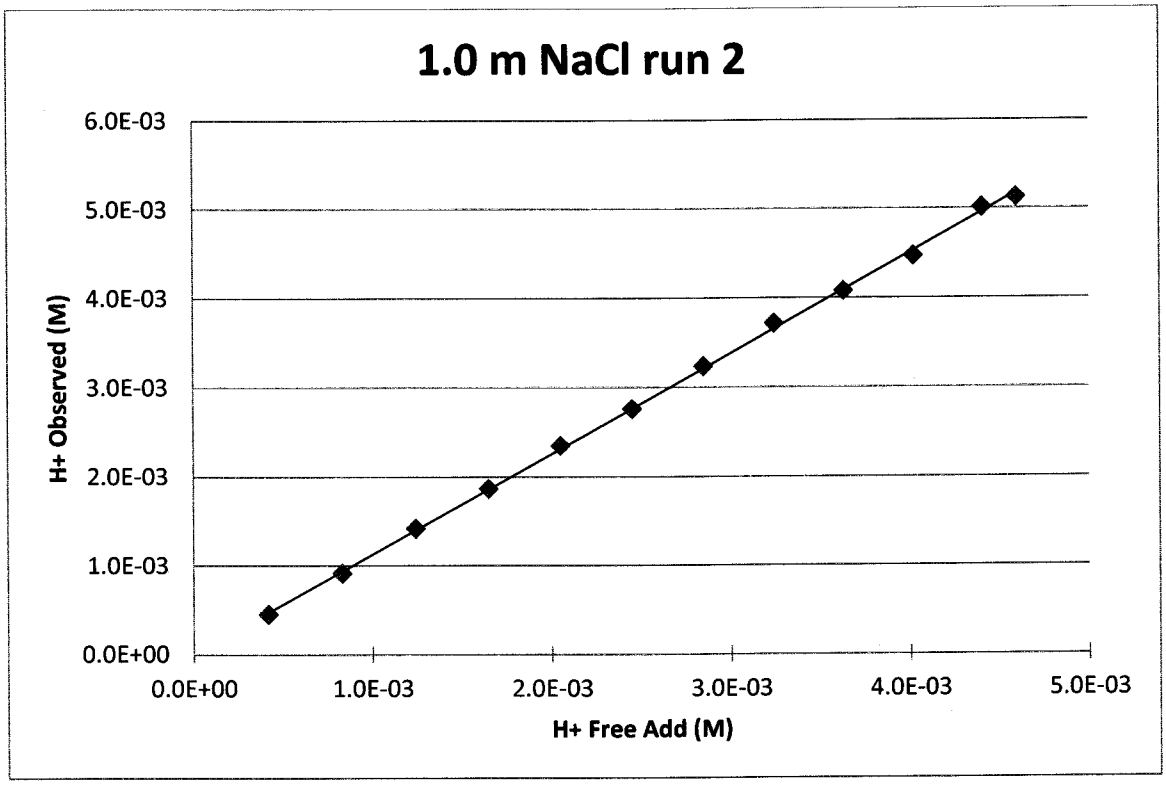
Type:	0.95 m NaCl with 0.1 M HCl
SN Reference	WIPP-Solubility-8 p. 75-77
Solution Reference:	WIPP-Solubility-8 p. 64 (see also WIPP-Solubility-8 Supplemental Binder 1, tab 11/9/10)
Brine Volume:	50.0 mL
pH Probe:	Ross Sure-Flow Combination
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.000	6.31	4.898E-07	0.000E+00
0.209	3.36	4.365E-04	4.163E-04
0.419	3.04	9.120E-04	8.310E-04
0.628	2.87	1.349E-03	1.240E-03
0.838	2.74	1.820E-03	1.648E-03
1.047	2.64	2.291E-03	2.051E-03
1.256	2.56	2.754E-03	2.450E-03
1.466	2.5	3.162E-03	2.848E-03
1.675	2.45	3.548E-03	3.241E-03
1.884	2.39	4.074E-03	3.631E-03
2.094	2.35	4.467E-03	4.020E-03
2.303	2.32	4.786E-03	4.403E-03
2.408	2.29	5.129E-03	4.595E-03



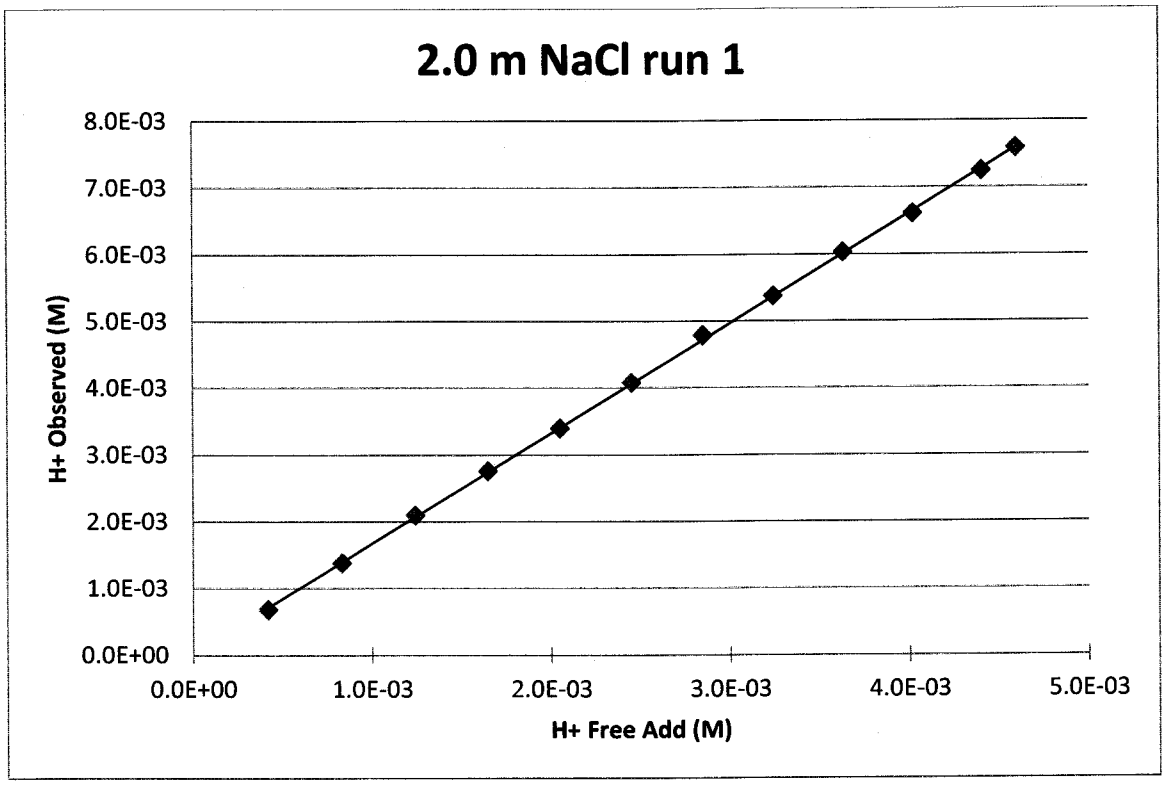
Type:	0.95 m NaCl with 0.1 M HCl
SN Reference	WIPP-Solubility-8 p. 75-77
Solution Reference:	WIPP-Solubility-8 p. 64 (see also WIPP-Solubility-8 Supplemental Binder 1, tab 11/9/10)
Brine Volume:	50.0 mL
pH Probe:	Ross Sure-Flow Combination
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.000	6.30	5.012E-07	0.000E+00
0.209	3.35	4.467E-04	4.163E-04
0.419	3.04	9.120E-04	8.310E-04
0.628	2.85	1.413E-03	1.240E-03
0.838	2.73	1.862E-03	1.648E-03
1.047	2.63	2.344E-03	2.051E-03
1.256	2.56	2.754E-03	2.450E-03
1.466	2.49	3.236E-03	2.848E-03
1.675	2.43	3.715E-03	3.241E-03
1.884	2.39	4.074E-03	3.631E-03
2.094	2.35	4.467E-03	4.020E-03
2.303	2.30	5.012E-03	4.403E-03
2.408	2.29	5.129E-03	4.595E-03



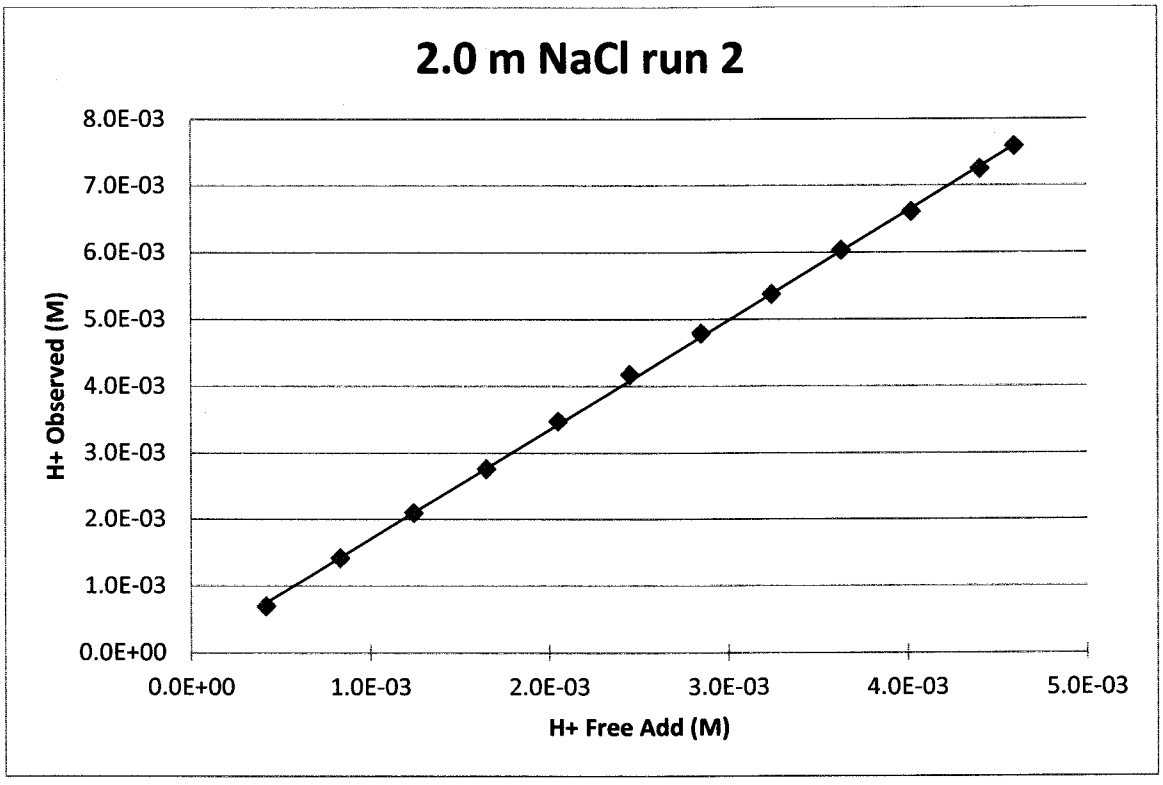
Type:	2.0 m NaCl with 0.1 M HCl
SN Reference	WIPP-Solubility-8 p. 75-77
Solution Reference:	WIPP-Solubility-8 p. 75-77
Brine Volume:	50.0 mL
pH Probe:	Ross Sure-Flow Combination
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.000	7.08	8.318E-08	0.000E+00
0.209	3.17	6.761E-04	4.163E-04
0.419	2.86	1.380E-03	8.310E-04
0.628	2.68	2.089E-03	1.240E-03
0.838	2.56	2.754E-03	1.648E-03
1.047	2.47	3.388E-03	2.051E-03
1.256	2.39	4.074E-03	2.450E-03
1.466	2.32	4.786E-03	2.848E-03
1.675	2.27	5.370E-03	3.241E-03
1.884	2.22	6.026E-03	3.631E-03
2.094	2.18	6.607E-03	4.020E-03
2.303	2.14	7.244E-03	4.403E-03
2.408	2.12	7.586E-03	4.595E-03



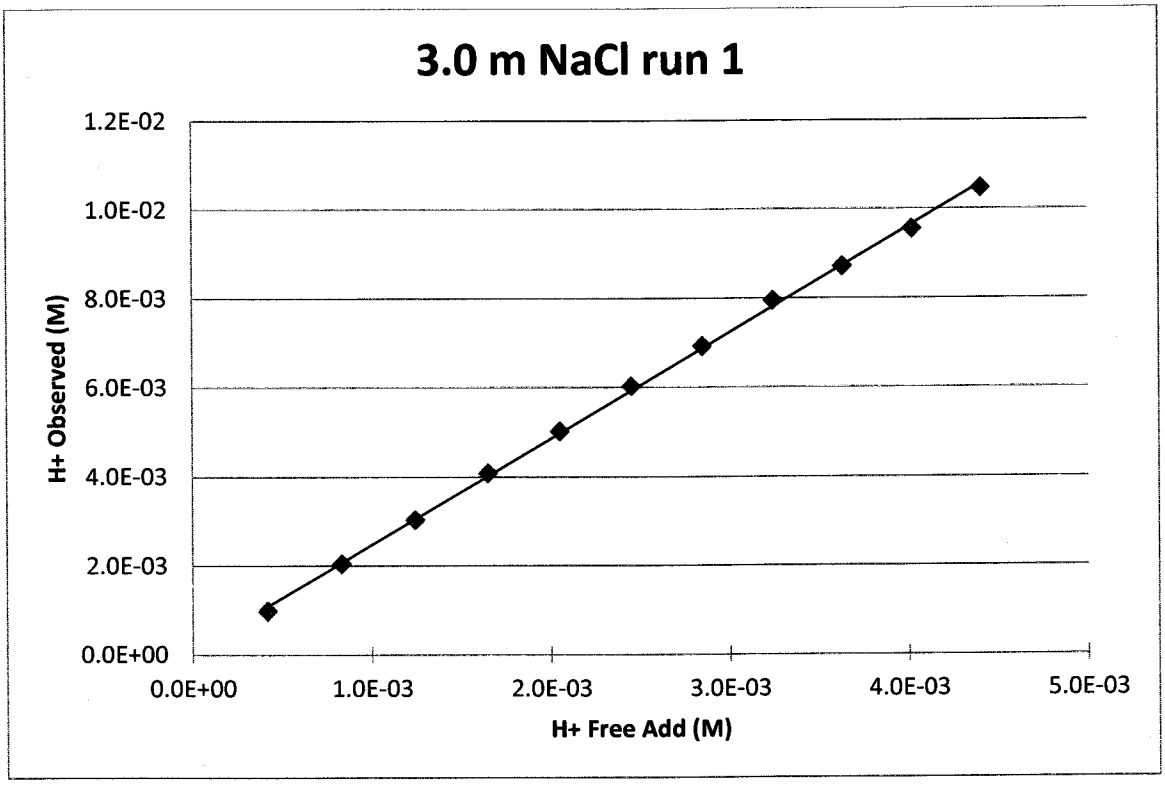
Type:	2.0 m NaCl with 0.1 M HCl
SN Reference	WIPP-Solubility-8 p. 75-77
Solution Reference:	WIPP-Solubility-8 p. 75-77
Brine Volume:	50.0 mL
pH Probe:	Ross Sure-Flow Combination
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.000	7.38	4.169E-08	0.000E+00
0.209	3.16	6.918E-04	4.163E-04
0.419	2.85	1.413E-03	8.310E-04
0.628	2.68	2.089E-03	1.240E-03
0.838	2.56	2.754E-03	1.648E-03
1.047	2.46	3.467E-03	2.051E-03
1.256	2.38	4.169E-03	2.450E-03
1.466	2.32	4.786E-03	2.848E-03
1.675	2.27	5.370E-03	3.241E-03
1.884	2.22	6.026E-03	3.631E-03
2.094	2.18	6.607E-03	4.020E-03
2.303	2.14	7.244E-03	4.403E-03
2.408	2.12	7.586E-03	4.595E-03



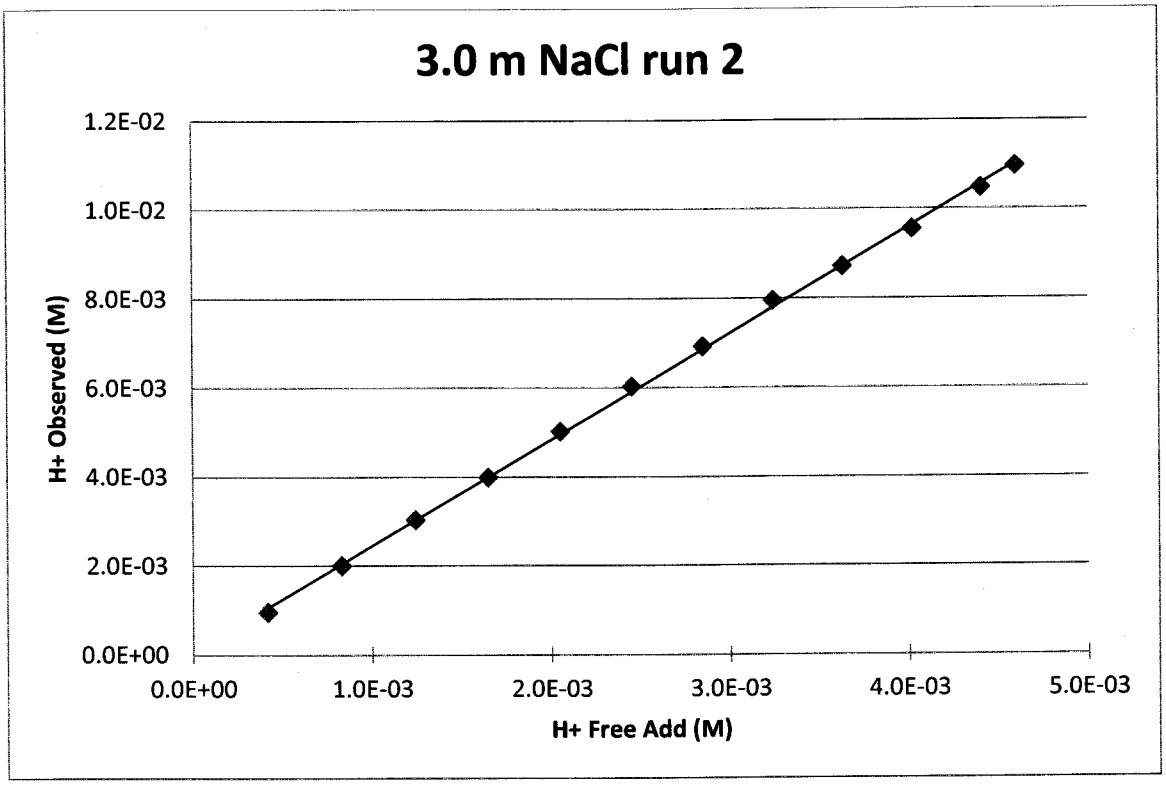
Type:	3.0 m NaCl with 0.1 M HCl
SN Reference	WIPP-Solubility-8 p. 75-77
Solution Reference:	WIPP-Solubility-8 p. 75-77
Brine Volume:	50.0 mL
pH Probe:	Ross Sure-Flow Combination
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.000	7.90	1.259E-08	0.000E+00
0.209	3.01	9.772E-04	4.163E-04
0.419	2.69	2.042E-03	8.310E-04
0.628	2.52	3.020E-03	1.240E-03
0.838	2.39	4.074E-03	1.648E-03
1.047	2.30	5.012E-03	2.051E-03
1.256	2.22	6.026E-03	2.450E-03
1.466	2.16	6.918E-03	2.848E-03
1.675	2.10	7.943E-03	3.241E-03
1.884	2.06	8.710E-03	3.631E-03
2.094	2.02	9.550E-03	4.020E-03
2.303	1.98	1.047E-02	4.403E-03



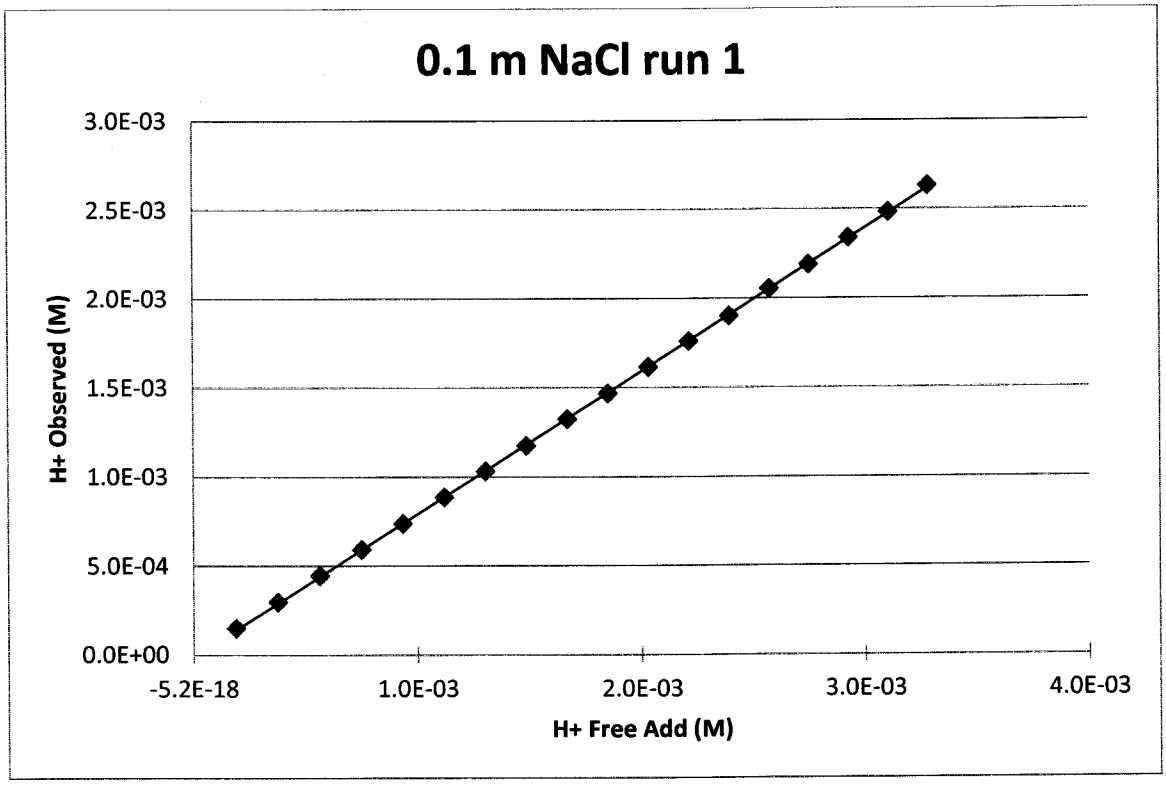
Type:	3.0 m NaCl with 0.1 M HCl
SN Reference	WIPP-Solubility-8 p. 75-77
Solution Reference:	WIPP-Solubility-8 p. 75-77
Brine Volume:	50.0 mL
pH Probe:	Ross Sure-Flow Combination
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.000	7.64	2.291E-08	0.000E+00
0.209	3.02	9.550E-04	4.163E-04
0.419	2.70	1.995E-03	8.310E-04
0.628	2.52	3.020E-03	1.240E-03
0.838	2.40	3.981E-03	1.648E-03
1.047	2.30	5.012E-03	2.051E-03
1.256	2.22	6.026E-03	2.450E-03
1.466	2.16	6.918E-03	2.848E-03
1.675	2.10	7.943E-03	3.241E-03
1.884	2.06	8.710E-03	3.631E-03
2.094	2.02	9.550E-03	4.020E-03
2.303	1.98	1.047E-02	4.403E-03
2.408	1.96	1.096E-02	4.595E-03



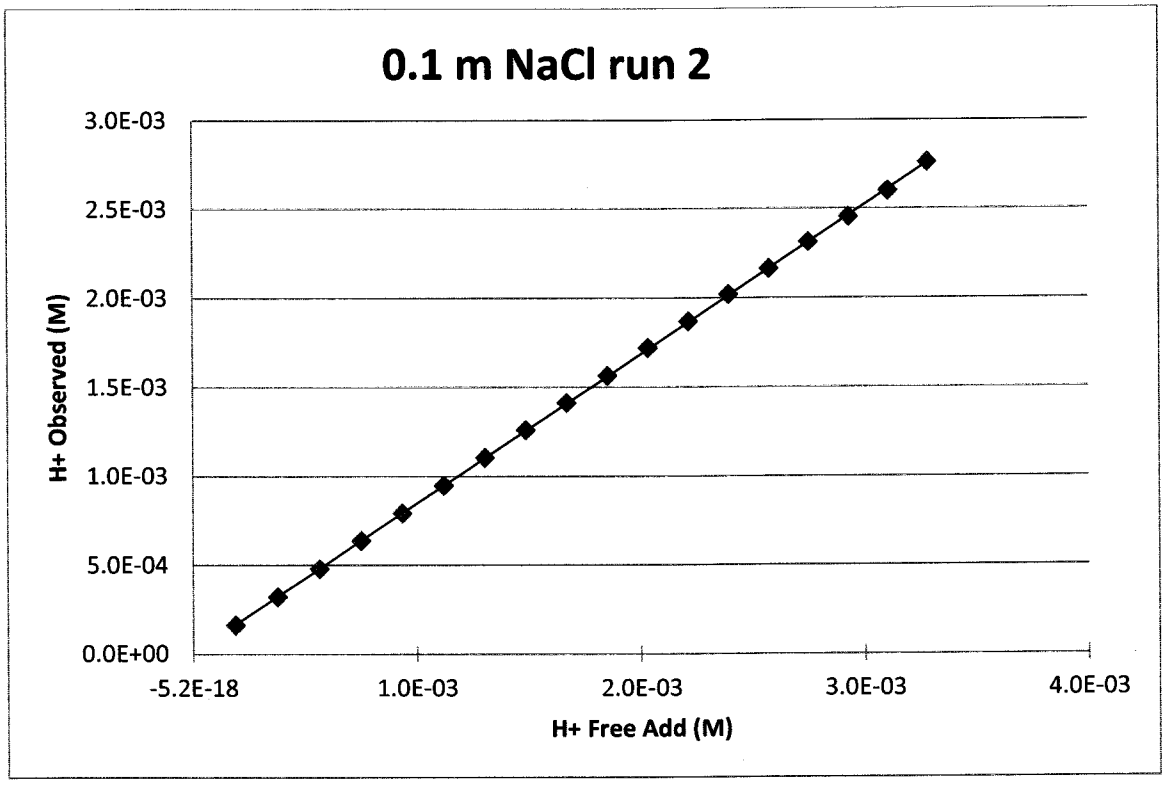
Type:	0.1 m NaCl with 0.1 M HCl
SN Reference	WIPP-Solubility-8 p. 12-13
Solution Reference:	WIPP-Solubility-6 p. 80
Brine Volume:	50.0 mL
pH Probe:	Mettler-Toledo DG111-SC
Titrant Actual M	0.09445 M HCl
Titrant Reference:	WIPP-Solubility-6 p. 75-76

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.00	5.508	3.105E-06	0.000E+00
0.10	3.830	1.479E-04	1.885E-04
0.20	3.529	2.958E-04	3.763E-04
0.30	3.353	4.436E-04	5.633E-04
0.40	3.229	5.902E-04	7.496E-04
0.50	3.133	7.362E-04	9.351E-04
0.60	3.054	8.831E-04	1.120E-03
0.70	2.987	1.030E-03	1.304E-03
0.80	2.931	1.172E-03	1.487E-03
0.90	2.879	1.321E-03	1.670E-03
1.00	2.834	1.466E-03	1.852E-03
1.10	2.792	1.614E-03	2.033E-03
1.20	2.755	1.758E-03	2.214E-03
1.30	2.721	1.901E-03	2.393E-03
1.40	2.688	2.051E-03	2.573E-03
1.50	2.660	2.188E-03	2.751E-03
1.60	2.631	2.339E-03	2.929E-03
1.70	2.605	2.483E-03	3.106E-03
1.80	2.580	2.630E-03	3.282E-03



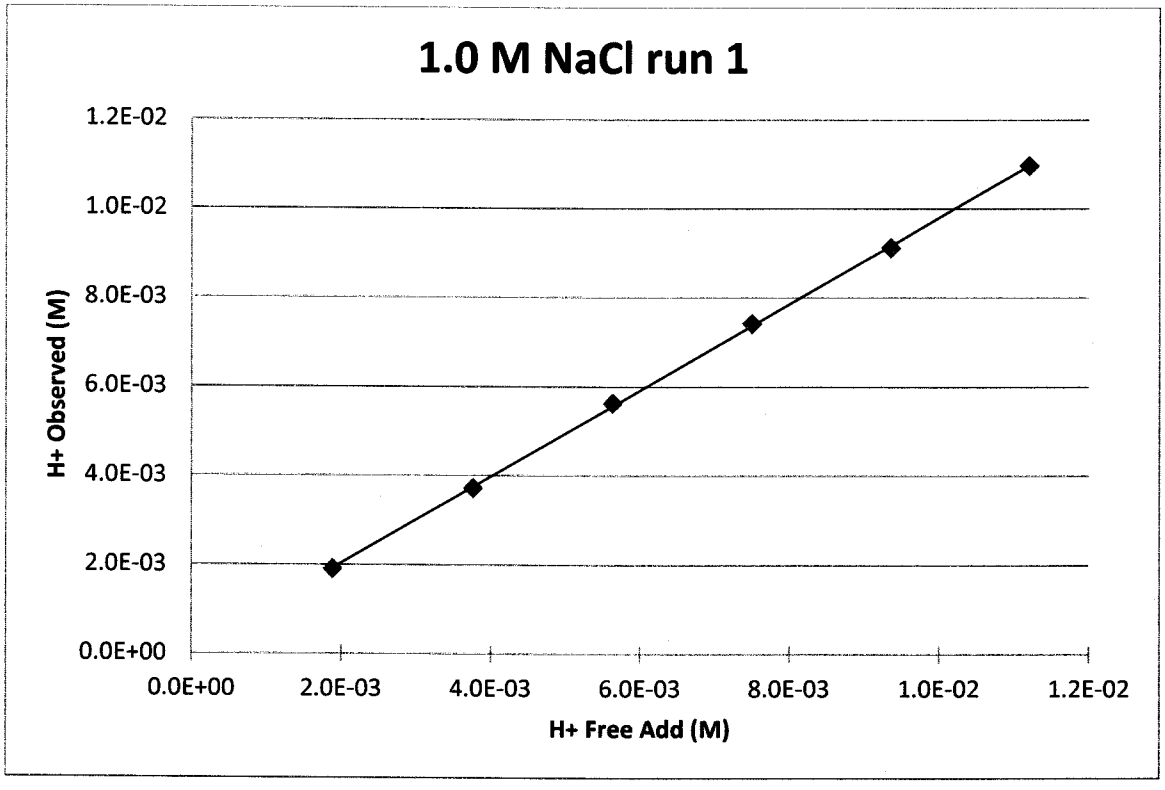
Type:	0.1 m NaCl with 0.1 M HCl
SN Reference	WIPP-Solubility-8 p. 12-13
Solution Reference:	WIPP-Solubility-6 p. 80
Brine Volume:	50.0 mL
pH Probe:	Mettler-Toledo DG111-SC
Titrant Actual M	0.09445 M HCl
Titrant Reference:	WIPP-Solubility-6 p. 75-76

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.00	5.435	3.673E-06	0.000E+00
0.10	3.796	1.600E-04	1.885E-04
0.20	3.497	3.184E-04	3.763E-04
0.30	3.320	4.786E-04	5.633E-04
0.40	3.198	6.339E-04	7.496E-04
0.50	3.103	7.889E-04	9.351E-04
0.60	3.025	9.441E-04	1.120E-03
0.70	2.958	1.102E-03	1.304E-03
0.80	2.901	1.256E-03	1.487E-03
0.90	2.851	1.409E-03	1.670E-03
1.00	2.806	1.563E-03	1.852E-03
1.10	2.765	1.718E-03	2.033E-03
1.20	2.729	1.866E-03	2.214E-03
1.30	2.695	2.018E-03	2.393E-03
1.40	2.665	2.163E-03	2.573E-03
1.50	2.636	2.312E-03	2.751E-03
1.60	2.610	2.455E-03	2.929E-03
1.70	2.585	2.600E-03	3.106E-03
1.80	2.559	2.761E-03	3.282E-03



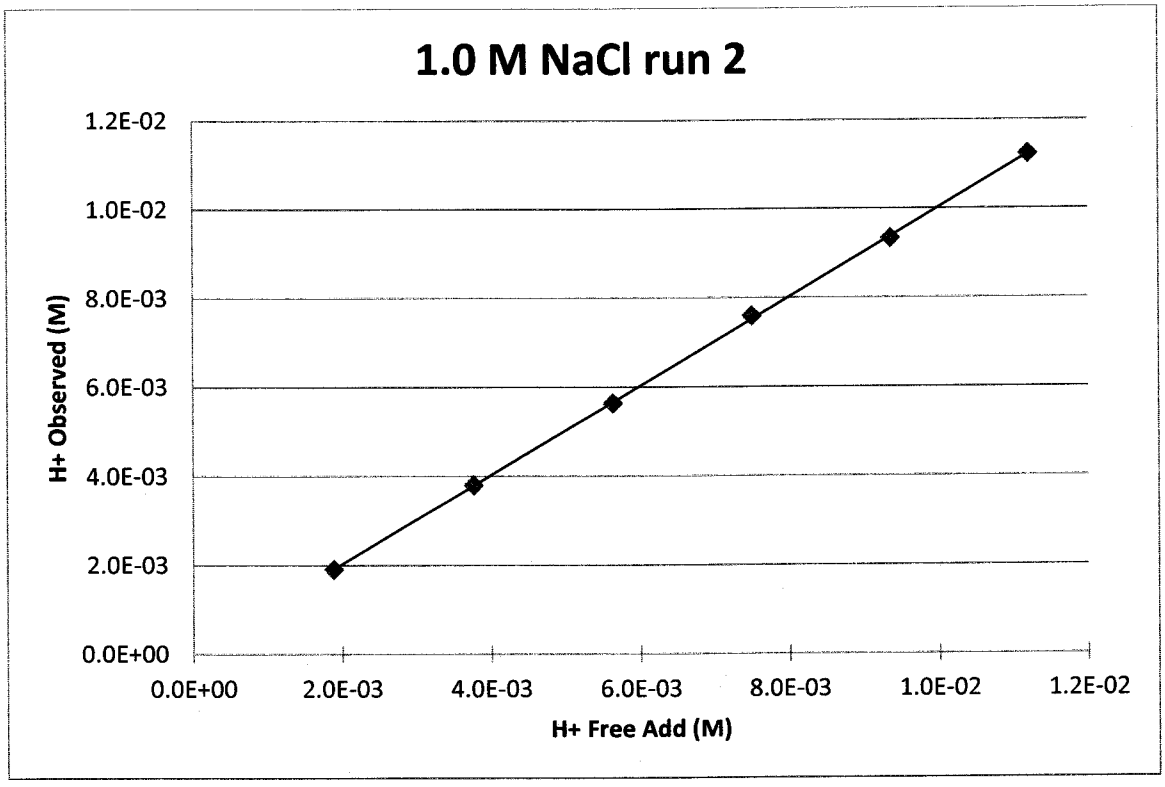
Type:	1.0 M NaCl with 1 M HCl
SN Reference	WIPP-Solubility-6 p. 93
Solution Reference:	WIPP-Solubility-3 p. 7-8
Brine Volume:	50.0 mL
pH Probe:	Mettler-Toledo DG111-SC
Titrant Actual M	0.9445 M HCl
Titrant Reference:	WIPP-MgO-CBD-26 p. 86-87

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.00	5.990	1.023E-06	0.000E+00
0.10	2.720	1.905E-03	1.885E-03
0.20	2.430	3.715E-03	3.763E-03
0.30	2.250	5.623E-03	5.633E-03
0.40	2.130	7.413E-03	7.496E-03
0.50	2.040	9.120E-03	9.351E-03
0.60	1.960	1.096E-02	1.120E-02



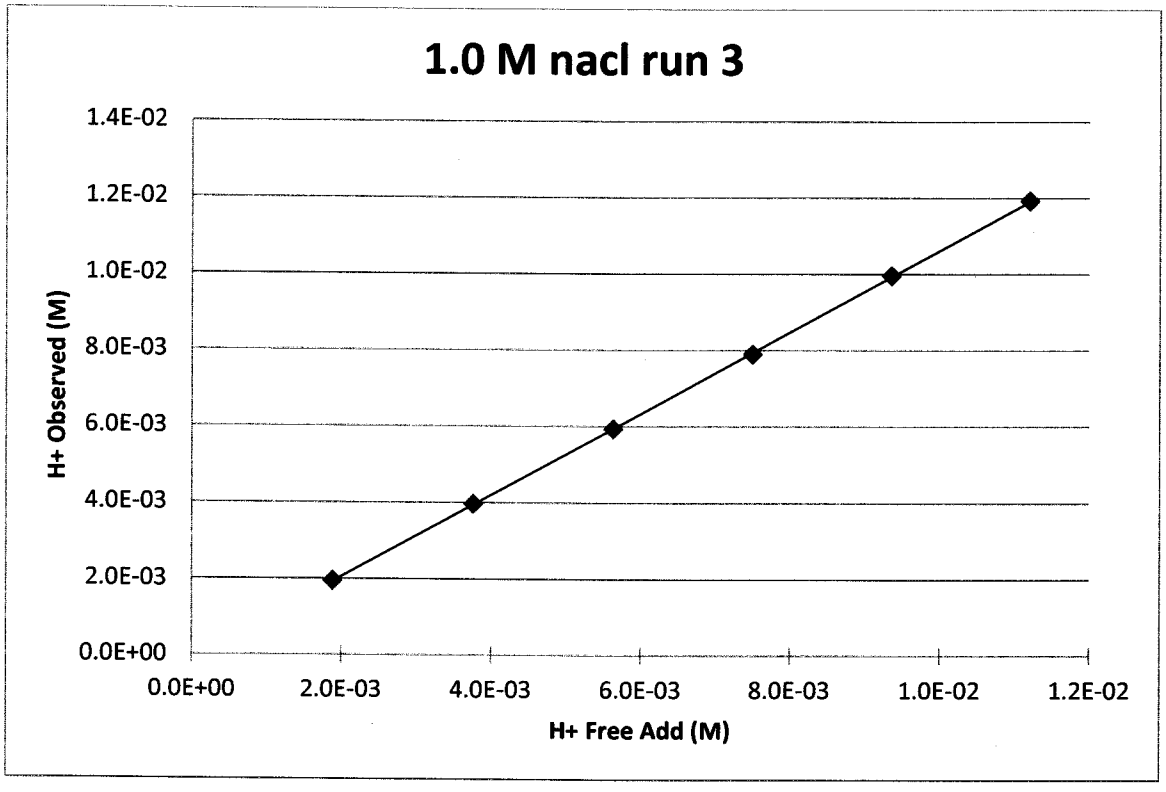
Type:	1.0 M NaCl with 1 M HCl
SN Reference	WIPP-Solubility-6 p. 93
Solution Reference:	WIPP-Solubility-3 p. 7-8
Brine Volume:	50.0 mL
pH Probe:	Mettler-Toledo DG111-SC
Titrant Actual M	0.9445 M HCl
Titrant Reference:	WIPP-MgO-CBD-26 p. 86-87

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.00	5.860	1.380E-06	0.000E+00
0.10	2.720	1.905E-03	1.885E-03
0.20	2.420	3.802E-03	3.763E-03
0.30	2.250	5.623E-03	5.633E-03
0.40	2.120	7.586E-03	7.496E-03
0.50	2.030	9.333E-03	9.351E-03
0.60	1.950	1.122E-02	1.120E-02



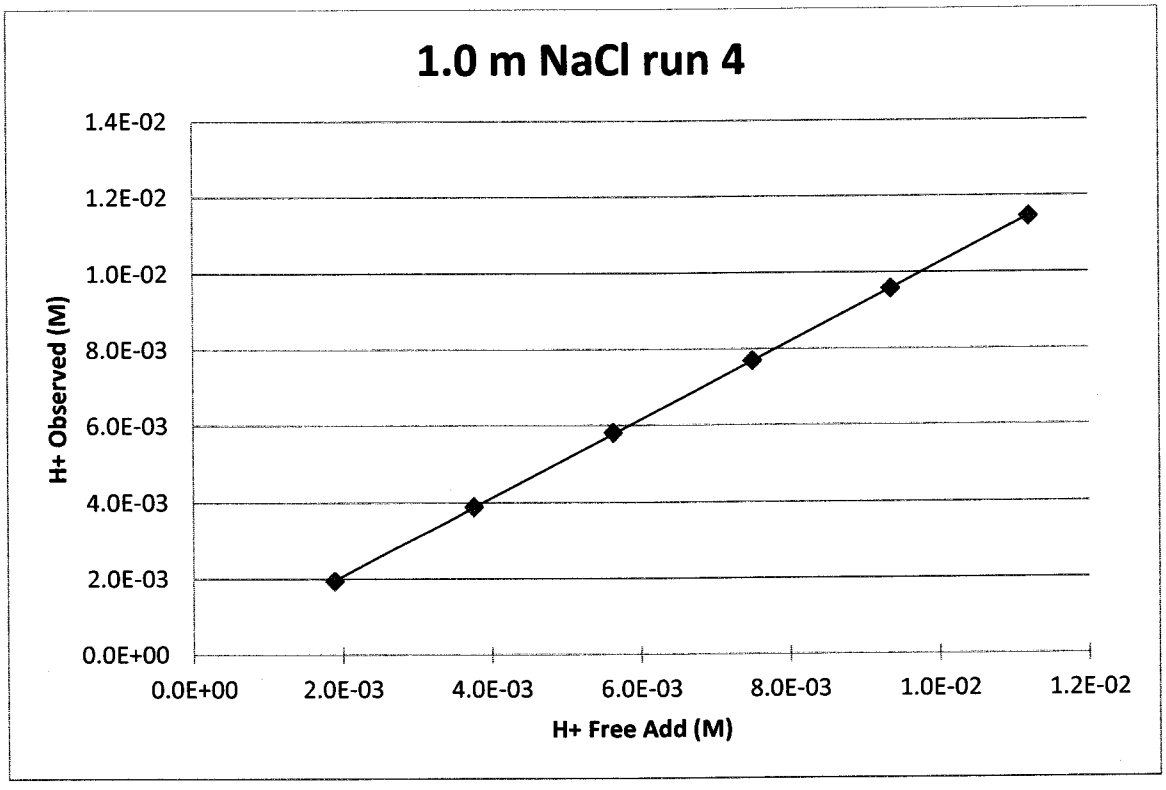
Type:	1.0 M NaCl with 1 M HCl
SN Reference	WIPP-Solubility-8 p. 12-13
Solution Reference:	WIPP-Solubility-3 p. 7-8
Brine Volume:	50.0 mL
pH Probe:	Mettler-Toledo DG111-SC
Titrant Actual M	0.9445 M HCl
Titrant Reference:	WIPP-MgO-CBD-26 p. 86-87

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.00	6.038	9.162E-07	0.000E+00
0.10	2.711	1.945E-03	1.885E-03
0.20	2.403	3.954E-03	3.763E-03
0.30	2.227	5.929E-03	5.633E-03
0.40	2.103	7.889E-03	7.496E-03
0.50	2.002	9.954E-03	9.351E-03
0.60	1.924	1.191E-02	1.120E-02



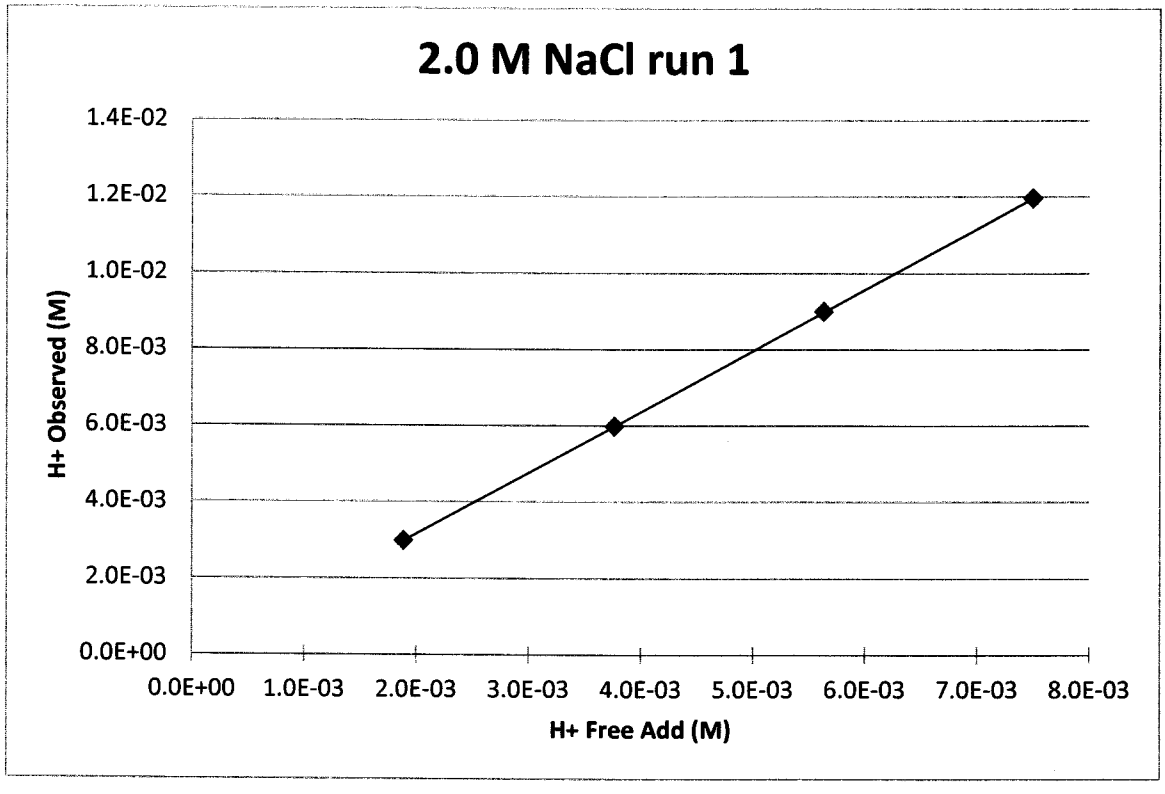
Type:	1.0 M NaCl with 1 M HCl
SN Reference	WIPP-Solubility-8 p. 12-13
Solution Reference:	WIPP-Solubility-3 p. 7-8
Brine Volume:	50.0 mL
pH Probe:	Mettler-Toledo DG111-SC
Titrant Actual M	0.9445 M HCl
Titrant Reference:	WIPP-MgO-CBD-26 p. 86-87

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.00	5.911	1.227E-06	0.000E+00
0.10	2.714	1.932E-03	1.885E-03
0.20	2.411	3.882E-03	3.763E-03
0.30	2.236	5.808E-03	5.633E-03
0.40	2.114	7.691E-03	7.496E-03
0.50	2.019	9.572E-03	9.351E-03
0.60	1.941	1.146E-02	1.120E-02



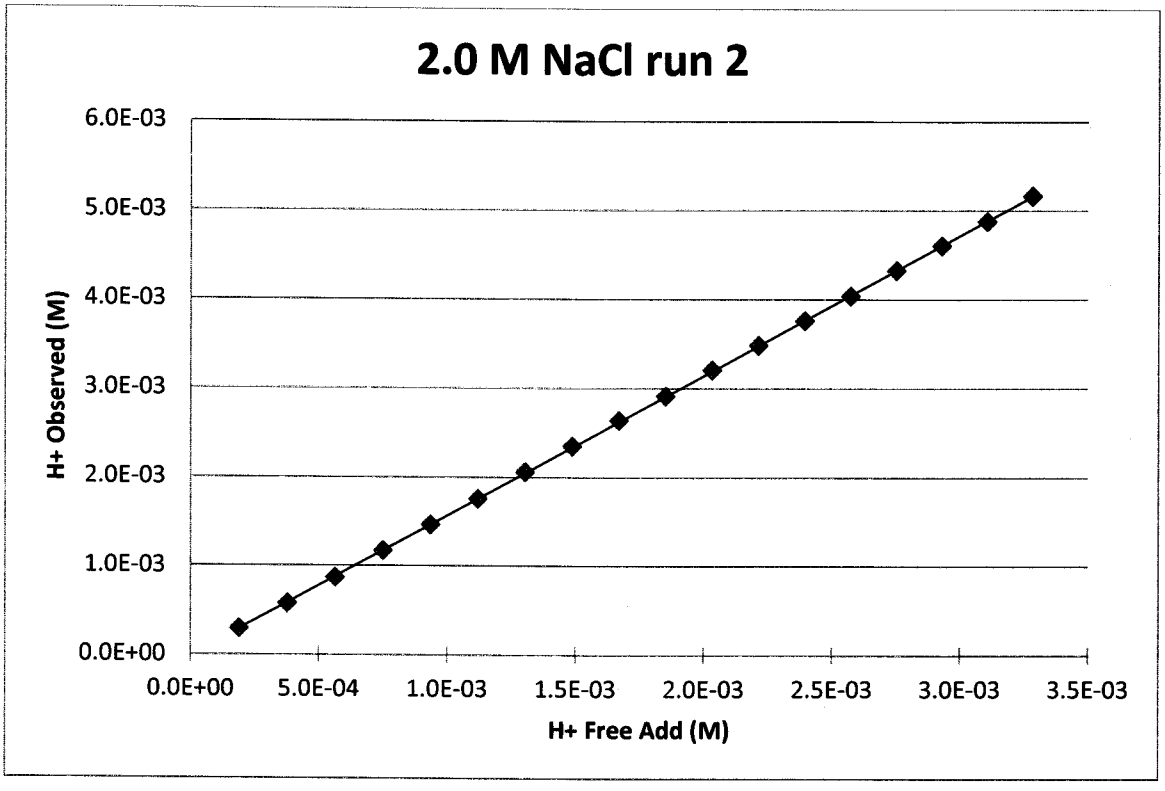
Type:	2.0 M NaCl with 1 M HCl
SN Reference	WIPP-Solubility-6 p. 94-95
Solution Reference:	WIPP-Solubility-6 p. 94-95
Brine Volume:	50.0 mL
pH Probe:	Mettler-Toledo DG111-SC
Titrant Actual M	0.9445 M HCl
Titrant Reference:	WIPP-MgO-CBD-26 p. 86-87

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.00	4.684	2.070E-05	0.000E+00
0.10	2.526	2.979E-03	1.885E-03
0.20	2.223	5.984E-03	3.763E-03
0.30	2.046	8.995E-03	5.633E-03
0.40	1.922	1.197E-02	7.496E-03



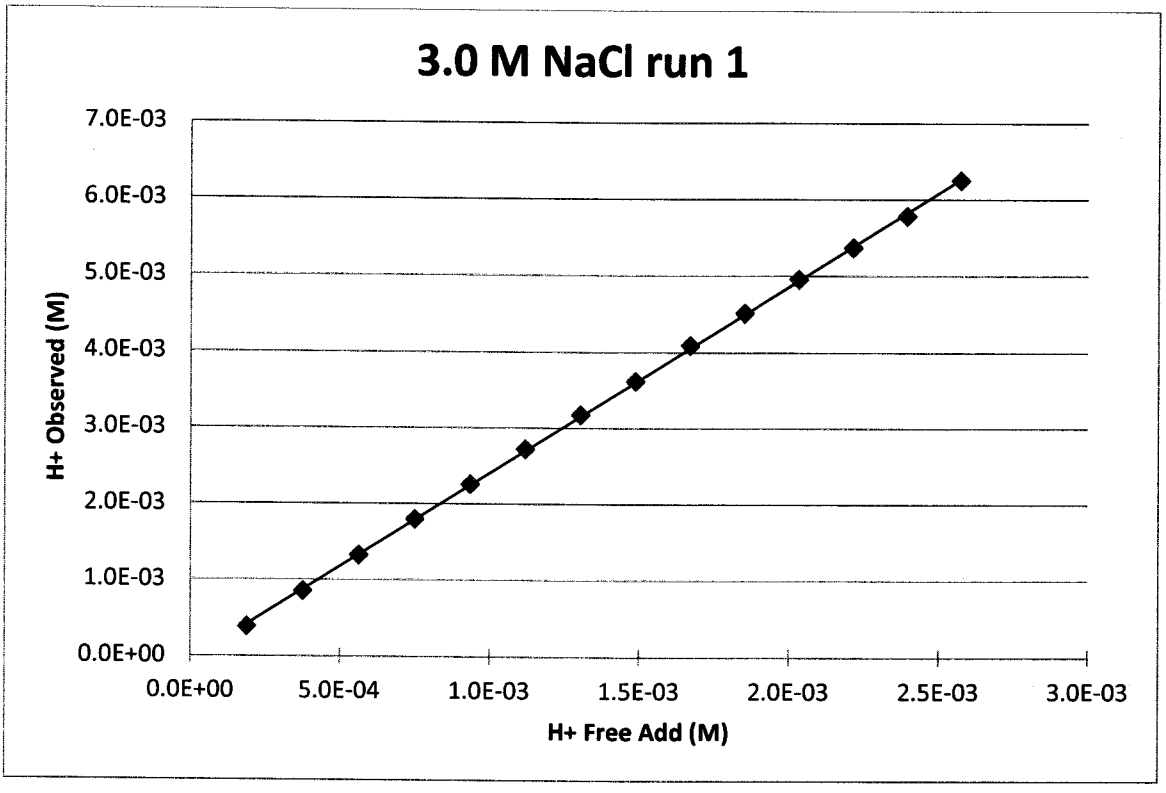
Type:	2.0 M NaCl with 1 M HCl
SN Reference	WIPP-Solubility-6 p. 94-95
Solution Reference:	WIPP-Solubility-3 p. 21
Brine Volume:	50.0 mL
pH Probe:	Mettler-Toledo DG111-SC
Titrant Actual M	0.9445 M HCl
Titrant Reference:	WIPP-MgO-CBD-26 p. 86-87

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.00	4.635	2.317E-05	0.000E+00
0.10	3.542	2.871E-04	1.885E-04
0.20	3.241	5.741E-04	3.763E-04
0.30	3.062	8.670E-04	5.633E-04
0.40	2.933	1.167E-03	7.496E-04
0.50	2.835	1.462E-03	9.351E-04
0.60	2.756	1.754E-03	1.120E-03
0.70	2.687	2.056E-03	1.304E-03
0.80	2.630	2.344E-03	1.487E-03
0.90	2.579	2.636E-03	1.670E-03
1.00	2.536	2.911E-03	1.852E-03
1.10	2.494	3.206E-03	2.033E-03
1.20	2.458	3.483E-03	2.214E-03
1.30	2.425	3.758E-03	2.393E-03
1.40	2.394	4.036E-03	2.573E-03
1.50	2.364	4.325E-03	2.751E-03
1.60	2.337	4.603E-03	2.929E-03
1.70	2.312	4.875E-03	3.106E-03
1.80	2.287	5.164E-03	3.282E-03



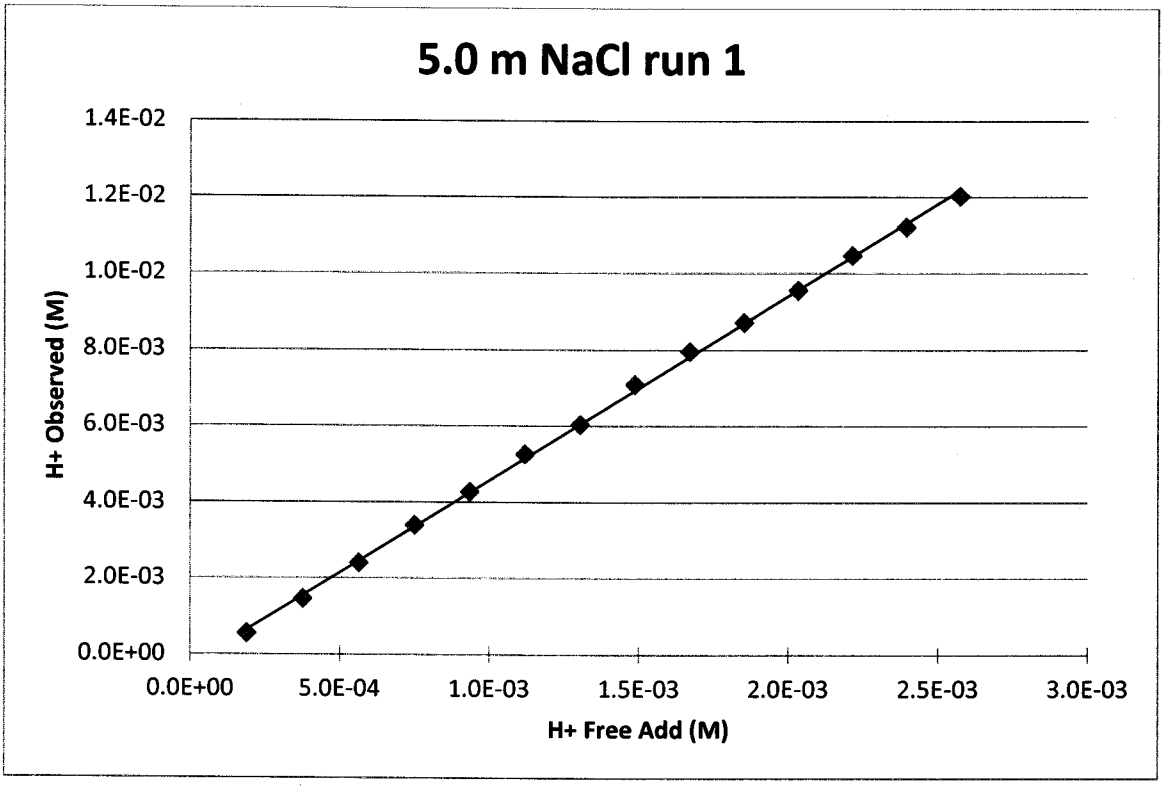
Type:	3.0 M NaCl with 0.1 M HCl
SN Reference	WIPP-Solubility-6 p. 94-95
Solution Reference:	WIPP-Solubility-3 p. 21
Brine Volume:	50.0 mL
pH Probe:	Mettler-Toledo DG111-SC
Titrant Actual M	0.09445 M HCl
Titrant Reference:	WIPP-Solubility-6 p. 75-76

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.00	6.029	9.354E-07	0.000E+00
0.10	3.421	3.793E-04	1.885E-04
0.20	3.071	8.492E-04	3.763E-04
0.30	2.879	1.321E-03	5.633E-04
0.40	2.746	1.795E-03	7.496E-04
0.50	2.647	2.254E-03	9.351E-04
0.60	2.566	2.716E-03	1.120E-03
0.70	2.499	3.170E-03	1.304E-03
0.80	2.442	3.614E-03	1.487E-03
0.90	2.389	4.083E-03	1.670E-03
1.00	2.346	4.508E-03	1.852E-03
1.10	2.305	4.955E-03	2.033E-03
1.20	2.270	5.370E-03	2.214E-03
1.30	2.238	5.781E-03	2.393E-03
1.40	2.204	6.252E-03	2.573E-03



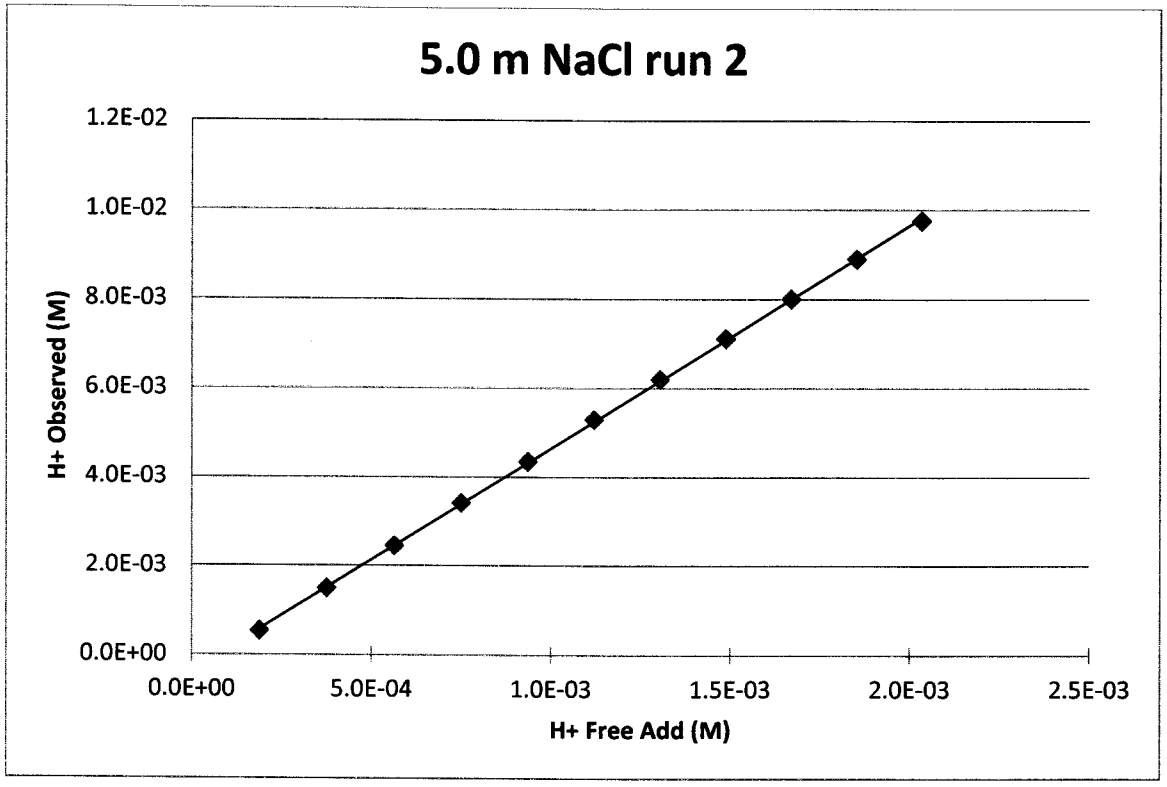
Type:	5.0 m NaCl with 0.1 M HCl
SN Reference	WIPP-Solubility-6 p. 93-94
Solution Reference:	WIPP-FePb-1 p. 50
Brine Volume:	50.0 mL
pH Probe:	Mettler-Toledo DG111-SC
Titrant Actual M	0.09445 M HCl
Titrant Reference:	WIPP-Solubility-6 p. 75-76

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.00	6.520	3.020E-07	0.000E+00
0.10	3.270	5.370E-04	1.885E-04
0.20	2.840	1.445E-03	3.763E-04
0.30	2.620	2.399E-03	5.633E-04
0.40	2.470	3.388E-03	7.496E-04
0.50	2.370	4.266E-03	9.351E-04
0.60	2.280	5.248E-03	1.120E-03
0.70	2.220	6.026E-03	1.304E-03
0.80	2.150	7.079E-03	1.487E-03
0.90	2.100	7.943E-03	1.670E-03
1.00	2.060	8.710E-03	1.852E-03
1.10	2.020	9.550E-03	2.033E-03
1.20	1.980	1.047E-02	2.214E-03
1.30	1.950	1.122E-02	2.393E-03
1.40	1.920	1.202E-02	2.573E-03



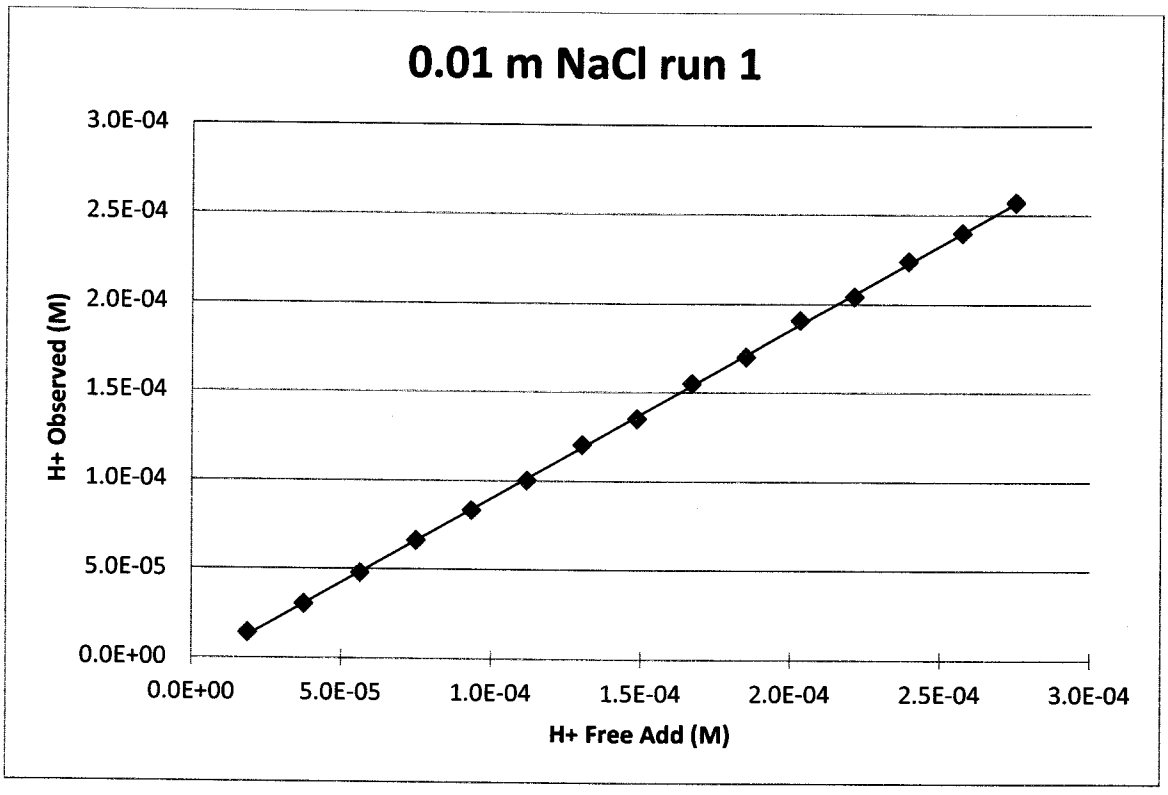
Type:	5.0 m NaCl with 0.1 M HCl
SN Reference	WIPP-Solubility-8 p. 12-13
Solution Reference:	WIPP-FePb-1 p. 50
Brine Volume:	50.0 mL
pH Probe:	Mettler-Toledo DG111-SC
Titrant Actual M	0.09445 M HCl
Titrant Reference:	WIPP-Solubility-6 p. 75-76

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.00	6.579	2.636E-07	0.000E+00
0.10	3.278	5.272E-04	1.885E-04
0.20	2.829	1.483E-03	3.763E-04
0.30	2.612	2.443E-03	5.633E-04
0.40	2.468	3.404E-03	7.496E-04
0.50	2.362	4.345E-03	9.351E-04
0.60	2.277	5.284E-03	1.120E-03
0.70	2.208	6.194E-03	1.304E-03
0.80	2.148	7.112E-03	1.487E-03
0.90	2.097	7.998E-03	1.670E-03
1.00	2.051	8.892E-03	1.852E-03
1.10	2.011	9.750E-03	2.033E-03



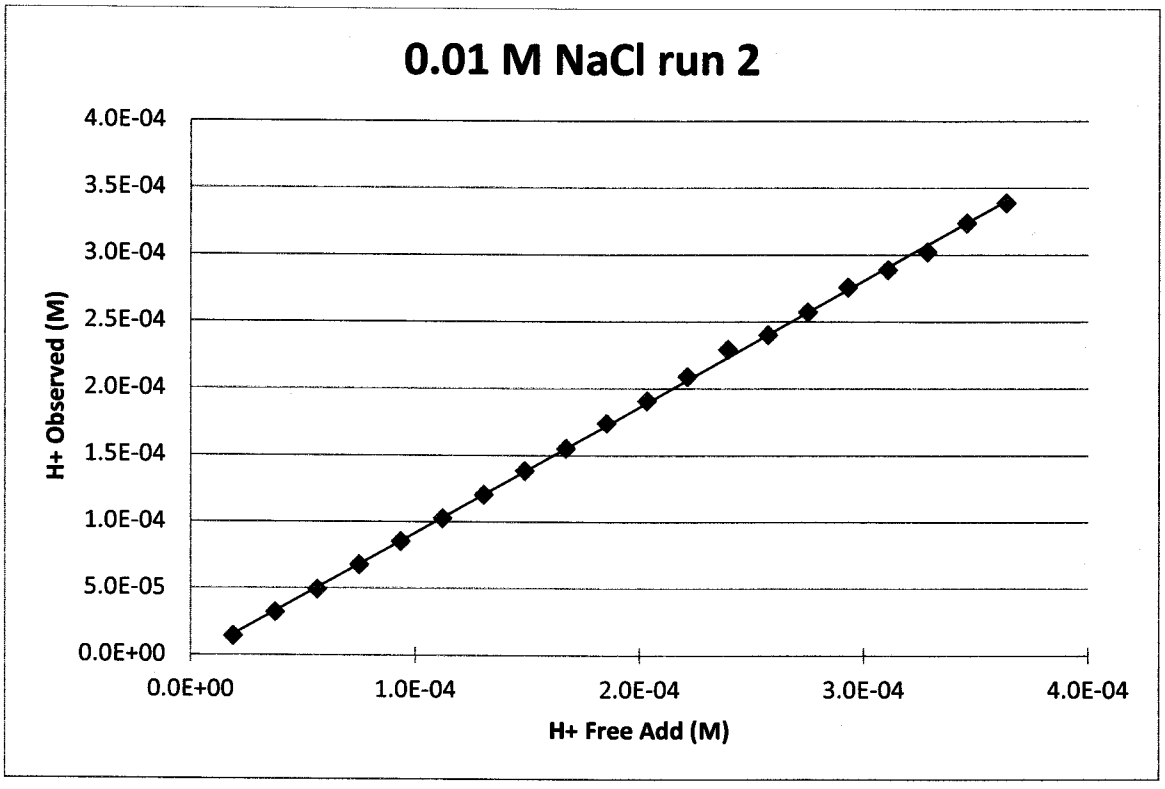
Type:	0.01 M NaCl with 0.01 M HCl
SN Reference	WIPP-Solubility-6 p. 82
Solution Reference:	WIPP-Solubility-3 p. 7
Brine Volume:	50.0 mL
pH Probe:	Orion Ross Semi-Micro
Titrant Actual M	0.009445 M HCl
Titrant Reference:	WIPP-Solubility-6 p. 75-76

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.00	5.81	1.549E-06	0.000E+00
0.10	4.86	1.380E-05	1.885E-05
0.20	4.52	3.020E-05	3.763E-05
0.30	4.32	4.786E-05	5.633E-05
0.40	4.18	6.607E-05	7.496E-05
0.50	4.08	8.318E-05	9.351E-05
0.60	4.00	1.000E-04	1.120E-04
0.70	3.92	1.202E-04	1.304E-04
0.80	3.87	1.349E-04	1.487E-04
0.90	3.81	1.549E-04	1.670E-04
1.00	3.77	1.698E-04	1.852E-04
1.10	3.72	1.905E-04	2.033E-04
1.20	3.69	2.042E-04	2.214E-04
1.30	3.65	2.239E-04	2.393E-04
1.40	3.62	2.399E-04	2.573E-04
1.50	3.59	2.570E-04	2.751E-04



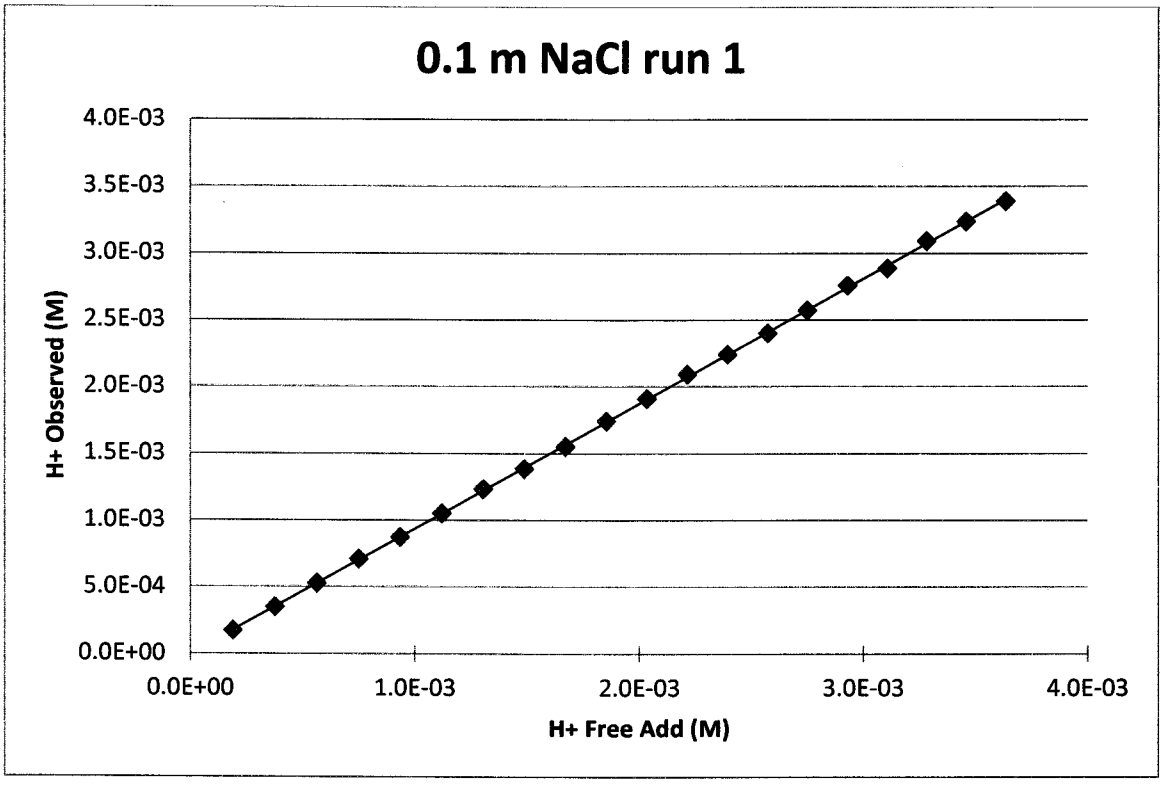
Type:	0.01 M NaCl with 0.01 M HCl
SN Reference	WIPP-Solubility-6 p. 82
Solution Reference:	WIPP-Solubility-3 p. 7
Brine Volume:	50.0 mL
pH Probe:	Orion Ross Semi-Micro
Titrant Actual M	0.009445 M HCl
Titrant Reference:	WIPP-Solubility-6 p. 75-76

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.00	5.80	1.585E-06	0.000E+00
0.10	4.86	1.380E-05	1.885E-05
0.20	4.50	3.162E-05	3.763E-05
0.30	4.31	4.898E-05	5.633E-05
0.40	4.17	6.761E-05	7.496E-05
0.50	4.07	8.511E-05	9.351E-05
0.60	3.99	1.023E-04	1.120E-04
0.70	3.92	1.202E-04	1.304E-04
0.80	3.86	1.380E-04	1.487E-04
0.90	3.81	1.549E-04	1.670E-04
1.00	3.76	1.738E-04	1.852E-04
1.10	3.72	1.905E-04	2.033E-04
1.20	3.68	2.089E-04	2.214E-04
1.30	3.64	2.291E-04	2.393E-04
1.40	3.62	2.399E-04	2.573E-04
1.50	3.59	2.570E-04	2.751E-04
1.60	3.56	2.754E-04	2.929E-04
1.70	3.54	2.884E-04	3.106E-04
1.80	3.52	3.020E-04	3.282E-04
1.90	3.49	3.236E-04	3.458E-04
2.00	3.47	3.388E-04	3.633E-04



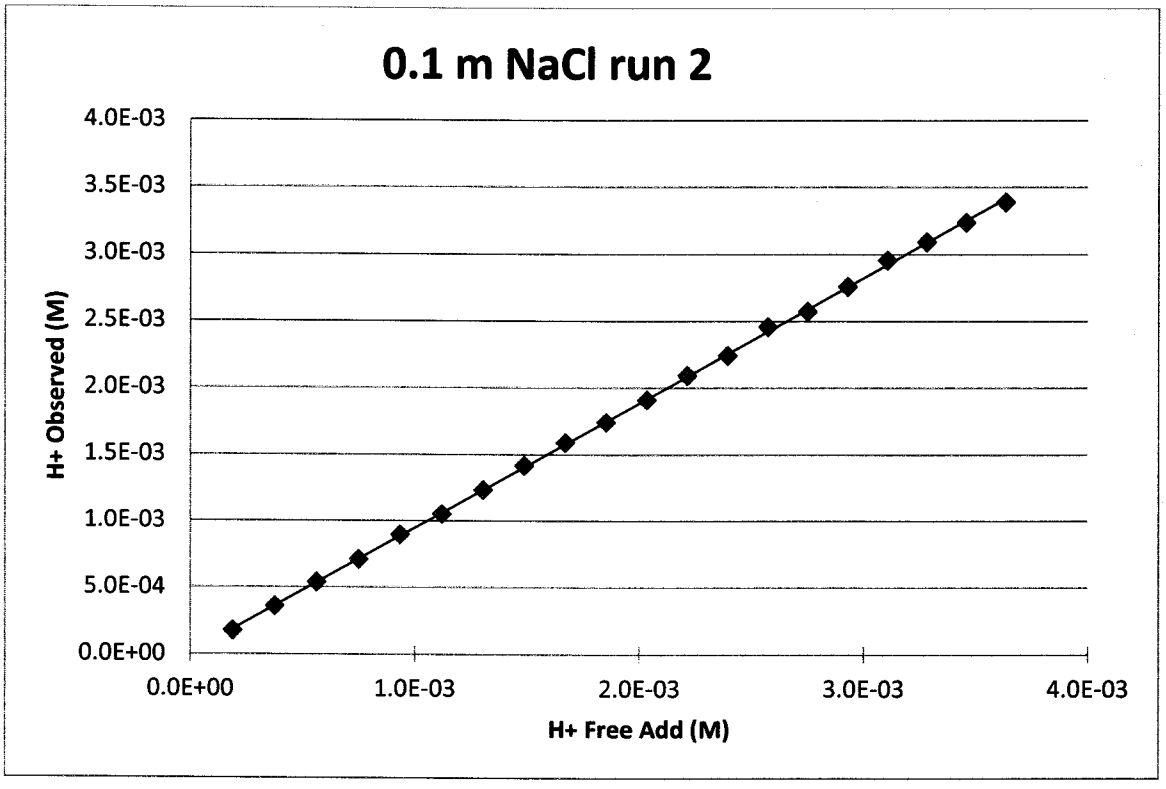
Type:	0.1 m NaCl with 0.1 M HCl
SN Reference	WIPP-Solubility-6 p. 82
Solution Reference:	WIPP-Solubility-6 p. 80
Brine Volume:	50.0 mL
pH Probe:	Orion Ross Semi-Micro
Titrant Actual M	0.09445 M HCl
Titrant Reference:	WIPP-Solubility-6 p. 75-76

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.00	5.74	1.820E-06	0.000E+00
0.10	3.77	1.698E-04	1.885E-04
0.20	3.46	3.467E-04	3.763E-04
0.30	3.28	5.248E-04	5.633E-04
0.40	3.15	7.079E-04	7.496E-04
0.50	3.06	8.710E-04	9.351E-04
0.60	2.98	1.047E-03	1.120E-03
0.70	2.91	1.230E-03	1.304E-03
0.80	2.86	1.380E-03	1.487E-03
0.90	2.81	1.549E-03	1.670E-03
1.00	2.76	1.738E-03	1.852E-03
1.10	2.72	1.905E-03	2.033E-03
1.20	2.68	2.089E-03	2.214E-03
1.30	2.65	2.239E-03	2.393E-03
1.40	2.62	2.399E-03	2.573E-03
1.50	2.59	2.570E-03	2.751E-03
1.60	2.56	2.754E-03	2.929E-03
1.70	2.54	2.884E-03	3.106E-03
1.80	2.51	3.090E-03	3.282E-03
1.90	2.49	3.236E-03	3.458E-03
2.00	2.47	3.388E-03	3.633E-03



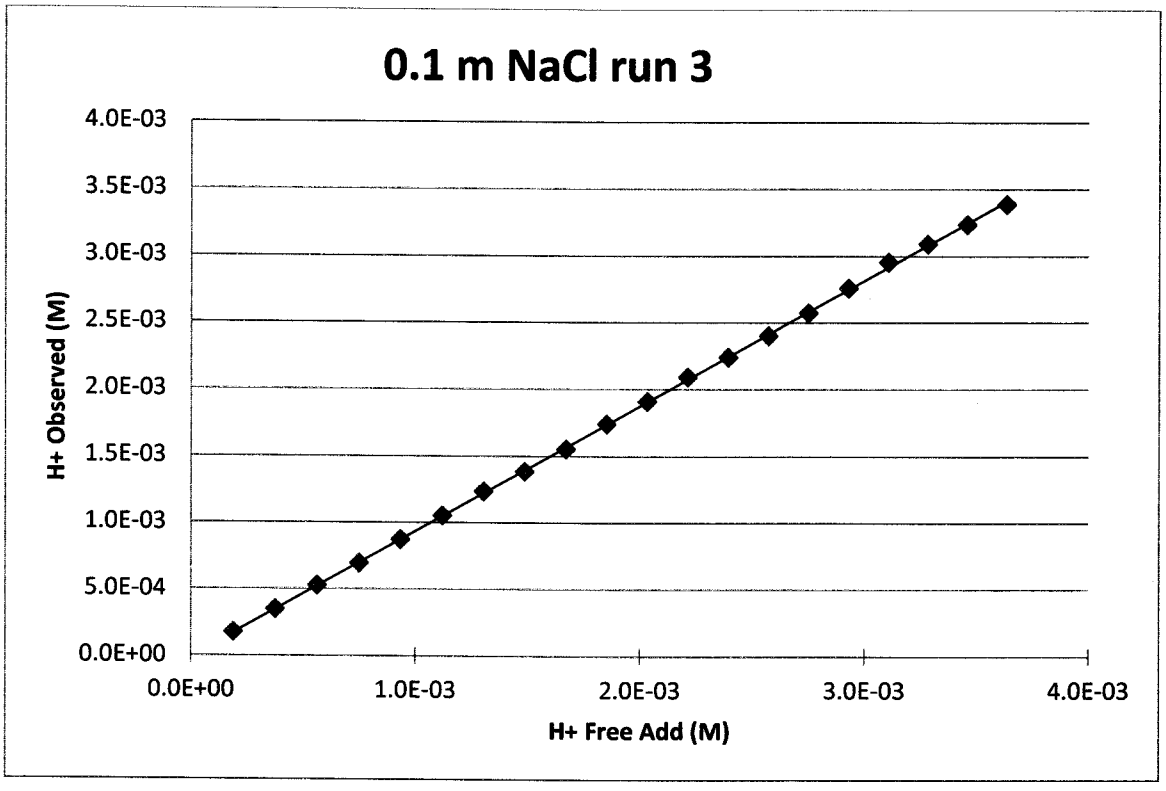
Type:	0.1 m NaCl with 0.1 M HCl
SN Reference	WIPP-Solubility-6 p. 82
Solution Reference:	WIPP-Solubility-6 p. 80
Brine Volume:	50.0 mL
pH Probe:	Orion Ross Semi-Micro
Titrant Actual M	0.09445 M HCl
Titrant Reference:	WIPP-Solubility-6 p. 75-76

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.00	5.61	2.455E-06	0.000E+00
0.10	3.76	1.738E-04	1.885E-04
0.20	3.45	3.548E-04	3.763E-04
0.30	3.27	5.370E-04	5.633E-04
0.40	3.15	7.079E-04	7.496E-04
0.50	3.05	8.913E-04	9.351E-04
0.60	2.98	1.047E-03	1.120E-03
0.70	2.91	1.230E-03	1.304E-03
0.80	2.85	1.413E-03	1.487E-03
0.90	2.80	1.585E-03	1.670E-03
1.00	2.76	1.738E-03	1.852E-03
1.10	2.72	1.905E-03	2.033E-03
1.20	2.68	2.089E-03	2.214E-03
1.30	2.65	2.239E-03	2.393E-03
1.40	2.61	2.455E-03	2.573E-03
1.50	2.59	2.570E-03	2.751E-03
1.60	2.56	2.754E-03	2.929E-03
1.70	2.53	2.951E-03	3.106E-03
1.80	2.51	3.090E-03	3.282E-03
1.90	2.49	3.236E-03	3.458E-03
2.00	2.47	3.388E-03	3.633E-03



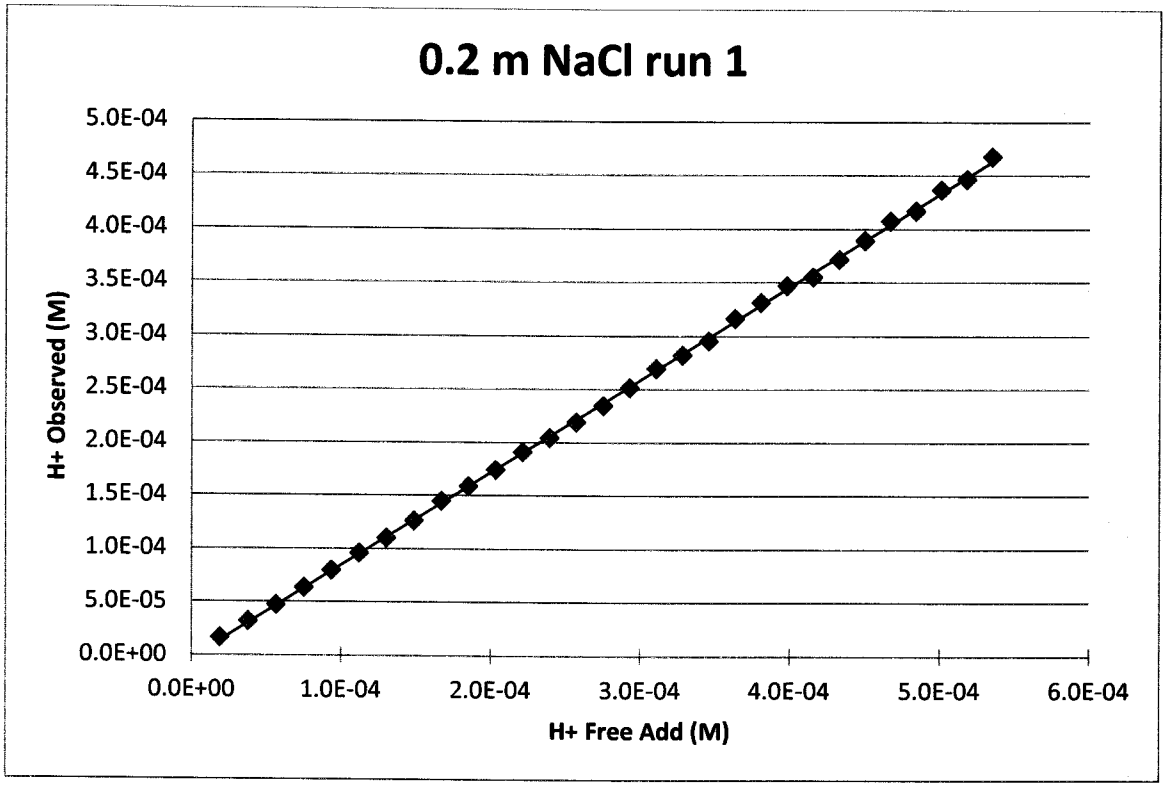
Type:	0.1 m NaCl with 0.1 M HCl
SN Reference	WIPP-Solubility-6 p. 82
Solution Reference:	WIPP-Solubility-6 p. 80
Brine Volume:	50.0 mL
pH Probe:	Orion Ross Semi-Micro
Titrant Actual M	0.09445 M HCl
Titrant Reference:	WIPP-Solubility-6 p. 75-76

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.00	5.75	1.778E-06	0.000E+00
0.10	3.76	1.738E-04	1.885E-04
0.20	3.46	3.467E-04	3.763E-04
0.30	3.28	5.248E-04	5.633E-04
0.40	3.16	6.918E-04	7.496E-04
0.50	3.06	8.710E-04	9.351E-04
0.60	2.98	1.047E-03	1.120E-03
0.70	2.91	1.230E-03	1.304E-03
0.80	2.86	1.380E-03	1.487E-03
0.90	2.81	1.549E-03	1.670E-03
1.00	2.76	1.738E-03	1.852E-03
1.10	2.72	1.905E-03	2.033E-03
1.20	2.68	2.089E-03	2.214E-03
1.30	2.65	2.239E-03	2.393E-03
1.40	2.62	2.399E-03	2.573E-03
1.50	2.59	2.570E-03	2.751E-03
1.60	2.56	2.754E-03	2.929E-03
1.70	2.53	2.951E-03	3.106E-03
1.80	2.51	3.090E-03	3.282E-03
1.90	2.49	3.236E-03	3.458E-03
2.00	2.47	3.388E-03	3.633E-03



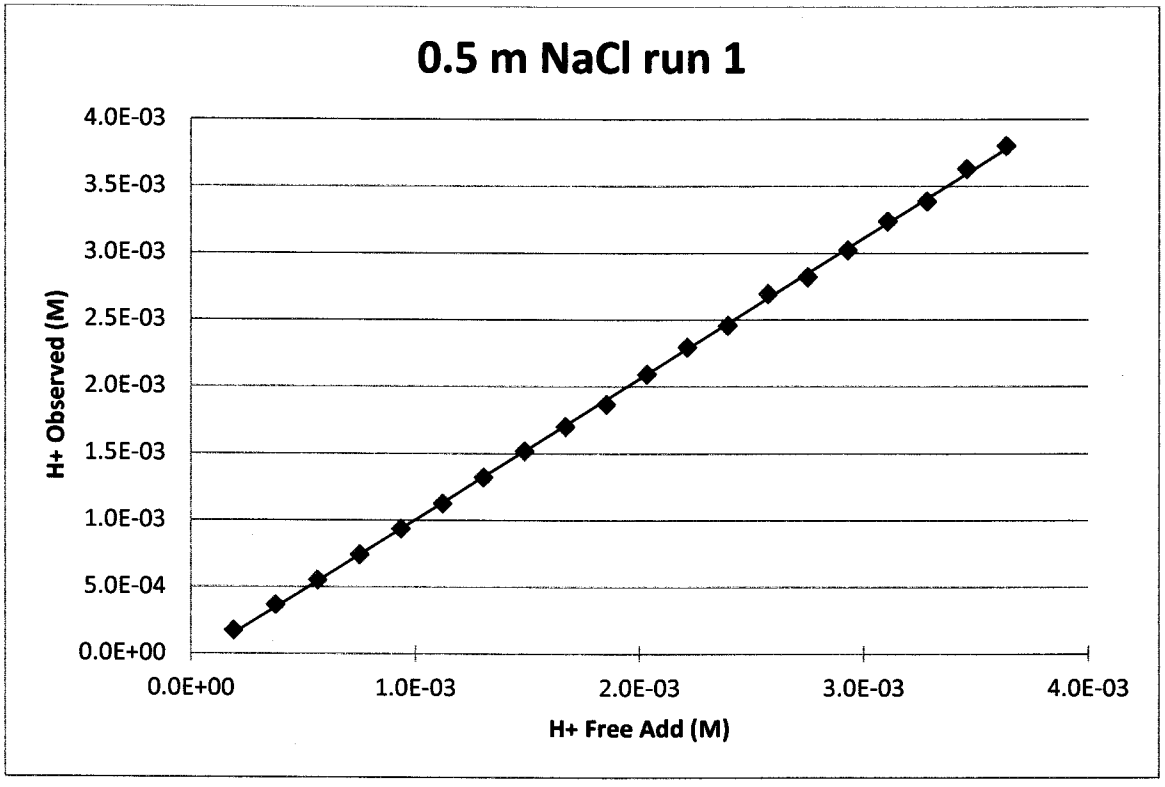
Type:	0.2 m NaCl with 0.01 M HCl
SN Reference	WIPP-Solubility-6 p. 78-80
Solution Reference:	WIPP-Solubility-6 p. 77
Brine Volume:	50.0 mL
pH Probe:	Orion Ross Semi-Micro
Titrant Actual M	0.009445 M HCl
Titrant Reference:	WIPP-Solubility-6 p. 75-76

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.10	4.79	1.622E-05	1.885E-05
0.20	4.50	3.162E-05	3.763E-05
0.30	4.33	4.677E-05	5.633E-05
0.40	4.20	6.310E-05	7.496E-05
0.50	4.10	7.943E-05	9.351E-05
0.60	4.02	9.550E-05	1.120E-04
0.70	3.96	1.096E-04	1.304E-04
0.80	3.90	1.259E-04	1.487E-04
0.90	3.84	1.445E-04	1.670E-04
1.00	3.80	1.585E-04	1.852E-04
1.10	3.76	1.738E-04	2.033E-04
1.20	3.72	1.905E-04	2.214E-04
1.30	3.69	2.042E-04	2.393E-04
1.40	3.66	2.188E-04	2.573E-04
1.50	3.63	2.344E-04	2.751E-04
1.60	3.60	2.512E-04	2.929E-04
1.70	3.57	2.692E-04	3.106E-04
1.80	3.55	2.818E-04	3.282E-04
1.90	3.53	2.951E-04	3.458E-04
2.00	3.50	3.162E-04	3.633E-04
2.10	3.48	3.311E-04	3.807E-04
2.20	3.46	3.467E-04	3.981E-04
2.30	3.45	3.548E-04	4.154E-04
2.40	3.43	3.715E-04	4.326E-04
2.50	3.41	3.890E-04	4.498E-04
2.60	3.39	4.074E-04	4.669E-04
2.70	3.38	4.169E-04	4.839E-04
2.80	3.36	4.365E-04	5.009E-04
2.90	3.35	4.467E-04	5.178E-04
3.00	3.33	4.677E-04	5.346E-04



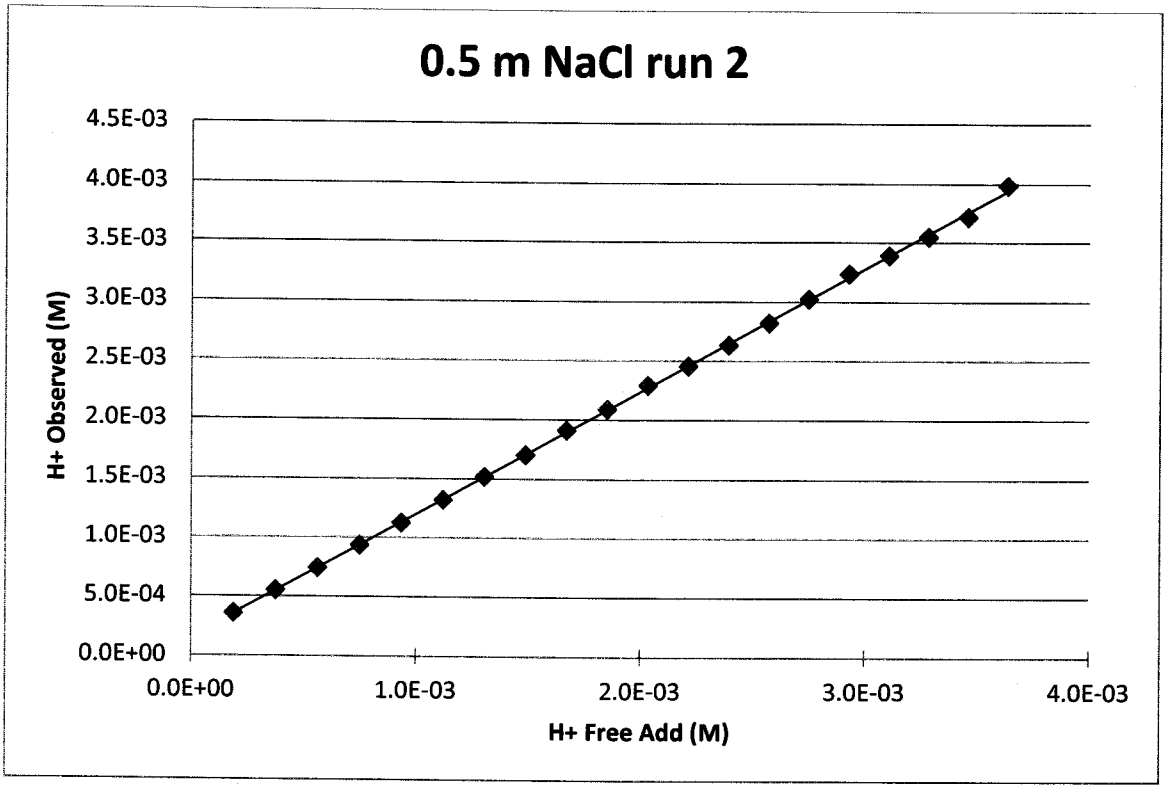
Type:	0.5 m NaCl with 0.1 M HCl
SN Reference	WIPP-Solubility-6 p. 82-83
Solution Reference:	WIPP-Solubility-6 p. 82
Brine Volume:	50.0 mL
pH Probe:	Orion Ross Semi-Micro
Titrant Actual M	0.09445 M HCl
Titrant Reference:	WIPP-Solubility-6 p. 75-76

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.00	6.37	4.266E-07	0.000E+00
0.10	3.77	1.698E-04	1.885E-04
0.20	3.44	3.631E-04	3.763E-04
0.30	3.26	5.495E-04	5.633E-04
0.40	3.13	7.413E-04	7.496E-04
0.50	3.03	9.333E-04	9.351E-04
0.60	2.95	1.122E-03	1.120E-03
0.70	2.88	1.318E-03	1.304E-03
0.80	2.82	1.514E-03	1.487E-03
0.90	2.77	1.698E-03	1.670E-03
1.00	2.73	1.862E-03	1.852E-03
1.10	2.68	2.089E-03	2.033E-03
1.20	2.64	2.291E-03	2.214E-03
1.30	2.61	2.455E-03	2.393E-03
1.40	2.57	2.692E-03	2.573E-03
1.50	2.55	2.818E-03	2.751E-03
1.60	2.52	3.020E-03	2.929E-03
1.70	2.49	3.236E-03	3.106E-03
1.80	2.47	3.388E-03	3.282E-03
1.90	2.44	3.631E-03	3.458E-03
2.00	2.42	3.802E-03	3.633E-03



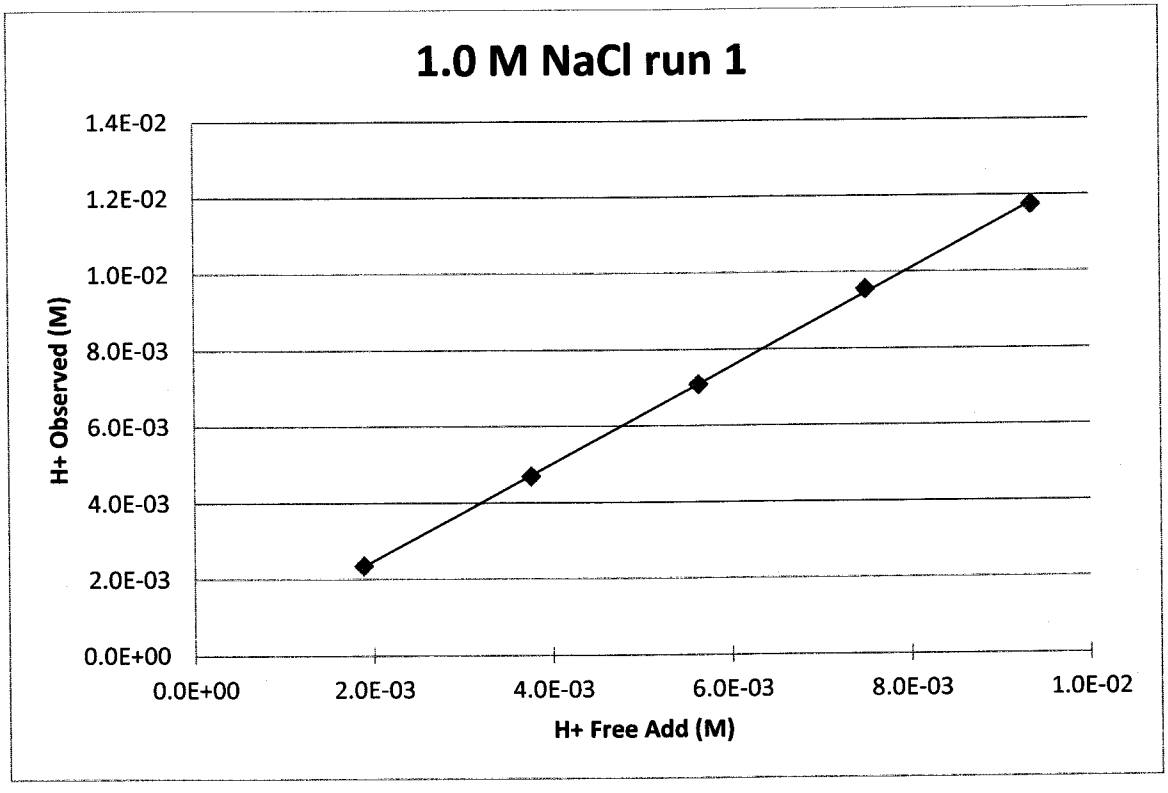
Type:	0.5 m NaCl with 0.1 M HCl
SN Reference	WIPP-Solubility-6 p. 82-83
Solution Reference:	WIPP-Solubility-6 p. 82
Brine Volume:	50.0 mL
pH Probe:	Orion Ross Semi-Micro
Titrant Actual M	0.09445 M HCl
Titrant Reference:	WIPP-Solubility-6 p. 75-76

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.00	3.77	1.698E-04	0.000E+00
0.10	3.45	3.548E-04	1.885E-04
0.20	3.26	5.495E-04	3.763E-04
0.30	3.13	7.413E-04	5.633E-04
0.40	3.03	9.333E-04	7.496E-04
0.50	2.95	1.122E-03	9.351E-04
0.60	2.88	1.318E-03	1.120E-03
0.70	2.82	1.514E-03	1.304E-03
0.80	2.77	1.698E-03	1.487E-03
0.90	2.72	1.905E-03	1.670E-03
1.00	2.68	2.089E-03	1.852E-03
1.10	2.64	2.291E-03	2.033E-03
1.20	2.61	2.455E-03	2.214E-03
1.30	2.58	2.630E-03	2.393E-03
1.40	2.55	2.818E-03	2.573E-03
1.50	2.52	3.020E-03	2.751E-03
1.60	2.49	3.236E-03	2.929E-03
1.70	2.47	3.388E-03	3.106E-03
1.80	2.45	3.548E-03	3.282E-03
1.90	2.43	3.715E-03	3.458E-03
2.00	2.40	3.981E-03	3.633E-03



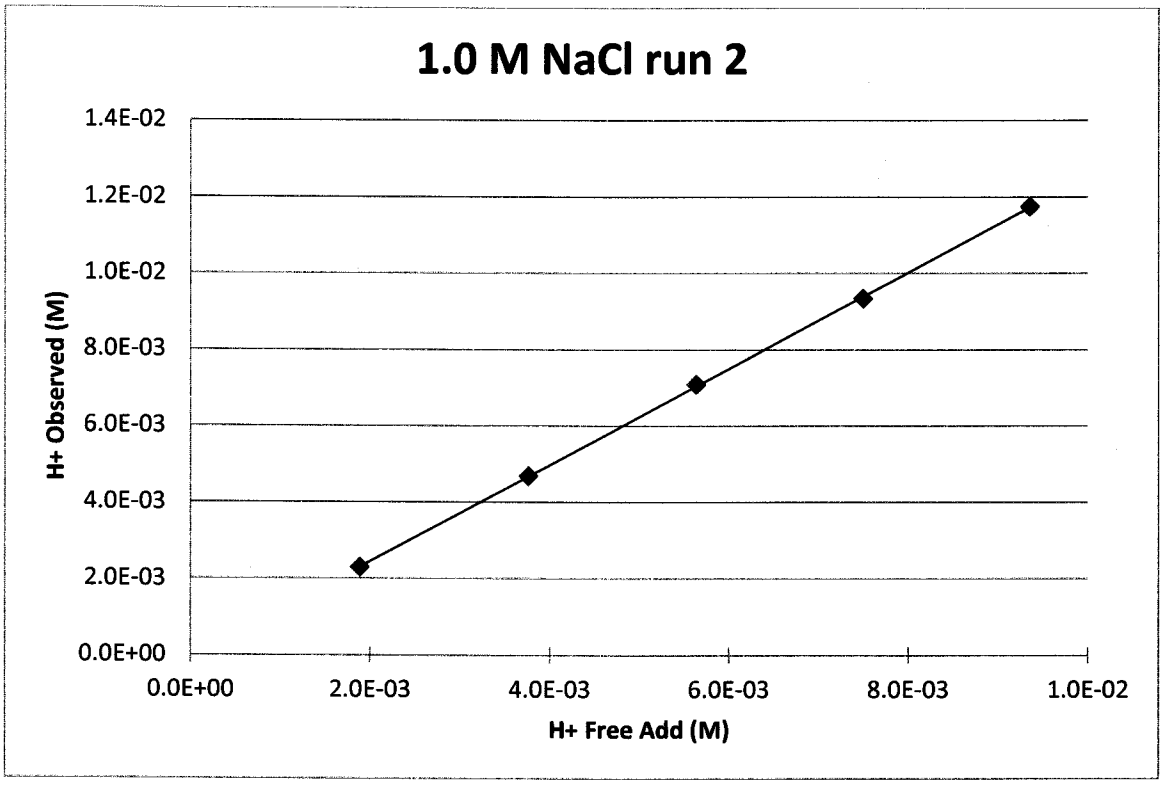
Type:	1.0 M NaCl with 1.0 M HCl
SN Reference	WIPP-Solubility-6 p. 82-83
Solution Reference:	WIPP-Solubility-3 p. 7-8
Brine Volume:	50.0 mL
pH Probe:	Orion Ross Semi-Micro
Titrant Actual M	0.9445 M HCl
Titrant Reference:	WIPP-MgO-CBD-26 p. 86-87

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.00	5.94	1.148E-06	0.000E+00
0.10	2.63	2.344E-03	1.885E-03
0.20	2.33	4.677E-03	3.763E-03
0.30	2.15	7.079E-03	5.633E-03
0.40	2.02	9.550E-03	7.496E-03
0.50	1.93	1.175E-02	9.351E-03



Type:	1.0 M NaCl with 1.0 M HCl
SN Reference	WIPP-Solubility-6 p. 82-83
Solution Reference:	WIPP-Solubility-3 p. 7-8
Brine Volume:	50.0 mL
pH Probe:	Orion Ross Semi-Micro
Titrant Actual M	0.9445 M HCl
Titrant Reference:	WIPP-MgO-CBD-26 p. 86-87

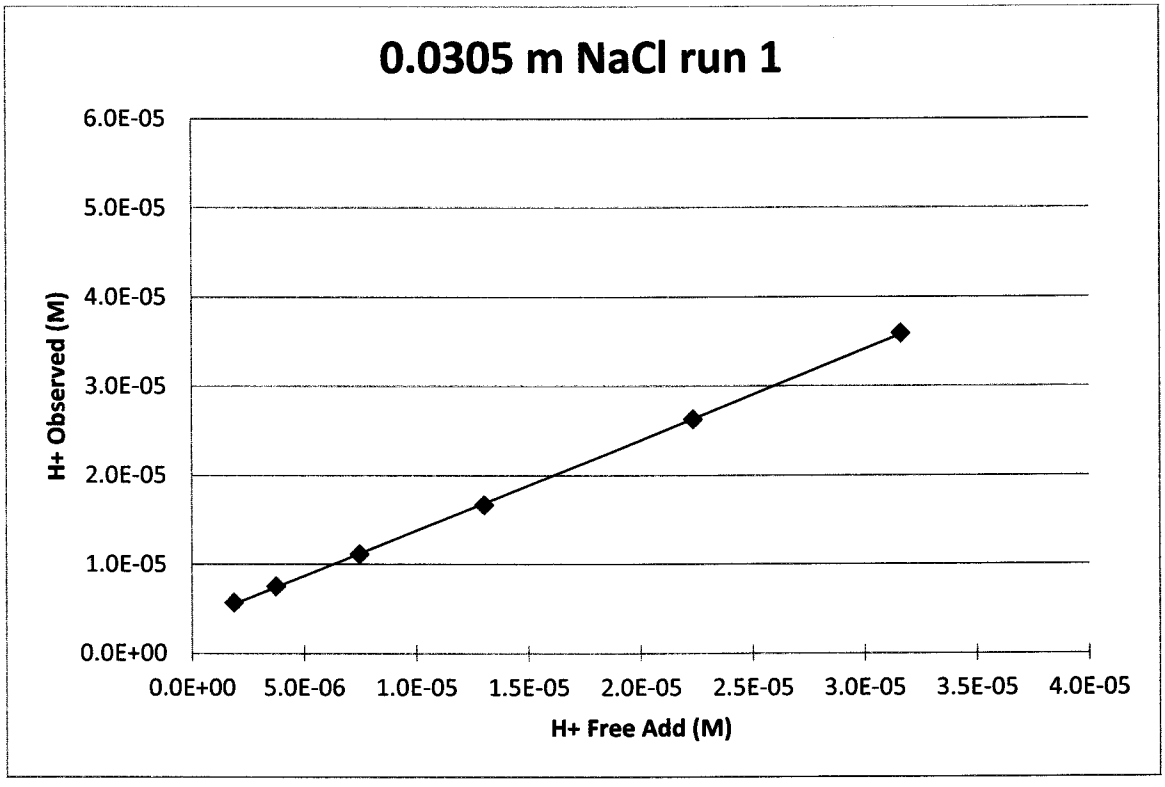
Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.00	5.88	1.318E-06	0.000E+00
0.10	2.64	2.291E-03	1.885E-03
0.20	2.33	4.677E-03	3.763E-03
0.30	2.15	7.079E-03	5.633E-03
0.40	2.03	9.333E-03	7.496E-03
0.50	1.93	1.175E-02	9.351E-03



Type:	0.0305 m NaCl with 0.01 M HCl
SN Reference	WIPP-Solubility-7 p. 83
Solution Reference:	WIPP-Solubility-7 p. 82
Brine Volume:	52.2 mL
pH Probe:	Fisher Accumet
Titrant Actual M	0.009994 M HCl
Titrant Reference:	WIPP-Solubility-7 p. 9

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.010	5.247	5.662E-06	1.864E-06
0.019	5.126	7.482E-06	3.728E-06
0.039	4.955	1.109E-05	7.454E-06
0.068	4.779	1.663E-05	1.304E-05
0.117	4.581	2.624E-05	2.233E-05
0.166	4.445	3.589E-05	3.160E-05
0.175	4.265	5.433E-05	*
0.185	4.139	7.261E-05	*
0.195	4.042	9.078E-05	*
0.214	3.894	1.276E-04	*
0.244	3.737	1.832E-04	*
0.292	3.559	2.761E-04	*
0.360	3.398	3.999E-04	*
0.460	3.235	5.821E-04	*
0.661	3.029	9.354E-04	*
1.161	2.742	1.811E-03	*
2.145	2.461	3.459E-03	*
3.129	2.300	5.012E-03	*
5.097	2.097	7.998E-03	*

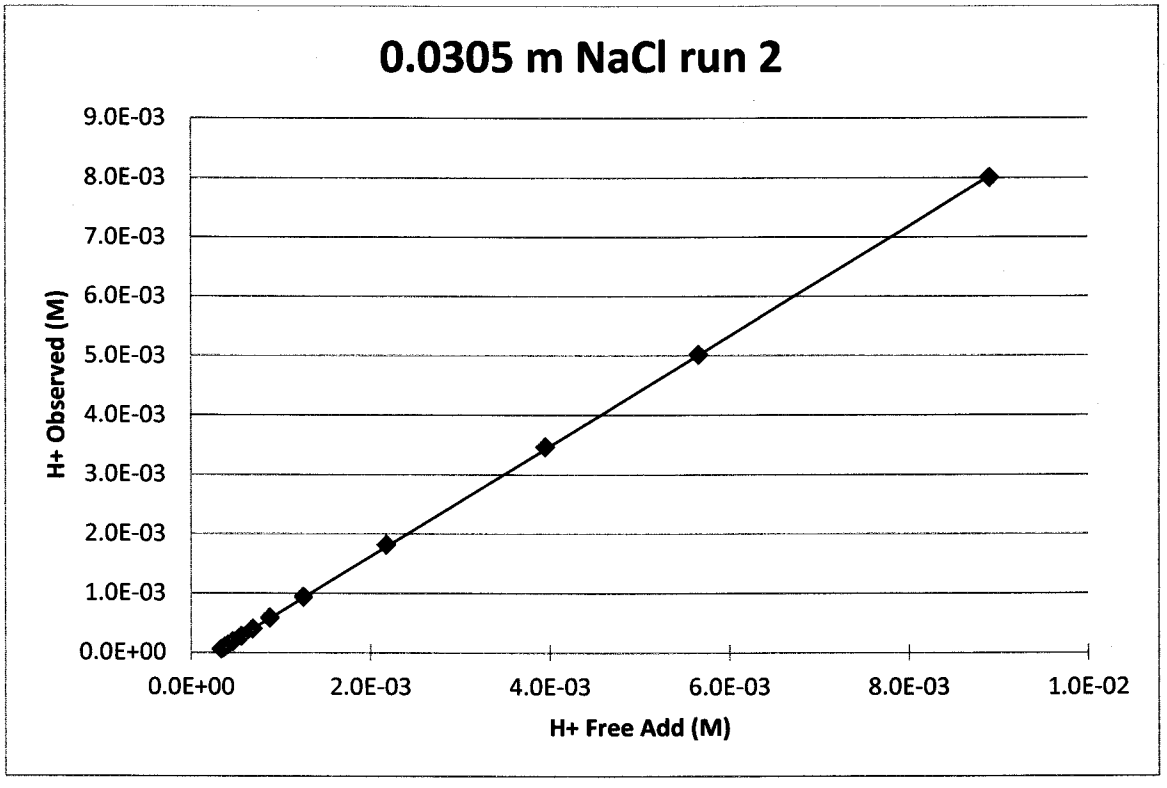
* Plotted as Run 2



Type:	0.0305 m NaCl with 0.1M HCl
SN Reference	WIPP-Solubility-7 p. 83
Solution Reference:	WIPP-Solubility-7 p. 82
Brine Volume:	52.2 mL
pH Probe:	Fisher Accumet
Titrant Actual M	0.1 M HCl
Titrant Reference:	WIPP-Solubility-7 p. 9

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.010	5.247	5.662E-06	*
0.019	5.126	7.482E-06	*
0.039	4.955	1.109E-05	*
0.068	4.779	1.663E-05	*
0.117	4.581	2.624E-05	*
0.166	4.445	3.589E-05	*
0.175	4.265	5.433E-05	3.347E-04
0.185	4.139	7.261E-05	3.533E-04
0.195	4.042	9.078E-05	3.718E-04
0.214	3.894	1.276E-04	4.088E-04
0.244	3.737	1.832E-04	4.643E-04
0.292	3.559	2.761E-04	5.567E-04
0.360	3.398	3.999E-04	6.856E-04
0.460	3.235	5.821E-04	8.744E-04
0.661	3.029	9.354E-04	1.250E-03
1.161	2.742	1.811E-03	2.176E-03
2.145	2.461	3.459E-03	3.947E-03
3.129	2.300	5.012E-03	5.656E-03
5.097	2.097	7.998E-03	8.896E-03

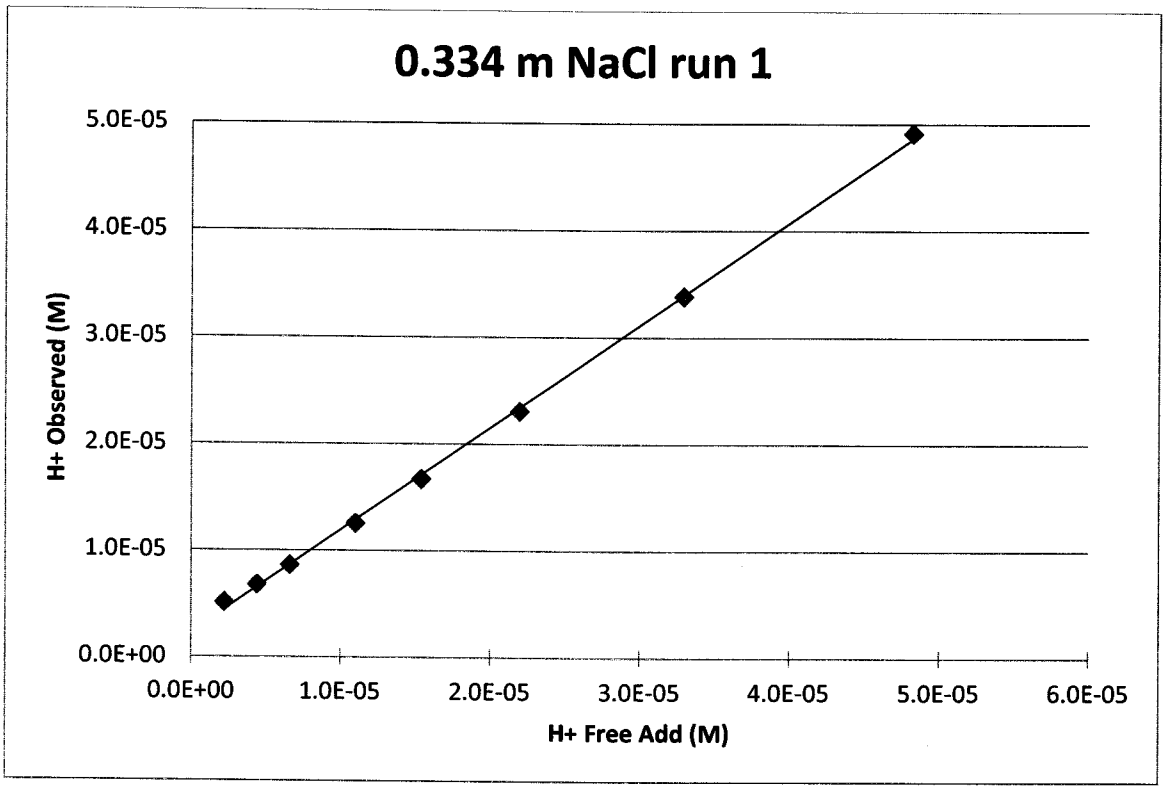
* Plotted as Run 1



Type:	0.334 m NaCl with 0.01M HCl
SN Reference	WIPP-Solubility-7 p. 94
Solution Reference:	WIPP-Solubility-7 p. 82
Brine Volume:	44.2 mL
pH Probe:	Fisher Accumet
Titrant Actual M	0.009994 M HCl
Titrant Reference:	WIPP-Solubility-7 p. 9

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.010	5.294	5.082E-06	2.202E-06
0.019	5.171	6.745E-06	4.403E-06
0.029	5.067	8.570E-06	6.603E-06
0.049	4.903	1.250E-05	1.100E-05
0.068	4.779	1.663E-05	1.539E-05
0.097	4.638	2.301E-05	2.197E-05
0.146	4.471	3.381E-05	3.293E-05
0.214	4.309	4.909E-05	4.822E-05
0.234	4.039	9.141E-05	*
0.263	3.809	1.552E-04	*
0.302	3.617	2.415E-04	*
0.370	3.408	3.908E-04	*
0.470	3.216	6.081E-04	*
0.670	2.985	1.035E-03	*
0.971	2.780	1.660E-03	*
1.571	2.539	2.891E-03	*
2.555	2.326	4.721E-03	*
4.523	2.092	8.091E-03	*

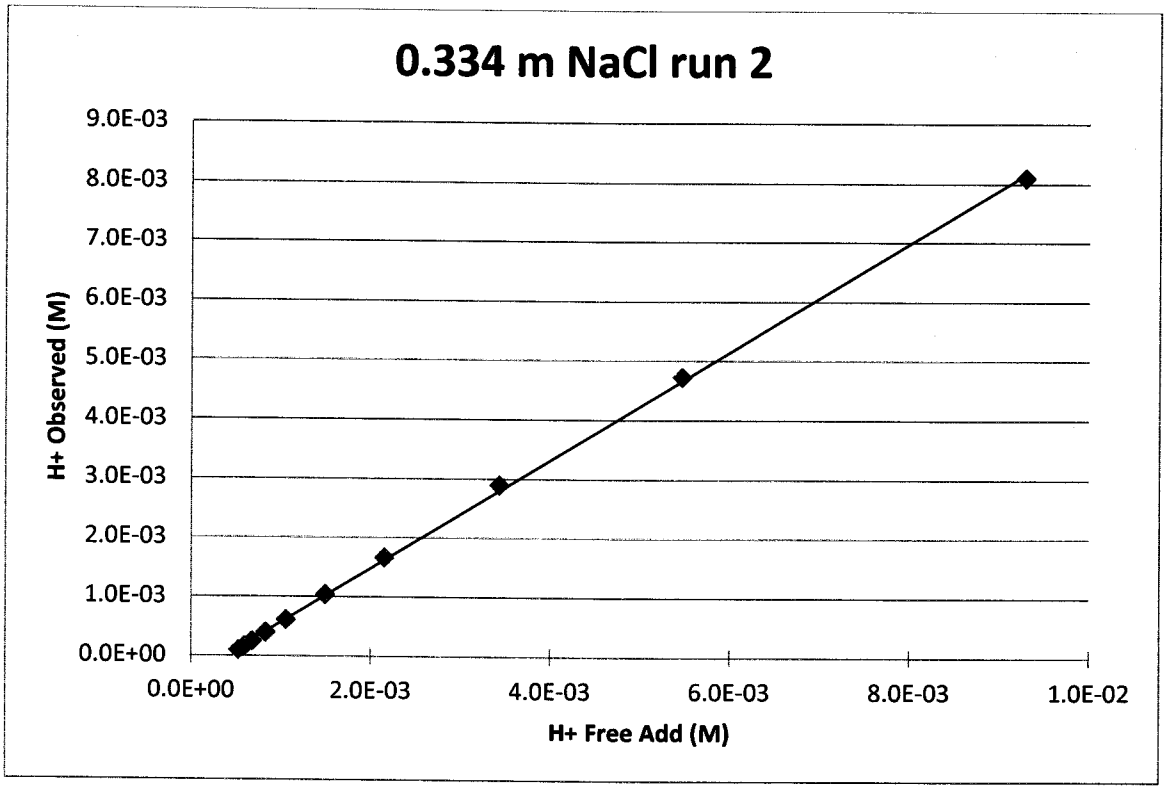
* Plotted as Run 2



Type:	0.334 m NaCl with 0.01M HCl
SN Reference	WIPP-Solubility-7 p. 94
Solution Reference:	WIPP-Solubility-7 p. 82
Brine Volume:	44.2 mL
pH Probe:	Fisher Accumet
Titrant Actual M	0.009994 M HCl
Titrant Reference:	WIPP-Solubility-7 p. 9

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.010	5.294	5.082E-06	*
0.019	5.171	6.745E-06	*
0.029	5.067	8.570E-06	*
0.049	4.903	1.250E-05	*
0.068	4.779	1.663E-05	*
0.097	4.638	2.301E-05	*
0.146	4.471	3.381E-05	*
0.214	4.309	4.909E-05	*
0.234	4.039	9.141E-05	5.261E-04
0.263	3.809	1.552E-04	5.915E-04
0.302	3.617	2.415E-04	6.785E-04
0.370	3.408	3.908E-04	8.304E-04
0.470	3.216	6.081E-04	1.053E-03
0.670	2.985	1.035E-03	1.494E-03
0.971	2.780	1.660E-03	2.149E-03
1.571	2.539	2.891E-03	3.433E-03
2.555	2.326	4.721E-03	5.465E-03
4.523	2.092	8.091E-03	9.284E-03

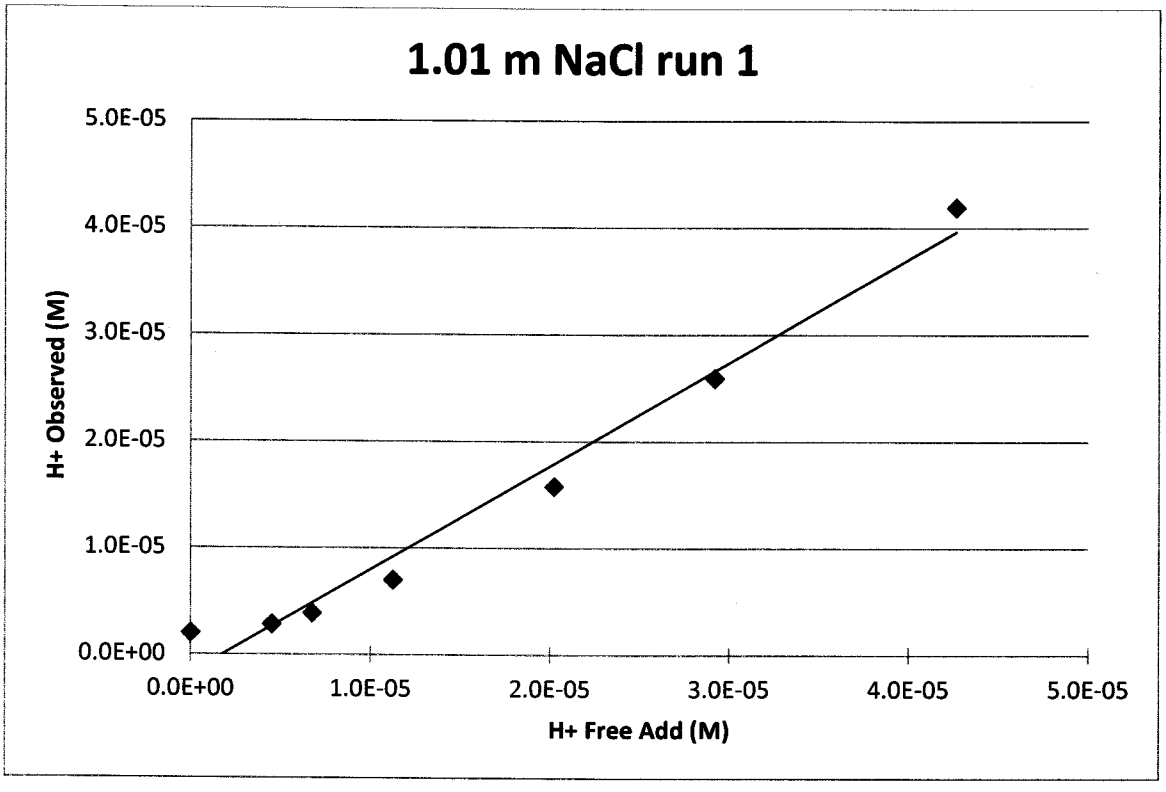
* Plotted as Run 1



Type:	1.01 m NaCl with 0.01M HCl
SN Reference	WIPP-Solubility-7 p. 94
Solution Reference:	WIPP-Solubility-7 p. 49
Brine Volume:	43.2 mL
pH Probe:	Fisher Accumet
Titrant Actual M	0.009994 M HCl
Titrant Reference:	WIPP-Solubility-7 p. 9

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.010	5.708	1.959E-06	2.253E-06
0.019	5.559	2.761E-06	4.505E-06
0.029	5.419	3.811E-06	6.755E-06
0.049	5.159	6.934E-06	1.125E-05
0.088	4.804	1.570E-05	2.024E-05
0.127	4.587	2.588E-05	2.921E-05
0.185	4.378	4.188E-05	4.263E-05
0.195	4.164	6.855E-05	*
0.214	3.911	1.227E-04	*
0.244	3.690	2.042E-04	*
0.292	3.470	3.388E-04	*
0.370	3.255	5.559E-04	*
0.470	3.081	8.299E-04	*
0.670	2.862	1.374E-03	*
0.971	2.663	2.173E-03	*
1.471	2.461	3.459E-03	*
2.272	2.267	5.408E-03	*
3.256	2.114	7.691E-03	*
4.240	2.008	9.817E-03	*

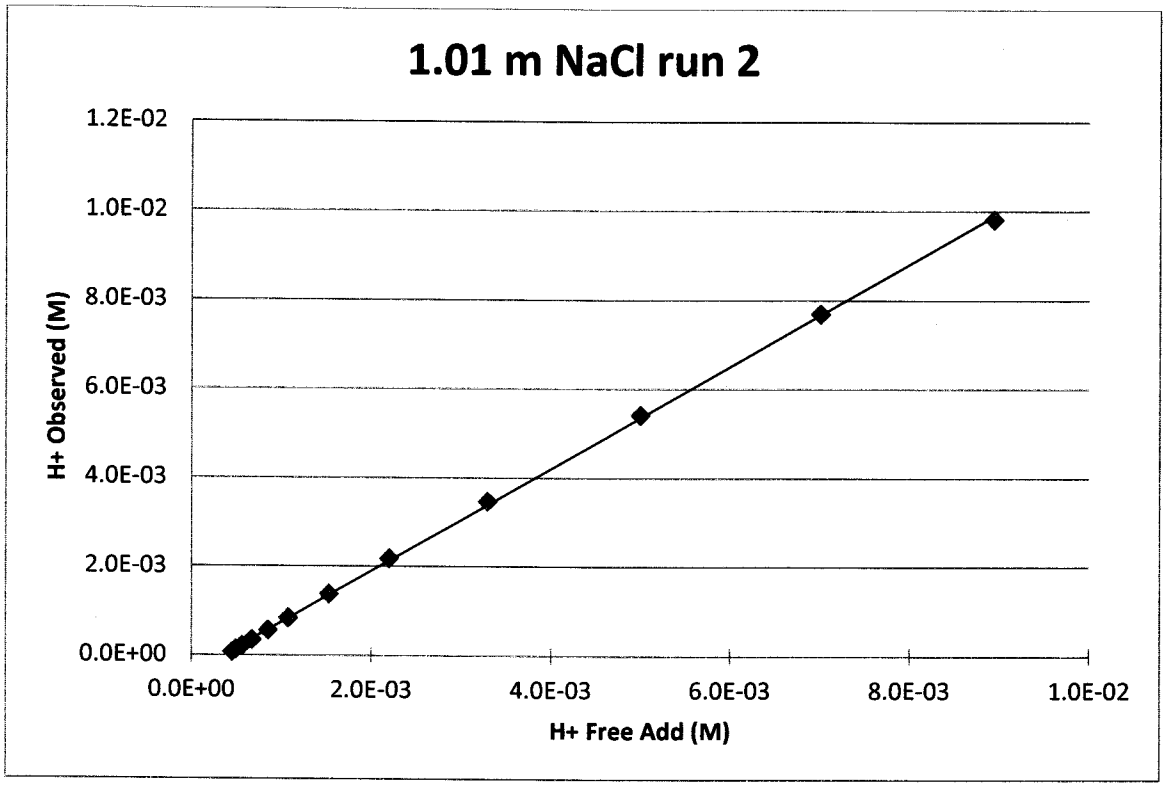
* Plotted as Run 2



Type:	1.01 m NaCl with 0.01M HCl
SN Reference	WIPP-Solubility-7 p. 94
Solution Reference:	WIPP-Solubility-7 p. 49
Brine Volume:	43.2 mL
pH Probe:	Fisher Accumet
Titrant Actual M	0.009994 M HCl
Titrant Reference:	WIPP-Solubility-7 p. 9

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.010	5.708	1.959E-06	*
0.019	5.559	2.761E-06	*
0.029	5.419	3.811E-06	*
0.049	5.159	6.934E-06	*
0.088	4.804	1.570E-05	*
0.127	4.587	2.588E-05	*
0.185	4.378	4.188E-05	*
0.195	4.164	6.855E-05	4.489E-04
0.214	3.911	1.227E-04	4.936E-04
0.244	3.690	2.042E-04	5.605E-04
0.292	3.470	3.388E-04	6.718E-04
0.370	3.255	5.559E-04	8.495E-04
0.470	3.081	8.299E-04	1.077E-03
0.670	2.862	1.374E-03	1.528E-03
0.971	2.663	2.173E-03	2.198E-03
1.471	2.461	3.459E-03	3.293E-03
2.272	2.267	5.408E-03	4.997E-03
3.256	2.114	7.691E-03	7.009E-03
4.240	2.008	9.817E-03	8.938E-03

* Plotted as Run 2

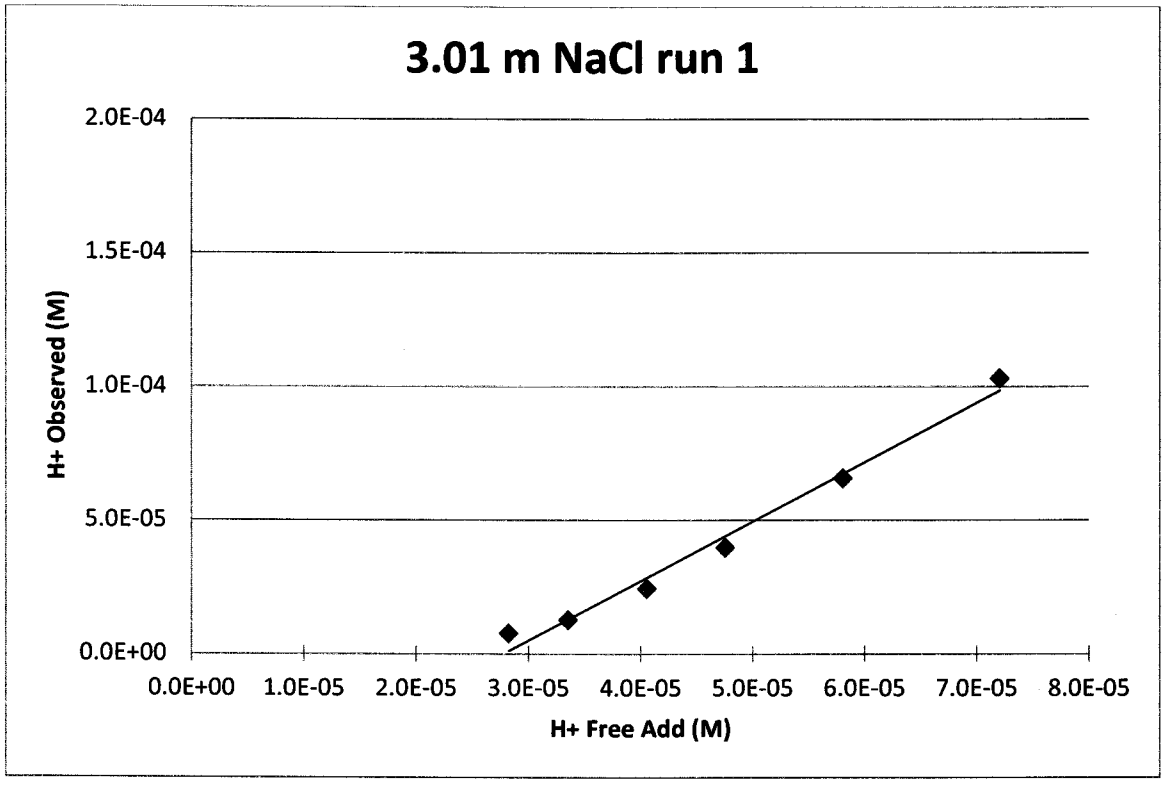


Type:	3.01 m NaCl with 0.01M HCl
SN Reference	WIPP-Solubility-7 p. 95
Solution Reference:	WIPP-Solubility-7 p. 82
Brine Volume:	55.0 mL
pH Probe:	Fisher Accumet
Titrant Actual M	0.009994 M HCl
Titrant Reference:	WIPP-Solubility-7 p. 9

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.010	6.196	6.368E-07	--
0.019	6.121	7.568E-07	--
0.039	5.963	1.089E-06	--
0.058	5.836	1.459E-06	--
0.088	5.624	2.377E-06	--
0.117	5.426	3.750E-06	--
0.156	5.128	7.447E-06	2.824E-05
0.185	4.901	1.256E-05	3.351E-05
0.224	4.616	2.421E-05	4.054E-05
0.263	4.403	3.954E-05	4.756E-05
0.321	4.183	6.561E-05	5.807E-05
0.399	3.987	1.030E-04	7.204E-05
0.409	3.827	1.489E-04	*
0.429	3.621	2.393E-04	*
0.458	3.418	3.819E-04	*
0.516	3.174	6.699E-04	*
0.594	2.978	1.052E-03	*
0.694	2.814	1.535E-03	*
0.894	2.604	2.489E-03	*
1.195	2.411	3.882E-03	*
1.695	2.215	6.095E-03	*
2.396	2.044	9.036E-03	*

-- Indicates data not used in slope regression

* Plotted as Run 2

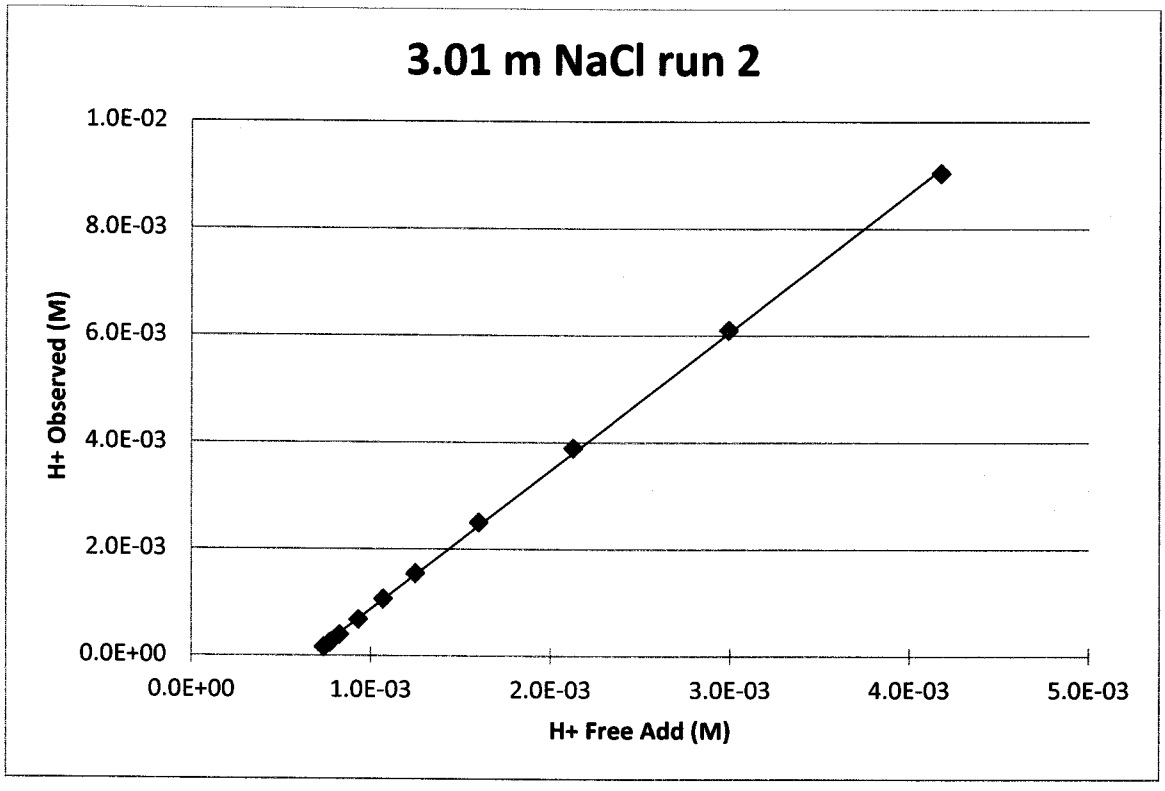


Type:	3.01 m NaCl with 0.01M HCl
SN Reference	WIPP-Solubility-7 p. 95
Solution Reference:	WIPP-Solubility-7 p. 82
Brine Volume:	55.0 mL
pH Probe:	Fisher Accumet
Titrant Actual M	0.009994 M HCl
Titrant Reference:	WIPP-Solubility-7 p. 9

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.010	6.196	6.368E-07	--
0.019	6.121	7.568E-07	--
0.039	5.963	1.089E-06	--
0.058	5.836	1.459E-06	--
0.088	5.624	2.377E-06	--
0.117	5.426	3.750E-06	--
0.156	5.128	7.447E-06	*
0.185	4.901	1.256E-05	*
0.224	4.616	2.421E-05	*
0.263	4.403	3.954E-05	*
0.321	4.183	6.561E-05	*
0.399	3.987	1.030E-04	*
0.409	3.827	1.489E-04	7.383E-04
0.429	3.621	2.393E-04	7.732E-04
0.458	3.418	3.819E-04	8.255E-04
0.516	3.174	6.699E-04	9.299E-04
0.594	2.978	1.052E-03	1.069E-03
0.694	2.814	1.535E-03	1.247E-03
0.894	2.604	2.489E-03	1.600E-03
1.195	2.411	3.882E-03	2.126E-03
1.695	2.215	6.095E-03	2.990E-03
2.396	2.044	9.036E-03	4.174E-03

-- Indicates data not used in slope regression

* Plotted as Run 1

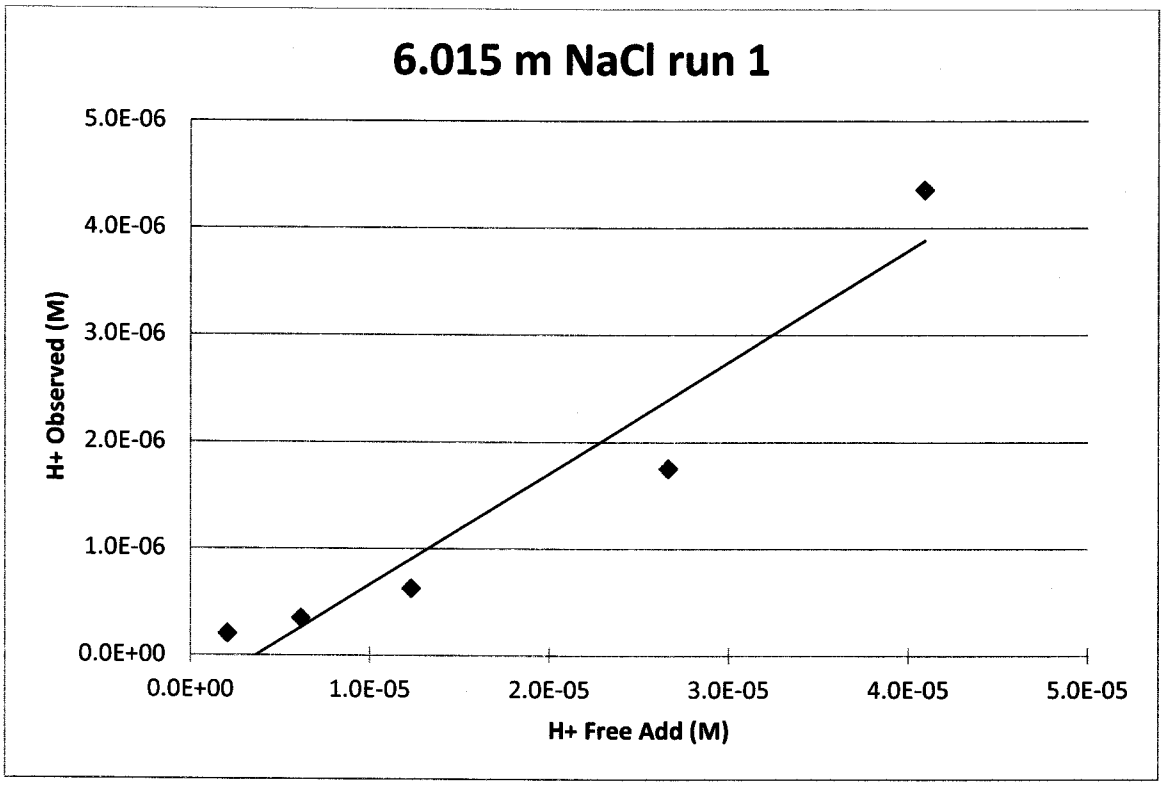


Type:	6.01 m NaCl with 0.01M HCl
SN Reference	WIPP-Solubility-7 p. 95
Solution Reference:	WIPP-Solubility-7 p. 82
Brine Volume:	47.4 mL
pH Probe:	Fisher Accumet
Titrant Actual M	0.009994 M HCl
Titrant Reference:	WIPP-Solubility-7 p. 9

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.010	6.705	1.972E-07	+2.053E-06
0.029	6.465	3.428E-07	+6.157E-06
0.058	6.208	6.194E-07	+1.231E-05
0.127	5.757	1.750E-06	+2.663E-05
0.195	5.361	4.355E-06	+4.090E-05
0.205	4.643	2.275E-05	*
0.214	3.844	1.432E-04	*
0.224	3.490	3.236E-04	*
0.234	3.279	5.260E-04	*
0.253	3.035	9.226E-04	*
0.292	2.760	1.738E-03	*
0.351	2.532	2.938E-03	*
0.451	2.307	4.932E-03	*
0.751	1.966	1.081E-02	*

+Data not used in analysis

* Plotted as Run 2

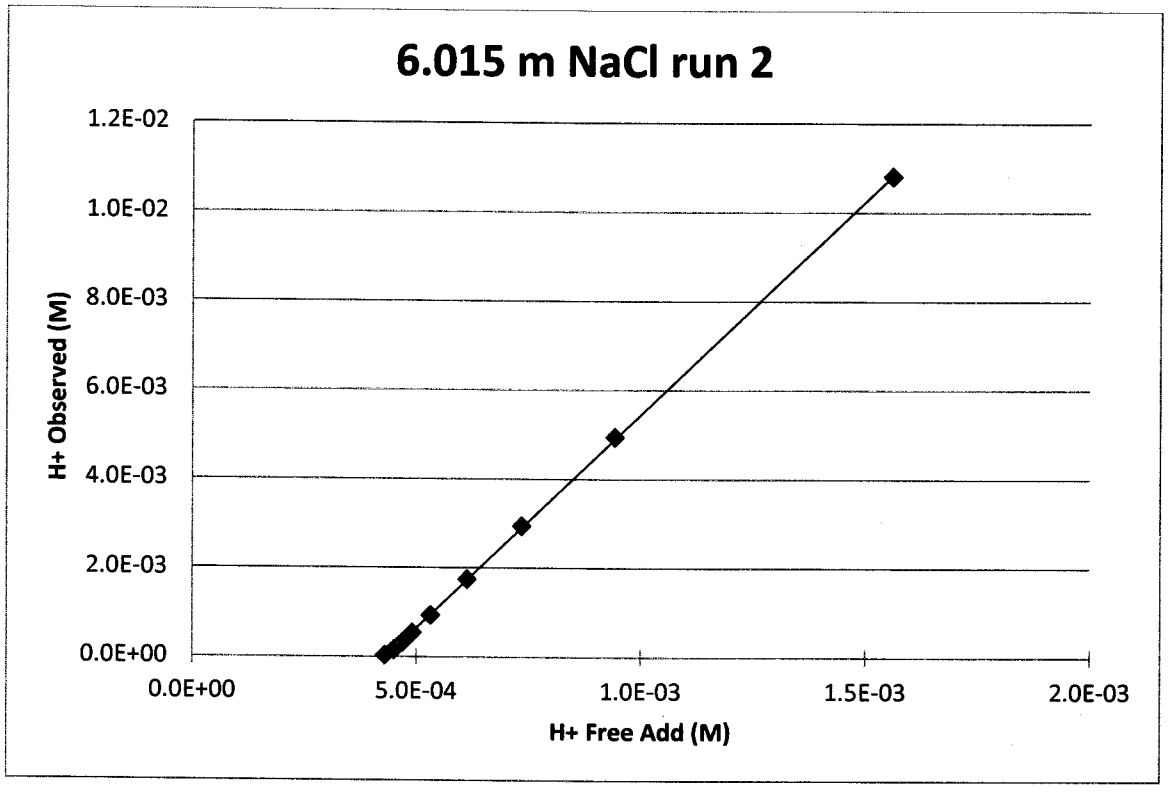


THIS DATA SET NOT USED IN ANALYSIS

Type:	6.01 m NaCl with 0.01M HCl
SN Reference	WIPP-Solubility-7 p. 95
Solution Reference:	WIPP-Solubility-7 p. 82
Brine Volume:	47.4 mL
pH Probe:	Fisher Accumet
Titrant Actual M	0.009994 M HCl
Titrant Reference:	WIPP-Solubility-7 p. 9

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.010	6.705	1.972E-07	*
0.029	6.465	3.428E-07	*
0.058	6.208	6.194E-07	*
0.127	5.757	1.750E-06	*
0.195	5.361	4.355E-06	*
0.205	4.643	2.275E-05	4.297E-04
0.214	3.844	1.432E-04	4.500E-04
0.224	3.490	3.236E-04	4.704E-04
0.234	3.279	5.260E-04	4.907E-04
0.253	3.035	9.226E-04	5.314E-04
0.292	2.760	1.738E-03	6.127E-04
0.351	2.532	2.938E-03	7.343E-04
0.451	2.307	4.932E-03	9.420E-04
0.751	1.966	1.081E-02	1.560E-03

* Plotted as Run 1

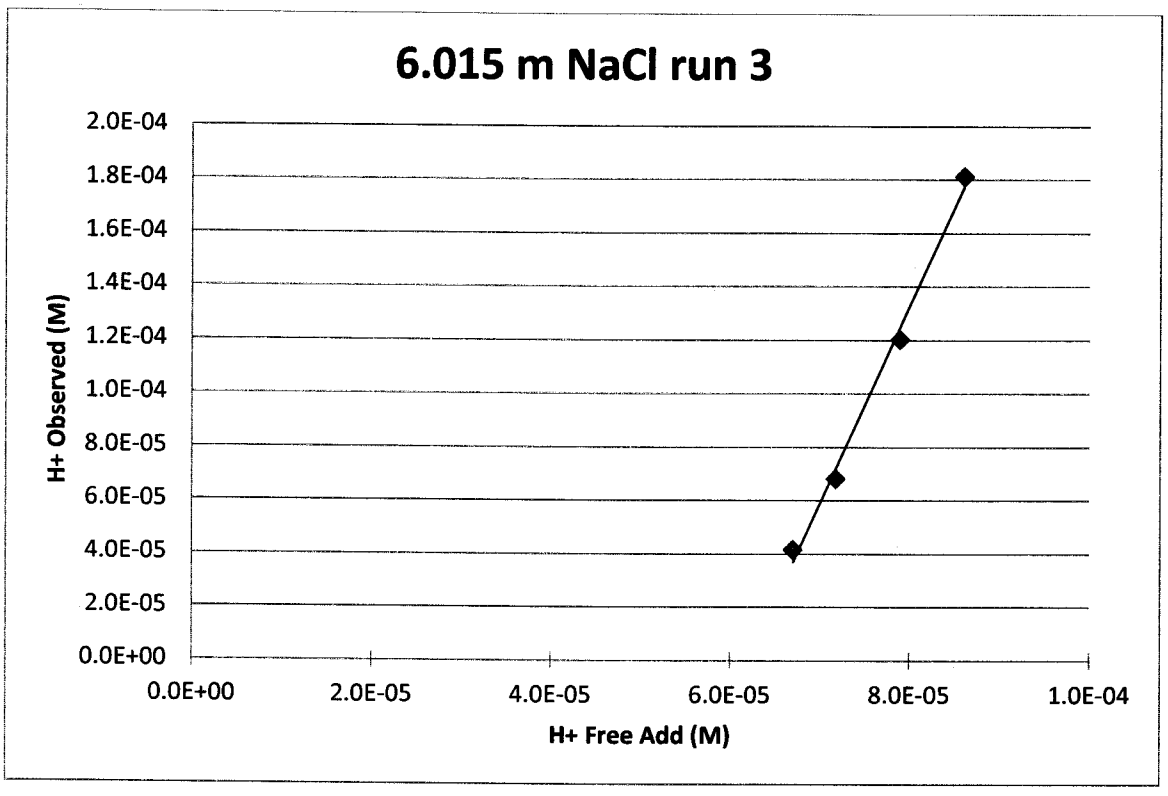


Type:	6.01 m NaCl with 0.1M HCl
SN Reference	WIPP-Solubility-7 p. 96
Solution Reference:	WIPP-Solubility-7 p. 82
Brine Volume:	40.4 mL
pH Probe:	Fisher Accumet
Titrant Actual M	0.1 M HCl
Titrant Reference:	WIPP-Solubility-7 p. 9

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.019	6.211	6.152E-07	--
0.049	5.996	1.009E-06	--
0.078	5.804	1.570E-06	--
0.107	5.645	2.265E-06	--
0.136	5.447	3.573E-06	--
0.175	5.191	6.442E-06	--
0.214	4.936	1.159E-05	--
0.253	4.584	2.606E-05	--
0.273	4.382	4.150E-05	6.701E-05
0.292	4.167	6.808E-05	7.176E-05
0.321	3.920	1.202E-04	7.888E-05
0.351	3.742	1.811E-04	8.599E-05
0.390	3.571	2.685E-04	9.546E-05
0.438	3.418	3.819E-04	1.073E-04
0.506	3.267	5.408E-04	1.237E-04
0.516	3.109	7.780E-04	*
0.536	2.904	1.247E-03	*
0.565	2.709	1.954E-03	*
0.614	2.506	3.119E-03	*
0.714	2.263	5.458E-03	*
0.814	2.112	7.727E-03	*
0.914	2.001	9.977E-03	*
1.014	1.914	1.219E-02	*

-- Indicates data not used in slope regression

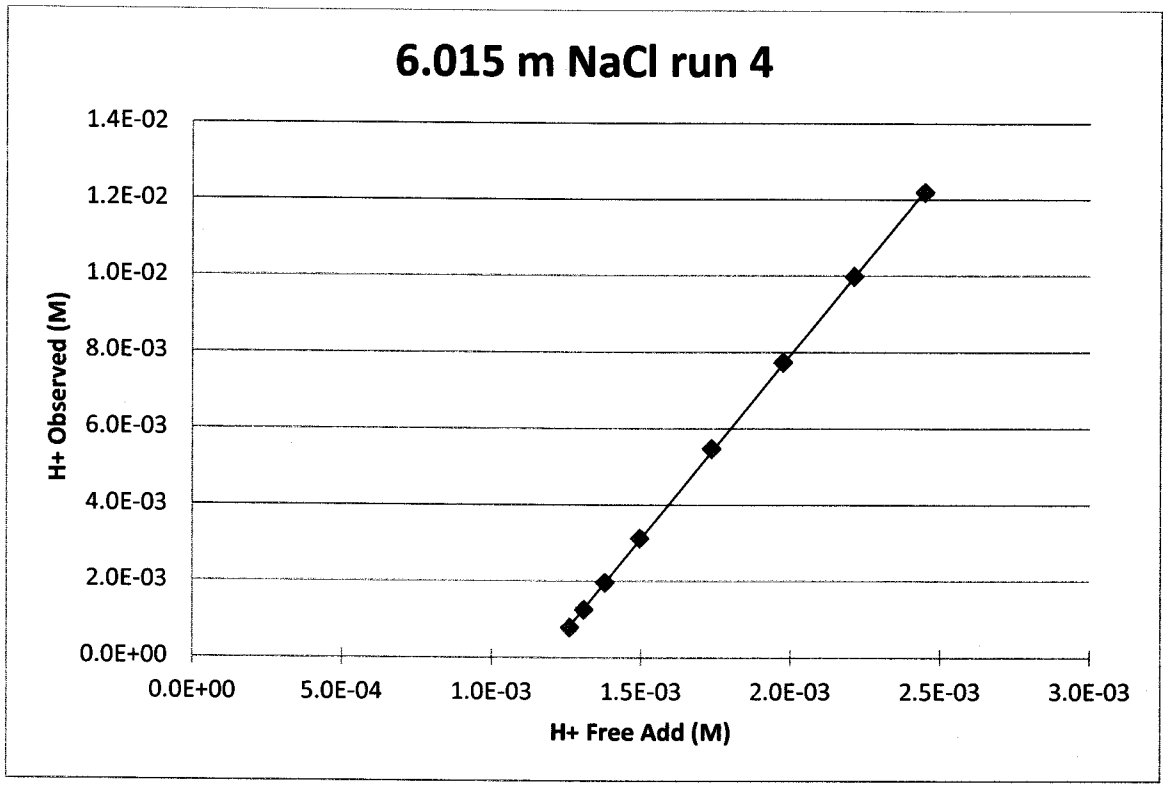
* Plotted as Run 4



Type:	6.01 m NaCl with 0.1M HCl
SN Reference	WIPP-Solubility-7 p. 96
Solution Reference:	WIPP-Solubility-7 p. 82
Brine Volume:	40.4 mL
pH Probe:	Fisher Accumet
Titrant Actual M	0.1 M HCl
Titrant Reference:	WIPP-Solubility-7 p. 9

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.019	6.211	6.152E-07	*
0.049	5.996	1.009E-06	*
0.078	5.804	1.570E-06	*
0.107	5.645	2.265E-06	*
0.136	5.447	3.573E-06	*
0.175	5.191	6.442E-06	*
0.214	4.936	1.159E-05	*
0.253	4.584	2.606E-05	*
0.273	4.382	4.150E-05	*
0.292	4.167	6.808E-05	*
0.321	3.920	1.202E-04	*
0.351	3.742	1.811E-04	*
0.390	3.571	2.685E-04	*
0.438	3.418	3.819E-04	*
0.506	3.267	5.408E-04	*
0.516	3.109	7.780E-04	1.262E-03
0.536	2.904	1.247E-03	1.309E-03
0.565	2.709	1.954E-03	1.379E-03
0.614	2.506	3.119E-03	1.496E-03
0.714	2.263	5.458E-03	1.736E-03
0.814	2.112	7.727E-03	1.975E-03
0.914	2.001	9.977E-03	2.212E-03
1.014	1.914	1.219E-02	2.448E-03

* Plotted as Run 3

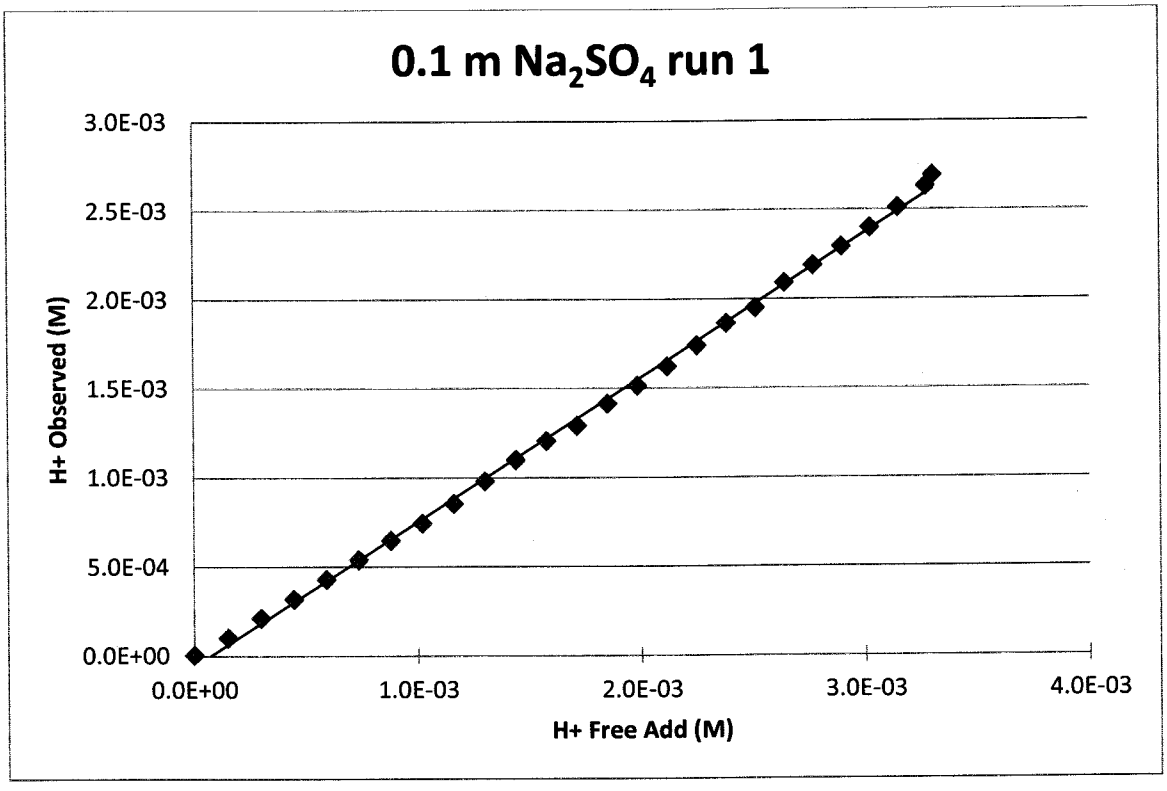


Appendix B

Titration Data for $Na_2SO_4 \pm NaCl$ Solutions

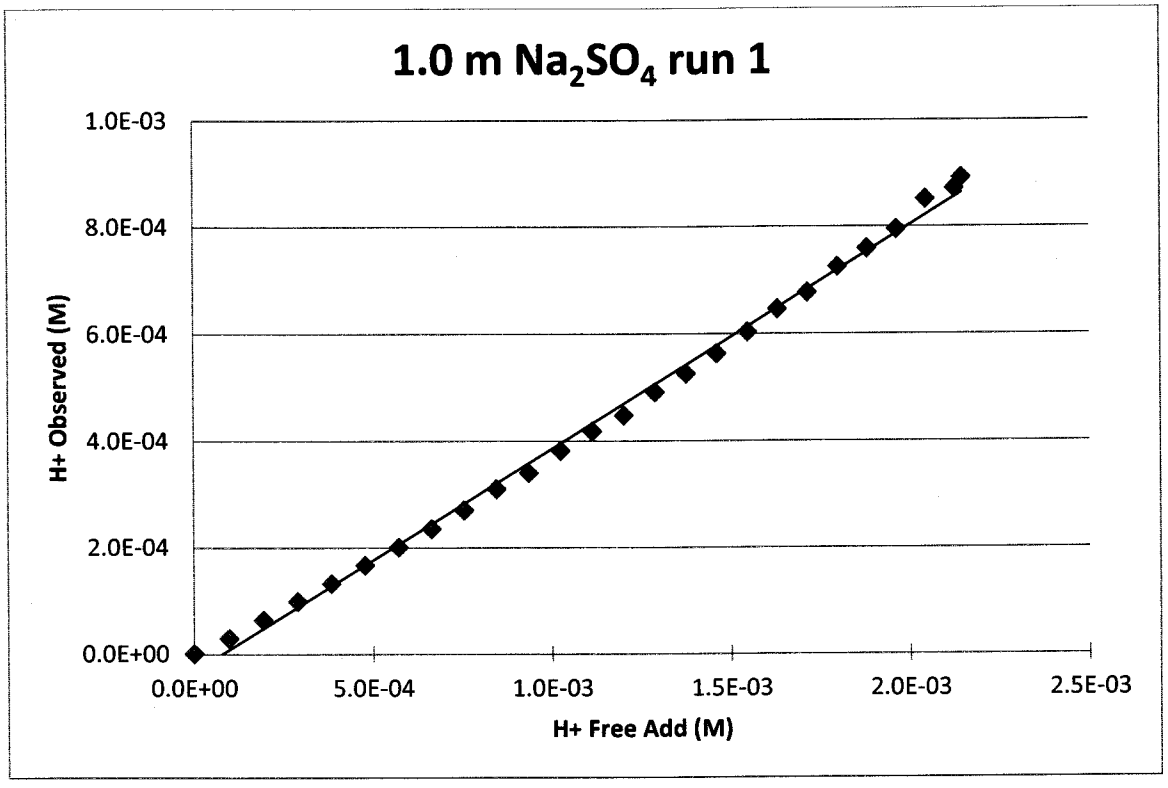
Type:	0.1 m Na_2SO_4 with 0.1 M HCl
SN Reference	WIPP-Solubility-13 p. 15-16
Solution Reference:	WIPP-Solubility-13 p. 15
Brine Volume:	50.0 mL
pH Probe:	Corning Semi-Micro Combo
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	5.99	1.023E-06	0.000E+00	0.000E+00
0.208	4.00	1.000E-04	4.143E-04	1.496E-04
0.416	3.68	2.089E-04	8.251E-04	2.980E-04
0.623	3.50	3.162E-04	1.231E-03	4.444E-04
0.831	3.37	4.266E-04	1.635E-03	5.904E-04
1.039	3.27	5.370E-04	2.036E-03	7.351E-04
1.247	3.19	6.457E-04	2.433E-03	8.787E-04
1.454	3.13	7.413E-04	2.826E-03	1.020E-03
1.662	3.07	8.511E-04	3.217E-03	1.162E-03
1.870	3.01	9.772E-04	3.605E-03	1.302E-03
2.078	2.96	1.096E-03	3.990E-03	1.441E-03
2.285	2.92	1.202E-03	4.370E-03	1.578E-03
2.493	2.89	1.288E-03	4.749E-03	1.715E-03
2.701	2.85	1.413E-03	5.125E-03	1.851E-03
2.909	2.82	1.514E-03	5.498E-03	1.985E-03
3.116	2.79	1.622E-03	5.866E-03	2.118E-03
3.324	2.76	1.738E-03	6.234E-03	2.251E-03
3.532	2.73	1.862E-03	6.598E-03	2.383E-03
3.740	2.71	1.950E-03	6.959E-03	2.513E-03
3.947	2.68	2.089E-03	7.316E-03	2.642E-03
4.155	2.66	2.188E-03	7.672E-03	2.771E-03
4.363	2.64	2.291E-03	8.026E-03	2.898E-03
4.571	2.62	2.399E-03	8.376E-03	3.025E-03
4.778	2.60	2.512E-03	8.722E-03	3.150E-03
4.986	2.58	2.630E-03	9.068E-03	3.275E-03
5.038	2.57	2.692E-03	9.154E-03	3.306E-03



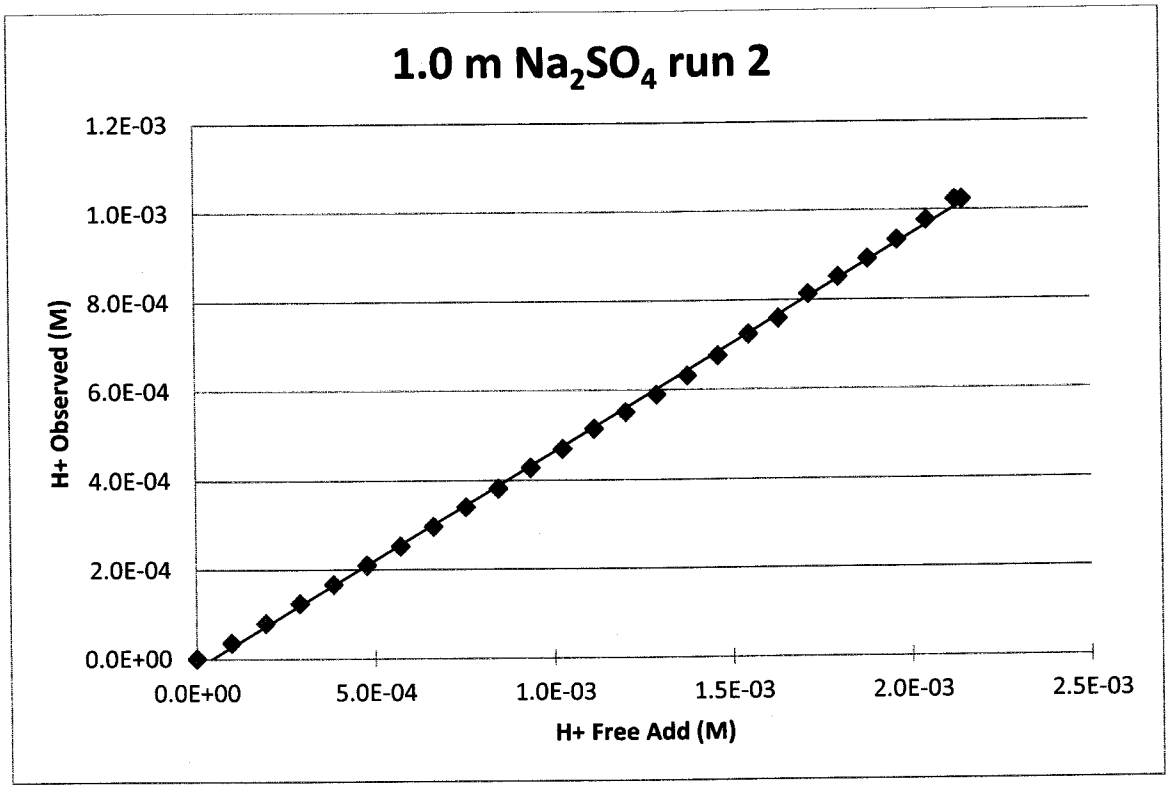
Type:	1.0 m Na_2SO_4 with 0.1 M HCl
SN Reference	WIPP-Solubility-13 p. 15-16
Solution Reference:	WIPP-Solubility-13 p. 15
Brine Volume:	50.0 mL
pH Probe:	Corning Semi-Micro Combo
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	7.35	4.467E-08	0.000E+00	0.000E+00
0.208	4.54	2.884E-05	4.143E-04	9.711E-05
0.416	4.20	6.310E-05	8.251E-04	1.934E-04
0.623	4.01	9.772E-05	1.231E-03	2.885E-04
0.831	3.88	1.318E-04	1.635E-03	3.832E-04
1.039	3.78	1.660E-04	2.036E-03	4.772E-04
1.247	3.70	1.995E-04	2.433E-03	5.704E-04
1.454	3.63	2.344E-04	2.826E-03	6.624E-04
1.662	3.57	2.692E-04	3.217E-03	7.541E-04
1.870	3.51	3.090E-04	3.605E-03	8.450E-04
2.078	3.47	3.388E-04	3.990E-03	9.353E-04
2.285	3.42	3.802E-04	4.370E-03	1.024E-03
2.493	3.38	4.169E-04	4.749E-03	1.113E-03
2.701	3.35	4.467E-04	5.125E-03	1.201E-03
2.909	3.31	4.898E-04	5.498E-03	1.289E-03
3.116	3.28	5.248E-04	5.866E-03	1.375E-03
3.324	3.25	5.623E-04	6.234E-03	1.461E-03
3.532	3.22	6.026E-04	6.598E-03	1.547E-03
3.740	3.19	6.457E-04	6.959E-03	1.631E-03
3.947	3.17	6.761E-04	7.316E-03	1.715E-03
4.155	3.14	7.244E-04	7.672E-03	1.798E-03
4.363	3.12	7.586E-04	8.026E-03	1.881E-03
4.571	3.10	7.943E-04	8.376E-03	1.963E-03
4.778	3.07	8.511E-04	8.722E-03	2.045E-03
4.986	3.06	8.710E-04	9.068E-03	2.125E-03
5.038	3.05	8.913E-04	9.154E-03	2.146E-03



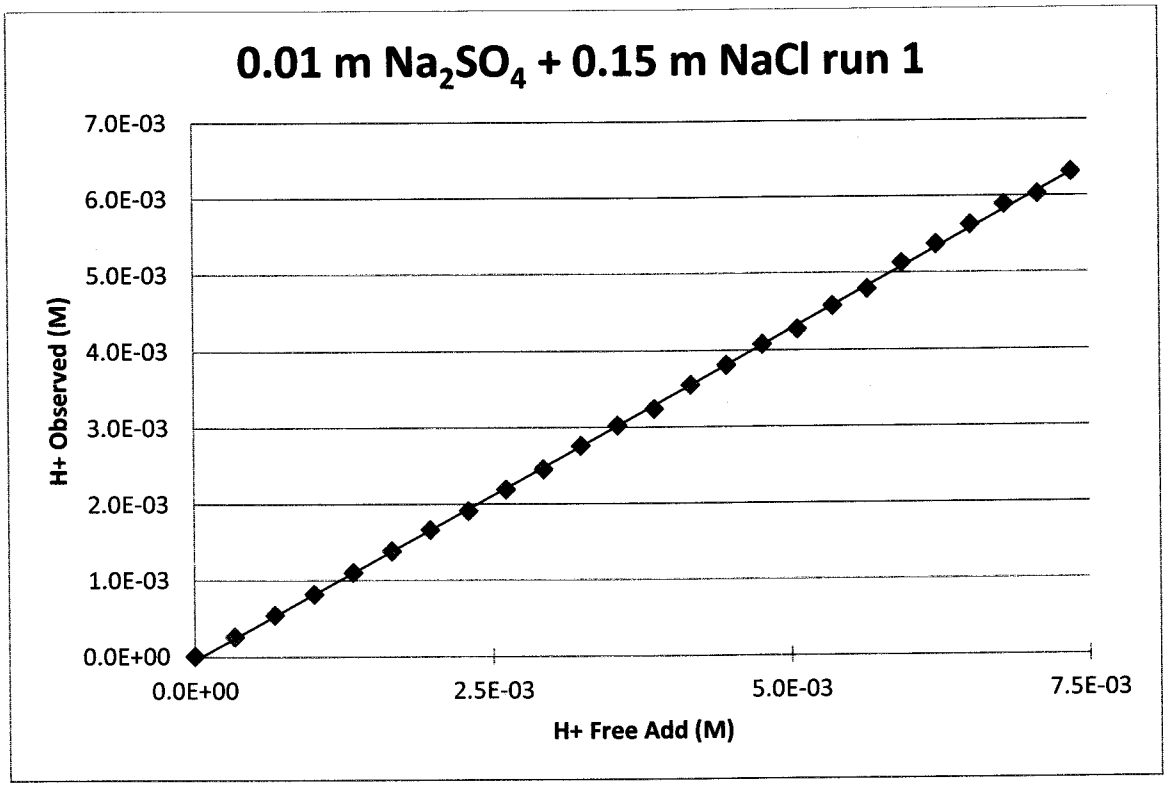
Type:	1.0 m Na_2SO_4 with 0.1 M HCl
SN Reference	WIPP-Solubility-13 p. 15-16
Solution Reference:	WIPP-Solubility-13 p. 15
Brine Volume:	50.0 mL
pH Probe:	Corning Semi-Micro Combo
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	7.31	4.898E-08	0.000E+00	0.000E+00
0.208	4.45	3.548E-05	4.143E-04	9.711E-05
0.416	4.10	7.943E-05	8.251E-04	1.934E-04
0.623	3.91	1.230E-04	1.231E-03	2.885E-04
0.831	3.78	1.660E-04	1.635E-03	3.832E-04
1.039	3.68	2.089E-04	2.036E-03	4.772E-04
1.247	3.60	2.512E-04	2.433E-03	5.704E-04
1.454	3.53	2.951E-04	2.826E-03	6.624E-04
1.662	3.47	3.388E-04	3.217E-03	7.541E-04
1.870	3.42	3.802E-04	3.605E-03	8.450E-04
2.078	3.37	4.266E-04	3.990E-03	9.353E-04
2.285	3.33	4.677E-04	4.370E-03	1.024E-03
2.493	3.29	5.129E-04	4.749E-03	1.113E-03
2.701	3.26	5.495E-04	5.125E-03	1.201E-03
2.909	3.23	5.888E-04	5.498E-03	1.289E-03
3.116	3.20	6.310E-04	5.866E-03	1.375E-03
3.324	3.17	6.761E-04	6.234E-03	1.461E-03
3.532	3.14	7.244E-04	6.598E-03	1.547E-03
3.740	3.12	7.586E-04	6.959E-03	1.631E-03
3.947	3.09	8.128E-04	7.316E-03	1.715E-03
4.155	3.07	8.511E-04	7.672E-03	1.798E-03
4.363	3.05	8.913E-04	8.026E-03	1.881E-03
4.571	3.03	9.333E-04	8.376E-03	1.963E-03
4.778	3.01	9.772E-04	8.722E-03	2.045E-03
4.986	2.99	1.023E-03	9.068E-03	2.125E-03
5.038	2.99	1.023E-03	9.154E-03	2.146E-03



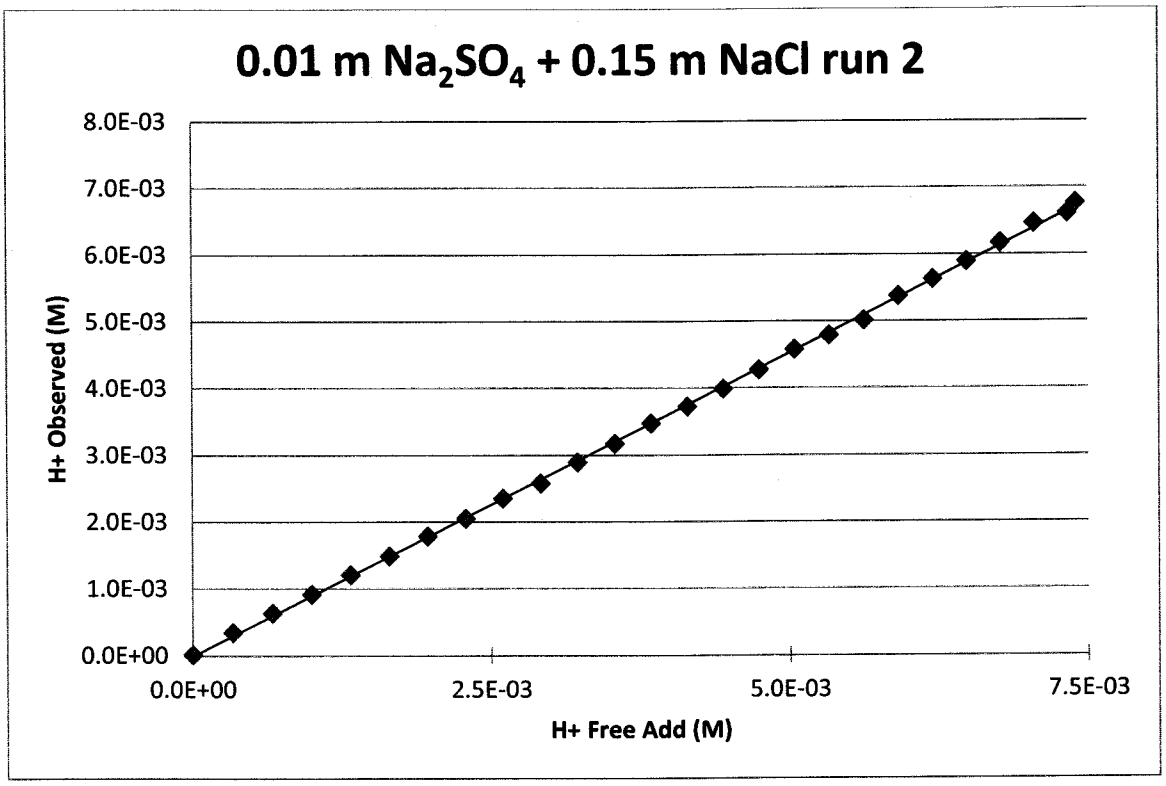
Type:	0.01 m Na2SO4 + 0.15 m NaCl with 0.1M HCl
SN Reference	WIPP-Solubility-13 p. 11
Solution Reference	WIPP-Solubility-3 p. 18
Brine Volume:	50.0 mL
Probe:	Corning Semi-Micro Combo
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	5.66	2.188E-06	0.000E+00	0.000E+00
0.209	3.59	2.570E-04	4.163E-04	3.354E-04
0.419	3.27	5.370E-04	8.310E-04	6.696E-04
0.628	3.09	8.128E-04	1.240E-03	9.994E-04
0.838	2.96	1.096E-03	1.648E-03	1.328E-03
1.047	2.86	1.380E-03	2.051E-03	1.653E-03
1.256	2.78	1.660E-03	2.450E-03	1.974E-03
1.466	2.72	1.905E-03	2.848E-03	2.295E-03
1.675	2.66	2.188E-03	3.241E-03	2.612E-03
1.884	2.61	2.455E-03	3.631E-03	2.926E-03
2.094	2.56	2.754E-03	4.020E-03	3.239E-03
2.303	2.52	3.020E-03	4.403E-03	3.548E-03
2.513	2.49	3.236E-03	4.785E-03	3.856E-03
2.722	2.45	3.548E-03	5.163E-03	4.160E-03
2.931	2.42	3.802E-03	5.537E-03	4.461E-03
3.141	2.39	4.074E-03	5.911E-03	4.762E-03
3.350	2.37	4.266E-03	6.279E-03	5.059E-03
3.559	2.34	4.571E-03	6.645E-03	5.354E-03
3.769	2.32	4.786E-03	7.010E-03	5.648E-03
3.978	2.29	5.129E-03	7.370E-03	5.938E-03
4.188	2.27	5.370E-03	7.729E-03	6.227E-03
4.397	2.25	5.623E-03	8.083E-03	6.513E-03
4.606	2.23	5.888E-03	8.435E-03	6.796E-03
4.816	2.22	6.026E-03	8.786E-03	7.079E-03
5.025	2.2	6.310E-03	9.132E-03	7.358E-03



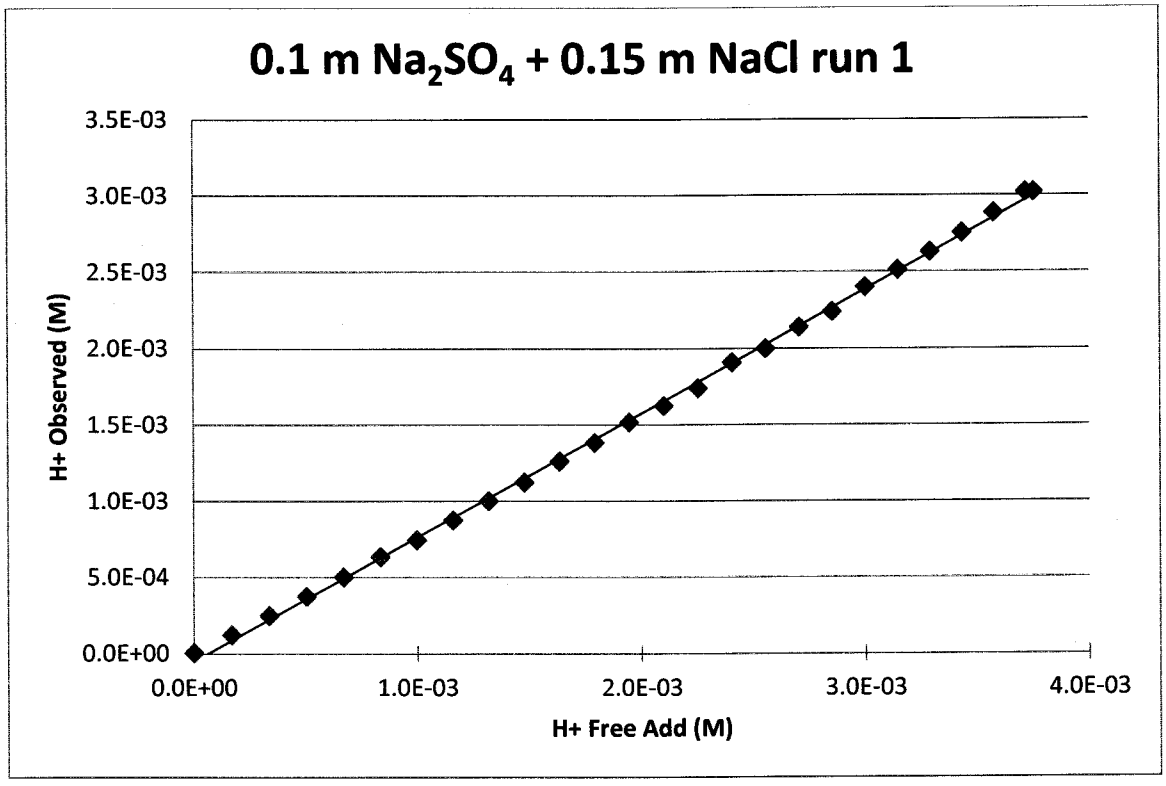
Type:	0.01 m Na2SO4 + 0.15 m NaCl with 0.1M HCl
SN Reference	WIPP-Solubility-13 p. 13
Solution Reference	WIPP-Solubility-3 p. 18
Brine Volume:	50.0 mL
Probe:	Corning Semi-Micro Combo
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	5.40	3.981E-06	0.000E+00	0.000E+00
0.208	3.47	3.388E-04	4.143E-04	3.338E-04
0.417	3.20	6.310E-04	8.271E-04	6.664E-04
0.625	3.04	9.120E-04	1.235E-03	9.947E-04
0.834	2.92	1.202E-03	1.641E-03	1.322E-03
1.042	2.83	1.479E-03	2.041E-03	1.645E-03
1.251	2.75	1.778E-03	2.441E-03	1.967E-03
1.459	2.69	2.042E-03	2.835E-03	2.284E-03
1.667	2.63	2.344E-03	3.226E-03	2.600E-03
1.876	2.59	2.570E-03	3.616E-03	2.914E-03
2.084	2.54	2.884E-03	4.001E-03	3.224E-03
2.293	2.50	3.162E-03	4.385E-03	3.533E-03
2.501	2.46	3.467E-03	4.764E-03	3.838E-03
2.710	2.43	3.715E-03	5.141E-03	4.142E-03
2.918	2.40	3.981E-03	5.514E-03	4.443E-03
3.126	2.37	4.266E-03	5.884E-03	4.741E-03
3.335	2.34	4.571E-03	6.253E-03	5.038E-03
3.543	2.32	4.786E-03	6.617E-03	5.331E-03
3.752	2.30	5.012E-03	6.980E-03	5.624E-03
3.960	2.27	5.370E-03	7.339E-03	5.913E-03
4.169	2.25	5.623E-03	7.696E-03	6.201E-03
4.377	2.23	5.888E-03	8.049E-03	6.485E-03
4.585	2.21	6.166E-03	8.400E-03	6.768E-03
4.794	2.19	6.457E-03	8.749E-03	7.049E-03
5.002	2.18	6.607E-03	9.094E-03	7.327E-03
5.054	2.17	6.761E-03	9.180E-03	7.396E-03



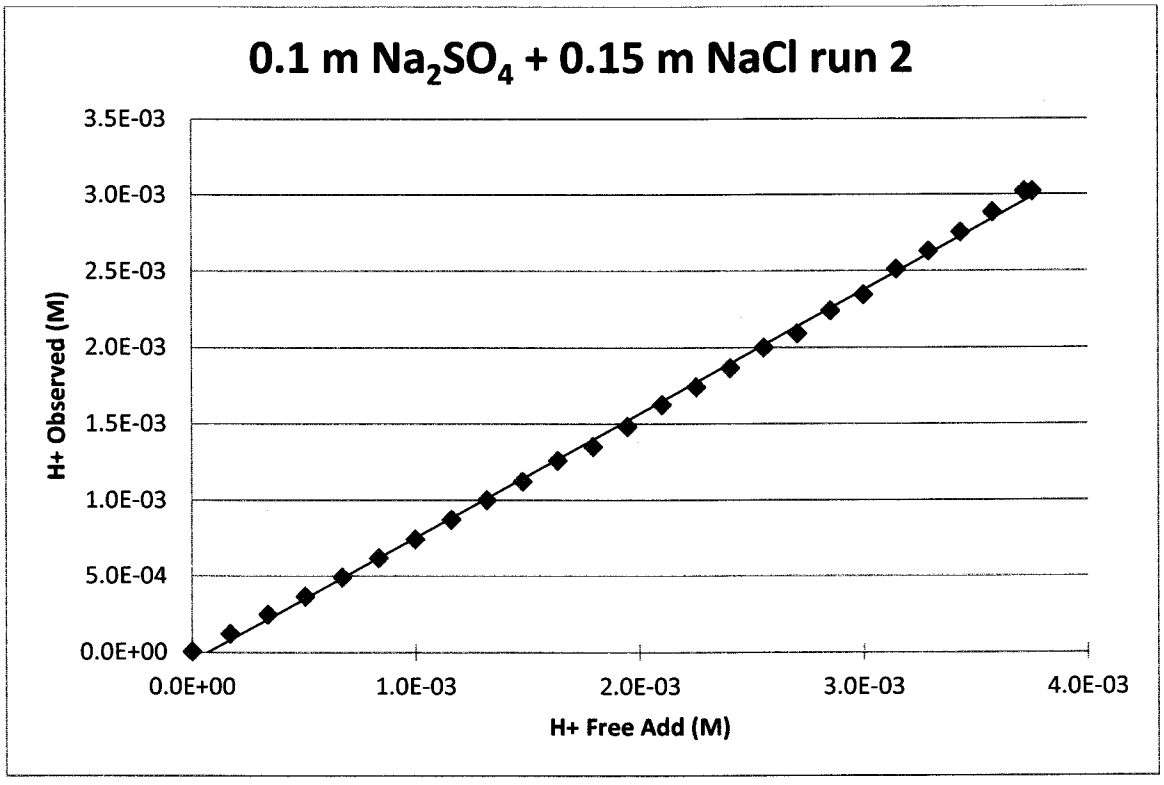
Type:	0.1 m Na2SO4 + 0.15 m NaCl with 0.1M HCl
SN Reference	WIPP-Solubility-13 p. 12
Solution Reference	WIPP-Solubility-3 p. 18
Brine Volume:	50.0 mL
Probe:	Corning Semi-Micro Combo
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	5.78	1.660E-06	0.000E+00	0.000E+00
0.208	3.92	1.202E-04	4.143E-04	1.693E-04
0.417	3.61	2.455E-04	8.271E-04	3.380E-04
0.625	3.43	3.715E-04	1.235E-03	5.045E-04
0.834	3.30	5.012E-04	1.641E-03	6.704E-04
1.042	3.20	6.310E-04	2.041E-03	8.342E-04
1.251	3.13	7.413E-04	2.441E-03	9.975E-04
1.459	3.06	8.710E-04	2.835E-03	1.159E-03
1.667	3.00	1.000E-03	3.226E-03	1.318E-03
1.876	2.95	1.122E-03	3.616E-03	1.478E-03
2.084	2.90	1.259E-03	4.001E-03	1.635E-03
2.293	2.86	1.380E-03	4.385E-03	1.792E-03
2.501	2.82	1.514E-03	4.764E-03	1.947E-03
2.710	2.79	1.622E-03	5.141E-03	2.101E-03
2.918	2.76	1.738E-03	5.514E-03	2.253E-03
3.126	2.72	1.905E-03	5.884E-03	2.404E-03
3.335	2.70	1.995E-03	6.253E-03	2.555E-03
3.543	2.67	2.138E-03	6.617E-03	2.704E-03
3.752	2.65	2.239E-03	6.980E-03	2.852E-03
3.960	2.62	2.399E-03	7.339E-03	2.999E-03
4.169	2.60	2.512E-03	7.696E-03	3.145E-03
4.377	2.58	2.630E-03	8.049E-03	3.289E-03
4.585	2.56	2.754E-03	8.400E-03	3.432E-03
4.794	2.54	2.884E-03	8.749E-03	3.575E-03
5.002	2.52	3.020E-03	9.094E-03	3.716E-03
5.054	2.52	3.020E-03	9.180E-03	3.751E-03



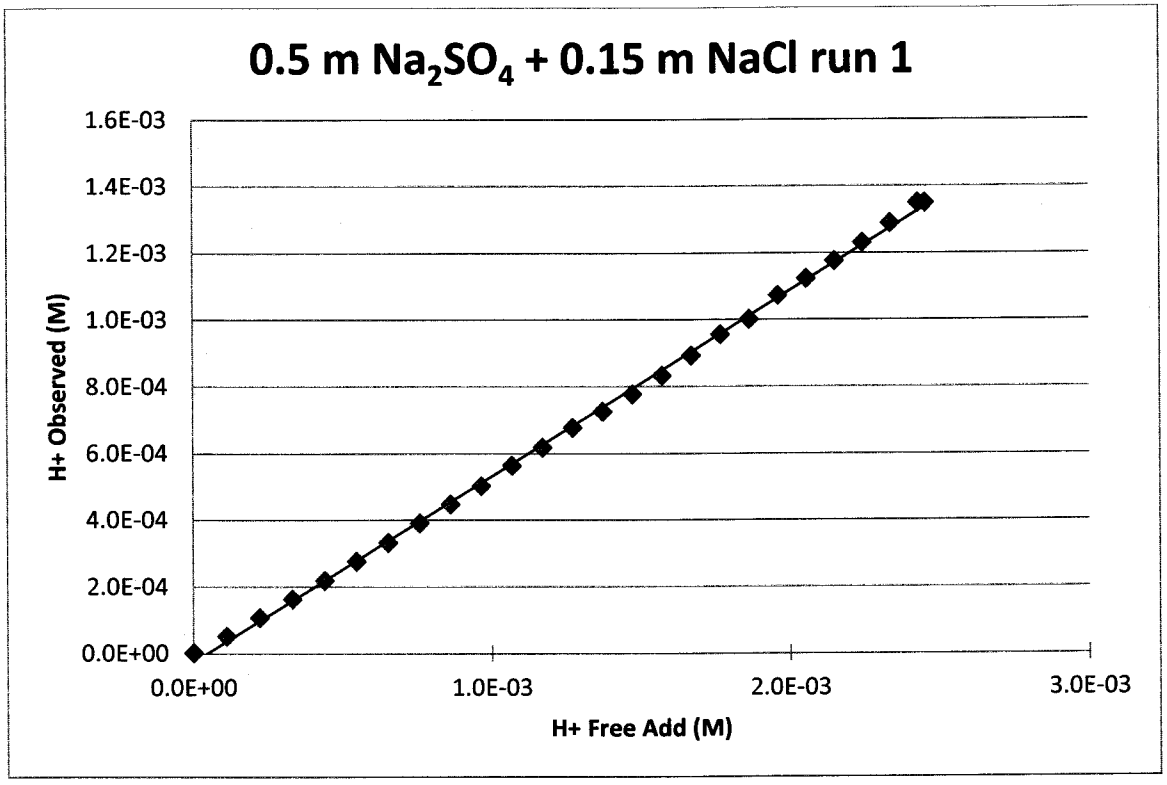
Type:	0.1 m Na2SO4 + 0.15 m NaCl with 0.1M HCl
SN Reference	WIPP-Solubility-13 p. 12
Solution Reference	WIPP-Solubility-3 p. 18
Brine Volume:	50.0 mL
Probe:	Corning Semi-Micro Combo
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	5.79	1.622E-06	0.000E+00	0.000E+00
0.208	3.92	1.202E-04	4.143E-04	1.693E-04
0.417	3.61	2.455E-04	8.271E-04	3.380E-04
0.625	3.44	3.631E-04	1.235E-03	5.045E-04
0.834	3.31	4.898E-04	1.641E-03	6.704E-04
1.042	3.21	6.166E-04	2.041E-03	8.342E-04
1.251	3.13	7.413E-04	2.441E-03	9.975E-04
1.459	3.06	8.710E-04	2.835E-03	1.159E-03
1.667	3.00	1.000E-03	3.226E-03	1.318E-03
1.876	2.95	1.122E-03	3.616E-03	1.478E-03
2.084	2.90	1.259E-03	4.001E-03	1.635E-03
2.293	2.87	1.349E-03	4.385E-03	1.792E-03
2.501	2.83	1.479E-03	4.764E-03	1.947E-03
2.710	2.79	1.622E-03	5.141E-03	2.101E-03
2.918	2.76	1.738E-03	5.514E-03	2.253E-03
3.126	2.73	1.862E-03	5.884E-03	2.404E-03
3.335	2.70	1.995E-03	6.253E-03	2.555E-03
3.543	2.68	2.089E-03	6.617E-03	2.704E-03
3.752	2.65	2.239E-03	6.980E-03	2.852E-03
3.960	2.63	2.344E-03	7.339E-03	2.999E-03
4.169	2.60	2.512E-03	7.696E-03	3.145E-03
4.377	2.58	2.630E-03	8.049E-03	3.289E-03
4.585	2.56	2.754E-03	8.400E-03	3.432E-03
4.794	2.54	2.884E-03	8.749E-03	3.575E-03
5.002	2.52	3.020E-03	9.094E-03	3.716E-03
5.054	2.52	3.020E-03	9.180E-03	3.751E-03



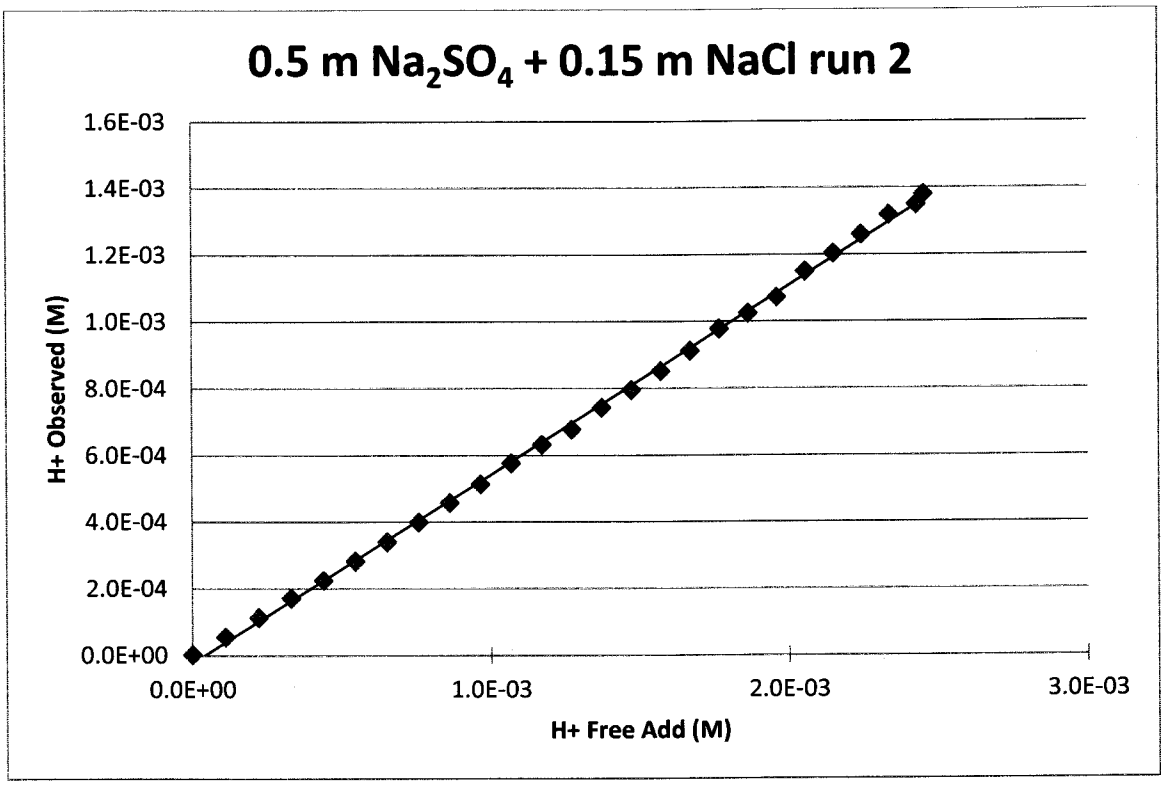
Type:	0.5 m Na2SO4 + 0.15 m NaCl with 0.1M HCl
SN Reference	WIPP-Solubility-13 p. 13
Solution Reference	WIPP-Solubility-3 p. 18
Brine Volume:	50.0 mL
Probe:	Corning Semi-Micro Combo
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	6.20	6.310E-07	0.000E+00	0.000E+00
0.208	4.29	5.129E-05	4.143E-04	1.106E-04
0.417	3.97	1.072E-04	8.271E-04	2.209E-04
0.625	3.79	1.622E-04	1.235E-03	3.297E-04
0.834	3.66	2.188E-04	1.641E-03	4.381E-04
1.042	3.56	2.754E-04	2.041E-03	5.451E-04
1.251	3.48	3.311E-04	2.441E-03	6.518E-04
1.459	3.41	3.890E-04	2.835E-03	7.571E-04
1.667	3.35	4.467E-04	3.226E-03	8.616E-04
1.876	3.30	5.012E-04	3.616E-03	9.657E-04
2.084	3.25	5.623E-04	4.001E-03	1.068E-03
2.293	3.21	6.166E-04	4.385E-03	1.171E-03
2.501	3.17	6.761E-04	4.764E-03	1.272E-03
2.710	3.14	7.244E-04	5.141E-03	1.373E-03
2.918	3.11	7.762E-04	5.514E-03	1.472E-03
3.126	3.08	8.318E-04	5.884E-03	1.571E-03
3.335	3.05	8.913E-04	6.253E-03	1.670E-03
3.543	3.02	9.550E-04	6.617E-03	1.767E-03
3.752	3.00	1.000E-03	6.980E-03	1.864E-03
3.960	2.97	1.072E-03	7.339E-03	1.960E-03
4.169	2.95	1.122E-03	7.696E-03	2.055E-03
4.377	2.93	1.175E-03	8.049E-03	2.149E-03
4.585	2.91	1.230E-03	8.400E-03	2.243E-03
4.794	2.89	1.288E-03	8.749E-03	2.336E-03
5.002	2.87	1.349E-03	9.094E-03	2.428E-03
5.054	2.87	1.349E-03	9.180E-03	2.451E-03



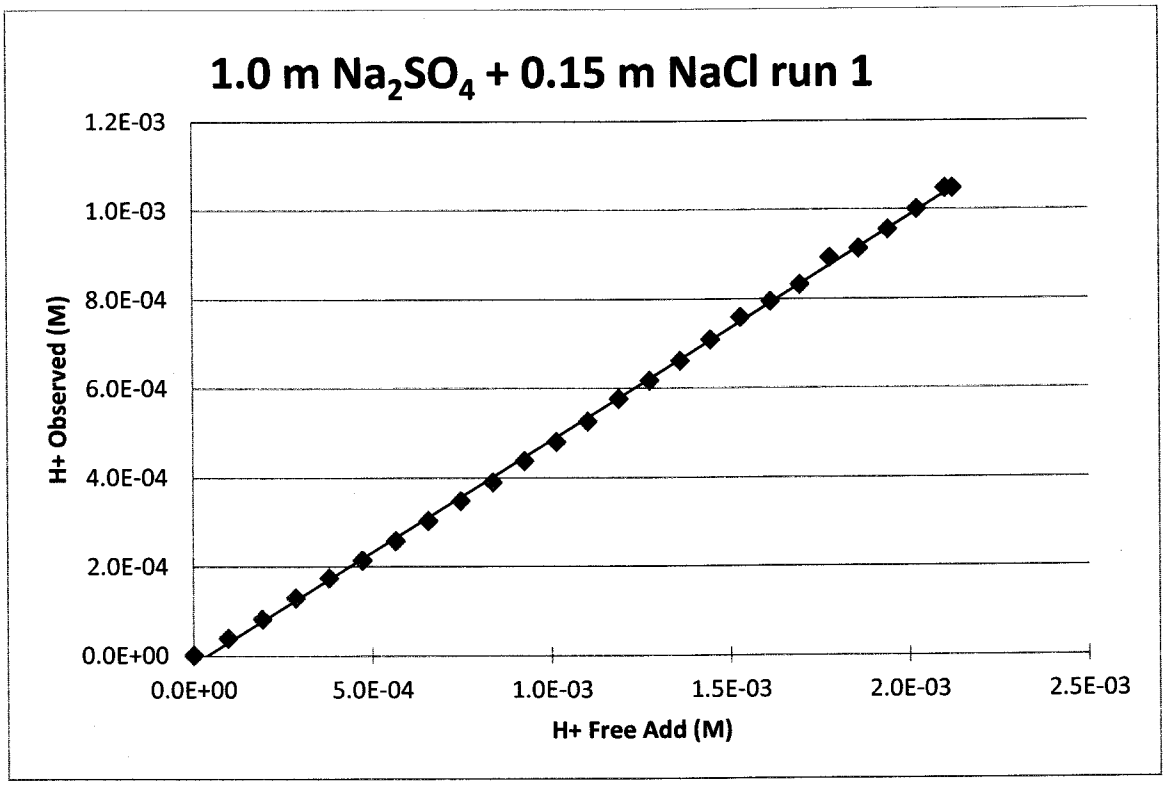
Type:	0.5 m Na2SO4 + 0.15 m NaCl with 0.1M HCl
SN Reference	WIPP-Solubility-13 p. 13
Solution Reference	WIPP-Solubility-3 p. 18
Brine Volume:	50.0 mL
Probe:	Corning Semi-Micro Combo
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	6.07	8.511E-07	0.000E+00	0.000E+00
0.208	4.27	5.370E-05	4.143E-04	1.106E-04
0.417	3.95	1.122E-04	8.271E-04	2.209E-04
0.625	3.77	1.698E-04	1.235E-03	3.297E-04
0.834	3.65	2.239E-04	1.641E-03	4.381E-04
1.042	3.55	2.818E-04	2.041E-03	5.451E-04
1.251	3.47	3.388E-04	2.441E-03	6.518E-04
1.459	3.40	3.981E-04	2.835E-03	7.571E-04
1.667	3.34	4.571E-04	3.226E-03	8.616E-04
1.876	3.29	5.129E-04	3.616E-03	9.657E-04
2.084	3.24	5.754E-04	4.001E-03	1.068E-03
2.293	3.20	6.310E-04	4.385E-03	1.171E-03
2.501	3.17	6.761E-04	4.764E-03	1.272E-03
2.710	3.13	7.413E-04	5.141E-03	1.373E-03
2.918	3.10	7.943E-04	5.514E-03	1.472E-03
3.126	3.07	8.511E-04	5.884E-03	1.571E-03
3.335	3.04	9.120E-04	6.253E-03	1.670E-03
3.543	3.01	9.772E-04	6.617E-03	1.767E-03
3.752	2.99	1.023E-03	6.980E-03	1.864E-03
3.960	2.97	1.072E-03	7.339E-03	1.960E-03
4.169	2.94	1.148E-03	7.696E-03	2.055E-03
4.377	2.92	1.202E-03	8.049E-03	2.149E-03
4.585	2.90	1.259E-03	8.400E-03	2.243E-03
4.794	2.88	1.318E-03	8.749E-03	2.336E-03
5.002	2.87	1.349E-03	9.094E-03	2.428E-03
5.054	2.86	1.380E-03	9.180E-03	2.451E-03



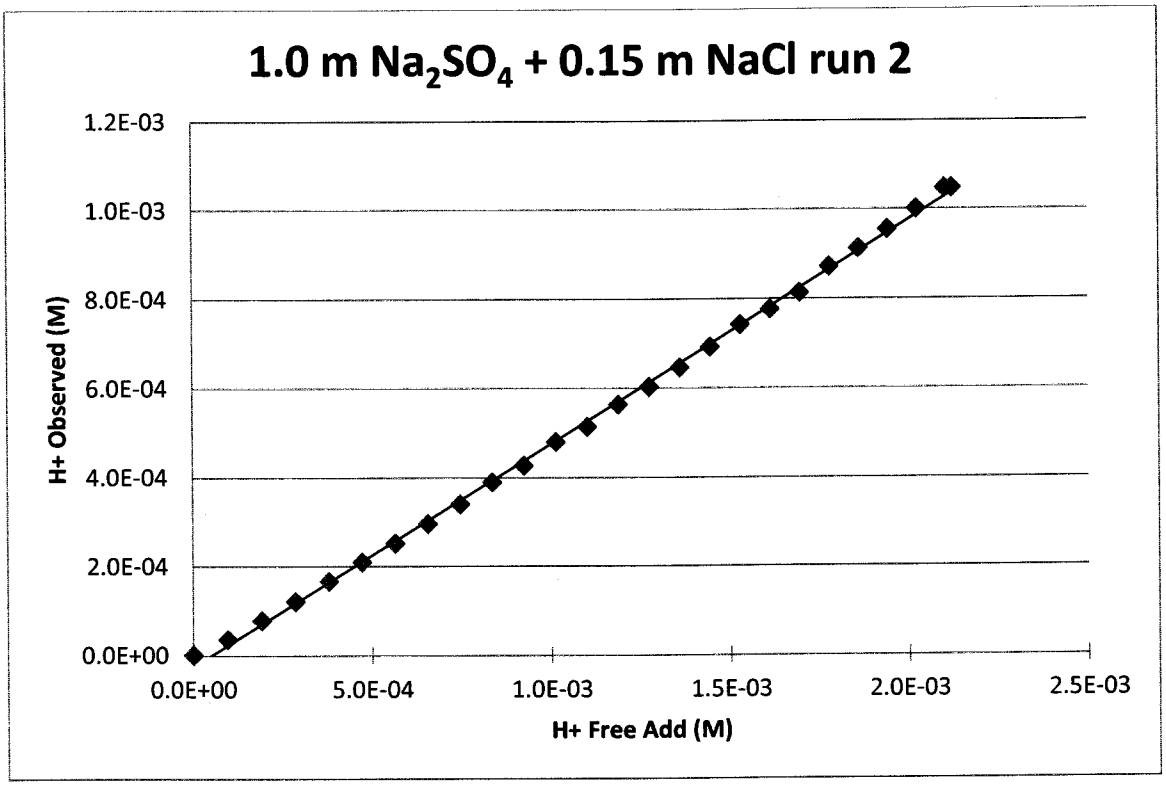
Type:	1.0 m Na2SO4 + 0.15 m NaCl with 0.1M HCl
SN Reference	WIPP-Solubility-13 p. 12
Solution Reference	WIPP-Solubility-3 p. 18
Brine Volume:	50.0 mL
Probe:	Corning Semi-Micro Combo
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	6.53	2.951E-07	0.000E+00	0.000E+00
0.208	4.41	3.890E-05	4.143E-04	9.573E-05
0.417	4.09	8.128E-05	8.271E-04	1.911E-04
0.625	3.89	1.288E-04	1.235E-03	2.853E-04
0.834	3.76	1.738E-04	1.641E-03	3.791E-04
1.042	3.67	2.138E-04	2.041E-03	4.717E-04
1.251	3.59	2.570E-04	2.441E-03	5.640E-04
1.459	3.52	3.020E-04	2.835E-03	6.551E-04
1.667	3.46	3.467E-04	3.226E-03	7.455E-04
1.876	3.41	3.890E-04	3.616E-03	8.356E-04
2.084	3.36	4.365E-04	4.001E-03	9.246E-04
2.293	3.32	4.786E-04	4.385E-03	1.013E-03
2.501	3.28	5.248E-04	4.764E-03	1.101E-03
2.710	3.24	5.754E-04	5.141E-03	1.188E-03
2.918	3.21	6.166E-04	5.514E-03	1.274E-03
3.126	3.18	6.607E-04	5.884E-03	1.360E-03
3.335	3.15	7.079E-04	6.253E-03	1.445E-03
3.543	3.12	7.586E-04	6.617E-03	1.529E-03
3.752	3.10	7.943E-04	6.980E-03	1.613E-03
3.960	3.08	8.318E-04	7.339E-03	1.696E-03
4.169	3.05	8.913E-04	7.696E-03	1.778E-03
4.377	3.04	9.120E-04	8.049E-03	1.860E-03
4.585	3.02	9.550E-04	8.400E-03	1.941E-03
4.794	3.00	1.000E-03	8.749E-03	2.022E-03
5.002	2.98	1.047E-03	9.094E-03	2.101E-03
5.054	2.98	1.047E-03	9.180E-03	2.121E-03



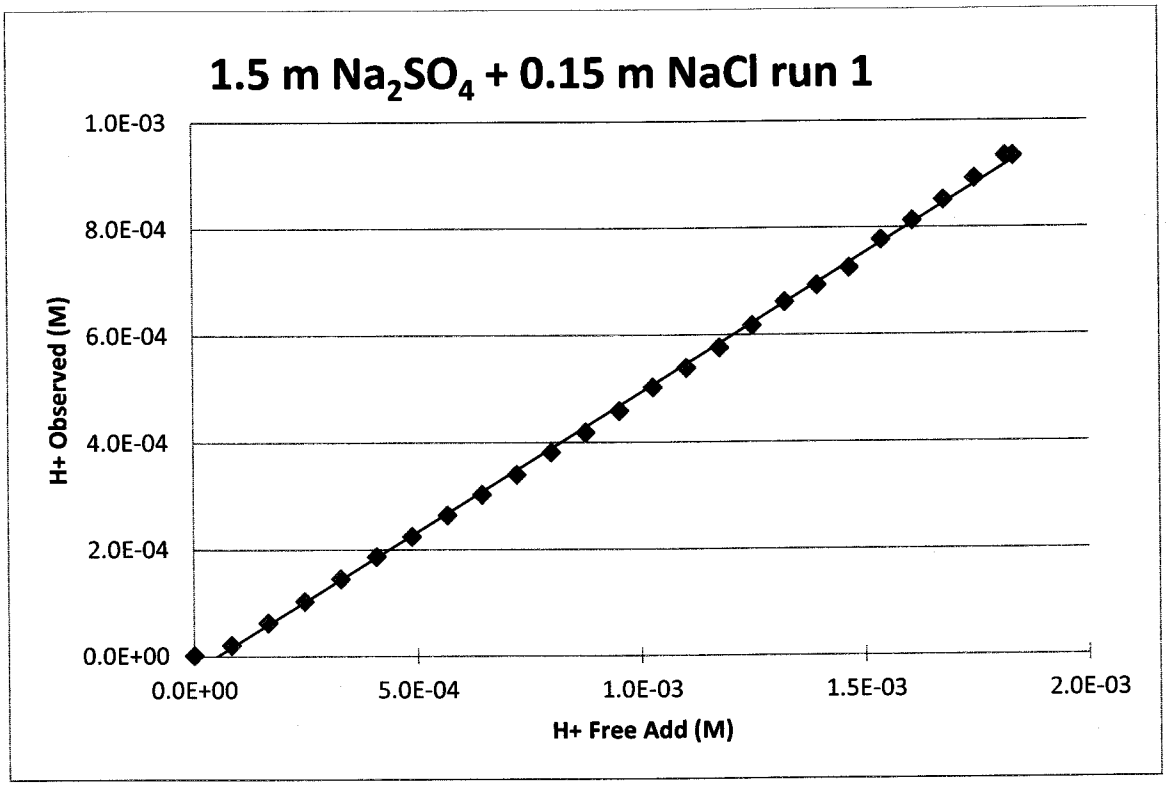
Type:	1.0 m Na2SO4 + 0.15 m NaCl with 0.1M HCl
SN Reference	WIPP-Solubility-13 p. 12
Solution Reference	WIPP-Solubility-3 p. 18
Brine Volume:	50.0 mL
Probe:	Corning Semi-Micro Combo
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	6.58	2.630E-07	0.000E+00	0.000E+00
0.208	4.45	3.548E-05	4.143E-04	9.573E-05
0.417	4.11	7.762E-05	8.271E-04	1.911E-04
0.625	3.92	1.202E-04	1.235E-03	2.853E-04
0.834	3.78	1.660E-04	1.641E-03	3.791E-04
1.042	3.68	2.089E-04	2.041E-03	4.717E-04
1.251	3.60	2.512E-04	2.441E-03	5.640E-04
1.459	3.53	2.951E-04	2.835E-03	6.551E-04
1.667	3.47	3.388E-04	3.226E-03	7.455E-04
1.876	3.41	3.890E-04	3.616E-03	8.356E-04
2.084	3.37	4.266E-04	4.001E-03	9.246E-04
2.293	3.32	4.786E-04	4.385E-03	1.013E-03
2.501	3.29	5.129E-04	4.764E-03	1.101E-03
2.710	3.25	5.623E-04	5.141E-03	1.188E-03
2.918	3.22	6.026E-04	5.514E-03	1.274E-03
3.126	3.19	6.457E-04	5.884E-03	1.360E-03
3.335	3.16	6.918E-04	6.253E-03	1.445E-03
3.543	3.13	7.413E-04	6.617E-03	1.529E-03
3.752	3.11	7.762E-04	6.980E-03	1.613E-03
3.960	3.09	8.128E-04	7.339E-03	1.696E-03
4.169	3.06	8.710E-04	7.696E-03	1.778E-03
4.377	3.04	9.120E-04	8.049E-03	1.860E-03
4.585	3.02	9.550E-04	8.400E-03	1.941E-03
4.794	3.00	1.000E-03	8.749E-03	2.022E-03
5.002	2.98	1.047E-03	9.094E-03	2.101E-03
5.054	2.98	1.047E-03	9.180E-03	2.121E-03



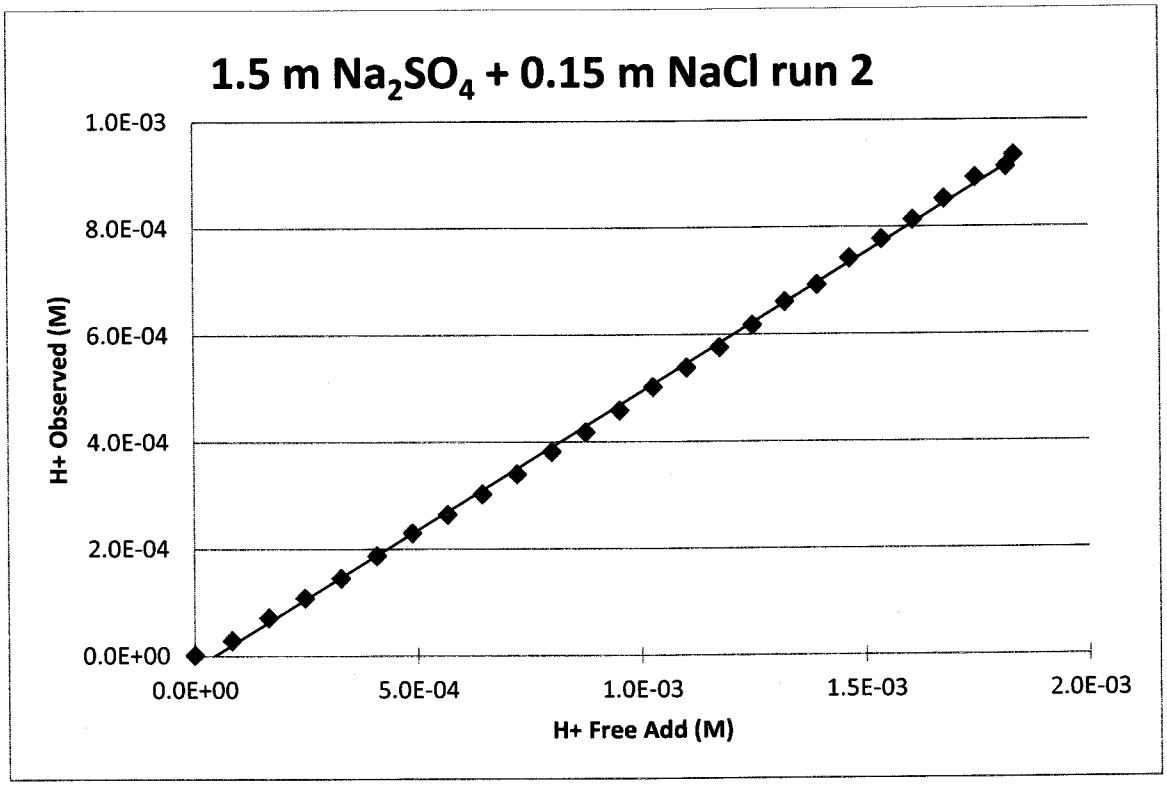
Type:	1.5 m Na2SO4 + 0.15 m NaCl with 0.1M HCl
SN Reference	WIPP-Solubility-13 p. 13
Solution Reference	WIPP-Solubility-3 p. 18
Brine Volume:	50.0 mL
Probe:	Corning Semi-Micro Combo
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	6.48	3.311E-07	0.000E+00	0.000E+00
0.208	4.70	1.995E-05	4.143E-04	8.274E-05
0.417	4.21	6.166E-05	8.271E-04	1.652E-04
0.625	3.99	1.023E-04	1.235E-03	2.466E-04
0.834	3.84	1.445E-04	1.641E-03	3.277E-04
1.042	3.73	1.862E-04	2.041E-03	4.077E-04
1.251	3.65	2.239E-04	2.441E-03	4.875E-04
1.459	3.58	2.630E-04	2.835E-03	5.662E-04
1.667	3.52	3.020E-04	3.226E-03	6.444E-04
1.876	3.47	3.388E-04	3.616E-03	7.222E-04
2.084	3.42	3.802E-04	4.001E-03	7.991E-04
2.293	3.38	4.169E-04	4.385E-03	8.757E-04
2.501	3.34	4.571E-04	4.764E-03	9.514E-04
2.710	3.30	5.012E-04	5.141E-03	1.027E-03
2.918	3.27	5.370E-04	5.514E-03	1.101E-03
3.126	3.24	5.754E-04	5.884E-03	1.175E-03
3.335	3.21	6.166E-04	6.253E-03	1.249E-03
3.543	3.18	6.607E-04	6.617E-03	1.322E-03
3.752	3.16	6.918E-04	6.980E-03	1.394E-03
3.960	3.14	7.244E-04	7.339E-03	1.466E-03
4.169	3.11	7.762E-04	7.696E-03	1.537E-03
4.377	3.09	8.128E-04	8.049E-03	1.608E-03
4.585	3.07	8.511E-04	8.400E-03	1.678E-03
4.794	3.05	8.913E-04	8.749E-03	1.747E-03
5.002	3.03	9.333E-04	9.094E-03	1.816E-03
5.054	3.03	9.333E-04	9.180E-03	1.833E-03



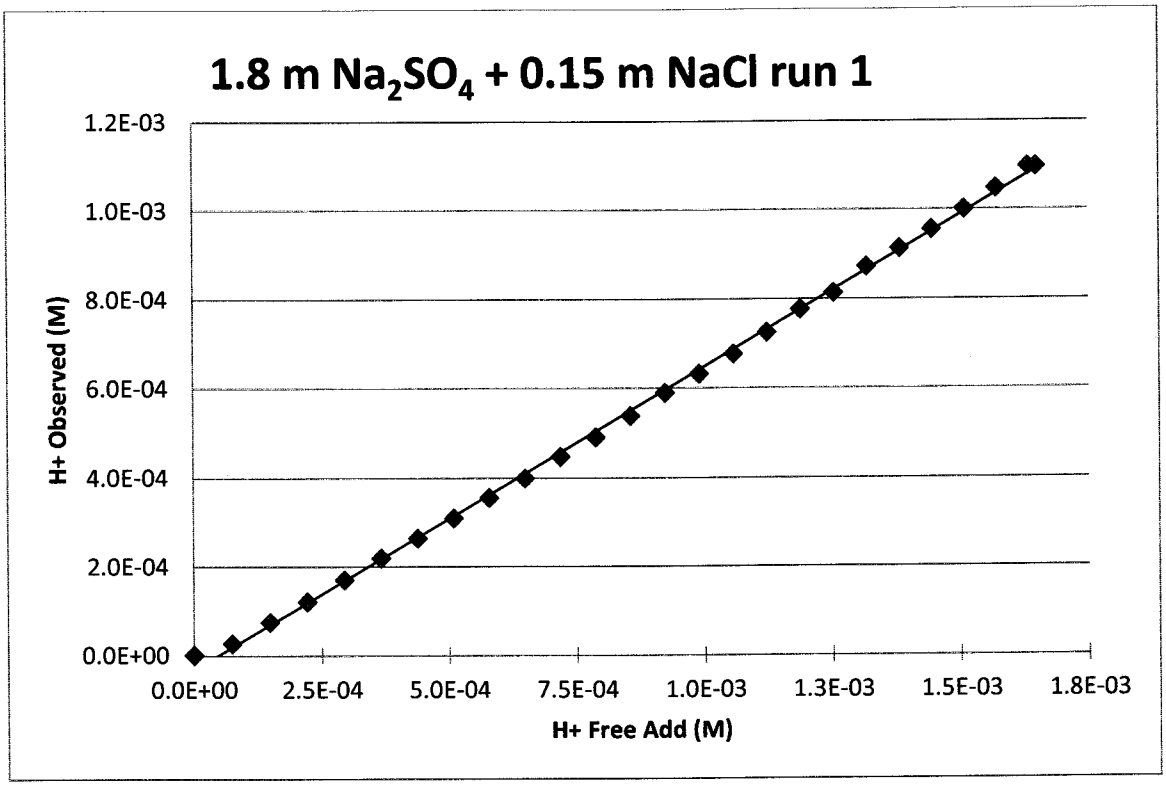
Type:	1.5 m Na2SO4 + 0.15 m NaCl with 0.1M HCl
SN Reference	WIPP-Solubility-13 p. 13
Solution Reference	WIPP-Solubility-3 p. 18
Brine Volume:	50.0 mL
Probe:	Corning Semi-Micro Combo
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	6.48	3.311E-07	0.000E+00	0.000E+00
0.208	4.55	2.818E-05	4.143E-04	8.274E-05
0.417	4.15	7.079E-05	8.271E-04	1.652E-04
0.625	3.97	1.072E-04	1.235E-03	2.466E-04
0.834	3.84	1.445E-04	1.641E-03	3.277E-04
1.042	3.73	1.862E-04	2.041E-03	4.077E-04
1.251	3.64	2.291E-04	2.441E-03	4.875E-04
1.459	3.58	2.630E-04	2.835E-03	5.662E-04
1.667	3.52	3.020E-04	3.226E-03	6.444E-04
1.876	3.47	3.388E-04	3.616E-03	7.222E-04
2.084	3.42	3.802E-04	4.001E-03	7.991E-04
2.293	3.38	4.169E-04	4.385E-03	8.757E-04
2.501	3.34	4.571E-04	4.764E-03	9.514E-04
2.710	3.30	5.012E-04	5.141E-03	1.027E-03
2.918	3.27	5.370E-04	5.514E-03	1.101E-03
3.126	3.24	5.754E-04	5.884E-03	1.175E-03
3.335	3.21	6.166E-04	6.253E-03	1.249E-03
3.543	3.18	6.607E-04	6.617E-03	1.322E-03
3.752	3.16	6.918E-04	6.980E-03	1.394E-03
3.960	3.13	7.413E-04	7.339E-03	1.466E-03
4.169	3.11	7.762E-04	7.696E-03	1.537E-03
4.377	3.09	8.128E-04	8.049E-03	1.608E-03
4.585	3.07	8.511E-04	8.400E-03	1.678E-03
4.794	3.05	8.913E-04	8.749E-03	1.747E-03
5.002	3.04	9.120E-04	9.094E-03	1.816E-03
5.054	3.03	9.333E-04	9.180E-03	1.833E-03



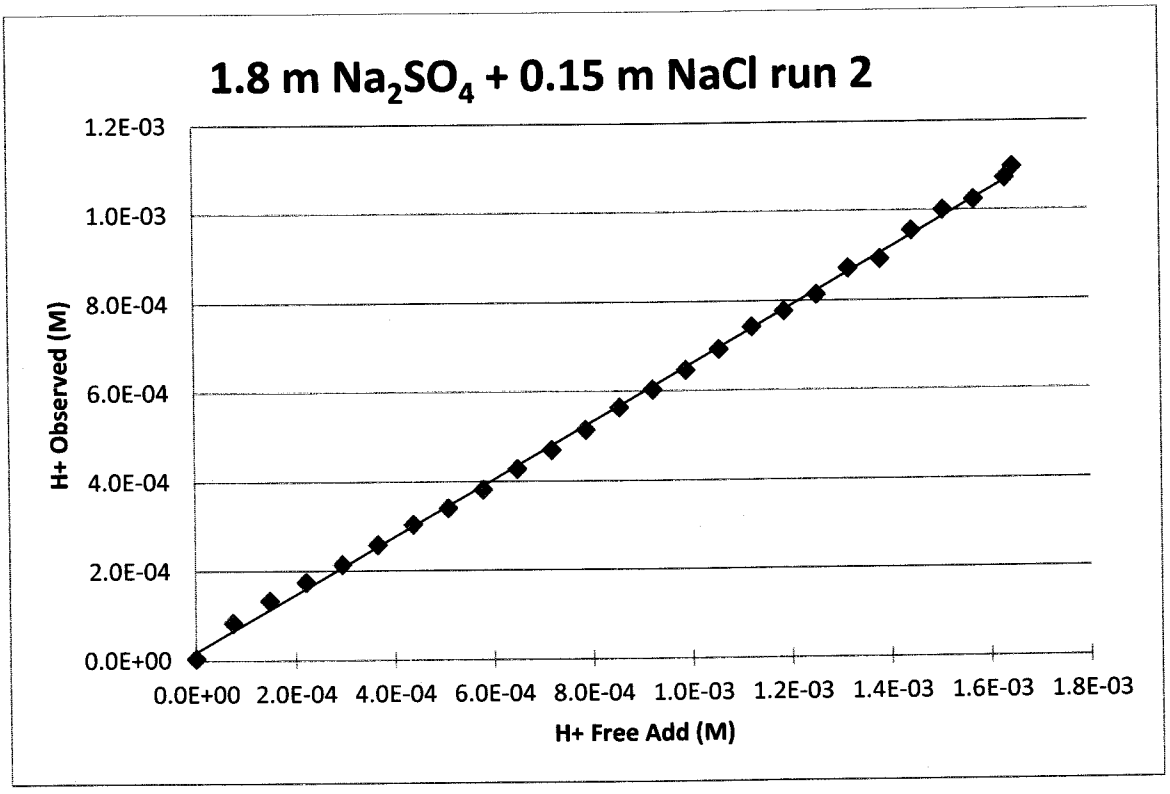
Type:	1.8 m Na2SO4 + 0.15 m NaCl with 0.1M HCl
SN Reference	WIPP-Solubility-13 p. 13
Solution Reference	WIPP-Solubility-3 p. 18
Brine Volume:	50.0 mL
Probe:	Corning Semi-Micro Combo
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	6.75	1.778E-07	0.000E+00	0.000E+00
0.208	4.59	2.570E-05	4.143E-04	7.435E-05
0.417	4.13	7.413E-05	8.271E-04	1.484E-04
0.625	3.92	1.202E-04	1.235E-03	2.216E-04
0.834	3.77	1.698E-04	1.641E-03	2.945E-04
1.042	3.66	2.188E-04	2.041E-03	3.664E-04
1.251	3.58	2.630E-04	2.441E-03	4.381E-04
1.459	3.51	3.090E-04	2.835E-03	5.089E-04
1.667	3.45	3.548E-04	3.226E-03	5.791E-04
1.876	3.40	3.981E-04	3.616E-03	6.490E-04
2.084	3.35	4.467E-04	4.001E-03	7.181E-04
2.293	3.31	4.898E-04	4.385E-03	7.870E-04
2.501	3.27	5.370E-04	4.764E-03	8.550E-04
2.710	3.23	5.888E-04	5.141E-03	9.228E-04
2.918	3.20	6.310E-04	5.514E-03	9.897E-04
3.126	3.17	6.761E-04	5.884E-03	1.056E-03
3.335	3.14	7.244E-04	6.253E-03	1.122E-03
3.543	3.11	7.762E-04	6.617E-03	1.188E-03
3.752	3.09	8.128E-04	6.980E-03	1.253E-03
3.960	3.06	8.710E-04	7.339E-03	1.317E-03
4.169	3.04	9.120E-04	7.696E-03	1.381E-03
4.377	3.02	9.550E-04	8.049E-03	1.445E-03
4.585	3.00	1.000E-03	8.400E-03	1.508E-03
4.794	2.98	1.047E-03	8.749E-03	1.570E-03
5.002	2.96	1.096E-03	9.094E-03	1.632E-03
5.054	2.96	1.096E-03	9.180E-03	1.648E-03



Type:	1.8 m Na2SO4 + 0.15 m NaCl with 0.1M HCl
SN Reference	WIPP-Solubility-13 p. 13
Solution Reference	WIPP-Solubility-3 p. 18
Brine Volume:	50.0 mL
Probe:	Corning Semi-Micro Combo
Titrant Actual M	0.1 M HCl
Titrant Reference:	Fisher Scientific, lot #091177, exp. 3/2011

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	5.52	3.020E-06	0.000E+00	0.000E+00
0.208	4.08	8.318E-05	4.143E-04	7.435E-05
0.417	3.88	1.318E-04	8.271E-04	1.484E-04
0.625	3.76	1.738E-04	1.235E-03	2.216E-04
0.834	3.67	2.138E-04	1.641E-03	2.945E-04
1.042	3.59	2.570E-04	2.041E-03	3.664E-04
1.251	3.52	3.020E-04	2.441E-03	4.381E-04
1.459	3.47	3.388E-04	2.835E-03	5.089E-04
1.667	3.42	3.802E-04	3.226E-03	5.791E-04
1.876	3.37	4.266E-04	3.616E-03	6.490E-04
2.084	3.33	4.677E-04	4.001E-03	7.181E-04
2.293	3.29	5.129E-04	4.385E-03	7.870E-04
2.501	3.25	5.623E-04	4.764E-03	8.550E-04
2.710	3.22	6.026E-04	5.141E-03	9.228E-04
2.918	3.19	6.457E-04	5.514E-03	9.897E-04
3.126	3.16	6.918E-04	5.884E-03	1.056E-03
3.335	3.13	7.413E-04	6.253E-03	1.122E-03
3.543	3.11	7.762E-04	6.617E-03	1.188E-03
3.752	3.09	8.128E-04	6.980E-03	1.253E-03
3.960	3.06	8.710E-04	7.339E-03	1.317E-03
4.169	3.05	8.913E-04	7.696E-03	1.381E-03
4.377	3.02	9.550E-04	8.049E-03	1.445E-03
4.585	3.00	1.000E-03	8.400E-03	1.508E-03
4.794	2.99	1.023E-03	8.749E-03	1.570E-03
5.002	2.97	1.072E-03	9.094E-03	1.632E-03
5.054	2.96	1.096E-03	9.180E-03	1.648E-03

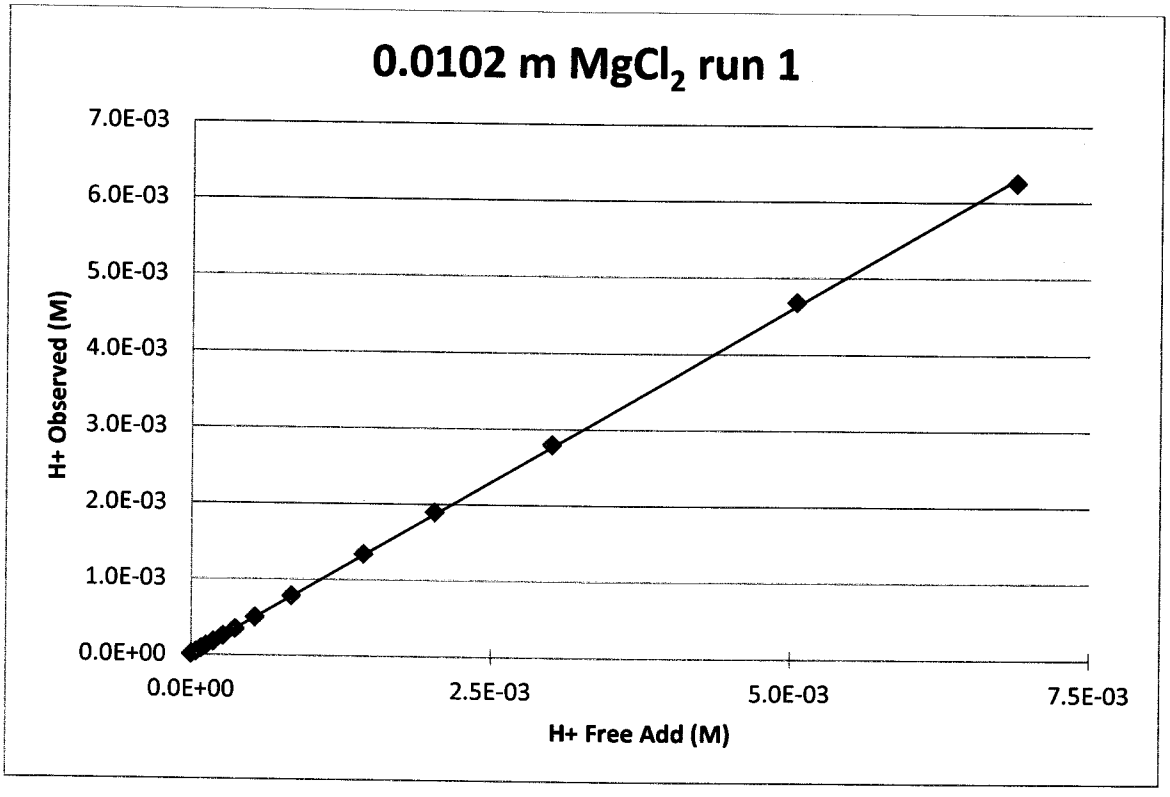


Appendix C

Titration Data for $MgCl_2 \pm NaCl$ Solutions

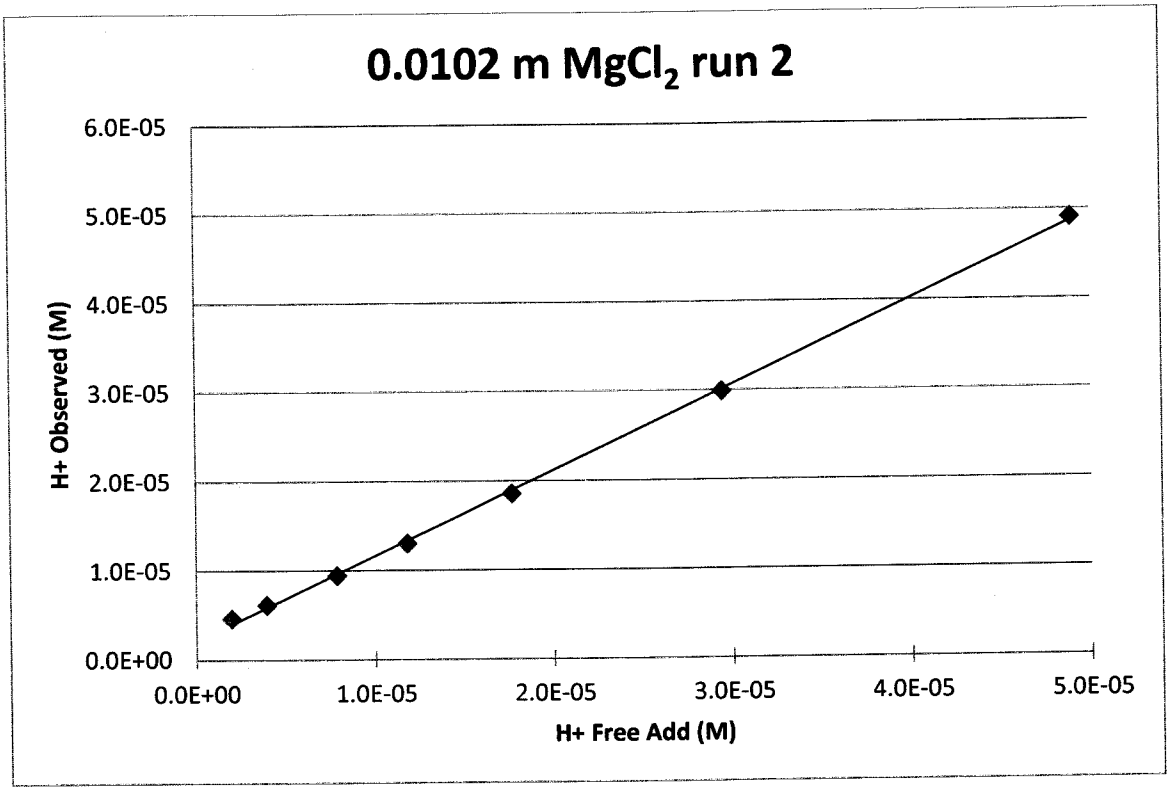
Type:	0.0102 m MgCl2 with 0.1M HCl
SN Reference	WIPP-Solubility-7 p. 85
Solution Reference	WIPP-Solubility-7 p. 49
Brine Volume:	47.5 mL
Probe:	Fisher Accumet
Titrant Actual M	0.1 M HCl
Titrant Reference:	WIPP-Solubility-7 p. 9

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.000	5.594	2.547E-06	0.000E+00
0.019	4.405	3.936E-05	4.099E-05
0.039	4.107	7.816E-05	8.195E-05
0.058	3.935	1.161E-04	1.229E-04
0.088	3.758	1.746E-04	1.842E-04
0.127	3.606	2.477E-04	2.659E-04
0.175	3.465	3.428E-04	3.677E-04
0.253	3.303	4.977E-04	5.303E-04
0.399	3.107	7.816E-04	8.337E-04
0.692	2.873	1.340E-03	1.435E-03
0.984	2.723	1.892E-03	2.029E-03
1.471	2.554	2.793E-03	3.003E-03
2.523	2.330	4.677E-03	5.044E-03
3.507	2.204	6.252E-03	6.875E-03



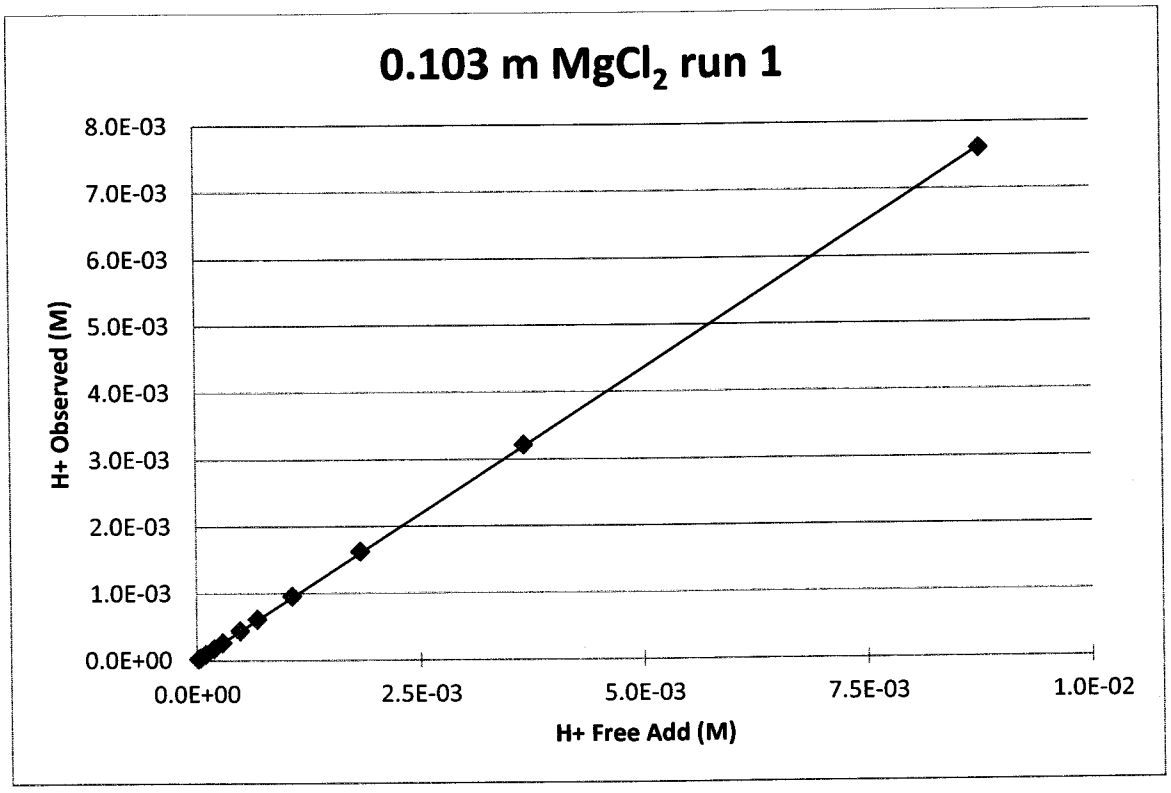
Type:	0.0102 m MgCl2 with 0.01M HCl
SN Reference	WIPP-Solubility-7 p. 91
Solution Reference	WIPP-Solubility-7 p. 49
Brine Volume:	49.5 mL
Probe:	Fisher Accumet
Titrant Actual M	0.009994 M HCl
Titrant Reference:	WIPP-Solubility-7 p. 9

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.010	5.34	4.624E-06	1.966E-06
0.019	5.21	6.138E-06	3.931E-06
0.039	5.03	9.397E-06	7.860E-06
0.058	4.89	1.300E-05	1.179E-05
0.088	4.73	1.854E-05	1.767E-05
0.146	4.53	2.985E-05	2.941E-05
0.244	4.31	4.909E-05	4.892E-05



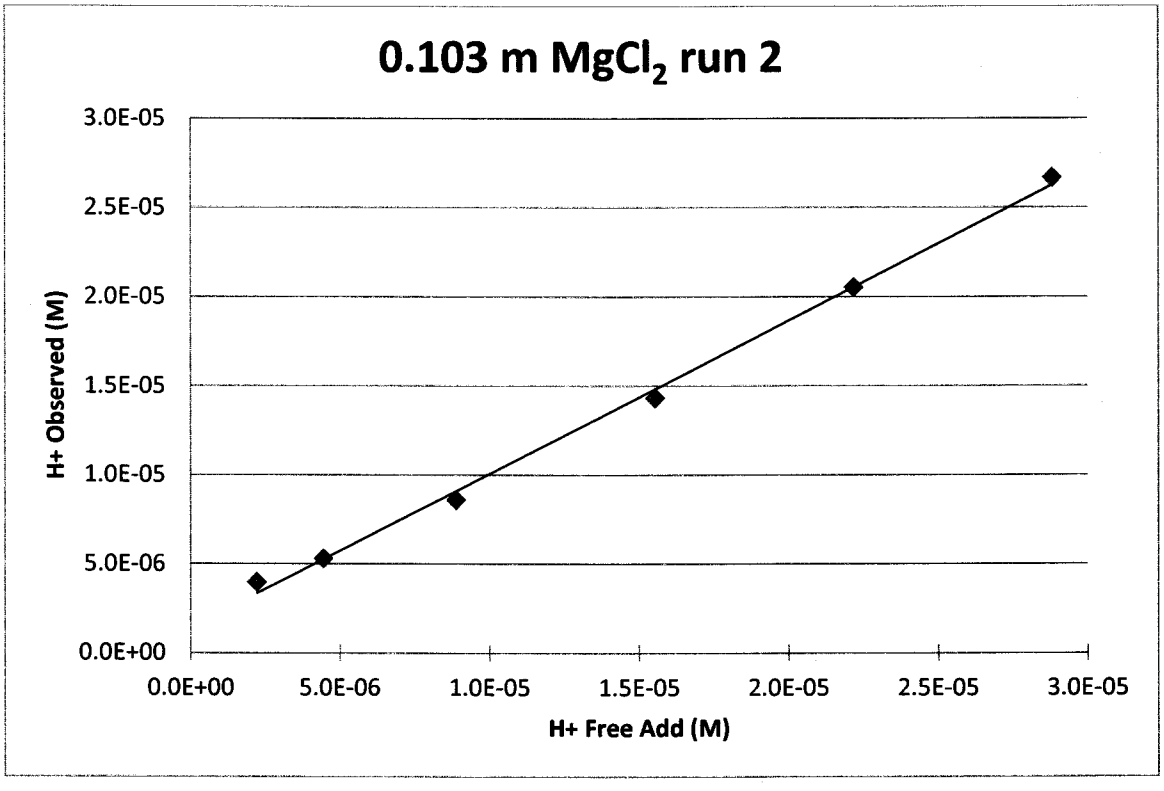
Type:	0.103 m MgCl2 with 0.1M HCl
SN Reference	WIPP-Solubility-7 p. 88
Solution Reference	WIPP-Solubility-7 p. 49
Brine Volume:	50.8 mL
Probe:	Fisher Accumet
Titrant Actual M	0.1 M HCl
Titrant Reference:	WIPP-Solubility-7 p. 9

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.010	4.780	1.660E-05	1.917E-05
0.019	4.471	3.381E-05	3.833E-05
0.049	4.064	8.630E-05	9.577E-05
0.097	3.760	1.738E-04	1.914E-04
0.146	3.583	2.612E-04	2.868E-04
0.246	3.357	4.395E-04	4.823E-04
0.346	3.213	6.124E-04	6.771E-04
0.547	3.021	9.528E-04	1.064E-03
0.947	2.790	1.622E-03	1.830E-03
1.931	2.494	3.206E-03	3.662E-03
4.883	2.119	7.603E-03	8.769E-03



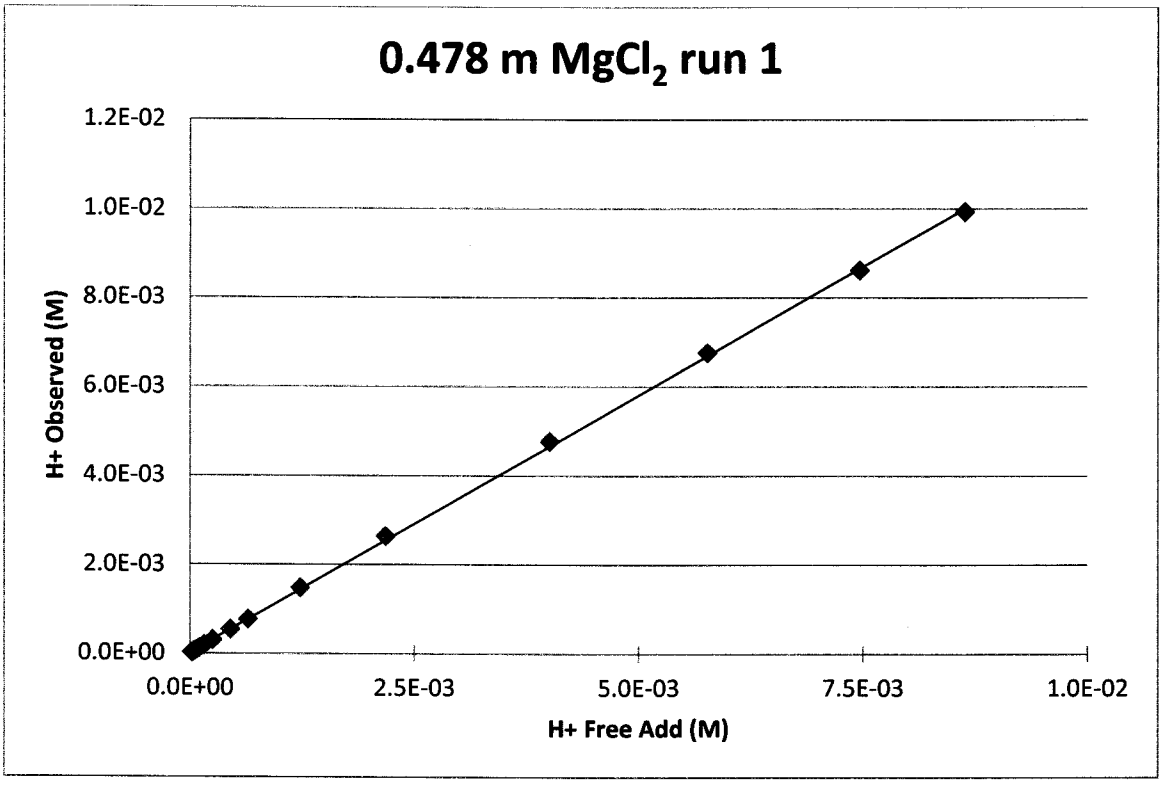
Type:	0.103 m MgCl2 with 0.01M HCl
SN Reference	WIPP-Solubility-7 p. 92
Solution Reference	WIPP-Solubility-7 p. 49
Brine Volume:	43.8 mL
Probe:	Fisher Accumet
Titrant Actual M	0.01 M HCl
Titrant Reference:	WIPP-Solubility-7 p. 9

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.010	5.402	3.963E-06	2.222E-06
0.019	5.276	5.297E-06	4.443E-06
0.039	5.066	8.590E-06	8.882E-06
0.068	4.844	1.432E-05	1.553E-05
0.097	4.688	2.051E-05	2.217E-05
0.127	4.574	2.667E-05	2.881E-05



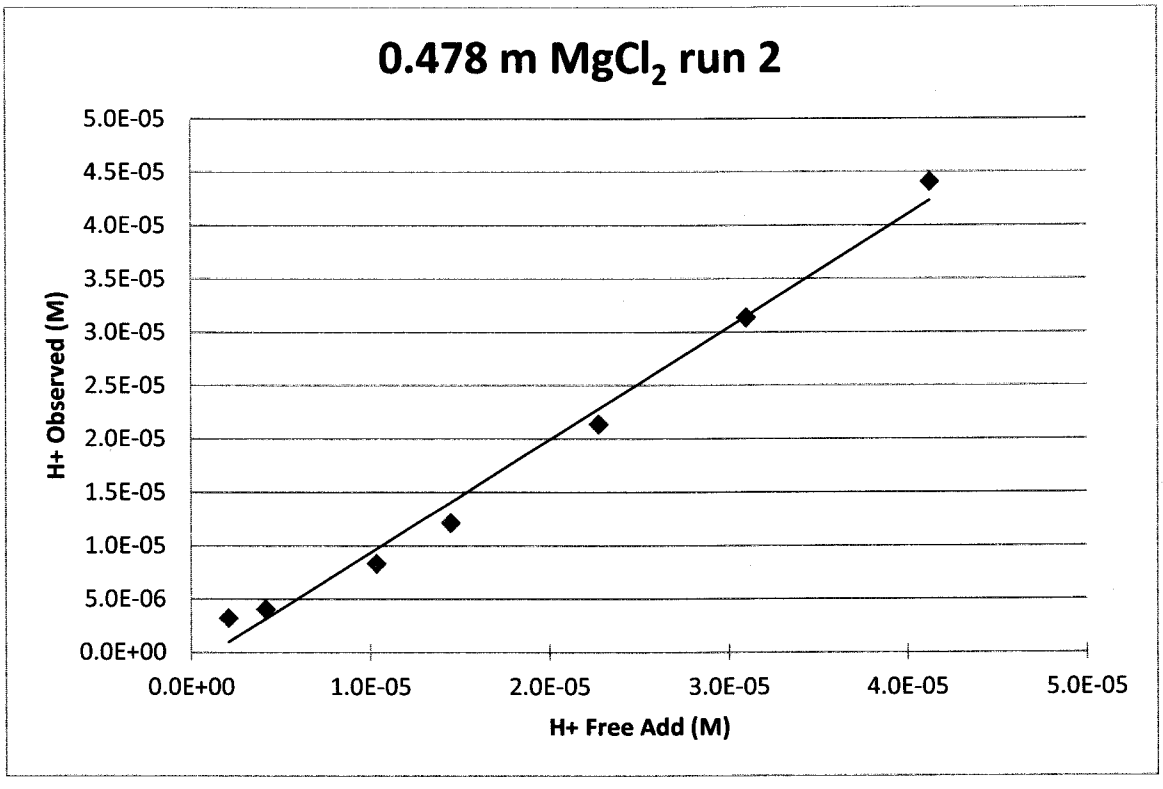
Type:	0.478 m MgCl2 with 0.1M HCl
SN Reference	WIPP-Solubility-7 p. 88
Solution Reference	WIPP-Solubility-7 p. 49
Brine Volume:	50.6 mL
Probe:	Fisher Accumet
Titrant Actual M	0.1 M HCl
Titrant Reference:	WIPP-Solubility-7 p. 9

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.010	4.805	1.567E-05	1.925E-05
0.019	4.425	3.758E-05	3.848E-05
0.029	4.216	6.081E-05	5.771E-05
0.049	3.968	1.076E-04	9.615E-05
0.078	3.748	1.786E-04	1.538E-04
0.127	3.529	2.958E-04	2.496E-04
0.227	3.272	5.346E-04	4.461E-04
0.327	3.115	7.674E-04	6.417E-04
0.627	2.832	1.472E-03	1.224E-03
1.128	2.580	2.630E-03	2.180E-03
2.112	2.322	4.764E-03	4.006E-03
3.096	2.170	6.761E-03	5.765E-03
4.080	2.065	8.610E-03	7.461E-03
4.780	2.003	9.931E-03	8.632E-03



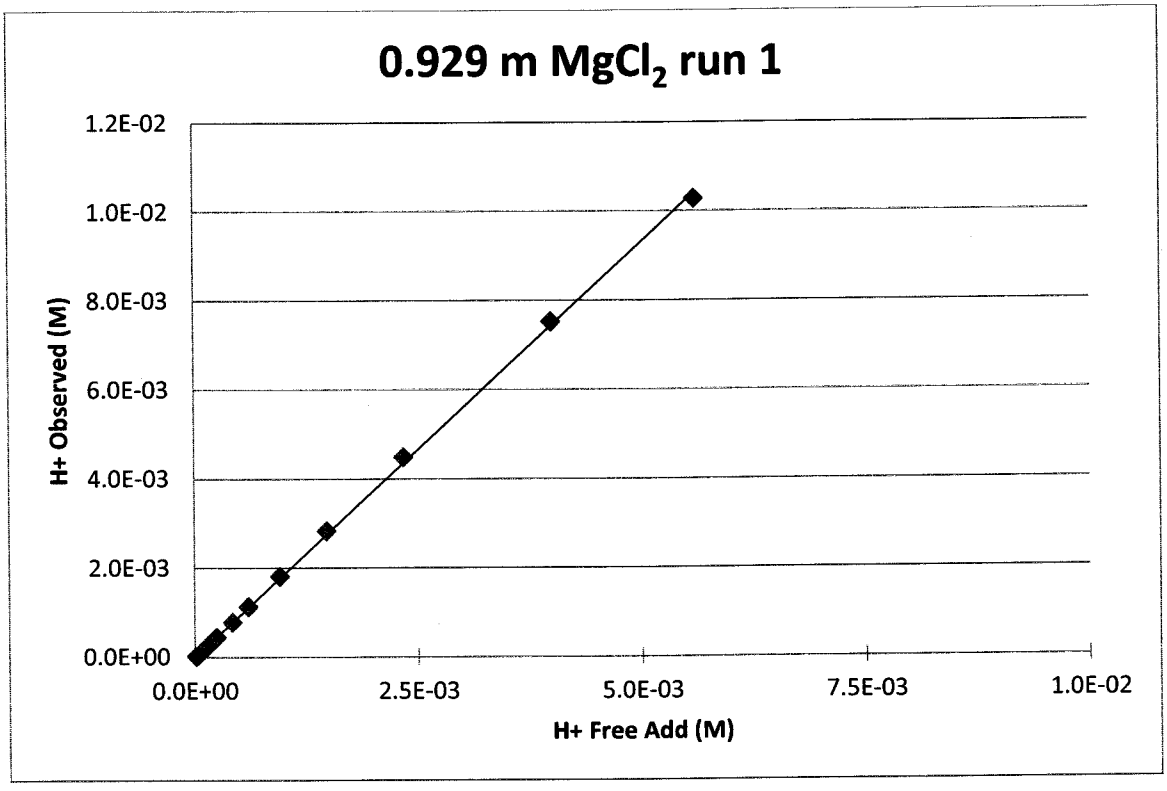
Type:	0.478 m MgCl2 with 0.01M HCl
SN Reference	WIPP-Solubility-7 p. 92
Solution Reference	WIPP-Solubility-7 p. 49
Brine Volume:	47.0 mL
Probe:	Fisher Accumet
Titrant Actual M	0.009994 M HCl
Titrant Reference:	WIPP-Solubility-7 p. 9

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.010	5.494	3.206E-06	2.071E-06
0.019	5.391	4.064E-06	4.140E-06
0.049	5.081	8.299E-06	1.034E-05
0.068	4.917	1.211E-05	1.448E-05
0.107	4.671	2.133E-05	2.273E-05
0.146	4.504	3.133E-05	3.097E-05
0.195	4.356	4.406E-05	4.125E-05



Type:	0.929 m MgCl2 with 0.1M HCl
SN Reference	WIPP-Solubility-7 p. 89
Solution Reference	WIPP-Solubility-7 p. 49
Brine Volume:	55.8 mL
Probe:	Fisher Accumet
Titrant Actual M	0.1 M HCl
Titrant Reference:	WIPP-Solubility-7 p. 9

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.010	5.053	8.851E-06	1.745E-05
0.019	4.493	3.214E-05	3.490E-05
0.029	4.206	6.223E-05	5.234E-05
0.039	4.022	9.506E-05	6.977E-05
0.058	3.792	1.614E-04	1.046E-04
0.088	3.578	2.642E-04	1.569E-04
0.136	3.362	4.345E-04	2.438E-04
0.236	3.107	7.816E-04	4.220E-04
0.337	2.950	1.122E-03	5.995E-04
0.537	2.744	1.803E-03	9.528E-04
0.837	2.550	2.818E-03	1.478E-03
1.338	2.349	4.477E-03	2.341E-03
2.322	2.124	7.516E-03	3.994E-03
3.306	1.988	1.028E-02	5.593E-03

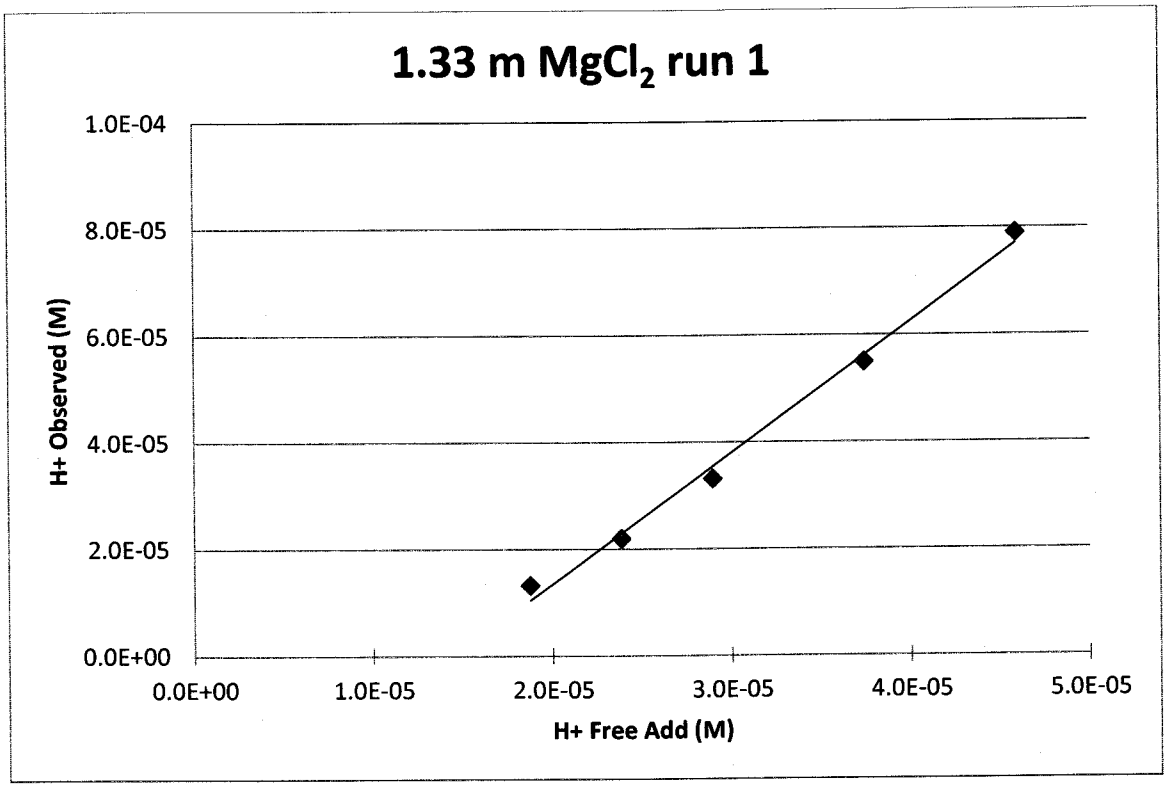


Type:	1.33 m MgCl2 with 0.01M HCl
SN Reference	WIPP-Solubility-7 p. 90
Solution Reference	WIPP-Solubility-7 p. 49
Brine Volume:	56.7 mL
Probe:	Fisher Accumet
Titrant Actual M	0.009994 M HCl
Titrant Reference:	WIPP-Solubility-7 p. 9

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.010	5.660	2.188E-06	--
0.019	5.586	2.594E-06	--
0.049	5.363	4.335E-06	--
0.078	5.124	7.516E-06	--
0.107	4.882	1.312E-05	1.875E-05
0.136	4.661	2.183E-05	2.385E-05
0.166	4.481	3.304E-05	2.894E-05
0.214	4.260	5.495E-05	3.742E-05
0.263	4.103	7.889E-05	4.589E-05
0.273	3.894	1.276E-04	*
0.282	3.747	1.791E-04	*
0.312	3.474	3.357E-04	*
0.341	3.307	4.932E-04	*
0.441	2.989	1.026E-03	*
0.541	2.81	1.549E-03	*
0.841	2.51	3.126E-03	*
1.142	2.33	4.667E-03	*
1.442	2.21	6.166E-03	*
1.943	2.07	8.551E-03	*
2.443	1.96	1.089E-02	*

-- Indicates data not used in slope regression

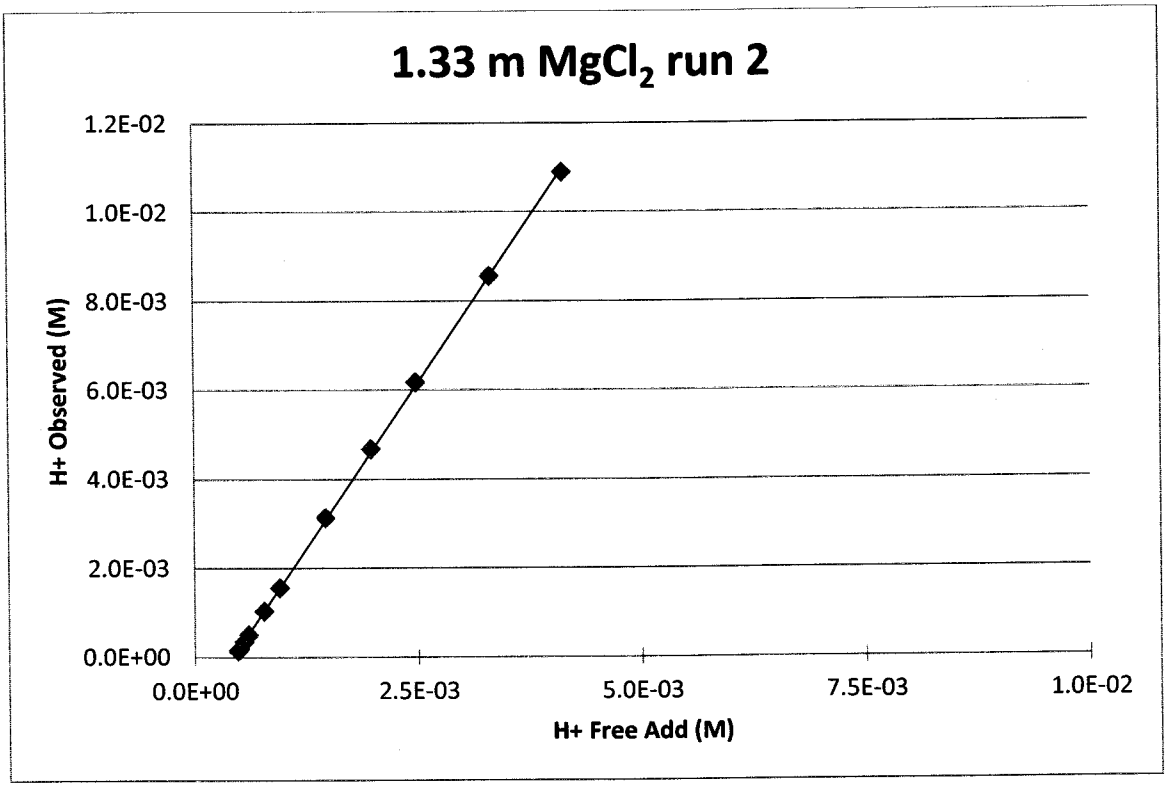
* Plotted as Run 2



Type:	1.33 m MgCl2 with 0.1M HCl
SN Reference	WIPP-Solubility-7 p. 90
Solution Reference	WIPP-Solubility-7 p. 49
Brine Volume:	56.7 mL
Probe:	Fisher Accumet
Titrant Actual M	0.1 M HCl
Titrant Reference:	WIPP-Solubility-7 p. 9

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.010	5.660	2.188E-06	*
0.019	5.586	2.594E-06	*
0.049	5.363	4.335E-06	*
0.078	5.124	7.516E-06	*
0.107	4.882	1.312E-05	*
0.136	4.661	2.183E-05	*
0.166	4.481	3.304E-05	*
0.214	4.260	5.495E-05	*
0.263	4.103	7.889E-05	*
0.273	3.894	1.276E-04	4.787E-04
0.282	3.747	1.791E-04	4.957E-04
0.312	3.474	3.357E-04	5.467E-04
0.341	3.307	4.932E-04	5.976E-04
0.441	2.989	1.026E-03	7.718E-04
0.541	2.81	1.549E-03	9.453E-04
0.841	2.51	3.126E-03	1.462E-03
1.142	2.33	4.667E-03	1.974E-03
1.442	2.21	6.166E-03	2.480E-03
1.943	2.07	8.551E-03	3.312E-03
2.443	1.96	1.089E-02	4.131E-03

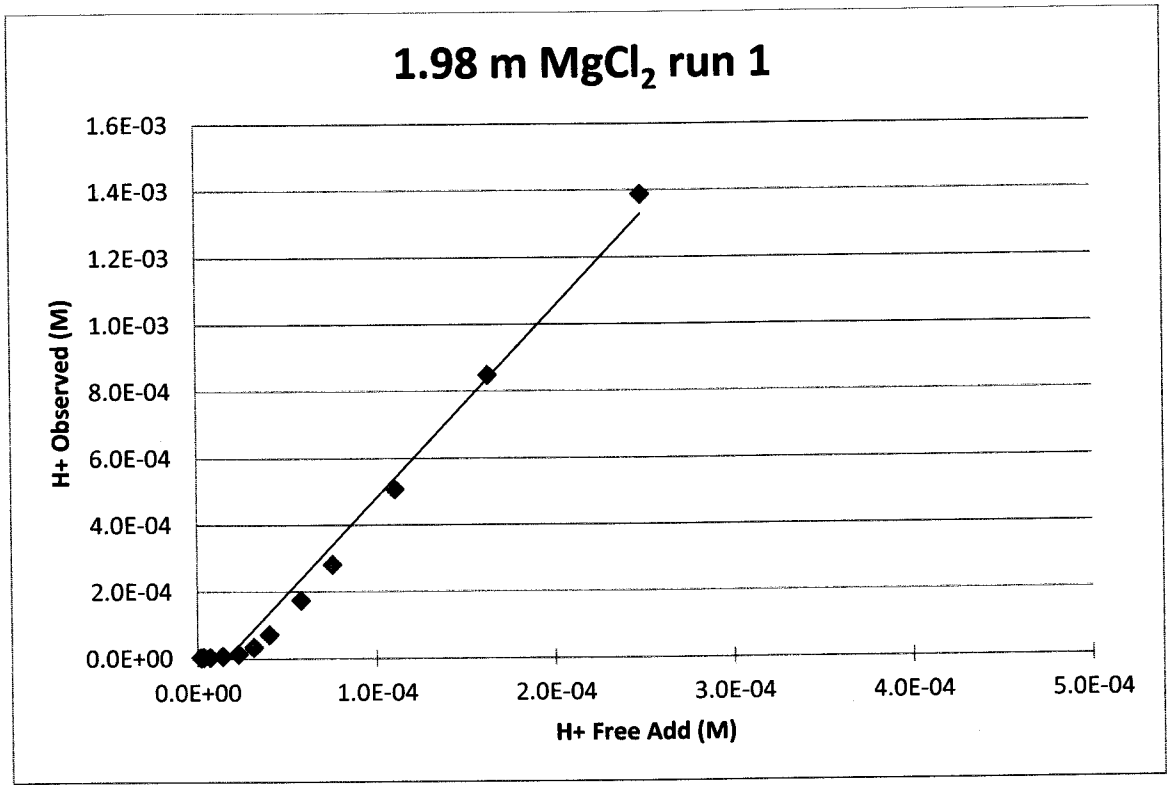
* Plotted as Run 1



Type:	1.98 m MgCl2 with 0.01M HCl
SN Reference	WIPP-Solubility-7 p. 91
Solution Reference	WIPP-Solubility-7 p. 49
Brine Volume:	55.8 mL
Probe:	Fisher Accumet
Titrant Actual M	0.009994 M HCl
Titrant Reference:	WIPP-Solubility-7 p. 9

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.010	5.637	2.307E-06	1.744E-06
0.019	5.586	2.594E-06	3.488E-06
0.039	5.490	3.236E-06	6.973E-06
0.078	5.233	5.848E-06	1.394E-05
0.127	4.889	1.291E-05	2.263E-05
0.175	4.481	3.304E-05	3.130E-05
0.224	4.154	7.015E-05	3.996E-05
0.324	3.762	1.730E-04	5.772E-05
0.424	3.551	2.812E-04	7.541E-05
0.624	3.296	5.058E-04	1.106E-04
0.925	3.072	8.472E-04	1.629E-04
1.425	2.858	1.387E-03	2.489E-04
1.525	2.605	2.483E-03	*
1.726	2.335	4.624E-03	*
2.026	2.109	7.780E-03	*
2.526	1.893	1.279E-02	*

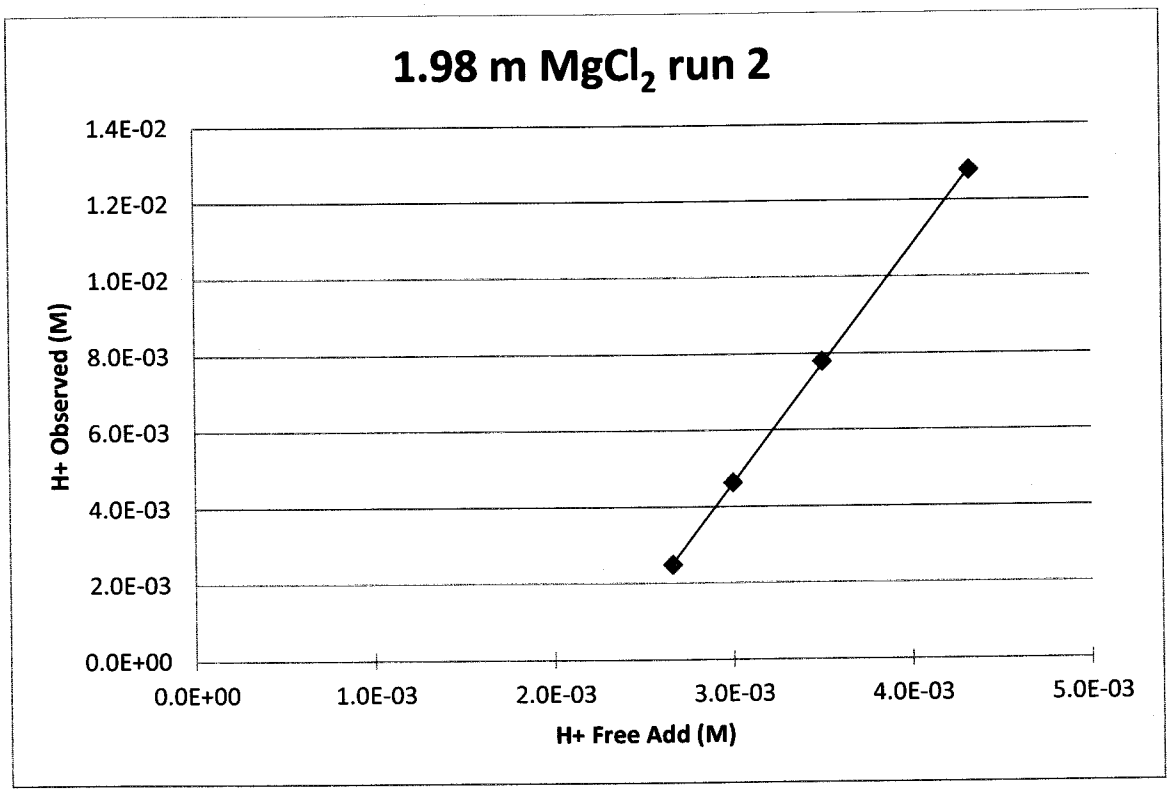
* Plotted as Run 2



Type:	1.98 m MgCl2 with 0.1M HCl
SN Reference	WIPP-Solubility-7 p. 91
Solution Reference	WIPP-Solubility-7 p. 49
Brine Volume:	55.8 mL
Probe:	Fisher Accumet
Titrant Actual M	0.1 M HCl
Titrant Reference:	WIPP-Solubility-7 p. 9

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.010	5.637	2.307E-06	*
0.019	5.586	2.594E-06	*
0.039	5.490	3.236E-06	*
0.078	5.233	5.848E-06	*
0.127	4.889	1.291E-05	*
0.175	4.481	3.304E-05	*
0.224	4.154	7.015E-05	*
0.324	3.762	1.730E-04	*
0.424	3.551	2.812E-04	*
0.624	3.296	5.058E-04	*
0.925	3.072	8.472E-04	*
1.425	2.858	1.387E-03	*
1.525	2.605	2.483E-03	2.661E-03
1.726	2.335	4.624E-03	3.000E-03
2.026	2.109	7.780E-03	3.503E-03
2.526	1.893	1.279E-02	4.331E-03

* Plotted as Run 1

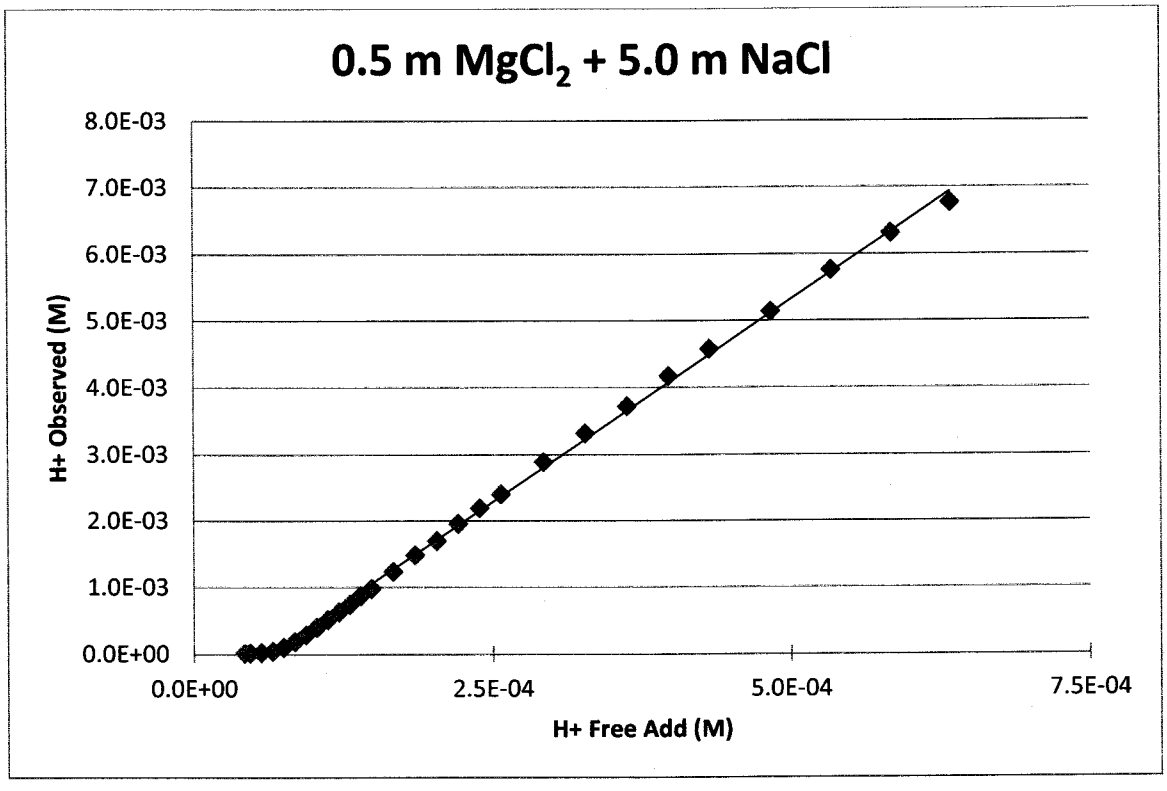


Type:	0.5 m MgCl2 + 5.0 m NaCl with 0.01M HCl
SN Reference	WIPP-MgO-CBD-26-13 p. 89
Solution Reference	WIPP-MgO-CBD-26-13 p. 69
Brine Volume:	50.0 mL
Probe:	Orion Ross Semi-Micro
Titrant Actual M	0.009431 M HCl
Titrant Reference:	WIPP-MgO-CBD-26-13 p. 89

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.000	6.29	5.129E-07	--
0.025	6.12	7.586E-07	--
0.050	5.96	1.096E-06	--
0.075	5.90	1.259E-06	--
0.100	5.74	1.820E-06	--
0.125	5.60	2.512E-06	--
0.150	5.46	3.467E-06	--
0.175	5.34	4.571E-06	--
0.200	5.23	5.888E-06	--
0.225	5.11	7.762E-06	4.225E-05
0.250	5.01	9.772E-06	4.692E-05
0.300	4.75	1.778E-05	5.625E-05
0.350	4.40	3.981E-05	6.556E-05
0.400	4.02	9.550E-05	7.485E-05
0.450	3.74	1.820E-04	8.412E-05
0.500	3.54	2.884E-04	9.338E-05
0.550	3.40	3.981E-04	1.026E-04
0.600	3.29	5.129E-04	1.118E-04
0.650	3.20	6.310E-04	1.210E-04
0.700	3.13	7.413E-04	1.302E-04
0.750	3.06	8.710E-04	1.394E-04
0.800	3.01	9.772E-04	1.485E-04
0.900	2.91	1.230E-03	1.668E-04
1.000	2.83	1.479E-03	1.849E-04
1.100	2.77	1.698E-03	2.030E-04
1.200	2.71	1.950E-03	2.210E-04
1.300	2.66	2.188E-03	2.390E-04
1.400	2.62	2.399E-03	2.569E-04
1.600	2.54	2.884E-03	2.924E-04
1.800	2.48	3.311E-03	3.277E-04
2.000	2.43	3.715E-03	3.627E-04
2.200	2.38	4.169E-03	3.975E-04

2.400	2.34	4.571E-03	4.320E-04
2.700	2.29	5.129E-03	4.832E-04
3.000	2.24	5.754E-03	5.338E-04
3.300	2.20	6.310E-03	5.839E-04
3.600	2.17	6.761E-03	6.334E-04

-- Indicates data not used in slope regression

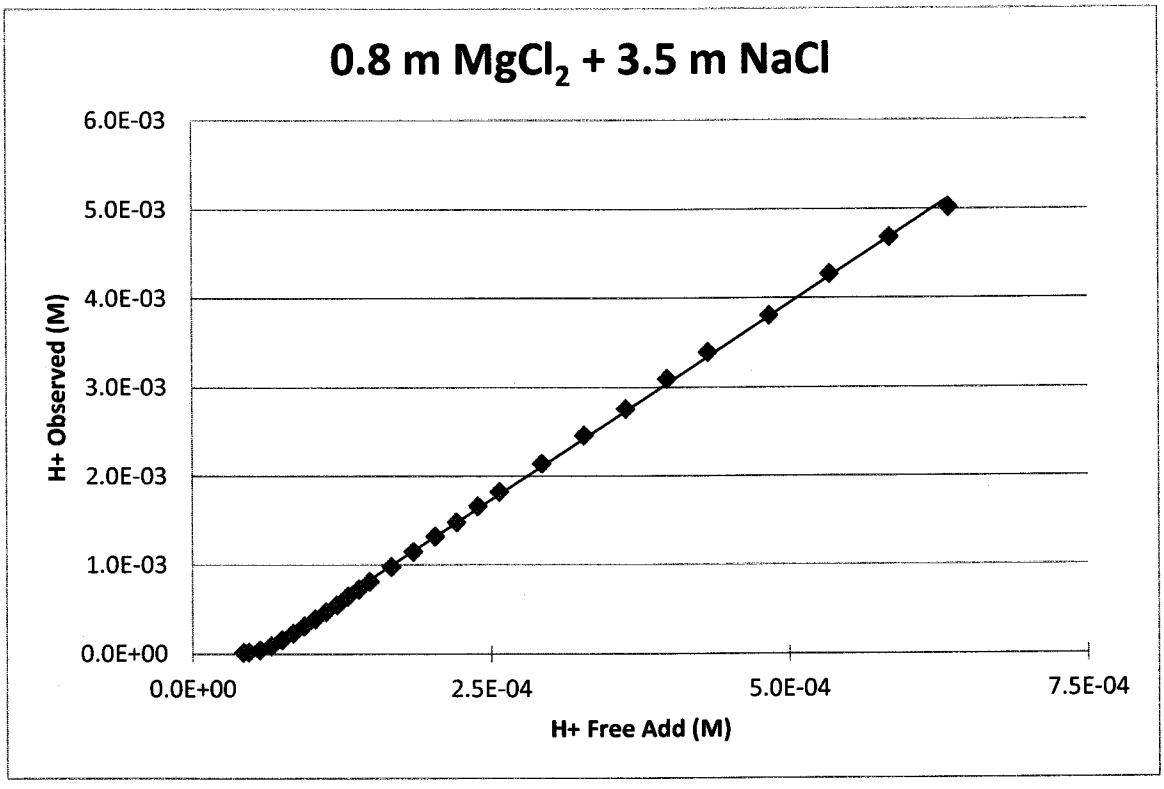


Type:	0.8 m MgCl2 + 3.5 m NaCl with 0.01M HCl
SN Reference	WIPP-MgO-CBD-26-13 p. 91
Solution Reference	WIPP-MgO-CBD-26-13 p. 69
Brine Volume:	50.0 mL
Probe:	Orion Ross Semi-Micro
Titrant Actual M	0.009431 M HCl
Titrant Reference:	WIPP-MgO-CBD-26-13 p. 89

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.000	6.11	7.762E-07	--
0.025	5.91	1.230E-06	--
0.050	5.75	1.778E-06	--
0.100	5.46	3.467E-06	--
0.125	5.33	4.677E-06	--
0.150	5.22	6.026E-06	--
0.175	5.11	7.762E-06	--
0.200	4.99	1.023E-05	--
0.225	4.87	1.349E-05	4.225E-05
0.250	4.73	1.862E-05	4.692E-05
0.300	4.39	4.074E-05	5.625E-05
0.350	4.06	8.710E-05	6.556E-05
0.400	3.81	1.549E-04	7.485E-05
0.450	3.64	2.291E-04	8.412E-05
0.500	3.51	3.090E-04	9.338E-05
0.550	3.41	3.890E-04	1.026E-04
0.600	3.33	4.677E-04	1.118E-04
0.650	3.26	5.495E-04	1.210E-04
0.700	3.19	6.457E-04	1.302E-04
0.750	3.14	7.244E-04	1.394E-04
0.800	3.09	8.128E-04	1.485E-04
0.900	3.01	9.772E-04	1.668E-04
1.000	2.94	1.148E-03	1.849E-04
1.100	2.88	1.318E-03	2.030E-04
1.200	2.83	1.479E-03	2.210E-04
1.300	2.78	1.660E-03	2.390E-04
1.400	2.74	1.820E-03	2.569E-04
1.600	2.67	2.138E-03	2.924E-04
1.800	2.61	2.455E-03	3.277E-04

2.000	2.56	2.754E-03	3.627E-04
2.200	2.51	3.090E-03	3.975E-04
2.400	2.47	3.388E-03	4.320E-04
2.700	2.42	3.802E-03	4.832E-04
3.000	2.37	4.266E-03	5.338E-04
3.300	2.33	4.677E-03	5.839E-04
3.600	2.30	5.012E-03	6.334E-04
4.000	2.26	5.495E-03	6.986E-04
4.400	2.23	5.888E-03	7.628E-04
4.800	2.20	6.310E-03	8.261E-04
5.200	2.17	6.761E-03	8.884E-04

-- Indicates data not used in slope regression

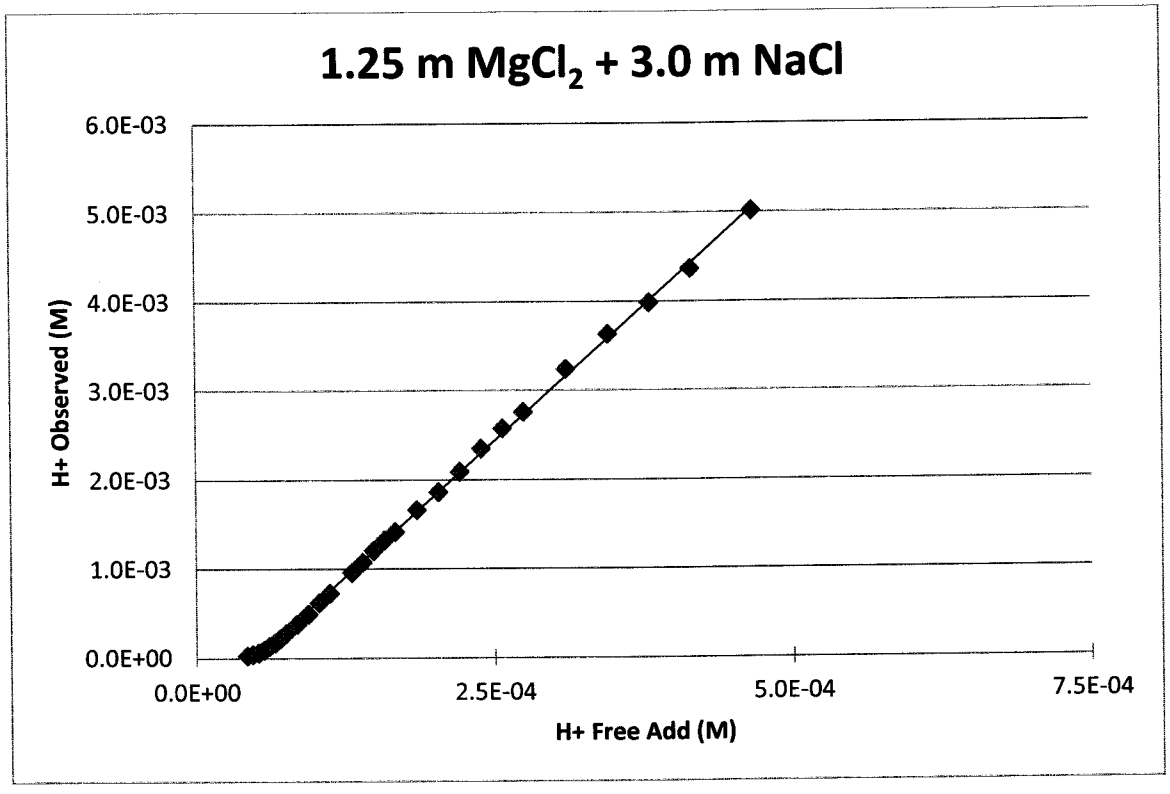


Type:	1.25 m MgCl2 + 3.0 m NaCl with 0.01M HCl
SN Reference	WIPP-MgO-CBD-26-13 p. 92
Solution Reference	WIPP-MgO-CBD-26-13 p. 69
Brine Volume:	50.0 mL
Probe:	Orion Ross Semi-Micro
Titrant Actual M	0.009431 M HCl
Titrant Reference:	WIPP-MgO-CBD-26-13 p. 89

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.000	5.99	1.023E-06	--
0.025	5.84	1.445E-06	--
0.050	5.66	2.188E-06	--
0.075	5.48	3.311E-06	--
0.100	5.33	4.677E-06	--
0.150	5.06	8.710E-06	--
0.175	4.93	1.175E-05	--
0.200	4.81	1.549E-05	--
0.225	4.65	2.239E-05	4.225E-05
0.250	4.46	3.467E-05	4.692E-05
0.275	4.27	5.370E-05	5.159E-05
0.300	4.07	8.511E-05	5.625E-05
0.325	3.90	1.259E-04	6.091E-05
0.350	3.77	1.698E-04	6.556E-05
0.375	3.66	2.188E-04	7.021E-05
0.400	3.56	2.754E-04	7.485E-05
0.450	3.42	3.802E-04	8.412E-05
0.500	3.31	4.898E-04	9.338E-05
0.550	3.21	6.166E-04	1.026E-04
0.600	3.14	7.244E-04	1.118E-04
0.700	3.02	9.550E-04	1.302E-04
0.750	2.97	1.072E-03	1.394E-04
0.800	2.92	1.202E-03	1.485E-04
0.850	2.88	1.318E-03	1.576E-04
0.900	2.85	1.413E-03	1.668E-04
1.000	2.78	1.660E-03	1.849E-04
1.100	2.73	1.862E-03	2.030E-04
1.200	2.68	2.089E-03	2.210E-04
1.300	2.63	2.344E-03	2.390E-04

1.400	2.59	2.570E-03	2.569E-04
1.500	2.56	2.754E-03	2.747E-04
1.700	2.49	3.236E-03	3.101E-04
1.900	2.44	3.631E-03	3.453E-04
2.100	2.40	3.981E-03	3.801E-04
2.300	2.36	4.365E-03	4.147E-04
2.600	2.30	5.012E-03	4.662E-04
2.900	2.26	5.495E-03	5.170E-04
3.200	2.22	6.026E-03	5.673E-04
3.500	2.18	6.607E-03	6.170E-04
3.800	2.15	7.079E-03	6.661E-04

-- Indicates data not used in slope regression

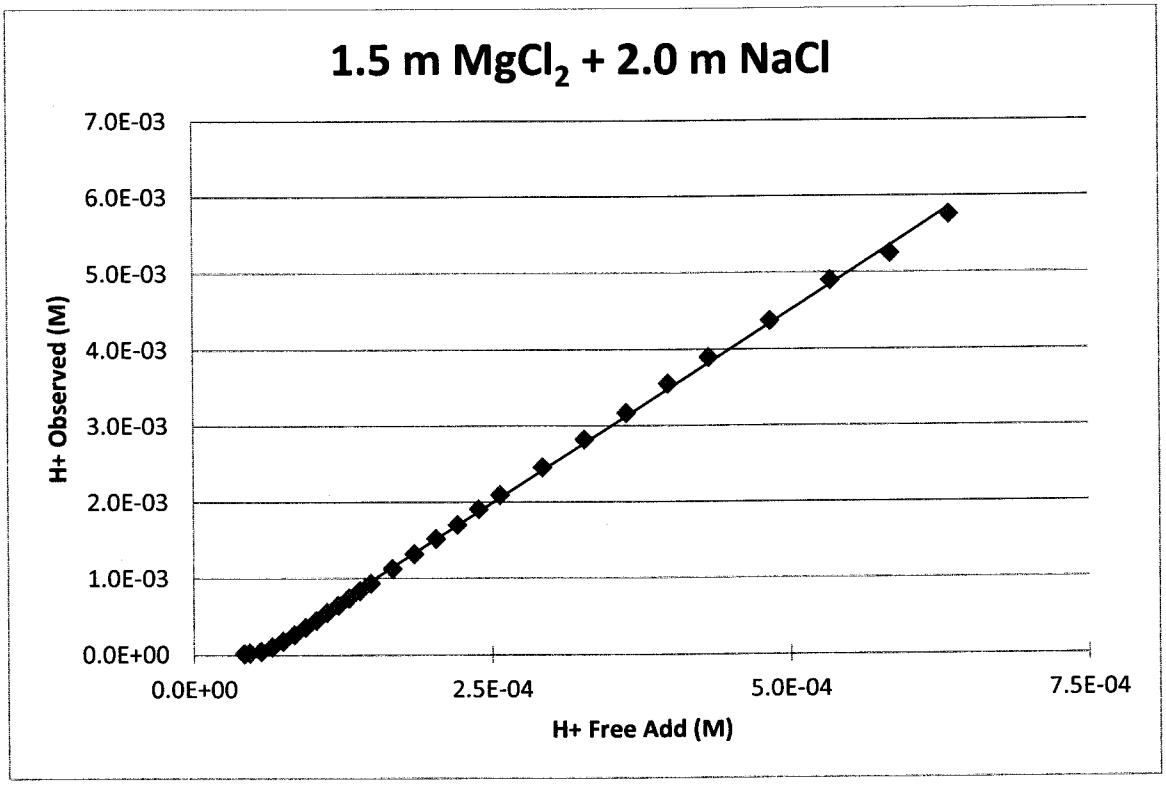


Type:	1.5 m MgCl2 + 2.0 m NaCl with 0.01M HCl
SN Reference	WIPP-MgO-CBD-26-13 p. 95
Solution Reference	WIPP-MgO-CBD-26-13 p. 69
Brine Volume:	50.0 mL
Probe:	Orion Ross Semi-Micro
Titrant Actual M	0.009431 M HCl
Titrant Reference:	WIPP-MgO-CBD-26-13 p. 89

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.000	6.02	9.550E-07	--
0.025	5.90	1.259E-06	--
0.050	5.76	1.738E-06	--
0.075	5.63	2.344E-06	--
0.100	5.50	3.162E-06	--
0.125	5.38	4.169E-06	--
0.150	5.25	5.623E-06	--
0.175	5.13	7.413E-06	--
0.200	5.00	1.000E-05	--
0.225	4.87	1.349E-05	4.225E-05
0.250	4.72	1.905E-05	4.692E-05
0.300	4.36	4.365E-05	5.625E-05
0.350	4.00	1.000E-04	6.556E-05
0.400	3.75	1.778E-04	7.485E-05
0.450	3.58	2.630E-04	8.412E-05
0.500	3.45	3.548E-04	9.338E-05
0.550	3.35	4.467E-04	1.026E-04
0.600	3.26	5.495E-04	1.118E-04
0.650	3.19	6.457E-04	1.210E-04
0.700	3.13	7.413E-04	1.302E-04
0.750	3.08	8.318E-04	1.394E-04
0.800	3.03	9.333E-04	1.485E-04
0.900	2.95	1.122E-03	1.668E-04
1.000	2.88	1.318E-03	1.849E-04
1.100	2.82	1.514E-03	2.030E-04
1.200	2.77	1.698E-03	2.210E-04
1.300	2.72	1.905E-03	2.390E-04
1.400	2.68	2.089E-03	2.569E-04
1.600	2.61	2.455E-03	2.924E-04
1.800	2.55	2.818E-03	3.277E-04

2.000	2.50	3.162E-03	3.627E-04
2.200	2.45	3.548E-03	3.975E-04
2.400	2.41	3.890E-03	4.320E-04
2.700	2.36	4.365E-03	4.832E-04
3.000	2.31	4.898E-03	5.338E-04
3.300	2.28	5.248E-03	5.839E-04
3.600	2.24	5.754E-03	6.334E-04
3.900	2.21	6.166E-03	6.824E-04
4.200	2.18	6.607E-03	7.308E-04

-- Indicates data not used in slope regression

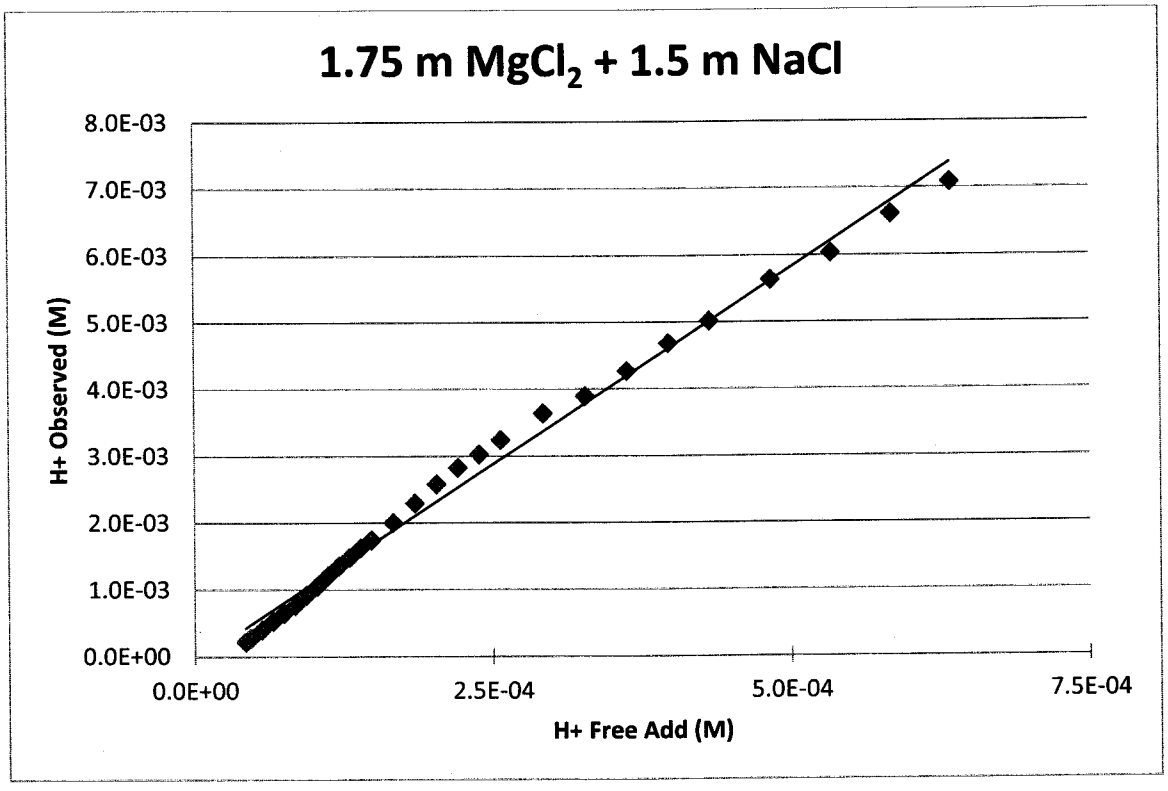


Type:	1.75 m MgCl2 + 1.5 m NaCl with 0.01M HCl
SN Reference	WIPP-MgO-CBD-26-13 p. 97
Solution Reference	WIPP-MgO-CBD-26-13 p. 69
Brine Volume:	50.0 mL
Probe:	Orion Ross Semi-Micro
Titrant Actual M	0.009431 M HCl
Titrant Reference:	WIPP-MgO-CBD-26-13 p. 89

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.000	5.68	2.089E-06	--
0.025	5.45	3.548E-06	--
0.050	5.22	6.026E-06	--
0.075	4.98	1.047E-05	--
0.100	4.77	1.698E-05	--
0.125	4.50	3.162E-05	--
0.150	4.21	6.166E-05	--
0.175	3.98	1.047E-04	--
0.200	3.81	1.549E-04	--
0.225	3.67	2.138E-04	4.225E-05
0.250	3.56	2.754E-04	4.692E-05
0.300	3.40	3.981E-04	5.625E-05
0.350	3.28	5.248E-04	6.556E-05
0.400	3.19	6.457E-04	7.485E-05
0.450	3.12	7.586E-04	8.412E-05
0.500	3.04	9.120E-04	9.338E-05
0.550	2.98	1.047E-03	1.026E-04
0.600	2.92	1.202E-03	1.118E-04
0.650	2.87	1.349E-03	1.210E-04
0.700	2.83	1.479E-03	1.302E-04
0.750	2.79	1.622E-03	1.394E-04
0.800	2.76	1.738E-03	1.485E-04
0.900	2.70	1.995E-03	1.668E-04
1.000	2.64	2.291E-03	1.849E-04
1.100	2.59	2.570E-03	2.030E-04
1.200	2.55	2.818E-03	2.210E-04
1.300	2.52	3.020E-03	2.390E-04
1.400	2.49	3.236E-03	2.569E-04
1.600	2.44	3.631E-03	2.924E-04
1.800	2.41	3.890E-03	3.277E-04

2.000	2.37	4.266E-03	3.627E-04
2.200	2.33	4.677E-03	3.975E-04
2.400	2.30	5.012E-03	4.320E-04
2.700	2.25	5.623E-03	4.832E-04
3.000	2.22	6.026E-03	5.338E-04
3.300	2.18	6.607E-03	5.839E-04
3.600	2.15	7.079E-03	6.334E-04

-- Indicates data not used in slope regression

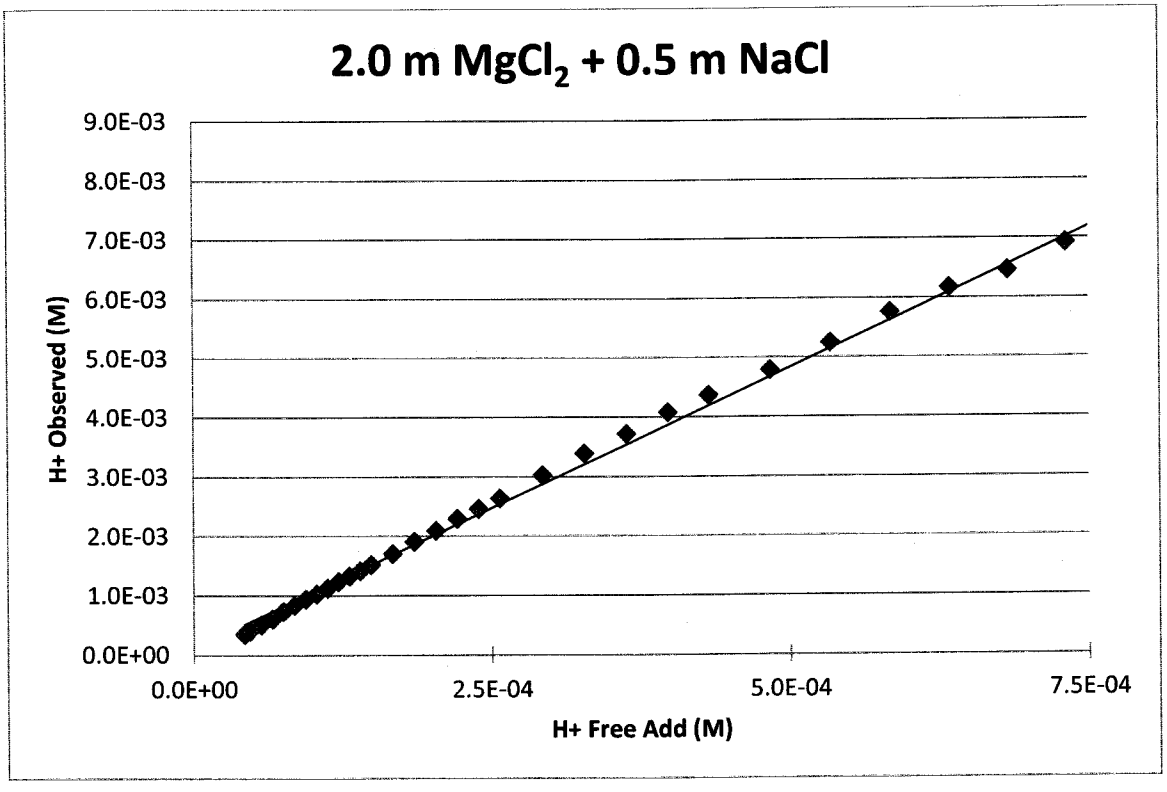


Type:	2.0 m MgCl2 + 0.5 m NaCl with 0.01M HCl
SN Reference	WIPP-MgO-CBD-26-13 p. 98
Solution Reference	WIPP-MgO-CBD-26-13 p. 69
Brine Volume:	50.0 mL
Probe:	Orion Ross Semi-Micro
Titrant Actual M	0.009431 M HCl
Titrant Reference:	WIPP-MgO-CBD-26-13 p. 89

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.000	5.16	6.918E-06	--
0.025	4.86	1.380E-05	--
0.050	4.54	2.884E-05	--
0.100	4.00	1.000E-04	--
0.125	3.84	1.445E-04	--
0.150	3.71	1.950E-04	--
0.175	3.61	2.455E-04	--
0.200	3.53	2.951E-04	--
0.225	3.46	3.467E-04	4.225E-05
0.250	3.40	3.981E-04	4.692E-05
0.300	3.30	5.012E-04	5.625E-05
0.350	3.22	6.026E-04	6.556E-05
0.400	3.14	7.244E-04	7.485E-05
0.450	3.08	8.318E-04	8.412E-05
0.500	3.03	9.333E-04	9.338E-05
0.550	2.99	1.023E-03	1.026E-04
0.600	2.95	1.122E-03	1.118E-04
0.650	2.91	1.230E-03	1.210E-04
0.700	2.88	1.318E-03	1.302E-04
0.750	2.85	1.413E-03	1.394E-04
0.800	2.82	1.514E-03	1.485E-04
0.900	2.77	1.698E-03	1.668E-04
1.000	2.72	1.905E-03	1.849E-04
1.100	2.68	2.089E-03	2.030E-04
1.200	2.64	2.291E-03	2.210E-04
1.300	2.61	2.455E-03	2.390E-04
1.400	2.58	2.630E-03	2.569E-04
1.600	2.52	3.020E-03	2.924E-04
1.800	2.47	3.388E-03	3.277E-04
2.000	2.43	3.715E-03	3.627E-04

2.200	2.39	4.074E-03	3.975E-04
2.400	2.36	4.365E-03	4.320E-04
2.700	2.32	4.786E-03	4.832E-04
3.000	2.28	5.248E-03	5.338E-04
3.300	2.24	5.754E-03	5.839E-04
3.600	2.21	6.166E-03	6.334E-04
3.900	2.19	6.457E-03	6.824E-04
4.200	2.16	6.918E-03	7.308E-04
4.500	2.14	7.244E-03	7.787E-04
4.800	2.12	7.586E-03	8.261E-04

-- Indicates data not used in slope regression

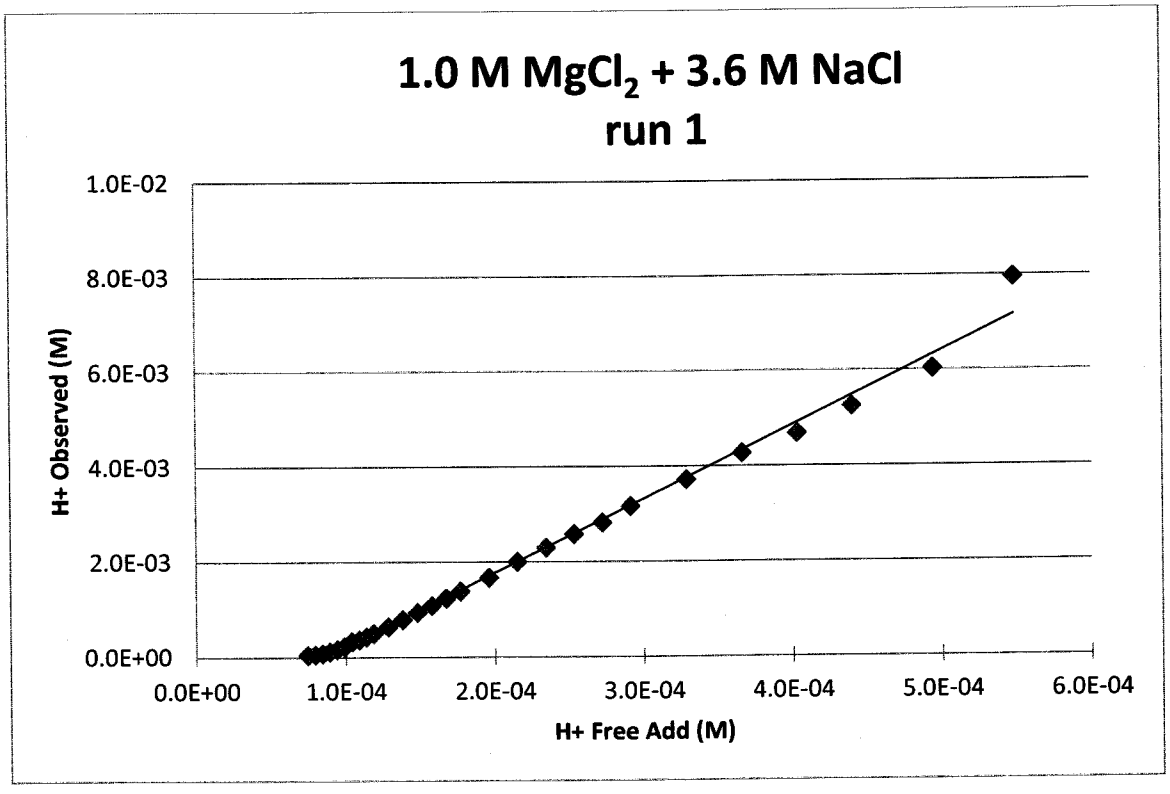


Type:	1.0M MgCl2 + 3.6M NaCl
SN Reference	WIPP-MM MgO-14 p. 18
Solution Reference	WIPP-MM MgO-4 p. 54
Brine Volume:	50.0 mL
Probe:	Mettler-Toledo DG-111-SC
Titrant Actual M	0.01 M HCl
Titrant Reference:	WIPP-MM MgO-14 p. 18

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.000	6.140	7.244E-07	--
0.025	6.040	9.120E-07	--
0.050	5.920	1.202E-06	--
0.100	5.640	2.291E-06	--
0.125	5.560	2.754E-06	--
0.150	5.460	3.467E-06	--
0.175	5.370	4.266E-06	--
0.200	5.260	5.495E-06	--
0.225	5.170	6.761E-06	--
0.250	5.020	9.550E-06	--
0.275	4.940	1.148E-05	--
0.300	4.870	1.349E-05	--
0.375	4.500	3.162E-05	7.444E-05
0.400	4.340	4.571E-05	7.937E-05
0.425	4.150	7.079E-05	8.428E-05
0.450	3.960	1.096E-04	8.920E-05
0.475	3.800	1.585E-04	9.411E-05
0.500	3.660	2.188E-04	9.901E-05
0.525	3.500	3.162E-04	1.039E-04
0.550	3.450	3.548E-04	1.088E-04
0.575	3.380	4.169E-04	1.137E-04
0.600	3.310	4.898E-04	1.186E-04
0.650	3.200	6.310E-04	1.283E-04
0.700	3.110	7.762E-04	1.381E-04
0.750	3.030	9.333E-04	1.478E-04
0.800	2.970	1.072E-03	1.575E-04
0.850	2.910	1.230E-03	1.672E-04
0.900	2.860	1.380E-03	1.768E-04
1.000	2.780	1.660E-03	1.961E-04
1.100	2.700	1.995E-03	2.153E-04

1.200	2.640	2.291E-03	2.344E-04
1.300	2.590	2.570E-03	2.534E-04
1.400	2.550	2.818E-03	2.724E-04
1.500	2.500	3.162E-03	2.913E-04
1.700	2.430	3.715E-03	3.288E-04
1.900	2.370	4.266E-03	3.661E-04
2.100	2.330	4.677E-03	4.031E-04
2.300	2.280	5.248E-03	4.398E-04
2.600	2.220	6.026E-03	4.943E-04
2.900	2.100	7.943E-03	5.482E-04

-- Indicates data not used in slope regression

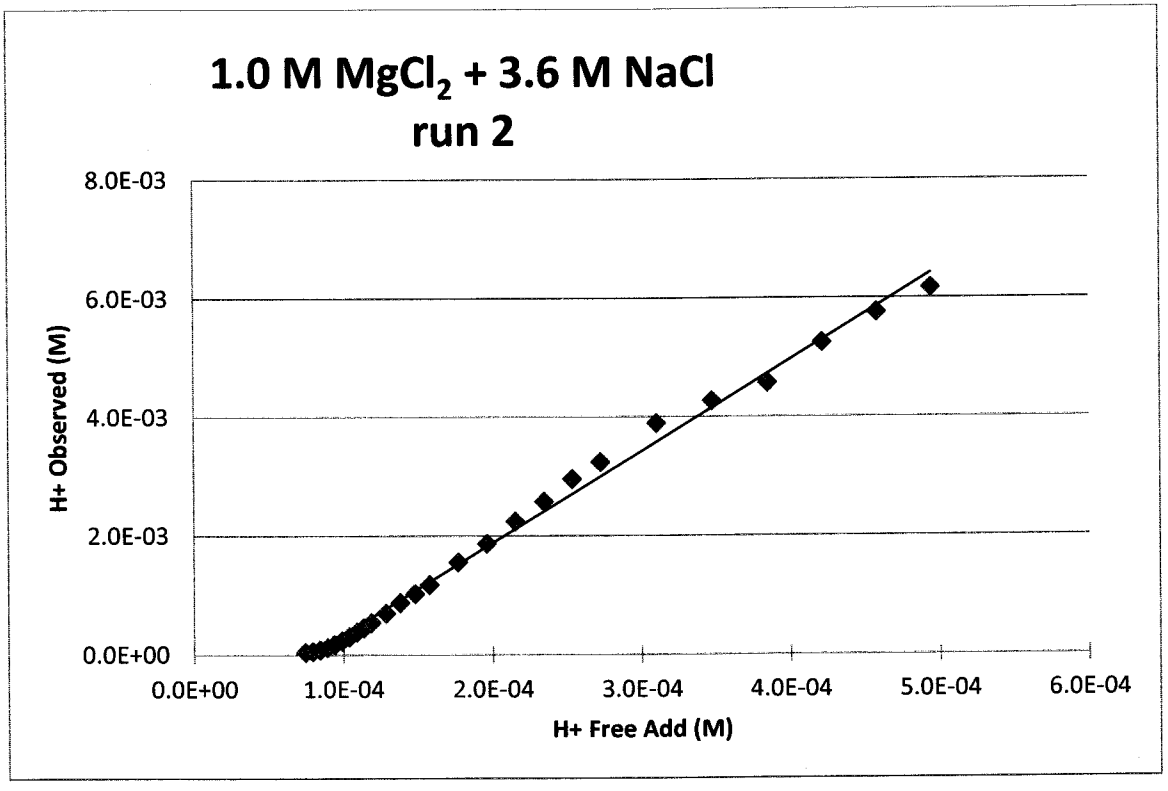


Type:	1.0M MgCl2 + 3.6M NaCl
SN Reference	WIPP-MM MgO-14 p. 19
Solution Reference	WIPP-MM MgO-4 p. 54
Brine Volume:	50.0 mL
Probe:	Mettler-Toledo DG-111-SC
Titrant Actual M	0.01 M HCl
Titrant Reference:	WIPP-MM MgO-14 p. 18

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.000	6.120	7.586E-07	--
0.025	6.000	1.000E-06	--
0.050	5.890	1.288E-06	--
0.100	5.640	2.291E-06	--
0.125	5.520	3.020E-06	--
0.150	5.410	3.890E-06	--
0.175	5.300	5.012E-06	--
0.200	5.190	6.457E-06	--
0.225	5.090	8.128E-06	--
0.250	4.990	1.023E-05	--
0.275	4.890	1.288E-05	--
0.300	4.790	1.622E-05	--
0.325	4.680	2.089E-05	--
0.350	4.570	2.692E-05	--
0.375	4.430	3.715E-05	7.444E-05
0.400	4.270	5.370E-05	7.937E-05
0.425	4.100	7.943E-05	8.428E-05
0.450	3.930	1.175E-04	8.920E-05
0.475	3.760	1.738E-04	9.411E-05
0.500	3.630	2.344E-04	9.901E-05
0.525	3.520	3.020E-04	1.039E-04
0.550	3.420	3.802E-04	1.088E-04
0.575	3.350	4.467E-04	1.137E-04
0.600	3.270	5.370E-04	1.186E-04
0.650	3.160	6.918E-04	1.283E-04
0.700	3.060	8.710E-04	1.381E-04
0.750	2.990	1.023E-03	1.478E-04
0.800	2.930	1.175E-03	1.575E-04
0.900	2.810	1.549E-03	1.768E-04
1.000	2.730	1.862E-03	1.961E-04
1.100	2.650	2.239E-03	2.153E-04
1.200	2.590	2.570E-03	2.344E-04

1.300	2.530	2.951E-03	2.534E-04
1.400	2.490	3.236E-03	2.724E-04
1.600	2.410	3.890E-03	3.101E-04
1.800	2.370	4.266E-03	3.475E-04
2.000	2.340	4.571E-03	3.846E-04
2.200	2.280	5.248E-03	4.215E-04
2.400	2.240	5.754E-03	4.580E-04
2.600	2.210	6.166E-03	4.943E-04

-- Indicates data not used in slope regression

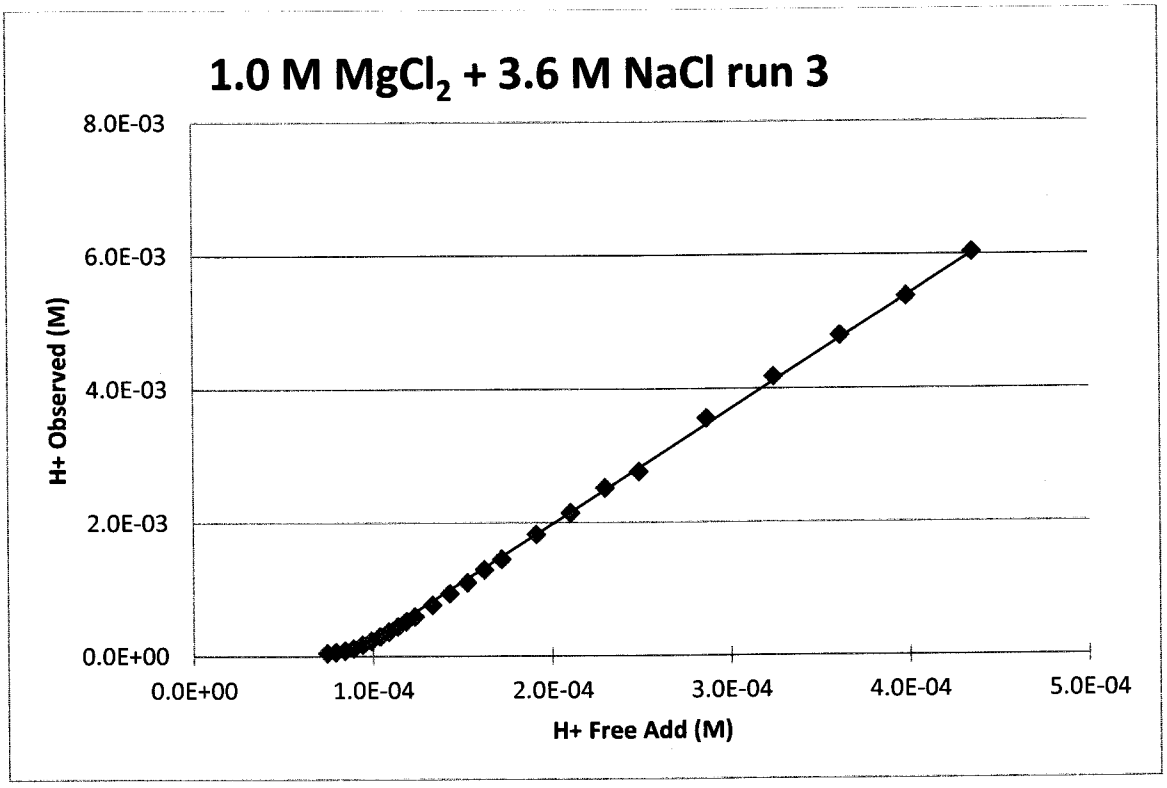


Type:	1.0M MgCl2 + 3.6M NaCl
SN Reference	WIPP-MM MgO-14 p. 20
Solution Reference	WIPP-MM MgO-4 p. 54
Brine Volume:	50.0 mL
Probe:	Mettler-Toledo DG-111-SC
Titrant Actual M	0.01 M HCl
Titrant Reference:	WIPP-MM MgO-14 p. 18

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)
0.000	6.130	7.413E-07	--
0.025	6.040	9.120E-07	--
0.050	5.920	1.202E-06	--
0.075	5.770	1.698E-06	--
0.100	5.650	2.239E-06	--
0.125	5.560	2.754E-06	--
0.150	5.450	3.548E-06	--
0.175	5.310	4.898E-06	--
0.200	5.210	6.166E-06	--
0.225	5.100	7.943E-06	--
0.250	4.980	1.047E-05	--
0.275	4.890	1.288E-05	--
0.300	4.790	1.622E-05	--
0.325	4.680	2.089E-05	--
0.375	4.420	3.802E-05	7.444E-05
0.400	4.260	5.495E-05	7.937E-05
0.425	4.110	7.762E-05	8.428E-05
0.450	3.960	1.096E-04	8.920E-05
0.475	3.790	1.622E-04	9.411E-05
0.500	3.650	2.239E-04	9.901E-05
0.525	3.540	2.884E-04	1.039E-04
0.550	3.440	3.631E-04	1.088E-04
0.575	3.360	4.365E-04	1.137E-04
0.600	3.290	5.129E-04	1.186E-04
0.625	3.230	5.888E-04	1.235E-04
0.675	3.120	7.586E-04	1.332E-04
0.725	3.030	9.333E-04	1.429E-04
0.775	2.960	1.096E-03	1.526E-04
0.825	2.890	1.288E-03	1.623E-04
0.875	2.840	1.445E-03	1.720E-04

0.975	2.740	1.820E-03	1.913E-04
1.075	2.670	2.138E-03	2.105E-04
1.175	2.600	2.512E-03	2.296E-04
1.275	2.560	2.754E-03	2.487E-04
1.475	2.450	3.548E-03	2.865E-04
1.675	2.380	4.169E-03	3.241E-04
1.875	2.320	4.786E-03	3.614E-04
2.075	2.270	5.370E-03	3.985E-04
2.275	2.220	6.026E-03	4.352E-04

-- Indicates data not used in slope regression



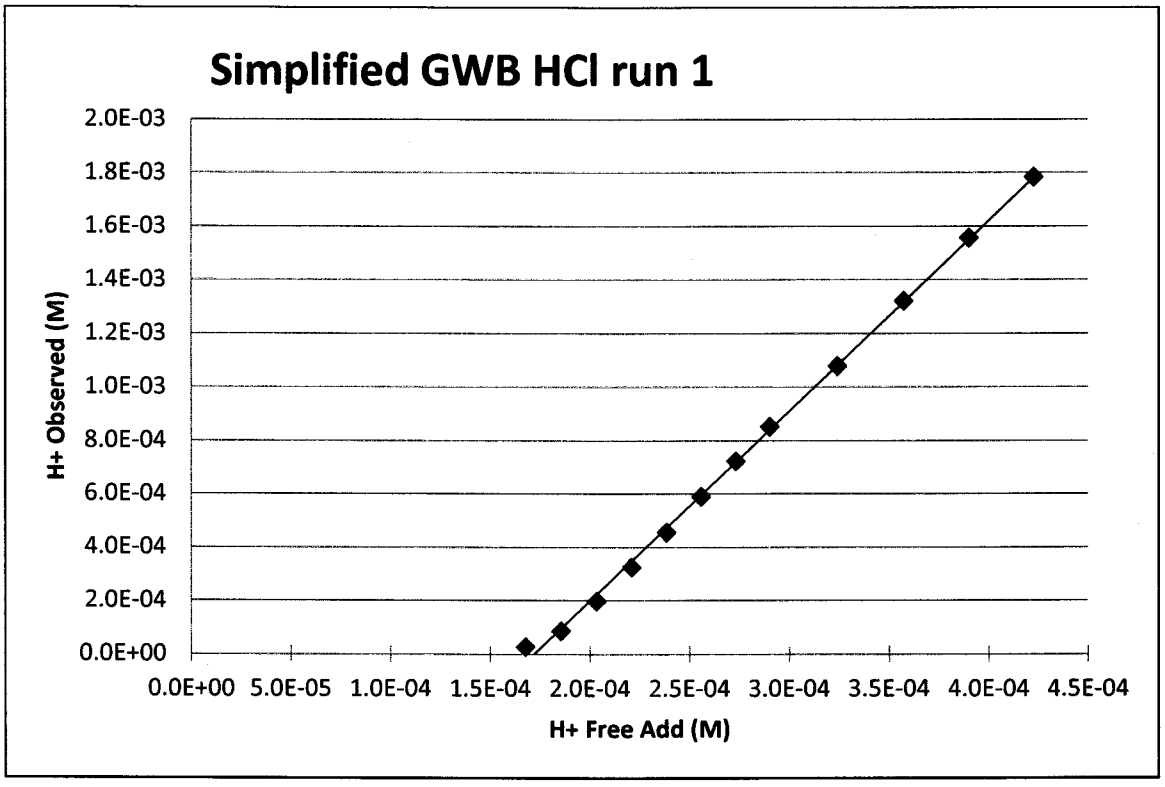
Appendix D

Titration Data for Complex Solutions

Type: Simplified GWB
SN Reference WIPP-FePb-3 p. 6
Solution Reference WIPP-FePb-1 p. 95
Brine Volume: 25.0 mL
Probe: Mettler-Toledo DG-111SC
Titrant Actual M 0.0101 M HCl
Titrant Reference: WIPP-FePb-1 p. 91

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	7.386	4.111E-08	0.000E+00	--
0.025	7.346	4.508E-08	1.009E-05	--
0.050	7.302	4.989E-08	2.016E-05	--
0.075	7.256	5.546E-08	3.021E-05	--
0.100	7.208	6.194E-08	4.024E-05	--
0.150	7.114	7.691E-08	6.024E-05	--
0.200	7.000	1.000E-07	8.016E-05	--
0.250	6.880	1.318E-07	1.000E-04	--
0.300	6.734	1.845E-07	1.198E-04	--
0.350	6.568	2.704E-07	1.394E-04	--
0.400	6.375	4.217E-07	1.591E-04	--
0.450	6.185	6.531E-07	1.786E-04	--
0.500	6.012	9.727E-07	1.980E-04	--
0.600	5.680	2.089E-06	2.367E-04	--
0.700	5.362	4.345E-06	2.751E-04	--
0.800	5.038	9.162E-06	3.132E-04	--
0.900	4.606	2.477E-05	3.510E-04	1.693E-04
1.000	4.074	8.433E-05	3.885E-04	1.874E-04
1.100	3.708	1.959E-04	4.257E-04	2.053E-04
1.200	3.491	3.228E-04	4.626E-04	2.231E-04
1.300	3.342	4.550E-04	4.992E-04	2.408E-04
1.400	3.230	5.888E-04	5.356E-04	2.584E-04
1.500	3.142	7.211E-04	5.717E-04	2.758E-04
1.600	3.070	8.511E-04	6.075E-04	2.930E-04
1.800	2.968	1.076E-03	6.784E-04	3.272E-04
2.000	2.879	1.321E-03	7.481E-04	3.609E-04
2.200	2.808	1.556E-03	8.169E-04	3.940E-04
2.400	2.749	1.782E-03	8.847E-04	4.267E-04
2.600	2.699	2.000E-03	9.514E-04	--
2.800	2.655	2.213E-03	1.017E-03	--
3.000	2.602	2.501E-03	1.082E-03	--

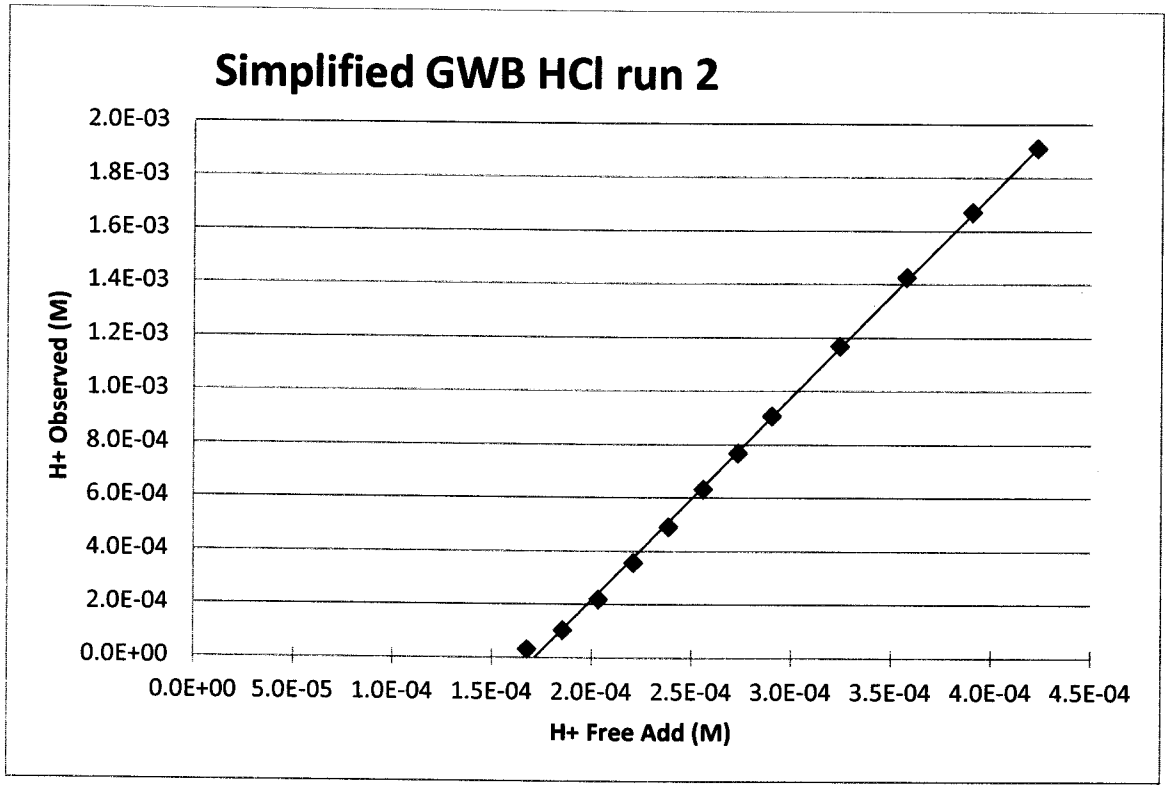
-- Indicates data not used in slope regression



Type:	Simplified GWB
SN Reference	WIPP-FePb-3 p. 7
Solution Reference	WIPP-FePb-1 p. 95
Brine Volume:	25.0 mL
Probe:	Mettler-Toledo DG-111SC
Titrant Actual M	0.0101 M HCl
Titrant Reference:	WIPP-FePb-1 p. 91

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	7.439	3.639E-08	0.000E+00	--
0.025	7.398	3.999E-08	1.009E-05	--
0.050	7.353	4.436E-08	2.016E-05	--
0.075	7.307	4.932E-08	3.021E-05	--
0.100	7.260	5.495E-08	4.024E-05	--
0.150	7.160	6.918E-08	6.024E-05	--
0.200	7.056	8.790E-08	8.016E-05	--
0.250	6.934	1.164E-07	1.000E-04	--
0.300	6.805	1.567E-07	1.198E-04	--
0.350	6.650	2.239E-07	1.394E-04	--
0.400	6.451	3.540E-07	1.591E-04	--
0.450	6.249	5.636E-07	1.786E-04	--
0.500	6.046	8.995E-07	1.980E-04	--
0.600	5.701	1.991E-06	2.367E-04	--
0.700	5.372	4.246E-06	2.751E-04	--
0.800	4.999	1.002E-05	3.132E-04	--
0.900	4.547	2.838E-05	3.510E-04	1.693E-04
1.000	3.997	1.007E-04	3.885E-04	1.874E-04
1.100	3.663	2.173E-04	4.257E-04	2.053E-04
1.200	3.450	3.548E-04	4.626E-04	2.231E-04
1.300	3.310	4.898E-04	4.992E-04	2.408E-04
1.400	3.200	6.310E-04	5.356E-04	2.584E-04
1.500	3.115	7.674E-04	5.717E-04	2.758E-04
1.600	3.043	9.057E-04	6.075E-04	2.930E-04
1.800	2.933	1.167E-03	6.784E-04	3.272E-04
2.000	2.846	1.426E-03	7.481E-04	3.609E-04
2.200	2.777	1.671E-03	8.169E-04	3.940E-04
2.400	2.719	1.910E-03	8.847E-04	4.267E-04
2.600	2.671	2.133E-03	9.514E-04	--
2.800	2.628	2.355E-03	1.017E-03	--
3.000	2.591	2.564E-03	1.082E-03	--

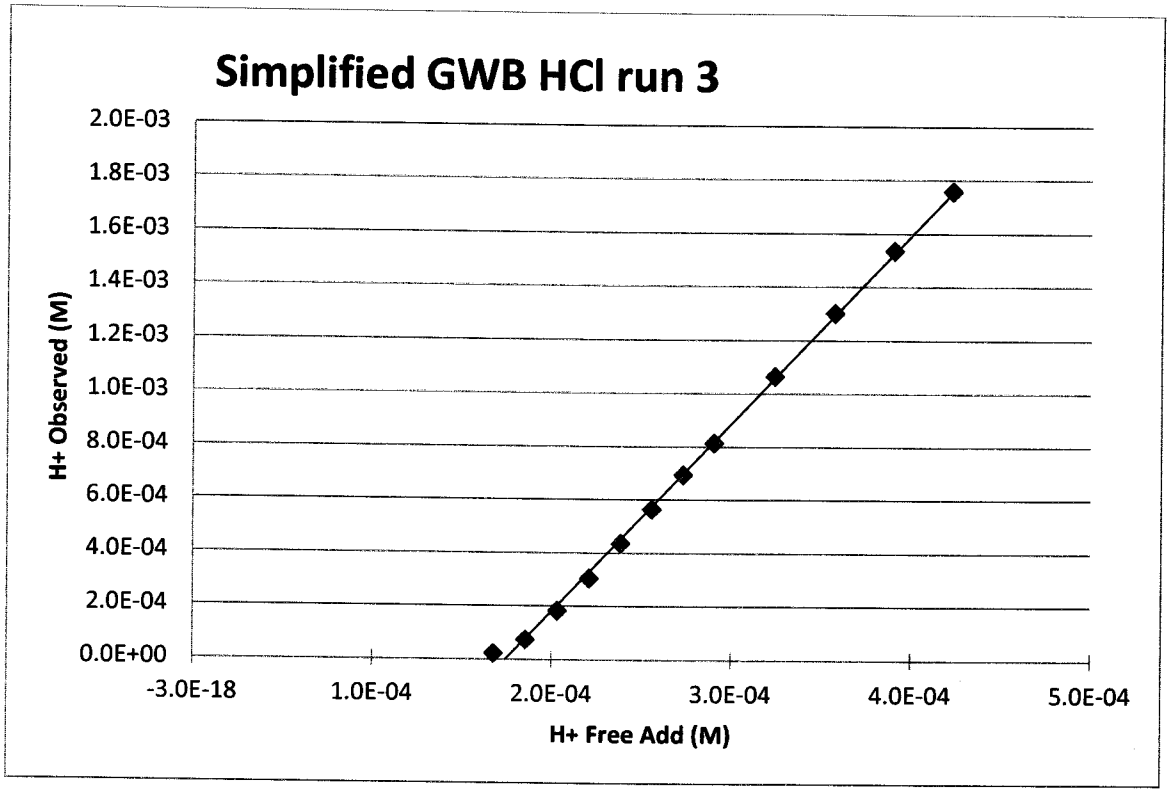
-- Indicates data not used in slope regression



Type:	Simplified GWB
SN Reference	WIPP-FePb-3 p. 8
Solution Reference	WIPP-FePb-1 p. 95
Brine Volume:	25.0 mL
Probe:	Mettler-Toledo DG-111SC
Titrant Actual M	0.0101 M HCl
Titrant Reference:	WIPP-FePb-1 p. 91

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	7.434	3.681E-08	0.000E+00	--
0.025	7.388	4.093E-08	1.009E-05	--
0.050	7.345	4.519E-08	2.016E-05	--
0.075	7.301	5.000E-08	3.021E-05	--
0.100	7.255	5.559E-08	4.024E-05	--
0.150	7.156	6.982E-08	6.024E-05	--
0.200	7.049	8.933E-08	8.016E-05	--
0.250	6.928	1.180E-07	1.000E-04	--
0.300	6.795	1.603E-07	1.198E-04	--
0.350	6.636	2.312E-07	1.394E-04	--
0.400	6.448	3.565E-07	1.591E-04	--
0.450	6.245	5.689E-07	1.786E-04	--
0.500	6.055	8.810E-07	1.980E-04	--
0.600	5.715	1.928E-06	2.367E-04	--
0.700	5.415	3.846E-06	2.751E-04	--
0.800	5.096	8.017E-06	3.132E-04	--
0.900	4.689	2.046E-05	3.510E-04	1.693E-04
1.000	4.145	7.161E-05	3.885E-04	1.874E-04
1.100	3.745	1.799E-04	4.257E-04	2.053E-04
1.200	3.518	3.034E-04	4.626E-04	2.231E-04
1.300	3.363	4.335E-04	4.992E-04	2.408E-04
1.400	3.250	5.623E-04	5.356E-04	2.584E-04
1.500	3.160	6.918E-04	5.717E-04	2.758E-04
1.600	3.090	8.128E-04	6.075E-04	2.930E-04
1.800	2.973	1.064E-03	6.784E-04	3.272E-04
2.000	2.886	1.300E-03	7.481E-04	3.609E-04
2.200	2.814	1.535E-03	8.169E-04	3.940E-04
2.400	2.755	1.758E-03	8.847E-04	4.267E-04
2.600	2.705	1.972E-03	9.514E-04	--
2.800	2.662	2.178E-03	1.017E-03	--
3.000	2.624	2.377E-03	1.082E-03	--

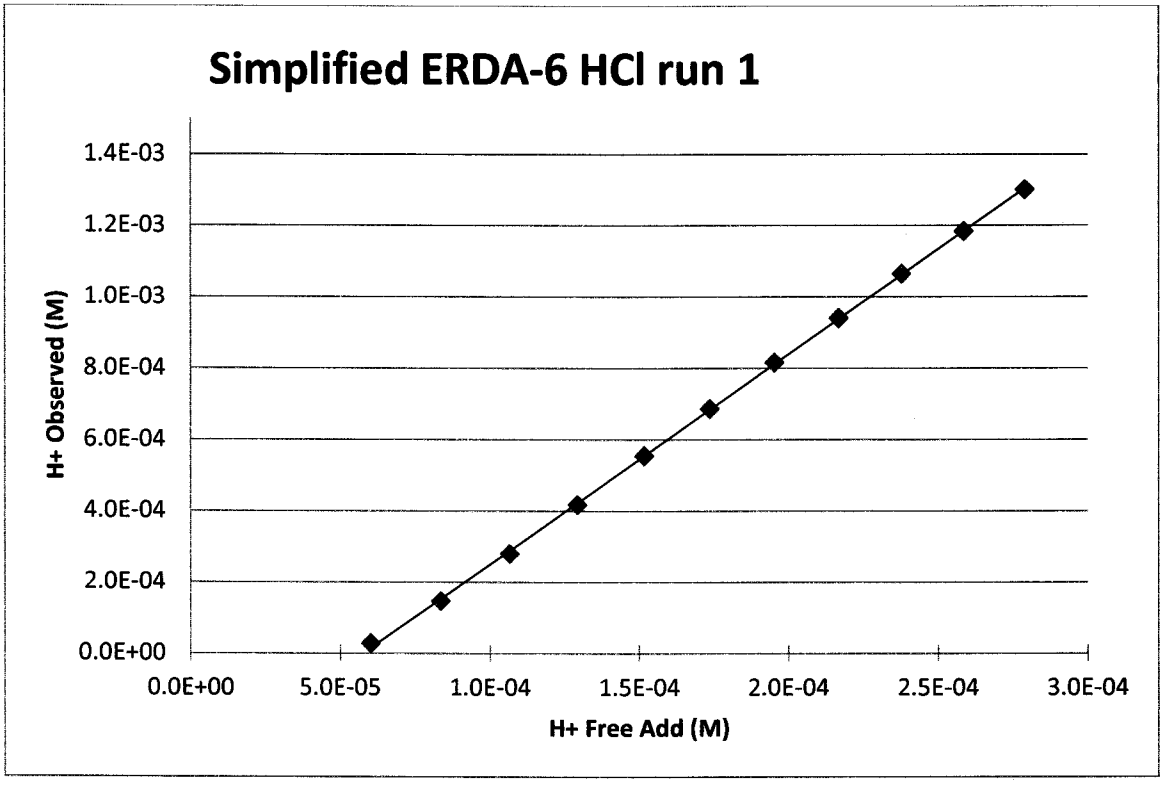
-- Indicates data not used in slope regression



Type:	Simplified ERDA-6
SN Reference	WIPP-FePb-1 p. 99
Solution Reference	WIPP-FePb-1 p. 95
Brine Volume:	25.2 mL
Probe:	Mettler-Toledo DG-111SC
Titrant Actual M	0.0101 M HCl
Titrant Reference:	WIPP-FePb-1 p. 91

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	8.684	2.070E-09	0.000E+00	--
0.500	4.577	2.649E-05	1.965E-04	6.011E-05
0.700	3.839	1.449E-04	2.730E-04	8.351E-05
0.900	3.555	2.786E-04	3.483E-04	1.065E-04
1.100	3.380	4.169E-04	4.224E-04	1.292E-04
1.300	3.257	5.534E-04	4.955E-04	1.516E-04
1.500	3.164	6.855E-04	5.674E-04	1.736E-04
1.700	3.089	8.147E-04	6.383E-04	1.953E-04
1.900	3.027	9.397E-04	7.081E-04	2.166E-04
2.100	2.973	1.064E-03	7.769E-04	2.377E-04
2.300	2.927	1.183E-03	8.447E-04	2.584E-04
2.500	2.886	1.300E-03	9.116E-04	2.789E-04
3.000	2.802	1.578E-03	1.074E-03	--
3.500	2.737	1.832E-03	1.232E-03	--
4.000	2.684	2.070E-03	1.384E-03	--
4.500	2.640	2.291E-03	1.530E-03	--
5.000	2.602	2.500E-03	1.672E-03	--

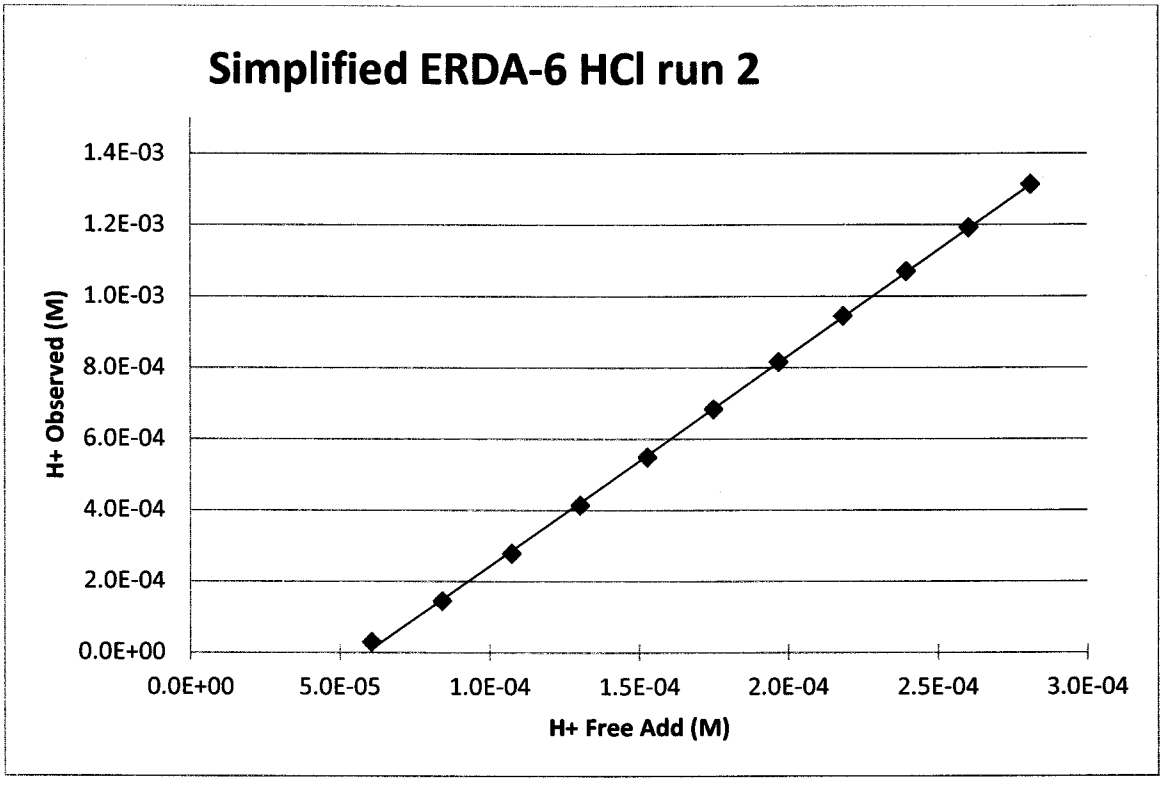
-- Indicates data not used in slope regression



Type:	Simplified ERDA-6
SN Reference	WIPP-FePb-1 p. 99
Solution Reference	WIPP-FePb-1 p. 95
Brine Volume:	25.0 mL
Probe:	Mettler-Toledo DG-111SC
Titrant Actual M	0.0101 M HCl
Titrant Reference:	WIPP-FePb-1 p. 91

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	8.715	1.928E-09	0.000E+00	--
0.500	4.547	2.838E-05	1.980E-04	6.058E-05
0.700	3.844	1.432E-04	2.751E-04	8.416E-05
0.900	3.558	2.767E-04	3.510E-04	1.074E-04
1.100	3.384	4.130E-04	4.257E-04	1.302E-04
1.300	3.261	5.483E-04	4.992E-04	1.527E-04
1.500	3.166	6.823E-04	5.717E-04	1.749E-04
1.700	3.089	8.147E-04	6.431E-04	1.967E-04
1.900	3.025	9.441E-04	7.134E-04	2.182E-04
2.100	2.971	1.069E-03	7.827E-04	2.394E-04
2.300	2.924	1.191E-03	8.509E-04	2.603E-04
2.500	2.882	1.312E-03	9.182E-04	2.809E-04
3.000	2.799	1.589E-03	1.082E-03	--
3.500	2.733	1.849E-03	1.240E-03	--
4.000	2.680	2.089E-03	1.393E-03	--
4.500	2.637	2.307E-03	1.541E-03	--
5.000	2.597	2.529E-03	1.683E-03	--

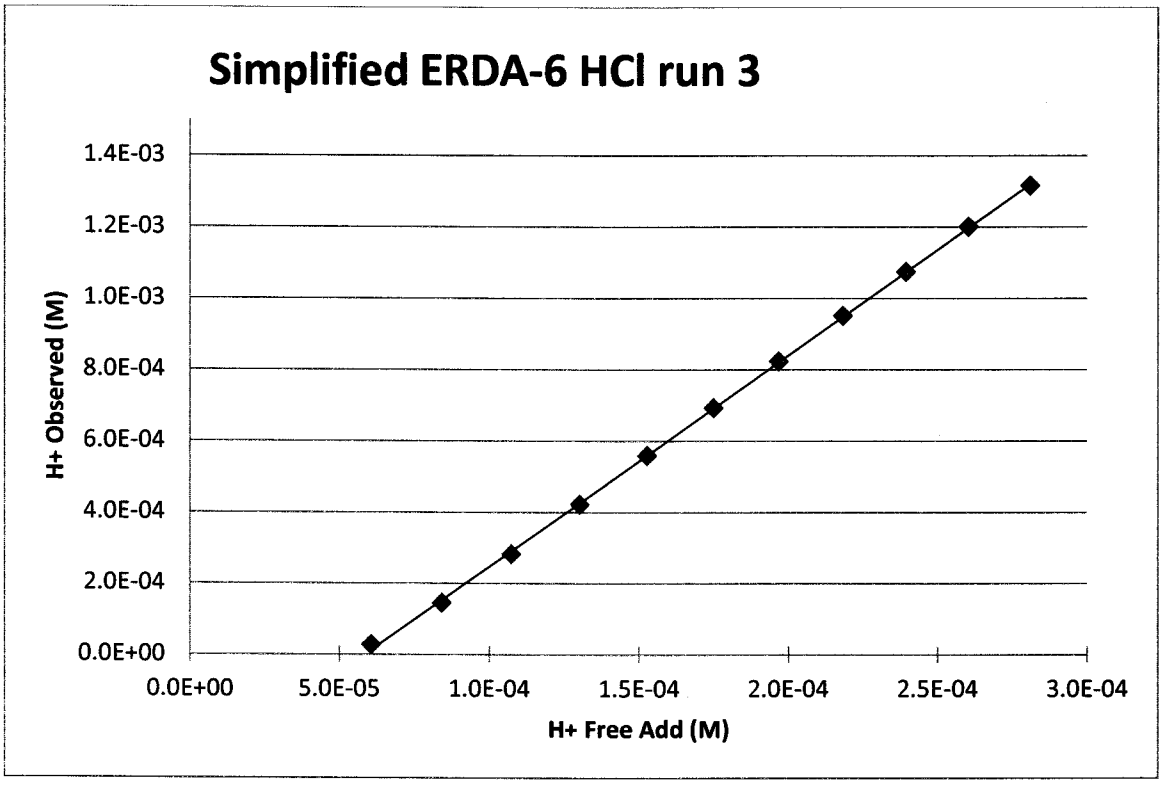
-- Indicates data not used in slope regression



Type:	Simplified ERDA-6
SN Reference	WIPP-FePb-1 p. 100
Solution Reference	WIPP-FePb-1 p. 95
Brine Volume:	25.0 mL
Probe:	Mettler-Toledo DG-111SC
Titrant Actual M	0.0101 M HCl
Titrant Reference:	WIPP-FePb-1 p. 91

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	8.727	1.875E-09	0.000E+00	--
0.500	4.575	2.661E-05	1.980E-04	6.058E-05
0.700	3.844	1.432E-04	2.751E-04	8.416E-05
0.900	3.551	2.812E-04	3.510E-04	1.074E-04
1.100	3.376	4.207E-04	4.257E-04	1.302E-04
1.300	3.253	5.585E-04	4.992E-04	1.527E-04
1.500	3.160	6.918E-04	5.717E-04	1.749E-04
1.700	3.085	8.222E-04	6.431E-04	1.967E-04
1.900	3.022	9.506E-04	7.134E-04	2.182E-04
2.100	2.969	1.074E-03	7.827E-04	2.394E-04
2.300	2.921	1.199E-03	8.509E-04	2.603E-04
2.500	2.881	1.315E-03	9.182E-04	2.809E-04
3.000	2.797	1.596E-03	1.082E-03	--
3.500	2.731	1.858E-03	1.240E-03	--
4.000	2.678	2.099E-03	1.393E-03	--
4.500	2.634	2.323E-03	1.541E-03	--
5.000	2.596	2.535E-03	1.683E-03	--

-- Indicates data not used in slope regression

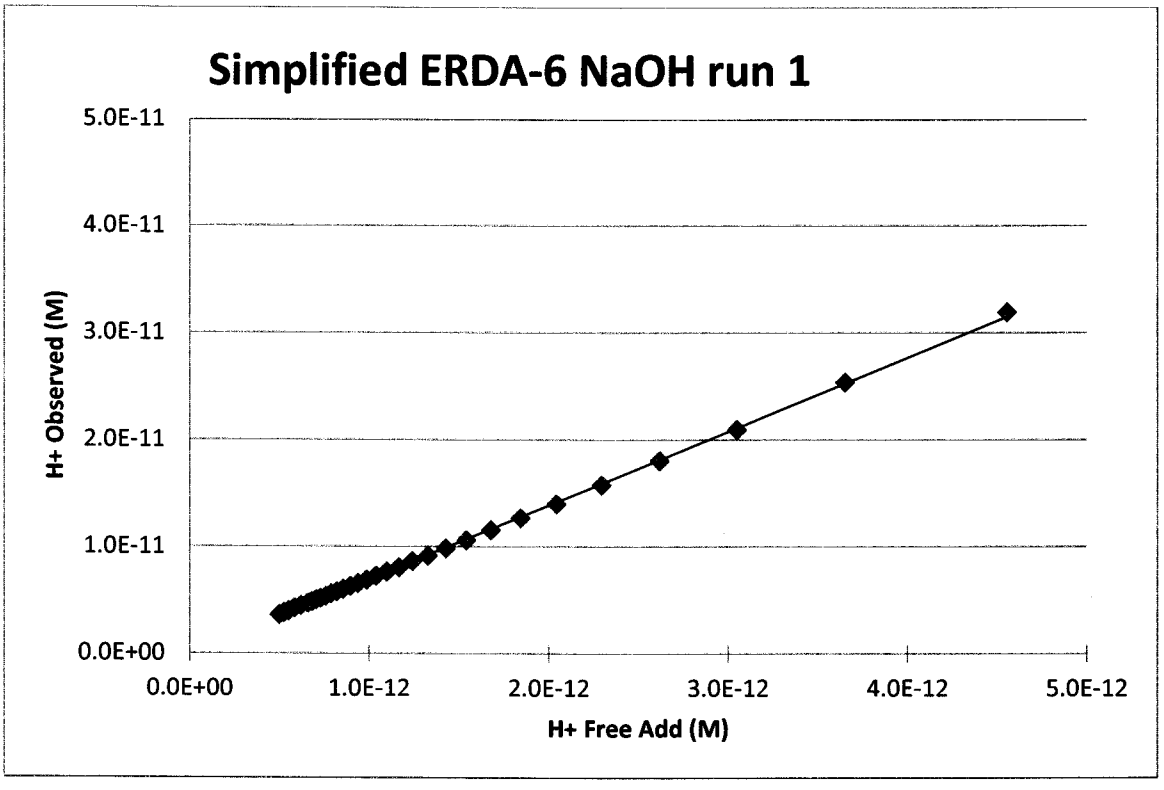


Type:	Simplified ERDA-6
SN Reference	WIPP-FePb-1 p. 82
Solution Reference	WIPP-FePb-1 p. 75
Brine Volume:	25.0 mL
Probe:	Mettler-Toledo DG-111SC
Titrant Actual M	0.099 M NaOH
Titrant Reference:	WIPP-FePb-1 p. 77

Addition (mL)	pH	H+ Observed (M)	OH- add (M)	H+ Free Add (M)
0.000	8.749	1.782E-09	0.000E+00	--
0.050	9.836	1.459E-10	1.976E-04	--
0.100	10.170	6.761E-11	3.944E-04	--
0.150	10.360	4.365E-11	5.905E-04	--
0.100	10.136	7.311E-11	3.944E-04	--
0.200	10.496	3.192E-11	7.857E-04	4.554E-12
0.250	10.596	2.535E-11	9.802E-04	3.650E-12
0.300	10.679	2.094E-11	1.174E-03	3.048E-12
0.350	10.744	1.803E-11	1.367E-03	2.618E-12
0.400	10.803	1.574E-11	1.559E-03	2.295E-12
0.450	10.855	1.396E-11	1.750E-03	2.044E-12
0.500	10.898	1.265E-11	1.941E-03	1.843E-12
0.550	10.939	1.151E-11	2.131E-03	1.679E-12
0.600	10.976	1.057E-11	2.320E-03	1.542E-12
0.650	11.009	9.795E-12	2.509E-03	1.426E-12
0.700	11.040	9.120E-12	2.696E-03	1.327E-12
0.750	11.066	8.590E-12	2.883E-03	1.241E-12
0.800	11.095	8.035E-12	3.070E-03	1.166E-12
0.850	11.119	7.603E-12	3.255E-03	1.099E-12
0.900	11.142	7.211E-12	3.440E-03	1.040E-12
0.950	11.164	6.855E-12	3.624E-03	9.872E-13
1.000	11.185	6.531E-12	3.808E-03	9.397E-13
1.050	11.205	6.237E-12	3.990E-03	8.967E-13
1.100	11.224	5.970E-12	4.172E-03	8.575E-13
1.150	11.241	5.741E-12	4.354E-03	8.218E-13
1.200	11.256	5.546E-12	4.534E-03	7.891E-13
1.250	11.274	5.321E-12	4.714E-03	7.590E-13
1.300	11.288	5.152E-12	4.894E-03	7.312E-13
1.350	11.302	4.989E-12	5.072E-03	7.054E-13
1.400	11.317	4.819E-12	5.250E-03	6.815E-13

1.450	11.331	4.667E-12	5.427E-03	6.593E-13
1.550	11.353	4.436E-12	5.780E-03	6.191E-13
1.650	11.375	4.217E-12	6.129E-03	5.837E-13
1.750	11.406	3.926E-12	6.477E-03	5.524E-13
1.850	11.426	3.750E-12	6.821E-03	5.245E-13
1.950	11.448	3.565E-12	7.163E-03	4.995E-13

-- Indicates data not used in slope regression

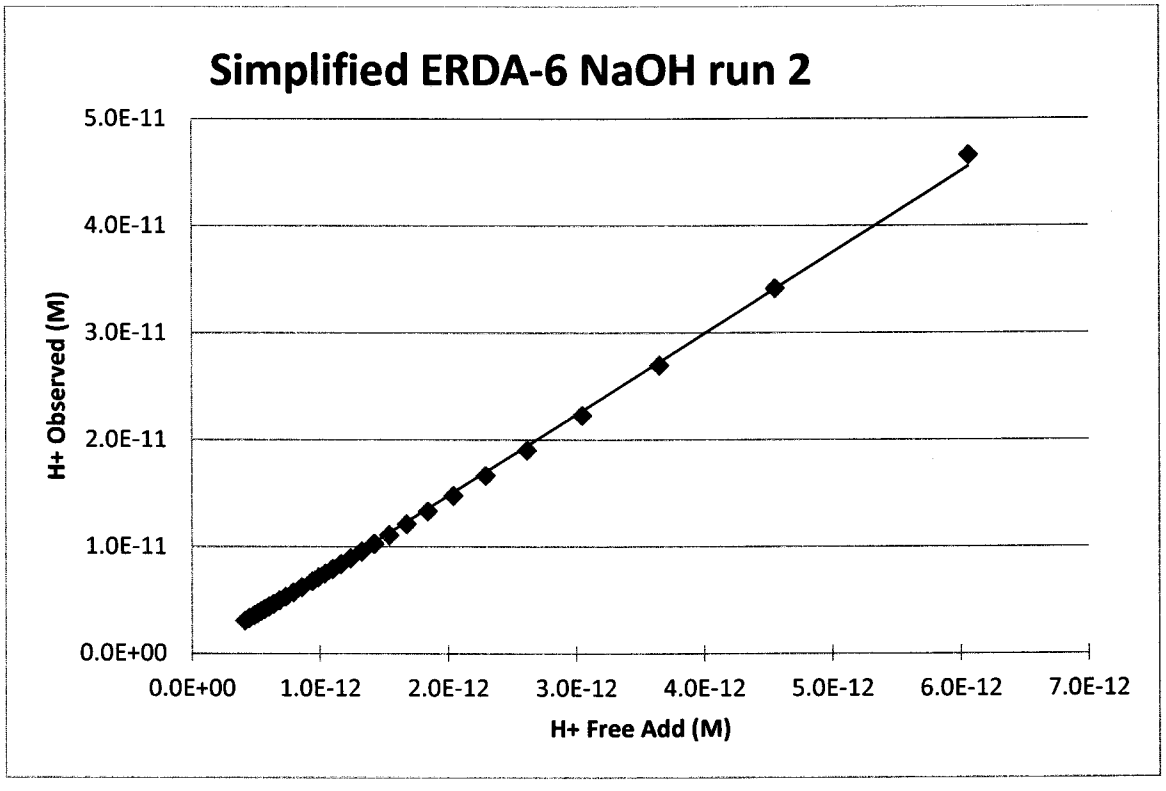


Type:	Simplified ERDA-6
SN Reference	WIPP-FePb-1 p. 84
Solution Reference	WIPP-FePb-1 p. 75
Brine Volume:	25.0 mL
Probe:	Mettler-Toledo DG-111SC
Titrant Actual M	0.099 M NaOH
Titrant Reference:	WIPP-FePb-1 p. 77

Addition (mL)	pH	H+ Observed (M)	OH- add (M)	H+ Free Add (M)
0.000	8.601	2.506E-09	0.000E+00	--
0.025	9.407	3.917E-10	9.890E-05	--
0.050	9.776	1.675E-10	1.976E-04	--
0.075	9.988	1.028E-10	2.961E-04	--
0.100	10.136	7.311E-11	3.944E-04	--
0.150	10.332	4.656E-11	5.905E-04	6.060E-12
0.200	10.467	3.412E-11	7.857E-04	4.554E-12
0.250	10.570	2.692E-11	9.802E-04	3.650E-12
0.300	10.653	2.223E-11	1.174E-03	3.048E-12
0.350	10.722	1.897E-11	1.367E-03	2.618E-12
0.400	10.780	1.660E-11	1.559E-03	2.295E-12
0.450	10.832	1.472E-11	1.750E-03	2.044E-12
0.500	10.878	1.324E-11	1.941E-03	1.843E-12
0.550	10.919	1.205E-11	2.131E-03	1.679E-12
0.600	10.957	1.104E-11	2.320E-03	1.542E-12
0.650	10.991	1.021E-11	2.509E-03	1.426E-12
0.700	11.023	9.484E-12	2.696E-03	1.327E-12
0.750	11.052	8.872E-12	2.883E-03	1.241E-12
0.800	11.079	8.337E-12	3.070E-03	1.166E-12
0.850	11.104	7.870E-12	3.255E-03	1.099E-12
0.900	11.128	7.447E-12	3.440E-03	1.040E-12
0.950	11.150	7.079E-12	3.624E-03	9.872E-13
1.000	11.171	6.745E-12	3.808E-03	9.397E-13
1.100	11.210	6.166E-12	4.172E-03	8.575E-13
1.200	11.246	5.675E-12	4.534E-03	7.891E-13
1.300	11.279	5.260E-12	4.894E-03	7.312E-13
1.400	11.308	4.920E-12	5.250E-03	6.815E-13
1.500	11.336	4.613E-12	5.604E-03	6.385E-13
1.600	11.362	4.345E-12	5.955E-03	6.009E-13
1.700	11.386	4.111E-12	6.303E-03	5.676E-13

1.800	11.409	3.899E-12	6.649E-03	5.381E-13
1.900	11.430	3.715E-12	6.993E-03	5.117E-13
2.000	11.449	3.556E-12	7.333E-03	4.879E-13
2.200	11.486	3.266E-12	8.007E-03	4.468E-13
2.400	11.519	3.027E-12	8.672E-03	4.126E-13
2.600	11.550	2.818E-12	9.326E-03	--
2.800	11.579	2.636E-12	9.971E-03	--
3.000	11.604	2.489E-12	1.061E-02	--
3.200	11.629	2.350E-12	1.123E-02	--
3.400	11.651	2.234E-12	1.185E-02	--

-- Indicates data not used in slope regression

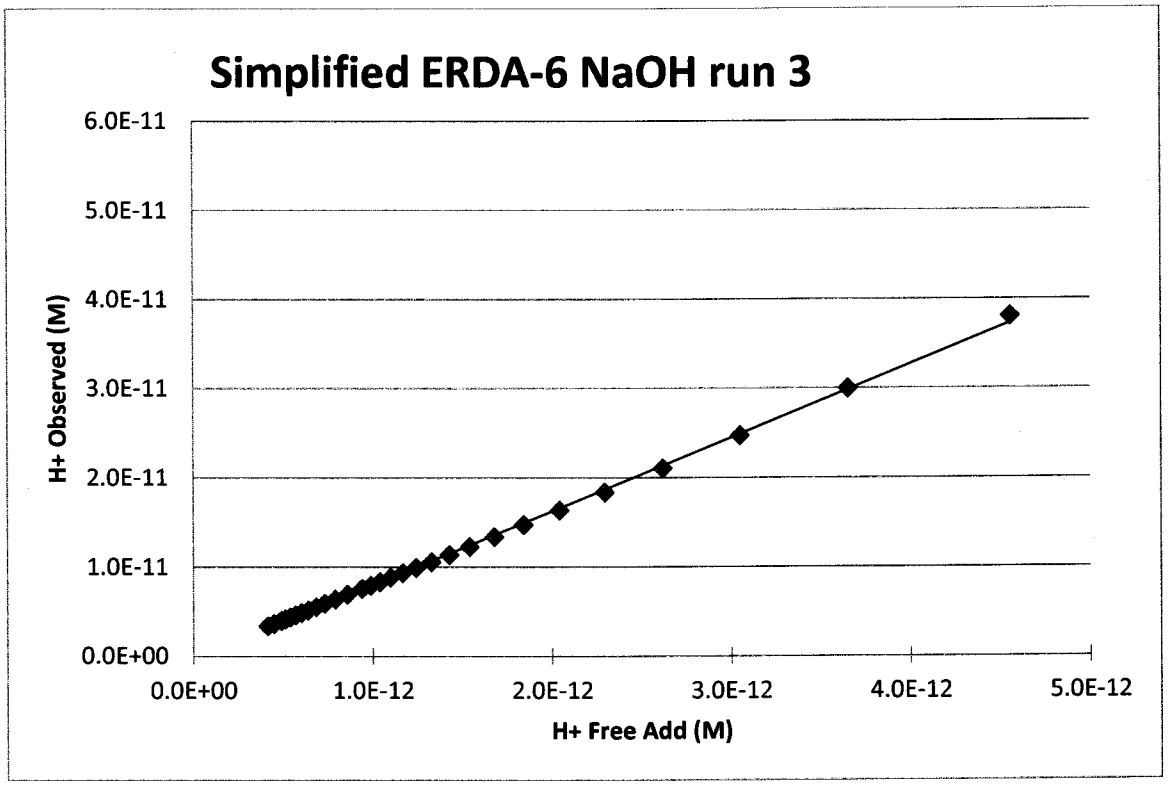


Type:	Simplified ERDA-6
SN Reference	WIPP-FePb-1 p. 85
Solution Reference	WIPP-FePb-1 p. 75
Brine Volume:	25.0 mL
Probe:	Mettler-Toledo DG-111SC
Titrant Actual M	0.099 M NaOH
Titrant Reference:	WIPP-FePb-1 p. 77

Addition (mL)	pH	H+ Observed (M)	OH- add (M)	H+ Free Add (M)
0.000	8.541	2.877E-09	0.000E+00	--
0.025	9.338	4.592E-10	9.890E-05	--
0.050	9.722	1.897E-10	1.976E-04	--
0.075	9.937	1.156E-10	2.961E-04	--
0.100	10.084	8.241E-11	3.944E-04	--
0.150	10.284	5.200E-11	5.905E-04	--
0.200	10.420	3.802E-11	7.857E-04	4.554E-12
0.250	10.524	2.992E-11	9.802E-04	3.650E-12
0.300	10.608	2.466E-11	1.174E-03	3.048E-12
0.350	10.678	2.099E-11	1.367E-03	2.618E-12
0.400	10.737	1.832E-11	1.559E-03	2.295E-12
0.450	10.788	1.629E-11	1.750E-03	2.044E-12
0.500	10.833	1.469E-11	1.941E-03	1.843E-12
0.550	10.875	1.334E-11	2.131E-03	1.679E-12
0.600	10.913	1.222E-11	2.320E-03	1.542E-12
0.650	10.946	1.132E-11	2.509E-03	1.426E-12
0.700	10.977	1.054E-11	2.696E-03	1.327E-12
0.750	11.005	9.886E-12	2.883E-03	1.241E-12
0.800	11.031	9.311E-12	3.070E-03	1.166E-12
0.850	11.056	8.790E-12	3.255E-03	1.099E-12
0.900	11.081	8.299E-12	3.440E-03	1.040E-12
0.950	11.102	7.907E-12	3.624E-03	9.872E-13
1.000	11.122	7.551E-12	3.808E-03	9.397E-13
1.100	11.161	6.902E-12	4.172E-03	8.575E-13
1.200	11.198	6.339E-12	4.534E-03	7.891E-13
1.300	11.232	5.861E-12	4.894E-03	7.312E-13
1.400	11.261	5.483E-12	5.250E-03	6.815E-13
1.500	11.290	5.129E-12	5.604E-03	6.385E-13
1.600	11.316	4.831E-12	5.955E-03	6.009E-13

1.700	11.340	4.571E-12	6.303E-03	5.676E-13
1.800	11.363	4.335E-12	6.649E-03	5.381E-13
1.900	11.385	4.121E-12	6.993E-03	5.117E-13
2.000	11.404	3.945E-12	7.333E-03	4.879E-13
2.200	11.441	3.622E-12	8.007E-03	4.468E-13
2.400	11.475	3.350E-12	8.672E-03	4.126E-13
2.600	11.506	3.119E-12	9.326E-03	--
2.800	11.533	2.931E-12	9.971E-03	--
3.000	11.559	2.761E-12	1.061E-02	--
3.500	11.616	2.421E-12	1.216E-02	--
4.000	11.666	2.158E-12	1.366E-02	--

-- Indicates data not used in slope regression

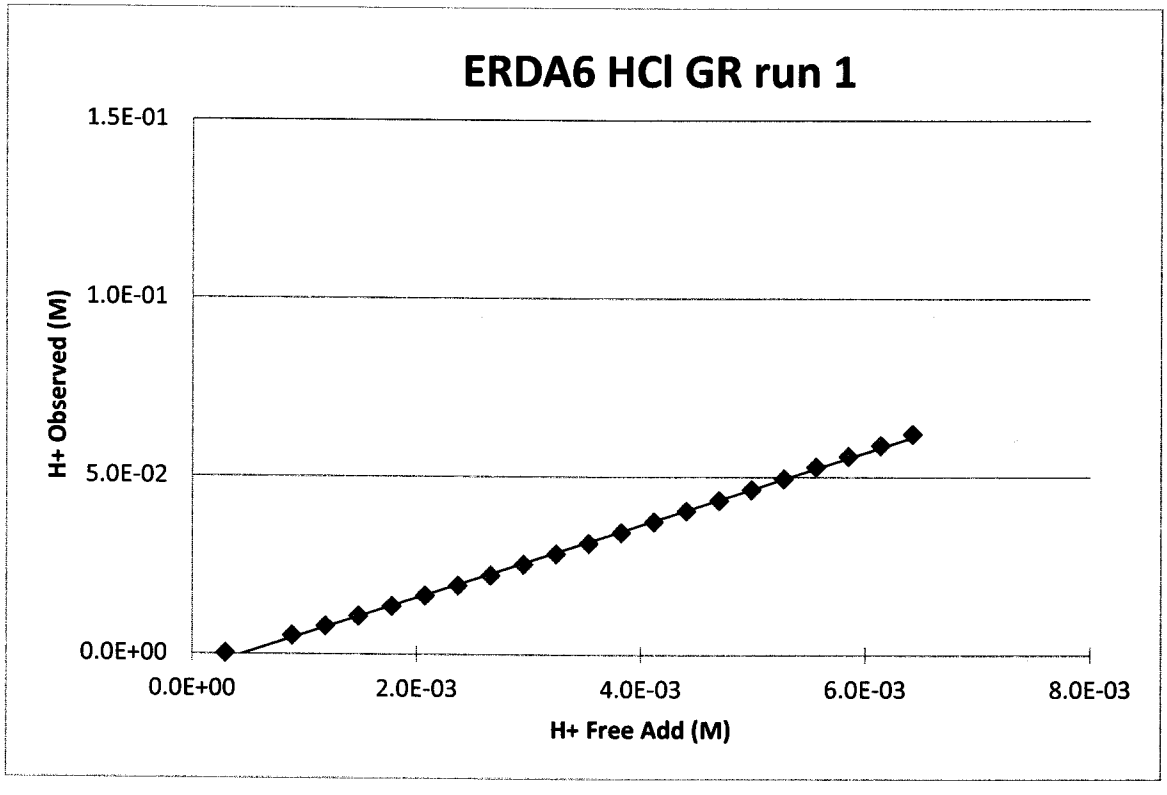


Type: ERDA-6
SN Reference: WIPP-FePb-3 p. 18
Solution Reference: WIPP-MM-MgO-6 p. 60
Brine Volume: 50.0 mL
V_{eq} 1.350 mL (WIPP-FePb-3, p. 19)
Probe: Mettler-Toledo DG-111SC
Titrant Actual M: 0.96 M HCl
Titrant Reference: WIPP-FePb-3 p. 10-12

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	8.001	9.977E-09	0.000E+00	--
0.050	7.970	1.072E-08	9.590E-04	--
0.100	7.939	1.151E-08	1.916E-03	--
0.150	7.907	1.239E-08	2.871E-03	--
0.200	7.875	1.334E-08	3.825E-03	--
0.250	7.842	1.439E-08	4.776E-03	--
0.300	7.807	1.560E-08	5.726E-03	--
0.350	7.772	1.690E-08	6.673E-03	--
0.400	7.734	1.845E-08	7.619E-03	--
0.450	7.697	2.009E-08	8.563E-03	--
0.500	7.658	2.198E-08	9.505E-03	--
0.600	7.575	2.661E-08	1.138E-02	--
0.700	7.495	3.199E-08	1.325E-02	--
0.800	7.394	4.036E-08	1.512E-02	--
0.900	7.278	5.272E-08	1.697E-02	--
1.000	7.134	7.345E-08	1.882E-02	--
1.100	6.951	1.119E-07	2.067E-02	--
1.200	6.682	2.080E-07	2.250E-02	--
1.300	6.126	7.482E-07	2.433E-02	--
1.400	4.121	7.568E-05	9.339E-04	2.980E-04
1.500	2.300	5.012E-03	2.796E-03	8.923E-04
1.550	2.110	7.762E-03	3.725E-03	1.189E-03
1.600	1.977	1.054E-02	4.651E-03	1.484E-03
1.650	1.875	1.334E-02	5.576E-03	1.779E-03
1.700	1.788	1.629E-02	6.499E-03	2.074E-03
1.750	1.717	1.919E-02	7.420E-03	2.368E-03
1.800	1.655	2.213E-02	8.340E-03	2.661E-03
1.850	1.600	2.512E-02	9.257E-03	2.954E-03
1.900	1.551	2.812E-02	1.017E-02	3.246E-03

1.950	1.507	3.112E-02	1.109E-02	3.538E-03
2.000	1.466	3.420E-02	1.200E-02	3.829E-03
2.050	1.429	3.724E-02	1.291E-02	4.120E-03
2.100	1.395	4.027E-02	1.382E-02	4.410E-03
2.150	1.364	4.325E-02	1.473E-02	4.699E-03
2.200	1.334	4.634E-02	1.563E-02	4.988E-03
2.250	1.306	4.943E-02	1.654E-02	5.277E-03
2.300	1.278	5.272E-02	1.744E-02	5.565E-03
2.350	1.254	5.572E-02	1.834E-02	5.852E-03
2.400	1.231	5.875E-02	1.924E-02	6.139E-03
2.450	1.208	6.194E-02	2.013E-02	6.425E-03

-- Indicates data not used in slope regression

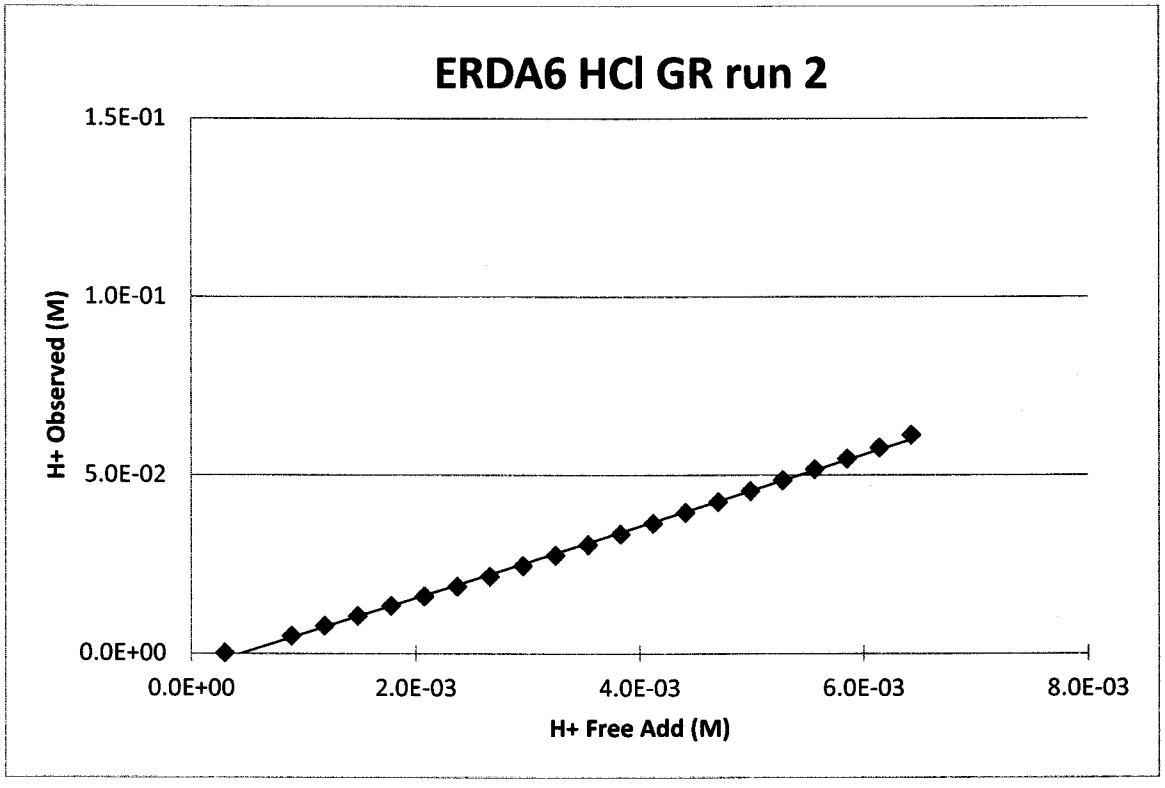


Type:	ERDA-6
SN Reference	WIPP-FePb-3 p. 20
Solution Reference	WIPP-MM-MgO-6 p. 60
Brine Volume:	50.0 mL
V_{eq}	1.350 mL (WIPP-FePb-3, p. 19)
Probe:	Mettler-Toledo DG-111SC
Titrant Actual M	0.96 M HCl
Titrant Reference:	WIPP-FePb-3 p. 10-12

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	7.963	1.089E-08	0.000E+00	--
0.050	7.936	1.159E-08	9.590E-04	--
0.100	7.906	1.242E-08	1.916E-03	--
0.150	7.875	1.334E-08	2.871E-03	--
0.200	7.843	1.435E-08	3.825E-03	--
0.250	7.810	1.549E-08	4.776E-03	--
0.300	7.777	1.671E-08	5.726E-03	--
0.350	7.742	1.811E-08	6.673E-03	--
0.400	7.705	1.972E-08	7.619E-03	--
0.450	7.668	2.148E-08	8.563E-03	--
0.500	7.630	2.344E-08	9.505E-03	--
0.600	7.551	2.812E-08	1.138E-02	--
0.700	7.460	3.467E-08	1.325E-02	--
0.800	7.361	4.355E-08	1.512E-02	--
0.900	7.248	5.649E-08	1.697E-02	--
1.000	7.108	7.798E-08	1.882E-02	--
1.100	6.923	1.194E-07	2.067E-02	--
1.200	6.658	2.198E-07	2.250E-02	--
1.300	6.129	7.430E-07	2.433E-02	--
1.400	4.286	5.176E-05	9.339E-04	2.980E-04
1.500	2.310	4.898E-03	2.796E-03	8.923E-04
1.550	2.116	7.656E-03	3.725E-03	1.189E-03
1.600	1.981	1.045E-02	4.651E-03	1.484E-03
1.650	1.876	1.330E-02	5.576E-03	1.779E-03
1.700	1.797	1.596E-02	6.499E-03	2.074E-03
1.750	1.727	1.875E-02	7.420E-03	2.368E-03
1.800	1.666	2.158E-02	8.340E-03	2.661E-03
1.850	1.610	2.455E-02	9.257E-03	2.954E-03
1.900	1.562	2.742E-02	1.017E-02	3.246E-03

1.950	1.518	3.034E-02	1.109E-02	3.538E-03
2.000	1.477	3.334E-02	1.200E-02	3.829E-03
2.050	1.440	3.631E-02	1.291E-02	4.120E-03
2.100	1.405	3.936E-02	1.382E-02	4.410E-03
2.150	1.373	4.236E-02	1.473E-02	4.699E-03
2.200	1.343	4.539E-02	1.563E-02	4.988E-03
2.250	1.315	4.842E-02	1.654E-02	5.277E-03
2.300	1.288	5.152E-02	1.744E-02	5.565E-03
2.350	1.264	5.445E-02	1.834E-02	5.852E-03
2.400	1.240	5.754E-02	1.924E-02	6.139E-03
2.450	1.214	6.109E-02	2.013E-02	6.425E-03

-- Indicates data not used in slope regression

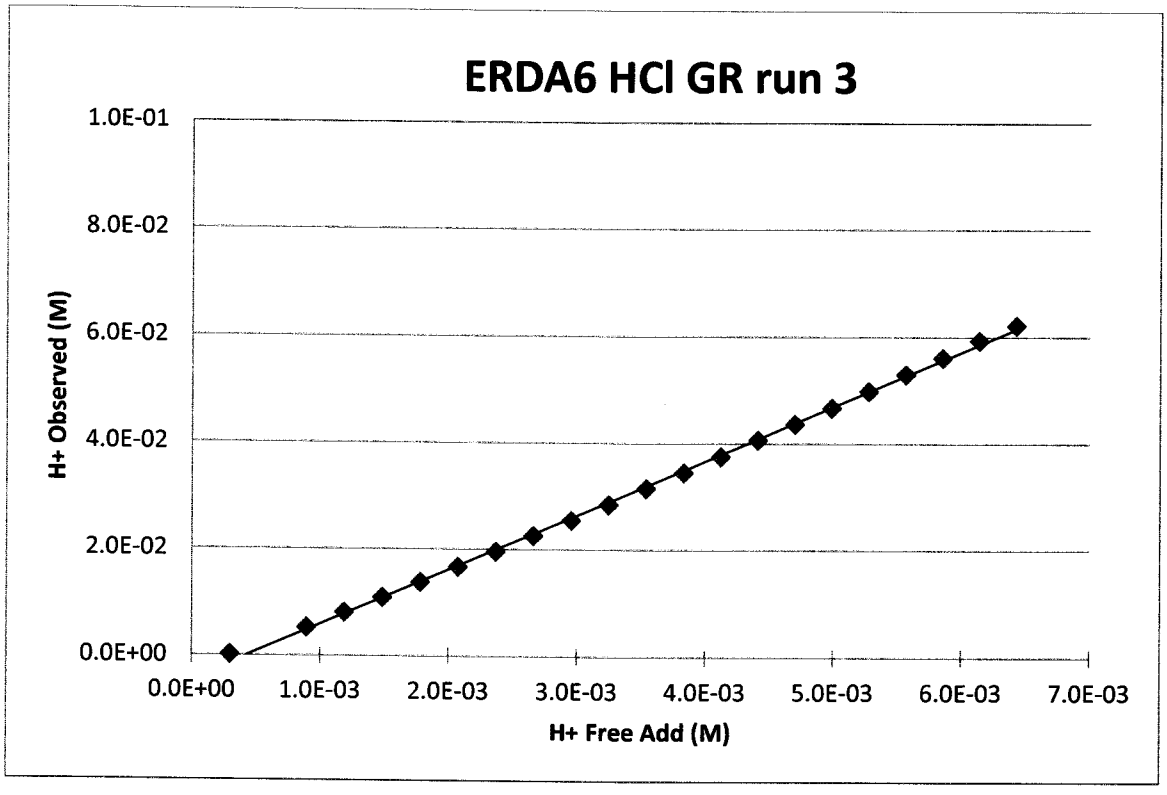


Type:	ERDA-6
SN Reference	WIPP-FePb-3 p. 21
Solution Reference	WIPP-MM-MgO-6 p. 60
Brine Volume:	50.0 mL
V_{eq}	1.350 mL (WIPP-FePb-3, p. 19)
Probe:	Mettler-Toledo DG-111SC
Titrant Actual M	0.96 M HCl
Titrant Reference:	WIPP-FePb-3 p. 10-12

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	7.965	1.084E-08	0.000E+00	--
0.050	7.935	1.161E-08	9.590E-04	--
0.100	7.903	1.250E-08	1.916E-03	--
0.150	7.872	1.343E-08	2.871E-03	--
0.200	7.840	1.445E-08	3.825E-03	--
0.250	7.806	1.563E-08	4.776E-03	--
0.300	7.773	1.687E-08	5.726E-03	--
0.350	7.737	1.832E-08	6.673E-03	--
0.400	7.701	1.991E-08	7.619E-03	--
0.450	7.665	2.163E-08	8.563E-03	--
0.500	7.625	2.371E-08	9.505E-03	--
0.600	7.543	2.864E-08	1.138E-02	--
0.700	7.453	3.524E-08	1.325E-02	--
0.800	7.352	4.446E-08	1.512E-02	--
0.900	7.235	5.821E-08	1.697E-02	--
1.000	7.092	8.091E-08	1.882E-02	--
1.100	6.908	1.236E-07	2.067E-02	--
1.200	6.634	2.323E-07	2.250E-02	--
1.300	6.066	8.590E-07	2.433E-02	--
1.400	3.903	1.250E-04	9.339E-04	2.980E-04
1.500	2.283	5.212E-03	2.796E-03	8.923E-04
1.550	2.094	8.054E-03	3.725E-03	1.189E-03
1.600	1.963	1.089E-02	4.651E-03	1.484E-03
1.650	1.862	1.374E-02	5.576E-03	1.779E-03
1.700	1.779	1.663E-02	6.499E-03	2.074E-03
1.750	1.709	1.954E-02	7.420E-03	2.368E-03
1.800	1.647	2.254E-02	8.340E-03	2.661E-03
1.850	1.594	2.547E-02	9.257E-03	2.954E-03
1.900	1.546	2.844E-02	1.017E-02	3.246E-03

1.950	1.502	3.148E-02	1.109E-02	3.538E-03
2.000	1.462	3.451E-02	1.200E-02	3.829E-03
2.050	1.426	3.750E-02	1.291E-02	4.120E-03
2.100	1.391	4.064E-02	1.382E-02	4.410E-03
2.150	1.360	4.365E-02	1.473E-02	4.699E-03
2.200	1.331	4.667E-02	1.563E-02	4.988E-03
2.250	1.303	4.977E-02	1.654E-02	5.277E-03
2.300	1.276	5.297E-02	1.744E-02	5.565E-03
2.350	1.251	5.610E-02	1.834E-02	5.852E-03
2.400	1.227	5.929E-02	1.924E-02	6.139E-03
2.450	1.206	6.223E-02	2.013E-02	6.425E-03

-- Indicates data not used in slope regression

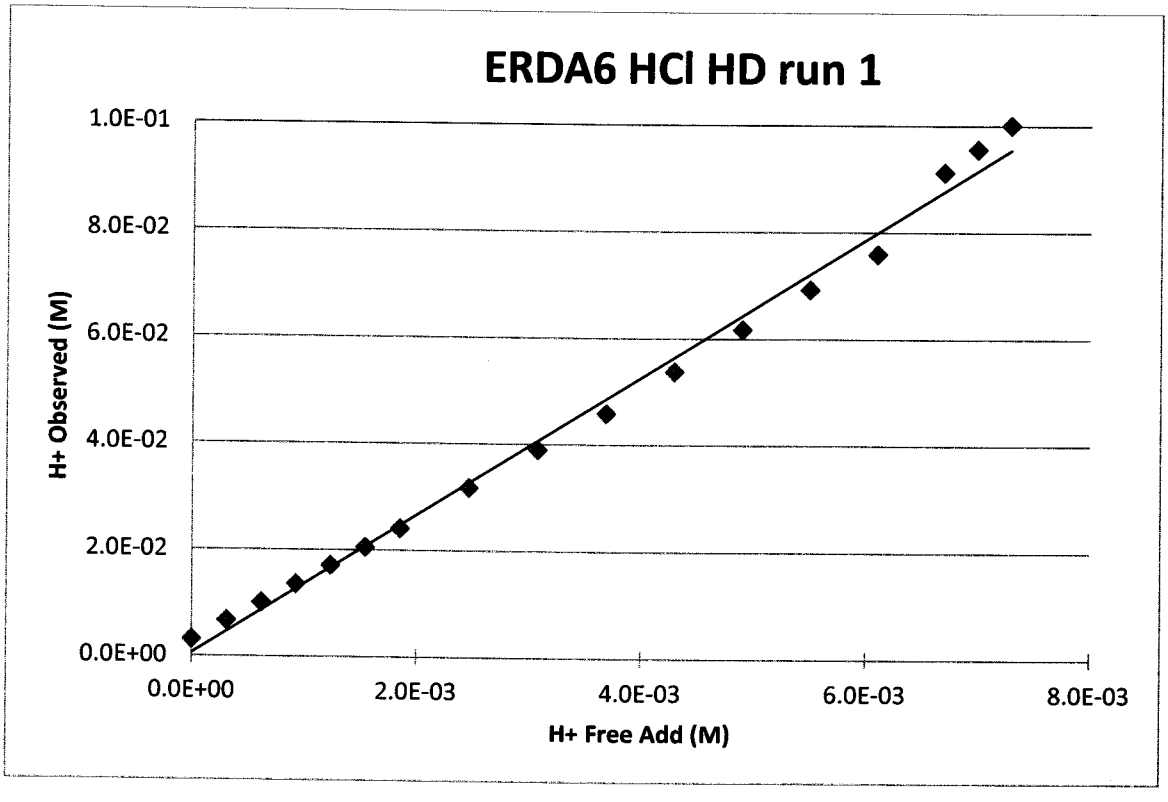


Type:	ERDA-6
SN Reference	WIPP-MM MgO-14 p. 12
Solution Reference	WIPP-MM-MgO-6 p. 60
Brine Volume:	50.0 mL
V_{eq}	1.350 mL (based on observation)
Probe:	Ross Sureflow combination pH
Titrant Actual M	1.00 M HCl
Titrant Reference:	WIPP-FePb-1 p. 6, 21

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	7.960	1.096E-08	0.000E+00	--
0.050	7.930	1.175E-08	9.990E-04	--
0.100	7.900	1.259E-08	1.996E-03	--
0.150	7.860	1.380E-08	2.991E-03	--
0.200	7.820	1.514E-08	3.984E-03	--
0.250	7.790	1.622E-08	4.975E-03	--
0.300	7.760	1.738E-08	5.964E-03	--
0.350	7.720	1.905E-08	6.951E-03	--
0.400	7.670	2.138E-08	7.937E-03	--
0.450	7.630	2.344E-08	8.920E-03	--
0.550	7.550	2.818E-08	1.088E-02	--
0.650	7.450	3.548E-08	1.283E-02	--
0.750	7.330	4.677E-08	1.478E-02	--
0.850	7.200	6.310E-08	1.672E-02	--
0.950	7.040	9.120E-08	1.865E-02	--
1.000	6.930	1.175E-07	1.961E-02	--
1.050	6.810	1.549E-07	2.057E-02	--
1.100	6.660	2.188E-07	2.153E-02	--
1.150	6.440	3.631E-07	2.248E-02	--
1.200	6.120	7.586E-07	2.344E-02	--
1.250	5.500	3.162E-06	2.439E-02	--
1.300	4.080	8.318E-05	2.534E-02	--
1.350	2.520	3.020E-03	0.000E+00	0.000E+00
1.400	2.180	6.607E-03	9.728E-04	3.104E-04
1.450	2.000	1.000E-02	1.944E-03	6.202E-04
1.500	1.870	1.349E-02	2.913E-03	9.295E-04
1.550	1.770	1.698E-02	3.880E-03	1.238E-03
1.600	1.690	2.042E-02	4.845E-03	1.546E-03
1.650	1.620	2.399E-02	5.808E-03	1.854E-03

1.750	1.500	3.162E-02	7.729E-03	2.467E-03
1.850	1.410	3.890E-02	9.643E-03	3.077E-03
1.950	1.340	4.571E-02	1.155E-02	3.686E-03
2.050	1.270	5.370E-02	1.345E-02	4.292E-03
2.150	1.210	6.166E-02	1.534E-02	4.895E-03
2.250	1.160	6.918E-02	1.722E-02	5.497E-03
2.350	1.120	7.586E-02	1.910E-02	6.096E-03
2.450	1.040	9.120E-02	2.097E-02	6.693E-03
2.500	1.020	9.550E-02	2.190E-02	6.990E-03
2.550	1.000	1.000E-01	2.284E-02	7.287E-03

-- Indicates data not used in slope regression

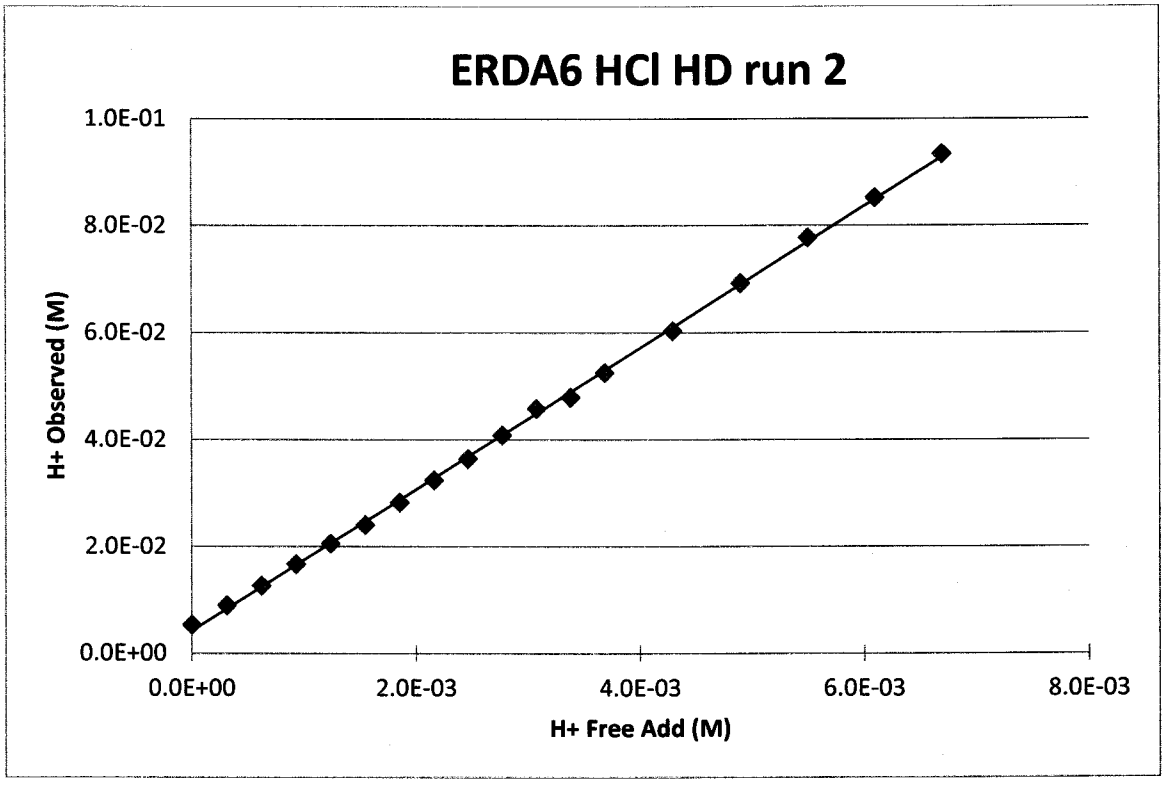


Type:	ERDA-6
SN Reference	WIPP-MM MgO-14 p. 13
Solution Reference	WIPP-MM-MgO-6 p. 60
Brine Volume:	50.0 mL
V_{eq}	1.350 mL (based on observation)
Probe:	Ross Sureflow combination pH
Titrant Actual M	1.00 M HCl
Titrant Reference:	WIPP-FePb-1 p. 6, 21

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	7.900	1.259E-08	0.000E+00	--
0.050	7.860	1.380E-08	9.990E-04	--
0.100	7.860	1.380E-08	1.996E-03	--
0.150	7.830	1.479E-08	2.991E-03	--
0.200	7.790	1.622E-08	3.984E-03	--
0.250	7.760	1.738E-08	4.975E-03	--
0.300	7.720	1.905E-08	5.964E-03	--
0.350	7.680	2.089E-08	6.951E-03	--
0.400	7.640	2.291E-08	7.937E-03	--
0.450	7.600	2.512E-08	8.920E-03	--
0.550	7.510	3.090E-08	1.088E-02	--
0.650	7.410	3.890E-08	1.283E-02	--
0.750	7.290	5.129E-08	1.478E-02	--
0.850	7.150	7.079E-08	1.672E-02	--
0.950	6.980	1.047E-07	1.865E-02	--
1.000	6.870	1.349E-07	1.961E-02	--
1.050	6.740	1.820E-07	2.057E-02	--
1.100	6.560	2.754E-07	2.153E-02	--
1.150	6.300	5.012E-07	2.248E-02	--
1.200	5.820	1.514E-06	2.344E-02	--
1.250	4.980	1.047E-05	2.439E-02	--
1.300	2.770	1.698E-03	2.534E-02	--
1.350	2.280	5.248E-03	0.000E+00	0.000E+00
1.400	2.050	8.913E-03	9.728E-04	3.104E-04
1.450	1.900	1.259E-02	1.944E-03	6.202E-04
1.500	1.780	1.660E-02	2.913E-03	9.295E-04
1.550	1.690	2.042E-02	3.880E-03	1.238E-03
1.600	1.620	2.399E-02	4.845E-03	1.546E-03
1.650	1.550	2.818E-02	5.808E-03	1.854E-03

1.700	1.490	3.236E-02	6.770E-03	2.160E-03
1.750	1.440	3.631E-02	7.729E-03	2.467E-03
1.800	1.390	4.074E-02	8.687E-03	2.772E-03
1.850	1.340	4.571E-02	9.643E-03	3.077E-03
1.900	1.320	4.786E-02	1.060E-02	3.382E-03
1.950	1.280	5.248E-02	1.155E-02	3.686E-03
2.050	1.220	6.026E-02	1.345E-02	4.292E-03
2.150	1.160	6.918E-02	1.534E-02	4.895E-03
2.250	1.110	7.762E-02	1.722E-02	5.497E-03
2.350	1.070	8.511E-02	1.910E-02	6.096E-03
2.450	1.030	9.333E-02	2.097E-02	6.693E-03

-- Indicates data not used in slope regression

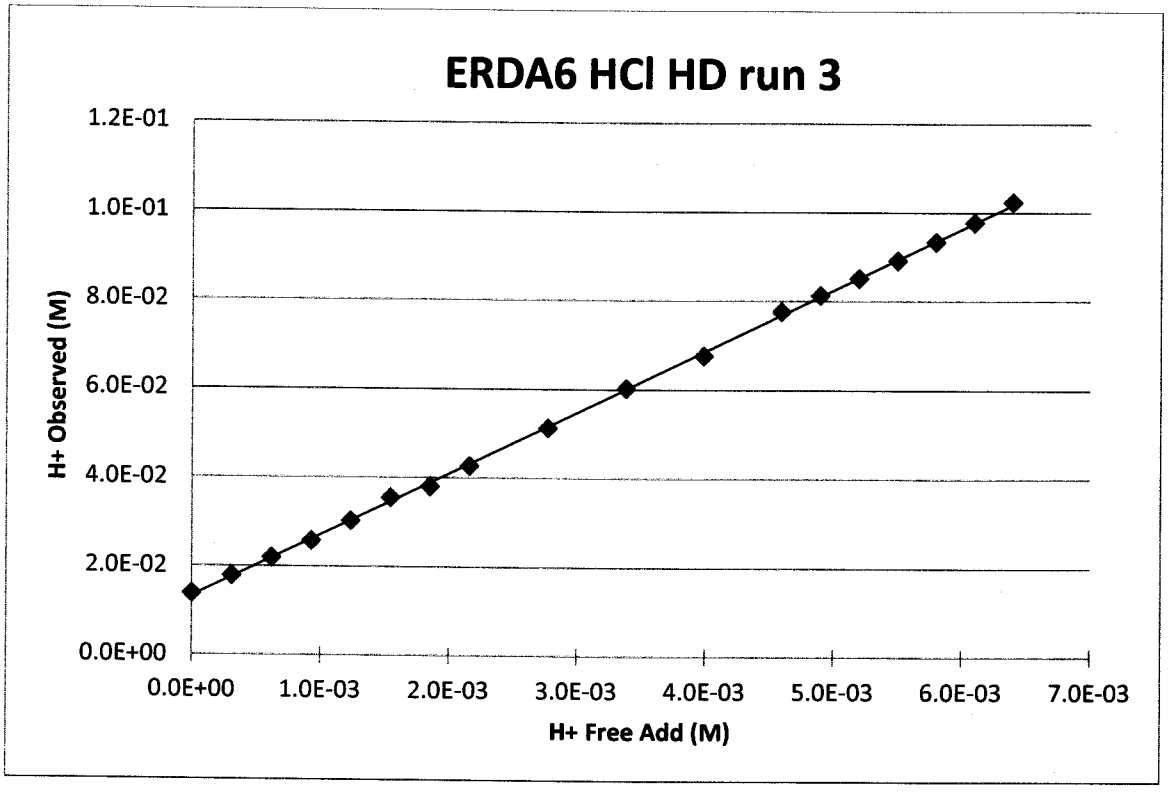


Type:	ERDA-6
SN Reference	WIPP-MM MgO-14 p. 14
Solution Reference	WIPP-MM-MgO-6 p. 60
Brine Volume:	50.0 mL
V_{eq}	1.350 mL (based on observation)
Probe:	Ross Sureflow combination pH
Titrant Actual M	1.00 M HCl
Titrant Reference:	WIPP-FePb-1 p. 6, 21

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	7.930	1.175E-08	0.000E+00	--
0.050	7.900	1.259E-08	9.990E-04	--
0.100	7.830	1.479E-08	1.996E-03	--
0.150	7.790	1.622E-08	2.991E-03	--
0.200	7.720	1.905E-08	3.984E-03	--
0.250	7.670	2.138E-08	4.975E-03	--
0.300	7.630	2.344E-08	5.964E-03	--
0.400	7.540	2.884E-08	7.937E-03	--
0.450	7.500	3.162E-08	8.920E-03	--
0.500	7.450	3.548E-08	9.901E-03	--
0.600	7.340	4.571E-08	1.186E-02	--
0.700	7.210	6.166E-08	1.381E-02	--
0.800	7.030	9.333E-08	1.575E-02	--
0.850	6.960	1.096E-07	1.672E-02	--
0.900	6.850	1.413E-07	1.768E-02	--
0.950	6.720	1.905E-07	1.865E-02	--
1.000	6.530	2.951E-07	1.961E-02	--
1.050	6.250	5.623E-07	2.057E-02	--
1.100	5.730	1.862E-06	2.153E-02	--
1.150	4.770	1.698E-05	2.248E-02	--
1.200	2.640	2.291E-03	2.344E-02	--
1.250	2.220	6.026E-03	2.439E-02	--
1.350	1.860	1.380E-02	0.000E+00	0.000E+00
1.400	1.750	1.778E-02	9.728E-04	3.104E-04
1.450	1.660	2.188E-02	1.944E-03	6.202E-04
1.500	1.590	2.570E-02	2.913E-03	9.295E-04
1.550	1.520	3.020E-02	3.880E-03	1.238E-03
1.600	1.450	3.548E-02	4.845E-03	1.546E-03
1.650	1.420	3.802E-02	5.808E-03	1.854E-03

1.700	1.370	4.266E-02	6.770E-03	2.160E-03
1.800	1.290	5.129E-02	8.687E-03	2.772E-03
1.900	1.220	6.026E-02	1.060E-02	3.382E-03
2.000	1.170	6.761E-02	1.250E-02	3.989E-03
2.100	1.110	7.762E-02	1.440E-02	4.594E-03
2.150	1.090	8.128E-02	1.534E-02	4.895E-03
2.200	1.070	8.511E-02	1.628E-02	5.196E-03
2.250	1.050	8.913E-02	1.722E-02	5.497E-03
2.300	1.030	9.333E-02	1.816E-02	5.796E-03
2.350	1.010	9.772E-02	1.910E-02	6.096E-03
2.400	0.990	1.023E-01	2.004E-02	6.394E-03

-- Indicates data not used in slope regression

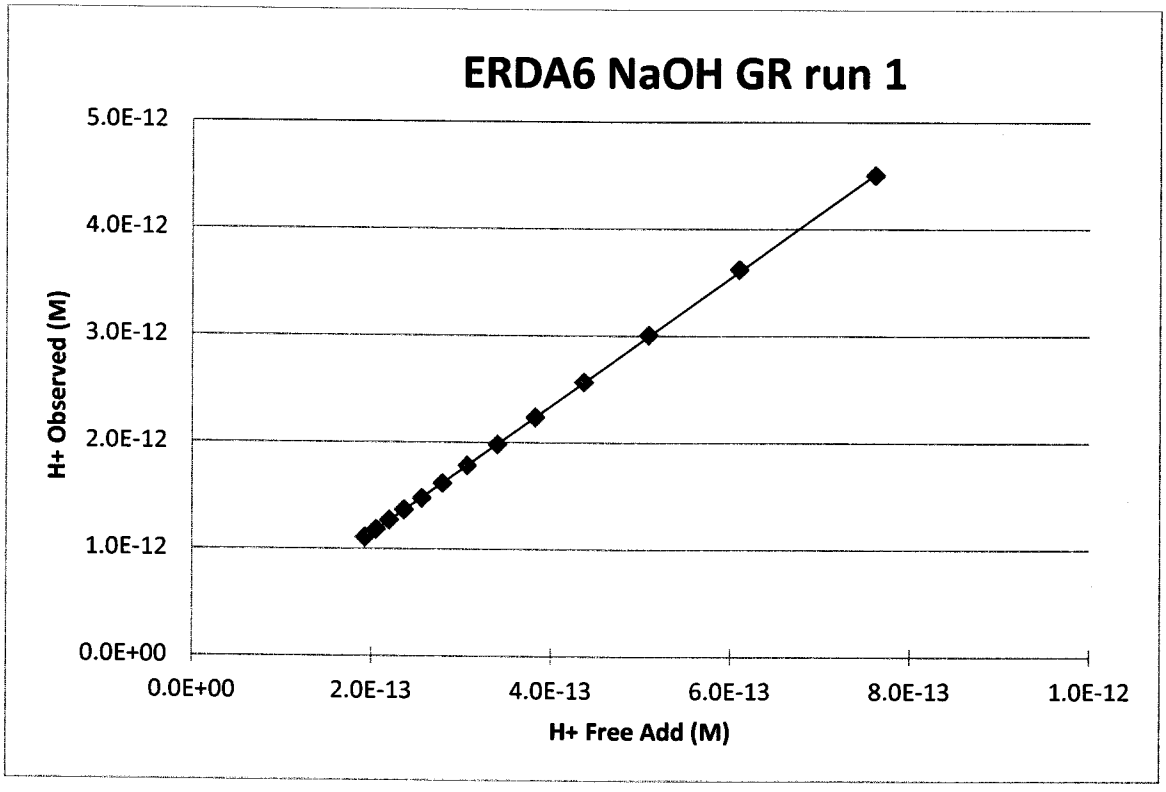


Type:	ERDA-6
SN Reference	WIPP-FePb-3 p. 24
Solution Reference	WIPP-MM-MgO-6 p. 60
Brine Volume:	40.0 mL
V_{eq}	3.200 mL (based on observation)
Probe:	Mettler-Toledo DG-111SC
Titrant Actual M	0.992 M NaOH
Titrant Reference:	WIPP-FePb-3 p. 17

Addition (mL)	pH	H+ Observed (M)	OH- add (M)	H+ Free Add (M)
0.000	8.087	8.185E-09	0.000E+00	--
0.100	8.164	6.855E-09	2.474E-03	--
0.200	8.241	5.741E-09	4.935E-03	--
0.300	8.315	4.842E-09	7.385E-03	--
0.400	8.387	4.102E-09	9.822E-03	--
0.500	8.460	3.467E-09	1.225E-02	--
0.600	8.533	2.931E-09	1.466E-02	--
0.700	8.606	2.477E-09	1.706E-02	--
0.800	8.680	2.089E-09	1.945E-02	--
0.900	8.758	1.746E-09	2.183E-02	--
1.000	8.838	1.452E-09	2.420E-02	--
1.100	8.924	1.191E-09	2.655E-02	--
1.200	9.018	9.594E-10	2.889E-02	--
1.300	9.124	7.516E-10	3.123E-02	--
1.400	9.248	5.649E-10	3.355E-02	--
1.500	9.400	3.981E-10	3.586E-02	--
1.600	9.603	2.495E-10	3.815E-02	--
1.700	9.819	1.517E-10	4.044E-02	--
1.800	9.860	1.380E-10	4.272E-02	--
1.900	9.844	1.432E-10	4.498E-02	--
2.000	9.864	1.368E-10	4.724E-02	--
2.200	9.908	1.236E-10	5.172E-02	--
2.400	9.996	1.009E-10	5.615E-02	--
2.600	10.103	7.889E-11	6.054E-02	--
2.800	10.248	5.649E-11	6.490E-02	--
3.000	10.267	5.408E-11	6.921E-02	--
3.200	10.636	2.312E-11	0.000E+00	--
3.400	11.347	4.498E-12	4.571E-03	7.609E-13
3.450	11.441	3.622E-12	5.708E-03	6.094E-13

3.500	11.522	3.006E-12	6.841E-03	5.084E-13
3.550	11.591	2.564E-12	7.972E-03	4.363E-13
3.600	11.651	2.234E-12	9.101E-03	3.822E-13
3.650	11.704	1.977E-12	1.023E-02	3.401E-13
3.700	11.750	1.778E-12	1.135E-02	3.065E-13
3.750	11.793	1.611E-12	1.247E-02	2.789E-13
3.800	11.833	1.469E-12	1.359E-02	2.560E-13
3.850	11.866	1.361E-12	1.470E-02	2.365E-13
3.900	11.898	1.265E-12	1.582E-02	2.199E-13
3.950	11.929	1.178E-12	1.693E-02	2.055E-13
4.000	11.957	1.104E-12	1.804E-02	1.928E-13

-- Indicates data not used in slope regression

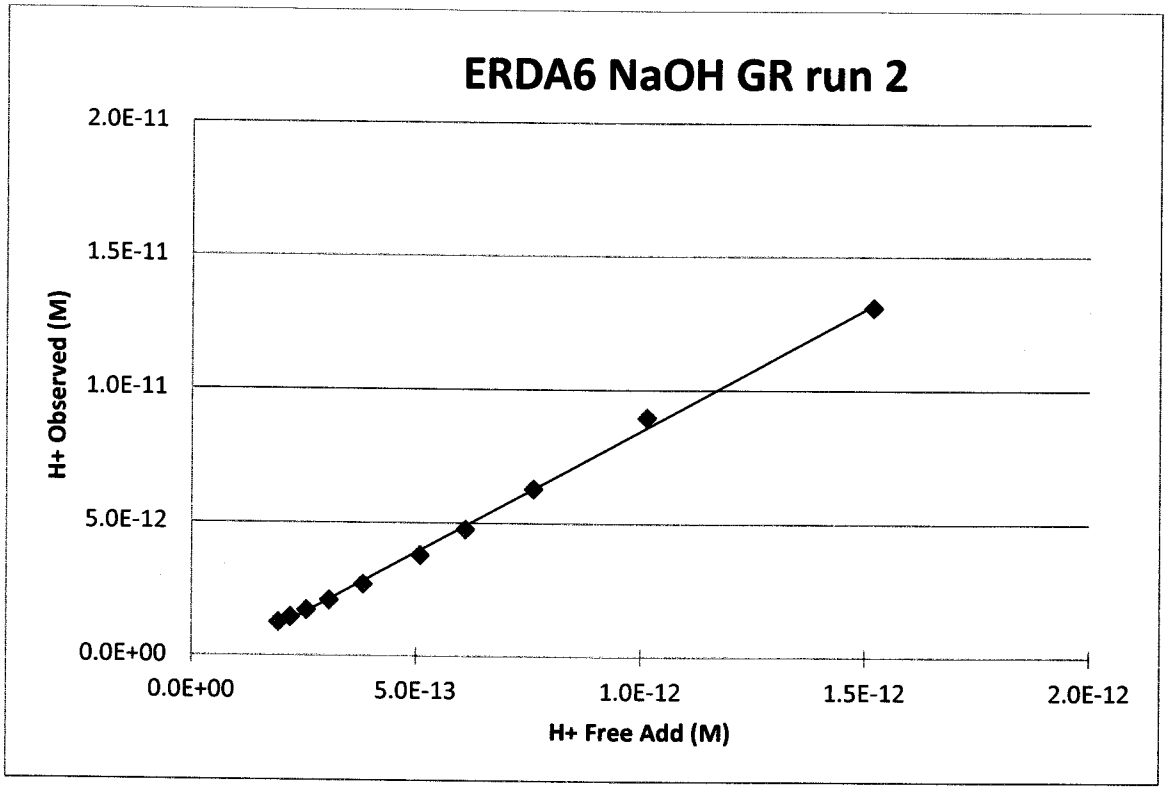


Type:	ERDA-6
SN Reference	WIPP-FePb-3 p. 25
Solution Reference	WIPP-MM-MgO-6 p. 60
Brine Volume:	40.0 mL
V_{eq}	3.200 mL (based on observation)
Probe:	Mettler-Toledo DG-111SC
Titrant Actual M	0.992 M NaOH
Titrant Reference:	WIPP-FePb-3 p. 17

Addition (mL)	pH	H+ Observed (M)	OH- add (M)	H+ Free Add (M)
0.000	8.029	9.354E-09	0.000E+00	--
0.100	8.107	7.816E-09	2.474E-03	--
0.200	8.184	6.546E-09	4.935E-03	--
0.300	8.259	5.508E-09	7.385E-03	--
0.400	8.333	4.645E-09	9.822E-03	--
0.500	8.407	3.917E-09	1.225E-02	--
0.600	8.481	3.304E-09	1.466E-02	--
0.700	8.555	2.786E-09	1.706E-02	--
0.800	8.630	2.344E-09	1.945E-02	--
0.900	8.709	1.954E-09	2.183E-02	--
1.000	8.790	1.622E-09	2.420E-02	--
1.200	8.972	1.067E-09	2.889E-02	--
1.400	9.198	6.339E-10	3.355E-02	--
1.600	9.552	2.805E-10	3.815E-02	--
1.800	9.762	1.730E-10	4.272E-02	--
2.000	9.806	1.563E-10	4.724E-02	--
2.200	9.867	1.358E-10	5.172E-02	--
2.400	9.943	1.140E-10	5.615E-02	--
2.600	10.044	9.036E-11	6.054E-02	--
2.800	10.185	6.531E-11	6.490E-02	--
3.000	10.441	3.622E-11	6.921E-02	--
3.200	10.730	1.862E-11	0.000E+00	--
3.250	10.750	1.778E-11	1.147E-03	--
3.300	10.883	1.309E-11	2.291E-03	1.518E-12
3.350	11.048	8.954E-12	3.433E-03	1.013E-12
3.400	11.202	6.281E-12	4.571E-03	7.609E-13
3.450	11.325	4.732E-12	5.708E-03	6.094E-13
3.500	11.424	3.767E-12	6.841E-03	5.084E-13
3.600	11.573	2.673E-12	9.101E-03	3.822E-13
3.700	11.684	2.070E-12	1.135E-02	3.065E-13
3.800	11.772	1.690E-12	1.359E-02	2.560E-13

3.900	11.845	1.429E-12	1.582E-02	2.199E-13
4.000	11.906	1.242E-12	1.804E-02	1.928E-13
4.100	11.959	1.099E-12	2.024E-02	--
4.200	12.006	9.863E-13	2.244E-02	--
4.300	12.049	8.933E-13	2.463E-02	--
4.400	12.088	8.166E-13	2.681E-02	--

-- Indicates data not used in slope regression

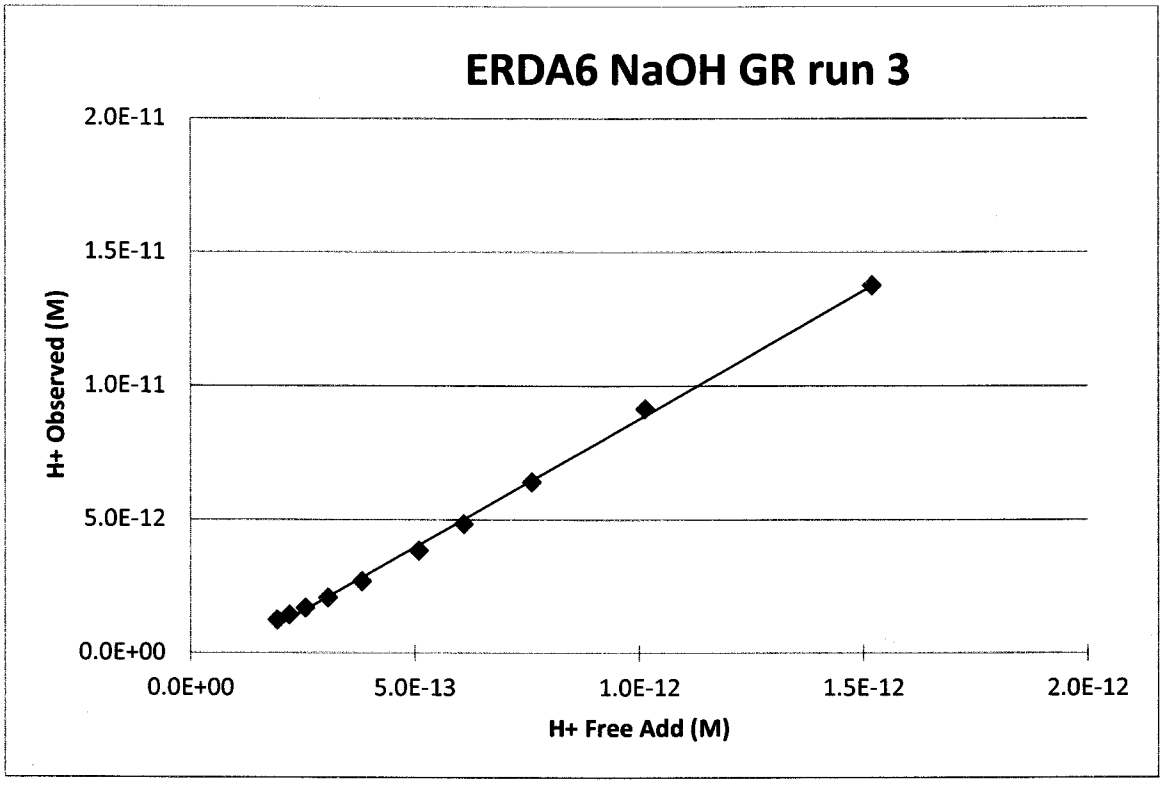


Type:	ERDA-6
SN Reference	WIPP-FePb-3 p. 26
Solution Reference	WIPP-MM-MgO-6 p. 60
Brine Volume:	40.0 mL
V_{eq}	3.200 mL (based on observation)
Probe:	Mettler-Toledo DG-111SC
Titrant Actual M	0.992 M NaOH
Titrant Reference:	WIPP-FePb-3 p. 17

Addition (mL)	pH	H+ Observed (M)	OH- add (M)	H+ Free Add (M)
0.000	8.054	8.831E-09	0.000E+00	--
0.100	8.133	7.362E-09	2.474E-03	--
0.200	8.210	6.166E-09	4.935E-03	--
0.300	8.285	5.188E-09	7.385E-03	--
0.400	8.360	4.365E-09	9.822E-03	--
0.500	8.434	3.681E-09	1.225E-02	--
0.600	8.508	3.105E-09	1.466E-02	--
0.700	8.581	2.624E-09	1.706E-02	--
0.800	8.656	2.208E-09	1.945E-02	--
0.900	8.735	1.841E-09	2.183E-02	--
1.000	8.817	1.524E-09	2.420E-02	--
1.200	8.998	1.005E-09	2.889E-02	--
1.400	9.224	5.970E-10	3.355E-02	--
1.600	9.566	2.716E-10	3.815E-02	--
1.800	9.821	1.510E-10	4.272E-02	--
2.000	9.841	1.442E-10	4.724E-02	--
2.200	9.897	1.268E-10	5.172E-02	--
2.400	9.978	1.052E-10	5.615E-02	--
2.600	10.072	8.472E-11	6.054E-02	--
2.800	10.221	6.012E-11	6.490E-02	--
3.000	10.492	3.221E-11	6.921E-02	--
3.050	10.584	2.606E-11	7.028E-02	--
3.100	10.623	2.382E-11	7.135E-02	--
3.150	10.695	2.018E-11	7.242E-02	--
3.200	10.699	2.000E-11	0.000E+00	--
3.250	10.755	1.758E-11	1.147E-03	--
3.300	10.862	1.374E-11	2.291E-03	1.518E-12
3.350	11.039	9.141E-12	3.433E-03	1.013E-12

3.400	11.195	6.383E-12	4.571E-03	7.609E-13
3.450	11.317	4.819E-12	5.708E-03	6.094E-13
3.500	11.419	3.811E-12	6.841E-03	5.084E-13
3.600	11.574	2.667E-12	9.101E-03	3.822E-13
3.700	11.687	2.056E-12	1.135E-02	3.065E-13
3.800	11.776	1.675E-12	1.359E-02	2.560E-13
3.900	11.849	1.416E-12	1.582E-02	2.199E-13
4.000	11.911	1.227E-12	1.804E-02	1.928E-13
4.100	11.965	1.084E-12	2.024E-02	--
4.200	12.012	9.727E-13	2.244E-02	--
4.300	12.055	8.810E-13	2.463E-02	--
4.400	12.093	8.072E-13	2.681E-02	--

-- Indicates data not used in slope regression



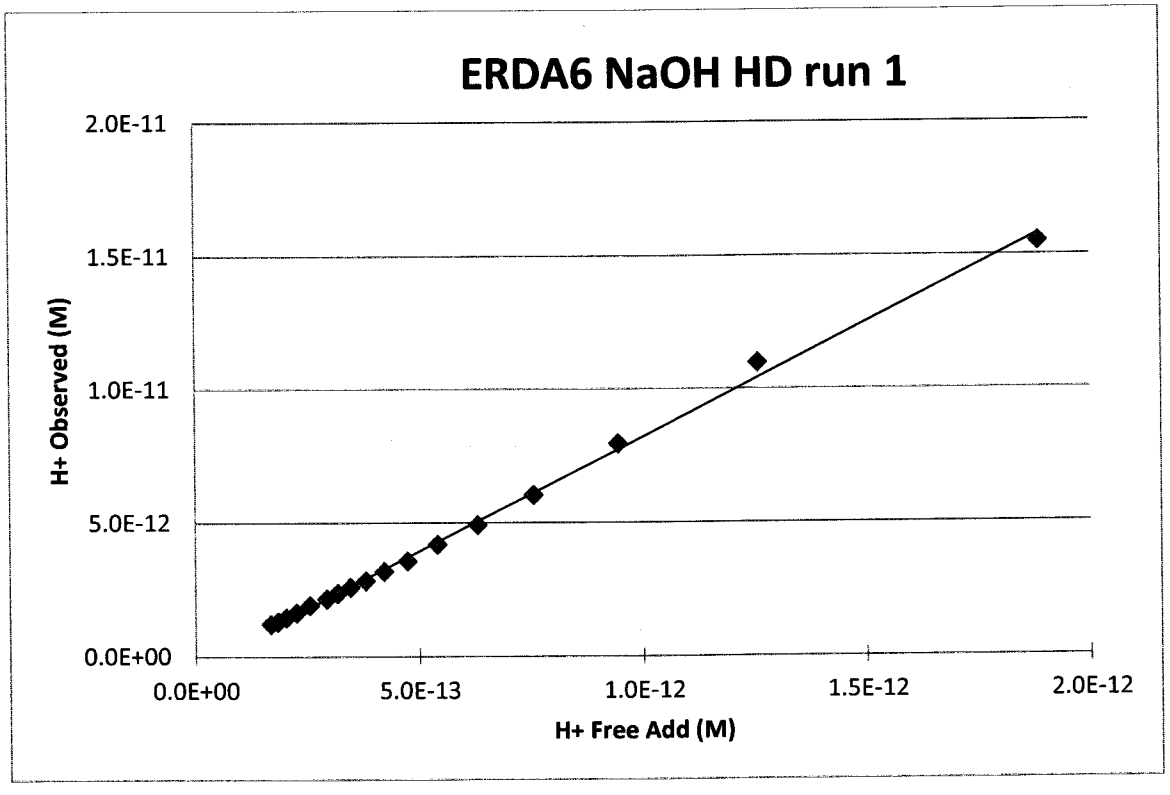
Type:	ERDA-6
SN Reference	WIPP-MM MgO-14 p. 21
Solution Reference	WIPP-MM-MgO-6 p. 60
Brine Volume:	50.0 mL
V_{eq}	3.900 mL (based on observation)
Probe:	Ross Sureflow combination pH
Titrant Actual M	0.9966 M NaOH
Titrant Reference:	WIPP-MM MgO-14 p. 8-11

Addition (mL)	pH	H+ Observed (M)	OH- add (M)	H+ Free Add (M)
0.000	7.85	1.413E-08	0.000E+00	--
0.100	7.92	1.202E-08	1.989E-03	--
0.200	7.99	1.023E-08	3.971E-03	--
0.300	8.05	8.913E-09	5.944E-03	--
0.400	8.11	7.762E-09	7.910E-03	--
0.600	8.23	5.888E-09	1.182E-02	--
0.700	8.29	5.129E-09	1.376E-02	--
0.900	8.42	3.802E-09	1.762E-02	--
1.100	8.55	2.818E-09	2.145E-02	--
1.200	8.61	2.455E-09	2.336E-02	--
1.300	8.68	2.089E-09	2.525E-02	--
1.400	8.75	1.778E-09	2.714E-02	--
1.500	8.82	1.514E-09	2.903E-02	--
1.600	8.90	1.259E-09	3.090E-02	--
1.700	8.99	1.023E-09	3.277E-02	--
1.800	9.09	8.128E-10	3.463E-02	--
1.900	9.21	6.166E-10	3.648E-02	--
2.000	9.35	4.467E-10	3.833E-02	--
2.050	9.44	3.631E-10	3.925E-02	--
2.100	9.53	2.951E-10	4.017E-02	--
2.150	9.64	2.291E-10	4.109E-02	--
2.200	9.73	1.862E-10	4.200E-02	--
2.250	9.75	1.778E-10	4.292E-02	--
2.300	9.66	2.188E-10	4.383E-02	--
2.350	9.70	1.995E-10	4.474E-02	--
2.400	9.70	1.995E-10	4.565E-02	--
2.450	9.72	1.905E-10	4.655E-02	--
2.500	9.73	1.862E-10	4.746E-02	--
2.550	9.73	1.862E-10	4.836E-02	--

2.600	9.73	1.862E-10	4.926E-02	--
2.650	9.73	1.862E-10	5.016E-02	--
2.700	9.74	1.820E-10	5.106E-02	--
2.800	9.74	1.820E-10	5.285E-02	--
2.900	9.78	1.660E-10	5.463E-02	--
2.950	9.78	1.660E-10	5.552E-02	--
3.000	9.81	1.549E-10	5.641E-02	--
3.050	9.80	1.585E-10	5.730E-02	--
3.100	9.82	1.514E-10	5.818E-02	--
3.150	9.84	1.445E-10	5.906E-02	--
3.200	9.86	1.380E-10	5.995E-02	--
3.250	9.87	1.349E-10	6.083E-02	--
3.300	9.96	1.096E-10	6.170E-02	--
3.350	9.98	1.047E-10	6.258E-02	--
3.400	10.01	9.772E-11	6.345E-02	--
3.450	10.08	8.318E-11	6.433E-02	--
3.500	10.08	8.318E-11	6.520E-02	--
3.550	10.11	7.762E-11	6.607E-02	--
3.600	10.15	7.079E-11	6.694E-02	--
3.650	10.23	5.888E-11	6.780E-02	--
3.700	10.25	5.623E-11	6.867E-02	--
3.750	10.31	4.898E-11	6.953E-02	--
3.800	10.37	4.266E-11	7.039E-02	--
3.850	10.44	3.631E-11	7.125E-02	--
3.900	10.54	2.884E-11	0.000E+00	--
3.950	10.64	2.291E-11	9.236E-04	--
4.000	10.81	1.549E-11	1.846E-03	1.885E-12
4.050	10.96	1.096E-11	2.766E-03	1.258E-12
4.100	11.10	7.943E-12	3.684E-03	9.441E-13
4.150	11.22	6.026E-12	4.601E-03	7.560E-13
4.200	11.31	4.898E-12	5.516E-03	6.306E-13
4.250	11.38	4.169E-12	6.430E-03	5.410E-13
4.300	11.45	3.548E-12	7.341E-03	4.738E-13
4.350	11.50	3.162E-12	8.252E-03	4.215E-13
4.400	11.55	2.818E-12	9.160E-03	3.797E-13
4.450	11.59	2.570E-12	1.007E-02	3.455E-13
4.500	11.63	2.344E-12	1.097E-02	3.170E-13
4.550	11.67	2.138E-12	1.188E-02	2.929E-13
4.650	11.72	1.905E-12	1.368E-02	2.543E-13
4.750	11.79	1.622E-12	1.547E-02	2.248E-13
4.850	11.84	1.445E-12	1.726E-02	2.015E-13
4.950	11.89	1.288E-12	1.904E-02	1.827E-13
5.050	11.92	1.202E-12	2.082E-02	1.671E-13

5.150	11.96	1.096E-12	2.259E-02	--
5.250	11.99	1.023E-12	2.435E-02	--
5.350	12.03	9.333E-13	2.611E-02	--
5.450	12.06	8.710E-13	2.786E-02	--
5.650	12.11	7.762E-13	3.134E-02	--
5.850	12.16	6.918E-13	3.480E-02	--
6.050	12.18	6.607E-13	3.823E-02	--

-- Indicates data not used in slope regression

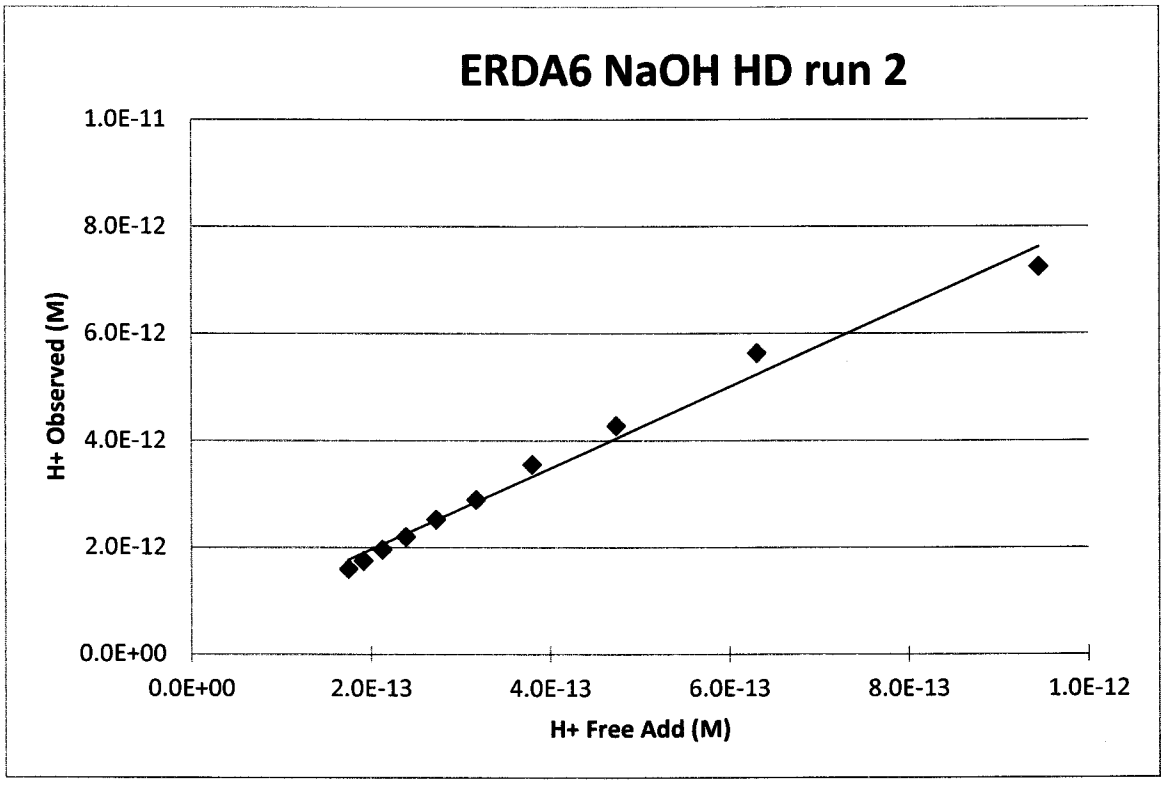


Type:	ERDA-6
SN Reference	WIPP-MM MgO-14 p. 25
Solution Reference	WIPP-MM-MgO-6 p. 60
Brine Volume:	50.0 mL
V_{eq}	3.900 mL (based on observation)
Probe:	Ross Sureflow combination pH
Titrant Actual M	0.9966 M NaOH
Titrant Reference:	WIPP-MM MgO-14 p. 8-11

Addition (mL)	pH	H+ Observed (M)	OH- add (M)	H+ Free Add (M)
0.000	7.820	1.514E-08	0.000E+00	--
0.100	7.890	1.288E-08	1.989E-03	--
0.200	7.950	1.122E-08	3.971E-03	--
0.300	8.010	9.772E-09	5.944E-03	--
0.400	8.070	8.511E-09	7.910E-03	--
0.500	8.190	6.457E-09	9.867E-03	--
0.600	8.250	5.623E-09	1.182E-02	--
0.700	8.310	4.898E-09	1.376E-02	--
0.800	8.370	4.266E-09	1.569E-02	--
0.900	8.430	3.715E-09	1.762E-02	--
1.100	8.560	2.754E-09	2.145E-02	--
1.300	8.690	2.042E-09	2.525E-02	--
1.500	8.850	1.413E-09	2.903E-02	--
1.700	9.040	9.120E-10	3.277E-02	--
1.800	9.150	7.079E-10	3.463E-02	--
1.900	9.310	4.898E-10	3.648E-02	--
2.000	9.500	3.162E-10	3.833E-02	--
2.100	9.660	2.188E-10	4.017E-02	--
2.200	9.750	1.778E-10	4.200E-02	--
2.300	9.730	1.862E-10	4.383E-02	--
2.400	9.750	1.778E-10	4.565E-02	--
2.500	9.750	1.778E-10	4.746E-02	--
2.600	9.740	1.820E-10	4.926E-02	--
2.700	9.760	1.738E-10	5.106E-02	--
2.800	9.800	1.585E-10	5.285E-02	--
2.900	9.780	1.660E-10	5.463E-02	--
3.000	9.840	1.445E-10	5.641E-02	--
3.200	9.940	1.148E-10	5.995E-02	--
3.400	10.070	8.511E-11	6.345E-02	--

3.600	10.210	6.166E-11	6.694E-02	--
3.800	10.540	2.884E-11	7.039E-02	--
3.900	10.750	1.778E-11	0.000E+00	--
4.000	10.990	1.023E-11	1.846E-03	--
4.100	11.140	7.244E-12	3.684E-03	9.441E-13
4.200	11.250	5.623E-12	5.516E-03	6.306E-13
4.300	11.370	4.266E-12	7.341E-03	4.738E-13
4.400	11.450	3.548E-12	9.160E-03	3.797E-13
4.500	11.540	2.884E-12	1.097E-02	3.170E-13
4.600	11.600	2.512E-12	1.278E-02	2.722E-13
4.700	11.660	2.188E-12	1.458E-02	2.386E-13
4.800	11.710	1.950E-12	1.637E-02	2.125E-13
4.900	11.760	1.738E-12	1.815E-02	1.916E-13
5.000	11.800	1.585E-12	1.993E-02	1.745E-13
5.100	11.840	1.445E-12	2.170E-02	--
5.200	11.870	1.349E-12	2.347E-02	--
5.300	11.900	1.259E-12	2.523E-02	--
5.400	11.930	1.175E-12	2.698E-02	--
5.500	11.960	1.096E-12	2.873E-02	--
5.600	11.990	1.023E-12	3.047E-02	--
5.700	12.010	9.772E-13	3.221E-02	--

-- Indicates data not used in slope regression

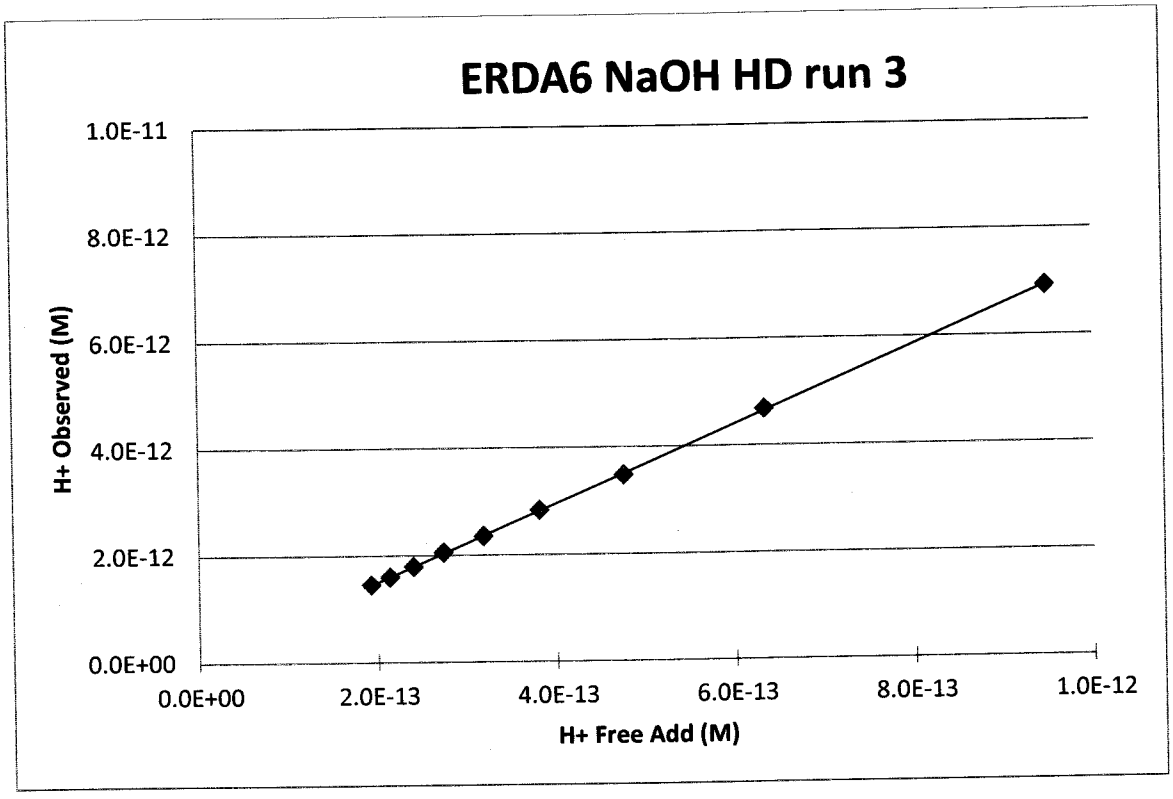


Type:	ERDA-6
SN Reference	WIPP-MM MgO-14 p. 27
Solution Reference	WIPP-MM-MgO-6 p. 60
Brine Volume:	50.0 mL
V_{eq}	4.100 mL (based on observation)
Probe:	Ross Sureflow combination pH
Titrant Actual M	0.9966 M NaOH
Titrant Reference:	WIPP-MM MgO-14 p. 8-11

Addition (mL)	pH	H+ Observed (M)	OH- add (M)	H+ Free Add (M)
0.000	7.840	1.445E-08	0.000E+00	--
0.100	7.900	1.259E-08	1.989E-03	--
0.200	7.960	1.096E-08	3.971E-03	--
0.300	8.030	9.333E-09	5.944E-03	--
0.400	8.090	8.128E-09	7.910E-03	--
0.500	8.150	7.079E-09	9.867E-03	--
0.600	8.210	6.166E-09	1.182E-02	--
0.700	8.260	5.495E-09	1.376E-02	--
0.800	8.330	4.677E-09	1.569E-02	--
0.900	8.350	4.467E-09	1.762E-02	--
1.000	8.450	3.548E-09	1.954E-02	--
1.100	8.510	3.090E-09	2.145E-02	--
1.200	8.570	2.692E-09	2.336E-02	--
1.300	8.630	2.344E-09	2.525E-02	--
1.400	8.700	1.995E-09	2.714E-02	--
1.500	8.780	1.660E-09	2.903E-02	--
1.600	8.850	1.413E-09	3.090E-02	--
1.700	8.940	1.148E-09	3.277E-02	--
1.800	9.030	9.333E-10	3.463E-02	--
1.900	9.140	7.244E-10	3.648E-02	--
2.000	9.260	5.495E-10	3.833E-02	--
2.100	9.430	3.715E-10	4.017E-02	--
2.200	9.610	2.455E-10	4.200E-02	--
2.300	9.730	1.862E-10	4.383E-02	--
2.400	9.770	1.698E-10	4.565E-02	--
2.500	9.780	1.660E-10	4.746E-02	--
2.600	9.780	1.660E-10	4.926E-02	--
2.700	9.810	1.549E-10	5.106E-02	--
2.800	9.820	1.514E-10	5.285E-02	--

2.900	9.850	1.413E-10	5.463E-02	--
3.000	9.850	1.413E-10	5.641E-02	--
3.000	9.830	1.479E-10	5.641E-02	--
3.100	9.860	1.380E-10	5.818E-02	--
3.200	9.900	1.259E-10	5.995E-02	--
3.300	9.950	1.122E-10	6.170E-02	--
3.400	10.010	9.772E-11	6.345E-02	--
3.500	10.060	8.710E-11	6.520E-02	--
3.600	10.130	7.413E-11	6.694E-02	--
3.700	10.210	6.166E-11	6.867E-02	--
3.800	10.310	4.898E-11	7.039E-02	--
3.900	10.430	3.715E-11	7.211E-02	--
4.000	10.510	3.090E-11	7.382E-02	--
4.100	10.680	2.089E-11	0.000E+00	--
4.200	10.940	1.148E-11	1.839E-03	--
4.300	11.160	6.918E-12	3.671E-03	9.476E-13
4.400	11.330	4.677E-12	5.496E-03	6.329E-13
4.500	11.460	3.467E-12	7.314E-03	4.755E-13
4.600	11.550	2.818E-12	9.126E-03	3.811E-13
4.700	11.630	2.344E-12	1.093E-02	3.182E-13
4.800	11.690	2.042E-12	1.273E-02	2.732E-13
4.900	11.750	1.778E-12	1.452E-02	2.395E-13
5.000	11.800	1.585E-12	1.631E-02	2.133E-13
5.100	11.840	1.445E-12	1.809E-02	1.923E-13
5.200	11.880	1.318E-12	1.986E-02	--
5.300	11.920	1.202E-12	2.163E-02	--
5.400	11.950	1.122E-12	2.339E-02	--
5.500	11.980	1.047E-12	2.514E-02	--
5.600	12.010	9.772E-13	2.689E-02	--

-- Indicates data not used in slope regression

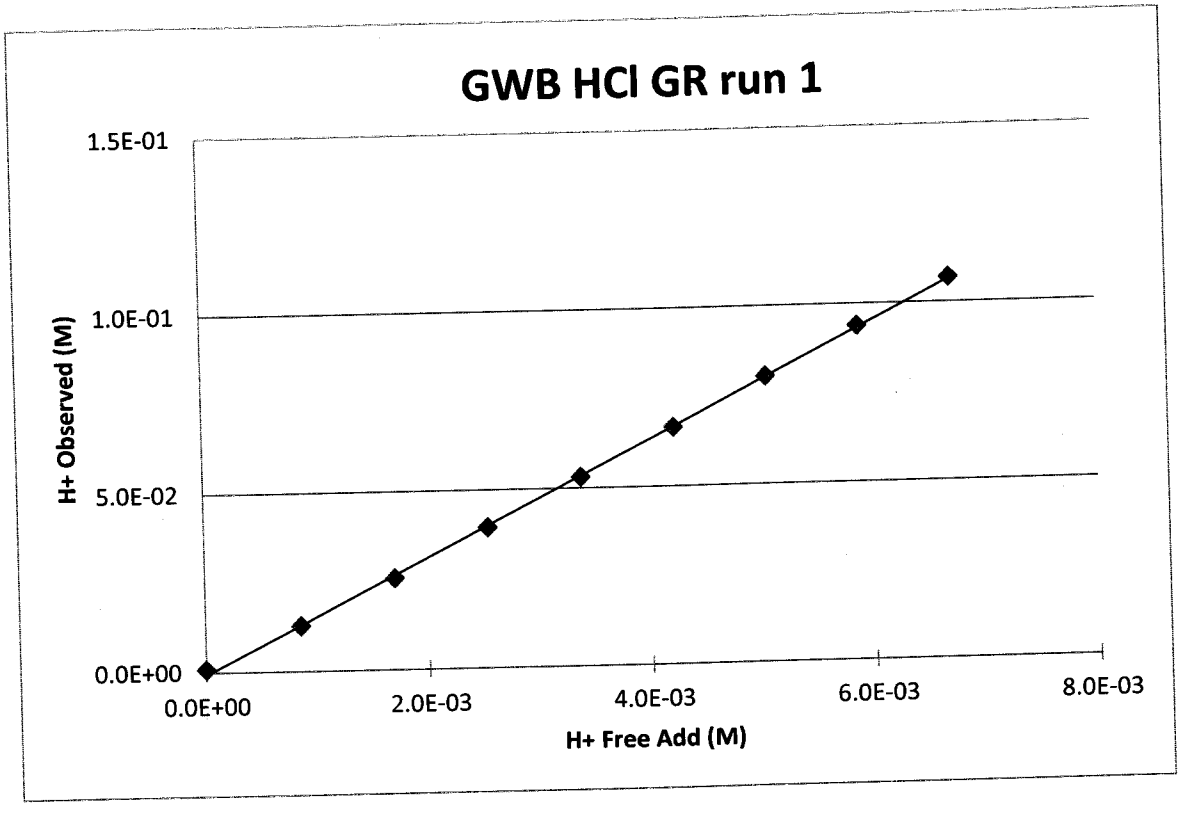


Type:	GWB
SN Reference	WIPP-FePb-3 p. 14
Solution Reference	WIPP-MM-MgO-6 p. 59
Brine Volume:	40.0 mL
V_{eq}	3.100 mL (WIPP-FePb-3, p. 22)
Probe:	Mettler-Toledo DG-111SC
Titrant Actual M	0.96 M HCl
Titrant Reference:	WIPP-FePb-3 p. 10-12

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	7.361	4.355E-08	0.000E+00	--
0.100	7.330	4.677E-08	2.394E-03	--
0.200	7.297	5.047E-08	4.776E-03	--
0.300	7.264	5.445E-08	7.146E-03	--
0.400	7.231	5.875E-08	9.505E-03	--
0.500	7.197	6.353E-08	1.185E-02	--
0.600	7.161	6.902E-08	1.419E-02	--
0.700	7.127	7.464E-08	1.651E-02	--
0.800	7.089	8.147E-08	1.882E-02	--
0.900	7.053	8.851E-08	2.112E-02	--
1.000	7.015	9.661E-08	2.341E-02	--
1.100	6.976	1.057E-07	2.569E-02	--
1.200	6.936	1.159E-07	2.796E-02	--
1.300	6.895	1.274E-07	3.022E-02	--
1.400	6.852	1.406E-07	3.246E-02	--
1.500	6.808	1.556E-07	3.470E-02	--
1.600	6.763	1.726E-07	3.692E-02	--
1.700	6.715	1.928E-07	3.914E-02	--
1.800	6.665	2.163E-07	4.134E-02	--
1.900	6.612	2.443E-07	4.353E-02	--
2.000	6.555	2.786E-07	4.571E-02	--
2.100	6.496	3.192E-07	4.789E-02	--
2.200	6.432	3.698E-07	5.005E-02	--
2.300	6.361	4.355E-07	5.220E-02	--
2.400	6.282	5.224E-07	5.434E-02	--
2.500	6.194	6.397E-07	5.647E-02	--
2.600	6.092	8.091E-07	5.859E-02	--
2.700	5.969	1.074E-06	6.070E-02	--
2.800	5.812	1.542E-06	6.280E-02	--

2.900	5.593	2.553E-06	6.490E-02	--
3.000	5.217	6.067E-06	6.698E-02	--
3.100	3.135	7.328E-04	0.000E+00	0.000E+00
3.200	1.895	1.274E-02	2.222E-03	8.515E-04
3.300	1.591	2.564E-02	4.434E-03	1.699E-03
3.400	1.405	3.936E-02	6.636E-03	2.543E-03
3.500	1.276	5.297E-02	8.828E-03	3.382E-03
3.600	1.177	6.653E-02	1.101E-02	4.218E-03
3.700	1.096	8.017E-02	1.318E-02	5.050E-03
3.800	1.028	9.376E-02	1.534E-02	5.879E-03
3.900	0.971	1.069E-01	1.749E-02	6.703E-03

-- Indicates data not used in slope regression

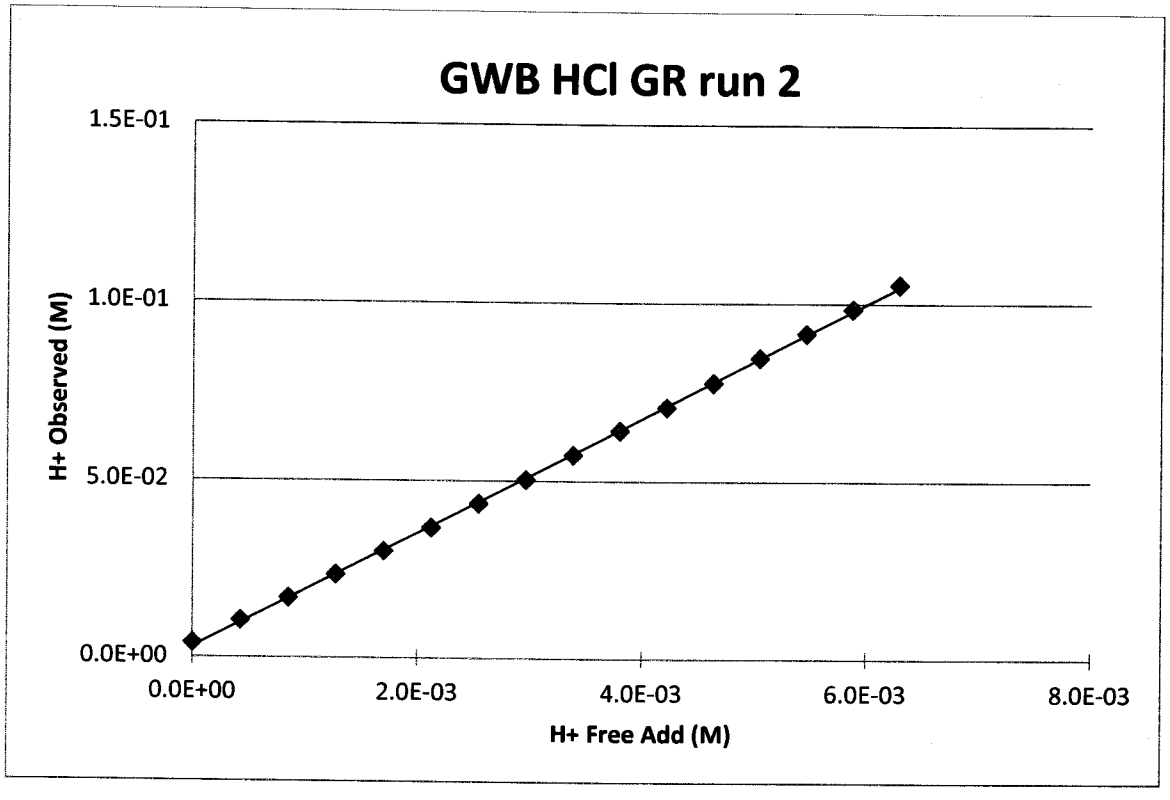


Type:	GWB
SN Reference	WIPP-FePb-3 p. 15
Solution Reference	WIPP-MM-MgO-6 p. 59
Brine Volume:	40.0 mL
V_{eq}	3.100 mL (WIPP-FePb-3, p. 22)
Probe:	Mettler-Toledo DG-111SC
Titrant Actual M	0.96 M HCl
Titrant Reference:	WIPP-FePb-3 p. 10-12

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	7.363	4.335E-08	0.000E+00	--
0.050	7.346	4.508E-08	1.199E-03	--
0.100	7.330	4.677E-08	2.394E-03	--
0.150	7.314	4.853E-08	3.587E-03	--
0.200	7.297	5.047E-08	4.776E-03	--
0.300	7.262	5.470E-08	7.146E-03	--
0.400	7.228	5.916E-08	9.505E-03	--
0.500	7.193	6.412E-08	1.185E-02	--
0.600	7.157	6.966E-08	1.419E-02	--
0.700	7.121	7.568E-08	1.651E-02	--
0.800	7.084	8.241E-08	1.882E-02	--
0.900	7.048	8.954E-08	2.112E-02	--
1.000	7.008	9.817E-08	2.341E-02	--
1.200	6.929	1.178E-07	2.796E-02	--
1.400	6.844	1.432E-07	3.246E-02	--
1.600	6.753	1.766E-07	3.692E-02	--
1.800	6.652	2.228E-07	4.134E-02	--
2.000	6.540	2.884E-07	4.571E-02	--
2.100	6.478	3.327E-07	4.789E-02	--
2.200	6.411	3.882E-07	5.005E-02	--
2.300	6.339	4.581E-07	5.220E-02	--
2.400	6.258	5.521E-07	5.434E-02	--
2.500	6.166	6.823E-07	5.647E-02	--
2.600	6.059	8.730E-07	5.859E-02	--
2.700	5.925	1.189E-06	6.070E-02	--
2.750	5.846	1.426E-06	6.175E-02	--
2.800	5.758	1.746E-06	6.280E-02	--
2.850	5.648	2.249E-06	6.385E-02	--
2.900	5.509	3.097E-06	6.490E-02	--

2.950	5.344	4.529E-06	6.594E-02	--
3.000	5.069	8.531E-06	6.698E-02	--
3.050	4.424	3.767E-05	6.801E-02	--
3.100	2.407	3.917E-03	0.000E+00	0.000E+00
3.150	1.989	1.026E-02	1.112E-03	4.262E-04
3.200	1.777	1.671E-02	2.222E-03	8.515E-04
3.250	1.633	2.328E-02	3.329E-03	1.276E-03
3.300	1.524	2.992E-02	4.434E-03	1.699E-03
3.350	1.436	3.664E-02	5.536E-03	2.121E-03
3.400	1.362	4.345E-02	6.636E-03	2.543E-03
3.450	1.299	5.023E-02	7.733E-03	2.963E-03
3.500	1.243	5.715E-02	8.828E-03	3.382E-03
3.550	1.194	6.397E-02	9.920E-03	3.801E-03
3.600	1.151	7.063E-02	1.101E-02	4.218E-03
3.650	1.111	7.745E-02	1.210E-02	4.635E-03
3.700	1.073	8.453E-02	1.318E-02	5.050E-03
3.750	1.039	9.141E-02	1.426E-02	5.465E-03
3.800	1.007	9.840E-02	1.534E-02	5.879E-03
3.850	0.978	1.052E-01	1.642E-02	6.291E-03

-- Indicates data not used in slope regression

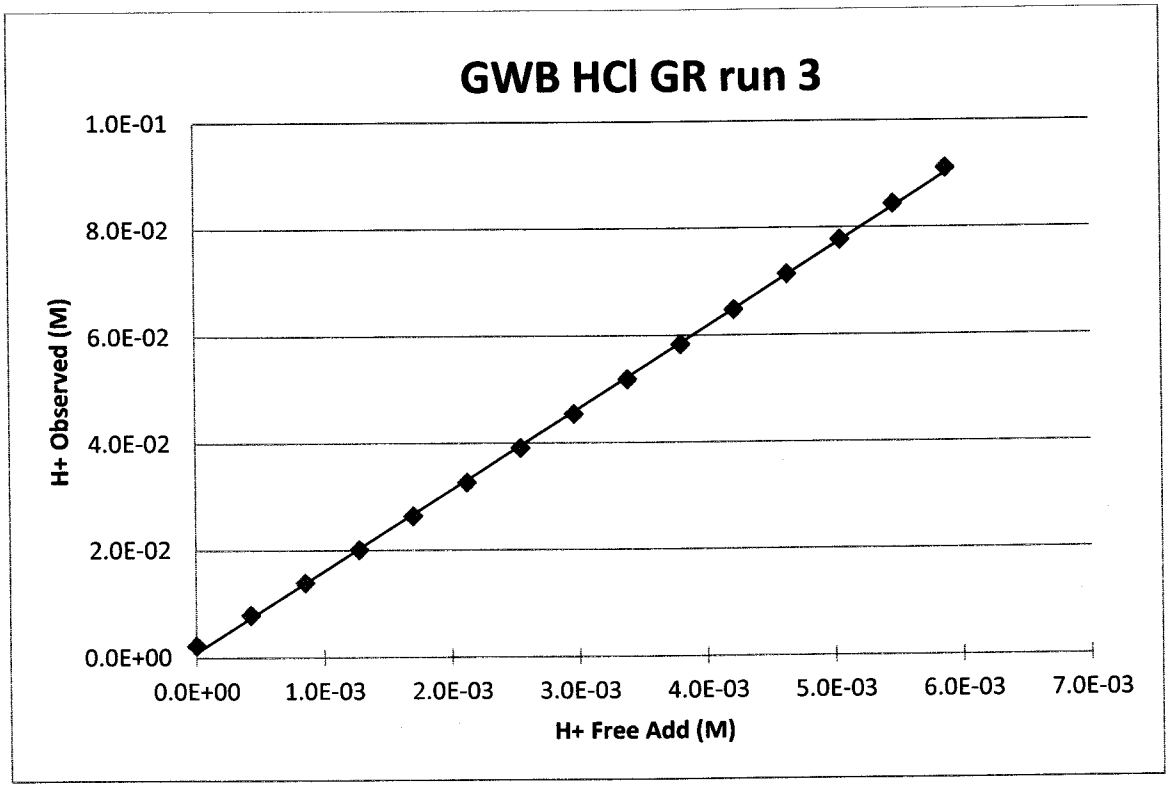


Type:	GWB
SN Reference	WIPP-FePb-3 p. 17
Solution Reference	WIPP-MM-MgO-6 p. 59
Brine Volume:	40.0 mL
V_{eq}	3.100 mL (WIPP-FePb-3, p. 22)
Probe:	Mettler-Toledo DG-111SC
Titrant Actual M	0.96 M HCl
Titrant Reference:	WIPP-FePb-3 p. 10-12

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	7.402	3.963E-08	0.000E+00	--
0.050	7.387	4.102E-08	1.199E-03	--
0.100	7.371	4.256E-08	2.394E-03	--
0.150	7.354	4.426E-08	3.587E-03	--
0.200	7.338	4.592E-08	4.776E-03	--
0.300	7.305	4.955E-08	7.146E-03	--
0.400	7.271	5.358E-08	9.505E-03	--
0.500	7.236	5.808E-08	1.185E-02	--
0.600	7.200	6.310E-08	1.419E-02	--
0.700	7.165	6.839E-08	1.651E-02	--
0.800	7.128	7.447E-08	1.882E-02	--
0.900	7.091	8.110E-08	2.112E-02	--
1.000	7.053	8.851E-08	2.341E-02	--
1.200	6.973	1.064E-07	2.796E-02	--
1.400	6.888	1.294E-07	3.246E-02	--
1.600	6.798	1.592E-07	3.692E-02	--
1.800	6.698	2.004E-07	4.134E-02	--
2.000	6.588	2.582E-07	4.571E-02	--
2.100	6.527	2.972E-07	4.789E-02	--
2.200	6.462	3.451E-07	5.005E-02	--
2.300	6.390	4.074E-07	5.220E-02	--
2.400	6.310	4.898E-07	5.434E-02	--
2.500	6.220	6.026E-07	5.647E-02	--
2.600	6.115	7.674E-07	5.859E-02	--
2.700	5.990	1.023E-06	6.070E-02	--
2.750	5.913	1.222E-06	6.175E-02	--
2.800	5.825	1.496E-06	6.280E-02	--
2.850	5.723	1.892E-06	6.385E-02	--

2.900	5.596	2.535E-06	6.490E-02	--
2.950	5.429	3.724E-06	6.594E-02	--
3.000	5.183	6.561E-06	6.698E-02	--
3.050	4.711	1.945E-05	6.801E-02	--
3.100	2.674	2.118E-03	0.000E+00	0.000E+00
3.150	2.106	7.834E-03	1.112E-03	4.262E-04
3.200	1.859	1.384E-02	2.222E-03	8.515E-04
3.250	1.699	2.000E-02	3.329E-03	1.276E-03
3.300	1.581	2.624E-02	4.434E-03	1.699E-03
3.350	1.487	3.258E-02	5.536E-03	2.121E-03
3.400	1.409	3.899E-02	6.636E-03	2.543E-03
3.450	1.344	4.529E-02	7.733E-03	2.963E-03
3.500	1.286	5.176E-02	8.828E-03	3.382E-03
3.550	1.235	5.821E-02	9.920E-03	3.801E-03
3.600	1.189	6.471E-02	1.101E-02	4.218E-03
3.650	1.147	7.129E-02	1.210E-02	4.635E-03
3.700	1.110	7.762E-02	1.318E-02	5.050E-03
3.750	1.074	8.433E-02	1.426E-02	5.465E-03
3.800	1.041	9.099E-02	1.534E-02	5.879E-03

-- Indicates data not used in slope regression

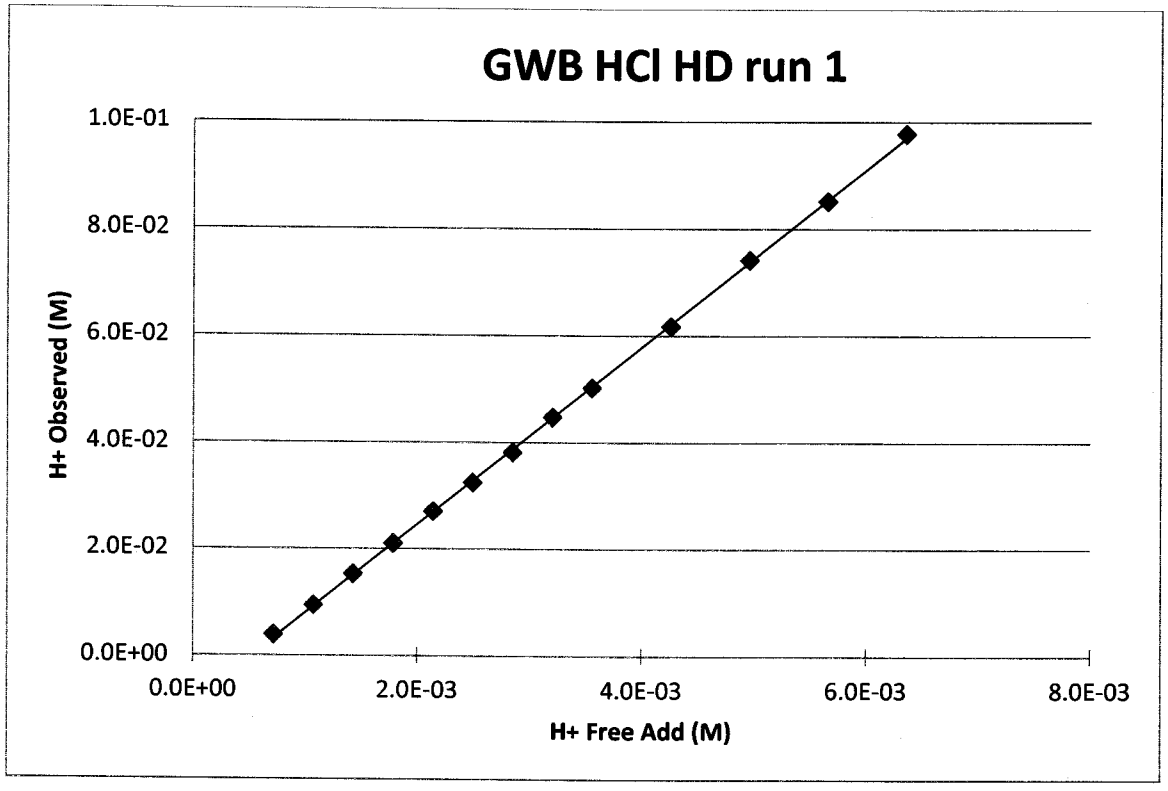


Type:	GWB
SN Reference	WIPP-MM MgO-14 p. 15
Solution Reference	WIPP-FePb-3 p. 34
Brine Volume:	50.0 mL
V_{eq}	3.400 mL (based on observation)
Probe:	Ross Sureflow combination pH
Titrant Actual M	1.00 M HCl
Titrant Reference:	WIPP-FePb-1 p. 6, 21

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	7.460	3.467E-08	0.000E+00	--
0.100	7.430	3.715E-08	1.996E-03	--
0.200	7.400	3.981E-08	3.984E-03	--
0.300	7.370	4.266E-08	5.964E-03	--
0.400	7.340	4.571E-08	7.937E-03	--
0.500	7.310	4.898E-08	9.901E-03	--
0.600	7.280	5.248E-08	1.186E-02	--
0.700	7.240	5.754E-08	1.381E-02	--
0.800	7.210	6.166E-08	1.575E-02	--
0.900	7.140	7.244E-08	1.768E-02	--
1.000	7.110	7.762E-08	1.961E-02	--
1.100	7.080	8.318E-08	2.153E-02	--
1.200	7.040	9.120E-08	2.344E-02	--
1.300	7.010	9.772E-08	2.534E-02	--
1.400	6.970	1.072E-07	2.724E-02	--
1.500	6.930	1.175E-07	2.913E-02	--
1.600	6.890	1.288E-07	3.101E-02	--
1.700	6.850	1.413E-07	3.288E-02	--
1.800	6.810	1.549E-07	3.475E-02	--
1.900	6.770	1.698E-07	3.661E-02	--
2.000	6.730	1.862E-07	3.846E-02	--
2.100	6.680	2.089E-07	4.031E-02	--
2.200	6.630	2.344E-07	4.215E-02	--
2.300	6.580	2.630E-07	4.398E-02	--
2.400	6.520	3.020E-07	4.580E-02	--
2.500	6.470	3.388E-07	4.762E-02	--
2.600	6.400	3.981E-07	4.943E-02	--
2.700	6.330	4.677E-07	5.123E-02	--

2.800	6.250	5.623E-07	5.303E-02	--
2.900	6.160	6.918E-07	5.482E-02	--
3.000	6.060	8.710E-07	5.660E-02	--
3.100	5.930	1.175E-06	5.838E-02	--
3.200	5.770	1.698E-06	6.015E-02	--
3.300	5.530	2.951E-06	6.191E-02	--
3.400	5.070	8.511E-06	0.000E+00	--
3.500	2.420	3.802E-03	1.869E-03	7.162E-04
3.550	2.030	9.333E-03	2.801E-03	1.073E-03
3.600	1.820	1.514E-02	3.731E-03	1.430E-03
3.650	1.680	2.089E-02	4.660E-03	1.785E-03
3.700	1.570	2.692E-02	5.587E-03	2.141E-03
3.750	1.490	3.236E-02	6.512E-03	2.495E-03
3.800	1.420	3.802E-02	7.435E-03	2.849E-03
3.850	1.350	4.467E-02	8.357E-03	3.202E-03
3.900	1.300	5.012E-02	9.276E-03	3.554E-03
4.000	1.210	6.166E-02	1.111E-02	4.257E-03
4.100	1.130	7.413E-02	1.294E-02	4.958E-03
4.200	1.070	8.511E-02	1.476E-02	5.656E-03
4.300	1.010	9.772E-02	1.657E-02	6.351E-03

-- Indicates data not used in slope regression

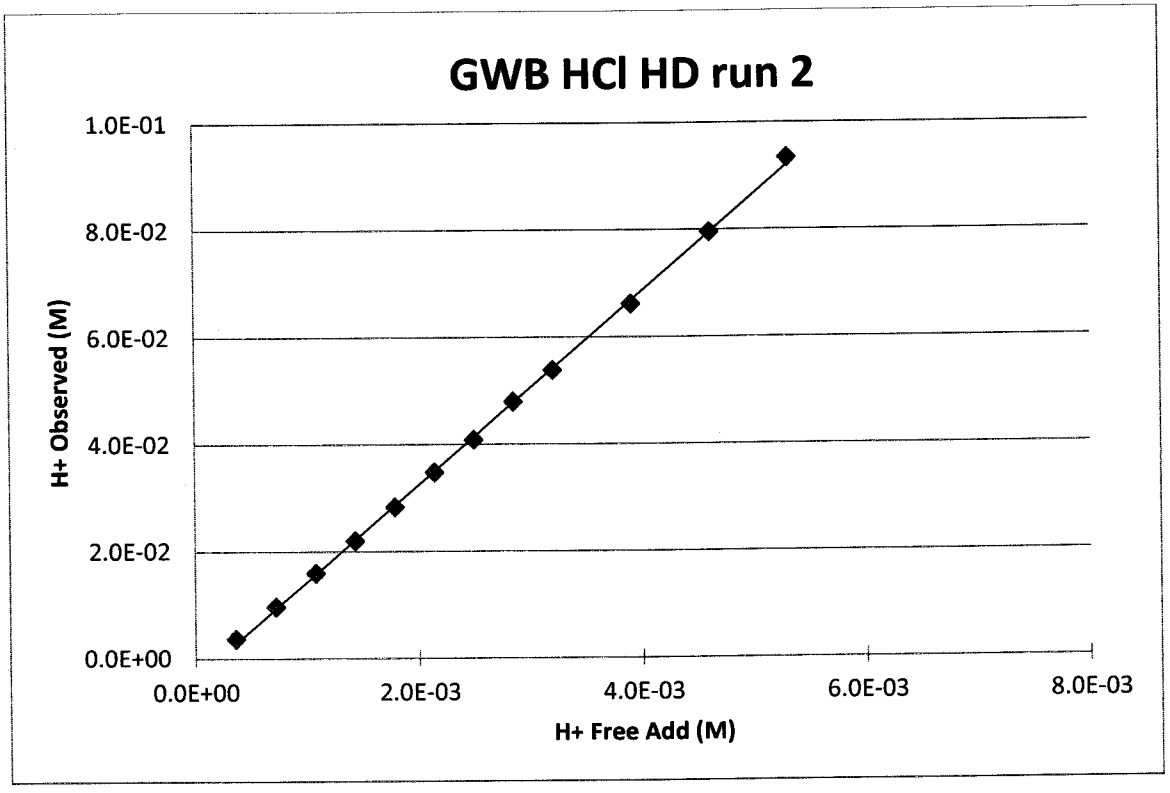


Type:	GWB
SN Reference	WIPP-MM MgO-14 p. 16
Solution Reference	WIPP-FePb-3 p. 34
Brine Volume:	50.0 mL
V_{eq}	3.400 mL (based on observation)
Probe:	Ross Sureflow combination pH
Titrant Actual M	1.00 M HCl
Titrant Reference:	WIPP-FePb-1 p. 6, 21

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	7.470	3.388E-08	0.000E+00	--
0.100	7.430	3.715E-08	1.996E-03	--
0.200	7.400	3.981E-08	3.984E-03	--
0.300	7.370	4.266E-08	5.964E-03	--
0.400	7.330	4.677E-08	7.937E-03	--
0.500	7.300	5.012E-08	9.901E-03	--
0.600	7.270	5.370E-08	1.186E-02	--
0.700	7.230	5.888E-08	1.381E-02	--
0.800	7.200	6.310E-08	1.575E-02	--
0.900	7.170	6.761E-08	1.768E-02	--
1.000	7.130	7.413E-08	1.961E-02	--
1.100	7.090	8.128E-08	2.153E-02	--
1.200	7.060	8.710E-08	2.344E-02	--
1.300	7.020	9.550E-08	2.534E-02	--
1.400	6.980	1.047E-07	2.724E-02	--
1.500	6.940	1.148E-07	2.913E-02	--
1.600	6.900	1.259E-07	3.101E-02	--
1.700	6.860	1.380E-07	3.288E-02	--
1.800	6.820	1.514E-07	3.475E-02	--
1.900	6.780	1.660E-07	3.661E-02	--
2.000	6.730	1.862E-07	3.846E-02	--
2.100	6.680	2.089E-07	4.031E-02	--
2.200	6.630	2.344E-07	4.215E-02	--
2.300	6.560	2.754E-07	4.398E-02	--
2.400	6.520	3.020E-07	4.580E-02	--
2.500	6.460	3.467E-07	4.762E-02	--
2.600	6.350	4.467E-07	4.943E-02	--
2.700	6.310	4.898E-07	5.123E-02	--
2.800	6.230	5.888E-07	5.303E-02	--

2.900	6.130	7.413E-07	5.482E-02	--
2.950	6.080	8.318E-07	5.571E-02	--
3.000	6.020	9.550E-07	5.660E-02	--
3.050	5.920	1.202E-06	5.749E-02	--
3.100	5.860	1.380E-06	5.838E-02	--
3.150	5.800	1.585E-06	5.927E-02	--
3.200	5.690	2.042E-06	6.015E-02	--
3.250	5.560	2.754E-06	6.103E-02	--
3.300	5.390	4.074E-06	6.191E-02	--
3.350	5.120	7.586E-06	6.279E-02	--
3.400	4.500	3.162E-05	0.000E+00	--
3.450	2.440	3.631E-03	9.355E-04	3.584E-04
3.500	2.020	9.550E-03	1.869E-03	7.162E-04
3.550	1.800	1.585E-02	2.801E-03	1.073E-03
3.600	1.660	2.188E-02	3.731E-03	1.430E-03
3.650	1.550	2.818E-02	4.660E-03	1.785E-03
3.700	1.460	3.467E-02	5.587E-03	2.141E-03
3.750	1.390	4.074E-02	6.512E-03	2.495E-03
3.800	1.320	4.786E-02	7.435E-03	2.849E-03
3.850	1.270	5.370E-02	8.357E-03	3.202E-03
3.950	1.180	6.607E-02	1.019E-02	3.906E-03
4.050	1.100	7.943E-02	1.203E-02	4.608E-03
4.150	1.030	9.333E-02	1.385E-02	5.307E-03

-- Indicates data not used in slope regression



Type:	GWB
SN Reference	WIPP-MM MgO-14 p. 17
Solution Reference	WIPP-FePb-3 p. 34
Brine Volume:	50.0 mL
V_{eq}	3.400 mL (based on observation)
Probe:	Ross Sureflow combination pH
Titrant Actual M	1.00 M HCl
Titrant Reference:	WIPP-FePb-1 p. 6, 21

Addition (mL)	pH	H+ Observed (M)	H+ Add (M)	H+ Free Add (M)
0.000	7.510	3.090E-08	0.000E+00	--
0.100	7.470	3.388E-08	1.996E-03	--
0.200	7.440	3.631E-08	3.984E-03	--
0.300	7.400	3.981E-08	5.964E-03	--
0.400	7.370	4.266E-08	7.937E-03	--
0.500	7.340	4.571E-08	9.901E-03	--
0.600	7.300	5.012E-08	1.186E-02	--
0.700	7.270	5.370E-08	1.381E-02	--
0.800	7.230	5.888E-08	1.575E-02	--
0.900	7.200	6.310E-08	1.768E-02	--
1.000	7.160	6.918E-08	1.961E-02	--
1.100	7.130	7.413E-08	2.153E-02	--
1.200	7.090	8.128E-08	2.344E-02	--
1.300	7.050	8.913E-08	2.534E-02	--
1.400	7.010	9.772E-08	2.724E-02	--
1.500	6.970	1.072E-07	2.913E-02	--
1.600	6.930	1.175E-07	3.101E-02	--
1.700	6.890	1.288E-07	3.288E-02	--
1.800	6.840	1.445E-07	3.475E-02	--
1.900	6.800	1.585E-07	3.661E-02	--
2.000	6.750	1.778E-07	3.846E-02	--
2.100	6.700	1.995E-07	4.031E-02	--
2.200	6.650	2.239E-07	4.215E-02	--
2.300	6.590	2.570E-07	4.398E-02	--
2.400	6.530	2.951E-07	4.580E-02	--
2.500	6.470	3.388E-07	4.762E-02	--
2.600	6.400	3.981E-07	4.943E-02	--
2.700	6.310	4.898E-07	5.123E-02	--
2.800	6.220	6.026E-07	5.303E-02	--

2.850	6.120	7.586E-07	5.393E-02	--
2.900	6.060	8.710E-07	5.482E-02	--
2.950	5.990	1.023E-06	5.571E-02	--
3.000	5.910	1.230E-06	5.660E-02	--
3.050	5.820	1.514E-06	5.749E-02	--
3.100	5.580	2.630E-06	5.838E-02	--
3.150	5.400	3.981E-06	5.927E-02	--
3.200	5.100	7.943E-06	6.015E-02	--
3.250	4.240	5.754E-05	0.000E+00	--
3.300	2.380	4.169E-03	9.381E-04	3.594E-04
3.350	2.010	9.772E-03	1.874E-03	7.182E-04
3.400	1.820	1.514E-02	2.809E-03	1.076E-03
3.450	1.680	2.089E-02	3.742E-03	1.434E-03
3.500	1.570	2.692E-02	4.673E-03	1.790E-03
3.550	1.490	3.236E-02	5.602E-03	2.147E-03
3.600	1.410	3.890E-02	6.530E-03	2.502E-03
3.650	1.350	4.467E-02	7.456E-03	2.857E-03
3.700	1.300	5.012E-02	8.380E-03	3.211E-03
3.750	1.250	5.623E-02	9.302E-03	3.564E-03
3.800	1.200	6.310E-02	1.022E-02	3.917E-03
3.850	1.160	6.918E-02	1.114E-02	4.269E-03
3.900	1.130	7.413E-02	1.206E-02	4.621E-03
3.950	1.090	8.128E-02	1.297E-02	4.972E-03
4.000	1.060	8.710E-02	1.389E-02	5.322E-03
4.050	1.030	9.333E-02	1.480E-02	5.671E-03

-- Indicates data not used in slope regression