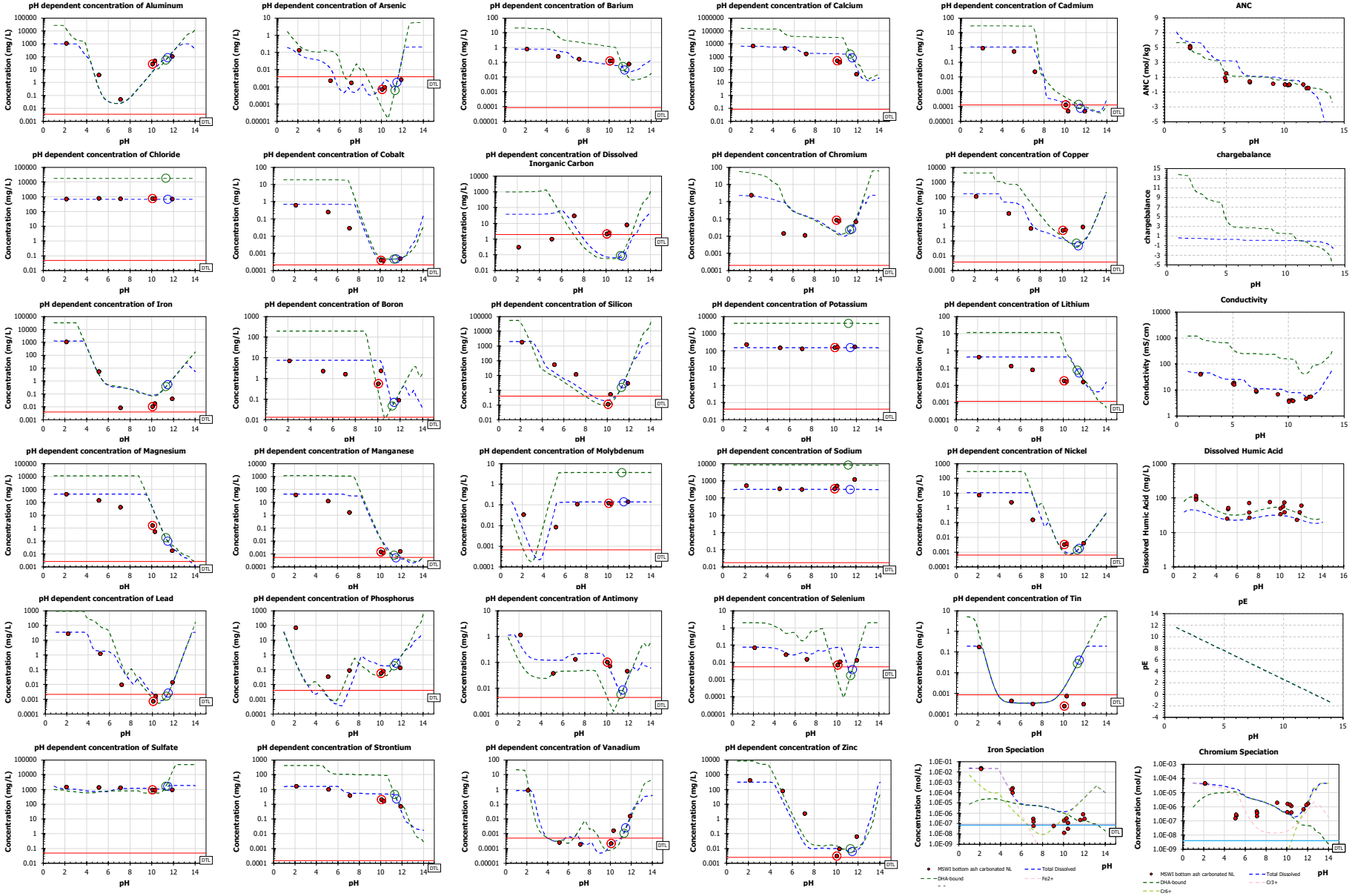
MSWI BOTTOM ASH CARBONATED NL

COMPARISON pH DEPENDENCE WITH MODEL



Object pH Dependent Leaching Test Model
Name MSWI Bottom ash Carbonated NL

pH Dependent Leaching Test Scenario

Lab Test

Extra L/S Simulation

Lab Test

Model Parameters

Entity	Unit	Default
c0		-5.079
c1		0.6359
c2		-0.2942
c3		0.05090
c4		-0.003732
c5		9.770E-05
Clay	mg/kg	3000
Hydrous Ferric Oxid	mg/kg	500.0
L/S	L/kg	10.59
pE		2.170
pH		10.43
Solid Humic Acid	mg/kg	800.0
Simulated Low L/S	L/kg	0.4000

Available Content

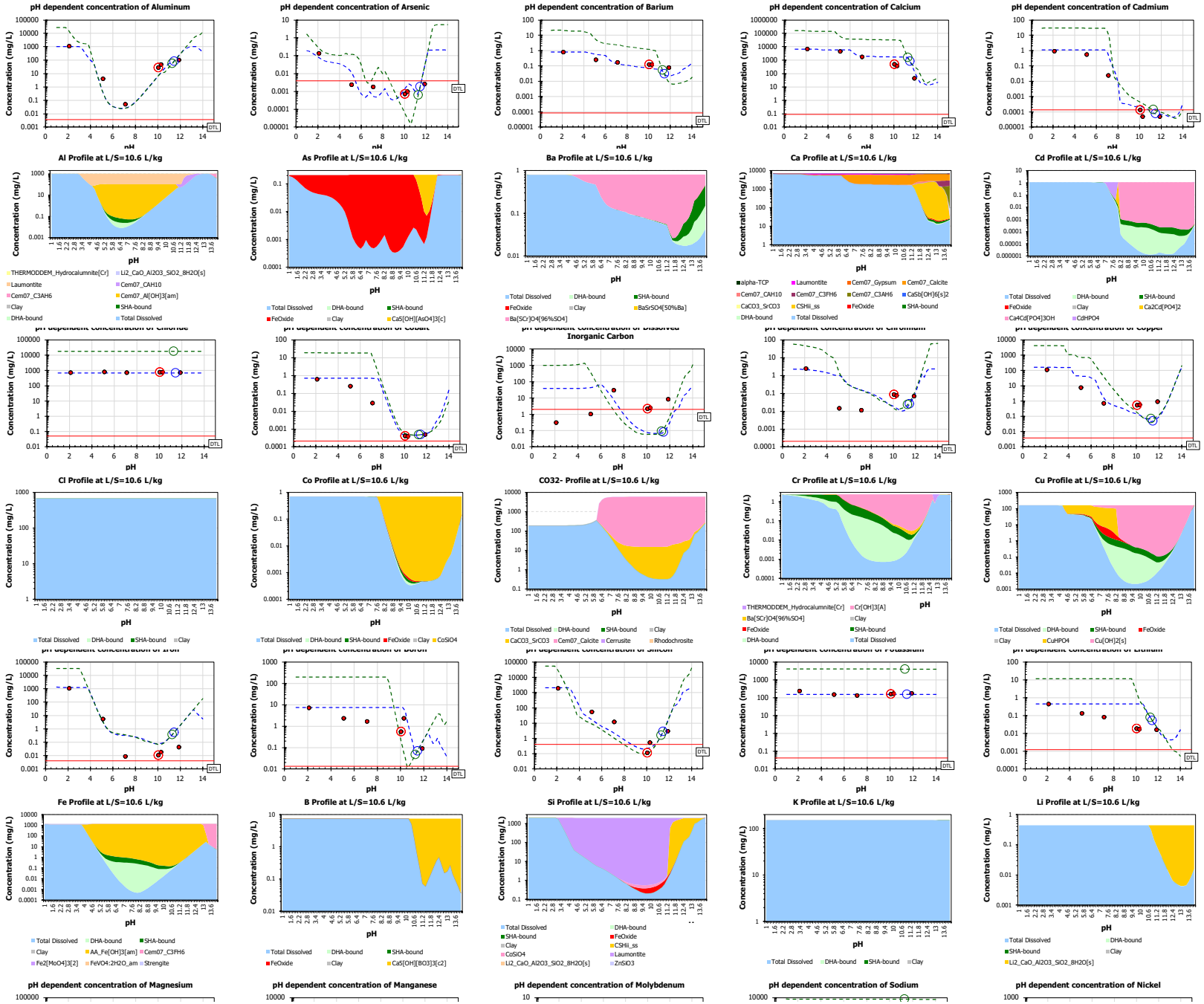
Entity	mg/kg	Entity	mg/kg	Entity	mg/kg
Al	1.083E+04	B	79.54	PO4	1948
As	2.203	Si	2.175E+04	Sb	12.02
Ba	8.447	K	1620	Se	0.7975
Ca	7.186E+04	Li	4.664	Sn	2.036
Cd	11.76	Mg	4501	SO4	1.949E+04
Cl	7190	Mn	464.3	Sr	167.4
Co	7.496	Mo	1.474	V	8.971
CO32-	6.294E+04	Na	3343	Zn	3313
Cr	24.99	Ni	114.7		
Cu	1688	NO3	6.200E-08		
F	1.900E-08	Pb	366.1		
Fe	1.422E+04				

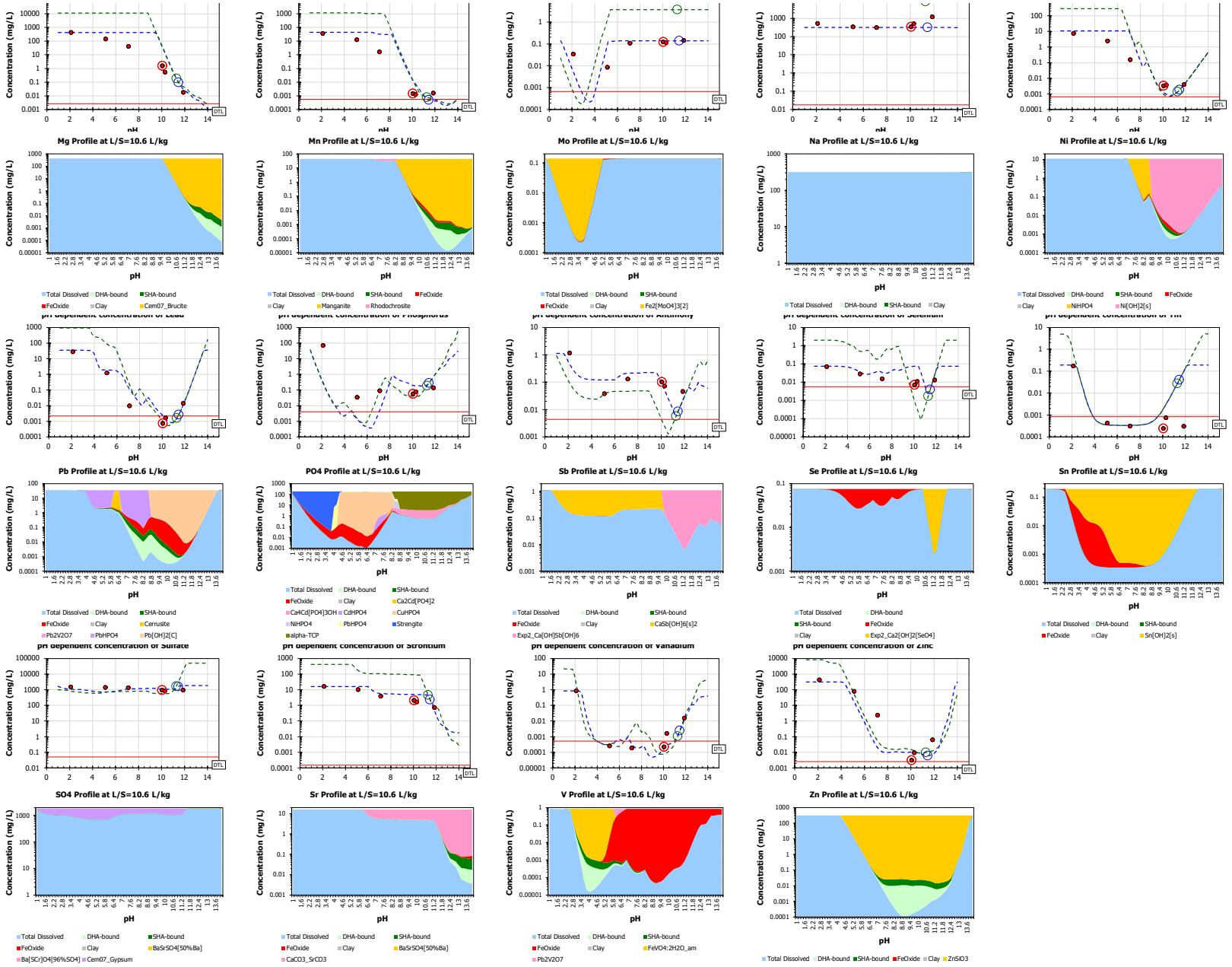
Solid Solutions

Name	End Member	Log(K)	Reaction
CSHii_ss	Cem07_Jenn_ss	-7.799	Cem07_Jenn_ss + 1.33333 H+ -> 1 CSHii_ss + 1.66667 Ca+2 + 1.76667 H2O + 1 H2SiO4-2
	Cem07_Tob_II_ss	10.36	Cem07_Tob_II_ss -> 1 CSHii_ss + 0.83333 Ca+2 + 0.33333 H+ + 0.16667 H2O + 1 H2SiO4-2

Minerals

Name	Log(K)	Reaction
AA_Fe[OH]3[am]	16.60	AA_Fe[OH]3[am] + 1 H2O -> 1 Fe[OH]4- + 1 H+
alpha-TCP	25.50	alpha-TCP -> 3 Ca+2 + 2 PO4-3
Ba[SCr]O4[96%SO4	9.790	Ba[SCr]O4[96%SO4] -> 1 Ba+2 + 0.04 CrO4-2 + 0.96 SO4-2
BaSrSO4[50%Ba]	8.221	BaSrSO4[50%Ba] -> 0.5 Ba+2 + 1 SO4-2 + 0.5 Sr+2
Ca2Cd[PO4]2	32.95	Ca2Cd[PO4]2 -> 2 Ca+2 + 1 Cd+2 + 2 PO4-3
Ca4Cd[PO4]3OH	39.23	Ca4Cd[PO4]3OH + 1 H+ -> 4 Ca+2 + 1 Cd+2 + 1 H2O + 3 PO4-3
Ca5[OH][AsO4]3[c]	26.13	Ca5[OH][AsO4]3[c] + 1 H+ -> 3 AsO4-3 + 5 Ca+2 + 1 H2O
Ca5[OH][BO3]3[c2]	-53.00	Ca5[OH][BO3]3[c2] + 7 H+ -> 5 Ca+2 + 3 H2BO3- + 1 H2O
CaCO3_SrCO3	19.85	CaCO3_SrCO3 -> 2 CO3-2 + 1 Ca+2 + 1 Sr+2
CaSb[OH]6[s]2	19.41	CaSb[OH]6[s]2 -> 1 Ca+2 + 2 Sb[OH]6-
CdHPO4	26.48	CdHPO4 -> 1 Cd+2 + 1 H+ + 1 PO4-3
Cem07_Al[OH]3[am	13.76	Cem07_Al[OH]3[am] + 1 H2O -> 1 Al[OH]4- + 1 H+
Cem07_Brucite	-16.83	Cem07_Brucite + 2 H+ -> 2 H2O + 1 Mg+2
Cem07_C3AH6	-35.14	Cem07_C3AH6 + 4 H+ -> 2 Al[OH]4- + 3 Ca+2 + 4 H2O
Cem07_C3FH6	-30.82	Cem07_C3FH6 + 4 H+ -> 3 Ca+2 + 2 Fe[OH]4- + 4 H2O
Cem07_CAH10	7.505	Cem07_CAH10 -> 2 Al[OH]4- + 1 Ca+2 + 6 H2O
Cem07_Calcite	8.485	Cem07_Calcite -> 1 CO3-2 + 1 Ca+2
Cem07_Gypsum	4.583	Cem07_Gypsum -> 1 Ca+2 + 2 H2O + 1 SO4-2
Cerrusite	13.13	Cerrusite -> 1 CO3-2 + 1 Pb+2
CoSiO4	6.289	CoSiO4 + 2 H+ -> 2 Co+2 + 1 H2SiO4-2
Cr[OH]3[A]	68.13	Cr[OH]3[A] + 1 H2O -> 1 CrO4-2 + 5 H+ + 3 e-
Cu[OH]2[s]	-8.640	Cu[OH]2[s] + 2 H+ -> 1 Cu+2 + 2 H2O
CuHPO4	26.00	CuHPO4 -> 1 Cu+2 + 1 H+ + 1 PO4-3
Exp2_Ca[OH]Sb[OH]6	1.000	Exp2_Ca[OH]Sb[OH]6 + 1 H+ -> 1 Ca+2 + 1 H2O + 1 Sb[OH]6-
Exp2_Ca2[OH]2[SeO4]	-8.000	Exp2_Ca2[OH]2[SeO4] + 2 H+ -> 2 Ca+2 + 2 H2O + 1 SeO4-2
Fe2[MoO4]3[2]	86.35	Fe2[MoO4]3[2] + 8 H2O -> 2 Fe[OH]4- + 8 H+ + 3 MoO4-2
FeVO4:2H2O_am	23.48	FeVO4:2H2O_am + 2 H2O -> 1 Fe[OH]4- + 1 VO2+
Laumontite	118.0	Laumontite + 8 H2O -> 2 Al[OH]4- + 1 Ca+2 + 8 H+ + 4 H2SiO4-2
Li2_CaO_Al2O3_SiO2_8H2O[s]	22.69	Li2_CaO_Al2O3_SiO2_8H2O[s] -> 2 Al[OH]4- + 1 Ca+2 + 3 H2O + 1 H2SiO4-2 + 2 Li+
Manganite	-25.27	Manganite + 3 H+ + 1 e- -> 2 H2O + 1 Mn+2
Ni[OH]2[s]	-10.80	Ni[OH]2[s] + 2 H+ -> 2 H2O + 1 Ni+2
NiHPO4	25.00	NiHPO4 -> 1 H+ + 1 Ni+2 + 1 PO4-3
Pb[OH]2[C]	-8.150	Pb[OH]2[C] + 2 H+ -> 2 H2O + 1 Pb+2
Pb2V2O7	0.9500	Pb2V2O7 + 3 H+ -> 1.5 H2O + 1 Pb+2 + 1 VO2+
Pb3[VO4]2	-3.070	Pb3[VO4]2 + 4 H+ -> 2 H2O + 1.5 Pb+2 + 1 VO2+
PbHPO4	28.00	PbHPO4 -> 1 H+ + 1 PO4-3 + 1 Pb+2
Rhodochrosite	10.41	Rhodochrosite -> 1 CO3-2 + 1 Mn+2
Sn[OH]2[s]	1.447	Sn[OH]2[s] + 2 H+ -> 2 H2O + 1 Sn+2
Strengite	48.00	Strengite + 2 H2O -> 1 Fe[OH]4- + 4 H+ + 1 PO4-3
THERMODDEM_Hydrocalumnite[Cr]	-25.34	THERMODDEM_Hydrocalumnite[Cr] + 4 H+ -> 2 Al[OH]4- + 4 Ca+2 + 1 CrO4-2 + 13 H2O
ZnSiO3	18.69	ZnSiO3 + 1 H2O -> 1 H2SiO4-2 + 1 Zn+2


pH dependent concentration of Aluminum
pH dependent concentration of Arsenic
pH dependent concentration of Barium
pH dependent concentration of Calcium
pH dependent concentration of Cadmium
Al Profile at L/S=10.6 L/kg
As Profile at L/S=10.6 L/kg
Ba Profile at L/S=10.6 L/kg
Ca Profile at L/S=10.6 L/kg
Cd Profile at L/S=10.6 L/kg
pH dependent concentration of Chloride
pH dependent concentration of Cobalt
Inorganic Carbon
pH dependent concentration of Chromium
pH dependent concentration of Copper
Cl Profile at L/S=10.6 L/kg
Co Profile at L/S=10.6 L/kg
CO32- Profile at L/S=10.6 L/kg
Cr Profile at L/S=10.6 L/kg
Cu Profile at L/S=10.6 L/kg
pH dependent concentration of Iron
pH dependent concentration of Boron
pH dependent concentration of Silicon
pH dependent concentration of Potassium
pH dependent concentration of Lithium
Fe Profile at L/S=10.6 L/kg
B Profile at L/S=10.6 L/kg
Si Profile at L/S=10.6 L/kg
K Profile at L/S=10.6 L/kg
Li Profile at L/S=10.6 L/kg
pH dependent concentration of Magnesium
pH dependent concentration of Manganese
pH dependent concentration of Molybdenum
pH dependent concentration of Sodium
pH dependent concentration of Nickel
Concentration (mg/L)
pH
DTL
Total Dissolved
DHA-bound
SHA-bound
FeOxide
Clay
THERMODDEM_Hydrocalumnite[Cr]
Li2_CaO_Al2O3_SiO2_8H2O[s]
Laumontite
Cem07_CAH10
Cem07_C3AH6
Cem07_Al[OH]3[am]
Ca5[OH][AsO4]3[c]
BaSrSO4[50%Ba]
Ba[SCr]O4[96%SO4]
alpha-TCP
Cem07_Gypsum
Cem07_Calcite
Cem07_CAH10
Cem07_C3FH6
Ca5b[OH]6[s]2
CaCO3_SrCO3
CSHii_ss
Ca2Cd[PO4]2
Ca4Cd[PO4]3OH
CdHPO4
Cr[OH]3[A]
CaCO3_SrCO3
Cem07_Calcite
Cerrusite
Rhodochrosite
CoSiO4
CuHPO4
Cu[OH]2[s]
AA_Fe[OH]3[am]
Fe2[MoO4]3[2]
FeVO4:2H2O_am
Strengite
Ca5[OH][BO3]3[c2]
ZnSiO3


Mg Profile at L/S=10.6 L/kg
Mn Profile at L/S=10.6 L/kg
Mo Profile at L/S=10.6 L/kg
Na Profile at L/S=10.6 L/kg
Ni Profile at L/S=10.6 L/kg
Pb Profile at L/S=10.6 L/kg
PO4 Profile at L/S=10.6 L/kg
Sb Profile at L/S=10.6 L/kg
Se Profile at L/S=10.6 L/kg
Sn Profile at L/S=10.6 L/kg
SO4 Profile at L/S=10.6 L/kg
Sr Profile at L/S=10.6 L/kg
V Profile at L/S=10.6 L/kg
Zn Profile at L/S=10.6 L/kg
Concentration (mg/L)
pH
Total Dissolved
DHA-bound
SHA-bound
FeOxide
Clay
Cem07_Brucite
Manganite
Rhodochrosite
Fe2[MoO4]3[2]
NiHPO4
Ni[OH]2[s]
Ca4Cd[PO4]3OH
CdHPO4
Ca2Cd[PO4]2
CuHPO4
PbHPO4
Strengite
alpha-TCP
CaSb[OH]6[s]2
Exp2_Ca[OH]Sb[OH]6
Exp2_Ca2[OH]2[SeO4]
Pb2V2O7
Pb[OH]2[C]
Cerusite
Sn[OH]2[s]
BaSrSO4[50%Ba]
Ba[SCr]O4[96%SO4]
Cem07_Gypsum
CaCO3_SrCO3
FeVO4:2H2O_am
ZrSiO3

Model Comparison: residuals - Concentration

Name **MSWI Bottom ash Carbonated NL**

Legend

Total Average Deviation Square root of the sum of the squared values of residuals divided by the number of values, over the entire X range.
User Average Deviation Square root of the sum of the squared values of residuals divided by the number of values, over the user defined X range.
Fractional Average Devi: Square root of the sum of the squared values of residuals divided by the number of values, over the fraction.
Note that the Total and User Average Deviation columns are averages as well.

Residual details, concentrations

Residuals as log(model/sample)

Fraction	*6*	*5*	*4*	*3*	*2*	*1*	*Total Avg*
pH	*2.13*	*5.13*	*7.13*	*10.1*	*10.3*	*11.9*	*Deviation*
Al	-0.03	-1.03	-0.26	-0.58	-0.58	0.33	0.23
As	-0.25	0.69	-0.50	0.32	0.37	1.01	0.24
Ba	0.01	0.37	-0.09	-0.24	-0.26	-0.54	0.12
Ca	-0.01	0.11	0.06	0.54	0.66	0.51	0.17
Cd	0.09	0.32	1.33	0.23	0.62	0.16	0.25
Cl	-0.02	-0.05	-0.02	-0.05	-0.04	-0.01	0.01
Co	0.07	0.46	1.39	0.02	0.01	0.03	0.24
CO32-	-	-	-	-	-	-	-
Cr	-0.04	1.83	1.14	-0.67	-0.71	0.04	0.40
Cu	0.18	0.77	0.36	-0.57	-0.68	-1.05	0.27
Fe	0.07	-0.23	1.58	0.88	0.67	1.51	0.41
B	0.03	0.52	0.66	1.13	0.43	0.31	0.25
Si	0.05	-0.52	-0.74	0.29	-0.32	0.68	0.20
K	-0.19	0.01	0.06	-0.01	-0.04	-0.05	0.03
Li	0.01	0.53	0.74	1.38	1.42	0.11	0.36
Mg	0.00	0.49	1.01	1.38	1.40	0.24	0.38
Mn	0.08	0.55	1.30	0.99	0.78	-0.55	0.33
Mo	-0.82	1.04	0.11	0.06	0.09	0.00	0.22
Na	-0.22	-0.03	0.01	-0.03	-0.20	-0.57	0.11
Ni	0.17	0.65	1.63	-0.43	-0.59	0.01	0.32
Pb	0.10	0.18	1.07	0.50	-0.04	-0.06	0.20
Sb	-0.41	0.50	0.21	-0.07	-0.15	-0.31	0.13
Se	0.03	0.11	0.36	1.03	0.83	0.30	0.23
Sn	0.01	-0.08	0.04	0.91	0.62	2.54	0.46
SO4	-0.14	-0.28	-0.06	0.06	0.10	0.30	0.08
Sr	-0.01	0.20	0.17	0.38	0.49	-0.23	0.12
V	-0.01	0.06	0.28	-0.07	-0.77	-0.01	0.14
Zn	-0.12	-0.69	-2.06	0.52	0.02	-0.91	0.40
Avg Deviation	0.04	0.12	0.17	0.12	0.12	0.14	0.23

Yellow = own pH All residuals within + 1 or - 1 are considered to represent a good fit.