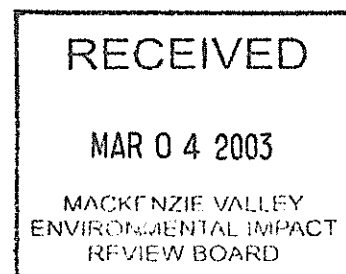


Rec'd via e-mail
Feb 28/03

DE BEERS
A DIAMOND IS FOREVER



28 February 2003

Mackenzie Valley Environmental Impact Review Board (MVEIRB)
Box 938, 5102 – 50th Avenue
Yellowknife, NT X1A 2N7

Attention: Glenda Fratton, Environmental Assessment Coordinator

Dear: Glenda

SUBJECT: Cemented Paste PK Kinetic Test Results

Please accept the attached technical memo titled "Snap Lake Diamond Project - Cemented Paste PK Kinetic Test Results" for submission to the Public Registry. This memo was compiled in response to issues raised by the Department of Fisheries and Oceans during the MVEIRB Technical Sessions.

Should you have any questions, please feel free to contact the undersigned.

Sincerely,

SNAP LAKE DIAMOND PROJECT

ORIGINAL SIGNED BY

Robin Johnstone
Senior Environmental Manager



DE BEERS CANADA MINING INC.

#300 – 5102 50th AVENUE
YELLOWKNIFE NT X1A 3S8 CANADA
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TECHNICAL MEMORANDUM



Golder Associates Ltd.

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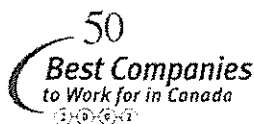
TO:	Robin Johnstone De Beers Canada Mining Inc.	DATE:	February 28, 2003
FROM:	Dawn Kelly and Rick Schryer	JOB NO:	03-1322-017/8800
Prepared By:	Ken DeVos and Rens Verburg		
RE:	SNAP LAKE DIAMOND PROJECT CEMENTED PASTE PK KINETIC TEST RESULTS		

The purpose of this memorandum is to provide a summary of the final data developed from the kinetic tests conducted on the cemented paste processed kimberlite (cemented paste PK) for the Snap Lake Diamond Project. These data were requested by the Department of Fisheries and Oceans Canada (DFO) in the MVEIRB Technical Sessions (November 26 to December 6, 2002) to confirm that the water quality data for cemented paste backfill, as used in the environmental assessment (EA), were appropriate. Of particular interest was the long-term behavior of aluminum and chromium, as the static test used for the EA had predicted elevated aluminum and chromium levels. Table 1 presents the leachate compositions used for the mine discharge water quality predictions generated as part of the EA.

KINETIC TESTS CONDUCTED IN CEMENTED PASTE PK

As discussed in the technical sessions, kinetic tests are repetitive leach tests designed to determine potential long-term leachate characteristics from a geologic material or mine waste (Price 1997; DIAND 1992). To simulate possible conditions on site, three types of kinetic tests were conducted on the cemented paste PK:

- Standard kinetic testing (2 cells; HC 33 and HC 34) – The standard kinetic test cells consist of an approximately 41 cm diameter by 4.5 cm thickness cylinder of cemented paste PK. The cemented paste PK is subjected to a weekly leach cycle. A standard seven-day leach cycle is used in these tests as outlined in Price (1997) modified such that humidified air is passed over the sample for the first six days (the humidified air is more typical of what would be expected underground), followed by a one-day flush whereby distilled water is added to the cell at a 0.5:1 liquid to solid ratio and allowed to soak the sample for 24 hours. The rinse water is analysed for a suite of chemical parameters.



- Subaqueous kinetic testing (2 cells; HC 35 and HC 36) – subaqueous (i.e. flooded) kinetic test cells are of the same dimensions and set-up as the standard kinetic test cells with the exception of the leach cycle. A seven-day leach cycle is still used; however, the water is added to the cell on the first day at a 0.5:1 liquid to solid ratio and allowed to soak the sample for the entire seven days. At the end of the seven days, the water is removed from the cell and analysed for the same suite of chemical parameters. A sub-sample of this water is used in the attenuation testing described below. The water removed from the cell is replaced with fresh water immediately after removal.
- Attenuation testing (2 cells; HC 37 and HC 38) – the attenuation test cells consist of columns containing screened (grain size of 0.5 to 1 inch diameter) and washed rock (HC 37 contains granite rock; HC 38 contains metavolcanic rock). A seven-day leach cycle is used. On the first day, rinse water generated by the subaqueous kinetic testing of cemented paste PK is added to the cell (water from HC 35 is added to HC 37 and water from HC 36 is added to HC 38) at a 0.5:1 liquid to solid ratio and allowed to soak the attenuation material for the entire seven days. At the end of the seven days, the water is removed from the cell and analysed for the comprehensive suite of chemical parameters. The water removed from the cell is replaced with new rinse water from the subaqueous kinetic testing immediately upon removal. This set-up is designed to allow for evaluation of interaction between leachate from cemented paste PK and the host rock material, since leachate will be transported through the host rock after closure. The emphasis of this investigation was on processes that could result in attenuation of certain leachate constituents, for instance through mineral precipitation and/or adsorption.

RESULTS AND CONCLUSIONS FROM KINETIC TESTING

Kinetic test results for the complete 20 week testing period (September 2002 to February 2003), plus the initial (Week 1) data are provided in Tables 2 through 7 and in Figures 1 through 4. The data from the kinetic testing show the following:

- In all kinetic test cells, pH decreased over time to values lower than the value used in the EA (11.8). This decrease is most noticeable in the standard humidity cells in which the pH stabilized at between 8.5 and 9.5. In the subaqueous cells, the decrease was less pronounced. However, in both cells HC 35 and HC 36 the values decreased from greater than 11.5 to less than 10.8 over the 20-week course of testing. The pH trends for each set of cells were very similar.
- In the subaqueous test cells, within the first few week of testing, the chromium concentrations in the kinetic tests rapidly decreased to values more than an order of magnitude lower ($<30 \mu\text{g/L}$) than those used in the EA ($313 \mu\text{g/L}$). In the standard humidity cells, the chromium values decreased even more rapidly, dropping below $5 \mu\text{g/L}$ within seven weeks of testing. Again, good reproducibility was found for the two cells within each set.

- Concentrations of aluminum in the standard humidity cell tests were lower than those used in the EA (468 µg/L) and decreased rapidly in the first five weeks of testing to values approaching 100 µg/L. In the subaqueous tests, concentrations decreased to less than the EA assessed values within 12 weeks of testing and continue on a downward trend.
- For the remaining key parameters as identified in the technical sessions (molybdenum, copper, and ammonium), all long-term concentrations generated by the kinetic tests are either lower than the values used in the EA (81 µg/L, 5.1 µg/L, and 6.6 mg/L, respectively) or, in the case of ammonium in the subaqueous test cell, rapidly decrease to below the values used in the EA (within 3 weeks). Reproducibility between columns is good for all these parameters.
- The data from the attenuation cells show that, in general, leachate quality from the cemented paste PK is not materially changed due to interaction with granite or metavolcanic rock. However, slight increases in the concentration of aluminum and copper (in the early weeks of testing) relative to the input water are observed. These correspond with decreases in the pH of the water from the attenuation column relative to the input water. This provides supporting evidence that the high-pH water from the cemented PK paste is reacting and equilibrating with the rock mass. Chromium concentrations do not appear to be affected by interaction with granite or metavolcanic rock within the timescale represented by the test data.

CLOSING STATEMENT

The kinetic testing completed on the cemented PK paste backfill testing demonstrates that values used in the EA for prediction of cemented PK paste backfill water quality were overly conservative. In other words, the concentrations used in the EA overestimate predicted potential impacts from cemented paste PK backfill. The high concentrations resulting from short-term test results used in the EA do not persist over time. Interaction of cemented PK paste leachate with granite or metavolcanic host rock does not appear to have a significant effect on leachate composition within the timescale represented by the test data, although geochemical reactions do result in a reduction in pH.

REFERENCES

- DIAND. 1992. Guidelines for ARD Prediction in the North. Department of Indian and Northern Affairs. September, 1992.
- Price, W.A. 1997. "Draft Guidelines and Recommended Methods for the Prediction of Metal Leaching and Acid Rock Drainage at Minesites in British Columbia". Reclamation Section, Energy and Minerals Division, BC Ministry of Employment and Investment. April, 1997.

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Table 1
Short-Term Leach Test Results from Cemented Paste Backfill as
Used for the EA Impact Assessment

Parameter	Unit	Concentration Applied to Cemented PK Consolidation Water
pH	pH	11.8
Ag	µg/L	0.025
Al	µg/L	468
As	µg/L	0.7
Ba	µg/L	440
Ca	mg/L	389
Cd	µg/L	0.15
Cl	mg/L	8.6
Co	µg/L	0.25
Cr	µg/L	313
Cu	µg/L	5.1
Fe	µg/L	5
Hg	µg/L	0.05 ^a
K	mg/L	19.0
Mg	mg/L	0.015
Mn	µg/L	0.15
Mo	µg/L	81.1
Na	mg/L	19.2
NH ₄	mg/L	6.6
Ni	µg/L	1.5
NO ₃	mg/L	42.7 ^b
Pb	µg/L	0.40
Se	µg/L	0.43 ^a
Silica	mg/L	177 ^b
SO ₄	mg/L	5.3
Sr	µg/L	4,950
Tl	µg/L	0.25
U	µg/L	0.025
Zn	µg/L	2.5
TSS	µg/L	0.0
TSSk	mg/L	0.0
TSSgt	mg/L	0.0
TSSmtvc	mg/L	0.0
EXP_Fuel_Oil	mg/L	0.0
Alkalinity - CaCO ₃	mg/L	760
Total-P	mg/L	0.013
PO ₄	mg/L	0.02 ^b
TKN	mg/L	26.6 ^b
Be	µg/L	0.1 ^a
V	µg/L	1.2 ^a

Notes:

Shaded values set at one half detection limit.

Values in Table 1 are December 2001 values included in the Site Water Quality mode and used for prediction of EA impacts.

^a elevated detection limit due to sample matrix, decant values used (See EA Appendix IX.1 for details).

^b no analyses available for cemented paste leach, decant value used (See EA Appendix IX.1 for details).

Table 2
Snap Lake Humidity Cell 33
Standard Humidity Cell - Cemented PK

Date	Accum. Weeks	pH	Conductivity (umhos/cm)	Alkalinity (mg CaCO3/L)	Sulphate (mg/L)	Eh (mv)	Chloride (mg/L)	Flouride (mg/L)	Ammonia (mg/L)	NO2 (mg/L)	NO3 (mg/L)	Total P (mg/L)	o-PO4 (mg/L)	TKN (mg/L)	Al (mg/L)	As (mg/L)
25/09/2002	1	11.1	948	176	10	80	5.11	0.035	1.96	0.54	2.05	<0.01	<0.01	3.92	0.36	<0.001
02/10/2002	2	11.1	1302	208	14											
09/10/2002	3	10.7	433	82	9	168	3.11	0.23	1.144	0.296	1.3	<0.01	<0.01	3.14	0.25	<0.001
16/10/2002	4	10.1	298	68	9											
23/10/2002	5	9.8	176	56	5	218	1.65	0.15	0.421	0.198	0.73	<0.01	<0.01	1.96	0.09	<0.001
30/10/2002	6	9.5	150	52	4											
06/11/2002	7	9.4	167	52	3	198	1.92	0.15	0.265	0.198	0.768	<0.01	<0.01	<1	0.1	<0.001
13/11/2002	8	9.5	153	43	2											
20/11/2002	9	9.2	163	43	<1	206	1.57	0.12	0.174	0.164	0.596	<0.01	<0.01	<1	0.11	<0.001
27/11/2002	10	9.3	174	54	4											
04/12/2002	11	9.3	157	47	3	175	1.81	0.13	0.157	0.174	0.709	<0.01	<0.01	<1	0.08	<0.001
11/12/2002	12	9.2	156	47	2											
18/12/2002	13	9.5	133	44	2	175	1.55	0.14	0.079	0.141	0.598	<0.01	<0.01	<1	0.07	<0.001
25/12/2002	14	9.2	121	33	2											
01/01/2003	15	9.2	102	36	2	176	1.11	<0.1	0.051	0.204	0.43	<0.01	<0.01	<1	0.04	<0.001
08/01/2003	16	8.9	128	46	3											
15/01/2003	17	9.2	142	47	2	180	1.2	0.1	0.075	0.135	0.494	<0.01	<0.01	<1	0.06	<0.001
22/01/2003	18	9.2	122	45	2											
29/01/2003	19	8.8	139	46	3	200	2.06	<0.1	0.051	0.195	0.878	<0.01	<0.01	<1	0.06	<0.001
05/02/2003	20	9.4	148	44	4											
12/02/2003	21	9.1	126	43	2	195	1.25	0.5	0.238	0.011	0.442	<0.01	<0.01	<1	0.07	<0.001
Date	Accum. Weeks	Cd (mg/L)	Ca (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Pb (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	K (mg/L)	Se (mg/L)	Ag (mg/L)	Na (mg/L)	Zn (mg/L)
25/09/2002	1	<0.0005	38.2	0.019	<0.001	<0.03	0.002	<0.05	<0.001	0.017	<0.005	38.8	<0.01	<0.0001	26.3	<0.005
02/10/2002	2															
09/10/2002	3	<0.0005	10.4	0.014	<0.001	<0.03	<0.001	<0.05	<0.001	0.012	<0.005	30.1	<0.01	<0.0001	20.3	<0.005
16/10/2002	4															
23/10/2002	5	<0.0005	2.98	0.006	<0.001	<0.03	0.001	0.05	<0.001	0.005	<0.005	21.4	<0.01	<0.0001	14.9	<0.005
30/10/2002	6															
06/11/2002	7	<0.0005	2.37	<0.005	<0.001	0.03	0.003	0.06	<0.001	0.005	<0.005	19.8	<0.01	0.0005	14	<0.005
13/11/2002	8															
20/11/2002	9	<0.0005	2.3	<0.005	<0.001	<0.03	0.002	0.07	<0.001	0.004	<0.005	21	<0.01	<0.0001	18.4	<0.005
27/11/2002	10															
04/12/2002	11	<0.0005	2.23	<0.005	<0.001	<0.03	0.002	0.05	<0.001	0.005	<0.005	18.4	<0.01	<0.0001	13.9	<0.005
11/12/2002	12															
18/12/2002	13	<0.0005	1.82	<0.005	<0.001	<0.03	<0.001	0.06	<0.001	0.004	<0.005	17.2	<0.01	<0.0001	12	<0.005
25/12/2002	14															
01/01/2003	15	<0.0005	1.91	<0.005	<0.001	<0.03	<0.001	<0.05	<0.001	0.004	<0.005	13.2	<0.01	<0.0001	8.7	<0.005
08/01/2003	16															
15/01/2003	17	<0.0005	2.16	<0.005	<0.001	<0.03	<0.001	<0.05	<0.001	0.004	<0.005	15.3	<0.01	<0.0001	11	<0.005
22/01/2003	18															
29/01/2003	19	<0.0005	2.44	<0.005	<0.001	<0.03	<0.001	0.06	<0.001	0.01	<0.005	16.7	<0.01	<0.0001	12.8	0.014
05/02/2003	20															
12/02/2003	21	<0.0005	2.54	<0.005	<0.001	<0.03	<0.001	<0.05	<0.001	0.005	<0.005	16	<0.01	<0.0001	10.3	<0.005

Table 3
Snap Lake Humidity Cell 34
Standard Humidity Cell -
Cemented PK

Date	Accum. Weeks	pH	Conductivity (umhos/cm)	Alkalinity (mg CaCO3/L)	Sulphate (mg/L)	Eh (mv)	Chloride (mg/L)	Flouride (mg/L)	Ammonia (mg/L)	NO2 (mg/L)	NO3 (mg/L)	Total P (mg/L)	o-PO4 (mg/L)	TKN (mg/L)	Al (mg/L)	As (mg/L)
25/09/2002	1	11.4	2400	470	7	75	8.17	0.37	6.63	1	3.65	<0.01	<0.01	7.84	0.46	<0.001
02/10/2002	2	11.6	3200	606	10											
09/10/2002	3	11.1	1107	186	9	116	6.32	0.27	2.59	0.632	2.88	0.02	<0.01	4.2	0.4	<0.001
16/10/2002	4	10.5	439	98	11											
23/10/2002	5	9.7	185	56	3	215	0.924	0.11	0.325	0.103	0.436	0.015	<0.01	<1	0.13	<0.001
30/10/2002	6	9.4	128	54	1											
06/11/2002	7	9.3	143	48	1	198	0.894	<0.1	0.402	0.096	0.402	<0.01	<0.01	<1	0.08	<0.001
13/11/2002	8	9.4	128	41	<1											
20/11/2002	9	9.0	136	42	<1	208	0.753	<0.1	0.228	0.071	0.28	<0.01	<0.01	<1	0.14	<0.001
27/11/2002	10	9.1	158	49	2											
04/12/2002	11	9.1	125	43	1	195	0.804	<0.1	0.172	0.064	0.288	<0.01	<0.01	<1	0.09	<0.001
11/12/2002	12	9.2	125	42	<1											
18/12/2002	13	9.2	110	42	1	180	0.679	<0.1	0.099	0.047	0.246	<0.01	<0.01	<1	0.07	<0.001
25/12/2002	14	9.2	96	29	<1											
01/01/2003	15	9.0	81	32	<1	176	0.557	<0.1	0.055	0.075	0.199	<0.01	<0.01	<1	0.04	<0.001
08/01/2003	16	8.7	109	41	2											
15/01/2003	17	8.9	115	42	<1	180	0.591	<0.1	0.084	0.045	0.232	<0.01	<0.01	<1	0.05	<0.001
22/01/2003	18	8.9	94	38	1											
29/01/2003	19	8.6	110	40	1	200	1.56	<0.1	0.072	0.103	0.68	<0.01	<0.01	<1	0.04	<0.001
05/02/2003	20	9.0	126	38	2											
12/02/2003	21	8.8	96	37	<1	200	0.645	0.29	0.208	0.014	0.229	<0.01	<0.01	<1	0.05	<0.001
Date	Accum. Weeks	Cd (mg/L)	Ca (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Pb (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	K (mg/L)	Se (mg/L)	Ag (mg/L)	Na (mg/L)	Zn (mg/L)
25/09/2002	1	<0.0005	142	0.027	0.001	<0.03	0.052	<0.05	<0.001	0.027	<0.005	40.8	<0.01	<0.0001	25.4	0.022
02/10/2002	2															
09/10/2002	3	<0.0005	50.6	0.017	<0.001	<0.03	<0.001	<0.05	<0.001	0.02	<0.005	40	<0.01	<0.0001	26.6	<0.005
16/10/2002	4															
23/10/2002	5	<0.0005	2.86	<0.005	<0.001	0.07	0.004	0.09	<0.001	0.002	<0.005	19.6	<0.01	<0.0001	13	<0.005
30/10/2002	6															
06/11/2002	7	<0.0005	2.57	<0.005	<0.001	0.03	0.002	0.1	<0.001	0.002	<0.005	16.4	<0.01	0.0002	11.2	<0.005
13/11/2002	8															
20/11/2002	9	<0.0005	2.66	<0.005	<0.001	0.07	0.005	0.16	<0.001	0.001	<0.005	17.6	<0.01	<0.0001	14.6	<0.005
27/11/2002	10															
04/12/2002	11	<0.0005	2.81	<0.005	<0.001	0.06	0.004	0.14	<0.001	0.002	<0.005	14.5	<0.01	<0.0001	10.2	<0.005
11/12/2002	12															
18/12/2002	13	<0.0005	3.57	<0.005	<0.001	0.04	0.002	0.13	<0.001	0.001	<0.005	13.5	<0.01	<0.0001	9.4	<0.005
25/12/2002	14															
01/01/2003	15	<0.0005	2.33	<0.005	<0.001	<0.03	0.001	0.1	<0.001	0.001	<0.005	9.8	<0.01	<0.0001	7	<0.005
08/01/2003	16															
15/01/2003	17	<0.0005	3.1	<0.005	<0.001	<0.03	<0.001	0.11	<0.001	0.002	<0.005	12.4	<0.01	<0.0001	8.6	<0.005
22/01/2003	18															
29/01/2003	19	<0.0005	3.22	<0.005	<0.001	<0.03	<0.001	0.15	<0.001	0.006	<0.005	12.2	<0.01	<0.0001	9.8	<0.005
05/02/2003	20															
12/02/2003	21	<0.0005	2.6	<0.005	<0.001	<0.03	<0.001	0.13	<0.001	0.002	<0.005	11.2	<0.01	<0.0001	7.3	<0.005

Table 4
 Snap Lake Humidity Cell 35
 Subaqueous Humidity Cell -
 Cemented PK

Date	Accum. Weeks	pH	Conductivity (umhos/cm)	Alkalinity (mg CaCO3/L)	Sulphate (mg/L)	Eh (mv)	Chloride (mg/L)	Flouride (mg/L)	Ammonia (mg/L)	NO2 (mg/L)	NO3 (mg/L)	Total P (mg/L)	o-PO4 (mg/L)	TKN (mg/L)	Al (mg/L)	As (mg/L)
25/09/2002	1	11.7	4020	800	8	80	16	0.54	13.7	2.05	7.44	<0.01	<0.01	15.96	0.52	<0.001
02/10/2002	2	11.7	3210	550	8											
09/10/2002	3	11.6	3140	545	11	103	7.08	0.46	6.205	0.546	3.82	<0.01	<0.01	7.84	0.57	<0.001
16/10/2002	4	11.3	2240	441	12											
23/10/2002	5	11.4	2060	413	14	131	4.58	0.5	3.618	0.475	2.4	<0.01	<0.01	4.2	0.62	<0.001
30/10/2002	6	11.3	1810	328	14											
06/11/2002	7	11.2	1591	310	14	142	3.23	0.47	2.702	0.289	1.69	<0.01	0.011	2.66	0.55	<0.001
13/11/2002	8	11.0	1313	228	16											
20/11/2002	9	11.1	1311	229	17	145	2.00	0.51	1.67	0.174	1.06	<0.01	<0.01	3.36	0.69	<0.001
27/11/2002	10	10.9	960	142	19											
04/12/2002	11	11.0	1024	173	25	163	1.76	0.52	1.11	0.108	1.02	0.014	<0.01	1.68	0.51	<0.001
11/12/2002	12	10.9	964	167	18											
18/12/2002	13	10.9	848	144	16	133	1.29	0.53	0.774	0.056	0.675	<0.01	<0.01	<1	0.41	<0.001
25/12/2002	14	10.8	620	116	16											
01/01/2003	15	10.7	715	126	17	155	0.916	0.51	0.522	0.095	0.551	<0.01	<0.01	<1	0.42	<0.001
08/01/2003	16	10.9	684	141	21											
15/01/2003	17	10.8	603	117	17	150	0.758	0.49	0.438	0.027	0.49	<0.01	<0.01	<1	0.37	<0.001
22/01/2003	18	10.8	574	120	15											
29/01/2003	19	10.7	540	99	20	150	0.082	0.46	0.296	0.017	0.435	<0.01	<0.01	<1	0.31	<0.001
05/02/2003	20	10.6	561	94	23											
12/02/2003	21	10.7	536	109	22	150	0.464	<0.1	0.028	0.113	0.35	<0.01	<0.01	<1	0.31	<0.001
Date	Accum. Weeks	Cd (mg/L)	Ca (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Pb (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	K (mg/L)	Se (mg/L)	Ag (mg/L)	Na (mg/L)	Zn (mg/L)
25/09/2002	1	<0.0005	243	0.048	0.003	<0.03	0.003	<0.05	<0.001	0.05	<0.005	61.9	<0.01	<0.0001	43.5	<0.005
02/10/2002	2															
09/10/2002	3	<0.0005	199	0.037	0.002	<0.03	0.002	<0.05	<0.001	0.039	<0.005	42	<0.01	<0.0001	26.7	<0.005
16/10/2002	4															
23/10/2002	5	<0.0005	151	0.03	0.002	<0.03	0.001	<0.05	<0.001	0.031	<0.005	32.9	<0.01	<0.0001	20.2	<0.005
30/10/2002	6															
06/11/2002	7	<0.0005	106	0.019	0.001	<0.03	<0.001	<0.05	<0.001	0.026	<0.005	25.3	<0.01	0.0002	15.1	<0.005
13/11/2002	8															
20/11/2002	9	<0.0005	85.2	0.016	0.001	<0.03	<0.001	<0.05	<0.001	0.022	<0.005	26.5	<0.01	<0.0001	18.8	<0.005
27/11/2002	10															
04/12/2002	11	<0.0005	65.1	0.014	0.001	<0.03	<0.001	<0.05	<0.001	0.024	<0.005	21.1	<0.01	<0.0001	13.7	<0.005
11/12/2002	12															
18/12/2002	13	<0.0005	60	0.008	<0.001	<0.03	<0.001	<0.05	<0.001	0.019	<0.005	19.1	<0.01	<0.0001	11.3	<0.005
25/12/2002	14															
01/01/2003	15	<0.0005	44.6	0.007	<0.001	<0.03	<0.001	<0.05	<0.001	0.017	<0.005	16.8	<0.01	<0.0001	9.6	<0.005
08/01/2003	16															
15/01/2003	17	<0.0005	42.5	0.006	<0.001	<0.03	<0.001	<0.05	<0.001	0.017	<0.005	14.9	<0.01	<0.0001	9	<0.005
22/01/2003	18															
29/01/2003	19	<0.0005	35	0.005	<0.001	<0.03	<0.001	<0.05	<0.001	0.016	<0.005	14.7	<0.01	<0.0001	8.7	<0.005
05/02/2003	20															
12/02/2003	21	<0.0005	35.4	0.005	<0.001	<0.03	<0.001	<0.05	<0.001	0.016	<0.005	14.1	<0.01	<0.0001	7.9	<0.005

Table 5
 Snap Lake Humidity Cell 36
 Subaqueous Humidity Cell -
 Cemented PK

Date	Accum. Weeks	pH	Conductivity (umhos/cm)	Alkalinity (mg CaCO3/L)	Sulphate (mg/L)	Eh (mv)	Chloride (mg/L)	Flouride (mg/L)	Ammonia (mg/L)	NO2 (mg/L)	NO3 (mg/L)	Total P (mg/L)	o-PO4 (mg/L)	TKN (mg/L)	Al (mg/L)	As (mg/L)
25/09/2002	1	11.7	3230	640	10	105	16.6	0.56	12.8	1.26	8.44	<0.01	<0.01	15.4	0.68	<0.001
02/10/2002	2	11.7	2740	492	10											
09/10/2002	3	11.5	2660	475	13	98	9.2	0.44	6.51	0.608	4.97	<0.01	<0.01	7.56	0.61	<0.001
16/10/2002	4	11.4	2030	403	12											
23/10/2002	5	11.5	1915	365	13	129	4.86	0.51	3.281	0.379	2.83	<0.01	<0.01	4.2	0.58	<0.001
30/10/2002	6	11.4	1583	280	14											
06/11/2002	7	11.3	1657	300	12	125	3.94	0.5	2.521	0.251	2.11	<0.01	<0.01	2.52	0.53	<0.001
13/11/2002	8	11.2	1484	278	14											
20/11/2002	9	11.1	1285	228	12	130	2.22	0.48	1.53	0.166	1.24	<0.01	<0.01	2.8	0.52	<0.001
27/11/2002	10	11.1	1228	186	16											
04/12/2002	11	11.0	1213	208	19	160	1.9	0.48	1.06	0.123	1.21	<0.01	<0.01	1.96	0.46	<0.001
11/12/2002	12	10.9	998	170	13											
18/12/2002	13	11.0	970	170	12	117	1.45	0.5	0.665	0.078	0.787	<0.01	<0.01	<1	0.38	<0.001
25/12/2002	14	10.8	580	106	11											
01/01/2003	15	10.8	653	113	12	140	1.01	0.45	0.44	0.112	0.617	<0.01	<0.01	<1	0.34	<0.001
08/01/2003	16	10.8	600	102	15											
15/01/2003	17	10.9	685	129	13	150	0.886	0.46	0.353	0.049	0.545	<0.01	<0.01	<1	0.33	<0.001
22/01/2003	18	10.3	254	50	8											
29/01/2003	19	10.3	300	65	9	160	0.093	0.31	0.263	0.014	0.293	<0.01	<0.01	<1	0.17	<0.001
05/02/2003	20	10.4	305	51	11											
12/02/2003	21	10.3	287	54	9	150	0.342	<0.1	0.028	0.113	0.35	<0.01	<0.01	<1	0.17	<0.001
Date	Accum. Weeks	Cd (mg/L)	Ca (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Pb (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	K (mg/L)	Se (mg/L)	Ag (mg/L)	Na (mg/L)	Zn (mg/L)
25/09/2002	1	<0.0005	167	0.052	0.003	<0.03	0.002	<0.05	<0.001	0.055	<0.005	78	<0.01	<0.0001	55.1	<0.005
02/10/2002	2															
09/10/2002	3	<0.0005	158	0.039	0.002	<0.03	0.001	<0.05	<0.001	0.04	<0.005	48	<0.01	<0.0001	31.1	<0.005
16/10/2002	4															
23/10/2002	5	<0.0005	123	0.031	0.002	<0.03	<0.001	<0.05	<0.001	0.03	<0.005	36	<0.01	<0.0001	22.6	<0.005
30/10/2002	6															
06/11/2002	7	<0.0005	102	0.02	0.001	<0.03	<0.001	<0.05	<0.001	0.025	<0.005	27.7	<0.01	0.0001	16.9	<0.005
13/11/2002	8															
20/11/2002	9	<0.0005	77.9	0.016	0.001	<0.03	<0.001	<0.05	<0.001	0.02	<0.005	26.6	<0.01	<0.0001	18.4	<0.005
27/11/2002	10															
04/12/2002	11	<0.0005	76.8	0.017	0.001	<0.03	<0.001	<0.05	<0.001	0.024	<0.005	22.2	<0.01	<0.0001	15.2	<0.005
11/12/2002	12															
18/12/2002	13	<0.0005	66.9	0.011	0.001	<0.03	<0.001	<0.05	<0.001	0.019	<0.005	19.2	<0.01	<0.0001	12.0	<0.005
25/12/2002	14															
01/01/2003	15	<0.0005	38.5	0.009	<0.001	<0.03	<0.001	<0.05	<0.001	0.016	<0.005	18.2	<0.01	<0.0001	10.3	<0.005
08/01/2003	16															
15/01/2003	17	<0.0005	47.3	0.008	<0.001	<0.03	<0.001	<0.05	<0.001	0.015	<0.005	14.4	<0.01	<0.0001	9.2	<0.005
22/01/2003	18															
29/01/2003	19	<0.0005	19.6	<0.005	<0.001	<0.03	<0.001	<0.05	<0.001	0.01	<0.005	12.5	<0.01	<0.0001	6.9	<0.005
05/02/2003	20															
12/02/2003	21	<0.0005	17.9	<0.005	<0.001	<0.03	<0.001	<0.05	<0.001	0.01	<0.005	10.6	<0.01	<0.0001	5.7	<0.005

Table 6
 Snap Lake Humidity Cell 37
 Granite Attenuation Column -
 Water from HC 35

Date	Accum. Weeks	pH	Conductivity (umhos/cm)	Alkalinity (mg CaCO3/L)	Sulphate (mg/L)	Eh (mv)	Chloride (mg/L)	Flouride (mg/L)	Ammonia (mg/L)	NO2 (mg/L)	NO3 (mg/L)	Total P (mg/L)	o-PO4 (mg/L)	TKN (mg/L)	Al (mg/L)	As (mg/L)
02/10/2002	1	11.7	2770	530	8	25	16.6	0.54	10.76	1.97	7.57	<0.01	<0.01	14.56	1.35	0.001
09/10/2002	2	11.6	2630	510	9											
16/10/2002	3	11.4	2250	480	11	105	6.93	0.4	7.54	0.902	3.95	<0.01	<0.01	7.84	0.99	<0.001
23/10/2002	4	11.4	1713	310	12											
30/10/2002	5	11.3	1445	283	13	155	4.46	0.5	3.94	0.499	2.28	<0.01	<0.01	4.48	0.9	<0.001
06/11/2002	6	11.0	1153	226	15											
13/11/2002	7	10.9	783	141	12	149	3.6	0.49	1.91	0.27	1.68	<0.01	<0.01	3.36	0.79	<0.001
20/11/2002	8	10.8	689	112	16											
27/11/2002	9	10.7	594	90	18	160	2.43	0.54	1.46	0.18	1.25	<0.01	<0.01	1.18	0.69	<0.001
04/12/2002	10	10.3	326	71	18											
11/12/2002	11	10.6	476	40	22	170	1.88	0.64	0.587	0.103	0.99	<0.01	<0.01	1.4	0.65	<0.001
18/12/2002	12	10.4	340	58	20											
25/12/2002	13	10.4	283	58	17	180	1.23	0.61	0.647	0.066	0.701	<0.01	<0.01	1.68	0.47	<0.001
01/01/2003	14	10.0	196	47	17											
08/01/2003	15	10.0	221	39	18	195	1.05	0.66	0.539	0.041	0.63	<0.01	<0.01	<1.0	0.43	<0.001
15/01/2003	16	10.1	211	51	19											
22/01/2003	17	9.9	195	44	20	165	0.824	0.62	0.411	0.026	0.546	<0.01	<0.01	<1	0.4	<0.001
29/01/2003	18	9.3	150	37	17											
05/02/2003	19	9.2	140	32	20	190	0.705	0.61	0.331	0.017	0.504	<0.01	<0.01	<1	0.32	<0.001
12/02/2003	20	9.1	150	30	20											
19/02/2003	21	9.5	149	31	23	200	0.581	0.66	0.301	0.015	0.426	<0.01	0.019	<1	0.31	<0.001

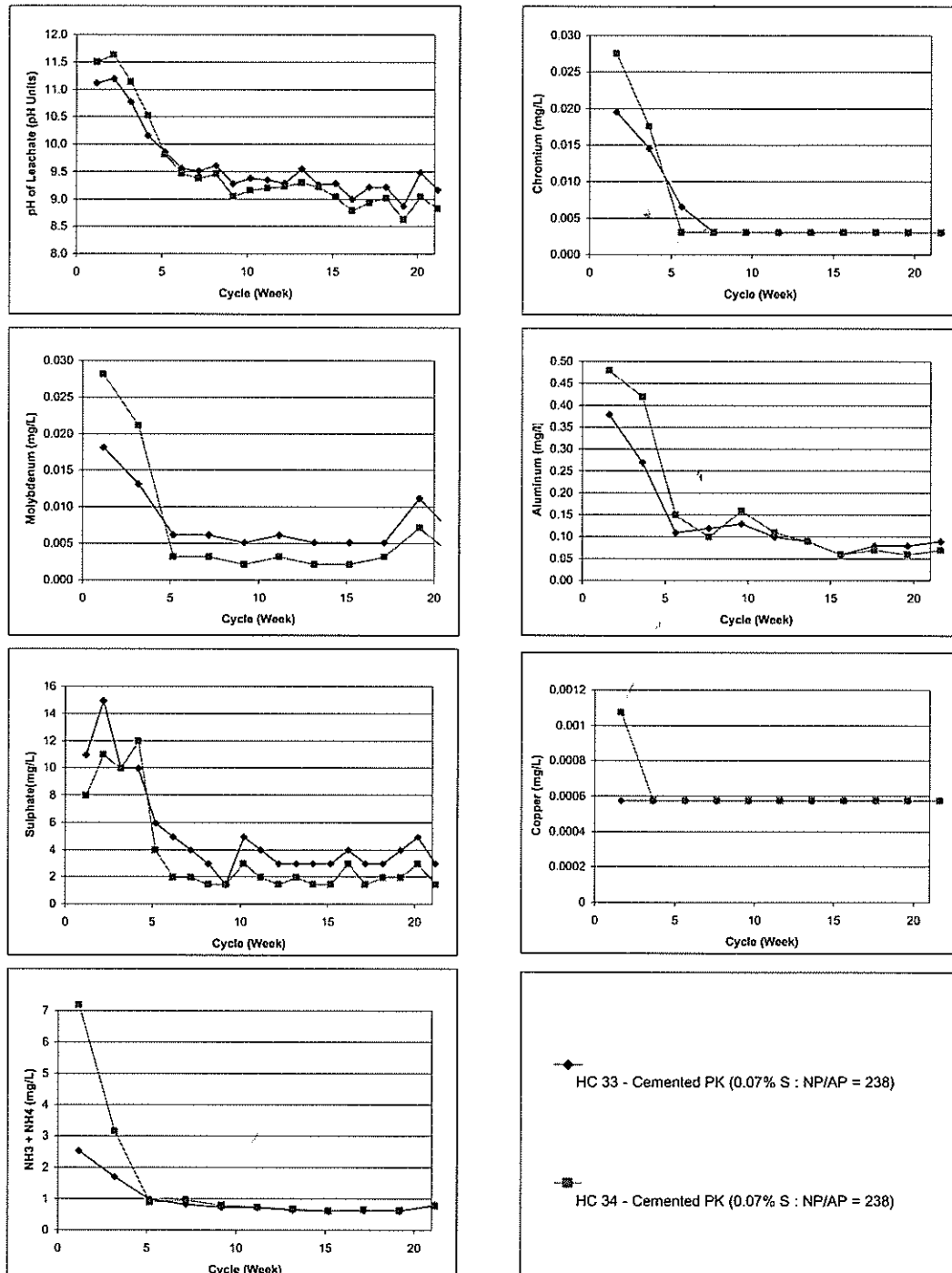
Date	Accum. Weeks	Cd (mg/L)	Ca (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Pb (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	K (mg/L)	Se (mg/L)	Ag (mg/L)	Na (mg/L)	Zn (mg/L)
02/10/2002	1	<0.0005	170	0.051	0.035	<0.03	0.002	<0.05	<0.001	0.056	<0.005	58.4	<0.01	<0.0001	47.9	<0.005
09/10/2002	2															
16/10/2002	3	<0.0005	148	0.037	0.019	<0.03	<0.001	<0.05	<0.001	0.04	<0.005	40.3	<0.01	<0.0001	26.8	<0.005
23/10/2002	4															
30/10/2002	5	<0.0005	97.5	0.031	0.013	<0.03	<0.001	0.1	0.003	0.032	<0.005	32.7	<0.01	<0.0001	20.5	0.03
06/11/2002	6															
13/11/2002	7	<0.0005	44	0.021	0.009	<0.03	<0.001	<0.05	<0.001	0.027	<0.005	26	<0.01	<0.0001	16.2	<0.005
20/11/2002	8															
27/11/2002	9	<0.0005	35.2	0.015	0.006	<0.03	<0.001	<0.05	<0.001	0.022	<0.005	23.5	<0.01	<0.0001	15.7	<0.005
04/12/2002	10															
11/12/2002	11	<0.0005	24.2	0.014	0.006	<0.03	<0.001	<0.05	<0.001	0.024	<0.005	21.2	<0.01	<0.0001	14.4	0.005
18/12/2002	12															
25/12/2002	13	<0.0005	15.3	0.008	0.004	<0.03	<0.001	<0.05	<0.001	0.019	<0.005	18.7	<0.01	<0.0001	11.7	<0.005
01/01/2003	14															
08/01/2003	15	<0.0005	10.8	0.007	0.004	<0.03	<0.001	<0.05	<0.001	0.018	<0.005	17.2	<0.01	<0.0001	10.4	<0.005
15/01/2003	16															
22/01/2003	17	<0.0005	9.98	0.006	0.003	<0.03	<0.001	<0.05	<0.001	0.017	<0.005	15.2	<0.01	<0.0001	9.6	<0.005
29/01/2003	18															
05/02/2003	19	<0.0005	5.41	0.005	0.003	<0.03	<0.001	<0.05	<0.001	0.016	<0.005	14.6	<0.01	<0.0001	9.2	<0.005
12/02/2003	20															
19/02/2003	21	<0.0005	6.68	0.005	0.002	<0.03	<0.001	<0.05	<0.001	0.016	<0.005	14.1	<0.01	<0.0001	8.8	<0.005

Table 7
Snap Lake Humidity Cell 38
MTVC Attenuation Column -
Water from HC 36

Date	Accum. Weeks	pH	Conductivity (umhos/cm)	Alkalinity (mg CaCO3/L)	Sulphate (mg/L)	Eh (mv)	Chloride (mg/L)	Flouride (mg/L)	Ammonia (mg/L)	NO2 (mg/L)	NO3 (mg/L)	Total P (mg/L)	o-PO4 (mg/L)	TKN (mg/L)	Al (mg/L)	As (mg/L)
02/10/2002	1	11.5	1770	340	13	35	19.9	0.57	11.78	1.26	9.49	0.043	<0.01	15.96	1.12	<0.001
09/10/2002	2	11.4	1162	250	12											
16/10/2002	3	11.5	1862	350	19	100	14.3	0.46	6.49	0.608	4.66	<0.01	<0.01	7	0.83	<0.001
23/10/2002	4	11.3	1143	250	13											
30/10/2002	5	11.1	964	170	13	150	5.27	0.51	4.04	0.395	2.79	<0.01	<0.01	4.34	0.66	<0.001
06/11/2002	6	11.1	1186	204	15											
13/11/2002	7	11.1	1112	199	12	161	4.23	0.52	2.28	0.227	2.22	<0.01	<0.01	3.92	0.65	<0.001
20/11/2002	8	10.8	754	119	15											
27/11/2002	9	10.7	525	80	16	160	2.81	0.51	1.00	0.182	1.50	<0.01	<0.01	<1	0.46	<0.001
04/12/2002	10	10.5	392	58	17											
11/12/2002	11	10.5	413	41	17	184	2.2	0.61	0.523	0.141	1.16	<0.01	<0.01	2.52	0.45	<0.001
18/12/2002	12	10.4	313	52	13											
25/12/2002	13	10.6	345	71	13	165	1.55	0.53	0.503	0.088	0.877	<0.01	<0.01	<1	0.50	<0.001
01/01/2003	14	10.0	213	47	13											
08/01/2003	15	10.9	211	42	13	195	1.18	0.5	0.354	0.06	0.694	<0.01	<0.01	<1	0.32	<0.001
15/01/2003	16	10.0	197	49	13											
22/01/2003	17	9.8	189	46	15	175	0.944	0.5	0.225	0.04	0.588	<0.01	<0.01	<1	0.34	<0.001
29/01/2003	18	8.9	130	39	10											
05/02/2003	19	8.9	137	45	10	200	0.561	0.42	0.19	0.027	0.37	<0.01	<0.01	<1	0.18	<0.001
12/02/2003	20	8.8	141	43	12											
19/02/2003	21	9.3	133	42	11	200	0.512	0.41	0.208	0.022	0.294	<0.01	<0.01	<1	0.2	<0.001
Date	Accum. Weeks	Cd (mg/L)	Ca (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Pb (mg/L)	Mg (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	K (mg/L)	Se (mg/L)	Ag (mg/L)	Na (mg/L)	Zn (mg/L)
02/10/2002	1	<0.0005	82	0.05	0.011	<0.03	0.001	<0.05	<0.001	0.057	<0.005	62	<0.01	<0.0001	54.7	0.013
09/10/2002	2															
16/10/2002	3	<0.0005	98.6	0.038	0.006	<0.03	<0.001	<0.05	<0.001	0.041	<0.005	50	<0.01	<0.0001	31.5	<0.005
23/10/2002	4															
30/10/2002	5	<0.0005	53.1	0.032	0.005	<0.03	<0.001	<0.05	<0.001	0.032	<0.005	36.3	<0.01	<0.0001	23.4	<0.005
06/11/2002	6															
13/11/2002	7	<0.0005	61.5	0.024	0.004	<0.03	<0.001	<0.05	<0.001	0.027	<0.005	29.6	<0.01	<0.0001	18.5	<0.005
20/11/2002	8															
27/11/2002	9	<0.0005	28.4	0.017	0.003	<0.03	<0.001	<0.05	<0.001	0.021	<0.005	24.5	<0.01	<0.0001	17.1	<0.005
04/12/2002	10															
11/12/2002	11	<0.0005	19.9	0.018	0.003	<0.03	<0.001	<0.05	<0.001	0.025	<0.005	21.5	<0.01	<0.0001	15.7	<0.005
18/12/2002	12															
25/12/2002	13	<0.0005	17.2	0.012	0.002	<0.03	<0.001	<0.05	<0.001	0.02	<0.005	21.1	<0.01	<0.0001	12.9	<0.005
01/01/2003	14															
08/01/2003	15	<0.0005	9.26	0.009	0.002	<0.03	<0.001	<0.05	<0.001	0.016	<0.005	18.8	<0.01	<0.0001	11	<0.005
15/01/2003	16															
22/01/2003	17	<0.0005	9.17	0.008	0.002	<0.03	<0.001	<0.05	<0.001	0.016	<0.005	16.4	<0.01	<0.0001	10.2	<0.005
29/01/2003	18															
05/02/2003	19	<0.0005	6.43	<0.005	0.001	<0.03	<0.001	0.11	<0.001	0.01	<0.005	14.4	<0.01	<0.0001	7.8	<0.005
12/02/2003	20															
19/02/2003	21	<0.0005	7.93	<0.005	0.001	<0.03	<0.001	0.11	<0.001	0.01	<0.005	13.3	<0.01	<0.0001	6.6	<0.005

HC 33 and 34 Cemented pK Leachate Concentrations

FIGURE 1



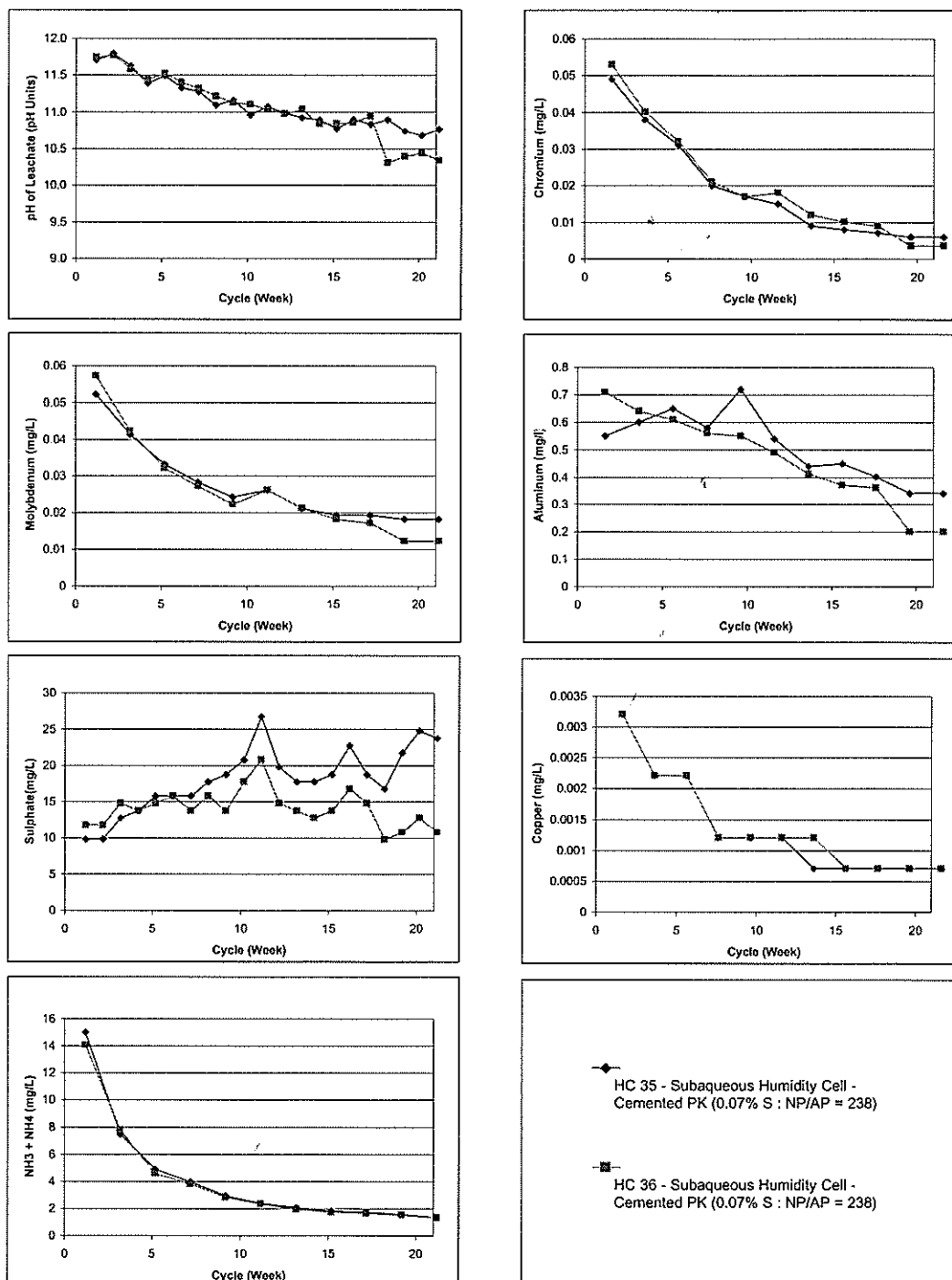
Date: February, 2003
Project: 022-2903

Drawn: GJA
Chkd: KJD

Golder Associates

HC 33 and 34 Cemented pK Leachate Concentrations

FIGURE 2



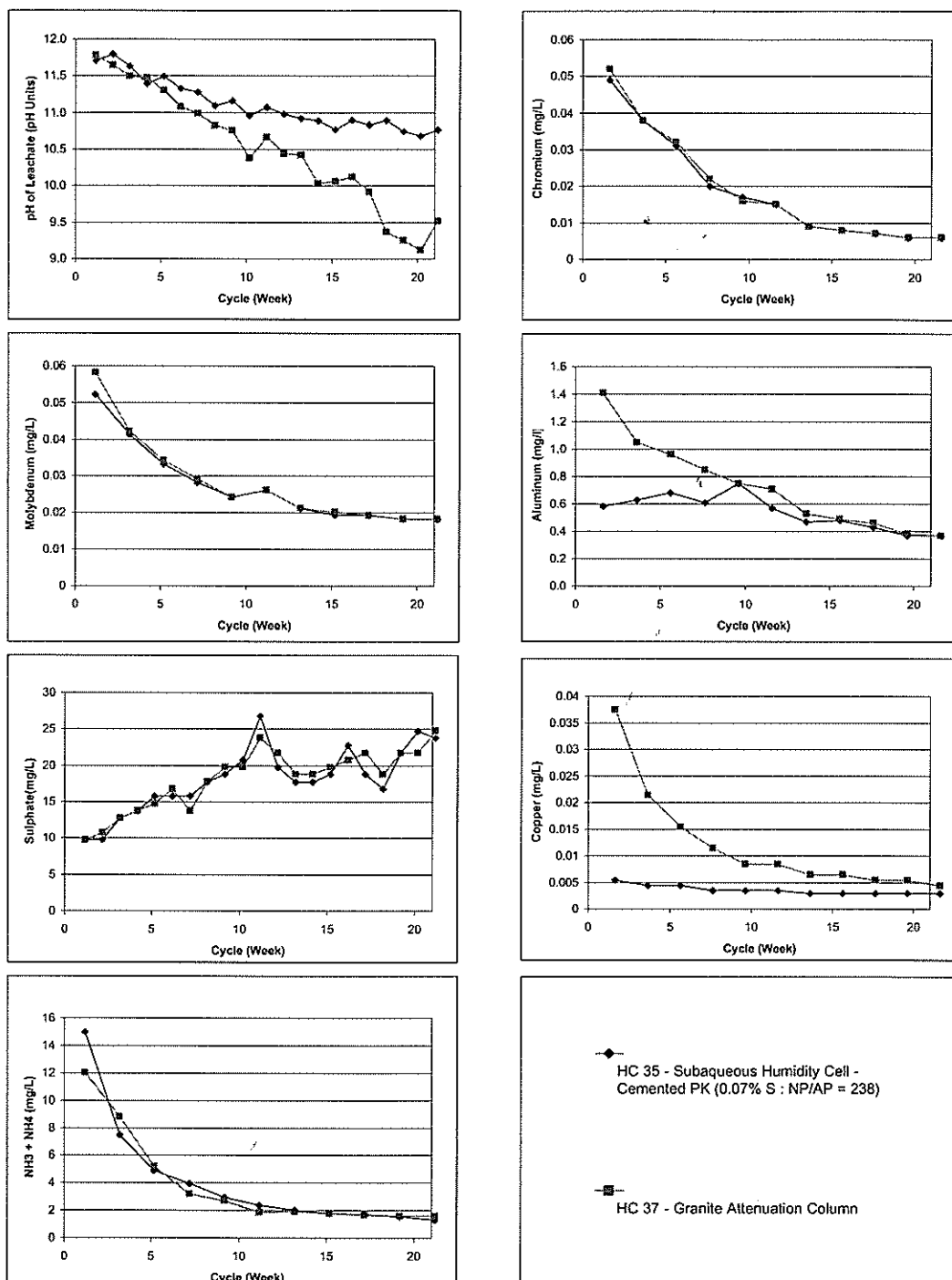
Date: February, 2003
Project: 022-2903

Drawn: GJA
Chkd: KJD

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HC 33 and 34 Cemented pK Leachate Concentrations

FIGURE 3



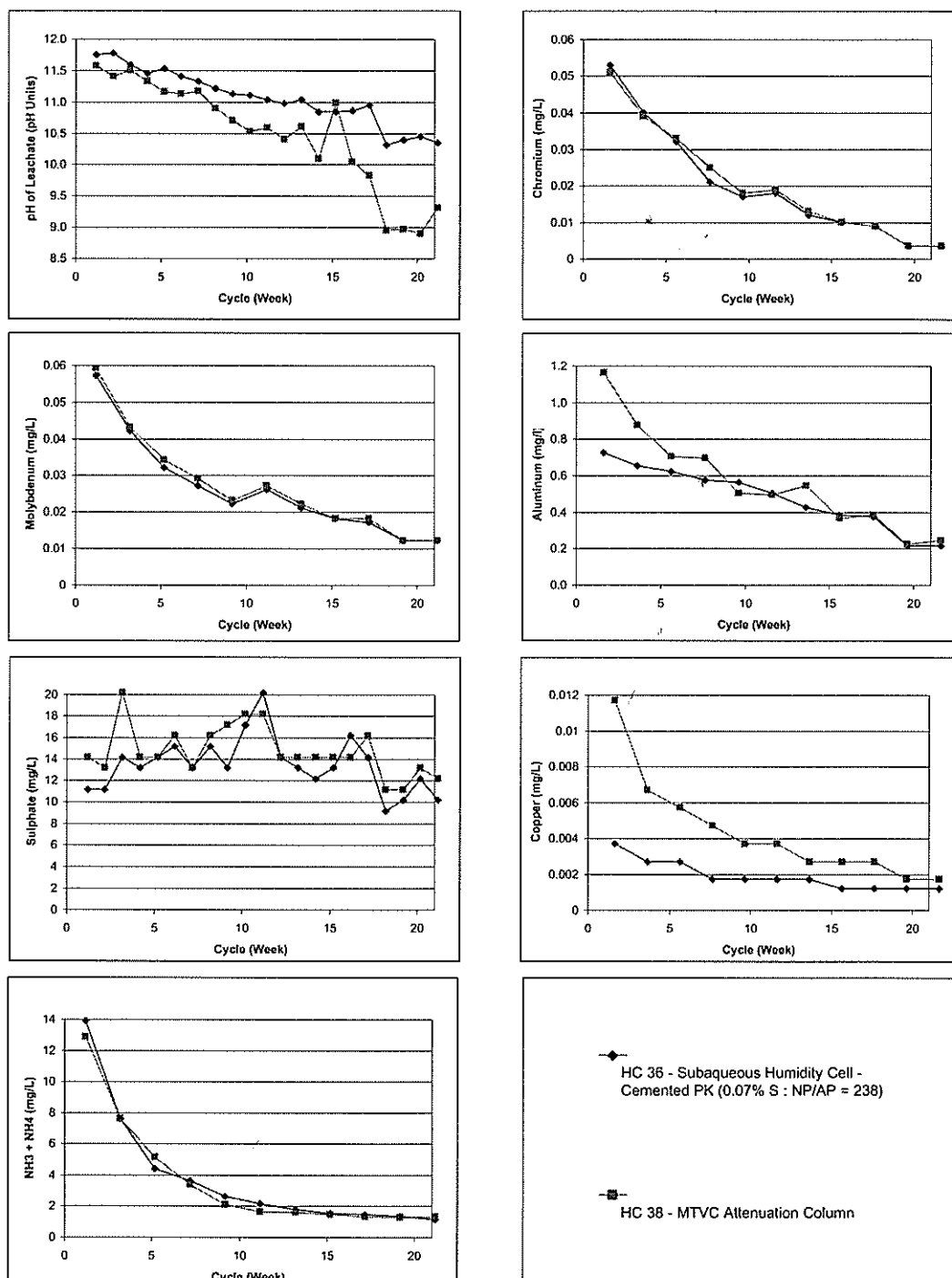
Date: February, 2003
Project: 022-2903

Drawn: GJA
Chkd: KJD

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HC 33 and 34 Cemented pK Leachate Concentrations

FIGURE 4



Date: February, 2003
Project: 022-2903

Drawn: GJA
Chkd: KJD

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