DCN 93-218-044-24
RCN 218-044-05-01

DOE/MC/22118-3583

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FIELD STUDY OF DISPOSED WASTES FROM ADVANCED COAL PROCESSES

DE-AC21-86MC22118

DOE Quarterly Technical Progress Report

April to June 1993

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1.0 OBJECTIVES

The Department of Energy/Morgantown Energy Technology Center (DOE/METC) has initiated research on the disposal of solid wastes from advanced coal processes. The objective of this research is to develop information to be used by private industry and government agencies for planning waste disposal practices associated with advanced coal processes. To accomplish this objective, DOE has contracted Radian Corporation and the North Dakota Energy & Environmental Research Center (EERC) to design, construct, and monitor a limited number of field disposal tests with advanced coal process wastes. These field tests will be monitored over a three year period with the emphasis on collecting data on the field disposal of these wastes.

There has been considerable research on the characteristics and laboratory leaching behavior of coal wastes -- a lesser amount on wastes from advanced coal processes. However, very little information exists on the field disposal behavior of these wastes. Information on field disposal behavior is needed (a) as input to predictive models being developed, b) as input to the development of rule of thumb design guidelines for the disposal of these wastes, and c) as evidence of the behavior of these wastes in the natural environment.

2.0 SUMMARY OF PREVIOUS WORK

This study is organized into four major Tasks. Tasks 1 and 2 were devoted to planning the Task 3 field study. Task 4 uses the results of the field testing to produce an Engineering Design Manual for the utilities and industrial users who manage wastes from advanced coal combustion technologies.

Task 1 identified and rated test design options. A Test Design Manual was prepared and submitted to METC in 1988. Specific test procedures suitable for each design option were identified under Task 2. These test methods were documented in a

Test Procedures Manual, submitted to METC in 1988. Also under Task 2, test sites were selected and site access was negotiated. Sites in Illinois and North Dakota were delayed at this stage, and the North Dakota site was dropped from consideration. Task 2 was completed and Final Test Plans were submitted to METC for three sites in 1988.

Task 3 progress for each of the test sites is summarized below:

2.1 Colorado

The test cell was constructed in June, 1989 with CFBC ash from a low sulfur western coal. The ash has low lime and sulfate content. Core samples were collected in June and December 1989, in March, June, and December of 1990, in June 1991, and most recently in June 1992. No groundwater or porewater samples have been recovered; one surface runoff sample was collected. At this time the three year monitoring period at the Colorado site is completed. The DOE plans further field monitoring at this site on an annual basis. A draft site assessment report, based on the initial three years of monitoring, was completed in December 1992.

The strength of core samples from the Colorado site is low to moderate (200 psi to 900 psi), with permeabilities of 2×10^{-3} to 3×10^{-4} . Laboratory leachates show moderate concentrations of calcium, sulfate, and other common ions. Trace element concentrations in test leachates are low compared to regulatory limits. No leachate has been generated from the test cell at this site.

2.2 Ohio

Two test cells were constructed, in February and April of 1989, using LIMB ash from an Ohio coal with 2.4% sulfur. The ash has a high lime and sulfate content. Test case 1 (North Cell) was constructed with 25% moisture; test case 2 (South Cell) was constructed with 38% moisture to optimize compaction. The wastes expanded,

heaved, and fractured during the first year, particularly in the South Cell. Mineralogical changes in the wastes with hydration and weathering are the primary cause. Core strength is low to moderate (<100 psi to 2000 psi) and highly variable because of fracturing. Field measurements of permeability vary from 3×10^{-3} to 5×10^{-5} cm/sec. Permeabilities are lowest in the North Cell.

Large amounts of water were bound in the wastes in the first year as the waste saturated and hydrated. Starting in the second year, leachate appears to have migrated out of the South Cell into one downgradient well. The leachate at the bottom of the test cell contains up to several thousand mg/L of sulfate, chloride, potassium, and sodium, with somewhat lower concentrations of calcium and silicon. Trace metal concentrations are generally low compared to regulatory limits, but a few samples contain arsenic at concentrations of up to 0.35 mg/L.

Core samples were first collected in June 1989, and quarterly and annual core sampling events have taken place according to schedule since that time. Water samples have been collected on a quarterly basis since October 1989. Final core sampling for the three year monitoring period took place in August 1992. A final site report is in preparation. Further monitoring, on an annual basis, is planned by the DOE.

2.3 Illinois

The first Illinois test cell was completed in April 1991, with BFBC ash from a Illinois coal with 3.1% sulfur. A large excess of limestone is used in the combustor; the ash is high in lime relative to most FBC wastes, containing up to 30% CaO. The ash also contains abundant sulfate, but has relatively low concentrations of typical coal ash constituents compared to other wastes included in this study. The two test cells planned for the second Illinois test case will evaluate the effects of added coal ash on cementitious reactions in the waste. Laboratory studies to define the optimum mix of

FBC waste and coal fly ash are completed. Cell construction, planned for late fall 1992, has been delayed until May 1993 because of permit complications.

The initial cell was instrumented and sampled in June 1991. Water samples and additional cores were collected in August and November 1991, and February and May 1992. No expansion has been noted at the site. The wastes are solidified with unconfined compressive strength between approximately 150 and 550 psi, although some fracture zones may be present in the waste and may reduce overall strength. The permeability measured on cores recovered from the test cell ranges from 1×10^{-6} to 2×10^{-4} ; field permeability measurements range from a high of 3×10^{-3} near the surface to a low of 2×10^{-5} at depth in the test cell. Two years of sampling has been completed at the site.

3.0 OBJECTIVES FOR THE CURRENT REPORTING PERIOD

The specific objectives for the reporting period of April 1993 to June 1993 were as follows:

- Submit cost data for continued monitoring at the Colorado and Ohio sites;
- Meet with the DOE/METC and Ohio Edison representatives in Morgantown in May;
- Collect and analyze eighth quarterly water samples from the first Illinois test case;
- Complete construction of the second Illinois test case;
- Complete production of a short video presentation on the advanced coal wastes test program;
- Load EERC data onto the project database and report as available; and
- Complete the Final Case Report on the Ohio test case.

4.0 ACTIVITIES FOR THE REPORTING PERIOD

A short video documenting the field study has been completed. Copies of the video will be made available to the DOE.

4.1 Colorado Ute Site

A revised cost proposal for continued annual monitoring at the Colorado site was submitted to DOE/METC. The draft Final Site Report will be completed as a final document and data delivered in electronic format pending receipt of comments on the draft document from the DOE.

4.2 Ohio Site

A revised cost proposal for continued annual monitoring at the Ohio site was submitted to the DOE. The draft Final Site Report is in preparation.

4.3 Illinois Site

The eighth set of quarterly water samples was collected in May 1993. The analytical results for these water samples are shown in Table 1. The data indicate no departures from the pattern described in the previous quarterly report. Major element concentrations in groundwater samples from upgradient and downgradient monitoring wells at the Illinois site are illustrated in Figures 1 and 2. The upgradient concentrations of the major analytes calcium, magnesium, sulfate, and alkalinity are highly variable with depth and over time, especially for the shallow well, ILMW-3. Variability of these analytes in the downgradient wells is much lower. In the downgradient wells the concentrations of all analytes except alkalinity are highest in the shallowest well. Upgradient and downgradient concentrations of the major species in the uppermost wells are comparable. The concentrations of calcium, magnesium, and sulfate are consistently

Figure 1. Major cation concentrations in groundwater from the Illinois site during the first two years of monitoring. The numbers shown in the legends indicate the elevation at the bottom of the screened interval in each well in feet above msl.

Chloride, mg/L

Chloride, mg/L

Sulfate, mg/L

Sulfate, mg/L

Total alkalinity, mg/L as HCO₃

Total alkalinity, mg/L as HCO₃

Figure 2. Major anion concentrations in groundwater from the Illinois site during the first two years of monitoring. The numbers shown in the legends indicate the elevation at the bottom of the screened interval in each well in feet above msl.

higher in the upgradient mid-depth well, ILMW-2, than in the downgradient mid-depth well, ILMW-5.

The other major ions, sodium and chloride, show little variation on concentration with depth. Sodium concentrations remain relatively stable over the monitoring period, while the chloride concentration in both upgradient and downgradient locations is much higher in the initial samples than in any subsequent samples. There is no obvious explanation for this trend. Contamination could have occurred, but the consistency of this pattern in all wells but ILMW-5, and the lack of a similar trend in any of the major cations, suggests that this is not the case. There is no clear indication of any contamination of downgradient groundwater as a result of leachate from the test cell.

Trace element concentrations in both upgradient and downgradient wells appear to be affected by prior coal mining operations in the area. Substantial background concentrations of barium, boron, iron, manganese, molybdenum, and strontium are present. No differences between upgradient and downgradient locations are apparent at this time. Concentrations of boron, iron, and manganese are below analytical detection in all lysimeter samples from within the ash indicating that migration of these species from the test is not a source of groundwater contamination. Statistical analysis will be used to evaluate groundwater data as further results are available.

4.3.1 Porewater Chemistry

Ten of the lysimeters installed in the Illinois site which yielded sufficient sample for complete testing were analyzed this quarter. A total of 18 lysimeter samples were collected as wet conditions continued at the site; the samples which were selected for analysis were chosen to represent a complete depth profile through the test cell. The porewater samples collected within the ash are generally similar to previous quarterly samples, with variable, but generally elevated, concentrations of common soluble ions dominated by sodium and potassium sulfates. Calcium concentrations are very low in

many samples, as in past sampling events at the site, but in six of the ten samples substantial calcium concentrations were present, possibly indicating a change in the mineralogical assemblage controlling calcium solubility in the FBC ash. Dissolved silicon concentrations and alkalinities in the porewaters also vary widely.

Figures 3 and 4 show trends in porewater composition with depth and over time. Figure 3 shows the continued decline in major species concentrations over time in near-surface porewaters at the test site. Figure 4 shows the variation in concentrations of eighth quarter porewater samples with depth in the test cell. All depths are relative to the top of the ash, which is presently covered by two feet of vegetated soil. Most of the major analytes shown have a similar distribution, with concentration peaks at depths of six feet and 9.5 feet, and a leached zone in the top two to three feet of the ash. The concentration peak at 9.5 feet occurs within the soils immediately below the base of the test cell.

Minor and trace species concentrations in the lysimeter samples are shown in Figure 5. Molybdenum concentrations mimic the depth profile of most of the major species shown in Figure 4. The distribution with depth of other trace species varies widely, suggesting that a number of different solubility control and leaching mechanisms are affecting trace element mobility in the test cell.

4.3.2 Deionized Water Leachate Chemistry

Deionized water leachates of second annual core samples from the Illinois site were analyzed during this quarter. These results are shown in Table 2. These leachates were prepared by agitating one part core sample from the specified intervals with four parts deionized water over a 48 hour period. The analytical results for selected major and trace species are shown in Figures 6 and 7. All depths are relative to the top of the test cell; two feet of soil cover the eight feet of ash in the cell. The test leachate compositions are dominated by calcium and sulfate, which are both present at concentra-

Figure 3. Major species concentrations in near-surface porewater from the Illinois test cell during the initial two years of monitoring. Concentrations shown represent the average concentrations from all lysimeters at one foot depth in the ash. No anion data are shown since samples were unavailable for analysis before quarter six.

Figure 4. Depth Trends in 8th quarter porewater major species composition. Values shown represent concentrations in individual lysimeters except for at the one foot interval, where two results were averaged. Calcium concentrations show an inverse relation to other major species because of solubility controls by minerals including gypsum, calcite, and ettringite-phase materials.

Minor Elements

Trace Metals

Trace Metals, (cont.)

Figure 5. Depth trends for minor and trace species in 8th quarter porewater samples from the Illinois site. Values less than the detection limits are shown as one half the detection limit value.

Major Cations

Major Anions

Figure 6. Depth trends of major cations and anions in deionized water leachates of core samples collected from the Illinois site 25 months after construction. Calcium and sulfate are the dominant ions; highly soluble ions including potassium, sodium, and chloride are mobilized towards the base of the test cell. Carbonate concentrations were not analyzed because of interference from atmospheric CO_2 .

Trace Metals

Minor elements and pH

Figure 7. Depth trends in the concentrations of minor and trace species in the deionized water leachates of second annual cores from the Illinois site. Other species, including As, Be, B, Mg, Mn, Si, and V are below analytical detection limits in all samples from within the FBC ash. Analytical data suggests that selenium results may have been affected by interferences from high major ion concentrations.

tions of approximately 1000 mg/L, and are distributed more or less uniformly with depth (see Figure 6). Other major ions present include chloride, potassium, and sodium; the peak concentrations of these ions are present between depths of 5 and 10 feet, suggesting that they are being progressively leached from surface zones of the test cell and redistributed towards its base, as is also shown by the lysimeter samples.

The top portion of Figure 7 shows trace element distributions with depth in the deionized water leachates. The regulated trace metals barium, chromium, lead, and selenium are present in above background concentrations in ash leachates, as is molybdenum. The leachable concentrations of all these elements drop sharply at the ash/soil interface suggesting that there has not been a large-scale redistribution of these species into the soils beneath the test cell. The lower portion of Figure 7 shows the solution pH and concentrations of elements present in minor amounts in the deionized water leachates. Dissolved concentrations of silicon and magnesium are lower in the ash leachates than for the underlying soils, while strontium and pH are higher in the ash leachates.

4.3.3 Test Case 5 Construction

Construction of the Test Case 5 test cells at the Illinois site was completed during this quarter. Construction activities and construction quality assurance are described below.

Objectives of the CQA activities and the Materials Testing Program

The objective of the CQA activities was to monitor and document construction of both test cells to confirm that they were constructed as Radian had planned and specified.

The objective of the material testing program was to demonstrate that the laboratory results could be duplicated in the field and to obtain "undisturbed" samples to evaluate material properties over time.

To date, we have been very successful in meeting these objectives. We have some excellent video (30 minutes), photo's, and documentation of how these two cells were constructed. In addition, we have collected all the material samples outlined in the revised test plan. Early sample results indicate we have successfully demonstrated that duplication of laboratory results is possible in a pilot scale situation.

Equipment and Procedures Used to Construct the Two Test Cells

The mixing equipment used for both cells was identical. Only the moisture content of the ash material was different with the two mixes. The main component of the mixing equipment was the Zim-Mixer. The Zim-Mixer is composed of two small silos and a screw mixer. It is typically used in the concrete industry. For our situation, the two silos were used to detain both the FBC ash and the PFA, separately. In addition to the mixer, two 220 barrel silos were utilized to store ash. Both materials were pneumatically transferred into the two silos via transport trucks. The ash was then conveyed by screw conveyors into the Zim-Mixer silos.

The capacity of this particular Zim-Mixer was about 100 tons per day (several other larger and smaller models are available). However, due to the lack of PFA we only achieved a production rate of about 50 to 60 tons per day. Water was added to the dry ash material as it moved from the two small silos to the screw mixer/conveyer. After the material was mixed, it dumped into a conveyer that transported the material into the two cells.

The South Cell (or soil like mix) had the consistency of a saturated sand as it moved up the conveyer. After the material was discharged into the cell, a dozer

spread the material out in 6- to 8-inch lifts. Thirty percent water by weight was added to the 1 to 1 mixture (by weight) of the two ashes. After the material was spread out in lifts, the material was compacted by a vibrating smooth drum roller (discussion of compaction characteristics presented in the next subsection).

The North Cell (or pumpable mix) was substantially more fluid in appearance than the South Cell mix. Forty-two percent water was added by weight to the 1 to 1 mixture of the two ash materials (by weight). The mixed material was transported into the cell by a conveyer which discharged into a back-hoe bucket. When the bucket was full, the ash mixture was poured into the North Cell.

The following major deviations from the project plans and specifications were documented during construction.

- Some material, that was not mixed in accordance with the project specifications, was placed in the cell because there was no other place to dispose of this material. It is estimated that approximately 10 to 15 percent of the mixed material of both cells was not mixed according to the project specifications. This is mainly due to the numerous mixer shut downs and bridging of the material in the silos.
- The thickness of both cells was reduced from 8 feet to 5 feet. This was due to the inadequate supply of the PFA material from SILCO - Duck Creek Station.
- The North Cell material set very quickly (approximately 30 minutes). Therefore, a berm was not needed around the cell to contain the "flowable mix." However, the west end of the cell was covered with soil to prevent erosion per the project plans.

Several other informative items (i.e. various ways to modify the mixing equipment to make it more efficient, a more effective way to transport and place the ash material, etc.) were documented during the construction activities. This information should be very valuable as we develop the design manual.

Results of the Materials Testing Program

The following 5 attachments list the results of the materials testing information to date:

- Attachment A - South Cell Material Testing Summary Tables;
- Attachment B - North Cell Material Testing Summary tables;
- Attachment C - South Cell Proctors;
- Attachment D - Field Density Test Sheets; and
- Attachment E - Unconfined Compression and Permeability Test Sheets.

Attachments A and B summarize the testing results presented in Attachments C through E. The following subsections provide a discussion of the techniques used to quantify the physical properties of the ash mixture placed in the two test cells.

Standard Proctors (ASTM D698)--Three proctors of the material placed in the South Cell were taken during the construction activities and are presented in Attachment C. The proctor results are listed below:

<u>No.</u>	<u>Dry Density (PCF)</u>	<u>Optimum Moisture Content (%)</u>
1	84.2	20.2
2	89.2	23.5
3	90.7	22.6

The first two Proctors were developed using the oven-dry method to obtain moisture content results. The moisture content for the third Proctor was developed using ASTM D4944 (Speedy Moisture Test using calcium carbide). The Speedy test was also the method used in the field to determine moisture contents (see next subsection). Proctor No. 3 was selected as the most representative Proctor of the material placed in

the South Cell and is used in Attachment A to determine percent compaction and the relationship between optimum and the field compaction moisture content.

Moisture Content--The following three techniques were used to determine the moisture content of the ash mixture:

- ASTM D2216 - Oven-dry;
- ASTM D4944 - Speedy Moisture Kit; and
- ASTM D2922 - Nuclear Density Test.

Of the three techniques used, the speedy moisture kit provided the most consistent, "believable", and quickest results. Theoretically it may also be the best technique for this type of waste because of the three techniques, it is the only one that determines the "free" moisture content without driving off water that is chemically bonded within the ash.

The general procedure for determining moisture content by means of a Speedy Kit or calcium carbide gas moisture tester is to place a certain weight of soil together with a certain amount of calcium carbide reagent and shake the tester vigorously with a rotating motion. The calcium carbide reacts with the free moisture within the ash. A simple dial reading is then made, which gives the percent moisture by wet weight of soil, which must then be converted to percent moisture by dry weight of soil.

This procedure was used throughout the construction of the South and North Cells. All the moisture content tests listed in Attachment A (Field Compaction Tests) were determined using this method. A few oven-dry tests were used to verify the Speedy tests during the construction of the South Cell. Generally, the results of the oven-dry tests were within 10 percent of the Speedy tests. The moisture contents listed in Attachment D were determined using the ASTM D2922 (Nuclear Method). The cor-

rection factors were developed by our subcontractor (Whitney and Associates) from the oven-dry moisture contents.

As stated earlier, approximately 30% of water (by weight) was added to the South Cell material during the mixing process. Generally, the materials moisture content during compaction ranged from 25% to 19% (optimum 22.6%). A summary of the South Cell's compaction moisture contents is presented in Attachment A.

Forty-two percent moisture (by weight) was added to the North Cell material during mixing. After the material had been placed in the cell and gained some strength (approximately 30 minutes) the moisture content had changed to approximately 28 to 29 percent.

Density (ASTM D2922)--The nuclear density method was used to determine the in-place wet density of the South Cell ash material after compaction. The wet density was converted to dry density using the Speedy moisture content (See Attachment A -- Field Compaction Results). Generally, over 100% Standard Proctor compaction was achieved on the South Cell material. This was mainly due to the large/heavy compaction equipment used. Dry densities (after compaction) ranged from 90.2 PCF to 104.2 PCF (ASTM max dry density was 90.7 PCF).

Unconfined Compressive Strength (UCS)--The two methods used to estimate the North and South Cell materials UCS was ASTM D2166 and a pocket penetrometer (PP). The PP was used to estimate the UCS of the material between placement and a seven day time period. ASTM D2166 was used to estimate the UCS after 7 days (see Attachment A and B for time period selected).

The preconstruction lab study indicated that a 28 day strength of between 1,200 and 16,00 psi could be achieved for the South Cell mixture. UCS tests performed on cylinders (3" diameter, 6" height) that were molded (ASTM D698) using freshly mixed

material achieved strengths of 1,120 and 1620 psi. A summary of the South Cell strength data is included in Attachment A. In addition, the estimated UCS using the PP immediately after compaction yielded strengths of 14 to 35 psi.

The preconstruction lab study of the North Cell material indicated that a 28 day strength of approximately 400 psi could be achieved. UCS tests performed on cylinders that were molded (no compaction) in the field indicated 28 day strengths of 760 and 790. A summary of the North Cell strength data is included in Attachment B. PP tests performed on the material approximately 30 minutes after placement indicated strengths of less than 7 psi; however, the material would not sluff when a vertical cut was made through the placed material. The PP strength approximately 24 hours after placement ranged from 20 psi to 35 psi.

Both materials achieved most of their maximum strength within a 14 day period.

Permeability (ASTM D5084)--The following 28 day permeability data has been obtained to date for both cells:

<u>Mix</u>	<u>Preconstruction Lab Tests</u>	<u>Sample From Cell</u>
South Cell	2.6E-8 cm/sec	5.16E-7 cm/sec
North Cell	1.5E-8 cm/sec	2.67E-7 cm/sec

The cylinders for the permeability tests were prepared similarly to the methods described above for the UCS tests. Additional permeability tests will be performed by EERC in the coming months. Actual test sheets are included in Appendix E.

5.0

ACTIVITIES PLANNED FOR THE NEXT QUARTER

The following activities are planned for the period of July 1993 through October 1993:

Completion of the Ohio site report;

Finalizing of Year 4 funding and contract modifications; and

Starting Year 4 sampling and analysis.

Table 1

Chemical Characteristics of Liquid From Illinois, Event 8

		Site ID / Location ID							
		Sample ID							
		Log Date							
		IL / ILMW01		IL / ILMW01		IL / ILMW02		IL / ILMW03	
		IL170		IL180 Dup of IL170		IL171		IL172	
		5/09/93		5/09/93		5/09/93		5/09/93	
Parameter	Units								

Anions									
Chloride	mg/L	22.2	(0.100)	24.7	(0.100)	14.1	(0.100)	74.9	(0.100)
Fluoride	mg/L	0.244	(0.0500)	0.253	(0.0500)	0.181	(0.0500)	0.151	(0.0500)
Sulfate	mg/L	491	(2.50)	489	(2.50)	1530	(2.50)	1130	(2.50)
Elements by ICPEs or AA									
Aluminum	mg/L	ND	(0.200)	0.394	(0.200)	< DL	(0.200)	ND	(0.200)
Arsenic	mg/L	ND	(0.00400)	ND	(0.00400)	NR	(0.00400)	NR	(0.00400)
Barium	mg/L	0.0210	(0.0100)	0.0215	(0.0100)	NR	(0.0100)	0.0314	(0.0100)
Beryllium	mg/L	< DL	(0.00200)	0.00414	(0.00200)	< DL	(0.00200)	< DL	(0.00200)
Boron	mg/L	1.16	(0.600)	1.10	(0.600)	NR	(0.600)	NR	(0.600)
Cadmium	mg/L	ND	(0.00100)	ND	(0.00100)	NR	(0.00100)	ND	(0.00100)
Calcium	mg/L	179	(1.00)	189	(1.00)	416	(1.00)	405	(1.00)
Chromium	mg/L	< DL	(0.0100)	< DL	(0.0100)	ND	(0.0100)	< DL	(0.0100)
Cobalt	mg/L	< DL	(0.0100)	< DL	(0.0100)	ND	(0.0100)	ND	(0.0100)
Copper	mg/L	< DL	(0.0200)	< DL	(0.0200)	ND	(0.0200)	< DL	(0.0200)
Iron	mg/L	0.929	(0.0500)	1.01	(0.0500)	ND	(0.0500)	ND	(0.0500)
Lead	mg/L	ND	(0.00300)	0.00350	(0.00300)	0.00720	(0.00300)	< DL	(0.00300)
Magnesium	mg/L	96.9	(1.00)	101	(1.00)	223	(1.00)	23.3	(1.00)
Manganese	mg/L	1.13	(0.0100)	1.21	(0.0100)	1.66	(0.0100)	0.114	(0.0100)
Mercury	mg/L	ND	(0.000180)	NA		ND	(0.000180)	ND	(0.000180)
Molybdenum	mg/L	ND	(0.0500)	ND	(0.0500)	ND	(0.0500)	0.0693	(0.0500)
Nickel	mg/L	ND	(0.0200)	< DL	(0.0200)	< DL	(0.0200)	ND	(0.0200)
Potassium	mg/L	6.62	(3.00)	5.62	(3.00)	NR	(3.00)	12.3	(3.00)
Selenium	mg/L	ND	(0.00500)	ND	(0.00500)	ND	(0.00500)	ND	(0.00500)
Silicon	mg/L	6.34	(1.00)	6.05	(1.00)	6.02	(1.00)	2.86	(1.00)
Silver	mg/L	ND	(0.0100)	ND	(0.0100)	ND	(0.0100)	ND	(0.0100)
Sodium	mg/L	116	(1.00)	120	(1.00)	60.2	(1.00)	64.5	(1.00)
Strontium	mg/L	1.44	(0.00300)	1.50	(0.00300)	0.754	(0.00300)	1.62	(0.00300)
Tin	mg/L	< DL	(0.600)	< DL	(0.600)	< DL	(0.600)	< DL	(0.600)

() = Reporting Limit

C1-1

Table 1
(Continued)

Parameter	Units	Site ID / Location ID							
		Sample ID				Log Date			
		IL / ILMW01		IL / ILMW01		IL / ILMW02		IL / ILMW03	
		IL170		IL180 Dup of IL170		IL171		IL172	
		5/09/93		5/09/93		5/09/93		5/09/93	
<hr/>									
Elements by ICPEs or AA, cont.									
Vanadium	mg/L	< DL	(0.0200)	ND	(0.0200)	< DL	(0.0200)	< DL	(0.0200)
Zinc	mg/L	< DL	(0.0200)	0.0581	(0.0200)	NR	(0.0200)	NR	(0.0200)
Field measurements									
Alkalinity	meq/L	13	(.03)	12.5	(.03)	9.5	(.03)	1.1	(.03)
Conductivity	umhos/cm	2225	(5)	2225	(5)	3075	(5)	2525	(5)
Filterable Residue	mg/L	1288	(1)	1312	(1)	2879	(1)	1900	(1)
Redox (Eh)	mV	0.7	()	0.8	()	3.1	()	-38.0	()
Temperature	deg. C	14.0	()	14.1	()	13.8	()	11.2	()
pH	pH units	6.78	()	6.76	()	6.72	()	7.47	()

() = Reporting Limit

C1-2

Table 1
(Continued)

Parameter	Units	Site ID / Location ID							
		Sample ID		Sample ID		Sample ID		Sample ID	
		Log Date		Log Date		Log Date		Log Date	
		IL / ILMW04		IL / ILMW05		IL / ILMW06		IL / ILMW07	
		IL173		IL174		IL175		IL176	
		5/09/93		5/09/93		5/09/93		5/09/93	
<hr/>									
Anions									
Chloride	mg/L	17.9	(0.100)	18.1	(0.100)	20.2	(0.100)	39.5	(0.100)
Fluoride	mg/L	0.254	(0.0500)	0.268	(0.0500)	0.146	(0.0500)	0.351	(0.0500)
Sulfate	mg/L	442	(2.50)	459	(2.50)	1960	(2.50)	235	(2.50)
<hr/>									
Elements by ICPEs or AA									
Aluminum	mg/L	< DL	(0.200)	0.354	(0.200)	< DL	(0.200)	< DL	(0.200)
Arsenic	mg/L	ND	(0.00400)	ND	(0.00400)	ND	(0.00400)	ND	(0.00400)
Barium	mg/L	0.0138	(0.0100)	0.0178	(0.0100)	0.0106	(0.0100)	0.0273	(0.0100)
Beryllium	mg/L	< DL	(0.00200)	0.00404	(0.00200)	< DL	(0.00200)	< DL	(0.00200)
Boron	mg/L	1.25	(0.600)	1.34	(0.600)	1.07	(0.600)	1.61	(0.600)
Cadmium	mg/L	ND	(0.00100)	< DL	(0.00100)	ND	(0.00100)	ND	(0.00100)
Calcium	mg/L	163	(1.00)	170	(1.00)	440	(1.00)	113	(1.00)
Chromium	mg/L	< DL	(0.0100)	0.0180	(0.0100)	< DL	(0.0100)	< DL	(0.0100)
Cobalt	mg/L	< DL	(0.0100)	ND	(0.0100)	NR	(0.0100)	ND	(0.0100)
Copper	mg/L	ND	(0.0200)	< DL	(0.0200)	< DL	(0.0200)	< DL	(0.0200)
Iron	mg/L	0.779	(0.0500)	0.775	(0.0500)	ND	(0.0500)	1.54	(0.0500)
Lead	mg/L	NR	(0.00300)	0.00340	(0.00300)	< DL	(0.00300)	ND	(0.00300)
Magnesium	mg/L	88.3	(1.00)	92.4	(1.00)	303	(1.00)	63.9	(1.00)
Manganese	mg/L	0.341	(0.0100)	0.374	(0.0100)	1.44	(0.0100)	0.292	(0.0100)
Mercury	mg/L	NA		NA		NA		ND	(0.000180)
Molybdenum	mg/L	ND	(0.0500)	ND	(0.0500)	ND	(0.0500)	< DL	(0.0500)
Nickel	mg/L	ND	(0.0200)	< DL	(0.0200)	0.0249	(0.0200)	ND	(0.0200)
Potassium	mg/L	6.44	(3.00)	6.87	(3.00)	16.2	(3.00)	5.42	(3.00)
Selenium	mg/L	ND	(0.00500)	< DL	(0.00500)	ND	(0.00500)	ND	(0.00500)
Silicon	mg/L	6.57	(1.00)	6.18	(1.00)	6.18	(1.00)	6.93	(1.00)
Silver	mg/L	ND	(0.0100)	< DL	(0.0100)	ND	(0.0100)	ND	(0.0100)
Sodium	mg/L	164	(1.00)	168	(1.00)	146	(1.00)	153	(1.00)
Strontium	mg/L	1.59	(0.00300)	1.67	(0.00300)	3.09	(0.00300)	1.18	(0.00300)
Tin	mg/L	< DL	(0.600)	< DL	(0.600)	< DL	(0.600)	< DL	(0.600)

() = Reporting Limit

C1-3

Table 1
(Continued)

Parameter	Units	Site ID / Location ID							
		Sample ID				Log Date			
		IL / ILMW04		IL / ILMW05		IL / ILMW06		IL / ILMW07	
		IL173		IL174		IL175		IL176	
-----	-----	5/09/93		5/09/93		5/09/93		5/09/93	
Elements by ICPEs or AA, cont.									
Vanadium	mg/L	ND	(0.0200)	< DL	(0.0200)	NR	(0.0200)	ND	(0.0200)
Zinc	mg/L	NR	(0.0200)	0.0213	(0.0200)	NR	(0.0200)	NR	(0.0200)
Field measurements									
Alkalinity	meq/L	14.5	(.03)	14.5	(.03)	15	(.03)	13	(.03)
Conductivity	umhos/cm	2360	(5)	2300	(5)	3775	(5)	2020	(5)
Filterable Residue	mg/L	1296	(1)	1328	(1)	3868	(1)	1004	(1)
Redox (Eh)	mV	4.3	()	-0.6	()	14.6	()	-1.6	()
Temperature	deg. C	13.1	()	14.5	()	13.5	()	14.3	()
pH	pH units	6.73	()	6.79	()	6.52	()	6.80	()

() = Reporting Limit

C1-4

Table 1
(Continued)

Parameter	Units	Site ID / Location ID							
		Sample ID				Log Date			
		IL / ILMW08		IL / ILMW09		IL / ILLBLNK		IL / ILLY05	
		IL177		IL178		IL179		IL181	
		5/09/93		5/09/93		5/09/93		5/16/93	
<hr/>									
Anions									
Chloride	mg/L	12.2	(0.100)	15.9	(0.100)	ND	(0.100)	NA	
Fluoride	mg/L	0.190	(0.0500)	0.169	(0.0500)	NR	(0.0500)	NA	
Sulfate	mg/L	1890	(2.50)	2690	(2.50)	ND	(2.50)	NA	
Elements by ICPEs or AA									
Aluminum	mg/L	< DL	(0.200)	< DL	(0.200)	< DL	(0.200)	NA	
Arsenic	mg/L	ND	(0.00400)	ND	(0.00400)	ND	(0.00400)	NA	
Barium	mg/L	0.0117	(0.0100)	0.0186	(0.0100)	< DL	(0.0100)	NA	
Beryllium	mg/L	< DL	(0.00200)	< DL	(0.00200)	NR	(0.00200)	NA	
Boron	mg/L	NR	(0.600)	NR	(0.600)	ND	(0.600)	NA	
Cadmium	mg/L	NR	(0.00100)	< DL	(0.00100)	NR	(0.00100)	NA	
Calcium	mg/L	427	(1.00)	419	(1.00)	NR	(1.00)	NA	
Chromium	mg/L	NR	(0.0100)	ND	(0.0100)	< DL	(0.0100)	NA	
Cobalt	mg/L	ND	(0.0100)	NR	(0.0100)	ND	(0.0100)	NA	
Copper	mg/L	NR	(0.0200)	ND	(0.0200)	< DL	(0.0200)	NA	
Iron	mg/L	ND	(0.0500)	ND	(0.0500)	ND	(0.0500)	NA	
Lead	mg/L	NR	(0.00300)	ND	(0.00300)	0.0121	(0.00300)	NA	
Magnesium	mg/L	309	(1.00)	488	(1.00)	NR	(1.00)	NA	
Manganese	mg/L	0.510	(0.0100)	5.98	(0.0100)	NR	(0.0100)	NA	
Mercury	mg/L	< DL	(0.000180)	< DL	(0.000180)	NA		NA	
Molybdenum	mg/L	< DL	(0.0500)	ND	(0.0500)	ND	(0.0500)	NA	
Nickel	mg/L	< DL	(0.0200)	NR	(0.0200)	ND	(0.0200)	NA	
Potassium	mg/L	3.50	(3.00)	5.67	(3.00)	< DL	(3.00)	NA	
Selenium	mg/L	ND	(0.00500)	ND	(0.00500)	ND	(0.00500)	NA	
Silicon	mg/L	6.66	(1.00)	4.66	(1.00)	< DL	(1.00)	NA	
Silver	mg/L	ND	(0.0100)	ND	(0.0100)	< DL	(0.0100)	NA	
Sodium	mg/L	69.8	(1.00)	75.0	(1.00)	NR	(1.00)	NA	
Strontium	mg/L	0.542	(0.00300)	1.18	(0.00300)	NR	(0.00300)	NA	
Tin	mg/L	< DL	(0.600)	< DL	(0.600)	ND	(0.600)	NA	

() = Reporting Limit

C1-5

Table 1
(Continued)

Parameter	Units	Site ID / Location ID							
		Sample ID				Log Date			
		IL / ILMW08		IL / ILMW09		IL / ILBLNK		IL / ILLY05	
		IL177		IL178		IL179		IL181	
		5/09/93		5/09/93		5/09/93		5/16/93	
<hr/>									
Elements by ICPES or AA, cont.									
Vanadium	mg/L	NR	(0.0200)	NR	(0.0200)	< DL	(0.0200)	NA	
Zinc	mg/L	NR	(0.0200)	0.0295	(0.0200)	NR	(0.0200)	NA	
Field measurements									
Alkalinity	meq/L	12	(.03)	13	(.03)	.1	(.03)	NA	
Conductivity	umhos/cm	3700	(5)	4100	(5)	5.5	(5)	2465	(5)
Filterable Residue	mg/L	3577	(1)	4950	(1)	ND	(1)	NA	
Redox (Eh)	mV	8.7	()	13.5	()	-96.3	()	-204.2	()
Temperature	deg. C	13.3	()	10.7	()	24.0	()	17.7	()
pH	pH units	6.61	()	6.57	()	8.36	()	10.38	()

() = Reporting Limit

C1-6

Table 1
(Continued)

Parameter	Units	Site ID / Location ID							
		Sample ID				Log Date			
		IL / ILLY13		IL / ILLY16		IL / ILLY17		IL / ILLY19	
		IL182		IL183		IL184		IL185	
		5/16/93		5/16/93		5/16/93		5/16/93	
<hr/>									
Anions									
Chloride	mg/L	NA		992	(0.100)	934	(0.100)	82.7	(0.100)
Fluoride	mg/L	NA		0.252	(0.0500)	0.256	(0.0500)	0.0883	(0.0500)
Sulfate	mg/L	NA		7080	(2.50)	6420	(2.50)	897	(2.50)
<hr/>									
Elements by ICPEs or AA									
Aluminum	mg/L	NA		2.44	(0.200)	1.75	(0.200)	< DL	(0.200)
Arsenic	mg/L	NA		0.0332	(0.00400)	0.0188	(0.00400)	ND	(0.00400)
Barium	mg/L	NA		< DL	(0.0100)	< DL	(0.0100)	NR	(0.0100)
Beryllium	mg/L	NA		0.00530	J (0.00200)	0.00222	J (0.00200)	< DL	(0.00200)
Boron	mg/L	NA		< DL	(0.600)	ND	(0.600)	< DL	(0.600)
Cadmium	mg/L	NA		NR	(0.00100)	NR	(0.00100)	NR	(0.00100)
Calcium	mg/L	NA		1.36	J (1.00)	6.84	(1.00)	60.3	(1.00)
Chromium	mg/L	NA		0.0384	(0.0100)	0.0731	(0.0100)	0.0254	(0.0100)
Cobalt	mg/L	NA		ND	(0.0100)	ND	(0.0100)	ND	(0.0100)
Copper	mg/L	NA		0.0232	J (0.0200)	0.0334	J (0.0200)	NR	(0.0200)
Iron	mg/L	NA		< DL	(0.0500)	0.0761	(0.0500)	ND	(0.0500)
Lead	mg/L	NA		ND	(0.00300)	ND	(0.00300)	0.00590	(0.00300)
Magnesium	mg/L	NA		ND	(1.00)	ND	(1.00)	ND	(1.00)
Manganese	mg/L	NA		NR	(0.0100)	NR	(0.0100)	NR	(0.0100)
Molybdenum	mg/L	NA		2.16	(0.0500)	1.92	(0.0500)	0.263	(0.0500)
Nickel	mg/L	NA		ND	(0.0200)	0.0421	J (0.0200)	ND	(0.0200)
Potassium	mg/L	NA		4870	(3.00)	4100	(3.00)	198	(3.00)
Selenium	mg/L	NA		NR	(0.00500)	NR	(0.00500)	< DL	(0.00500)
Silicon	mg/L	NA		2140	(1.00)	1760	(1.00)	139	(1.00)
Silver	mg/L	NA		ND	(0.0100)	ND	(0.0100)	ND	(0.0100)
Sodium	mg/L	NA		4280	(1.00)	4080	(1.00)	457	(1.00)
Strontium	mg/L	NA		1.21	(0.00300)	1.47	(0.00300)	24.5	(0.00300)
Tin	mg/L	NA		ND	(0.600)	ND	(0.600)	ND	(0.600)
Vanadium	mg/L	NA		0.0765	(0.0200)	0.0424	(0.0200)	NR	(0.0200)

() = Reporting Limit

C1-7

Table 1
(Continued)

Parameter	Units	Site ID / Location ID							
		Sample ID		Log Date					
		IL / ILLY13	IL / ILLY16	IL / ILLY17	IL / ILLY19				
		IL182	IL183	IL184	IL185				
		5/16/93	5/16/93	5/16/93	5/16/93				
-----	-----	-----	-----	-----	-----				
Elements by ICPEs or AA, cont.									
Zinc	mg/L	NA	0.0729 (0.0200)	0.0723 (0.0200)	NR (0.0200)				
Field measurements									
Alkalinity	meq/L	NA	161 (.03)	142.5 (.03)	9.5 (.03)				
Conductivity	umhos/cm	20800 (5)	27850 (5)	25900 (5)	3490 (5)				
Filterable Residue	mg/L	NA	30080 (1)	26761 (1)	2403 (1)				
Redox (Eh)	mV	-346.9 (1)	-342.3 (1)	-341.3 (1)	-274.7 (1)				
Temperature	deg. C	13.9 (1)	14.2 (1)	15.1 (1)	16.9 (1)				
pH	pH units	12.89 (1)	12.78 (1)	12.79 (1)	11.51 (1)				

() = Reporting Limit

C1-8

Table 1
(Continued)

Parameter	Units	Site ID / Location ID							
		Sample ID				Log Date			
		IL / ILLY22		IL / ILLY23		IL / ILLY24		IL / ILLY25	
		IL186	IL187	IL188	IL189	IL186	IL187	IL188	IL189
		5/16/93	5/16/93	5/16/93	5/16/93	5/16/93	5/16/93	5/16/93	5/16/93
Anions									
Chloride	mg/L	43.2	(0.100)	NA	NA	71.4	(0.100)	NA	NA
Fluoride	mg/L	0.177	(0.0500)	NA	NA	0.0910	(0.0500)	NA	NA
Sulfate	mg/L	1020	(2.50)	NA	NA	899	(2.50)	NA	NA
Elements by ICPEs or AA									
Aluminum	mg/L	0.462	(0.200)	NA	NA	< DL	(0.200)	NA	NA
Arsenic	mg/L	ND	(0.00400)	NA	NA	ND	(0.00400)	NA	NA
Barium	mg/L	0.0987	(0.0100)	NA	NA	0.0143	(0.0100)	NA	NA
Beryllium	mg/L	0.00426 J	(0.00200)	NA	NA	< DL	(0.00200)	NA	NA
Boron	mg/L	ND	(0.600)	NA	NA	ND	(0.600)	NA	NA
Cadmium	mg/L	< DL	(0.00100)	NA	NA	ND	(0.00100)	NA	NA
Calcium	mg/L	1280	(1.00)	NA	NA	120	(1.00)	NA	NA
Chromium	mg/L	ND	(0.0100)	NA	NA	0.0375	(0.0100)	NA	NA
Cobalt	mg/L	ND	(0.0100)	NA	NA	ND	(0.0100)	NA	NA
Copper	mg/L	0.0250 J	(0.0200)	NA	NA	0.0509	(0.0200)	NA	NA
Iron	mg/L	< DL	(0.0500)	NA	NA	ND	(0.0500)	NA	NA
Lead	mg/L	0.00760	(0.00300)	NA	NA	NR	(0.00300)	NA	NA
Magnesium	mg/L	ND	(1.00)	NA	NA	NR	(1.00)	NA	NA
Manganese	mg/L	NR	(0.0100)	NA	NA	NR	(0.0100)	NA	NA
Molybdenum	mg/L	0.188	(0.0500)	NA	NA	0.244	(0.0500)	NA	NA
Nickel	mg/L	ND	(0.0200)	NA	NA	NR	(0.0200)	NA	NA
Potassium	mg/L	68.0	(3.00)	NA	NA	124	(3.00)	NA	NA
Selenium	mg/L	< DL	(0.00500)	NA	NA	ND	(0.00500)	NA	NA
Silicon	mg/L	1.90	(1.00)	NA	NA	94.7	(1.00)	NA	NA
Silver	mg/L	ND	(0.0100)	NA	NA	ND	(0.0100)	NA	NA
Sodium	mg/L	57.3	(1.00)	NA	NA	385	(1.00)	NA	NA
Strontium	mg/L	9.05	(0.00300)	NA	NA	25.5	(0.00300)	NA	NA
Tin	mg/L	< DL	(0.600)	NA	NA	< DL	(0.600)	NA	NA
Vanadium	mg/L	ND	(0.0200)	NA	NA	NR	(0.0200)	NA	NA

() = Reporting Limit

Table 1
(Continued)

Parameter	Units	Site ID / Location ID							
		Sample ID		Sample ID		Sample ID		Sample ID	
		Log Date		Log Date		Log Date		Log Date	
		IL / ILLY22		IL / ILLY23		IL / ILLY24		IL / ILLY25	
		IL186		IL187		IL188		IL189	
		5/16/93		5/16/93		5/16/93		5/16/93	
Elements by ICPEs or AA, cont.									
Zinc	mg/L	0.158	(0.0200)	NA		0.0473	(0.0200)	NA	
Field measurements									
Alkalinity	meq/L	47.5	(.03)	NA		7.5	(.03)	NA	
Conductivity	umhos/cm	7865	(5)	11300	(5)	2960	(5)	6150	(5)
Filterable Residue	mg/L	3807	(1)	NA		2097	(1)	NA	
Redox (Eh)	mV	-330.1	()	-332.5	()	-270.8	()	-288.3	()
Temperature	deg. C	17.1	()	19.0	()	17.8	()	16.3	()
pH	pH units	12.54	()	12.50	()	11.49	()	11.84	()

() = Reporting Limit

C1-10

Table 1
(Continued)

Parameter	Units	Site ID / Location ID							
		Sample ID		Log Date					
		IL / ILLY27		IL / ILLY01		IL / ILLY04		IL / ILLY10	
		IL191		IL194		IL195		IL196	
		5/16/93		5/16/93		5/16/93		5/16/93	
<hr/>									
Anions									
Chloride	mg/L	495	(0.100)	NA		365	(0.100)	71.2	(0.100)
Fluoride	mg/L	0.406	(0.0500)	NA		0.257	(0.0500)	0.217	(0.0500)
Sulfate	mg/L	4270	(2.50)	NA		2090	(2.50)	977	(2.50)
<hr/>									
Elements by ICPEs or AA									
Aluminum	mg/L	1.05	(0.200)	NA		NR	(0.200)	0.235	(0.200)
Arsenic	mg/L	0.00800	(0.00400)	NA		ND	(0.00400)	NR	(0.00400)
Barium	mg/L	NR	(0.0100)	NA		0.0910	(0.0100)	NA	(0.0100)
Beryllium	mg/L	0.00472	J (0.00200)	NA		< DL	(0.00200)	NA	(0.00200)
Boron	mg/L	< DL	(0.600)	NA		< DL	(0.600)	NR	(0.600)
Cadmium	mg/L	< DL	(0.00100)	NA		0.00136	(0.00100)	NR	(0.00100)
Calcium	mg/L	1.74	(1.00)	NA		531	(1.00)	984	(1.00)
Chromium	mg/L	0.0574	(0.0100)	NA		NR	(0.0100)	0.0245	(0.0100)
Cobalt	mg/L	ND	(0.0100)	NA		ND	(0.0100)	ND	(0.0100)
Copper	mg/L	< DL	(0.0200)	NA		0.0295	(0.0200)	NA	(0.0200)
Iron	mg/L	0.0514	J (0.0500)	NA		ND	(0.0500)	88.4	(0.0500)
Lead	mg/L	< DL	(0.00300)	NA		ND	(0.00300)	NR	(0.00300)
Magnesium	mg/L	< DL	(1.00)	NA		ND	(1.00)	< DL	(1.00)
Manganese	mg/L	NR	(0.0100)	NA		NR	(0.0100)	NA	(0.0100)
Molybdenum	mg/L	1.14	(0.0500)	NA		0.784	(0.0500)	NA	(0.0500)
Nickel	mg/L	< DL	(0.0200)	NA		ND	(0.0200)	ND	(0.0200)
Potassium	mg/L	2500	(3.00)	NA		1290	(3.00)	82.1	(3.00)
Selenium	mg/L	< DL	(0.00500)	NA		< DL	(0.00500)	ND	(0.00500)
Silicon	mg/L	1440	(1.00)	NA		4.26	(1.00)	1.46	(1.00)
Silver	mg/L	ND	(0.0100)	NA		ND	(0.0100)	NA	(0.0100)
Sodium	mg/L	3370	(1.00)	NA		1090	(1.00)	163	(1.00)
Strontium	mg/L	2.42	(0.00300)	NA		31.4	(0.00300)	NA	(0.00300)
Tin	mg/L	ND	(0.600)	NA		< DL	(0.600)	< DL	(0.600)
Vanadium	mg/L	0.0289	(0.0200)	NA		NR	(0.0200)	NA	(0.0200)

() = Reporting Limit

C1-11

Table 1
(Continued)

Parameter	Units	Site ID / Location ID							
		IL / ILLY27		IL / ILLY01		IL / ILLY04		IL / ILLY10	
		IL191	5/16/93	IL194	5/16/93	IL195	5/16/93	IL196	5/16/93
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Elements by ICPEs or AA, cont.									
Zinc	mg/L	0.0658	(0.0200)	NA		NR	(0.0200)	NA	(0.0200)
Field measurements									
Alkalinity	meq/L	118	(.03)	NA		61	(.03)	36	(.03)
Conductivity	umhos/cm	19550	(5)	2325	(5)	14350	(5)	7300	(5)
Filterable Residue	mg/L	20720	(1)	NA		7655	(1)	3163	(1)
Redox (Eh)	mV	-341.0	()	-213.1	()	-339.6	()	-329.2	()
Temperature	deg. C	14.1	()	19.1	()	16.7	()	14.6	()
pH	pH units	12.79	()	10.51	()	12.57	()	12.56	()

() = Reporting Limit

C1-12

Table 1
(Continued)

Parameter	Units	Site ID / Location ID			
		Sample ID			
		Log Date			
		IL / ILLY11	IL / ILLY12	IL / ILLY14	IL / ILLY20
		IL197	IL198	IL199	IL200
		5/16/93	5/16/93	5/16/93	5/16/93
<hr/>					
Anions					
Chloride	mg/L	NA	NA	21.0 (0.100)	NA
Fluoride	mg/L	NA	NA	0.349 (0.0500)	NA
Sulfate	mg/L	NA	NA	2240 (2.50)	NA
<hr/>					
Elements by ICPEs or AA					
Aluminum	mg/L	NA	NA	< DL (0.200)	NA
Arsenic	mg/L	NA	NA	ND (0.00400)	NA
Barium	mg/L	NA	NA	0.0168 (0.0100)	NA
Beryllium	mg/L	NA	NA	< DL (0.00200)	NA
Boron	mg/L	NA	NA	0.676 (0.600)	NA
Cadmium	mg/L	NA	NA	< DL (0.00100)	NA
Calcium	mg/L	NA	NA	493 (1.00)	NA
Chromium	mg/L	NA	NA	< DL (0.0100)	NA
Cobalt	mg/L	NA	NA	ND (0.0100)	NA
Copper	mg/L	NA	NA	ND (0.0200)	NA
Iron	mg/L	NA	NA	ND (0.0500)	NA
Lead	mg/L	NA	NA	0.00390 (0.00300)	NA
Magnesium	mg/L	NA	NA	158 (1.00)	NA
Manganese	mg/L	NA	NA	NR (0.0100)	NA
Molybdenum	mg/L	NA	NA	NR (0.0500)	NA
Nickel	mg/L	NA	NA	ND (0.0200)	NA
Potassium	mg/L	NA	NA	NR (3.00)	NA
Selenium	mg/L	NA	NA	ND (0.00500)	NA
Silicon	mg/L	NA	NA	34.5 (1.00)	NA
Silver	mg/L	NA	NA	ND (0.0100)	NA
Sodium	mg/L	NA	NA	253 (1.00)	NA
Strontium	mg/L	NA	NA	0.897 (0.00300)	NA
Tin	mg/L	NA	NA	< DL (0.600)	NA
Vanadium	mg/L	NA	NA	NR (0.0200)	NA

() = Reporting Limit

Table 1
(Continued)

Parameter	Units	Site ID / Location ID							
		Sample ID				Log Date			
		IL / ILLY11		IL / ILLY12		IL / ILLY14		IL / ILLY20	
		IL197		IL198		IL199		IL200	
		5/16/93		5/16/93		5/16/93		5/16/93	
<hr/>									
Elements by ICPEs or AA, cont.									
Zinc	mg/L	NA		NA		NR	(0.0200)	NA	
Field measurements									
Alkalinity	meq/L	NA		NA		2.5	(.03)	NA	
Conductivity	umhos/cm	8250	(5)	3125	(5)	3700	(5)	6950	(5)
Filterable Residue	mg/L	NA		NA		4341	(1)	NA	
Redox (Eh)	mV	-308.1	()	-197.1	()	NA		-321.5	()
Temperature	deg. C	16.1	()	13.5	()	14.4	()	17.0	()
pH	pH units	12.15	()	10.08	()	8.65	()	12.35	()

() = Reporting Limit

C1-14

Table 1
(Continued)

		Site ID / Location ID	
		Sample ID	
		Log Date	
		IL / ILLY21	
		IL201	
		5/16/93	
Parameter	Units		
-----	----	-----	-----
Anions			
Chloride	mg/L	141	(0.100)
Fluoride	mg/L	0.138	(0.0500)
Sulfate	mg/L	1150	(2.50)
Elements by ICPEs or AA			
Aluminum	mg/L	NR	(0.200)
Arsenic	mg/L	0.00510	(0.00400)
Barium	mg/L	0.0496	(0.0100)
Beryllium	mg/L	< DL	(0.00200)
Boron	mg/L	< DL	(0.600)
Cadmium	mg/L	ND	(0.00100)
Calcium	mg/L	624	(1.00)
Chromium	mg/L	0.0322	(0.0100)
Cobalt	mg/L	ND	(0.0100)
Copper	mg/L	0.0286	(0.0200)
Iron	mg/L	ND	(0.0500)
Lead	mg/L	ND	(0.00300)
Magnesium	mg/L	< DL	(1.00)
Manganese	mg/L	NR	(0.0100)
Molybdenum	mg/L	0.312	(0.0500)
Nickel	mg/L	NR	(0.0200)
Potassium	mg/L	507	(3.00)
Selenium	mg/L	ND	(0.00500)
Silicon	mg/L	4.68	(1.00)
Silver	mg/L	0.0220	(0.0100)
Sodium	mg/L	334	(1.00)
Strontium	mg/L	41.3	(0.00300)
Tin	mg/L	< DL	(0.600)
Vanadium	mg/L	NR	(0.0200)

() = Reporting Limit

C1-15

Table 1
(Continued)

Site ID / Location ID
Sample ID
Log Date

Parameter	Units	IL / ILLY21 IL201 5/16/93	
-----	-----	-----	
Elements by ICPES or AA, cont.			
Zinc	mg/L	NR	(0.0200)
Field measurements			
Alkalinity	meq/L	36	(.03)
Conductivity	umhos/cm	7940	(5)
Filterable Residue	mg/L	4090	(1)
Redox (Eh)	mV	-326.6	()
Temperature	deg. C	15.4	()
pH	pH units	12.52	()

() = Reporting Limit

Table 2A

Chemical Characteristics of Deionized Water Leachates of Illinois Ash, Event 8

Parameter	Units	Site ID / Location ID							
		Sample ID				Log Date			
		IL / 93MAY1L03		IL / 93MAY1L03		IL / 93MAY1L03		IL / 93MAY1L03	
		93MAY1L03-1		93MAY1L03-3		93MAY1L03-5		93MAY1L03-7	
		5/14/93		5/14/93		5/14/93		5/14/93	
Anions									
Chloride	mg/L	0.401	(0.100)	4.58	(0.100)	12.4	(0.100)	65.6	(0.100)
Sulfate	mg/L	16.9	(2.50)	625	(2.50)	681	(2.50)	698	(2.50)
Elements by ICPEs or AA									
Aluminum	mg/L	NR	(0.200)	1.68	(0.200)	0.374	(0.200)	< DL	(0.200)
Arsenic	mg/L	ND	(0.00400)	ND	(0.00400)	ND	(0.00400)	ND	(0.00400)
Barium	mg/L	0.0184	(0.0100)	0.139	(0.0100)	0.122	(0.0100)	0.104	(0.0100)
Beryllium	mg/L	ND	(0.00200)	ND	(0.00200)	ND	(0.00200)	ND	(0.00200)
Boron	mg/L	NR	(0.600)	NR	(0.600)	NR	(0.600)	NR	(0.600)
Cadmium	mg/L	< DL	(0.00100)	NR	(0.00100)	< DL	(0.00100)	< DL	(0.00100)
Calcium	mg/L	14.8	(1.00)	1050	(1.00)	1020	(1.00)	835	(1.00)
Chromium	mg/L	< DL	(0.0100)	0.0244	(0.0100)	0.0278	(0.0100)	< DL	(0.0100)
Cobalt	mg/L	< DL	(0.0100)	< DL	(0.0100)	< DL	(0.0100)	< DL	(0.0100)
Copper	mg/L	NR	(0.0200)	NR	(0.0200)	0.0291	(0.0200)	NR	(0.0200)
Iron	mg/L	NR	(0.0500)	ND	(0.0500)	< DL	(0.0500)	ND	(0.0500)
Lead	mg/L	NR	(0.00300)	0.00410	(0.00300)	NR	(0.00300)	NR	(0.00300)
Magnesium	mg/L	2.49	(1.00)	NR	(1.00)	NR	(1.00)	NR	(1.00)
Manganese	mg/L	NR	(0.0100)	NR	(0.0100)	NR	(0.0100)	NR	(0.0100)
Molybdenum	mg/L	< DL	(0.0500)	0.0552	(0.0500)	0.0757	(0.0500)	0.119	(0.0500)
Nickel	mg/L	ND	(0.0200)	ND	(0.0200)	0.0551	(0.0200)	ND	(0.0200)
Potassium	mg/L	NR	(3.00)	8.20	(3.00)	35.7	(3.00)	303	(3.00)
Selenium	mg/L	ND	(0.00500)	0.0832	(0.00500)	0.0754	(0.00500)	ND	(0.00500)
Silicon	mg/L	NR	(1.00)	< DL	(1.00)	< DL	(1.00)	< DL	(1.00)
Silver	mg/L	ND	(0.0100)	ND	(0.0100)	ND	(0.0100)	ND	(0.0100)
Sodium	mg/L	NR	(1.00)	3.40	(1.00)	16.1	(1.00)	246	(1.00)
Strontium	mg/L	0.0407	(0.00300)	6.85	(0.00300)	11.2	(0.00300)	4.95	(0.00300)
Tin	mg/L	ND	(0.600)	ND	(0.600)	< DL	(0.600)	< DL	(0.600)
Vanadium	mg/L	< DL	(0.0200)	ND	(0.0200)	< DL	(0.0200)	ND	(0.0200)
Zinc	mg/L	< DL	(0.0200)	ND	(0.0200)	ND	(0.0200)	ND	(0.0200)

() = Reporting Limit

Table 2A
(Continued)

		Site ID / Location ID							
		Sample ID							
		Log Date							
		1L / 93MAY1L03		1L / 93MAY1L03		1L / 93MAY1L03		1L / 93MAY1L03	
		93MAY1L03-1		93MAY1L03-3		93MAY1L03-5		93MAY1L03-7	
Parameter	Units	5/14/93		5/14/93		5/14/93		5/14/93	
-----	-----	-----		-----		-----		-----	
Field measurements									
Conductivity	umhos/cm	98	(NA)	7260	(NA)	7160	(NA)	8710	(NA)
pH	NA	9.01	(NA)	11.83	(NA)	12.02	(NA)	12.19	(NA)

Table 2A
(Continued)

Parameter	Units	Site ID / Location ID							
		Sample ID		Log Date					
		IL / 93MAY104		IL / 93MAY104		IL / 93MAY104		IL / 93MAY104	
		93MAY104-10		93MAY104-2		93MAY104-4		93MAY104-6	
		5/14/93		5/14/93		5/14/93		5/14/93	
Anions									
Chloride	mg/L	21.6	(0.100)	1.77	(0.100)	13.3	(0.100)	61.2	(0.100)
Sulfate	mg/L	309	(2.50)	674	(2.50)	987	(2.50)	1250	(2.50)
Elements by ICPEs or AA									
Aluminum	mg/L	< DL	(0.200)	< DL	(0.200)	< DL	(0.200)	ND	(0.200)
Arsenic	mg/L	ND	(0.00400)	ND	(0.00400)	ND	(0.00400)	ND	(0.00400)
Barium	mg/L	0.0748	(0.0100)	0.0903	(0.0100)	0.130	(0.0100)	0.154	(0.0100)
Beryllium	mg/L	ND	(0.00200)	ND	(0.00200)	ND	(0.00200)	ND	(0.00200)
Boron	mg/L	NR	(0.600)	NR	(0.600)	< DL	(0.600)	< DL	(0.600)
Cadmium	mg/L	< DL	(0.00100)	NR	(0.00100)	NR	(0.00100)	< DL	(0.00100)
Calcium	mg/L	618	(1.00)	1020	(1.00)	1210	(1.00)	1100	(1.00)
Chromium	mg/L	NR	(0.0100)	0.0180	(0.0100)	0.0199	(0.0100)	0.0196	(0.0100)
Cobalt	mg/L	< DL	(0.0100)	< DL	(0.0100)	< DL	(0.0100)	0.0190	(0.0100)
Copper	mg/L	NR	(0.0200)	NR	(0.0200)	NR	(0.0200)	0.0231	(0.0200)
Iron	mg/L	ND	(0.0500)	ND	(0.0500)	ND	(0.0500)	ND	(0.0500)
Lead	mg/L	0.00320	(0.00300)	0.00420	(0.00300)	0.00390	(0.00300)	0.00410	(0.00300)
Magnesium	mg/L	NR	(1.00)	NR	(1.00)	NR	(1.00)	NR	(1.00)
Manganese	mg/L	NR	(0.0100)	NR	(0.0100)	NR	(0.0100)	NR	(0.0100)
Molybdenum	mg/L	0.0677	(0.0500)	NR	(0.0500)	0.0768	(0.0500)	0.134	(0.0500)
Nickel	mg/L	ND	(0.0200)	ND	(0.0200)	ND	(0.0200)	ND	(0.0200)
Potassium	mg/L	51.5	(3.00)	6.54	(3.00)	34.2	(3.00)	232	(3.00)
Selenium	mg/L	ND	(0.00500)	0.0668 F	(0.00500)	0.0470 F	(0.00500)	ND	(0.00500)
Silicon	mg/L	NR	(1.00)	< DL	(1.00)	< DL	(1.00)	< DL	(1.00)
Silver	mg/L	ND	(0.0100)	ND	(0.0100)	ND	(0.0100)	ND	(0.0100)
Sodium	mg/L	41.8	(1.00)	3.77	(1.00)	18.0	(1.00)	170	(1.00)
Strontium	mg/L	3.88	(0.00300)	1.97	(0.00300)	13.5	(0.00300)	9.85	(0.00300)
Tin	mg/L	< DL	(0.600)	ND	(0.600)	ND	(0.600)	< DL	(0.600)
Vanadium	mg/L	NR	(0.0200)	ND	(0.0200)	< DL	(0.0200)	< DL	(0.0200)
Zinc	mg/L	ND	(0.0200)	ND	(0.0200)	0.0242	(0.0200)	ND	(0.0200)

() = Reporting Limit

Table 2A
(Continued)

Parameter	Units	Site ID / Location ID							
		Sample ID				Log Date			
		1L / 93MAY1L04		1L / 93MAY1L04		1L / 93MAY1L04		1L / 93MAY1L04	
		93MAY1L04-10		93MAY1L04-2		93MAY1L04-4		93MAY1L04-6	
-----	-----	5/14/93		5/14/93		5/14/93		5/14/93	
Field measurements									
Conductivity	umhos/cm	5330	(NA)	6890	(NA)	7910	(NA)	8920	(NA)
pH	NA	12.19	(NA)	12.13	(NA)	12.15	(NA)	12.2	(NA)

() = Reporting Limit

D2-4

Table 2A

(Continued)

		Site ID / Location ID	
		Sample ID	
		Log Date	
		1L / 93MAY1L04	
		93MAY1L04-B	
		5/14/93	
Parameter	Units		

Anions			
Chloride	mg/L	33.7	(0.100)
Sulfate	mg/L	1180	(2.50)
Elements by ICPEs or AA			
Aluminum	mg/L	ND	(0.200)
Arsenic	mg/L	ND	(0.00400)
Barium	mg/L	0.166	(0.0100)
Beryllium	mg/L	ND	(0.00200)
Boron	mg/L	NR	(0.600)
Cadmium	mg/L	< DL	(0.00100)
Calcium	mg/L	1120	(1.00)
Chromium	mg/L	0.0120	(0.0100)
Cobalt	mg/L	< DL	(0.0100)
Copper	mg/L	< DL	(0.0200)
Iron	mg/L	ND	(0.0500)
Lead	mg/L	NR	(0.00300)
Magnesium	mg/L	NR	(1.00)
Manganese	mg/L	NR	(0.0100)
Molybdenum	mg/L	0.166	(0.0500)
Nickel	mg/L	ND	(0.0200)
Potassium	mg/L	248	(3.00)
Selenium	mg/L	ND	(0.00500)
Silicon	mg/L	< DL	(1.00)
Silver	mg/L	ND	(0.0100)
Sodium	mg/L	167	(1.00)
Strontium	mg/L	9.88	(0.00300)
Tin	mg/L	< DL	(0.600)
Vanadium	mg/L	ND	(0.0200)
Zinc	mg/L	ND	(0.0200)

() = Reporting Limit

D2-5

Table 2A
(Continued)

Parameter -----	Units -----	Site ID / Location ID Sample ID Log Date	
		IL / 93MAY1L04 93MAY1L04-8 5/14/93	-----
Field measurements			
Conductivity	umhos/cm	8880	(NA)
pH	NA	12.24	(NA)

Table 2B

Chemical Characteristics of Deionized Water Leachates of Illinois Soils, Event 8

		Site ID / Location ID							
		Sample ID				Beg. Depth - End Depth (ft.)			
		IL / 93MAY1L03		IL / 93MAY1L03		IL / 93MAY1L03		IL / 93MAY1L04	
		93MAY1L03-11		93MAY1L03-13		93MAY1L03-15		93MAY1L04-1	
Parameter	Units	10.5 - 11		12.5 - 13		14.5 - 15		.5 - 1	
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
Anions									
Chloride	mg/L	2.68	(0.100)	0.614	(0.100)	0.668	(0.100)	0.526	(0.100)
Sulfate	mg/L	284	(2.50)	82.4	(2.50)	62.8	(2.50)	31.5	(2.50)
Elements by ICPEs or AA									
Aluminum	mg/L	< DL	(0.200)	NR	(0.200)	NR	(0.200)	< DL	(0.200)
Arsenic	mg/L	ND	(0.00400)	ND	(0.00400)	ND	(0.00400)	ND	(0.00400)
Barium	mg/L	0.0252	(0.0100)	0.0229	(0.0100)	0.0186	(0.0100)	0.0216	(0.0100)
Beryllium	mg/L	ND	(0.00200)	ND	(0.00200)	ND	(0.00200)	ND	(0.00200)
Boron	mg/L	NR	(0.600)	NR	(0.600)	< DL	(0.600)	NR	(0.600)
Cadmium	mg/L	NR	(0.00100)	< DL	(0.00100)	< DL	(0.00100)	NR	(0.00100)
Calcium	mg/L	96.5	(1.00)	36.1	(1.00)	27.8	(1.00)	19.4	(1.00)
Chromium	mg/L	< DL	(0.0100)	< DL	(0.0100)	< DL	(0.0100)	ND	(0.0100)
Cobalt	mg/L	< DL	(0.0100)	< DL	(0.0100)	< DL	(0.0100)	< DL	(0.0100)
Copper	mg/L	< DL	(0.0200)	NR	(0.0200)	NR	(0.0200)	NR	(0.0200)
Iron	mg/L	< DL	(0.0500)	NR	(0.0500)	NR	(0.0500)	NR	(0.0500)
Lead	mg/L	NR	(0.00300)	NR	(0.00300)	NR	(0.00300)	NR	(0.00300)
Magnesium	mg/L	21.5	(1.00)	10.6	(1.00)	9.58	(1.00)	3.34	(1.00)
Manganese	mg/L	NR	(0.0100)	0.0806	(0.0100)	0.0561	(0.0100)	NR	(0.0100)
Molybdenum	mg/L	< DL	(0.0500)	< DL	(0.0500)	< DL	(0.0500)	< DL	(0.0500)
Nickel	mg/L	ND	(0.0200)	ND	(0.0200)	ND	(0.0200)	< DL	(0.0200)
Potassium	mg/L	NR	(3.00)	NR	(3.00)	NR	(3.00)	NR	(3.00)
Selenium	mg/L	ND	(0.00500)	ND	(0.00500)	ND	(0.00500)	ND	(0.00500)
Silicon	mg/L	1.09	(1.00)	1.79	(1.00)	1.99	(1.00)	NR	(1.00)
Silver	mg/L	ND	(0.0100)	ND	(0.0100)	ND	(0.0100)	ND	(0.0100)
Sodium	mg/L	5.19	(1.00)	NR	(1.00)	1.84	(1.00)	NR	(1.00)
Strontium	mg/L	0.111	(0.00300)	0.0496	(0.00300)	0.0382	(0.00300)	0.0447	(0.00300)
Tin	mg/L	< DL	(0.600)	< DL	(0.600)	< DL	(0.600)	ND	(0.600)
Vanadium	mg/L	ND	(0.0200)	ND	(0.0200)	NR	(0.0200)	< DL	(0.0200)
Zinc	mg/L	< DL	(0.0200)	ND	(0.0200)	ND	(0.0200)	ND	(0.0200)

() = Reporting Limit

D2-1

Table 2B

(Continued)

Parameter	Units	Site ID / Location ID							
		Sample ID							
		Beg. Depth - End Depth (ft.)							
		IL / 93MAY103		IL / 93MAY103		IL / 93MAY103		IL / 93MAY104	
		93MAY103-11		93MAY103-13		93MAY103-15		93MAY104-1	
		10.5 - 11		12.5 - 13		14.5 - 15		.5 - 1	
-----	-----	-----		-----		-----		-----	
Field measurements									
Conductivity	umhos/cm	573	(NA)	255	(NA)	210	(NA)	125	(NA)
pH	NA	8.48	(NA)	8.34	(NA)	8.37	(NA)	8.66	(NA)

() = Reporting Limit

02-2

Table 2B

(Continued)

Parameter	Units	Site ID / Location ID							
		Sample ID							
		Beg. Depth - End Depth (ft.)							
		IL / 93MAY104 93MAY104-10.5 10 - 10.5		IL / 93MAY104 93MAY104-14.5 14 - 14.5		IL / 93MAY104 93MAY104-15 14.5 - 15		IL / 93MAY104 93MAY104-18 17.5 - 18	
Anions									
Chloride	mg/L	1.99	(0.100)	2.09	(0.100)	NA		0.624	(0.100)
Sulfate	mg/L	59.8	(2.50)	105	(2.50)	NA		57.1	(2.50)
Elements by ICPEs or AA									
Aluminum	mg/L	NR	(0.200)	NR	(0.200)	NA		NR	(0.200)
Arsenic	mg/L	ND	(0.00400)	NR	(0.00400)	NA		ND	(0.00400)
Barium	mg/L	NR	(0.0100)	0.0193	(0.0100)	NA		0.0132	(0.0100)
Beryllium	mg/L	ND	(0.00200)	ND	(0.00200)	NA		ND	(0.00200)
Boron	mg/L	< DL	(0.600)	NR	(0.600)	NA		NR	(0.600)
Cadmium	mg/L	< DL	(0.00100)	NR	(0.00100)	NA		NR	(0.00100)
Calcium	mg/L	17.2	(1.00)	72.3	(1.00)	NA		22.9	(1.00)
Chromium	mg/L	< DL	(0.0100)	< DL	(0.0100)	NA		< DL	(0.0100)
Cobalt	mg/L	ND	(0.0100)	ND	(0.0100)	NA		< DL	(0.0100)
Copper	mg/L	NR	(0.0200)	NR	(0.0200)	NA		NR	(0.0200)
Iron	mg/L	0.189	(0.0500)	ND	(0.0500)	NA		NR	(0.0500)
Lead	mg/L	NR	(0.00300)	NR	(0.00300)	NA		NR	(0.00300)
Magnesium	mg/L	3.99	(1.00)	NR	(1.00)	NA		7.82	(1.00)
Manganese	mg/L	NR	(0.0100)	NR	(0.0100)	NA		0.0752	(0.0100)
Molybdenum	mg/L	< DL	(0.0500)	NR	(0.0500)	NA		< DL	(0.0500)
Nickel	mg/L	ND	(0.0200)	ND	(0.0200)	NA		ND	(0.0200)
Potassium	mg/L	NR	(3.00)	NR	(3.00)	NA		NR	(3.00)
Selenium	mg/L	ND	(0.00500)	ND	(0.00500)	NA		NR	(0.00500)
Silicon	mg/L	1.40	(1.00)	2.86	(1.00)	NA		1.44	(1.00)
Silver	mg/L	ND	(0.0100)	ND	(0.0100)	NA		ND	(0.0100)
Sodium	mg/L	8.34	(1.00)	3.86	(1.00)	NA		1.03	(1.00)
Strontium	mg/L	0.0299	(0.00300)	0.104	(0.00300)	NA		0.0299	(0.00300)
Tin	mg/L	ND	(0.600)	< DL	(0.600)	NA		< DL	(0.600)
Vanadium	mg/L	ND	(0.0200)	NR	(0.0200)	NA		NR	(0.0200)
Zinc	mg/L	ND	(0.0200)	ND	(0.0200)	NA		ND	(0.0200)

() = Reporting Limit

02-3

Table 2B

(Continued)

Parameter	Units	Site ID / Location ID							
		Sample ID							
		Beg. Depth - End Depth (ft.)							
		IL / 93MAY1L04 93MAY1L04-10.5 10 - 10.5		IL / 93MAY1L04 93MAY1L04-14.5 14 - 14.5		IL / 93MAY1L04 93MAY1L04-15 14.5 - 15		IL / 93MAY1L04 93MAY1L04-18 17.5 - 18	
Field measurements									
Conductivity	umhos/cm	157	(NA)	376	(NA)	167	(NA)	NA	
pH	NA	8.7	(NA)	10.24	(NA)	8.67	(NA)	NA	

() = Reporting Limit

02-4

DATE

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2/28/94

END