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CLEVELAND CLIFFS IRON COMPANY
Collins Draw Project
Post H₂S Injection - Stability Monitoring Program

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CLEVELAND CLIFFS IRON COMPANY
Collins Draw Project
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PREPARED FOR
CLEVELAND CLIFFS IRON COMPANY
Collins Draw Project
Campbell County, Wyoming

Post H₂S Injection - Stability Monitoring Program

1.0 Introduction:

The Collins Draw In-situ uranium mining research and development project was authorized by Wyoming Permit #3RD (issued 10/29/79) and US-NRC Source Material License No. SUA-1352 (issued 06/29/79). The mining phase of the operation was conducted from 03/10/80 to 07/23/81 and was followed by groundwater restoration processing which continued until 12/23/82.

Two wellfield patterns were mined (A and B Fields) between 1979 and 1981 with the circulation of 83 pore volumes of lixiviant. Best practicable technology groundwater restoration processes were utilized in an attempt to return A and B Fields to pre-mining quality. Agency approval of adequate A Field restoration was received in 1986.

This report primarily addresses the background and present status of B Field restoration. The following identifies the general history of the B Field restoration and stability effort.

- o 07/81 - 12/82 Groundwater Restoration Processing
- o 01/83 - 09/83 Groundwater Chemical Stability Sampling Program
- o 10/83 - 10/86 Agency Negotiations (WY-DEQ, US-NRC) Concerning Restoration
- o 09/86 NRC Published Draft F.O.N.S.I.
- o 10/86 Hydrogen Sulfide Injection Suggested by WY-DEQ to Reduce Selenium Concentrations to a Target of 0.05 mg/l
- o 07/87 H₂S Injection Program Initiated
- o 08/87 H₂S Program Terminated after Treatment of 2.8 Million Gallons of Water with 8,000 lbs of the Reductant
- o 09/08/87 Initial Post-H₂S Samples Collected from Wells: 190, 231, 232, 233, 234, 237, 260, 276, 277, 283, 285, and 5 Associated Field Monitor Wells - Initial sampling round of one year monitoring program
- o 11/12/87 Second Round - Groundwater Stability Sampling
- o 01/05/88 Third Round - Groundwater Stability Sampling Discovered Sample Instability Problem
- o 03/03/88 Fourth Round - Groundwater Stability Sampling
- o 04/04/88 Initiated Se Analysis Only Sampling on Bi-monthly Frequency
- o 05/05/88 Fifth Round - Groundwater Stability Sampling
- o 06/02/88 Se Analysis Only Sampling - Field Wells
- o 07/06/88 Final Round - Groundwater Stability Sampling
- o 10/87-Present Site Decontamination and Decommissioning

2.0 Post H₂S Treatment: Groundwater Sampling and Analysis

CCIC contracted Energy Laboratories, Inc. (ELI) of Casper, WY to provide independent well sampling and sample preservation, and all post-H₂S water quality analyses presented herein (excepting the 09/08/87 sample round) were performed at ELI's EPA certified laboratory.

2.1 Sampling Technique: CCIC's contractor utilizes downhole submersible pumps set on FRP or plastic piping to extract groundwater from the wells prior to sampling. The stainless steel pumps range from 1/2 to 7.5 HP and vary in flow capability from 5 gpm to 50 gpm as installed. Prior to wellfield sampling, all sample wells are tested for water level. The individual wells are then pumped a minimum of two casing displacements while monitoring pH and electrical conductivity. The foregoing is performed to assure that representative, formation water samples are obtained.

Due to the lengthy time requirements for pumping the 11 field wells, WY-DEQ had authorized pre-stabilizing (pumping) the wells within 24 to 72 hours of agency split sampling. Due to the potential of materials within the casing being solubilized during the soak period (see Attachment 1), this practice was discontinued after the 11/12/87 round and samples were collected immediately upon achieving chemical stability. Field sample collection data for the field and monitor wells is included in the individual well packages.

2.2 Sample Preservation: Samples were filtered and preserved on site at the time of collection. The following chart outlines the appropriate preservation technique employed for the parameters selected by WY-DEQ.

Measurement	Container	Preservative
o Alkalinity, Carbonate Bicarbonate, Sulfate TDS	Plastic	Cool to 4°C
o Chloride	Plastic	None
o pH	Plastic	Analyze on-site immediately
o Ca, Mg, Na, K, As, Mo, Se, V, U, Ra ²²⁶ (dissolved)	Plastic	Filter to 0.45µm HNO ₃ to pH <2
o Ammonia (Nitrogen)	Plastic	Cool to 4°C H ₂ SO ₄ to pH <2

Round 2 and 3 HNO₃ preserved samples were noted to have developed a brownish precipitate upon standing, and, significant variation in selenium concentration between the two sample rounds was observed. Tests of the precipitate indicated a high selenium percentage in the solids which prompted an investigation into the stability of the preserved sample. The testwork conducted is presented as Attachment 1. It was concluded that, due to excess residual H₂S(g) entrained in the samples, that selenium was being partially precipitated as a metal-sulfide upon the addition of nitric acid. Beginning with Round 4, and following agreement with WY-DEQ, a filtered, non-acidified sample was delivered directly to the digestion vessel used in the selenium analysis. This precluded any loss due to selenium precipitation prior to analysis. Analyses presented (beginning 04/88) compare this value to that obtained from the US-EPA (technique) preserved sample.

2.3 * Sample Analysis/Quality Assurance: Samples collected and preserved were analyzed by the EPA approved techniques listed in the table below. Sample turnaround was achieved in 13 to 21 days on all rounds. Laboratory Quality Assurance practices included:

- o >10% Duplicate and Spike Analysis
- o Performance of Ionic Balance to +/- 5%
- o Adherence to Energy Laboratories, Inc.'s US-EPA Approved Quality Assurance Program

Analytical Methods

Method/Description	EPA Method Reference	Detection Limits
pH - Electrometric	150.1	0.14 Units
Total Dissolved Solids - Gravimetric	160.1	1 mg/l
Calcium - AA Direct Aspiration	215.1	0.05 mg/l
Magnesium - AA Direct Aspiration	242.1	0.01 mg/l
Sodium - AA Direct Aspiration	273.1	0.05 mg/l
Potassium - AA Direct Aspiration	258.1	0.10 mg/l
Arsenic - AA Hydride	206.3	0.001 mg/l
Selenium - AA Hydride	270.3	0.001 mg/l
Molybdenum - AA Direct Aspiration	246.1	0.05 mg/l
Vanadium - AA Direct Aspiration	286.1	0.10 mg/l
Alkalinity - Titrimetric	310.1	0.10 mg/l
Chloride - Titrimetric	325.3	0.10 mg/l
Ammonia - Potentiometric	350.3	0.05 mg/l
Sulfate - Turbidimetric	375.4	1.0 mg/l
Uranium - Fluorometric	908.1	0.0003 mg/l
Radium ²²⁶ - Alpha Emitting	903.0	0.20 pCi/l

* 2.3 Refers to Rounds 2-7 performed at ELI-Casper facility

3.0 Collins Draw Project: Post H_2S Treatment: Groundwater Quality and Trends

3.1 Selenium Concentration Trends - Pre- H_2S

3.1.1 Post B Field Restoration/Stability - 10/83

In order to best display the effect of the $H_2S(g)$ treatment, it is important to observe the water quality trends of the B Field wells following the 1982 restoration program. In general, 8 of 10 wells sampled over a 10 month stability demonstration (12/82-09/83), increased in selenium concentration by an average of 3000%. The wellfield mean Se concentration at month 10 of 1.021 mg/l exceeded the present 0.05 mg/l goal by a factor of 20.4. Parameters including TDS, SO_4 , NH_4 , and $U-NH_4$ also followed similar increasing trends over the original stability period, however none of these exceeded restoration goals by significant amounts. (See Tables 1 and 2)

3.1.2 Pre- H_2S Injection Selenium Concentration - 07/87
From 10/83 - 07/87 B Field was allowed to soak while CCIC and WY-DEQ jointly arrived at the decision to chemically reduce soluble Se with $H_2S(g)$ injection. Analyses of the 11 field wells selected for the demonstration indicated that, on an average, the soak period increased (Se) by 147% to 2.524 mg/l (50.5 times Restoration Goal [0.05]). (See Table 3)

3.2 Post H_2S Injection Selenium Concentration and Trends: The balance of this report deals primarily with the parameter of concern to both WY-DEQ and C.C.I.C.; selenium. Other parameter field averages and trends will be noted, however, it should be stated that the intent of the H_2S reductant program was solely to decrease the B Field selenium concentration toward the 0.05 mg/l WY-DEQ established target.

From 07/87 to 08/87, 8,000 lbs $H_2S(g)$ were injected and recirculated with 2.8 million gallons of zone water through the B Field. Following this program, initial samples were collected from 11 field wells at 09/87 (190, 231, 232, 233, 234, 237, 260, 276, 277, 283, 285) and 5 monitor wells (230, 238, 239, 240, 241) (See Attachment 2: Wellfield Map). Field well samples were to be analyzed for Ca, Mg, Na, K, CO_3 , HCO_3 , SO_4 , Cl, NO_3 , TDS, pH, As, Mo, Se, V, U and Ra^{226} on a bi-monthly frequency to 07/88. Monitor wells were to be analyzed for Se only on the same frequency. Due to significant fluctuations in selenium concentration noted on the 11 field wells, sampling frequency was increased to monthly (for selenium analysis only) following the 03/88 sample round.

Table 4 presents the status of the B Field post H₂S groundwater water at the final sampling and shows the trends observed during the stability period.

An evaluation of Table 4 reveals the following:

- o At 07/88 sampling, 6 of 11 field wells were below the 0.05 mg/l Se target and 1 well was at the goal (0.053 mg/l). These 7 demonstrated a decreasing trend during the stability sampling period. (Refer to Sec. 8.0 graphics)

- o The wells not meeting the 0.05 mg/l Se target are 190, 234, 283, and 285. All four wells showed reasonably stable values during the final four sample periods. Although the WY-DEQ target concentration of 0.05 mg/l was not achieved, significant improvement in selenium concentrations was noted at all four wells as follows:

- 190 - Decreased 86.8% from pre-H₂S levels
 - 234 - Decreased 81.3% from pre-H₂S levels
 - 283 - Decreased 80.6% from post-H₂S level
 - 285 - Decreased 98.6% from pre-H₂S levels

Wells 190 and 283 showed an overall decreasing trend during the stability sampling period. (Refer to Sec. 8.0 graphics)

- o The final wellfield mean selenium concentration decreased by 93% from pre-H₂S levels to the 07/88 sampling round. The mean value at 07/88 (0.178 mg/l) was 3.6 times the proposed target. However, this is due primarily to the values recorded for wells 190 and 234. Eliminating those two well values from the survey results in a mean wellfield selenium value of 0.050 mg/l.

3.3 General Water Quality Evaluation

WY-DEQ and C.C.I.C. anticipated changes in parameters other than selenium as a function of the H₂S injection program. Table 5 investigates those parameters analyzed both during the 1982/1983 restoration stability period and the 1987/1988 post-H₂S sampling. Probable explanations for some of the noted water quality effects by parameter follow:

SO₄: Oxidation of residual H₂S/HS⁻ (to SO₄) would tend to increase sulfate concentrations

As: H₂S reduction of ferric arsenide generated by oxidation of arsenopyrite during mining is the probable cause of the arsenic increase. The subsequent concentration reduction to 0.048 mg/l during the post-H₂S stability monitoring period is due to residual H₂S further reducing the arsenic or precipitating it as a metal-sulfide.

U^{VI}: Although H₂S(aq) should have reduced the uranium to an insoluble state, the elevation noted may have been a function of reduced pH during the sulfide injection. The 50% reduction in concentration over the post-H₂S stability monitoring period is due to a combination continued reduction and a general upward trend in pH.

In order to investigate all parameters, complete WY-DEQ Guideline 8 analyses were performed on the 01/05-01/06/88 sample round. The analytical mean values for the 11 field wells (Attachment 3) did not reveal any anomalous, elevated, trace metal or major parameter values excepting potassium. Potassium salts were introduced to the zone during restoration in 1981 in an effort to strip clays of the ammonium ion.

Wells which remain elevated in selenium at the final sampling included 234, 190, 283, 285, and, to a lesser extent 237. Investigations into residual levels of H₂S(aq) at all wells did not reveal any differences which would explain the heterogeneous nature of the wellfield data.

3.4 Monitor Well Analysis: During the post-H₂S stabilization monitoring period 5 monitor wells were sampled to note any lateral or vertical movement of wellfield solutions. Well 230 was selected as a shallow zone monitor and showed no involvement with the wellfield zone during the testwork. Wells 238, 239, 240 and 241 were sampled to monitor ore zone solution migration and analyzed on the bi-monthly frequency for selenium only.

Well 241, at the 03/04/88 sampling began showing signs of elevated selenium and the upward trend continued to 06/06/88 (Se: 0.163 mg/l), and then declined to 0.121 mg/l at the 07/06/88 sampling. Guideline 8 analysis of the well

conducted 03/04 and 05/09, and the wellfield parameter analysis list performed on the 07/06 sample did not indicate the presence of wellfield solution at well 241. In comparison to baseline values presented in Table 6, typical leach indicators or constituents known to be elevated in the wellfield water, were not present at elevated levels at well 241. (Refer to Sec. 3.0 - Table 6)

No other monitor well sampled indicated any wellfield solution involvement.

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TABLE 1

Se Concentration - 1982/1983 Restoration Test

Well #	At Rest. Termination 12/82	At Stab. Termination 10/83	% Increase	Mean Over Period
190	0.023	1.586	6796%	0.557
231	0.010	<0.001	-90%	<0.005
232	0.011	0.200	1718%	<0.074
233	0.029	0.483	1566%	0.208
234	0.042	0.747	1679%	0.321
237	0.077	1.862	2318%	0.735
260	0.063	0.021	-67%	0.034
276	0.044	1.678	3714%	0.451
277	0.042	0.446	962%	0.141
285	0.040	3.172	7830%	1.356
10 Well Mean	0.038	1.021	2587%	0.388

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TABLE 2

Restoration Stability - B Wellfield
Month 10 - Sampling 10/83

Parameter	10 Well Mean	Goal	% of Goal
TDS mg/l	594	500	118.8
SO ₄ mg/l	252	-	-
pH	8.71	5-9	within
NH ₄ mg/l	34.3	30	114.3
NO ₃ mg/l	0.28	-	-
NO ₂ mg/l	0.31	-	-
As mg/l	0.004	0.050	8.0
Se mg/l	1.021	0.050	2042
U-nat mg/l	5.28	5.0	105.6
V mg/l	<0.10	-	-
Ra226 pCi/l	36.4	-	-

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TABLE 3

Pre-H₂S(g) Injection Test: Selenium Trend

Well #	10/83 (Se)	07/87 (Se)	% Change	07/87 % of Goal
190	1.586	4.82	+203.9	9640
231	<0.001	0.37	+36900	740
232	0.214	0.37	+72.9	740
233	0.483	2.01	+316.1	402
234	0.747	4.65	+522.5	9300
237	1.862	3.65	+96.0	7300
260	0.021	0.027	+28.6	54
276	1.678	2.990	+78.2	5980
277	0.446	0.84	+88.3	1680
283	-	2.20	-	4400
285	3.172	5.84	+84.1	11680
Mean	1.021	2.524	+147.2	5048%

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TABLE 4

B Wellfield Selenium - Trend Analysis
Post-H₂S Stability Sampling

1 Pre-H₂S - Post Restoration

2 Post-H₂S Injection - Beginning of Stability Period

3 Final Stability Sample (filtered only sample)

Well #	07/87 (Se µg/l) 1	09/87 (Se µg/l) 2	% Change 1 to 2	07/88 (Se µg/l) 3	% Change 1 to 3	% Change 2 to 3	% of Goal 0.05 µg/l	Trend Over Period
190	4.82	1.420	-70.5	0.636	-86.9	-78.4	1272	Stable
231	0.37	0.039	-89.5	0.021	-94.3	-46.2	42	Decreasing
232	0.37	0.086	-76.8	0.029	-92.9	-56.3	58	Decreasing
233	2.01	0.045	-97.8	0.016	-99.2	-64.4	32	Decreasing
234	4.65	0.023	-99.5	0.370	-81.3	+3683	1740	Stable
237	3.65	1.420	-61.1	0.053	-98.5	-96.3	106	Decreasing
260	0.027	0.060	+122	0.007	-74.1	-88.3	14	Decreasing
276	2.99	0.434	-85.8	0.013	-99.6	-97.0	26	Decreasing
277	0.34	0.028	-96.7	0.026	-96.9	-7.1	52	Decreasing
283	2.20	1.050	-52.3	0.204	-90.7	-80.6	408	Stable
285	5.84	0.032	-99.5	0.082	-98.6	+156	164	Stable
B Field Mean	2.52	0.422	-83.3	0.178	-93.0	-57.8	356	Decreasing

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TABLE 5

Additional B Field Parameters
Mean Values

Parameters	Post Restoration 1982	Post Restoration Stability 1983	Post H ₂ S Injection 1987	Post H ₂ S Stability 1988
TDS mg/l	423	594	964	1347
SO ₄ mg/l	186	252	450	523
pH	7.76	8.71	7.48	7.89
NH ₄ mg/l	1.14	34.3	96.0	85.2
As mg/l	0.004	0.004	0.171	0.048
Se mg/l	0.038	1.021	0.422	0.178
U-nat mg/l	0.87	5.28	16.375	8.474
V mg/l	<0.10	<0.10	<0.10	<0.10
Ra226 pCi/l	65.3	36.4	66.5	483.9

TABLE 6

PRODUCTION ZONE AQUIFER (1 SAND)
GROUNDWATER QUALITY AT EXCURSION MONITOR WELLS PRIOR TO MINING
COLLINS DRAW PROJECT

Parameter mg/l	EPA National Drinking Water Standard	Well 238 Average (N-5)	Well 239 Average (N-5)	Well 240 Average (N-5)	Well 241 Average (N-5)
Total Dissolved Solids (105°C)	500	360	433	387	374
Conductivity μ Mohms (Lab)		539	699	479	566
Conductivity μ Mohms (Field)		810	888	964	790
Sodium		97	100	107	95
Potassium		7	8	6	7
Calcium		23	47	25	30
Magnesium		2	4	1	2
Sulfate	250	138	132	136	133
Chloride	250	12	45	22	18
Carbonate		10	2	5	12
Bicarbonate		141	201	147	144
pH unit - Lab	6.5-8.5	8.3	7.8	7.9	8.3
pH unit - Field		8.0	7.1	7.7	7.8
Ammonia as N		0.12	0.06	0.08	0.04
Nitrate as N	10	0.10	10.01	0.06	0.23
Nitrite as N		0.03	0.05	0.04	0.09
Aluminum	0.05	10.05	10.05	10.05	10.05
Arsenic	1.0	10.01	10.01	10.01	10.01
Barium		10.05	10.05	10.05	10.05
Boron		11.0	11.0	11.0	11.0
Cadmium	0.01	10.002	10.002	10.002	10.002
Chromium	0.05	10.01	10.01	10.01	10.01
Copper	1.0	10.01	10.01	10.01	10.01
Fluoride	4.0	0.16	0.18	0.17	0.22
Iron	0.3	0.02	0.11	0.11	0.10
Lead	0.05	10.05	10.05	10.05	10.05
Manganese	0.05	10.01	0.05	10.01	10.01
Mercury	0.002	10.001	10.001	10.001	10.001
Selenium	0.01	10.01	10.01	10.01	10.01
Nickel		10.01	10.01	10.01	10.01
Zinc	5.0	10.01	0.02	10.01	0.02
Molybdenum		10.05	10.05	10.05	10.05
Vanadium (V_{2O_5})		10.05	10.05	10.05	10.05
Uranium		0.35	0.69	0.013	0.040
Radium 226 pCi/l	5.0	10.1	4.41	1.29	1.94

N - Number of samples.
L - Less than.



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March 2, 1988

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Re: CCIC Restoration Stability Sampling - Groundwater
Zone and Sampling Instability

Dear Gary:

Per our discussion of the past two months, the following report documents analytical and sample instability problems encountered during the analysis of your Collins Draw Restoration Stability samples. The problem was identified on the January sample round (01-05-88 to 01-06-88 sampling) and was confirmed through a combination of analytical testwork and data comparisons between sample rounds. Although we have not received crosscheck data from WY-DEQ or US-NRC on the 11-12-87 sample splits, ELI management is concerned that wide variances may exist within the split data. ELI can demonstrate that these differences, and those observed from sample round to sample round on individual wells, are related to aquifer non-homogeneity and sample instability. This data may have an impact on CCIC's restoration stability program. The purpose of this report therefore is to:

- a. Establish causes of variations in reported analytical data
- b. Propose preservation and sampling techniques that could minimize the noted interferences
- c. Outline an analytical and sampling test (to be performed on Round 4 sampling 03-02-88 to 03-04-88) to further isolate the problem.

1.0 Historical Data and Procedures

Energy Laboratories Inc's (ELI) involvement with the Collins Draw Restoration Stability sampling and analytical program began with Round 2 (11-12-87) split sampling. One previous round of samples had been collected by CCIC personnel with samples split with concerned agencies, and CCIC's split analyzed by WAMCO. ELI again sampled the 11 field wells 01-05-88 to 01-06-88. Data comparisons from the three sample rounds indicated significant variances

in certain parameters from field well to field well and between sampling rounds. The parameters, showing the greatest variation (as determined by % std. dev to mean value) included As, Se, and Un*^b.

1.1 Sampling Technique (ELI):

Samples are collected from the zone using submersible stainless steel pumps set on PVC plastic or fiberglass pipe. Wells are pumped and metered for a minimum two casing displacements with pH and specific conductance monitored to verify chemical stability. Collected samples are filtered and preserved in accordance with WY-DEQ and US-EPA guidelines. Generally wells are sampled as stability is reached (following 2 C.D), however, in order to allow agencies to split samples in a timely fashion, wells have been pumped to stability up to 48 hours prior to sampling.

1.2 Preservation Technique:

Samples for various parameters are preserved as follows:

1.2.1 pH, SO₄, Cl, CO₃/HCO₃ - Poly bottle - Cool to 4°C.

1.2.2 TDS - Poly bottle - 0.45 um filtration - Cool to 4°C.

1.2.3 NH₄ - Poly bottle - 0.45 um filtration - H₂SO₄ to pH <2.0 - Cool to 4°C

1.2.4 Na, Ca, Mo, As, Se, V, U, Ra²²⁶, Mg, K - Poly - bottle - 0.45 um filtration - HNO₃ to pH <2.0

1.3 Analytical Technique:

Samples received by ELI are analyzed by the following US-EPA procedures. Quality assurance crosschecks include duplicate and spike analysis, ion balance and TDS balance. It should be noted that several trace metal and nutrient parameters have been omitted from the usual WY-DEQ Guideline 8 list, thereby allowing some doubt as to the validity of the ion and TDS balances.

Parameter	EPA Method
pH	150.1
SO ₄	375.4
*Cl	407.A
CO ₃ /HCO ₃	310.1
TDS	160.1
NH ₄	350.3

*Standard Methods for the Examination of Water and Wastewater

Parameter	EPA Method
Na	273.1
Ca	215.1
Mo	246.1
As	206.3
Se	270.3
V	286.1
U	903.1
Ra 226	900.0 or 900.1
Mg	242.1
K	258.1

- 2.0 CCIC Sample/Aquifer Instability - Data Analysis
- Following the 01-05-88 to 01-06-88 sampling round at CCIC's Collins Draw Project, it was noted that samples which had been filtered and preserved for trace metal/radiometric analysis showed a noticeable precipitate. The red to brownish solid was observed in most of the 11 field wells. ELI was concerned that the presence of what appeared to be a metallic sulfide precipitate, could have jeopardized the accuracy of trace metal analysis (primarily As and Se). Re-analysis of the samples verified this with variances averaging 5473 % and 13.6 % on As and Se respectively. Inductively Coupled Argon Spectroscopy (ICAP) analysis was attempted to isolate the correct value, however, a third set of results surfaced (see Attachment 1). Standard addition spikes were performed on all samples for As and Se (Attachment 2) which, in most cases, tended to verify that the re-analysis was closer to correct, however, accuracy was still in question.

The precipitate noted in the preserved samples was collected and washed and digested to a known volume. The resulting solution was then analyzed for a number of common and trace metallic cations with results listed in Attachment 3 (% metal by weight in ppt). Of the traces tested, Al, Fe, As, and Se were present at concentrations ranging from 0.27 to 7.1 %. The 1.65 % As by weight could have resulted in assay variances of up to ± 0.35 mg As/liter sample.

Noted analytical difficulties encountered in the analysis of the CCIC samples included:

- 2.1 Chloride - due to the excessive levels of free H_2SO_4 in the samples, it is necessary to pretreat the sample aliquot with peroxide and heat to prevent precipitation of silver sulfide (failure to perform results in elevated chloride).
- 2.2 Alkalinity (CO_3-HCO_3) - these values may be suspect, depending on the amount of free ammonia present in the samples. The EPA approved technique calls for a titrimetric method, however, experience indicates that free ammonia titrated to ammonium can elevate results artificially.
- 2.3 Major and trace metals - analysis of the precipitate encountered in ~one month old nitric acid preserved samples indicates that a strong probability exists that insoluble metal-sulfide complexes are being formed in the samples. This would tend to produce erratic analytical results, which, in fact exist.
- 2.4 Ion Balances - due to a combination of the factors listed above, and the following, ion balances seem to consistently favor cationic species. Additional factors which may be involved could include:
 - 2.4.1 Major N-base ions excepting NH_4^+ have not been requested (NO_2 , NO_3), and therefore, to date have not been analyzed. With the high NH_4^+ levels, conversion in the post mining zone to NO_2 or NO_3 could have occurred.
 - 2.4.2 With the high level of $H_2S_{(g)}$ present, it is possible that the balance of the anion portion is present as dissociated HS^- .
 - 2.4.3 The excessive level of $H_2S_{(g)}$ may have an effect on the specific ion ammonia method which employs a gas permeable membrane.

In order to establish that all major contributors to the ion balance were identified, the balance of trace elements were analyzed and reported as Attachment 4. Unfortunately, lack of sample and the time delay, made NO₂-NO₃ analysis impossible. No other major trace metals were identified, however it would appear (from the precipitate analysis) that significant concentrations of Al, Fe, Ca (additional) and As could exist at the point of sampling and preservation.

3.0 Results and Discussion - Recommended Tests

At the request of DEQ, during 1987 CCIC employed hydrogen sulfide gas injection to the post ISL mining/restoration aquifer in an effort to reduce certain trace metal concentrations. Although the long term effect of this on the Collins Draw wellfield is uncertain, the short term effect has apparently led to analytical and sample instability problems which render a true analysis of the test's value somewhat difficult. A well by well analysis of the post mining field indicates that a condition of non-homogeneity now exists in the relatively small pattern. The testwork discussed in 2.0 suggests that, even if representative samples of the zone are collected, it is unlikely that separate facility analysis of the water will yield comparable results. ELI, in order to present the best analysis possible of the of the well field solution, has incorporated the following test schedule in Round 4 sampling.

3.1 As-Se Stability

Samples will be collected from "stabilized" wells and delivered directly to the digestion vessels used for hydride analysis. These will include samples taken directly at the well head (total As, Se) and aliquots from the filtered portion (soluble As, Se - without the potential of sample precipitation). These values will be compared with results derived from the normal filtered-nitric acid preserved sample.

Gary D. Aho
March 2, 1988
Page Six

3.2 Aquifer - Casing Volume Stability

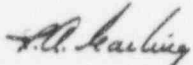
In order to establish the relative stability between samples originating from the well casing (wells pumped to stability with up to a 48 hour delay to sampling) to those sampled immediately on achieving two displacements with chemical stability (pH-spec. conductance), five wellfield wells will be stabilized and sampled on 03-02-88. These same wells will be sampled 03-04-88 without pumping over one displacement and analytical values will be compared.

4.0 Conclusion

ELI management is concerned that the problems noted in the report with respect to zone homogeneity and sample instability may impair a realistic appraisal of CCIC's wellfield restoration efforts. It is therefore our intent to further research this problem and, if possible, provide further recommendations to CCIC management. The test data collected during Round 1 sampling will be presented as an addendum to this report.

Any other tests which CCIC deems appropriate will, if possible, be performed and reported upon CCIC's request.

Sincerely,



R.A. Garling
Branch Manager

RAG/sh

Attachments

**ATTACHMENT 1
CLEVELAND CLIFFS IRON COMPANY - STABILITY PROGRAM**

Well/ Parameter	Round 1 WANCO	Round 2 ELI	Round 3 ELI Original	Round 3 ELI Recheck	Round 3 ELI ICAP
190					
As	0.085	0.118	0.120	0.130	0.12
Se	1.420	0.077	0.199	0.157	0.36
U	13.823	11.066	10.094		
231					
As	0.008	0.008	0.019	0.036	<0.05
Se	0.039	0.063	0.039	0.040	<0.05
U	9.752	2.567	3.281		
232					
As	0.012	0.007	0.120	0.080	0.09
Se	0.086	0.062	0.023	0.017	<0.05
U	12.805	16.157	22.712		
233					
As	0.420	0.010	0.084	0.247	0.10
Se	0.045	0.118	0.027	0.024	<0.05
U	36.465	11.288	13.122		
234					
As	0.088	0.008	0.008	0.136	<0.05
Se	0.023	0.308	0.379	0.412	0.62
U	14.840	12.394	8.832		
237					
As	0.220	0.027	0.028	1.238	0.06
Se	1.420	0.461	0.235	0.270	0.37
U	2.883	15.271	12.366		
260					
As	0.007	0.005	0.007	0.017	<0.05
Se	0.060	0.176	0.036	0.027	<0.05
U	7.293	5.312	4.795		
276					
As	0.350	0.025	0.072	0.325	0.12
Se	0.434	0.164	0.096	0.090	0.17
U	28.833	9.738	10.851		
277					
As	0.114	0.292	0.199	0.206	0.19
Se	0.028	0.054	0.022	0.023	<0.05
U	18.156	13.280	9.337		
283					
As	0.082	0.085	0.056	0.051	0.07
Se	1.050	0.062	0.109	0.095	0.22
U	14.077	13.943	8.832		
285					
As	0.500	0.234	0.080	0.206	<0.05
Se	0.032	0.006	0.025	0.021	0.17
U	21.201	12.616	7.571		

ATTACHMENT 2
QUALITY ASSURANCE DATA - ROUND 3 DATA

Well	Recheck	Original	Spike	Exp.	Original	Obs.	% Recovery	
	As	As		Recheck			Recheck	Original
190	0.130	0.120	0.100	0.230	0.220	0.208	90.43	94.55
231	0.036	0.019	0.020	0.056	0.039	0.027	48.21	69.23
232	0.080	0.120	0.100	0.180	0.220	0.146	81.11	66.36
233	0.247	0.084	0.100	0.347	0.184	0.311	89.63	163.04
234*	0.136	0.008	0.100	0.236	0.108	0.099	41.95	91.67
237	1.238	0.028	0.030	1.268	0.058	0.804	63.41	13862.1
260	0.017	0.007	0.010	0.027	0.017	0.100	370.37	588.24
276	0.325	0.072	0.200	0.525	0.272	0.392	74.67	144.12
277	0.206	0.199	0.070	0.276	0.266	0.209	75.72	78.57
283	0.051	0.056	0.050	0.101	0.106	0.090	89.11	84.91
285	0.206	0.080	0.080	0.286	0.160	0.168	58.74	105.00

Well	Recheck	Original	Spike	Exp.	Original	Obs.	% Recovery	
	Se	Se		Recheck			Recheck	Original
190	0.157	0.199	0.200	0.357	0.399	0.335	93.84	83.96
231	0.040	0.039	0.050	0.090	0.089	0.066	73.33	74.16
232	0.017	0.023	0.020	0.037	0.043	0.023	62.16	53.49
233	0.024	0.027	0.030	0.054	0.057	0.046	85.19	80.70
234	0.412	0.379	0.400	0.812	0.779	0.614	75.62	78.82
237	0.270	0.235	0.200	0.470	0.435	0.327	69.57	75.17
260	0.027	0.036	0.040	0.067	0.076	0.049	73.13	64.47
276	0.090	0.096	0.020	0.110	0.116	0.039	35.45	33.62
277	0.023	0.022	0.100	0.123	0.122	0.167	111.38	136.89
283	0.095	0.109	0.100	0.195	0.209	0.191	97.95	91.39
285	0.021	0.025	0.025	0.046	0.050	0.032	69.57	64.00

WATER ANALYSIS REPORT - CLEVELAND CLIFFS

Project: Collins Draw

Sample I.D.: Filtrate
Report Date: 03-02-88
Sample Number: 88-0421
 % by Weight

MAJOR IONS:

Ca	50.2
Mg	1.4

TRACE METALS:

Al	7.13
As	1.65
Ba	0.08
Cd	0.02
Co	0.02
Cr	0.02
Cu	0.02
Fe	2.23
Pb	0.05
Mn	0.02
Mo	0.04
Ni	0.11
Se	0.27
Sr	0.47
Ti	1.57
W	1.49
Zn	0.09

% Identified 66.88

Balance probably in sulfides, carbonates, silicates

Q.A. MANAGER: *PA. Harding*
ENERGY LABORATORIES, INC.

Results of Recommended Tests

The following tables represent results of testwork suggested in the test of this attachment. Samples analyzed were collected 03/02-04/88 (Round 3 - Post H₂S Stabilization Sampling).

Selenium Concentration vs. Well Stabilization Technique

Well	2 Casing Displacement	48 Hour Soak & 5 Min Pump
	Filtered Sample in Digestion Vial (Se) 03/02/88	Filtered Sample in Digestion Vial (Se) 03/04/88
231	0.029	0.029
232	0.021	0.040
260	0.011	0.014
276	0.028	0.029
277	0.054	0.055

Comments: Slight elevation in concentration noted following 48 hour casing soak

Selenium Concentration vs. Sample Preservation Technique

Well	Raw Sample to Digestion Vial (Se)	Filtered Sample To Digestion Vial (Se)	HNO ₃ Preserved Filtered Sample (EPA) (Se)
190	0.538	0.530	0.248
231	0.046	0.029	0.016
232	0.048	0.021	0.014
233	0.055	0.029	0.011
234	0.674	0.655	0.498
237	0.146	0.114	0.074
260	0.018	0.011	0.007
276	0.033	0.028	0.020
277	0.088	0.954	0.033
283	0.183	0.171	0.110
285	0.091	0.079	0.033
241	0.050	0.049	0.050

Comments: Selenium precipitates were noted in the raw samples and were removed by filtration. The HNO₃ preserved filtered samples continued to demonstrate continued selenium precipitation.

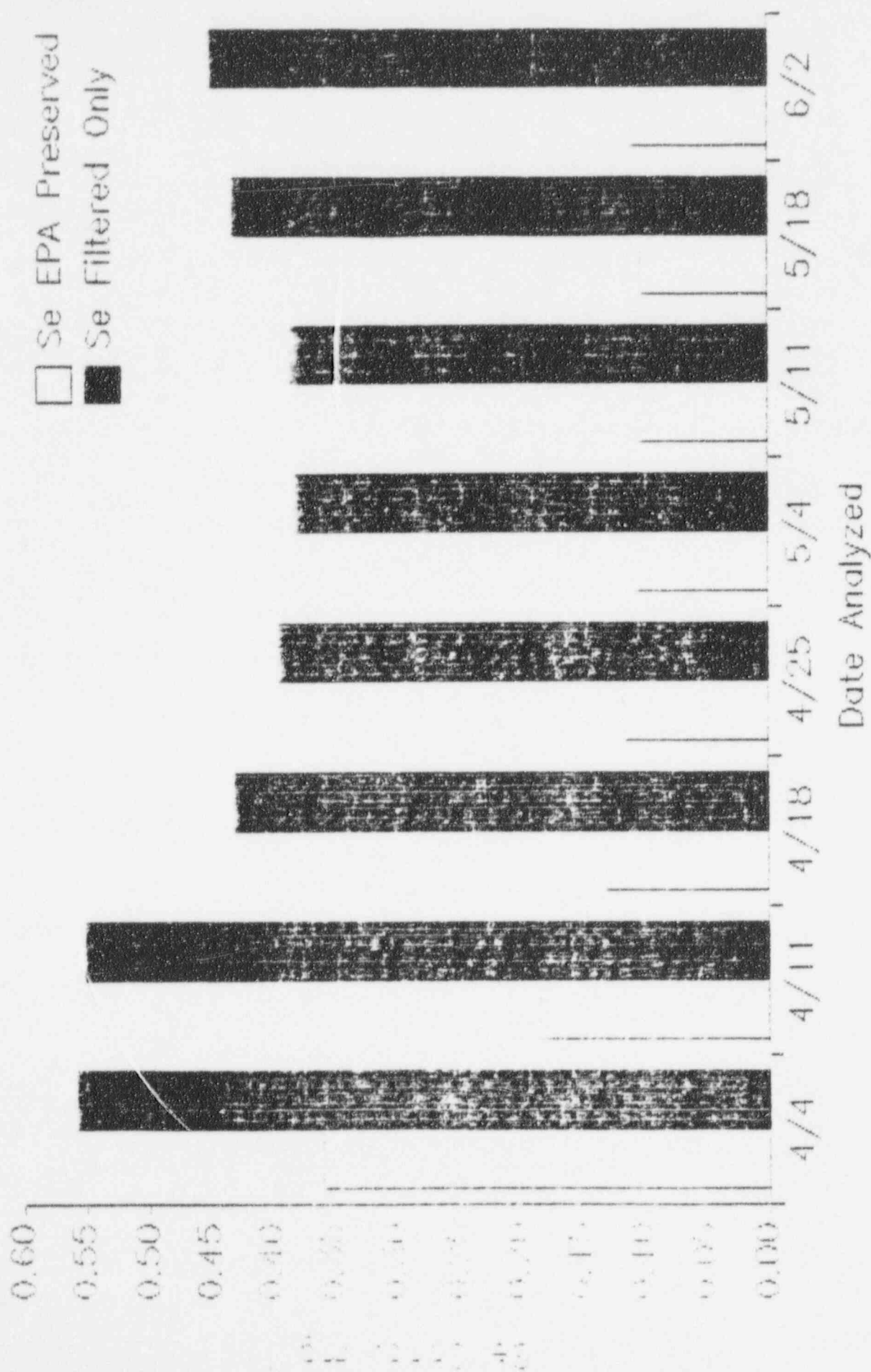
WATER ANALYSIS REPORT - CLEVELAND CLIFFS

Project: Collins Draw

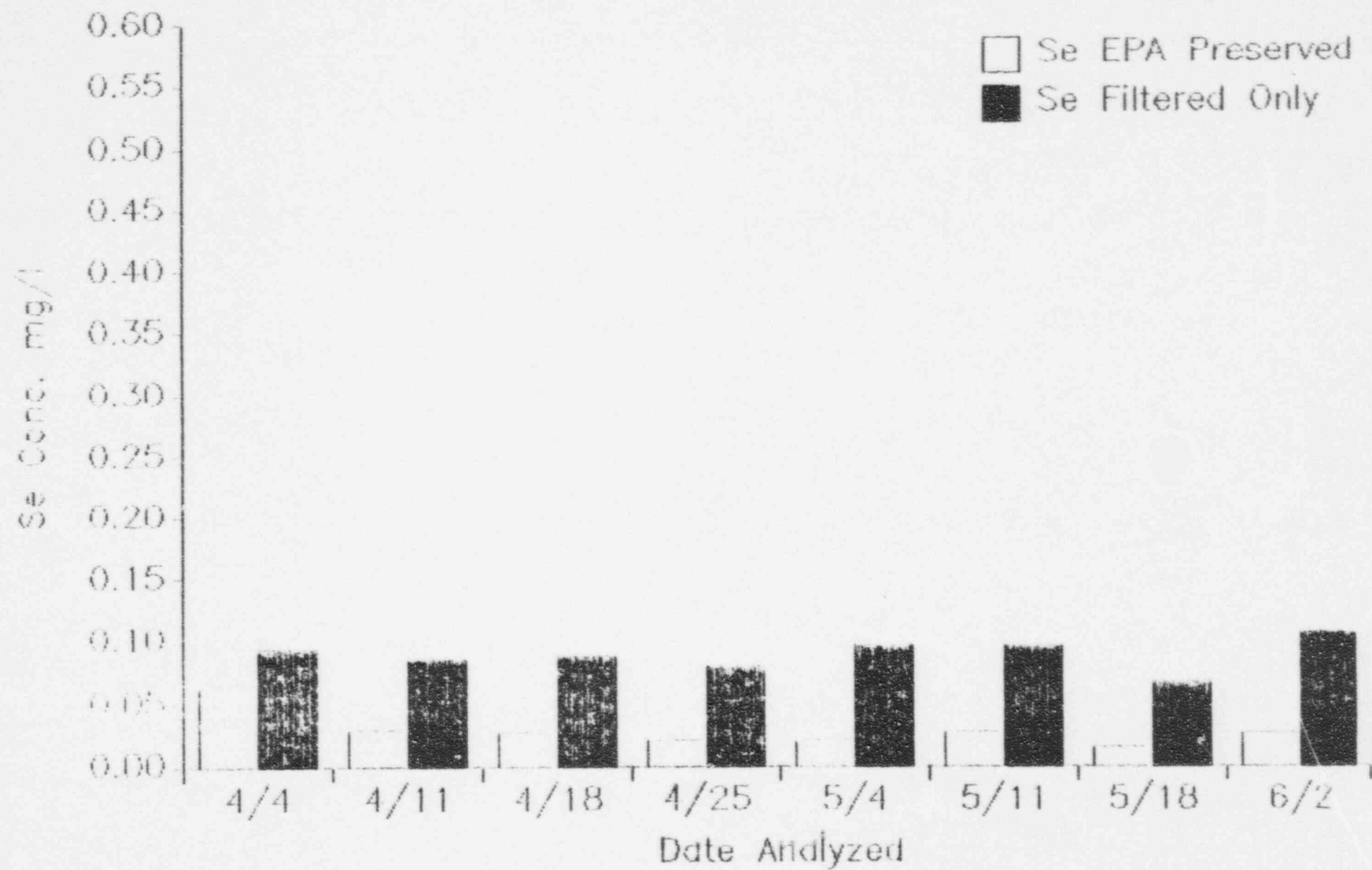
Sample I.D.:	Well #190	Well #231	Well #232	Well #233	Well #234	Well #237	Well #260	Well #270	Well #277	Well #283	Well #285
04-04-88											
Se - HNO3	0.358	0.018	0.015	0.013	0.594	0.085	0.006	0.010	0.031	0.147	0.028
Se - Filtered Only	0.557	0.030	0.036	0.028	0.746	0.095	0.012	0.019	0.047	0.147	0.088
04-11-88											
Se - HNO3	0.183	0.010	<0.001	0.002	0.576	0.029	0.003	0.006	0.015	0.129	0.005
Se - Filtered Only	0.550	0.017	0.028	0.032	0.758	0.086	0.004	0.018	0.054	0.149	0.089
04-18-88											
Se - HNO3	0.128	0.008	0.001	0.005	0.405	0.027	0.002	0.007	0.012	0.105	0.002
Se - Filtered Only	0.430	0.019	0.027	0.028	0.845	0.089	0.007	0.016	0.045	0.110	0.069
04-25-88											
Se - HNO3	0.114					0.021				0.080	
Se - Filtered Only	0.393					0.082				0.112	
05-04-88											
Se - HNO3	0.105					0.021				0.083	
Se - Filtered Only	0.380					0.098				0.120	
05-11-88											
Se - HNO3	0.103					0.027				0.084	
Se - Filtered Only	0.384					0.098				0.127	
05-18-88											
Se - HNO3	0.101					0.015				0.060	
Se - Filtered Only	0.430					0.070				0.116	
06-02-88											
Se - HNO3	0.108					0.026				0.086	
Se - Filtered Only	0.447					0.107				0.118	

O.A. MANAGER: *M. L. King*
ENERGY LABORATORIES, INC.

SELENIUM STUDY WELL #190 1988 SAMPLING PERIOD

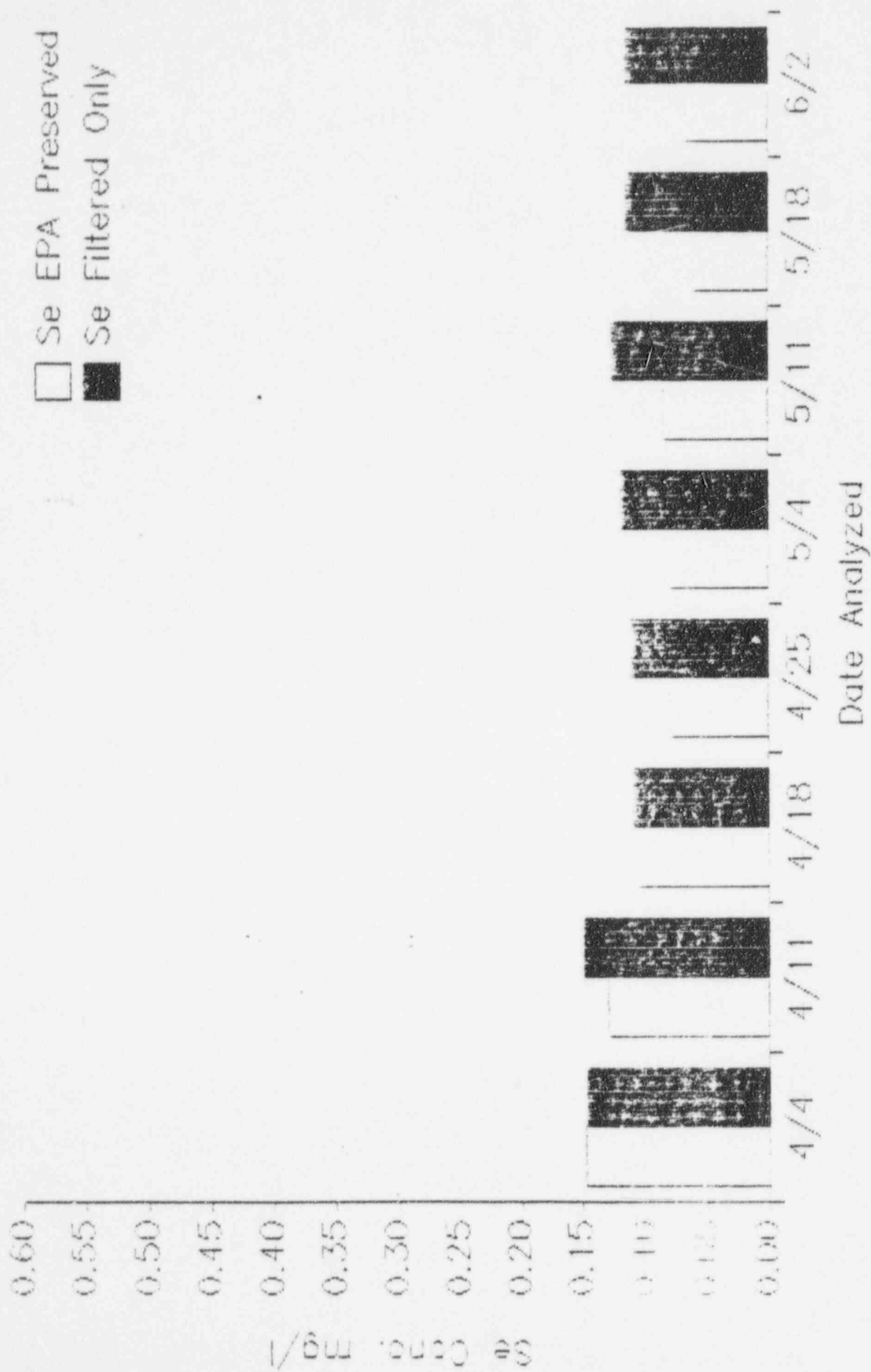


SELENIUM STUDY WELL #237
1998 SAMPLING PERIOD



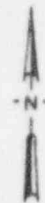
SELENIUM STUDY WELL #283 1988 SAMPLING PERIOD

☐ Se EPA Preserved
☒ Se Filtered Only



LEGEND
B WELL FIELD

- INITIAL PRODUCTION WELL
- INITIAL INJECTION WELL
- X EXCURSION MONITOR WELL
- POSTRESTORATION MONITOR WELL



SCALE

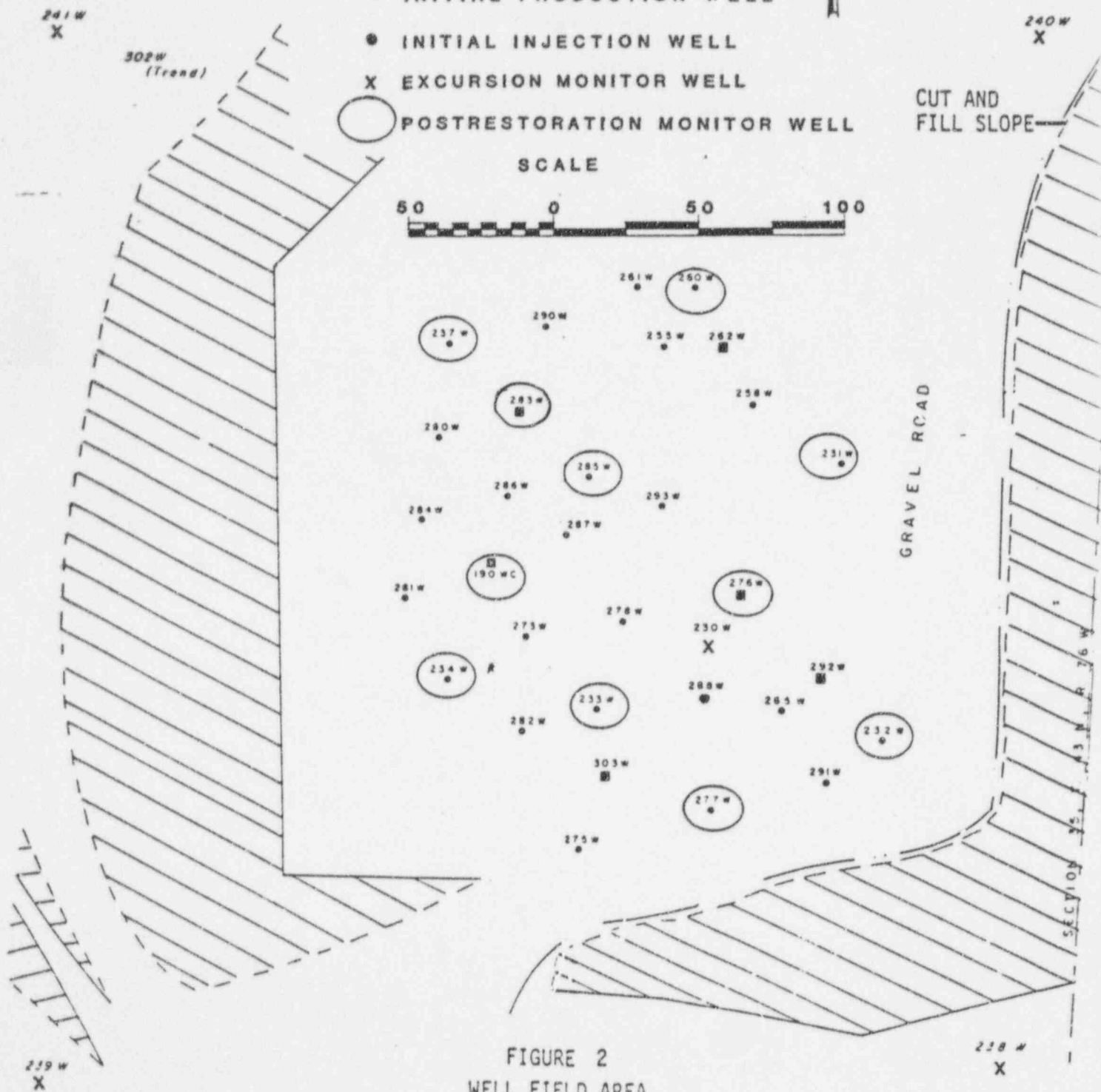


FIGURE 2
WELL FIELD AREA
COLLINS DRAW PROJECT
1 INCH = 50 FEET

**ATTACHMENT 3
01/88 MEAN B FIELD ANALYTICAL DATA**

Project:

Collins Draw

Date: 01/05-06/88

B Field Mean

Std Dev

Det. Limit
& Range

MAJOR IONS mg/l:

Ca	46.8	± 36.8	0.05
Mg	5.9	± 3.8	0.01
Na	120.7	± 24.7	0.05
K	276	± 48.5	0.10
CO ₃	-	-	0.10
HCO ₃	507.7	± 186	0.10
SO ₄	530	± 165	0.50
Cl	31.3	± 6.2	0.10
SiO ₂	15.9	± 4.6	1.00
NH ₄ (N)	92.3	± 17.3	0.05
TDS @ 180 C	1339	± 295	1.0
pH (units)	7.91	+ 0.37	1-14

TRACE METALS mg/l:

Al	<0.20	± 0.11	0.10
As	0.133	± 0.102	0.001
As-ICAP	<0.09	0.04	0.001
Ba	<0.10		0.10
B	<0.10		0.10
Cd	<0.01		0.01
Cr	<0.05		0.05
Cu	<0.01	± 0.01	0.01
Fe	<0.04	± 0.01	0.05
Pb	<0.05		0.05
Mn	0.04	± 0.03	0.01
Mo	<0.10		0.10
Ni	<0.05		0.05
Se	0.108	± 0.122	0.001
Se-ICAP	<0.20	± 0.19	0.001
V	<0.14	± 0.12	0.10
Zn	<0.01		0.01

RADIOMETRIC pCi/l:

U (mg/l)	10.163	± 5.086	0.0003
Ra ²²⁶	473	± 388	0.20
Ra Prec. +/-			

Q.A. DATA:

Anion meq:

Cation meq:

A/C Balance:

WYDEQ A/C Bal. %

Calc TDS mg/l:

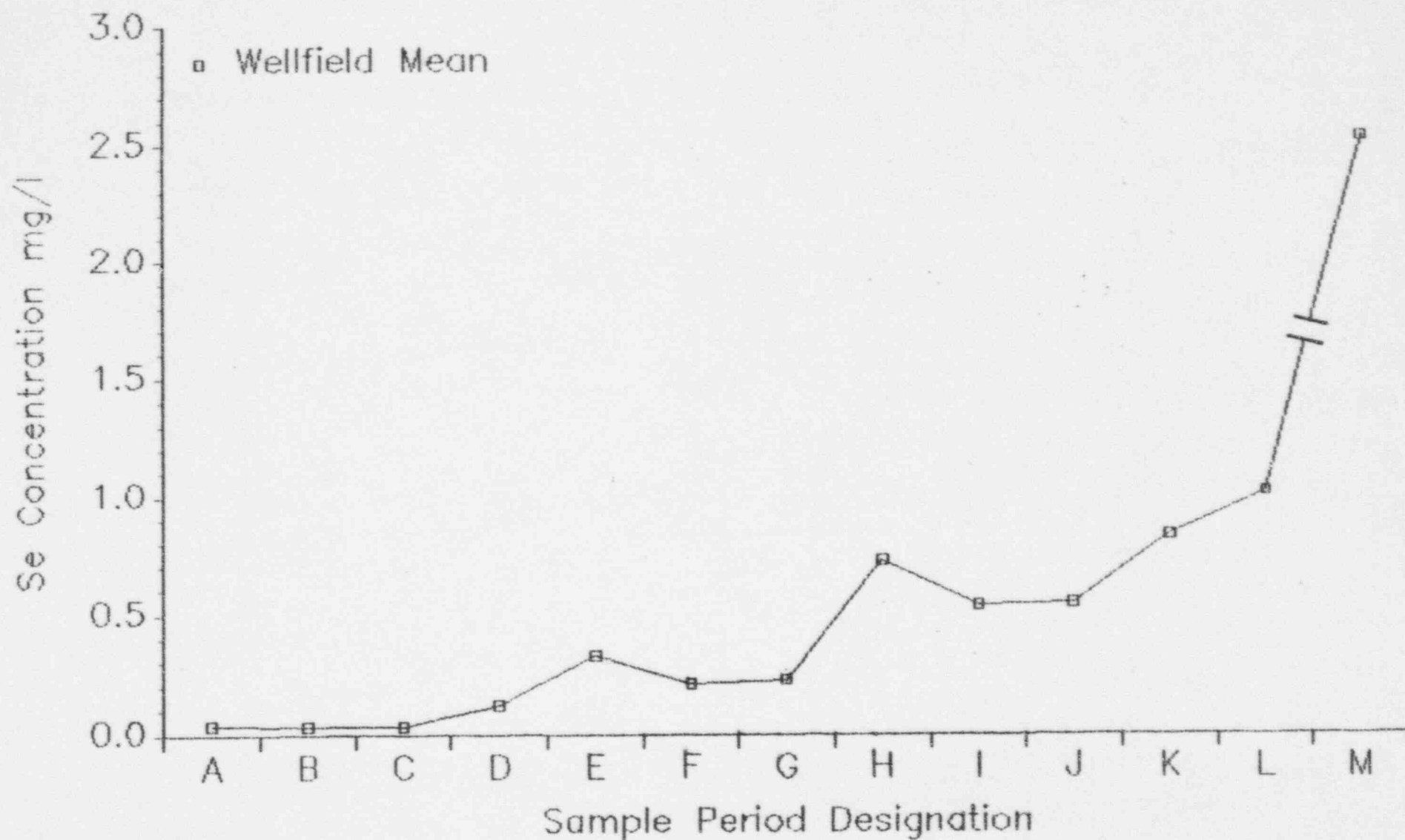
TDS A/C Bal:

0.95-1.05

0.90-1.10

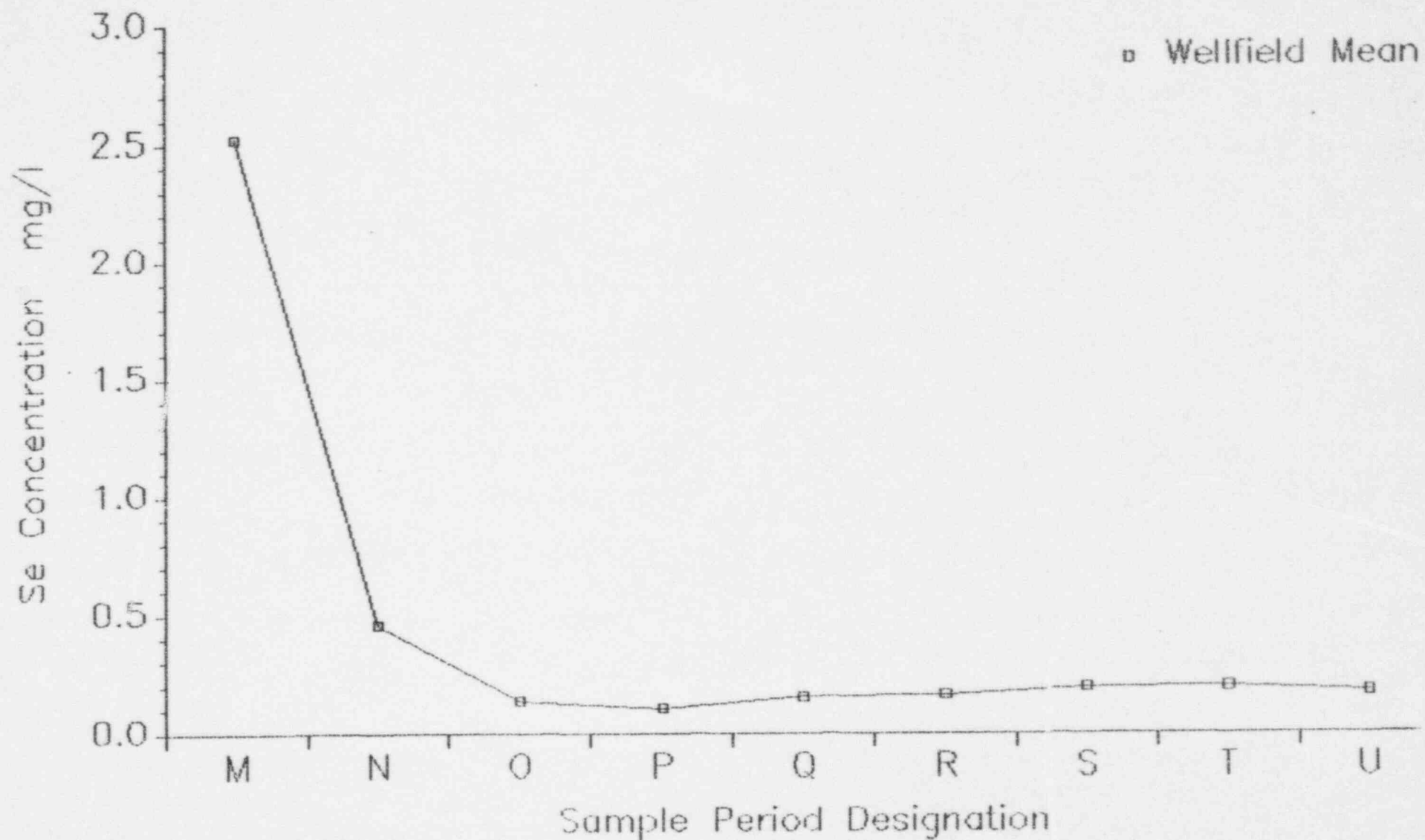
Q.A. MANAGER: *S.A. Harding*
ENERGY LABORATORIES, INC.

Cleveland Cliffs Iron Company
B-Field Restoration Stability Data
Pre H2S 1983



See attached data for further
information

Cleveland Cliffs Iron Company
B-Field Post H₂S Stability Data
1987 through 1988



See attached data for further
information

August 22, 1988

Cleveland Cliffs Iron Company
Post H₂S Injection - Stability Monitoring Program

B Wellfield Restoration and Post H₂S Stability Data
Graphics Support

Graphic Desig.	Date	Round #/I.D.	Wellfield Mean
A	12/82	2 week	0.038
B	1/83	4 week	0.035
C	2/83	6 week	0.033
D	2/83	8 week	0.121
E	3/83	3 month	0.328
F	4/83	4 month	0.209
G	5/83	5 month	0.227
H	6/83	6 month	0.724
I	7/83	7 month	0.541
J	8/83	8 month	0.549
K	9/83	9 month	0.834
L	10/83	10 month	1.021
M	7/87	Pre H ₂ S	2.524
N	9/87	Round 1	0.458
O	11/87	Round 2	0.139
P	1/88	Round 3	0.108
Q	3/88	Round 4	0.156
R	4/88	Round 5	0.164
S	5/88	Round 6	0.195
T	6/88	Round 7	0.198
U	7/88	Round 8	0.178

WATER ANALYSIS REPORT - CLEVELAND CLIFFS

Project: Collins Draw

SAMPLE I.D.: Well #190

	#1	#2	#3	#4	#5	#6	
Sample Round:	09-08-87	11-12-87	01-06-88	03-03-88	04-04-88	05-05-88	06-02-88
Sample Dates:	09-29-87	12-28-87	01-27-88	03-24-88	05-23-88	05-23-88	06-23-88
Report Dates:	01	87-14699	88-0133	88-1924	88-3790	88-3909	88-6915
Sample Numbers:	WAMCO	ELI	ELI	ELI	ELI	ELI	ELI
Labs:							

MAJOR IONS mg/l:

Ca	7.0	12.7	9.3	7.8	8.6	9.6	0.05
Mg	5.0	5.6	3.0	2.8	3.1	3.7	0.01
Na	99	140	111	110	119	125	0.05
K	211	408	312	253	343	346	0.10
CO3	150	17.3	20.7	23.5	20.1	14.8	0.10
HCO3	449	697	662	641	642	682	0.10
SO4	372	564	397	412	440	481	0.50
Cl	53.0	48.7	44.9	29.7	39.5	36.7	0.10
NO3 (N)	127	121	104	118	105	117	0.05
TDS @ 180 C (Calculated)	952	1545	1343	1305	1429	1510	1.0
pH (units)	8.57	8.73	8.83	8.90	8.83	8.67	1-14
H2S - g						14.4	

TRACE METALS mg/l:

As	0.085	0.118	0.125	0.063	0.128	0.096	0.001
Hg	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Se EPA Pres.	1.420	0.077	0.179	0.248	0.358	0.326	0.434
Se Filt. Only				0.530	0.357	0.715	0.729
V	<0.10	0.40	0.50	0.40	0.10	0.30	0.10

RADIOMETRIC pCi/l:

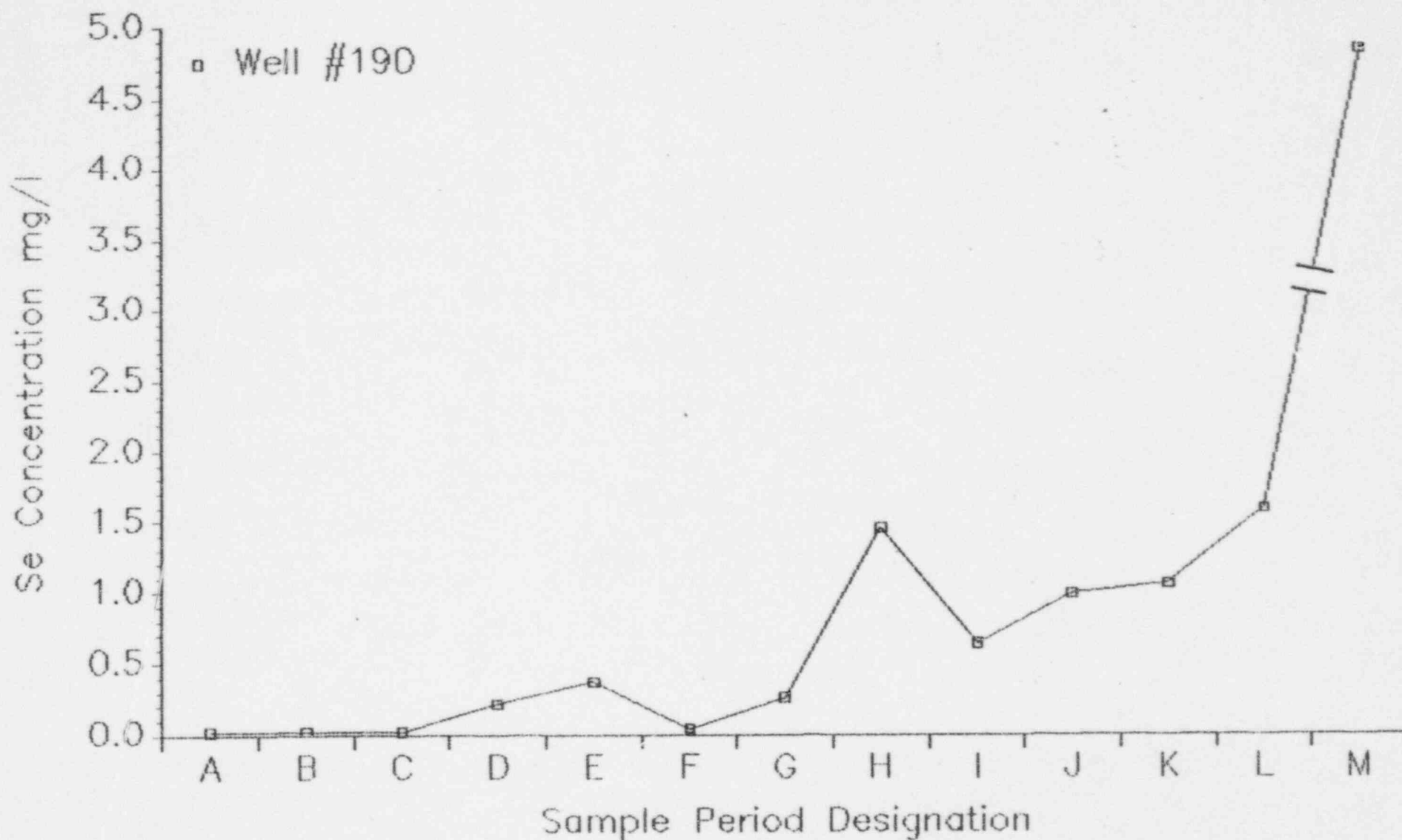
U (mg/l)	13.823	11.066	10.094	16.651	13.322	14.400	0.0003
Ra226	63.0	630.6	432.6	631.4	473	714	0.20
Ra Proc. +/-	6.1	7.9	5.2	6.9	18.7	24.4	

Q.A. DATA:

Anion eqq:	19.54	25.12	21.08	20.74	21.47	22.73	
Cation eqq:	21.59	26.29	20.96	20.32	22.16	23.62	
A/C Balance:	0.905	0.953	1.006	1.021	0.969	0.962	0.95-1.05
MYDEQ A/C Bal. %	4.98	2.28	-0.29	-1.02	1.58	1.92	-5 - +5

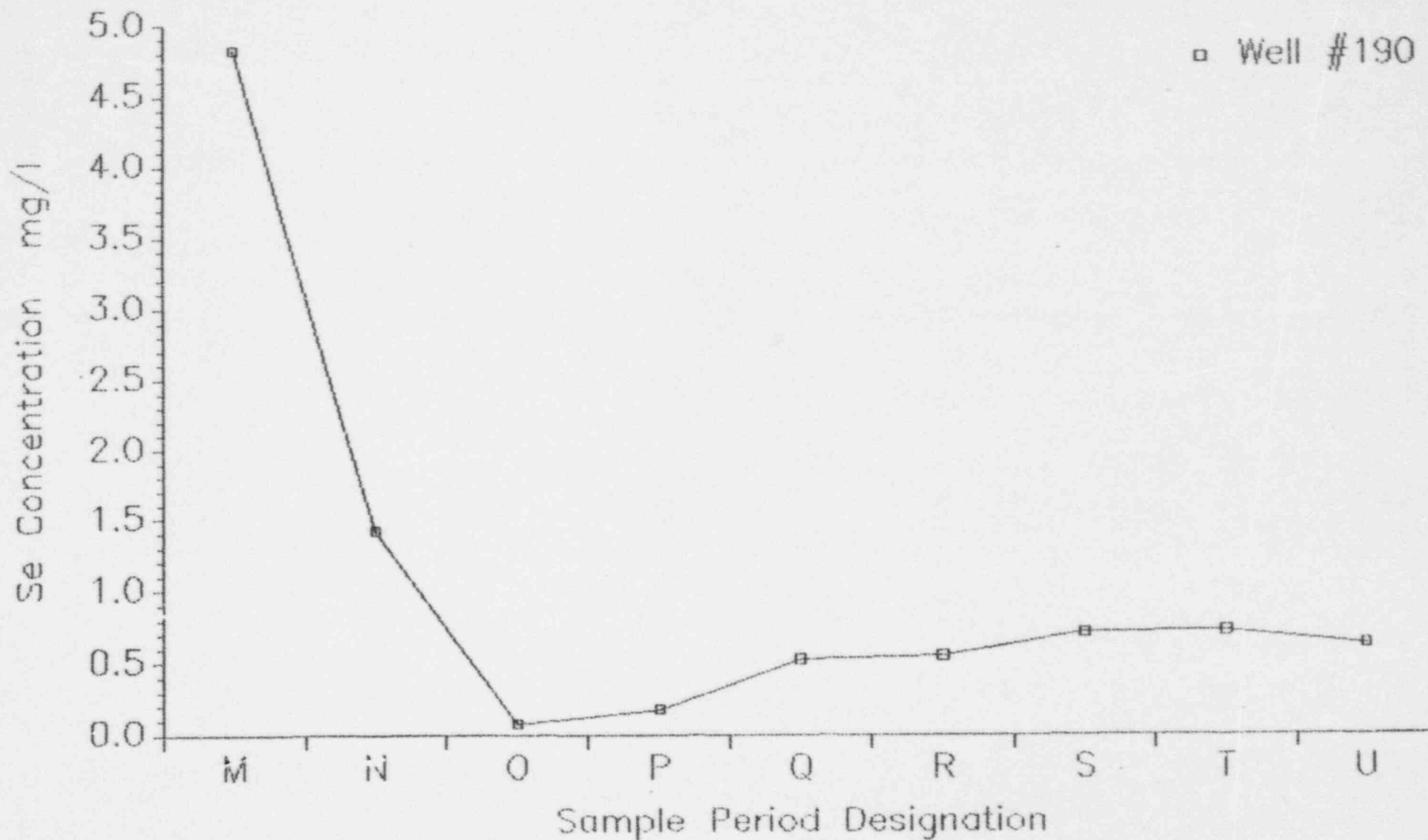
Q.A. MANAGER: Rag/KK.
ENERGY LABORATORIES, INC.

Cleveland Cliffs Iron Company
B-Field Restoration Stability Data
Pre H₂S 1983



See attached data for further
information

Cleveland Cliffs Iron Company
B-Field Post H₂S Stability Data
1987 through 1988



See attached data for further
information

August 22, 1988

Cleveland Cliffs Iron Company
Post H₂S Injection - Stability Monitoring Program

B Wellfield Restoration and Post H₂S Stability Data
Graphics Support

Graphic	Desig.	Date	Round #/I.D.	Wellfield Mean	Well #190
A		12/82	2 week	0.038	0.023
B		1/83	4 week	0.035	0.024
C		2/83	6 week	0.033	0.021
D		2/83	8 week	0.121	0.217
E		3/83	3 month	0.328	0.372
F		4/83	4 month	0.209	0.041
G		5/83	5 month	0.227	0.262
H		6/83	6 month	0.724	1.450
I		7/83	7 month	0.541	0.642
J		8/83	8 month	0.549	0.990
K		9/83	9 month	0.834	1.059
L		10/83	10 month	1.021	1.586
M		7/87	Pre H ₂ S	2.524	4.820
N		9/87	Round 1	0.458	1.420
O		11/87	Round 2	0.139	0.077
P		1/88	Round 3	0.108	0.179
Q		3/88	Round 4	0.156	0.530
R		4/88	Round 5	0.164	0.557
S		5/88	Round 6	0.195	0.715
T		6/88	Round 7	0.198	0.729
U		7/88	Round 8	0.178	0.636

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 190
Water Level to Casing: 73.67 '
Casing Height: 3.04 '
Water Level: 70.63 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 414 Gal
Date Sampled: 11-12-87
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
11/11/87	14:36	165565				
	14:40	165660	23.8	8.65	13.2	1295
	14:51	165933	24.8	8.75	13.8	1375
	15:08	166360	25.1	8.69	14.0	1500
	15:13	166495	27.0	8.65	14.0	1510
	15:15	166550				
11/12/87	10:49 -	Stability				
	10:54	Sampled		8.64	13.2	1710

Total Time Pumped: 39 min
Total Gal. Pumped: 985 gal + ~119 gal at sampling
Casing Displacement: 2.38
Time Sampled: 10:54
Sampler: Energy Laboratories, Inc./RAG

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 190
Water Level to Casing: 73.29 '
Casing Height: 3.04 '
Water Level: 70.25 '
I.D./Casing I.D.: 48 5/8"
Casing Volume: 423 Gal
Date Sampled: 01-06-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
01-06-88	10:30	171850		8.65	10.50	
	10:45	172300		8.95	11.5	1500
	10:55	172600		8.90	12.0	1310
	11:05	172865				1350

Total Time Pumped: 35 min
Total Gal. Pumped: 1015 Gal
Casing Displacement: 2.40
Time Sampled: 11:05
Sampler: Energy Laboratories, Inc./RAG/SMD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 190
Water Level to Casing: 73.54 '
Casing Height: 3.04 '
Water Level: 70.50 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 422.7 Gal
Date Sampled: 03-03-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
03-03-88	09:54	146215				
	10:05	146500	25.9	8.72	12.3	1295
	10:20	146890	26.0	8.65	12.3	1340
	10:36	147255	23.4	8.62	13.0	1405
	10:43	147433	25.4	8.42	12.9	1380

Total Time Pumped: 49 min
Total Gal. Pumped: 1217.5 Gal
Casing Displacement: 2.9
Time Sampled: 10:43
Sampler: Energy Laboratories, Inc./SAG/SD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 190
Water Level to Casing: 73.34 '
Casing Height: 3.04 '
Water Level: 70.30 '
T.D./Casing I.D.: 485' / 5"
Casing Volume: 423 Gal
Date Sampled: 04-04-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
04-04-88	10:22	183578				
	10:34	183747	14.0	9.00	13.2	1200
	11:03	184360	21.1	9.00	13.5	1380
	11:12	184460	11.1	8.80	13.5	1350
	11:22	184490	Sampled	8.85	13.5	1350

Total Time Pumped: 60 min
Total Gal. Pumped: 911.5 Gal
Casing Displacement: 2.15
Time Sampled: 11:22
Sampler: Energy Laboratories, Inc./SAG/KS

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 190
Water Level to Casing: 73.57 '
Casing Height: 3.04 '
Water Level: 70.53 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 422.7 Gal
Date Sampled: 05-05-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
05-05-88	13:31	161292				
	13:35	161420	25.6	8.79	14.9	1300
	13:45	161670	27.3	8.75	15.0	1390
	13:57	161900	19.2	8.70	15.5	1390
	14:09	162200	25.0	8.75	15.9	1310

Total Time Pumped: 38 Min
Total Gal. Pumped: 908
Casing Displacement: 2.15
Time Sampled: 14:09
Sampler: Energy Laboratories, Inc./SAG/KS

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 190
Water Level to Casing: 73.64 '
Casing Height: 3.04 '
Water Level: 70.60 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 422.6 Gal
Date Sampled: 06-02-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
06-02-88	12:23	158665		9.14	13.1	1700
	12:34	168935	24.5	9.22	14.7	1200
	12:44	169190	25.5	9.22	15.0	1200
	12:59	169565	25.0	9.08	15.0	1250

Total Time Pumped: 36 min
Total Gal. Pumped: 900
Casing Displacement: 2.1
Time Sampled: 12:59
Sampler: Energy Laboratories, Inc./ES/SMD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 190
Water Level to Casing: 73.71 '
Casing Height: 3.04 '
Water Level: 70.67 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 422.6 Gal
Date Sampled: 07-05-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Cond
07-06-88	10:30	175929		9.04	12.4	580
	11:02	176670	23.2	8.99	14.7	920
	11:15	177005	25.8	8.95	14.7	1110
	11:25	177323	31.8	8.96	15.8	1156

Total Time Pumped: 55 Min
Total Gal. Pumped: 1394
Casing Displacement: 3.30
Time Sampled: 11:25
Sampler: Energy Laboratories, Inc./RAG/KRS

WATER ANALYSIS REPORT - CLEVELAND CLIFFS

Project: Collins Draw

SAMPLE I.D.: Well #231

Sample Round:	#1	#2	#3	#4	#5	#6	
Sample Date:	09-08-87	11-12-87	01-05-88	03-02-88	04-04-88	05-05-88	06-02-88
Report Date:	09-29-87	12-28-87	01-27-88	03-24-88	05-25-88	05-25-88	06-13-88
Sample Number:	#2	87-14700	88-0119	88-1831	88-3791	88-5910	88-6916
Lab:	WARCO	ELI	ELI	ELI	ELI	ELI	ELI

MAJOR IONS mg/l:

	#1	#2	#3	#4	#5	#6	Det. Limit
Ca	9.0	12.8	14.2	12.3	12.1	10.0	0.05
Mg	6.0	1.5	1.7	1.7	1.7	1.4	0.01
Na	93	84.0	86.4	77.8	81	73.4	0.05
K	163	223	181	146	126	103	0.10
CO3	0	3.5	0	0	0	0	0.10
HCO3	299	327	315	312	265	206	0.10
SO4	452	411	360	286	318	260	0.50
Cl	30.0	21.2	23.5	21.8	20.1	19.1	0.10
NH4 (N)	74.0	58.0	55.2	55.2	51.4	39.3	0.05
TDS @ 180 C (Calculated)	835	921	383	783	757	622	1.0
pH (units)	7.24	8.37	7.94	7.51	7.86	7.84	1-14
H2S - g						27.2	

TRACE METALS mg/l:

	#1	#2	#3	#4	#5	#6	
As	0.008	0.008	0.028	0.020	0.026	0.026	0.001
Mo	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Se EPA Pres.	0.039	0.063	0.040	0.016	0.018	0.005	0.011
Se Filt. Only				0.029	0.030	0.023	0.022
V	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10

RADIOMETRIC pCi/l:

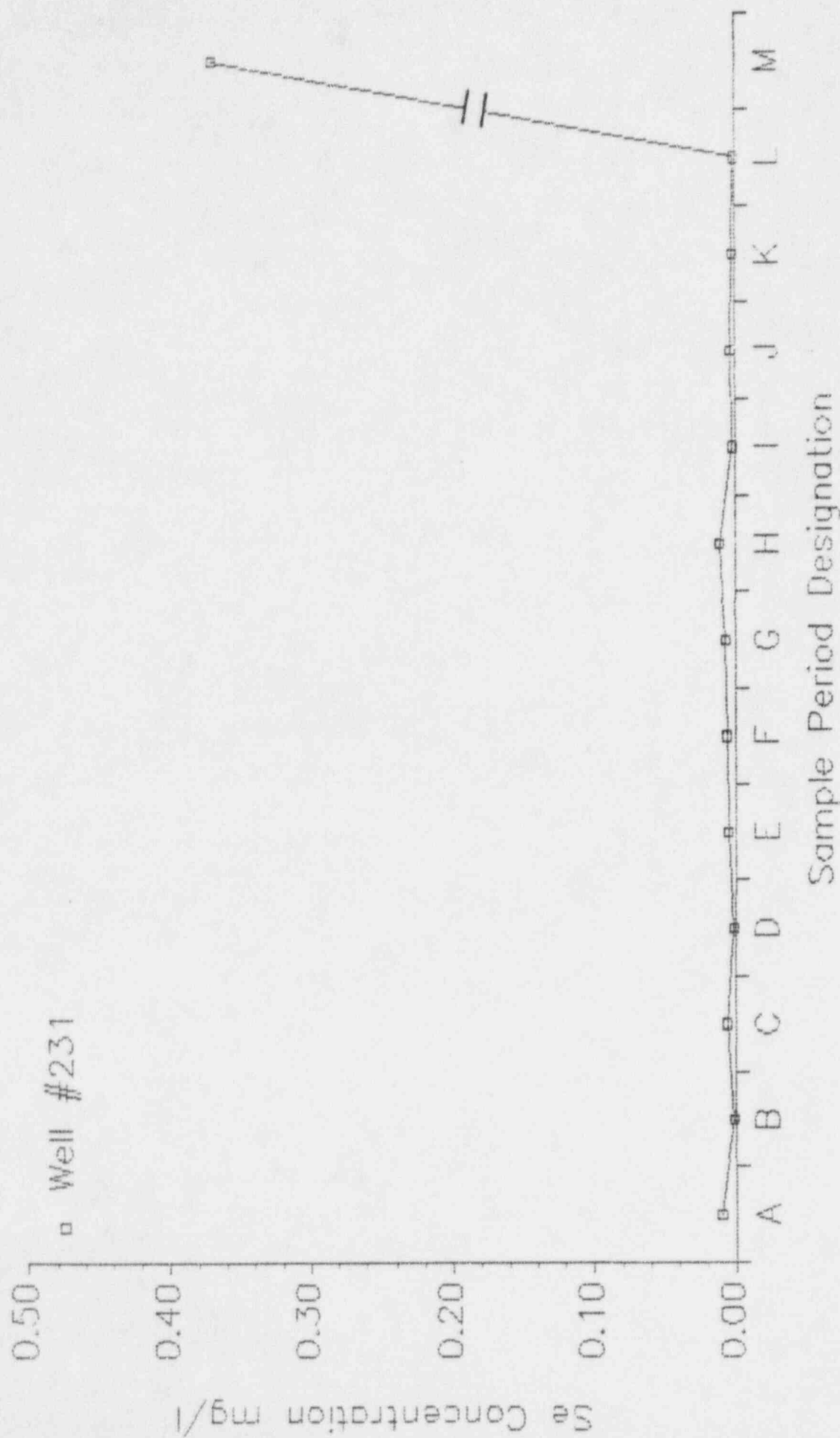
	#1	#2	#3	#4	#5	#6	
U (eq/l)	9.752	2.567	3.281	2.306	1.460	1.228	0.0003
Ra226	146.0	106.7	145.2	124.4	116	86.2	0.20
Ra Prec. +/-	9.0	3.3	3.4	3.1	9.3	8.6	

Q.A. DATA:

	#1	#2	#3	#4	#5	#6	
Anion eqq:	14.45	14.64	13.33	11.71	11.54	9.33	
Cation eqq:	15.15	14.28	13.19	11.83	11.17	9.26	
A/C Balance:	0.954	1.025	1.011	0.990	0.968	1.008	0.95-1.05
MYDER A/C Bal. %	2.36	-1.24	-0.53	0.51	-1.63	-0.38	-5 - +5

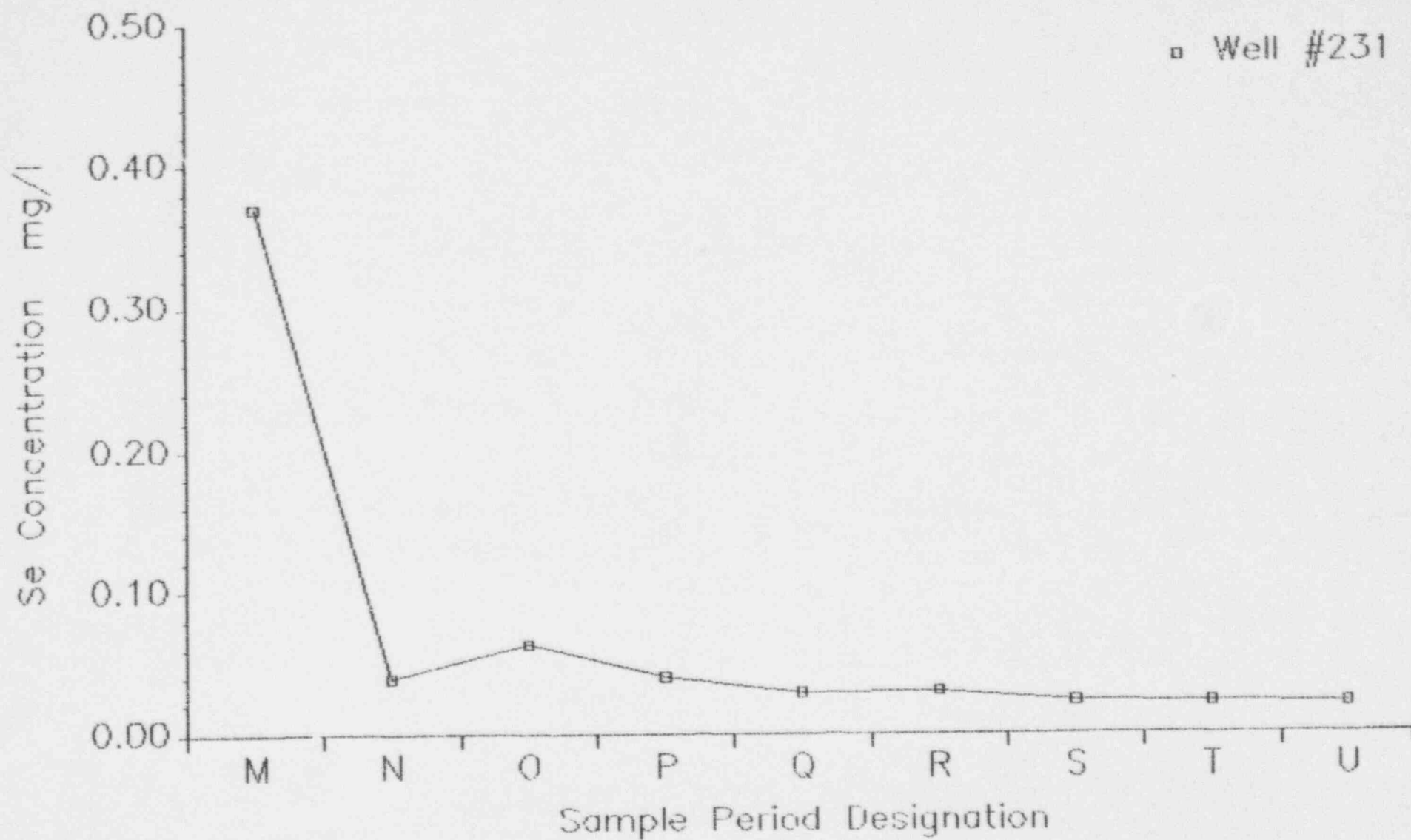
Q.A. MANAGER: RAG/KK.
ENERGY LABORATORIES, INC.

Cleveland Cliffs Iron Company
B-Field Restoration Stability Data
Pre H2S 1983



See attached data for further information

Cleveland Cliffs Iron Company
B-Field Post H₂S Stability Data
1987 through 1988



See attached data for further
information

August 22, 1988

Cleveland Cliffs Iron Company
Post H₂S Injection - Stability Monitoring Program

B Wellfield Restoration and Post H₂S Stability Data
Graphics Support

Graphic Desig.	Date	Round #/I.D.	Wellfield Mean	Well #231
A	12/82	2 week	0.038	0.010
B	1/83	4 week	0.035	0.001
C	2/83	6 week	0.033	0.006
D	2/83	8 week	0.121	<0.001
E	3/83	3 month	0.328	0.005
F	4/83	4 month	0.209	0.006
G	5/83	5 month	0.227	0.007
H	6/83	6 month	0.724	0.011
I	7/83	7 month	0.541	0.002
J	8/83	8 month	0.549	0.003
K	9/83	9 month	0.834	0.002
L	10/83	10 month	1.021	<0.001
M	7/87	Pre H ₂ S	2.524	0.370
N	9/87	Round 1	0.458	0.039
O	11/87	Round 2	0.139	0.063
P	1/88	Round 3	0.108	0.040
Q	3/88	Round 4	0.156	0.029
R	4/88	Round 5	0.164	0.030
S	5/88	Round 6	0.195	0.023
T	6/88	Round 7	0.198	0.022
U	7/88	Round 8	0.178	0.021

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 231
Water Level to Casing: 73.83 '
Casing Height: 1.52 '
Water Level: 72.31 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 421 Gal
Date Sampled: 11-12-87
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
11/10/87	13:53	161648				
	13:56	161755	35.8	7.21	13.0	1080
	14:07	162075	29.1	7.22	14.0	970
	14:27	162620	27.3	7.08	14.0	1000
		Stability				
11/12/87	11:18 - 11:23	Sampled		7.05	12.9	990

Total Time Pumped: 34 min
Total Gal. Pumped: 972 gal + ~179 gal at sampling
Casing Displacement: 2.31
Time Sampled: 11:23
Sampler: Energy Laboratories, Inc./RAG

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 231
Water Level to Casing: 73.75 '
Casing Height: 1.52 '
Water Level: 72.23 '
Y.D./Casing I.D.: 485'/5"
Casing Volume: 421 Gal
Date Sampled: 01-05-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
01-05-88	12:16	167583				
	12:23	167880		7.05	12.0	1000
	12:38	168390		6.74	12.2	993
	13:05	169230		6.62	13.0	900
	13:16	169570				

Total Time Pumped: 60 min
Total Gal. Pumped: 1987 gal
Casing Displacement: 4.72
Time Sampled: 13:16
Sampler: Energy Laboratories, Inc./SAG/RAG

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 231
Water Level to Casing: 73.63 '
Casing Height: 1.52 '
Water Level: 72.11 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 421 Gal
Date Sampled: 03-03-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
03-03-88	11:00	175136				
	11:07	175435	42.7	6.91	12.5	790
	11:43	176570	31.5	9.82	13.1	795
	11:54	176930	32.7	6.84	11.9	800

Total Time Pumped: 54 min
Total Gal. Pumped: 1793.7
Casing Displacement: 4.3
Time Sampled: 11:54
Sampler: Energy Laboratories, Inc./SAG/SD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 231
Water Level to Casings: 73.50 '
Casing Height: 1.52 '
Water Level: 71.98 '
I.D./Casing I.D.: 485"/5"
Casing Volume: 421 Gal
Date Sampled: 04-04-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
04-04-88	09:15	150295				
	09:35	150915	31.0	7.20	13.0	480
	09:54	151460	28.7	7.15	13.0	700
	10:03	151770	34.4	7.20	13.0	790
	10:13	152042	27.2	7.20	13.0	800
	10:20	152300	36.9	7.10	13.5	800

Total Time Pumped: 65 min
Total Gal. Pumped: 2005 Gal
Casing Displacement: 4.76
Time Sampled: 10:20
Sampler: Energy Laboratories, Inc./SA6/KS

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 231
Water Level to Casing: 73.70 '
Casing Height: 1.52 '
Water Level: 72.18 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 421 Gal
Date Sampled: 05-05-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
05-05-88	09:20	158200				
	09:24	158280	20.0	7.20	13.0	700
	09:40	158880	37.5	7.20	14.0	680
	09:59	159460	30.5	7.10	14.5	710
	10:02	159580	40.0	7.10	14.5	720

Total Time Pumped: 42 Min.
Total Gal. Pumped: 1380 Gal.
Casing Displacement: 4.75
Time Sampled: 10:02
Sampler: Energy Laboratories, Inc./SAB/KS

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 231
Water Level to Casing: 73.75 '
Casing Height: 1.52 '
Water Level: 72.23 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 421 Gal
Date Sampled: 06-02-88
Pump Depth: 406'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
06-02-88	9:35	166025		7.39	13.4	475
	9:48	166420	30.4	7.33	13.4	580
	9:57	166720	33.3	7.55	14.1	590
	10:04	166930	30.0	7.50	14.4	600
						720

Total Time Pumped: 29 min.
Total Gal. Pumped: 986 Gal
Casing Displacement: 2.3
Time Sampled: 10:04
Sampler: Energy Laboratories, Inc./ES/SMD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 231
Water Level to Casing: 73.71 '
Casing Height: 1.52 '
Water Level: 72.19 '
I.D./Casing I.D.: 485'/5"
Casing Volume: 421.0 Gal
Date Sampled: 07-06-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

<u>Date</u>	<u>Time</u>	<u>Meter</u>	<u>Rate</u>	<u>pH</u>	<u>Temp</u>	Uncorrected
						<u>Cond</u>
07-06-88	14:25	203767				
	14:48	204330	24.5	7.63	15.0	620
	15:00	204580	20.8	7.45	15.3	690
	15:13	204850	20.8	7.51	17.2	670

Total Time Pumped: 48 Min
Total Gal. Pumped: 1083 Gal
Casing Displacement: 2.57
Time Sampled: 15:13
Sampler: Energy Laboratories, Inc./RAG/KRS

WATER ANALYSIS REPORT - CLEVELAND CLIFFS

Project: Collins Draw

SAMPLE I.D.: Well #232

	#1	#2	#3	#4	#5	#6	
Sample Round:	09-08-87	11-12-87	01-05-88	03-02-88	04-04-88	05-05-88	06-02-88 07-06-88 Det. Limit
Sample Date:	09-29-87	12-28-87	01-27-88	03-24-88	05-25-88	05-25-88	06-13-88 07-19-88 & Range
Report Date:	#3	87-14701	88-0120	88-1853	88-3792	88-5911	88-6917 88-8710
Sample Number:	MANCO	ELI	ELI	ELI	ELI	ELI	ELI
Lab:							

MAJOR IONS mg/l:

Ca	30.0	38.8	47.2	35.6		33.1	32.9	0.05
Mg	3.0	5.4	5.4	4.4		4.0	3.5	0.01
Na	105	122.0	124	107		103	97.6	0.05
K	181	336	285	197		236	204	0.10
CO3	0	0	0	0		0	0	0.10
HCO3	348	606	546	561		517	498	0.10
SO4	640	630	582	457		416	335	0.50
Cl	27.0	22.5	26.7	25.2		23.0	27.4	0.10
NH4 (M)	85.0	98.0	101	98.0		70.8	72.0	0.05
TD8 @ 180 C (Calculated)	983	1457	1467	1249		1185	1054	1.0
pH (units)	7.07	7.87	7.69	7.86		7.99	7.94	1-14
K2S - g							72.8	

TRACE METALS mg/l:

As	0.012	0.007	0.100	0.114		0.071	0.054	0.001
Mo	<0.10	<0.10	<0.10	<0.10		<0.10	<0.10	0.10
Se EPA Pres.	0.086	0.062	0.020	0.014	0.015	0.004	0.010	0.006 0.001
Se Filtr. Only				0.021	0.036	0.035	0.030	0.029 0.001
V	<0.10	<0.10	<0.10	<0.10		<0.10	<0.10	0.10

RADIOMETRIC pCi/l:

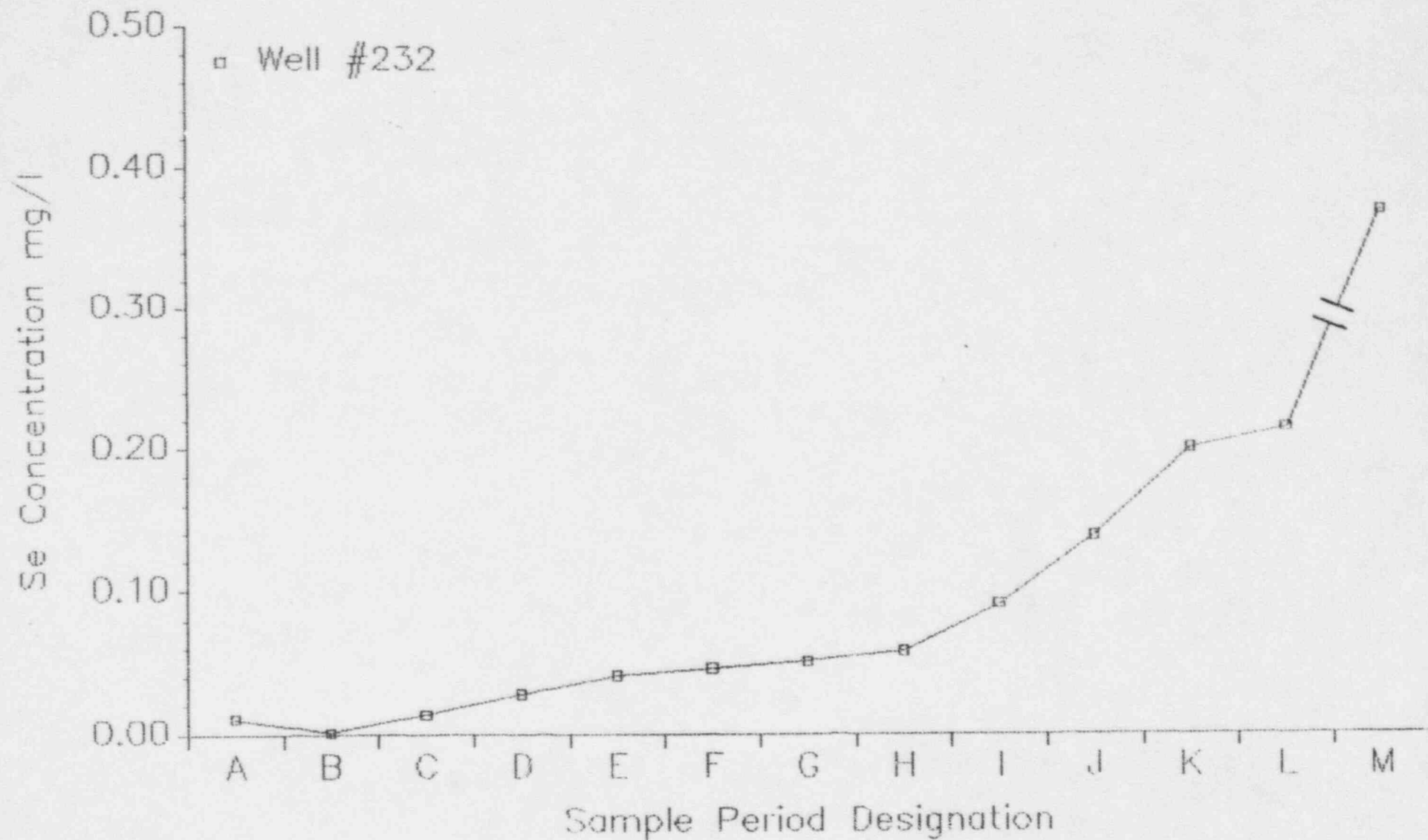
U (mg/l)	12.805	16.157	22.712	24.336		13.322	12.267	0.0003
Ra226	6.4	160.7	276.1	159.3		137	109	0.20
Ra Prec. +/-	6.0	3.6	4.5	3.5		10.1	9.6	

Q.A. DATA:

Anion aeq:	19.54	23.69	21.83	19.45		17.79	15.91	
Cation aeq:	21.59	23.31	22.72	19.46		18.09	16.51	
A/C Balances:	0.905	1.016	0.961	0.999		0.984	0.964	0.95-1.05
WYDER A/C Bal.%	4.98	-0.81	2.00	0.03		0.84	1.85	-5 - +5

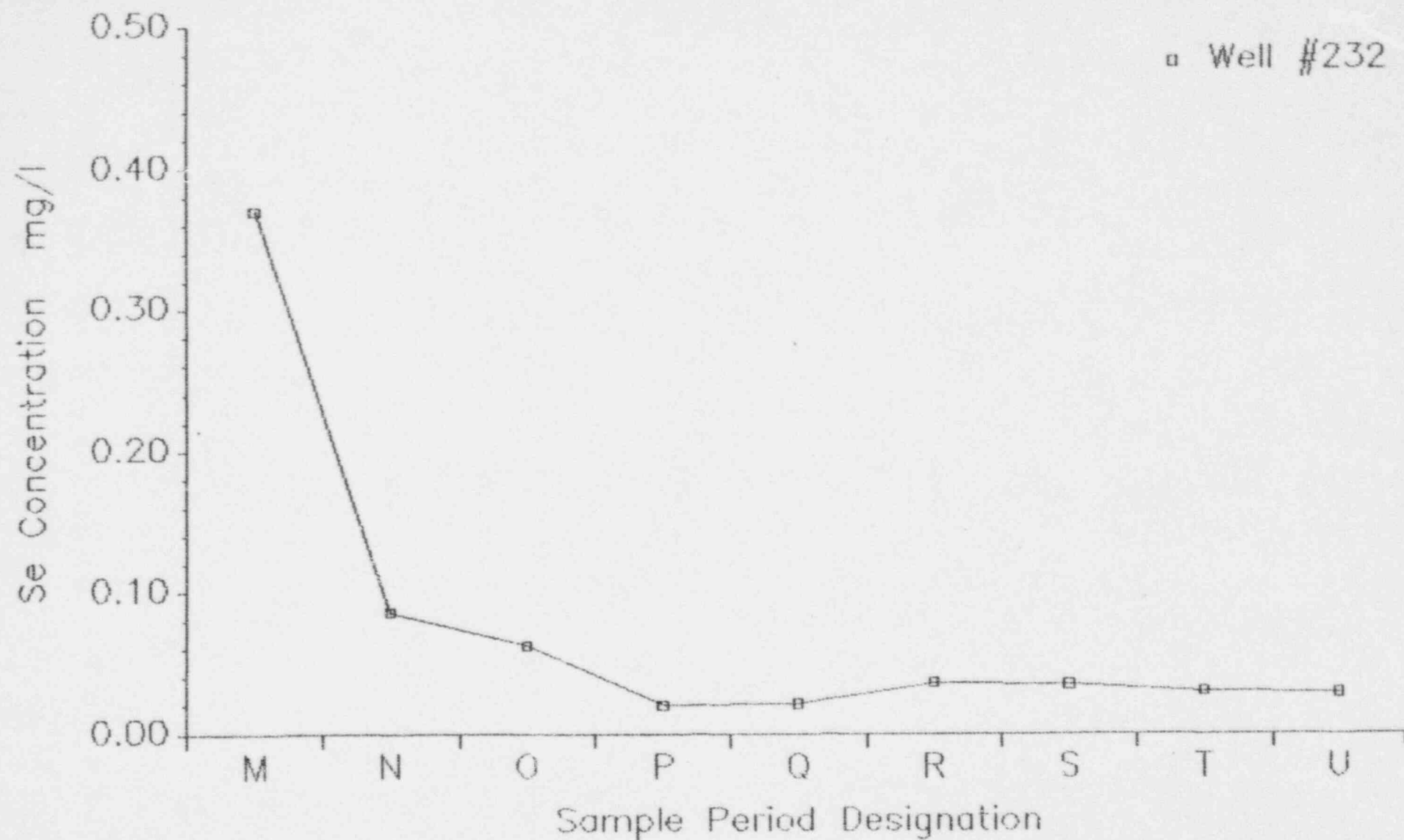
Q.A. MANAGER: Rag/KK.
ENERGY LABORATORIES, INC.

Cleveland Cliffs Iron Company
B-Field Restoration Stability Data
Pre H2S 1983



See attached data for further
information

Cleveland Cliffs Iron Company
B-Field Post H₂S Stability Data
1987 through 1988



See attached data for further
information

August 22, 1988

Cleveland Cliffs Iron Company
Post H₂S Injection - Stability Monitoring Program

B Wellfield Restoration and Post H₂S Stability Data
Graphics Support

Graphic Desig.	Date	Round #/I.D.	Wellfield Mean	Well #232
A	12/82	2 week	0.038	0.011
B	1/83	4 week	0.035	<0.001
C	2/83	6 week	0.033	0.014
D	2/83	8 week	0.121	0.028
E	3/83	3 month	0.328	0.041
F	4/83	4 month	0.209	0.046
G	5/83	5 month	0.227	0.051
H	6/83	6 month	0.724	0.058
I	7/83	7 month	0.541	0.091
J	8/83	8 month	0.549	0.138
K	9/83	9 month	0.834	0.200
L	10/83	10 month	1.021	0.214
M	7/87	Pre H ₂ S	2.524	0.370
N	9/87	Round 1	0.458	0.086
O	11/87	Round 2	0.139	0.062
P	1/88	Round 3	0.108	0.020
Q	3/88	Round 4	0.156	0.021
R	4/88	Round 5	0.164	0.036
S	5/88	Round 6	0.195	0.035
T	6/88	Round 7	0.198	0.030
U	7/88	Round 8	0.178	0.029

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 232
Water Level to Casing: 73.08 '
Casing Height: 2.02 '
Water Level: 71.06 '
T.D./Casing I.D.: 485' / 5"
Casing Volume: 422 Gal
Date Sampled: 11-12-87
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
11/10/87	14:35	162734				
	14:38	162770	12.0	6.98	12.0	1400
	14:51	162946	13.5	7.00	14.0	1380
	15:24	163322	11.4	7.20	14.5	1400
	15:50	163666	13.2	7.20	14.5	1410
		Stability				
11/12/87	11:45 -	Sampled		7.18	13.0	1330
	11:50					

Total Time Pumped: 75 min
Total Gal. Pumped: 932 gal + ~60 gal at sampling
Casing Displacement: 2.21
Time Sampled: 11:50
Sampler: Energy Laboratories, Inc./RAG

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 232
Water Level to Casing: 73.33 '
Casing Height: 2.02 '
Water Level: 71.31 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 422 Gal
Date Sampled: 01-05-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
01-05-88	14:27	169780				
	14:47	169990		7.00	11.9	1625
	15:20	170160				
	15:35	170370		7.00	11.5	1700
	15:58	170704		7.00	11.5	1500
		Sampled				
	16:11	170875				

Total Time Pumped: 104 min
Total Gal. Pumped: 1095 gal
Casing Displacement: 2.59
Time Sampled: 16:11
Sampler: Energy Laboratories, Inc./SAG/RA6

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 232
Water Level to Casing: 72.96 '
Casing Height: 2.02 '
Water Level: 70.94 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 422 Gal
Date Sampled: 03-02-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
03-02-88	13:07	144154		7.28	10.2	1340
	13:20	144303	11.4	7.19	11.5	1380
	13:58	144434	13.1	7.29	12.0	1310
	14:10	144607	14.4	7.23	12.4	1280
	14:32	144890	12.9	7.20	13.0	1310
	14:45	145065	13.5	7.28	12.9	1305

Total Time Pumped: 70 min
Total Gal. Pumped: 910.2 Gal
Casing Displacement: 2.2
Time Sampled: 14:45
Sampler: Energy Laboratories, Inc./SAG/SD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 232
Water Level to Casing: 72.82 '
Casing Height: 2.02 '
Water Level: 70.80 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 422 Gal
Date Sampled: 04-04-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
04-04-88	10:32	152332				
	10:33	152370	37.5	7.55	12.5	1310
	11:00	152670	11.1	7.50	13.5	1250
	11:13	152890	16.9	7.50	13.5	1290
	11:26	153050	12.3	7.50	13.9	1250
	11:58	153223	5.4	7.50	14.0	1300

Total Time Pumped: 86 min
Total Gal. Pumped: 890.5
Casing Displacement: 2.1
Time Sampled: 11:58
Sampler: Energy Laboratories, Inc./SAG/KS

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 232
Water Level to Casing: 72.93 '
Casing Height: 2.02 '
Water Level: 70.91 '
I.D./Casing I.D.: 485'/5"
Casing Volume: 422.3 Gal
Date Sampled: 05-05-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
05-05-88	10:08	187997				
	10:24	188210	13.3	7.40	14.5	1130
	10:44	188450	12.0	7.40	15.0	1120
	10:56	188640	15.3	7.40	15.0	1150
	11:15	188855	11.3	7.40	15.5	1110

Total Time Pumped: 67 Min.
Total Gal. Pumped: 858 Gal
Casing Displacement: 2.1
Time Sampled: 11:15
Sampler: Energy Laboratories, Inc./SAG/KS

CLEVELAND CLIFFS - BOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 232
Water Level to Casing: 73.00 '
Casing Height: 2.02 '
Water Level: 70.98 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 422 Gal
Date Sampled: 06-02-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
06-02-88	10:08	166928				
	10:13	166992	12.8	7.82	12.7	910
	10:24	167155	13.6	7.89	13.9	900
	10:39	167353	13.2	7.84	14.4	920
	10:53	167548	13.9	7.86	14.7	905
	11:10	167784	13.8	7.79	15.0	950

Total Time Pumped: 68 min
Total Gal. Pumped: 856 Gal
Casing Displacement: 2.0
Time Sampled: 11:10
Sampler: Energy Laboratories, Inc./XS/SHD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 232
Water Level to Casing: 73.00 '
Casing Height: 2.02 '
Water Level: 70.98 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 422.3 Gal
Date Sampled: 07-06-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

<u>Date</u>	<u>Time</u>	<u>Meter</u>	<u>Rate</u>	<u>pH</u>	<u>Temp</u>	Uncorrected
						<u>Cond.</u>
07-06-88	15:25	204850				
	15:37	205000	12.5	7.85	15.3	1000
	16:05	205350	10.9	7.81	15.3	1000
	16:11	205495	24.1	7.75	16.9	1060
	16:52	205950	11.1	7.75	15.2	1060
	17:05	206038	12.6	7.82	15.9	1050

Total Time Pumped: 100 Min
Total Gal. Pumped: 1188
Casing Displacement: 2.81
Time Sampled: 17:05
Sampler: Energy Laboratories, Inc./RAG/KRS

WATER ANALYSIS REPORT - CLEVELAND CLIFFS

Project: Collins Drive

SAMPLE I.D.: Well #233

Sample Round:	#1	#2	#3	#4	#5	#6	
Sample Date:	09-08-87	11-12-87	01-03-88	03-03-88	04-04-88	05-05-88	06-02-88 07-04-88 Det. Limit
Report Date:	09-29-87	12-28-87	01-27-88	03-24-88	05-25-88	05-25-88	06-13-88 07-19-88 & Range
Sample Number:	#4	87-14702	98-0123	38-1925	98-3793	98-3912	98-3912 98-8711
Lab:	WAMCO	ELI	ELI	ELI	ELI	ELI	ELI

MAJOR IONS mg/l:

Ca	19.0	49.9	72.6	73.7		77.9	75.9	0.05
Mg	4.0	7.5	5.4	10.0		10.0	9.8	0.01
Na	102	128.0	130	127		132	123	0.05
K	172	306	323	259		312	301	0.10
CO3	0	0	0	0		0	0	0.10
HCO3	633	627	564	600		568	575	0.10
SO4	386	666	720	772		748	646	0.50
Cl	36.0	31.2	30.2	33.4		29.3	36.6	0.10
NH4 (N)	94.0	108	115	124		99.0	100	0.05
TDS @ 180 C (Calculated)	956	1505	1691	1741		1720	1617	1.0
pH (units)	7.23	7.92	7.68	7.80		7.73	7.59	1-14
K29 - g							34.4	

TRACE METALS mg/l:

As	0.420	0.010	0.247	0.065		0.174	0.052	0.001
Mo	<0.10	<0.10	<0.10	<0.10		<0.10	<0.10	0.10
Se EPA Pres.	0.045	0.118	0.026	0.011	0.013	0.008	0.013	0.002 0.001
Se Filt. Only				0.029	0.028	0.024	0.022	0.016 0.001
V	<0.10	<0.10	<0.10	<0.10		<0.10	<0.10	0.10

RADIOMETRIC pCi/l:

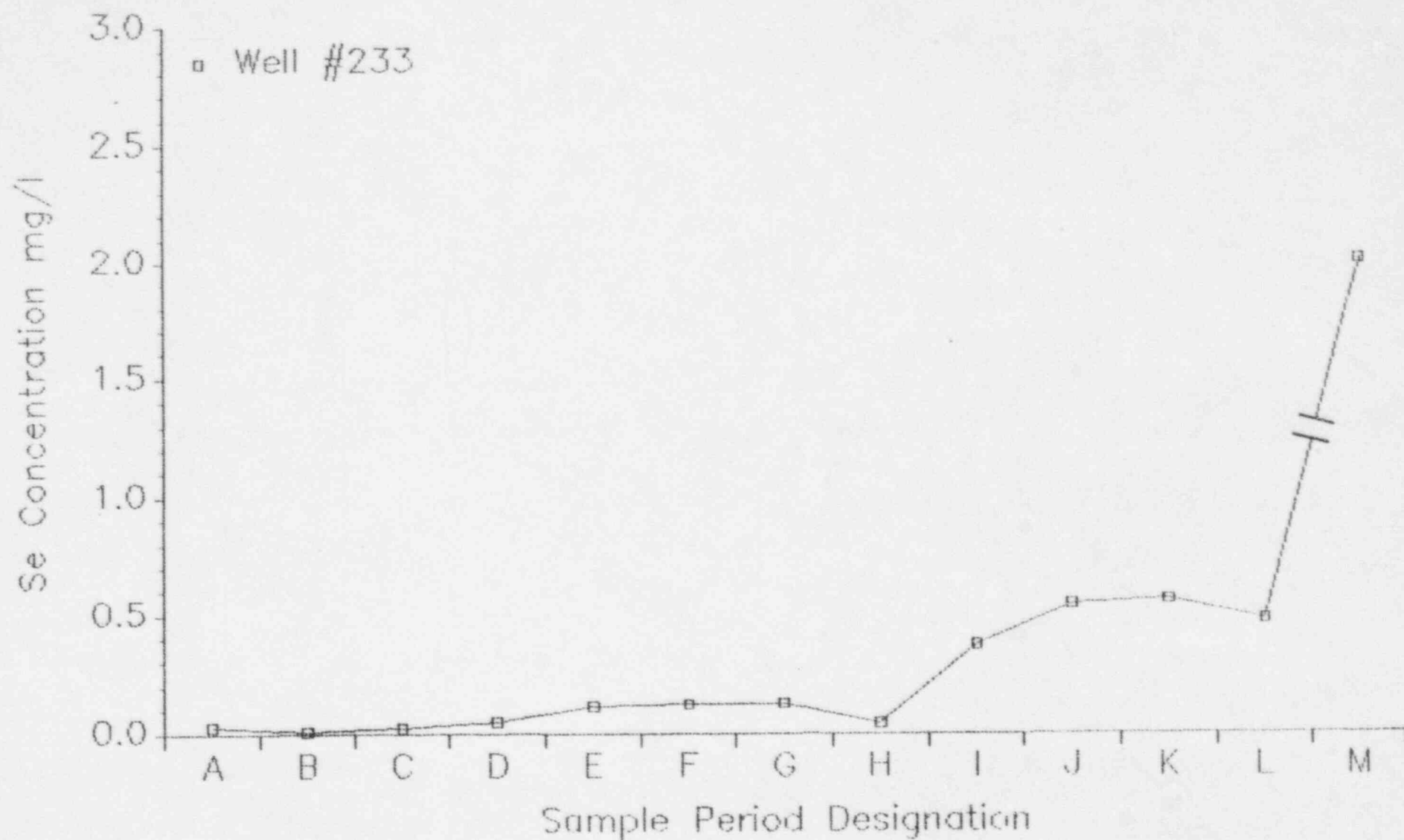
U (mg/l)	36.465	11.288	13.122	14.090		8.711	8.807	0.0003
Ra226	37.0	492.4	725.3	617.8		722	751	0.20
Ra Proc. +/-	4.6	6.3	6.7	6.7		23.2	22.7	

G.A. DATA:

Anion eq:	16.83	25.03	25.10	26.89		25.72	23.92	
Cation eq:	19.76	24.24	26.22	25.92		25.54	24.82	
A/C Balance:	0.852	1.033	0.957	1.037		1.007	0.964	0.95-1.05
WYDER A/C Bal.1	8.01	-1.60	2.18	-1.84		-0.35	1.85	-5 - +5

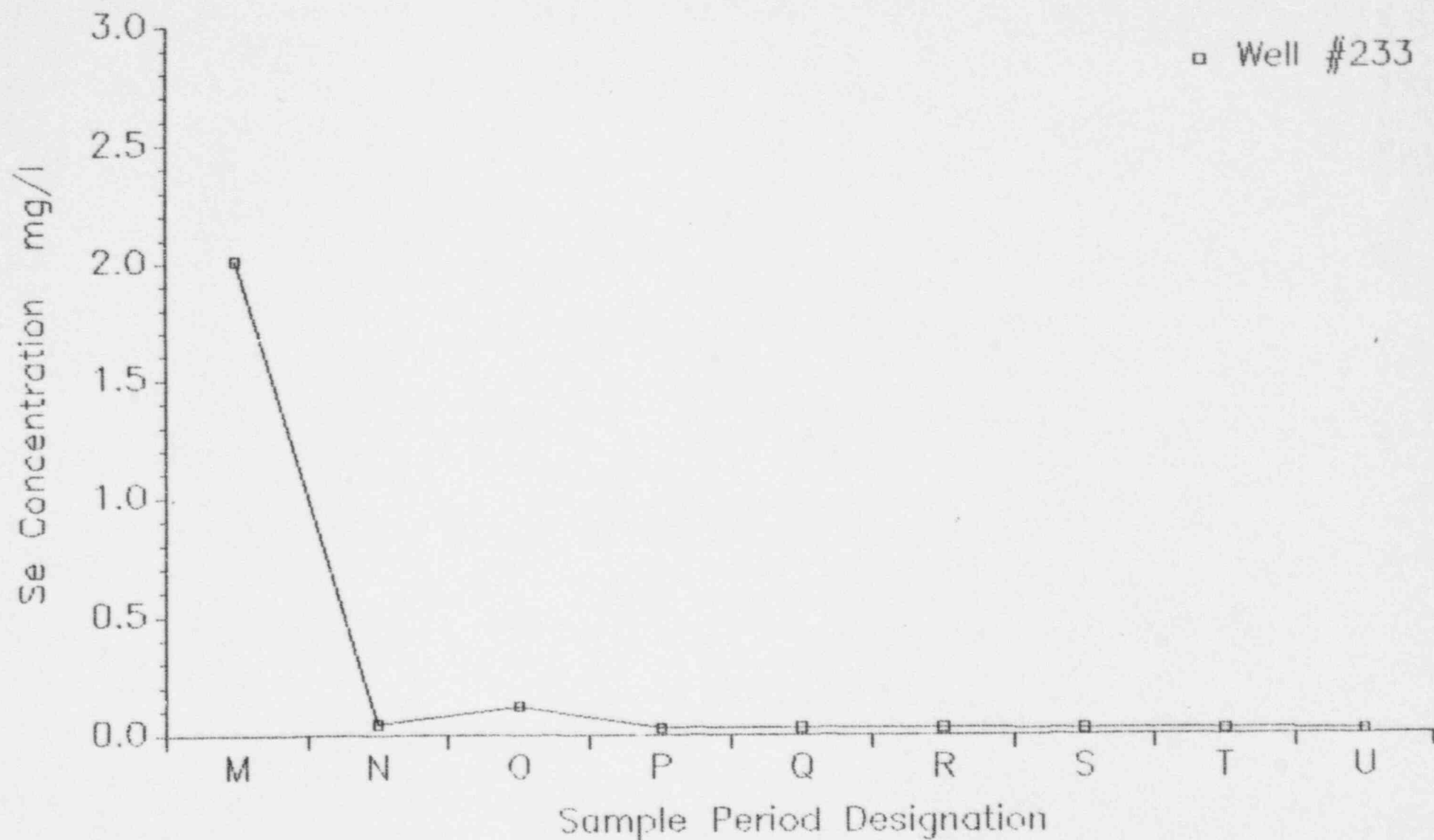
G.A. MANAGER: RAG/KK
ENERGY LABORATORIES, INC.

Cleveland Cliffs Iron Company
B-Field Restoration Stability Data
Pre H2S 1983



See attached data for further
information

Cleveland Cliffs Iron Company
B-Field Post H₂S Stability Data
1987 through 1988



See attached data for further
information

August 22, 1988

Cleveland Cliffs Iron Company
Post H₂S Injection - Stability Monitoring Program

B Wellfield Restoration and Post H₂S Stability Data
Graphics Support

Graphic Desig.	Date	Round #/I.D.	Wellfield Mean	Well #233
A	12/82	2 week	0.038	0.029
B	1/83	4 week	0.035	0.007
C	2/83	6 week	0.033	0.024
D	2/83	8 week	0.121	0.049
E	3/83	3 month	0.328	0.116
F	4/83	4 month	0.209	0.125
G	5/83	5 month	0.227	0.129
H	6/83	6 month	0.724	0.045
I	7/83	7 month	0.541	0.375
J	8/83	8 month	0.549	0.550
K	9/83	9 month	0.834	0.568
L	10/83	10 month	1.021	0.483
M	7/87	Pre H ₂ S	2.524	2.010
N	9/87	Round 1	0.458	0.045
O	11/87	Round 2	0.139	0.118
P	1/88	Round 3	0.108	0.026
Q	3/88	Round 4	0.156	0.029
R	4/88	Round 5	0.164	0.028
S	5/88	Round 6	0.195	0.024
T	6/88	Round 7	0.198	0.022
U	7/88	Round 8	0.178	0.016

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 233
Water Level to Casing: 71.38 '
Casing Height: 1.92 '
Water Level: 69.46 '
T.D./Casing I.D.: 485' / 5"
Casing Volume: 424 Gal
Date Sampled: 11-12-87
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
11/11/87	13:11	164133				
	13:14	164220	29.0	7.19	12.4	1200
	13:27	164410	14.6	7.39	13.2	1220
	13:45	164550	7.8	7.45	14.5	1500
		Down for Recharge				
	17:45	135553				
	17:50	135660	21.4	7.22	13.5	1500
	17:59	135820	17.8			
	18:08	135910	7.8	7.30	14.5	1500
		Stability				
11/12/87	11:07 - 11:12	Sampled		7.23	13.0	1300

Total Time Pumped: 57 min
Total Gal. Pumped: 774 gal + ~145 gal at sampling
Casing Displacement: 1.83
Time Sampled: 11:12
Sampler: Energy Laboratories, Inc./RA6

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 233
Water Level to Casing: 71.88 '
Casing Height: 1.92 '
Water Level: 69.96 '
I.D./Casing I.D.: 485'/5"
Casing Volume: 423 Gal
Date Sampled: 01-05-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
01-05-88	16:15	170875				
	16:28	171120		6.90	10.0	1600
	16:50	171352		7.00	12.0	1560
	17:20	171590		7.00	12.0	1805
	17:46	171850		7.00	12.0	1800

Total Time Pumped: 93 min
Total Gal. Pumped: 975 gal
Casing Displacement: 2.30
Time Sampled: 17:46
Sampler: Energy Laboratories, Inc./SAG/RAG

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 233
Water Level to Casing: 71.42 '
Casing Height: 1.92 '
Water Level: 69.50 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 422 gal
Date Sampled: 02-03-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
03-03-88	09:06	180342				
	09:10	180344	25.4	7.29	12.0	1510
	09:27	180690	14.5	7.34	13.0	1510
	09:37	180787	13.9	7.26	13.3	1590
	10:10	181082	8.9	7.23	13.0	1700
	10:19	181177	10.6	7.25	12.8	1720
	10:27	181251		7.32	12.9	1740

Total Time Pumped: 78 min
Total Gal. Pumped: 909 Gal
Casing Displacement: 2.1
Time Sampled: 10:27
Sampler: Energy Laboratories, Inc./SAS/SD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 233
Water Level to Casing: 71.32 '
Casing Height: 1.92 '
Water Level: 69.40 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 424 Gal
Date Sampled: 04-04-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
04-04-88	12:45	185622				
	12:48	185690	22.7	7.45	13.0	1630
	13:08	186000	15.5	7.45	14.5	1600
	13:32	186222	9.3	7.45	14.0	1680
	13:53	186415	9.2	7.40	14.0	1620
	14:00	186490	10.7	7.40	14.0	1680

Total Time Pumped: 75 min
Total Gal. Pumped: 868 Gal
Casing Displacement: 2.05
Time Sampled: 14:00
Sampler: Energy Laboratories, Inc./SAG/KS

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 233
Water Level to Casings: 71.60 '
Casing Height: 1.92 '
Water Level: 69.68 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 423.6
Date Sampled: 05-05-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
05-05-88	12:07	160404				
	12:38	160830	13.7	7.35	16.0	1490
	13:01	161075	10.6	7.30	15.5	1500
	13:20	161280	10.8	7.30	18.0	1550

Total Time Pumped: 73 Min.
Total Gal. Pumped: 876 Gal
Casing Displacement: 2.1
Time Sampled: 13:20
Sampler: Energy Laboratories, Inc./SAG/SD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 233
Water Level to Casing: 71.62 '
Casing Height: 1.92 '
Water Level: 69.70 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 423.6
Date Sampled: 06-02-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
06-02-88	11:13	167783				
	11:23	168040	25.5	7.67	14.0	1240
	11:46	168310	11.7	7.72	15.3	1255
	12:01	168470	10.7	7.70	15.3	1290
	12:17	168650	11.3	7.64	15.6	1280

Total Time Pumped: 64 min
Total Gal. Pumped: 865 Gal
Casing Displacement: 2.0
Time Sampled: 12:17
Sampler: Energy Laboratories, Inc./KS/SMD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 233
Water Level to Casing: 71.71 '
Casing Height: 1.92 '
Water Level: 69.79 '
T.D./Casing I.D.: 485'/3"
Casing Volume: 423.5
Date Sampled: 07-06-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
07-06-88	11:50	177323				
	12:03	177500	13.6	7.36	13.7	1100
	12:26	177792	12.7	7.49	15.3	1030
	12:44	177950	8.8	7.54	15.4	1020
	13:07	178220	11.7	7.46	15.8	1020
	13:15	178310	11.3	7.60	16.7	1060

Total Time Pumped: 95 Min
Total Gal. Pumped: 987 Gal
Casing Displacement: 2.33
Time Sampled: 13:15
Sampler: Energy Laboratories, Inc./RAG/KRS

WATER ANALYSIS REPORT - CLEVELAND CLIFFS

Project: Collins Draw

SAMPLE I.D.: Well #234

Sample Round:	#1	#2	#3	#4	#5	#6	
Sample Date:	09-08-87	11-12-87	01-06-88	03-03-88	04-04-88	05-05-88	07-06-88 Det. Limit
Report Date:	09-29-87	12-28-87	01-27-88	03-24-88	05-25-88	05-25-88	06-13-88 & Range
Sample Number:	85	87-14703	88-0134	88-1926	88-3794	88-5913	88-6919 88-8712
Lab:	MSDCO	ELI	ELI	ELI	ELI	ELI	ELI

MAJOR IONS mg/l:

Ca	15.0	21.8	24.7	29.0	38.0	42.0	0.05
Mg	6.0	4.4	4.1	4.7	5.0	5.2	0.01
Na	106	109.0	95.6	102	106	106	0.05
K	179	280	228	195	241	245	0.10
CO3	0	0	0	0	5.7	6.0	0.10
HCO3	409	503	466	508	488	493	0.10
SO4	466	528	445	464	498	467	0.50
Cl	46.0	33.4	31.2	31.6	31.9	34.8	0.10
NH4 (N)	92.0	102.0	93.0	108	91.2	92.0	0.05
TDS @ 180 C (Calculated)	982	1228	1164	1223	1287	1273	1.0
pH (units)	7.14	8.19	7.92	8.24	8.40	8.42	1-14
H2S - g						28.8	

TRACE METALS mg/l:

As	0.088	0.008	0.136	0.009	0.069	0.044	0.001
Mn	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Se EPA Pres.	0.023	0.308	0.396	0.498	0.594	0.570	0.001
Se Filt. Only				0.655	0.746	1.024	0.001
V	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10

RADIOMETRIC pCi/l:

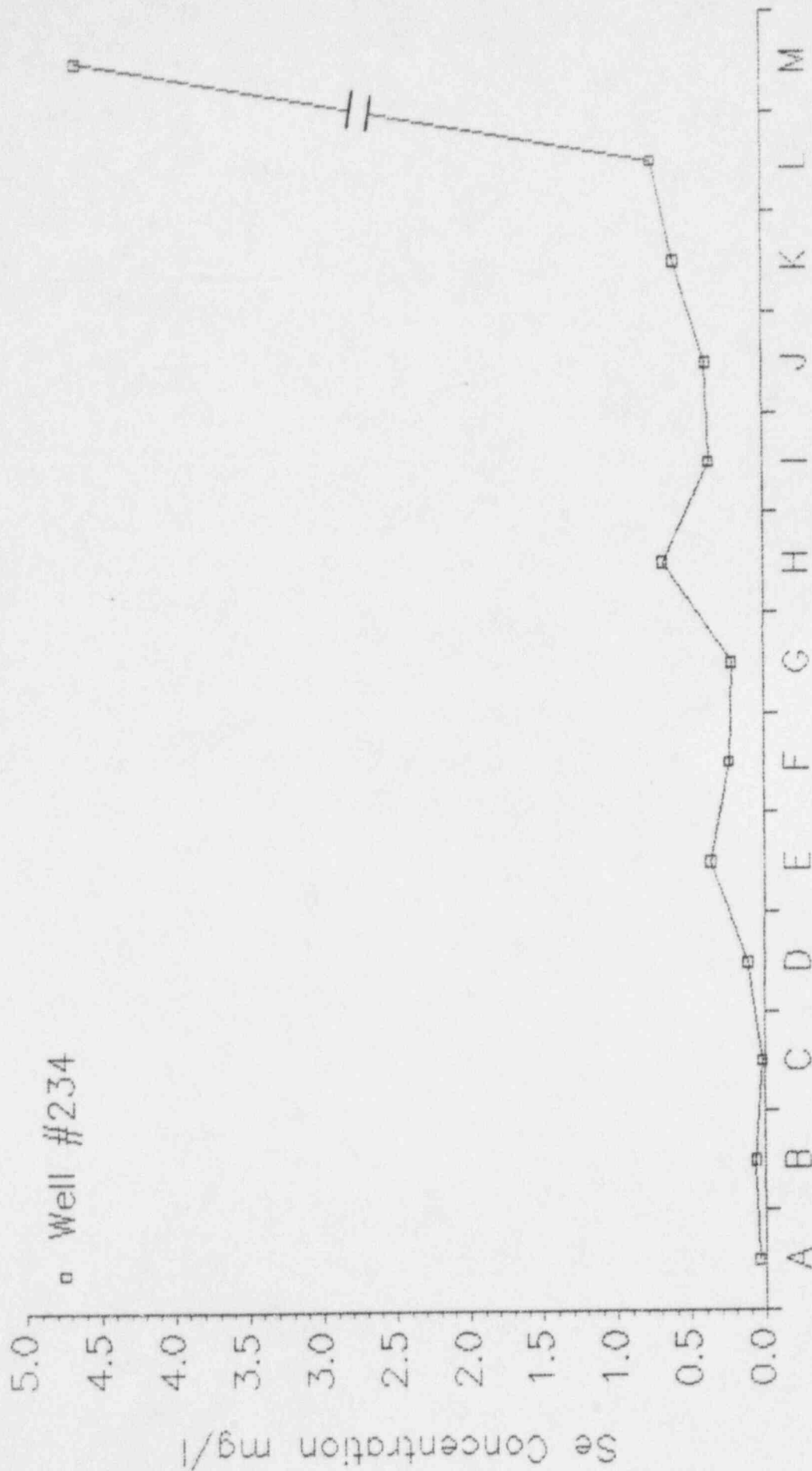
U (mg/l)	14.840	12.394	8.832	11.328	8.455	8.267	0.0003
Ra226	52.0	127.8	140.1	173.9	204	203	0.20
Ra Prec. +/-	5.4	3.2	2.9	3.6	12.4	13.1	

Q.A. DATA:

Anion eqq:	17.00	20.19	17.79	18.92	19.46	18.99	
Cation eqq:	17.73	20.67	18.22	19.28	19.61	19.73	
A/C Balance:	0.959	0.977	0.976	1.019	0.992	0.962	0.95-1.05
MYDER A/C Bal.I	2.10	1.17	1.19	0.94	0.38	1.91	-5 - +5

Q.A. MANAGER: Rag/KK
ENERGY LABORATORIES, INC.

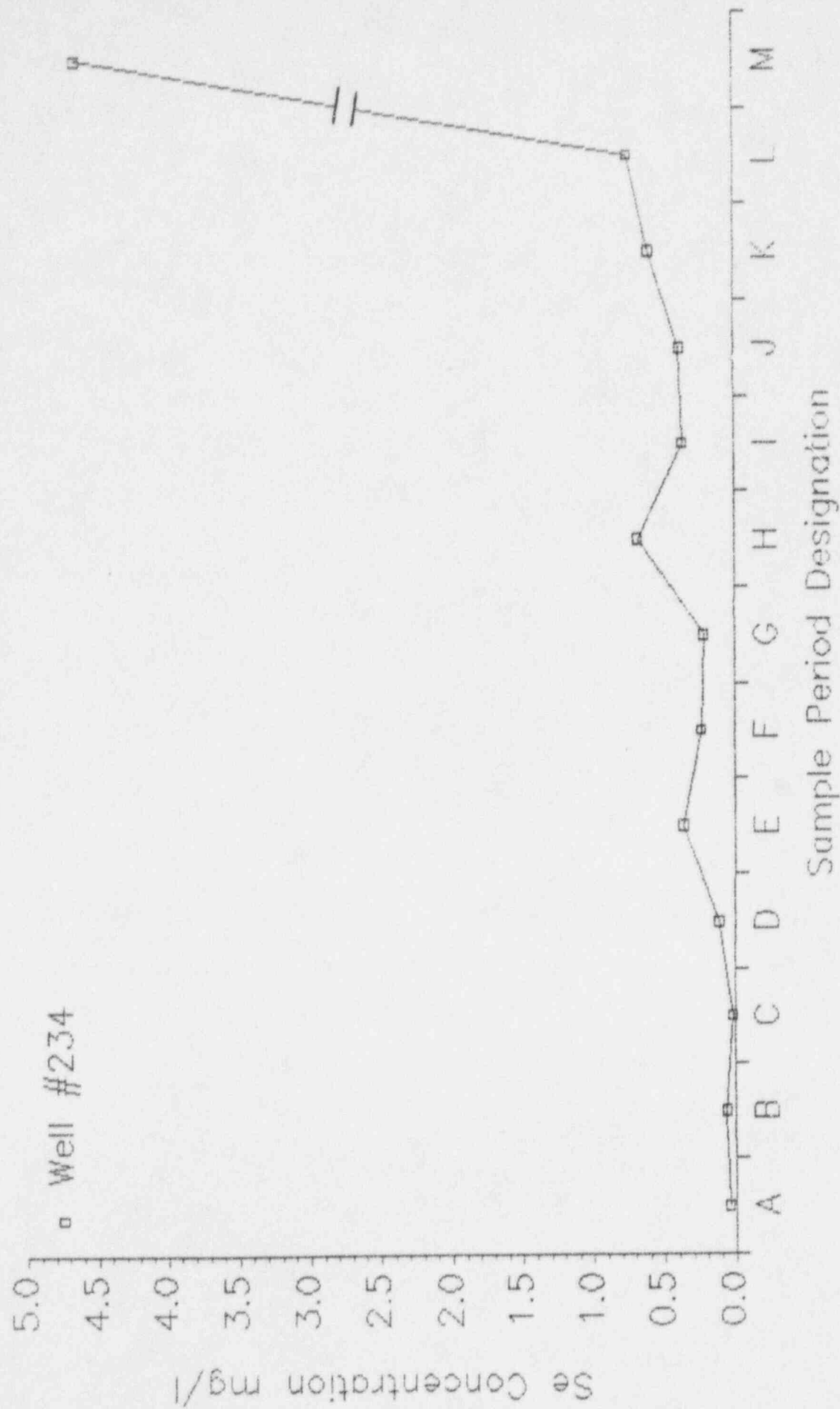
Cleveland Cliffs Iron Company
 B-Field Restoration Stability Data
 Pre H2S 1983



See attached data for further information

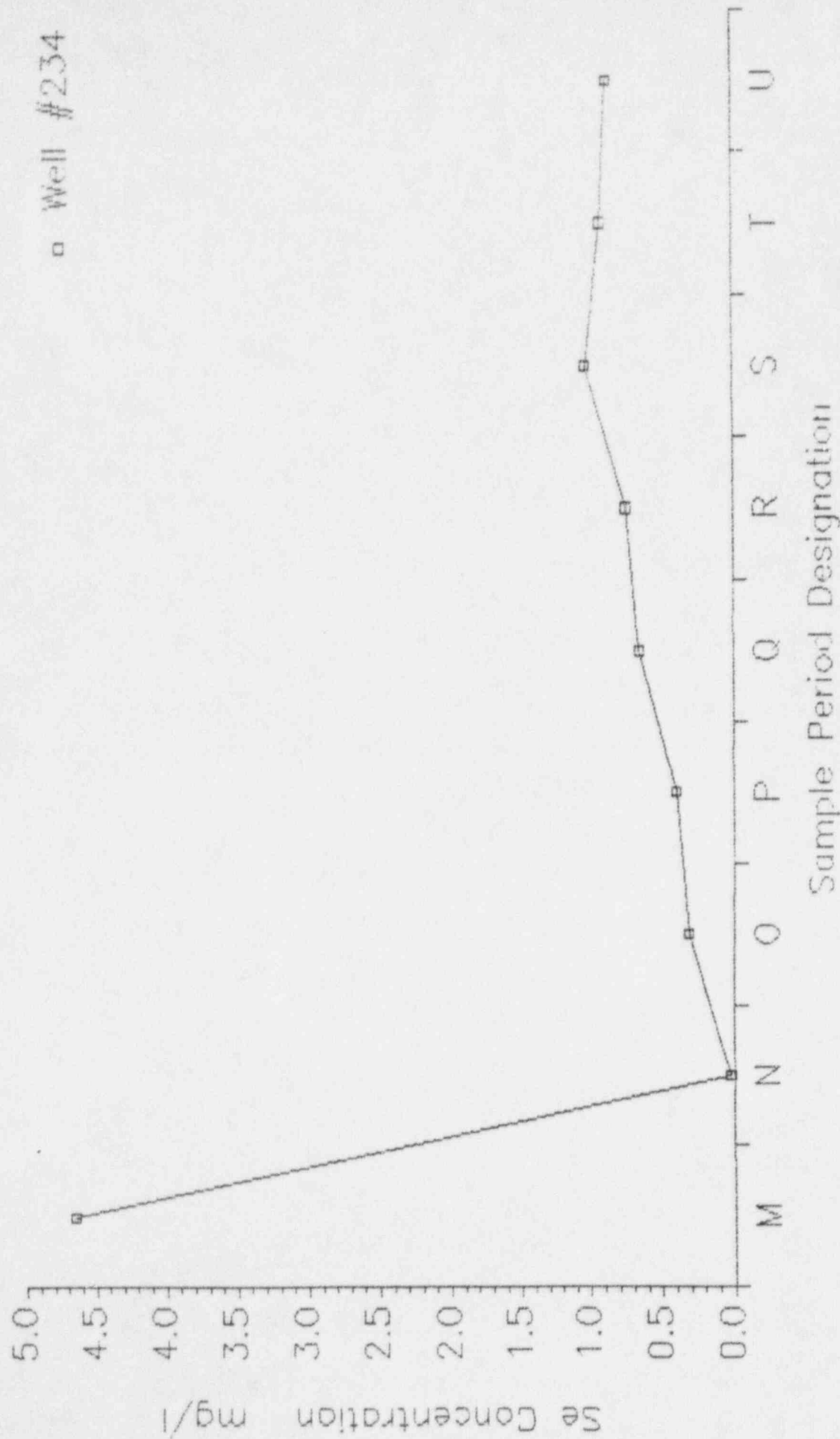
Cleveland Cliffs Iron Company
 B-Field Restoration Stability Data
 Pre H2S 1983
 Graphical Summary

Cleveland Cliffs Iron Company
 B-Field Restoration Stability Data
 Pre H2S 1983



See attached data for further information

Cleveland Cliffs Iron Company
B-Field Post H2S Stability Data
1987 through 1988



See attached data for further information

August 22, 1988

Cleveland Cliffs Iron Company
Post H₂S Injection - Stability Monitoring Program

B Wellfield Restoration and Post H₂S Stability Data
Graphics Support

Graphic Desig.	Date	Round #/I.D. Wellfield	Mean	Well #234
A	12/82	2 week	0.038	0.042
B	1/83	4 week	0.035	0.061
C	2/83	6 week	0.033	0.017
D	2/83	8 week	0.121	0.115
E	3/83	3 month	0.328	0.366
F	4/83	4 month	0.209	0.239
G	5/83	5 month	0.227	0.222
H	6/83	6 month	0.724	0.680
I	7/83	7 month	0.541	0.369
J	8/83	8 month	0.549	0.388
K	9/83	9 month	0.834	0.600
L	10/83	10 month	1.021	0.747
M	7/87	Pre H ₂ S	2.524	4.650
N	9/87	Round 1	0.458	0.023
O	11/87	Round 2	0.139	0.308
P	1/88	Round 3	0.108	0.396
Q	3/88	Round 4	0.156	0.655
R	4/88	Round 5	0.164	0.746
S	5/88	Round 6	0.195	1.024
T	6/88	Round 7	0.198	0.917
U	7/88	Round 8	0.178	0.870

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 234
Water Level to Casing: 71.46 '
Casing Height: 1.80 '
Water Level: 69.66 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 424 Gal
Date Sampled: 11-12-87
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
11/11/87	13:57	164720				
	14:00	164900	26.7	7.62	13.2	1300
	14:08	165085	35.6	7.70	13.5	1300
	14:26	165485	22.2	7.95	14.5	1325
	14:30	165567				
		Stability				
11/12/87	10:58 -	Sampled		7.71	13.0	1290
	11:03					

Total Time Pumped: 33 min
Total Gal. Pumped: 847 gal + ~134 gal at sampling
Casing Displacement: 2.00
Time Sampled: 11:03
Sampler: Energy Laboratories, Inc./RAG

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 234
Water Level to Casing: 71.79 '
Casing Height: 1.80 '
Water Level: 69.99 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 423 Gal
Date Sampled: 01-06-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
01-06-88	10:30	139112		7.75	10.5	1200
	10:45	139640		8.18	12.5	1260
	10:55	139880		8.13	12.9	1310
	11:05	140090				

Total Time Pumped: 35 min
Total Gal. Pumped: 978 Gal
Casing Displacement: 2.31
Time Sampled: 11:05
Sampler: Energy Laboratories, Inc./RAG/SMD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 234
Water Level to Casing: 71.42 '
Casing Height: 1.80 '
Water Level: 69.62 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 423 Gal
Date Sampled: 03-03-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
03-03-88	09:05	145092				
	09:09	145240	37.0	7.88	11.7	1060
	09:26	145705	27.4	7.94	13.2	1230
	09:36	145910	25.6	7.92	13.2	1295
	09:49	146215	23.5	8.08	12.9	1310

Total Time Pumped: 44 min
Total Gal. Pumped: 1124 Gal
Casing Displacement: 2.7
Time Sampled: 09:49
Sampler: Energy Laboratories, Inc./SAG/SD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 234
Water Level to Casing: 71.30 '
Casing Height: 1.80 '
Water Level: 69.50 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 424 Gal
Date Sampled: 04-04-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
04-04-88	13:13	153894				
	13:15	153980	43.0	8.2	13.0	1290
	13:34	154465	25.5	8.2	14.0	1300
	13:54	154930	23.3	8.15	14.0	1300

Total Time Pumped: 41 min
Total Gal. Pumped: 1036 Gal
Casing Displacement: 2.44
Time Sampled: 13:54
Sampler: Energy Laboratories, Inc./SAG/KS

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 234
Water Level to Casing: 71.50 '
Casing Height: 1.30 '
Water Level: 69.90 '
T.O./Casing I.O.: 485' / 5"
Casing Volume: 423.5
Date Sampled: 03-05-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

<u>Date</u>	<u>Time</u>	<u>Meter</u>	<u>Rate</u>	<u>CH</u>	<u>Temp</u>
03-05-88	13:31	190535			
	13:35	190695	40.0	8.20	14.5
	13:46	191020	24.5	8.20	15.0
	13:58	191230	17.5	8.20	15.0
	14:10	191470	20.0	8.15	16.0

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 234
Water Level to Casing: 71.60 '
Casing Height: 1.80 '
Water Level: 69.80 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 423.4
Date Sampled: 06-02-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
06-02-88	12:21	196073				
	12:24	196095	23.3	8.83	13.7	1060
	12:35	196440	31.4	8.76	14.6	1100
	12:45	196660	22.0	8.74	15.0	1100
	12:57	196920	21.6	8.66	16.0	1100

Total Time Pumped: 36 min
Total Gal. Pumped: 895 Gal
Casing Displacement: 2.1
Time Sampled: 12:57
Sampler: Energy Laboratories, Inc./KS/SMD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 234
Water Level to Casing: 71.58 '
Casing Height: 1.80 '
Water Level: 69.78 '
T.D./Casing I.D.: 485' / 5"
Casing Volume: 423.5 Gal
Date Sampled: 07-06-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
07-06-88	11:00	200800				
	11:02	200885	42.5	8.78	13.3	910
	11:16	201260	26.8	8.70	14.8	990
	11:36	201660	20.0	8.68	15.1	1000
	11:44	201890	28.75	8.64	17.2	1025

Total Time Pumped: 44 Min
Total Gal. Pumped: 1090 Gal
Casing Displacement: 2.57
Time Sampled: 11:44
Sampler: Energy Laboratories, Inc./RAG/KRS

WATER ANALYSIS REPORT - CLEVELAND CLIFFS

Project: Collins Draw

SAMPLE I.D.: Well #237

Sample Round:	#1	#2	#3	#4	#5	#6	
Sample Date:	09-08-87	11-12-87	01-06-88	03-03-88	04-04-88	05-05-88	06-02-88 07-06-88 Det. Limit
Report Date:	09-29-87	12-23-87	01-27-88	03-24-88	05-25-88	05-25-88	06-13-88 07-19-88 & Range
Sample Number:	#6	87-14704	88-0137	88-1927	88-3795	88-5914	88-5920 88-8713
Lab:	AMCO	ELI	ELI	ELI	ELI	ELI	ELI

MAJOR IONS mg/l:

	#1	#2	#3	#4	#5	#6	
Ca	50.0	51.3	56.7	63.9	104	133	0.05
Mg	3.0	7.2	6.7	8.4	11.7	14.3	0.01
Na	118	118	111	112	135	146	0.05
K	228	275	257	240	287	326	0.10
CO3	0	0	0	0	0	0	0.10
HCO3	744	740	651	694	722	764	0.10
SO4	500	508	445	540	711	759	0.50
Cl	7.0	30.8	30.3	28.8	31.7	41.3	0.10
NH4 (M)	107	105	90.6	112	103	108	0.05
TDS @ 180 C (Calculated)	1145	1360	1335	1508	1787	1646	1.0
pH (units)	8.06	8.24	8.07	8.08	7.81	7.71	1-14
H2S - g						27.6	

TRACE METALS mg/l:

	#1	#2	#3	#4	#5	#6	
As	0.220	0.027	0.028	0.032	0.098	0.035	0.001
Mo	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Se EPA Pres.	1.420	0.461	0.253	0.074	0.065	0.028	0.037 0.025 0.001
Se Filt. Only				0.114	0.095	0.076	0.078 0.053 0.001
V	0.15	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10 0.10

RADIOMETRIC pCi/l:

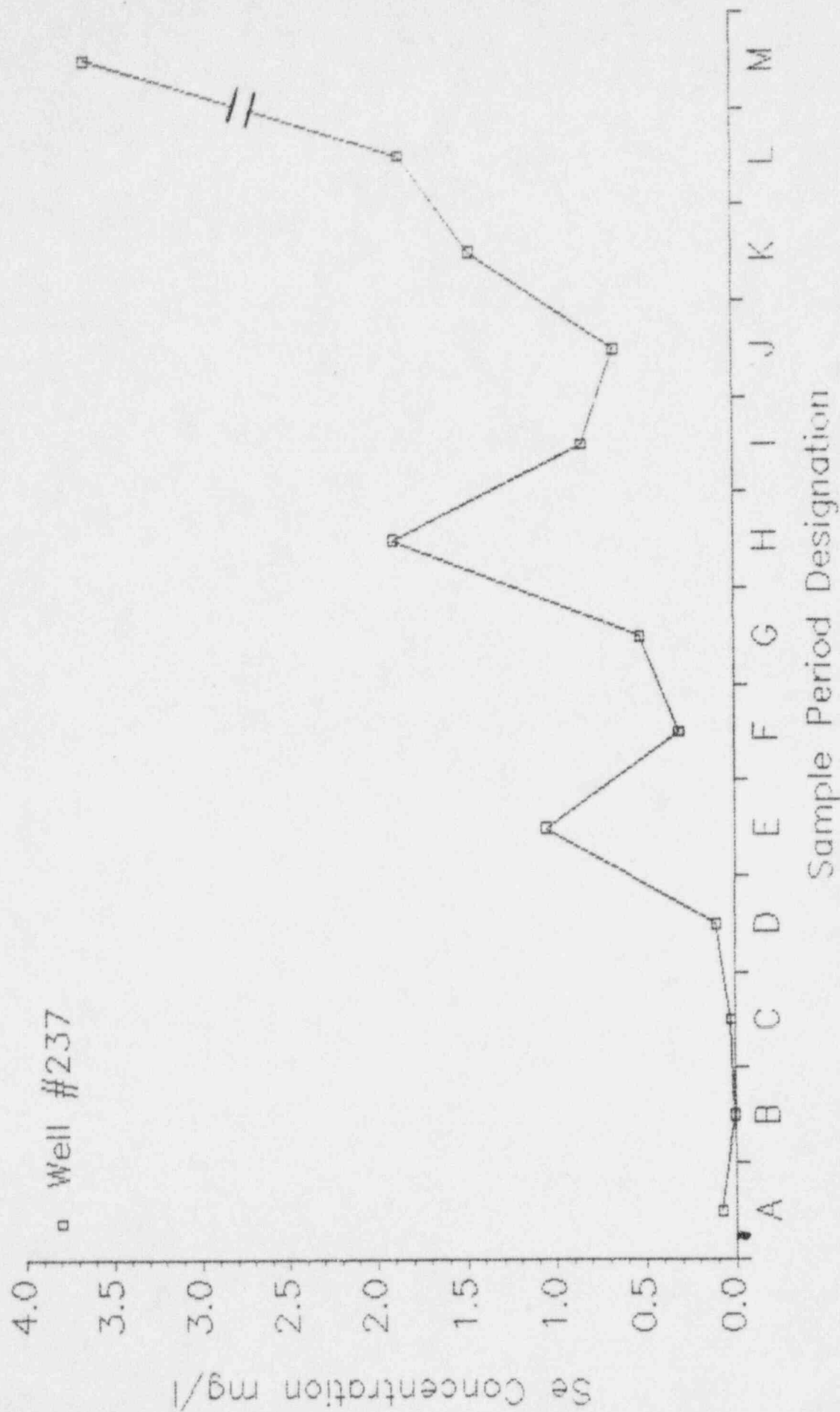
	#1	#2	#3	#4	#5	#6	
U (ug/l)	2.883	15.271	12.366	35.064	22.033	22.933	0.0003
Ra226	123.0	182.0	193.6	292.1	351	374	0.20
Ra Prec. +/-	8.3	3.9	3.4	4.7	16.2	17.8	

Q.A. DATA:

	#1	#2	#3	#4	#5	#6	
Anion eq:	21.36	23.58	20.80	23.47	27.54	29.53	
Cation eq:	22.80	22.83	21.38	23.84	27.10	30.26	
A/C Balance:	0.937	1.033	0.977	0.984	0.984	0.976	0.95-1.05
WYDER A/C Bal. I	3.26	-1.62	1.38	0.78	-0.81	1.22	-5 - +5

Q.A. MANAGER: *Rag/KK*
ENERGY LABORATORIES, INC.

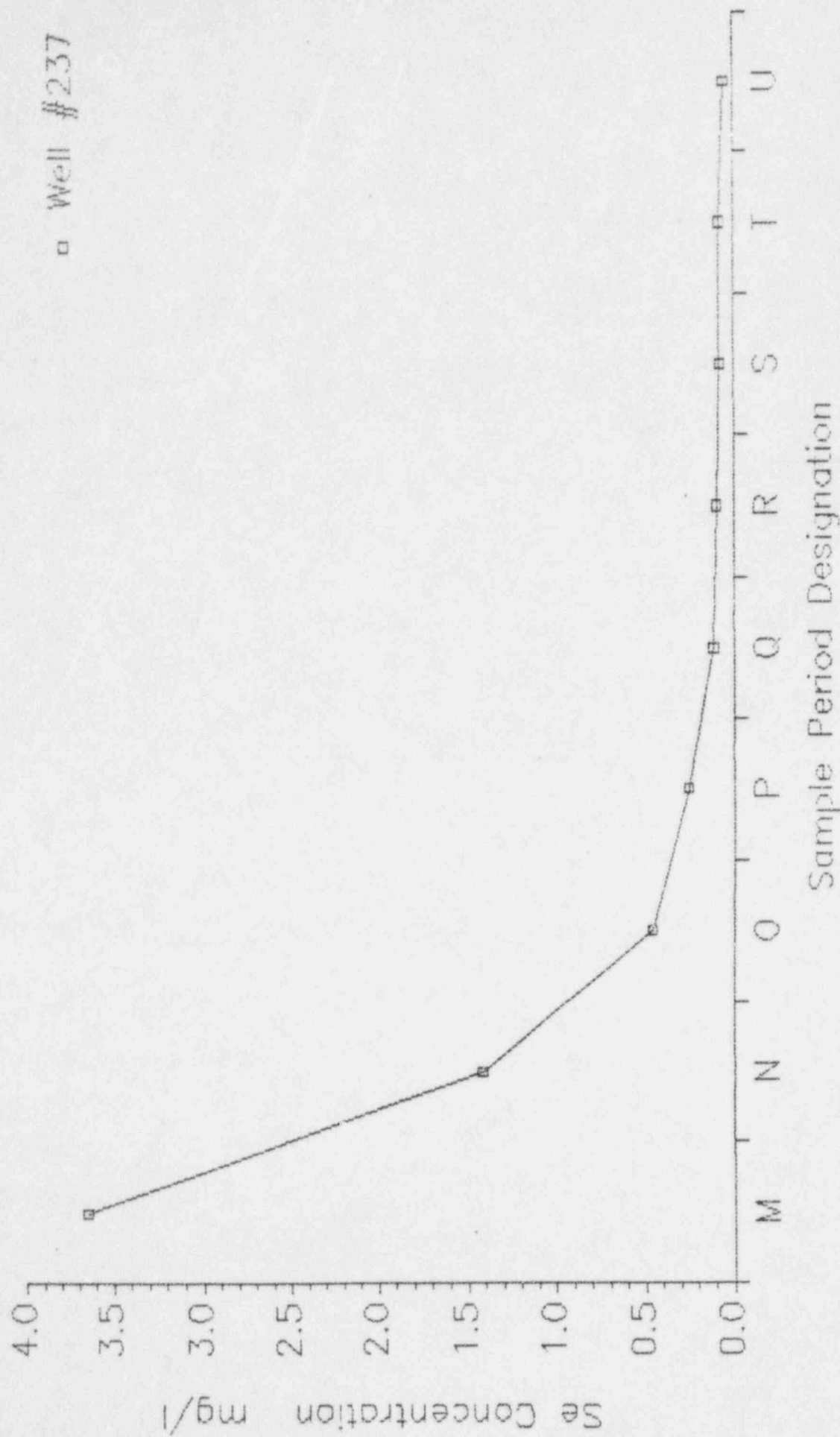
Cleveland Cliffs Iron Company
B-Field Restoration Stability Data
Pre H2S 1983



See attached data for further information

Cleveland Cliffs Iron Company
B-Field Post H2S Stability Data
1987 through 1988

□ Well #237



See attached data for further information

August 22, 1988

Cleveland Cliffs Iron Company
Post H₂S Injection - Stability Monitoring Program

B Wellfield Restoration and Post H₂S Stability Data
Graphics Support

Graphic Desig.	Date	Round #/I.D.	Wellfield Mean	Well #237
A	12/82	2 week	0.038	0.077
B	1/83	4 week	0.035	0.001
C	2/83	6 week	0.033	0.021
D	2/83	8 week	0.121	0.105
E	3/83	3 month	0.328	1.050
F	4/83	4 month	0.209	0.306
G	5/83	5 month	0.227	0.524
H	6/83	6 month	0.724	1.900
I	7/83	7 month	0.541	0.842
J	8/83	8 month	0.549	0.665
K	9/83	9 month	0.834	1.470
L	10/83	10 month	1.021	1.862
M	7/87	Pre H ₂ S	2.524	3.650
N	9/87	Round 1	0.458	1.420
O	11/87	Round 2	0.139	0.461
P	1/88	Round 3	0.108	0.253
Q	3/88	Round 4	0.156	0.114
R	4/88	Round 5	0.164	0.095
S	5/88	Round 6	0.195	0.076
T	6/88	Round 7	0.198	0.078
U	7/88	Round 8	0.178	0.053

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 237
Water Level to Casing: 73.46 '
Casing Height: 1.71 '
Water Level: 71.75 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 422 Gal
Date Sampled: 11-12-87
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
11/11/87	17:02	134705				
	17:07	134913	41.6	6.85	12.9	1500
	17:15	135092	22.4	7.10	14.5	1500
	17:27	135293	16.8	7.03	14.5	1500
	17:41	135553	18.6			
		Stability				
11/12/87	10:14 -	Sampled		7.28	13.0	1500
	10:19					

Total Time Pumped: 39 min
Total Gal. Pumped: 848 gal + ~208 gal at sampling
Casing Displacement: 2.01
Time Sampled: 10:19
Sampler: Energy Laboratories, Inc./RAG

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 237
Water Level to Casing: 73.75 '
Casing Height: 1.71 '
Water Level: 72.04 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 421 Gal
Date Sampled: 01-06-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
01-06-88	12:10	140766		6.13	11.0	1290
	12:15	140970		6.03	11.1	1350
	12:25	141200		6.05	13.3	1420
	12:40	141420		6.09	13.3	1405
	12:55	141780				

Total Time Pumped: 45 min
Total Gal. Pumped: 1014 gal
Casing Displacement: 2.41
Time Sampled: 12:55
Sampler: Energy Laboratories, Inc./RAG/SND

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 237
Water Level to Casing: 73.46 '
Casing Height: 1.71 '
Water Level: 71.79 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 421 Gal
Date Sampled: 03-03-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
03-03-88	11:27	148806				
	11:35	149055	31.1	7.36	11.8	1320
	11:55	149400	17.3	7.29	13.0	1620
	12:03	149545	18.1	7.00	13.0	1600
	12:12	149692	16.3	7.44	13.4	1505
		Sampled				

Total Time Pumped: 45 min
Total Gal. Pumped: 885.5 Gal
Casing Displacement: 2.1
Time Sampled: 12:12
Sampler: Energy Laboratories, Inc./SAG/SD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 237
Water Level to Casing: 73.30 '
Casing Height: 1.71 '
Water Level: 71.59 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 421 Gal
Date Sampled: 04-04-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
04-04-88	14:10	154931				
	14:18	155235	35.5	7.45	13.0	1500
	14:30	155450	17.9	7.50	13.0	1550
	14:44	155670	15.7	7.50	13.5	1550
	14:51	155860	27.1	7.45	14.0	1580

Total Time Pumped: 41 min
Total Gal. Pumped: 909 Gal
Casing Displacement: 2.2
Time Sampled: 14:51
Sampler: Energy Laboratories, Inc./SAG/KS

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 237
Water Level to Casing: 73.60 '
Casing Height: 1.71 '
Water Level: 71.89 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 421 Gal
Date Sampled: 05-05-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
05-05-88	15:01	192948				
	15:04	193040	30.7	7.25	14.0	1500
	15:18	193378	24.1	7.35	15.5	1700
	15:30	193550	14.3	7.30	16.0	1750
	15:53	193990	19.1	7.30	15.5	1725

Total Time Pumped: 52 min
Total Gal. Pumped: 1042 Gal
Casing Displacement: 2.2
Time Sampled: 15:53
Sampler: Energy Laboratories, Inc./SAB/KS

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 237
Water Level to Casing: 73.61 '
Casing Height: 1.71 '
Water Level: 71.90 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 421 Gal
Date Sampled: 06-02-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
06-02-88	1:43	170800				
	1:47	170830	7.5	7.64	12.6	1380
	1:58	171160	30.0	7.72	15.3	1395
	2:05	171275	16.4	7.68	15.3	1505
	2:16	171490	19.5	7.61	15.3	1500
	2:28	171650	13.3	7.42	15.8	1510

Total Time Pumped: 45 min
Total Gal. Pumped: 650 Gal
Casing Displacement: 2.0
Time Sampled: 15:53
Sampler: Energy Laboratories, Inc./KS/SMD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 237
Water Level to Casing: 73.67 '
Casing Height: 1.71 '
Water Level: 71.96 '
I.D./Casing I.D.: 485'/5"
Casing Volume: 421.3 Gal
Date Sampled: 07-06-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
07-06-88	13:25	178320				
	13:42	178680	21.2	7.41	15.6	1200
	14:04	178980	13.6	7.45	15.3	1340
	14:37	179500	15.6	7.45	17.8	1510

Total Time Pumped: 72 Min
Total Gal. Pumped: 1180
Casing Displacement: 2.80
Time Sampled: 14:37
Sampler: Energy Laboratories, Inc./RAG/KRS

WATER ANALYSIS REPORT - CLEVELAND CLIFFS

Project: Collins & Draw

SAMPLE I.D.: Well #260

Sample Round:	#1	#2	#3	#4	#5	#6	
Sample Date:	09-18-87	11-12-87	01-05-88	03-02-88	04-04-88	05-05-88	06-02-88 07-06-88 Det. Limit
Report Date:	09-29-87	12-28-87	01-27-88	03-24-88	05-25-88	05-25-88	06-13-88 07-19-88 % Range
Sample Number:	17	87-14705	88-0118	88-1934	88-3796	88-5917	88-5921 88-8714
Lab:	WANC	ELI	ELI	ELI	ELI	ELI	ELI

MAJOR IONS mg/l:

Ca	29.0	35.4	32.5	32.8	41.2	34.2	0.05
Mg	4.0	3.7	3.4	3.6	3.9	3.8	0.01
Na	100	108	107	99.7	103	94.0	0.05
K	169	249	276	146	165	164	0.10
CO3	0	0	0	0	0	0	0.10
HCO3	323	498	342	451	401	357	0.10
SO4	490	492	349	337	372	334	0.50
Cl	39.0	28.7	27.6	32.6	27.1	25.0	0.10
NH4 (M)	92.0	78.0	70.8	70.2	56.4	49	0.05
TDS @ 180 C (Calculated)	922	1166	967	964	985	897	1.0
pH (units)	7.00	8.06	7.63	7.67	7.84	7.73	1-14
H2S - g						36.4	

TRACE METALS mg/l:

As	0.007	0.005	0.012	0.005	0.012	0.026	0.001
Mo	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Se EPA Pres.	0.060	0.176	0.032	0.007	0.006	<0.001	0.011 0.002 0.001
Se Filt. Only				0.011	0.012	0.005	0.005 0.007 0.001
V	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10 0.10

RADIOMETRIC pCi/l:

U (eq/l)	7.293	5.312	4.795	2.721	1.307	0.828	0.0003
Ra226	59.0	157.4	170.7	162.3	139	130	0.20
Ra Prec. +/-	5.7	3.6	3.6	3.5	10.2	10.6	

Q.A. DATA:

Anion eqq:	17.03	19.22	13.65	15.35	15.09	13.52	
Cation eqq:	16.59	18.73	13.64	15.10	15.11	13.82	
A/C Balance:	1.027	1.026	1.001	1.017	0.998	0.978	0.95-1.05
MYDEB A/C Bal. I	-1.31	-1.29	-0.04	-0.32	0.07	1.10	-5 - +5

Q.A. MANAGER: *RAJ/KK*
ENERGY LABORATORIES, INC.

Cleveland Cliffs Iron Company
 B-Field Restoration Stability Data
 Pre H2S 1983

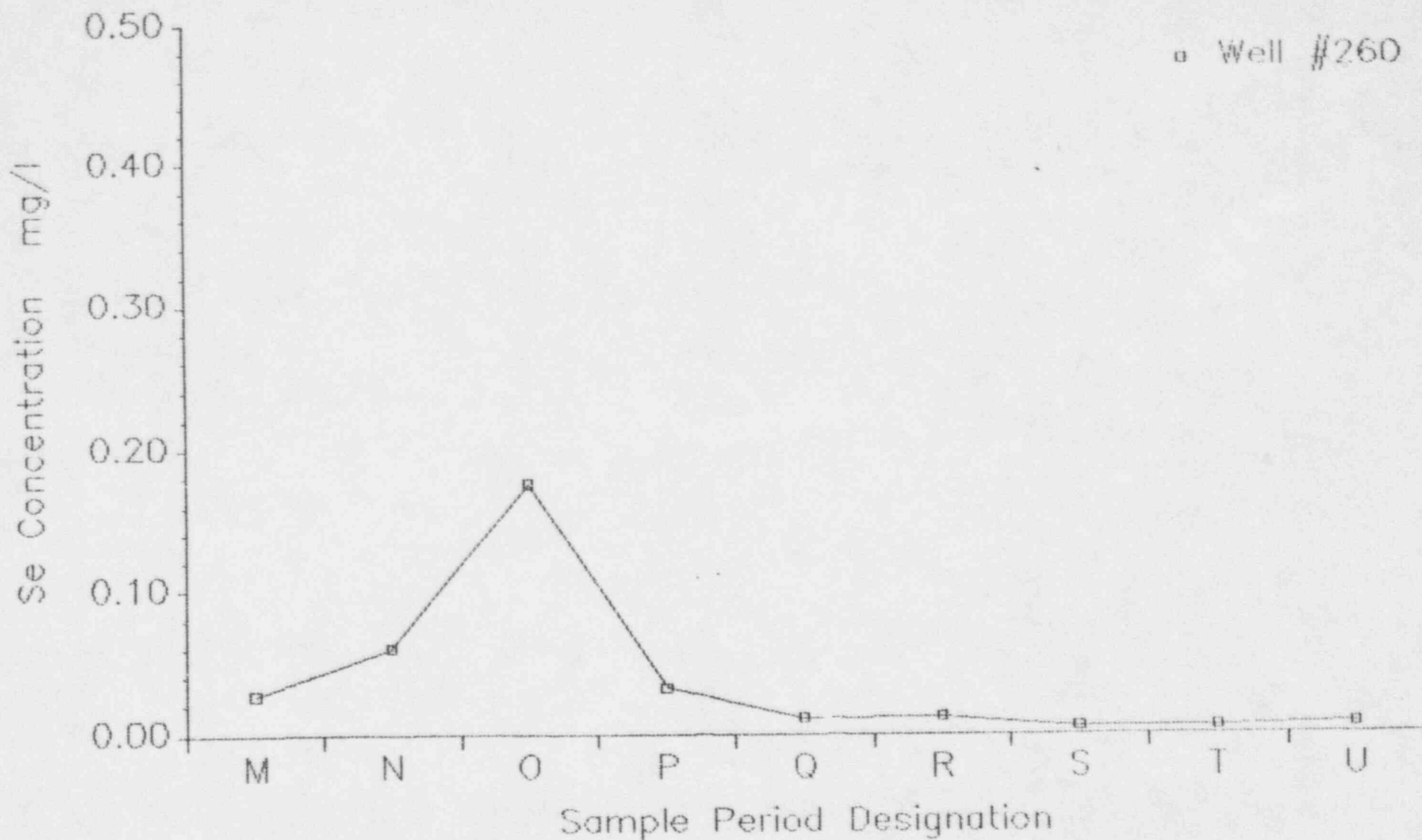


Sample Period Designation

See attached data for further information

Cleveland Cliffs Iron Company
B-Field Post H₂S Stability Data
1987 through 1988

□ Well #260



See attached data for further
information

August 22, 1988

Cleveland Cliffs Iron Company
Post H₂S Injection - Stability Monitoring Program

B Wellfield Restoration and Post H₂S Stability Data
Graphics Support

Graphic Desig.	Date	Round #/I.D.	Wellfield Mean	Well #260
A	12/82	2 week	0.038	0.063
B	1/83	4 week	0.035	0.066
C	2/83	6 week	0.033	0.026
D	2/83	8 week	0.121	0.039
E	3/83	3 month	0.328	0.041
F	4/83	4 month	0.209	0.026
G	5/83	5 month	0.227	0.016
H	6/83	6 month	0.724	0.035
I	7/83	7 month	0.541	0.028
J	8/83	8 month	0.549	0.022
K	9/83	9 month	0.834	0.022
L	10/83	10 month	1.021	0.021
M	7/87	Pre H ₂ S	2.524	0.027
N	9/87	Round 1	0.458	0.060
O	11/87	Round 2	0.139	0.176
P	1/88	Round 3	0.108	0.032
Q	3/88	Round 4	0.156	0.011
R	4/88	Round 5	0.164	0.012
S	5/88	Round 6	0.195	0.005
T	6/88	Round 7	0.198	0.005
U	7/88	Round 8	0.178	0.007

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 260
Water Level to Casing: 76.92 '
Casing Height: 3.58 '
Water Level: 73.34 '
T.D./Casing I.D.: 483'/4.33"
Casing Volume: 313 Gal
Date Sampled: 11-12-87
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
11/11/87	16:23	134068				
	16:28	134220	30.5	7.00	12.9	1200
	16:35	134330	15.7	7.20	14.0	1200
	16:49	134555	16.1	7.10	14.9	1000
	16:59	134700	14.5	7.05	14.5	1000
		Stability				
11/12/87	10:32 -	Sampled		7.09	13.0	1230
	10:37					

Total Time Pumped: 36 min
Total Gal. Pumped: 632 gal + ~153 gal @ sampling
Casing Displacement: 2.02
Time Sampled: 10:37
Sampler: Energy Laboratories, Inc./RAG

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 260
Water Level to Casing: 76.54 '
Casing Height: 3.58 '
Water Level: 72.96 '
T.D./Casing I.D.: 485'/4.33"
Casing Volume: 315 Gal
Date Sampled: 01-05-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
01-05-88	11:00	166458				
	11:25	166900		6.89	12.0	800
	11:53	167385		6.75	13.3	1100
	12:03	167540		6.80	13.5	1125

Total Time Pumped: 63 min
Total Gal. Pumped: 1082 Gal
Casing Displacement: 3.43
Time Sampled: 12:03
Sampler: Energy Laboratories, Inc./SAB/RAG

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 260
Water Level to Casing: 76.78 '
Casing Height: 3.58 '
Water Level: 73.20 '
T.D./Casing I.D.: 485'/4.33"
Casing Volume: 412 Gal
Date Sampled: 03-02-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
03-02-88	09:25	Timed Flow				
	09:50	Lack of	17.1	6.95	12.5	940
	10:13	Meter	17.5	6.85	13.1	960
	10:27		16.6	6.87	13.5	970
	10:35			6.85	13.3	990

Total Time Pumped: 62 min
Total Gal. Pumped: 1064 Gal
Casing Displacement: 2.6
Time Sampled: 10:35
Sampler: Energy Laboratories, Inc./SAG/SD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 260
Water Level to Casing: 75.07 '
Casing Height: 1.90 '
Water Level: 73.17 '
T.D./Casing I.D.: 485'/4.33"
Casing Volume: 315 gal
Date Sampled: 04-04-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
04-04-88	09:15	182500				
	09:38	182935	18.9	6.95	13.9	900
	09:53	183243	18.1	7.15	14.1	1000
	10:05	183411	16.8	7.10	13.9	1010
	10:14	183540	16.6	7.10	14.0	1010

Total Time Pumped: 59 min
Total Gal. Pumped: 1060 Gal
Casing Displacement: 3.4
Time Sampled: 10:14
Sampler: Energy Laboratories, Inc./SAG/KS

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 260
Water Level to Casing: 76.48 '
Casing Height: 3.58 '
Water Level: 72.90 '
T.D./Casing I.D.: 485'/4.33"
Casing Volume: 315.2
Date Sampled: 05-05-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
05-05-88	08:10	156838				
	08:33	157405	24.6	7.10	15.0	700
	08:47	157670	18.9	7.10	14.5	900
	09:00	157900	17.6	7.00	14.5	900
	09:12	158040	11.7	7.00	14.5	900

Total Time Pumped: 62 Min.
Total Gal. Pumped: 1201.5 Gal
Casing Displacement: 3.4
Time Sampled: 09:12
Sampler: Energy Laboratories, Inc./SAG/KS

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 260
Water Level to Casing: 76.78 '
Casing Height: 3.58 '
Water Level: 73.20 '
T.D./Casing I.D.: 485'/4.33"
Casing Volume: 411 Gal
Date Sampled: 06-02-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
06-02-88		193993				
	9:36	194090		7.30	14.5	790
	9:49	194338	19.0	7.48	14.5	800
	9:59	194567	22.9	7.40	14.7	805
	10:08	194742	19.4	7.32	15.2	810

Total Time Pumped: 32 min
Total Gal. Pumped: 749
Casing Displacement: 2.4
Time Sampled: 10:08
Sampler: Energy Laboratories, Inc./KS/SMD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 269
Water Level to Casing: 76.88 '
Casing Height: 3.58 '
Water Level: 73.30 '
T.D./Casing I.D.: 485'/4.33"
Casing Volume: 314.9 gal
Date Sampled: 07-06-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

<u>Date</u>	<u>Time</u>	<u>Meter</u>	<u>Rate</u>	<u>pH</u>	<u>Temp</u>	<u>Uncorrected Cond</u>
07-06-88	13:07	202616				
	13:26	203069	23.8	7.28	15.3	770
	13:40	203250	12.9	7.23	15.6	800
	14:02	203535	13.9	7.26	15.6	820
	14:11	203685	14.4	7.20	16.8	900

Total Time Pumped: 64 Min
Total Gal. Pumped: 1069 Gal
Casing Displacement: 3.39
Time Sampled: 14:11
Sampler: Energy Laboratories, Inc./rAG/KRS

WATER ANALYSIS REPORT - CLEVELAND CLIFFS

Project: Collins Draw

SAMPLE I.D.: Well #276

Sample Round:	#1	#2	#3	#4	#5	#6	
Sample Date:	09-08-87	11-12-87	01-05-88	03-02-88	04-04-88	05-05-88	06-02-88 07-06-88 Det. Limit
Report Date:	09-29-87	12-23-87	01-27-88	03-24-88	05-25-88	05-25-88	06-13-88 07-19-88 k Range
Sample Number:	#8	87-14707	88-0121	88-1852	88-3797	88-5918	88-6922 88-6715
Lab:	WACCO	ELI	ELI	ELI	ELI	ELI	ELI

MAJOR IONS mg/l:

Ca	21.0	91.0	123	117	121	101	0.05
Mg	9.0	11.3	14.4	15.0	14.6	14.0	0.01
Na	103	140	154	148	140	124	0.05
K	169	291	328	278	317	290	0.10
CO3	0	0	0	0	0	0	0.10
HCO3	427	581	615	699	621	561	0.10
SO4	426	726	840	854	832	691	0.50
Cl	38.0	36.3	35.6	28.1	20.8	35.1	0.10
NH4 (M)	96.0	103	103	120	96.0	85.0	0.05
TDS @ 180 C (Calculated)	1018	1586	1915	1958	1879	1648	1.0
pH (units)	7.69	7.49	7.59	7.22	7.63	7.44	1-14
H2S - g						21.6	

TRACE METALS mg/l:

As	0.350	0.292	0.203	0.119	0.045	0.034	0.001
Mo	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Se EPA Pres.	0.434	0.034	0.023	0.020	0.010	0.005	0.008
Se Filt. Only				0.028	0.019	0.011	0.011
V	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10

RADIOMETRIC pCi/l:

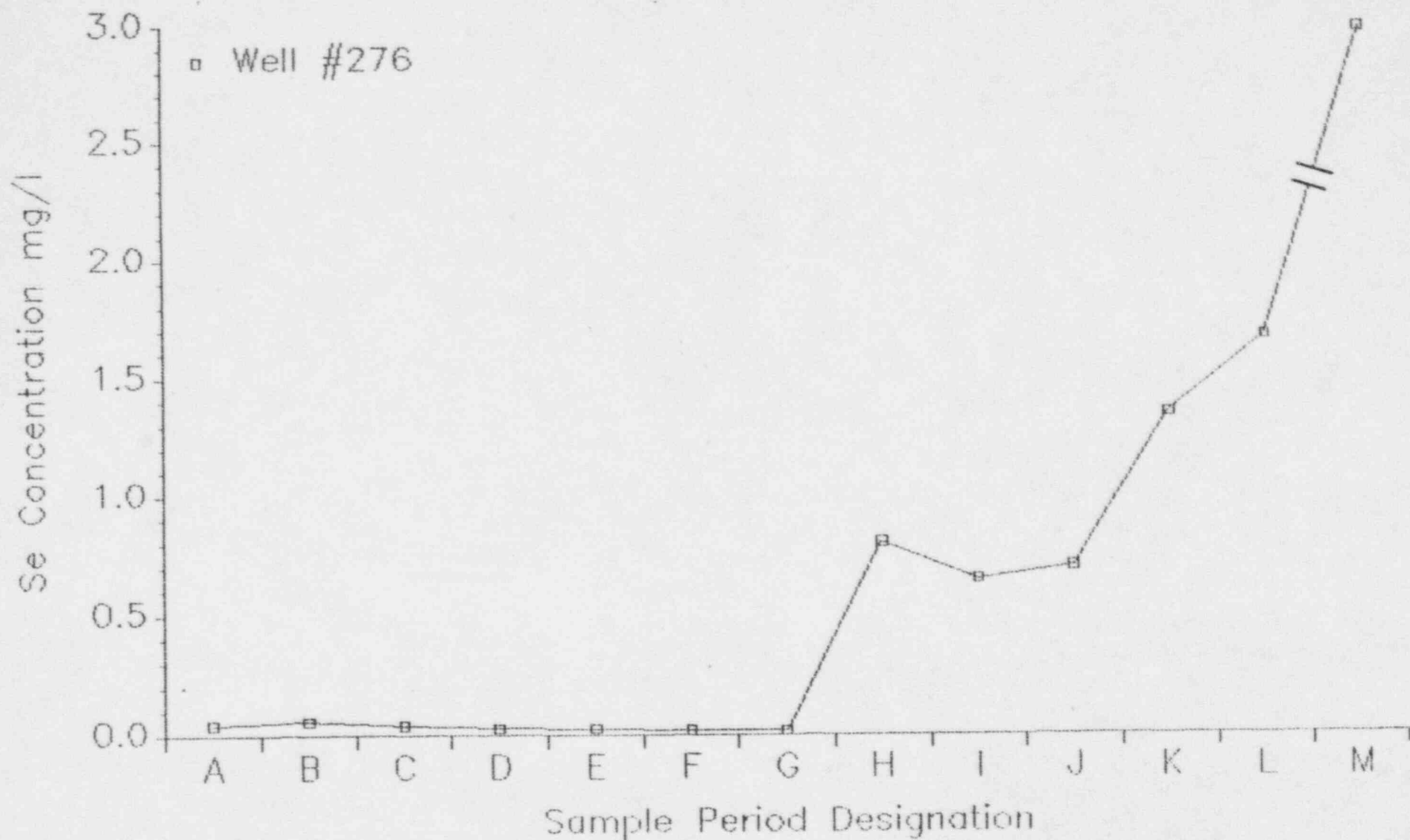
U (mg/l)	28.833	13.280	9.337	8.166	4.279	3.148	0.0003
Ra226	52.0	739.1	1193	1623	1288	1061	0.20
Ra Prec. +/-	5.4	7.8	8.9	10.9	31.2	30.3	

Q.A. DATA:

Anion seq:	17.46	25.67	28.58	30.06	28.10	24.58	
Cation seq:	16.93	26.40	29.81	29.44	28.34	25.14	
A/C Balance:	1.031	0.972	0.959	1.021	0.992	0.978	0.95-1.05
WYDER A/C Bal.%	-1.54	1.40	2.11	-1.04	0.43	1.13	-5 - +5

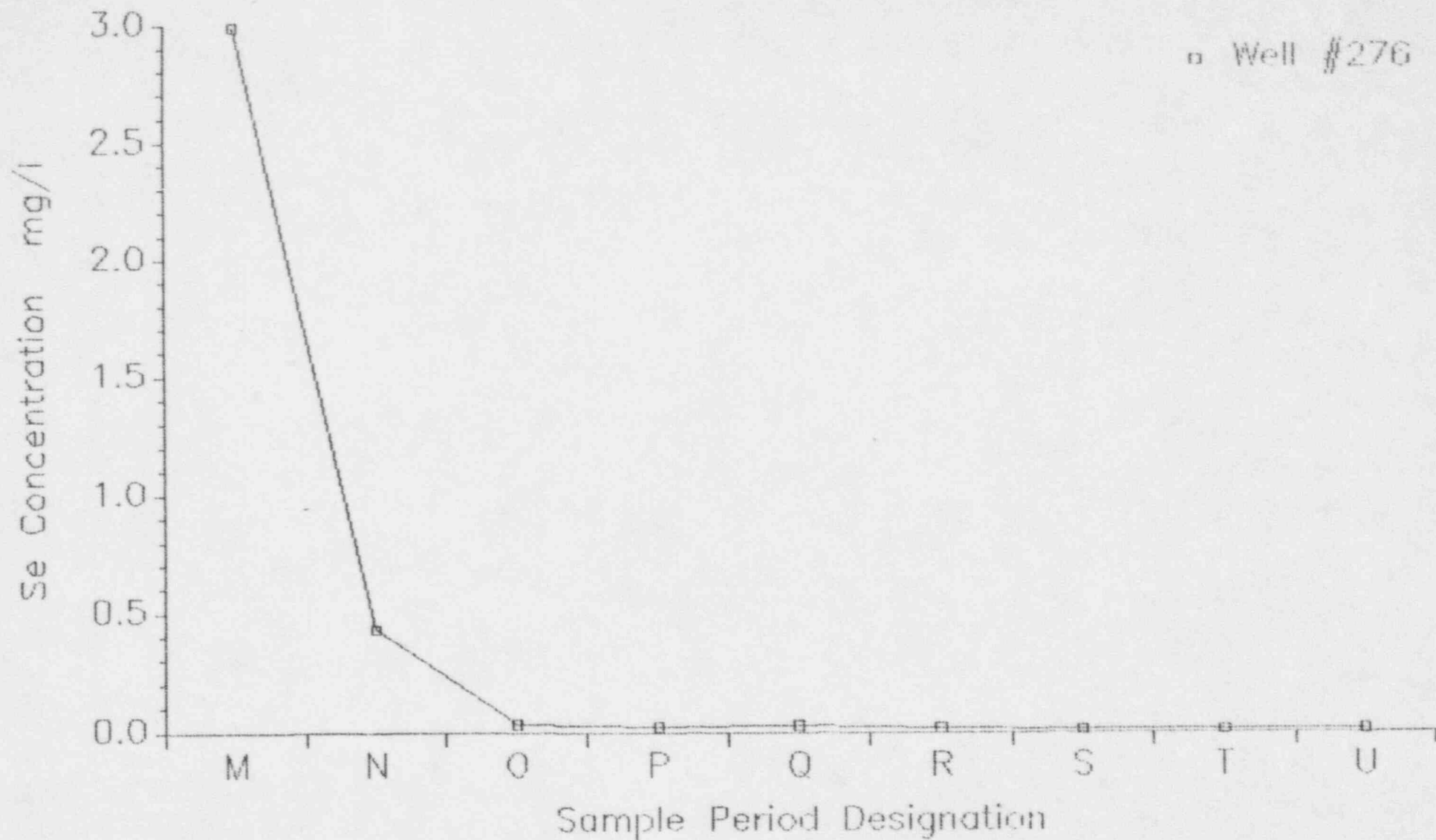
Q.A. MANAGER: RAG/KK
ENERGY LABORATORIES, INC.

Cleveland Cliffs Iron Company
B-Field Restoration Stability Data
Pre H2S 1983



See attached data for further
information

Cleveland Cliffs Iron Company
B-Field Post H₂S Stability Data
1987 through 1988



See attached data for further
information

August 22, 1988

Cleveland Cliffs Iron Company
Post H₂S Injection - Stability Monitoring Program

B Wellfield Restoration and Post H₂S Stability Data
Graphics Support

Graphic Desig.	Date	Round #/I.D.	Wellfield Mean	Well #276
A	12/82	2 week	0.038	0.044
B	1/83	4 week	0.035	0.058
C	2/83	6 week	0.033	0.039
D	2/83	8 week	0.121	0.027
E	3/83	3 month	0.328	0.025
F	4/83	4 month	0.209	0.018
G	5/83	5 month	0.227	0.016
H	6/83	6 month	0.724	0.802
I	7/83	7 month	0.541	0.650
J	8/83	8 month	0.549	0.705
K	9/83	9 month	0.834	1.353
L	10/83	10 month	1.021	1.678
M	7/87	Pre H ₂ S	2.524	2.990
N	9/87	Round 1	0.458	0.434
O	11/87	Round 2	0.139	0.034
P	1/88	Round 3	0.108	0.023
Q	3/88	Round 4	0.156	0.028
R	4/88	Round 5	0.164	0.019
S	5/88	Round 6	0.195	0.011
T	6/88	Round 7	0.198	0.011
U	7/88	Round 8	0.178	0.013

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 276
Water Level to Casing: 73.21 '
Casing Height: 2.54 '
Water Level: 70.67 '
T.D./Casing I.D.: 485'/4.23"
Casing Volume: 315 Gal
Date Sampled: 11-12-87
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
11/10/87	12:37	160852				
	12:39	160920	33.9	7.30	13.7	1230
	12:47	161070	18.8	7.22	12.8	1100
	13:11	161300	9.5	7.25	14.2	1220
	13:35	161514	8.9	7.25	14.5	1610
	13:45	161612	9.8	7.20	14.5	1670
	13:50	161653				1700
		Stability				
11/12/87	11:26 -	Sampled		7.23	13.0	1710
	11:31					

Total Time Pumped: 73 min
Total Gal. Pumped: 801 gal + ~170 gal @ sampling
Casing Displacement: 2.54
Time Sampled: 11:31
Sampler: Energy Laboratories, Inc./RAG

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 276
Water Level to Casing: 73.79 '
Casing Height: 2.54 '
Water Level: 71.25 '
T.D./Casing I.D.: 485'/4.23"
Casing Volume: 317 Gal
Date Sampled: 01-05-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
01-05-88	13:04	135500				
	13:17	136740		6.70	11.0	1800
	13:35	136900		6.75	11.0	1950
	14:16	137220		6.72	12.2	2005
	14:26	137817				

Total Time Pumped: 82 min
Total Gal. Pumped: 1317.5 Gal
Casing Displacement: 4.16
Time Sampled: 14:26
Sampler: Energy Laboratories, Inc./SAG/RAG

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 276
Water Level to Casing: 73.38 '
Casing Height: 2.54 '
Water Level: 70.84 '
T.D./Casing I.D.: 485'/4.33"
Casing Volume: 317 Gal
Date Sampled: 03-02-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
03-02-88	12:11	177061				
	12:14	177112	17.0	7.05	11.8	1500
	12:40	177390	10.3	7.01	12.9	1810
	13:09	177659	9.6	7.01	12.9	1790
	13:19	177760	10.1	7.00	12.9	1800

Total Time Pumped: 63 min
Total Gal. Pumped: 699 Gal
Casing Displacement: 2.2
Time Sampled: 13:19
Sampler: Energy Laboratories, Inc./SAG/SD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 276
Water Level to Casing: 73.42 '
Casing Height: 2.54 '
Water Level: 70.88 '
T.D./Casing I.D.: 485'/4.33"
Casing Volume: 317 Gal
Date Sampled: 04-04-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
04-04-88	11:46	184976				
	12:03	185255	14.6	7.10	14.0	1800
	12:10	185330	10.7	7.05	13.8	1820
	12:20	185420	9.0	7.00	14.0	1790
	12:25	185620		7.00	14.0	1820

Total Time Pumped: 39 min
Total Gal. Pumped: 644 Gal
Casing Displacement: 2.03
Time Sampled: 12:25
Sampler: Energy Laboratories, Inc./SAG/KS

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 276
Water Level to Casing: 73.49 '
Casing Height: 2.54 '
Water Level: 70.95 '
I.D./Casing I.D.: 485'/4.33"
Casing Volume: 316.7
Date Sampled: 05-05-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
05-05-88	10:10	157585				
	10:22	159840	21.3	7.0	13.5	1400
	10:42	160030	9.5	7.0	14.5	1500
	10:55	160160	10.0	7.0	15.0	1620
	11:07	160280	10.0	6.99	16.0	1575

Total Time Pumped: 57 Min
Total Gal. Pumped: 695 Gal
Casing Displacement: 2.03
Time Sampled: 11:07
Sampler: Energy Laboratories, Inc./SAG/KS

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 276
Water Level to Casing: 73.50 '
Casing Height: 2.54 '
Water Level: 70.96 '
T.D./Casing I.D.: 485'/4.23"
Casing Volume: 316.7 Gal
Date Sampled: 06-02-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
06-02-88	10:12	194750		7.20	12.6	1290
	10:23	194985	21.4	7.39	13.7	1310
	10:37	195135	10.7	7.37	15.3	1340
	10:52	195288	10.2	7.34	15.3	1315
	11:02	195387	9.9	7.34	16.1	1385

Total Time Pumped: 50 min
Total Gal. Pumped: 637 Gal
Casing Displacement: 2.0
Time Sampled: 11:02
Sampler: Energy Laboratories, Inc./KS/SMD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 276
Water Level to Casing: 73.21 '
Casing Height: 2.54 '
Water Level: 70.67 '
I.D./Casing I.D.: 485'/4.33"
Casing Volume: 316.9
Date Sampled: 07-06-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
07-06-88	12:03	201935				
	12:25	202285	12.5	7.27	15.8	1110
	12:42	202435	8.8	7.28	16.1	1090
	13:00	202605	9.4	7.39	16.7	1080

Total Time Pumped: 57 Min
Total Gal. Pumped: 670 Gal
Casing Displacement: 2.11
Time Sampled: 13:00
Sampler: Energy Laboratories, Inc./RAB/KRS

WATER ANALYSIS REPORT - CLEVELAND CLIFFS

Project: Collins Draw

SAMPLE I.D.: Well #277

Sample Round:	#1	#2	#3	#4	#5	#6		
Sample Date:	09-08-87	11-12-87	01-05-88	03-02-88	04-04-88	05-05-88	06-02-88	07-06-88
Report Date:	09-29-87	12-28-87	01-27-88	03-24-88	05-25-88	05-25-88	06-13-88	07-19-88
Sample Number:	#8	87-14706	88-0122	88-1854	88-3798	88-5919	88-6923	88-8716
Lab:	WAMCO	ELI	ELI	ELI	ELI	ELI	ELI	ELI

MAJOR IONS mg/l:

	#1	#2	#3	#4	#5	#6	Det. Limit
Ca	15.0	17.7	22.2	21.9	26.1	26.3	0.05
Mg	3.0	4.1	3.2	3.7	3.9	4.6	0.01
Na	98	119	104	111	110	104	0.05
K	165	249	229	180	220	235	0.10
CO3	0	0	0	0	0	0	0.10
HCO3	342	515	468	517	441	412	0.10
SO4	426	480	403	413	481	473	0.50
Cl	32.0	28.7	24.9	23.2	25.4	26.0	0.10
NH4 (N)	92.0	86.0	80.2	83.0	76.8	82.0	0.05
TDS @ 180 C (Calculated)	915	1156	1116	1138	1186	1188	1.0
pH (units)	7.00	8.03	7.79	7.58	7.85	7.70	1-14
H2S - g						34.0	

TRACE METALS mg/l:

	#1	#2	#3	#4	#5	#6	
As	0.114	0.025	0.325	0.119	0.157	0.041	0.001
Mo	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Se EPA Pres.	0.434	0.164	0.093	0.033	0.031	0.011	0.001
Se Filt. Only				0.054	0.047	0.022	0.001
V	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10

RADIOMETRIC pCi/l:

	#1	#2	#3	#4	#5	#6	
U (mg/l)	18.156	9.738	10.351	10.887	7.942	7.468	0.0003
Ra226	33.0	124.7	206.1	242.2	268	498	0.20
Ra Prec. +/-	4.6	3.2	3.7	4.4	14.3	15.4	

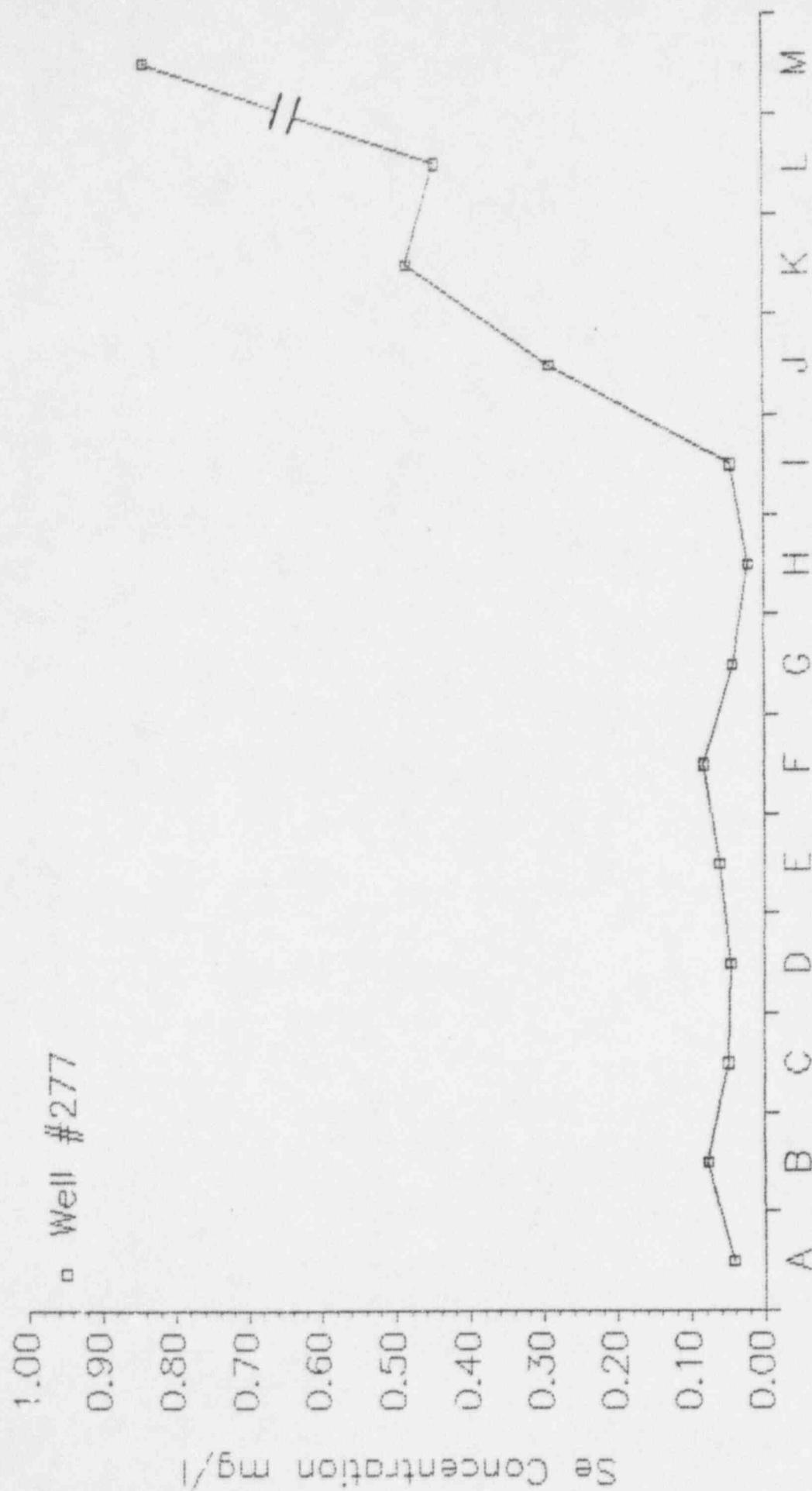
Q.A. DATA:

	#1	#2	#3	#4	#5	#6	
Anion meq:	16.05	19.25	16.93	17.94	17.97	17.34	
Cation meq:	15.37	18.93	17.50	17.75	17.54	18.10	
A/C Balance:	1.044	1.017	0.967	1.011	1.025	0.958	0.95-1.05
WYDEQ A/C Bal. %	-2.16	-0.34	1.66	-0.53	-1.21	2.14	-5 - +5

Q.A. MANAGER:

ENERGY LABORATORIES, INC.

Cleveland Cliffs Iron Company
B-Field Restoration Stability Data
Pre H2S 1983

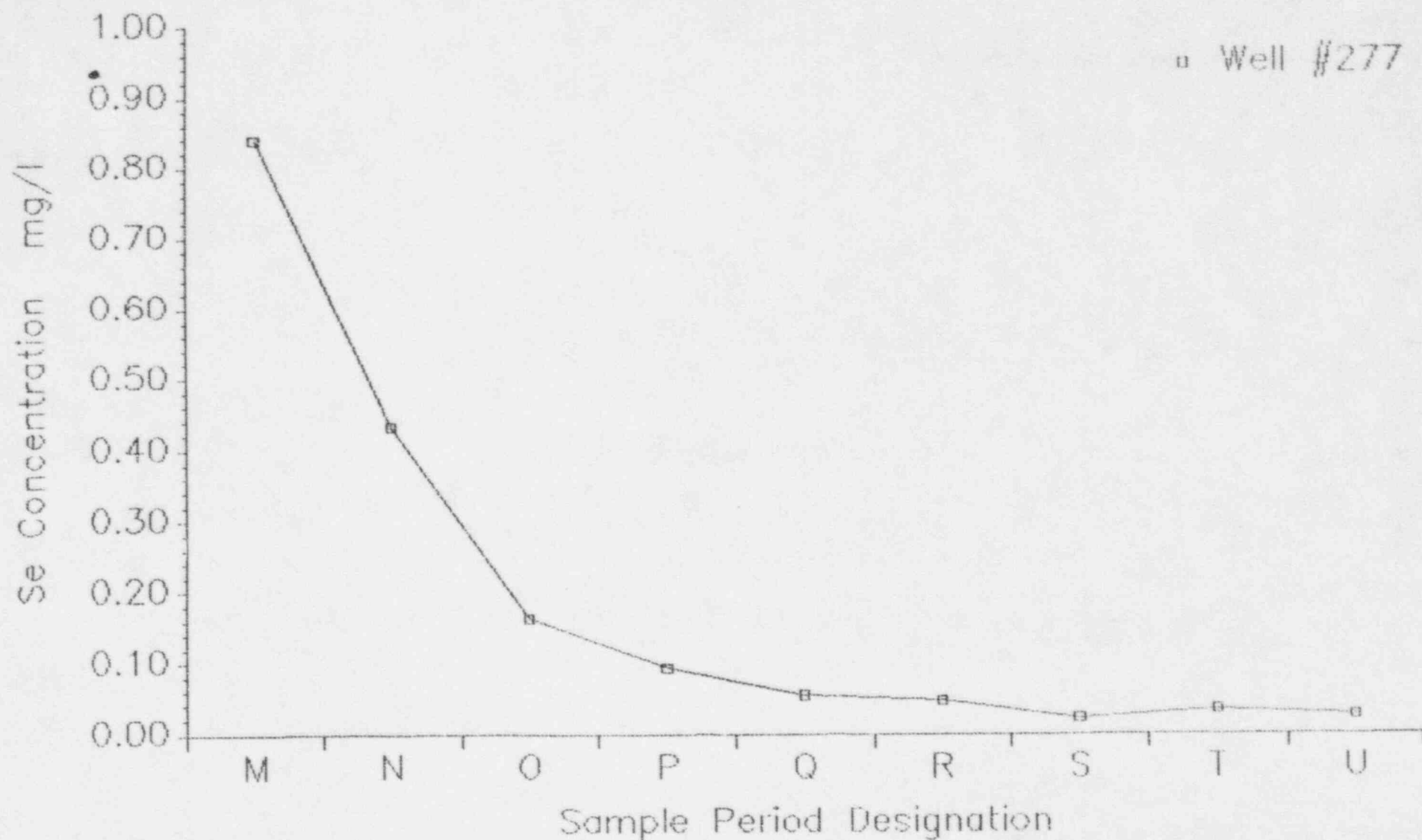


Sample Period Designation

See attached data for further information

Cleveland Cliffs Iron Company
B-Field Post H₂S Stability Data
1987 through 1988

□ Well #277



See attached data for further
information

August 22, 1988

Cleveland Cliffs Iron Company
Post H₂S Injection - Stability Monitoring Program

B Wellfield Restoration and Post H₂S Stability Data
Graphics Support

Graphic Desig.	Date	Round #/I.D.	Wellfield Mean	Well #277
A	12/82	2 week	0.038	0.042
B	1/83	4 week	0.035	0.078
C	2/83	6 week	0.033	0.049
D	2/83	8 week	0.121	0.046
E	3/83	3 month	0.328	0.061
F	4/83	4 month	0.209	0.083
G	5/83	5 month	0.227	0.043
H	6/83	6 month	0.724	0.021
I	7/83	7 month	0.541	0.046
J	8/83	8 month	0.549	0.290
K	9/83	9 month	0.834	0.484
L	10/83	10 month	1.021	0.446
M	7/87	Pre H ₂ S	2.524	0.840
N	9/87	Round 1	0.458	0.434
O	11/87	Round 2	0.139	0.164
P	1/88	Round 3	0.108	0.093
Q	3/88	Round 4	0.156	0.054
R	4/88	Round 5	0.164	0.047
S	5/88	Round 6	0.195	0.022
T	6/88	Round 7	0.198	0.034
U	7/88	Round 8	0.178	0.026

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 277
Water Level to Casing: 73.50 '
Casing Height: 3.50 '
Water Level: 70.00 '
T.D./Casing I.D.: 485'/4.23"
Casing Volume: 315 Gal
Date Sampled: 11-12-87
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
11/11/87	16:00	163673				
	16:05	163780	21.4	7.58	12.9	1125
	16:20	163895	7.7	7.90	13.0	1100
	16:53	164050	4.7	7.35	14.0	1260
	17:08	164130		Down for		
11/11/87	13:46	164550		Darkness		
	13:55	164725	19.4	7.30	13.2	1280
		Stability				
11/12/87	11:38	Sampled		7.31	13.0	1310
	11:43					

Total Time Pumped: 77 min
Total Gal. Pumped: 632 gal + ~107 gal at sampling
Casing Displacement: 2.01
Time Sampled: 11:43
Sampler: Energy Laboratories, Inc./RAG

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 277
Water Level to Casing: 73.58 '
Casing Height: 3.50 '
Water Level: 70.08 '
I.D./Casing I.D.: 485'/4.23"
Casing Volume: 317 Gal
Date Sampled: 01-05-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
01-05-88	15:35	137317				
	16:00	137605		7.40	12.0	1295
	16:28	137820		7.00	11.9	1390
	16:50	138017		7.00	12.5	1375
	17:06	138100				

Total Time Pumped: 91 min
Total Gal. Pumped: 783 Gal
Casing Displacement: 2.47
Time Sampled: 17:06
Sampler: Energy Laboratories, Inc./SAG/RAG

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 277
Water Level to Casing: 73.40 '
Casing Height: 3.50 '
Water Level: 69.90 '
T.D./Casing I.D.: 485'/4.33"
Casing Volume: 317.5 Gal
Date Sampled: 03-02-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
03-02-88	14:42	178812				
	14:48	178957	24.1	7.20	11.2	1150
	15:28	179250	7.3	7.28	12.9	1140
	15:55	179451	7.4	7.28	13.1	1110

Total Time Pumped: 73 min
Total Gal. Pumped: 639 Gal
Casing Displacement: 2.0
Time Sampled: 15:55
Sampler: Energy Laboratories, Inc./SAG/SD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 277
Water Level to Casing: 73.30 '
Casing Height: 3.50 '
Water Level: 69.80 '
T.D./Casing I.D.: 485'/4.33"
Casing Volume: 317.5 Gal
Date Sampled: 04-04-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
04-04-88	12:00	153247				
	12:12	153430	15.3	7.50	12.5	1150
	12:22	153550	12.0	7.50	14.0	1150
	12:37	153695	9.7	7.50	14.0	1200
	13:10	153890	7.2	7.50	14.0	1200

Total Time Pumped: 70 min
Total Gal. Pumped: 643 Gal
Casing Displacement: 2.02
Time Sampled: 13:10
Sampler: Energy Laboratories, Inc./SAG/KS

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 277
Water Level to Casing: 73.59 '
Casing Height: 3.50 '
Water Level: 70.09 '
T.D./Casing I.D.: 485'/4.33"
Casing Volume: 317.4
Date Sampled: 05-05-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
05-05-88	12:04	189845				
	12:10	189980	22.5	7.40	14.5	1100
	12:40	190200	7.3	7.50	16.0	1100
	13:02	190376	8.0	7.40	16.0	1100
	13:22	190530	7.7	7.35	17.0	1220

Total Time Pumped: 78 Min
Total Gal. Pumped: 685 Gal
Casing Displacement: 2.02
Time Sampled: 13:22
Sampler: Energy Laboratories, Inc./SAG/KS

CLEVELAND CLIPPE - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 177
Water Level to Casing: 73.70 '
Casing Height: 3.50 '
Water Level: 70.20 '
T.D./Casing I.D.: 485'/4.33"
Casing Volume: 317.2 Gal
Date Sampled: 06-02-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	meter	Rate	pH	Temp	Uncorrected Cond
06-02-88	11:09	195440		7.63	13.6	1000
	11:24	195633	14.8	7.80	14.1	940
	11:47	195820	8.1	7.85	15.3	910
	12:02	195932	7.5	7.80	15.2	990
	12:12	196030	9.8	7.69	16.2	1040

Total Time Pumped: 63 min
Total Gal. Pumped: 637 Gal
Casing Displacement: 2.0
Time Sampled: 12:12
Sampler: Energy Laboratories, Inc./ES/SMD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 277
Water Level to Casing: 73.63 '
Casing Height: 3.50 '
Water Level: 70.13 '
T.D./Casing I.D.: 485'/4.33"
Casing Volume: 317.4
Date Sampled: 07-06-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

<u>Date</u>	<u>Time</u>	<u>Meter</u>	<u>Rate</u>	<u>pH</u>	<u>Temp</u>	<u>Uncorrected Cond</u>
07-06-88	14:55	179530				
	15:37	179950	10.0	7.82	16.1	1010
	16:04	180150	6.1	7.68	15.7	1090
	16:17	180250	7.69	7.86	16.9	1080

Total Time Pumped: 82 Min
Total Gal. Pumped: 720 Gal
Casing Displacement: 2.27
Time Sampled: 16:17
Sampler: Energy Laboratories, Inc./RAB/KRS

WATER ANALYSIS REPORT - CLEVELAND CLIFFS

Project: Collins Draw

SAMPLE I.D.: Well #283

Sample Round:	#1	#2	#3	#4	#5	#6	Det. Limit
Sample Date:	09-08-87	11-12-87	01-06-88	03-03-88	04-04-88	05-05-88	% Range
Report Date:	09-29-87	12-28-87	01-27-88	03-24-88	04-08-88	05-25-88	
Sample Number:	#10	87-14708	88-0135	88-1928	88-3799	88-5920	
Lab:	WAMCO	ELI	ELI	ELI	ELI	ELI	

MAJOR IONS mg/l:

Ca	6.0	12.2	17.1	14.9		15.6	14.4	0.05
Mg	4.0	3.7	4.3	4.2		4.7	4.4	0.01
Na	115	140	167	171		178	170	0.05
K	168	256	333	298		394	402	0.10
CO3	0	6.9	0	0		0	0	0.10
HCO3	500	593	639	656		648	645	0.10
SO4	350	426	600	647		698	650	0.50
Cl	43.0	35.9	37.7	28.2		26.5	33.4	0.10
NH4 (N)	92.0	97.0	103	122		103	100	0.05
TDS @ 180 C (Calculated)	886	1177	1591	1641		1773	1739	1.0
pH (units)	8.04	8.40	8.24	8.25		8.28	8.23	1-14
H2S - g							8.8	

TRACE METALS mg/l:

As	0.082	0.085	0.054	0.034		0.058	0.061	0.001
Mo	<0.10	<0.10	<0.10	<0.10		<0.10	<0.10	0.10
Se EPA Pres.	1.050	0.062	0.102	0.110	0.147	0.123	0.165	0.001
Se Filt. Only				0.171	0.147	0.117	0.187	0.001
V	0.35	<0.10	0.20	0.10		<0.10	<0.10	0.10

RADIOMETRIC pCi/l:

U (ug/l)	14.077	13.943	8.832	15.371		11.785	13.600	0.0003
Ra226	94.0	340.2	605.1	595.6		625	632	0.20
Ra Prec. +/-	7.3	5.4	6.1	6.7		21.5	21.3	

Q.A. DATA:

Anion meq:	16.50	19.84	24.04	25.05		25.91	25.06	
Cation meq:	16.69	20.50	24.37	25.27		26.37	25.93	
A/C Balance:	0.989	0.968	0.986	0.991		0.983	0.967	0.95-1.05
WYDED A/C Bal.%	0.57	1.64	0.68	0.44		0.68	1.71	-5 - +5

Q.A. MANAGER:

ENERGY LABORATORIES, INC.

Cleveland Cliffs Iron Company
 B-Field Restoration Stability Data
 Pre H2S 1983

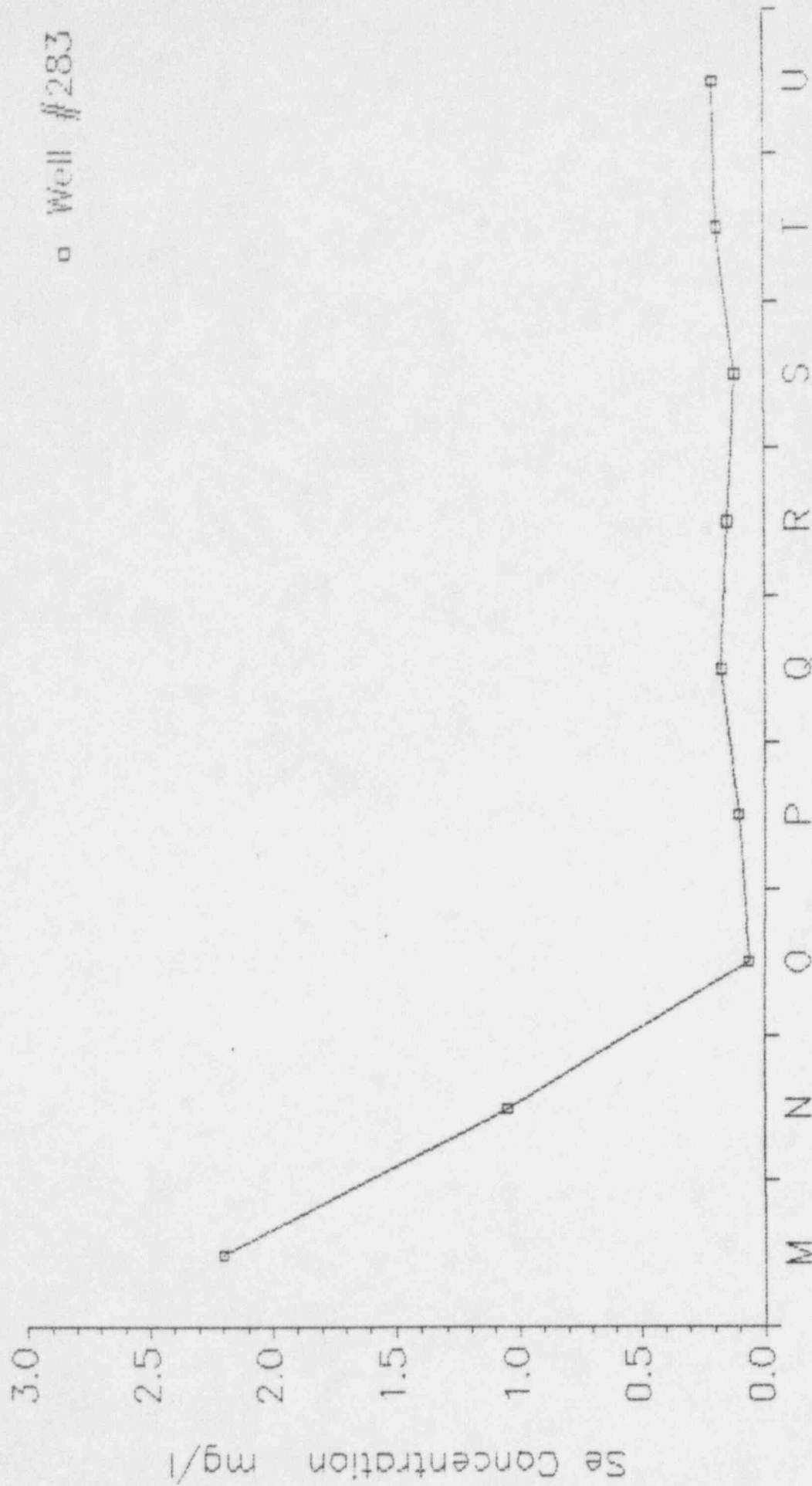


Sample Period Designation

See attached data for further information

Cleveland Cliffs Iron Company
B-Field Post H2S Stability Data
1987 through 1988

□ Well #283



Sample Period Designation

See attached data for further information

August 22, 1988

Cleveland Cliffs Iron Company
Post H₂S Injection - Stability Monitoring Program

B Wellfield Restoration and Post H₂S Stability Data
Graphics Support

Graphic Desig.	Date	Round #/I.D.	Wellfield Mean	Well #283
A	12/82	2 week	0.038	No
B	1/83	4 week	0.035	
C	2/83	6 week	0.033	
D	2/83	8 week	0.121	
E	3/83	3 month	0.328	
F	4/83	4 month	0.209	Data
G	5/83	5 month	0.227	
H	6/83	6 month	0.724	
I	7/83	7 month	0.541	
J	8/83	8 month	0.549	
K	9/83	9 month	0.834	Available
L	10/83	10 month	1.021	
M	7/87	Pre H ₂ S	2.524	2.200
N	9/87	Round 1	0.458	1.050
O	11/87	Round 2	0.139	0.062
P	1/88	Round 3	0.108	0.102
Q	3/88	Round 4	0.156	0.171
R	4/88	Round 5	0.164	0.147
S	5/88	Round 6	0.195	0.117
T	6/88	Round 7	0.198	0.187
U	7/88	Round 8	0.178	0.204

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 283
Water Level to Casing: 74.46 '
Casing Height: 3.04 '
Water Level: 71.42 '
T.D./Casing I.D.: 485'/4.33"
Casing Volume: 314 Gal
Date Sampled: 11-12-87
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
11/11/87	15:57	133261				
	15:59	133310	24.5	7.59	12.5	1320
	16:07	133665	44.4	8.30	13.5	1275
	16:14	133910	35.0	8.25	14.0	1290
		Stability				
11/12/87	10:23 -	Sampled		8.14	13.9	1400
	10:28					

Total Time Pumped: 17 min
Total Gal. Pumped: 649 gal + ~123 gal @ sampling
Casing Displacement: 2.07
Time Sampled: 10:28
Sampler: Energy Laboratories, Inc./RAG

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 283
Water Level to Casing: 74.83 '
Casing Height: 3.04 '
Water Level: 71.79 '
T.D./Casing I.D.: 485'/4.33"
Casing Volume: 316 Gal
Date Sampled: 01-06-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
01-06-88	11:15	172912		7.45	11.5	1400
	11:25	173230		8.19	12.0	1500
	11:40	173730		7.62	12.4	1510
	11:55	174220		7.26	12.5	1580
	12:15	174920		6.73	12.9	1560
	12:20	Sampled				

Total Time Pumped: 65 min
Total Gal. Pumped: 2008 gal
Casing Displacement: 6.35
Time Sampled: 12:20
Sampler: Energy Laboratories, Inc./RAG/SMD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 283
Water Level to Casing: 74.54 '
Casing Height: 3.04 '
Water Level: 71.50 '
T.D./Casing I.D.: 485'/4.33"
Casing Volume: 316 Gal
Date Sampled: 03-03-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
03-03-88	10:46	147459				
	10:58	147735	23.0	7.82	12.9	1805
	11:13	148355	41.3	7.89	12.9	1805
	11:25	148800	37.0	8.02	13.0	1800
		Sampled				

Total Time Pumped: 39 min
Total Gal. Pumped: 1341
Casing Displacement: 4.2
Time Sampled: 11:25
Sampler: Energy Laboratories, Inc./SAG/SD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 293
Water Level to Casing: 74.54 '
Casing Height: 3.04 '
Water Level: 71.50 '
T.D./Casing I.D.: 485'/4.33"
Casing Volume: 316 Gal
Date Sampled: 04-04-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
04-04-88	14:53	155813				
	14:58	155970	52.3	8.00	13.0	1700
	15:05	156313	49.3	8.05	13.0	1670
	15:10	156515	40.0	8.05	13.5	1680
	15:15	156725	42.0	8.00	13.5	1700

Total Time Pumped: 20 min
Total Gal. Pumped: 912 Gal
Casing Displacement: 2.9
Time Sampled: 15:15
Sampler: Energy Laboratories, Inc./SAG/KS

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 293
Water Level to Casing: 73.60 '
Casing Height: 3.04 '
Water Level: 70.56 '
I.D./Casing I.D.: 485'/4.33"
Casing Volume: 317 Gal
Date Sampled: 05-05-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
05-05-88	14:15	191478				
	14:21	191760	47.0	7.95	15.0	1820
	14:37	192330	35.6	8.05	15.0	1700
	14:45	192560	28.8	8.00	15.0	1705
	14:55	192930	37.0	8.00	15.5	1700

Total Time Pumped: 40 Min
Total Gal. Pumped: 1452 Gal
Casing Displacement: 2.9
Time Sampled: 14:55
Sampler: Energy Laboratories, Inc./SAG/KS

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 283
Water Level to Casing: 74.64 '
Casing Height: 3.04 '
Water Level: 71.60 '
T.D./Casing I.D.: 485'/4.33"
Casing Volume: 316 Gal
Date Sampled: 06-02-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
06-02-88	13:03	169813		7.70	12.9	1490
	13:20	170240	41.7	8.42	16.7	1500
	13:30	170680	44.0	8.47	15.5	1480

Total Time Pumped: 25 min
Total Gal. Pumped: 1095 Gal
Casing Displacement: 3.5
Time Sampled: 13:30
Sampler: Energy Laboratories, Inc./KS/SKD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 283
Water Level to Casing: 74.69 '
Casing Height: 3.04 '
Water Level: 71.65 '
T.D./Casing I.D.: 485'/4.33"
Casing Volume: 316.2 Gal
Date Sampled: 07-06-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

<u>Date</u>	<u>Time</u>	<u>Meter</u>	<u>Rate</u>	<u>pH</u>	<u>Temp</u>	<u>Uncorrected Cond</u>
07-06-88	09:47	174288				
	09:55	174710	52.7	8.48	14.1	1000
	10:04	175040	36.7	8.44	15.5	1050
	10:20	175545	21.0	8.45	14.6	1000
	10:28	175815	33.75	8.46	15.3	1080

Total Time Pumped: 41 Min
Total Gal. Pumped: 1527
Casing Displacement: 4.83
Time Sampled: 10:28
Sampler: Energy Laboratories, Inc./RAG/KRS

WATER ANALYSIS REPORT - CLEVELAND CLIFFS

Project: Collins Draw

SAMPLE I.D.: Well #285

Sample Round:	#1	#2	#3	#4	#5	#6	
Sample Date:	09-08-87	11-12-87	01-06-88	03-03-88	04-04-88	05-05-88	06-02-88
Report Date:	09-29-87	12-28-87	01-27-88	03-24-88	04-08-88	05-25-88	06-13-88
Sample Number:	#11	87-14709	88-0136	88-1929	89-3800	88-5921	88-6925
Lab:	WAMCO	ELI	ELI	ELI	ELI	ELI	ELI

MAJOR IONS mg/l:

	#1	#2	#3	#4	#5	#6	Det.Limit
Ca	36.0	84.2	95.2	95.5	93.5	85.0	0.05
Mg	5.0	8.9	9.4	10.4	10.7	9.9	0.01
Na	102	127	138	140	141	130	0.05
K	176	269	285	259	292	290	0.10
CO3	0	0	0	0	0	0	0.10
HCO3	451	597	617	661	602	571	0.10
SO4	444	648	684	739	703	655	0.50
Cl	96.0	32.4	32.0	33.7	38.0	37.6	0.10
NH4 (N)	105	109.0	99.0	112	93.0	93.0	0.05
TDS @ 180 C (Calculated)	1006	1468	1669	1760	1699	1621	1.0
pH (units)	7.25	7.71	7.59	7.73	7.62	7.54	1-14
H2S - g						17.6	

TRACE METALS mg/l:

	#1	#2	#3	#4	#5	#6	
As	0.500	0.234	0.206	0.054	0.148	0.060	0.001
Mo	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10
Se EPA Pres.	0.032	0.006	0.023	0.033	0.028	0.030	0.001
Se Filt. Only				0.079	0.086	0.098	0.001
V	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.10

RADIOMETRIC pCi/l:

	#1	#2	#3	#4	#5	#6	
U (ug/l)	21.201	12.616	7.571	13.609	9.736	8.267	0.0003
Ra226	109	1094	1112	1079	1081	865	0.20
Ra Prec. +/-	7.8	9.3	8.2	10.3	28.6	27.2	

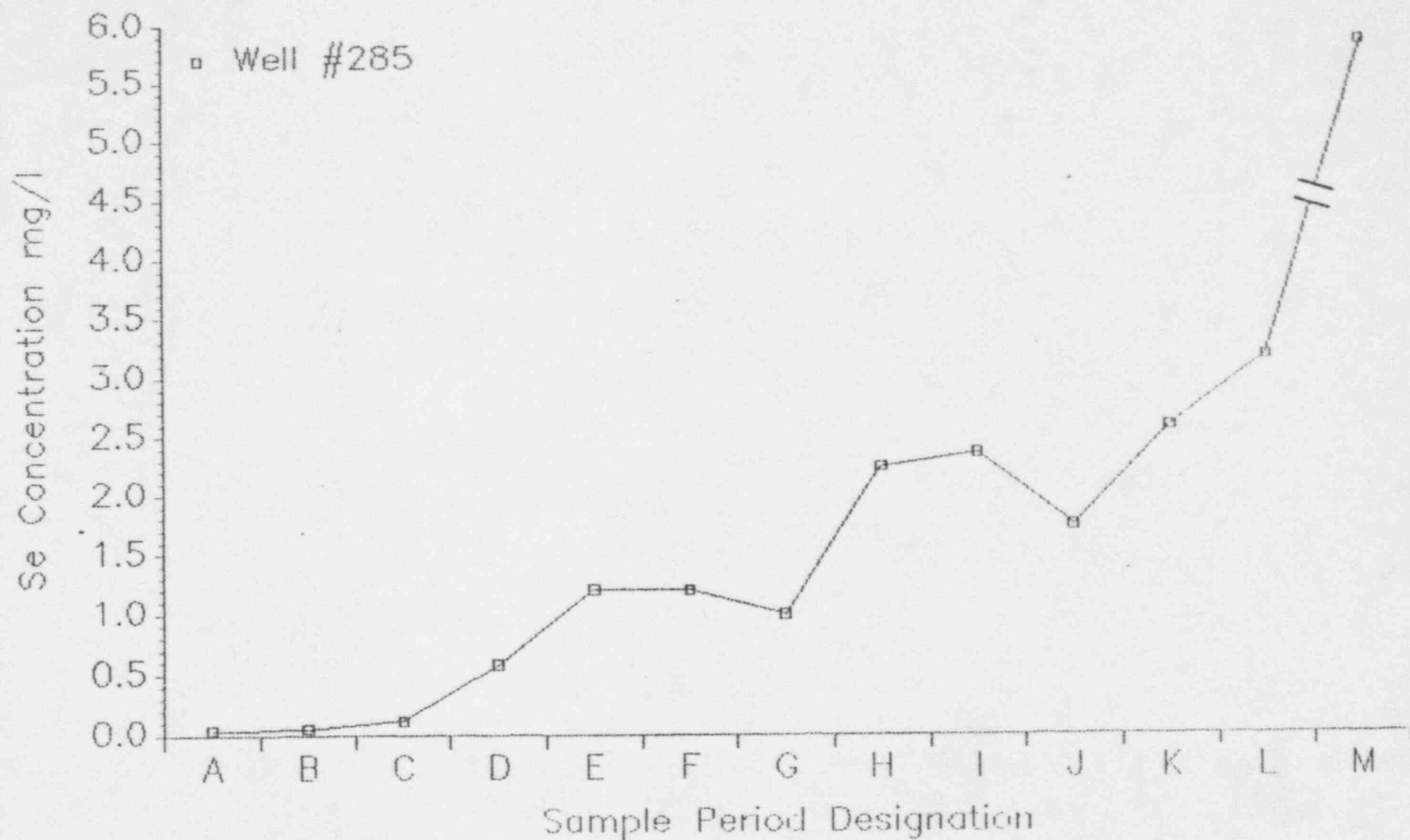
Q.A. DATA:

	#1	#2	#3	#4	#5	#6	
Anion meq:	19.35	24.20	26.11	27.21	25.59	24.07	
Cation meq:	18.66	25.17	25.92	26.71	25.82	24.81	
A/C Balance:	1.037	0.961	1.007	1.019	0.991	0.970	0.95-1.05
WYDEQ A/C Bal.%	-1.82	1.96	-0.37	-0.93	0.45	1.51	-5 - +5
Calc TDS mg/l:		1468	1689				
TDS A/C Bal:		0.939	0.925				0.90-1.10

Q.A. MANAGER:

ENERGY LABORATORIES, INC.

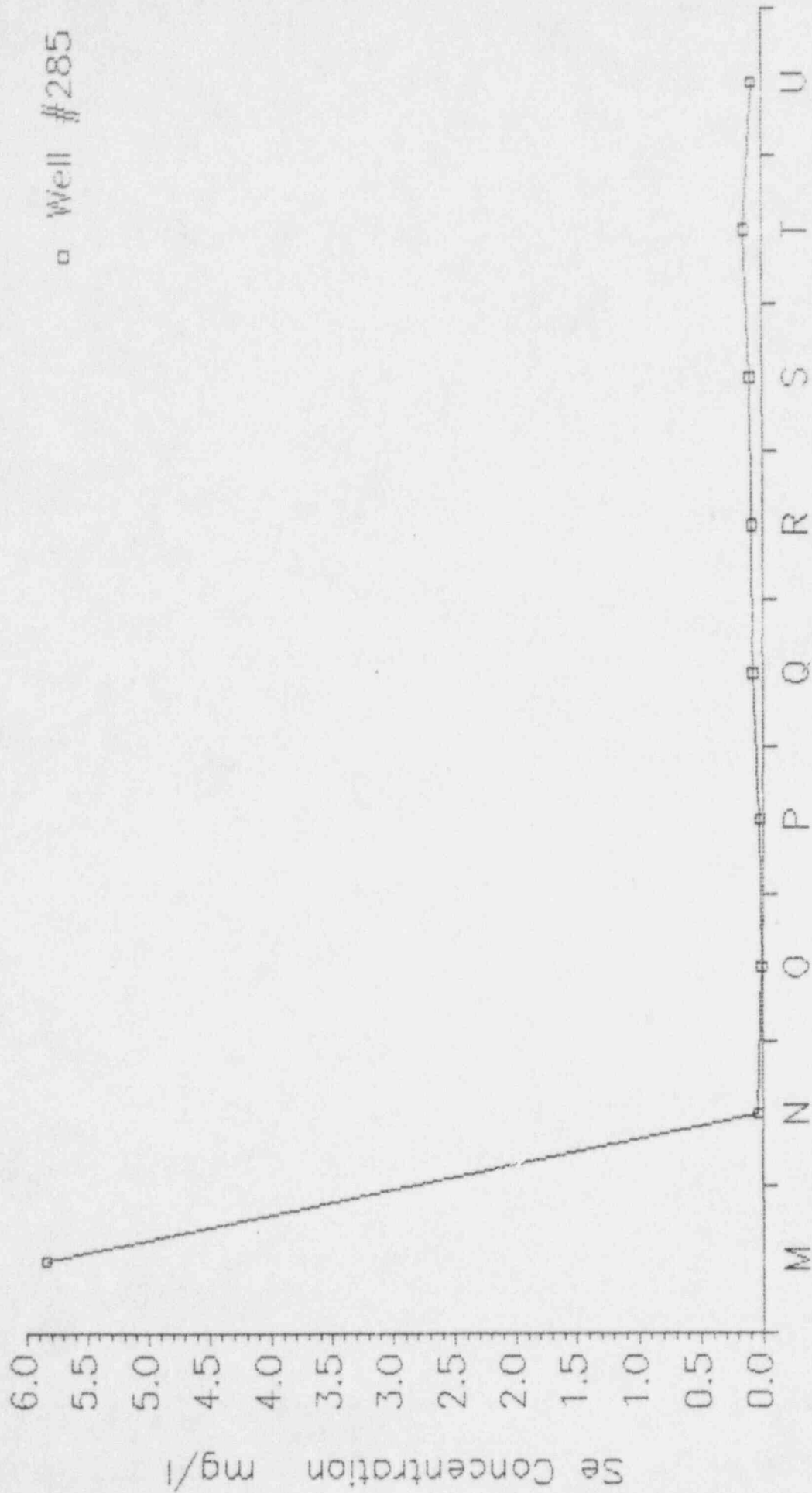
Cleveland Cliffs Iron Company
B-Field Restoration Stability Data
Pre H2S 1983



See attached data for further
information

Cleveland Cliffs Iron Company
B-Field Post H2S Stability Data
1987 through 1988

□ Well #285



Sample Period Designation

See attached data for further information

August 22, 1988

Cleveland Cliffs Iron Company
Post H₂S Injection - Stability Monitoring Program

B Wellfield Restoration and Post H₂S Stability Data
Graphics Support

Graphic Desig.	Date	Round #/I.D.	Wellfield Mean	Well #285
A	12/82	2 week	0.038	0.040
B	1/83	4 week	0.035	0.049
C	2/83	6 week	0.033	0.114
D	2/83	8 week	0.121	0.582
E	3/83	3 month	0.328	1.204
F	4/83	4 month	0.209	1.199
G	5/83	5 month	0.227	0.996
H	6/83	6 month	0.724	2.240
I	7/83	7 month	0.541	2.360
J	8/83	8 month	0.549	1.740
K	9/83	9 month	0.834	2.579
L	10/83	10 month	1.021	3.172
M	7/87	Pre H ₂ S	2.524	5.840
N	9/87	Round 1	0.458	0.032
O	11/87	Round 2	0.139	0.006
P	1/88	Round 3	0.108	0.023
Q	3/88	Round 4	0.156	0.079
R	4/88	Round 5	0.164	0.086
S	5/88	Round 6	0.195	0.098
T	6/88	Round 7	0.198	0.147
U	7/88	Round 8	0.178	0.082

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 285
Water Level to Casing: 73.96 '
Casing Height: 2.67 '
Water Level: 71.29 '
T.D./Casing I.D.: 485'/4.33"
Casing Volume: 314 Gal
Date Sampled: 11-12-87
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
11/11/87	15:15	132579				
	15:24	132710	14.6			
	15:27	132780	23.3	7.30	13.9	1299
	15:37	132944	16.4	7.30	14.1	1300
	15:50	133170	17.4	7.30	14.4	1300
	15:55	133269				
11/12/87	10:40 -	Stability				
	10:45	Sampled		7.35	13.2	1300

Total Time Pumped: 40 min
Total Gal. Pumped: 690 gal + ~73 gal @ sampling
Casing Displacement: 2.20
Time Sampled: 10:45
Sampler: Energy Laboratories, Inc./RAG

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 285
Water Level to Casing: 73.85 '
Casing Height: 2.67 '
Water Level: 71.18 '
T.D./Casing I.D.: 485'/4.33"
Casing Volume: 312 Gal
Date Sampled: 01-06-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
01-06-88	11:15	140075		7.18	10.2	1480
	11:25	140240		7.15	12.2	1400
	11:40	140470		6.65	12.1	1570
	11:55	140670		6.29	13.3	1590
	12:05	140766				

Total Time Pumped: 50 min
Total Gal. Pumped: 691 gal
Casing Displacement: 2.21
Time Sampled: 12:05
Sampler: Energy Laboratories, Inc./RAG/SMD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 285
Water Level to Casing: 73.87 '
Casing Height: 2.67 '
Water Level: 71.20 '
T.D./Casing I.D.: 485'/4.33"
Casing Volume: 317 Gal
Date Sampled: 03-03-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
03-03-88	10:35	181252				
	10:44	181409	16.3	7.12	13.0	1590
	10:59	181635	15.0	7.10	12.8	1650
	11:14	181863	15.2	7.14	13.0	1710
	11:34	182145	14.1	7.23	13.0	1800
		Sampled				

Total Time Pumped: 59 min
Total Gal. Pumped: 893 Gal
Casing Displacement: 2.8
Time Sampled: 11:34
Sampler: Energy Laboratories, Inc./SAS/SD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 203
Water Level to Casing: 73.75 '
Casing Height: 2.67 '
Water Level: 71.08 '
T.D./Casing I.D.: 485'/4.33"
Casing Volume: 312 Gal
Date Sampled: 04-04-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
04-04-88	14:08	186491				
	14:20	186685	16.2	7.2	13.0	1680
	14:33	186860	13.5	7.1	13.0	1690
	14:43	187000	14.0	7.1	12.9	1680
	14:49	187130	21.7	7.1	14.0	1690

Total Time Pumped: 41 min
Total Gal. Pumped: 639 Gal
Casing Displacement: 2.02
Time Sampled: 14:49
Sampler: Energy Laboratories, Inc./RAG/KS

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 285
Water Level to Casing: 71.26 '
Casing Height: 2.67 '
Water Level: 68.59 '
T.D./Casing I.D.: 485'/4.33"
Casing Volume: 316.5
Date Sampled: 05-05-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
05-05-88	14:14	162215				
	14:20	162380	27.5	7.10	14.0	1550
	14:38	162600	12.2	7.05	15.0	1550
	14:46	162690	11.3	7.05	15.0	1600
	15:03	162860	10.0	7.05	15.0	1550

Total Time Pumped: 49 Min
Total Gal. Pumped: 645 Gal
Casing Displacement: 2.63
Time Sampled: 12:00
Sampler: L&L Laboratories, Inc./RAG/KS

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 285
Water Level to Casing: 74.00 '
Casing Height: 2.67 '
Water Level: 71.33 '
T.D./Casing I.D.: 485'/4.33"
Casing Volume: 316.4 Gal
Date Sampled: 06-02-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
06-02-88	1:06	195954		7.44	12.9	1305
	1:37	197024		7.56	14.6	1270
	3:37	197232		7.32	13.5	1300

Total Time Pumped: 151 min
Total Gal. Pumped: 309 Gal
Casing Displacement: 1.0
Time Sampled: 3:37
Sampler: Energy Laboratories, Inc./KS/SWD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 285
Water Level to Casing: 73.17 '
Casing Height: 2.67 '
Water Level: 70.5 '
I.D./Casing I.D.: 485'/4.33"
Casing Volume: 317.1
Date Sampled: 07-06-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
07-06-88	7:58	173623				
	8:05	173688	9.3	7.39	12.9	75'
	08:25	173820	6.6	7.42	14.0	800
	08:49	173967	6.13	7.44	14.3	790
	09:06	174070	6.06	7.43	14.6	850
	09:25	174185	6.05	7.45	14.3	850
	09:40	174275	6.00	7.58	16.1	900

Total Time Pumped: 102 min.
Total Gal. Pumped: 652 gal.
Casing Displacement: 2.06
Time Sampled: 09:40
Sampler: Energy Laboratories, Inc./RAG/KRS

WATER ANALYSIS REPORT - CLEVELAND CLIFFS

Project: Collins Draw

SAMPLE I.D.: Well #230

Sample Date:	11-12-87	01-06-88	03-04-88	05-09-88	07-07-88	Det.Limit
Report Date:	12-28-87	01-27-88	03-24-88	05-31-88	08-30-88	% Range
Sample Number:	87-14710	88-0125	88-1938	88-5966	88-9242	

TRACE METALS mg/l:

Se	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
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Q.A. MANAGER:

ENERGY LABORATORIES, INC.

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 230 (SM)
Water Level to Casing: 76.56 '
Casing Height: 2.83 '
Water Level: 73.73 '
T.D./Casing I.D.: 270'/5"
Casing Volume: 200 Gal
Date Sampled: 11-12-87
Pump Depth: 200'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
11/10/87	12:30	129680				
	12:45	129724	2.93	8.80	12.0	480
	13:10	129775	2.04	8.92	14.0	500
	13:35	129795	0.80	8.80	14.2	500
	14:04	129820	0.86	8.60	14.3	520
	14:52	129856	0.75	8.59	14.5	520
	15:45	129900	0.83	8.40	14.5	580
	16:20	129927	0.77	8.30	14.0	590
	16:30	129937				
		Stability				
11/12/87	09:45	Sampled		7.90	14.9	580
	09:50					

Total Time Pumped: 240 min
Total Gal. Pumped: 257 gal + ~15 gal at sampling
Casing Displacement: 1.29
Time Sampled: 09:50
Sampler: Energy Laboratories, Inc./RAG

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 230 (SM)
Water Level to Casing: 76.29 '
Casing Height: 2.83 '
Water Level: 73.46 '
T.D./Casing I.D.: 270'/5"
Casing Volume: 200 Gal
Date Sampled: 01-05-68
Pump Depth: 200'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
01-05-68	13:40	169727				
	14:17	Meter not		7.80	11.5	600
	14:46	rotating due		7.55	11.5	675
	15:32	slow flow		7.45	11.0	695
	15:32	Sampled				

Total Time Pumped: 113 min
Total Gal. Pumped: 326 Gal
Casing Displacement: 1.63
Time Sampled: 15:33
Sampler: Energy Laboratories, Inc./SAG/RAG

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 230 (SM)
 Water Level to Casing: 76'
 Casing Height: 2.33'
 Water Level: 72.50'
 T.D./Casing I.D.: 2"0"/5"
 Casing Volume: 200
 Date Sampled: 5-5-88 thru 5-9-88
 Pump Depth: 200'
 Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
05-05-88	11:14	160299				
	11:24	160330	2.1	7.50	14.8	600
	11:40	160370	2.3	7.30	15.3	600
	12:07	160404	1.3	7.30	16.0	700
	12:17	162875				
05-06-88	12:31	162920	2.3	7.30	16.0	675
	12:53	162963		7.50	19.0	725
	12:05	163012	4.1	7.40	13.5	600
	13:15	163040	2.3	7.50	13.5	600
05-09-88	9:47	163046				
	10:00	163094	3.7	7.35	14.7	620
	10:25	163146	2.1	7.35	15.7	700
	10:45	163166	1.0	7.43	16.5	701
	10:52	163174	1.1			
	11:03	164965		7.30	16.0	695
	11:29	165045		7.29	16.5	695
	11:35	165051	1.0			

Total Time Pumped: 156 Min.
 Total Gal. Pumped: 441 Gal
 Casing Displacement: 2.1
 Time Sampled: 15:35
 Sampler: Energy Laboratories, Inc./SAG/SD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 230 (SN)
 Water Level to Casing: 75.00 '
 Casing Height: 2.83 '
 Meter Level: 72.2 '
 T.D./Casing I.D.: 270' / 5"
 Casing Volume: 201.8 Gal
 Date Sampled: 07-07-88
 Pump Depth: 200'
 Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
07-07-88	12:41	173380				
	12:43	173395	7.5	7.49	15.3	320
	13:01	173450	3.1	7.43	17.1	342
	13:28	173480	1.1	7.49	20.5	365
	13:45	173497	1.0			
	15:45	173497				
	16:12	173571	1.1	7.34	19.6	395
	16:43	173600	0.94	7.47	20.9	399
	17:05	173622	1.0	7.46	21.0	400
	17:10	173627	1.0			
07-06-88	16:21	180257				
	16:54	180327		8.06	16.4	680
	17:05	180335				
07-07-88	13:35	180330				
	14:10	180430		7.73	16.9	332
	14:30	180454		7.96	19.2	630

Total Time Pumped: 220 Min
 Total Gal. Pumped: 441 Gal
 Casing Displacement: 2.19
 Time Sampled: 14:30
 Sampler: Energy Laboratories, Inc./RAG/KRS

WATER ANALYSIS REPORT - CLEVELAND CLIFFS

Project: Collins Draw

SAMPLE I.D.: Well #238

Sample Date:	11-12-87	01-06-88	03-02-88	05-05-88	07-05-88	Det. Limit
Report Date:	12-28-87	01-27-88	03-24-88	05-31-88	08-30-88	± Range
Sample Number:	88-14712	88-0124	88-1856	88-5915	88-8723	

TRACE METALS mg/l:

Se	<0.001	<0.001	0.008	0.006	0.012	0.001
Se Filt. Only					0.009	

Q.A. MANAGER:
ENERGY LABORATORIES, INC.

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 238 (M)
Water Level Casing: 90.58 '
Casing Hgt: 3.42 '
Water Level: 87.16 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 406 Gal
Date Sampled: 11-12-87
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
11/10/87	16:37	129937				
	16:40	130010	24.3	7.90	11.5	380
	16:53	130372	27.9	7.90	13.0	390
	17:07	130750	27.0	7.80	13.0	390
		Stability				
11/12/87	09:52 -	Sampled		7.64	14.0	390
	09:57					

Total Time Pumped: 30 min
Total Gal. Pumped: 813 gal + ~122 gal at sampling
Casing Displacement: 2.00
Time Sampled: 09:57
Sampler: Energy Laboratories, Inc./RAG

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 238 (N)
Water Level to Casing: 89.75 '
Casing Height: 3.42 '
Water Level: 86.33 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 407 Gal
Date Sampled: 01-05-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
01-05-88	17:10	138100				
	17:17	138340		7.60	11.0	355
	17:31	138655		7.60	11.0	350
	17:49	139112		7.60	11.0	355

Total Time Pumped: 39 min
Total Gal. Pumped: 1012 Gal
Casing Displacement: 2.49
Time Sampled: 17:49
Sampler: Energy Laboratories, Inc./SAG/RAG

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 238 (M)
Water Level to Casing: 89.63 '
Casing Height: 3.42 '
Water Level: 86.21 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 407 Gal
Date Sampled: 03-02-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
03-02-88	13:57	177770		7.42	10.2	305
	14:11	178130	25.7	7.25	11.5	329
	14:37	178790	25.4	7.29	12.0	330

Total Time Pumped: 40 min
Total Gal. Pumped: 1020 Gal
Casing Displacement: 2.5
Time Sampled: 14:37
Sampler: Energy Laboratories, Inc./SAG/SD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 238 (H)
Water Level to Casing: 89.52 '
Casing Height: 3.42 '
Water Level: 86.20 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 406 gal
Date Sampled: 05-05-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
05-05-88	11:21	188850				
	11:25	188960	25.0	7.80	14.0	350
	11:42	189380	24.7	7.60	15.0	330
	11:58	189830	28.1	7.50	15.0	350

Total Time Pumped: 37 Min
Total Gal. Pumped: 970 Gal
Casing Displacement: 2.5
Time Sampled: 11:58
Sampler: Energy Laboratories, Inc./SAG/SD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 238 (K)
Water Level to Casing: 89.79 '
Casing Height: 3.42 '
Water Level: 86.37 '
I.D./Casing I.D.: 485'/5"
Casing Volume: 406.6 Gal
Date Sampled: 07-05-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
07-05-88	12:40	197232				
	12:42	197300	34	7.79	14.8	225
	13:02	197795	24.8	7.91	15.6	235
	13:29	198480	25.4	7.88	15.8	242
	13:30	198510	30.0	7.71	15.4	242
		Sampled				

Total Time Pumped: 50 Min
Total Gal. Pumped: 1278
Casing Displacement: 3.14
Time Sampled: 13:30
Sampler: Energy Laboratories, Inc./RAG/KRS

WATER ANALYSIS REPORT - CLEVELAND CLIFFS

Project: Collins Draw

SAMPLE I.D.: Well #239

Sample Date:	11-12-87	01-06-88	03-04-88	05-09-88	07-05-88	Det.Limit
Report Date:	12-28-87	01-27-88	03-24-88	05-31-88	08-30-88	& Range
Sample Number:	87-14711	88-0138	88-1855	88-5967	88-8724	

TRACE METALS mg/l:

Se	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
Se Filt. Only					<0.001	

Q.A. MANAGER:
ENERGY LABORATORIES, INC.

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 239 (M)
Water Level to Casing: 49.83 '
Casing Height: 2.71 '
Water Level: 47.12 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 447 Gal
Date Sampled: 11-12-87
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
11/11/87	08:35	130776				
	08:39	130870	10.9	8.00	12.9	310
	09:15	131220	11.1	7.40	13.0	310
	09:45	131524	10.1	7.35	13.2	330
	10:01	131685	10.1	7.45	13.5	335
		Stability				
11/12/87	09:58 -	Sampled		7.50	13.5	370
	10:03					

Total Time Pumped: 86 min
Total Gal. Pumped: 909 gal + ~55 gal @ sampling
Casing Displacement: 2.03
Time Sampled: 10:03
Sampler: Energy Laboratories, Inc./RAG

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 239 (M)
Water Level to Casing: 30.83 '
Casing Height: 2.71 '
Water Level: 28.12 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 460 Gal
Date Sampled: 01-06-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH*	Temp	Uncorrected Cond
01-06-88	15:10	142368		-	10.0	302
	15:20	142580		-	11.7	296
	15:45	142780		-	11.5	327
	16:10	143000		-	11.8	340
	16:30	143288		-		

*Meter failure - stability determined by specific conductance.

Total Time Pumped: 80 min
Total Gal. Pumped: 920 gal
Casing Displacement: 2.0
Time Sampled: 16:30
Sampler: Energy Laboratories, Inc./RAG

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 239 (N)
Water Level to Casing: 50.00 '
Casing Height: 2.71 '
Water Level: 47.29 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 446 Gal
Date Sampled: 03-02-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
03-02-88	16:06	179444				
	16:10	179483	9.8	7.42	10.0	300
	16:43	179834	10.6	7.10	10.2	305
	17:04	180038	9.7	7.20	10.5	312
	17:27	180250	9.2	7.31	10.6	307
	17:36	180340	10.0	7.30	10.9	311

Total Time Pumped: 90 min
Total Gal. Pumped: 896 Gal
Casing Displacement: 2.0
Time Sampled: 17:36
Sampler: Energy Laboratories, Inc./SAG/SD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 239 (M)
Water Level to Casing: 50.20 '
Casing Height: 2.71 '
Water Level: 47.49 '
I.D./Casing I.D.: 485'/5"
Casing Volume: 446.2
Date Sampled: 05-09-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
05-09-88	11:02	163172		7.75	13.9	327
	11:13	163315	13.0	7.24	14.9	321
	11:35	163543	10.4	7.42	14.6	338
	12:10	163877	9.5	7.37	14.8	345
	12:29	164070	10.2	7.48	14.7	344

Total Time Pumped: 87 min
Total Gal. Pumped: 898 gal
Casing Displacement: 2.0
Time Sampled: 12:29
Sampler: Energy Laboratories, Inc./SAG/SD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 239 (H)
Water Level to Casing: 50.21 '
Casing Height: 2.71 '
Water Level: 47.50 '
T.D./Casing I.D.: 485' / 3"
Casing Volume: 446.2 Gal
Date Sampled: 07-05-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

<u>Date</u>	<u>Time</u>	<u>Meter</u>	<u>Rate</u>	<u>pH</u>	<u>Temp</u>	<u>Uncorrected Cond</u>
07-05-88	14:05	198876				
	14:11	198930	9.0	7.78	15.8	240
	14:44	199285	10.8	7.55	15.7	248
	15:15	199593	9.9	7.65	16.1	250
	15:37	199790	8.9	7.69	15.1	245
	15:38	199794				

Total Time Pumped: 93 Min
Total Gal. Pumped: 918 Gal
Casing Displacement: 2.06
Time Sampled: 15:38
Sampler: Energy Laboratories, Inc./RAG/KRS

WATER ANALYSIS REPORT - CLEVELAND CLIFFS

Project: Collins Draw

SAMPLE I.D.: Well #240

Sample Date:	11-12-87	01-06-88	03-02-88	05-05-88	07-05-88	Det. Limit
Report Date:	12-28-87	01-27-88	03-24-88	05-31-88	08-30-88	% Range
Sample Number:	88-14713	88-0126	88-1357	88-5916	88-8725	

TRACE METALS mg/l:

Se	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
Se Filt. Only					<0.001	

Q.A. MANAGER:
ENERGY LABORATORIES, INC.

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 240 (M)
Water Level to Casing: 79.85 '
Casing Height: 3.50 '
Water Level: 76.35 '
Y.D./Casing I.D.: 485'/5"
Casing Volume: 417 Gal
Date Sampled: 11-12-87
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
11/10/87	10:52	128820				
	11:05	128960	10.8	7.60	13.0	330
	11:23	129110	8.3	7.81	13.1	350
	11:45	129300	8.6	7.88	13.5	350
	11:55	129390	9.0	7.75	13.5	340
	11:13	129550	8.9	7.90	13.1	350
	12:28	129680	8.7	7.79	13.5	360
		Stability				
11/12/87	09:37 -	Sampled		7.65	13.4	360
	09:42					

Total Time Pumped: 96 min
Total Gal. Pumped: 860 gal + ~54 gal at sampling
Casing Displacement: 2.06
Time Sampled: 09:42
Sampler: Energy Laboratories, Inc./RAG

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 240 (N)
Water Level to Casing: 79.83 '
Casing Height: 3.50 '
Water Level: 76.33 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 417 Gal
Date Sampled: 01-05-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
01-05-88	11:00	135586				
	11:27	135838		7.60	10.5	160
	11:55	136075		7.65	12.0	340
	12:16	136224		7.62	12.0	353
	12:10	136430		7.58	12.1	360
		Sampled				
	12:47	136495				

Total Time Pumped: 107 min
Total Gal. Pumped: 908.5 Gal
Casing Displacement: 2.18
Time Sampled: 12:47
Sampler: Energy Laboratories/SAG/RAG

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 240 (M)
Water Level to Casing: 79.80 '
Casing Height: 3.50 '
Water Level: 76.30 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 416.8 Gal
Date Sampled: 03-02-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp.	Uncorrected Cond
03-02-88	09:40	143293				
	09:54	143415	8.7	7.65	11.7	274
	10:19	143595	7.2	7.43	12.3	282
	10:38	143764	8.9	7.21	12.5	282
	11:00	143961	8.9	7.29	12.8	283
	11:13	144060	7.6	7.21	12.7	288
	11:22	144135	8.3	7.31	12.9	290

Total Time Pumped: 102 min
Total Gal. Pumped: 841.8 Gal
Casing Displacement: 2.0
Time Sampled: 11:22
Sampler: Energy Laboratories, Inc./SAG/SD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 240 (M)
Water Level to Casing: 30.00 '
Casing Height: 3.50 '
Water Level: 76.50 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 416.6
Date Sampled: 05-05-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
05-05-88	08:16	187154				
	08:36	187337	9.1	7.50	15.0	200
	08:48	187440	3.6	7.50	14.0	300
	09:01	187530	6.7	7.50	14.0	280
	09:13	187600	5.8	7.50	14.0	290
	09:21	187710	13.8	7.50	14.0	280
	09:39	187850	7.8	7.50	13.8	290
	09:56	187990	8.2	7.50	15.0	300

Total Time Pumped: 100 Min
Total Gal. Pumped: 835.5 Gal
Casing Displacement: 2.0
Time Sampled: 09:56
Sampler: Energy Laboratories, Inc./SAG/SD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 240 (H)
Water Level to Casing: 78.83 '
Casing Height: 3.50 '
Water Level: 75.33 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 417.8 Gal
Date Sampled: 07-05-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
07-05-88	10:48	172509				
	10:50	172510		7.77	15.8	210
	11:24	172610	8.8	8.08	14.8	210
	11:35	172913	9.4	8.12	14.3	210
	11:55	173090	8.9	7.77	14.6	210
	12:18	173292	8.8	7.76	15.1	219
	12:29	173380	8.0	7.86	14.3	215
		Sampled				

Total Time Pumped: 91 Min
Total Gal. Pumped: 971
Casing Displacement: 2.08
Time Sampled: 12:29
Sampler: Energy Laboratories, Inc./RA/KRS

WATER ANALYSIS REPORT - CLEVELAND CLIFFS

Project:

Collins Draw

SAMPLE I.D.: Well #241

Sample Date:	11-12-87	01-06-88	03-04-88	05-09-88	06-01-88	07-06-88	Det.Limit
Report Date:	12-28-87	01-27-88	03-24-88	05-31-88	06-13-88	07-19-88	± Range
Sample Number:	88-14714	88-0139	88-1937	88-5965	88-6901	88-8719	

TRACE METALS mg/l:

Se	<0.001	0.044	0.050	0.143	0.157	0.092	0.001
Se Filt. Only					0.163	0.121	

Q.A. MANAGER:

ENERGY LABORATORIES, INC.

WATER ANALYSIS REPORT - CLEVELAND CLIFFS

Project: Collins Draw

SAMPLE I.D.: WELL #241 M

Sample Date:	03-04-88	05-09-88	06-01-88	07-06-88	Det. Limit
Report Date:	04-30-88	05-31-88	06-13-88	07-19-88	& Range
Lab Number:	88-1937	88-5965	88-6901	88-8719	

MAJOR IONS mg/l:

Ca	30.1	30.9	30.5	0.05
Mg	2.9	3.3	3.4	0.01
Na	107	101	102	0.05
K	3.8	4.2	4.7	0.10
CO3	0	0	0	0.10
HCO3	126	128	125	0.10
SO4	178	184	174	0.50
Cl	32.2	23.9	17.2	0.10
NH4 (N)	0.22	0.22	0.48	0.05
NO2 (N)	<0.01	0.01		0.01
NO3 (N)	0.30	<0.01		0.01
F	0.20	0.20		0.10
SiO2	10.9	10.5		1.00
TDS @ 180 C	402	396	402	1.0
Cond. (umho/cm)	675	648		1.0
Alk-CaCO3	103	105		0.1
pH (units)	7.81	8.17	8.01	1-14

TRACE METALS mg/l:

Al	<0.10	<0.10		0.10
As	<0.001	0.003	0.002	0.001
Ba	<0.10	<0.10		0.10
B	<0.10	<0.10		0.10
Cd	<0.01	<0.01		0.01
Cr	<0.05	<0.05		0.05
Cu	<0.01	<0.01		0.01
Fe	<0.05	<0.05		0.05
Pb	<0.05	<0.05		0.05
Mn	0.02	0.02		0.01
Hg	<0.001	<0.001		0.001
Mo	<0.10	<0.10	<0.10	0.10
Ni	<0.05	<0.05		0.05
Se EPA Pres.	0.050	0.143	0.157	0.001
Se Filt. only			0.165	0.10
V	<0.10	<0.10	<0.10	0.01
Zn	<0.01	<0.01		

RADIOMETRIC pCi/l:

U (mg/l)	0.6404	0.0475	0.0630	0.0003
Ra226	2.1	2.5	3.2	0.20
Ra Prec +/-	0.5	1.6	2.0	

Q.A. DATA:

Anion Meg:	6.71	6.62	6.16	
Cation meg:	6.49	6.32	6.40	
A/C Balancer:	1.033	1.047	0.962	0.95-1.05
WYDEQ A/C Bal. %		-2.32	1.92	-5 - +5
Calc TDS mg/l:	429	422	395	
TDS A/C Bal:	0.936	0.938	1.018	0.90-1.10

Q.A. MANAGER: *RAG/KK*
Energy Laboratories, Inc.

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 241 (M)
Water Level to Casing: 57.67 '
Casing Height: 2.00 '
Water Level: 55.67 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 438 Gal
Date Sampled: 11-12-87
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
11/11/87	10:06	131700				
	10:15	131765	7.2	7.55	13.2	395
	10:38	131900	5.9	7.45	13.9	400
	11:12	132106	6.1	7.82	13.9	400
	11:44	132290	5.8	7.80	13.9	400
	12:23	132527	6.1	7.80	13.9	400
	12:35	132579				
		Stability				
11/12/87	10:04 -	Sampled		7.42	13.0	400
	10:09					

Total Time Pumped: 149 min
Total Gal. Pumped: 879 gal + ~36 gal at sampling
Casing Displacement: 2.01
Time Sampled: 10:09
Sampler: Energy Laboratories, Inc./RAG

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 241 (M)
Water Level to Casing: 57.58 '
Casing Height: 2.00 '
Water Level: 55.58 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 438 Gal
Date Sampled: 01-06-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
01-06-88	13:05	141784				
	13:35	141965		5.89	11.5	367
	14:00	142040		6.03	13.2	376
	14:30	142210		6.05	12.9	330
	14:50	142330		6.35	12.9	374
	15:00	142370			13.1	368

Total Time Pumped: 155 min
Total Gal. Pumped: 586 gal
Casing Displacement: 1.34
Time Sampled: 15:00
Sampler: Energy Laboratories, Inc./RAG/SAG

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 241 (M)
Water Level to Casing: 57.42 '
Casing Height: 2.00 '
Water Level: 55.42 '
I.D./Casing I.D.: 48 5/8" / 5"
Casing Volume: 438 Gal
Date Sampled: 03-03-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
03-03-88	14:20	149705		7.41	10.5	380
	14:44	149843	5.8	7.31	12.1	358
	15:26	150077	5.6	7.35	13.0	363
	15:57	150251	5.6	7.35	13.0	399
	16:05	150295	5.5			
03-04-88	13:15	182155				
	13:37	182296		7.52	13.2	399
	14:05	182456		7.35	13.2	399
	14:12	182497		7.42	14.1	400
		Sampled				

Total Time Pumped: 162 min
Total Gal. Pumped: 932 Gal
Casing Displacement: 2.1
Time Sampled: 14:12
Sampler: Energy Laboratories Inc./SAG/SD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 241 (M)
Water Level to Casing: 53.70 '
Casing Height: 2.00 '
Water Level: 53.70 '
T.O. Casing I.D.: 485'/5"
Casing Volume: 437.3
Date Sampled: 05-09-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
05-09-88	12:35	154082		7.29	14.2	373
	13:01	164260	6.8	7.39	15.2	372
	13:25	164416	6.5	7.05	15.7	381
	13:52	164583	6.2	7.16	16.0	390
	14:20	164760	6.3	7.18	15.9	394
	14:35	164853	6.2	7.32	16.3	397
	14:55	164960	5.4	7.49	16.9	406

Total Time Pumped: 140 Min
Total Gal. Pumped: 878 Gal
Casing Displacement: 2.1
Time Sampled: 14:55
Sampler: Energy Laboratories Inc./SAG/SD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 241 (M)
Water Level to Casing: 57.79 '
Casing Height: 2.00 '
Water Level: 55.79 '
T.D./Casing I.D.: 485' / 5"
Casing Volume: 436 Gal
Date Sampled: 06-01-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
06-01-88	1:00	165051				
	1:22	165192	6.4	7.60	15.9	210
	1:47	165348	6.3	7.58	14.7	238
	2:04	165451	6.1	7.77	14.8	255
	2:26	165587	6.2	7.77	14.7	278
	2:43	165690	6.1	7.83	15.0	286
	3:02	165808	6.2	7.78	14.4	285
	3:24	165940	6.0	8.02	15.0	290

Total Time Pumped: 144 min
Total Gal. Pumped: 889 Gal
Casing Displacement: 2.0
Time Sampled: 3:24
Sampler: Energy Laboratories Inc./KS/SMD

CLEVELAND CLIFFS - DOWNHOLE SAMPLING REPORT

Project: Collins Draw

Well No: 241 (M)
Water Level to Casing: 57.53 '
Casing Height: 2.00 '
Water Level: 55.53 '
T.D./Casing I.D.: 485'/5"
Casing Volume: 437.9
Date Sampled: 07-06-88
Pump Depth: 400'
Pump Type: Downhole Submersible Pump

Date	Time	Meter	Rate	pH	Temp	Uncorrected Cond
07-06-88	7:58	199798				
	8:03	199835	7.4	7.74	13.0	245
	08:23	199964	6.45	8.02	14.0	251
	08:47	200111	6.125	7.97	14.3	258
	09:04	200199	3.18	8.03	14.2	253
	09:23	200307	5.68	8.02	14.2	267
	09:56	200494	6.92	8.02	14.1	270
	10:18	200626	6.05	8.02	14.3	282
	10:40	200735	4.95			

Total Time Pumped: 162 Min
Total Gal. Pumped: 937 Gal
Casing Displacement: 1.93
Time Sampled: 10:40
Sampler: Energy Laboratories Inc./KRS/RAG