

Section 4

Graphical

~~Compiled~~ Analysis of Plant Operating Data

Examination of 1988 routine plant operating data proceeded on the following basis:

- Dependent variable - % gold extraction to solution
- Independent variables
 - Head grade, oz/ton Au
 - Feed slurry flowrate, USGPM. Calculated from daily tonnage, % solids, and plant availability.
 - Feed slurry density, % solids.
 - Feed slurry pH
 - Tailings residual NaCN, lb/ton solution.

The data are presented in three formats to depict the nature of the variations in each variable and to allow examination of interrelationships. Due to time limitations, the emphasis is on presentation of results and only first pass indication of cause/effects.

A. Trends or Histograms of Raw Data

- o The main variable, % gold extraction, was plotted in Graph 1 on a moving 3 day average to convey an overview of the season's performance.
- o Graphs 2 to 6 depict the raw daily gold extraction data versus each of the plant variables - one at a time.

B. Sorting of Data by Increasing Extraction (Recovery)

- o Daily data rows have been sorted by increasing extraction and plotted as a progression. The associated independent variable is then plotted in time correspondence and a linear regression line determined.
- o Graph 7 - shows that decreasing tonnage (tons of feed solids/24 hours) is associated with increasing gold extraction to solution.
- o Graph 8 - shows that changes in feed % solids are not associated with changes in gold extraction. This is a strong indication since the linear regression line is horizontal.

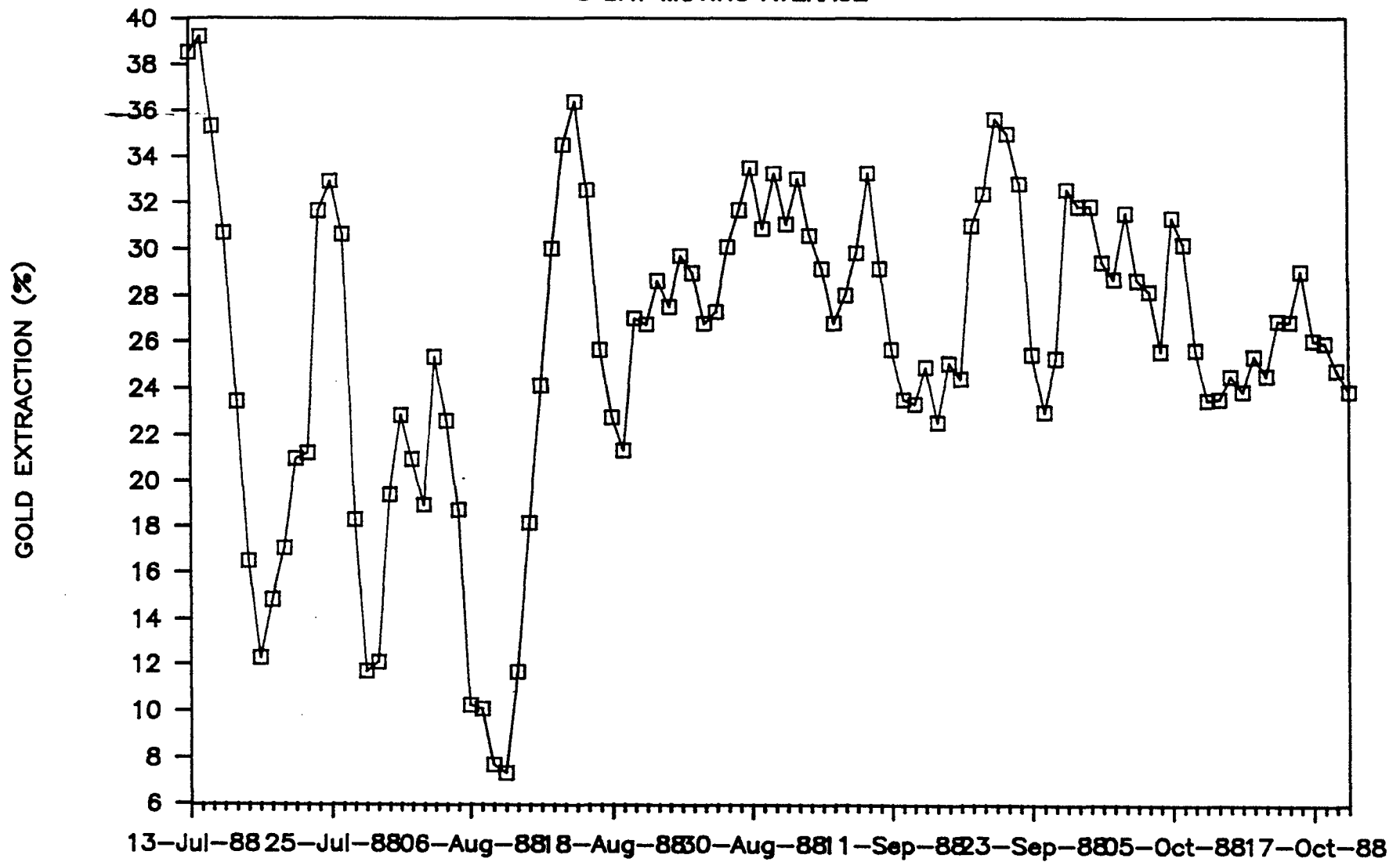
C. Linear Regression of Gold Extraction Versus each Independent Variable

- o Tailings cyanide concentration was removed from this analysis as there was insufficient recorded measurements at the start of the season.
- o Graphs 9-12 show the relationship between gold extraction and head grade, flowrate, density and pH. All linear regressions are statistically weak. The strongest correlation of the four was with head grade - and this is not a controllable variable.

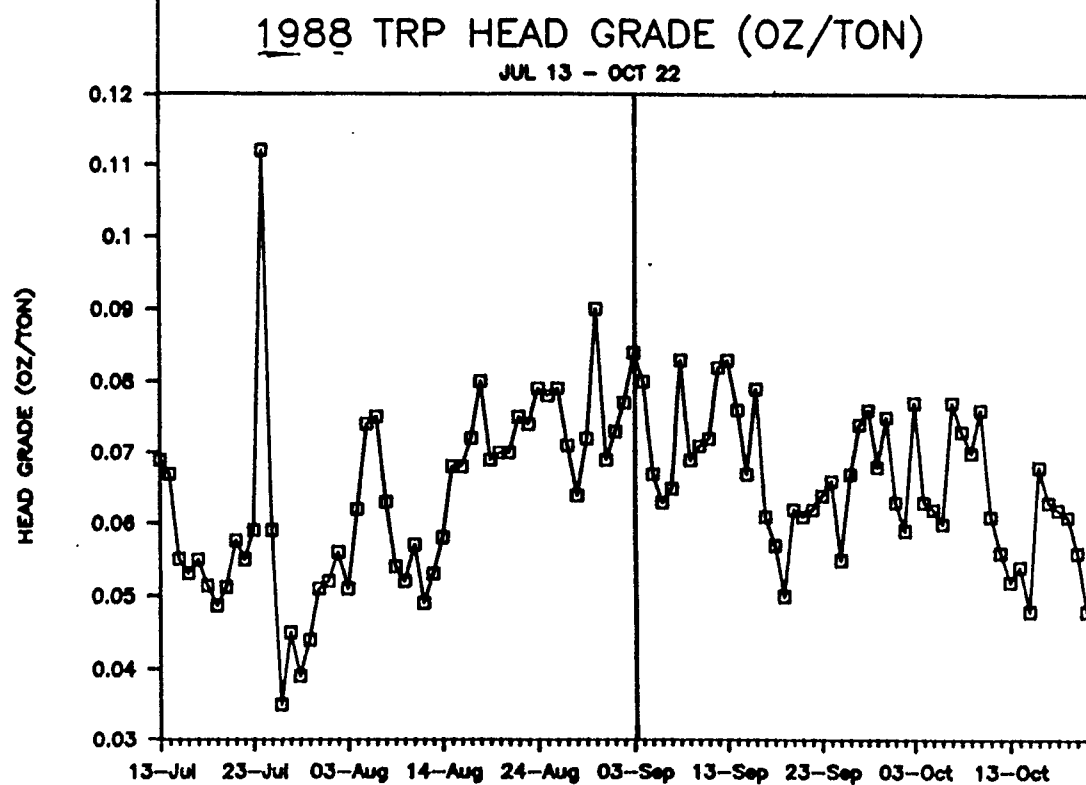
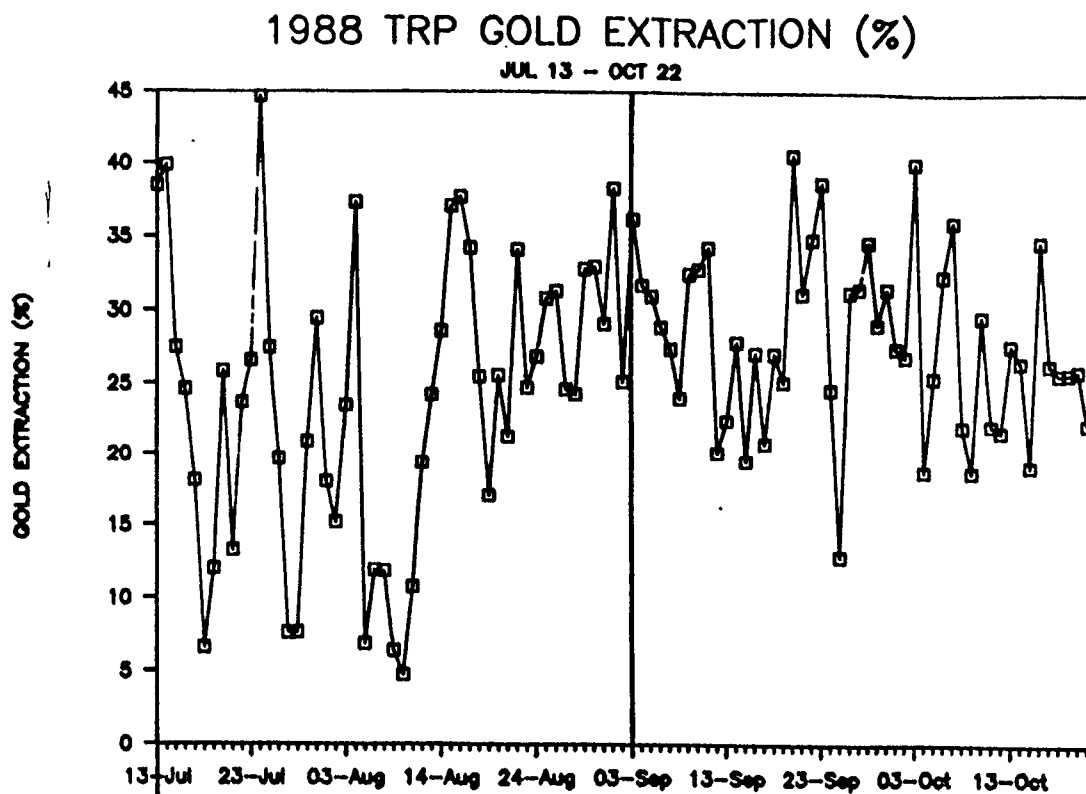
D.R. Bartlett
November 7, 1988

TRP GOLD EXTRACTION

3 DAY MOVING AVERAGE

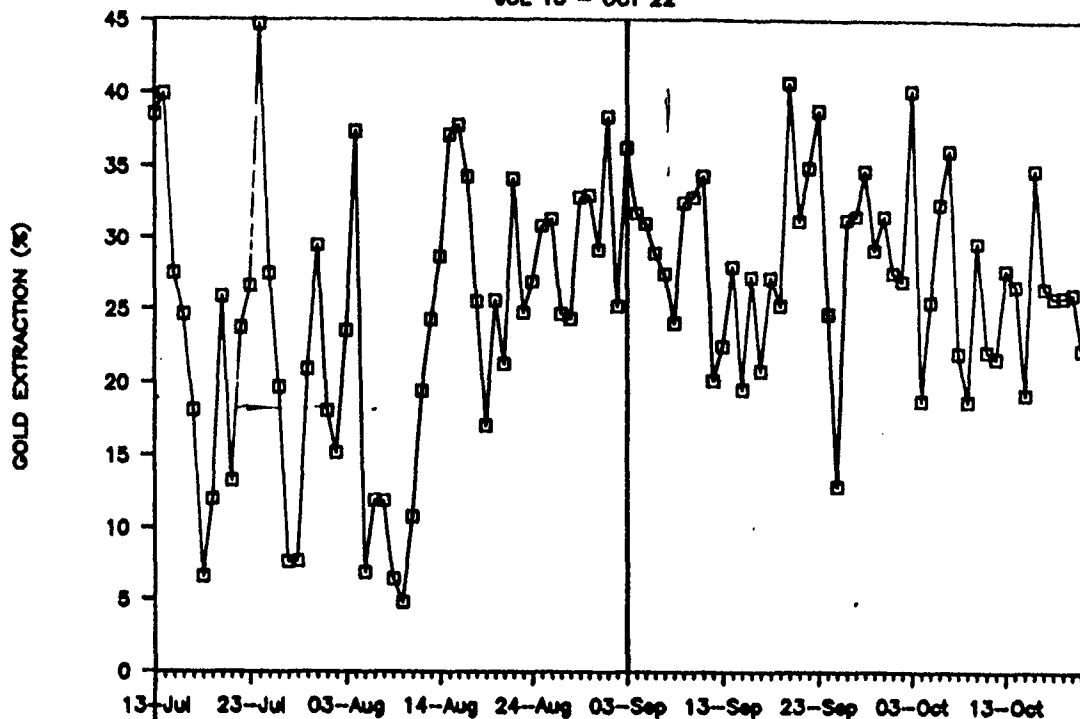


Graph 1



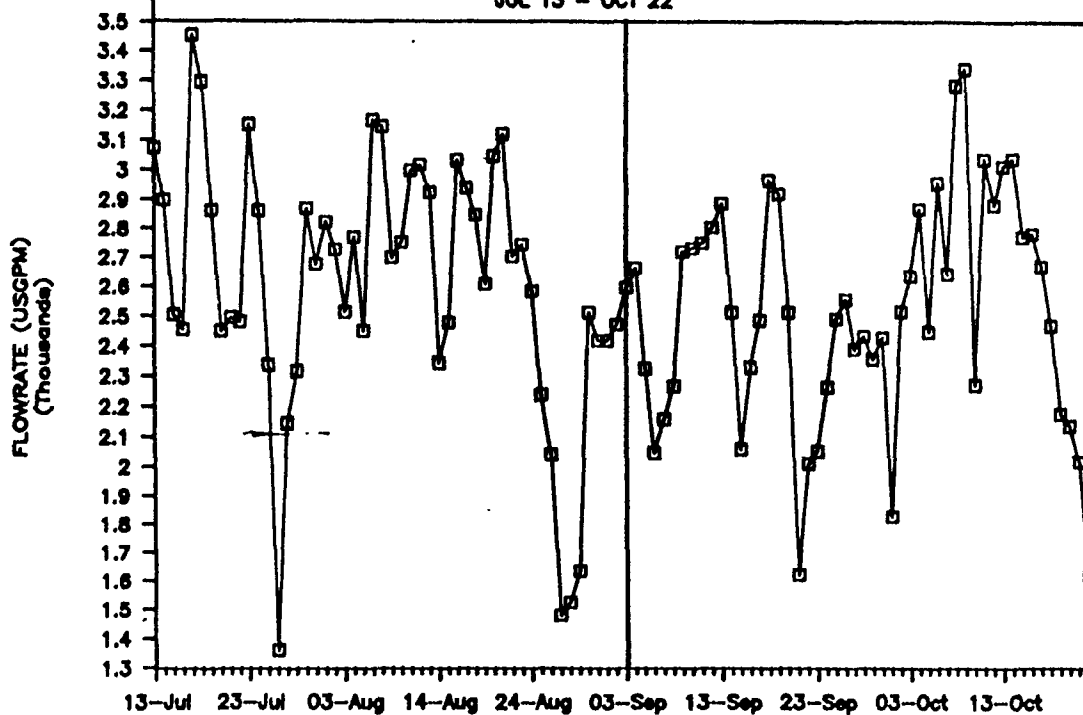
1988 TRP GOLD EXTRACTION (%)

JUL 13 - OCT 22



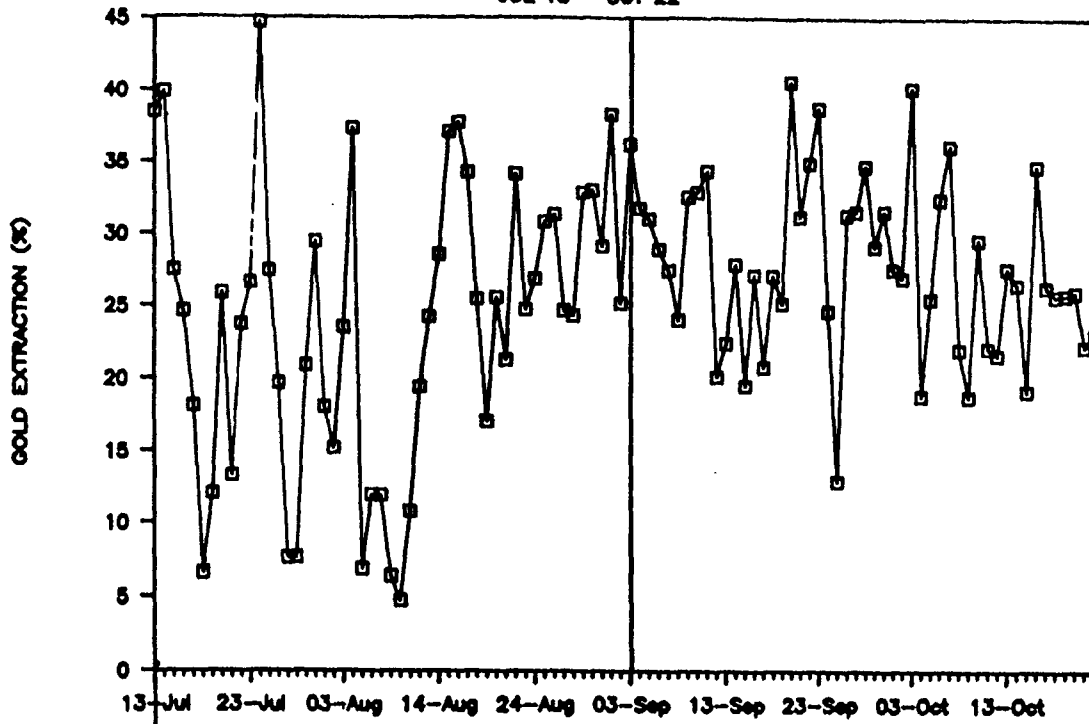
1988 TRP FLOWRATE (USGPM)

JUL 13 - OCT 22



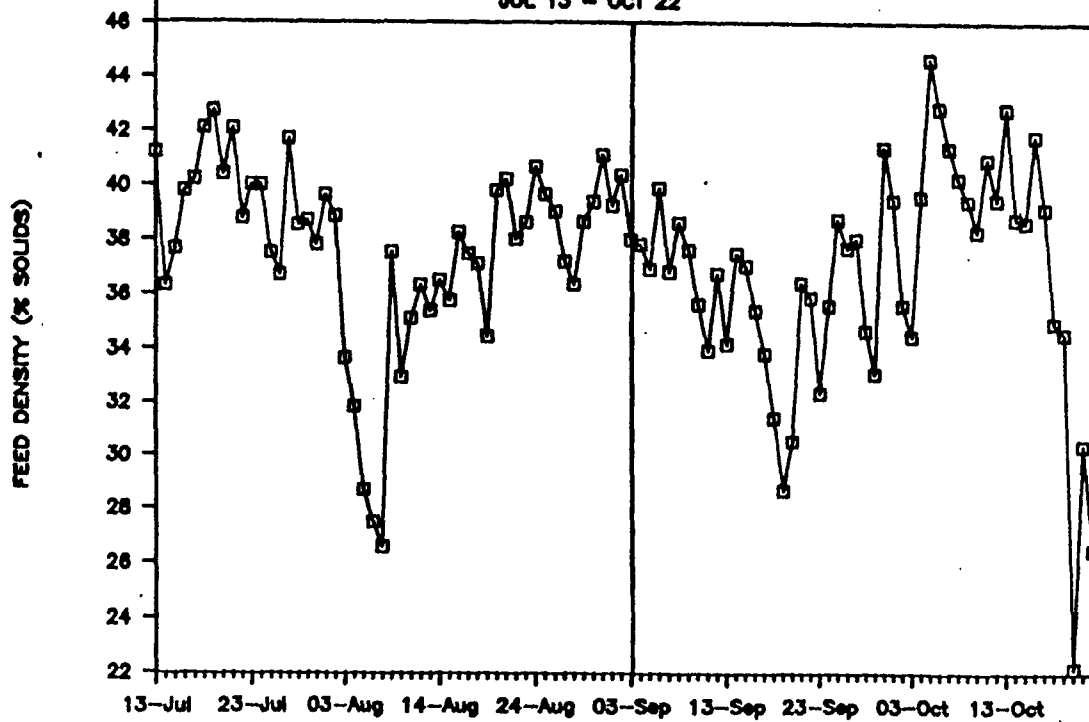
1988 TRP GOLD EXTRACTION (%)

JUL 13 - OCT 22



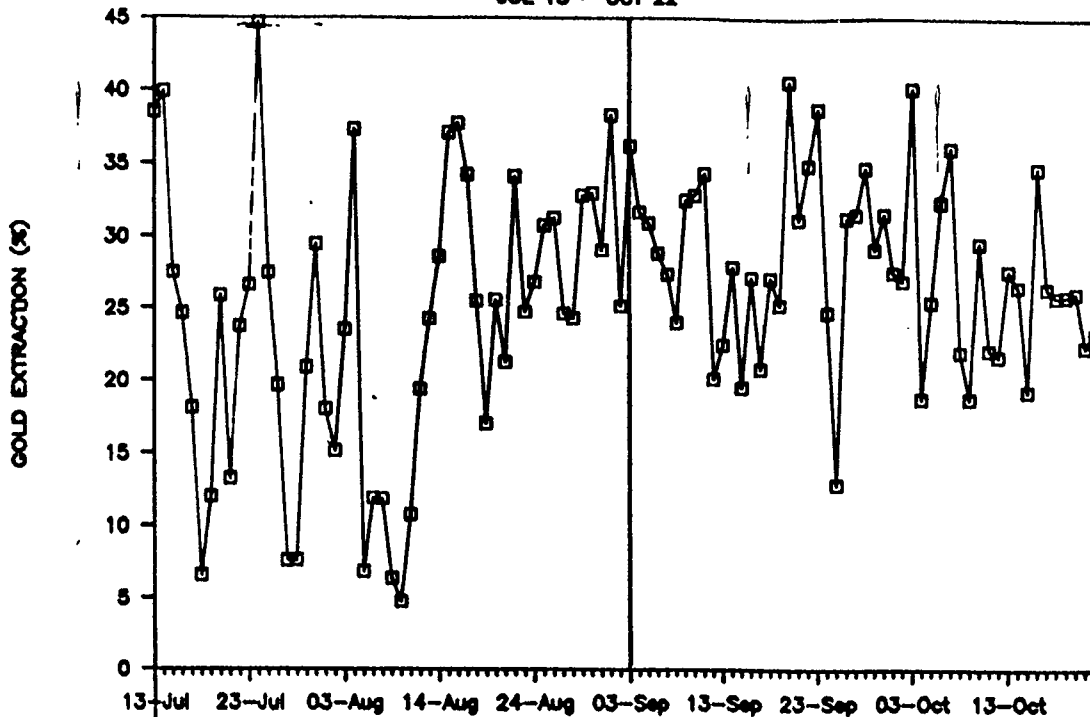
1988 TRP FEED DENSITY (% SOLIDS)

JUL 13 - OCT 22



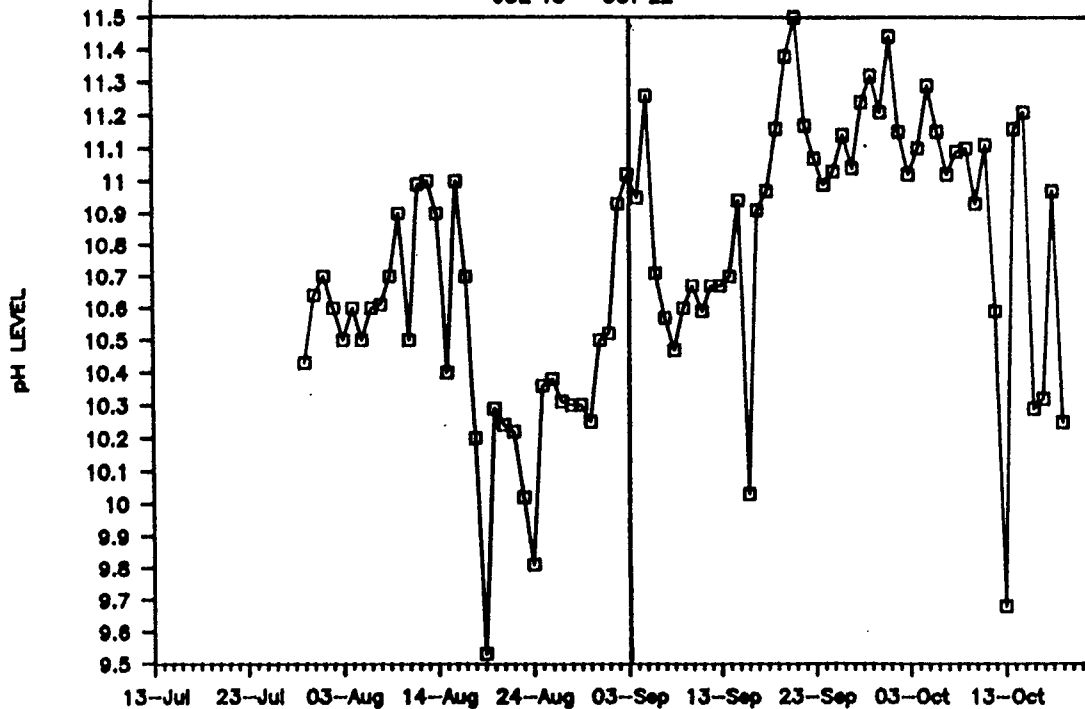
1988 TRP GOLD EXTRACTION (%)

JUL 13 - OCT 22



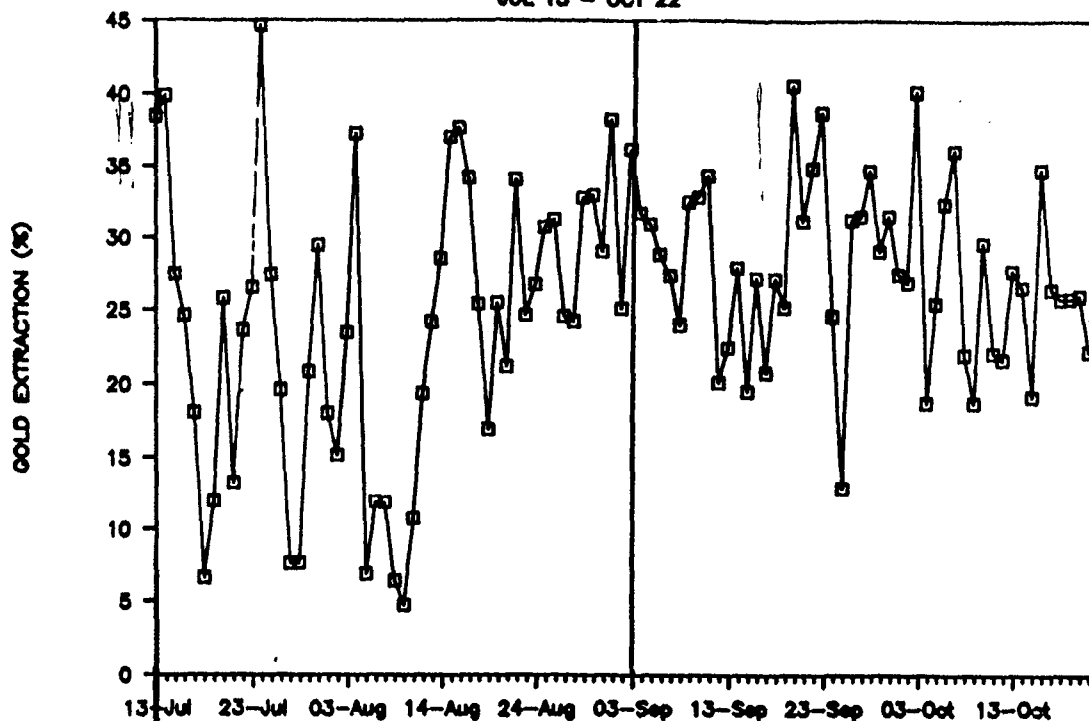
1988 TRP pH LEVELS

JUL 13 - OCT 22



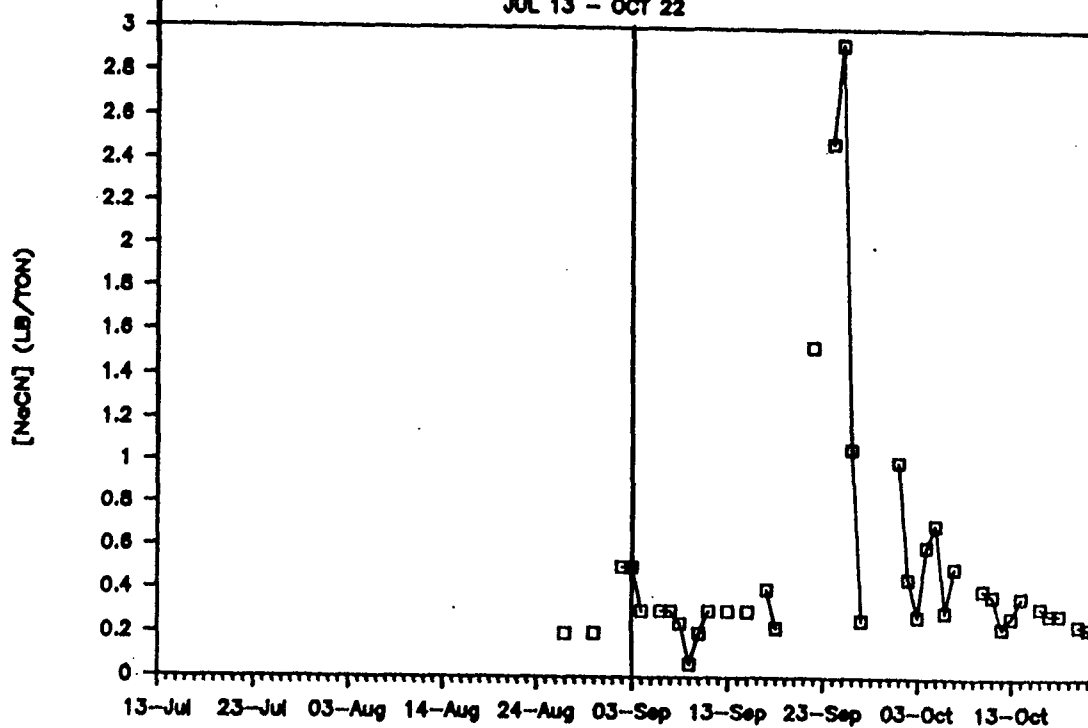
1988 TRP GOLD EXTRACTION (%)

JUL 13 - OCT 22



1988 TRP [NaCN] (LB/TON)

JUL 13 - OCT 22



1988 TRP OPERATING DATA
JUL 25, AUG 4 DELETED

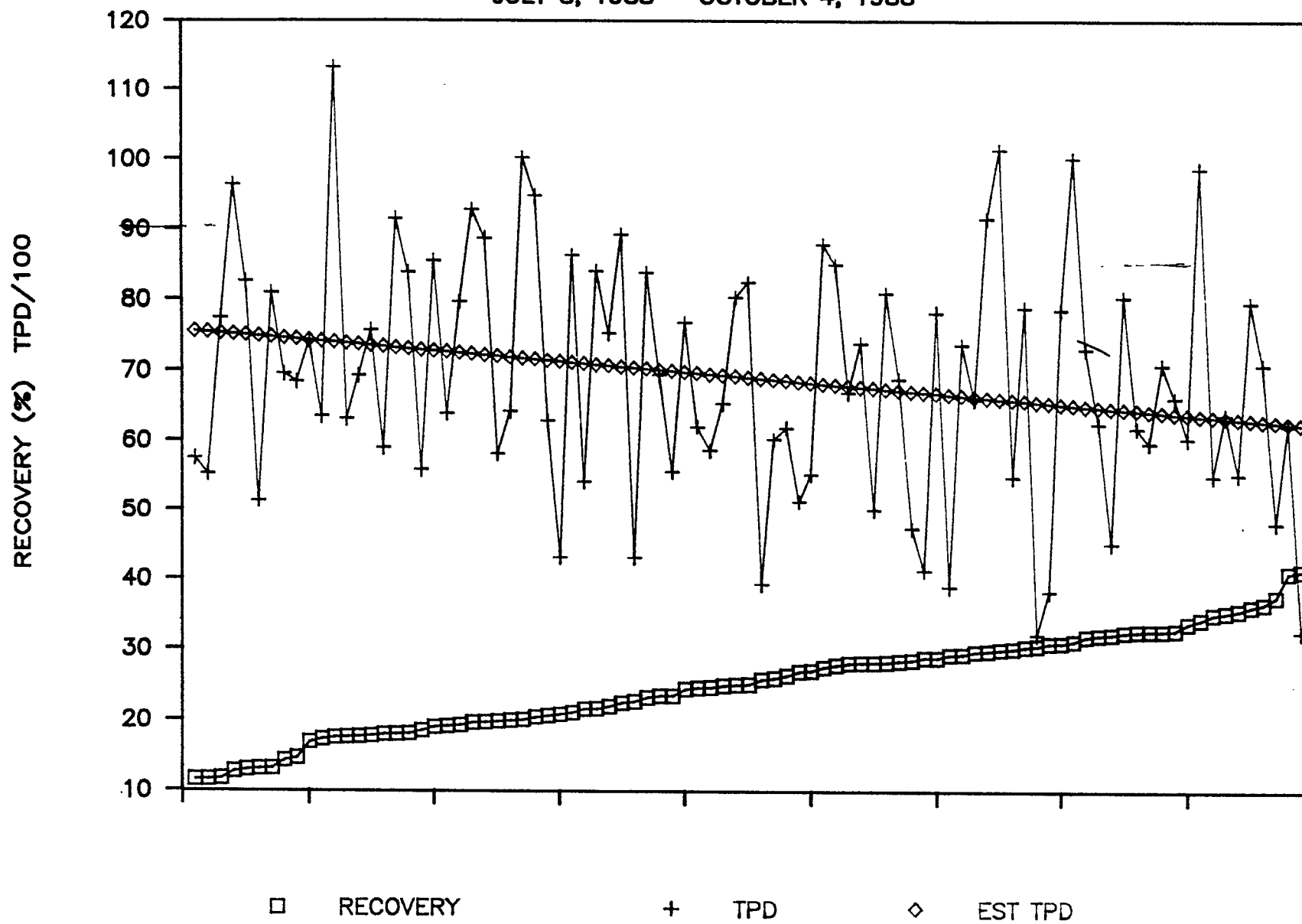
Date	Gold	Ext	Feed	ISol	Head	Oz	Tails	Oz	USGPM	CN	CONC	pH
13-Jul	38.55	41.23	0.069	0.042	3076							
14-Jul	39.94	36.34	0.067	0.040	2899							
15-Jul	27.53	37.67	0.055	0.040	2506							
16-Jul	24.67	39.80	0.053	0.040	2457							
17-Jul	18.18	40.21	0.055	0.045	3454							
18-Jul	6.64	42.10	0.051	0.048	3296							
19-Jul	12.03	42.72	0.049	0.043	2863							
20-Jul	25.88	40.39	0.051	0.038	2450							
21-Jul	13.31	42.07	0.058	0.050	2496							
22-Jul	23.73	38.78	0.055	0.042	2482							
23-Jul	26.61	40.01	0.059	0.044	3151							
24-Jul	44.69	40.00	0.112	0.062	2862							
26-Jul	27.50	37.51	0.059	0.042	2339							
27-Jul	19.73	36.73	0.035	0.028	1361							
28-Jul	7.65	41.70	0.045	0.041	2147							
29-Jul	7.69	38.56	0.039	0.036	2317							
30-Jul	20.96	38.71	0.044	0.035	2869			10.43				
31-Jul	29.50	37.81	0.051	0.036	2677			10.64				
01-Aug	18.11	39.63	0.052	0.043	2823			10.70				
02-Aug	15.21	38.87	0.056	0.048	2728			10.60				
03-Aug	23.53	33.65	0.051	0.039	2515			10.50				
04-Aug	37.33	31.83	0.062	0.077	2770			10.60				
06-Aug	6.91	28.68	0.074	0.069	2451			10.50				
07-Aug	11.93	27.47	0.075	0.066	3167			10.60				
08-Aug	11.89	26.57	0.063	0.056	3145			10.61				
09-Aug	6.42	37.53	0.054	0.050	2699			10.70				
10-Aug	4.77	32.93	0.052	0.049	2752			10.90				
11-Aug	10.80	35.10	0.057	0.051	2998			10.50				
12-Aug	19.43	36.33	0.049	0.040	3017			10.99				
13-Aug	24.28	35.38	0.053	0.040	2925			11.00				
14-Aug	28.65	36.51	0.058	0.042	2344			10.90				
15-Aug	37.10	35.77	0.068	0.043	2480			10.40				
16-Aug	37.74	38.27	0.068	0.042	3033			11.00				
17-Aug	34.30	37.49	0.072	0.047	2939			10.70				
18-Aug	25.54	37.11	0.080	0.059	2847			10.20				
19-Aug	17.12	34.44	0.069	0.057	2609			9.53				
20-Aug	25.60	39.80	0.070	0.052	3047			10.29				
21-Aug	21.30	40.22	0.070	0.055	3120			10.24				
22-Aug	34.19	38.02	0.075	0.050	2703			10.22				
23-Aug	24.80	38.62	0.074	0.056	2743			10.02				
24-Aug	26.90	40.66	0.079	0.058	2585			9.81				
25-Aug	30.87	39.66	0.078	0.054	2241			10.36				
26-Aug	31.37	39.03	0.079	0.054	2042			10.38				
27-Aug	24.68	37.18	0.071	0.053	1480	0.2		10.31				
28-Aug	24.35	36.36	0.064	0.048	1524			10.30				
29-Aug	32.88	38.67	0.072	0.048	1635			10.30				
30-Aug	33.04	39.39	0.090	0.060	2513	0.2		10.25				
31-Aug	29.16	41.09	0.069	0.049	2418			10.50				
01-Sep	38.32	39.24	0.073	0.045	2418			10.52				
02-Sep	25.20	40.36	0.077	0.058	2473	0.5		10.93				

1988 TRP OPERATING DATA
JUL 25, AUG 4 DELETED

Date	Gold	Ext	Feed	ISol	Head	Oz	Tails	Oz	USGPM	CN	CONC	pH
03-Sep	36.26	38.00	0.084	0.053	2596	0.5						11.02
04-Sep	31.78	37.83	0.080	0.054	2663	0.3						10.95
05-Sep	31.04	36.92	0.067	0.047	2327							11.26
06-Sep	28.93	39.88	0.063	0.045	2049	0.3						10.71
07-Sep	27.46	36.83	0.065	0.048	2161	0.3						10.57
08-Sep	24.06	38.63	0.083	0.063	2270	0.245						10.47
09-Sep	32.57	37.62	0.069	0.047	2722	0.06						10.60
10-Sep	32.89	35.63	0.071	0.048	2733	0.2						10.67
11-Sep	34.35	33.93	0.072	0.047	2749	0.3						10.59
12-Sep	20.20	36.76	0.082	0.065	2804							10.67
13-Sep	22.50	34.17	0.083	0.064	2887	0.3						10.67
14-Sep	27.93	37.48	0.076	0.055	2514							10.70
15-Sep	19.59	37.05	0.067	0.054	2062	0.3						10.94
16-Sep	27.21	35.40	0.079	0.058	2332							10.03
17-Sep	20.85	33.83	0.061	0.048	2487	0.4						10.91
18-Sep	27.16	31.41	0.057	0.041	2966	0.225						10.97
19-Sep	25.22	28.68	0.050	0.037	2919							11.16
20-Sep	40.63	30.54	0.062	0.037	2513							11.38
21-Sep	31.24	36.44	0.061	0.042	1622							11.50
22-Sep	34.95	35.90	0.062	0.040	2013	1.53						11.17
23-Sep	38.76	32.35	0.064	0.039	2054							11.07
24-Sep	24.69	35.61	0.066	0.050	2268	2.48						10.99
25-Sep	12.90	38.77	0.055	0.048	2492	2.93						11.03
26-Sep	31.34	37.72	0.067	0.046	2557	1.06						11.14
27-Sep	31.57	38.04	0.074	0.051	2392	0.26						11.04
28-Sep	34.74	34.68	0.076	0.050	2433							11.24
29-Sep	29.16	33.10	0.068	0.048	2358							11.32
30-Sep	31.58	41.39	0.075	0.052	2430							11.21
01-Oct	27.54	39.48	0.063	0.046	1831	1						11.44
02-Oct	26.95	35.62	0.059	0.043	2517	0.45						11.15
03-Oct	40.15	34.48	0.077	0.046	2638	0.28						11.02
04-Oct	18.83	39.59	0.063	0.051	2869	0.6						11.10
05-Oct	25.48	44.66	0.062	0.046	2449	0.7						11.29
06-Oct	32.41	42.83	0.060	0.040	2956	0.3						11.15
07-Oct	36.09	41.36	0.077	0.049	2643	0.5						11.02
08-Oct	22.02	40.24	0.073	0.057	3284							11.09
09-Oct	18.80	39.44	0.070	0.057	3339							11.10
10-Oct	29.65	38.33	0.076	0.054	2274	0.4						10.93
11-Oct	22.14	40.95	0.061	0.047	3038	0.375						11.11
12-Oct	21.72	39.48	0.056	0.044	2881	0.23						10.59
13-Oct	27.73	42.81	0.052	0.038	3014	0.278						9.68
14-Oct	26.59	38.79	0.054	0.040	3039	0.365						11.16
15-Oct	19.28	38.66	0.048	0.039	2772							11.21
16-Oct	34.78	41.79	0.068	0.045	2783	0.32						10.29
17-Oct	26.45	39.16	0.063	0.046	2671	0.29						10.32
18-Oct	25.81	34.97	0.062	0.046	2471	0.29						10.97
19-Oct	25.87	34.59	0.061	0.046	2181							10.25
20-Oct	26.06	22.20	0.056	0.042	2143	0.24						
21-Oct	22.33	30.37	0.048	0.038	2023	0.228						
22-Oct	23.19	26.51	0.050	0.039	1623	0.13						

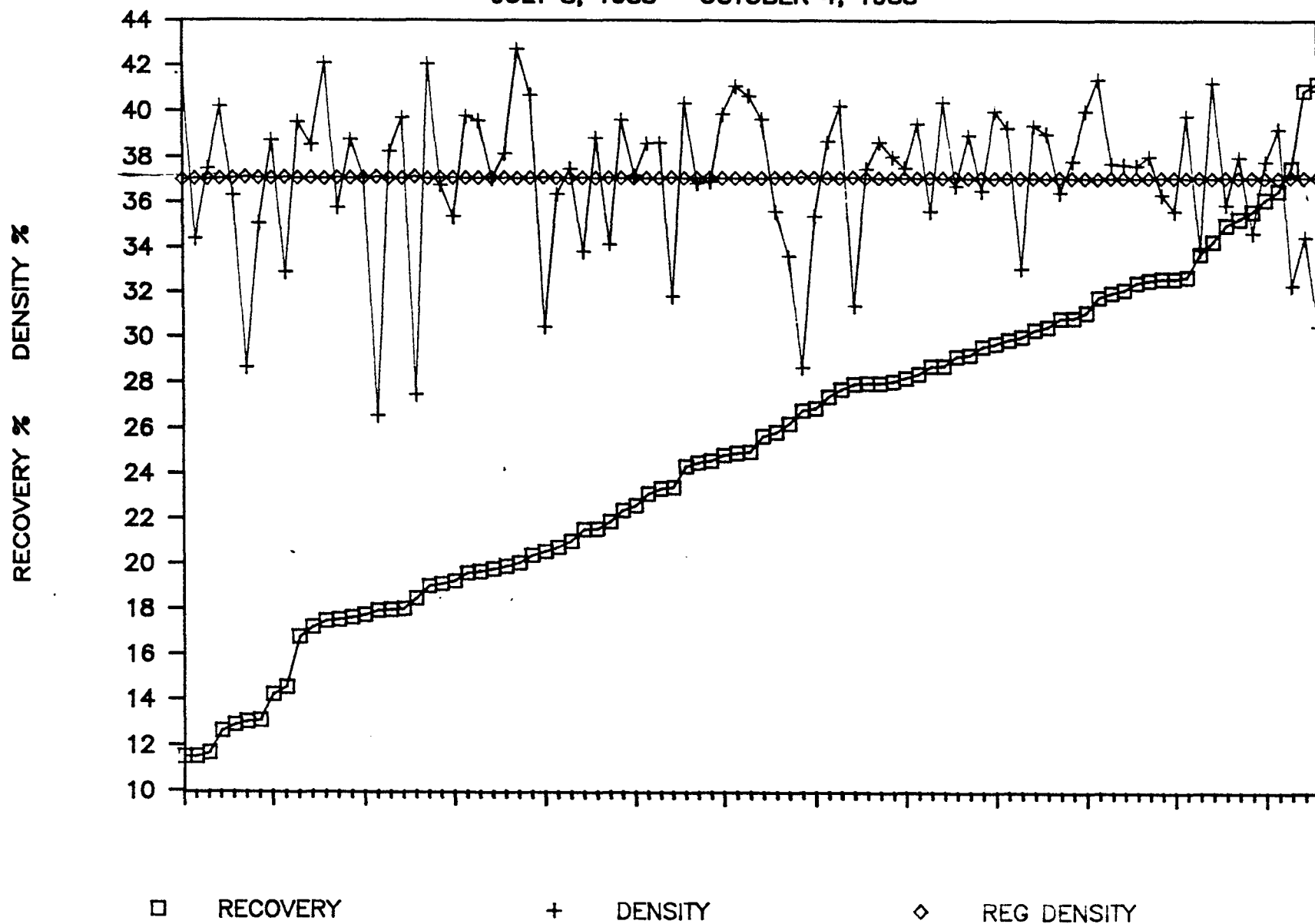
TRP TONNAGE/RECOVERY REGRESSION

JULY 8, 1988 - OCTOBER 4, 1988



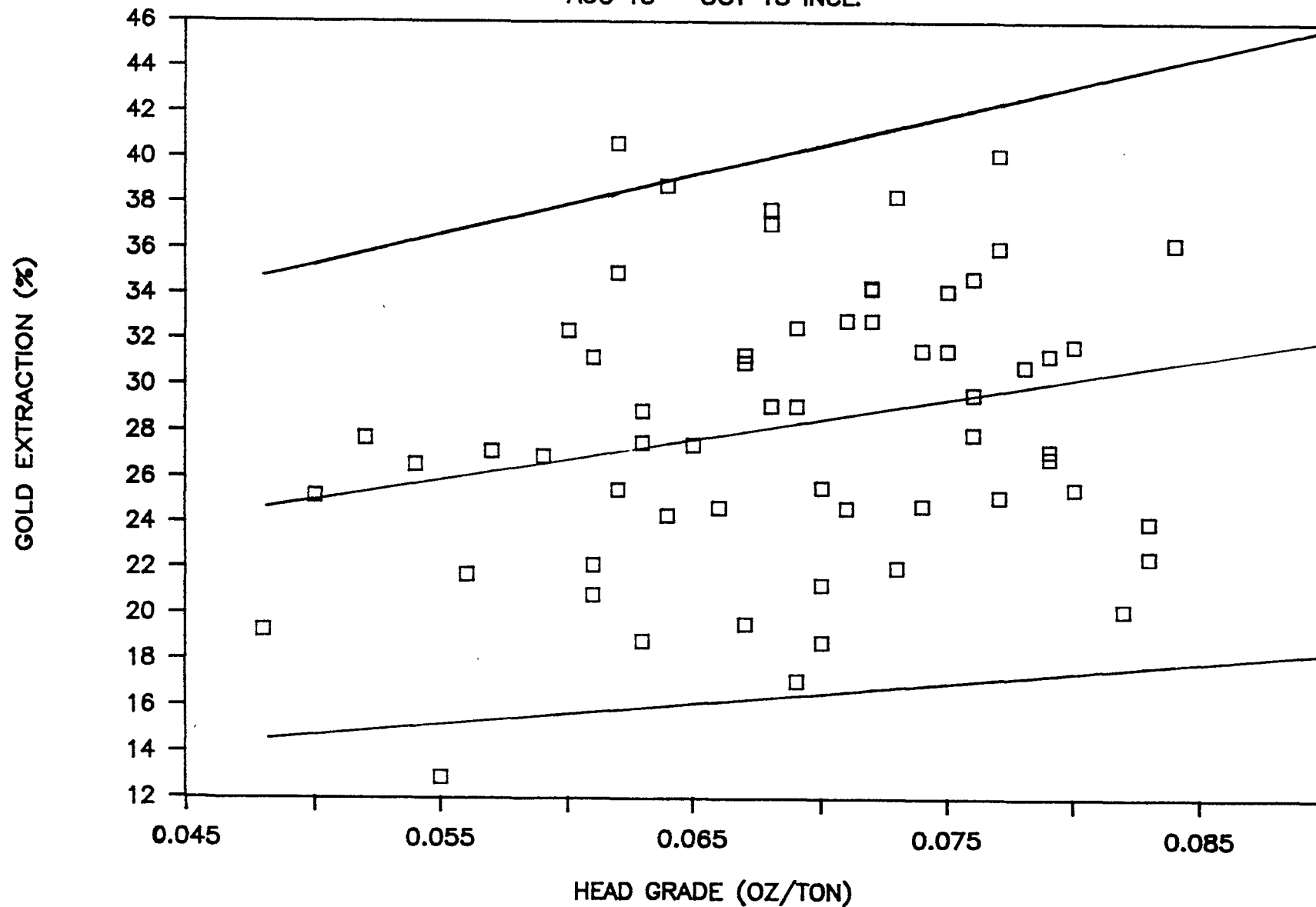
TRP DENSITY/RECOVERY REGRESSION

JULY 8, 1988 - OCTOBER 4, 1988



1988 TRP GOLD EXTRACTION VS HEAD GRADE

AUG 15 - OCT 15 INCL.



1988 TRP OPERATING DATA
AUG 15 - OCT 15 INCL.

INDEP VAR (X): HEAD GRADE
DEP VAR (Y): GOLD EXTRACTION

STD CONCLUSION: GOLD EXTRACTION INCREASES WITH
INCREASING HEAD GRADE

Regression Output:

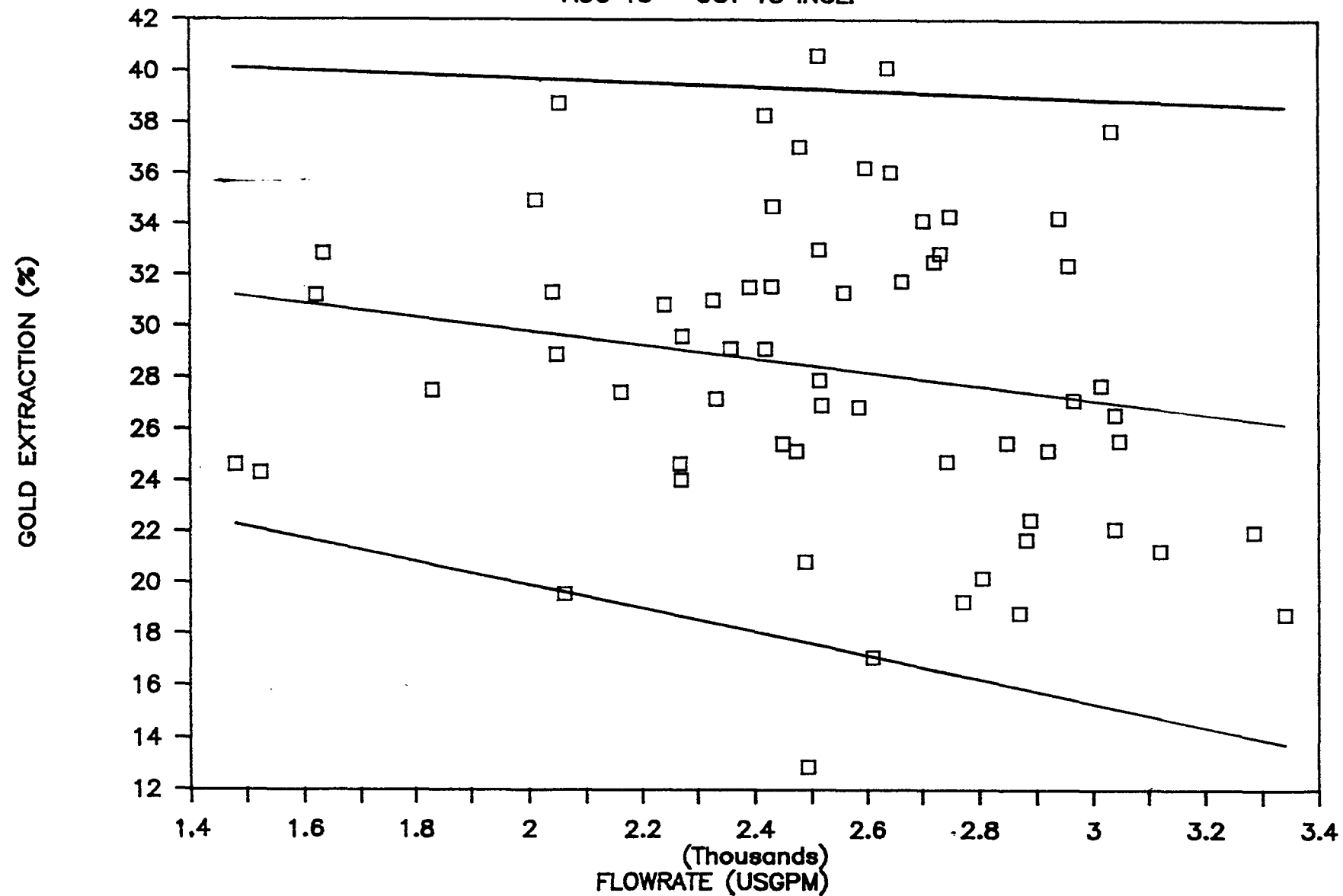
Constant	16.22235
Std Err of Y Est	5.998861
R Squared	0.066110
No. of Observations	62
Degrees of Freedom	60

X Coefficient(s)	176.2159
Std Err of Coef.	85.50292

J.H. Shepherd, Giant Yellowknife Engineering Dept.

1988 TRP GOLD EXTRACTION VS FLOWRATE

AUG 15 - OCT 15 INCL.



1988 TRP OPERATING DATA
AUG 15 - OCT 15 INCL.

INDEP VAR (X): FLOWRATE (USGPM)
DEP VAR (Y): GOLD EXTRACTION

STD CONCLUSION: GOLD EXTRACTION IS NOT SIGNIFICANTLY
AFFECTED BY FLOWRATE

Regression Output:

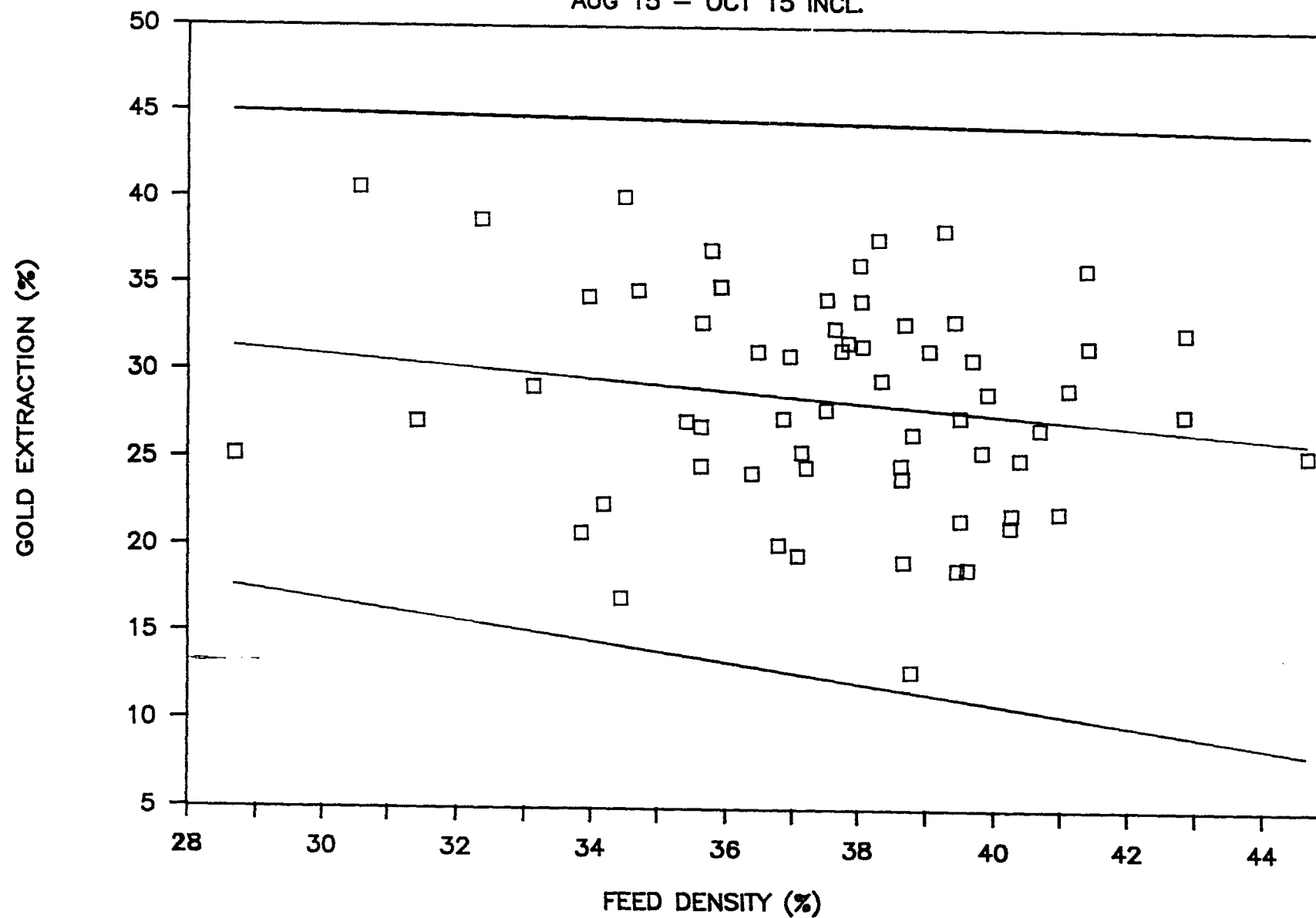
Constant	35.22470
Std Err of Y Est	6.105200
R Squared	0.032708
No. of Observations	62
Degrees of Freedom	60

X Coefficient(s)	-0.00269
Std Err of Coef.	0.001892

J.H. Shepherd, Giant Yellowknife Engineering Dept.

1988 TRP GOLD EXTRACTION VS DENSITY

AUG 15 - OCT 15 INCL.



1988 TRP OPERATING DATA
AUG 15 - OCT 15 INCL.

INDEP VAR (X): FEED DENSITY
DEP VAR (Y): GOLD EXTRACTION

STD CONCLUSION: GOLD EXTRACTION IS NOT SIGNIFICANTLY
AFFECTED BY FEED DENSITY

Regression Output:

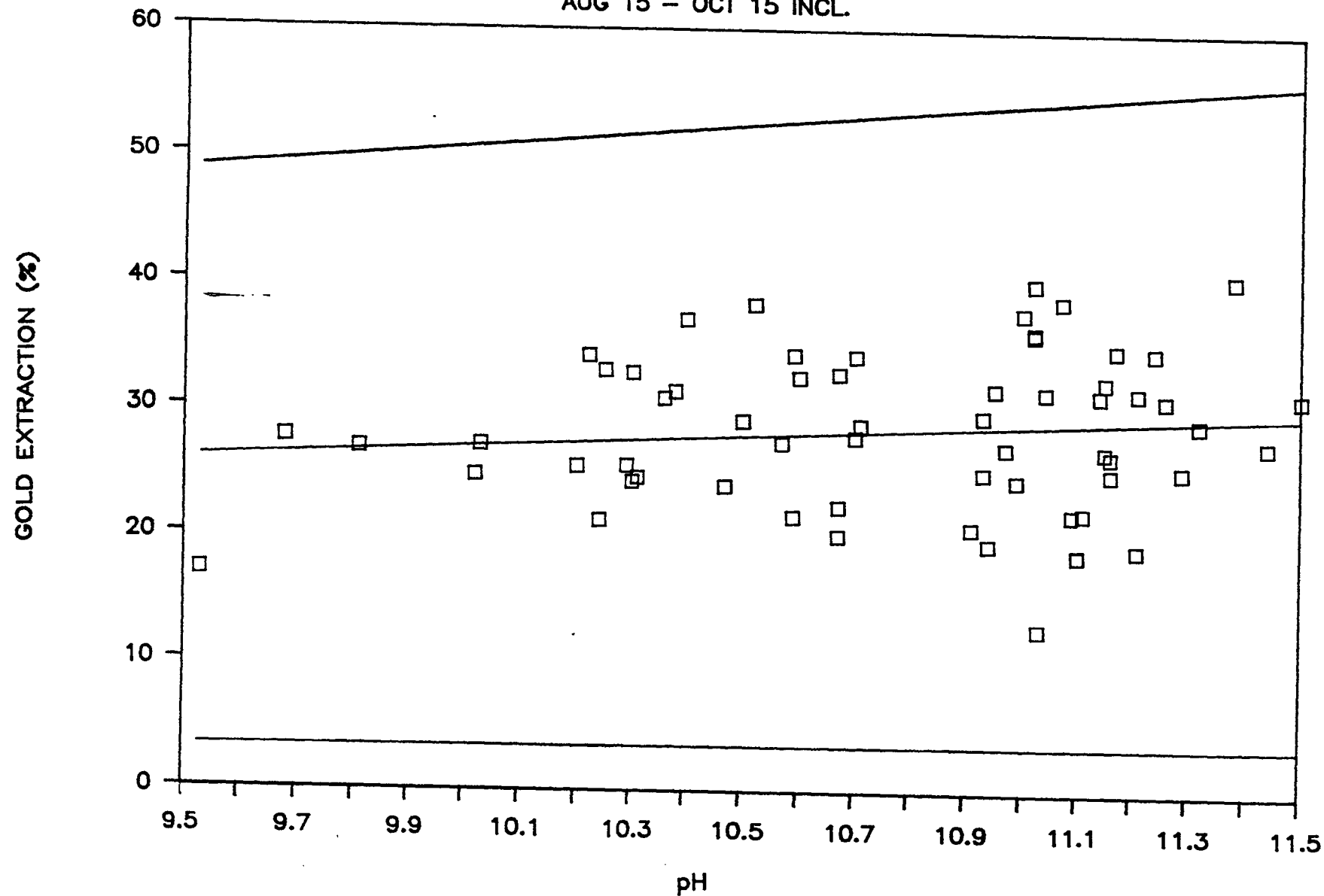
Constant	40.74367
Std Err of Y Est	6.128599
R Squared	0.025279
No. of Observations	62
Degrees of Freedom	60

X Coefficient(s) -0.32782
Std Err of Coef. 0.262796

J.H. Shepherd, Giant Yellowknife Engineering Dept.

1988 TRP GOLD EXTRACTION VS pH

AUG 15 - OCT 15 INCL.



1988 TRP OPERATING DATA
AUG 15 - OCT 15 INCL.

INDEP VAR (X): pH
DEP VAR (Y): GOLD EXTRACTION

STD CONCLUSION: GOLD EXTRACTION IS NOT SIGNIFICANTLY
AFFECTED BY pH

Regression Output:

Constant	8.454443
Std Err of Y Est	6.149752
R Squared	0.018539
No. of Observations	62
Degrees of Freedom	60

X Coefficient(s) 1.854130
Std Err of Coef. 1.741630

J.H. Shepherd, Giant Yellowknife Engineering Dept.

1988 TRP OPERATING DATA
AUG 15 - OCT 15 INCL.

INDEP VAR (X): HEAD GRADE
DEP VAR (Y): GOLD EXTRACTION

STD CONCLUSION: GOLD EXTRACTION INCREASES WITH
INCREASING HEAD GRADE

Regression Output:

Constant 16.22235
Std Err of Y Est 5.998861
R Squared 0.066110
No. of Observations 62
Degrees of Freedom 60

X Coefficient(s) 176.2159
Std Err of Coef. 85.50292

J.H. Shepherd, Giant Yellowknife Engineering Dept.

Date Gold Ext Heads Reg Line Low Lim Up Lim

AUG 15	37.10	0.068	28.21	16.39	40.02
AUG 16	37.74	0.068	28.21	16.39	40.02
AUG 17	34.30	0.072	28.91	16.75	41.06
AUG 18	25.54	0.080	30.32	17.48	43.16
AUG 19	17.12	0.069	28.38	16.48	40.28
AUG 20	25.60	0.070	28.56	16.57	40.54
AUG 21	21.30	0.070	28.56	16.57	40.54
AUG 22	34.19	0.075	29.44	17.03	41.85
AUG 23	24.80	0.074	29.26	16.94	41.59
AUG 24	26.90	0.079	30.14	17.39	42.90
AUG 25	30.87	0.078	29.97	17.30	42.64
AUG 26	31.37	0.079	30.14	17.39	42.90
AUG 27	24.68	0.071	28.73	16.66	40.80
AUG 28	24.35	0.064	27.50	16.03	38.97
AUG 29	32.88	0.072	28.91	16.75	41.06
AUG 30	33.04	0.090	32.08	18.39	45.78
AUG 31	29.16	0.069	28.38	16.48	40.28
SEP 01	38.32	0.073	29.09	16.85	41.33
SEP 02	25.20	0.077	29.79	17.21	42.37
SEP 03	36.26	0.084	31.02	17.84	44.21
SEP 04	31.78	0.080	30.32	17.48	43.16
SEP 05	31.04	0.067	28.03	16.30	39.76
SEP 06	28.93	0.063	27.32	15.94	38.71
SEP 07	27.46	0.065	27.68	16.12	39.23
SEP 08	24.06	0.083	30.85	17.75	43.94
SEP 09	32.57	0.069	28.38	16.48	40.28
SEP 10	32.89	0.071	28.73	16.66	40.80
SEP 11	34.35	0.072	28.91	16.75	41.06
SEP 12	20.20	0.082	30.67	17.66	43.68
SEP 13	22.50	0.083	30.85	17.75	43.94
SEP 14	27.93	0.076	29.61	17.12	42.11
SEP 15	19.59	0.067	28.03	16.30	39.76

SEP 16	27.21	0.079	30.14	17.39	42.90
SEP 17	20.85	0.061	26.97	15.76	38.19
SEP 18	27.16	0.057	26.27	15.39	37.14
SEP 19	25.22	0.050	25.03	14.76	35.31
SEP 20	40.63	0.062	27.15	15.85	38.45
SEP 21	31.24	0.061	26.97	15.76	38.19
SEP 22	34.95	0.062	27.15	15.85	38.45
SEP 23	38.76	0.064	27.50	16.03	38.97
SEP 24	24.69	0.066	27.85	16.21	39.49
SEP 25	12.90	0.055	25.91	15.21	36.62
SEP 26	31.34	0.067	28.03	16.30	39.76
SEP 27	31.57	0.074	29.26	16.94	41.59
SEP 28	34.74	0.076	29.61	17.12	42.11
SEP 29	29.16	0.068	28.21	16.39	40.02
SEP 30	31.58	0.075	29.44	17.03	41.85
OCT 01	27.54	0.063	27.32	15.94	38.71
OCT 02	26.95	0.059	26.62	15.58	37.66
OCT 03	40.15	0.077	29.79	17.21	42.37
OCT 04	18.83	0.063	27.32	15.94	38.71
OCT 05	25.48	0.062	27.15	15.85	38.45
OCT 06	32.41	0.060	26.80	15.67	37.92
OCT 07	36.09	0.077	29.79	17.21	42.37
OCT 08	22.02	0.073	29.09	16.85	41.33
OCT 09	18.80	0.070	28.56	16.57	40.54
OCT 10	29.65	0.076	29.61	17.12	42.11
OCT 11	22.14	0.061	26.97	15.76	38.19
OCT 12	21.72	0.056	26.09	15.30	36.88
OCT 13	27.73	0.052	25.39	14.94	35.83
OCT 14	26.59	0.054	25.74	15.12	36.35
OCT 15	19.28	0.048	24.68	14.58	34.78

1988 TRP OPERATING DATA
AUG 15 - OCT 15 INCL.

INDEP VAR (X): FLOWRATE (USGPM)
DEP VAR (Y): GOLD EXTRACTION

STD CONCLUSION: GOLD EXTRACTION IS NOT SIGNIFICANTLY
AFFECTED BY FLOWRATE

Regression Output:

Constant 35.22470
Std Err of Y Est 6.105200
R Squared 0.032708
No. of Observations 62
Degrees of Freedom 60

X Coefficient(s) -0.00269
Std Err of Coef. 0.001892

J.H. Shepherd, Giant Yellowknife Engineering Dept.

Date Gold Ext Flow Reg Line Low Lim Up Lim

AUG 15	37.10	2480	28.54	17.74	39.34
AUG 16	37.74	3033	27.05	15.20	38.89
AUG 17	34.30	2939	27.30	15.64	38.97
AUG 18	25.54	2847	27.55	16.06	39.04
AUG 19	17.12	2609	28.19	17.15	39.23
AUG 20	25.60	3047	27.01	15.14	38.88
AUG 21	21.30	3120	26.82	14.81	38.82
AUG 22	34.19	2703	27.94	16.72	39.16
AUG 23	24.80	2743	27.83	16.54	39.13
AUG 24	26.90	2585	28.26	17.26	39.25
AUG 25	30.87	2241	29.18	18.84	39.53
AUG 26	31.37	2042	29.72	19.75	39.69
AUG 27	24.68	1480	31.24	22.33	40.14
AUG 28	24.35	1524	31.12	22.13	40.11
AUG 29	32.88	1635	30.82	21.62	40.02
AUG 30	33.04	2513	28.45	17.59	39.31
AUG 31	29.16	2418	28.71	18.03	39.39
SEP 01	38.32	2418	28.71	18.03	39.39
SEP 02	25.20	2473	28.56	17.78	39.34
SEP 03	36.26	2596	28.23	17.21	39.25
SEP 04	31.78	2663	28.05	16.90	39.19
SEP 05	31.04	2327	28.95	18.44	39.46
SEP 06	28.93	2049	29.70	19.72	39.68
SEP 07	27.46	2161	29.40	19.20	39.59
SEP 08	24.06	2270	29.11	18.70	39.51
SEP 09	32.57	2722	27.89	16.63	39.14
SEP 10	32.89	2733	27.86	16.58	39.14
SEP 11	34.35	2749	27.82	16.51	39.12
SEP 12	20.20	2804	27.67	16.25	39.08
SEP 13	22.50	2887	27.44	15.87	39.01
SEP 14	27.93	2514	28.45	17.59	39.31
SEP 15	19.59	2062	29.67	19.66	39.67

SEP 16	27.21	2332	28.94	18.42	39.46
SEP 17	20.85	2487	28.52	17.71	39.33
SEP 18	27.16	2966	27.23	15.52	38.95
SEP 19	25.22	2919	27.36	15.73	38.99
SEP 20	40.63	2513	28.45	17.59	39.31
SEP 21	31.24	1622	30.85	21.68	40.03
SEP 22	34.95	2013	29.80	19.88	39.71
SEP 23	38.76	2054	29.69	19.70	39.68
SEP 24	24.69	2268	29.11	18.71	39.51
SEP 25	12.90	2492	28.51	17.69	39.33
SEP 26	31.34	2557	28.33	17.39	39.28
SEP 27	31.57	2392	28.78	18.15	39.41
SEP 28	34.74	2433	28.67	17.96	39.38
SEP 29	29.16	2358	28.87	18.30	39.44
SEP 30	31.58	2430	28.67	17.97	39.38
OCT 01	27.54	1831	30.29	20.72	39.86
OCT 02	26.95	2517	28.44	17.57	39.31
OCT 03	40.15	2638	28.12	17.02	39.21
OCT 04	18.83	2869	27.49	15.96	39.03
OCT 05	25.48	2449	28.62	17.88	39.36
OCT 06	32.41	2956	27.26	15.56	38.96
OCT 07	36.09	2643	28.10	17.00	39.21
OCT 08	22.02	3284	26.37	14.05	38.69
OCT 09	18.80	3339	26.23	13.80	38.65
OCT 10	29.65	2274	29.10	18.69	39.50
OCT 11	22.14	3038	27.04	15.18	38.89
OCT 12	21.72	2881	27.46	15.90	39.02
OCT 13	27.73	3014	27.10	15.29	38.91
OCT 14	26.59	3039	27.03	15.18	38.89
OCT 15	19.28	2772	27.75	16.40	39.10

1988 TRP OPERATING DATA
AUG 15 - OCT 15 INCL.

INDEP VAR (X): FEED DENSITY
DEP VAR (Y): GOLD EXTRACTION

STD CONCLUSION: GOLD EXTRACTION IS NOT SIGNIFICANTLY
AFFECTED BY FEED DENSITY

Regression Output:

Constant 40.74367
Std Err of Y Est 6.128599
R Squared 0.025279
No. of Observations 62
Degrees of Freedom 60

X Coefficient(s) -0.32782
Std Err of Coef. 0.262796

J.H. Shepherd, Giant Yellowknife Engineering Dept.

Date	Gold Ext	Density	Reg Line	Low Lim	Up Lim
AUG 15	37.10	35.77	29.02	13.49	44.55
AUG 16	37.74	38.27	28.20	12.01	44.38
AUG 17	34.30	37.49	28.45	12.47	44.43
AUG 18	25.54	37.11	28.58	12.70	44.46
AUG 19	17.12	34.44	29.45	14.27	44.63
AUG 20	25.60	39.80	27.70	11.11	44.28
AUG 21	21.30	40.22	27.56	10.86	44.26
AUG 22	34.19	38.02	28.28	12.16	44.40
AUG 23	24.80	38.62	28.08	11.81	44.36
AUG 24	26.90	40.66	27.41	10.60	44.23
AUG 25	30.87	39.66	27.74	11.19	44.29
AUG 26	31.37	39.03	27.95	11.56	44.33
AUG 27	24.68	37.18	28.56	12.66	44.45
AUG 28	24.35	36.36	28.82	13.14	44.51
AUG 29	32.88	38.67	28.07	11.78	44.36
AUG 30	33.04	39.39	27.83	11.35	44.31
AUG 31	29.16	41.09	27.27	10.35	44.20
SEP 01	38.32	39.24	27.88	11.44	44.32
SEP 02	25.20	40.36	27.51	10.78	44.25
SEP 03	36.26	38.00	28.29	12.17	44.40
SEP 04	31.78	37.83	28.34	12.27	44.41
SEP 05	31.04	36.92	28.64	12.81	44.47
SEP 06	28.93	39.88	27.67	11.06	44.28
SEP 07	27.46	36.83	28.67	12.86	44.48
SEP 08	24.06	38.63	28.08	11.80	44.36
SEP 09	32.57	37.62	28.41	12.40	44.43
SEP 10	32.89	35.63	29.06	13.57	44.56
SEP 11	34.35	33.93	29.62	14.58	44.67
SEP 12	20.20	36.76	28.69	12.90	44.48
SEP 13	22.50	34.17	29.54	14.43	44.65
SEP 14	27.93	37.48	28.46	12.48	44.44
SEP 15	19.59	37.05	28.60	12.73	44.46
SEP 16	27.21	35.40	29.14	13.71	44.57
SEP 17	20.85	33.83	29.65	14.63	44.67
SEP 18	27.16	31.41	30.45	16.06	44.83
SEP 19	25.22	28.68	31.34	17.68	45.01
SEP 20	40.63	30.54	30.73	16.58	44.89
SEP 21	31.24	36.44	28.80	13.09	44.50
SEP 22	34.95	35.90	28.97	13.41	44.54
SEP 23	38.76	32.35	30.14	15.51	44.77
SEP 24	24.69	35.61	29.07	13.58	44.56
SEP 25	12.90	38.77	28.03	11.72	44.35
SEP 26	31.34	37.72	28.38	12.34	44.42
SEP 27	31.57	38.04	28.27	12.15	44.40
SEP 28	34.74	34.68	29.37	14.13	44.62
SEP 29	29.16	33.10	29.89	15.07	44.72
SEP 30	31.58	41.39	27.18	10.17	44.18
OCT 01	27.54	39.48	27.80	11.30	44.31
OCT 02	26.95	35.62	29.07	13.58	44.56
OCT 03	40.15	34.48	29.44	14.25	44.63
OCT 04	18.83	39.59	27.77	11.23	44.30
OCT 05	25.48	44.66	26.10	8.24	43.97
OCT 06	32.41	42.83	26.70	9.32	44.09
OCT 07	36.09	41.36	27.18	10.19	44.18
OCT 08	22.02	40.24	27.55	10.85	44.26
OCT 09	18.80	39.44	27.81	11.32	44.31
OCT 10	29.65	38.33	28.18	11.98	44.38
OCT 11	22.14	40.95	27.32	10.43	44.21
OCT 12	21.72	39.48	27.80	11.30	44.31
OCT 13	27.73	42.81	26.71	9.33	44.09
OCT 14	26.59	38.79	28.03	11.70	44.35
OCT 15	19.28	38.66	28.07	11.78	44.36

1988 TRP OPERATING DATA
AUG 15 - OCT 15 INCL.

INDEP VAR (X): pH
DEP VAR (Y): GOLD EXTRACTION

STD CONCLUSION: GOLD EXTRACTION IS NOT SIGNIFICANTLY
AFFECTED BY pH

Regression Output:

Constant 8.454443
Std Err of Y Est 6.149752
R Squared 0.018539
No. of Observations 62
Degrees of Freedom 60

X Coefficient(s) 1.854130
Std Err of Coef. 1.741630

J.H. Shepherd, Giant Yellowknife Engineering Dept.

Date	Gold Ext	pH	Reg Line	Low Lim	Up Lim						
AUG 15	37.10	10.40	27.74	3.47	52.00	SEP 16	27.21	10.03	27.05	3.43	50.67
AUG 16	37.74	11.00	28.85	3.54	54.16	SEP 17	20.85	10.91	28.68	3.53	53.83
AUG 17	34.30	10.70	28.29	3.51	53.08	SEP 18	27.16	10.97	28.79	3.54	54.05
AUG 18	25.54	10.20	27.37	3.45	51.28	SEP 19	25.22	11.16	29.15	3.56	54.73
AUG 19	17.12	9.53	26.12	3.38	48.87	SEP 20	40.63	11.38	29.55	3.58	55.52
AUG 20	25.60	10.29	27.53	3.46	51.60	SEP 21	31.24	11.50	29.78	3.60	55.96
AUG 21	21.30	10.24	27.44	3.46	51.42	SEP 22	34.95	11.17	29.17	3.56	54.77
AUG 22	34.19	10.22	27.40	3.45	51.35	SEP 23	38.76	11.07	28.98	3.55	54.41
AUG 23	24.80	10.02	27.03	3.43	50.63	SEP 24	24.69	10.99	28.83	3.54	54.12
AUG 24	26.90	9.81	26.64	3.41	49.88	SEP 25	12.90	11.03	28.91	3.55	54.27
AUG 25	30.87	10.36	27.66	3.47	51.86	SEP 26	31.34	11.14	29.11	3.56	54.66
AUG 26	31.37	10.38	27.70	3.47	51.93	SEP 27	31.57	11.04	28.92	3.55	54.30
AUG 27	24.68	10.31	27.57	3.46	51.68	SEP 28	34.74	11.24	29.29	3.57	55.02
AUG 28	24.35	10.30	27.55	3.46	51.64	SEP 29	29.16	11.32	29.44	3.58	55.31
AUG 29	32.88	10.30	27.55	3.46	51.64	SEP 30	31.58	11.21	29.24	3.57	54.91
AUG 30	33.04	10.25	27.46	3.46	51.46	OCT 01	27.54	11.44	29.67	3.59	55.74
AUG 31	29.16	10.50	27.92	3.49	52.36	OCT 02	26.95	11.15	29.13	3.56	54.70
SEP 01	38.32	10.52	27.96	3.49	52.43	OCT 03	40.15	11.02	28.89	3.54	54.23
SEP 02	25.20	10.93	28.72	3.53	53.91	OCT 04	18.83	11.10	29.04	3.55	54.52
SEP 03	36.26	11.02	28.89	3.54	54.23	OCT 05	25.48	11.29	29.39	3.57	55.20
SEP 04	31.78	10.95	28.76	3.54	53.98	OCT 06	32.41	11.15	29.13	3.56	54.70
SEP 05	31.04	11.26	29.33	3.57	55.09	OCT 07	36.09	11.02	28.89	3.54	54.23
SEP 06	28.93	10.71	28.31	3.51	53.11	OCT 08	22.02	11.09	29.02	3.55	54.48
SEP 07	27.46	10.57	28.05	3.49	52.61	OCT 09	18.80	11.10	29.04	3.55	54.52
SEP 08	24.06	10.47	27.87	3.48	52.25	OCT 10	29.65	10.93	28.72	3.53	53.91
SEP 09	32.57	10.60	28.11	3.50	52.72	OCT 11	22.14	11.11	29.05	3.55	54.55
SEP 10	32.89	10.67	28.24	3.51	52.97	OCT 12	21.72	10.59	28.09	3.50	52.68
SEP 11	34.35	10.59	28.09	3.50	52.68	OCT 13	27.73	9.68	26.40	3.39	49.41
SEP 12	20.20	10.67	28.24	3.51	52.97	OCT 14	26.59	11.16	29.15	3.56	54.73
SEP 13	22.50	10.67	28.24	3.51	52.97	OCT 15	19.28	11.21	29.24	3.57	54.91
SEP 14	27.93	10.70	28.29	3.51	53.08						
SEP 15	19.59	10.94	28.74	3.54	53.94						

File note: DND

Nov 3/88

- CIL - Residence Time.

$$A. \text{ Flowrate} = 0.060928 \frac{T}{PA} [P + 2.75(1-P)]$$

where $T =$ Tons dry solids / 24 hrs
 $P =$ % solids, fraction
 $A =$ % availability, fraction.

Design 8000 tpd at 40% solids.

$$\text{Flowrate} = 0.060928 \times \frac{8000}{0.4 \times 1.0} [0.4 + 2.75 \times 0.6]$$

$$= 2498, \text{ say } 2500 \text{ USGPM.}$$

$$B. \text{ Working volume of one vessel}^* \begin{matrix} 2659,405 \text{ L} \\ 93,918 \text{ ft}^3 \end{matrix}$$

$$\text{Design Retention Time} = \frac{6 \times 2659,405 \text{ US Gal.} \times \frac{\text{hr}}{60 \text{ min}}}{3.76 \times 2498 \text{ USGPM.}}$$

$$= 28.3 \text{ hrs.}$$

* Don Cooper's Calculation

Tank Size 47.5 ft x 54.5 high . minus 1.5' freeboard

Conversation with Sadek

Design data were
8000 tpd
40% solids
2.7 ft solids.

Flowrate 2619 USGPM.

Quoted retention time was in the order of 24-26 hrs.

$$\begin{aligned} T_{\text{per Sadek}} &= \frac{6 \times 2,659,405}{3.76 \times 60 \times 2619} \\ &= 27 \text{ hrs.} \end{aligned}$$

GIANT
Yellowknife Mines Limited

DATE: November 15, 1988
TO: Doug Bartlett
FROM: Jim Shepherd
CC: Sadek El-Alfy, Gerry Wolfe
RE: TRP Multivariate Analysis

CONCLUSIONS

1. Gold extraction is not significantly related to any plant operating variables for which data is available.
2. Tailings grade provides a better basis for comparison of operating variables than gold extraction.
3. The only significant prediction of tailings grade appears to be based on head grade, eg: plant feed characteristics, not plant operating characteristics.

FIGURE 1:

Variability in gold extraction is not explained by a combination of density, pH, flow rate, tonnage, and head grade.

Since gold extraction is a mathematical value calculated as a function of head grade and tailings grade, the variability of gold extraction is effectively doubled in comparison with head grade and tails grade which are directly measured. Therefore, gold extraction provides a relatively meaningless basis for comparison of operating variables.

FIGURE 2:

Variability in tails grade is approximately 67% accounted for by a combination of density, pH, flow rate, tonnage, and head grade.

Expressing tailings grade instead of gold extraction as a function of the same independent variables as Figure 1 produces a relatively strong correlation.

FIGURE 3:

Variability in tails grade is approximately 64% accounted for by variation in head grade.

Head grade essentially provides the correlation in Figure 2.

Memo to D. Bartlett
November 15, 1988
Page Two


FIGURE 4:

Variability in tails grade is not explained by variation in density, pH, flow, and tonnage.

Tested individually against tails grade to account for approximate variability: tonnage 0.8%, density 3.5%, flow rate 0.1%, pH 14% (head grade 64%).

FIGURE 5:

Variation in tails grade is not explained by variation in pH.


Jim Shepherd
Planning Engineer

/lh

1988 TRP MULTIVARIATE ANALYSIS

EXT. VS DENSITY, pH, FLOW, TONS, HEADS

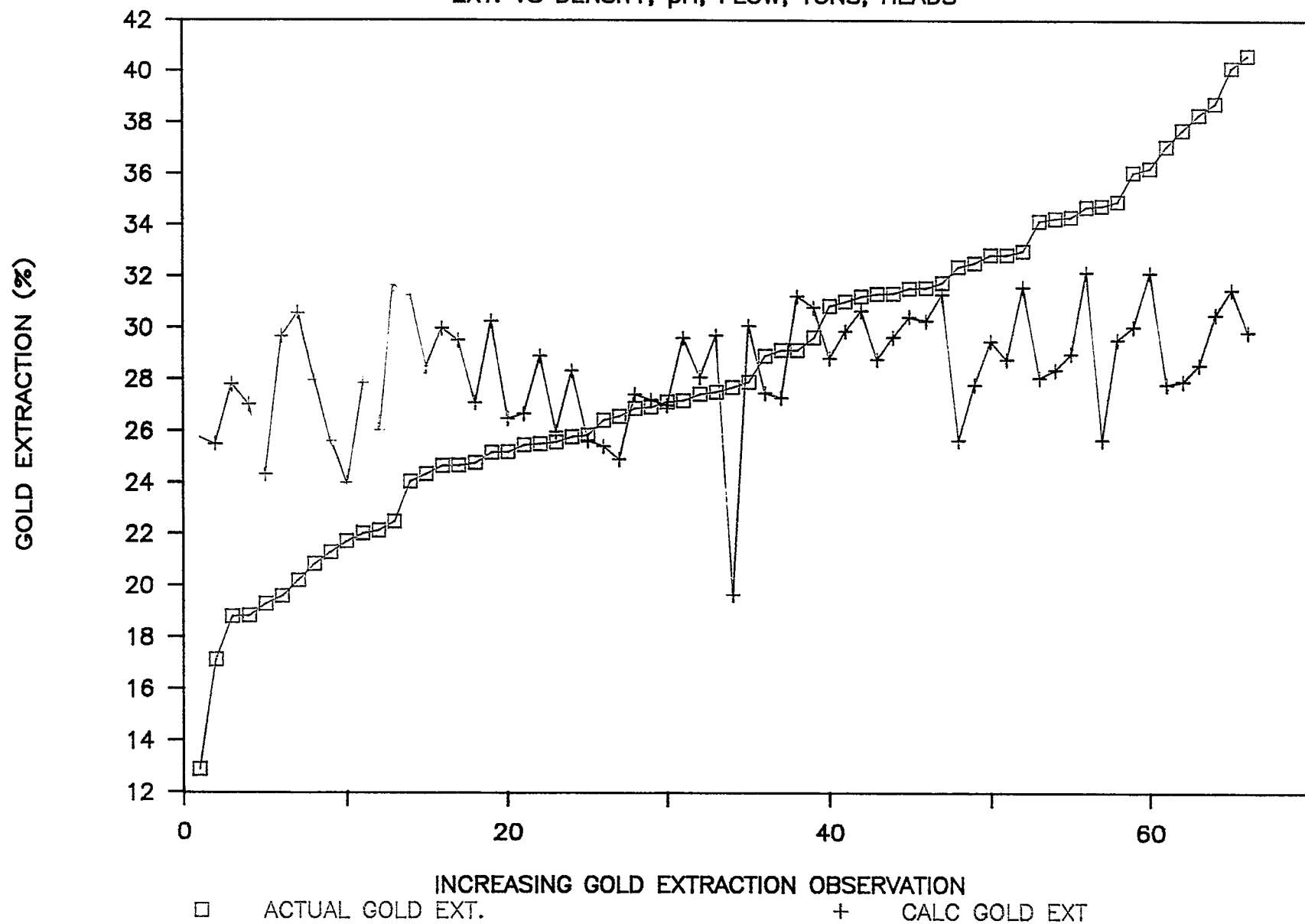


FIG. 1

1988 TRP OPERATING DATA
AUG 15 - OCT 15
JUL 25, AUG 4 DELETED

INDEP VAR (X): DENSITY, pH, FLOW, TONNAGE, HEAD GRADE
DEP VAR (Y): GOLD EXTRACTION

STD CONCLUSION: VARIABILITY IN GOLD EXTRACTION IS NOT
EXPLAINED BY COMBINATION OF DENSITY, pH,
FLOW, TONNAGE, AND HEAD GRADE.

Regression Output:

Constant -0.00708
Std Err of Y Est 5.806707
R Squared 0.146258
No. of Observations 66
Degrees of Freedom 60

X Coefficient(s) 0.000251 -0.30316 226.4954 -0.00266 2.720645
Std Err of Coef. 0.000801 0.361023 86.01191 0.003093 1.691115

Date	Gold Ext	Feed Tons	Feed %Sol	Head Oz	USGPM	pH	Tails Oz	Est Rec	Observation
25-Sep	12.90	6951.0	38.77	0.055	2492	11.03	0.048	25.82	1
19-Aug	17.12	5528.8	34.44	0.069	2609	9.53	0.057	25.56	2
09-Oct	18.80	10493.0	39.44	0.070	3339	11.10	0.057	27.85	3
04-Oct	18.83	8871.4	39.59	0.063	2869	11.10	0.051	27.06	4
15-Oct	19.28	8304.4	38.66	0.048	2772	11.21	0.039	24.36	5
15-Sep	19.59	5816.7	37.05	0.067	2062	10.94	0.054	29.68	6
12-Sep	20.20	6393.2	36.76	0.082	2804	10.67	0.065	30.60	7
17-Sep	20.85	5414.6	33.83	0.061	2487	10.91	0.048	27.98	8
21-Aug	21.30	9642.1	40.22	0.070	3120	10.24	0.055	25.64	9
12-Oct	21.72	8577.9	39.48	0.056	2881	10.59	0.044	24.01	10
08-Oct	22.02	8439.0	40.24	0.073	3284	11.09	0.057	27.88	11
11-Oct	22.14	10040.7	40.95	0.061	3038	11.11	0.047	26.06	12
13-Sep	22.50	7524.7	34.17	0.083	2887	10.67	0.064	31.67	13
08-Sep	24.06	6941.0	38.63	0.083	2270	10.47	0.063	31.27	14
28-Aug	24.35	4303.9	36.36	0.064	1524	10.30	0.048	28.51	15
27-Aug	24.68	4302.3	37.18	0.071	1480	10.31	0.053	30.00	16
24-Sep	24.69	6027.3	35.61	0.066	2268	10.99	0.050	29.53	17
23-Aug	24.80	8383.0	38.62	0.074	2743	10.02	0.056	27.12	18
02-Sep	25.20	7678.0	40.36	0.077	2473	10.93	0.058	30.29	19
19-Sep	25.22	5122.0	28.68	0.050	2919	11.16	0.037	26.51	20
05-Oct	25.48	7980.0	44.66	0.062	2449	11.29	0.046	26.70	21
18-Aug	25.54	7571.0	37.11	0.080	2847	10.20	0.059	28.94	22
20-Aug	25.60	9285.3	39.80	0.070	3047	10.29	0.052	26.01	23
18-Oct	25.81	6634.1	34.97	0.062	2471	10.97	0.046	28.37	24
19-Oct	25.87	1056.4	34.59	0.061	2181	10.25	0.046	25.67	25
17-Oct	26.45	8314.4	39.16	0.063	2671	10.32	0.046	25.45	26
14-Oct	26.59	8763.5	38.79	0.054	3039	11.16	0.040	24.94	27
24-Aug	26.90	8250.0	40.66	0.079	2585	9.81	0.058	27.45	28
02-Oct	26.95	4124.5	35.62	0.059	2517	11.15	0.043	27.23	29
18-Sep	27.16	6691.0	31.41	0.057	2966	10.97	0.041	27.02	30
16-Sep	27.21	5515.0	35.40	0.079	2332	10.03	0.058	29.62	31

07-Sep	27.46	6205.0	36.83	0.065	2161	10.57	0.048	28.12	32
01-Oct	27.54	4730.1	39.48	0.063	1831	11.44	0.046	29.74	33
13-Oct	27.73	10192.2	42.81	0.052	3014	9.68	0.038	19.67	34
14-Sep	27.93	7384.5	37.48	0.076	2514	10.70	0.055	30.12	35
06-Sep	28.93	6536.9	39.88	0.063	2049	10.71	0.045	27.50	36
31-Aug	29.16	8030.0	41.09	0.069	2418	10.50	0.049	27.32	37
29-Sep	29.16	5482.5	33.10	0.068	2358	11.32	0.048	31.26	38
10-Oct	29.65	6191.0	38.33	0.076	2274	10.93	0.054	30.83	39
25-Aug	30.87	3930.7	39.66	0.078	2241	10.36	0.054	28.85	40
05-Sep	31.04	5865.2	36.92	0.067	2327	11.26	0.047	29.89	41
21-Sep	31.24	3826.2	36.44	0.061	1622	11.50	0.042	30.69	42
26-Sep	31.34	6248.0	37.72	0.067	2557	11.14	0.046	28.81	43
26-Aug	31.37	3215.4	39.03	0.079	2042	10.38	0.054	29.67	44
27-Sep	31.57	6183.0	38.04	0.074	2392	11.04	0.051	30.45	45
30-Sep	31.58	7302.1	41.39	0.075	2430	11.21	0.052	30.30	46
04-Sep	31.78	7854.9	37.83	0.080	2663	10.95	0.054	31.33	47
06-Oct	32.41	10386.6	42.83	0.060	2956	11.15	0.040	25.68	48
09-Sep	32.57	8035.0	37.62	0.069	2722	10.60	0.047	27.83	49
29-Aug	32.88	5005.0	38.67	0.072	1635	10.30	0.048	29.51	50
10-Sep	32.89	7079.1	35.63	0.071	2733	10.67	0.048	28.81	51
30-Aug	33.04	7883.8	39.39	0.090	2513	10.25	0.060	31.62	52
22-Aug	34.19	8090.0	38.02	0.075	2703	10.22	0.050	28.10	53
17-Aug	34.30	8636.1	37.49	0.072	2939	10.70	0.047	28.40	54
11-Sep	34.35	6035.2	33.93	0.072	2749	10.59	0.047	29.03	55
28-Sep	34.74	5519.0	34.68	0.076	2433	11.24	0.050	32.19	56
16-Oct	34.78	9456.8	41.79	0.068	2783	10.29	0.045	25.69	57
22-Sep	34.95	5495.7	35.90	0.062	2013	11.17	0.040	29.57	58
07-Oct	36.09	8854.5	41.36	0.077	2643	11.02	0.049	30.07	59
03-Sep	36.26	6376.0	38.00	0.084	2596	11.02	0.053	32.18	60
15-Aug	37.10	6312.3	35.77	0.068	2480	10.40	0.043	27.83	61
16-Aug	37.74	9159.0	38.27	0.068	3033	11.00	0.042	27.95	62
01-Sep	38.32	7080.0	39.24	0.073	2418	10.52	0.045	28.60	63
23-Sep	38.76	4809.1	32.35	0.064	2054	11.07	0.039	30.54	64
03-Oct	40.15	6230.3	34.48	0.077	2638	11.02	0.046	31.51	65
20-Sep	40.63	3246.7	30.54	0.062	2513	11.38	0.037	29.87	66

1988 TRP MULTIVARIATE ANALYSIS

TAILS VS DENSITY, pH, FLOW, TONS, HEADS

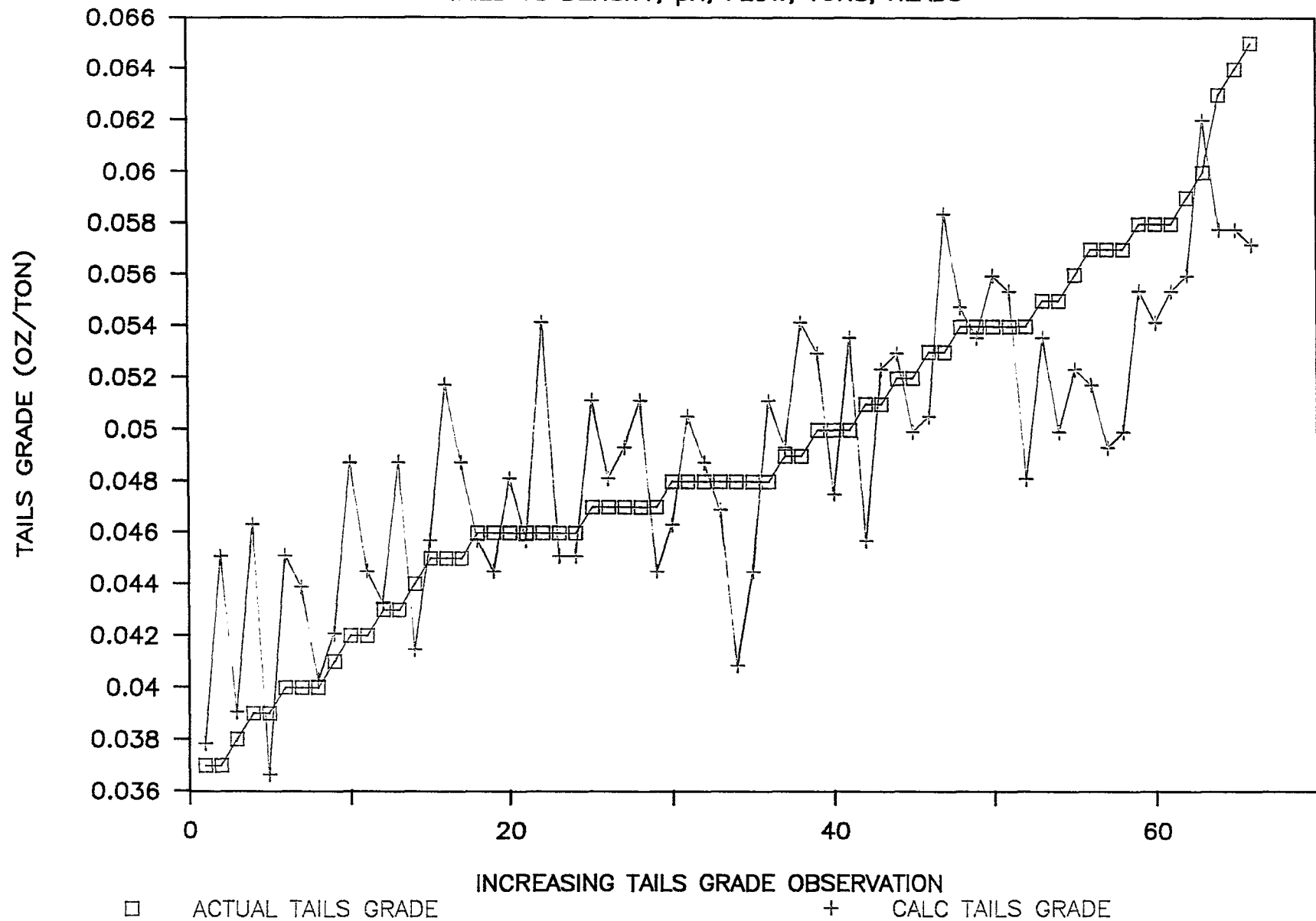


FIG. 2

1988 TRP OPERATING DATA

AUG 15 - OCT 15

JUL 25, AUG 4 DELETED

INDEP VAR (X): DENSITY, pH, FLOW, TONNAGE, HEAD GRADE
 DEP VAR (Y): TAILS GRADE

STD CONCLUSION: VARIABILITY IN TAILS GRADE IS APPROX 67%
 ACCOUNTED FOR BY COMBINATION OF DENSITY, pH,
 FLOW, TONNAGE, AND HEAD GRADE.

Regression Output:

Constant 0.020550
 Std Err of Y Est 0.003975
 R Squared 0.671500
 No. of Observations 66
 Degrees of Freedom 60

X Coefficient(s) -0.00000 0.000214 0.569127 0.000001 -0.00202
 Std Err of Coef. 0.000000 0.000247 0.058892 0.000002 0.001157

Date	Gold Ext	Feed Tons	Feed %Sol	Head Oz	USGPM	pH	Tails Oz	Est Rec	Observation
19-Sep	25.22	5122.0	28.68	0.050	2919	11.16	0.037	0.037	1
20-Sep	40.63	3246.7	30.54	0.062	2513	11.38	0.037	0.043	2
13-Oct	27.73	10192.2	42.81	0.052	3014	9.68	0.038	0.043	3
23-Sep	38.76	4809.1	32.35	0.064	2054	11.07	0.039	0.044	4
15-Oct	19.28	8304.4	38.66	0.048	2772	11.21	0.039	0.037	5
22-Sep	34.95	5495.7	35.90	0.062	2013	11.17	0.040	0.043	6
06-Oct	32.41	10386.6	42.83	0.060	2956	11.15	0.040	0.044	7
14-Oct	26.59	8763.5	38.79	0.054	3039	11.16	0.040	0.041	8
18-Sep	27.16	6691.0	31.41	0.057	2966	10.97	0.041	0.041	9
16-Aug	37.74	9159.0	38.27	0.068	3033	11.00	0.042	0.049	10
21-Sep	31.24	3826.2	36.44	0.061	1622	11.50	0.042	0.042	11
02-Oct	26.95	4124.5	35.62	0.059	2517	11.15	0.043	0.043	12
15-Aug	37.10	6312.3	35.77	0.068	2480	10.40	0.043	0.049	13
12-Oct	21.72	8577.9	39.48	0.056	2881	10.59	0.044	0.043	14
06-Sep	28.93	6536.9	39.88	0.063	2049	10.71	0.045	0.046	15
01-Sep	38.32	7080.0	39.24	0.073	2418	10.52	0.045	0.052	16
16-Oct	34.78	9456.8	41.79	0.068	2783	10.29	0.045	0.050	17
01-Oct	27.54	4730.1	39.48	0.063	1831	11.44	0.046	0.044	18
19-Oct	25.87	1056.4	34.59	0.061	2181	10.25	0.046	0.046	19
26-Sep	31.34	6248.0	37.72	0.067	2557	11.14	0.046	0.048	20
17-Oct	26.45	8314.4	39.16	0.063	2671	10.32	0.046	0.047	21
03-Oct	40.15	6230.3	34.48	0.077	2638	11.02	0.046	0.053	22
05-Oct	25.48	7980.0	44.66	0.062	2449	11.29	0.046	0.045	23
18-Oct	25.81	6634.1	34.97	0.062	2471	10.97	0.046	0.044	24
11-Sep	34.35	6035.2	33.93	0.072	2749	10.59	0.047	0.051	25
05-Sep	31.04	5865.2	36.92	0.067	2327	11.26	0.047	0.047	26
09-Sep	32.57	8035.0	37.62	0.069	2722	10.60	0.047	0.050	27
17-Aug	34.30	8636.1	37.49	0.072	2939	10.70	0.047	0.051	28
11-Oct	22.14	10040.7	40.95	0.061	3038	11.11	0.047	0.045	29
28-Aug	24.35	4303.9	36.36	0.064	1524	10.30	0.048	0.046	30
10-Sep	32.89	7079.1	35.63	0.071	2733	10.67	0.048	0.050	31

29-Sep	29.16	5482.5	33.10	0.068	2358	11.32	0.048	0.047	32
07-Sep	27.46	6205.0	36.83	0.065	2161	10.57	0.048	0.047	33
25-Sep	12.90	6951.0	38.77	0.055	2492	11.03	0.048	0.041	34
17-Sep	20.85	5414.6	33.83	0.061	2487	10.91	0.048	0.044	35
29-Aug	32.88	5005.0	38.67	0.072	1635	10.30	0.048	0.051	36
31-Aug	29.16	8030.0	41.09	0.069	2418	10.50	0.049	0.050	37
07-Oct	36.09	8854.5	41.36	0.077	2643	11.02	0.049	0.054	38
22-Aug	34.19	8090.0	38.02	0.075	2703	10.22	0.050	0.054	39
24-Sep	24.69	6027.3	35.61	0.066	2268	10.99	0.050	0.046	40
28-Sep	34.74	5519.0	34.68	0.076	2433	11.24	0.050	0.052	41
04-Oct	18.83	8871.4	39.59	0.063	2869	11.10	0.051	0.046	42
27-Sep	31.57	6183.0	38.04	0.074	2392	11.04	0.051	0.052	43
30-Sep	31.58	7302.1	41.39	0.075	2430	11.21	0.052	0.052	44
20-Aug	25.60	9285.3	39.80	0.070	3047	10.29	0.052	0.052	45
27-Aug	24.68	4302.3	37.18	0.071	1480	10.31	0.053	0.050	46
03-Sep	36.26	6376.0	38.00	0.084	2596	11.02	0.053	0.058	47
25-Aug	30.87	3930.7	39.66	0.078	2241	10.36	0.054	0.056	48
10-Oct	29.65	6191.0	38.33	0.076	2274	10.93	0.054	0.053	49
04-Sep	31.78	7854.9	37.83	0.080	2663	10.95	0.054	0.055	50
26-Aug	31.37	3215.4	39.03	0.079	2042	10.38	0.054	0.056	51
15-Sep	19.59	5816.7	37.05	0.067	2062	10.94	0.054	0.047	52
14-Sep	27.93	7384.5	37.48	0.076	2514	10.70	0.055	0.053	53
21-Aug	21.30	9642.1	40.22	0.070	3120	10.24	0.055	0.052	54
23-Aug	24.80	8383.0	38.62	0.074	2743	10.02	0.056	0.054	55
08-Oct	22.02	8439.0	40.24	0.073	3284	11.09	0.057	0.052	56
19-Aug	17.12	5528.8	34.44	0.069	2609	9.53	0.057	0.051	57
09-Oct	18.80	10493.0	39.44	0.070	3339	11.10	0.057	0.050	58
16-Sep	27.21	5515.0	35.40	0.079	2332	10.03	0.058	0.056	59
02-Sep	25.20	7678.0	40.36	0.077	2473	10.93	0.058	0.054	60
24-Aug	26.90	8250.0	40.66	0.079	2585	9.81	0.058	0.057	61
18-Aug	25.54	7571.0	37.11	0.080	2847	10.20	0.059	0.057	62
30-Aug	33.04	7883.8	39.39	0.090	2513	10.25	0.060	0.062	63
08-Sep	24.06	6941.0	38.63	0.083	2270	10.47	0.063	0.058	64
13-Sep	22.50	7524.7	34.17	0.083	2887	10.67	0.064	0.057	65
12-Sep	20.20	6393.2	36.76	0.082	2804	10.67	0.065	0.057	66

1988 TRP MULTIVARIATE ANALYSIS

TAILS GRADE VS HEAD GRADE

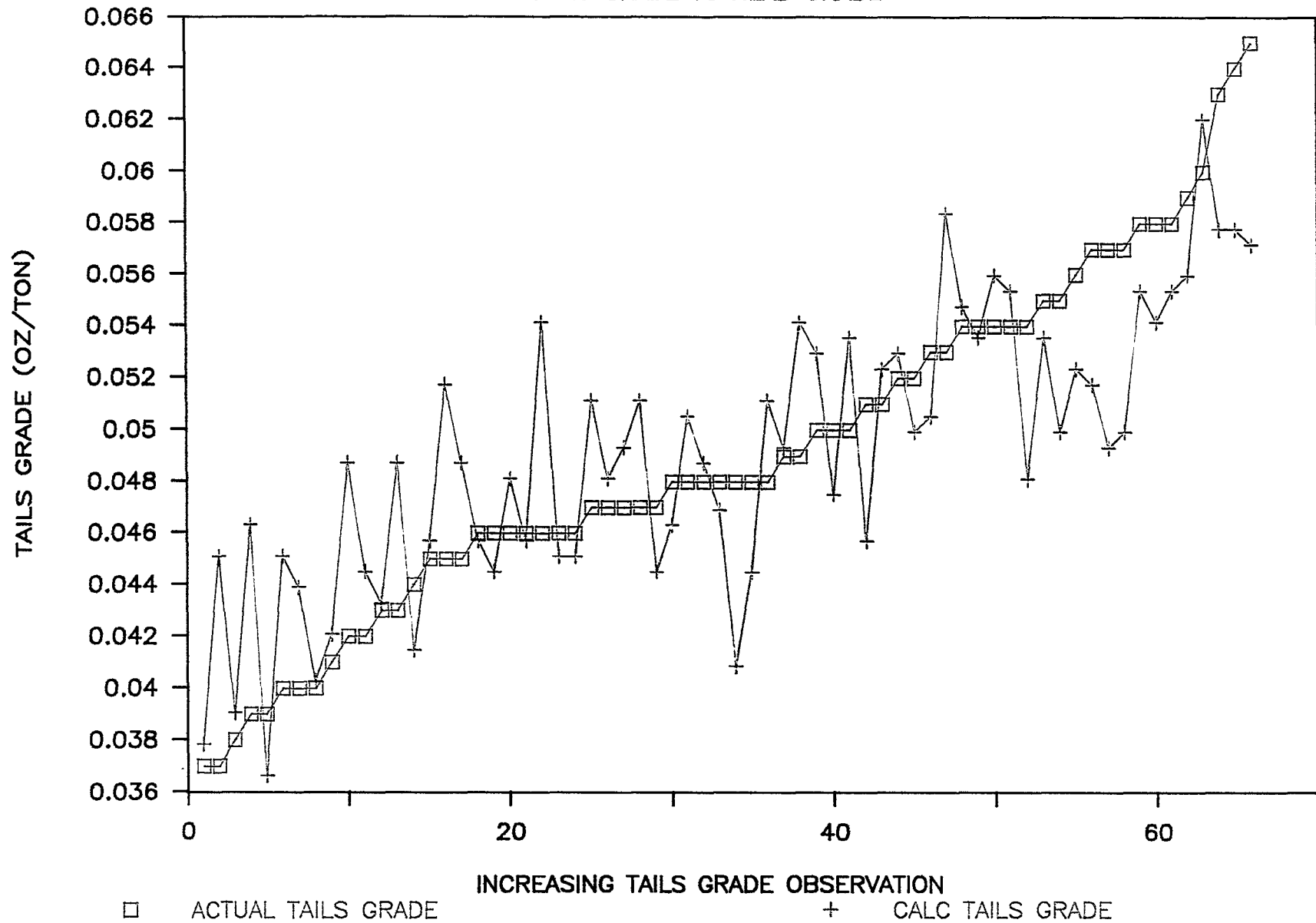


FIG. 3

1988 TRP OPERATING DATA
AUG 15 - OCT 15
JUL 25, AUG 4 DELETED

INDEP VAR (X): HEAD GRADE
DEP VAR (Y): TAILS GRADE

STD CONCLUSION: VARIABILITY IN TAILS GRADE IS APPROX 64%
ACCOUNTED FOR BY VARIATION IN HEAD GRADE

Regression Output:

Constant 0.007605
Std Err of Y Est 0.004025
R Squared 0.640705
No. of Observations 66
Degrees of Freedom 64

X Coefficient(s) 0.603925
Std Err of Coef. 0.056531

Date	Gold Ext	Feed Tons	Feed %Sol	Head Oz	USGPM	pH	Tails Oz Est	Tails Observation
19-Sep	25.22	5122.0	28.68	0.050	2919	11.16	0.037	0.038 1
20-Sep	40.63	3246.7	30.54	0.062	2513	11.38	0.037	0.045 2
13-Oct	27.73	10192.2	42.81	0.052	3014	9.68	0.038	0.039 3
23-Sep	38.76	4809.1	32.35	0.064	2054	11.07	0.039	0.046 4
15-Oct	19.28	8304.4	38.66	0.048	2772	11.21	0.039	0.037 5
22-Sep	34.95	5495.7	35.90	0.062	2013	11.17	0.040	0.045 6
06-Oct	32.41	10386.6	42.83	0.060	2956	11.15	0.040	0.044 7
14-Oct	26.59	8763.5	38.79	0.054	3039	11.16	0.040	0.040 8
18-Sep	27.16	6691.0	31.41	0.057	2966	10.97	0.041	0.042 9
16-Aug	37.74	9159.0	38.27	0.068	3033	11.00	0.042	0.049 10
21-Sep	31.24	3826.2	36.44	0.061	1622	11.50	0.042	0.044 11
02-Oct	26.95	4124.5	35.62	0.059	2517	11.15	0.043	0.043 12
15-Aug	37.10	6312.3	35.77	0.068	2480	10.40	0.043	0.049 13
12-Oct	21.72	8577.9	39.48	0.056	2881	10.59	0.044	0.041 14
06-Sep	28.93	6536.9	39.88	0.063	2049	10.71	0.045	0.046 15
01-Sep	38.32	7080.0	39.24	0.073	2418	10.52	0.045	0.052 16
16-Oct	34.78	9456.8	41.79	0.068	2783	10.29	0.045	0.049 17
01-Oct	27.54	4730.1	39.48	0.063	1831	11.44	0.046	0.046 18
19-Oct	25.87	1056.4	34.59	0.061	2181	10.25	0.046	0.044 19
26-Sep	31.34	6248.0	37.72	0.067	2557	11.14	0.046	0.048 20
17-Oct	26.45	8314.4	39.16	0.063	2671	10.32	0.046	0.046 21
03-Oct	40.15	6230.3	34.48	0.077	2638	11.02	0.046	0.054 22
05-Oct	25.48	7980.0	44.66	0.062	2449	11.29	0.046	0.045 23
18-Oct	25.81	6634.1	34.97	0.062	2471	10.97	0.046	0.045 24
11-Sep	34.35	6035.2	33.93	0.072	2749	10.59	0.047	0.051 25
05-Sep	31.04	5865.2	36.92	0.067	2327	11.26	0.047	0.048 26
09-Sep	32.57	8035.0	37.62	0.069	2722	10.60	0.047	0.049 27
17-Aug	34.30	8636.1	37.49	0.072	2939	10.70	0.047	0.051 28
11-Oct	22.14	10040.7	40.95	0.061	3038	11.11	0.047	0.044 29
28-Aug	24.35	4303.9	36.36	0.064	1524	10.30	0.048	0.046 30
10-Sep	32.89	7079.1	35.63	0.071	2733	10.67	0.048	0.050 31
29-Sep	29.16	5482.5	33.10	0.068	2358	11.32	0.048	0.049 32

07-Sep	27.46	6205.0	36.83	0.065	2161	10.57	0.048	0.047	33
25-Sep	12.90	6951.0	38.77	0.055	2492	11.03	0.048	0.041	34
17-Sep	20.85	5414.6	33.83	0.061	2487	10.91	0.048	0.044	35
29-Aug	32.88	5005.0	38.67	0.072	1635	10.30	0.048	0.051	36
31-Aug	29.16	8030.0	41.09	0.069	2418	10.50	0.049	0.049	37
07-Oct	36.09	8854.5	41.36	0.077	2643	11.02	0.049	0.054	38
22-Aug	34.19	8090.0	38.02	0.075	2703	10.22	0.050	0.053	39
24-Sep	24.69	6027.3	35.61	0.066	2268	10.99	0.050	0.047	40
28-Sep	34.74	5519.0	34.68	0.076	2433	11.24	0.050	0.054	41
04-Oct	18.83	8871.4	39.59	0.063	2869	11.10	0.051	0.046	42
27-Sep	31.57	6183.0	38.04	0.074	2392	11.04	0.051	0.052	43
30-Sep	31.58	7302.1	41.39	0.075	2430	11.21	0.052	0.053	44
20-Aug	25.60	9285.3	39.80	0.070	3047	10.29	0.052	0.050	45
27-Aug	24.68	4302.3	37.18	0.071	1480	10.31	0.053	0.050	46
03-Sep	36.26	6376.0	38.00	0.084	2596	11.02	0.053	0.058	47
25-Aug	30.87	3930.7	39.66	0.078	2241	10.36	0.054	0.055	48
10-Oct	29.65	6191.0	38.33	0.076	2274	10.93	0.054	0.054	49
04-Sep	31.78	7854.9	37.83	0.080	2663	10.95	0.054	0.056	50
26-Aug	31.37	3215.4	39.03	0.079	2042	10.38	0.054	0.055	51
15-Sep	19.59	5816.7	37.05	0.067	2062	10.94	0.054	0.048	52
14-Sep	27.93	7384.5	37.48	0.076	2514	10.70	0.055	0.054	53
21-Aug	21.30	9642.1	40.22	0.070	3120	10.24	0.055	0.050	54
23-Aug	24.80	8383.0	38.62	0.074	2743	10.02	0.056	0.052	55
08-Oct	22.02	8439.0	40.24	0.073	3284	11.09	0.057	0.052	56
19-Aug	17.12	5528.8	34.44	0.069	2609	9.53	0.057	0.049	57
09-Oct	18.80	10493.0	39.44	0.070	3339	11.10	0.057	0.050	58
16-Sep	27.21	5515.0	35.40	0.079	2332	10.03	0.058	0.055	59
02-Sep	25.20	7678.0	40.36	0.077	2473	10.93	0.058	0.054	60
24-Aug	26.90	8250.0	40.66	0.079	2585	9.81	0.058	0.055	61
18-Aug	25.54	7571.0	37.11	0.080	2847	10.20	0.059	0.056	62
30-Aug	33.04	7883.8	39.39	0.090	2513	10.25	0.060	0.062	63
08-Sep	24.06	6941.0	38.63	0.083	2270	10.47	0.063	0.058	64
13-Sep	22.50	7524.7	34.17	0.083	2887	10.67	0.064	0.058	65
12-Sep	20.20	6393.2	36.76	0.082	2804	10.67	0.065	0.057	66

1988 TRP MULTIVARIATE ANALYSIS

TAILS GRADE VS DENSITY, pH, FLOW, TONS

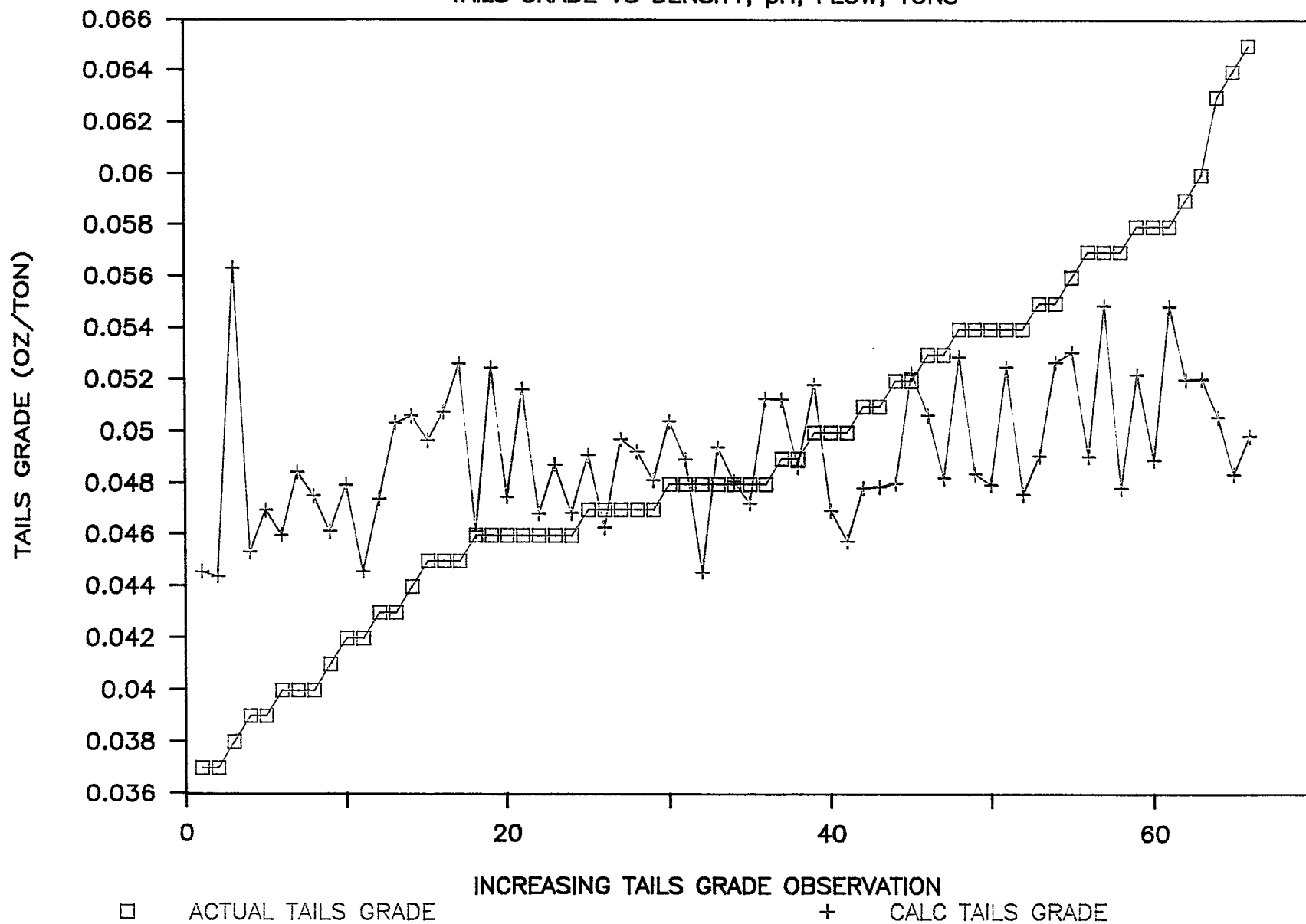


FIG. 4

1988 TRP OPERATING DATA
AUG 15 - OCT 15
JUL 25, AUG 4 DELETED

INDEP VAR (X): DENSITY, pH, FLOW, TONNAGE
DEP VAR (Y): TAILS GRADE

STD CONCLUSION: VARIABILITY IN TAILS GRADE IS NOT
EXPLAINED BY VARIATION IN
DENSITY, pH, FLOW, AND TONNAGE.

Regression Output:

Constant 0.087850
Std Err of Y Est 0.006304
R Squared 0.160183
No. of Observations 66
Degrees of Freedom 61

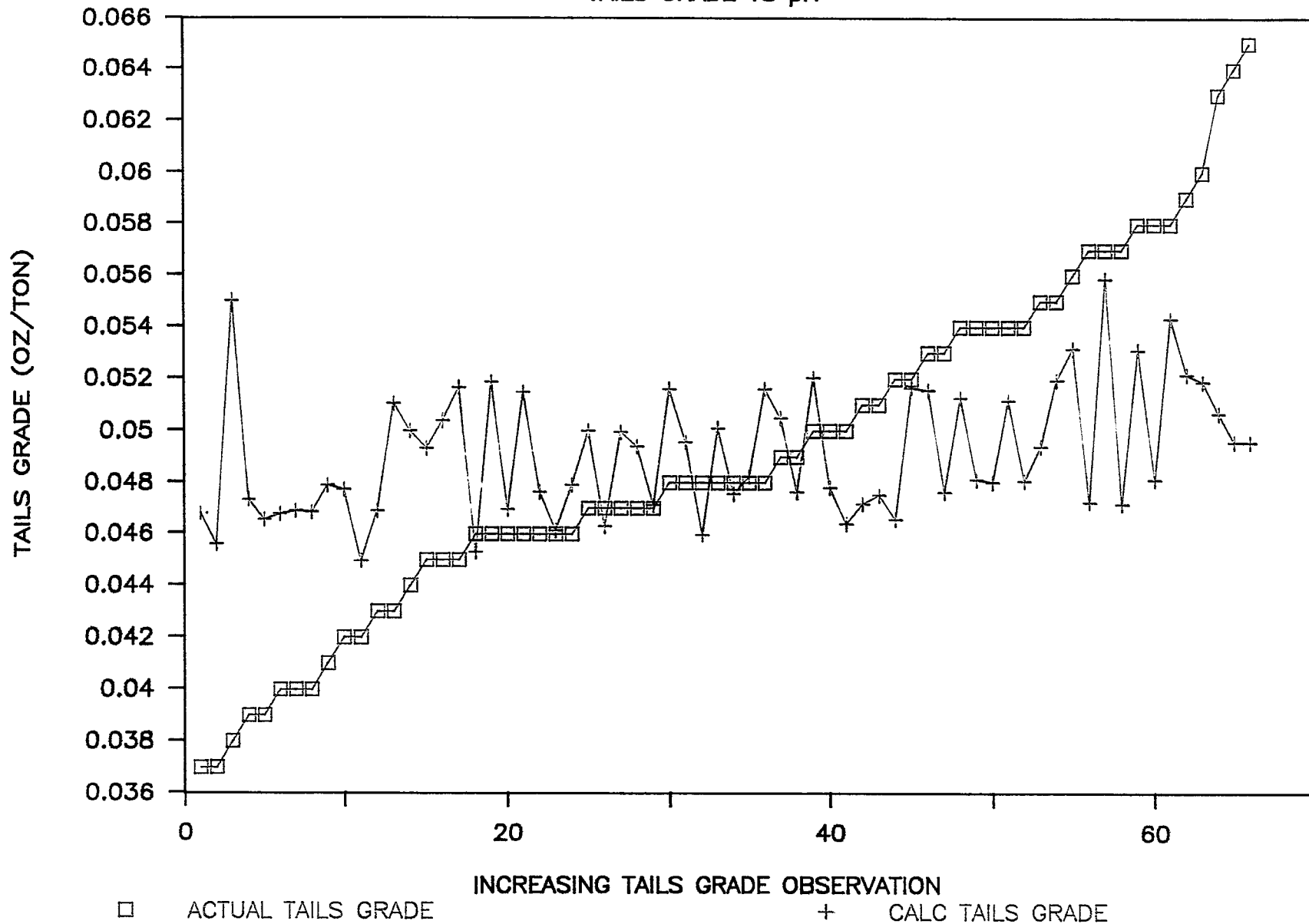
X Coefficient(s) -0.00000 0.000433 0.000001 -0.00522 2.720645
Std Err of Coef. 0.000000 0.000390 0.000003 0.001759 1.691115

Date	Gold Ext	Head Oz	Feed Tons	Feed %Sol	USGPM	pH	Tails Oz	Est Rec	Observation
19-Sep	25.22	0.050	5122.0	28.68	2919	11.16	0.037	0.04	1
20-Sep	40.63	0.062	3246.7	30.54	2513	11.38	0.037	0.04	2
13-Oct	27.73	0.052	10192.2	42.81	3014	9.68	0.038	0.06	3
23-Sep	38.76	0.064	4809.1	32.35	2054	11.07	0.039	0.05	4
15-Oct	19.28	0.048	8304.4	38.66	2772	11.21	0.039	0.05	5
22-Sep	34.95	0.062	5495.7	35.90	2013	11.17	0.040	0.05	6
06-Oct	32.41	0.060	10386.6	42.83	2956	11.15	0.040	0.05	7
14-Oct	26.59	0.054	8763.5	38.79	3039	11.16	0.040	0.05	8
18-Sep	27.16	0.057	6691.0	31.41	2966	10.97	0.041	0.05	9
16-Aug	37.74	0.068	9159.0	38.27	3033	11.00	0.042	0.05	10
21-Sep	31.24	0.061	3826.2	36.44	1622	11.50	0.042	0.04	11
02-Oct	26.95	0.059	4124.5	35.62	2517	11.15	0.043	0.05	12
15-Aug	37.10	0.068	6312.3	35.77	2480	10.40	0.043	0.05	13
12-Oct	21.72	0.056	8577.9	39.48	2881	10.59	0.044	0.05	14
06-Sep	28.93	0.063	6536.9	39.88	2049	10.71	0.045	0.05	15
01-Sep	38.32	0.073	7080.0	39.24	2418	10.52	0.045	0.05	16
16-Oct	34.78	0.068	9456.8	41.79	2783	10.29	0.045	0.05	17
01-Oct	27.54	0.063	4730.1	39.48	1831	11.44	0.046	0.05	18
19-Oct	25.87	0.061	1056.4	34.59	2181	10.25	0.046	0.05	19
26-Sep	31.34	0.067	6248.0	37.72	2557	11.14	0.046	0.05	20
17-Oct	26.45	0.063	8314.4	39.16	2671	10.32	0.046	0.05	21
03-Oct	40.15	0.077	6230.3	34.48	2638	11.02	0.046	0.05	22
05-Oct	25.48	0.062	7980.0	44.66	2449	11.29	0.046	0.05	23
18-Oct	25.81	0.062	6634.1	34.97	2471	10.97	0.046	0.05	24
11-Sep	34.35	0.072	6035.2	33.93	2749	10.59	0.047	0.05	25
05-Sep	31.04	0.067	5865.2	36.92	2327	11.26	0.047	0.05	26
09-Sep	32.57	0.069	8035.0	37.62	2722	10.60	0.047	0.05	27
17-Aug	34.30	0.072	8636.1	37.49	2939	10.70	0.047	0.05	28
11-Oct	22.14	0.061	10040.7	40.95	3038	11.11	0.047	0.05	29
28-Aug	24.35	0.064	4303.9	36.36	1524	10.30	0.048	0.05	30

10-Sep	32.89	0.071	7079.1	35.63	2733	10.67	0.048	0.05	31
29-Sep	29.16	0.068	5482.5	33.10	2358	11.32	0.048	0.04	32
07-Sep	27.46	0.065	6205.0	36.83	2161	10.57	0.048	0.05	33
25-Sep	12.90	0.055	6951.0	38.77	2492	11.03	0.048	0.05	34
17-Sep	20.85	0.061	5414.6	33.83	2487	10.91	0.048	0.05	35
29-Aug	32.88	0.072	5005.0	38.67	1635	10.30	0.048	0.05	36
31-Aug	29.16	0.069	8030.0	41.09	2418	10.50	0.049	0.05	37
07-Oct	36.09	0.077	8854.5	41.36	2643	11.02	0.049	0.05	38
22-Aug	34.19	0.075	8090.0	38.02	2703	10.22	0.050	0.05	39
24-Sep	24.69	0.066	6027.3	35.61	2268	10.99	0.050	0.05	40
28-Sep	34.74	0.076	5519.0	34.68	2433	11.24	0.050	0.05	41
04-Oct	18.83	0.063	8871.4	39.59	2869	11.10	0.051	0.05	42
27-Sep	31.57	0.074	6183.0	38.04	2392	11.04	0.051	0.05	43
30-Sep	31.58	0.075	7302.1	41.39	2430	11.21	0.052	0.05	44
20-Aug	25.60	0.070	9285.3	39.80	3047	10.29	0.052	0.05	45
27-Aug	24.68	0.071	4302.3	37.18	1480	10.31	0.053	0.05	46
03-Sep	36.26	0.084	6376.0	38.00	2596	11.02	0.053	0.05	47
25-Aug	30.87	0.078	3930.7	39.66	2241	10.36	0.054	0.05	48
10-Oct	29.65	0.076	6191.0	38.33	2274	10.93	0.054	0.05	49
04-Sep	31.78	0.080	7854.9	37.83	2663	10.95	0.054	0.05	50
26-Aug	31.37	0.079	3215.4	39.03	2042	10.38	0.054	0.05	51
15-Sep	19.59	0.067	5816.7	37.05	2062	10.94	0.054	0.05	52
14-Sep	27.93	0.076	7384.5	37.48	2514	10.70	0.055	0.05	53
21-Aug	21.30	0.070	9642.1	40.22	3120	10.24	0.055	0.05	54
23-Aug	24.80	0.074	8383.0	38.62	2743	10.02	0.056	0.05	55
08-Oct	22.02	0.073	8439.0	40.24	3284	11.09	0.057	0.05	56
19-Aug	17.12	0.069	5528.8	34.44	2609	9.53	0.057	0.05	57
09-Oct	18.80	0.070	10493.0	39.44	3339	11.10	0.057	0.05	58
16-Sep	27.21	0.079	5515.0	35.40	2332	10.03	0.058	0.05	59
02-Sep	25.20	0.077	7678.0	40.36	2473	10.93	0.058	0.05	60
24-Aug	26.90	0.079	8250.0	40.66	2585	9.81	0.058	0.05	61
18-Aug	25.54	0.080	7571.0	37.11	2847	10.20	0.059	0.05	62
30-Aug	33.04	0.090	7883.8	39.39	2513	10.25	0.060	0.05	63
08-Sep	24.06	0.083	6941.0	38.63	2270	10.47	0.063	0.05	64
13-Sep	22.50	0.083	7524.7	34.17	2887	10.67	0.064	0.05	65
12-Sep	20.20	0.082	6393.2	36.76	2804	10.67	0.065	0.05	66

1988 TRP MULTIVARIATE ANALYSIS

TAILS GRADE VS pH



1988 TRP OPERATING DATA
AUG 15 - OCT 15
JUL 25, AUG 4 DELETED

INDEP VAR (X): pH
DEP VAR (Y): TAILS GRADE

STD CONCLUSION: VARIABILITY IN TAILS GRADE IS NOT
EXPLAINED BY VARIATION IN pH.

Regression Output:
Constant 0.108590
Std Err of Y Est 0.006230
R Squared 0.139547
No. of Observations 66
Degrees of Freedom 64

X Coefficient(s) -0.00553
Std Err of Coef. 0.001716

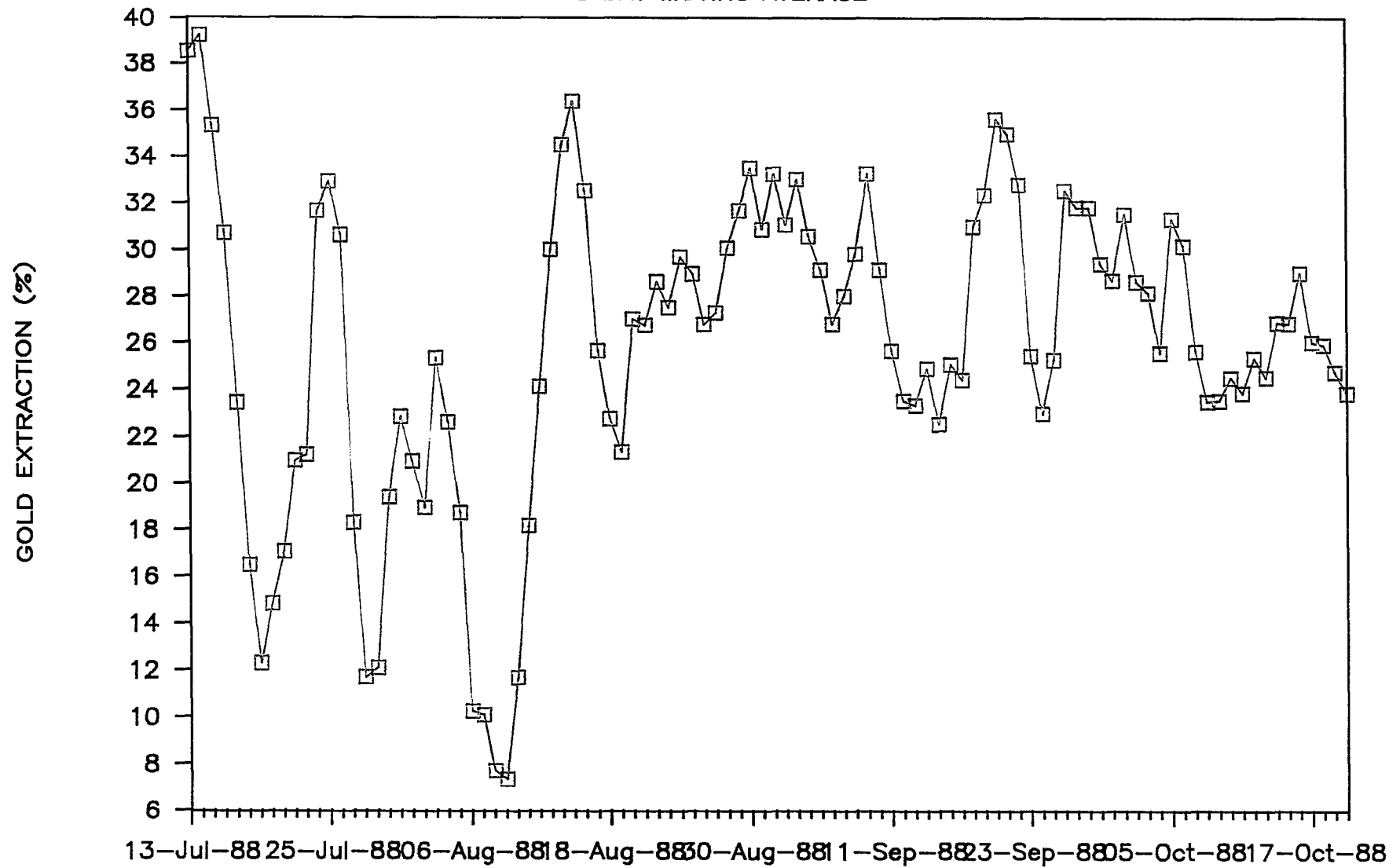
Date	Gold Ext	Head Oz	Feed Tons	Feed %Sol	USGPM	pH	Tails Oz	Est Tails	Observation
19-Sep	25.22	0.050	5122.0	28.68	2919	11.16	0.037	0.05	1
20-Sep	40.63	0.062	3246.7	30.54	2513	11.38	0.037	0.05	2
13-Oct	27.73	0.052	10192.2	42.81	3014	9.68	0.038	0.06	3
23-Sep	38.76	0.064	4809.1	32.35	2054	11.07	0.039	0.05	4
15-Oct	19.28	0.048	8304.4	38.66	2772	11.21	0.039	0.05	5
22-Sep	34.95	0.062	5495.7	35.90	2013	11.17	0.040	0.05	6
06-Oct	32.41	0.060	10386.6	42.83	2956	11.15	0.040	0.05	7
14-Oct	26.59	0.054	8763.5	38.79	3039	11.16	0.040	0.05	8
18-Sep	27.16	0.057	6691.0	31.41	2966	10.97	0.041	0.05	9
16-Aug	37.74	0.068	9159.0	38.27	3033	11.00	0.042	0.05	10
21-Sep	31.24	0.061	3826.2	36.44	1622	11.50	0.042	0.04	11
02-Oct	26.95	0.059	4124.5	35.62	2517	11.15	0.043	0.05	12
15-Aug	37.10	0.068	6312.3	35.77	2480	10.40	0.043	0.05	13
12-Oct	21.72	0.056	8577.9	39.48	2881	10.59	0.044	0.05	14
06-Sep	28.93	0.063	6536.9	39.88	2049	10.71	0.045	0.05	15
01-Sep	38.32	0.073	7080.0	39.24	2418	10.52	0.045	0.05	16
16-Oct	34.78	0.068	9456.8	41.79	2783	10.29	0.045	0.05	17
01-Oct	27.54	0.063	4730.1	39.48	1831	11.44	0.046	0.05	18
19-Oct	25.87	0.061	1056.4	34.59	2181	10.25	0.046	0.05	19
26-Sep	31.34	0.067	6248.0	37.72	2557	11.14	0.046	0.05	20
17-Oct	26.45	0.063	8314.4	39.16	2671	10.32	0.046	0.05	21
03-Oct	40.15	0.077	6230.3	34.48	2638	11.02	0.046	0.05	22
05-Oct	25.48	0.062	7980.0	44.66	2449	11.29	0.046	0.05	23
18-Oct	25.81	0.062	6634.1	34.97	2471	10.97	0.046	0.05	24
11-Sep	34.35	0.072	6035.2	33.93	2749	10.59	0.047	0.05	25
05-Sep	31.04	0.067	5865.2	36.92	2327	11.26	0.047	0.05	26
09-Sep	32.57	0.069	8035.0	37.62	2722	10.60	0.047	0.05	27
17-Aug	34.30	0.072	8636.1	37.49	2939	10.70	0.047	0.05	28
11-Oct	22.14	0.061	10040.7	40.95	3038	11.11	0.047	0.05	29
28-Aug	24.35	0.064	4303.9	36.36	1524	10.30	0.048	0.05	30
10-Sep	32.89	0.071	7079.1	35.63	2733	10.67	0.048	0.05	31

29-Sep	29.16	0.068	5482.5	33.10	2358	11.32	0.048	0.05	32
07-Sep	27.46	0.065	6205.0	36.83	2161	10.57	0.048	0.05	33
25-Sep	12.90	0.055	6951.0	38.77	2492	11.03	0.048	0.05	34
17-Sep	20.85	0.061	5414.6	33.83	2487	10.91	0.048	0.05	35
29-Aug	32.88	0.072	5005.0	38.67	1635	10.30	0.048	0.05	36
31-Aug	29.16	0.069	8030.0	41.09	2418	10.50	0.049	0.05	37
07-Oct	36.09	0.077	8854.5	41.36	2643	11.02	0.049	0.05	38
22-Aug	34.19	0.075	8090.0	38.02	2703	10.22	0.050	0.05	39
24-Sep	24.69	0.066	6027.3	35.61	2268	10.99	0.050	0.05	40
28-Sep	34.74	0.076	5519.0	34.68	2433	11.24	0.050	0.05	41
04-Oct	18.83	0.063	8871.4	39.59	2869	11.10	0.051	0.05	42
27-Sep	31.57	0.074	6183.0	38.04	2392	11.04	0.051	0.05	43
30-Sep	31.58	0.075	7302.1	41.39	2430	11.21	0.052	0.05	44
20-Aug	25.60	0.070	9285.3	39.80	3047	10.29	0.052	0.05	45
27-Aug	24.68	0.071	4302.3	37.18	1480	10.31	0.053	0.05	46
03-Sep	36.26	0.084	6376.0	38.00	2596	11.02	0.053	0.05	47
25-Aug	30.87	0.078	3930.7	39.66	2241	10.36	0.054	0.05	48
10-Oct	29.65	0.076	6191.0	38.33	2274	10.93	0.054	0.05	49
04-Sep	31.78	0.080	7854.9	37.83	2663	10.95	0.054	0.05	50
26-Aug	31.37	0.079	3215.4	39.03	2042	10.38	0.054	0.05	51
15-Sep	19.59	0.067	5816.7	37.05	2062	10.94	0.054	0.05	52
14-Sep	27.93	0.076	7384.5	37.48	2514	10.70	0.055	0.05	53
21-Aug	21.30	0.070	9642.1	40.22	3120	10.24	0.055	0.05	54
23-Aug	24.80	0.074	8383.0	38.62	2743	10.02	0.056	0.05	55
08-Oct	22.02	0.073	8439.0	40.24	3284	11.09	0.057	0.05	56
19-Aug	17.12	0.069	5528.8	34.44	2609	9.53	0.057	0.06	57
09-Oct	18.80	0.070	10493.0	39.44	3339	11.10	0.057	0.05	58
16-Sep	27.21	0.079	5515.0	35.40	2332	10.03	0.058	0.05	59
02-Sep	25.20	0.077	7678.0	40.36	2473	10.93	0.058	0.05	60
24-Aug	26.90	0.079	8250.0	40.66	2585	9.81	0.058	0.05	61
18-Aug	25.54	0.080	7571.0	37.11	2847	10.20	0.059	0.05	62
30-Aug	33.04	0.090	7883.8	39.39	2513	10.25	0.060	0.05	63
08-Sep	24.06	0.083	6941.0	38.63	2270	10.47	0.063	0.05	64
13-Sep	22.50	0.083	7524.7	34.17	2887	10.67	0.064	0.05	65
12-Sep	20.20	0.082	6393.2	36.76	2804	10.67	0.065	0.05	66

END
Jim's Memo

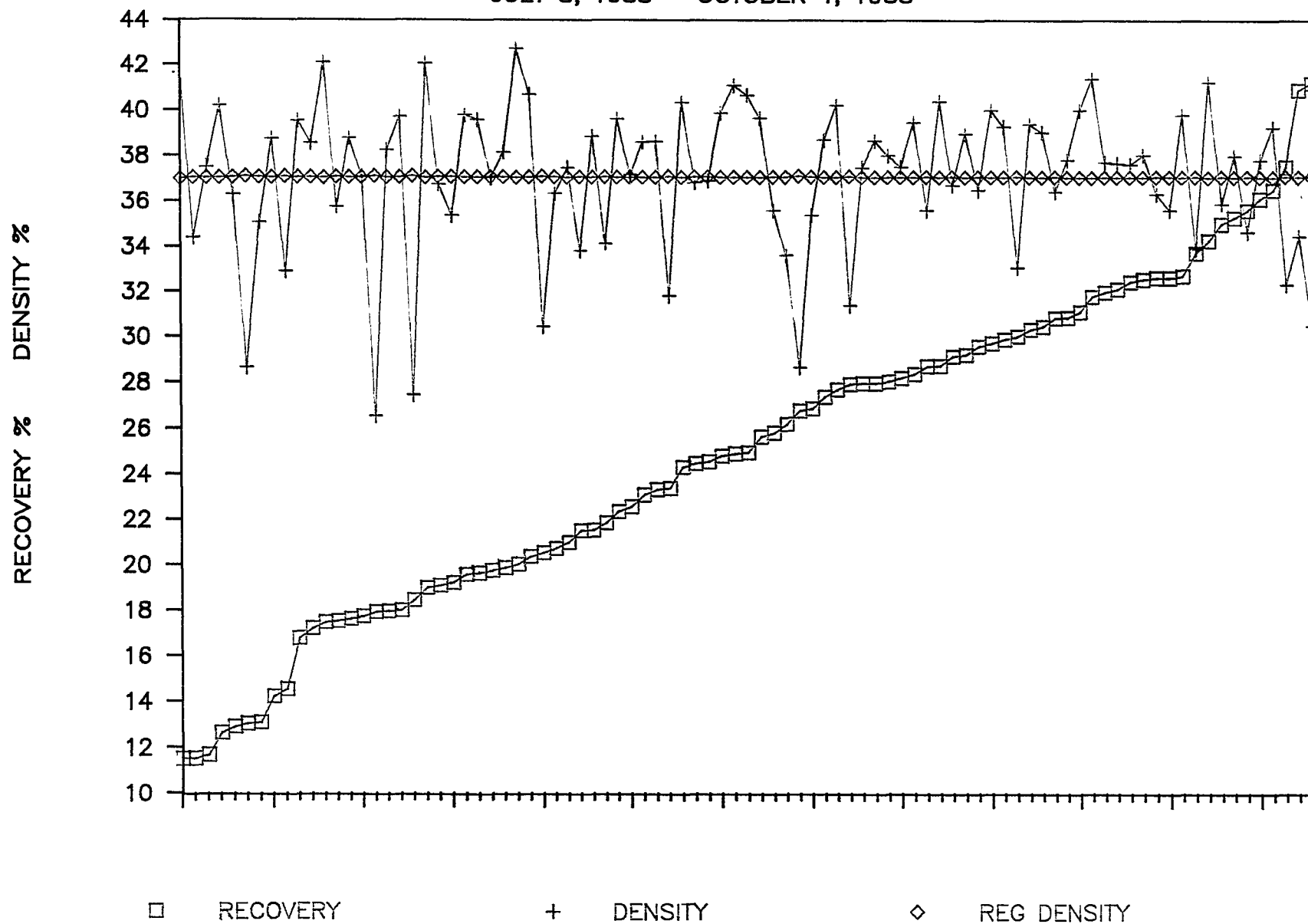
TRP GOLD EXTRACTION

3 DAY MOVING AVERAGE



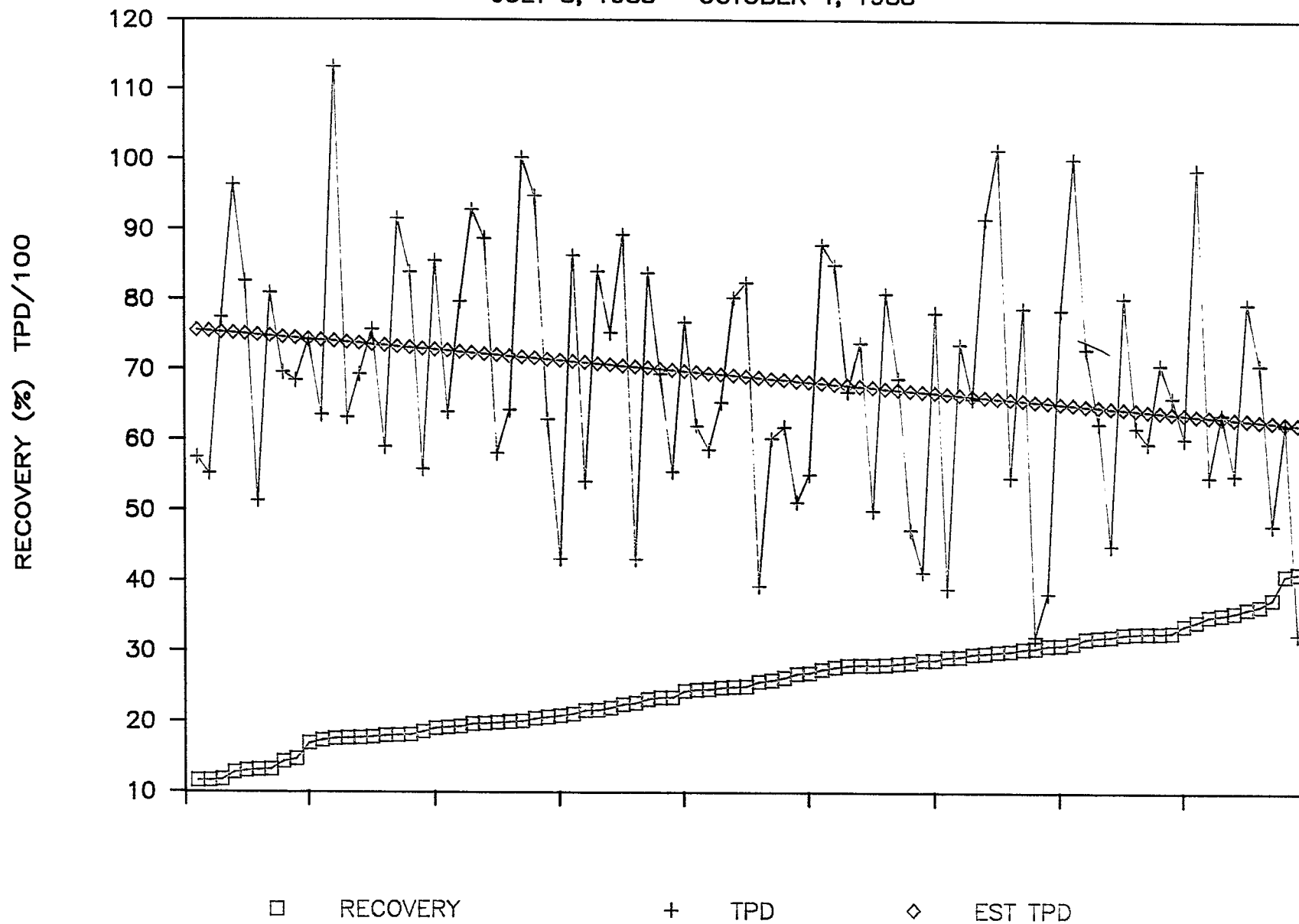
TRP DENSITY/RECOVERY REGRESSION

JULY 8, 1988 - OCTOBER 4, 1988



TRP TONNAGE/RECOVERY REGRESSION

JULY 8, 1988 - OCTOBER 4, 1988



TRP TONNAGE/RECOVERY REGRESSION

CONCLUSION: RECOVERY INCREASES WITH DECREASED TONNAGE

DATE	HEADS	TAILS	RECOVERY	TONS/DAY	DENSITY	ORDER	REG TONS	TPD/100	REG/100
July 28	0.058	0.051	11.52	5760.9	41.70	1	7558.87	57.6	75.6
AUG 19	0.072	0.064	11.52	5528.8	34.44	2	7543.81	55.3	75.4
Aug 9	0.065	0.057	11.68	7743.1	37.53	3	7528.75	77.4	75.3
Aug 21	0.072	0.063	12.64	9642.1	40.22	4	7513.69	96.4	75.1
AUG 12	0.063	0.055	12.90	8261.5	36.33	5	7498.63	82.6	75.0
Aug 6	0.091	0.079	13.03	5132.2	28.68	6	7483.57	51.3	74.8
Aug 11	0.069	0.060	13.10	8087.1	35.10	7	7468.51	80.9	74.7
Sept 25	0.057	0.049	14.22	6951.0	38.77	8	7453.45	69.5	74.5
Aug 10	0.066	0.056	14.55	6842.0	32.93	9	7438.39	68.4	74.4
July 10	0.075	0.062	16.78	7412.7	39.54	10	7423.33	74.1	74.2
JUL 29	0.054	0.045	17.21	6353.7	38.56	11	7408.27	63.5	74.1
July 18	0.066	0.054	17.47	11313.8	42.10	12	7393.21	113.1	73.9
Aug 15	0.071	0.058	17.53	6312.3	35.77	13	7378.15	63.1	73.8
JUL 22	0.059	0.049	17.63	6925.1	38.78	14	7363.09	69.3	73.6
Aug 18	0.082	0.068	17.74	7571.0	37.11	15	7348.03	75.7	73.5
Aug 8	0.080	0.066	17.93	5901.0	26.57	16	7332.97	59.0	73.3
Aug 16	0.070	0.058	17.96	9159.0	38.27	17	7317.91	91.6	73.2
July 12	0.059	0.049	18.01	8393.1	39.72	18	7302.85	83.9	73.0
Aug 7	0.095	0.078	18.45	5587.1	27.47	19	7287.79	55.9	72.9
July 21	0.066	0.053	18.99	8558.9	42.07	20	7272.73	85.6	72.7
Sept 12	0.084	0.068	19.09	6393.2	36.76	21	7257.67	63.9	72.6
Aug 13	0.064	0.052	19.22	7971.2	35.38	22	7242.61	79.7	72.4
Aug 20	0.072	0.058	19.59	9285.3	39.80	23	7227.55	92.9	72.3
Oct 4	0.066	0.053	19.64	8871.4	39.59	24	7212.49	88.7	72.1
Sept 15	0.070	0.056	19.77	5816.7	37.05	25	7197.43	58.2	72.0
July 11	0.077	0.061	19.88	6427.5	38.15	26	7182.37	64.3	71.8
July 19	0.060	0.048	20.03	10025.8	42.72	27	7167.31	100.3	71.7
JUL 8	0.075	0.060	20.38	9482.0	40.69	28	7152.25	94.8	71.5
AUG 5	0.103	0.082	20.54	6288.9	30.47	29	7137.20	62.9	71.4
Aug 28	0.067	0.053	20.74	4303.9	36.36	30	7122.14	43.0	71.2
Aug 17	0.074	0.058	21.01	8636.1	37.49	31	7107.08	86.4	71.1
Sept 17	0.064	0.050	21.52	5414.6	33.83	32	7092.02	54.1	70.9
Aug 2	0.066	0.052	21.53	8407.5	38.87	33	7076.96	84.1	70.8
Sept 13	0.086	0.067	21.86	7524.7	34.17	34	7061.90	75.2	70.6
Aug 1	0.061	0.047	22.36	8929.0	39.63	35	7046.84	89.3	70.5
Aug 27	0.074	0.057	22.56	4302.3	37.18	36	7031.78	43.0	70.3
Aug 23	0.077	0.059	23.09	8383.0	38.62	37	7016.72	83.8	70.2
Sept 8	0.086	0.066	23.32	6941.0	38.63	38	7001.66	69.4	70.0
Aug 4	0.091	0.070	23.37	5555.9	31.83	39	6986.60	55.6	69.9
SEP 2	0.080	0.061	24.30	7678.0	40.36	40	6971.54	76.8	69.7
Sept 7	0.069	0.052	24.47	6205.0	36.83	41	6956.48	62.1	69.6
Sept 5	0.070	0.053	24.55	5865.2	36.92	42	6941.42	58.7	69.4
Sept 6	0.065	0.049	24.80	6536.9	39.88	43	6926.36	65.4	69.3
Aug 31	0.071	0.054	24.89	8030.0	41.09	44	6911.30	80.3	69.1
Aug 24	0.082	0.061	24.96	8250.0	40.66	45	6896.24	82.5	69.0
Aug 25	0.080	0.060	25.64	3930.7	39.66	46	6881.18	39.3	68.8
Sept 24	0.069	0.051	25.82	6027.3	35.61	47	6866.12	60.3	68.7
Aug 3	0.065	0.048	26.20	6190.2	33.65	48	6851.06	61.9	68.5
Sept 19	0.053	0.039	26.77	5122.0	28.68	49	6836.00	51.2	68.4

Sept 25	0.057	0.049	14.22	6951.0	38.77	55	0.071	0.049
Sept 26	0.070	0.047	31.98	6248.0	37.72	56	0.071	0.049
Sept 27	0.077	0.052	32.55	6183.0	38.04	57	0.071	0.049
Sept 28	0.079	0.051	35.59	5519.0	34.68	58	0.071	0.049
Sept 29	0.071	0.050	30.03	5482.5	33.10	59	0.070	0.048
Sept 30	0.078	0.053	31.79	7302.1	41.39	60	0.070	0.048
Oct 1	0.066	0.047	28.38	4730.1	39.48	61	0.070	0.048
Oct 2	0.061	0.044	28.72	4124.5	35.62	62	0.070	0.048
Oct 3	0.080	0.047	40.88	6230.3	34.48	63	0.070	0.047
Oct 4	0.066	0.053	19.64	8871.4	39.59	64	0.070	0.047

HEAD GRADE REGRESSION

Regression Output:

Constant	0.077351
Std Err of Y Est	0.009352
R Squared	0.051890
No. of Observations	64
Degrees of Freedom	62

X Coefficient(s)	-0.00011
Std Err of Coef.	0.000063

TAILS GRADE REGRESSION

Regression Output:

Constant	0.063647
Std Err of Y Est	0.007444
R Squared	0.300254
No. of Observations	64
Degrees of Freedom	62

X Coefficient(s)	-0.00025
Std Err of Coef.	0.000050

DATE	HEADS	TAILS	REC	TONS	DENS		REG HEAD	REG TAIL
Aug 1	0.061	0.047	22.36	8929.0	39.63	1	0.077	0.063
Aug 2	0.066	0.052	21.53	8407.5	38.87	2	0.077	0.063
Aug 3	0.065	0.048	26.20	6190.2	33.65	3	0.077	0.063
Aug 5	0.103	0.082	20.54	6288.9	30.47	4	0.077	0.063
Aug 6	0.091	0.079	13.03	5132.2	28.68	5	0.077	0.062
Aug 7	0.095	0.078	18.45	5587.1	27.47	6	0.077	0.062
Aug 8	0.080	0.066	17.93	5901.0	26.57	7	0.077	0.062
Aug 9	0.065	0.057	11.68	7743.1	37.53	8	0.076	0.062
Aug 10	0.066	0.056	14.55	6842.0	32.93	9	0.076	0.061
Aug 11	0.069	0.060	13.10	8087.1	35.10	10	0.076	0.061
Aug 12	0.063	0.055	12.90	8261.5	36.33	11	0.076	0.061
Aug 13	0.064	0.052	19.22	7971.2	35.38	12	0.076	0.061
Aug 14	0.082	0.058	29.59	6599.6	36.51	13	0.076	0.060
Aug 15	0.071	0.058	17.53	6312.3	35.77	14	0.076	0.060
Aug 16	0.070	0.058	17.96	9159.0	38.27	15	0.076	0.060
Aug 17	0.074	0.058	21.01	8636.1	37.49	16	0.075	0.059
Aug 18	0.082	0.068	17.74	7571.0	37.11	17	0.075	0.059
Aug 19	0.072	0.064	11.52	5528.8	34.44	18	0.075	0.059
Aug 20	0.072	0.058	19.59	9285.3	39.80	19	0.075	0.059
Aug 21	0.072	0.063	12.64	9642.1	40.22	20	0.075	0.058
Aug 22	0.078	0.056	28.05	8090.0	38.02	21	0.075	0.058
Aug 23	0.077	0.059	23.09	8383.0	38.62	22	0.075	0.058
Aug 24	0.082	0.061	24.96	8250.0	40.66	23	0.075	0.058
Aug 25	0.080	0.060	25.64	3930.7	39.66	24	0.075	0.057
Aug 26	0.081	0.057	30.48	3215.4	39.03	25	0.074	0.057
Aug 27	0.074	0.057	22.56	4302.3	37.18	26	0.074	0.057
Aug 28	0.067	0.053	20.74	4303.9	36.36	27	0.074	0.057
Aug 29	0.074	0.054	27.98	5005.0	38.67	28	0.074	0.056
Aug 30	0.092	0.064	30.35	7883.8	39.39	29	0.074	0.056
Aug 31	0.071	0.054	24.89	8030.0	41.09	30	0.074	0.056
Sept 1	0.076	0.048	36.50	7080.0	39.24	31	0.074	0.056
Sept 2	0.080	0.061	24.30	7678.0	40.36	32	0.074	0.055
Sept 3	0.087	0.056	35.27	6376.0	38.00	33	0.074	0.055
Sept 4	0.083	0.057	30.88	7854.9	37.83	34	0.073	0.055
Sept 5	0.070	0.053	24.55	5865.2	36.92	35	0.073	0.055
Sept 6	0.065	0.049	24.80	6536.9	39.88	36	0.073	0.054
Sept 7	0.069	0.052	24.47	6205.0	36.83	37	0.073	0.054
Sept 8	0.086	0.066	23.32	6941.0	38.63	38	0.073	0.054
Sept 9	0.072	0.048	32.44	8035.0	37.62	39	0.073	0.054
Sept 10	0.074	0.050	32.64	7079.1	35.63	40	0.073	0.053
Sept 11	0.075	0.050	33.73	6035.2	33.93	41	0.073	0.053
Sept 12	0.084	0.068	19.09	6393.2	36.76	42	0.072	0.053
Sept 13	0.086	0.067	21.86	7524.7	34.17	43	0.072	0.052
Sept 14	0.079	0.057	27.97	7384.5	37.48	44	0.072	0.052
Sept 15	0.070	0.056	19.77	5816.7	37.05	45	0.072	0.052
Sept 16	0.082	0.060	26.87	5515.0	35.40	46	0.072	0.052
Sept 17	0.064	0.050	21.52	5414.6	33.83	47	0.072	0.051
Sept 18	0.060	0.043	27.94	6691.0	31.41	48	0.072	0.051
Sept 19	0.053	0.039	26.77	5122.0	28.68	49	0.072	0.051
Sept 20	0.066	0.039	41.19	3246.7	30.54	50	0.072	0.051
Sept 21	0.063	0.044	30.85	3826.2	36.44	51	0.071	0.050
Sept 22	0.065	0.042	35.00	5495.7	35.90	52	0.071	0.050
Sept 23	0.066	0.042	37.50	4809.1	32.35	53	0.071	0.050
Sept 24	0.069	0.051	25.82	6027.3	35.61	54	0.071	0.050

TRP TONNAGE/RECOVERY REGRESSION
REGRESSION ANALYSIS TO DETERMINE TONNAGE
BASED ON RECOVERY

CONCLUSION: DENSITY DOES NOT AFFECT RECOVERY

DATE	HEADS	TAILS	RECOVERY	TONS	DENSITY	DENSITY	REG	DENSI
July 28	0.058	0.051	11.52	5760.9	41.70	41.7	37.2	
Aug 19	0.072	0.064	11.52	5528.8	34.44	34.4	37.2	
Aug 9	0.065	0.057	11.68	7743.1	37.53	37.5	37.2	
Aug 21	0.072	0.063	12.64	9642.1	40.22	40.2	37.2	
Aug 12	0.063	0.055	12.90	8261.5	36.33	36.3	37.2	
Aug 6	0.091	0.079	13.03	5132.2	28.68	28.7	37.2	
Aug 11	0.069	0.060	13.10	8087.1	35.10	35.1	37.2	
Sept 25	0.057	0.049	14.22	6951.0	38.77	38.8	37.2	
Aug 10	0.066	0.056	14.55	6842.0	32.93	32.9	37.2	
July 10	0.075	0.062	16.78	7412.7	39.54	39.5	37.2	
July 29	0.054	0.045	17.21	6353.7	38.56	38.6	37.2	
July 18	0.066	0.054	17.47	11313.8	42.10	42.1	37.2	
Aug 15	0.071	0.058	17.53	6312.3	35.77	35.8	37.2	
July 22	0.059	0.049	17.63	6925.1	38.78	38.8	37.2	
Aug 18	0.082	0.068	17.74	7571.0	37.11	37.1	37.2	
Aug 8	0.080	0.066	17.93	5901.0	26.57	26.6	37.2	
Aug 16	0.070	0.058	17.96	9159.0	38.27	38.3	37.2	
July 12	0.059	0.049	18.01	8393.1	39.72	39.7	37.2	
Aug 7	0.095	0.078	18.45	5587.1	27.47	27.5	37.2	
July 21	0.066	0.053	18.99	8558.9	42.07	42.1	37.2	
Sept 12	0.084	0.068	19.09	6393.2	36.76	36.8	37.2	
Aug 13	0.064	0.052	19.22	7971.2	35.38	35.4	37.2	
Aug 20	0.072	0.058	19.59	9285.3	39.80	39.8	37.2	
Oct 4	0.066	0.053	19.64	8871.4	39.59	39.6	37.2	
Sept 15	0.070	0.056	19.77	5816.7	37.05	37.1	37.2	
July 11	0.077	0.061	19.88	6427.5	38.15	38.2	37.2	
July 19	0.060	0.048	20.03	10025.8	42.72	42.7	37.2	
July 8	0.075	0.060	20.38	9482.0	40.69	40.7	37.2	
Aug 5	0.103	0.082	20.54	6288.9	30.47	30.5	37.2	
Aug 28	0.067	0.053	20.74	4303.9	36.36	36.4	37.2	
Aug 17	0.074	0.058	21.01	8636.1	37.49	37.5	37.2	
Sept 17	0.064	0.050	21.52	5414.6	33.83	33.8	37.1	
Aug 2	0.066	0.052	21.53	8407.5	38.87	38.9	37.1	
Sept 13	0.086	0.067	21.86	7524.7	34.17	34.2	37.1	
Aug 1	0.061	0.047	22.36	8929.0	39.63	39.6	37.1	
Aug 27	0.074	0.057	22.56	4302.3	37.18	37.2	37.1	
Aug 23	0.077	0.059	23.09	8383.0	38.62	38.6	37.1	
Sept 8	0.086	0.066	23.32	6941.0	38.63	38.6	37.1	
Aug 4	0.091	0.070	23.37	5555.9	31.83	31.8	37.1	
Sept 2	0.080	0.061	24.30	7678.0	40.36	40.4	37.1	
Sept 7	0.069	0.052	24.47	6205.0	36.83	36.8	37.1	
Sept 5	0.070	0.053	24.55	5865.2	36.92	36.9	37.1	
Sept 6	0.065	0.049	24.80	6536.9	39.88	39.9	37.1	
Aug 31	0.071	0.054	24.89	8030.0	41.09	41.1	37.1	
Aug 24	0.082	0.061	24.96	8250.0	40.66	40.7	37.1	
Aug 25	0.080	0.060	25.64	3930.7	39.66	39.7	37.1	
Sept 24	0.069	0.051	25.82	6027.3	35.61	35.6	37.1	
Aug 3	0.065	0.048	26.20	6190.2	33.65	33.7	37.1	

Sept 19	0.053	0.039	26.77	5122.0	28.68	28.7	37.1
Sept 16	0.082	0.060	26.87	5515.0	35.40	35.4	37.1
July 30	0.058	0.042	27.39	8794.8	38.71	38.7	37.1
July 17	0.070	0.051	27.70	8500.6	40.21	40.2	37.1
Sept 18	0.060	0.043	27.94	6691.0	31.41	31.4	37.1
Sept 14	0.079	0.057	27.97	7384.5	37.48	37.5	37.1
Aug 29	0.074	0.054	27.98	5005.0	38.67	38.7	37.1
Aug 22	0.078	0.056	28.05	8090.0	38.02	38.0	37.1
July 26	0.071	0.051	28.21	6876.7	37.51	37.5	37.1
Oct 1	0.066	0.047	28.38	4730.1	39.48	39.5	37.1
Oct 2	0.061	0.044	28.72	4124.5	35.62	35.6	37.1
July 20	0.062	0.044	28.73	7815.5	40.39	40.4	37.1
July 27	0.048	0.034	29.16	3894.5	36.73	36.7	37.1
July 9	0.080	0.057	29.24	7365.1	38.98	39.0	37.1
Aug 14	0.082	0.058	29.59	6599.6	36.51	36.5	37.1
July 24	0.141	0.099	29.74	9165.2	40.00	40.0	37.1
July 25	0.083	0.059	29.90	10148.1	39.28	39.3	37.1
Sept 29	0.071	0.050	30.03	5482.5	33.10	33.1	37.1
Aug 30	0.092	0.064	30.35	7883.8	39.39	39.4	37.1
Aug 26	0.081	0.057	30.48	3215.4	39.03	39.0	37.1
Sept 21	0.063	0.044	30.85	3826.2	36.44	36.4	37.1
Sept 4	0.083	0.057	30.88	7854.9	37.83	37.8	37.1
July 23	0.072	0.049	31.12	10014.8	40.01	40.0	37.1
Sept 30	0.078	0.053	31.79	7302.1	41.39	41.4	37.1
Sept 26	0.070	0.047	31.98	6248.0	37.72	37.7	37.1
July 15	0.067	0.046	32.12	4508.5	37.67	37.7	37.1
Sept 9	0.072	0.048	32.44	8035.0	37.62	37.6	37.1
Sept 27	0.077	0.052	32.55	6183.0	38.04	38.0	37.1
July 14	0.069	0.046	32.63	5971.6	36.34	36.3	37.1
Sept 10	0.074	0.050	32.64	7079.1	35.63	35.6	37.1
July 16	0.068	0.046	32.72	6611.3	39.80	39.8	37.1
Sept 11	0.075	0.050	33.73	6035.2	33.93	33.9	37.1
July 13	0.071	0.047	34.27	9870.9	41.23	41.2	37.1
Sept 22	0.065	0.042	35.00	5495.7	35.90	35.9	37.1
Sept 3	0.087	0.056	35.27	6376.0	38.00	38.0	37.1
Sept 28	0.079	0.051	35.59	5519.0	34.68	34.7	37.1
July 31	0.064	0.041	36.11	7954.3	37.81	37.8	37.1
Sept 1	0.076	0.048	36.50	7080.0	39.24	39.2	37.1
Sept 23	0.066	0.042	37.50	4809.1	32.35	32.4	37.1
Oct 3	0.080	0.047	40.88	6230.3	34.48	34.5	37.1
Sept 20	0.066	0.039	41.19	3246.7	30.54	30.5	37.1

Regression Output:

Constant	37.25
Std Err of Y Est	3.35
R Squared	0.00
No. of Observations	89.00
Degrees of Freedom	87.00

X Coefficient(s)	-0.00469
Std Err of Coef.	0.049990

Aug 28	0.067	0.053	20.74	4303.9	36.36	52	0.073
Aug 29	0.074	0.054	27.98	5005.0	38.67	53	0.073
Aug 30	0.092	0.064	30.35	7883.8	39.39	54	0.073
Aug 31	0.071	0.054	24.89	8030.0	41.09	55	0.073
Sept 1	0.076	0.048	36.50	7080.0	39.24	56	0.073
Sept 2	0.080	0.061	24.30	7678.0	40.36	57	0.073
Sept 3	0.087	0.056	35.27	6376.0	38.00	58	0.073
Sept 4	0.083	0.057	30.88	7854.9	37.83	59	0.073
Sept 5	0.070	0.053	24.55	5865.2	36.92	60	0.073
Sept 6	0.065	0.049	24.80	6536.9	39.88	61	0.073
Sept 7	0.069	0.052	24.47	6205.0	36.83	62	0.073
Sept 8	0.086	0.066	23.32	6941.0	38.63	63	0.073
Sept 9	0.072	0.048	32.44	8035.0	37.62	64	0.073
Sept 10	0.074	0.050	32.64	7079.1	35.63	65	0.073
Sept 11	0.075	0.050	33.73	6035.2	33.93	66	0.073
Sept 12	0.084	0.068	19.09	6393.2	36.76	67	0.073
Sept 13	0.086	0.067	21.86	7524.7	34.17	68	0.073
Sept 14	0.079	0.057	27.97	7384.5	37.48	69	0.073
Sept 15	0.070	0.056	19.77	5816.7	37.05	70	0.073
Sept 16	0.082	0.060	26.87	5515.0	35.40	71	0.073
Sept 17	0.064	0.050	21.52	5414.6	33.83	72	0.073
Sept 18	0.060	0.043	27.94	6691.0	31.41	73	0.073
Sept 19	0.053	0.039	26.77	5122.0	28.68	74	0.073
Sept 20	0.066	0.039	41.19	3246.7	30.54	75	0.073
Sept 21	0.063	0.044	30.85	3826.2	36.44	76	0.073
Sept 22	0.065	0.042	35.00	5495.7	35.90	77	0.073
Sept 23	0.066	0.042	37.50	4809.1	32.35	78	0.073
Sept 24	0.069	0.051	25.82	6027.3	35.61	79	0.073
Sept 25	0.057	0.049	14.22	6951.0	38.77	80	0.073
Sept 26	0.070	0.047	31.98	6248.0	37.72	81	0.073
Sept 27	0.077	0.052	32.55	6183.0	38.04	82	0.073
Sept 28	0.079	0.051	35.59	5519.0	34.68	83	0.073
Sept 29	0.071	0.050	30.03	5482.5	33.10	84	0.073
Sept 30	0.078	0.053	31.79	7302.1	41.39	85	0.073
Oct 1	0.066	0.047	28.38	4730.1	39.48	86	0.073
Oct 2	0.061	0.044	28.72	4124.5	35.62	87	0.073
Oct 3	0.080	0.047	40.88	6230.3	34.48	88	0.073
Oct 4	0.066	0.053	19.64	8871.4	39.59	89	0.073

Regression Output:

Constant	0.072880
Std Err of Y Est	0.012338
R Squared	0.000057
No. of Observations	89
Degrees of Freedom	87

X Coefficient(s)	-0.00000
Std Err of Coef.	0.000050

TRP HEAD GRADE/TIME REGRESSION ANALYSIS

DATE	HEADS	TAILS	RECOVERY	TONS/DAY	DENSITY	ORDER	REG HEADS
July 8	0.075	0.060	20.38	9482.0	40.69	1	0.073
July 9	0.080	0.057	29.24	7365.1	38.98	2	0.073
July 10	0.075	0.062	16.78	7412.7	39.54	3	0.073
July 11	0.077	0.061	19.88	6427.5	38.15	4	0.073
July 12	0.059	0.049	18.01	8393.1	39.72	5	0.073
July 13	0.071	0.047	34.27	9870.9	41.23	6	0.073
July 14	0.069	0.046	32.63	5971.6	36.34	7	0.073
July 15	0.067	0.046	32.12	4508.5	37.67	8	0.073
July 16	0.068	0.046	32.72	6611.3	39.80	9	0.073
July 17	0.070	0.051	27.70	8500.6	40.21	10	0.073
July 18	0.066	0.054	17.47	11313.8	42.10	11	0.073
July 19	0.060	0.048	20.03	10025.8	42.72	12	0.073
July 20	0.062	0.044	28.73	7815.5	40.39	13	0.073
July 21	0.066	0.053	18.99	8558.9	42.07	14	0.073
July 22	0.059	0.049	17.63	6925.1	38.78	15	0.073
July 23	0.072	0.049	31.12	10014.8	40.01	16	0.073
July 24	0.141	0.099	29.74	9165.2	40.00	17	0.073
July 25	0.083	0.116	-39.32	10148.1	39.28	18	0.073
July 26	0.071	0.051	28.21	6876.7	37.51	19	0.073
July 27	0.048	0.034	29.16	3894.5	36.73	20	0.073
July 28	0.058	0.051	11.52	5760.9	41.70	21	0.073
July 29	0.054	0.045	17.21	6353.7	38.56	22	0.073
July 30	0.058	0.042	27.39	8794.8	38.71	23	0.073
July 31	0.064	0.041	36.11	7954.3	37.81	24	0.073
Aug 1	0.061	0.047	22.36	8929.0	39.63	25	0.073
Aug 2	0.066	0.052	21.53	8407.5	38.87	26	0.073
Aug 3	0.065	0.048	26.20	6190.2	33.65	27	0.073
Aug 4	0.091	0.111	-22.25	5555.9	31.83	28	0.073
Aug 5	0.103	0.082	20.54	6288.9	30.47	29	0.073
Aug 6	0.091	0.079	13.03	5132.2	28.68	30	0.073
Aug 7	0.095	0.078	18.45	5587.1	27.47	31	0.073
Aug 8	0.080	0.066	17.93	5901.0	26.57	32	0.073
Aug 9	0.065	0.057	11.68	7743.1	37.53	33	0.073
Aug 10	0.066	0.056	14.55	6842.0	32.93	34	0.073
Aug 11	0.069	0.060	13.10	8087.1	35.10	35	0.073
Aug 12	0.063	0.055	12.90	8261.5	36.33	36	0.073
Aug 13	0.064	0.052	19.22	7971.2	35.38	37	0.073
Aug 14	0.082	0.058	29.59	6599.6	36.51	38	0.073
Aug 15	0.071	0.058	17.53	6312.3	35.77	39	0.073
Aug 16	0.070	0.058	17.96	9159.0	38.27	40	0.073
Aug 17	0.074	0.058	21.01	8636.1	37.49	41	0.073
Aug 18	0.082	0.068	17.74	7571.0	37.11	42	0.073
Aug 19	0.072	0.064	11.52	5528.8	34.44	43	0.073
Aug 20	0.072	0.058	19.59	9285.3	39.80	44	0.073
Aug 21	0.072	0.063	12.64	9642.1	40.22	45	0.073
Aug 22	0.078	0.056	28.05	8090.0	38.02	46	0.073
Aug 23	0.077	0.059	23.09	8383.0	38.62	47	0.073
Aug 24	0.082	0.061	24.96	8250.0	40.66	48	0.073
Aug 25	0.080	0.060	25.64	3930.7	39.66	49	0.073
Aug 26	0.081	0.057	30.48	3215.4	39.03	50	0.073
Aug 27	0.074	0.057	22.56	4302.3	37.18	51	0.073

SEP 16	0.082	0.060	26.87	5515.0	35.40	50	6820.94	55.2	68.2
July 30	0.058	0.042	27.39	8794.8	38.71	51	6805.88	87.9	68.1
July 17	0.070	0.051	27.70	8500.6	40.21	52	6790.82	85.0	67.9
Sept 18	0.060	0.043	27.94	6691.0	31.41	53	6775.76	66.9	67.8
Sept 14	0.079	0.057	27.97	7384.5	37.48	54	6760.70	73.8	67.6
Aug 29	0.074	0.054	27.98	5005.0	38.67	55	6745.64	50.1	67.5
Aug 22	0.078	0.056	28.05	8090.0	38.02	56	6730.58	80.9	67.3
July 26	0.071	0.051	28.21	6876.7	37.51	57	6715.52	68.8	67.2
Oct 1	0.066	0.047	28.38	4730.1	39.48	58	6700.46	47.3	67.0
Oct 2	0.061	0.044	28.72	4124.5	35.62	59	6685.40	41.2	66.9
July 20	0.062	0.044	28.73	7815.5	40.39	60	6670.34	78.2	66.7
July 27	0.048	0.034	29.16	3894.5	36.73	61	6655.28	38.9	66.6
July 9	0.080	0.057	29.24	7365.1	38.98	62	6640.22	73.7	66.4
Aug 14	0.082	0.058	29.59	6599.6	36.51	63	6625.16	66.0	66.3
July 24	0.141	0.099	29.74	9165.2	40.00	64	6610.10	91.7	66.1
July 25	0.083	0.059	29.90	10148.1	39.28	65	6595.04	101.5	66.0
Sept 29	0.071	0.050	30.03	5482.5	33.10	66	6579.98	54.8	65.8
Aug 30	0.092	0.064	30.35	7883.8	39.39	67	6564.92	78.8	65.6
AUG 26	0.081	0.057	30.48	3215.4	39.03	68	6549.87	32.2	65.5
Sept 21	0.063	0.044	30.85	3826.2	36.44	69	6534.81	38.3	65.3
Sept 4	0.083	0.057	30.88	7854.9	37.83	70	6519.75	78.5	65.2
July 23	0.072	0.049	31.12	10014.8	40.01	71	6504.69	100.1	65.0
SEP 30	0.078	0.053	31.79	7302.1	41.39	72	6489.63	73.0	64.9
Sept 26	0.070	0.047	31.98	6248.0	37.72	73	6474.57	62.5	64.7
JUL 15	0.067	0.046	32.12	4508.5	37.67	74	6459.51	45.1	64.6
SEP 9	0.072	0.048	32.44	8035.0	37.62	75	6444.45	80.4	64.4
Sept 27	0.077	0.052	32.55	6183.0	38.04	76	6429.39	61.8	64.3
July 14	0.069	0.046	32.63	5971.6	36.34	77	6414.33	59.7	64.1
Sept 10	0.074	0.050	32.64	7079.1	35.63	78	6399.27	70.8	64.0
July 16	0.068	0.046	32.72	6611.3	39.80	79	6384.21	66.1	63.8
Sept 11	0.075	0.050	33.73	6035.2	33.93	80	6369.15	60.4	63.7
July 13	0.071	0.047	34.27	9870.9	41.23	81	6354.09	98.7	63.5
Sept 22	0.065	0.042	35.00	5495.7	35.90	82	6339.03	55.0	63.4
Sept 3	0.087	0.056	35.27	6376.0	38.00	83	6323.97	63.8	63.2
Sept 28	0.079	0.051	35.59	5519.0	34.68	84	6308.91	55.2	63.1
July 31	0.064	0.041	36.11	7954.3	37.81	85	6293.85	79.5	62.9
Sept 1	0.076	0.048	36.50	7080.0	39.24	86	6278.79	70.8	62.8
SEP 23	0.066	0.042	37.50	4809.1	32.35	87	6263.73	48.1	62.6
Oct 3	0.080	0.047	40.88	6230.3	34.48	88	6248.67	62.3	62.5
Sept 20	0.066	0.039	41.19	3246.7	30.54	89	6233.61	32.5	62.3

Regression Output:

Constant	7573.927
Std Err of Y Est	1680.887
R Squared	0.051410
No. of Observations	89
Degrees of Freedom	87

X Coefficient(s)	-15.0597
Std Err of Coef.	6.935403

TRP Operating DATA

1. Gold Extraction to Solution , %
2. Gold Adsorption to Carbon , %.
3. Total Gold Recovery , %
4. Total Tail Assay , g / ton
5. Feed Tons
6. Feed % Solids
7. ~~Feed Grade~~ HEAD GRADE g / ton Au
8. Reclaim Solution Assay g / ton Au
9. Tails Solids Assay g / ton Au
10. Tails Solution Assay g / ton Au
11. % Availability
12. Average Feed Flowrate us gpm.
To be calculated.

	Gold Ext'n to Sol'n	Gold Adsorp to Carbon	Gold Recovery	Total Tails Assay	Plant Availability	Day Feed Tons per Day	Feed % Solids	Head Grade	Reclaim Solution	Tails Solids Assay	Tails Solution Assay	Average Feed Spent.	Feed Tonnage Rate	Residual Time
Date	1 Gold Ext %	2 Gold Ads %	3 Gold Rec %	4 Tail Oz oz/ton	5 Avail %	6 Feed Tons 24 hrs	7 Feed %Sol	8 Head Oz oz/ton	9 Rec Soln oz/ton	10 Tails Oz	11 Tail Soln	12 Flowrate US GPM.	13 Tons/24hr	14 hrs.
13-Jul-88	30.47	85.59	34.27	0.047	96.2	9870.9	41.23	0.061	0.0058	0.042	0.0029			
14-Jul-88	28.6	78.1	32.63	0.046	73	5971.6	36.34	0.056	0.0072	0.04	0.0036			
15-Jul-88	27.53	78.98	32.2	0.046	60.83	4508.5	37.67	0.0551	0.0074	0.04	0.0035			
16-Jul-88	24.67	79.5	32.72	0.046	84.6	6611.3	39.8	0.0531	0.0098	0.04	0.0038			
17-Jul-88	18.18	76.64	27.7	0.051	76.3	8500.6	40.21	0.055	0.0104	0.045	0.004			
18-Jul-88	6.64	65.16	17.47	0.054	100	11313.8	42.1	0.0514	0.0103	0.048	0.0045			
19-Jul-88	12.03	69.09	20.03	0.048	100	10025.8	42.72	0.0487	0.0087	0.043	0.004			
20-Jul-88	25.88	75.01	28.73	0.044	98.3	7815.5	40.39	0.0512	0.007	0.038	0.004			
21-Jul-88	13.31	79.59	18.99	0.053	100	8558.9	42.07	0.0576	0.0058	0.05	0.0023			
22-Jul-88	23.73	60.06	17.63	0.049	90.8	6925.1	38.78	0.055	0.0028	0.042	0.0044			
23-Jul-88	26.61	79.26	31.12	0.049	99.2	10014.8	40.01	0.059	0.0083	0.044	0.0039			
24-Jul-88	44.69	53.33	29.74	0.099	100	9165.2	40	0.112	0.0188	0.062	0.0244			
25-Jul-88	-0.36	198.14	39.32	0.116	100	10148.1	39.28	0.067	0.0109	0.067	0.0319			
26-Jul-88	27.5	70.36	28.21	0.051	100	6876.7	37.51	0.059	0.0074	0.042	0.0051			
27-Jul-88	19.73	70.68	29.16	0.034	100	3894.5	36.73	0.035	0.0074	0.028	0.0033			
28-Jul-88	7.65	40.26	11.52	0.051	79.2	5760.9	41.7	0.045	0.0094	0.041	0.0071			
29-Jul-88	7.69	50.79	17.21	0.045	89.9	6353.7	38.56	0.039	0.0097	0.036	0.0057			
30-Jul-88	20.96	68.98	27.39	0.042	100	8794.8	38.71	0.044	0.0087	0.035	0.0045			
31-Jul-88	29.5	82.47	36.11	0.041	100	7954.3	37.81	0.051	0.0079	0.036	0.003			
01-Aug-88	18.11	75.4	22.36	0.047	100	8929	39.63	0.052	0.0056	0.043	0.0029			
02-Aug-88	15.21	76.77	21.53	0.052	100	8407.5	38.87	0.056	0.0064	0.048	0.0027			
03-Aug-88	23.53	66.12	28.2	0.048	96.3	6190.2	33.65	0.051	0.0069	0.039	0.0044			
04-Aug-88	-7.5	143.21	-22.25	0.111	84.2	5555.9	31.83	0.071	0.0091	0.077	0.016			
05-Aug-88	17.57	59.4	20.54	0.082	94.6	6288.9	30.47	0.082	0.0093	0.067	0.0063			
06-Aug-88	6.91	54.07	23.03	0.079	100	5132.2	28.68	0.074	0.0067	0.069	0.004			
07-Aug-88	11.93	60.06	18.45	0.078	88.8	5587.1	27.47	0.075	0.0077	0.066	0.0044			
08-Aug-88	11.89	58.9	17.93	0.066	98.3	5901	26.57	0.063	0.0061	0.056	0.0036			
09-Aug-88	6.42	53.27	11.68	0.057	97.5	7743.1	37.53	0.054	0.0064	0.05	0.004			
10-Aug-88	4.77	57.71	14.55	0.056	100	6842	32.93	0.052	0.0069	0.049	0.0034			
11-Aug-88	10.8	49.67	13.1	0.06	100	8087.1	35.1	0.057	0.0065	0.051	0.0049			
12-Aug-88	19.43	34.57	12.9	0.055	97.1	8261.5	36.33	0.049	0.008	0.04	0.0088			
13-Aug-88	24.28	50.78	19.22	0.052	100	7971.2	35.38	0.053	0.0061	0.04	0.0067			
14-Aug-88	28.65	60.02	29.59	0.058	99.2	6599.6	36.51	0.058	0.0097	0.042	0.0093			
15-Aug-88	37.1	44.38	17.53	0.058	92.1	6312.3	35.77	0.068	0.0015	0.043	0.0087			
16-Aug-88	37.74	45.51	17.96	0.058	100	9159	38.27	0.068	0.0012	0.042	0.0094			
17-Aug-88	34.3	58.23	21.01	0.058	100	8636.1	37.49	0.072	0.0012	0.047	0.0066			
18-Aug-88	25.54	64.06	17.74	0.068	91.7	7571	37.11	0.08	0.0014	0.059	0.0048			
19-Aug-88	17.12	57.04	11.52	0.064	80.5	5528.8	34.44	0.069	0.0014	0.057	0.0033			
20-Aug-88	25.6	70.52	19.59	0.058	95.8	9285.3	39.8	0.07	0.0014	0.052	0.0039			
21-Aug-88	21.3	53.62	12.64	0.063	95.8	9642.1	40.22	0.07	0.0014	0.055	0.0053			
22-Aug-88	34.19	77.64	28.05	0.056	100	8090	38.02	0.075	0.0014	0.05	0.0039			
23-Aug-88	24.8	86.07	23.09	0.059	100	8383	38.62	0.074	0.0013	0.056	0.0018			
24-Aug-88	26.9	86.46	24.96	0.061	97.5	8250	40.66	0.079	0.0015	0.058	0.0022			
25-Aug-88	30.87	77.18	25.64	0.06	55.4	3930.7	39.66	0.078	0.0018	0.054	0.004			
26-Aug-88	31.37	90.34	30.48	0.057	50.8	3215.4	39.03	0.079	0.0018	0.054	0.0017			
27-Aug-88	24.68	81.21	22.56	0.057	100	4302.3	37.18	0.071	0.0018	0.053	0.0023			
28-Aug-88	24.35	74.34	20.74	0.053	100	4303.9	36.36	0.064	0.0018	0.048	0.0028			
29-Aug-88	32.88	78.9	27.98	0.054	100	5005	38.67	0.072	0.0018	0.048	0.0035			
30-Aug-88	33.04	86.61	30.35	0.064	100	7883.8	39.39	0.09	0.0018	0.06	0.0028			
31-Aug-88	29.16	78.1	24.89	0.054	100	8030	41.09	0.069	0.0019	0.049	0.0035			
01-Sep-88	38.32	89.66	36.5	0.048	93.8	7080	39.24	0.073	0.0019	0.045	0.0021			
02-Sep-88	25.2	87.31	24.3	0.061	95.8	7678	40.36	0.077	0.0019	0.058	0.0019			
03-Sep-88	36.26	91.52	35.27	0.056	82.1	6376	38	0.084	0.0019	0.053	0.0017			
04-Sep-88	31.78	89.9	30.88	0.057	99.2	7854.9	37.83	0.08	0.0019	0.054	0.0018			

05-Sep-88	31.04	72.79	24.55	0.053	87.5	5865.2	36.92	0.067	0.0016	0.047	0.0038
06-Sep-88	28.93	79.83	24.8	0.049	100	6536.9	39.88	0.063	0.0013	0.045	0.0027
07-Sep-88	27.46	79.65	24.47	0.052	100	6205	36.83	0.065	0.0018	0.048	0.0025
08-Sep-88	24.06	88.61	23.32	0.066	100	6941	38.63	0.083	0.0016	0.063	0.0016
09-Sep-88	32.57	92.11	32.44	0.048	100	8035	37.62	0.069	0.0017	0.047	0.0012
10-Sep-88	32.89	91.49	32.64	0.05	94.2	7079.1	35.63	0.071	0.0017	0.048	0.0012
11-Sep-88	34.35	91.01	33.73	0.05	85	6035.2	33.93	0.072	0.0016	0.047	0.0013
12-Sep-88	20.2	83.72	19.09	0.068	79.6	6393.2	36.76	0.082	0.0016	0.065	0.0018
13-Sep-88	22.5	85.92	21.86	0.067	100	7524.7	34.17	0.083	0.0017	0.064	0.0016
14-Sep-88	27.93	91.19	27.97	0.057	100	7384.5	37.48	0.076	0.0018	0.055	0.0013
15-Sep-88	19.59	88.49	19.77	0.056	97.5	5816.7	37.05	0.067	0.0014	0.054	0.0011
16-Sep-88	27.21	91.15	26.87	0.06	86.7	5515	35.4	0.079	0.0014	0.058	0.0012
17-Sep-88	20.85	86.98	21.52	0.05	84.6	5414.6	33.83	0.061	0.0016	0.048	0.0011
18-Sep-88	27.16	89.03	27.94	0.043	96.3	6691	31.41	0.057	0.0016	0.041	0.001
19-Sep-88	25.22	87.95	26.77	0.039	83.8	5122	28.68	0.05	0.0015	0.037	0.0008
20-Sep-88	40.63	94.21	41.19	0.039	57.1	3246.7	30.54	0.062	0.0015	0.037	0.0007
21-Sep-88	31.24	91.55	30.85	0.044	83.3	3826.2	36.44	0.061	0.0013	0.042	0.001
22-Sep-88	34.95	92.12	35	0.042	98.3	5495.7	35.9	0.062	0.0017	0.04	0.0011
23-Sep-88	38.76	90.47	37.5	0.042	96.3	4809.1	32.35	0.064	0.0014	0.039	0.0013
24-Sep-88	24.69	93.41	25.82	0.051	96.7	6027.3	35.61	0.066	0.0015	0.05	0.0007
25-Sep-88	12.9	83.79	14.22	0.049	90.8	6951	38.77	0.055	0.0017	0.048	0.001
26-Sep-88	31.34	93.75	31.98	0.047	82.5	6248	37.72	0.067	0.0017	0.046	0.0009
27-Sep-88	31.57	95.63	32.55	0.052	86.3	6183	38.04	0.074	0.0017	0.051	0.0007
28-Sep-88	34.74	95.61	35.59	0.051	85.4	5519	34.68	0.076	0.0016	0.05	0.0007
29-Sep-88	29.16	92.74	30.03	0.05	92.9	5482.5	33.1	0.068	0.0016	0.048	0.0008
30-Sep-88	31.58	94.66	31.79	0.053	89.6	7302.1	41.39	0.075	0.0016	0.052	0.001
01-Oct-88	27.54	93.85	28.38	0.047	82.1	4730.1	39.48	0.063	0.0016	0.046	0.0008
02-Oct-88	26.95	94.49	28.72	0.044	59.6	4124.5	35.62	0.059	0.0016	0.043	0.0006
03-Oct-88	40.15	96.37	40.88	0.047	89.6	6230.3	34.48	0.077	0.0016	0.046	0.0007
04-Oct-88	18.83	89.87	19.64	0.053	97.9	8871.4	39.59	0.063	0.0016	0.051	0.001
05-Oct-88	25.48	93.67	25.9	0.047	87.5	7980	44.66	0.062	0.0015	0.046	0.0009
06-Oct-88	32.41	93.68	32.68	0.042	100	10386.6	42.83	0.06	0.0017	0.04	0.001
07-Oct-88	36.09	95.47	36.09	0.051	100	8854.5	41.36	0.077	0.0015	0.049	0.001
08-Oct-88	22.02	91.66	22.3	0.059	79.6	8439	40.24	0.073	0.0015	0.057	0.001
09-Oct-88	18.8	84.84	18.15	0.059	100	10493	39.44	0.07	0.0015	0.057	0.0015
10-Oct-88	29.65	94.18	29.82	0.055	90	6191	38.33	0.076	0.0014	0.054	0.0009
11-Oct-88	22.14	87.39	21.54	0.049	100	10040.7	40.95	0.061	0.0014	0.047	0.0014
12-Oct-88	21.72	86.7	21.32	0.046	94.6	8577.9	39.48	0.056	0.0014	0.044	0.0012
13-Oct-88	27.73	91	27.51	0.039	96.3	10192.2	42.81	0.052	0.0014	0.038	0.0011
14-Oct-88	26.59	88.54	26.1	0.041	93.8	8763.5	38.79	0.054	0.0014	0.04	0.0012
15-Oct-88	19.28	75.88	17.35	0.041	97.9	8304.4	38.66	0.048	0.0014	0.039	0.0017
16-Oct-88	34.78	93.51	34.22	0.046	100	9456.8	41.79	0.068	0.0014	0.045	0.0012
17-Oct-88	26.45	84.6	24.45	0.049	100	8314.4	39.16	0.063	0.0014	0.046	0.0019
18-Oct-88	25.81	88.7	25.56	0.048	100	6634.1	34.97	0.062	0.0014	0.046	0.0011
19-Oct-88	25.87	88.37	25.56	0.048	18.3	1056.4	34.59	0.061	0.0014	0.046	0.0011
20-Oct-88	26.06	83.58	26.74	0.045	56.3	1862	22.2	0.056	0.0014	0.042	0.0009
21-Oct-88	22.33	88.86	24.06	0.039	100	4545.8	30.37	0.048	0.0014	0.038	0.0007
22-Oct-88	23.19	85.39	24.49	0.041	64.6	1995.2	26.51	0.05	0.0014	0.039	0.0008

	[CN ⁻]	pH
Sept. 5	-	11.26
4	0.3	10.95
3	0.5	11.02
2	0.5	10.93
1	-	10.52
Aug 31	-	10.50
30	0.2	10.25
29	-	10.30
28	-	10.30
27	0.2 0.2	10.31
26	-	10.38
25	-	10.36
24	-	9.81
23	-	10.02
22	-	10.22
21	-	10.24
20	-	10.29
19	-	9.53
18	-	10.2
17	-	10.7
16	-	11.0
15	-	10.4
14	-	10.9
13	-	11.0
12	-	10.99
11	-	10.50
10	-	10.90
9	-	10.70
8	-	10.61
7	-	10.60
6	-	10.50
5	-	10.6
4	-	10.6
3	-	10.5
2	-	10.6
1	-	10.7
July 31	-	10.64
30	-	10.43
29		
28		
27		
26		
25		
24		
23		
22		

	CN ⁻	pH
Oct. 22	.13 10.2 16/tn	Frozen Manual add'n
21	.228	"
20	.24	"
19	-	10.25
18	.29	10.97
17	.29	10.32
16	.32	10.29
15	-	11.21
14	.365	11.16
13	.278	9.68
12	.23	10.59
11	.375	11.11
10	.40	10.93
9	-	11.10
8	-	11.09
7	0.50	11.02
6	0.30	11.15
5	0.70	11.29
4	0.60	11.10
3	0.28	11.02
2	0.45	11.15
1	1.00	11.44
Sept 30	-	11.21
29	-	11.32
28	-	11.24
27	0.26	11.04
26	1.06	11.14
25	2.93	11.03
24	2.48	10.99
23	-	11.07
22	1.53	11.17
21	-	11.50
20	-	11.38
19	-	11.16
18	11.6 .225	10.97
17	0.40	10.91
16	-	10.03
15	0.3	10.94
14	-	10.70
13	0.3	10.67
12	-	10.67
11	0.3	10.59
10	0.11 0.2	10.67
9	0.06	10.60
8	.245	10.47
7	.3	10.57
6	.3	10.71

lowest degree model that adequately describes the data. The lack of a theory may be useful in this respect. However, it is always possible to fit a polynomial of degree $n - 1$ to n data points, and the experimenter should consider using a model that is "saturated," that is, that has very few independent variables as observations on y .

12-5.3 The Coefficient of Determination

The quantity

$$R^2 = \frac{SS_R}{S_{yy}} = 1 - \frac{SS_E}{S_{yy}}$$

is called the coefficient of determination, and it is often used to judge the adequacy of a regression model. (We will see subsequently that in the case where x and y are jointly distributed random variables R^2 is the square of the correlation coefficient between x and y .) Clearly $0 \leq R^2 \leq 1$. We often refer loosely to R^2 as the amount of variability in the data explained or accounted for by the regression model. For the data in Example 12-1, we have $R^2 = SS_R/S_{yy} = 1924.87/1932.10 = .9963$; that is, 99.63 percent of the variability in the data is accounted for by the model.

The statistic R^2 should be used with caution, since it is always possible to make R^2 unity by simply adding enough terms to the model. For example, we can obtain a "perfect" fit to n data points with a polynomial of degree $n - 1$. Also, R^2 will always increase if we add a variable to the model, but this does not necessarily mean the new model is superior to the old one. Unless the error sum of squares in the new model is reduced by an amount equal to the original error mean square, the new model will have a larger error mean square than the old one, because of the loss of one degree of freedom. Thus the new model will actually be worse than the old one.

There are several important misconceptions about R^2 . In general, R^2 does not measure the magnitude of the slope of the regression line. A large value of R^2 does not imply a steep slope. Furthermore, R^2 does not measure the appropriateness of the model, since it can be artificially inflated by adding higher-order polynomial terms. Even if y and x are related in a nonlinear fashion, R^2 will often be large. For example, R^2 for the regression equation in Fig. 12-3b will be relatively large, even though the linear approximation is poor. Finally, even though R^2 is large, this does not necessarily imply that the regression model will provide accurate predictions of future observations.

12-6 Transformations to a Straight Line

We occasionally find that the straight-line regression model $y = \beta_0 + \beta_1 x + \epsilon$ is inappropriate because the true regression function is nonlinear. Sometimes this is visually determined from the scatter diagram, and sometimes we know

that the model is nonlinear by theory. In some situations a straight line can be obtained by using a suitable transformation. An example of a nonlinear model is the exponential function

$$y = e^{\beta_0 + \beta_1 x}$$

which is intrinsically linear, since a logarithmic transformation

$$\ln y = \ln e^{\beta_0 + \beta_1 x}$$

transformation requires that the variables be jointly and independently distributed. Another example of an intrinsically linear function is

$$y = \beta_0 + \beta_1 e^x$$

which can be linearized by using the reciprocal transform

$$y = 1/(e^{\beta_0 + \beta_1 x})$$

Sometimes the logarithmic and reciprocal transforms are used jointly to linearize a function. For example,

$$y = \frac{1}{e^{\beta_0 + \beta_1 x}}$$

Letting $y^* = 1/y$, we have the linear function

$$\ln y^* = \beta_0 + \beta_1 x$$

Several other examples of nonlinear functions are given by Daniel and Wood (1971).

12-7 Correlation

Our development of regression theory has been based on the assumption that the mathematical variable, measured variable, and the independent variable, both x and y are random variables. Many applications of regression analysis require that the observations (y_i, x_i) , $i = 1, 2, \dots, n$, be independent variables obtained from the distribution. We wish to develop a regression model for the weld diameter. In this example we would randomly select n spot

Therefore, we have

$$SS_R(\beta_2|\beta_1, \beta_0) = 5990.7712 - 5885.8521 = 104.9191 \quad (1 \text{ degree of freedom})$$

This is the increase in the regression sum of squares by adding x_2 to already containing x_1 . To test $H_0: \beta_2 = 0$, form the test statistic

$$F_0 = \frac{SS_R(\beta_2 | \beta_1, \beta_0)/1}{MS_E} = \frac{104.9191/1}{5.2352} = 20.04$$

Note that the MS_E from the *full* model, using both x_1 and x_2 , is used in the denominator of the test statistic. Since $F_{0.05, 1, 22} = 4.30$, we reject $H_0: \beta_2 = 0$ and conclude that distance (x_2) contributes significantly to the model.

Since this partial F -test involves a single variable, it is equivalent to a t -test. To see this, recall that the t -test on $H_0: \beta_2 = 0$ resulted in the statistic $t_0 = 4.4767$. Furthermore, the square of a t random variable with ν degrees of freedom is an F random variable with one and ν degrees of freedom, and we note that $t_0^2 = (4.4767)^2 = 20.04 = F_0$.

13-6 Measures of Model Adequacy

A number of techniques can be used to measure the adequacy of a multiple regression model. This section will present several of these techniques. Model validation is an important part of the multiple regression model building process. A good paper on this subject is Snee (1977).

13-6.1 The Coefficient of Multiple Determination

The coefficient of multiple determination R^2 is defined as

$$R^2 = \frac{SS_R}{S_{yy}} = 1 - \frac{SS_E}{S_{yy}} \quad (13-39)$$

R^2 is a measure of the amount of reduction in the variability of y obtained by using the regressor variables x_1, x_2, \dots, x_k . As in the simple linear regression case, we must have $0 \leq R^2 \leq 1$. However, a large value of R^2 does not necessarily imply that the regression model is a good one. Adding a variable to the model will always increase R^2 , regardless of whether the additional variable is statistically significant or not. Thus it is possible for models that have large values of R^2 to yield poor predictions of new observations or estimates of the mean response.

The positive square root of R^2 is the multiple correlation coefficient between y and the set of regressor variables x_1, x_2, \dots, x_k . That is, R is a measure of the linear association between y and x_1, x_2, \dots, x_k . When $k = 1$, this becomes the simple correlation between y and x .

13-8. The coefficient of estimated in Example 13-1

$$R^2 = \frac{SS_R}{S_{yy}} =$$

about 98.11 percent of the variance is explained when the two independent variables (x_1 and x_2) are used. In Example 1, the model was developed. The value of R^2 for the model is 0.9811. The variable x_2 to the model has

2.2 Residual Analysis

residuals from the estimate $y_i - \hat{y}_i$, play an important role in simple linear regression. As you know, residual plots that are often used to check the assumptions are also helpful to plot the residuals against the independent variable. In the following, we will use the residuals from the regression in Fig. 12-5, indicate the possible candidates for the independent variable.

Example 13-9. The residuals shown in Table 13-3. These are shown in Fig. 13-2. No severe deviations are apparent, although the two largest residuals are extremely close to a straight line. However, the standardized residuals of 1.89, do not seem excessively large. The error in collecting observations may modify these two points.

The residuals are plotted against x_1 in Fig. 13-4 and 13-5, respectively. The Fig. 13-4 there is some indication of a non-linear relationship with small delivery volumes (7 cases), and over predicts the time for larger volumes ($7 \leq x_1 \leq 14$ cases). The same relationship between time and volume, say, be added to the model affect the regression variable is required.

- **Example 13-8.** The coefficient of multiple determination for the regression model estimated in Example 13-1 is

$$R^2 = \frac{SS_R}{S_{yy}} = \frac{5990.7712}{6105.9447} = .981137$$

That is, about 98.11 percent of the variability in delivery time y has been explained when the two independent variables delivery volume (x_1) and distance (x_2) are used. In Example 12-7, a model relating y to x_1 only was developed. The value of R^2 for this model is $R^2 = .963954$. Therefore, adding the variable x_2 to the model has increased R^2 from .963954 to .981137.

13-6.2 Residual Analysis

The residuals from the estimated multiple regression model, defined by $e_i = y_i - \hat{y}_i$, play an important role in judging model adequacy just as they do in simple linear regression. As noted in Section 12-5.1, there are several residual plots that are often useful. These are illustrated in Example 13-9. It is so helpful to plot the residuals against variables not presently in the model that are possible candidates for inclusion. Patterns in these plots, similar to those in Fig. 12-5, indicate that the model may be improved by adding the candidate variable.

● **Example 13-9.** The residuals for the model estimated in Example 13-1 are shown in Table 13-3. These residuals are plotted on normal probability paper in Fig. 13-2. No severe deviations from normality are obviously apparent, although the two largest residuals ($e_{15} = 5.88$ and $e_{17} = 4.33$) do not fall very close to a straight line drawn through the remaining residuals. However, the standardized residuals, $5.88/\sqrt{5.2352} = 2.57$ and $4.33/\sqrt{5.2352} = 1.91$, do not seem excessively large. Inspection of the data does not reveal any unusual observations in collecting observations 15 and 17, or any other reason to discard or question these two points.

The residuals are plotted against \hat{y} in Fig. 13-3, and against x_1 and x_2 in Fig. 13-5, respectively. The two largest residuals e_{15} and e_{17} are apparent. In Fig. 13-5, there is some indication that the model underpredicts the time at outlets with small delivery volumes ($x_1 \leq 6$ cases) and large delivery volumes ($x_1 \geq 15$ cases). The same impression is obtained from Fig. 13-3. Possibly the relationship between time and delivery volume is not linear (requiring that a term for x_1^2 , say, be added to the model), or other regressor variables not included in the model affect the response. We will see subsequently that a third variable is required to adequately model this data.

5.8521

degree of freedom)

squares by adding x_2 to a model
in the test statistic

$$\frac{04.9191/1}{5.2352} = 20.04$$

ing both x_1 and x_2 , is used in the
test statistic $F = 4.30$, we reject $H_0: \beta_2 = 0$ and
conclude that x_2 is significantly
important to the model.

variable, it is equivalent to the
test of $H_0: \beta_2 = 0$ resulted in the test
statistic of a t random variable with
degrees of freedom one and ν degrees of
freedom $F_{0.05}$.

by

measure the adequacy of a multiple
regression model. Several of these techniques. Most
of these techniques. Multiple regression model built
using the technique of (1977).

Definition

is defined as

$$\frac{SS_E}{S_{yy}} \quad (13-1)$$

the variability of y obtained
from the simple linear regression
model. A large value of R^2 indicates
that the model is a good one. Adding a
new variable to the model, regardless of whether the
variable is significant, may lead to
a model that is overfitted. It is possible for model
adequacy to be improved by adding new observations.

multiple correlation coefficient
between y and x_1, x_2, \dots, x_k . That is,
the multiple correlation coefficient between y and x_1, x_2, \dots, x_k is
the square root of the coefficient of multiple determination R^2 .

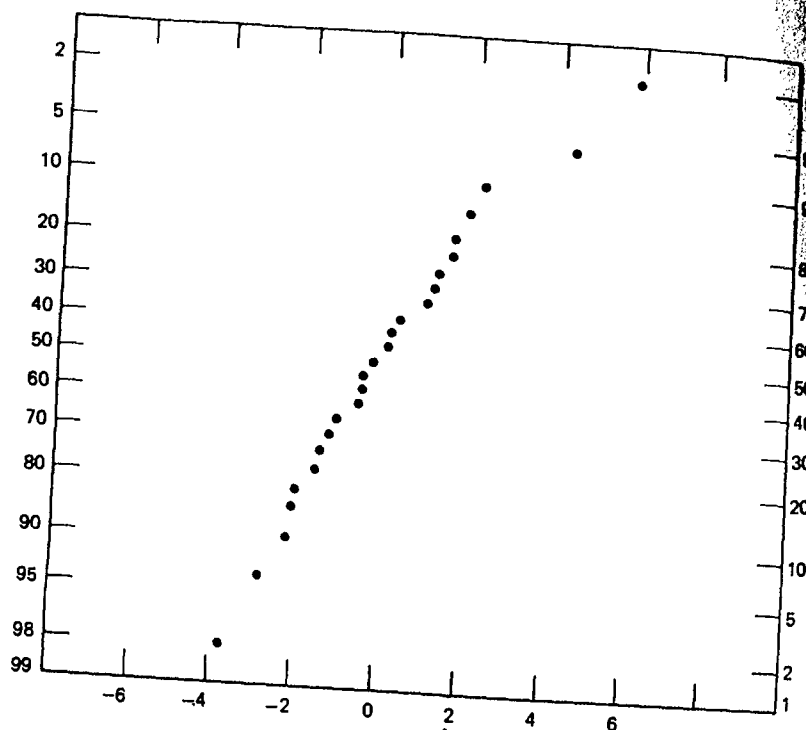


Fig. 13-2. Normal probability plot of residuals.

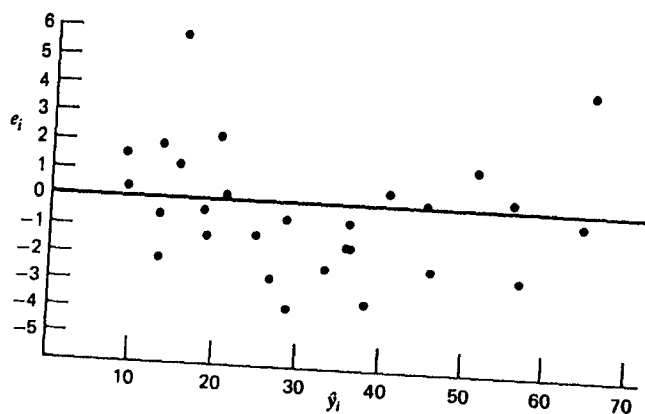


Fig. 13-3. Plot of residuals against \hat{y} .

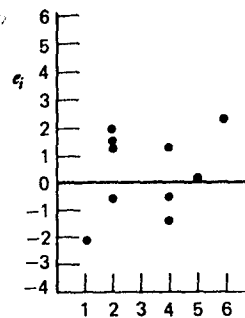


Fig. 13-4. Plot of residuals against \hat{y} .

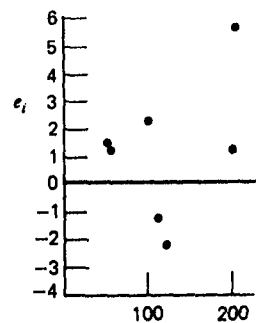


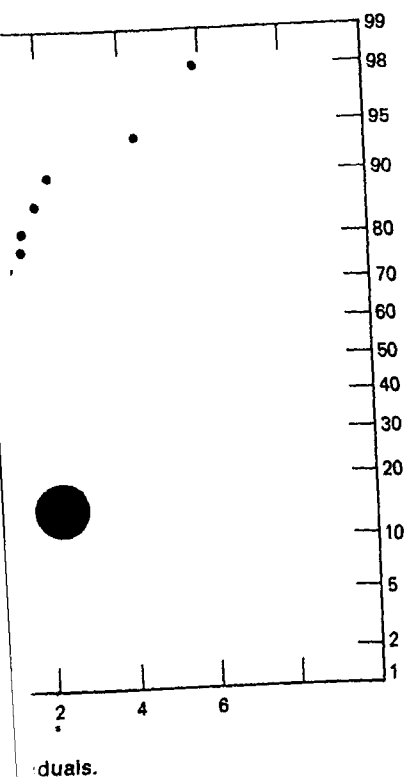
Fig. 13-5. Plot of residuals against \hat{y} .

13-6.3 Estimation of Pure Error

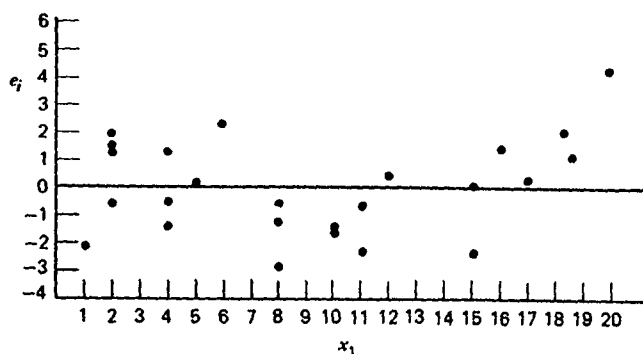
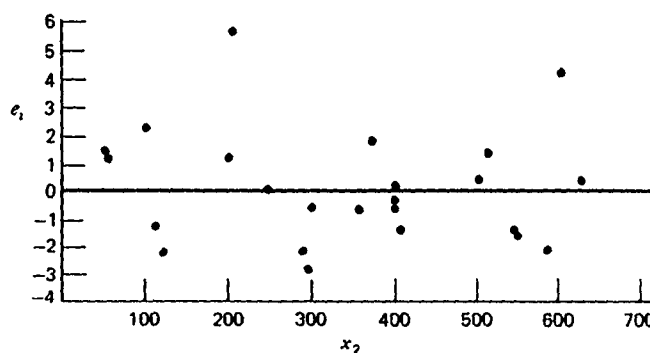
In Section 12-5.2 we described the procedure involved in estimating the pure error component due to pure error.

The pure error sum of squares is calculated by repeated observations at each level of the regressor.

This general procedure can be applied to any set of levels on the regressor. The calculation of SS_{PE} requires that the set of levels on the regressor of the X matrix must be



duals.

Fig. 13-4. Plot of residuals against x_1 .Fig. 13-5. Plot of residuals against x_2 .

12.5.3 Estimation of Pure Error from Near Neighbors

In Section 12-5.2 we described a test for lack of fit in simple linear regression. The procedure involved partitioning the error or residual sum of squares into a component due to pure error and a component due to lack of fit, say

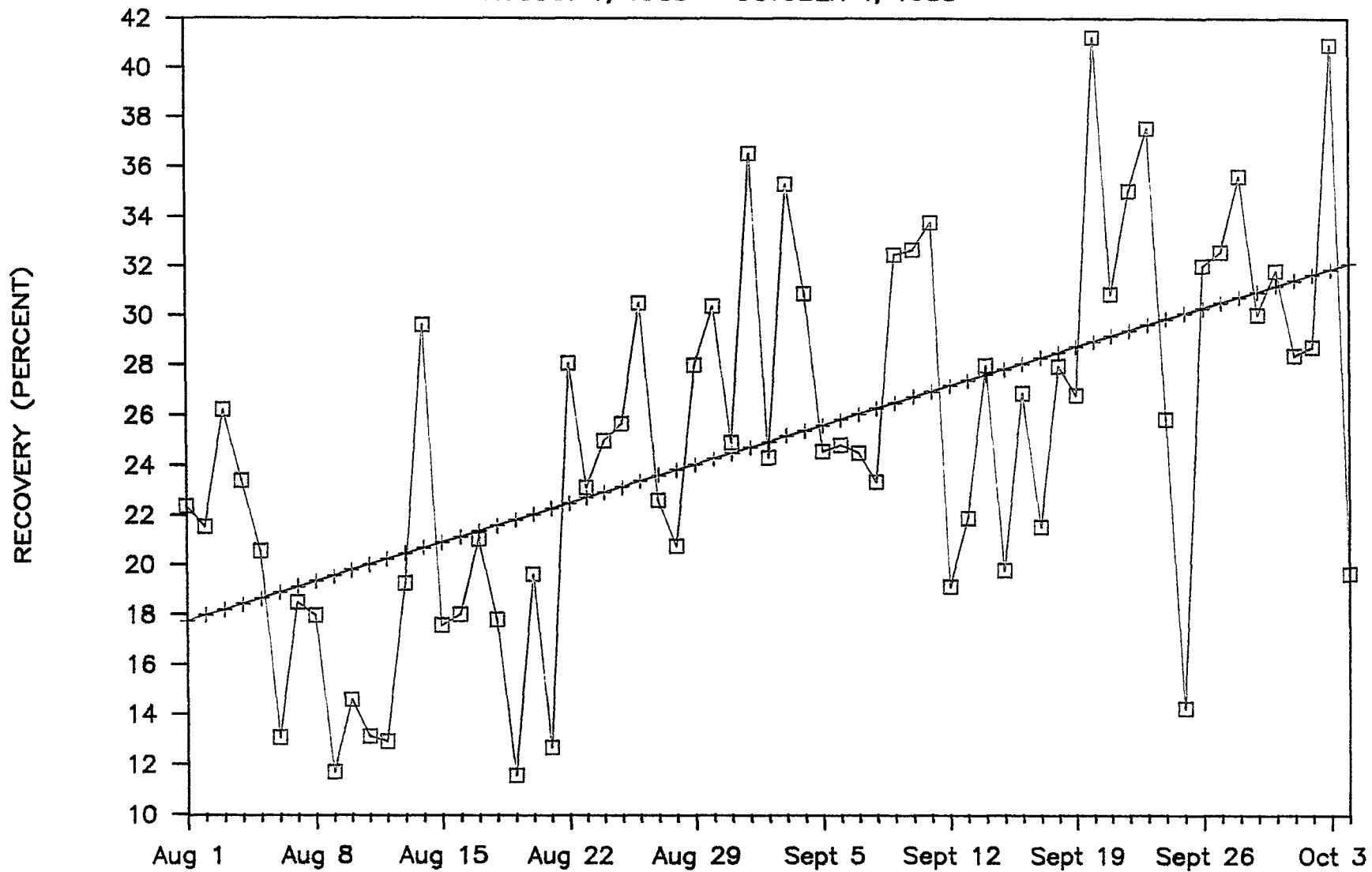
$$SS_E = SS_{PE} + SS_{LOF}$$

The pure error sum of squares SS_{PE} is computed from the responses obtained from repeated observations at the same level of x .

The general procedure can, in principle, be extended to multiple regression. The calculation of SS_{PE} requires repeated observations on y at the same levels on the regressor variables x_1, x_2, \dots, x_k . That is, some of the rows of the X matrix must be the same. However, the occurrence of repeated

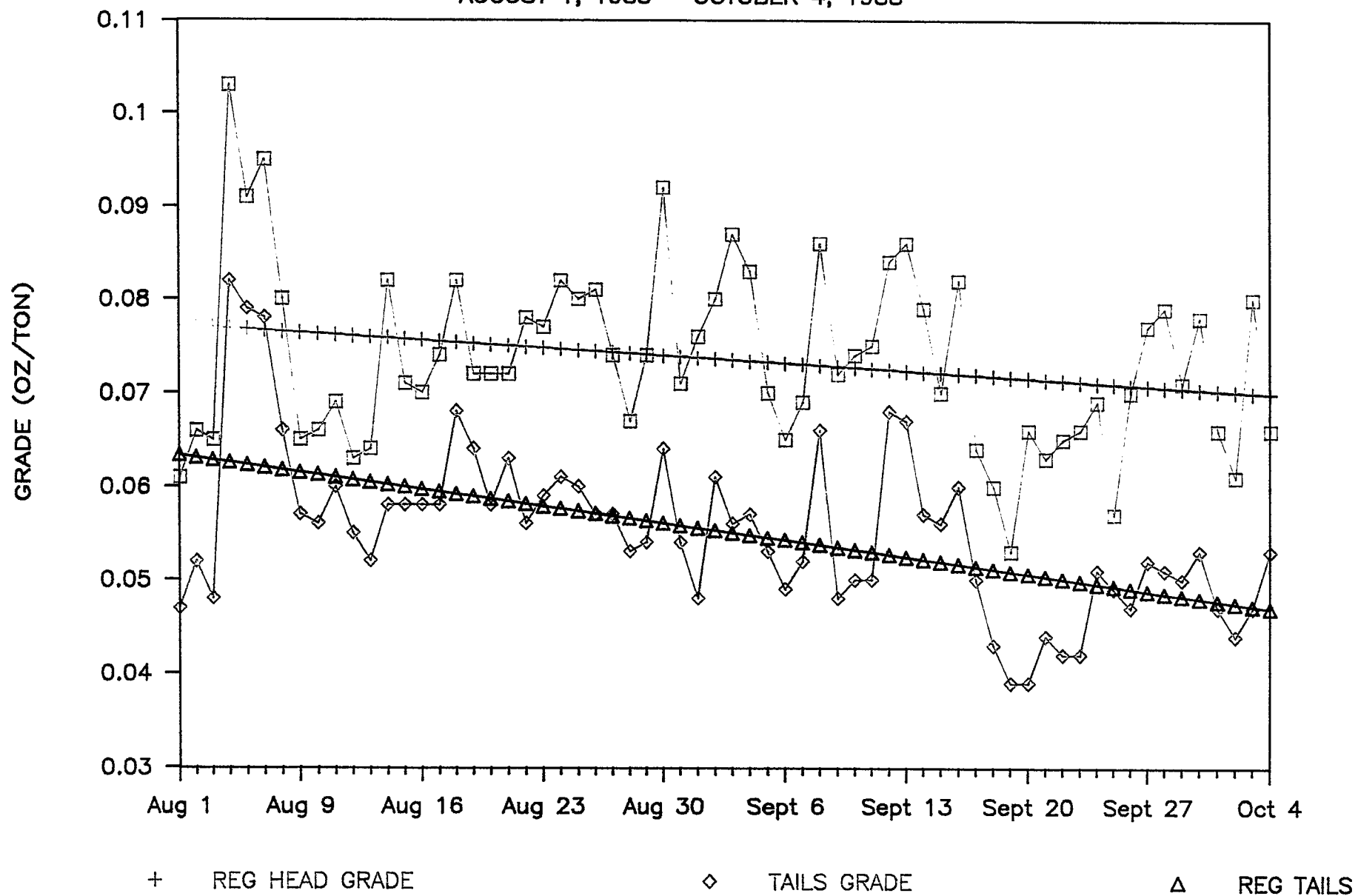
TRP RECOVERY/TIME REGRESSION ANALYSIS

AUGUST 1, 1988 - OCTOBER 4, 1988



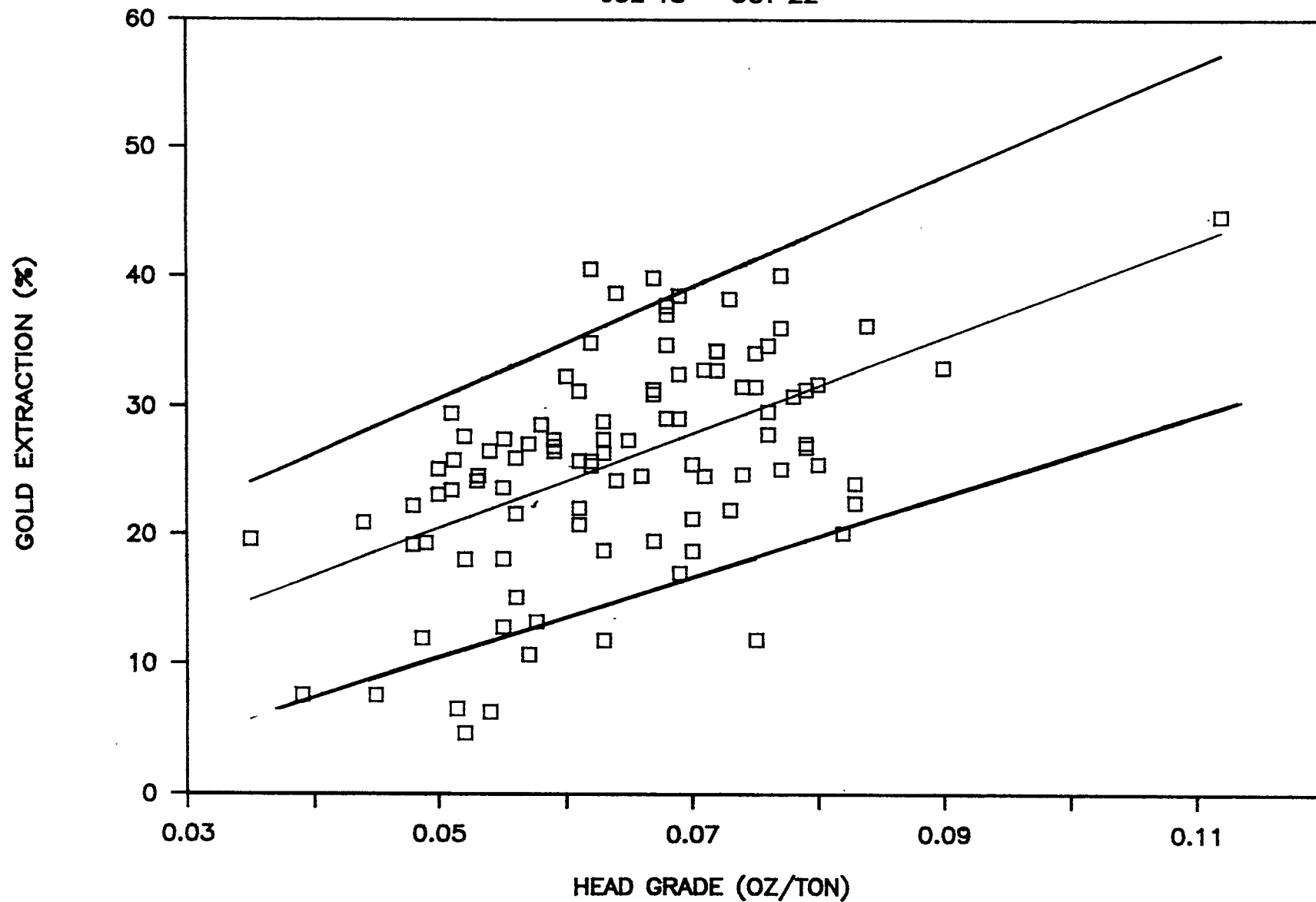
TRP HEAD/TAILS GRADE REGRESSION

AUGUST 1, 1988 - OCTOBER 4, 1988



1988 TRP GOLD EXTRACTION VS HEAD GRADE

JUL 13 - OCT 22



GIANT
Yellowknife Mines Limited

MEMO TO: Don Cooper
FROM: Doug Bartlett *DB*
CC: J.S. McAlpine, S.E. El-Alfy
DATE: November 7, 1988
RE: GOLD AND PARTICLE SIZE DISTRIBUTIONS IN TRP FEED AND TAILINGS

SUMMARY

A one week composite sample of TRP feed and tailings solids was prepared using assay rejects to investigate gold distribution and recovery by particle size. Samples of both streams were wet and dry screened, and each size fraction was weighed and assayed for gold.

The key findings were:

1. There was negligible +65 mesh material in the feed and tailings samples.
2. Both stream solids are extremely fine, 70 to 75% minus 325 mesh.
3. Cycloning and grinding a portion of the T.R.P. feed does not look promising. The gold concentrates to the finest fractions.

+150 mesh 8% of weight containing 5.6% of the gold
+200 mesh 18.4% of the weight containing 12.3% of the gold.

Even if grinding doubles the gold extraction from the above mesh fraction, the overall plant recovery would only increase from say 30% to 32-34%.

4. The % extraction of gold was the same from each size fraction of T.R.P. feed solids, about 26%. On the plant this would have been 32% due to incremental extraction in the surge tank.

INTRODUCTION

With 1988 TRP recovery being less than expected, the question was raised as what particle size range incurred the heaviest gold loss. The +65 mesh fraction of one grab sample of tailings taken September 30, 1988 assayed 0.41 oz/ton. Other associated points were:

- o How much fine carbon (if any) is there in the coarse tailings fraction and in what size range?
- o If the coarser feed particles (say cyclone split at 150 mesh) were ground to minus 200 mesh, could extra recovery be gained?

To answer all the above questions, a program was started to prepare, screen, and assay composite samples representative of TRP feed and tailings streams.

PROCEDURE

Assay sample rejects of TRP feed and tailings were obtained for the period September 25, 1988 to October 1, 1988. During this period the high cyanide addition test (increase from 1.0 to 2.0 lb/ton) was conducted.

For each operating shift there were two samples of each stream. These two samples were combined in total and blended by rolling. Then a one week composite was prepared by taking a weighted amount from each shift composite. The weighting factor was based on the total tons of dry solids fed to the TRP during that shift. Table 1 contains the sample compositing details along with the routine shift solids and solution gold assays. Blending of the week composites was achieved by bottle rolling, riffing and mat rolling.

Approximately 800 g of feed and tailings was separated into nine size fractions. This was done by first wet screening everything on 200 mesh and then dry screening (35 to 200 mesh nest) the plus 200 mesh fraction. The minus 200 mesh fraction was wet screened on 325 mesh and the plus fraction dry screened at 270 and 325 mesh. All screen fractions were weighed, sampled, and assayed.

RESULTS

Detailed screening data are included in Tables 2 and 3. The key results are summarized in Table 4.

DISCUSSION

Microscopic and carbon analysis work have not yet been conducted on the coarse size fractions. This will be undertaken on the 100 mesh and 150 mesh fractions. With the exception of the few grains of +65 mesh solids, all solids gold assays were within the routine range of TRP data. Thus a significant loss of gold to carbon fines is not expected.

The gold in both feed and tailings concentrates to the finer size fractions. This trend does not contribute to potential benefits from separating and regrinding a coarse feed fraction. Nevertheless, the cyanidation response to regrinding will be investigated for each size fraction.

About the same % gold extraction from solids was noted for each size fraction in the 100 to 325 mesh range. This is an extremely interesting result. It means that whatever changed the refractory gold to liberated gold in the tailings dams, did so uniformly on a size basis down to minus 325 mesh. However, it should be noted that about 20% of the gold solubilized prior to the feed samples being taken. The distribution of this "surge tank" gold between the feed size fractions cannot be determined using routine TRP samples.

RECOMMENDATION

Work should continue to investigate the metallurgical response of each size fraction of TRP feed and tailings. This will provide the database to search for low cost flowsheet additions to improve overall project economics.

TABLE 1

PREPARATION OF TRP ONE WEEK COMPOSITE FEED AND TAILINGS

Day	Date/Shift	Feed Tons	Solids Assay		Solution Assays		(1) Sample wts, grams Removed for Composite	
			<u>oz/ton Au</u>		<u>oz/ton Au</u>		<u>Feed</u> <u>Tails</u>	
			<u>Feed</u>	<u>Tails</u>	<u>Feed</u>	<u>Tails</u>		
Sun.	Sept. D/S	3070	0.044	0.047	0.0052	0.0010	399	254
	25 N/S	3881	0.050	0.048	0.0060	0.0010	504	322
Mon.	Sept. D/S	3261	0.053	0.044	0.0063	0.0009	424	271
	26 N/S	2987	0.066	0.048	0.0051	0.0009	388	248
Tues.	Sept. D/S	2822	0.064	0.050	0.0040	0.0007	367	234
	27 N/S	3361	0.074	0.050	0.0046	0.0006	437	279
Wed.	Sept. D/S	2678	0.061	0.049	0.0041	0.0008	348	222
	28 N/S	2841	0.082	0.049	0.0034	0.00055	369	236
Thurs.	Sept. D/S	2749	0.061	0.048	0.0032	0.0008	357	228
	29 N/S	2734	0.066	0.048	0.0040	0.0008	355	227
Fri.	Sept. D/S	3200	0.059	0.051	0.0043	0.0009	416	266
	30 N/S	4102	0.080	0.051	0.0051	0.0011	533	340
Sat.	Oct. D/S	2180	0.058	0.049	0.0041	0.0008	283	181
	1 N/S	2550	0.061	0.043	0.0041	0.0008	331	212
		42,416	0.063	0.048	0.0045	0.0008	5511	3520

(1) Basis:

Feed - 0.13 g sample per ton of TRP feed.

Tails - 0.083 g sample per ton of TRP feed.

TABLE 2

TRP FEED SIZING DATA

<u>Screen Size</u>		<u>Weight Fraction</u>			<u>Gold</u>			
<u>Mesh</u>	<u>Microns</u>	<u>g</u>	<u>%</u>	<u>Cum % Ret</u>	<u>Assay oz/ton</u>	<u>Fraction oz/100 ton</u>	<u>% Dist</u>	<u>Cum % Ret</u>
35	420	Nil						
48	297	<0.1	0.01	.01 }				
65	210	0.6	0.07	.08 }	0.185	0.015	0.17	
100	149	14.3	1.73	1.81	0.074	0.128	1.43	1.60
150	105	52.0	6.30	8.11	0.057	0.359	4.00	5.60
200	74	85.3	10.34	18.45	0.058	0.600	6.69	12.29
270	53	48.9	5.93	24.38	0.064	0.380	4.24	16.53
325	44	38.6	4.68	29.06	0.068	0.318	3.55	20.08
-325		585.2	70.94	100.00	0.101	7.165	79.92	100.00
TOTAL		825.0	100.00		*0.076	8.965		

NOTE:

*indicates Direct Assay

TABLE 3

TRP TAILINGS SIZING DATA

<u>Screen Size</u>		<u>Weight Fraction</u>			<u>Gold</u>			
<u>Mesh</u>	<u>Microns</u>	<u>g</u>	<u>%</u>	<u>Cum % Ret</u>	<u>Assay oz/ton</u>	<u>Fraction oz/100 ton</u>	<u>% Dist</u>	<u>Cum % Ret</u>
35	420	Nil						
48	297	<0.1	0.01	0.01				
65	210	0.5	0.06	0.07	0.274	0.019	0.28	
100	149	10.3	1.28	1.35	0.059	0.076	1.13	1.41
150	105	39.2	4.89	6.24	0.043	0.210	3.12	4.53
200	74	66.7	8.32	14.56	0.040	0.333	4.95	9.48
270	53	49.0	6.11	20.67	0.048	0.293	4.36	13.84
325	44	36.4	4.54	25.21	0.057	0.259	3.85	17.69
-325		599.8	74.79	100.00	0.074	5.534	82.31	100.00
TOTAL		802.0	100.00		*0.056	6.724		

NOTE:

*indicates Direct Assay

TABLE 4

SUMMARIZED RESULTS

<u>Mesh Size</u>	<u>Cum % Wt Retain</u>		<u>Cum % Gold Retain</u>		<u>Recovery from</u>	
	<u>Feed</u>	<u>Tailings</u>	<u>Feed</u>	<u>Tailings</u>	<u>Solids</u>	<u>*TRP Feed</u>
+65	0.1	0.1	0.2	0.3	-	-
+100	1.8	1.3	1.6	1.4	20.3	26.9
+150	8.1	6.2	5.6	4.5	24.6	32.5
+200	18.4	14.6	12.3	9.5	31.0	38.2
+270	24.4	20.7	16.5	13.8	25.0	32.1
+325	29.1	25.2	20.1	17.7	16.2	23.7
-325	100.0	100.0	100.0	100.0	26.7	31.3
Total					26.3	32.3

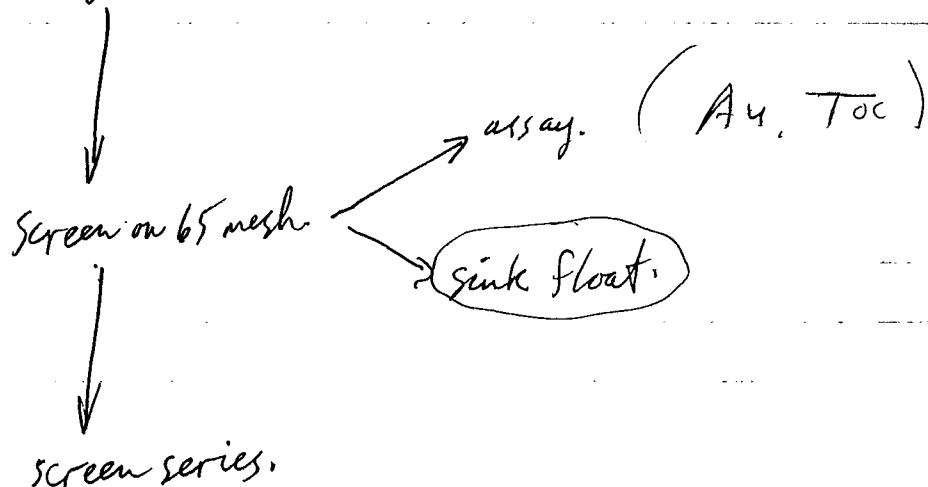
*Based on 40% solids and solution containing 0.0045 oz/ton gold.

Filante: DAD

Oct 10/88.

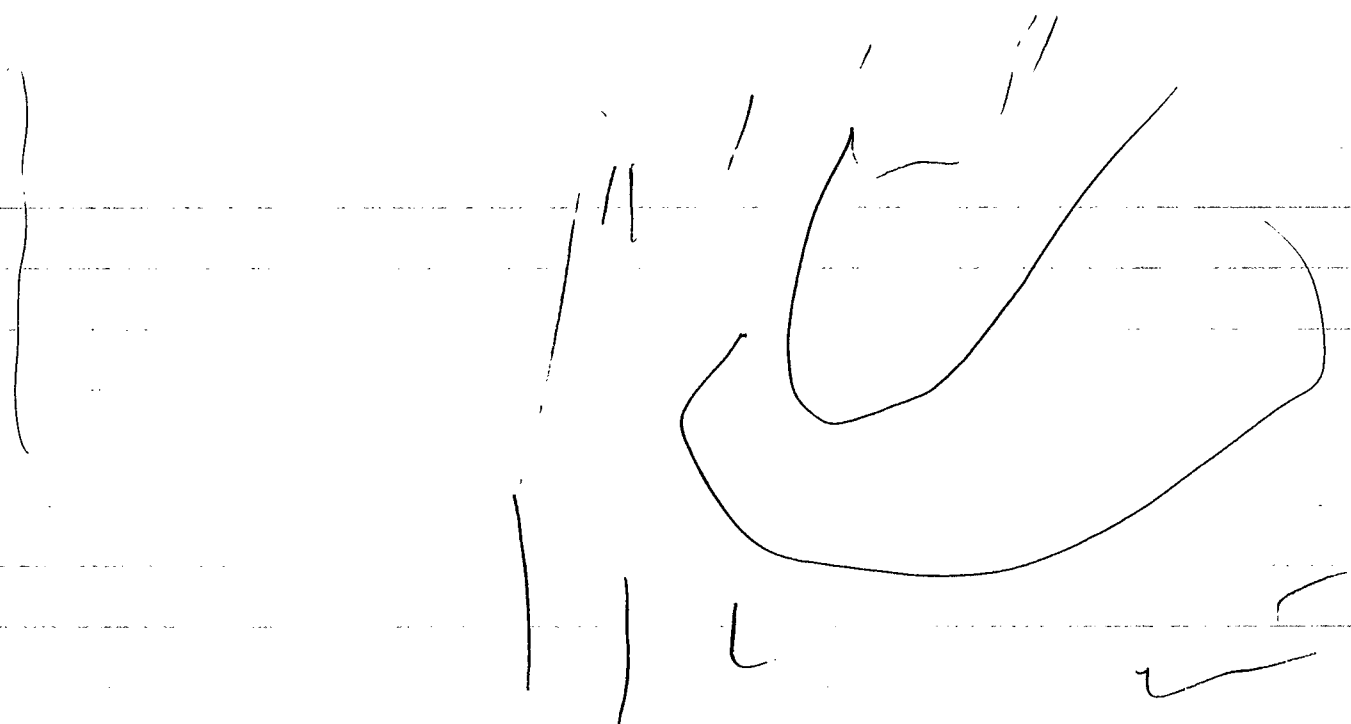
- To Record a conversation with Don Cooper on
Coarse Gold in TRP TAILINGS.

Tailings Comp.



Feed.

Tails



— Brian Cross's Plant Sample / Bottle Rolls
Tests appended to back of Section 6.0

Section 6

Plant Versus Laboratory Cyanidation

The enclosed report by Dan Kivari of Kilborn Engineering documents a daily laboratory program conducted on samples of fresh TRP feed and tailings slurry. Compared to previous laboratory programs on dried samples or stored moist samples, this current work has increased credibility. The slurry samples were taken directly from the routine plant sample points to the laboratory bottle rolls.

The key performance trends, that will be evaluated using these data are:

- o Effect of increased processing (residence) time.
Justification for more TRP vessels?
- o Effect of increased cyanide addition to the circuit (see Section 10).

The study will allow plant performance to be compared directly against laboratory results on equivalent TRP feed. Thus the effect of any plant operating inefficiencies can be highlighted. The laboratory evaluation technique (bottle rolls) was the same one used to generate the plant design parameters and thus the performance reference is valid.

The analysis of Dan's data has not yet been completed. Routine plant operating data for the period in question are being integrated with the laboratory results to calculate overall gold extractions as per TRP metallurgical accounting practice.

D.R. Bartlett
November 7, 1988

KILBORN

REPORT TO: Don Cooper
FROM: Dan Kivari
DATE: November 3, 1988
SUBJECT: Cyanidation Testwork for Giant Yellowknife Mines Limited
- Tailings Retreatment Plant

1.0 INTRODUCTION

- 1.1 The following is the report on the cyanidation testwork that was performed on the TRP feed and tailing samples.

2.0 SUMMARY

- 2.1 The bottle roll tests demonstrated that the Tailing Retreatment Plant performed as well as could be expected for the testwork time period. The recoveries for the TRP and bottle roll tests were in the same range. However, the bottle roll tests were performed on the slurry that was pumped from the storage tank therefore the effect of the leaching in the storage tank was not added to the bottle roll tests.
- 2.2 The addition of hydrogen peroxide to the slurry had no effect on the gold dissolution.
- 2.3 The addition of calcium peroxide to the slurry samples had little or no effect on the gold dissolution.
- 2.4 Drying the samples at 425°F for one hour did not affect the gold dissolution.

3.0 DISCUSSION

Testwork that was performed by GYML on Polishing Pond material in May and June 1988 produced similar results as the results that are presented in this report. However, one test on June 27, 1988 produced a gold recovery of 67.1% when the material was roasted at 1500°F for a short period of time (approximately 1/2 hour). This would indicate that most of the gold is associated with un-reacted sulphide minerals.

Because of the significant increase in the gold recovery with roasting, the following testwork should be done:

- (1) Produce a flotation concentrate for roasting. Leach the combined roasted concentrate and flotation tailings in the CIL plant.
- (2) Produce a flotation concentrate and pressure leach the concentrate. Leach the flotation tailing in the CIL plant.
- (3) Add strong oxidizing chemicals to a thickened slurry, then leach in CIL plant.
- (4) Produce a magnetic concentrate, roast or pressure leach the concentrate. Leach the tailing from the magnetic separator in the CIL plant.

4.0 CYANIDATION

4.1 Test Purpose.

4.2 The purpose of the testwork was to determine the gold recovery for the CIL feed and tailing at the tailings retreatment plant with bottle roll tests.

4.3 Test Procedure.

4.3.1 Sufficient samples of the CIL feed slurry and tailing slurry were taken to perform five 24 hour bottle roll tests on the feed sample and two 16 hour bottle roll tests on the tailing sample. The reagent additions for each test is summarized on the attached data sheets.

On October 15 and October 16, one additional feed sample was included in the test work. The feed sample was filtered and dried in an oven for one hour at 425°F prior to the bottle roll cyanidation.

4.3.2 On October 17, sufficient CIL feed sample was taken to perform bottle roll tests on slurry samples that had been reacted with varying amounts of hydrogen peroxide. The reagent additions are summarized on Data Sheet (4).

- 4.3.3 Bottle roll tests were performed on four dried weekly CIL feed and tailing composites for a 24 hour period. Since no assays are available for the bottle roll test feed samples, no recoveries were calculated.
- 4.3.4 For pH control in the above tests, lime was added to each sample. The slurry pH after the 24 hour bottle roll tests ranged from 10.5 to 10.8.

CYANIDATION TESTWORK FOR
GIANT YELLOWKNIFE MINES LIMITED
TAILINGS RETREATMENT PLANT

PAGE 4

DATA SHEET (1)

DATE	SAMPLE	SAMPLE WEIGHT (gm)	ASSAY (oz/T)	CYANIDE (lb/T)	FREE CYANIDE (ppm)	H ₂ O ₂ (lb/T)	CaO ₂ (lb/T)	RECOV. (%)
12 Oct	FEED COMP		0.044					
	RES. 1	230	0.034	1	240	NIL	NIL	22.7
	RES. 2	258	0.033	1	200	NIL	NIL	25.0
	RES. 3	233	0.033	2	450	NIL	NIL	25.0
	RES. 4	237	0.034	2	145	2	NIL	22.7
	RES. 5	241	0.034	2	345	NIL	2	22.7
	TAILING COMP		0.043					
	RES. 1	250	0.040	0	170	NIL	NIL	7.0
	RES. 2	266	0.040	0.5	300	NIL	NIL	7.0
13 Oct	FEED COMP		0.056					
	RES. 1	275	0.045	1	120	NIL	NIL	19.6
	RES. 2	301	0.043	1	170	NIL	NIL	23.2
	RES. 3	301	0.043	2	450	NIL	NIL	23.2
	RES. 4	285	0.044	2	200	5	NIL	21.4
	RES. 5	285	0.041	2	305	NIL	5	26.8
	TAILING COMP		0.041					
	RES. 1	280	0.037	0.	185	NIL	NIL	9.7
	RES. 2	265	0.036	0.5	210	NIL	NIL	12.2

CYANIDATION TESTWORK FOR
GIANT YELLOWKNIFE MINES LIMITED
TAILINGS RETREATMENT PLANT

PAGE 5

DATA SHEET (2)

DATE	SAMPLE	SAMPLE WEIGHT (gm)	ASSAY (oz/T)	CYANIDE (lb/T)	FREE CYANIDE (ppm)	H ₂ O ₂ (lb/T)	CaO ₂ (lb/T)	RECOV. (%)
14 Oct	FEED COMP		0.057					
	RES. 1	222	0.044	1	230	NIL	NIL	22.8
	RES. 2	207	0.044	1	200	NIL	NIL	22.8
	RES. 3	212	0.044	2	495	NIL	NIL	22.8
	RES. 4	206	0.045	2	300	5	NIL	21.1
	RES. 5	197	0.040	2	495	NIL	5	29.8
	TAILING COMP		0.041					
	RES. 1	283	0.039	0	100	NIL	NIL	5.1
	RES. 2	276	0.040	0.5	155	NIL	NIL	2.4
15 Oct	FEED COMP		0.044					
	FEED COMP"B"		0.051					
	RES. 1	255	0.034	1	190	NIL	NIL	22.7
	RES. 2	250	0.033	1	130	NIL	NIL	25.0
	RES. 3	260	0.033	2	485	NIL	NIL	25.0
	RES. 4	258	0.034	2	20	15	NIL	22.7
	RES. 5	265	0.033	2	470	NIL	15	25.0
	RES. 6	265	0.037	2	595	NIL	NIL	27.4
	TAILING COMP		0.033					
	RES. 1	221	0.033	0	135	NIL	NIL	0.0
	RES. 2	234.7	0.033	* 0.0 0.5	190	NIL	NIL	0.0

* Typing error, changed per handwritten report.

CYANIDATION TESTWORK FOR
GIANT YELLOWKNIFE MINES LIMITED
TAILINGS RETREATMENT PLANT

PAGE 6

DATA SHEET (3)

DATE	SAMPLE	SAMPLE WEIGHT (gm)	ASSAY (oz/T)	CYANIDE (lb/T)	FREE CYANIDE (ppm)	H ₂ O ₂ (lb/T)	CaO ₂ (lb/T)	RECOV. (%)
16 Oct	FEED COMP		0.064					
	RES. 1	271	0.056	1	225	NIL	NIL	12.5
	RES. 2	263	0.057	1	255	NIL	NIL	10.9
	RES. 3	247	0.057	2	505	NIL	NIL	10.9
	RES. 4	267	0.056	2	130	15	NIL	12.5
	RES. 5	270	0.054	2	450	NIL	15	15.6
	RES. 6	269	0.056	2	515	NIL	NIL	12.5
	TAIL COMP		0.039					
	RES. 1	237	0.038	0	155	NIL	NIL	2.6
	RES. 2	234	0.038	0.5	265	NIL	NIL	2.6

CYANIDATION TESTWORK FOR
GIANT YELLOWKNIFE MINES LIMITED
TAILINGS RETREATMENT PLANT

PAGE 7

DATA SHEET (4)

DATE	SAMPLE	SAMPLE WEIGHT (gm)	ASSAY (oz/T)	CYANIDE (lb/T)	H ₂ O ₂ (lb/T)	FREE CYANIDE (PPM)	RECOV. (%)
	FEED COMP		0.054				
	FO #1 RESIDUE	235	0.042	2	0	415	22.2
	FO #2 RESIDUE	240	0.044	2	5	390	18.5
	FO #3 RESIDUE	237	0.043	2	10	380	20.4
	FO #4 RESIDUE	236	0.042	2	15	240	22.2
	FO #5 RESIDUE	243	0.042	2	20	300	22.2
	<u>TAILING TRP #1 RESIDUE</u>	250	0.044	0.5	NIL	135	
DRB COMP	<u>TAILING TRP #2 RESIDUE</u>	250	0.043	1.0	NIL	355	
	<u>FEED TRP #3 RESIDUE</u>	250	0.041	1.0	NIL	300	
	<u>FEED TRP #4 RESIDUE</u>	250	0.047	2.0	NIL	750	

DATE	SAMPLE	SAMPLE WEIGHT (gm)	ASSAY (oz/t)	CYANIDE (lb/t)	FREE CYANIDE (ppm)	H ₂ O ₂ (lb/t)	CaO ₂ (lb/t)	RECOVER (%)
12 OCT	FEED COMP		0.044					
	Res. 1	220	0.034	1	210		NIL	22.7
			0.0347					
	Res. 2	255	0.022	1	211		NIL	25.0
	Res. 3	222	0.020	2	450		NIL	25.0
	Res. 4		0.020	2	200		NIL	22.7
	Res. 5		0.017		212		NIL	
	TRANSITION		0.017					
	Res. 1						NIL	7.0
	Res. 2						NIL	7.0
13 OCT	FEED COMP		0.017					
	Res. 1		0.017		210			7.0
	Res. 2		0.017		210			23.2
	Res. 3		0.017		210			23.2
	Res. 4		0.017		210			21.4
	Res. 5	265	0.017		210		NIL	26.8
	RE TRANSITION		0.017					
	Res. 1	280	0.017	0	185		NIL	9.7
	Res. 2	265	0.036	0.5	210 210		NIL	12.2

DATE	SAMPLE	SAMPLE WEIGHT(gm)	ASSAY (oz/t)	CYANIDE (1/t)	FREE CYANIDE(ppm)	H ₂ O ₂ (1/t)	CaO ₂ (1/t)	RECOVER (%)
4 Oct	FEED COMP		0.057					
	Res 1	222	0.044	1	230	NIL	NIL	22.8
	Res 2	207	0.044	1	200	NIL	NIL	22.8
	Res 3	212	0.044	2	495	NIL	NIL	22.8
	Res 4	206	0.045	2	300	5	NIL	21.1
	Res 5	197	0.040	2	495	NIL	5	
	TAILING COMP		0.041					
	Res. 1	283	0.027	0	0		NIL	5.1
	Res. 2	276	0.040	0.5	155	NIL	NIL	2.4
15 Oct	FEED COMP		0.044					
	FEED COMP "B"		0.051					
	Res. 1	255	0.027	1	170	NIL	NIL	22.7
	Res. 2	250	0.027	1	130	NIL	NIL	25.0
	Res 3	220	0.033	2	485	NIL	NIL	25.0
	Res 4	268	0.034	2	20	15	NIL	22.7
	Res 5	265	0.033	2	470	NIL	15	25.0
	Res 6	265	0.037	2	595	NIL	NIL	27.4
	TAILING COMP		0.033					
	Res. 1	221	0.033	0	135	NIL	NIL	0.0
	Res. 2	234.7	0.033	0.5	190	NIL	NIL	0.0

DATE	SAMPLE	SAMPLE (WEIGHT(gm))	ASSAY (oz/t)	CYANIDE (lb/t)	FREE CYANIDE(ppm)	H ₂ O ₂ (lb/t)	CaO ₂ (lb/t)	Loss (%)
1/6/54	FEED COMP		0.064					
	Res 1	271	0.056	1	225	NIL	NIL	12.5
	Res 2	263	0.057	1	255	NIL	NIL	10.9
	Res 3	247	0.057	2	505	NIL	NIL	10.9
	Res 4	267	0.058	2	130	15	NIL	12.5
	Res 5	270	0.059	2	450	NIL		15.6
	Res 6	269	0.056	2	515	NIL	NIL	12.5
	TAIL (wtd)		0.059					
	Res 1	257	0.058	0	155 245	NIL		2.6
	Res 2	231	0.058	0.5	245	NIL		2.6

* Res #6 - Cyanide Assay: About 16.5% to 42.5%



MEMORANDUM

To D. Cooper
S.E. El-Alfy; B. Cross; G. Deorksen; G. Halverson; file
To W.L. Richardson
From
Subject TRP Production of October 13th

Date October 14-88

Ref.

	Solid Au(oz./ton)	Solution Au(oz./ton)
Feed Mid-6AM	.044	.0044
Tail	.038	.0013
Feed 6AM-Noon	.051	.0050
Tail	.038	.0010
Feed Noon-6PM	.053	.0051
Tail	.038	.0010
Feed 6PM-Mid	.043	.0045
Tail	.037	.0011
CIL #2 Feed	.044	.0069
#3	.040	.0064
#4	.039	.0046
#5	.038	.0032
#6	.037	.0018
October 12th DK Feed #1	.034	
#2	.033	
#3	.013	
#4	.034	
#5	.034	
CCTP	.044	
DK Tails #1	.040	
#2	.040	
CCTP	.033	
October 10th Tails #1	.037	
#2	.036	
#88-29 Loaded	\$0.76	

	Li ppm
A	.29
B	.27
C	.27
D	1.51
E	.23
F	.35
G	.12
H	.10
I	.26
J	.08
K	.18
L	.10
M	.15
N	.09

W.L. Richardson

D. Cooper

October 17-88

To

Date

S.E. El-Alfy; G. Deorksen; B. Cross; G. Halversen; file

Copies To

Ref.

W.L. Richardson

From

Subject TRP Samples of October 16th

	Solid Au(oz./ton)	Solution Au(oz./ton)
Feed Mid-6AM	.078	no solution
Tails	.049	.0011
Feed 6AM-Noon	.063	.0044
Tails	.043	.0012
Feed Noon-6PM	.057	.0044
Tails	.040	.0012
Feed 6PM-Mid	.058	.0042
Tails	.046	.0013
DRB Feed Comp REASSAY	.061	
DK Feed #1 Oct 13th	.045 - 1 lb/ton CN	
#2	.043 - "	
#3	.043 - 2 lb/ton	
#4	.044 - 2 lb/ton + H ₂ O ₂	
#5	.041 - 2 lb/ton + CN	
COMP	.056 - feed for above	
DK Tails COMP	.041	
DK Feed #1 Oct 14th	.044	
#2	.044	
#3	.044	
#4	.045	
#5	.040	
COMP	.057	
DK Tails #1	.039	
#2	.040	
COMP	.052 .041	
DK Feed #1 Oct 15th	.034	
#2	.033	
#3	.033	
#4	.034	
#5	.033	
#6	.037	
COMP	.044	
COMP B	.051	
DK Tails #1	.033 - 16 hr No CN	
#2	.033 - 16 hr 0.5 lb/ton CN	
COMP	.033 feed to above	

M. L. Richardson

To D. Cooper
Copies To S.E. El-Alfy; G. Deorksen; B. Cross; G. Halverson; file
From W.L. Richardson
Subject TRP Productions of October 17th

Date October 18-88
Ref.

	Solid Au(oz./ton)	Solution Au(oz./ton)
Feed MID-6AM	.047	.0026
Tail	.045	.0026
Feed 6AM-Noon	.063	.0044
Tail	.043	.0016
Feed Noon-6PM	.060	.0045
Tail	.048	.0015
Feed 6PM-Mid	.065	.0013
Tail	.049	.0046

DK #1 Oct. 16th	.056
#2	.057
#3	.057
#4	.056
#5	.054
#6	.055
COMP	.064
DK Tail's #1 carbon	.038
#2 carbon	.038
COMP Carbon	.039
DRB Feed COMP Oct 18th	.067
+270	.064
+325	.105
PAN	.074
-325	.101

DRB Tail COMP	.057
+270	.048
+325	.122
PAN	.063
-325	.074

W. L. Richardson

To D. Cooper
S.E. El-Alfy; G. Deorksen; B. Cross; G. Halverson; file
To W.L. Richardson
From
Subject TRP Samples

Date October 19-88

Ref.

	Solid Au(oz./ton)	
DRB Feed Comp 19th	.061 .062 .060	
+325	.053	
Pan	.080	
DRB Tails COMP	.049 .049 .049	
+325	.062	
Pan	.063	
DR Feed #1 17th	.042	0 10% H ₂ O ₂
#2	.044	5 10% H ₂ O ₂
#3	.043	10 10% H ₂ O ₂ + 2 10% NaCN
#4	.042	15 10% H ₂ O ₂ + 2 10% NaCN
#5	.042	20 10% H ₂ O ₂ + 2 10% NaCN
COMP	.054	
DR TRP Comp #1	.041	TRP TRAIL
(DRB Comp #2)	.043	TRP TRAIL
#3	.041	TRP TRAIL
#4	.047	TRP TRAIL

ADD H₂O₂ 1/2 Roll
15 min.
20 NaCN AND
Roll 24 HRS.
5 10% NaCN } 24 HR.
10 10% NaCN } LEACH
15 10% NaCN } 30%
20 10% NaCN } 50% NaCN

	Au(oz./ton)
#38-39 Stripped 16th	4.4
No Number Stripped	2.7
#38-40 Loaded	41.31
#38-41 Loaded 17th	33.42

DRB Feed Soln 19th
Tails

Solution Au(oz./ton)
.0040
.001

	Li ppm
Solution A	.52
B	.14
C	.25
D	1.03
E	.16
F	.24
G	.12
H	.10
I	.15
J	.05
K	.10
L	.05
M	.09
N	.04

W. L. Richardson

G I A N T
Yellowknife Mines Limited

MEMO TO: Sadek El-Alfy
CC: Don Cooper
FROM: Dan Kivari - Kilborn Engineering
DATE: October 3, 1988
SUBJECT: T.R.P. REVIEW AND RECOMMENDATIONS

The following is a summary for the review of the TRP and a list of recommendations.

1.0 SUMMARY

- 1.1.1 The gold dissolution is the most serious problem at the TRP. The present levels of cyanide addition at 2 pounds per ton have not improved the gold recovery. This plant test coupled with the attached cyanidation testwork demonstrates that extensive testwork will be required to determine the reagents and the leach time that are required for optimum gold recovery.
- 1.1.2 The wood chips that are trapped in the CIL circuit are being recovered with the carbon may have been activated in the kiln. Thus samples of the wood chips were taken at the trash screens and safety screens to determine if there is any difference in the gold content.
- 1.1.3 The wood chips that are being transferred with the carbon are causing carbon transfer problems at the loaded carbon screen. The wood chips can be separated from the carbon by elutriation at the acid wash tank. This would require a piping change at the acid wash vessel so that the wood chips can be pumped to the tailings. If the gold content of the wood chips are high, then a system for

recovering the wood chips for future processing should be installed after the elutriation of the carbon.

- 1.1.4 The gold losses in the CIL tailings have improved dramatically in the recent weeks. The present gold content in the tailing solution ranges from 0.0005 ounces per ton to 0.0015 ounces per ton whereas previous tailing solution assays were 0.006 ounces per ton.
- 1.1.5 Further effort in improving the time required for the loaded carbon transfer and strip cycle is required. The operations staff are actively pursuing methods of improving the cycle time.
- 1.1.6 The uneven distribution of the slurry feed to the safety and trash screens is causing flooding on the screens. The volume flow to the screens could be increased if a more even split of the feed to the screens could be obtained.
- 1.1.7 Presently the trash screens are operating well without the high pressure spray water. However the screens should be checked and cleaned on a regular basis, probably once per day.
- 1.1.8 The dissolved oxygen in the CIL slurry is very high at 11 to 12 ppm. This high level of dissolved oxygen can cause the formation of bicarbonates which will foul the carbon. Thus careful monitoring of the carbon and tailing solution will be required.
- 1.1.9 The mechanical availability of the CIL plant is good; thus it is not adversely affecting the gold recovery.

100 mesh
*
20 mesh
Screen blend
Gypsum / carbonates.

1.2 RECOMMENDATIONS

- 1.2.1 Daily bottle roll tests are required on the CIL feed and tailing samples. This will provide gold recovery information on a parallel test basis.
- 1.2.2 Additional testwork on the use of calcium peroxide and hydrogen peroxide as oxidizing agents in the CIL circuit should be done in the laboratory.

Lakefield did this.

1.2.3

Bottle roll tests using reclaim water and fresh water should be done to determine if the gold dissolution is affected by the reclaim water.

1.2.4

Five millilitres of 10% lead nitrate solution should be added to the CIL tailing solution prior to the free cyanide determination. The samples must be filtered to remove any precipitate prior to titrating with silver nitrate.

*Assumes
No chemical
consumption.*

1.2.5

Free cyanide determination should be done on samples of the CIL feed solution containing one to five pounds per ton of cyanide. These tests will determine the amount of cyanide that is required to be added to the CIL circuit to achieve the 300 ppm of free cyanide in the CIL solution. The tests can be done in the laboratory.

1.2.6

Recovery by size fraction must be determined. This can be done by sampling the CIL feed and CIL tailing on a daily basis and making a weekly composite for the testwork.

1.2.7

The determination of the fine carbon concentration in the CIL circuit should be done by carbon analysis or sink float tests.

1.2.8

As a temporary fix for the uneven split of the slurry feed to the safety and trash screens, valves could be instilled on the lines feeding the flooded screens.

1.2.9

To achieve higher rates of carbon transfer in the strip circuit, the size of the eductors can be increased. However the drainage of the extra water will require the piping to be modified.

1.2.10

A metallurgist dedicated to solving the cyanidation problems is required immediately.

2.0 CYANIDATION TESTS

2.1 Purpose

To investigate the recovery of gold from samples of the CIL feed and tailing.

TABLE 1
TEST RESULTS SUMMARY

TEST	FEED AU OZ/T	FEED AU OZ/T	RECOVERY %	LEACH TIME (HRS)	NACN LB/T	PB(NO3) LB/T 2	CAO2 LB/T	SAMPLE WEIGHT(GM)	PH
1	0.087	0.065	25.3 AVE 24.7	16	2.0	NIL	NIL	164.0	10.7
2	0.087	0.066	24.1	16	2.0	NIL	NIL	161.6	10.7
3	0.087	0.059	32.2 31.6	16	1.9	NIL	1.5	168.2	10.7
4	0.087	0.060	31.0	16	2.0	NIL	1.5 NIL	162.2	10.8
5	0.087	0.067	24.1 24.4	16	2.0	0.5	NIL	161.5	* 10.7
6	0.087	0.067	24.7	16	2.1	0.5	NIL	155.4	* 10.4
7	0.046	0.045	2.2	16	1.8	NIL	NIL	175.8	10.5
8	0.046	0.043	6.5	16	1.7	NIL	1.5	183.0	10.8

LEACH TIME = 16 HOURS

$$\text{Cost of } H_2O_2 = \$2 / \text{kg}$$

$$7\% \text{ Gold Recovery} = 1 \text{ ton} \times \frac{.067 \text{ g}}{\text{ton}} \times 0.07 \times \frac{\$540 \text{ Cdn}}{.3} = \$2.53 / \text{ton.}$$

$$1.5 \text{ lb / ton } H_2O_2 = 1 \text{ ton} \times \frac{1.5 \text{ lb} \times \$2 / \text{kg}}{2.2 \text{ kg}} = \$1.36 / \text{ton.}$$

* Cyanidation Handbook.

High pH cancels effect of $Pb(NO_3)_2$
 phosphate type lead dissolution PbO_2^- ?
 Duffy Lake found that pre aeration must be at pH 11.0

2.2 Procedure

- 2.2.1 Samples of the CIL feed were taken on two hour intervals over a 16 hour period and filtered to remove the excess moisture. The feed samples were blended together with a pit sample of equal size to make a test feed composite.

Six portions of approximately equal sizes were taken from the composite as feed for the cyanidation tests. The remaining portion of the composite were used for moisture and gold assays.

The six test portions were placed in thoroughly cleaned acid bottles. Tap water was added to the bottles to make a slurry of 35 percent solids by weight. The reagents as outlined on the Test Results Summary sheet were added to the test bottles. Lime was added for pH control.

- 2.2.2 The CIL tailing was sampled every two hours over a 16 hour period and the samples were filtered to remove the excess moisture. The filtered samples were blended together to make a tailing composite for the cyanidation tests. Two portions of approximately equal size were removed from the tailing composite for the cyanidation tests. The remainder of the tailing composite was used for the gold and moisture assays. After the test portions were added to the clean acid bottles, water was added to the bottles to make a slurry of 35 percent solids by weight. The reagents were added to the test bottles as outlined on the Test Result Summary sheet. Lime was added for pH control.

3.0 FREE CYANIDE TITRATION

3.1 Purpose

To investigate the effect of the addition of a lead nitrate solution to samples of the CIL tailing solution in the determination of free cyanide.

TABLE 2
TEST RESULTS SUMMARY

TEST	LEAD NITRATE (ML)	SILVER NITRATE (ML)		FREE CYANIDE (LB/T)	
		UNFILTERED	FILTERED	UNFILTERED	FILTERED
1	2	7.1	---	0.71	---
2	4	6.7	5.6	0.67	0.56
3	6	5.8	---	0.58	---
4	8	5.3	5.2	0.53	0.52
5	10	4.8	---	0.48	---
6	20	2.3	2.5	0.23	0.25
7	0	8.0	8.0	0.80	0.80

SILVER NITRATE STOCK SOLUTION = 8.67 GM/L

LEAD NITRATE STOCK SOLUTION = 10%

3.2 Procedure

Approximately 1.5 litres of tailing was filtered with the filtrate being saved for the determination of free cyanide. Eleven 120 millilitre samples were removed from the tailing solution sample for the free cyanide titration tests. A 10 percent solution of lead nitrate was added to nine of the test solution samples. After the addition of the lead nitrate solution, three of the samples were filtered through sharkskin filter paper to remove any precipitate prior to the titration with silver nitrate.

4.0 DISCUSSION

4.1 Cyanidation Tests

- (1) The bottle roll tests gave substantially lower gold recoveries than previous tests that were performed by Lakefield Research and by in-house personnel i.e. 25% versus 40% after 16 hours.
- (2) The addition of 0.5 lb/t of lead nitrate had no effect on the gold recovery.
- (3) The addition of calcium peroxide to the bottle tests increased the gold recovery by approximately seven percent on the CIL feed sample and by approximately four percent on the CIL tailing sample.
- (4) An extra 16 hours of leaching on the CIL tailing had a minimal effect on the gold recovery.
- (5) The lower overall gold recoveries when compared to previous tests may be the result of different testing procedures. The previous cyanidation tests were performed on oven dried samples where the oxidation of gold bearing sulphides could occur thereby giving better results than the present tests.

*Lakefield
Checked This.*

Also, the CIL feed composite sample was collected over a short period of time thus the ore type that was entering the CIL circuit at the time of the sampling may have had an affect on the cyanidation test results.

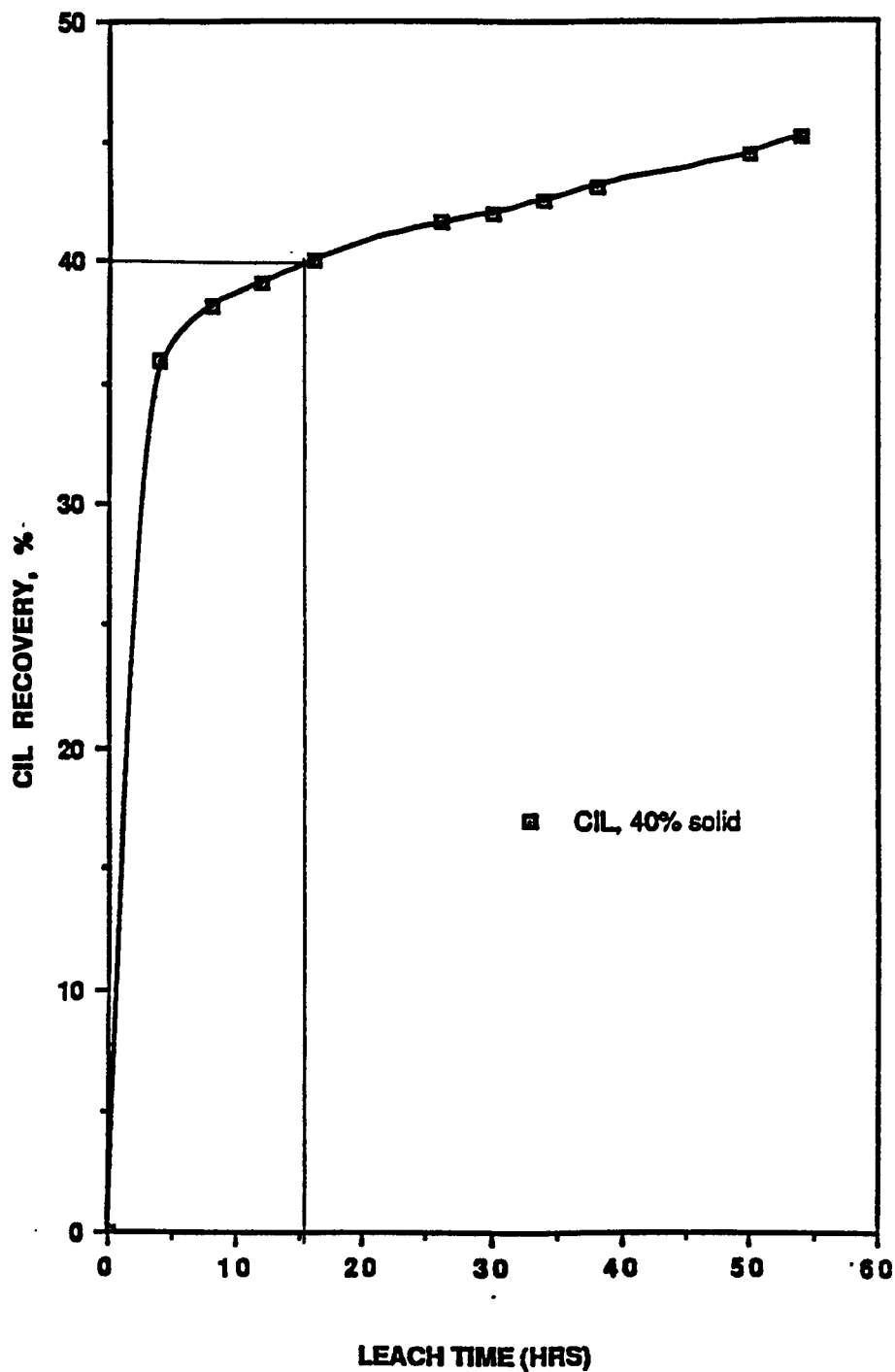
4.2 Free Cyanidation Determination

- (1) The addition of lead nitrate to the tailing test solutions caused a lower free cyanide determination.
- (2) A large excess of lead nitrate in the tailing solution caused erroneous free cyanide determinations.
- (3) The precipitate that is created by the addition of lead nitrate to the tailing solution interferes with the free cyanidation determination.

Dan Kivari
Kilborn Engineering

FIGURE NO. 6 COMPOSITE No. 1-12 (Inclusive)
LAKEFIELD RESEARCH TESTWORK

*Where is this
from?*



Giant

YELLOWKNIFE MINES LIMITED

YELLOWKNIFE, N.W.T.
X1A 2M2

TELEPHONE 403-873-6301

TELEX:

PURCHASING 034-45503

OTHER DEPT. 034-45514

URGENT! ☐ AS SOON AS POSSIBLE ☐

05899

FROM

Bryan Cross

DEPT.

5

COPY TO

Don Cooper

DATE

July 22/88

SUBJECT

Lab Cyanidation of TRP Tails

SEND TO

Steve McAlpine

MESSAGE

Residual Tails samples were re-cyanided (2.0 lb NaCN/ton) for 24 hrs with the following

results %	Date	Shift Assay	Test Tail	Sol'n (Volume adj.)	Calc. Head	Add'n Rec. %
	July 10D	0.058 oz/tn	0.045 oz/tn	0.0058 oz/tn	0.0508 oz/tn	11.43 %
	July 10N	0.056 "	0.044 "	0.0054 "	0.0494 "	10.85 "
	July 11D	0.051 "	0.042 "	0.0069 "	0.0489 "	14.16 "
	July 11N	0.056 "	0.040 "	0.0197 "	0.0597 "	32.94 "
	July 12D	0.046 "	0.046 "	0.0060 "	0.0520 "	11.59 "
	July 12N	0.040 "	0.039 "	0.0112 "	0.0502 "	22.34 "

REPLY

Bryan Cross

4500E - 1

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REPLY
FROM

DATE

FT THIS SHEET TO REMOVE
(RETAIN FOR YOUR FOLLOW-UP)

Effect of Increased Residence Time + NaCN
on Cyanidation of TRP Tailings Samples.

Giant

YELLOWKNIFE MINES LIMITED

YELLOWKNIFE, N.W.T.
X1A 2M2

TELEPHONE 403-873-6301

TELEX:

PURCHASING 034-45503

OTHER DEPT. 034-45514

URGENT! ☐ AS SOON AS POSSIBLE ☐

05900

FROM

Bryan Cross

DEPT.

5

COPY TO

DATE

July 27/88

SUBJECT

TRP Recovery Testwork

SEND TO

Don Cooper

MESSAGE

- ① Attached is a July 22 memo showing further straight cyanidation recovery from TRP tails.
- ② Individual tank assays (July 26) from July 24 samples were all contaminated as the operator managed to use pails previously used to take electrowon sludge to the lab, the sampling is being repeated and assays can be expected in a couple days.
- ③ Full plant air on C.I.L. #6 greatly increased agitation as expected but sample carbon concentration (6.67gm/l) did not change: $\frac{1}{2}$ hr after full air 5.67gm/l and 6.67gm/l after 1 hr.
- ④ Five bottle test samples ready for chemical additions ~~when~~ I get a chance to get to lab.
- ⑤ Gov't depth sampler unavailable, will try plugged pipe soon.
- ⑥ Retention time may be a factor after all, with recalculated times and graph trends.
- ⑦ Intend to get plots of cyanide consumption, avg. pulp density, pH, head grade, versus recovery.

Bryan Cross

4500E - 1

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REPLY
FROM

DATE

LIFT THIS SHEET TO REMOVE
(RETAIN FOR YOUR FOLLOW-UP)

D. Cooper

July 26-88

To

Date

Copies To S.E. El alfy; G. Deorksen; B. Cross; G. Halverson; file

Ref.

From W.L. Richardson

Subject T.R.P. Production of July 25th plus special samples

	Au(oz./ton)
Solid IN Day	.070
Solution	.0088
Solid OUT Day	.092
Solution	.0568
Solid IN Night	.064
Solution	.0128
Solid OUT Night	.047
Solution	.0088
CIL #2 Carbon	48.3
#3 Carbon	29.0
CIL Residue #1	.074
T.R.P. #2	.655
#3	.316
#4	.361
#5	4.32132
#6	4.320
CIL #1 Preg Wash	.0057
#2	.0667 .088
#3	.118 .160
#4	.195
#5	.342
#6	.321

W. L. Richardson

Giant
YELLOWKNIFE MINES LIMITED
YELLOWKNIFE, N.W.T.
X1A 2M2

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TELEX:
PURCHASING 034-45503
OTHER DEPT. 034-45514

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05937

FROM

Bryan Cross
5

DEPT.

COPY TO

DATE

Aug. 5/88

SUBJECT

Lab Cyanidation of TRP Tails

SEND TO

Don Cooper

MESSAGE

TRP Tailings samples were re-cyanided (2.0 lb NaCN/ton) for 24 hrs, the results:

Date	Shift Assay	Test Tail	Sol'n (Vol. adj.)	Calc. Head	Add'n Rec. %
July 16N	0.040 oz/t _n	0.031 oz/t _n	0.0045 0.0043 oz/t _n	0.0354 0.0353 oz/t _n	12.61 12.07 %
July 17D	0.045	0.031	0.0065 0.0064	0.0375 0.0374	17.29 17.09 %
July 18D	0.051	0.030	0.0091	0.0391	23.22 %
July 19N	0.042	0.029	0.0044	0.0334	13.20 %
July 20D	0.038	0.029	0.0052	0.0342	15.13 %
July 21N	0.051	0.034	0.0066	0.0406	16.30 %

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AUTHORITY: B. CROSS

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EXPLORATION DEPARTMENT

BAG 3000

YELLOWKNIFE, NWT. X1A 2M2

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21-OCT-88

PAGE: 1 OF 4

COPY: 2 OF 2

P. O. : 105272, 320

WORK ORDER: 5281D-88

*** FINAL REPORT ***

GEOCHEMICAL LABORATORY

SAMPLE TYPE: WATER

SAMPLE NUMBER

FEED SOLUTION

TO CIL #1

DUPLICATES

Calcium	-ppm	236.3	239.5
Potassium	-ppm	15.75	15.25
Silica	-ppm	4.86	4.42
Titanium	-ppm	<0.01	0.02
Copper	-ppm	7.9	7.88
Arsenic	-ppm	17.55	19.53
Iron	-ppm	0.4	0.53
Manganese	-ppm	0.02	0.01
Zinc	-ppm	<0.01	<0.01
Chromium	-ppm	<0.01	<0.01
Nickel	-ppm	0.85	0.95
Lead	-ppm	0.01	0.01
Cadmium	-ppm	<0.01	<0.01
Gold	-ppm	0.11	0.11
Silver	-ppm	0.04	0.01
Strontium	-ppm	0.43	0.39
Tungsten	-ppm	<0.1	<0.1
Antimony	-ppm	0.92	1.14
Thorium	-ppm	0.06	<0.05
Sulphur	-ppm	200.0	190.0
Tannic acid	-ppm	11.0	10.0
Humic acid	-ppm	<2.0	<2.0
T.O.C.	-ppm	18.0	18.0
Sulfide	-ppm	26.9	43.4

TAILINGS SOLUTION

From CIL #6

DUPLICATES

214.1	224.9
15.75	15.5
3.66	3.66
0.02	0.02
9.35	8.35
24.4	24.58
1.03	1.18
0.01	0.01
<0.01	<0.01
<0.01	<0.01
1.08	1.05
0.01	0.03
<0.01	<0.01
<0.01	<0.01
0.11	0.12
0.35	0.4
<0.1	<1.0
1.58	1.61
<0.05	<0.05
180.0	190.0
13.0	14.0
6.0	8.0
19.0	19.0
36.7	35.5

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21-OCT-88

PAGE: 2 OF 4

COPY: 2 OF 2

P. O. : 105272, 320

WORK ORDER: 5281D-88

*** FINAL REPORT ***

GEOCHEMICAL LABORATORY REPORT**SAMPLE TYPE: WATER**
 RECYCLE
 POND
 WATER

 ELECTROWINNING CELL FEED
 CARBON STRIP SOL^N
SAMPLE NUMBER
 START
 OF STRIP CYCLE

 FINISH
 After 12 hrs

Calcium	-ppm	182.1
Potassium	-ppm	14.25
Silica	-ppm	3.32
Titanium	-ppm	0.03
Copper	-ppm	8.83

1.09	1.43
14.85	14.84
NA	NA
0.04	0.03
88.28	92.64

Arsenic	-ppm	13.8
Iron	-ppm	0.14
Manganese	-ppm	<0.01
Zinc	-ppm	<0.01
Chromium	-ppm	<0.01

112.6	165.8
<0.01	0.06
0.01	<0.01
0.76	1.17
0.15	0.15

Nickel	-ppm	0.9
Lead	-ppm	0.01
Cadmium	-ppm	<0.01
Gold	-ppm	<0.01
Silver	-ppm	0.13

288.1	211.9
0.05	0.01
<0.01	0.11
7.1	1.27
3.4	0.02

Strontium	-ppm	0.56
Tungsten	-ppm	<0.1
Antimony	-ppm	1.09
Thorium	-ppm	<0.05
Sulphur	-ppm	140.0

0.04	0.03
<0.1	<0.1
0.17	0.37
<0.05	<0.05
280.0	250.0

Tannic acid	-ppm	9.0
Humic acid	-ppm	58.0
T.O.C.	-ppm	19.0
Sulfide	-ppm	27.9

1300.0	740.0
8800.0	500.0
5700.0	5800.0
35.2	3.5

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YELLOWKNIFE, NWT. X1A 2M2

P. O. : 105272, 320

WORK ORDER: 5281D-88
*** FINAL REPORT ***

GEOCHEMICAL

CARBON SAMPLES

SAMPLE TYPE: OTHE

REGENERATED

STRIPPED

STRIPPED

LOADED

BATCH 88-03

88-09

88-11

88-04

S A M P L E N U M B E

Calcium	-ppm	2240.0	4600.0	6080.0	3620.0
Potassium	-ppm	64.0	24.0	32.0	24.0
Silica	-ppm	NA	NA	NA	NA
Titanium	-ppm	2.0	<1.0	<1.0	<1.0
Copper	-ppm	43.0	28.0	28.0	359.0
Arsenic	-ppm	20.0	200.0	182.0	342.0
Iron	-ppm	132.0	56.0	28.0	32.0
Manganese	-ppm	27.0	23.0	9.0	8.0
Zinc	-ppm	48.0	31.0	26.0	48.0
Chromium	-ppm	1.0	<1.0	<1.0	1.0
Nickel	-ppm	237.0	512.0	88.0	1200.0
Lead	-ppm	8.0	5.0	4.0	3.0
Cadmium	-ppm	<1.0	<1.0	<1.0	1.0
Gold	-ppm	<0.02	<0.02	<0.02	<0.02
Silver	-ppm	32.8	53.6	7.5	58.5
Strontium	-ppm	6.0	12.0	17.0	8.0
Tungsten	-ppm	<2.0	<2.0	<2.0	<2.0
Antimony	-ppm	<1.0	<1.0	<1.0	<1.0
Thorium	-ppm	<2.5	<2.5	<2.5	<2.5
Sulphur	-ppm	1700.0	1600.0	1400.0	3200.0
T.O.C.	-ppm	NA	NA	NA	NA

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21-OCT-88

PAGE: 4 OF 4

COPY: 2 OF 2

P. O. : 105272, 320

WORK ORDER: 5281D-88
*** FINAL REPORT *****GEOCHEMICAL LABORATORY REPORT**

SAMPLE TYPE: OTHER

SAMPLE NUMBER		VIRGIN CARBON	FEED SOLIDS To CIL#1	TAILINGS SOLIDS
Calcium	-ppm	303.0	4.59%	4.1%
Potassium	-ppm	8920.0	88.0	96.0
Silica	-ppm	NA	NA	NA
Titanium	-ppm	1.0	3.0	2.0
Copper	-ppm	6.0	51.0	63.0
Arsenic	-ppm	1.0	3330.0	3490.0
Iron	-ppm	2.0	5.24%	4.74%
Manganese	-ppm	5.0	867.0	835.0
Zinc	-ppm	<1.0	606.0	624.0
Chromium	-ppm	<1.0	57.0	32.0
Nickel	-ppm	<1.0	70.0	67.0
Lead	-ppm	<1.0	431.0	466.0
Cadmium	-ppm	<1.0	4.0	4.0
Gold	-ppm	<0.02	1.28	1.56
Silver	-ppm	0.2	6.5	1.84
Strontium	-ppm	6.0	24.0	26.0
Tungsten	-ppm	<2.0	<2.0	<2.0
Antimony	-ppm	<1.0	5.0	6.0
Thorium	-ppm	<2.5	<2.5	<2.5
Sulphur	-ppm	900.0	7700.0	8300.0
T.O.C.	-ppm	NA	2000.0	2000.0

SIGNED: _____

C. Douglas Read,
LABORATORY MANAGER

FOOTNOTES:

P=QUESTIONABLE PRECISION; *=INTERFERENCE; TR=TRACE; ND=NOT DETECTED;
IS=INSUFFICIENT SAMPLE; NA=NOT ANALYZED; MS=MISSING SAMPLE

705-652-6365

MEMO TO: Don Cooper

COPY TO: Doug Bartlett

FROM: Bryan Cross

DATE: November 5, 1988

SUBJECT: ORGANIC AND INORGANIC ANALYSIS OF TRP SAMPLES.

Attached is the Laboratory Report with the analysis done on the samples obtained from the Tailings Retreatment Plant on August 23rd and 24th. The first page shows under titles of Feed and Tails numbers 1 and 2 what is actually from two slurry filtrates. Grab samples with no additives for preservation were taken from the CIL feed line and from the Safety Screen feed line. After filtration the solution samples from each was placed in 2 new, rinsed one litre polyethylene bottles for transportation to the lab. The lab analysed all 4 bottles.

On the second page the sample labelled RECL. SOLN is our process water from August 23rd, the water reclaimed from the Northwest Pond. The next two columns are for stripping solutions. The START sample is solution from the sample line for the barren solution coming from the electro-winning cells at the start of Strip number 88-12. The FINISH sample is the same only taken at the end of the same batch.

On the third page all of these samples are carbons. Left to right across the page they are: Regenerated carbon from batch 88-03, Stripped carbon from batch 88-09, Stripped carbon from batch 88-11, and loaded carbon from batch 88-04.

The 4th or last page has the analysis done on virgin carbon labelled SAMPLE BLANK and solids labelled FEED and TAILS. These are the two washed filtercakes from which the page one filtrates were taken namely CIL Plant Feed and Tailings

Bryan Cross

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AUTHORITY: B. CROSS

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21-OCT-88

PAGE: 1 OF 4

COPY: 2 OF 2

P. O. : 105272, 320

WORK ORDER: 5281D-88
 *** FINAL REPORT ***

GEOCHEMICAL LABORATORY REPORT**SAMPLE TYPE: WATER**

S A M P L E N U M B E R		SAMPLE FEED 1 AUG.23	SAMPLE FEED 2 AUG.23	SAMPLE TAILS 1 AUG.23	SAMPLE TAILS 2 AUG.23
Calcium	-ppm	236.3	239.5	214.1	224.9
Potassium	-ppm	15.75	15.25	15.75	15.5
Silica	-ppm	4.86	4.42	3.66	3.66
Titanium	-ppm	<0.01	0.02	0.02	0.02
Copper	-ppm	7.9	7.88	9.35	8.35
Arsenic	-ppm	17.55	19.53	24.4	24.58
Iron	-ppm	0.4	0.53	1.03	1.18
Manganese	-ppm	0.02	0.01	0.01	0.01
Zinc	-ppm	<0.01	<0.01	<0.01	<0.01
Chromium	-ppm	<0.01	<0.01	<0.01	<0.01
Nickel	-ppm	0.85	0.95	1.08	1.05
Lead	-ppm	0.01	0.01	0.01	0.03
Cadmium	-ppm	<0.01	<0.01	<0.01	<0.01
Gold	-ppm	0.11	0.11	<0.01	<0.01
Silver	-ppm	0.04	0.01	0.11	0.12
Strontium	-ppm	0.43	0.39	0.35	0.4
Tungsten	-ppm	<0.1	<0.1	<0.1	<1.0
Antimony	-ppm	0.92	1.14	1.58	1.61
Thorium	-ppm	0.06	<0.05	<0.05	<0.05
Sulphur	-ppm	200.0	190.0	180.0	190.0
Tannic acid	-ppm	11.0	10.0	13.0	14.0
Humic acid	-ppm	<2.0	<2.0	6.0	8.0
T.O.C.	-ppm	18.0	18.0	19.0	19.0
Sulfide	-ppm	26.9	43.4	36.7	35.5

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21-OCT-88

PAGE: 2 OF 4

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P. O. : 105272, 320

WORK ORDER: 5281D-88
 *** FINAL REPORT ***

GEOCHEMICAL LABORATORY REPORT**SAMPLE TYPE: WATER**

SAMPLE NUMBER		SAMPLE RECL. SOLN	SAMPLE START 88-12	SAMPLE FINISH 88-12
Calcium	-ppm	182.1	1.09	1.43
Potassium	-ppm	14.25	14.85	14.84
Silica	-ppm	3.32	NA	NA
Titanium	-ppm	0.03	0.04	0.03
Copper	-ppm	8.83	88.28	92.64
Arsenic	-ppm	13.8	112.6	165.8
Iron	-ppm	0.14	<0.01	0.06
Manganese	-ppm	<0.01	0.01	<0.01
Zinc	-ppm	<0.01	0.76	1.17
Chromium	-ppm	<0.01	0.15	0.15
Nickel	-ppm	0.9	288.1	211.9
Lead	-ppm	0.01	0.05	0.01
Cadmium	-ppm	<0.01	<0.01	0.11
Gold	-ppm	<0.01	7.1	1.27
Silver	-ppm	0.13	3.4	0.02
Strontium	-ppm	0.56	0.04	0.03
Tungsten	-ppm	<0.1	<0.1	<0.1
Antimony	-ppm	1.09	0.17	0.37
Thorium	-ppm	<0.05	<0.05	<0.05
Sulphur	-ppm	140.0	280.0	250.0
Tannic acid	-ppm	9.0	1300.0	740.0
Humic acid	-ppm	58.0	8800.0	500.0
T.O.C.	-ppm	19.0	5700.0	5800.0
Sulfide	-ppm	27.9	35.2	3.5

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PAGE: 3 OF 4

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P. O. : 105272, 320

WORK ORDER: 5281D-88
*** FINAL REPORT ***

GEOCHEMICAL LABORATORY REPORT

SAMPLE TYPE: OTHER

SAMPLE TYPE: OTHER		After Kiln SAMPLE 88-03	Str. C SAMPLE 88-09	Str. C. SAMPLE 88-11	Loaded C SAMPLE C-4
S A M P L E N U M B E R					
Calcium	-ppm	2240.0	4600.0	6080.0	3620.0
Potassium	-ppm	64.0	24.0	32.0	24.0
Silica	-ppm	NA	NA	NA	NA
Titanium	-ppm	2.0	<1.0	<1.0	<1.0
Copper	-ppm	43.0	28.0	28.0	359.0
Arsenic	-ppm	20.0	200.0	182.0	342.0
Iron	-ppm	132.0	56.0	28.0	32.0
Manganese	-ppm	27.0	23.0	9.0	8.0
Zinc	-ppm	48.0	31.0	26.0	48.0
Chromium	-ppm	1.0	<1.0	<1.0	1.0
Nickel	-ppm	237.0	512.0	88.0	1200.0
Lead	-ppm	8.0	5.0	4.0	3.0
Cadmium	-ppm	<1.0	<1.0	<1.0	1.0
Gold	-ppm	<0.02	<0.02	<0.02	<0.02
Silver	-ppm	32.8	53.6	7.5	58.5
Strontium	-ppm	6.0	12.0	17.0	8.0
Tungsten	-ppm	<2.0	<2.0	<2.0	<2.0
Antimony	-ppm	<1.0	<1.0	<1.0	<1.0
Thorium	-ppm	<2.5	<2.5	<2.5	<2.5
Sulphur	-ppm	1700.0	1600.0	1400.0	3200.0
T.O.C.	-ppm	NA	NA	NA	NA

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P. O. : 105272, 320

WORK ORDER: 5281D-88

***** FINAL REPORT *******GEOCHEMICAL LABORATORY REPORT****SAMPLE TYPE: OTHER**

S A M P L E N U M B E R		SAMPLE BLANK	SAMPLE FEED	SAMPLE TAILS
Calcium	-ppm	303.0	4.59%	4.1%
Potassium	-ppm	8920.0	88.0	96.0
Silica	-ppm	NA	NA	NA
Titanium	-ppm	1.0	3.0	2.0
Copper	-ppm	6.0	51.0	63.0
Arsenic	-ppm	1.0	3330.0	3490.0
Iron	-ppm	2.0	5.24%	4.74%
Manganese	-ppm	5.0	867.0	835.0
Zinc	-ppm	<1.0	606.0	624.0
Chromium	-ppm	<1.0	57.0	32.0
Nickel	-ppm	<1.0	70.0	67.0
Lead	-ppm	<1.0	431.0	466.0
Cadmium	-ppm	<1.0	4.0	4.0
Gold	-ppm	<0.02	1.28	1.56
Silver	-ppm	0.2	6.5	1.84
Strontium	-ppm	6.0	24.0	26.0
Tungsten	-ppm	<2.0	<2.0	<2.0
Antimony	-ppm	<1.0	5.0	6.0
Thorium	-ppm	<2.5	<2.5	<2.5
Sulphur	-ppm	900.0	7700.0	8300.0
T.O.C.	-ppm	NA	2000.0	2000.0

SIGNED: _____

C. Douglas Read
 C. Douglas Read,
 LABORATORY MANAGER

FOOTNOTES:

P=QUESTIONABLE PRECISION; A=INTERFERENCE; TR=TRACE; ND=NOT DETECTED;
 IS=INSUFFICIENT SAMPLE; NA=NOT ANALYZED; MS=MISSING SAMPLE

ORIGINAL BARRINGER REPORT
SEVERAL ERRORS NOTED.

No. KM_{NO4} added to
these samples.

BARRINGER MAGENTA
Laboratories (Alberta) Ltd.

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EXPLORATION DEPARTMENT
BAG 3000
YELLOWKNIFE, NWT. X1A 2M2

P. O. : 105272, 320

WORK ORDER: 5281D-88 PRELIMINARY
*** REPORT ***

GEOCHEMICAL LABORATORY REPORT

SAMPLE TYPE: WATER

SAMPLE NUMBER		SAMPLE FEED 1	SAMPLE FEED 2	SAMPLE TAILS 1	SAMPLE TAILS 2
		AUG 23	AUG 23	AUG 23	AUG 23
Calcium	-ppm	236.3	239.5	214.1	224.9
Potassium	-ppm	15.75	15.25	15.75	15.5
Silica	-ppm	4.86	4.42	3.66	3.66
Titanium	-ppm	<0.01	0.02	0.02	0.02
Copper	-ppm	7.9	7.88	9.35	8.35
Arsenic	-ppm	17.55	19.53	24.4	24.58
Iron	-ppm	0.4	0.53	1.03	1.18
Manganese	-ppm	0.02	0.01	0.01	0.01
Zinc	-ppm	<0.01	<0.01	<0.01	<0.01
Chromium	-ppm	<0.01	<0.01	<0.01	<0.01
Nickel	-ppm	0.85	0.95	1.08	1.05
Lead	-ppm	0.01	0.01	0.01	0.03
Cadmium	-ppm	<0.01	<0.01	<0.01	<0.01
Gold	-ppm	0.11	0.11	<0.01	<0.01
Silver	-ppm	0.04	0.01	0.11	0.12
Strontium	-ppm	0.43	0.39	0.35	0.4
Tungsten	-ppm	<0.1	<0.1	<0.1	<1.0
Antimony	-ppm	0.92	1.14	1.58	1.61
Thorium	-ppm	0.06	<0.05	<0.05	<0.05
Total Sulphur	-ppm	200.0	190.0	180.0	190.0
Tannic acid	-ppm	11.0	10.0	13.0	14.0
Humic acid	-ppm	<2.0	<2.0	6.0	8.0
T.O.C.	-ppm	18.0	18.0	19.0	19.0

BARRINGER MAGENTA
Laboratories (Alberta) Ltd.

4200B - 10 STREET N.E., CALGARY, ALBERTA, CANADA T2E6K3
PHONE: (403) 250-1901

AUTHORITY: B. CROSS

BARRINGER
Laboratories (NWT) Ltd.

P.O. BOX 864, YELLOWKNIFE, NWT, CANADA X1A 2N6
PHONE: (403) 920-4500

19-SEP-88

PAGE: 2 OF 4

COPY: 2 OF 2

GIANT YELLOWKNIFE MINES LTD.

EXPLORATION DEPARTMENT

BAG 3000

YELLOWKNIFE, NWT. X1A 2M2

P. O. : 105272, 320

WORK ORDER: 5281D-88

REPORT ***

GEOCHEMICAL LABORATORY REPORT

SAMPLE TYPE: WATER

SAMPLE NUMBER		SAMPLE RECL. SOLN	SAMPLE START 88-12	SAMPLE FINISH 88-12
Calcium	-ppm	182.1	1.09	1.43
Potassium	-ppm	14.25	14.85	14.84
Silica	-ppm	3.32	NA	NA
Titanium	-ppm	0.03	0.04	0.03
Copper	-ppm	8.83	88.28	92.64
Arsenic	-ppm	13.8	112.6	165.8
Iron	-ppm	0.14	<0.01	0.06
Manganese	-ppm	<0.01	0.01	<0.01
Zinc	-ppm	<0.01	0.76	1.17
Chromium	-ppm	<0.01	0.15	0.15
Nickel	-ppm	0.9	288.1	211.9
Lead	-ppm	0.01	0.05	0.01
Cadmium	-ppm	<0.01	<0.01	0.11
Gold	-ppm	<0.01	7.1	1.27
Silver	-ppm	0.13	3.4	0.02
Strontium	-ppm	0.56	0.04	0.03
Tungsten	-ppm	<0.1	<0.1	<0.1
Antimony	-ppm	1.09	0.17	0.37
Thorium	-ppm	<0.05	<0.05	<0.05
<i>Total</i> Sulphur	-ppm	140.0	280.0	250.0
Tannic acid	-ppm	9.0	1300.0	740.0
Humic acid	-ppm	58.0	8800.0	500.0
T.O.C.	-ppm	19.0	5700.0	5800.0

BARRINGER MAGENTA
Laboratories (Alberta) Ltd.

4200B - 10 STREET N.E., CALGARY, ALBERTA, CANADA T2E 6K3
PHONE: (403) 250-1901

AUTHORITY: B. CROSS

BARRINGER
Laboratories (NWT) Ltd.

P.O. BOX 864, YELLOWKNIFE, NWT, CANADA X1A 2N6
PHONE: (403) 920-4500

19-SEP-88

PAGE: 3 OF 4

COPY: 2 OF 2

GIANT YELLOWKNIFE MINES LTD.

EXPLORATION DEPARTMENT

BAG 3000

YELLOWKNIFE, NWT. X1A 2M2

P. O. : 105272, 320

WORK ORDER: 5281D-88

REPORT ***

GEOCHEMICAL LABORATORY REPORT

SAMPLE TYPE: OTHER

AFTER KILN
SAMPLE
88-03

STRIPPED
SAMPLE
88-09

STRIPPED
SAMPLE
88-11

LOADED
SAMPLE
C-4

S A M P L E N U M B E R

Calcium	-ppm	2240.0	4600.0	6080.0	3620.0
Potassium	-ppm	64.0	24.0	32.0	24.0
Silica	-ppm	NA	NA	NA	NA
Titanium	-ppm	2.0	<1.0	<1.0	<1.0
Copper	-ppm	43.0	28.0	28.0	359.0
Arsenic	-ppm	20.0	200.0	182.0	342.0
Iron	-ppm	132.0	56.0	28.0	32.0
Manganese	-ppm	27.0	23.0	9.0	8.0
Zinc	-ppm	48.0	31.0	26.0	48.0
Chromium	-ppm	1.0	<1.0	<1.0	1.0
Nickel	-ppm	237.0	512.0	88.0	1200.0
Lead	-ppm	8.0	5.0	4.0	3.0
Cadmium	-ppm	<1.0	<1.0	<1.0	1.0
Gold	-ppm	<0.02	<0.02	<0.02	<0.02
Silver	-ppm	32.8	53.6	7.5	58.5
Strontium	-ppm	6.0	12.0	17.0	8.0
Tungsten	-ppm	<2.0	<2.0	<2.0	<2.0
Antimony	-ppm	<1.0	<1.0	<1.0	<1.0
Thorium	-ppm	<2.5	<2.5	<2.5	<2.5
Sulphur	-ppm	1,7 ⁰⁰	1,6 ⁰⁰	1,4 ⁰⁰	3,2 ⁰⁰
T.O.C.	-ppm	NA	NA	NA	NA

BARRINGER MAGENTA Laboratories (Alberta) Ltd.

4200B - 10 STREET N.E., CALGARY, ALBERTA, CANADA T2E6K3
PHONE: (403) 250-1901

AUTHORITY: B. CROSS

GIANT YELLOWKNIFE MINES LTD.
EXPLORATION DEPARTMENT
BAG 3000
YELLOWKNIFE, NWT. X1A 2M2

BARRINGER Laboratories (NWT) Ltd.

P.O. BOX 864, YELLOWKNIFE, NWT, CANADA X1A 2N6
PHONE: (403) 920-4500

19-SEP-88

PAGE: 4 OF 4

COPY: 2 OF 2

P. O. : 105272, 320

WORK ORDER: 5281D-88

*** REPORT ***

GEOCHEMICAL LABORATORY REPORT

SAMPLE TYPE: OTHER

SAMPLE NUMBER		SAMPLE BLANK	SAMPLE FEED	SAMPLE TAILS
Calcium	-ppm	303.0	4.59%	4.1%
Potassium	-ppm	8920.0	88.0	96.0
Silica	-ppm	NA	NA	NA
Titanium	-ppm	1.0	3.0	2.0
Copper	-ppm	6.0	51.0	63.0
Arsenic	-ppm	1.0	3330.0	3490.0 0.35%
Iron	-ppm	2.0	5.24%	4.74%
Manganese	-ppm	5.0	867.0	835.0
Zinc	-ppm	<1.0	606.0	624.0
Chromium	-ppm	<1.0	57.0	32.0
Nickel	-ppm	<1.0	70.0	67.0
Lead	-ppm	<1.0	431.0	466.0
Cadmium	-ppm	<1.0	4.0	4.0
Gold	-ppm	<0.02	1.28	1.56 — fire assay
Silver	-ppm	0.2	6.5	1.84
Strontium	-ppm	6.0	24.0	26.0
Tungsten	-ppm	<2.0	<2.0	<2.0
Antimony	-ppm	<1.0	5.0	6.0
Thorium	-ppm	<2.5	<2.5	<2.5
Sulphur	-ppm	0.990	7.700	8.300 → 0.83 wt%
* T.O.C.	-ppm	NA	* 2.000	2.000
			0.2 wt%	0.2 wt%

SIGNED: _____

C. Douglas Read,
LABORATORY MANAGER

* Doug Read.

* Transmittance removed by acidification
Sample dried, filtered. — run on
Leco for Total Carbon.

FOOTNOTES:

P=QUESTIONABLE PRECISION; * = INTERFERENCE; TR=TRACE; ND=NOT DETECTED;
IS=INSUFFICIENT SAMPLE; NA=NOT ANALYZED; MS=MISSING SAMPLE

Dave Doyle

Terry Regimbald

Arsenic - Organic } done by University of Laval
Inorganic } - Gary Halverson has contacts

Mercury.

Other heavy metals.

668 YZF 05669392

668-05669392

Shipper's Name and Address Nom et adresse de l'expéditeur GIANT MINES BAG 3000 YELLOWKNIFE NWT		Shipper's Account Number Numéro de compte de l'expéditeur		Not negotiable / Non négociable Air Waybill Lettre de transport aérien Issued by / Émis par NORTHWEST TERRITORIAL AIRWAYS LTD POSTAL SERVICE 9000 YELLOWKNIFE N.W.T. X1A 2R3 CANADA INCORPORATED IN CANADA WITH LIMITED LIABILITY		Copies 1, 2, and 3 of this Air Waybill are originals and have the same validity. Les exemplaires 1, 2, et 3 de cette lettre de transport aérien sont originaux et ont la même validité	
Consignee's Name and Address Nom et adresse du destinataire BARRINGER LABS 4200 B-10 STN.E CALGARY ALTA		Consignee's Account Number Numéro de compte du destinataire		It is agreed that the goods described herein are accepted in apparent good order and condition (except as noted) for carriage SUBJECT TO THE CONDITIONS OF CONTRACT ON THE REVERSE HEREOF. THE SHIPPER'S ATTENTION IS DRAWN TO THE NOTICE CONCERNING CARRIER'S LIMITATION OF LIABILITY. Shipper may increase such limitation of liability by declaring a higher value for carriage and paying a supplemental charge if required. Il est convenu que les marchandises décrites dans le présent document sont acceptées pour le transport en bon état apparent (sauf annotation contraire) et que le transport, est SOUMIS AUX CONDITIONS DU CONTRAT QUI FIGURENT AU VERSO. L'ATTENTION DE L'EXPÉDITEUR EST ATTIRÉE SUR L'AVIS CONCERNANT LA LIMITATION DE RESPONSABILITÉ DU TRANSPORTEUR. L'expéditeur peut augmenter cette limitation de responsabilité en déclarant une valeur pour le transport plus élevée et en payant des frais supplémentaires s'il y a lieu.			
Issuing Carrier's Agent Name and City / Nom et ville de l'agent du transporteur émetteur				Accounting Information / Renseignements comptables			
Agent's IATA Code / Code IATA de l'agent		Account No. / Numéro de compte					
Airport of Departure (Addr. of first Carrier) and Requested Routing Aéroport de départ (Adresse du premier transporteur) et itinéraire demandé YELLOWKNIFE NWT							
to / à	By first Carrier Par premier transporteur	Routing and Destination Routage et dest	to / à	by / par	to / à	by / par	
YEG	NV		YYC	AC			
Airport of Destination / Aéroport de destination CALGARY ALTA		Flight Date Vol / Date	For Carrier Use Only Réserve au transporteur	Flight Date Vol / Date	Amount of Insurance Montant de l'assurance	INSURANCE - If Carrier offers insurance, and such insurance is requested in accordance with conditions on reverse hereof, indicate amount to be insured in figures in box marked Amount of Insurance. ASSURANCE - Si le transporteur propose une assurance et que l'expéditeur en fait la demande conformément aux conditions figurant au verso indiquer le montant à assurer en chiffres dans la case Montant de l'assurance.	
Handling Information / Renseignements pour le traitement de l'expédition							
No. of Pieces Nombre de colis RCP	Gross Weight Poids brut	Kg lb	Rate Class / Classeur du tarif Commodity Item No N° d'article de la marchandise	Chargeable Weight Poids de taxation	Rate / Charge Tarif / Montant	Total	Nature and Quantity of Goods (inc. Dimensions or Volume) Nature et quantité des marchandises (y compris dimensions ou volume)
1	8	K M		8	MIN	23.00	WATER SAMPLES NIL HAZ
1	8					23.00	
Prepaid / Port Payé 23.00		Weight Charge / Taxation au poids 23.00		Collect / Port dû DEL 4.70		Other Charges / Autres frais	
Valuation charge / Taxation à la valeur							
Tax / Taxe							
Total other Charges Due Agent / Total des autres frais dus à l'agent							
Total other Charges Due Carrier / Total des autres frais dus au transporteur 4.70							
TYPE OF SERVICE REQUIRED / TYPE DE SERVICE				Shipper certifies that the particulars on the face hereof are correct and that insofar as any part of the consignment contains dangerous goods, such part is properly described by name and is in proper condition for carriage by air according to the applicable Dangerous Goods Regulations. L'expéditeur certifie que les indications portées sur le présent document sont exactes et que dans la mesure où une partie quelconque de l'expédition contient des marchandises dangereuses, cette partie d'expédition est correctement dénommée et bien préparée pour le transport par air conformément à la réglementation applicable.			
GENERAL FREIGHT FRET GÉNÉRAL <input checked="" type="checkbox"/>		EXPRESS PRIORITY EXPRES PRIORITAIRE <input type="checkbox"/>		GUARANTEED GARANTI <input type="checkbox"/>		Signature of Shipper or his Agent / Signature de l'expéditeur ou de son agent 21/DEC/88...YZF	
Executed on Fait le		(Date) (Date)		at à		(Place) (Lieu)	
Signature of Issuing Carrier or its Agent Signature du transporteur émetteur ou de son agent							

668-05669392

**Giant Yellowknife Mines Limited**

Yellowknife Division
P.O. Bag 3000
Yellowknife, N.W.T.
X1A 2M2

TELEPHONE (403) 873-6301
FAX (403) 873-8983
TELEX 034-45503

REQUISITIONER**PURCHASE ORDER**

THIS NUMBER MUST APPEAR ON ALL
SHIPMENTS AND DOCUMENTS

PAGE NO.

104276

SCHEDULE

SHIP TO:

GIANT YELLOWKNIFE MINES LTD.
P.O. BAG 3000
YELLOWKNIFE DIVISION, N.W.T.
X1A 2M2

FAX NO.

PHONE NO.

DATE ORDERED 03/01/89	DATE REQUIRED 01/01/89	SUPPLIER NO. 014900	TERMS NET 30	VIA YOUR DELIVERY	F.O.B. POINT MINESITE	
BUYER'S NAME LYLE BEXSON		RESP. NO. 6495	REQUISITION NO. 503709			BUYER 01

ITEM	STORES CODE	QUANTITY	UNIT	DESCRIPTION	FED.	PROV.	PRICE	LOCATION
1	9901 507400020 00000	3	LT	CONFIRMATION OF ORDER MAILED JAN 4/89 ANALYSE THREE CYML WATER STREAMS FOR THE FOLLOWING - HUMIC, TANIC, FULMIC ACIDS STREAMS ARE NORTHWEST POND WATER, TRP FEED FILTRATE AND TRP TAILINGS FILTRATE.	F	1	T.B.A. LT	
2	9901 507400020 00000	1	LT	ANALYSE TRP TAILINGS SOLIDS SIZE FRACTIONS FOR INORGANIC CARBON. METHOD MUST REMOVE CARBONATES PRIOR TO GRAPHITIC CARBON DETERMINATION.	F	1	T.B.A. LT	

SEE REVERSE FOR
SALES TAX CODE EXPLANATIONS

Lyle A. Bexson

AUTHORIZED SIGNATURE

CONDITIONS

Acceptance of this order shall be considered an agreement to the conditions specified.

1. ACKNOWLEDGE order immediately to this Company at Yellowknife, N.W.T. and state definitely when material will be shipped.
2. If unable to make shipment on date specified, notify us at once.
3. No charges will be allowed for boxing, crating or cartage unless previously agreed. If through routing is not specified, ship by route taking lowest rate, otherwise excess will be charged to your account.
4. The right is reserved to cancel this order if not filled in accordance with our delivery schedule.
5. This order is subject to modification in the event of fires, strikes, or other conditions beyond our control.
6. PACKING LIST must accompany each shipment.
7. INVOICES IN DUPLICATE, Bills of Lading or Express Receipts must be mailed to our address on date of shipment.
8. INVOICE must show our order number, terms and full description of material shipped.
9. DRAFTS and/or C.O.D. Shipments will not be accepted.
10. FOREIGN SHIPPERS must supply one set of duplicate Commercial Invoices and one set of quadruplicate Canadian Customs Invoices compiled and Certified in accordance with Canadian Customs Regulations, all which are to be mailed to Giant Yellowknife Mines on date of shipment otherwise the shipper will be held responsible for storage or demurrage.
 - (1) Gross weight of each shipment to be shown on Customs Invoice to agree exactly with weight shown on waybill.
 - (2) Complete routing information to be shown on Customs Invoice.
11. All Bills of Lading and/or shipping documents must show value of materials shipped.

SALES TAX CODE EXPLANATIONS	
<u>FEDERAL EXEMPTIONS</u>	<u>TAXABLE</u>
A - PROCESSING MATERIALS	E - BUILDING MATERIALS (F.S.T. PAYABLE AT 8% ONLY)
B - GOV'T RULED EXEMPT	F - INCLUDED
C - LICENSE	
D - PRODUCTION EQUIPMENT AND PLANS	
H - HEALTH	



Giant Yellowknife Mines Limited
Yellowknife Division
P.O. Bag 3000
Yellowknife, N.W.T.
X1A 2M2

TELEPHONE (403) 873-6301
FAX (403) 873-8983
TELEX 034-45503

REQUISITIONER

PURCHASE ORDER	
THIS NUMBER SHIPMENT	APPEAR ON ALL DOCUMENTS
108276	PAGE NO. 01

SUPPLIER

- BARRINGER MAGENTA LABORATORIES
- 4200 B-10 STREET, N.E.
- CALGARY, ALBERTA
- T2E 8K3

SHIP TO:
GIANT YELLOWKNIFE MINES LTD.
P.O. BAG 3000
YELLOWKNIFE DIVISION, N.W.T.
X1A 2M2

FAX NO. PHONE NO. VIA

DATE ORDERED 03/01/89	DATE REQUIRED 31/01/89	SUPPLIER NO. 014900	TERMS NET 30	VIA YOUR DELIVERY	F.O.B. POINT MINESITE	
BUYER'S NAME LYLE BEXSON		RESP. NO. 6495	REQUISITION NO. 503709			BUYER 03

ITEM	STORES CODE	QUANTITY	UNIT	DESCRIPTION	FED.	PROV.	PRICE	LOCATION
1	9901 507400020 00000	3	LT	CONFIRMATION OF ORDER MAILED JAN 4/89 ANALYSE THREE CYML WATER STREAMS FOR THE FOLLOWING - HUMIC, TANNIC, FULVIC ACIDS STREAMS ARE NORTHWEST POND WATER, TRP FEED FILTRATE AND TRP TAILINGS FILTRATE.	F	1	T.B.A. LT	
2	9901 507400020 00000	1	LT	ANALYSE TRP TAILINGS SOLIDS SIZE FRACTIONS FOR INORGANIC CARBON. METHOD MUST REMOVE CARBONATES PRIOR TO GRAPHITIC CARBON DETERMINATION.	F	1	T.B.A. LT	

SEE REVERSE FOR
SALES TAX CODE EXPLANATIONS

Lyle A. Bexson
AUTHORIZED SIGNATURE

NATURE OF THE GANGUE

The nature of the gangue affects leaching kinetics and recovery efficiency in several ways. Those that come to mind immediately are:

- permeability of the ore grains
- preg-robbing species
- precipitation effects
- adsorption effects on clays, etc.

Fulvic
Acid

Permeability of Ore Particles

The permeability of the ore can be affected by the degree of silicification, i.e. silica encapsulation of the precious metal particles or simply the nature of the gangue and the distribution of metal values in it. Those ores where gold and silver values were distributed in "boxwork" fractures without being encapsulated by silica or manganese would be expected to be particularly leachable by cyanide solutions.

The permeability or accessibility of the gold and silver particles depends on the nature of the gangue and determines the degree of fineness to which the ore must be ground to expose the gold and silver. This characteristic of the ore is best determined in an empirical way through a series of grind-leach tests although here again a good process mineralogist and microprobe analyst will be able to provide a good idea of what to expect.

Although nothing was found on the subject in the literature, RANDOL believes that clogging of pores and fractures in sulfide mineral grains, possibly by elemental sulfur, may reduce the permeability of such particles and that this may make them sometimes appear more refractory than they really are.

Preg-robbing Species

Preg-robbing of gold and silver from cyanide pulps may occur as a result of various not yet completely defined naturally occurring species in the ore or as a result of extraneously introduced materials.

Naturally occurring preg-robbing species in gold and silver ores include activated carbons, certain types of pyrite and possibly clay minerals impregnated with humic or fulvic acids which can all adsorb gold and silver from pulp during leaching with cyanide. The preg-robbing properties of the so-called "graphite" or carbonaceous content that exists in certain ores in Nevada, California, Montana, Columbia, West Africa and Western Australia was shown by DORR and BOSQUI (1950) to have been a source of difficulty for many years.

It was GUAY (1980) who first pointed out that certain types of framboidal pyrite clusters, and not only activated carbon, results in preg-robbing from cyanide pulps and solutions.

This phenomenon is particularly prevalent in the Western United States. Processes for the recovery of gold from some of these ores have been proposed by GUAY (1973, 1980) and GUAY and GROSS (1981), RADTKE and SCHEINER (1970), SCHEINER et al (1971, 1972) and WELLS and MULLENS (1973). Natural preg-robbing species have also been reported by STILLWELL and EDWARDS (1946) in Fiji and described by FEATHER and KOEN (1975) as well as in Colombia by WILSON and DARNELL (1942) and by DORR and BOSQUI (1950).

BOYLE et al (1975) described an experiment with humic material in water:

GIANT YELLOWKNIFE MINES LIMITED
P.O. Bag 3000
Yellowknife, N.W.T.
X1A 2M2

FAX COVER PAGE

DATE:

JAN 5, 1989

TIME:

10:37

OUR REF. NO:

GT 4057

ATTENTION:

Doug Read

FAX 403-250-8265

BARRINGER Magenta LABS

FROM:

Doug Bartlett

GYML

NO. OF PAGES TO FOLLOW:

2

(Excluding This Cover Page)

COMMENTS OR INSTRUCTIONS:

P.O. Attached for analytical work discussed. Reference
attached from Randol "Gold Bible" on fulvic acid.

Tailings solids samples for Inorganic carbon
remain to be shipped.

Regards

DM

If there is a problem with this transmission, or if you wish to contact us, following are our numbers:

Telephone: 403-873-6301 ext. 128

Fax: 403-873-2980

Telex: 034-45514

BARRINGER

Laboratories (Alberta) Ltd.

SERVICES FOR THE EARTH AND ENVIRONMENTAL SCIENCES

Giant Yellowknife Mines Ltd.
Exploration Department
Bag 3000
Yellowknife, NWT
X1A 2M2

TERMS: NET 30 DAYS

AUTHORITY: D. Bartlett

TO:

3	Hemic Acid determinations
3	Tannic Acid determinations

26.00	78.00
25.00	75.00
	<hr/> 153.00

50% surcharge for less than 6 samples

76.50

TOTAL AMOUNT DUE:

\$229.50

Feb 1, 1989.
Requested by letter to
Keep P.O. open.

4200B - 10 STREET N.E.
CALGARY, ALBERTA T2E 6K3
PHONE: (403) 250-1901

DATE: Jan. 23, 1989

PROJECT:

PERIOD COVERED:

SALES ORDER:
PROGRESS BILLING: P.O.NO.108276
SHIPPING REPORT:
WORK REPORT: 6001-89
FED. SALES TAX: Exempt

INVOICE 3446

BARRINGER

Laboratories (Alberta) Ltd.

4200B - 10 STREET N.E., CALGARY, ALBERTA, CANADA T2E 6K3
PHONE: (403) 250-1901

AUTHORITY: DOUG BARTLETT

GIANT YELLOWKNIFE MINES LTD.

EXPLORATION DEPARTMENT

BAG 3000

YELLOWKNIFE, NWT. X1A 2M2

P. O. : 108276

WORK ORDER: 6001D-89

*** FINAL REPORT ***

GEOCHEMICAL LABORATORY REPORT

SAMPLE TYPE: WATER

SAMPLE NUMBER	FEED TRP	RECYCLE TRP	TAILING TRP
Humic acid -mg/L	4.0	9.0	14.0
Tannic acid -mg/L	2.0	15.0	37.0

SIGNED: _____

C. Douglas Read
C. Douglas Read,
LABORATORY MANAGER

FOOTNOTES:

P=QUESTIONABLE PRECISION; A=INTERFERENCE; TR=TRACE; ND=NOT DETECTED;
IS=INSUFFICIENT SAMPLE; NA=NOT ANALYZED; MS=MISSING SAMPLE

MEMO TO: Don Cooper
COPY TO: Doug Bartlett
FROM: Bryan Cross
DATE: November 5, 1988
SUBJECT: TRP TANK PROFILES.

Attached are the CIL Tank Profiles for the 1988 operating season. The upper table on each page was reported with the daily metallurgical balance reports, the lower table was just added to get a look at the inventories in each vessel. Due to the Assay Lab workload and the number of launder screens requiring changing by the operators, etcetera, the amount of data available is limited. The data seems to indicate that we had wide swings in the grade of material mined. Looking at the results for September 24th to the 28th you can see the Surge Tank grade change ie 0.057, 0.045, 0.051, 0.059, and 0.052 oz Au/ton on the solids. The solutions also showed a similar behavior ie 0.0028, 0.0037, 0.0048, 0.0035, and 0.0037. We may want to take samples from each tank on a shift basis next year having the Met Balance as a moving inventory of ounces in process and on carbon. That would be much more difficult to do but the data may be more realistic. I cannot determine from this data if more leach tanks would be economic. The Pilot Plant data tells a definite no to further leach vessels. TRP tailings recyanidation shows further leaching but that was only a few tests. More lab leaches are required for a decision of this magnitude.

CIL TANK PROFILE

AUG. 31, 1988

TANK FEED	ASSAY SOLIDS	oz Au/TON SOLUTION	pH	CN lb/ton	% SOLIDS	D.O. mg/l
SURGE			10.12		42.00	8.40
1	0.0630	0.0080	9.75	0.05	42.00	6.80
2	0.0510	0.0080	10.09	0.20	39.00	10.20
3	0.0500	0.0080	10.17	0.30	39.00	10.40
4	0.0500	0.0080	10.34	0.50	39.00	10.30
5	0.0480	0.0070	10.20	0.50	38.50	10.50
6	0.0470	0.0070	10.15	0.40	41.00	10.20
TAILS						

TANK FEED	TONS SOLIDS	TONS SOLUTION	ozs Au SOLIDS	ozs Au SOLUTION	TOTAL ozs Au	PERCENT OF #1
SURGE						
1	1675.4	2312.1	105.552	18.497	124.048	100.00
2	1517.5	2367.4	77.394	18.939	96.333	77.66
3	1517.5	2367.4	75.877	18.939	94.816	76.43
4	1517.5	2367.4	75.877	18.939	94.816	76.43
5	1494.3	2375.9	71.726	16.632	88.358	71.23
6	1619.8	2332.5	76.131	16.328	92.459	74.53
TAILS						

CIL TANK PROFILE

SEPT. 4, 1988

TANK FEED	ASSAY oz Au/TON SOLIDS	SOLUTION	pH	CN lb/ton	% SOLIDS
SURGE	0.1050	0.0069	10.99		37.80
1	0.0610	0.0057	10.25	0.200	34.00
2	0.0620	0.0059	10.24	0.200	34.00
3	0.0590	0.0057	10.39	0.400	34.00
4	0.0580	0.0065	10.36	0.400	38.00
5	0.0570	0.0045	10.20	0.500	37.50
6	0.0580	0.0030	10.19	0.400	36.00
TAILS	0.0580	0.0041	10.22	0.300	

TANK FEED	TONS SOLIDS	TONS SOLUTION	ozs Au SOLIDS	ozs Au SOLUTION	TOTAL ozs Au	PERCENT OF #1
SURGE	1466.0	2389.6	153.930	16.488	170.418	186.44
1	1268.5	2461.0	77.381	14.027	91.408	100.00
2	1268.5	2461.0	78.649	14.520	93.169	101.93
3	1268.5	2461.0	74.844	14.027	88.871	97.22
4	1466.0	2389.6	85.028	15.532	100.560	110.01
5	1466.0	2389.6	83.562	10.753	94.315	103.18
6	1363.7	2427.4	79.094	7.282	86.376	94.50
TAILS						

CIL TANK PROFILE

SEPT. 13, 1988

TANK FEED	ASSAY SOLIDS	oz Au/TON SOLUTION	pH	CN lb/ton	% SOLIDS	D.O. mg/l
SURGE	0.0800	0.0030	8.96	0.050	36.00	11.10
1	0.0820	0.0033	9.86	0.050	30.00	10.60
2	0.0760	0.0047	9.97	0.050	29.00	12.20
3	0.0700	0.0053	9.94	0.100	30.00	13.00
4	0.0690	0.0030	9.95	0.150	30.00	12.60
5	0.0680	0.0021	9.87	0.150	33.00	13.20
6	0.0680	0.0022	9.87	0.150	34.00	12.60
TAILS	0.0660	0.0013	9.81	0.150	34.00	11.80

TANK FEED	TONS SOLIDS	TONS SOLUTION	ozs Au SOLIDS	ozs Au SOLUTION	TOTAL ozs Au	PERCENT OF #1
SURGE	1363.7	2427.4	109.095	7.282	116.378	119.52
1	1085.6	2529.5	89.022	8.347	97.369	100.00
2	1039.4	2546.5	78.992	11.968	90.961	93.42
3	1085.6	2529.5	75.994	13.406	89.401	91.82
4	1085.6	2529.5	74.908	7.589	82.497	84.73
5	1221.2	2479.0	83.040	5.206	88.246	90.63
6	1268.5	2461.0	86.260	5.414	91.675	94.15
TAILS						

CIL TANK PROFILE

SEPT. 16, 1988

TANK FEED	ASSAY SOLIDS	oz Au/TON SOLUTION	pH	CN lb/ton	% SOLIDS	D.O. mg/l
SURGE	0.093	0.0034	8.63	0.020	33.00	11.50
1	0.0820	0.0041	8.73	0.010	36.00	11.00
2	0.0730	0.0054	9.41	0.100	35.00	13.00
3	0.0620	0.0044	9.74	0.150	36.00	13.20
4	0.0600	0.0030	10.00	0.240	36.00	13.20
5	0.0570	0.0016	10.12	0.260	36.00	13.40
6	0.0580	0.0010	10.12	0.260	36.00	13.00
TAILS	0.0580	0.0013	10.10	0.230	37.00	12.50

TANK FEED	TONS SOLIDS	TONS SOLUTION	ozs Au SOLIDS	ozs Au SOLUTION	TOTAL ozs Au	PERCENT OF #1
SURGE	1221.2	2479.0	113.570	8.429	121.998	100.18
1	1363.7	2427.4	111.823	9.952	121.775	100.00
2	1315.3	2446.5	96.017	13.211	109.227	89.70
3	1363.7	2427.4	84.549	10.680	95.229	78.20
4	1363.7	2427.4	81.822	7.282	89.104	73.17
5	1363.7	2427.4	77.731	3.884	81.614	67.02
6	1363.7	2427.4	79.094	2.427	81.522	66.94
TAILS						

CIL TANK PROFILE

SEPT. 22, 1988

TANK FEED	ASSAY SOLIDS	oz Au/TON SOLUTION	pH	CN lb/ton	% SOLIDS	D.O. mg/l	TEMPERATURE DEG C
SURGE	0.041	0.0025	12.16	0.001	37	11.80	5.0
1	0.0440	0.0042	10.54	0.005	36.00	10.40	8.0
2	0.0380	0.0058	10.51	0.145	36.00	11.80	10.0
3	0.0400	0.0047	10.46	0.215	30.00	11.60	10.5
4	0.0400	0.0029	10.45	0.295	30.00	11.80	11.0
5	0.0410	0.0022	10.51	0.295	29.00	11.60	10.5
6	0.0370	0.0018	10.38	0.300	34.00	12.00	10.5
TAILS	0.0390	0.0013	10.26	0.170		12.10	9.5

TANK FEED	TONS SOLIDS	TONS SOLUTION	ozs Au SOLIDS	ozs Au SOLUTION	TOTAL ozs Au	PERCENT OF #1
SURGE						
1	1363.7	2427.4	60.003	10.195	70.197	100.00
2	1363.7	2427.4	51.820	14.079	65.899	93.88
3	1085.6	2529.5	43.425	11.889	55.314	78.80
4	1085.6	2529.5	43.425	7.336	50.761	72.31
5	1039.4	2546.5	42.614	5.602	48.216	68.69
6	1268.5	2461.0	46.936	4.430	51.366	73.17
TAILS						

CIL TANK PROFILE

SEPT. 24, 1988

TANK FEED	ASSAY SOLIDS	oz Au/TON SOLUTION	pH	CN lb/ton	% SOLIDS	D.O. mg/l	TEMPERATURE DEG C
SURGE	0.057	0.0028	9.95	0.010		11.80	11.5
1	0.0600	0.0046	10.06	0.130	36.50	10.40	10.0
2	0.0540	0.0048	10.38	0.200	36.00	11.80	9.5
3	0.0520	0.0037	10.44	0.270	36.00	11.60	10.0
4	0.0520	0.0019	10.48	0.290	35.00	11.80	10.0
5	0.0580	0.0011	10.45	0.340	34.50	11.60	10.5
6	0.0470	0.0008	10.37	0.260	35.00	12.00	10.0
TAILS	0.0490	0.0016	10.32	0.210		12.10	10.0

TANK FEED	TONS SOLIDS	TONS SOLUTION	ozs Au SOLIDS	ozs Au SOLUTION	TOTAL ozs Au	PERCENT OF #1
SURGE						
1	1389.0	2416.8	83.337	11.117	94.454	100.00
2	1363.7	2427.4	73.639	11.651	85.291	90.30
3	1363.7	2427.4	70.912	8.981	79.893	84.58
4	1315.3	2446.5	68.395	4.648	73.044	77.33
5	1292.1	2455.0	74.942	2.700	77.642	82.20
6	1315.3	2446.5	61.819	1.957	63.776	67.52
TAILS						

CIL TANK PROFILE

SEPT. 25, 1988

TANK FEED	ASSAY SOLIDS	oz Au/TON SOLUTION	pH	CN lb/ton	% SOLIDS	D.O. mg/l	TEMPERATURE DEG C
SURGE	0.045	0.0037	10.70	0.020		11.40	7.0
1	0.0480	0.0049	10.35	0.030	36.50	10.40	8.0
2	0.0450	0.0052	10.53	0.260	36.00	12.90	8.0
3	0.0470	0.0042	10.57	0.420	36.00	12.80	8.0
4	0.0490	0.0029	10.63	0.520	35.00	12.70	8.0
5	0.0480	0.0017	10.52	0.510	34.50	13.20	8.0
6	0.0580	0.0012	10.49	0.420	35.00	13.30	7.0
TAILS	0.0550	0.0009	10.42	0.310		13.80	7.0

TANK FEED	TONS SOLIDS	TONS SOLUTION	ozs Au SOLIDS	ozs Au SOLUTION	TOTAL ozs Au	PERCENT OF #1
SURGE						
1	1389.0	2416.8	66.670	11.842	78.512	100.00
2	1363.7	2427.4	61.366	12.622	73.989	94.24
3	1363.7	2427.4	64.094	10.195	74.289	94.62
4	1315.3	2446.5	64.450	7.095	71.544	91.13
5	1292.1	2455.0	62.021	4.173	66.194	84.31
6	1315.3	2446.5	76.287	2.936	79.223	100.91
TAILS			0.000	0.000	0.000	0.00

CIL TANK PROFILE

SEPT. 26, 1988

TANK FEED	ASSAY SOLIDS	oz Au/TON SOLUTION	pH	CN lb/ton	% SOLIDS	D.O. mg/l	TEMPERATURE DEG C
SURGE	0.051	0.0048	10.98	0.060		10.35	9.0
1	0.0580	0.0062	10.40	0.070	36.50	11.50	8.0
2	0.0470	0.0058	10.60	0.370	37.00	13.00	8.0
3	0.0430	0.0049	10.63	0.570	36.00	13.45	8.0
4	0.0420	0.0033	10.70	0.630	36.50	12.80	8.0
5	0.0420	0.0026	10.61	0.670	36.00	13.20	8.0
6	0.0420	0.0014	10.55	0.550	36.50	12.70	8.0
TAILS	0.0440	0.0011	10.51	0.380			8.0

TANK FEED	TONS SOLIDS	TONS SOLUTION	ozs Au SOLIDS	ozs Au SOLUTION	TOTAL ozs Au	PERCENT OF #1
SURGE						
1	1389.0	2416.8	80.559	14.984	95.543	100.00
2	2407.3	1416.0	113.142	8.213	121.355	127.02
3	1363.7	2427.4	58.639	11.894	70.533	73.82
4	1389.0	2416.8	58.336	7.975	66.311	69.40
5	1363.7	2427.4	57.275	6.311	63.586	66.55
6	1389.0	2416.8	58.336	3.383	61.719	64.60
TAILS			0.000	0.000	0.000	0.00

CIL TANK PROFILE

SEPT. 27, 1988

TANK FEED	ASSAY oz Au/TON SOLIDS	oz Au/TON SOLUTION	pH	CN lb/ton	% SOLIDS	D.O. mg/l	TEMPERATURE DEG C
SURGE	0.059	0.0035	9.74	0.010		11.40	9.0
1	0.0650	0.0040	10.32	0.020	37.00	11.30	8.0
2	0.0540	0.0059	10.50	0.180	36.50	12.30	7.0
3	0.0510	0.0045	10.55	0.290	36.00	13.80	8.0
4	0.0520	0.0033	10.69	0.580	35.50	12.60	9.0
5	0.0510	0.0018	10.63	0.540	35.00	12.80	9.0
6	0.0490	0.0011	10.55	0.460	34.50	12.60	9.0
TAILS	0.0450	0.0008	10.58	0.380		12.20	9.0

TANK FEED	TONS SOLIDS	TONS SOLUTION	ozs Au SOLIDS	ozs Au SOLUTION	TOTAL ozs Au	PERCENT OF #1
SURGE						
1	1416.0	2446.0	92.043	9.784	101.827	100.00
2	1389.0	2416.8	75.003	14.259	89.262	87.66
3	1363.7	2427.4	69.548	10.923	80.472	79.03
4	1339.2	2437.3	69.636	8.043	77.679	76.29
5	1315.3	2446.5	67.080	4.404	71.484	70.20
6	1291.1	2453.1	63.263	2.698	65.962	64.78
TAILS			0.000	0.000	0.000	0.00

CIL TANK PROFILE

SEPT. 28, 1988

TANK FEED	ASSAY SOLIDS	oz Au/TON SOLUTION	pH	CN lb/ton	% SOLIDS	D.O. mg/l	TEMPERATURE DEG C
SURGE	0.052	0.0037	10.14	0.010		11.40	9.0
1	0.0610	0.0042	10.21	0.010	38.00	11.40	8.0
2	0.0570	0.0059	10.50	0.310	39.00	13.20	8.0
3	0.0530	0.0055	10.59	0.460	40.00	13.00	8.0
4	0.0500	0.0033	10.68	0.570	36.00	13.30	8.0
5	0.0510	0.0025	10.61	0.640	37.00	14.00	8.0
6	0.0490	0.0009	10.57	0.630	36.00	13.70	9.0
TAILS	0.0500	0.0006	10.51	0.600		13.60	10.0

TANK FEED	TONS SOLIDS	TONS SOLUTION	ozs Au SOLIDS	ozs Au SOLUTION	TOTAL ozs Au	PERCENT OF #1
SURGE						
1	1466.0	2389.6	89.426	10.036	99.462	100.00
2	1517.5	2367.4	86.500	13.967	100.467	101.01
3	1568.0	2352.0	83.106	12.936	96.042	96.56
4	1363.7	2427.4	68.185	8.010	76.195	76.61
5	1416.0	2446.0	72.218	6.115	78.333	78.76
6	1363.7	2427.4	66.821	2.185	69.006	69.38
TAILS			0.000	0.000	0.000	0.00

CIL TANK PROFILE

OCT. 8, 1988

TANK FEED	ASSAY SOLIDS	oz Au/TON SOLUTION	pH	CN lb/ton	% SOLIDS	D.O. mg/l	TEMPERATURE DEG C
SURGE							
1	0.0620	0.0058	10.81		41.82		
2	0.0630	0.0104	10.56	0.477	39.00	9.20	12.0
3	0.0630	0.0110	10.64	0.479	39.00	10.10	12.0
4	0.0610	0.0060	10.68	0.478	38.00	9.30	12.0
5	0.0580	0.0042	10.69	0.484	40.00	11.10	12.0
6	0.0590	0.0028	10.62	0.476	40.00	11.10	12.0
TAILS	0.0550	0.0011					

TANK FEED	TONS SOLIDS	TONS SOLUTION	ozs Au SOLIDS	ozs Au SOLUTION	TOTAL ozs Au	PERCENT OF #1
SURGE						
1	1675.4	2312.1	103.876	13.410	117.286	100.00
2	1517.5	2367.4	95.605	24.621	120.225	102.51
3	1517.5	2367.4	95.605	26.041	121.646	103.72
4	3093.3	2389.6	188.688	14.337	203.026	173.10
5	1568.0	2352.0	90.946	9.879	100.824	85.96
6	1568.0	2352.0	92.514	6.586	99.100	84.49
TAILS						

CIL TANK PROFILE

OCT. 12, 1988

TANK FEED	ASSAY oz Au/TON SOLIDS	SOLUTION	pH	CN lb/ton	% SOLIDS	D.O. mg/l	TEMPERATURE DEG C
SURGE							
1	0.0550	0.00500			39.60		
2	0.0510	0.00800	10.90	0.200	39.00	10.40	7.0
3	0.0510	0.00780	9.39	0.270	37.00	10.40	7.0
4	0.0490	0.00500	9.61	0.360	36.50	10.30	7.5
5	0.0470	0.00310	9.61	0.350	39.00	10.60	7.5
6	0.0470	0.00210	9.58	0.370	37.00	10.50	7.0
TAILS	0.0430	0.00140					

SAMPLES TAKEN AT MIDNIGHT ON THE 12TH,

TANK FEED	TONS SOLIDS	TONS SOLUTION	ozs Au SOLIDS	ozs Au SOLUTION	TOTAL ozs Au	PERCENT OF #1
SURGE						
1	1563.3	2345.0	85.984	11.725	97.709	100.00
2	1517.5	2367.4	77.394	18.939	96.333	98.59
3	1416.0	2407.3	72.218	18.777	90.995	93.13
4	1389.0	2416.8	68.059	12.084	80.143	82.02
5	1517.5	2367.4	71.324	7.339	78.663	80.51
6	1416.0	2407.3	66.554	5.055	71.609	73.29
TAILS			0.000	0.000	0.000	0.00

CIL TANK PROFILE

OCT. 13, 1988

TANK FEED	ASSAY SOLIDS	oz Au/TON SOLUTION	pH	CN lb/ton	% SOLIDS	D.O. mg/l
SURGE						
1	0.0475	0.0047			39.60	
2	0.0440	0.0069	10.90	0.2	39.00	10.40
3	0.0400	0.0064	9.39	0.27	37.00	10.40
4	0.0390	0.0046	9.61	0.36	36.50	10.30
5	0.0380	0.0032	9.61	0.35	39.00	10.60
6	0.0370	0.0018	9.58	0.37	37.00	10.50
TAILS	0.0380	0.0012				

TANK FEED	TONS SOLIDS	TONS SOLUTION	ozs Au SOLIDS	ozs Au SOLUTION	TOTAL ozs Au	PERCENT OF #1
SURGE						
1	1568.0	2352.0	74.481	11.055	85.536	100.00
2	1517.5	2367.4	66.772	16.335	83.106	97.16
3	1416.0	2407.3	56.642	15.407	72.048	84.23
4	1389.0	2416.8	54.169	11.117	65.286	76.33
5	1517.5	2367.4	57.666	7.576	65.242	76.27
6	1416.0	2407.3	52.394	4.333	56.727	66.32
TAILS						

TO: CIL Plant Operators

CC: TRP Shifters, D. Cooper, G. Doerksen

FROM: Bryan Cross

DATE: October 7, 1988

SUBJECT: CIL TANK PROFILE SAMPLING.

Starting at midnight tonight (0000 hrs Oct. 8/88) Plant Operators will be required to perform sampling on all of the CIL tanks twice weekly. The Surge tank is not required but in addition to the regular shift Feed and Tails samples, Feed Samples to Tanks #2, #3, #4, #5 and #6 are necessary. Tonight's samples will be the first and until the plant shuts down these "tank profile" samples are to be taken twice a week. As "carbon profile" samples are being taken on Mondays and Thursdays take the "tank profile" samples on Tuesday and Wednesdays for the midnight to noon period. The 8pm-8am Operator is to put out the properly labelled pails complete with permanganate addition and initiate sampling on a once hourly basis. Sampling is to be from the feed launders, use a plastic one litre density pail on a rope to obtain them. Along with the sampler pail carry a 20 mesh screen with you when performing a sampling round, this is to screen out carbon that would contaminate assays. To do this pour the obtained sample from the one litre pail through the screen into the composite sample pail. It is good practice to replace the lid on the composite sample pails to minimize contamination risk.

The 8am-8pm Operator is to continue the sampling during their portion of the sampling period until noon, then filter the samples. Cleanliness and care must be taken to avoid sample contamination during filtration, handling of the filter cake, and bottling the filtrate. After removing the filtrate flask use some filtrate to rinse the labelled sample bottle, discard the rinse and fill the bottle with the solution sample. The flask then should be reassembled into the filtration apparatus so a litre or so of tap water can be filtered through the filter cake to wash any residual solution out of the solids sample. Vacuum dry filter cake can then be removed to a sample tray, be labeled, and sent to the lab for a gold assay. There are seven of each solid and solution samples, please make sure they all get to the lab.

In addition to the above sampling during the 12 hour period one set of the following readings must be taken for each sampling point: pH, temperature, dissolved oxygen, and cyanide (titration) concentration. Record the readings on the forms provided.

Bryan Cross

CIL TANK PROFILE

DATE AND TIME OF SAMPLING =

TANK FEED	ASSAY OZ Au/TON SOLIDS	SOLUTION	pH	CN lb/ton	% SOLIDS	D.O. mg/l	TEMPERATURE DEG C
SURGE							
1							
2							
3							
4							
5							
6							
TAILS							

CIL TANK PROFILE

SEPT. 24 to 28, 1988 AVERAGES

TANK FEED	ASSAY oz Au/TON SOLIDS	SOLUTION	pH	CN lb/ton	% SOLIDS
SURGE	0.0528	0.0037	10.30	0.022	
1	0.0584	0.0048	10.27	0.052	36.90
2	0.0514	0.0055	10.50	0.264	36.90
3	0.0492	0.0046	10.56	0.406	36.80
4	0.0490	0.0029	10.64	0.518	35.60
5	0.0500	0.0019	10.56	0.540	35.40
6	0.0490	0.0011	10.51	0.464	35.40
TAILS	0.0486	0.0010	10.47	0.376	

My Averages for the season:

Feed to surge tank 0.0038 g/ton

Feed to CIL #1 w/o NaCN 0.0050 g/ton

Feed to CIL #2 (with NaCN & Carbon) .0055 g/ton.

Bryan Cross
Nov 15/88

GIANT

Yellowknife Mines Limited

MEMO TO: D. W. Cooper

FROM: D.R. Bartlett *DM*

CC: J.S. McAlpine, S.E. El-Alfy

SUBJECT: Processability of Polishing Pond Material
Giant Versus Lakefield Reports

Both Lakefield Research and GYML Mill Lab have conducted cyanidation test programs on drill core from the Polishing Pond. Table 1 and 2 contain the respective head assay and gold extraction data.

There is a major discrepancy in results. Lakefield shows consistent lower head assays and higher gold extractions. Following is the overall comparison.

Overall Polishing Pond Composite Cyanidation Performance

	<u>Lakefield</u>	<u>Giant</u>
Assayed Head, oz/ton Au	0.086	0.103
Calculated Head, oz/ton Au	0.096	0.105
% Gold Extraction	34.2	28.9
% Mass Balance	112%	102%

The points in GYML's favour are:

- o A better mass balance accuracy (ratio of calculated test/ assayed heads).
- o Good assay comparison with the original drill program log. (Table 3)

CONCLUSION

I recommend acceptance of the Giant data unless the TRP gold reconciliation can indicate a deviation. The expected recovery of gold from the Polishing Pond will vary from 24.5 to 33.4% and average 28.9%. These expectations are consistent with the October, 1988 decrease in TRP gold extraction associated with higher mine production from the Polishing Pond.

TABLE 1

Polishing Pond Cyanidation Results
Lakefield Research *Program

Drill Hole	Depth	Gold Head, oz/ton		Gold Extraction %
		Assay	Calculated	
88-1, 2, 3	Total Cores	0.088	0.095	35.0
88-4, 5	" "	0.076	0.079	30.5
88-6, 7	" "	0.094	0.119	39.0
88-8, 12	" "	0.088	0.098	37.0
88-9 10	" "	<u>0.083</u>	<u>0.085</u>	<u>31.1</u>
Average 1-12		0.086	0.096	34.2

NOTE:

* Project L.R. 3515, Progress Report No. 1, August 24, 1988

TABLE 2

POLISHING POND CYANIDATION RESULTS
GIANT MILL LAB *PROGRAM

Drill Hole	Depth	Gold Head, oz/ton		Gold Extraction %
		Assay	Calculated	
88-1	Total Core	0.103	0.114	30.0
88-2	" "	0.107	0.113	26.5
88-3	" "	0.106	0.106	29.8
88-4	" "	0.103	0.098	29.9
88-5	" "	0.100	0.104	28.6
88-6	" "	0.103	0.100	27.0
88-7	" "	0.102	0.102	30.6
88-8	" "	0.105	0.105	33.4
88-9	" "	0.103	0.104	27.5
88-10	" "	0.102	0.104	24.5
88-12	" "	<u>0.099</u>	<u>0.102</u>	<u>30.1</u>
Avg.		0.103	0.105	28.91
88-12	0-10	0.101	0.124	49.6
	10-20	0.138	0.152	24.1
88-1	0-10	0.101	0.125	49.6
	10-20	0.138	0.151	24.1
	20-30	0.104	0.119	26.1
88-10	Total, CIL	0.095	0.106	30.7
	Total, repulp	0.095	0.101	30.8

NOTE:

* Data from References 10 to 14

TABLE 3

1988 POLISHING POND DRILL PROGRAM RESULTS

GRADE (oz./TON)

ELEVATION	HOLE 88-1	HOLE 88-2	HOLE 88-3	HOLE 88-4	HOLE 88-5	HOLE 88-6	HOLE 88-7	HOLE 88-8	HOLE 88-9	HOLE 88-10	HOLE 88-12	AVE.
6036- 6034					0.022					0.033		0.028
6034- 6032			0.058	0.047	0.054					0.03		0.047
6032- 6030	0.087		0.061	0.051	0.045		0.035		0.047	0.048		0.053
6030- 6028	0.047	0.062	0.067	0.047	0.061		0.041		0.053	0.08		0.057
6028- 6026	0.055	0.072	0.064	0.047	0.059		0.056		0.076	0.082		0.064
6026- 6024	0.132	0.08	0.099	0.067	0.109		0.076		0.063	0.075		0.088
6024- 6022	0.148	0.101	0.162	0.067	0.126		0.087		0.101	0.115		0.113
6022- 6020	0.102	0.094	0.115	0.093	0.095		0.127		0.112	0.09		0.104
6020- 6018	0.134	0.106	0.123	0.077	0.154		0.11		0.131	0.139		0.122
6018- 6016	0.085	0.103	0.117	0.13	0.146		0.127		0.126	0.119		0.119
6016- 6014	0.107	0.113	0.203	0.105	0.101		0.205		0.099	0.116		0.131
6014- 6012	0.215	0.224	0.074	0.072	0.08		0.188		0.099	0.118		0.134
6012- 6010	0.069	0.115	0.123	0.119	0.099		0.074		0.125	0.074		0.100
6010- 6008	0.096	0.101	0.102	0.168	0.107		0.111		0.079			0.109
6008- 6006	0.109	0.112	0.119	0.082	0.088		0.108		0.117			0.105
6006- 6004	0.062	0.154	0.134	0.119			0.103		0.088			0.110
6004- 6002		0.161	0.105	0.122			0.111		0.094			0.119
6002- 6000		0.134	0.099	0.128			0.103		0.089			0.111
6000- 5998		0.07		0.094			0.096		0.117			0.094
5998- 5996							0.118		0.132			0.125
5996- 5994							0.129		0.099			0.114
5994- 5992							0.108		0.104			0.106
5992- 5990							0.121					0.121
AVE.	0.103	0.113	0.107	0.091	0.090		0.106		0.098	0.086		0.099