

EXELON VICTORIA - B3228 OFFSET (58.5'-60' sample)
OP: JNH

Hammer ID: MEC21; Driller: T.HAHN CME55 (MACTEC)
Test date: 25-Jan-2009

AR: 1.22 in² SP: 0.492 k/ft³
LE: 64.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.70

CSX: Max Measured Compr. Stress BPM: Blows per Minute
TSX: Tension Stress Maximum EF2: Energy of F²
VMX: Maximum Velocity ETR: Energy Transfer Ratio
FMX: Maximum Force EMX: Max Transferred Energy
FVP: Force/Velocity proportionality

BL#	CSX ksi	TSX ksi	VMX f/s	FMX kips	FVP []	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
2	22.4	18.4	17.7	27	0.7	1.9	0.271	82.8	0.290
3	22.5	16.4	16.7	27	0.8	61.0	0.299	86.1	0.301
4	22.3	16.5	18.2	27	0.7	59.4	0.296	85.1	0.298
5	22.6	16.8	17.9	28	0.7	59.1	0.295	85.3	0.299
6	22.7	16.3	18.4	28	0.7	59.1	0.296	87.6	0.307
7	22.4	16.5	17.5	27	0.7	59.0	0.296	86.4	0.302
8	21.1	15.0	17.5	26	0.7	58.9	0.295	87.8	0.307
9	22.5	15.3	18.9	27	0.7	59.0	0.293	93.3	0.326
10	22.0	15.9	17.4	27	0.7	58.7	0.291	95.4	0.334
11	21.5	16.4	17.0	26	0.7	59.2	0.292	91.8	0.321
12	22.2	16.8	18.0	27	0.7	58.7	0.294	92.4	0.324
13	22.3	17.3	18.3	27	0.7	58.9	0.292	93.9	0.329
14	21.9	15.9	18.0	27	0.7	59.0	0.292	86.2	0.302
15	22.4	17.3	18.2	27	0.7	58.9	0.292	87.6	0.307
16	22.4	16.7	18.9	27	0.7	59.0	0.291	86.4	0.302
17	21.4	16.6	17.5	26	0.7	58.9	0.292	90.4	0.316
18	22.2	16.3	18.5	27	0.7	59.1	0.289	88.9	0.311
19	21.5	15.0	18.0	26	0.7	58.9	0.287	89.3	0.313
20	22.3	15.6	17.1	27	0.7	59.1	0.290	86.6	0.303
21	22.6	15.8	17.8	28	0.7	58.6	0.292	85.7	0.300
22	22.8	15.5	18.0	28	0.7	59.1	0.291	88.4	0.309
23	22.5	15.3	18.5	27	0.7	58.8	0.288	87.6	0.307
24	22.2	14.2	16.8	27	0.7	59.0	0.293	87.9	0.308
25	21.7	14.2	16.9	27	0.7	58.9	0.287	88.0	0.308
26	22.2	14.4	17.7	27	0.7	59.0	0.289	89.1	0.312
27	20.8	14.0	17.0	25	0.7	58.9	0.286	88.9	0.311
28	21.9	14.3	18.7	27	0.7	59.1	0.287	90.1	0.315
29	21.3	13.5	17.3	26	0.7	58.8	0.287	91.3	0.320
30	21.9	14.1	18.6	27	0.7	58.8	0.288	89.7	0.314
31	21.1	14.3	16.7	26	0.7	58.9	0.288	88.6	0.310
32	21.6	13.6	17.7	26	0.7	58.9	0.288	90.5	0.317
33	21.6	13.4	17.8	26	0.7	59.1	0.282	88.2	0.309
34	22.0	14.1	18.3	27	0.7	58.7	0.286	89.1	0.312
35	21.1	14.6	16.6	26	0.7	58.7	0.286	86.5	0.303
36	22.3	13.7	18.6	27	0.7	58.9	0.286	89.4	0.313
37	22.2	14.0	18.5	27	0.7	58.8	0.289	88.0	0.308
Average	22.0	15.4	17.8	27	0.7	57.4	0.290	88.6	0.310

Total number of blows analyzed: 36

Time Summary

Drive 1 minute 15 seconds

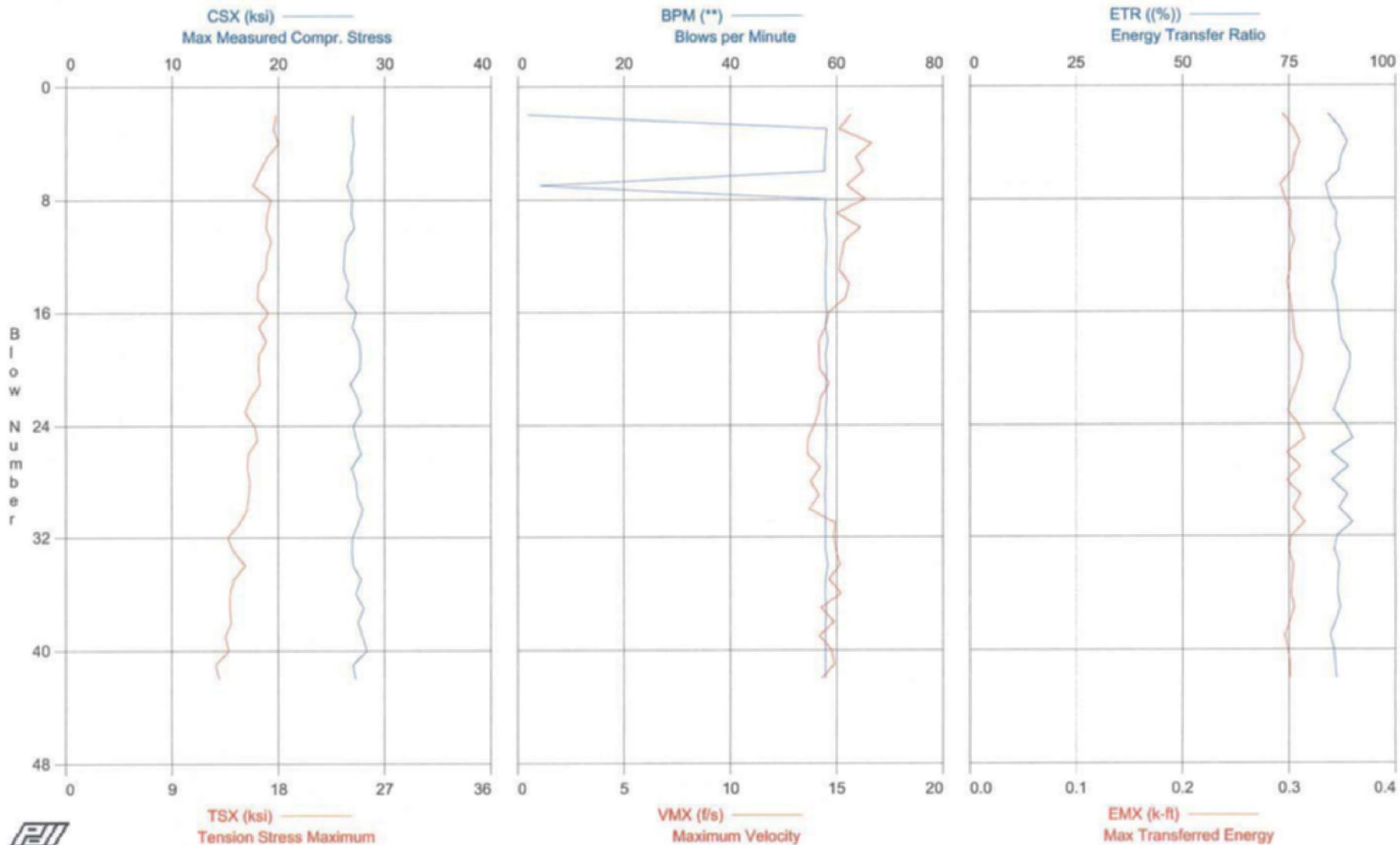
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PDIPLOT Ver. 2008.2 - Printed: 9-Mar-2009

MACTEC Engineering and Consulting, Inc. - Case Method Results

Test date: 26-Jan-2009

EXELON VICTORIA - Boring B3228 (43.5'-45' sample)



EXELON VICTORIA - Boring B3228 (43.5'-45' sample)
OP: JNH

Hammer ID: MEC21; Driller: T.HAHN CME 55 (MACTEC)
Test date: 26-Jan-2009

AR: 1.43 in² SP: 0.492 k/ft³
LE: 49.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.70

CSX: Max Measured Compr. Stress BPM: Blows per Minute
TSX: Tension Stress Maximum EF2: Energy of F²
VMX: Maximum Velocity ETR: Energy Transfer Ratio
FMX: Maximum Force EMX: Max Transferred Energy
FVP: Force/Velocity proportionality

BL#	CSX ksi	TSX ksi	VMX f/s	FMX kips	FVP []	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
2	27.0	17.8	15.7	39	0.8	1.9	0.333	84.1	0.294
3	26.9	17.6	15.1	39	0.8	58.1	0.345	86.9	0.304
4	27.1	18.0	16.6	39	0.9	57.9	0.345	88.6	0.310
5	26.9	17.0	15.9	38	0.8	57.7	0.340	87.2	0.305
6	26.9	16.4	16.3	39	0.9	57.7	0.341	86.7	0.303
7	26.5	15.8	15.5	38	0.9	4.0	0.337	83.6	0.292
8	27.0	17.4	16.3	39	0.9	57.9	0.341	84.5	0.296
9	26.9	17.1	15.0	38	0.8	57.7	0.339	86.2	0.302
10	27.1	17.0	16.1	39	0.8	57.9	0.337	85.9	0.301
11	26.3	17.4	15.4	38	1.0	58.1	0.337	87.0	0.305
12	26.2	17.0	15.2	37	1.0	58.0	0.336	85.9	0.301
13	26.1	17.0	15.1	37	1.0	57.9	0.337	85.9	0.301
14	26.6	16.3	15.6	38	0.9	57.9	0.337	85.1	0.298
15	26.4	16.2	15.4	38	1.0	57.9	0.335	86.1	0.301
16	27.3	17.2	14.6	39	0.8	58.1	0.336	86.5	0.303
17	26.9	16.4	14.5	39	1.0	57.9	0.336	86.8	0.304
18	27.6	17.0	14.2	39	0.9	58.3	0.337	87.4	0.306
19	27.7	16.4	14.2	40	0.9	57.9	0.337	89.4	0.313
20	27.7	16.3	14.2	40	0.9	58.1	0.335	89.3	0.312
21	26.8	16.5	14.7	38	1.0	58.0	0.333	87.9	0.308
22	27.5	15.7	14.3	39	0.9	58.1	0.332	86.6	0.303
23	27.8	15.2	14.2	40	0.9	57.9	0.334	85.5	0.299
24	27.0	16.0	13.9	39	1.1	58.0	0.334	88.3	0.309
25	27.4	16.2	13.6	39	1.1	58.0	0.334	90.1	0.315
26	27.8	15.5	13.6	40	0.9	57.9	0.333	85.1	0.298
27	26.9	15.4	14.2	38	1.1	58.0	0.330	89.0	0.311
28	27.3	15.6	13.8	39	1.1	57.9	0.334	85.2	0.298
29	27.4	15.5	14.2	39	1.1	57.8	0.333	88.7	0.311
30	27.9	15.3	13.7	40	0.9	57.9	0.333	86.8	0.304
31	27.5	14.7	14.9	39	1.0	57.9	0.332	90.0	0.315
32	27.0	13.7	14.9	39	1.0	57.9	0.332	86.3	0.302
33	26.9	14.2	15.0	38	1.0	57.9	0.332	85.6	0.300
34	27.0	15.2	15.2	39	1.0	58.3	0.329	86.8	0.304
35	27.8	14.2	14.6	40	1.1	57.9	0.331	86.5	0.303
36	27.3	13.9	15.2	39	1.0	57.8	0.337	86.4	0.302
37	28.0	13.9	14.3	40	1.1	58.0	0.334	87.1	0.305
38	27.5	14.0	14.9	39	1.0	57.9	0.332	85.9	0.301
39	27.9	13.5	14.2	40	1.1	57.9	0.334	84.7	0.296
40	28.3	13.8	14.8	40	0.9	57.9	0.335	85.6	0.299
41	27.0	12.7	14.9	39	1.0	57.9	0.330	85.9	0.301
42	27.3	13.0	14.3	39	1.1	57.9	0.330	86.1	0.301
Average	27.2	15.7	14.8	39	1.0	55.3	0.335	86.7	0.303

Total number of blows analyzed: 41

Time Summary

Drive 1 minute 24 seconds

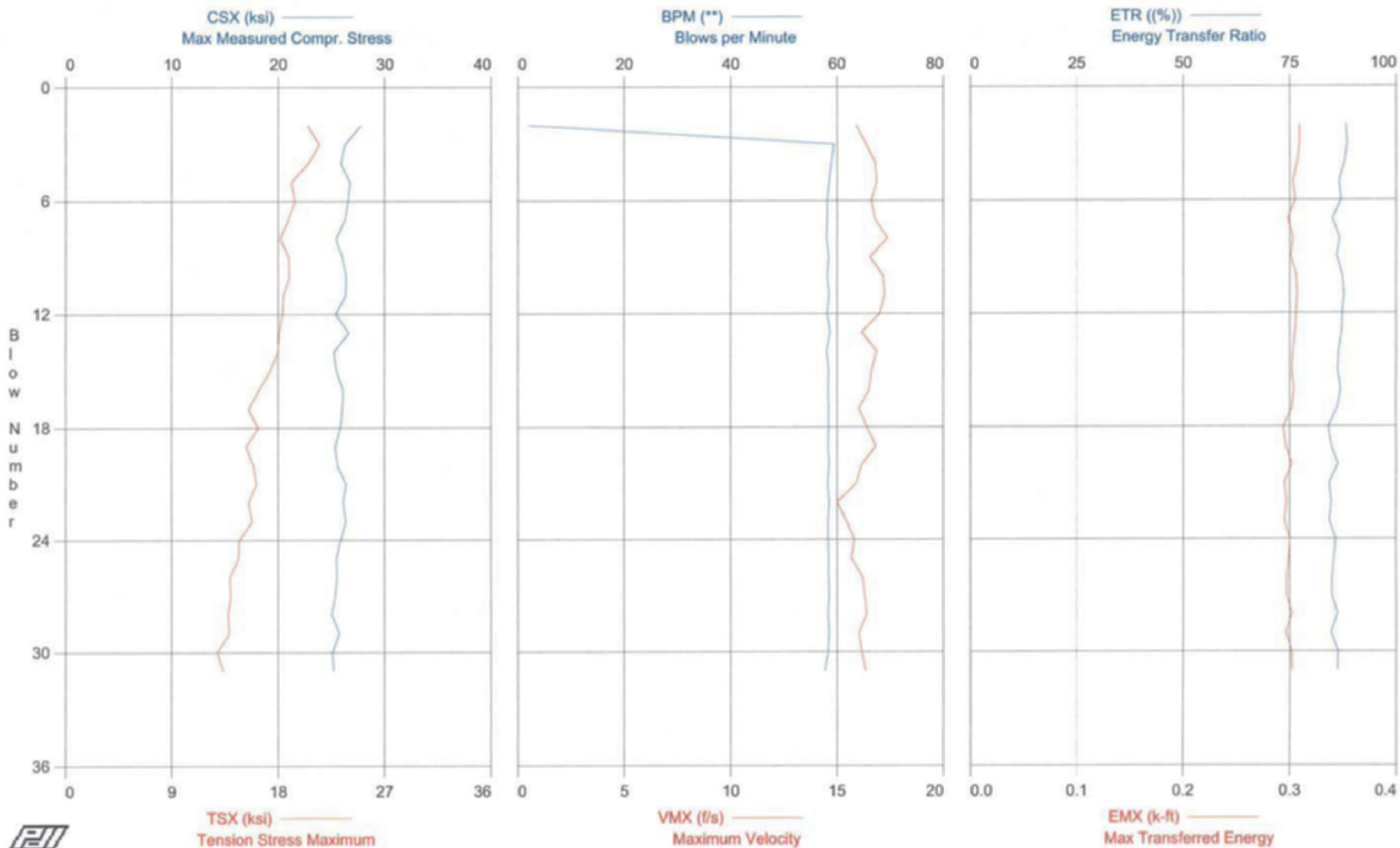
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PDIPLOT Ver. 2008.2 - Printed: 9-Mar-2009

MACTEC Engineering and Consulting, Inc. - Case Method Results

Test date: 26-Jan-2009

EXELON VICTORIA - Boring B3228 (48.5'-50' sample)



EXELON VICTORIA - Boring B3228 (48.5'-50' sample)
OP: JNH

Hammer ID: MEC21; Driller: T.HAHN CME 55 (MACTEC)
Test date: 26-Jan-2009

AR: 1.43 in² SP: 0.492 k/ft³
LE: 54.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.70

CSX: Max Measured Compr. Stress BPM: Blows per Minute
TSX: Tension Stress Maximum EF2: Energy of F²
VMX: Maximum Velocity ETR: Energy Transfer Ratio
FMX: Maximum Force EMX: Max Transferred Energy
FVP: Force/Velocity proportionality

BL#	CSX ksi	TSX ksi	VMX f/s	FMX kips	FVP []	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
2	27.7	20.5	15.9	40	0.8	1.9	0.343	88.2	0.309
3	26.3	21.5	16.4	38	0.9	59.4	0.337	88.4	0.309
4	25.9	20.6	16.8	37	0.9	58.9	0.330	87.8	0.307
5	26.7	19.1	16.9	38	0.7	58.5	0.327	86.6	0.303
6	26.6	19.4	16.6	38	0.7	58.1	0.326	87.0	0.305
7	26.3	18.8	16.8	38	0.8	58.1	0.328	85.0	0.298
8	25.4	18.2	17.4	36	0.8	58.0	0.327	86.6	0.303
9	26.0	18.9	16.6	37	0.9	58.4	0.324	86.0	0.301
10	26.4	19.0	17.2	38	0.8	58.1	0.326	87.3	0.306
11	26.3	18.5	17.2	38	0.8	58.5	0.321	87.7	0.307
12	25.4	18.4	17.0	36	0.8	58.1	0.323	87.3	0.306
13	26.6	18.1	16.2	38	0.9	58.7	0.319	87.2	0.305
14	25.2	18.0	16.9	36	0.8	58.0	0.321	86.4	0.303
15	25.5	17.3	16.6	36	0.9	58.4	0.321	86.2	0.302
16	26.1	16.4	16.5	37	0.8	58.3	0.322	87.0	0.304
17	26.0	15.5	16.0	37	0.8	58.4	0.318	86.2	0.302
18	25.8	16.3	16.4	37	0.9	58.4	0.320	84.0	0.294
19	25.3	15.3	16.8	36	0.8	58.3	0.318	84.7	0.296
20	25.6	15.9	16.2	37	0.9	58.5	0.317	86.3	0.302
21	26.4	16.1	15.9	38	0.9	58.2	0.318	84.3	0.295
22	26.1	15.5	15.0	37	1.0	58.5	0.316	84.7	0.297
23	26.4	15.8	15.4	38	0.8	58.3	0.317	84.3	0.295
24	25.9	14.7	15.8	37	0.9	58.3	0.312	85.7	0.300
25	25.5	14.6	15.7	36	0.9	58.4	0.314	85.4	0.299
26	25.5	13.9	16.2	36	0.9	58.4	0.316	84.9	0.297
27	25.3	14.0	16.3	36	0.9	58.5	0.317	84.8	0.297
28	25.0	13.8	16.4	36	0.9	58.3	0.316	86.2	0.302
29	25.8	13.9	16.0	37	0.9	58.5	0.314	84.6	0.296
30	25.1	12.9	16.2	36	0.9	58.3	0.310	86.3	0.302
31	25.2	13.4	16.3	36	0.8	57.7	0.315	86.1	0.302
Average	25.9	16.8	16.4	37	0.8	56.5	0.321	86.1	0.301

Total number of blows analyzed: 30

Time Summary

Drive 4 minutes 12 seconds

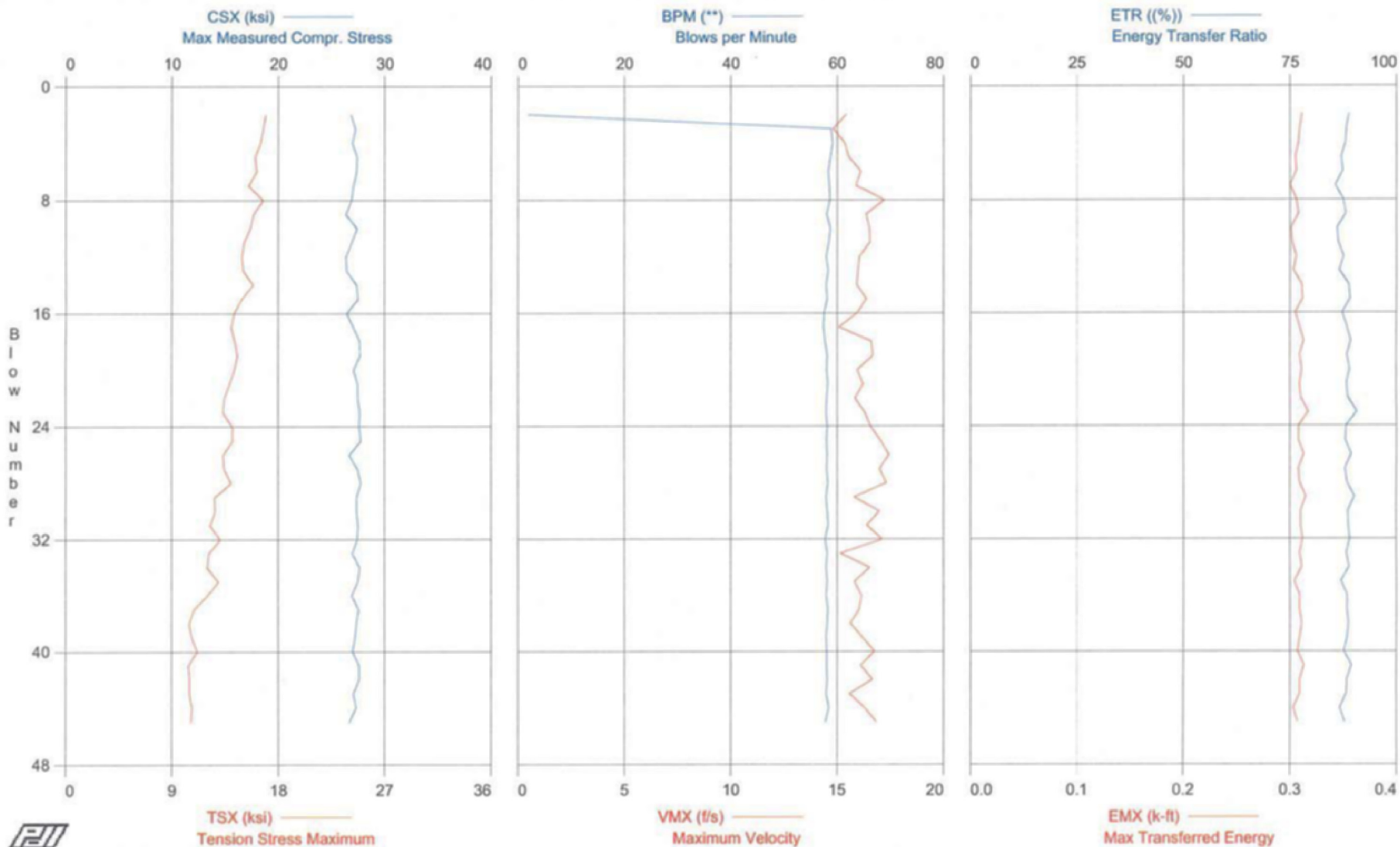
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PDIPLOT Ver. 2008.2 - Printed: 9-Mar-2009

MACTEC Engineering and Consulting, Inc. - Case Method Results

Test date: 26-Jan-2009

EXELON VICTORIA - Boring B3228 (53.5'-55' sample)



EXELON VICTORIA - Boring B3228 (53.5'-55'sample)
OP: JNH

Hammer ID: MEC21; Driller: T.HAHN CME 55 (MACTEC)
Test date: 26-Jan-2009

AR: 1.43 in² SP: 0.492 k/ft³
LE: 59.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.70

CSX: Max Measured Compr. Stress BPM: Blows per Minute
TSX: Tension Stress Maximum EF2: Energy of F²
VMX: Maximum Velocity ETR: Energy Transfer Ratio
FMX: Maximum Force EMX: Max Transferred Energy
FVP: Force/Velocity proportionality

BL#	CSX ksi	TSX ksi	VMX f/s	FMX kips	FVP []	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
2	26.8	16.9	15.4	38	1.0	1.9	0.331	88.8	0.311
3	27.2	16.7	14.8	39	0.8	58.8	0.332	88.2	0.309
4	27.0	16.5	15.4	39	1.0	59.1	0.329	88.0	0.308
5	27.4	16.0	15.5	39	0.8	58.7	0.327	87.0	0.305
6	27.3	16.2	16.1	39	0.8	58.3	0.330	87.4	0.306
7	27.1	15.5	15.9	39	0.8	58.5	0.326	85.6	0.300
8	26.9	16.7	17.2	38	0.9	58.6	0.327	87.5	0.306
9	26.3	15.9	16.4	38	0.9	58.0	0.339	88.1	0.308
10	27.4	15.6	16.5	39	0.8	58.7	0.338	86.0	0.301
11	26.9	15.1	16.5	38	0.8	58.4	0.339	86.3	0.302
12	26.3	14.9	16.0	38	0.9	57.9	0.341	87.5	0.306
13	26.4	15.0	16.0	38	0.9	58.3	0.327	86.5	0.303
14	27.4	15.9	15.9	39	0.8	57.9	0.342	88.8	0.311
15	27.5	14.9	16.4	39	0.8	58.1	0.331	89.1	0.312
16	26.4	14.3	15.9	38	0.9	57.5	0.337	87.3	0.305
17	27.1	14.0	15.1	39	1.0	57.4	0.338	88.4	0.309
18	27.7	14.3	16.6	40	0.8	57.7	0.334	89.3	0.313
19	27.7	14.5	16.7	40	0.8	58.1	0.333	88.3	0.309
20	27.1	14.3	15.9	39	1.0	58.0	0.331	89.0	0.311
21	27.5	13.9	16.2	39	0.8	58.2	0.331	88.2	0.309
22	27.5	13.4	15.8	39	0.8	58.0	0.341	88.6	0.310
23	27.7	13.3	16.3	40	0.8	57.9	0.333	90.7	0.317
24	27.6	14.1	16.6	39	0.9	58.1	0.330	88.1	0.308
25	27.8	14.1	17.0	40	0.8	58.0	0.332	88.0	0.308
26	26.7	13.3	17.4	38	0.9	58.1	0.329	89.4	0.313
27	27.4	13.4	17.0	39	0.8	58.0	0.331	87.9	0.308
28	27.8	14.0	17.3	40	0.8	58.2	0.332	88.4	0.309
29	27.4	12.6	15.8	39	0.8	57.9	0.328	90.1	0.315
30	27.3	12.7	17.0	39	0.8	58.1	0.337	88.6	0.310
31	27.5	12.2	16.4	39	0.8	58.3	0.324	88.7	0.310
32	27.4	13.1	17.1	39	0.8	57.7	0.338	89.0	0.312
33	27.0	12.1	15.2	39	0.8	58.1	0.323	88.2	0.309
34	27.6	12.0	16.5	40	0.8	57.9	0.341	88.8	0.311
35	27.5	12.9	15.8	39	0.8	58.1	0.337	87.0	0.304
36	26.9	12.0	16.1	38	0.9	57.9	0.337	88.4	0.309
37	27.5	10.9	16.0	39	0.8	58.2	0.335	88.3	0.309
38	27.3	10.5	15.6	39	0.8	58.1	0.333	88.7	0.311
39	27.2	10.7	16.2	39	0.9	57.9	0.337	88.4	0.309
40	27.0	11.2	16.8	39	0.9	58.0	0.335	87.6	0.307
41	27.6	10.4	16.1	39	0.8	58.0	0.335	89.4	0.313
42	27.6	10.5	16.7	39	0.8	58.1	0.335	88.3	0.309
43	27.1	10.5	15.6	39	1.0	57.9	0.335	88.1	0.309
44	27.3	10.7	16.3	39	0.8	58.4	0.330	86.6	0.303
45	26.7	10.6	16.9	38	0.9	57.8	0.333	87.8	0.307
Average	27.2	13.6	16.2	39	0.8	56.8	0.333	88.1	0.309

Total number of blows analyzed: 44

Time Summary

Drive 8 minutes 28 seconds

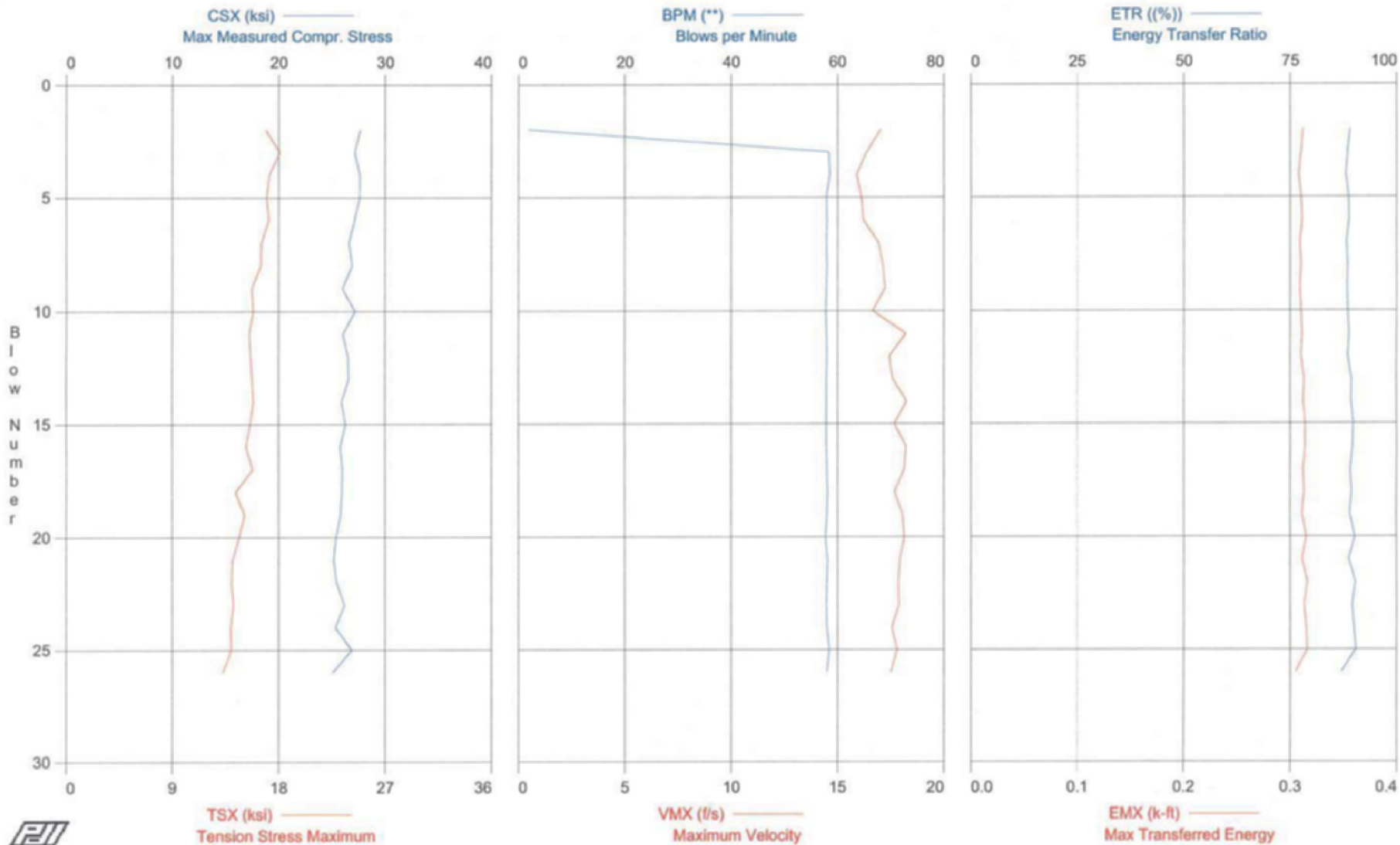
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PDILOT Ver. 2008.2 - Printed: 9-Mar-2009

MACTEC Engineering and Consulting, Inc. - Case Method Results

Test date: 26-Jan-2009

EXELON VICTORIA - Boring B3228 (58.5'-60' sample)



EXELON VICTORIA - Boring B3228 (58.5'-60' sample)
OP: JNH

Hammer ID: MEC21; Driller: T.HAHN CME 55 (MACTEC)
Test date: 26-Jan-2009

AR: 1.43 in² SP: 0.492 k/ft³
LE: 64.00 ft EM: 30,000 ksi
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BL#	CSX ksi	TSX ksi	VMX f/s	FMX kips	FVP []	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
2	27.7	16.9	17.0	40	0.9	1.9	0.336	89.0	0.312
3	27.1	18.1	16.4	39	0.9	58.3	0.340	88.4	0.310
4	27.6	17.2	15.9	39	1.0	58.5	0.332	88.0	0.308
5	27.6	17.0	16.1	39	1.0	57.9	0.334	88.7	0.310
6	27.1	17.2	16.2	39	0.9	58.0	0.331	88.8	0.311
7	26.6	16.5	16.9	38	0.9	57.9	0.331	88.2	0.309
8	26.9	16.5	17.1	38	0.9	58.0	0.330	88.5	0.310
9	26.0	15.7	17.2	37	0.8	57.9	0.330	88.3	0.309
10	27.2	15.8	16.6	39	0.9	57.8	0.331	88.5	0.310
11	26.0	15.5	18.2	37	0.8	57.9	0.333	88.8	0.311
12	26.5	15.6	17.4	38	0.8	58.0	0.326	88.5	0.310
13	26.6	15.7	17.6	38	0.8	57.9	0.331	89.4	0.313
14	25.9	15.9	18.2	37	0.8	57.9	0.332	89.3	0.312
15	26.3	15.6	17.7	38	0.8	57.9	0.331	89.7	0.314
16	25.8	15.2	18.2	37	0.8	57.9	0.328	89.6	0.314
17	26.0	15.8	18.1	37	0.8	58.0	0.328	89.0	0.312
18	25.9	14.3	17.7	37	0.8	58.1	0.328	89.4	0.313
19	25.8	15.1	18.1	37	0.8	58.0	0.325	89.0	0.311
20	25.4	14.6	18.1	36	0.8	57.7	0.329	90.1	0.315
21	25.2	14.1	17.9	36	0.8	58.1	0.326	88.7	0.311
22	25.4	14.0	17.9	36	0.8	58.0	0.328	90.3	0.316
23	26.2	14.2	17.9	37	0.8	57.9	0.330	89.5	0.313
24	25.3	13.9	17.6	36	0.8	58.0	0.326	90.0	0.315
25	26.9	14.0	17.8	38	0.8	58.4	0.329	90.4	0.316
26	25.1	13.3	17.5	36	0.8	58.0	0.318	87.0	0.305
Average	26.3	15.5	17.4	38	0.8	55.8	0.330	89.0	0.312

Total number of blows analyzed: 25

Time Summary

Drive 1 minute 43 seconds

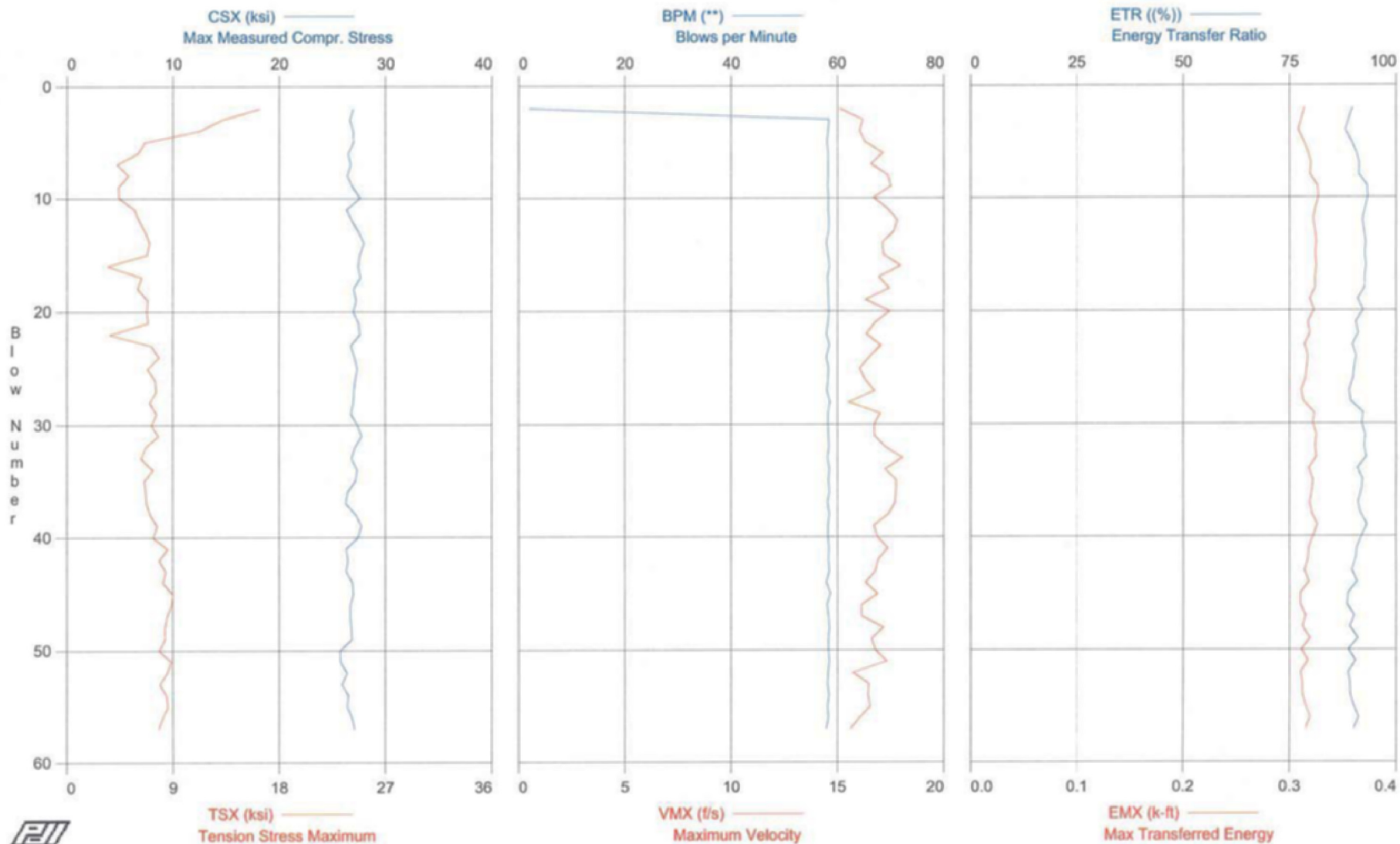
12:01:44 PM - 12:03:27 PM (1/26/2009) BN 1 - 26

PDIPLOT Ver. 2008.2 - Printed: 23-Apr-2009

MACTEC Engineering and Consulting, Inc. - Case Method Results

Test date: 26-Jan-2009

EXELON COL VICTORIA - Boring B3228 (63.5'-63.8' sample)



EXELON COL VICTORIA - Boring B3228 (63.5'-63.8' sample)
OP: JNH

Hammer ID: MEC21; Driller: T.HAHN CME 55 (MACTEC)
Test date: 26-Jan-2009

AR: 1.43 in²
LE: 69.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/R3
EM: 30,000 ksi
JC: 0.70

CSX: Max Measured Compr. Stress
TSX: Tension Stress Maximum
VMX: Maximum Velocity
FMX: Maximum Force
FVP: Force/Velocity proportionality

BPM: Blows per Minute
EF2: Energy of F²
ETR: Energy Transfer Ratio
EMX: Max Transferred Energy

BL#	CSX ksi	TSX ksi	VMX f/s	FMX kips	FVP []	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
2	26.9	16.3	15.1	39	1.0	1.9	0.340	89.7	0.314
3	26.6	13.1	16.2	38	0.9	58.4	0.332	88.9	0.311
4	27.0	11.2	16.0	39	0.9	58.2	0.335	88.0	0.308
5	27.0	6.6	16.3	39	0.8	58.0	0.335	89.5	0.313
6	26.5	6.0	17.1	38	0.9	58.2	0.336	90.7	0.317
7	26.7	4.3	16.6	38	0.8	58.2	0.335	91.3	0.320
8	26.4	5.2	17.4	38	0.8	58.2	0.334	91.2	0.319
9	26.9	4.4	17.5	38	0.9	58.1	0.341	93.2	0.326
10	27.6	4.4	16.7	39	0.9	58.3	0.338	93.4	0.327
11	26.3	5.7	17.4	38	0.8	58.2	0.339	92.7	0.324
12	26.8	6.1	17.8	38	0.8	58.4	0.340	92.1	0.322
13	27.5	6.7	17.6	39	0.9	58.3	0.337	92.5	0.324
14	28.0	7.0	17.1	40	0.9	57.9	0.342	92.9	0.325
15	27.6	6.8	17.2	39	0.8	58.2	0.344	92.6	0.324
16	27.4	3.5	18.0	39	0.9	58.5	0.341	92.9	0.325
17	27.6	6.3	17.0	40	0.8	58.1	0.343	92.6	0.324
18	27.0	6.0	17.4	39	0.9	58.2	0.339	92.6	0.324
19	27.2	6.9	16.3	39	0.8	58.3	0.338	91.0	0.319
20	27.0	6.8	17.5	39	0.9	58.4	0.338	92.3	0.323
21	27.5	6.9	16.8	39	0.8	58.2	0.339	90.5	0.317
22	27.6	3.6	16.4	39	0.8	57.9	0.341	91.1	0.319
23	26.7	7.2	17.0	38	0.9	58.5	0.334	89.8	0.314
24	27.1	7.8	16.5	39	0.8	57.9	0.338	90.7	0.317
25	27.3	6.9	16.1	39	0.8	58.3	0.335	90.2	0.316
26	27.1	7.5	16.3	39	0.8	58.2	0.335	89.9	0.315
27	27.0	7.6	16.8	39	0.8	58.0	0.333	89.0	0.311
28	27.0	7.0	15.5	39	1.0	58.6	0.332	89.4	0.313
29	26.7	7.6	17.0	38	0.9	58.2	0.337	92.3	0.323
30	27.4	7.2	16.7	39	0.9	58.2	0.334	92.0	0.322
31	27.7	7.8	16.7	40	0.9	58.3	0.337	92.8	0.325
32	27.1	6.7	17.2	39	0.9	58.4	0.335	92.5	0.324
33	26.8	6.3	18.1	38	0.8	58.1	0.333	93.0	0.325
34	27.3	7.3	17.3	39	0.9	58.5	0.332	90.9	0.318
35	27.2	6.6	17.8	39	0.9	58.3	0.337	92.1	0.322
36	26.4	6.7	17.8	38	0.8	58.5	0.333	91.8	0.321
37	26.3	6.8	17.7	38	0.8	58.1	0.333	91.1	0.319
38	27.2	7.1	17.4	39	0.9	58.5	0.333	91.7	0.321
39	27.7	7.7	16.7	40	0.9	58.2	0.336	93.2	0.326
40	27.4	7.3	16.9	39	0.9	58.2	0.340	91.9	0.322
41	26.3	8.5	17.4	38	0.8	58.4	0.334	90.8	0.318
42	26.4	7.8	16.9	38	0.8	58.3	0.334	90.5	0.317
43	26.3	8.4	16.8	38	0.9	58.5	0.334	89.6	0.314
44	26.9	8.1	16.3	38	0.9	57.9	0.330	90.8	0.318
45	27.0	9.0	16.9	39	0.9	58.7	0.326	88.7	0.310
46	26.7	8.9	16.1	38	0.8	58.0	0.329	88.5	0.310
47	26.7	8.5	16.1	38	0.8	58.3	0.332	90.1	0.315
48	26.8	8.3	17.2	38	0.9	58.5	0.326	89.1	0.312
49	26.8	8.3	16.6	38	0.9	58.3	0.329	91.0	0.319
50	25.7	7.8	16.8	37	0.9	58.3	0.327	88.7	0.311
51	25.7	8.9	17.3	37	0.8	58.5	0.322	90.5	0.317
52	26.4	8.5	15.7	38	0.9	58.2	0.326	88.7	0.310
53	25.9	7.9	16.5	37	0.9	58.1	0.331	89.1	0.312
54	26.5	8.4	16.4	38	0.9	58.4	0.330	89.2	0.312
55	26.4	8.6	16.6	38	0.8	58.1	0.329	90.0	0.315
56	26.9	8.1	16.1	38	0.8	58.3	0.331	91.2	0.319
57	27.1	7.8	15.6	39	0.9	57.9	0.334	90.1	0.315
Average	26.9	7.4	16.8	38	0.9	57.2	0.335	90.9	0.318

Total number of blows analyzed: 56

Time Summary

Drive 2 minutes 6 seconds

12:23:56 PM - 12:26:02 PM (1/26/2009) BN 1 - 57



Engineering and constructing a better tomorrow

October 20, 2009

Memorandum to File

From: Jon Honeycutt, Staff Professional JWH

Reviewed By: Steve Kiser, Principal Professional SK

Subject: **Report of SPT Energy – MACTEC Atlanta CME 550X ATV, Rev.1**
Hammer Serial No. MEC-22 Automatic Hammer
WORK INSTRUCTION No. 311 (DCN EXE917)
Exelon Texas COL Project – Supplemental Investigation, Including UHS
Victoria County, Texas
MACTEC Project No. 6468-07-1777

Jonathan Honeycutt, of MACTEC Engineering and Consulting, Inc. (MACTEC), performed energy measurements on the above referenced drill rig at the subject site per the referenced Work Instructions. This memorandum summarizes the field testing activities and presents the results of the energy measurements.

SPT Energy Field Measurements

SPT energy measurements were made on January 22 and 23, 2009, during drilling of Boring B3252 at the referenced site. The testing was performed by Jonathan Honeycutt from approximately 5:15 PM to 5:40 PM on January 22 under sunny skies with a temperature of about 70 degrees Fahrenheit and from approximately 9:30 AM to 10:10 AM on January 23 under sunny and clear skies with a temperature of about 70 degrees Fahrenheit. The boring was drilled with personnel and equipment from the MACTEC Atlanta office. The drilling equipment consisted of a CME 550X model ATV-mounted drill rig with an SPT automatic hammer. The drilling tools consisted of AW-J-sized drilling rods and a 2-foot long split tube sampler. Mud rotary drilling techniques were used to advance the boring. The drill rig operator during sampling was Mr. Ruben Landeros. Energy measurements were recorded during sampling at the depth intervals shown in Table 1.

The energy measurements were performed with a Pile Driving Analyzer (PDA) model PAX (Serial No. 3622L), and calibrated accelerometers (Serial Nos. K0686 and K983) and strain gages (Serial Nos. AW#75/1 and AW#75/2). A steel drill rod, 2-feet long and instrumented with dedicated strain gages, was inserted at the top of the drill rod string immediately below the SPT hammer. The inserted rod was also instrumented with two piezoresistive accelerometers that were bolted to the outside of the rod. The instrumented rod insert had a cross-sectional area of approximately 1.22 square inches and an outside diameter of approximately 1.75 inches at the gage location. The drill rods included in the drill rod string were hollow rods in 5 to 10 foot long

17 Pages Total

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sections, with an outside and inside diameter of approximately 1.75 and 1.375 inches, respectively. The recommended operation rate of the hammer is not known. Due to the closed hammer system, the hammer lubrication condition and anvil dimensions could not be observed.

Calibration Records

The calibration records for all the above are filed in DCN EXE 918.

Calculations for EFV

The work was done in general accordance with ASTM D 4633-05. The strain and acceleration signals were converted to force and velocity by the PDA, and the data was interpreted by the PDA according to the Case Method equation. The maximum energy transmitted to the drill rod string (as measured at the location of the strain gages and accelerometers) was calculated by the PDA using the EFV method equation, as shown below:

$$EFV = \int F(t) * V(t) * dt$$

Where: EFV = Transferred energy (EFV equation), or Energy of FV

F(t) = Calculated force at time t

V(t) = Calculated velocity at time t

The EFV method of energy calculation is recommended in ASTM Standard D4633-05. The EFV equation, integrated over the complete wave event, measures the total energy content of the event using both force and velocity measurements. The EFV values associated with each blow analyzed are tabulated in the attached PDILOT tables and are also shown graphically in the PDILOT charts.

Calculations for ETR

The ratio of the measured transferred energy (EFV) to the theoretical potential energy of the SPT system (140 lb weight with the specified 30 inch fall) is the ETR. The ETR values (as percent of the theoretical value) are shown in Table 3.

Comparison of ETR to Typical Energy Transfer Ratio Range

Based on a research report published by the Florida Department of Transportation (FDOT) (Report WPI No. 0510859, 1999), the average ETR measured for automatic hammers is 79.6%. The standard deviation was 7.9%; therefore, the range of ETRs within one standard deviation of the average was reported to be 71.7% to 87.5%. This range of ETRs was also consistent with other research that was cited in the FDOT research paper; however, maximum and minimum ETR values of up to 98% and 56%, respectively, were reported in the literature. The ETR values shown in Table 1 are generally within the range of typical values for automatic hammers as reported in the literature.

Discussion

Based on the field testing results, observations from the SPT energy measurements are summarized below:

- The data obtained by the PDA are consistent between individual hammer blows and between the sample depths tested. In general, the first and last one (and sometimes two) hammer blow records recorded by the PDA produced poor quality data (which is relatively common) and, as such, the record(s) was(were) not used in the data reduction. This may result in more or less blows evaluated for ETR than what is shown on the boring logs.
- The average energy transferred from the hammer to the drill rods for each individual depth interval using the EFV method ranged from 303 foot-pounds to 317 foot-pounds. These average energy transfers correspond to energy transfer ratios (ETR) of 87% to 91% of the theoretical energy (350 foot-pounds) of the SPT hammer.
- The average at each depth interval was calculated as the transferred energy for each analyzed blow of the depth intervals divided by the total number of hammer blows analyzed. The overall average energy transfer of the SPT system (for all the depth intervals tested) was 309.1 foot-pounds, with an average ETR of 88.3%.

Attachments: Page 4 Table 1 - Summary of SPT Energy Measurements – 1 Page
Page 5 Work Instruction No. 311 – DCN EXE917 – 1 Page
Pages 6 – 7 Record of SPT Energy Measurement – 2 Pages
Pages 8 – 17 PDILOT Output – 10 Pages

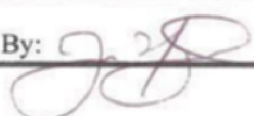
TABLE 1
SUMMARY OF SPT ENERGY MEASUREMENTS (ASTM D4633-05)
 Exelon Texas COL Project - Supplemental Investigation, Including UHS
 Victoria, Texas
 MACTEC Project No. 6468-07-1777

Automatic Hammer Serial Number and Rig Model	Rig Owner	Rig Operator	Boring No. Tested	Date Tested	Drill Rod Size	Sample Depth (feet)	SPT Blow Count (blows per six inches)	No. of Blows Analyzed	Average Measured Energy (Average EFV) (ft-lbs) ^a	Energy Transfer Ratio (%) ^b (Average ETR)
MEC-22 (CME 550X ATV)	MACTEC Atlanta	Ruben Landeros	B3252	1/22/2009	AW-J	12.5 - 14	5 - 8 - 9	22	304	86.9%
				1/23/2009		19.5 - 21	5 - 7 - 7	18	317	90.6%
						24.5 - 26	5 - 7 - 9	21	303	86.6%
						29.5 - 31	5 - 9 - 10	24	317	90.6%
						34.5 - 36	6 - 9 - 13	28	306	87.4%
										Average for Rig:

^aMeasured Energy is energy based on the EFV method, as outlined in ASTM D4633-05, for each blow recorded by the PDA. In some cases, the initial and final one to two blows produced poor quality data, and were not used to calculate the Average Measured Energy. This may result in more or less blows evaluated for ETR than what is shown on the boring logs.

EFV = EMX * 1000 lbs/kip, where EMX equals the maximum transferred energy measured by the PDA (see attached PDA data).

^bEnergy Transfer Ratio is the Measured Energy divided by the theoretical SPT energy of 350 foot-pounds (140 pound hammer falling 2.5 feet). The average EFV and ETR values may differ slightly and insignificantly from those in the PDILOT tables due to roundoff.

Prepared By: 	Date: 5/4/09	Checked By: 	Date: 5-4-09
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Work Instruction No. 311
Exelon COL Victoria Site
MACTEC Engineering and Consulting, Inc.
MACTEC Project 6468-07-1777

DCN 11/2/09

Issued To: Steve Kiser and Jonathan Honeycutt
Issued By: Daniel E. Atkinson
Valid From: 11/12/09
Rev. No. 0
Date: 11/12/09
To: 12/31/09

Task Description: Perform SPT Energy Measurements

Applicable Technical Procedures or Plans, or other reference:

1. Geotechnical Work Plan (current revision; available at Site Office), and
2. ASTM D 4633-05 (copy attached.).

Specific Instructions (note attachments where necessary): Perform energy measurements for each drill rig on site in accordance with ASTM D-4633-05. Consult with Site Manager as to schedule for performing the measurements. Hammer weights have been checked by site personnel, and records will be available on site. All rigs are using automatic hammer systems. Confirm that automatic hammer system is being operated within manufacturer's recommendations or in a typical operating fashion as observed from watching one or two SPT measurements prior to measuring energy. Check each drill rig using all hammer/rod combinations that it will be using. Depths for measurements should be coordinated with the Site Manager. See Site Manager for current boring logs of holes drilled and use these to plan most effective field measurement program. Submit copies of calibration records for equipment to Project Principal for review prior to beginning work on site.

Special Instructions (note attachments where necessary): Confirm with Site Manager that approval of equipment calibration records have been received prior to beginning field testing. If unexpected conditions are encountered that affect measurements, contact Site Manager or Project Principal immediately.

Report Format: Prepare standard report in accordance with ASTM D 4633 requirements.

Specific Quality Assurance Procedures Applicable: QAP 20-1; QAP 25-1; QAP for Reporting Nuclear-Related Defects, or Noncompliances, per Federal Regulation 10CFR21 and Section 306 of the Energy Reorganization Act of 1974. Current revisions apply.

Hold Points or Witness Points: None

Records: All records generated shall be considered QA Records.

Reviewed and Approved by: (Note: Only one signature is required for issuance)

Project Manager: _____ Date: _____
Project Principal Engineer: _____ Date: _____
Site Manager/Coordinator: [Signature] Date: 11/12/09
Pages: 1 plus attachment
Attachments: ASTM D 4633-05
DCN: EXE917



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RECORD OF SPT ENERGY MEASUREMENT

GENERAL INFORMATION		DRILL RIG DATA	
PROJECT:	Exelon	MAKE:	CME 550 X
LOCATION:	Victoria, Texas	MODEL:	550 X
PROJECT NO.:	8468-07-1777	SERIAL NO.:	MEC 22
DATE:	1/22/2009	HAMMER TYPE:	Auto
WEATHER:	Sunny 70°F	ROPE CONDITION:	N/A
INSPECTOR:	JWH	ROD SIZE:	1.5
DRILLING COMPANY:	MACTEC	NO. OF SHEAVES:	N/A

BORING DATA			
BORING NUMBER:	B3252		
DEPTH DRILLED:	VARIABLE		
TIME DRIVEN:	4:30 pm - 5:00 pm		
RIG OPERATOR:	R. LUNDENOV		
HAMMER OPERATOR:	N/A		
PDA PAK SERIAL NO.:	3622L		
INSTR. ROD AREA:	1.22 in ²		
ACCEL. SERIAL NOS.:	43-40686 49-4983		
STRAIN SERIAL NOS.:	75AW 1/2		

REMARKS:

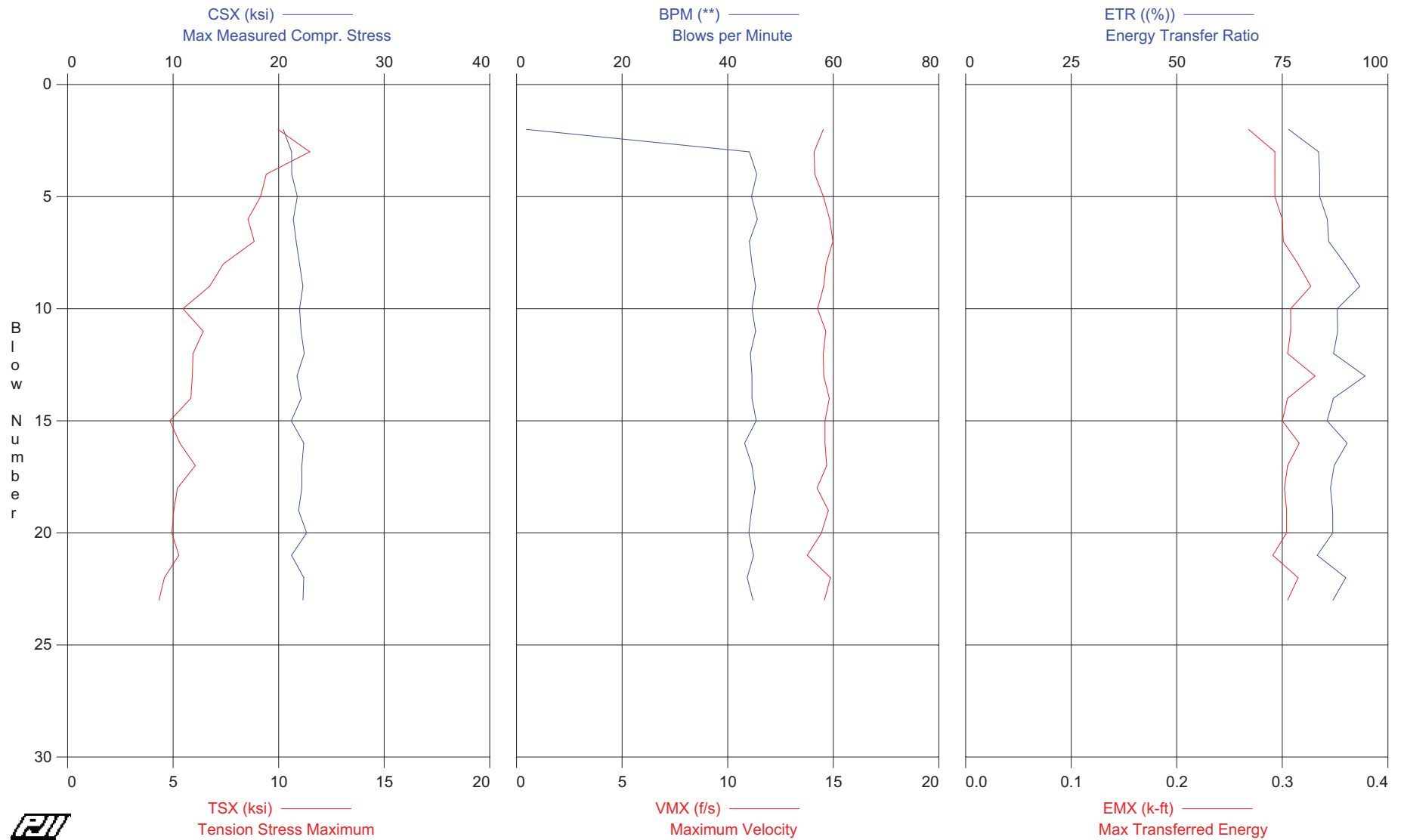
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Telephone: (704) 357-8600 / Facsimile: (704) 357-8638

RECORD OF SPT ENERGY MEASUREMENT

GENERAL INFORMATION		DRILL RIG DATA	
PROJECT:	Exelon	MAKE:	CME
LOCATION:	Victoria, Texas	MODEL:	SSO X
PROJECT NO.:	6468-07-1777	SERIAL NO.:	MEL 22
DATE:	1/23/2009	HAMMER TYPE:	AUTO
WEATHER:	70°F Sunny CLEAR SKIES	ROPE CONDITION:	N/A
INSPECTOR:	JNH	ROD SIZE:	AW 5
DRILLING COMPANY:	MACEC	NO. OF SHEAVES:	N/A

[illegible]

EXELON VICTORIA - Boring B3252 (12.5'-14' sample)



EXELON VICTORIA - Boring B3252 (12.5'-14' sample)
OP: JNH

Hammer ID: MEC22; Driller: R.LANDERS CME 550X (MACTEC)
Test date: 22-Jan-2009

AR: 1.22 in² SP: 0.492 k/ft³
LE: 18.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.70

CSX: Max Measured Compr. Stress BPM: Blows per Minute
TSX: Tension Stress Maximum EF2: Energy of F²
VMX: Maximum Velocity ETR: Energy Transfer Ratio
FMX: Maximum Force EMX: Max Transferred Energy
FVP: Force/Velocity proportionality

BL#	CSX ksi	TSX ksi	VMX f/s	FMX kips	FVP []	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
2	20.4	10.0	14.5	25	0.8	1.9	0.250	76.5	0.268
3	21.2	11.5	14.1	26	0.8	44.1	0.265	83.6	0.293
4	21.2	9.4	14.1	26	0.8	45.5	0.258	83.8	0.293
5	21.8	9.1	14.5	27	0.8	44.5	0.260	83.8	0.293
6	21.4	8.5	14.8	26	0.8	45.6	0.256	85.7	0.300
7	21.7	8.8	15.0	26	0.8	44.1	0.263	86.0	0.301
8	22.0	7.4	14.7	27	0.8	44.6	0.266	89.9	0.315
9	22.3	6.7	14.5	27	0.9	45.3	0.258	93.4	0.327
10	22.0	5.5	14.3	27	0.9	44.6	0.261	88.0	0.308
11	22.1	6.4	14.6	27	0.8	45.3	0.259	88.1	0.308
12	22.4	5.9	14.5	27	0.9	44.3	0.265	87.1	0.305
13	21.7	5.9	14.5	27	0.8	44.6	0.263	94.6	0.331
14	22.2	5.8	14.8	27	0.8	44.6	0.267	87.1	0.305
15	21.2	4.8	14.6	26	0.8	45.4	0.253	85.6	0.300
16	22.4	5.3	14.6	27	0.9	43.2	0.261	90.3	0.316
17	22.2	6.1	14.7	27	0.8	44.6	0.260	87.3	0.305
18	22.2	5.2	14.2	27	0.9	45.2	0.259	86.4	0.302
19	21.9	5.0	14.8	27	0.8	44.5	0.256	86.9	0.304
20	22.6	4.9	14.4	28	0.9	44.0	0.264	87.0	0.304
21	21.2	5.3	13.8	26	0.9	44.9	0.248	83.3	0.291
22	22.4	4.6	14.9	27	0.8	43.7	0.270	90.0	0.315
23	22.3	4.3	14.6	27	0.9	44.8	0.268	87.0	0.305
Average	21.9	6.7	14.5	27	0.8	42.7	0.260	86.9	0.304

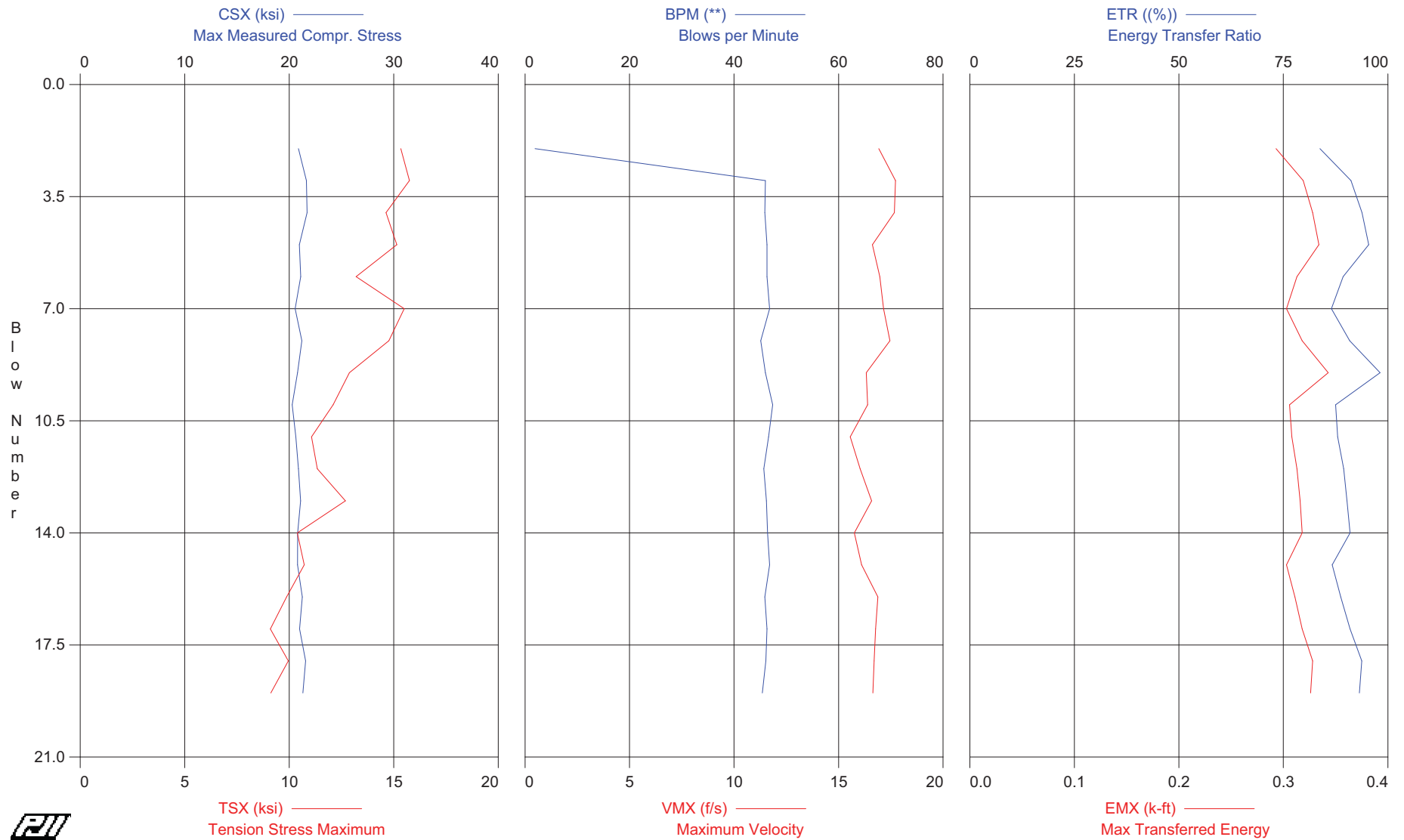
Total number of blows analyzed: 22

Time Summary

Drive 7 minutes 28 seconds

5:16:03 PM - 5:23:31 PM (1/22/2009) BN 1 - 23

EXELON VICTORIA - Boring B3252 (19.5'-21' sample)



EXELON VICTORIA - Boring B3252 (19.5'-21' sample)
OP: JNH

Hammer ID: MEC22; Driller: R.LANDERS CME 550X (MACTEC)
Test date: 22-Jan-2009

AR: 1.22 in² SP: 0.492 k/ft³
LE: 25.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.70

CSX: Max Measured Compr. Stress BPM: Blows per Minute
TSX: Tension Stress Maximum EF2: Energy of F²
VMX: Maximum Velocity ETR: Energy Transfer Ratio
FMX: Maximum Force EMX: Max Transferred Energy
FVP: Force/Velocity proportionality

BL#	CSX ksi	TSX ksi	VMX f/s	FMX kips	FVP []	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
2	20.9	15.3	16.9	25	0.7	1.9	0.278	83.7	0.293
3	21.6	15.8	17.7	26	0.7	46.0	0.279	91.2	0.319
4	21.7	14.6	17.7	26	0.7	45.9	0.286	93.8	0.328
5	21.0	15.1	16.6	26	0.7	46.3	0.279	95.4	0.334
6	21.1	13.2	17.0	26	0.7	46.3	0.273	89.3	0.313
7	20.6	15.5	17.2	25	0.7	46.8	0.274	86.5	0.303
8	21.2	14.8	17.5	26	0.7	45.1	0.283	90.9	0.318
9	20.8	12.9	16.3	25	0.7	46.0	0.286	98.1	0.343
10	20.3	12.1	16.4	25	0.7	47.4	0.270	87.5	0.306
11	20.6	11.1	15.6	25	0.7	46.6	0.271	88.0	0.308
12	20.9	11.3	16.0	25	0.7	45.7	0.276	89.4	0.313
13	21.1	12.7	16.6	26	0.7	46.2	0.283	90.2	0.316
14	20.8	10.4	15.8	25	0.7	46.4	0.278	91.0	0.318
15	20.8	10.7	16.1	25	0.7	46.8	0.275	86.7	0.303
16	21.3	9.9	16.9	26	0.7	45.9	0.277	88.7	0.311
17	21.0	9.1	16.8	26	0.7	46.3	0.276	91.0	0.318
18	21.6	10.0	16.7	26	0.7	46.1	0.276	93.8	0.328
19	21.3	9.1	16.6	26	0.7	45.4	0.284	93.2	0.326
Average	21.0	12.4	16.7	26	0.7	43.7	0.278	90.5	0.317

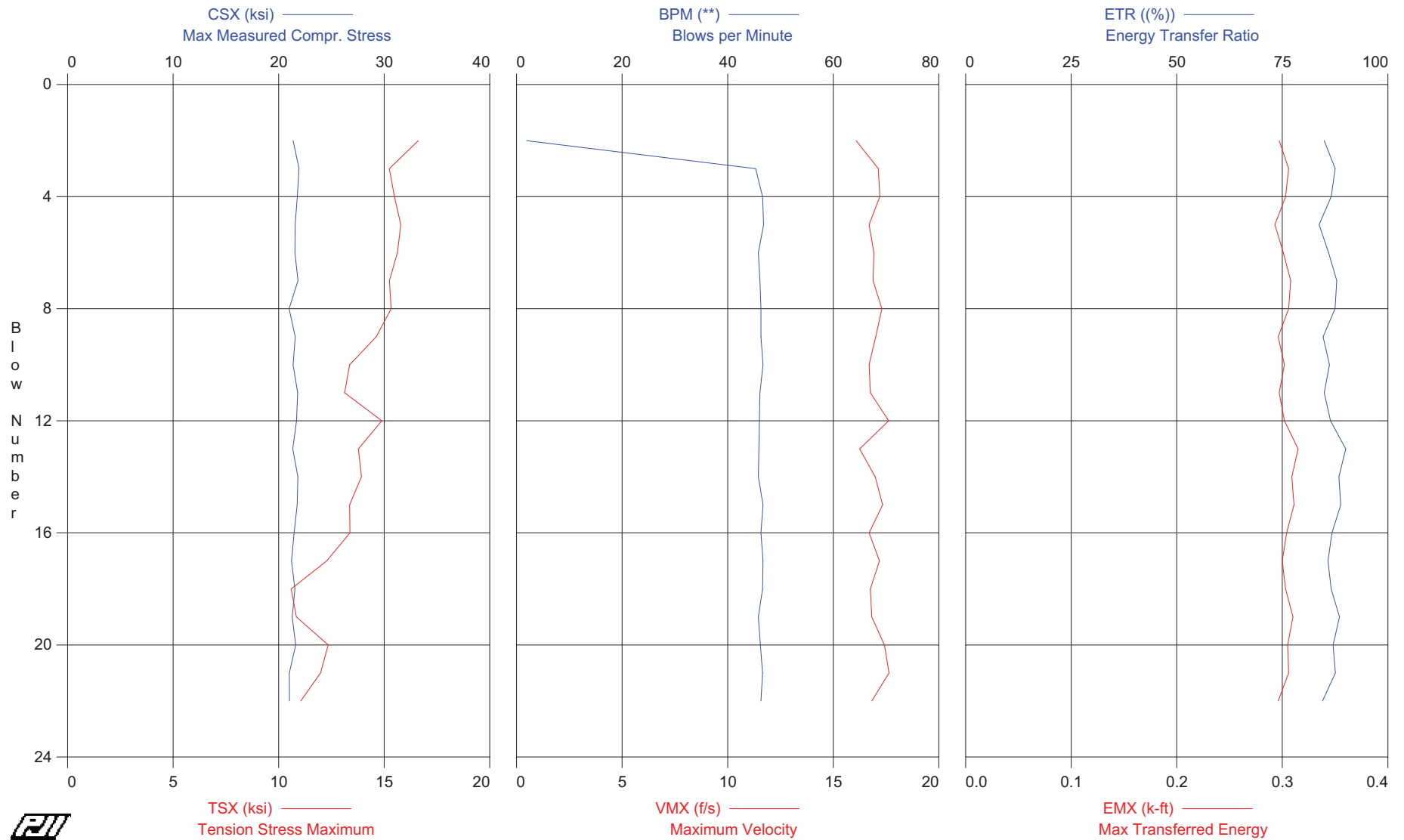
Total number of blows analyzed: 18

Time Summary

Drive 2 minutes 5 seconds

5:37:49 PM - 5:39:54 PM (1/22/2009) BN 1 - 19

EXELON VICTORIA - Boring B3252 (24.5'-26' sample)



EXELON VICTORIA - Boring B3252 (24.5'-26' sample)
OP: JNH

Hammer ID: MEC22; Driller: R.LANDERS CME 550X (MACTEC)
Test date: 23-Jan-2009

AR: 1.22 in² SP: 0.492 k/ft³
LE: 30.00 ft EM: 30,000 ksi
WS: 16,807.9 f/s JC: 0.70

CSX: Max Measured Compr. Stress BPM: Blows per Minute
TSX: Tension Stress Maximum EF2: Energy of F²
VMX: Maximum Velocity ETR: Energy Transfer Ratio
FMX: Maximum Force EMX: Max Transferred Energy
FVP: Force/Velocity proportionality

BL#	CSX ksi	TSX ksi	VMX f/s	FMX kips	FVP []	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
2	21.4	16.6	16.1	26	0.7	1.9	0.290	84.9	0.297
3	21.9	15.2	17.1	27	0.7	45.3	0.305	87.5	0.306
4	21.8	15.5	17.2	27	0.7	46.6	0.299	86.6	0.303
5	21.6	15.8	16.7	26	0.7	46.8	0.292	83.7	0.293
6	21.5	15.6	16.9	26	0.7	45.8	0.296	85.9	0.301
7	21.8	15.2	16.9	27	0.7	46.1	0.297	87.9	0.308
8	21.0	15.3	17.3	26	0.7	46.3	0.299	87.5	0.306
9	21.6	14.6	17.0	26	0.7	46.3	0.295	84.7	0.296
10	21.4	13.4	16.7	26	0.7	46.7	0.294	86.2	0.302
11	21.8	13.1	16.8	27	0.7	46.1	0.295	85.0	0.297
12	21.7	14.9	17.6	26	0.7	46.0	0.296	86.4	0.302
13	21.3	13.8	16.2	26	0.7	45.9	0.303	90.0	0.315
14	21.8	13.9	17.0	27	0.7	45.8	0.300	88.4	0.309
15	21.8	13.4	17.3	27	0.7	46.7	0.296	88.8	0.311
16	21.5	13.4	16.7	26	0.7	46.3	0.298	86.8	0.304
17	21.2	12.3	17.2	26	0.7	46.7	0.296	85.8	0.300
18	21.5	10.6	16.8	26	0.7	46.6	0.285	86.6	0.303
19	21.3	10.8	16.8	26	0.7	45.8	0.291	88.5	0.310
20	21.6	12.3	17.4	26	0.7	46.2	0.294	87.0	0.305
21	21.0	12.0	17.6	26	0.7	46.6	0.291	87.6	0.306
22	21.0	11.1	16.8	26	0.7	46.3	0.292	84.5	0.296
Average	21.5	13.8	17.0	26	0.7	44.1	0.295	86.7	0.303

Total number of blows analyzed: 21

Time Summary

Drive 1 minute 57 seconds

9:32:46 AM - 9:34:43 AM (1/23/2009) BN 1 - 22

EXELON VICTORIA - Boring B3252 (29.5'-31' sample)

