

June 27, 2007

Memorandum to File DCN VGCOL 105

From: Steve Kiser *SK*

Reviewed By: Pieter Depree *PD*

Subject: **Report of SPT Energy – MACTEC Atlanta CME 75 Truck
Hammer Serial No. 219907 Automatic Hammer
WORK INSTRUCTION VGCOL 105
Vogle Units 3 & 4 COL Project
Burke County, Georgia
MACTEC Project No. 6141-06-0286**

Steve Kiser, of MACTEC Engineering and Consulting, Inc. (MACTEC), performed energy measurements on the 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 March 8, 2007, during drilling of Boring B-4017 at the referenced site. The testing was performed from approximately 10:05 to 11:50 AM under sunny skies and a temperature of about 60 degrees Fahrenheit. The boring was drilled with personnel and equipment from the Atlanta office of MACTEC. The drilling equipment consisted of a CME 75 model truck-mounted drill rig with an SPT automatic hammer. The drilling tools consisted of N3-sized drilling rods and a 2-foot long split tube sampler. Mud rotary drilling techniques were used to advance the boring below the depth at which groundwater was encountered at the time of energy testing. The drill rig operator during sampling was Mr. Jimmy Oglesby. 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 PAK (Serial No. 1430), and calibrated accelerometers (Serial Nos. P5953 and P5094) and strain gages (Serial Nos. NW #146/1 and NW#146/2). An NW-sized 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 1.49 square inches and an outside diameter of approximately 2.625 inches at the gage location. The drill rods included in the drill rod string were hollow rods in 5 to 10 foot long sections, with an outside and inside diameter of approximately 2.625 and 2.25 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 VGCOL-14.

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 1.

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.

- The average energy transferred from the hammer to the drill rods for each individual depth interval using the EFV method ranged from 268 foot-pounds to 296 foot-pounds. These average energy transfers correspond to energy transfer ratios (ETR) of 77% to 85% 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 weighted average energy transfer of the SPT system (for all the depth intervals tested) was 280.9 foot-pounds, with a weighted average ETR of 80.2%.

Attachments: Page 4 Table 1 - Summary of SPT Energy Measurements – 1 Page
Page 5 Work Instruction – DCN VGCOL 105 – 1 Page
Page 6 Record of SPT Energy Measurement – 1 Page
Pages 7 - 14 PDILOT Output – 8 Pages

TABLE 1
SUMMARY OF SPT ENERGY MEASUREMENTS (ASTM D4633-05)

Vogle Units 3 and 4 COL Project
 Burke County, Georgia
 MACTEC Project No. 6141-06-0286



Rig Serial No.	Rig Owner	Rig Operator	Boring No. Tested	Rod Size	Date Tested	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)
219907 (CME 75 Truck)	MACTEC Atlanta	Jimmy Oglesby	B-4017	N3	3/8/2007	138.5 - 140.0	13 - 14 - 43	71	268	76.6%
						143.5 - 145.0	21 - 35 - 50/4"	109	283	80.9%
						148.5 - 150.0	12 - 12 - 21	45	296	84.6%
							Weighted Average for Rig:		280.9	80.2%

^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.

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 ETR values may differ slightly and insignificantly from those in the PDILOT tables due to roundoff.

Prepared By: 	Date: 6-27-07	Checked By: 	Date: 7/31/07
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**Work Instructions – SPT Energy MACTEC CME-75 (Oglesby)
(Hammer #219907)**

Vogtle COL Project
Project No. 6141-06-0286

Issued To: Steve Kiser _____
Location: Vogtle COL Project Field Office _____ Date: 12/20/06 _____
Issued By: Matthew F. Cooke, Site Coordinator _____
Valid From: 12/20/06 _____ To: 12/20/07 _____

Task Description: Measurement of energy transferred to the drill string rods from a Standard Penetration Test (SPT) automatic hammer mounted on a drill rig. Testing will be performed using a Pile Driving Analyzer (PDA) model PAK at various depth intervals below a depth of approximately 10 feet below the ground surface for the above referenced rig drilling SPT borings at the Vogtle COL Site.

Applicable Technical Procedures or Plans, or other reference: ASTM D4633-05 Standard Test Method for Energy Measurement for Dynamic Penetrometers.

Specific Instructions (note attachments where necessary): Obtain energy measurements with the PDA at various depth intervals below a depth of about 10 feet below the ground surface in general accordance with ASTM D4633-05. Perform energy measurement testing for the above referenced drill rig.

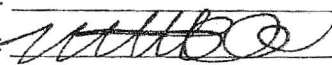
Report Format: Written report documenting results of field testing in general accordance with ASTM D4633-05, to include completed Summary of Daily Observations and Testing, Record of SPT Energy Measurement sheet(s), and PDILOT output data.

Specific Quality Assurance Procedures Applicable: _____ None _____

Hold Points or Witness Points: Direction to perform energy measurements received from the Site Coordinator.

Records: All records generated shall be considered QA Records.

Reviewed and Approved By (Note: Only One Signature is Required to Issue):

Project Manager: _____ Date: _____
Project Principal: _____ Date: _____
Site Coordinator:  Date: 12/20/06
No. of Pages: 1 _____ DCN: _____ VGCOL 105 _____

2801 YORKMONT ROAD, SUITE 100 D CHARLOTTE, NC 28208
Telephone: (704) 357-8600 / Facsimile: (704) 357-8638

RECORD OF SPT ENERGY MEASUREMENT

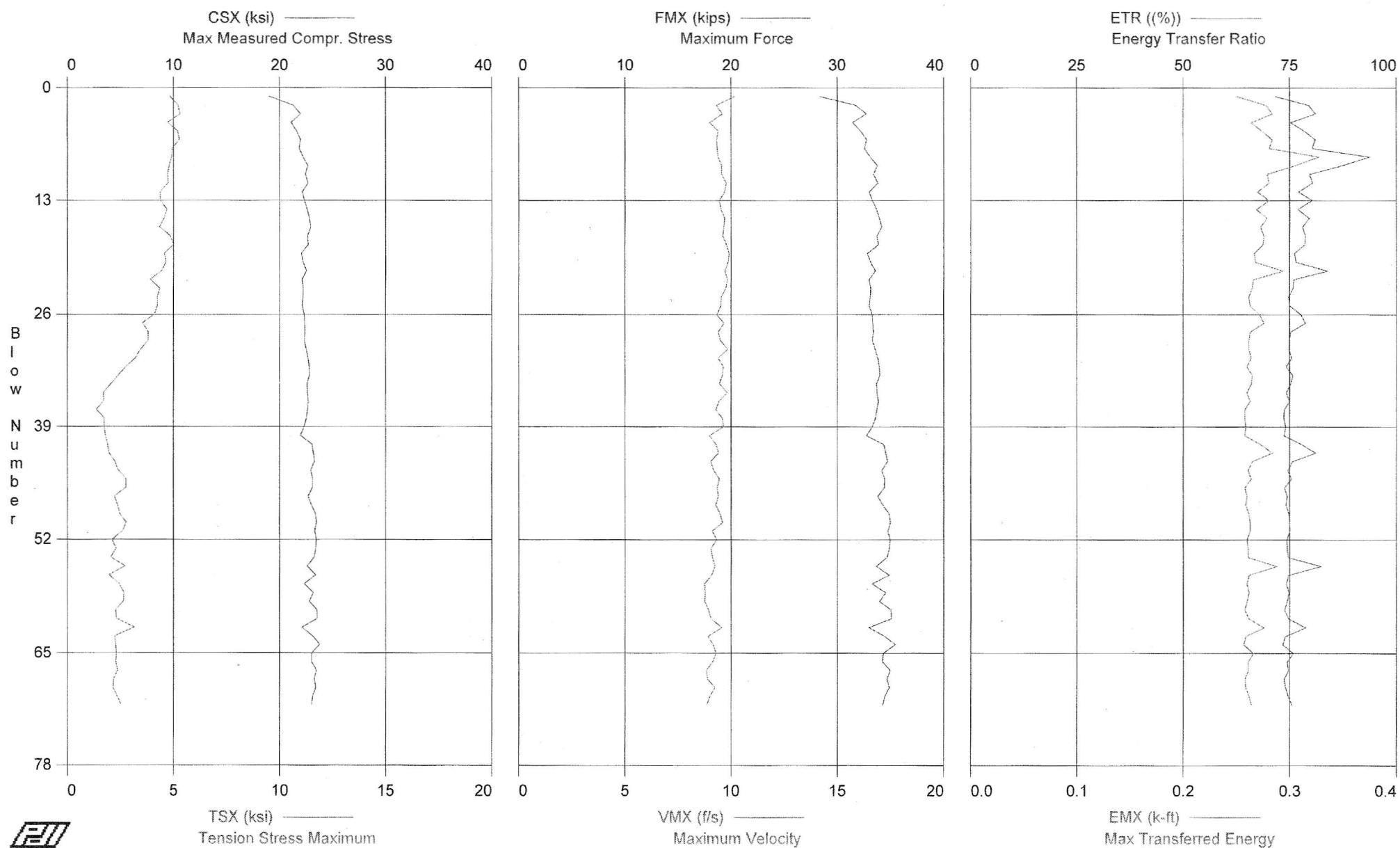
GENERAL INFORMATION		DRILL RIG DATA	
PROJECT:	ALWR Vogtle COL Site	MAKE:	CME
LOCATION:	Waynesboro, Georgia	MODEL:	75 TRUCK
PROJECT NO.:	6141-06-0286	SERIAL NO.:	219907
DATE:	3-8-07	HAMMER TYPE:	AUTOMATIC
WEATHER:	SUNNY; NICE 60°	ROPE CONDITION:	N/A
INSPECTOR:	Steve Kiser	ROD SIZE:	N3
DRILLING COMPANY:	MACTEC ATLANTA	NO. OF SHEAVES:	N/A

BORING DATA			
BORING NUMBER:	B-4017		
DEPTH DRILLED:	150' PLANNED		
TIME DRIVEN:	9:40 AM		
RIG OPERATOR:	JIMMY OGLESBY		
HAMMER OPERATOR:	N.R.		
PDA PAK SERIAL NO.:	1430	1430	1430
INSTR. ROD AREA:	1.49 in ²		
ACCEL. SERIAL NOS.:	P5094 / P5753		
STRAIN SERIAL NOS.:	NW # 146 1/2		

[illegible]

REMARKS:

Plant Vogtle COL Project - Boring B-4017; 138.5' - 140' Sample



Plant Vogtle COL Project - Boring B-4017; 138.5' - 140' Sample
OP: SEK

Rig Serial No. 219907 (MACTEC Atlanta CME 75 Truck)
Test date: 8-Mar-2007

AR: 1.49 in^2
LE: 144.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000.0 ksi
JC: 0.60

CSX: Max Measured Compr. Stress
TSX: Tension Stress Maximum
FMX: Maximum Force
VMX: Maximum Velocity
DFN: Final Displacement

BPM: Blows per Minute
EF2: Energy of F^2
ETR: Energy Transfer Ratio
EMX: Max Transferred Energy

BL#	depth ft	CSX ksi	TSX ksi	FMX kips	VMX f/s	DFN in	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
1	0.00	19.03	4.84	28	10.2	1.09	0.0	0.228	71.8	0.251
2	0.00	21.30	5.22	32	9.3	1.86	47.2	0.267	79.5	0.278
3	0.00	21.97	5.31	33	9.6	1.26	48.0	0.285	81.1	0.284
4	0.00	21.10	4.71	31	9.0	1.01	53.1	0.264	75.3	0.264
5	0.00	21.61	5.19	32	9.4	0.84	48.3	0.279	78.4	0.274
6	0.00	21.99	5.27	33	9.3	1.63	49.3	0.277	81.1	0.284
7	0.00	21.85	4.94	33	9.3	1.77	48.8	0.280	80.3	0.281
8	0.00	22.20	4.91	33	9.4	2.40	48.5	0.277	93.8	0.328
9	0.00	22.68	4.79	34	9.6	2.21	48.5	0.289	87.2	0.305
10	0.00	22.43	4.74	33	9.6	1.48	48.3	0.284	79.7	0.279
11	0.00	22.70	4.75	34	9.8	1.54	48.2	0.288	80.4	0.281
12	0.00	22.14	4.38	33	9.7	1.39	48.2	0.277	77.1	0.270
13	0.00	22.36	4.37	33	9.5	1.24	48.2	0.282	80.4	0.281
14	0.00	22.62	4.69	34	9.5	1.93	48.2	0.284	77.0	0.269
15	0.00	22.79	4.56	34	9.7	2.49	48.2	0.284	79.7	0.279
16	0.00	22.95	4.34	34	9.7	1.29	48.2	0.284	78.0	0.273
17	0.00	22.64	4.83	34	9.6	1.58	48.1	0.282	78.7	0.276
18	0.00	22.72	5.02	34	9.8	1.38	48.2	0.287	78.6	0.275
19	0.00	22.04	4.57	33	9.9	0.63	48.2	0.276	76.2	0.267
20	0.00	22.23	4.64	33	9.9	1.60	48.2	0.275	76.5	0.268
21	0.00	22.54	4.44	34	9.7	1.73	48.2	0.284	83.9	0.294
22	0.00	22.14	3.90	33	9.8	0.76	48.2	0.274	76.1	0.266
23	0.00	22.25	4.36	33	9.8	1.81	48.2	0.276	75.8	0.265
24	0.00	22.21	4.25	33	9.5	1.33	48.2	0.274	74.8	0.262
25	0.00	22.14	4.24	33	9.5	1.12	48.2	0.271	75.1	0.263
26	0.00	22.33	4.09	33	9.3	1.31	48.2	0.280	77.7	0.272
27	0.00	22.37	3.53	33	9.7	1.32	48.3	0.280	78.7	0.276
28	0.00	22.41	3.80	33	9.4	1.33	48.2	0.277	75.2	0.263
29	0.00	22.35	3.80	33	9.5	0.91	48.3	0.281	75.0	0.262
30	0.00	22.52	3.46	34	9.8	1.41	48.3	0.280	74.9	0.262
31	0.00	22.70	3.21	34	9.4	0.76	48.3	0.283	75.5	0.264
32	0.00	22.79	2.76	34	9.6	0.72	48.3	0.281	74.2	0.260
33	0.00	22.81	2.41	34	9.6	0.69	48.3	0.283	75.7	0.265
34	0.00	22.61	2.06	34	9.4	0.88	48.4	0.280	75.3	0.264
35	0.00	22.63	1.70	34	9.8	0.76	48.4	0.282	74.2	0.260
36	0.00	22.73	1.71	34	9.4	0.43	48.5	0.282	75.0	0.263
37	0.00	22.64	1.36	34	9.3	0.33	48.4	0.281	73.8	0.258
38	0.00	22.54	1.73	34	9.6	0.71	48.4	0.276	73.7	0.258
39	0.00	22.34	1.73	33	9.6	0.80	48.3	0.276	74.1	0.259
40	0.00	21.98	1.79	33	9.0	0.22	48.4	0.278	73.8	0.258
41	0.00	23.06	1.90	34	9.3	1.04	48.3	0.286	77.9	0.273
42	0.00	23.19	1.95	35	9.4	0.89	48.4	0.291	81.2	0.284
43	0.00	23.31	2.23	35	9.0	0.79	48.5	0.290	75.7	0.265
44	0.00	22.95	2.39	34	9.2	0.64	48.5	0.287	74.6	0.261
45	0.00	23.12	2.76	34	9.5	1.06	48.4	0.288	75.4	0.264
46	0.00	23.10	2.76	34	9.4	0.54	48.4	0.286	73.8	0.258
47	0.00	22.68	2.22	34	9.4	0.49	48.5	0.287	74.4	0.260
48	0.00	23.00	2.35	34	9.3	0.24	48.3	0.288	74.1	0.259
49	0.00	23.39	2.47	35	9.5	0.59	48.5	0.291	74.9	0.262
50	0.00	23.50	2.77	35	9.6	0.70	48.4	0.292	75.0	0.263
51	0.00	23.32	2.61	35	9.1	0.62	48.4	0.292	75.1	0.263
52	0.00	23.46	2.10	35	9.3	0.73	48.5	0.293	74.3	0.260
53	0.00	23.41	2.29	35	9.1	0.70	48.6	0.294	74.5	0.261
54	0.00	23.26	2.03	35	9.1	0.84	48.5	0.290	74.6	0.261
55	0.00	22.61	2.72	34	9.2	1.23	48.5	0.289	82.4	0.288
56	0.00	23.41	1.96	35	9.1	0.65	48.6	0.293	74.8	0.262
57	0.00	22.34	2.43	33	8.8	0.13	48.7	0.294	74.2	0.260
58	0.00	23.19	2.66	35	8.8	0.29	48.6	0.295	74.9	0.262
59	0.00	22.80	2.64	34	8.8	0.47	48.5	0.294	74.4	0.260
60	0.00	23.52	2.28	35	8.9	-1.15	48.5	0.295	73.9	0.258
61	0.00	23.56	2.30	35	9.1	0.39	48.6	0.296	74.8	0.262
62	0.00	22.12	3.16	33	9.6	-0.96	48.5	0.000	78.8	0.276
63	0.00	23.12	2.22	34	8.9	0.02	48.6	0.294	74.0	0.259
64	0.00	23.80	2.28	35	9.2	-0.06	48.5	0.296	73.4	0.257
65	0.00	23.04	2.30	34	9.3	-0.03	48.7	0.292	75.9	0.266

Plant Vogtle COL Project - Boring B-4017; 138.5' - 140' Sample
OP: SEK

Rig Serial No. 219907 (MACTEC Atlanta CME 75 Truck)
Test date: 8-Mar-2007

BL#	depth ft	CSX ksi	TSX ksi	FMX kips	VMX f/s	DFN in	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
66	0.00	22.99	2.28	34	9.1	-0.01	48.6	0.294	74.5	0.261
67	0.00	23.46	2.36	35	8.8	0.63	48.5	0.297	74.7	0.261
68	0.00	23.26	2.17	35	8.9	0.35	48.5	0.294	73.7	0.258
69	0.00	23.41	2.14	35	9.2	-0.07	48.5	0.295	74.0	0.259
70	0.00	23.13	2.33	34	9.0	0.18	48.6	0.290	74.7	0.262
71	0.00	23.01	2.52	34	8.9	-0.59	48.5	0.286	75.6	0.264
Average		22.65	3.24	34	9.4	0.86	48.5	0.280	76.6	0.268

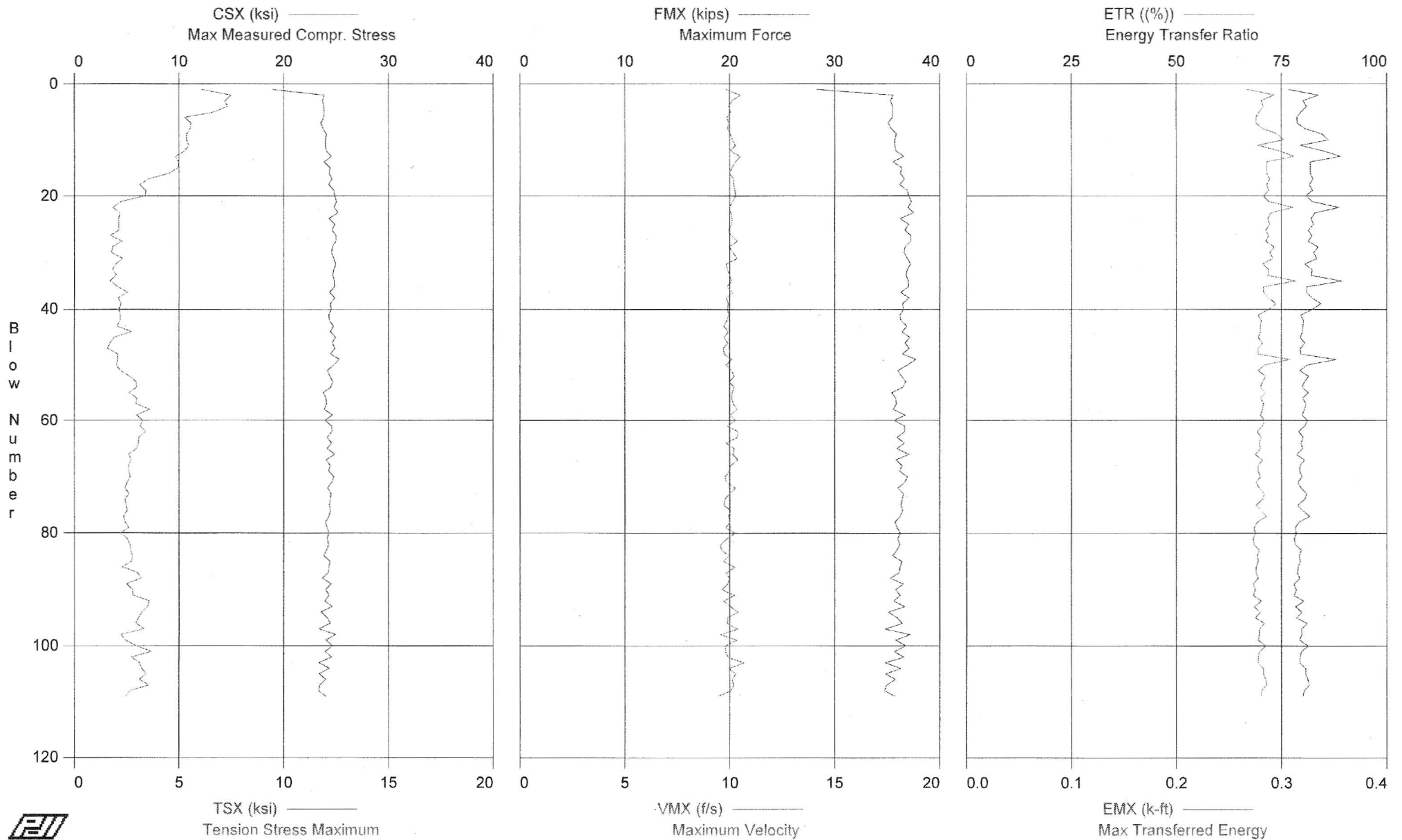
Total number of blows analyzed: 71

Time Summary

Drive 1 minute 27 seconds

10:05:13 AM - 10:06:40 AM (3/8/2007) BN 1 - 71

Plant Vogtle COL Project - Boring B-4017; 143.5' - 145' Sample



Plant Vogtle COL Project - Boring B-4017; 143.5' - 145' Sample
OP: SEK

Rig Serial No. 219907 (MACTEC Atlanta CME 75 Truck)
Test date: 8-Mar-2007

AR: 1.49 in²
LE: 149.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000.0 ksi
JC: 0.60

CSX: Max Measured Compr. Stress
TSX: Tension Stress Maximum
FMX: Maximum Force
VMX: Maximum Velocity
DFN: Final Displacement

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

BL#	depth ft	CSX ksi	TSX ksi	FMX kips	VMX f/s	DFN in	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
1	0.00	18.98	6.09	28	9.8	1.69	0.0	0.238	76.6	0.268
2	0.00	23.89	7.51	36	10.5	1.82	42.5	0.308	83.8	0.293
3	0.00	23.72	7.20	35	10.1	1.65	54.2	0.293	80.2	0.281
4	0.00	23.85	7.32	36	10.0	1.53	53.0	0.297	81.0	0.283
5	0.00	23.85	6.69	36	10.1	1.03	52.8	0.293	79.7	0.279
6	0.00	23.85	5.27	36	9.9	0.64	52.8	0.296	78.7	0.276
7	0.00	23.57	5.57	35	10.0	1.02	52.9	0.295	78.7	0.276
8	0.00	23.75	5.54	35	9.9	0.84	52.8	0.294	80.5	0.282
9	0.00	24.08	5.36	36	10.0	0.75	52.7	0.300	84.6	0.296
10	0.00	23.98	5.36	36	10.1	0.95	53.0	0.304	86.2	0.302
11	0.00	23.98	5.46	36	10.3	0.75	52.7	0.296	79.5	0.278
12	0.00	24.05	5.29	36	10.0	0.76	52.9	0.303	85.0	0.298
13	0.00	24.54	4.84	37	10.5	1.00	52.7	0.308	89.0	0.312
14	0.00	23.87	4.99	36	10.3	0.78	52.8	0.302	81.8	0.286
15	0.00	24.42	4.95	36	10.1	0.90	52.8	0.300	81.8	0.286
16	0.00	24.34	4.52	36	10.0	1.00	52.8	0.301	81.8	0.286
17	0.00	24.59	3.54	37	10.2	0.93	52.7	0.303	82.5	0.289
18	0.00	24.29	3.12	36	10.2	1.01	52.7	0.297	81.6	0.286
19	0.00	24.79	3.41	37	10.2	0.69	52.8	0.303	82.4	0.288
20	0.00	24.86	3.38	37	10.3	0.73	52.8	0.300	80.8	0.283
21	0.00	25.04	2.24	37	10.1	0.86	52.7	0.306	82.3	0.288
22	0.00	24.82	1.83	37	10.0	0.95	52.8	0.309	88.8	0.311
23	0.00	25.18	2.18	38	10.1	0.86	52.9	0.307	83.0	0.290
24	0.00	24.31	2.11	36	10.1	0.97	52.6	0.303	82.1	0.287
25	0.00	24.87	2.12	37	10.1	0.77	52.7	0.305	82.7	0.289
26	0.00	24.62	2.13	37	9.9	0.74	52.6	0.302	81.4	0.285
27	0.00	25.00	1.72	37	10.1	0.94	52.7	0.305	82.2	0.288
28	0.00	25.00	2.28	37	10.4	1.03	52.8	0.302	81.3	0.285
29	0.00	24.64	1.82	37	10.0	0.83	52.8	0.308	83.7	0.293
30	0.00	24.56	1.77	37	10.2	0.85	52.7	0.305	82.6	0.289
31	0.00	24.78	2.30	37	10.4	1.22	52.7	0.302	83.4	0.292
32	0.00	24.98	1.99	37	9.8	1.09	52.8	0.301	80.5	0.282
33	0.00	24.77	1.82	37	9.9	1.26	52.7	0.302	82.3	0.288
34	0.00	24.70	2.01	37	10.0	0.89	52.8	0.301	82.1	0.287
35	0.00	24.84	1.69	37	10.1	1.16	52.7	0.305	89.4	0.313
36	0.00	24.85	2.07	37	9.9	1.42	52.8	0.301	81.0	0.283
37	0.00	24.36	2.55	36	10.1	0.88	52.8	0.302	81.0	0.283
38	0.00	24.89	2.09	37	9.8	1.05	52.8	0.304	82.4	0.288
39	0.00	24.47	2.24	36	9.9	1.55	52.7	0.302	84.4	0.295
40	0.00	24.53	2.12	37	9.9	1.22	52.5	0.296	82.3	0.288
41	0.00	24.31	2.19	36	10.0	1.03	53.0	0.303	79.6	0.278
42	0.00	24.36	2.19	36	9.9	0.76	52.5	0.298	80.3	0.281
43	0.00	24.75	2.02	37	9.7	0.94	52.7	0.301	80.1	0.280
44	0.00	24.47	2.73	36	9.9	0.88	52.7	0.300	80.0	0.280
45	0.00	24.95	1.91	37	9.7	0.83	52.5	0.302	79.5	0.278
46	0.00	24.64	1.71	37	9.9	0.77	52.7	0.309	80.6	0.282
47	0.00	24.90	1.58	37	9.7	0.63	52.8	0.305	79.5	0.278
48	0.00	24.47	2.07	36	9.7	0.60	52.7	0.301	79.6	0.278
49	0.00	25.32	2.08	38	10.1	1.03	52.4	0.310	88.0	0.308
50	0.00	24.79	2.01	37	9.8	1.09	52.5	0.304	81.1	0.284
51	0.00	24.17	2.19	36	10.1	0.59	52.4	0.299	79.4	0.278
52	0.00	24.40	2.62	36	10.2	0.45	52.4	0.298	81.5	0.285
53	0.00	24.68	2.94	37	10.0	0.74	52.4	0.300	80.5	0.282
54	0.00	24.48	2.98	36	10.2	0.61	52.4	0.295	79.9	0.280
55	0.00	23.78	2.61	35	10.1	0.30	52.4	0.291	81.4	0.285
56	0.00	24.03	2.98	36	10.1	0.61	52.5	0.290	80.1	0.280
57	0.00	24.09	2.94	36	10.2	0.46	52.4	0.296	80.8	0.283
58	0.00	23.88	3.59	36	10.3	0.15	52.4	0.296	80.5	0.282
59	0.00	24.66	2.97	37	10.0	0.60	52.4	0.299	80.0	0.280
60	0.00	23.94	3.26	36	10.3	0.07	52.4	0.304	81.2	0.284
61	0.00	24.61	3.14	37	9.9	0.02	52.6	0.305	80.5	0.282
62	0.00	24.62	3.40	37	10.4	0.43	52.4	0.298	79.1	0.277
63	0.00	24.13	3.08	36	10.4	0.40	52.6	0.298	80.2	0.281
64	0.00	24.59	3.06	37	9.8	0.82	52.3	0.299	79.7	0.279
65	0.00	24.14	2.96	36	10.2	0.22	52.5	0.300	80.1	0.280

Plant Vogtle COL Project - Boring B-4017; 143.5' - 145' Sample
OP: SEK

Rig Serial No. 219907 (MACTEC Atlanta CME 75 Truck)
Test date: 8-Mar-2007

BL#	depth ft	CSX ksi	TSX ksi	FMX kips	VMX f/s	DFN in	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
66	0.00	24.89	2.60	37	10.1	0.28	52.4	0.302	78.6	0.275
67	0.00	24.06	2.71	36	10.4	0.68	52.3	0.300	80.5	0.282
68	0.00	24.45	2.59	36	10.0	0.45	52.4	0.300	79.5	0.278
69	0.00	24.29	2.61	36	10.0	0.60	52.4	0.299	79.4	0.278
70	0.00	24.79	2.66	37	9.8	0.94	52.5	0.304	79.9	0.280
71	0.00	24.61	2.53	37	9.8	0.12	52.4	0.302	78.9	0.276
72	0.00	24.19	2.42	36	10.3	0.49	52.4	0.299	79.7	0.279
73	0.00	24.53	2.60	37	10.0	0.93	52.4	0.306	81.1	0.284
74	0.00	24.45	2.42	36	9.8	0.94	52.4	0.299	80.5	0.282
75	0.00	24.37	2.46	36	9.7	0.84	52.3	0.299	78.9	0.276
76	0.00	24.48	2.52	36	10.1	0.89	52.4	0.303	80.2	0.281
77	0.00	24.31	2.35	36	10.0	1.19	52.3	0.299	81.8	0.286
78	0.00	24.00	2.43	36	10.0	0.82	52.3	0.291	79.1	0.277
79	0.00	24.13	2.60	36	9.8	0.84	52.5	0.299	78.3	0.274
80	0.00	24.33	2.19	36	10.3	0.76	52.3	0.299	78.5	0.275
81	0.00	24.15	2.52	36	9.9	0.75	52.3	0.295	78.0	0.273
82	0.00	24.30	2.66	36	9.6	0.55	52.3	0.296	78.3	0.274
83	0.00	24.11	2.69	36	9.6	1.05	52.3	0.301	79.7	0.279
84	0.00	23.85	2.77	36	10.0	0.93	52.3	0.299	79.2	0.277
85	0.00	24.43	2.74	36	9.7	1.04	52.0	0.303	79.5	0.278
86	0.00	24.32	2.29	36	10.2	0.85	52.4	0.297	79.0	0.276
87	0.00	24.26	3.02	36	9.8	1.08	52.1	0.301	78.8	0.276
88	0.00	23.69	3.20	35	10.0	0.54	52.5	0.295	79.4	0.278
89	0.00	24.54	2.49	37	9.9	0.34	52.2	0.298	78.0	0.273
90	0.00	24.02	2.79	36	9.6	0.54	52.6	0.295	78.5	0.275
91	0.00	24.31	2.80	36	10.2	0.57	52.0	0.298	78.0	0.273
92	0.00	23.92	3.58	36	9.7	1.14	52.2	0.297	80.3	0.281
93	0.00	24.62	3.49	37	10.1	0.85	52.2	0.298	78.4	0.274
94	0.00	23.56	3.23	35	10.4	0.85	52.1	0.292	79.9	0.280
95	0.00	24.14	3.07	36	9.9	0.87	52.5	0.292	78.6	0.275
96	0.00	24.45	2.94	36	9.9	0.57	52.0	0.302	81.2	0.284
97	0.00	23.34	3.34	35	10.4	0.66	52.2	0.290	79.7	0.279
98	0.00	24.98	2.23	37	9.6	0.73	52.2	0.304	79.8	0.279
99	0.00	24.04	2.42	36	10.3	0.69	52.4	0.289	79.3	0.278
100	0.00	24.67	2.96	37	9.8	0.83	52.1	0.305	81.4	0.285
101	0.00	23.96	3.69	36	9.8	1.03	52.4	0.294	79.7	0.279
102	0.00	24.58	2.71	37	9.9	0.23	52.0	0.305	79.5	0.278
103	0.00	23.36	3.11	35	10.7	-0.05	52.2	0.285	79.4	0.278
104	0.00	24.37	3.20	36	10.0	0.51	52.1	0.293	80.8	0.283
105	0.00	23.38	3.44	35	10.3	-0.08	52.3	0.284	80.8	0.283
106	0.00	24.01	3.09	36	10.1	0.73	52.1	0.294	81.3	0.285
107	0.00	23.43	3.54	35	10.2	-0.04	52.2	0.292	81.6	0.286
108	0.00	23.31	2.68	35	10.1	0.40	52.2	0.283	80.4	0.281
109	0.00	24.00	2.46	36	9.4	0.66	52.1	0.294	80.2	0.281
Average		24.29	3.07	36	10.0	0.79	52.4	0.299	80.8	0.283

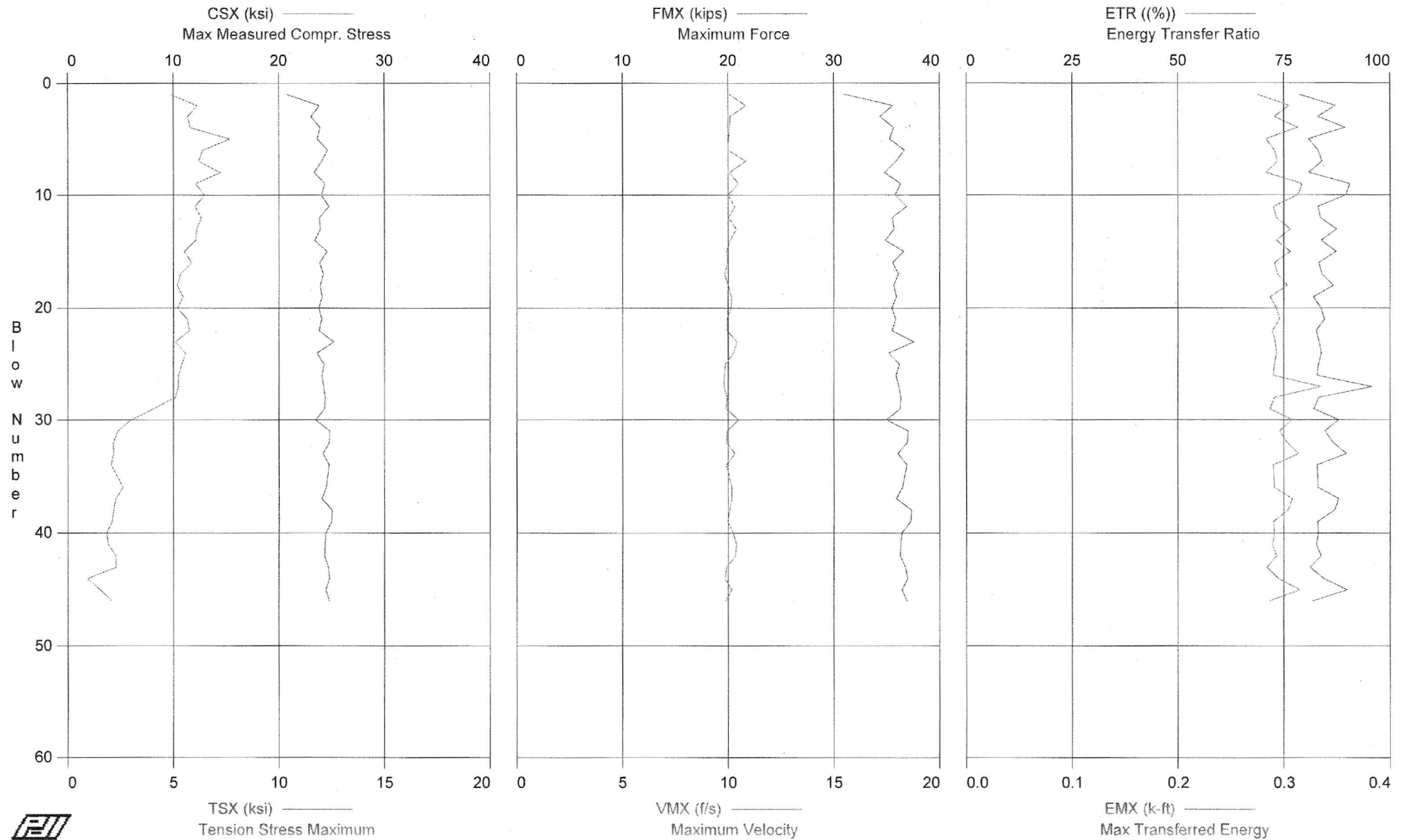
Total number of blows analyzed: 109

Time Summary

Drive 2 minutes 4 seconds

10:51:19 AM - 10:53:23 AM (3/8/2007) BN 1 - 109

Plant Vogtle COL Project - Boring B-4017; 148.5' - 150' Sample



Plant Vogtle COL Project - Boring B-4017; 148.5' - 150' Sample
OP: SEK

Rig Serial No. 219907 (MACTEC Atlanta CME 75 Truck)
Test date: 8-Mar-2007

AR: 1.49 in²
LE: 154.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000.0 ksi
JC: 0.60

CSX: Max Measured Compr. Stress
TSX: Tension Stress Maximum
FMX: Maximum Force
VMX: Maximum Velocity
DFN: Final Displacement

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

BL#	depth ft	CSX ksi	TSX ksi	FMX kips	VMX f/s	DFN in	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
1	0.00	20.81	4.88	31	10.1	3.98	0.0	0.251	78.5	0.275
2	0.00	23.87	6.15	36	10.8	2.70	45.5	0.287	87.1	0.305
3	0.00	23.07	5.68	34	10.1	1.25	51.4	0.288	83.0	0.291
4	0.00	23.93	5.82	36	10.1	1.72	51.1	0.301	89.4	0.313
5	0.00	23.67	7.67	35	10.0	1.02	51.1	0.291	80.9	0.283
6	0.00	24.62	6.41	37	10.0	0.95	51.2	0.301	83.0	0.291
7	0.00	24.08	6.21	36	10.8	1.48	51.2	0.290	84.0	0.294
8	0.00	23.34	7.23	35	10.1	1.49	51.2	0.289	80.8	0.283
9	0.00	24.37	6.05	36	10.5	1.42	51.0	0.302	90.5	0.317
10	0.00	24.02	6.48	36	10.0	1.60	52.6	0.308	89.6	0.313
11	0.00	24.74	6.02	37	10.3	1.80	52.7	0.296	83.0	0.290
12	0.00	23.84	6.33	36	10.0	1.73	52.3	0.299	83.6	0.293
13	0.00	23.95	6.12	36	10.4	1.62	52.4	0.303	87.4	0.306
14	0.00	23.41	6.06	35	10.1	1.26	52.6	0.299	83.8	0.293
15	0.00	24.57	5.52	37	9.9	1.58	52.5	0.301	87.3	0.306
16	0.00	23.86	5.88	36	10.0	1.29	52.5	0.301	83.2	0.291
17	0.00	24.22	5.35	36	9.8	1.33	52.4	0.299	83.9	0.294
18	0.00	23.93	5.19	36	10.0	1.25	52.6	0.303	86.7	0.303
19	0.00	24.11	5.47	36	10.2	1.01	52.4	0.292	82.0	0.287
20	0.00	23.80	5.20	35	10.1	1.62	52.4	0.300	83.8	0.293
21	0.00	24.07	5.66	36	10.0	1.36	52.4	0.301	84.6	0.296
22	0.00	23.82	5.77	35	10.0	1.64	52.4	0.298	82.7	0.289
23	0.00	25.21	5.09	38	10.4	1.29	52.5	0.304	83.3	0.292
24	0.00	23.62	5.59	35	10.3	1.62	52.6	0.305	83.8	0.293
25	0.00	24.29	5.40	36	9.9	1.89	52.5	0.296	83.2	0.291
26	0.00	24.08	5.24	36	9.8	1.46	52.5	0.301	82.8	0.290
27	0.00	24.26	5.24	36	9.8	1.44	52.4	0.306	95.8	0.335
28	0.00	24.40	5.10	36	10.0	1.48	52.6	0.304	83.2	0.291
29	0.00	24.34	4.05	36	9.9	0.64	52.5	0.299	82.1	0.287
30	0.00	23.48	2.98	35	10.5	1.15	52.3	0.304	87.9	0.308
31	0.00	24.85	2.38	37	10.0	1.16	52.5	0.303	84.7	0.296
32	0.00	24.80	2.16	37	9.9	1.08	52.4	0.306	86.6	0.303
33	0.00	24.20	2.17	36	10.3	1.41	52.6	0.308	89.7	0.314
34	0.00	24.77	2.05	37	9.9	1.09	52.4	0.303	82.8	0.290
36	0.00	24.49	2.62	36	10.2	1.45	52.4	0.303	83.0	0.291
37	0.00	24.09	2.27	36	10.2	1.39	52.6	0.301	87.9	0.308
38	0.00	25.06	2.17	37	10.1	1.44	52.4	0.307	86.9	0.304
39	0.00	25.01	2.09	37	10.0	1.10	52.3	0.307	83.0	0.290
40	0.00	24.44	1.83	36	10.2	1.10	52.5	0.303	83.2	0.291
41	0.00	24.38	1.91	36	10.4	1.00	52.4	0.309	82.6	0.289
42	0.00	24.34	2.27	36	10.3	1.07	52.4	0.303	83.8	0.293
43	0.00	24.68	2.29	37	9.9	1.17	52.3	0.302	81.2	0.284
44	0.00	24.82	0.93	37	9.9	1.20	52.6	0.307	84.4	0.295
45	0.00	24.45	1.53	36	10.2	1.09	52.2	0.313	90.0	0.315
46	0.00	24.78	2.11	37	9.9	0.81	52.5	0.302	81.7	0.286
Average		24.15	4.46	36	10.1	1.41	52.1	0.300	84.7	0.296

Total number of blows analyzed: 45

Time Summary

Drive 52 seconds

11:46:57 AM - 11:47:49 AM (3/8/2007) BN 1 - 46

June 27, 2007

Memorandum to File DCN VGCOL 106

From: Steve Kiser *SK*

Reviewed By: Pieter Depree *PD*

Subject: **Report of SPT Energy – MACTEC Atlanta CME 55 Truck
Hammer Serial No. 219505 Automatic Hammer
WORK INSTRUCTION VGCOL 106**
Vogtle Units 3 & 4 COL Project
Burke County, Georgia
MACTEC Project No. 6141-06-0286

Steve Kiser, of MACTEC Engineering and Consulting, Inc. (MACTEC), performed energy measurements on the 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 17, 2007, during drilling of Boring B-3033, and on February 7, 2007, during drilling of Boring B-4028, at the referenced site. The testing was performed from approximately 3:35 to 4:00 PM under partly cloudy skies and a temperature of about 40 degrees Fahrenheit on January 17, and from approximately 8:20 to 8:30 AM under partly cloudy skies and a temperature of about 40 degrees Fahrenheit on February 7. The borings were drilled with personnel and equipment from the Atlanta office of MACTEC. The drilling equipment consisted of a CME 55 model truck-mounted drill rig with an SPT automatic hammer. The drilling tools consisted of N3-sized drilling rods and a 2-foot long split tube sampler. Mud rotary drilling techniques were used to advance the borings below the depth at which groundwater was encountered at the time of energy testing. The drill rig operator during sampling was Mr. Wayne Melvin. 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 PAK (Serial No. 1430), and calibrated accelerometers (Serial Nos. P5953 and P5094) and strain gages (Serial Nos. NW #146/1 and NW#146/2). An NW-sized 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 1.49 square inches and an outside diameter of approximately 2.625 inches at the gage location. The drill rods included in the drill rod string were hollow rods in 5 to 10 foot long sections, with an outside and inside diameter of approximately 2.625 and 2.25 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 VGCOL-14.

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 1.

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.

- The average energy transferred from the hammer to the drill rods for each individual depth interval using the EFV method ranged from 235 foot-pounds to 282 foot-pounds. These average energy transfers correspond to energy transfer ratios (ETR) of 67% to 80% 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 weighted average energy transfer of the SPT system (for all the depth intervals tested) was 245.4 foot-pounds, with a weighted average ETR of 70.1%.

Attachments: Page 4 Table 1 - Summary of SPT Energy Measurements – 1 Page
Page 5 Work Instruction – DCN VGCOL 106 – 1 Page
Page 6 Record of SPT Energy Measurement – 1 Page
Pages 7 - 13 PDILOT Output – 7 Pages

TABLE 1
SUMMARY OF SPT ENERGY MEASUREMENTS (ASTM D4633-05)

Vogtle Units 3 and 4 COL Project
 Burke County, Georgia
 MACTEC Project No. 6141-06-0286



Rig Serial No.	Rig Owner	Rig Operator	Boring No. Tested	Rod Size	Date Tested	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)
219505 (CME 55 Truck)	MACTEC Atlanta	Wayne Melvin	B-3033	N3	1/17/2007	18.5 - 20.0	5 - 5 - 7	16	282	80.6%
					23.5 - 25.0	5 - 8 - 6	20	259	74.0%	
			B-4028	2/7/2007	123.5 - 125.0	20 - 23 - 37	82	235	67.1%	
							Weighted Average for Rig:	245.4	70.1%	

^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.

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 ETR values may differ slightly and insignificantly from those in the PDILOT tables due to roundoff.

Prepared By: 	Date: 6-27-07	Checked By: 	Date: 7/3/07
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Work Instructions – SPT Energy MACTEC CME-55 (Melvin)

(Hammer #219505)

Vogtle COL Project
Project No. 6141-06-0286

Issued To: Steve Kiser _____

Location: Vogtle COL Project Field Office _____ Date: 12/20/06 _____

Issued By: Matthew F. Cooke, Site Coordinator _____

Valid From: 12/20/06 _____ To: 12/20/07 _____

Task Description: Measurement of energy transferred to the drill string rods from a Standard Penetration Test (SPT) automatic hammer mounted on a drill rig. Testing will be performed using a Pile Driving Analyzer (PDA) model PAK at various depth intervals below a depth of approximately 10 feet below the ground surface for the above referenced rig drilling SPT borings at the Vogtle COL Site.

Applicable Technical Procedures or Plans, or other reference: ASTM D4633-05 Standard Test Method for Energy Measurement for Dynamic Penetrometers.

Specific Instructions (note attachments where necessary): Obtain energy measurements with the PDA at various depth intervals below a depth of about 10 feet below the ground surface in general accordance with ASTM D4633-05. Perform energy measurement testing for the above referenced drill rig.

Report Format: Written report documenting results of field testing in general accordance with ASTM D4633-05, to include completed Summary of Daily Observations and Testing, Record of SPT Energy Measurement sheet(s), and PDILOT output data.

Specific Quality Assurance Procedures Applicable: _____ None _____

Hold Points or Witness Points: Direction to perform energy measurements received from the Site Coordinator.

Records: All records generated shall be considered QA Records.

Reviewed and Approved By (Note: Only One Signature is Required to Issue):

Project Manager: _____ Date: _____

Project Principal: _____ Date: _____

Site Coordinator:  _____ Date: 12/20/06 _____

No. of Pages: _____ 1 _____ DCN: _____ VGCOL 106 _____

2801 YORKMONT ROAD, SUITE 100 D CHARLOTTE, NC 28208
Telephone: (704) 357-8600 / Facsimile: (704) 357-8638

RECORD OF SPT ENERGY MEASUREMENT

GENERAL INFORMATION		DRILL RIG DATA	
PROJECT:	ALWR Vogtle COL Site	MAKE:	CME
LOCATION:	Waynesboro, Georgia	MODEL:	35 TRUCK
PROJECT NO.:	6141-06-0286	SERIAL NO.:	219505
DATE:	1-17-07 1-17-07 ; 2-7-07	HAMMER TYPE:	AUTOMATIC
WEATHER:	PARTLY CLOUDY ; 40°	ROPE CONDITION:	N/A
INSPECTOR:	Steve Kiser	ROD SIZE:	N3
DRILLING COMPANY:	MACTEC ATLANTA	NO. OF SHEAVES:	N/A

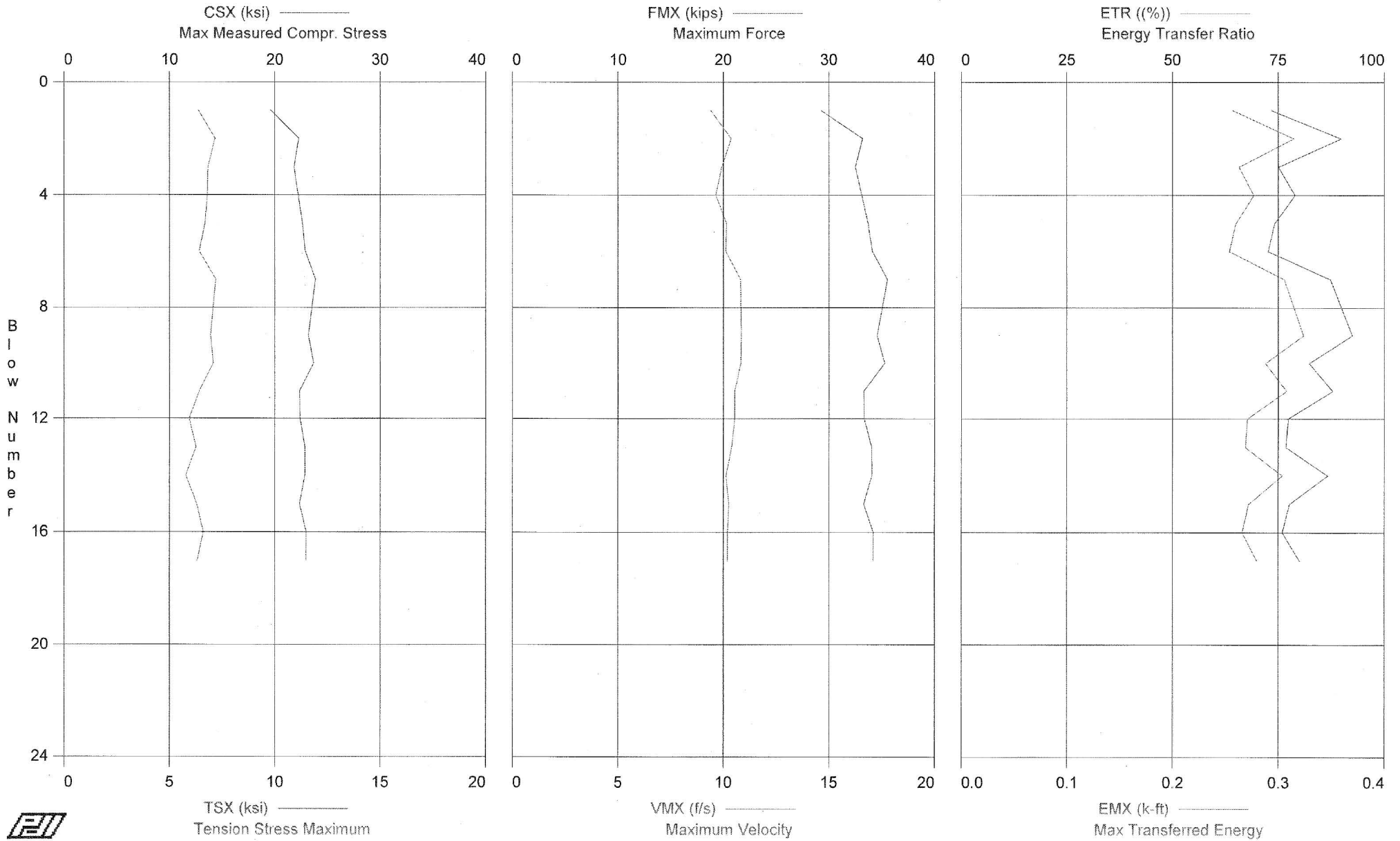
BORING DATA

BORING NUMBER:	B-3033 (1-17-07)	B-4028 (2-7-07)	
DEPTH DRILLED:	150' PLANNED	150' PLANNED	
TIME DRIVEN:	4:00 PM	9:10 AM	
RIG OPERATOR:	WAYNE MELVIN	WAYNE MELVIN	
HAMMER OPERATOR:	N.R.	N.R.	
PDA PAK SERIAL NO.:	1430	1430	1430
INSTR. ROD AREA:	1.49 in ²	1.49 in ²	
ACCEL. SERIAL NOS.:	P5094 / P5953	P5094 / P5953	
STRAIN SERIAL NOS.:	146 NW 1/2	146 NW 1/2	

[illegible]

REMARKS:

Plant Vogtle COL Project - Boring B-3033; 18.5' - 20' Sample



Plant Vogtle COL Project - Boring B-3033; 18.5' - 20' Sample
OP: SEK

Rig Serial No. 219505 (MACTEC Atlanta CME 55 Truck)
Test date: 17-Jan-2007

AR: 1.49 in²
LE: 24.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000.0 ksi
JC: 0.60

CSX: Max Measured Compr. Stress
TSX: Tension Stress Maximum
FMX: Maximum Force
VMX: Maximum Velocity
DFN: Final Displacement

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

BL#	depth ft	CSX ksi	TSX ksi	FMX kips	VMX f/s	DFN in	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
1	0.00	19.61	6.36	29	9.4	1.94	0.0	0.228	73.4	0.257
2	0.00	22.29	7.17	33	10.4	2.32	55.9	0.267	89.9	0.315
3	0.00	21.82	6.83	33	9.9	2.14	55.3	0.255	75.1	0.263
4	0.00	22.21	6.79	33	9.6	1.74	53.7	0.256	79.0	0.277
5	0.00	22.62	6.69	34	10.2	2.29	54.7	0.268	74.2	0.260
6	0.00	22.90	6.41	34	10.1	2.38	54.3	0.258	72.7	0.254
7	0.00	23.86	7.20	36	10.8	2.35	53.9	0.281	87.4	0.306
9	0.00	23.20	6.95	35	10.9	2.32	53.6	0.271	92.5	0.324
10	0.00	23.68	7.08	35	10.8	2.79	54.3	0.276	82.4	0.288
11	0.00	22.35	6.42	33	10.5	2.10	53.3	0.257	87.9	0.308
12	0.00	22.38	5.93	33	10.5	2.69	54.1	0.254	77.4	0.271
13	0.00	22.86	6.26	34	10.4	2.50	53.9	0.256	76.8	0.269
14	0.00	22.87	5.78	34	10.1	2.34	53.6	0.255	86.7	0.304
15	0.00	22.36	6.29	33	10.3	2.45	54.2	0.257	77.6	0.272
16	0.00	22.96	6.60	34	10.2	2.26	53.7	0.258	76.0	0.266
17	0.00	22.95	6.31	34	10.2	2.03	54.3	0.263	80.1	0.280
Average		22.56	6.57	34	10.3	2.29	54.2	0.260	80.6	0.282

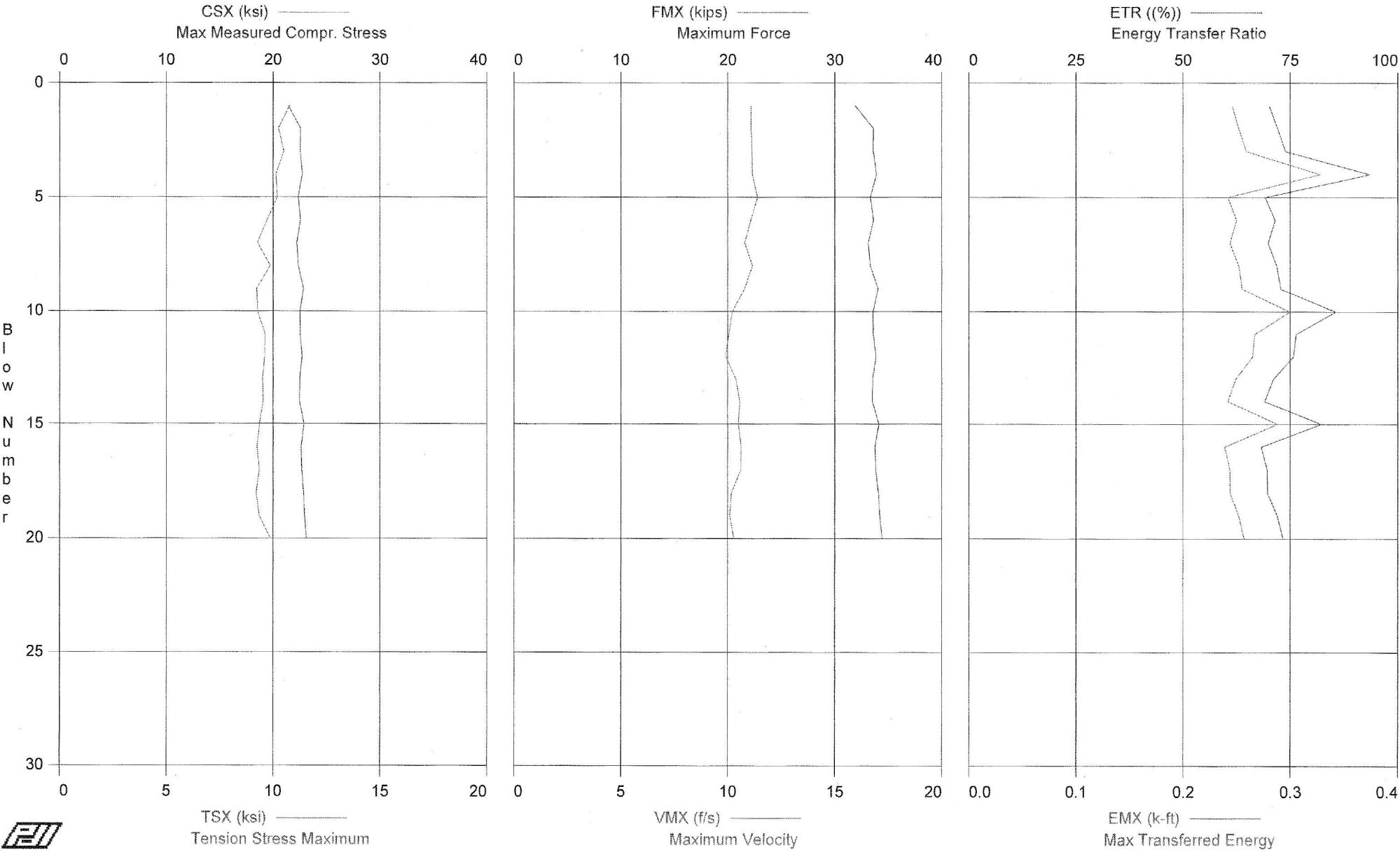
Total number of blows analyzed: 16

Time Summary

Drive 17 seconds

3:38:52 PM - 3:39:09 PM (1/17/2007) BN 1 - 17

Plant Vogtle COL Project - Boring B-3033; 23.5' - 25' Sample



Plant Vogtle COL Project - Boring B-3033; 23.5' - 25' Sample
OP: SEK

Rig Serial No. 219505 (MACTEC Atlanta CME 55 Truck)
Test date: 17-Jan-2007

AR: 1.49 in²
LE: 29.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft³
EM: 30,000.0 ksi
JC: 0.60

CSX: Max Measured Compr. Stress
TSX: Tension Stress Maximum
FMX: Maximum Force
VMX: Maximum Velocity
DFN: Final Displacement

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

BL#	depth ft	CSX ksi	TSX ksi	FMX kips	VMX f/s	DFN in	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
1	0.00	21.42	10.78	32	11.1	2.26	0.0	0.251	70.1	0.246
2	0.00	22.57	10.25	34	11.1	3.25	55.2	0.259	72.1	0.252
3	0.00	22.54	10.51	34	11.1	2.58	52.7	0.257	73.9	0.259
4	0.00	22.75	10.13	34	11.2	2.96	53.1	0.260	93.6	0.328
5	0.00	22.36	10.20	33	11.4	3.01	52.8	0.252	69.1	0.242
6	0.00	22.56	9.72	34	11.1	2.65	53.1	0.261	71.5	0.250
7	0.00	22.23	9.27	33	10.8	2.51	53.1	0.249	69.8	0.244
8	0.00	22.36	9.86	33	11.2	2.88	52.8	0.261	71.9	0.252
9	0.00	22.85	9.24	34	10.8	2.46	53.2	0.263	72.8	0.255
10	0.00	22.53	9.28	34	10.2	2.28	52.0	0.256	85.6	0.300
11	0.00	22.55	9.63	34	10.0	2.09	53.0	0.255	76.4	0.267
12	0.00	22.71	9.62	34	9.9	1.53	52.8	0.260	75.8	0.265
13	0.00	22.50	9.51	34	10.4	2.16	52.7	0.255	71.0	0.249
14	0.00	22.48	9.54	34	10.6	2.11	52.7	0.253	69.1	0.242
15	0.00	22.90	9.36	34	10.5	2.05	52.5	0.263	82.3	0.288
16	0.00	22.64	9.25	34	10.6	2.43	52.9	0.251	68.3	0.239
17	0.00	22.71	9.36	34	10.6	2.27	52.3	0.254	69.6	0.244
18	0.00	22.86	9.21	34	10.2	2.24	53.1	0.252	69.7	0.244
19	0.00	22.96	9.35	34	10.1	2.20	52.5	0.259	72.0	0.252
20	0.00	23.12	9.86	34	10.3	2.17	52.8	0.266	73.4	0.257
Average		22.58	9.70	34	10.7	2.40	52.9	0.257	73.9	0.259

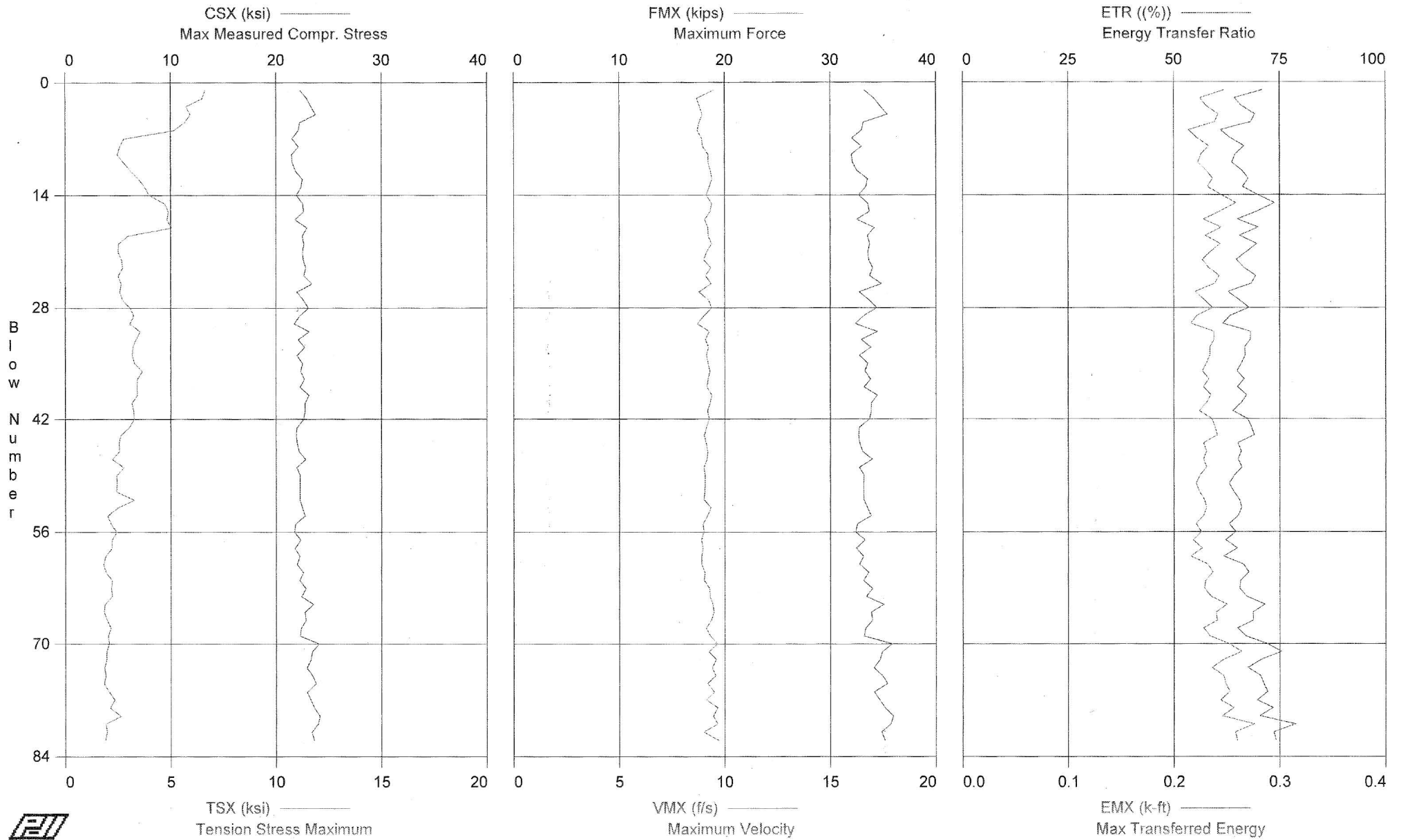
Total number of blows analyzed: 20

Time Summary

Drive 21 seconds

3:55:42 PM - 3:56:03 PM (1/17/2007) BN 1 - 20

Plant Vogtle COL Project - Boring B-4028; 123.5' - 125' Sample



Plant Vogtle COL Project - Boring B-4028; 123.5' - 125' Sample
OP: SEK

Rig Serial No. 219505 (MACTEC Atlanta CME 55 Truck)
Test date: 7-Feb-2007

AR: 1.49 in^2
LE: 129.00 ft
WS: 16,807.9 f/s

SP: 0.492 k/ft3
EM: 30,000.0 ksi
JC: 0.60

CSX: Max Measured Compr. Stress
TSX: Tension Stress Maximum
FMX: Maximum Force
VMX: Maximum Velocity
DFN: Final Displacement

BPM: Blows per Minute
EF2: Energy of F^2
ETR: Energy Transfer Ratio
EMX: Max Transferred Energy

BL#	depth ft	CSX ksi	TSX ksi	FMX kips	VMX f/s	DFN in	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
1	0.00	22.31	6.64	33	9.5	1.03	0.0	0.251	71.0	0.248
2	0.00	22.93	6.49	34	8.7	0.92	52.3	0.261	64.4	0.225
3	0.00	23.33	5.73	35	8.8	1.32	51.0	0.258	66.1	0.231
4	0.00	23.77	5.94	35	8.9	1.15	51.3	0.270	69.2	0.242
5	0.00	22.26	5.67	33	8.8	1.09	51.0	0.251	68.2	0.239
6	0.00	22.14	5.15	33	8.7	1.11	25.6	0.239	61.1	0.214
7	0.00	21.52	2.78	32	8.9	0.63	51.5	0.242	63.4	0.222
8	0.00	22.13	2.58	33	9.0	0.75	51.3	0.251	66.6	0.233
9	0.00	21.48	2.47	32	9.2	0.34	51.4	0.238	64.5	0.226
10	0.00	21.57	2.79	32	9.2	0.67	51.2	0.235	63.8	0.223
11	0.00	21.84	3.11	33	9.3	0.27	51.3	0.246	66.1	0.231
12	0.00	22.51	3.49	34	9.4	0.37	51.4	0.250	67.7	0.237
13	0.00	22.40	3.78	33	9.3	0.03	51.3	0.247	66.3	0.232
14	0.00	21.93	3.99	33	9.1	1.07	50.8	0.249	69.9	0.245
15	0.00	22.53	4.72	34	9.4	1.28	51.1	0.257	73.9	0.259
16	0.00	22.62	4.89	34	9.3	1.24	51.3	0.254	69.8	0.244
17	0.00	21.81	4.82	33	9.1	0.98	51.2	0.240	65.1	0.228
18	0.00	22.94	5.04	34	9.2	1.27	50.5	0.252	70.0	0.245
19	0.00	22.49	2.96	34	9.2	1.02	51.3	0.243	65.6	0.230
20	0.00	22.66	2.52	34	9.4	0.51	50.8	0.258	69.6	0.244
21	0.00	22.52	2.51	34	9.2	0.68	51.1	0.253	67.2	0.235
22	0.00	22.58	2.67	34	9.0	1.07	51.0	0.240	64.8	0.227
23	0.00	22.83	2.72	34	9.3	0.81	51.4	0.251	66.6	0.233
24	0.00	22.64	2.51	34	9.1	0.62	50.6	0.260	69.4	0.243
25	0.00	23.40	2.66	35	9.4	1.05	51.2	0.254	68.4	0.239
26	0.00	21.98	2.58	33	8.8	1.00	50.6	0.231	62.8	0.220
27	0.00	22.61	2.72	34	9.2	1.17	50.8	0.246	65.5	0.229
28	0.00	23.09	3.09	34	9.4	0.28	51.1	0.253	67.8	0.237
29	0.00	22.24	3.24	33	9.0	0.96	50.1	0.239	63.4	0.222
30	0.00	21.73	3.05	32	8.7	0.73	51.0	0.230	61.6	0.216
31	0.00	23.14	3.55	34	9.3	1.18	50.4	0.252	68.1	0.238
32	0.00	22.10	3.36	33	9.1	0.85	51.2	0.247	68.1	0.238
33	0.00	22.71	3.20	34	9.2	0.54	50.3	0.251	66.7	0.234
34	0.00	21.99	3.18	33	9.1	0.93	50.7	0.249	66.9	0.234
35	0.00	22.51	3.28	34	9.2	1.08	50.5	0.245	66.0	0.231
36	0.00	22.34	3.66	33	9.3	0.67	50.3	0.243	65.0	0.227
37	0.00	22.69	3.42	34	9.2	0.66	50.5	0.253	66.6	0.233
38	0.00	22.28	3.40	33	9.2	0.82	50.4	0.243	65.1	0.228
39	0.00	23.11	3.42	34	9.4	1.03	50.7	0.251	67.2	0.235
40	0.00	22.74	3.15	34	9.3	0.85	50.0	0.245	65.9	0.231
41	0.00	22.73	3.25	34	9.2	0.58	50.8	0.239	63.9	0.224
42	0.00	22.62	3.27	34	9.3	0.59	50.3	0.254	67.4	0.236
43	0.00	21.99	3.04	33	9.1	1.03	50.6	0.251	68.3	0.239
44	0.00	21.93	2.63	33	9.0	1.09	50.3	0.253	69.0	0.241
45	0.00	22.00	2.54	33	9.1	0.20	50.5	0.245	65.1	0.228
46	0.00	22.18	2.56	33	9.2	0.11	50.2	0.254	65.9	0.231
47	0.00	22.79	2.23	34	9.2	0.48	50.1	0.248	65.2	0.228
48	0.00	21.97	2.78	33	9.0	0.74	50.5	0.248	66.1	0.231
49	0.00	22.28	2.44	33	9.1	0.50	50.0	0.244	64.4	0.225
50	0.00	22.26	2.44	33	9.1	0.90	50.4	0.239	63.1	0.221
51	0.00	22.25	2.43	33	9.0	0.84	50.4	0.241	64.1	0.224
52	0.00	22.26	3.27	33	9.0	0.56	49.9	0.243	65.5	0.229
53	0.00	22.50	2.49	34	9.3	0.95	50.5	0.252	66.0	0.231
54	0.00	22.73	2.00	34	9.2	0.24	49.9	0.245	65.2	0.228
55	0.00	21.84	2.16	33	9.0	0.78	50.0	0.238	63.0	0.221
56	0.00	21.75	2.44	32	9.0	0.51	50.0	0.244	64.6	0.226
57	0.00	22.33	2.21	33	8.9	0.39	50.2	0.238	62.2	0.218
58	0.00	21.79	2.19	32	9.0	0.59	50.0	0.249	65.0	0.227
59	0.00	22.23	1.91	33	8.9	0.38	50.4	0.237	61.8	0.216
60	0.00	21.99	1.81	33	8.9	0.79	49.6	0.249	66.4	0.232
61	0.00	22.58	1.93	34	9.0	0.63	50.3	0.252	67.7	0.237
62	0.00	22.24	2.22	33	9.0	0.45	50.2	0.253	65.8	0.230
63	0.00	22.81	2.17	34	9.3	0.47	50.0	0.252	65.5	0.229
64	0.00	22.42	2.22	33	9.3	0.58	50.2	0.258	67.1	0.235
65	0.00	23.53	1.87	35	9.4	0.64	50.0	0.264	71.5	0.250

Plant Vogtle COL Project - Boring B-4028; 123.5' - 125' Sample
OP: SEK

Rig Serial No. 219505 (MACTEC Atlanta CME 55 Truck)
Test date: 7-Feb-2007

BL#	depth ft	CSX ksi	TSX ksi	FMX kips	VMX f/s	DFN in	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
66	0.00	22.72	1.83	34	9.5	0.47	50.3	0.258	68.7	0.240
67	0.00	22.81	1.98	34	9.4	0.88	50.1	0.252	68.8	0.241
68	0.00	22.37	2.16	33	9.1	0.47	50.0	0.243	65.0	0.228
69	0.00	22.27	2.03	33	9.3	0.58	50.5	0.253	67.0	0.234
70	0.00	24.07	2.08	36	9.7	0.53	50.2	0.273	72.0	0.252
71	0.00	23.43	1.95	35	9.3	0.97	50.1	0.270	75.5	0.264
72	0.00	23.29	1.95	35	9.6	0.61	49.7	0.269	70.7	0.247
73	0.00	22.90	1.85	34	9.4	0.69	50.2	0.256	67.5	0.236
74	0.00	23.45	1.90	35	9.6	0.42	50.3	0.265	70.5	0.247
75	0.00	23.76	1.85	35	9.2	0.77	49.9	0.266	71.2	0.249
76	0.00	22.93	2.08	34	9.5	0.73	50.3	0.271	72.2	0.253
77	0.00	23.28	2.34	35	9.1	0.78	49.5	0.255	69.7	0.244
78	0.00	23.61	2.12	35	9.7	0.25	50.3	0.285	73.5	0.257
79	0.00	24.13	2.64	36	9.4	0.76	49.6	0.265	70.3	0.246
80	0.00	23.98	1.92	36	9.7	1.20	50.0	0.279	78.8	0.276
81	0.00	23.39	1.97	35	9.0	0.94	49.4	0.260	73.6	0.258
82	0.00	23.61	1.88	35	9.7	0.89	50.3	0.287	74.2	0.260
Average		22.59	2.95	34	9.2	0.74	50.2	0.252	67.2	0.235

Total number of blows analyzed: 82

Time Summary

Drive 1 minute 37 seconds

8:25:32 AM - 8:27:09 AM (2/7/2007) BN 1 - 82