June 27, 2007

Memorandum to File DCN VGCOL 101
From: Steve Kiser
Reviewed By: Pieter Depree

Subject: **Report of SPT Energy – MACTEC Raleigh CME 55LC Track Hammer Serial No. 331145 Automatic Hammer**
WORK INSTRUCTION VGCOL 101
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 December 20, 2006, during drilling of Boring B-1154 at the referenced site. The testing was performed from approximately 11:10 AM to 12:15 PM under cloudy skies and a temperature of about 50 degrees Fahrenheit. The boring was drilled with personnel and equipment from the Raleigh office of MACTEC. The drilling equipment consisted of a CME 55LC model track-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 below the depth at which groundwater was encountered at the time of energy testing. The drill rig operator during sampling was Mr. David White. 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. AW #144/1 and AW#144/2). An AW-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 1.19 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 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 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 PDIPLOT tables and are also shown graphically in the PDIPLOT 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 300 foot-pounds to 315 foot-pounds. These average energy transfers correspond to energy transfer ratios (ETR) of 86% to 90% 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 309.5 foot-pounds, with a weighted average ETR of 88.4%.

Attachments: Page 4 Table 1 - Summary of SPT Energy Measurements – 1 Page
Page 5 Work Instruction – DCN VGCOL 101 – 1 Page
Page 6 Record of SPT Energy Measurement – 1 Page
Pages 7 - 17 PDIPLOT Output – 11 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)
331145 (CME 55LC Track)	MACTEC Raleigh	David White	B-1154	AW-J	12/20/2006	78.5 - 80.0	4 - 7 - 8	18	315	90.0%
						83.5 - 85.0	9 - 14 - 21	42	300	85.7%
						88.5 - 90.0	7 - 14 - 26	47	315	90.0%
						93.5 - 95.0	14 - 24 - 48	85	307	87.7%
						98.5 - 100.0	50 / 3"	48	315	90.0%
							Weighted Average for Rig:		**309.5**	**88.4%**

[a]Measured 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).

[b]Energy 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 PDIPLOT tables due to roundoff.

Prepared By:	Date: 6-27-07	Checked By:	Date: 7/31/07

Work Instructions – SPT Energy MACTEC CME-55LC (White)
(Hammer #331145)
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 PDIPLOT 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 101

MACTEC

2801 YORKMONT ROAD, SUITE 100 □ 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:	55LC TRACK
PROJECT NO.:	6141-06-0286	SERIAL NO.:	331145
DATE:	12-20-06	HAMMER TYPE:	AUTOMATIC
WEATHER:	CLOUDY COOL 50°	ROPE CONDITION:	N/A
INSPECTOR:	Steve Kiser	ROD SIZE:	AW-J
DRILLING COMPANY:	MACTEC RALEIGH	NO. OF SHEAVES:	N/A

BORING DATA

BORING NUMBER:	B-1154		
DEPTH DRILLED:	100' PLANNED		
TIME DRIVEN:	12:15 PM		
RIG OPERATOR:	DAVID WHITE		
HAMMER OPERATOR:	N.R.		
PDA PAK SERIAL NO.:	1430	1430	1430
INSTR. ROD AREA:	1.19 in²		
ACCEL. SERIAL NOS.:	P5094 / P5953		
STRAIN SERIAL NOS.:	144 AW 1/2		

SAMPLE DEPTH (feet)	SPT N-VALUE (bpf)	DEPTH cont. (feet)	SPT N-VALUE (bpf)	SAMPLE DEPTH (feet)	SPT N-VALUE (bpf)	DEPTH cont. (feet)	SPT N-VALUE (bpf)	SAMPLE DEPTH (feet)	SPT N-VALUE (bpf)	DEPTH cont. (feet)	SPT N-VALUE (bpf)
78.5/80'	4-7-8										
83.5/85'	9-14-21										
88.5/90'	7-14-26										
93.5/95'	14-24-48										
98.5/100'	50/3"										

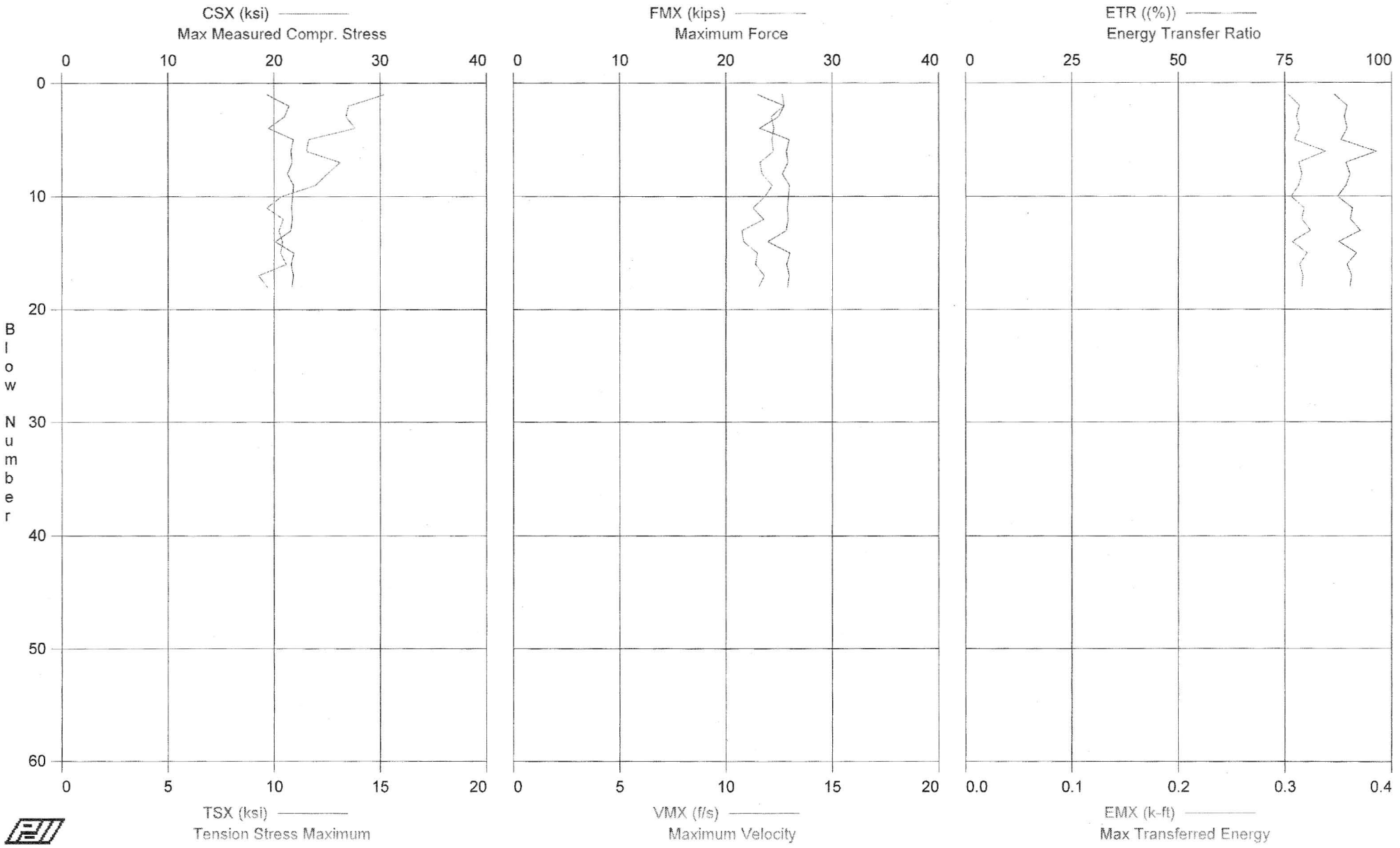
REMARKS:

MACTEC Engineering and Consulting, Inc. - Case Method Results

PDIPLOT Ver. 2005.2 - Printed: 16-May-2007

Test date: 20-Dec-2006

Vogtle COL Project - Boring B-1154; 78.5' - 80' Sample



Vogtle COL Project - Boring B-1154; 78.5' - 80' Sample
OP: SEK

Rig Serial No. 331145(MACTEC Raleigh 55LC)
Test date: 20-Dec-2006

AR: 1.19 in^2
LE: 84.00 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	CSX	TSX	FMX	VMX	DFN	BPM	EF2	ETR	EMX
	ft	ksi	ksi	kips	f/s	in	**	k-ft	(%)	k-ft
1	0.00	19.34	15.21	23	12.7	1.85	0.0	0.000	86.6	0.303
2	0.00	21.42	13.52	25	12.7	2.12	57.4	0.284	89.6	0.314
3	0.00	20.98	13.39	25	12.1	1.93	52.4	0.286	89.0	0.311
4	0.00	19.48	13.82	23	12.3	2.26	52.5	0.289	89.6	0.314
5	0.00	21.80	11.63	26	12.2	2.02	52.4	0.283	88.1	0.309
6	0.00	21.60	11.53	26	12.2	2.08	52.4	0.300	96.5	0.338
7	0.00	21.70	13.11	26	11.6	1.97	52.4	0.285	89.3	0.313
8	0.00	21.26	12.51	25	11.7	2.63	52.5	0.295	90.3	0.316
9	0.00	21.83	11.95	26	12.2	2.69	52.7	0.296	89.4	0.313
10	0.00	21.75	10.35	26	11.8	1.71	52.1	0.281	87.4	0.306
11	0.00	21.63	9.66	26	11.3	1.46	52.4	0.298	90.8	0.318
12	0.00	21.72	10.43	26	11.8	3.56	52.0	0.298	90.4	0.316
13	0.00	21.58	10.22	26	10.8	1.62	52.4	0.296	92.7	0.324
14	0.00	20.10	10.39	24	10.8	2.03	52.2	0.301	87.6	0.307
15	0.00	21.86	10.30	26	11.5	2.05	52.2	0.300	91.8	0.321
16	0.00	21.61	10.57	26	11.4	1.92	52.6	0.294	89.6	0.314
17	0.00	21.81	9.26	26	11.8	0.29	52.3	0.301	90.7	0.317
18	0.00	21.67	9.69	26	11.5	2.00	52.5	0.295	90.3	0.316
	Average	21.29	11.53	25	11.8	2.01	52.7	0.277	90.0	0.315

Total number of blows analyzed: 18

Time Summary

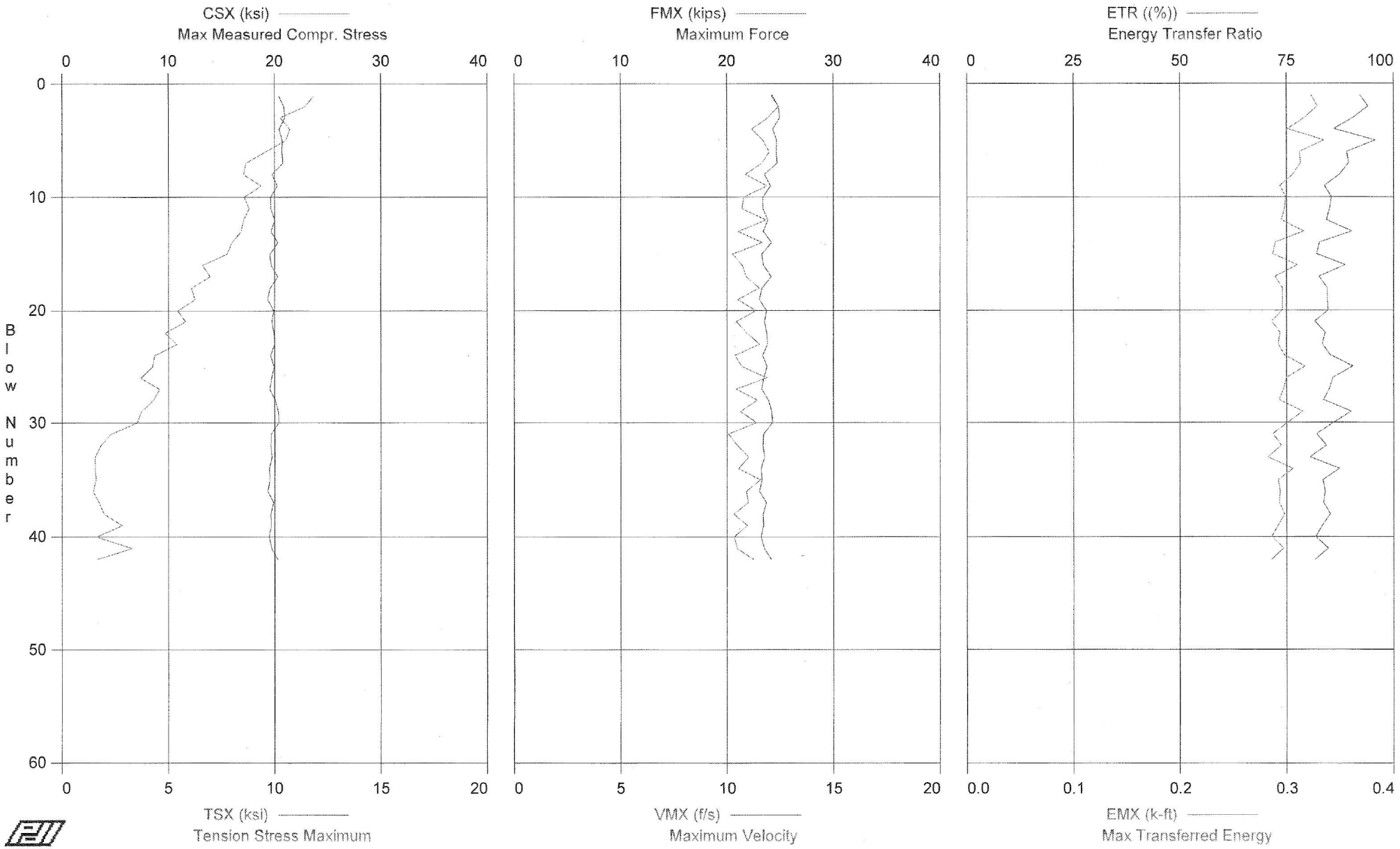
Drive 21 seconds 11:10:12 AM - 11:10:33 AM (12/20/2006) BN 1 - 19

MACTEC Engineering and Consulting, Inc. - Case Method Results

PDIPLOT Ver. 2005.2 - Printed: 16-May-2007

Test date: 20-Dec-2006

Vogtle COL Project - Boring B-1154; 83.5' - 85' Sample



Vogtle COL Project - Boring B-1154; 83.5' - 85' Sample
OP: SEK

Rig Serial No. 331145(MACTEC Raleigh 55LC)
Test date: 20-Dec-2006

AR: 1.19 in^2
LE: 89.00 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	20.40	11.86	24	12.1	2.19	0.0	0.296	92.2	0.323
2	0.00	20.88	11.44	25	12.4	3.09	55.5	0.273	94.0	0.329
3	0.00	20.98	10.28	25	11.9	1.71	25.8	0.284	90.7	0.317
4	0.00	20.44	10.73	24	11.2	1.87	51.7	0.277	86.1	0.301
5	0.00	20.73	10.53	25	11.7	2.94	51.7	0.275	95.7	0.335
6	0.00	20.72	9.56	25	12.0	1.06	51.5	0.274	89.1	0.312
7	0.00	20.78	8.66	25	11.6	1.43	51.9	0.278	89.5	0.313
8	0.00	19.77	8.55	24	10.9	1.97	51.6	0.276	87.4	0.306
9	0.00	20.25	9.37	24	11.9	0.61	51.6	0.272	83.9	0.294
10	0.00	19.64	8.57	23	10.8	1.49	51.6	0.266	85.5	0.299
11	0.00	19.64	8.81	23	10.7	1.67	51.4	0.272	85.1	0.298
12	0.00	20.02	8.54	24	11.8	1.18	51.7	0.270	84.3	0.295
13	0.00	19.67	8.43	23	10.5	1.61	51.3	0.276	90.3	0.316
14	0.00	20.32	7.99	24	11.6	0.93	51.3	0.275	82.7	0.289
15	0.00	19.56	7.77	23	10.3	1.15	51.7	0.273	82.0	0.287
16	0.00	19.69	6.61	23	10.7	1.09	51.5	0.284	88.7	0.310
17	0.00	20.30	6.98	24	10.9	1.26	51.3	0.279	82.6	0.289
18	0.00	19.58	6.09	23	11.5	1.39	51.5	0.274	84.5	0.296
19	0.00	19.37	6.27	23	10.5	1.13	51.5	0.271	84.6	0.296
20	0.00	19.95	5.45	24	11.4	0.92	51.5	0.275	84.7	0.296
21	0.00	19.75	5.82	23	10.4	1.15	51.7	0.273	81.6	0.286
22	0.00	19.94	4.86	24	10.9	1.07	51.4	0.275	84.0	0.294
23	0.00	20.01	5.42	24	11.5	1.01	51.5	0.267	83.3	0.292
24	0.00	19.62	4.36	23	10.4	0.93	51.5	0.273	85.2	0.298
25	0.00	19.96	4.26	24	10.7	1.23	51.5	0.277	90.5	0.317
26	0.00	19.73	3.70	23	11.9	1.10	51.5	0.269	85.8	0.300
27	0.00	19.54	4.60	23	10.4	1.65	51.5	0.271	85.0	0.297
28	0.00	20.06	4.28	24	11.4	1.30	51.7	0.269	83.6	0.293
29	0.00	20.34	3.74	24	10.6	1.15	51.3	0.284	90.1	0.315
30	0.00	20.40	3.53	24	11.4	1.56	51.6	0.272	86.0	0.301
31	0.00	19.68	2.30	23	10.1	0.58	51.1	0.270	82.0	0.287
32	0.00	19.64	1.82	23	10.5	0.18	51.2	0.271	84.3	0.295
33	0.00	19.75	1.55	23	11.0	0.54	51.4	0.265	80.4	0.282
34	0.00	19.49	1.56	23	10.5	1.06	51.2	0.266	87.4	0.306
35	0.00	19.55	1.60	23	11.6	0.40	51.4	0.264	83.5	0.292
36	0.00	19.37	1.46	23	10.9	0.78	51.3	0.264	84.0	0.294
37	0.00	19.91	1.74	24	11.0	0.83	51.3	0.268	83.6	0.293
38	0.00	19.64	1.98	23	10.3	0.48	51.2	0.278	85.2	0.298
39	0.00	19.68	2.82	23	10.9	0.53	51.4	0.267	83.3	0.292
40	0.00	19.48	1.63	23	10.3	0.58	51.5	0.266	81.8	0.286
41	0.00	19.74	3.28	23	10.5	0.83	51.4	0.278	84.7	0.297
42	0.00	20.30	1.61	24	11.3	0.95	51.2	0.280	81.6	0.286
	Average	19.96	5.72	24	11.1	1.20	50.9	0.273	85.7	0.300

Total number of blows analyzed: 42

Time Summary

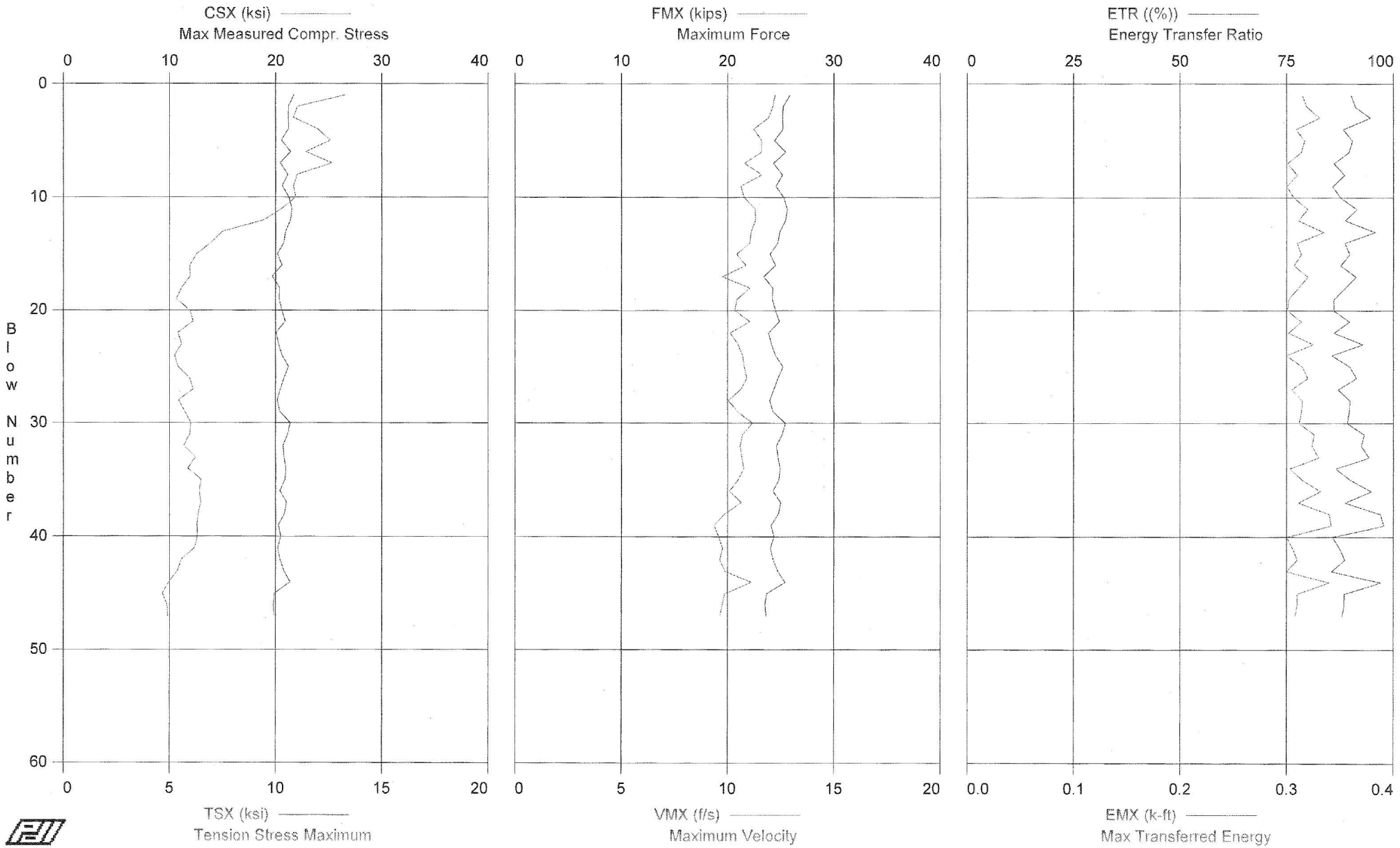
Drive 48 seconds 11:22:54 AM - 11:23:42 AM (12/20/2006) BN 1 - 42

MACTEC Engineering and Consulting, Inc. - Case Method Results

PDIPLOT Ver. 2005.2 - Printed: 16-May-2007

Test date: 20-Dec-2006

Vogtle COL Project - Boring B-1154; 88.5' - 90' Sample



Vogtle COL Project - Boring B-1154; 88.5' - 90' Sample
OP: SEK

Rig Serial No. 331145(MACTEC Raleigh 55LC)
Test date: 20-Dec-2006

AR: 1.19 in^2
LE: 94.00 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	CSX	TSX	FMX	VMX	DFN	BPM	EF2	ETR	EMX
	ft	ksi	ksi	kips	f/s	in	**	k-ft	(%)	k-ft
1	0.00	21.72	13.26	26	12.2	2.17	0.0	0.319	90.1	0.315
2	0.00	21.21	11.03	25	12.1	3.41	52.9	0.304	91.2	0.319
3	0.00	21.18	10.84	25	11.9	2.70	51.2	0.304	94.6	0.331
4	0.00	21.19	11.97	25	11.2	2.24	51.5	0.305	88.3	0.309
5	0.00	20.53	12.57	24	11.6	2.45	51.2	0.304	90.5	0.317
6	0.00	21.41	11.42	25	11.6	2.07	51.3	0.305	89.7	0.314
7	0.00	20.43	12.66	24	10.8	0.96	50.9	0.307	86.1	0.301
8	0.00	21.14	11.02	25	11.6	1.74	51.3	0.306	88.6	0.310
9	0.00	20.63	10.84	25	10.6	1.66	51.2	0.305	85.8	0.300
10	0.00	21.25	10.95	25	10.8	2.02	51.2	0.306	87.7	0.307
11	0.00	21.52	10.28	26	11.3	1.66	51.5	0.312	91.5	0.320
12	0.00	21.39	9.45	25	11.3	1.51	50.8	0.307	88.8	0.311
13	0.00	20.92	7.49	25	11.1	1.09	51.4	0.311	95.8	0.335
14	0.00	20.77	6.95	25	11.0	1.40	50.9	0.305	88.7	0.310
15	0.00	20.16	6.28	24	10.4	0.75	51.4	0.310	89.8	0.314
16	0.00	20.59	5.96	25	10.9	0.67	50.7	0.304	87.7	0.307
17	0.00	19.67	5.96	23	9.8	1.36	50.8	0.308	91.3	0.320
18	0.00	20.37	5.57	24	11.1	2.01	50.9	0.299	88.8	0.311
19	0.00	20.35	5.32	24	10.4	1.15	51.2	0.302	86.2	0.302
20	0.00	20.59	5.96	24	10.3	1.55	50.9	0.306	86.1	0.301
21	0.00	20.90	6.11	25	11.0	1.65	51.0	0.304	89.7	0.314
22	0.00	20.05	5.40	24	10.1	1.61	50.6	0.300	86.2	0.302
23	0.00	20.28	5.57	24	10.5	1.67	51.1	0.307	92.9	0.325
24	0.00	20.60	5.25	25	10.7	1.19	51.2	0.302	85.7	0.300
25	0.00	21.20	5.39	25	10.8	0.89	50.8	0.305	89.9	0.315
26	0.00	20.80	5.95	25	10.9	1.52	50.8	0.301	91.4	0.320
27	0.00	20.46	6.12	24	10.6	1.57	50.8	0.304	87.1	0.305
28	0.00	20.14	5.43	24	10.0	1.40	51.1	0.306	89.9	0.315
29	0.00	20.39	5.72	24	10.5	1.58	51.2	0.300	89.7	0.314
30	0.00	21.36	6.01	25	11.2	1.13	50.8	0.303	89.2	0.312
31	0.00	21.14	5.96	25	10.7	1.48	50.8	0.308	93.2	0.326
32	0.00	20.70	5.68	25	10.6	1.16	50.8	0.310	92.6	0.324
33	0.00	20.80	6.23	25	10.7	1.63	51.1	0.310	94.4	0.330
34	0.00	20.95	5.86	25	10.8	1.39	50.9	0.305	86.5	0.303
35	0.00	20.87	6.48	25	10.5	1.26	51.0	0.311	90.1	0.315
36	0.00	20.40	6.40	24	10.1	1.38	50.8	0.312	94.9	0.332
37	0.00	21.01	6.47	25	10.6	1.00	50.7	0.309	88.7	0.311
38	0.00	20.84	6.35	25	9.9	1.73	51.4	0.314	97.0	0.340
39	0.00	20.26	6.29	24	9.4	1.90	51.1	0.314	97.8	0.342
40	0.00	20.49	6.32	24	9.6	1.47	51.1	0.308	85.8	0.300
41	0.00	20.19	6.18	24	9.8	1.74	51.0	0.301	87.5	0.306
42	0.00	20.41	5.55	24	9.6	0.80	51.2	0.312	88.6	0.310
43	0.00	20.78	5.37	25	9.9	0.94	51.1	0.314	85.6	0.300
44	0.00	21.35	4.96	25	11.1	2.01	51.2	0.308	97.1	0.340
45	0.00	19.89	4.66	24	9.9	1.26	51.2	0.303	88.5	0.310
46	0.00	19.79	4.88	24	9.8	1.07	50.9	0.308	88.5	0.310
47	0.00	19.85	4.90	24	9.6	0.78	51.2	0.305	88.1	0.308
	Average	20.70	7.26	25	10.7	1.53	51.1	0.307	89.9	0.315

Total number of blows analyzed: 47

Time Summary

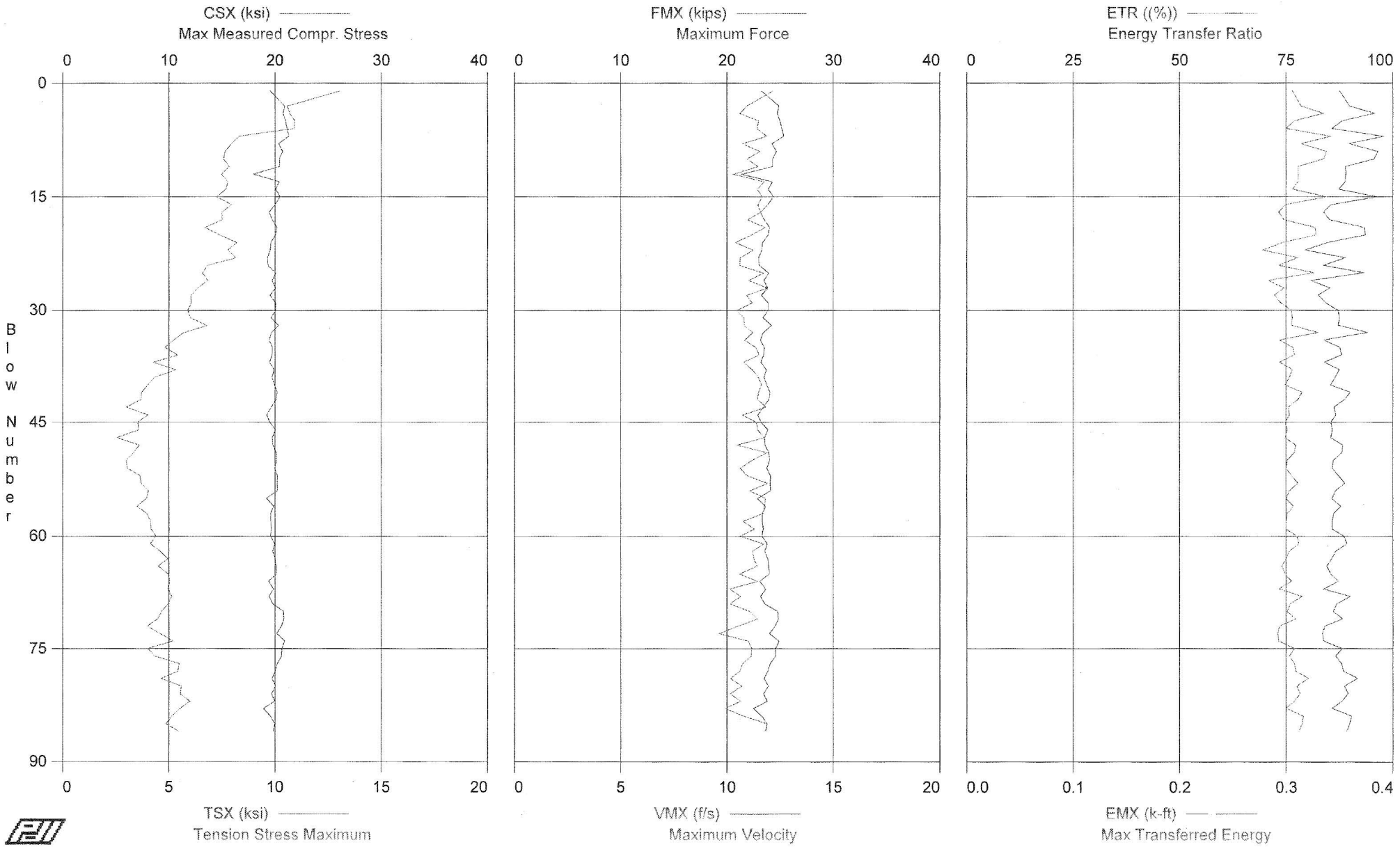
Drive 54 seconds 11:38:33 AM - 11:39:27 AM (12/20/2006) BN 1 - 47

MACTEC Engineering and Consulting, Inc. - Case Method Results

PDIPLOT Ver. 2005.2 - Printed: 16-May-2007

Test date: 20-Dec-2006

Vogtle COL Project - Boring B-1154; 93.5' - 95' Sample



Vogtle COL Project - Boring B-1154; 93.5' - 95' Sample
OP: SEK

Rig Serial No. 331145(MACTEC Raleigh 55LC)
Test date: 20-Dec-2006

AR: 1.19 in^2
LE: 99.00 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	CSX	TSX	FMX	VMX	DFN	BPM	EF2	ETR	EMX
	ft	ksi	ksi	kips	f/s	in	**	k-ft	(%)	k-ft
1	0.00	19.55	13.07	23	12.1	1.28	0.0	0.298	87.5	0.306
3	0.00	20.91	10.59	25	10.9	4.31	51.2	0.301	89.8	0.314
4	0.00	20.77	10.70	25	10.6	2.57	51.0	0.305	95.7	0.335
5	0.00	20.99	10.94	25	11.5	2.22	51.2	0.296	88.1	0.308
6	0.00	21.13	10.89	25	11.4	2.04	51.2	0.301	85.7	0.300
7	0.00	21.30	8.30	25	11.9	2.58	51.2	0.297	97.8	0.342
8	0.00	20.36	7.94	24	10.7	1.73	51.2	0.295	89.7	0.314
9	0.00	20.72	7.65	25	11.5	2.00	51.1	0.297	96.5	0.338
10	0.00	20.42	7.58	24	10.9	1.76	51.0	0.296	95.6	0.335
11	0.00	20.41	7.84	24	11.5	1.86	51.1	0.288	88.9	0.311
12	0.00	17.96	7.47	21	10.3	4.58	50.8	0.232	89.0	0.311
13	0.00	20.39	7.78	24	11.7	1.38	50.9	0.294	88.8	0.311
14	0.00	20.06	7.67	24	11.4	-0.07	51.4	0.285	87.3	0.306
15	0.00	20.48	7.25	24	11.7	3.07	50.9	0.288	96.4	0.338
16	0.00	20.01	7.96	24	11.5	1.79	50.9	0.288	85.4	0.299
17	0.00	19.45	7.50	23	11.6	1.33	51.2	0.280	83.7	0.293
18	0.00	19.75	7.52	23	11.0	0.77	51.0	0.282	85.2	0.298
19	0.00	20.18	6.70	24	11.8	2.25	50.6	0.286	93.3	0.327
20	0.00	20.04	7.41	24	11.1	1.36	51.2	0.286	93.6	0.328
21	0.00	19.60	8.19	23	10.4	1.51	51.2	0.285	84.7	0.297
22	0.00	19.56	7.78	23	11.2	0.99	51.2	0.276	79.4	0.278
23	0.00	19.30	8.17	23	10.6	1.52	50.9	0.284	88.9	0.311
24	0.00	19.36	6.82	23	10.6	4.60	50.8	0.277	83.7	0.293
25	0.00	20.09	6.59	24	11.7	3.29	51.0	0.278	93.2	0.326
26	0.00	19.72	6.84	23	11.0	0.79	50.8	0.280	80.8	0.283
27	0.00	20.04	6.36	24	11.9	0.96	51.2	0.282	85.2	0.298
28	0.00	19.53	6.04	23	10.9	0.75	50.8	0.277	82.5	0.289
29	0.00	20.07	6.05	24	11.2	0.73	50.9	0.284	84.3	0.295
30	0.00	20.07	5.89	24	10.5	1.69	50.8	0.290	87.2	0.305
31	0.00	19.64	6.02	23	10.8	1.55	50.9	0.281	87.5	0.306
32	0.00	20.35	6.79	24	10.8	1.07	51.2	0.292	87.2	0.305
33	0.00	19.67	5.69	23	11.2	2.06	50.9	0.285	94.2	0.330
34	0.00	19.46	5.21	23	10.8	0.05	51.2	0.284	83.9	0.294
35	0.00	19.76	4.81	24	11.4	1.12	50.8	0.285	87.6	0.306
36	0.00	19.71	5.43	23	11.5	1.13	51.3	0.281	88.0	0.308
37	0.00	19.49	4.26	23	10.8	0.49	51.1	0.280	83.9	0.294
38	0.00	19.92	5.33	24	11.2	1.59	50.8	0.283	87.5	0.306
39	0.00	19.74	4.33	23	11.5	1.11	50.9	0.284	86.5	0.303
40	0.00	19.96	4.02	24	11.6	0.37	50.6	0.284	85.4	0.299
41	0.00	20.22	3.72	24	11.5	1.27	50.6	0.289	90.0	0.315
42	0.00	20.11	3.69	24	11.4	1.00	50.8	0.289	88.7	0.311
43	0.00	19.68	3.00	23	11.8	0.44	50.7	0.282	86.2	0.302
44	0.00	19.24	4.01	23	10.7	0.27	50.7	0.286	86.6	0.303
45	0.00	19.50	3.54	23	11.4	0.43	50.7	0.286	85.5	0.299
46	0.00	20.05	3.59	24	11.5	0.10	50.6	0.287	85.9	0.301
47	0.00	19.78	2.57	24	11.7	-0.09	50.5	0.286	85.5	0.299
48	0.00	19.81	3.62	24	10.5	0.68	50.6	0.288	88.3	0.309
49	0.00	20.12	3.35	24	11.9	1.14	51.0	0.289	88.1	0.308
50	0.00	20.17	2.99	24	11.2	0.07	50.7	0.288	86.0	0.301
51	0.00	19.96	3.04	24	10.6	0.28	50.6	0.296	85.8	0.300
52	0.00	20.25	3.65	24	10.9	-0.40	50.3	0.300	87.3	0.305
53	0.00	20.22	3.69	24	11.9	-0.42	50.8	0.296	88.7	0.311
54	0.00	20.25	4.05	24	11.1	0.11	50.8	0.296	86.6	0.303
55	0.00	19.20	3.95	23	11.8	-0.17	50.5	0.291	85.7	0.300
56	0.00	19.87	3.51	24	11.8	0.88	51.0	0.292	87.8	0.307
57	0.00	19.60	3.95	23	11.7	0.02	50.4	0.288	86.1	0.301
58	0.00	19.60	4.14	23	10.8	0.06	50.8	0.293	85.8	0.300
59	0.00	19.68	4.16	23	11.3	0.07	50.4	0.295	85.8	0.300
60	0.00	19.57	4.39	23	10.6	0.24	50.9	0.300	88.6	0.310
61	0.00	19.99	4.13	24	11.7	0.59	50.8	0.301	89.2	0.312
62	0.00	19.80	4.58	24	11.2	-0.59	50.4	0.294	86.6	0.303
63	0.00	20.02	4.97	24	11.3	0.87	50.7	0.293	85.7	0.300
64	0.00	20.09	4.51	24	11.4	0.42	50.6	0.295	84.5	0.296
65	0.00	20.15	4.96	24	10.6	-0.12	51.0	0.295	85.4	0.299
66	0.00	19.41	5.04	23	11.4	1.03	50.5	0.294	87.2	0.305

Vogtle COL Project - Boring B-1154; 93.5' - 95' Sample
OP: SEK

Rig Serial No. 331145(MACTEC Raleigh 55LC)
Test date: 20-Dec-2006

BL#	depth	CSX	TSX	FMX	VMX	DFN	BPM	EF2	ETR	EMX
	ft	ksi	ksi	kips	f/s	in	**	k-ft	(%)	k-ft
67	0.00	19.86	4.94	24	10.1	0.31	50.6	0.300	83.8	0.293
68	0.00	19.45	5.14	23	10.6	1.15	50.8	0.297	90.0	0.315
69	0.00	19.79	4.96	24	10.1	0.60	50.8	0.301	86.9	0.304
70	0.00	20.81	4.67	25	11.1	0.53	50.7	0.304	86.0	0.301
71	0.00	20.86	4.47	25	11.4	1.05	50.5	0.298	88.2	0.309
72	0.00	20.61	3.99	25	10.5	0.79	51.0	0.301	84.1	0.294
73	0.00	20.16	4.57	24	9.6	0.66	50.6	0.306	83.5	0.292
74	0.00	20.92	5.19	25	11.0	0.45	50.6	0.301	83.8	0.293
75	0.00	20.65	4.01	25	11.2	0.50	50.7	0.306	88.1	0.308
76	0.00	20.64	4.33	25	11.1	0.72	50.8	0.302	86.6	0.303
77	0.00	20.22	5.49	24	10.7	0.38	50.5	0.300	88.0	0.308
78	0.00	20.03	5.42	24	10.6	0.90	50.7	0.301	88.4	0.309
79	0.00	19.74	4.64	23	10.2	1.23	51.0	0.299	91.8	0.321
80	0.00	20.06	5.59	24	10.7	0.81	50.5	0.295	88.7	0.310
81	0.00	19.69	5.54	23	10.2	0.68	50.8	0.299	89.5	0.313
82	0.00	19.99	6.00	24	10.6	0.86	50.5	0.299	88.1	0.308
83	0.00	18.90	5.52	22	9.9	-0.13	50.8	0.294	85.7	0.300
84	0.00	19.56	5.15	23	10.8	0.23	50.5	0.300	90.3	0.316
85	0.00	19.98	4.87	24	11.9	0.94	50.7	0.295	89.9	0.315
86	0.00	19.83	5.46	24	11.9	0.87	50.9	0.293	89.2	0.312
	Average	19.98	5.70	24	11.1	1.03	50.8	0.291	87.6	0.307

Total number of blows analyzed: 85

Time Summary

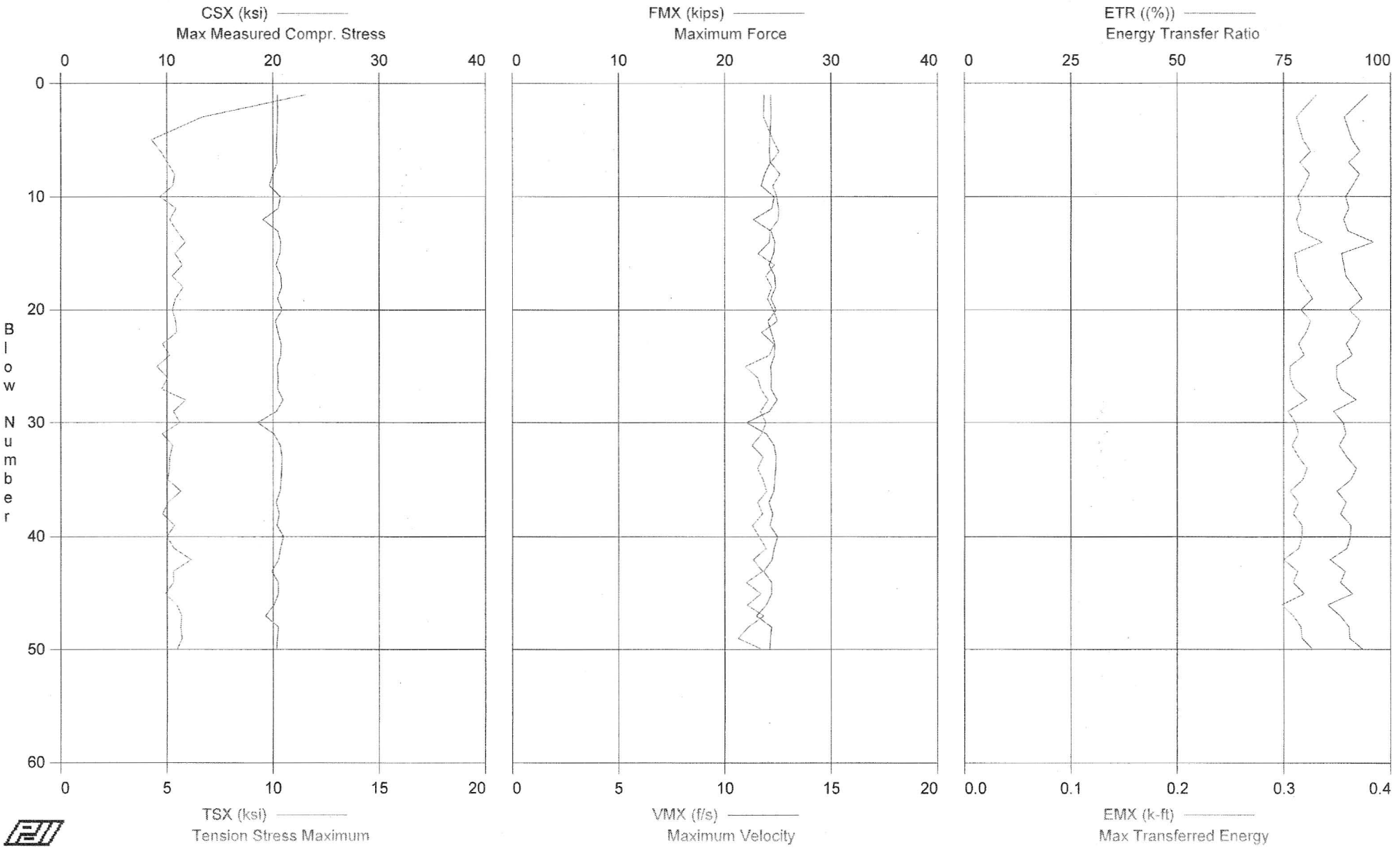
Drive 1 minute 41 seconds 11:54:42 AM - 11:56:23 AM (12/20/2006) BN 1 - 86

MACTEC Engineering and Consulting, Inc. - Case Method Results

PDIPLOT Ver. 2005.2 - Printed: 16-May-2007

Test date: 20-Dec-2006

Vogtle COL Project - Boring B-1154; 98.5' - 100' Sample



Vogtle COL Project - Boring B-1154; 98.5' - 100' Sample
OP: SEK

Rig Serial No. 331145(MACTEC Raleigh 55LC)
Test date: 20-Dec-2006

AR: 1.19 in^2
LE: 104.00 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	20.44	11.53	24	11.9	3.10	0.0	0.294	94.6	0.331
3	0.00	20.46	6.66	24	11.8	1.02	51.1	0.296	89.2	0.312
5	0.00	20.36	4.28	24	12.3	0.02	41.2	0.292	91.0	0.318
6	0.00	20.32	4.71	24	12.5	1.93	50.8	0.292	92.9	0.325
7	0.00	20.40	5.03	24	12.2	1.06	50.5	0.294	90.1	0.315
8	0.00	19.96	5.36	24	12.6	1.48	50.8	0.293	92.7	0.324
9	0.00	19.67	5.29	23	12.2	0.72	50.7	0.294	91.1	0.319
10	0.00	20.69	4.67	25	12.4	0.81	50.5	0.292	89.5	0.313
11	0.00	20.51	5.44	24	12.5	1.55	50.8	0.293	90.2	0.316
12	0.00	19.06	5.13	23	12.5	1.64	50.7	0.292	89.0	0.312
13	0.00	20.46	5.48	24	12.1	2.01	50.5	0.287	90.0	0.315
14	0.00	20.75	5.86	25	12.1	2.64	50.5	0.289	96.1	0.336
15	0.00	20.66	5.38	25	11.6	0.93	50.7	0.288	88.5	0.310
16	0.00	20.29	5.73	24	12.3	1.11	50.7	0.296	89.0	0.312
17	0.00	20.75	5.25	25	11.9	1.31	50.5	0.293	89.5	0.313
18	0.00	20.81	5.77	25	12.2	1.37	50.9	0.293	91.5	0.320
19	0.00	20.44	5.40	24	12.0	1.85	50.5	0.287	93.3	0.327
20	0.00	20.86	5.26	25	12.3	1.88	50.9	0.295	90.3	0.316
21	0.00	20.22	5.42	24	12.5	1.58	50.5	0.296	92.9	0.325
22	0.00	20.49	5.45	24	11.7	2.17	50.9	0.287	91.7	0.321
23	0.00	20.76	4.80	25	12.3	0.79	50.3	0.292	89.7	0.314
24	0.00	20.73	5.13	25	12.1	0.72	50.8	0.288	91.1	0.319
25	0.00	20.42	4.53	24	11.0	1.45	50.4	0.292	87.4	0.306
26	0.00	20.48	5.03	24	11.5	1.85	50.8	0.284	87.4	0.306
27	0.00	20.46	4.75	24	11.7	0.49	50.6	0.293	88.5	0.310
28	0.00	20.96	5.90	25	12.0	3.42	50.5	0.294	92.0	0.322
29	0.00	20.32	5.32	24	11.7	3.25	50.8	0.288	86.7	0.304
30	0.00	18.53	5.62	22	11.9	1.41	50.3	0.283	88.9	0.311
31	0.00	20.10	4.78	24	11.7	1.16	50.8	0.293	89.6	0.314
32	0.00	20.70	5.27	25	11.3	1.33	50.6	0.293	88.0	0.308
33	0.00	20.86	5.13	25	11.8	1.71	50.5	0.297	89.8	0.314
34	0.00	20.83	5.12	25	11.5	1.63	50.5	0.295	92.1	0.322
35	0.00	20.76	5.04	25	11.8	1.51	50.7	0.291	90.8	0.318
36	0.00	20.68	5.66	25	12.0	1.50	50.5	0.288	87.5	0.306
37	0.00	20.28	5.06	24	11.5	1.40	50.7	0.292	89.7	0.314
38	0.00	20.59	4.79	25	11.8	1.17	50.6	0.293	88.3	0.309
39	0.00	20.37	5.36	24	11.3	1.96	50.6	0.284	90.7	0.317
40	0.00	20.98	4.99	25	11.6	0.90	50.6	0.297	90.6	0.317
41	0.00	20.70	5.33	25	11.9	2.08	50.7	0.289	89.8	0.314
42	0.00	20.54	6.15	24	11.3	0.79	50.7	0.287	85.8	0.300
43	0.00	19.89	5.31	24	11.8	1.32	50.5	0.285	89.4	0.313
44	0.00	20.50	5.32	24	11.0	0.95	50.6	0.290	88.3	0.309
45	0.00	20.50	4.93	24	11.7	2.84	50.7	0.286	91.1	0.319
46	0.00	20.09	5.46	24	11.1	0.85	50.5	0.280	85.3	0.298
47	0.00	19.30	5.70	23	11.8	1.58	50.6	0.285	88.2	0.309
48	0.00	20.50	5.64	24	11.1	2.80	50.8	0.286	90.3	0.316
49	0.00	20.39	5.72	24	10.6	1.92	50.5	0.285	90.4	0.317
50	0.00	20.35	5.48	24	11.8	1.08	50.8	0.292	93.5	0.327
	Average	20.40	5.43	24	11.8	1.54	50.4	0.291	90.1	0.315

Total number of blows analyzed: 48

Time Summary

Drive 58 seconds 12:12:25 PM - 12:13:23 PM (12/20/2006) BN 1 - 50

June 27, 2007

Memorandum to File DCN VGCOL 104
From: Steve Kiser
Reviewed By: Pieter Depree

Subject: **Report of SPT Energy – MACTEC Knoxville CME 75 Truck Hammer Serial No. 211797 Automatic Hammer**
WORK INSTRUCTION VGCOL 104
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 December 20, 2006, during drilling of Boring B-3016 at the referenced site. The testing was performed from approximately 12:50 to 1:50 PM under partly sunny skies and a temperature of about 53 degrees Fahrenheit. The boring was drilled with personnel and equipment from the Knoxville 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 NW-J-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 Warren. 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 PDIPLOT tables and are also shown graphically in the PDIPLOT 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 263 foot-pounds to 281 foot-pounds. These average energy transfers correspond to energy transfer ratios (ETR) of 75% 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 271.5 foot-pounds, with a weighted average ETR of 77.6%.

Attachments: Page 4 Table 1 - Summary of SPT Energy Measurements – 1 Page
Page 5 Work Instruction – DCN VGCOL 104 – 1 Page
Page 6 Record of SPT Energy Measurement – 1 Page
Pages 7 - 14 PDIPLOT Output – 8 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)
211797 (CME 75 Truck)	MACTEC Knoxville	Jimmy Warren	B-3016	NW-J	12/20/2006	98.5 - 100.0	16 - 50/3"	68	263	75.1%
						103.5 - 105.0	17 - 50/2"	69	281	80.3%
						108.5 - 110.0	50 / 1"	52	270	77.1%
							Weighted Average for Rig:		**271.5**	**77.6%**

[a]Measured 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).

[b]Energy 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 PDIPLOT tables due to roundoff.

Prepared By:	Date: 6-27-07	Checked By:	Date: 7/31/07

Work Instructions – SPT Energy MACTEC CME-75 (Warren) (Hammer #211797)

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 PDIPLOT 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 104

MACTEC

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 75
LOCATION:	Waynesboro, Georgia	MODEL:	75 TRUCK
PROJECT NO.:	6141-06-0286	SERIAL NO.:	211797
DATE:	12-20-06	HAMMER TYPE:	AUTOMATIC
WEATHER:	SUNNY - COOL 53°	ROPE CONDITION:	N/A
INSPECTOR:	Steve Kiser	ROD SIZE:	NW - J
DRILLING COMPANY:	MACTEC KNOXVILLE	NO. OF SHEAVES:	N/A

BORING DATA			
BORING NUMBER:	B-306		
DEPTH DRILLED:	150' PLANNED		
TIME DRIVEN:	1:45 PM		
RIG OPERATOR:	JIMMY WARREN		
HAMMER OPERATOR:	N.R.		
PDA PAK SERIAL NO.:	1430	1430	1430
INSTR. ROD AREA:	1.49 in²		
ACCEL. SERIAL NOS.:	PS094 / PS953		
STRAIN SERIAL NOS.:	146 NW 1/2		

SAMPLE DEPTH (feet)	SPT N-VALUE (bpf)	DEPTH cont. (feet)	SPT N-VALUE (bpf)	SAMPLE DEPTH (feet)	SPT N-VALUE (bpf)	DEPTH cont. (feet)	SPT N-VALUE (bpf)	SAMPLE DEPTH (feet)	SPT N-VALUE (bpf)	DEPTH cont. (feet)	SPT N-VALUE (bpf)
78.5/100'	16-50/3"										
103.5/105'	17-50/2"										
108.5/110'	50/1"										

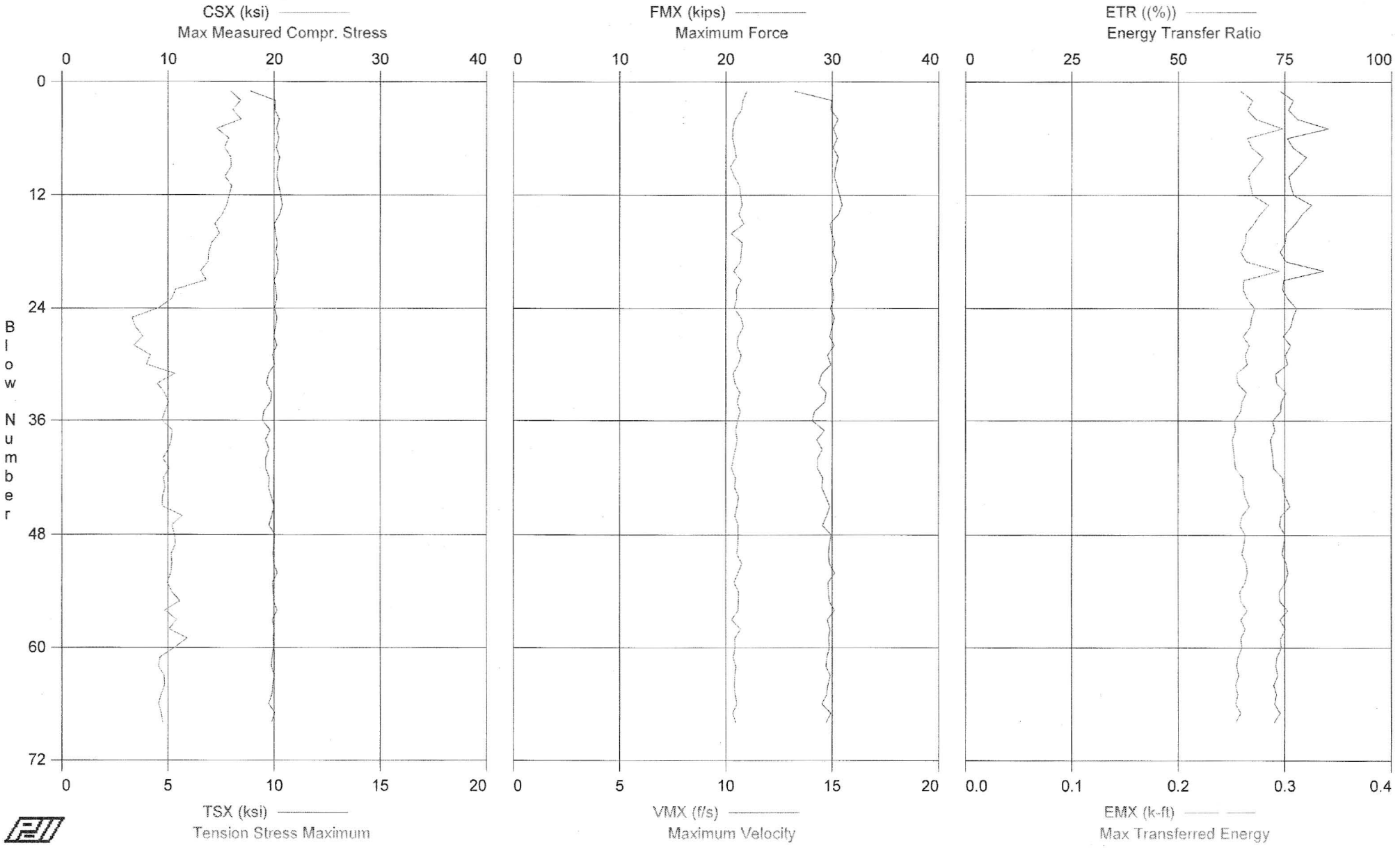
REMARKS:

MACTEC Engineering and Consulting, Inc. - Case Method Results

PDIPLOT Ver. 2005.2 - Printed: 16-May-2007

Test date: 20-Dec-2006

Vogtle COL Project - Boring B-3016; 98.5' - 100' Sample



Vogtle COL Project - Boring B-3016; 98.5' - 100' Sample
OP: SEK

Rig Serial No. 211797 (MACTEC Knoxville CME 75)
Test date: 20-Dec-2006

AR: 1.49 in^2
LE: 104.00 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	CSX	TSX	FMX	VMX	DFN	BPM	EF2	ETR	EMX
	ft	ksi	ksi	kips	f/s	in	**	k-ft	(%)	k-ft
1	0.00	17.79	7.95	27	11.0	1.10	0.0	0.255	74.0	0.259
2	0.00	20.09	8.41	30	10.8	1.07	47.1	0.260	77.0	0.270
3	0.00	20.05	8.05	30	10.7	1.18	48.7	0.256	75.9	0.265
4	0.00	20.50	8.44	31	10.4	2.00	48.9	0.261	78.0	0.273
5	0.00	20.21	7.29	30	10.3	1.27	48.9	0.261	85.2	0.298
6	0.00	20.44	7.85	30	10.3	1.30	48.2	0.257	75.6	0.265
7	0.00	20.20	7.65	30	10.4	0.71	48.8	0.259	77.0	0.269
8	0.00	20.52	7.96	31	10.5	0.99	48.7	0.261	80.1	0.280
9	0.00	20.35	7.97	30	10.2	1.18	48.5	0.262	78.1	0.273
10	0.00	20.26	7.68	30	10.4	1.01	49.0	0.253	76.0	0.266
11	0.00	20.44	8.01	30	10.6	1.26	49.1	0.257	76.4	0.268
12	0.00	20.59	7.88	31	10.7	1.05	48.6	0.259	77.2	0.270
13	0.00	20.76	7.77	31	10.8	1.12	48.9	0.264	81.3	0.285
14	0.00	20.53	7.57	31	10.6	1.25	48.9	0.261	79.1	0.277
15	0.00	20.01	7.21	30	10.9	1.15	48.8	0.259	77.5	0.271
16	0.00	20.12	7.42	30	10.2	0.60	48.7	0.255	75.4	0.264
17	0.00	20.31	7.05	30	10.8	0.08	48.7	0.254	75.1	0.263
18	0.00	20.18	6.92	30	10.7	0.64	48.7	0.251	74.0	0.259
19	0.00	20.39	6.89	30	10.7	1.23	48.8	0.256	75.3	0.264
20	0.00	20.32	6.54	30	10.4	1.12	48.7	0.265	84.2	0.295
21	0.00	20.02	6.80	30	10.7	1.10	48.8	0.252	74.8	0.262
22	0.00	20.18	5.35	30	10.5	1.02	48.6	0.251	74.6	0.261
23	0.00	20.25	5.18	30	10.5	0.88	48.9	0.253	75.8	0.265
24	0.00	20.04	4.54	30	10.4	1.12	48.7	0.254	77.8	0.272
25	0.00	20.28	3.31	30	10.7	1.05	48.9	0.257	77.0	0.269
26	0.00	20.14	3.46	30	10.8	0.71	48.7	0.252	76.5	0.268
27	0.00	20.00	3.81	30	10.6	1.06	48.5	0.245	74.7	0.261
28	0.00	20.26	3.39	30	10.5	1.49	48.8	0.259	76.4	0.267
29	0.00	19.85	4.16	30	10.7	0.89	48.6	0.250	75.2	0.263
30	0.00	20.07	3.99	30	10.6	0.70	48.7	0.251	75.7	0.265
31	0.00	19.48	5.32	29	10.3	0.70	48.5	0.242	72.9	0.255
32	0.00	19.29	4.49	29	10.4	0.72	48.7	0.246	73.2	0.256
33	0.00	19.76	4.82	29	10.7	0.76	48.5	0.252	75.4	0.264
34	0.00	19.68	5.02	29	10.5	0.79	48.7	0.247	74.2	0.260
35	0.00	19.02	4.86	28	10.7	0.97	48.7	0.245	74.1	0.259
36	0.00	18.90	4.71	28	10.6	0.11	48.6	0.238	72.2	0.253
37	0.00	19.64	5.19	29	10.5	0.71	48.9	0.242	72.7	0.254
38	0.00	19.17	5.15	29	10.5	0.97	48.8	0.237	71.7	0.251
39	0.00	19.52	5.03	29	10.5	0.53	48.6	0.241	72.0	0.252
40	0.00	19.21	4.76	29	10.4	0.25	48.9	0.242	72.3	0.253
41	0.00	19.21	5.05	29	10.3	0.43	48.9	0.240	72.4	0.254
42	0.00	19.56	4.79	29	10.4	0.66	48.7	0.246	74.6	0.261
43	0.00	19.48	4.86	29	10.4	0.99	49.2	0.248	74.7	0.261
44	0.00	19.74	4.74	29	10.6	0.81	48.8	0.251	75.2	0.263
45	0.00	20.00	4.73	30	10.5	1.05	48.7	0.251	76.3	0.267
46	0.00	19.79	5.67	29	10.4	1.04	49.1	0.244	74.2	0.260
47	0.00	19.53	5.18	29	10.6	0.64	48.9	0.245	73.8	0.258
48	0.00	20.08	5.31	30	10.6	0.91	48.5	0.254	75.2	0.263
49	0.00	19.96	5.35	30	10.6	0.67	48.9	0.252	74.8	0.262
50	0.00	19.91	5.15	30	10.5	0.31	48.7	0.250	74.4	0.260
51	0.00	19.96	5.18	30	10.8	0.77	48.9	0.253	75.4	0.264
52	0.00	20.30	5.13	30	10.6	0.88	48.7	0.254	75.8	0.265
53	0.00	19.87	4.97	30	10.4	0.71	48.6	0.255	75.2	0.263
54	0.00	19.91	5.17	30	10.6	0.78	48.7	0.246	73.7	0.258
55	0.00	19.96	5.56	30	10.6	0.75	48.8	0.247	73.9	0.259
56	0.00	20.29	4.84	30	10.6	1.03	48.9	0.255	75.7	0.265
57	0.00	19.84	5.41	30	10.3	1.04	48.7	0.251	73.9	0.259
58	0.00	20.00	5.05	30	10.7	0.85	48.8	0.256	75.2	0.263
59	0.00	19.92	5.89	30	10.4	0.57	48.8	0.251	74.1	0.259
60	0.00	19.96	5.31	30	10.4	0.50	48.9	0.251	74.2	0.260
61	0.00	19.80	4.63	30	10.3	0.50	48.8	0.250	73.2	0.256
62	0.00	19.75	4.55	29	10.5	0.47	48.7	0.248	73.0	0.255
63	0.00	20.02	4.82	30	10.4	0.69	48.9	0.251	73.4	0.257
64	0.00	19.87	4.84	30	10.4	0.46	48.7	0.247	72.4	0.254
65	0.00	19.79	4.67	29	10.4	0.65	49.0	0.247	73.1	0.256

Vogtle COL Project - Boring B-3016; 98.5' - 100' Sample
OP: SEK

Rig Serial No. 211797 (MACTEC Knoxville CME 75)
Test date: 20-Dec-2006

BL#	depth	CSX	TSX	FMX	VMX	DFN	BPM	EF2	ETR	EMX
	ft	ksi	ksi	kips	f/s	in	**	k-ft	(%)	k-ft
66	0.00	19.48	4.55	29	10.5	0.85	48.8	0.246	72.6	0.254
67	0.00	20.05	4.67	30	10.3	0.68	48.8	0.253	73.9	0.259
68	0.00	19.76	4.74	29	10.5	0.61	48.5	0.247	72.5	0.254
	Average	19.92	5.69	30	10.5	0.85	48.7	0.252	75.3	0.263

Total number of blows analyzed: 68

Time Summary

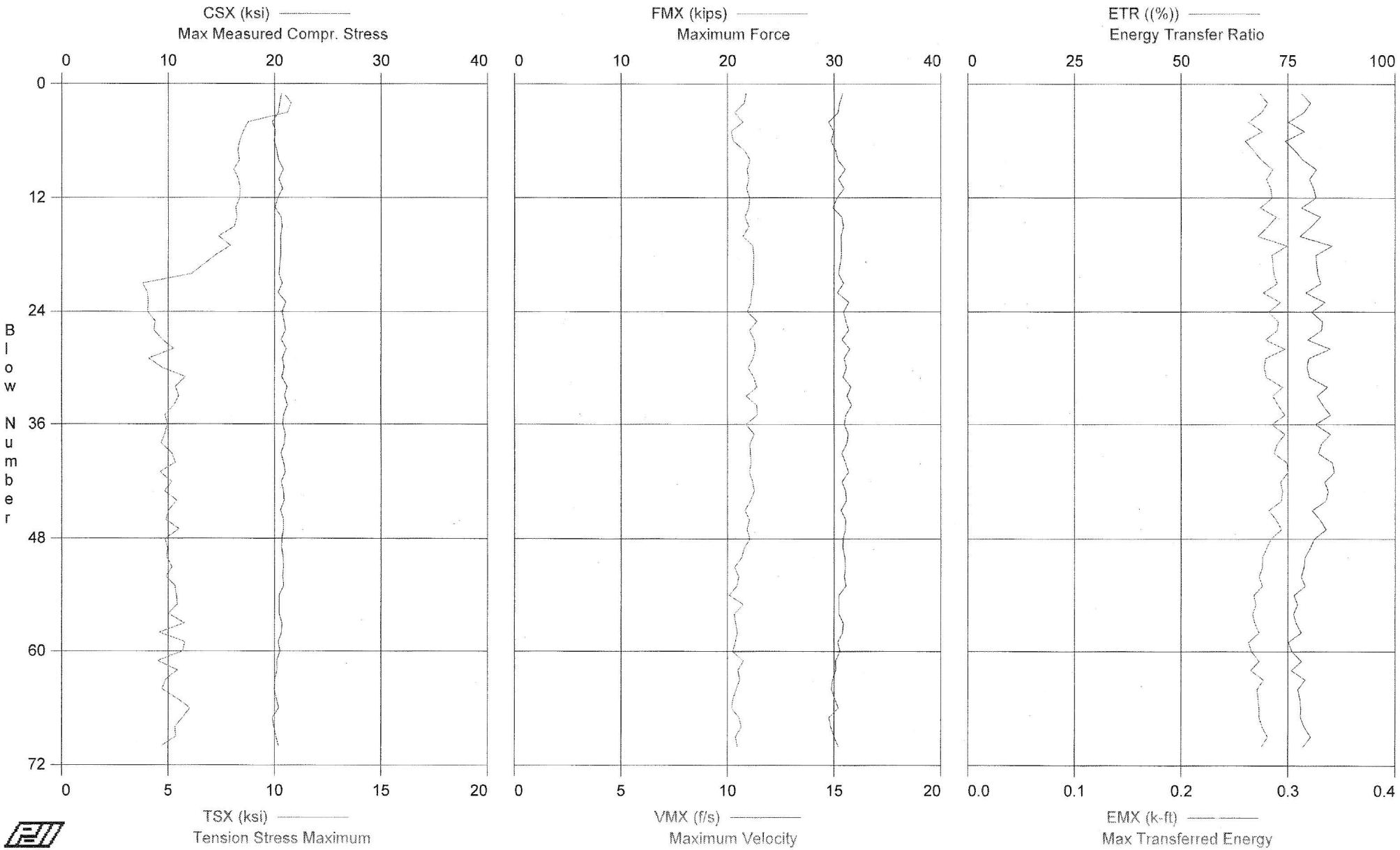
Drive 1 minute 23 seconds 12:50:13 PM - 12:51:36 PM (12/20/2006) BN 1 - 68

MACTEC Engineering and Consulting, Inc. - Case Method Results

PDIPLOT Ver. 2005.2 - Printed: 16-May-2007

Test date: 20-Dec-2006

Vogtle COL Project - Boring B-3016; 103.5' - 105' Sample



Vogtle COL Project - Boring B-3016; 103.5' - 105' Sample
OP: SEK

Rig Serial No. 211797 (MACTEC Knoxville CME 75)
Test date: 20-Dec-2006

AR: 1.49 in^2
LE: 109.00 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	20.67	10.45	31	10.9	0.98	0.0	0.279	78.2	0.274
2	0.00	20.47	10.78	31	10.8	1.52	50.3	0.274	80.3	0.281
3	0.00	20.37	10.62	30	10.3	1.42	50.5	0.272	78.7	0.275
4	0.00	19.79	8.75	29	10.7	0.33	50.0	0.262	75.2	0.263
5	0.00	20.10	8.53	30	10.2	1.28	50.0	0.265	78.9	0.276
6	0.00	19.95	8.37	30	10.3	0.93	50.1	0.255	74.4	0.260
7	0.00	20.22	8.27	30	10.8	1.07	49.8	0.261	76.6	0.268
8	0.00	20.36	8.35	30	11.1	1.13	50.1	0.270	78.5	0.275
9	0.00	20.82	8.09	31	10.9	1.27	50.5	0.278	81.6	0.286
10	0.00	20.41	8.30	30	11.0	1.36	50.0	0.271	80.1	0.280
11	0.00	20.75	8.39	31	10.9	1.26	50.1	0.277	81.0	0.284
12	0.00	20.31	8.37	30	11.0	1.01	49.9	0.276	81.6	0.285
13	0.00	20.04	8.18	30	11.0	1.15	50.4	0.269	78.2	0.274
14	0.00	20.61	8.24	31	10.8	1.26	49.8	0.279	82.6	0.289
15	0.00	20.71	8.11	31	11.0	0.96	50.1	0.274	80.4	0.281
16	0.00	20.56	7.37	31	10.7	1.19	49.8	0.266	77.8	0.272
17	0.00	20.59	7.93	31	11.2	1.24	50.0	0.280	85.3	0.299
18	0.00	20.60	7.23	31	11.2	1.33	50.3	0.273	81.6	0.285
20	0.00	20.42	6.10	30	11.2	1.24	50.2	0.277	82.0	0.287
21	0.00	20.73	3.81	31	11.2	0.99	49.9	0.274	82.7	0.290
22	0.00	20.33	4.03	30	11.1	0.61	49.9	0.271	79.2	0.277
23	0.00	21.06	4.07	31	11.1	1.17	49.7	0.282	83.7	0.293
24	0.00	20.73	4.04	31	10.9	0.67	49.9	0.275	80.5	0.282
25	0.00	20.88	4.38	31	11.4	0.77	49.5	0.277	83.0	0.291
26	0.00	21.04	4.34	31	11.0	0.91	49.8	0.277	82.9	0.290
27	0.00	20.63	4.71	31	11.3	1.13	49.8	0.271	79.6	0.279
28	0.00	21.11	5.26	31	11.3	1.41	49.5	0.280	84.9	0.297
29	0.00	20.75	4.09	31	11.2	1.01	49.7	0.271	79.9	0.279
30	0.00	20.91	4.72	31	11.0	1.01	49.9	0.268	79.5	0.278
31	0.00	20.70	5.81	31	11.2	1.20	49.6	0.269	80.0	0.280
32	0.00	21.19	5.35	32	11.4	1.27	49.4	0.275	84.2	0.295
33	0.00	20.95	5.49	31	10.9	0.85	49.7	0.269	81.8	0.286
34	0.00	21.23	5.28	32	11.4	1.17	49.6	0.275	83.2	0.291
35	0.00	20.86	4.85	31	11.4	0.83	49.9	0.279	84.9	0.297
36	0.00	20.77	4.98	31	10.9	1.25	49.5	0.266	81.5	0.285
37	0.00	21.01	4.84	31	11.2	1.70	49.6	0.277	84.9	0.297
38	0.00	20.93	4.67	31	11.1	0.81	49.6	0.277	82.9	0.290
39	0.00	20.61	5.18	31	11.1	1.20	49.9	0.270	82.1	0.287
40	0.00	20.84	5.34	31	11.1	0.65	49.8	0.278	85.4	0.299
41	0.00	21.03	4.62	31	11.0	1.14	49.5	0.282	85.8	0.300
42	0.00	20.63	5.16	31	11.2	0.73	49.5	0.275	83.6	0.293
43	0.00	20.85	4.84	31	11.2	0.98	49.6	0.279	84.4	0.295
44	0.00	20.90	5.40	31	11.1	1.14	49.8	0.278	83.9	0.294
45	0.00	20.57	5.03	31	10.8	1.05	49.5	0.267	80.6	0.282
46	0.00	20.86	4.89	31	11.0	1.03	49.8	0.276	82.5	0.289
47	0.00	20.84	5.51	31	10.9	1.31	49.6	0.282	83.9	0.294
48	0.00	20.70	4.85	31	11.0	0.82	49.7	0.275	81.2	0.284
49	0.00	20.68	4.98	31	10.8	1.18	49.8	0.271	80.1	0.280
50	0.00	20.80	4.94	31	10.7	0.79	49.4	0.273	78.9	0.276
51	0.00	20.85	5.19	31	10.3	0.98	49.6	0.281	78.8	0.276
52	0.00	20.77	4.91	31	10.5	0.88	49.7	0.277	78.1	0.273
53	0.00	20.87	5.32	31	10.4	1.36	49.4	0.273	79.0	0.276
54	0.00	20.45	5.40	30	10.1	0.52	49.5	0.271	76.5	0.268
55	0.00	20.44	5.43	30	10.7	1.26	49.6	0.273	77.2	0.270
56	0.00	20.44	5.01	30	10.3	0.71	49.5	0.271	76.3	0.267
57	0.00	20.71	5.77	31	10.4	0.18	49.5	0.274	77.0	0.269
58	0.00	20.67	4.58	31	10.5	0.68	49.9	0.271	78.1	0.273
59	0.00	20.36	5.79	30	10.4	0.77	49.3	0.264	75.1	0.263
60	0.00	20.52	5.69	31	10.2	0.50	50.0	0.269	75.9	0.266
61	0.00	20.22	4.51	30	10.7	1.02	49.3	0.274	78.1	0.273
62	0.00	20.24	5.43	30	10.5	0.50	49.3	0.263	75.8	0.265
63	0.00	20.03	4.89	30	10.6	1.23	49.6	0.268	79.0	0.277
64	0.00	19.96	4.72	30	10.4	1.36	49.4	0.263	77.3	0.271
65	0.00	20.17	5.42	30	10.6	1.21	49.7	0.268	77.8	0.272
66	0.00	20.39	6.02	30	10.2	1.03	49.8	0.270	78.0	0.273

Vogtle COL Project - Boring B-3016; 103.5' - 105' Sample
OP: SEK

Rig Serial No. 211797 (MACTEC Knoxville CME 75)
Test date: 20-Dec-2006

BL#	depth ft	CSX ksi	TSX ksi	FMX kips	VMX f/s	DFN in	BPM **	EF2 k-ft	ETR (%)	EMX k-ft
67	0.00	19.80	5.69	30	10.5	1.23	49.6	0.270	78.0	0.273
68	0.00	19.93	5.33	30	10.6	0.66	49.3	0.267	78.8	0.276
69	0.00	20.13	5.36	30	10.4	1.45	49.6	0.274	80.3	0.281
70	0.00	20.40	4.69	30	10.5	0.64	49.3	0.270	78.5	0.275
	Average	20.58	5.96	31	10.8	1.03	49.8	0.273	80.3	0.281

Total number of blows analyzed: 69

Time Summary

Drive 1 minute 23 seconds 1:16:56 PM - 1:18:19 PM (12/20/2006) BN 1 - 70