SPT ENERGY RATIO MEASUREMENTS

June 27, 2007

Memorandum to File DCN VGCOL 102
From: Steve Kiser
Reviewed By: Pieter Depree

Subject: **Report of SPT Energy – Gregg Drilling CME 850**
Hammer Serial No. 165592 Automatic Hammer
WORK INSTRUCTION VGCOL 102
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-1185, and on January 17, 2007, during drilling of Boring B-3002A, at the referenced site. The drill rig was retested on January 17 due to a switch in the drilling rod sizes from AW-J to NW-J. The testing was performed from approximately 9:15 to 10:25 AM under sunny skies and a temperature of about 50 degrees Fahrenheit on December 20, and from approximately 8:10 to 8:45 AM under cloudy skies and a temperature of about 40 degrees Fahrenheit on January 17. The boring was drilled with personnel and equipment from Gregg Drilling. The drilling equipment consisted of a CME 850 model ATV-mounted drill rig with an SPT automatic hammer. The drilling tools on consisted of AW-J-sized drilling rods and NW-J sized drilling rods on December 20, 2006 and January 17, 2007, respectively. During drilling on both days, a 2-foot long split tube sampler was used. 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. Marshall Burnett. 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 on December 20, 2006; NW #146/1 and NW#146/2 on January 17, 2007). An AW or 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 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.

The instrumented AW-sized 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 (when drilling with AW-J rods) 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 instrumented NW-sized 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 (when drilling with NW-J rods) 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.

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 range of average energy transferred from the hammer to the drill rods for each individual depth interval using the EFV method is shown in Table 1 below for each rod size tested. The corresponding energy transfer ratio of the SPT hammer system is also shown.

Table 1: Average Energy Transfer Range for the Depth Intervals Tested

Rod Size	Range of Average Energy Transferred (foot-pounds)	Range of Average Energy Transfer Ratio (ETR)
AW-J	301 to 315	86% to 90%
NW-J	276 to 277	79%

- The average at each depth interval was calculated as the transferred energy for each analyzed blow of the depth intervals divided by the total number of hammer blows analyzed. The overall average energy transfer of the SPT system (for all the depth intervals tested) is shown in Table 2 below for each rod size tested.

Table 2: Overall Energy Testing Results for Each Rod Size

Rod Size	Range of Overall Weighted Average Energy Transferred (foot-pounds)	Range of Overall Weighted Average Energy Transfer Ratio (ETR)
AW-J	306.3	87.5%
NW-J	276.5	79.0%
All Rod Sizes (Combined)	291.9	83.4%

Attachments: Page 4 Table 3 - Summary of SPT Energy Measurements – 1 Page
Page 5 Work Instruction – DCN VGCOL 102 – 1 Page
Pages 6 – 7 Record of SPT Energy Measurement – 2 Pages
Pages 8 - 23 PDIPLOT Output – 16 Pages

TABLE 3

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	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)
165592 (CME 850 ATV)	Gregg Drilling	Marshall Burnett	B-1185 (AW-J Rods)	12/20/2006	73.5 - 75.0	10 - 12 -16	32	304	86.9%
					78.5 - 80.0	50 / 2"	48	301	86.0%
					83.5 - 85.0	8 - 15 - 20	40	315	90.0%
					88.5 - 90.0	15 - 18 - 38	68	306	87.4%
					Weighted Average for AW-J Rods:			306.3	87.5%
			B-3002A (NW-J Rods)	1/17/2007	13.5 - 15.0	12 - 14 - 18	44	277	79.1%
					18.5 - 20.0	12 - 16 - 16	45	277	79.1%
					20.0 - 21.5	15 - 29 - 42	86	276	78.9%
					Weighted Average for NW-J Rods:			276.5	79.0%
						Weighted Average for Rig:		**291.9**	**83.4%**

[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: GLV	Date: 6-27-07	Checked By: WAL	Date: 7/3/07

Work Instructions – SPT Energy Gregg Drilling CME-850 (Burnett) (Hammer #165592)
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 102

MACTEC

2801 YORKMONT ROAD, SUITE 100 O 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 850
LOCATION:	Waynesboro, Georgia	MODEL:	850 TRACK
PROJECT NO.:	6141-06-0286	SERIAL NO.:	165592
DATE:	12-20-06	HAMMER TYPE:	AUTOMATIC
WEATHER:	SUNNY - COOL 50°	ROPE CONDITION:	N/A
INSPECTOR:	Steve Kiser	ROD SIZE:	AW-J
DRILLING COMPANY:	GREGG DRILLING	NO. OF SHEAVES:	N/A

BORING DATA

BORING NUMBER:	B-1185		
DEPTH DRILLED:	150'		
TIME DRIVEN:	10:15 AM		
RIG OPERATOR:	MARSHALL BURNETT		
HAMMER OPERATOR:	N. R.		
PDA PAK SERIAL NO.:	1430	1430	1430
INSTR. ROD AREA:	1.19 in^2		
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)
73.5/75'	10-12-16										
78.5/80'	50/2"										
83.5/85'	8-15-20										
88.5/90'	15-18-30										

REMARKS: - OPERATOR MISSED RECORDING OF LAST SEVERAL BLOWS AT 75' SAMPLE

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RECORD OF SPT ENERGY MEASUREMENT

GENERAL INFORMATION		DRILL RIG DATA	
PROJECT:	ALWR Vogtle COL Site	MAKE:	CME
LOCATION:	Waynesboro, Georgia	MODEL:	850 TRACK
PROJECT NO.:	6141-06-0286	SERIAL NO.:	165592
DATE:	1-17-07	HAMMER TYPE:	AUTOMATIC
WEATHER:	CLOUDY; COLD; 40°	ROPE CONDITION:	N/A
INSPECTOR:	Steve Kiser	ROD SIZE:	NW-I
DRILLING COMPANY:	GREGG DRILLING	NO. OF SHEAVES:	N/A

BORING DATA			
BORING NUMBER:	B-3002 A		
DEPTH DRILLED:	30' PLANNED		
TIME DRIVEN:	9:00 AM		
RIG OPERATOR:	MARSHALL BURNETT		
HAMMER OPERATOR:	N.R.		
PDA PAK SERIAL NO.:	1430	1430	1430
INSTR. ROD AREA:	1.49 in^2		
ACCEL. SERIAL NOS.:	P5094 / P5953		
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)
13.5-15.0	12-14-18										
18.5/20	12-16-16										
20/21.5	15-29-42										

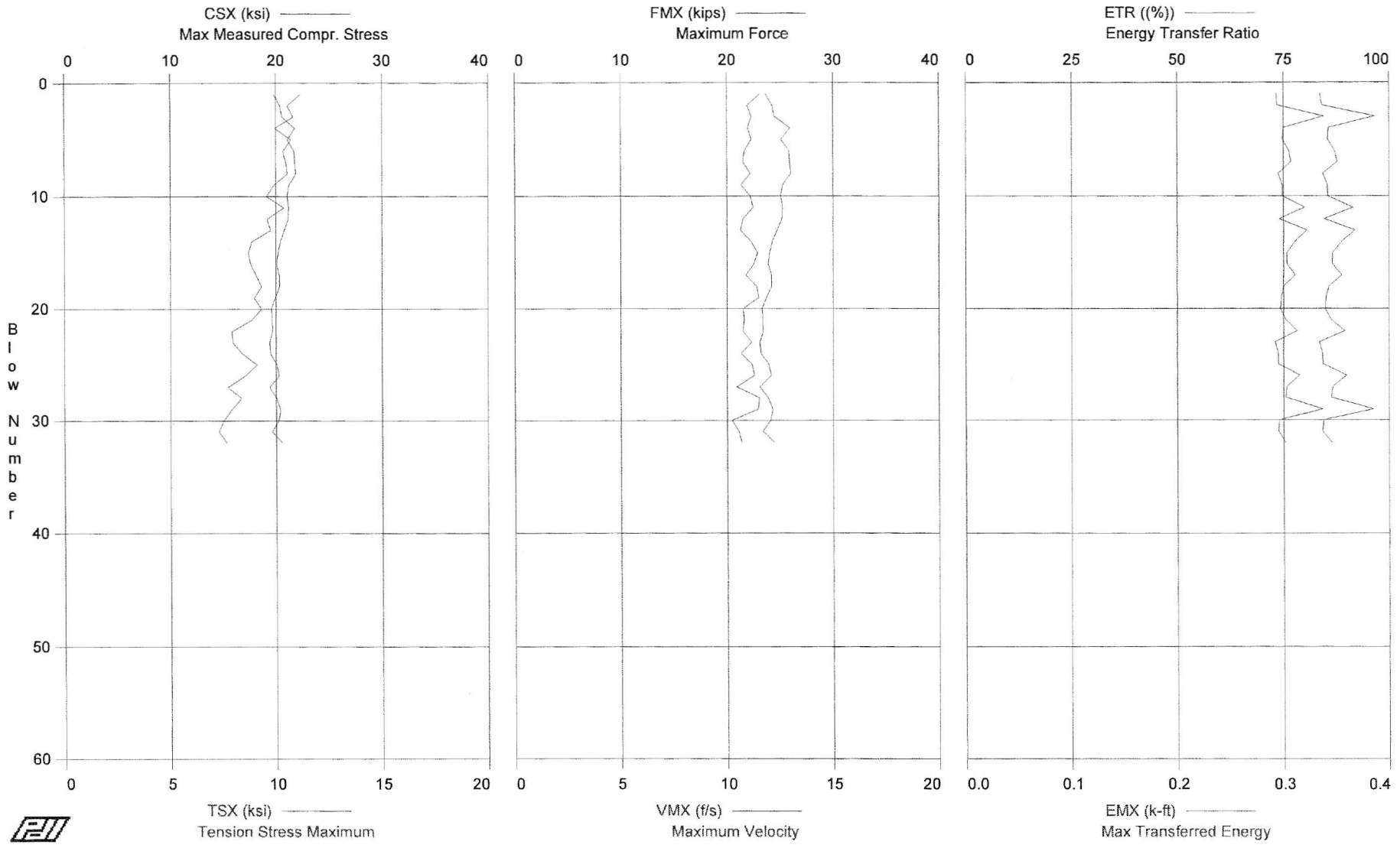
REMARKS: HOLLOW STEM AUGER USED TO ADVANCE HOLE - WATER PUMP BROKEN ON RIG

MACTEC Engineering and Consulting, Inc. - Case Method Results

PDIPLOT Ver. 2005.2 - Printed: 8-May-2007

Test date: 20-Dec-2006

Vogtle COL Project - Boring B-1185; 73.5' - 75' Sample



Vogtle COL Project - Boring B-1185; 73.5' - 75' Sample
OP: SEK

Rig Serial No. 165592 (Gregg CME 850)
Test date: 20-Dec-2006

AR: 1.19 in^2
LE: 79.00 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	19.86	11.15	24	11.6	2.46	0.0	0.262	83.7	0.293
2	0.00	20.37	10.55	24	10.9	1.54	52.5	0.262	84.1	0.294
3	0.00	20.58	10.82	24	11.2	1.85	52.9	0.277	96.6	0.338
4	0.00	21.80	9.97	26	11.0	1.25	52.8	0.270	85.6	0.300
5	0.00	21.08	10.72	25	11.1	1.17	53.7	0.264	85.4	0.299
6	0.00	21.74	10.32	26	10.8	1.10	52.3	0.276	87.1	0.305
7	0.00	21.78	10.47	26	10.7	1.67	53.4	0.272	87.7	0.307
8	0.00	21.87	10.54	26	11.1	1.55	52.6	0.268	84.3	0.295
9	0.00	21.22	9.90	25	10.7	1.13	53.7	0.263	85.4	0.299
10	0.00	21.06	9.55	25	11.1	1.39	52.6	0.265	85.5	0.299
11	0.00	21.21	10.37	25	11.2	1.30	53.6	0.274	91.5	0.320
12	0.00	21.16	9.59	25	10.7	1.45	53.1	0.265	84.7	0.296
13	0.00	20.78	9.75	25	10.6	1.60	53.1	0.264	92.0	0.322
14	0.00	20.38	8.85	24	11.1	1.19	53.3	0.262	88.8	0.311
15	0.00	20.18	8.69	24	11.4	1.12	53.2	0.255	86.6	0.303
16	0.00	20.07	8.79	24	11.3	1.20	53.2	0.257	86.6	0.303
17	0.00	20.32	9.05	24	10.9	1.55	53.1	0.258	88.8	0.311
18	0.00	20.34	9.31	24	11.4	0.79	53.0	0.257	85.8	0.300
19	0.00	19.92	8.96	24	11.5	0.83	53.5	0.258	85.1	0.298
20	0.00	19.55	9.30	23	10.8	0.54	53.1	0.256	84.8	0.297
21	0.00	19.64	8.85	23	10.8	0.47	53.1	0.262	86.3	0.302
22	0.00	19.66	7.91	23	10.7	0.87	53.3	0.264	89.5	0.313
23	0.00	19.38	7.95	23	11.2	1.17	53.9	0.248	83.4	0.292
24	0.00	19.48	8.40	23	10.7	1.02	52.5	0.258	84.3	0.295
25	0.00	20.09	9.09	24	11.2	0.78	52.5	0.258	84.3	0.295
26	0.00	20.28	8.53	24	11.3	1.42	52.8	0.261	89.9	0.315
27	0.00	19.38	7.72	23	10.4	0.84	53.1	0.261	86.7	0.303
28	0.00	20.04	8.35	24	11.5	0.55	52.5	0.267	86.2	0.302
29	0.00	20.39	7.89	24	11.4	1.64	53.7	0.263	96.3	0.337
30	0.00	20.24	7.51	24	10.2	0.78	53.3	0.260	84.4	0.296
31	0.00	19.61	7.29	23	10.6	0.82	53.1	0.258	84.1	0.295
32	0.00	20.57	7.65	24	10.7	0.87	52.4	0.264	86.4	0.302
	Average	20.44	9.18	24	11.0	1.18	53.1	0.263	86.9	0.304

Total number of blows analyzed: 32

Time Summary

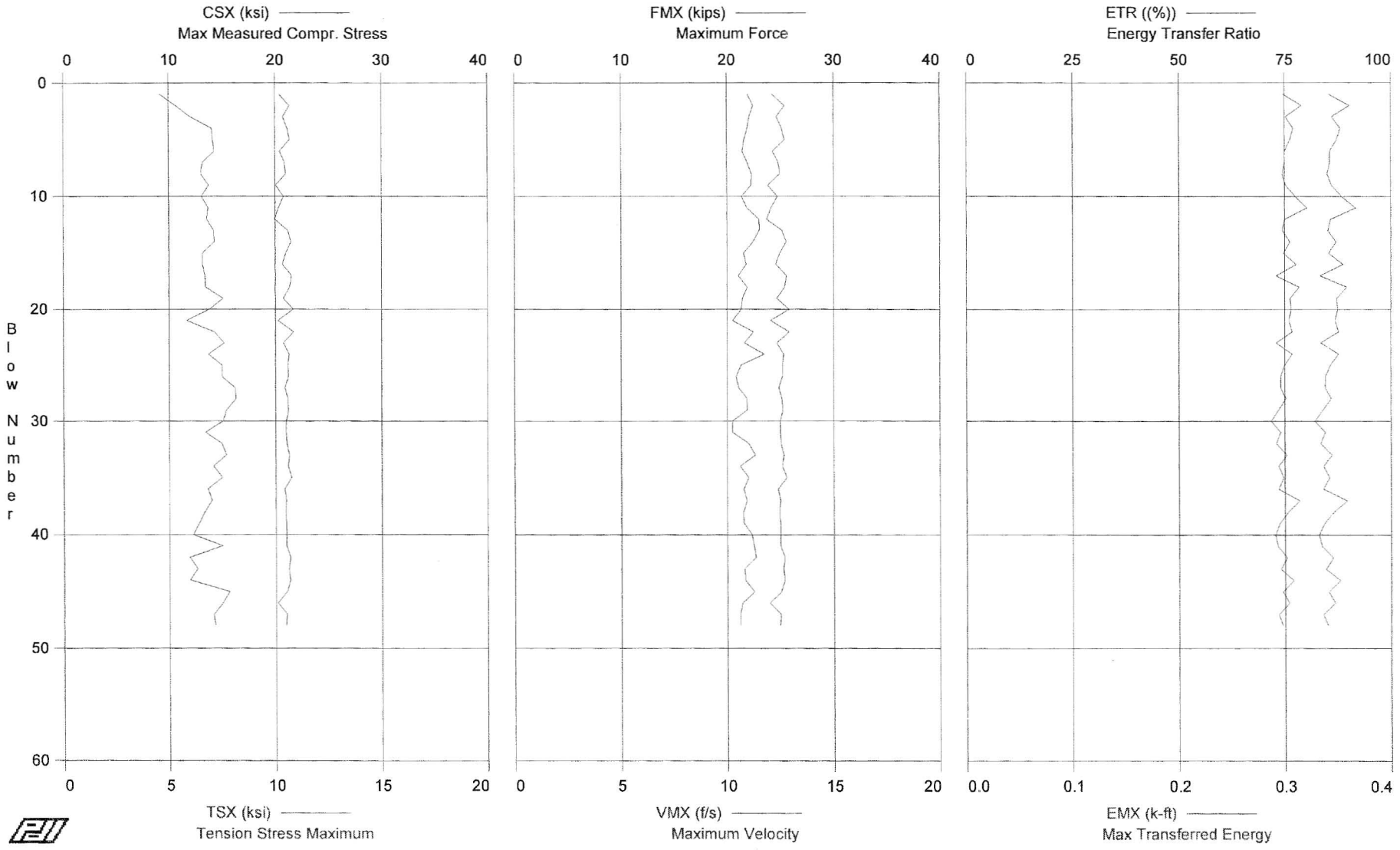
Drive 35 seconds 9:17:12 AM - 9:17:47 AM (12/20/2006) BN 1 - 32

MACTEC Engineering and Consulting, Inc. - Case Method Results

PDIPLOT Ver. 2005.2 - Printed: 8-May-2007

Test date: 20-Dec-2006

Vogtle COL Project - Boring B-1185; 78.5' - 80' Sample



Vogtle COL Project - Boring B-1185; 78.5' - 80' Sample
OP: SEK

Rig Serial No. 165592 (Gregg CME 850)
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 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	4.58	24	11.0	0.66	0.0	0.273	85.4	0.299
2	0.00	21.35	5.34	25	11.2	0.84	52.6	0.285	90.3	0.316
3	0.00	20.73	6.01	25	11.1	1.13	54.4	0.264	86.1	0.301
4	0.00	21.14	7.02	25	11.0	1.07	53.0	0.269	88.1	0.308
5	0.00	21.36	7.08	25	10.8	0.71	53.6	0.277	87.3	0.305
6	0.00	20.43	7.14	24	10.7	1.20	52.6	0.270	85.7	0.300
7	0.00	20.87	6.59	25	11.0	1.45	54.3	0.262	85.7	0.300
8	0.00	21.00	6.51	25	11.2	6.81	52.9	0.269	85.1	0.298
9	0.00	20.04	6.87	24	11.1	1.40	53.9	0.000	86.1	0.301
10	0.00	20.79	6.54	25	10.7	2.17	52.9	0.270	88.4	0.310
11	0.00	20.30	6.85	24	10.9	0.13	26.8	0.270	91.8	0.321
12	0.00	19.94	6.78	24	11.5	0.59	53.4	0.268	85.8	0.300
13	0.00	21.16	7.10	25	11.5	1.04	53.8	0.273	85.2	0.298
14	0.00	21.48	7.14	26	11.2	1.33	52.8	0.272	87.2	0.305
15	0.00	20.97	6.57	25	10.8	1.61	53.5	0.267	85.4	0.299
16	0.00	20.65	6.59	25	10.9	2.09	52.4	0.269	88.8	0.311
17	0.00	21.52	6.69	26	10.5	1.15	54.7	0.271	83.3	0.292
18	0.00	21.35	6.71	25	10.9	1.92	53.0	0.274	89.7	0.314
19	0.00	20.74	7.55	25	10.7	1.77	53.9	0.261	87.2	0.305
20	0.00	21.70	6.91	26	10.7	1.60	53.6	0.271	87.5	0.306
21	0.00	20.23	5.82	24	10.3	1.97	52.8	0.264	86.9	0.304
22	0.00	21.72	7.14	26	11.2	0.79	53.5	0.266	87.7	0.307
23	0.00	20.73	7.60	25	10.8	0.62	53.4	0.274	83.5	0.292
24	0.00	21.27	6.86	25	11.7	2.54	53.4	0.000	87.7	0.307
25	0.00	21.17	7.49	25	10.6	0.50	26.7	0.267	85.8	0.300
26	0.00	21.19	7.49	25	10.4	0.29	52.8	0.275	84.6	0.296
27	0.00	20.87	8.11	25	10.5	2.37	53.5	0.263	84.5	0.296
28	0.00	21.14	8.15	25	10.9	1.18	53.7	0.268	85.9	0.301
29	0.00	21.21	7.69	25	10.9	-0.25	53.0	0.271	84.0	0.294
30	0.00	20.99	7.54	25	10.3	1.77	53.1	0.266	82.1	0.287
31	0.00	21.00	6.70	25	10.3	-1.32	52.3	0.277	84.5	0.296
32	0.00	21.05	7.48	25	11.0	0.44	53.8	0.265	83.5	0.292
33	0.00	21.28	7.69	25	11.3	1.15	52.3	0.274	86.2	0.302
34	0.00	21.16	7.07	25	10.6	1.35	53.2	0.272	84.1	0.294
35	0.00	21.49	7.50	26	11.0	2.61	52.5	0.267	85.5	0.299
36	0.00	20.82	6.81	25	10.8	1.08	53.1	0.264	84.0	0.294
37	0.00	21.01	7.01	25	10.9	0.77	52.7	0.274	89.7	0.314
38	0.00	20.91	6.67	25	10.8	1.24	53.9	0.265	86.6	0.303
39	0.00	21.00	6.39	25	10.8	0.99	53.3	0.263	84.3	0.295
40	0.00	20.99	6.11	25	11.2	1.09	52.0	0.255	83.0	0.291
41	0.00	20.99	7.51	25	11.2	2.95	53.3	0.250	83.7	0.293
42	0.00	21.34	5.94	25	11.3	2.12	52.9	0.262	86.4	0.302
43	0.00	21.21	6.31	25	10.8	1.66	52.7	0.264	84.7	0.296
44	0.00	21.32	5.96	25	10.8	1.39	51.6	0.274	88.1	0.308
45	0.00	21.05	7.82	25	11.3	1.39	53.8	0.259	85.3	0.298
46	0.00	20.15	7.49	24	10.7	2.05	52.2	0.261	86.9	0.304
47	0.00	21.02	7.09	25	10.6	1.55	53.4	0.266	84.0	0.294
48	0.00	20.96	7.14	25	10.6	1.72	53.0	0.266	85.2	0.298
	Average	20.98	6.90	25	10.9	1.39	52.0	0.257	86.0	0.301

Total number of blows analyzed: 48

Time Summary

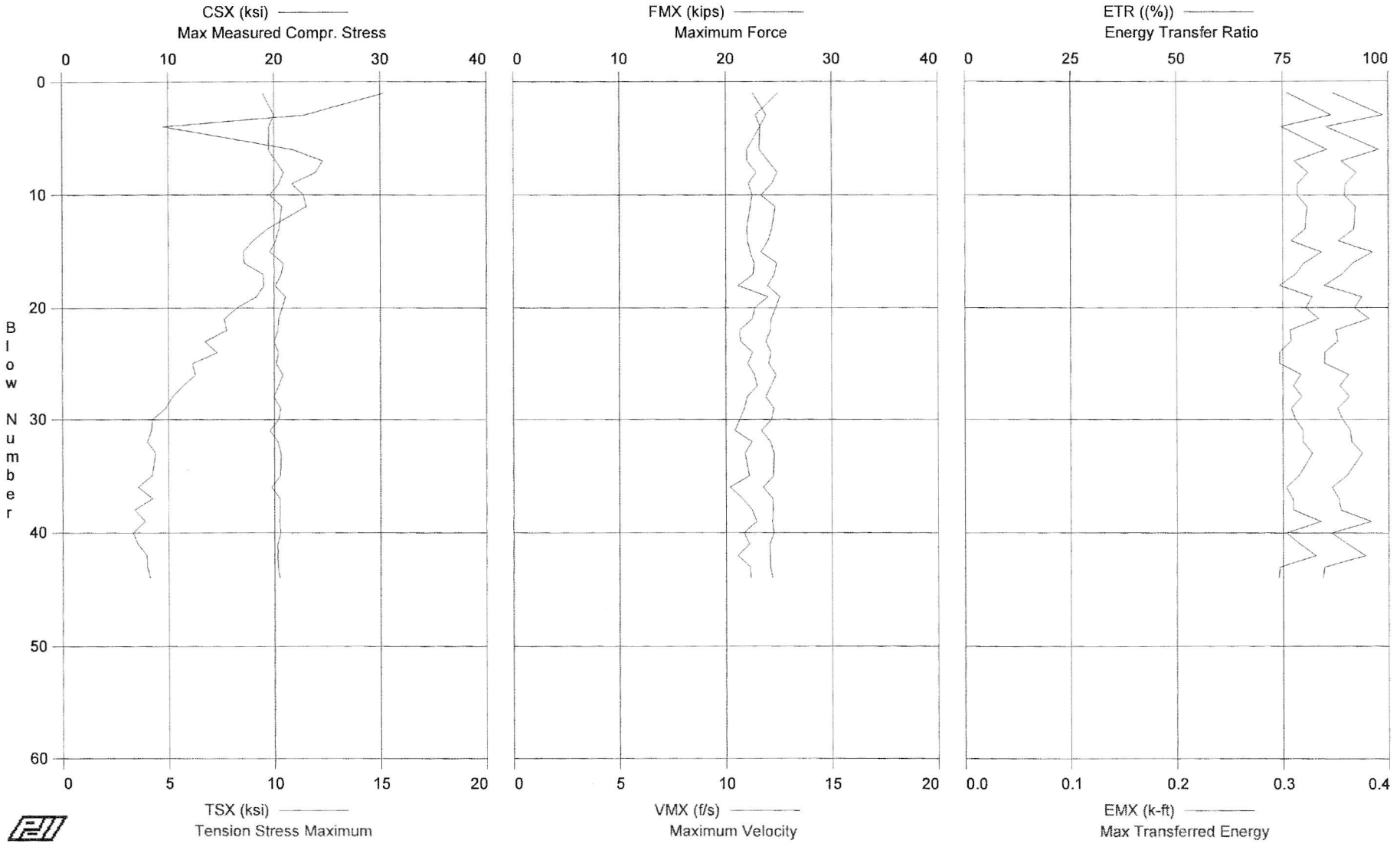
Drive 56 seconds 9:44:35 AM - 9:45:31 AM (12/20/2006) BN 1 - 48

MACTEC Engineering and Consulting, Inc. - Case Method Results

PDIPLOT Ver. 2005.2 - Printed: 8-May-2007

Test date: 20-Dec-2006

Vogtle COL Project - Boring B-1185; 83.5' - 85' Sample



Vogtle COL Project - Boring B-1185; 83.5' - 85' Sample
OP: SEK

Rig Serial No. 165592 (Gregg CME 850)
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	CSX	TSX	FMX	VMX	DFN	BPM	EF2	ETR	EMX
	ft	ksi	ksi	kips	f/s	in	**	k-ft	(%)	k-ft
1	0.00	18.95	15.20	23	12.5	2.86	0.0	0.287	86.8	0.304
3	0.00	20.03	11.43	24	11.4	3.47	54.0	0.285	98.8	0.346
4	0.00	19.54	4.77	23	11.6	0.69	55.6	0.000	85.3	0.299
6	0.00	19.49	10.90	23	11.0	2.00	54.6	0.290	97.8	0.342
7	0.00	20.17	12.30	24	11.0	1.03	54.2	0.288	88.9	0.311
8	0.00	20.91	11.97	25	11.4	2.04	54.3	0.289	92.4	0.324
9	0.00	20.46	10.84	24	11.1	1.18	55.0	0.282	89.9	0.314
10	0.00	19.62	11.40	23	11.3	2.11	54.1	0.279	89.6	0.314
11	0.00	20.74	11.52	25	11.2	1.72	54.5	0.283	92.3	0.323
13	0.00	20.45	9.68	24	11.0	1.32	55.5	0.281	91.8	0.321
14	0.00	20.15	9.02	24	11.0	1.77	53.8	0.280	88.1	0.308
15	0.00	19.62	8.53	23	11.2	1.61	55.6	0.288	96.3	0.337
16	0.00	20.86	8.59	25	11.3	1.44	53.9	0.283	91.6	0.320
17	0.00	20.66	9.49	25	11.3	1.40	54.5	0.282	89.0	0.312
18	0.00	20.13	9.52	24	10.6	1.18	54.4	0.279	84.8	0.297
19	0.00	21.08	9.16	25	12.0	1.89	53.6	0.289	93.7	0.328
20	0.00	20.77	8.24	25	11.4	1.30	54.3	0.283	92.0	0.322
21	0.00	20.42	7.65	24	11.3	1.56	53.5	0.284	95.5	0.334
22	0.00	20.36	7.76	24	10.6	1.32	55.5	0.284	87.6	0.307
23	0.00	19.99	6.74	24	10.7	0.95	53.9	0.280	88.0	0.308
24	0.00	20.40	7.31	24	11.3	1.25	55.1	0.275	85.0	0.297
25	0.00	20.22	6.15	24	11.0	1.14	53.3	0.274	84.9	0.297
26	0.00	20.80	6.28	25	11.3	1.05	54.4	0.286	90.6	0.317
27	0.00	20.39	5.67	24	11.5	1.45	54.7	0.274	88.5	0.310
28	0.00	19.97	5.18	24	11.0	1.31	53.8	0.280	90.8	0.318
29	0.00	20.60	4.86	25	10.9	1.66	54.7	0.276	88.0	0.308
30	0.00	20.43	4.23	24	10.7	1.08	53.4	0.284	89.1	0.312
31	0.00	19.60	4.19	23	10.4	1.45	54.8	0.276	91.0	0.319
32	0.00	20.33	4.00	24	11.2	1.64	54.3	0.276	91.3	0.319
33	0.00	20.63	4.38	25	10.9	1.72	54.5	0.280	93.8	0.328
35	0.00	20.57	4.21	24	11.1	1.92	54.2	0.283	90.1	0.315
36	0.00	19.74	3.56	23	10.2	1.23	54.1	0.282	86.6	0.303
37	0.00	20.50	4.23	24	10.8	1.01	53.3	0.285	88.2	0.309
38	0.00	20.53	3.41	24	11.2	1.00	54.7	0.282	88.7	0.310
39	0.00	20.48	3.87	24	11.4	1.57	53.7	0.284	95.9	0.336
40	0.00	20.60	3.31	25	10.8	1.30	54.3	0.285	86.5	0.303
41	0.00	20.28	3.53	24	11.1	1.03	53.5	0.284	90.3	0.316
42	0.00	20.30	3.97	24	10.6	1.03	54.8	0.287	94.5	0.331
43	0.00	20.31	3.99	24	11.1	0.72	53.6	0.275	84.8	0.297
44	0.00	20.50	4.12	24	11.2	1.54	53.7	0.273	84.5	0.296
	Average	20.29	7.13	24	11.1	1.47	54.3	0.275	90.1	0.315

Total number of blows analyzed: 40

Time Summary

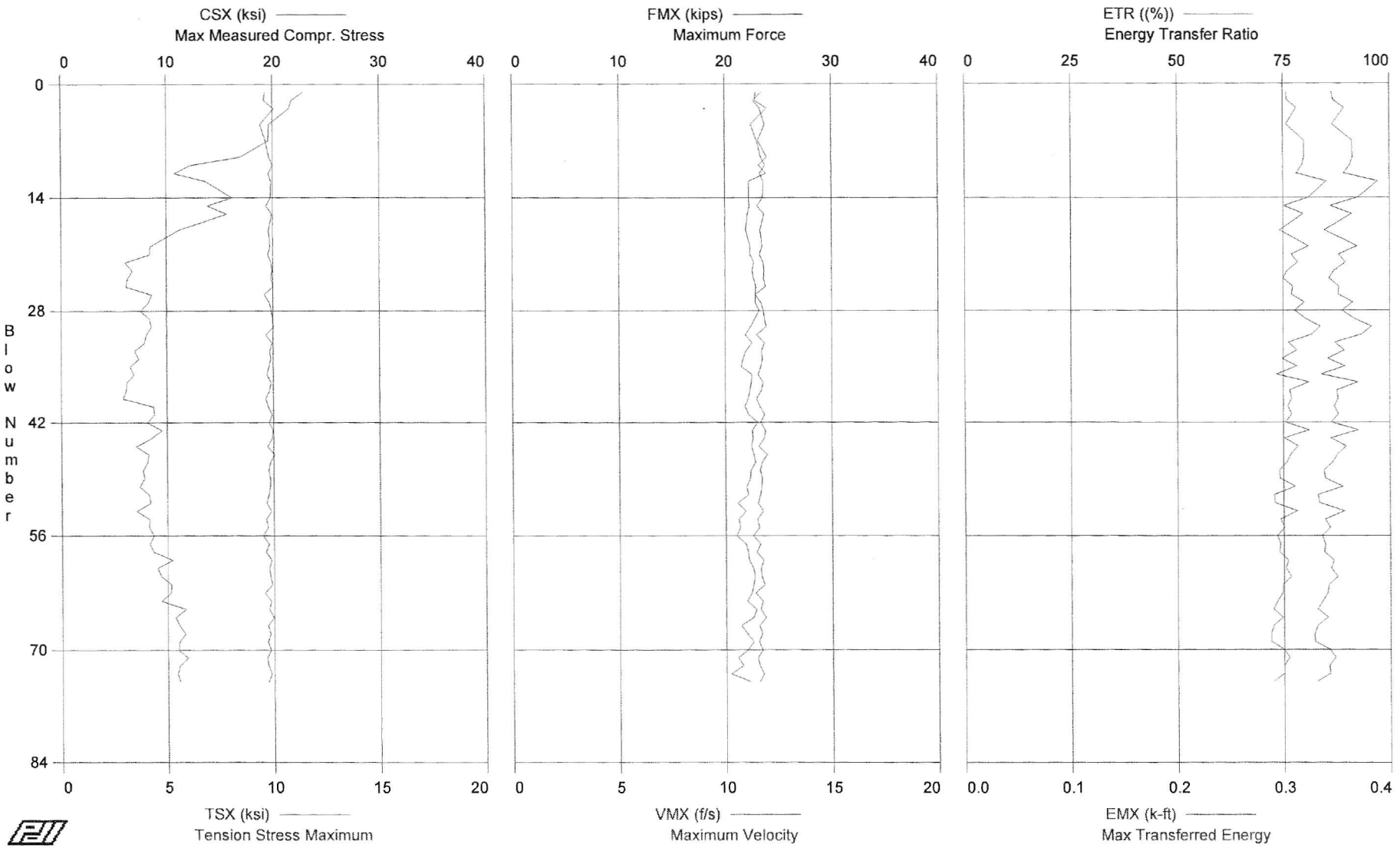
Drive 48 seconds 10:03:20 AM - 10:04:08 AM (12/20/2006) BN 1 - 44

MACTEC Engineering and Consulting, Inc. - Case Method Results

PDIPLOT Ver. 2005.2 - Printed: 8-May-2007

Test date: 20-Dec-2006

Vogtle COL Project - Boring B-1185; 88.5' - 90' Sample



Vogtle COL Project - Boring B-1185; 88.5' - 90' Sample
OP: SEK

Rig Serial No. 165592 (Gregg CME 850)
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	19.30	11.44	23	11.8	1.71	0.0	0.263	86.5	0.303
2	0.00	19.21	10.90	23	11.3	2.78	53.2	0.251	86.9	0.304
3	0.00	20.13	10.77	24	11.7	2.88	52.3	0.262	89.5	0.313
5	0.00	18.87	9.84	22	11.9	1.67	52.1	0.257	86.6	0.303
7	0.00	19.36	9.81	23	11.6	2.47	52.6	0.257	91.3	0.320
9	0.00	19.68	8.48	23	12.0	2.16	52.7	0.260	91.5	0.320
10	0.00	20.00	6.14	24	11.6	1.76	51.9	0.263	90.8	0.318
11	0.00	19.59	5.39	23	11.9	1.83	53.0	0.250	89.3	0.313
12	0.00	19.84	6.86	24	11.1	2.32	51.6	0.266	97.4	0.341
14	0.00	19.79	8.10	24	11.1	2.23	52.2	0.262	92.6	0.324
15	0.00	19.38	6.95	23	11.2	1.33	52.7	0.254	86.1	0.301
16	0.00	19.90	7.85	24	11.1	1.80	52.4	0.262	91.2	0.319
18	0.00	19.60	5.55	23	11.0	1.41	52.9	0.249	84.8	0.297
20	0.00	19.75	4.23	23	11.2	1.81	52.8	0.251	92.5	0.324
21	0.00	19.53	4.20	23	11.2	1.50	53.0	0.256	88.1	0.308
22	0.00	19.83	3.04	24	11.4	1.33	53.4	0.251	89.8	0.314
23	0.00	19.91	3.38	24	11.3	1.53	51.6	0.250	87.0	0.304
24	0.00	19.85	3.16	24	11.4	1.63	53.2	0.247	85.8	0.300
25	0.00	20.00	3.07	24	11.5	1.48	51.6	0.252	88.1	0.309
26	0.00	19.19	4.29	23	11.4	1.36	52.7	0.252	88.1	0.308
27	0.00	19.66	4.13	23	11.4	2.07	52.5	0.251	91.4	0.320
28	0.00	19.83	3.75	24	11.6	1.55	52.0	0.256	88.9	0.311
29	0.00	19.93	4.19	24	11.4	1.44	53.1	0.256	91.7	0.321
30	0.00	20.02	4.27	24	11.2	1.84	52.1	0.265	95.8	0.335
31	0.00	19.30	4.03	23	11.0	1.79	53.4	0.255	93.4	0.327
32	0.00	19.91	3.95	24	11.3	1.39	51.8	0.257	87.2	0.305
33	0.00	19.68	3.47	23	11.0	1.54	52.6	0.254	89.4	0.313
34	0.00	19.76	3.68	24	10.8	1.05	52.4	0.257	85.4	0.299
35	0.00	19.60	3.27	23	10.8	1.76	51.9	0.257	89.5	0.313
36	0.00	19.42	3.44	23	11.3	1.17	52.2	0.251	83.9	0.294
37	0.00	19.80	3.11	24	11.2	1.33	51.7	0.253	92.5	0.324
38	0.00	19.64	3.07	23	11.2	1.48	53.6	0.251	87.6	0.306
39	0.00	19.29	2.93	23	11.1	1.21	51.1	0.252	87.9	0.308
40	0.00	19.54	4.37	23	10.9	1.19	53.0	0.247	87.0	0.304
41	0.00	19.89	4.40	24	11.1	1.12	51.8	0.252	88.0	0.308
42	0.00	19.60	4.08	23	11.5	1.04	53.2	0.247	86.3	0.302
43	0.00	19.97	4.76	24	11.3	1.68	51.4	0.260	92.6	0.324
44	0.00	19.86	4.22	24	11.3	0.94	52.1	0.252	86.1	0.301
45	0.00	19.43	3.54	23	11.2	1.19	52.4	0.253	89.8	0.314
46	0.00	20.09	4.14	24	11.3	0.66	50.9	0.258	87.7	0.307
47	0.00	19.70	4.07	23	11.4	1.11	53.1	0.249	86.6	0.303
48	0.00	19.52	3.86	23	11.2	0.71	51.5	0.255	84.5	0.296
49	0.00	19.69	3.93	23	11.2	1.05	52.3	0.256	84.8	0.297
50	0.00	19.67	3.69	23	11.0	1.03	51.7	0.265	89.0	0.311
51	0.00	19.54	4.12	23	11.1	1.46	53.5	0.247	83.1	0.291
52	0.00	19.35	4.22	23	10.6	1.42	51.7	0.251	83.4	0.292
53	0.00	19.78	3.55	24	10.9	1.25	51.6	0.266	89.3	0.313
54	0.00	19.30	4.16	23	10.6	1.42	52.2	0.251	84.8	0.297
55	0.00	19.45	4.13	23	10.7	0.52	51.4	0.255	85.9	0.301
56	0.00	18.99	4.35	23	10.5	1.28	52.6	0.245	84.0	0.294
57	0.00	19.52	4.15	23	10.9	0.71	51.1	0.253	84.8	0.297
58	0.00	19.24	4.34	23	11.1	1.38	53.1	0.244	84.5	0.296
59	0.00	19.77	5.22	24	11.1	1.71	50.9	0.247	86.8	0.304
60	0.00	19.55	4.52	23	11.3	0.80	52.8	0.249	86.2	0.302
61	0.00	19.63	4.69	23	11.4	1.17	51.9	0.255	87.7	0.307
62	0.00	19.84	5.18	24	11.3	0.90	52.4	0.249	85.6	0.299
63	0.00	19.13	5.14	23	11.2	0.63	51.9	0.248	85.3	0.299
64	0.00	19.71	4.70	23	11.0	1.44	50.8	0.251	84.1	0.294
65	0.00	19.52	5.85	23	11.4	0.74	53.4	0.245	82.9	0.290
66	0.00	19.96	5.35	24	11.3	0.98	50.6	0.257	85.3	0.299
67	0.00	19.42	5.54	23	10.7	0.85	52.9	0.250	82.9	0.290
68	0.00	19.63	5.82	23	11.0	0.50	51.8	0.248	82.3	0.288
69	0.00	19.38	5.54	23	11.3	0.94	52.0	0.251	82.3	0.288
70	0.00	19.68	5.50	23	11.0	0.92	52.0	0.324	85.8	0.300
71	0.00	19.30	5.94	23	10.6	0.67	51.8	0.257	87.1	0.305

Vogtle COL Project - Boring B-1185; 88.5' - 90' Sample
OP: SEK

Rig Serial No. 165592 (Gregg CME 850)
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
72	0.00	19.43	5.54	23	10.8	0.12	53.2	0.257	85.7	0.300
73	0.00	19.74	5.45	23	10.2	1.67	51.4	0.259	85.8	0.300
74	0.00	19.43	5.57	23	11.1	0.67	52.5	0.254	82.8	0.290
	Average	19.61	5.06	23	11.2	1.36	52.3	0.255	87.5	0.306

Total number of blows analyzed: 68

Time Summary

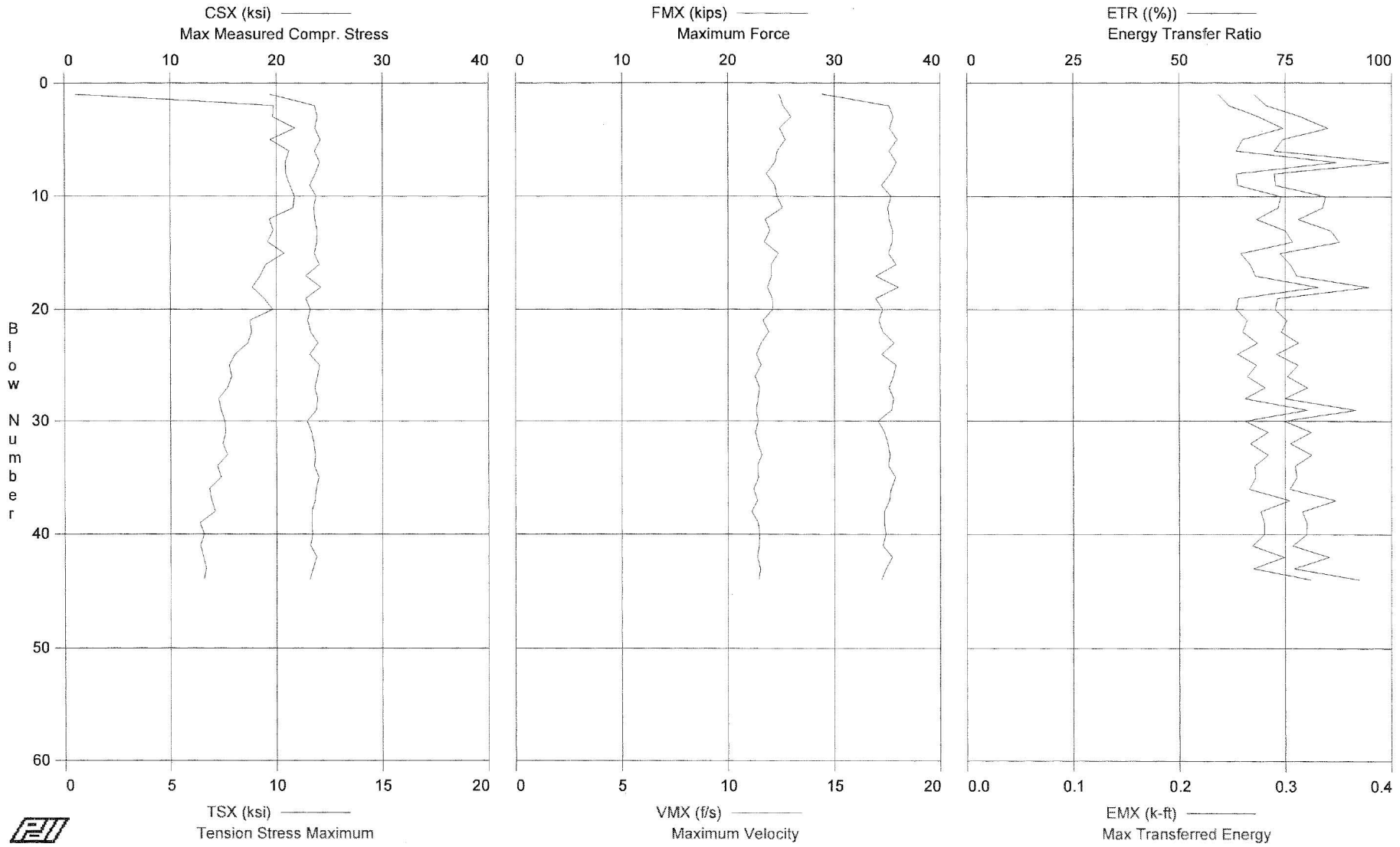
Drive 1 minute 24 seconds 10:23:38 AM - 10:25:02 AM (12/20/2006) BN 1 - 74

MACTEC Engineering and Consulting, Inc. - Case Method Results

PDIPLOT Ver. 2005.2 - Printed: 8-May-2007

Test date: 17-Jan-2007

Plant Vogtle COL Project - Boring B-3002A; 13.5' - 15' Sample



Plant Vogtle COL Project - Boring B-3002A; 13.5' - 15' Sample
OP: SEK

Rig Serial No. 165592 (Gregg CME 850 Track)
Test date: 17-Jan-2007

AR: 1.49 in^2
LE: 19.00 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	19.39	0.52	29	12.4	-0.43	0.0	0.000	67.7	0.237
2	0.00	23.61	9.88	35	12.6	0.57	50.0	0.274	70.6	0.247
3	0.00	23.87	9.82	36	13.0	2.81	50.6	0.273	78.7	0.275
4	0.00	23.63	10.87	35	12.4	1.81	50.9	0.277	85.0	0.298
5	0.00	24.13	9.70	36	12.7	1.34	50.2	0.278	74.4	0.260
6	0.00	23.61	10.59	35	12.3	1.63	51.4	0.273	72.4	0.254
7	0.00	24.07	10.41	36	12.2	1.72	49.8	0.294	99.4	0.348
8	0.00	23.69	10.44	35	11.8	0.89	51.8	0.280	72.5	0.254
9	0.00	23.12	10.64	34	12.2	1.39	49.8	0.280	72.7	0.255
10	0.00	23.74	10.84	35	12.3	2.62	51.2	0.281	84.5	0.296
11	0.00	23.52	10.78	35	12.5	1.93	50.3	0.288	83.8	0.293
12	0.00	23.61	9.66	35	11.7	1.54	50.5	0.280	78.1	0.273
13	0.00	23.83	9.85	35	12.0	2.08	51.2	0.278	85.7	0.300
14	0.00	23.80	9.57	35	11.7	1.61	49.7	0.289	87.8	0.307
15	0.00	23.56	10.35	35	12.4	1.92	51.7	0.277	73.7	0.258
16	0.00	24.05	9.49	36	12.0	1.85	49.5	0.282	76.3	0.267
17	0.00	22.77	9.22	34	12.0	1.85	51.5	0.277	77.7	0.272
18	0.00	24.18	8.86	36	11.9	1.81	49.8	0.290	94.6	0.331
19	0.00	22.76	9.42	34	12.1	1.30	51.2	0.278	73.2	0.256
20	0.00	23.20	9.82	35	12.1	1.07	50.3	0.278	72.6	0.254
21	0.00	22.95	8.74	34	11.6	1.58	50.7	0.276	75.3	0.264
22	0.00	23.21	8.82	35	11.9	1.82	50.9	0.271	74.2	0.260
23	0.00	23.92	8.65	36	11.6	1.79	50.0	0.281	78.2	0.274
24	0.00	23.13	8.03	34	11.3	1.40	51.5	0.275	72.9	0.255
25	0.00	24.06	7.78	36	11.6	1.33	49.6	0.285	78.0	0.273
26	0.00	23.87	7.88	36	11.3	1.78	51.5	0.278	75.5	0.264
27	0.00	23.61	7.69	35	11.5	1.40	49.8	0.286	80.2	0.281
28	0.00	23.89	7.27	36	11.4	1.10	25.4	0.281	74.9	0.262
29	0.00	23.76	7.38	35	11.3	1.30	50.5	0.285	91.6	0.321
30	0.00	22.90	7.56	34	11.4	1.02	51.1	0.276	74.8	0.262
31	0.00	23.31	7.60	35	11.3	0.75	49.8	0.288	81.1	0.284
32	0.00	23.52	7.46	35	11.4	1.23	51.5	0.277	76.2	0.267
33	0.00	23.65	7.68	35	11.6	1.90	49.5	0.285	81.3	0.284
34	0.00	23.56	7.20	35	11.4	-0.18	51.7	0.281	77.4	0.271
35	0.00	24.00	7.38	36	11.4	1.21	49.7	0.283	77.7	0.272
36	0.00	23.74	6.83	35	11.2	0.76	51.1	0.276	76.1	0.266
37	0.00	23.62	6.93	35	11.4	1.34	50.3	0.286	86.9	0.304
38	0.00	23.30	7.09	35	11.1	1.33	50.5	0.279	79.1	0.277
39	0.00	23.30	6.37	35	11.4	1.64	51.0	0.276	80.1	0.280
40	0.00	23.39	6.58	35	11.5	0.94	50.0	0.283	80.0	0.280
41	0.00	23.20	6.39	35	11.5	0.90	51.4	0.274	76.7	0.269
42	0.00	23.78	6.54	35	11.4	0.89	49.5	0.286	85.3	0.299
43	0.00	23.42	6.67	35	11.5	0.45	51.5	0.276	77.1	0.270
44	0.00	23.12	6.56	34	11.5	1.34	49.7	0.291	92.4	0.324
	Average	23.46	8.36	35	11.8	1.37	50.0	0.274	79.2	0.277

Total number of blows analyzed: 44

Time Summary

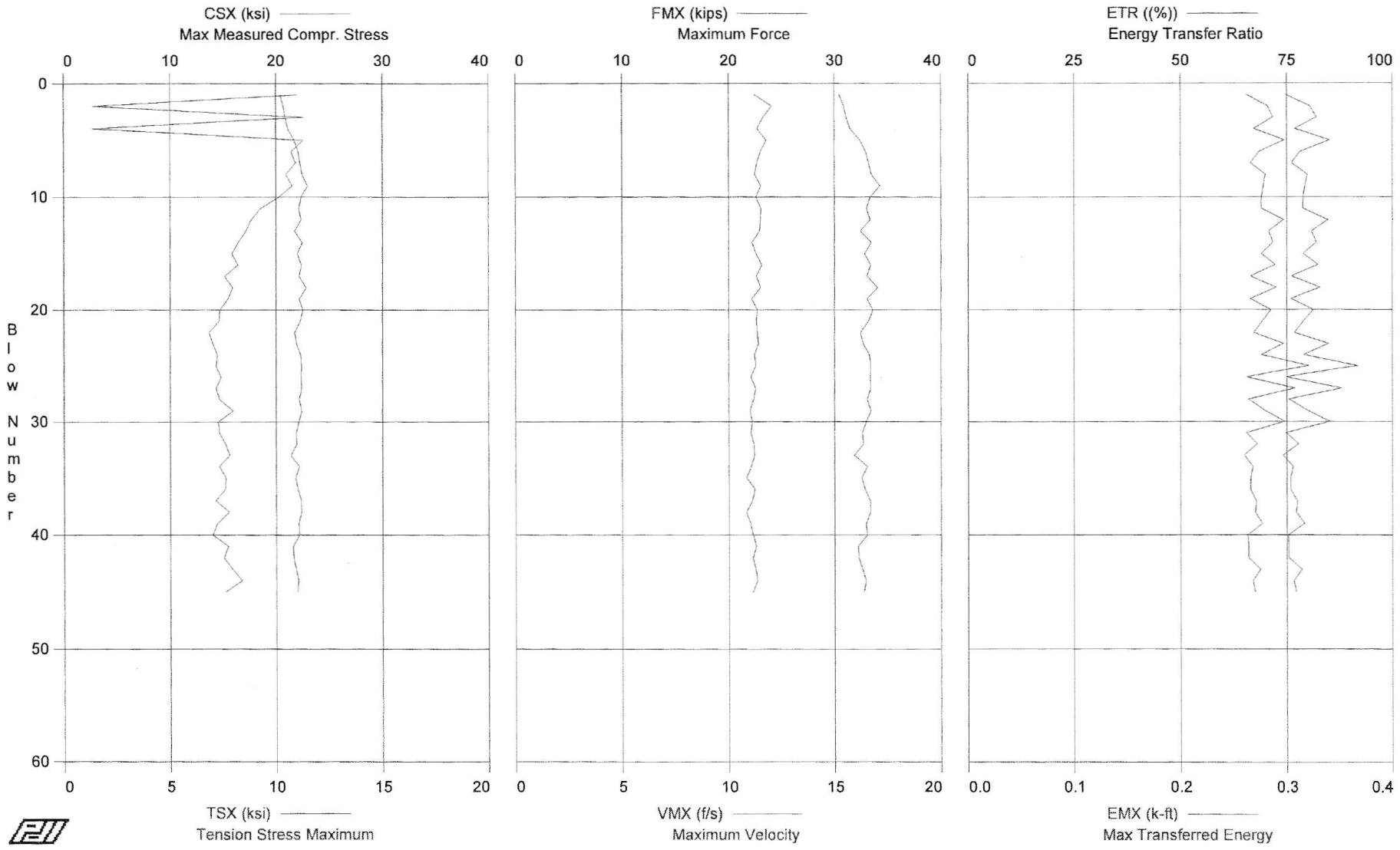
Drive 52 seconds 8:11:47 AM - 8:12:39 AM (1/17/2007) BN 1 - 44

MACTEC Engineering and Consulting, Inc. - Case Method Results

PDIPLOT Ver. 2005.2 - Printed: 8-May-2007

Test date: 17-Jan-2007

Plant Vogtle COL Project - Boring B-3002A; 18.5' - 20' Sample



Plant Vogtle COL Project - Boring B-3002A; 18.5' - 20' Sample
OP: SEK

Rig Serial No. 165592 (Gregg CME 850 Track)
Test date: 17-Jan-2007

AR: 1.49 in^2
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 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	20.43	10.98	30	11.2	0.38	0.0	0.261	74.7	0.262
2	0.00	20.72	1.32	31	12.0	1.19	50.0	0.000	80.5	0.282
3	0.00	20.89	11.31	31	11.6	1.26	52.8	0.287	82.1	0.287
4	0.00	21.13	1.33	31	11.4	1.33	53.1	0.000	76.9	0.269
5	0.00	21.74	11.28	32	11.8	1.13	51.7	0.297	85.2	0.298
6	0.00	22.11	10.72	33	11.5	0.88	53.9	0.280	78.1	0.274
7	0.00	22.29	10.93	33	11.3	1.66	51.3	0.279	76.1	0.266
8	0.00	22.46	10.47	33	11.2	0.66	53.7	0.279	79.9	0.280
9	0.00	23.00	10.78	34	11.5	1.97	51.7	0.284	79.3	0.278
10	0.00	22.37	10.15	33	11.3	1.17	53.1	0.279	78.9	0.276
11	0.00	22.15	9.28	33	11.5	0.47	52.2	0.280	78.8	0.276
12	0.00	22.37	8.84	33	11.5	0.91	53.0	0.284	84.7	0.297
13	0.00	21.76	8.58	32	11.5	1.00	52.6	0.282	80.9	0.283
14	0.00	22.46	8.22	33	11.1	1.22	52.5	0.278	82.0	0.287
15	0.00	22.02	7.93	33	11.3	1.09	52.9	0.279	78.9	0.276
16	0.00	22.42	8.20	33	11.6	1.20	51.6	0.286	82.5	0.289
17	0.00	22.20	7.58	33	11.3	0.74	53.8	0.274	76.1	0.266
18	0.00	22.86	7.96	34	11.5	0.50	51.3	0.294	82.9	0.290
19	0.00	22.20	7.73	33	11.1	0.71	53.3	0.271	76.1	0.266
20	0.00	22.55	7.34	34	11.4	1.17	51.8	0.284	81.3	0.285
21	0.00	22.29	7.32	33	11.3	1.78	52.6	0.278	79.0	0.277
22	0.00	21.76	6.84	32	11.4	0.33	52.8	0.278	76.9	0.269
23	0.00	21.95	7.03	33	11.4	1.00	51.9	0.284	84.9	0.297
24	0.00	22.33	7.25	33	11.2	1.57	53.3	0.275	79.0	0.276
25	0.00	22.42	7.16	33	11.3	2.41	51.6	0.284	91.8	0.321
26	0.00	22.37	7.41	33	11.1	1.32	53.6	0.272	74.8	0.262
27	0.00	22.42	7.17	33	11.3	1.58	51.5	0.282	88.1	0.308
28	0.00	22.20	7.34	33	11.2	1.68	53.4	0.273	75.5	0.264
29	0.00	22.42	7.98	33	11.0	0.85	52.1	0.278	80.1	0.280
30	0.00	22.13	7.26	33	11.1	1.95	52.5	0.273	85.2	0.298
31	0.00	21.90	7.33	33	11.1	1.42	52.7	0.269	74.9	0.262
32	0.00	21.95	7.63	33	11.2	0.89	52.2	0.279	77.8	0.272
33	0.00	21.37	7.81	32	11.2	0.99	53.3	0.274	74.2	0.260
34	0.00	22.20	7.32	33	11.1	0.74	51.2	0.279	76.5	0.268
35	0.00	21.84	7.63	33	10.8	1.38	53.4	0.269	75.9	0.266
36	0.00	22.04	7.60	33	11.2	1.03	52.0	0.279	75.9	0.266
37	0.00	22.37	7.16	33	11.1	0.66	52.9	0.278	77.5	0.271
38	0.00	22.38	7.79	33	10.8	1.27	51.9	0.280	77.2	0.270
39	0.00	22.11	7.22	33	11.0	1.24	52.9	0.274	79.2	0.277
40	0.00	22.19	7.00	33	11.1	1.25	52.4	0.273	75.3	0.263
41	0.00	21.60	7.75	32	11.3	1.25	52.0	0.276	75.4	0.264
42	0.00	21.65	7.53	32	11.1	1.77	53.3	0.267	75.5	0.264
43	0.00	21.89	7.95	33	11.3	1.14	51.5	0.276	78.6	0.275
44	0.00	22.09	8.38	33	11.3	1.81	53.3	0.272	76.7	0.268
45	0.00	21.98	7.60	33	11.1	2.12	51.4	0.274	77.2	0.270
	Average	22.04	7.94	33	11.3	1.20	52.5	0.266	79.1	0.277

Total number of blows analyzed: 45

Time Summary

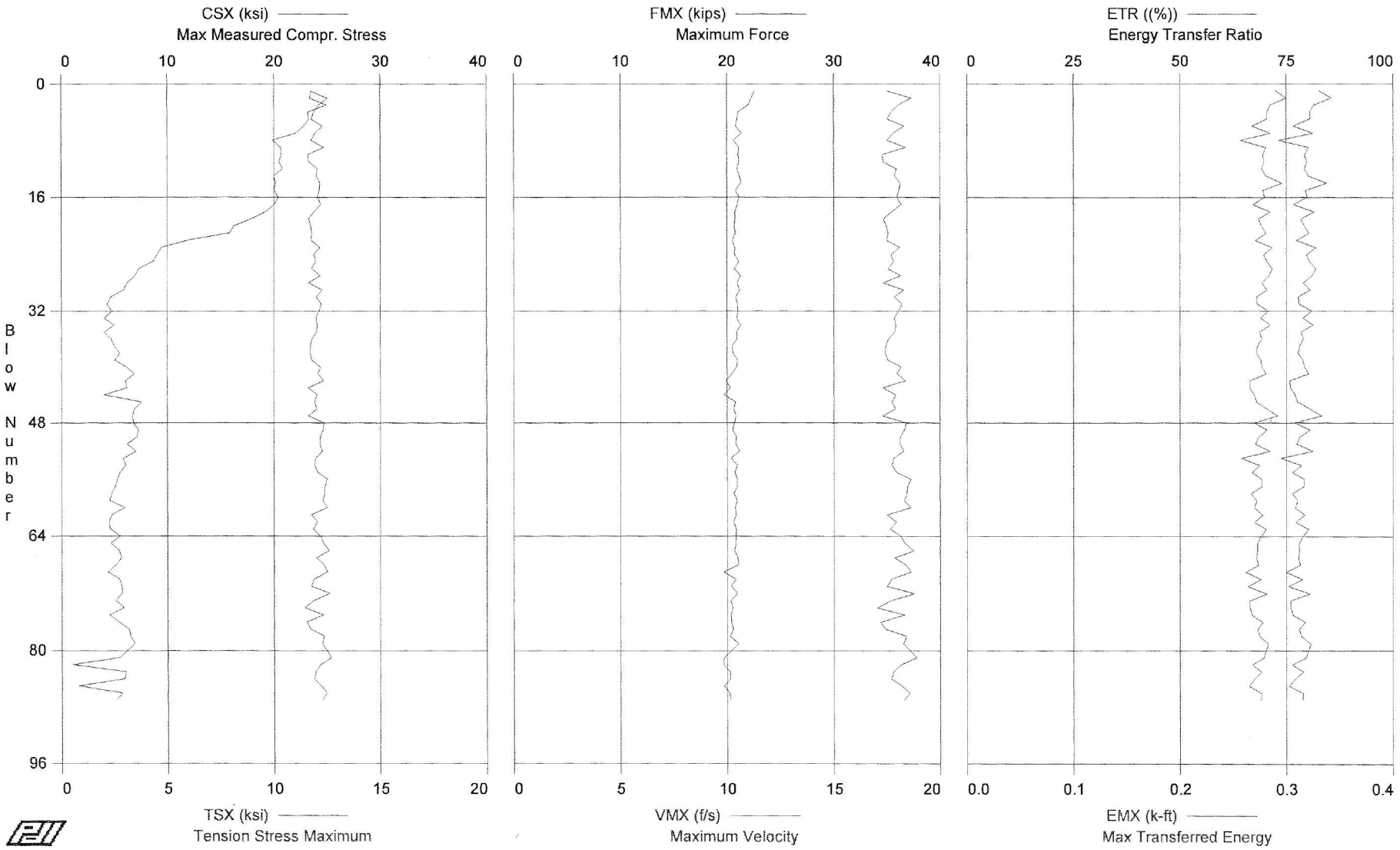
Drive 50 seconds 8:25:10 AM - 8:26:00 AM (1/17/2007) BN 1 - 45

MACTEC Engineering and Consulting, Inc. - Case Method Results

PDIPLOT Ver. 2005.2 - Printed: 8-May-2007

Test date: 17-Jan-2007

Plant Vogtle COL Project - Boring B-3002A; 20' - 21.5' Sample



Plant Vogtle COL Project - Boring B-3002A; 20' - 21.5' Sample
OP: SEK

Rig Serial No. 165592 (Gregg CME 850 Track)
Test date: 17-Jan-2007

AR: 1.49 in^2
LE: 26.00 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	23.50	11.74	35	11.3	1.85	0.0	0.286	82.8	0.290
2	0.00	25.03	11.69	37	11.1	1.89	48.9	0.298	85.6	0.300
3	0.00	24.20	12.48	36	11.0	1.10	50.7	0.300	81.4	0.285
4	0.00	23.74	11.59	35	10.5	1.26	51.5	0.303	80.6	0.282
5	0.00	23.52	11.64	35	10.5	0.88	50.4	0.304	80.6	0.282
6	0.00	24.59	11.39	37	10.4	0.98	51.9	0.294	76.7	0.268
7	0.00	23.87	11.03	36	10.7	0.87	50.0	0.308	81.4	0.285
8	0.00	23.50	9.95	35	10.3	0.71	51.5	0.282	73.3	0.257
9	0.00	24.70	10.31	37	10.6	1.24	50.5	0.304	80.3	0.281
10	0.00	23.19	10.36	35	10.5	0.52	51.1	0.299	79.3	0.278
11	0.00	23.27	10.25	35	10.6	1.02	50.8	0.302	79.8	0.279
12	0.00	24.08	10.40	36	10.5	0.98	51.2	0.303	79.3	0.277
13	0.00	23.97	10.00	36	10.6	1.05	51.3	0.299	80.3	0.281
14	0.00	24.33	10.08	36	10.7	1.44	50.5	0.308	84.5	0.296
15	0.00	24.25	10.02	36	10.4	1.23	51.8	0.295	79.5	0.278
16	0.00	24.12	10.21	36	10.6	1.17	50.0	0.302	79.9	0.280
17	0.00	24.40	10.02	36	10.5	0.99	52.0	0.293	76.7	0.269
18	0.00	23.80	9.65	35	10.4	1.36	50.3	0.311	81.6	0.285
19	0.00	23.26	8.97	35	10.4	1.02	51.6	0.302	78.4	0.274
20	0.00	23.46	8.14	35	10.4	1.06	50.6	0.301	79.3	0.277
21	0.00	23.56	7.91	35	10.4	1.23	51.3	0.306	80.3	0.281
22	0.00	23.47	5.99	35	10.2	1.10	51.4	0.294	77.4	0.271
23	0.00	24.29	4.73	36	10.4	0.97	50.3	0.303	82.0	0.287
24	0.00	23.76	4.52	35	10.4	0.71	51.9	0.304	79.8	0.279
25	0.00	23.92	4.34	36	10.6	0.88	50.0	0.311	80.5	0.282
26	0.00	23.54	3.66	35	10.4	0.60	51.9	0.304	81.9	0.287
27	0.00	24.36	3.47	36	10.6	0.71	50.8	0.312	81.1	0.284
28	0.00	23.25	3.11	35	10.5	0.72	51.4	0.302	79.0	0.277
29	0.00	24.54	2.95	37	10.6	0.55	50.4	0.310	80.7	0.282
30	0.00	23.97	2.32	36	10.4	0.83	51.0	0.294	77.9	0.272
31	0.00	24.44	2.15	36	10.5	0.82	50.9	0.294	78.0	0.273
32	0.00	24.23	2.39	36	10.5	0.50	50.0	0.304	81.0	0.283
33	0.00	23.95	2.03	36	10.5	0.97	51.8	0.300	78.9	0.276
34	0.00	24.07	2.49	36	10.6	0.72	49.6	0.308	81.3	0.285
35	0.00	24.00	2.02	36	10.5	0.65	51.8	0.297	78.5	0.275
36	0.00	23.58	2.36	35	10.5	0.40	50.0	0.303	79.0	0.277
37	0.00	23.42	2.49	35	10.2	0.46	51.6	0.297	78.1	0.273
38	0.00	23.37	2.75	35	10.3	1.05	50.5	0.298	77.8	0.272
39	0.00	23.54	2.53	35	10.5	0.78	51.0	0.300	78.9	0.276
40	0.00	24.37	3.07	36	10.5	0.92	50.9	0.300	79.2	0.277
41	0.00	24.13	3.44	36	10.2	0.58	49.9	0.306	80.2	0.281
42	0.00	24.67	3.01	37	10.0	0.50	51.6	0.291	75.9	0.266
43	0.00	23.23	3.08	35	10.2	2.58	49.9	0.302	76.0	0.266
44	0.00	24.06	1.99	36	9.9	1.54	51.6	0.000	77.1	0.270
45	0.00	23.79	3.79	35	10.4	1.21	50.4	0.300	77.6	0.272
46	0.00	24.03	3.44	36	10.3	0.96	51.5	0.297	80.6	0.282
47	0.00	23.23	3.35	35	10.4	1.96	50.5	0.304	83.4	0.292
48	0.00	24.71	3.40	37	10.4	0.44	51.0	0.297	77.0	0.270
49	0.00	24.59	3.63	37	10.3	1.14	51.6	0.295	80.6	0.282
50	0.00	24.34	3.56	36	10.5	0.88	50.6	0.299	78.2	0.274
51	0.00	24.31	3.09	36	10.4	-0.06	51.3	0.290	77.5	0.271
52	0.00	24.55	3.51	37	10.6	0.97	50.4	0.308	81.4	0.285
53	0.00	23.91	2.91	36	10.2	0.62	51.7	0.285	73.8	0.258
54	0.00	23.80	3.03	35	10.5	0.70	50.3	0.302	78.6	0.275
55	0.00	24.09	2.77	36	10.4	0.69	51.6	0.294	76.5	0.268
56	0.00	25.00	2.63	37	10.5	1.03	50.9	0.308	79.2	0.277
57	0.00	24.78	2.54	37	10.5	0.83	50.7	0.298	79.1	0.277
58	0.00	24.76	2.36	37	10.3	0.63	50.9	0.294	76.4	0.267
59	0.00	24.56	2.27	37	10.5	1.19	50.5	0.300	77.7	0.272
60	0.00	24.99	2.99	37	10.4	1.09	51.3	0.290	77.1	0.270
61	0.00	23.50	2.37	35	10.4	0.99	50.1	0.305	79.4	0.278
62	0.00	24.07	2.23	36	10.3	1.13	51.8	0.297	77.2	0.270
63	0.00	23.69	2.30	35	10.4	1.15	50.4	0.309	80.3	0.281
64	0.00	24.36	2.76	36	10.4	0.48	51.5	0.296	78.9	0.276
65	0.00	24.62	2.32	37	10.4	0.69	51.1	0.305	78.1	0.273

Plant Vogtle COL Project - Boring B-3002A; 20' - 21.5' Sample
OP: SEK

Rig Serial No. 165592 (Gregg CME 850 Track)
Test date: 17-Jan-2007

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	25.17	2.71	37	10.3	0.44	50.9	0.296	78.1	0.273
67	0.00	23.97	2.82	36	10.5	0.27	51.0	0.293	77.8	0.272
68	0.00	24.69	2.57	37	10.5	-0.07	50.6	0.300	78.3	0.274
69	0.00	24.99	2.17	37	9.8	1.10	51.4	0.291	75.0	0.262
70	0.00	23.77	2.73	35	10.4	0.61	50.3	0.311	78.8	0.276
71	0.00	23.50	2.83	35	10.2	0.57	51.5	0.286	75.5	0.264
72	0.00	25.21	2.85	38	10.5	0.28	50.5	0.312	80.6	0.282
73	0.00	23.74	2.54	35	10.2	0.90	51.3	0.294	76.1	0.266
74	0.00	22.89	2.94	34	10.3	0.63	50.4	0.299	76.0	0.266
75	0.00	24.61	2.27	37	10.2	0.90	51.4	0.298	76.6	0.268
76	0.00	23.07	2.69	34	10.2	1.17	51.6	0.306	79.5	0.278
77	0.00	23.42	3.18	35	10.3	0.79	50.8	0.296	78.0	0.273
78	0.00	24.70	3.24	37	10.1	-0.40	51.7	0.300	78.6	0.275
79	0.00	24.52	3.46	37	10.5	-0.07	50.4	0.308	80.8	0.283
81	0.00	25.37	2.73	38	9.9	0.95	41.3	0.305	79.6	0.279
82	0.00	24.36	0.49	36	9.8	-0.24	51.5	0.000	76.4	0.268
83	0.00	23.90	3.02	36	10.1	0.69	51.1	0.305	79.0	0.277
84	0.00	23.76	2.97	35	10.1	2.85	51.2	0.306	77.1	0.270
85	0.00	24.42	0.80	36	9.9	0.28	51.0	0.000	75.7	0.265
86	0.00	24.94	2.85	37	10.1	0.80	50.8	0.305	79.0	0.277
87	0.00	24.54	2.57	37	10.2	0.90	51.4	0.298	78.8	0.276
	Average	24.09	4.70	36	10.4	0.88	50.8	0.290	78.9	0.276

Total number of blows analyzed: 86

Time Summary

Drive 1 minute 41 seconds 8:43:35 AM - 8:45:16 AM (1/17/2007) BN 1 - 87

June 27, 2007

Memorandum to File DCN VGCOL 218
From: Steve Kiser SK
Reviewed By: Pieter Depree PdP

Subject: **Report of SPT Energy – Gregg Drilling CME 55**
Hammer Serial No. 311025 Automatic Hammer
WORK INSTRUCTION VGCOL 218
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 February 7, 2007, during drilling of Boring B-3028 at the referenced site. The testing was performed from approximately 8:40 to 9:40 AM under sunny skies with breezy conditions and a temperature of about 60 degrees Fahrenheit. The boring was drilled with personnel and equipment from Gregg Drilling. The drilling equipment consisted of a CME 55 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. Brian Giesecke. 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 309 foot-pounds to 324 foot-pounds. These average energy transfers correspond to energy transfer ratios (ETR) of 88% to 93% 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 315.7 foot-pounds, with a weighted average ETR of 90.2%.

Attachments: Page 4 Table 1 - Summary of SPT Energy Measurements – 1 Page
Page 5 Work Instruction – DCN VGCOL 218 – 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 & 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)
311025 (CME 55 Truck)	Gregg Drilling	B. Giesecke	B-3028	NW-J	2/7/2007	33.5 - 35.0	5 - 10 - 13	23	311	88.9%
						38.5 - 40.0	7 - 10 - 8	22	324	92.6%
						43.5 - 45.0	1 - 3 - 6	12	309	88.3%
						48.5 - 50.0	3 - 6 - 5	15	316	90.3%
							Weighted Average for Rig:		**315.7**	**90.2%**

[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: GLL	Date: 6-27-07	Checked By: WLL	Date: 7/31/07

Work Instructions – SPT Energy Gregg Drilling CME-55 (Giesecke) (Hammer #311025)

Vogtle COL Project

Project No. 6141-06-0286

Issued To: Steve Kiser

Location: Vogtle COL Project Field Office Date: 2/7/07

Issued By: Matthew F. Cooke, Site Coordinator

Valid From: 2/7/07 To: 2/7/08

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: 2/7/07

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