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BECHTEL PROJECT NO.: 25409	MACTEC PROJECT NO.: 6468-07-1950	COUNTY: Miami-Dade	GEOLOGIST: J. Liles
SITE DESCRIPTION: Turkey Point COL	DRILL MACHINE: CME-550 (Miller)	DRILLER: R. White/ J. Dugger/ C. White	GROUND WATER (ft)
BORING NO.: B-814	DRILL METHOD: Mud Rotary/ Core	SAMPLE METHODS: SPT/Core	0 HR. NA
GROUND ELEV.: 9.0 ft (NAVD88)	NORTHING: 399,139 US ft (NAD83/90)	EASTING: 877,405 US ft (NAD83/90)	24 HR. NA
TOTAL DEPTH: 153.2 ft	BORING DIAMETER: 4" to 98.0', 3" to 153.2'	CASING DEPTH: 4" to 98.0'	HAMMER (ID): 140 lb. Auto (M06)
DATE STARTED: 5/15/08	COMPLETED: 5/18/08	CORE SIZE: HQ3	BITS USED: 2 7/8" Roller Cone

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-140.6					Continued from previous page				
-142.7	151.7	4	4	5	9	814-20			-144.2 151.7ft: loose 153.2
									Boring Terminated at Elevation -144.2 ft

TURKEY POINT COL BORE TURKEY POINT.GPJ TURKEY POINT COL.GDT 5/30/08

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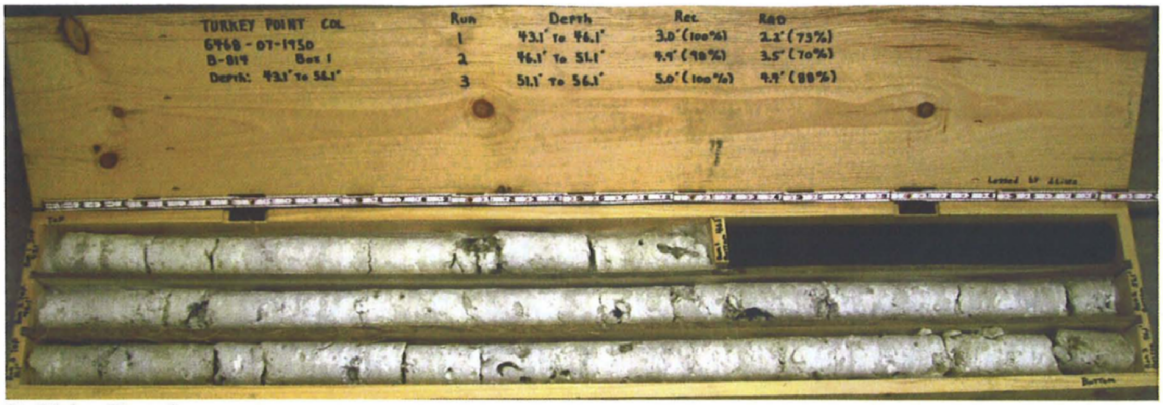
SHEET 1 OF 1

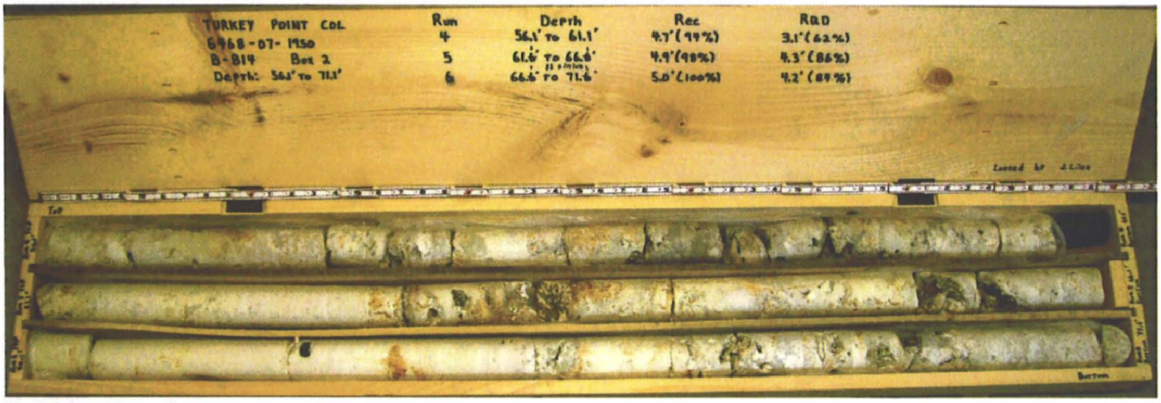
BECHTEL PROJECT NO.: 25409	MACTEC PROJECT NO.: 6468-07-1950	COUNTY: Miami-Dade	GEOLOGIST: J. Liles	
SITE DESCRIPTION: Turkey Point COL	DRILL MACHINE: CME-550 (Miller)	DRILLER: R. White/ J. Dugger/ C. White	GROUND WATER (ft)	
BORING NO.: B-814	DRILL METHOD: Mud Rotary/ Core	SAMPLE METHODS: SPT/Core	0 HR.	NA
GROUND ELEV.: 9.0 ft (NAVD88)	NORTHING: 399,139 US ft (NAD83/90)	EASTING: 877,405 US ft (NAD83/90)	24 HR.	NA
TOTAL DEPTH: 153.2 ft	CASING DEPTH: 4" to 98.0'		HAMMER (ID): 140 lb. Auto (M06)	
DATE STARTED: 5/15/08	COMPLETED: 5/18/08	CORE SIZE: HQ3	CORE BARREL TYPE: Triple Tube Wireline (Split inner liners)	

ELEV. (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
										Begin Coring @ 43.1 ft
-34.1	43.1	3.0	1:53 1:05 0:48	(3.0) 100%	(2.2) 73%	RUN-1	(17.6) 98%	(13.2) 73%		LIMESTONE, boundstone, pale yellow (2.5Y8/2), hard, wet, some coarse grained sand, strong HCl (Upper Fort Thompson Formation) *(continued)*
-37.1	46.1									43.1ft: medium hard to moderately hard, friable to moderately indurated, trace vugs
		5.0	1:07 1:07 1:09 1:17 1:18	(4.9) 98%	(3.5) 70%	RUN-2				
-42.1	51.1									
		5.0	1:24 1:26 1:11 0:54 1:13	(5.0) 100%	(4.4) 88%	RUN-3				51.5ft: moderately hard to hard, moderately indurated to indurated
-47.1	56.1									
		5.0	1:28 1:21 1:07 1:47 1:32	(4.7) 94%	(3.1) 62%	RUN-4				56.1ft: few vugs, recrystallized calcite
-52.1	61.1									-52.1 61.1
		5.0	1:51 2:00 2:10 2:08 1:28	(4.9) 98%	(4.3) 86%	RUN-5	(19.3) 58%	(10.7) 32%		LIMESTONE, boundstone, white (2.5Y8/1), hard, indurated, trace vugs, recrystallized calcite, strong HCl reaction (Lower Fort Thompson Formation)
-57.1	66.1									
		5.0	2:24 1:42 1:24 1:12 1:04	(5.0) 100%	(4.2) 84%	RUN-6				
-62.1	71.1									
		5.0	0:51 1:02 0:51 2:21 1:54	(4.0) 80%	(1.3) 26%	RUN-7				71.1ft: few fine grained sand, few vugs
-67.1	76.1									
		5.0	1:50 0:24 0:06 0:32 1:37	(2.5) 50%	(0.9) 18%	RUN-8				76.1ft: moderately hard to hard, moderately indurated to indurated, trace vugs 77.0 to 99.0ft: interbedded sand layers
-72.1	81.1									
		5.0	0:53 0:50 0:23 0:22 0:05	(0.9) 18%	(0.0) 0%	RUN-9				81.0ft: hard, indurated, some sand
-77.1	86.1									
			N=0			*814-13*				86.1ft: Switch sampling method to SPT
-78.6	87.6	3.5	WOR/0.5 0:11 0:27 1:02	(1.0) 29%	(0.0) 0%	RUN-10				86.1ft: interbedded sand, very loose, fine grained sand, wet, strong HCl reaction 87.6ft: Switch sampling method to coring 87.6 to 88.1ft: rod drop 88.1ft: moderately hard, moderately indurated
-82.1	91.1									
		5.0	0:02 0:09 0:06 0:15 1:25	(1.0) 20%	(0.0) 0%	RUN-11				
-87.1	96.1									-87.1 96.1
										Coring Terminated at Elevation -87.1

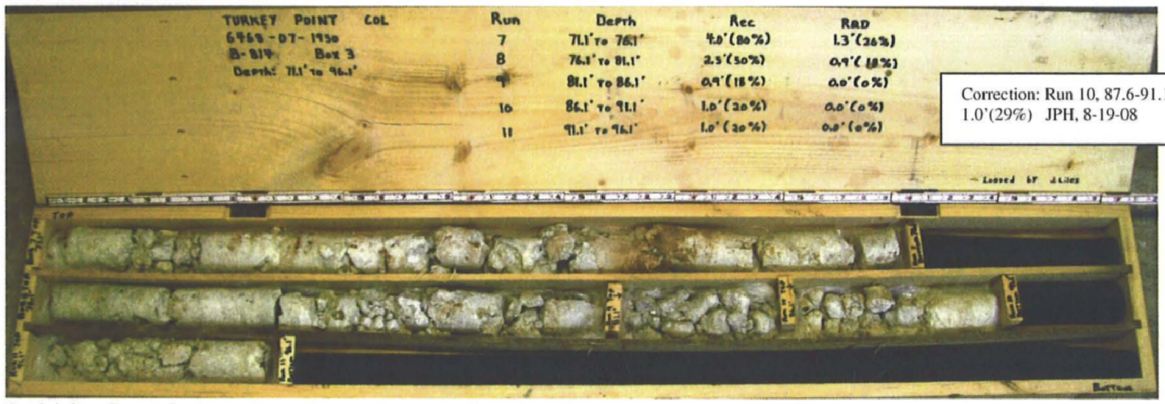
TURKEY POINT COL CORE TURKEY POINT.GPJ TURKEY POINT COL.GDT 5/30/08



B-814 – Box 1



B-814 – Box 2



Correction: Run 10, 87.6-91.1', REC 1.0'(29%) JPH, 8-19-08

B-814 – Box 3

Back Hoe Test Pit Logs

MACTEC

GEOTECHNICAL BORING LOG

Prepared By: JPT Date: 5-30-08

Checked By: WM Date: 5-30-08

SHEET 1 OF 1

BECHTEL PROJECT NO.: 25409	MACTEC PROJECT NO.: 6468-07-1950	COUNTY: Miami-Dade	GEOLOGIST: S. Woodham
SITE DESCRIPTION: Turkey Point COL	DRILL MACHINE: Deere 310G	DRILLER: Dan Rhodes	GROUND WATER (ft)
BORING NO.: TP-601	DRILL METHOD: Backhoe	SAMPLE METHODS: Bulk	0 HR. 0.5
GROUND ELEV.: -1.4 ft (NAVD88)	NORTHING: 397,106 US ft (NAD83/90)	EASTING: 876,036 US ft (NAD83/90)	24 HR. NA
TOTAL DEPTH: 5.2 ft	BORING DIAMETER: NA	CASING DEPTH: NA	HAMMER (ID):NA
DATE STARTED: 5/1/08	COMPLETED: 5/1/08	CORE SIZE: NA	BITS USED: Backhoe bucket with steel rock teeth

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-1.4					Ground Surface				-1.4 0.0
					SEE LEGEND FOR ROCK HARDNESS CRITERIA BASED ON SPT DATA		▽		MUCK, some to mostly organics, clayey, organics increase with depth Not Sampled
-4.6	3.2					TP-601-1			-4.6 3.2 LIMESTONE, boundstone, white (10YR8/1), very soft to moderately hard, friable to moderately indurated, wet, oolitic, strong HCL reaction (Miami Formation) Samples Collected: Ten (10) 5-gallon buckets (TP-601-1, Buckets 1 to 10)
									-6.6 5.2 Boring Terminated at Elevation -6.6 ft

TURKEY POINT COL BORE TURKEY POINT.GPJ TURKEY POINT COL.GDT 5/30/08

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GEOTECHNICAL BORING LOG

Prepared By [illegible] Date 5-30-08

Checked By [illegible] Date 5-30-08

SHEET 1 OF 1

BECHTEL PROJECT NO.: 25409	MACTEC PROJECT NO.: 6468-07-1950	COUNTY: Miami-Dade	GEOLOGIST: S. Woodham
SITE DESCRIPTION: Turkey Point COL	DRILL MACHINE: Deere 310G	DRILLER: Dan Rhodes	GROUND WATER (ft)
BORING NO.: TP-701	DRILL METHOD: Backhoe	SAMPLE METHODS: Bulk	0 HR. 0.0
GROUND ELEV.: -1.4 ft (NAVD88)	NORTHING: 396,988 US ft (NAD83/90)	EASTING: 875,509 US ft (NAD83/90)	24 HR. NA
TOTAL DEPTH: 5.0 ft	BORING DIAMETER: NA	CASING DEPTH: NA	HAMMER (ID):NA
DATE STARTED: 5/1/08	COMPLETED: 5/1/08	CORE SIZE: NA	BITS USED: Backhoe bucket with steel rock teeth

ELEV. (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 20 40 60 80 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
-1.4					Ground Surface		▽		-1.4 0.0
-1.4	0.0					TP-701-3			MUCK, some to mostly organics, clayey, organics increase with depth Samples Collected: Two (2) 5-gallon buckets (TP-701-2, bucket 12; TP-701-3, bucket 11)
-2.9	1.5				SEE LEGEND FOR ROCK HARDNESS CRITERIA BASED ON SPT DATA	TP-701-2			
-4.4	3.0					TP-701-1			-4.4 3.0 LIMESTONE, boundstone, white (10YR8/1), very soft to moderately hard, friable to moderately indurated, wet, oolitic, some coarse sand, strong HCl reaction (Miami Formation) Samples Collected: Ten (10) 5-gallon buckets (TP-701-1, buckets 1 to 10)
									-6.4 5.0 Boring Terminated at Elevation -6.4 ft

TURKEY POINT COL BORE TURKEY POINT.GPJ TURKEY POINT COL.GDT 5/30/08

SPT Energy Measurement Reports

MACTEC

engineering and constructing a better tomorrow

August 15, 2008

Memorandum to File
From: Steve Kiser SK 8-15-08
Reviewed By: Tom McDaniel TJM 8/19/08

Subject: **Report of SPT Energy – MACTEC Raleigh CME 55LC**
Hammer Serial No. MEC-02 Automatic Hammer
WORK INSTRUCTION TUR-055
Turkey Point COL Project
Dade County, Florida
MACTEC Project No. 6468-07-1950

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

SPT Energy Field Measurements

SPT energy measurements were made on March 25, 2008, during drilling of Borings B-615 at the referenced site. The testing was performed by Jay Cerceo from approximately 4:30 PM on March 25 to 9:10 AM on March 26 under clear skies and a temperature of about 70 degrees Fahrenheit. The boring was drilled with personnel and equipment from MACTEC. The drilling equipment consisted of a CME 55LC model 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 borings below the depth at which groundwater was encountered at the time of energy testing. The drill rig operator during sampling was Mr. Robert Banks. Energy measurements were recorded during sampling at the depth intervals shown in Table 1.

The energy measurements were performed with a Pile Driving Analyzer (PDA) model PAX (Serial No. 3622L), and calibrated accelerometers (Serial Nos. K1050 and P5992) and strain gages (Serial Nos. AW #75/1 and AW#75/2). A steel drill rod, 2 feet long and instrumented with dedicated strain gages, was inserted at the top of the drill rod string immediately below the SPT hammer. The inserted rod was also instrumented with two piezoresistive accelerometers that were bolted to the outside of the rod. The instrumented rod insert had a cross-sectional area of approximately 1.19 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 TUR054.

13 Pages Total

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 accclerometers) 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 286 foot-pounds to 303 foot-pounds. These average energy transfers correspond to energy transfer ratios (ETR) of 82% to 87% of the theoretical energy (350 foot-pounds) of the SPT hammer.

- The average at each depth interval was calculated as the transferred energy for each analyzed blow of the depth intervals divided by the total number of hammer blows analyzed. The overall average energy transfer of the SPT system (for all the depth intervals tested) was 292.8 foot-pounds, with an average ETR of 83.7%.

Attachments: Page 4 Table 1 - Summary of SPT Energy Measurements – 1 Page
Page 5 Work Instruction – DCN TUR-055 – 1 Page
Pages 6 Record of SPT Energy Measurement – 1 Page
Pages 7 - 13 PDIPLOT Output - 7 Pages

TABLE 1
SUMMARY OF SPT ENERGY MEASUREMENTS (ASTM D4633-05)
Turkey Point COL Project
Dade County, Florida
MACTEC Project No. 6468-07-1950

Hammer 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)
MEC-02 (CME 55LC)	MACTEC Raleigh	Robert Banks	B-615	AW-J	3/25/2008	117.3 - 118.8	27 - 22 - 31	82	287	82.0%
						127.0 - 128.5	4 - 8 - 8	19	286	81.7%
						139.1 - 140.6	27 - 24 - 16	59	303	86.6%
								Average for Rig:	**292.8**	**83.7%**

[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: 8-15-08	Checked By:	Date: 8/19/08

Work Instruction No. 9
Turkey Point COL Project
MACTEC Engineering and Consulting, Inc.
MACTEC Project 6468-07-1950

Issued To: Steve Kiser and Jay Cerceo **Rev. No.** 1

Issued By: Tom McDaniel **Date:** 3-24-08

Valid From: 3-24-08 **To:** 4-30-08

Task Description: Perform SPT Energy Measurements

Applicable Technical Procedures or Plans, or other reference: Geotechnical Work Plan (current revision; available at Site Office), Bechtel Specification 25409-102-3PS-CY00-00001, Rev. 000 or later revision, section 4.3, ASTM D 4633-05 (copy attached.).

Specific Instructions (note attachments where necessary): Perform energy measurements for each drill rig on site in accordance with ASTM D-4633-05. Consult with Site Coordinator as to schedule for rigs that may be planned for use that are not yet present. Hammer weights have been checked by site personnel, and records will be available on site. All rigs are using automatic hammer systems. Confirm that automatic hammer system is being operated within manufacturer's recommendations or in a typical operating fashion as observed from watching one or two SPT measurements prior to measuring energy. Be sure to check each drill rig using all hammer/rod combinations that it will be using. Depths for measurements should be coordinated with the Site Coordinator, and can be directed by Becthel in accordance with the specification. Site profile consists of very soft soils to about 5 feet followed by high-N-value soft rock to about 20 feet where coring begins. Sands are present below about 100 to 125 feet. Energy measurements should be made in the deeper sand zone as often as can be done, consistent with the drilling depths at the time of the measurements. See Site Coordinator for current boring logs of holes drilled and use these to plan most effective field measurement program.

Submit copies of calibration records for equipment to Project Principal for review prior to beginning work on site.

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

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

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

Hold Points or Witness Points: None

Records: All records generated shall be considered QA Records.

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

Project Manager: _____ Date: _____

Project Principal Engineer: _____ Date: 3/24/08

Site Manager/Coordinator: _____ Date: _____

Pages: 1 plus attachment **DCN:** TUR-055

Attachments: ASTM D 4633-05

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:	Turkey Point COL Project	MAKE:	CME
LOCATION:	Florida City, Florida	MODEL:	55LC
PROJECT NO.:	6468-07-1950	SERIAL NO.:	331145
DATE:	3-25-2008	HAMMER TYPE:	Automatic
WEATHER:	clear 70's windy	ROPE CONDITION:	N/A
INSPECTOR: ~~HBC 3/25/08~~	~~Steve Kiser~~ Jay Cerceo	ROD SIZE:	AWJ
DRILLING COMPANY:	MACTEC	NO. OF SHEAVES:	N/A

BORING DATA

BORING NUMBER:	B-615		
DEPTH DRILLED:	117.3 ft		
TIME DRIVEN:	5:40 pm		
RIG OPERATOR:	B. Banks		
HAMMER OPERATOR:	J. Rosser		
PDA PAK SERIAL NO.:	3622L	3622L	3622L
INSTR. ROD AREA:	1.19 in^2		
ACCEL. SERIAL NOS.:	K1050 & P5992		
STRAIN SERIAL NOS.:	75AW-1 & 75AW-2		

Date	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)
	~~LE~~ HBC 3/25/08											
3/25/08	117.3-118.8	53	124									
3/26/08	127-128.5	16	134									
	137.1-140.6	40	144									

REMARKS: ETR dropped from ~75-85% to 60% during sampling from 117.3-118.8' - tightened accelerometer bolts.