

**QUALITY CONTROL AND QUALITY ASSURANCE REVIEW
FORT CALHOUN NUCLEAR FACILITY
GEOTECHNICAL INVESTIGATION AND TESTING PROGRAM**

Following is Report No. 1 for my Quality Assurance Reviews performed during the week of September 12 to September 16, 2011. This report also includes results of calibration of field and laboratory equipment furnished by the geotechnical contractor, Thiele Geotech, Inc., Omaha, NE.

Subsequent reports will follow on the completion of additional testing and drilling.

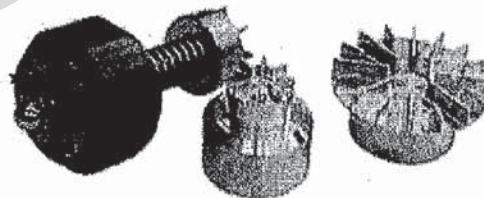
LIST OF APPENDICES

Appendix I	SPT Calibration Records	67 sheets
Appendix II	CPT Calibration Records	2 sheets
Appendix III	Laboratory Calibration Records and Accreditations	10 sheets
Appendix IV	Logs of SPT Borings	21 sheets
Appendix V	Logs of CPT Borings	10 sheets

Findings for this report are as follows:

1. I made a visit to Thiele Geotech, the contractors engaged to perform geotechnical borings, obtain samples, and perform assigned laboratory tests on the samples. I obtained calibration records for the SPT hammer(s) used in performing those tests, calibration records for the cone penetration apparatus, and calibration records for all the laboratory equipment. Calibration records are provided in Appendix III to this report.
2. I was given a tour of the the laboratory where the tests will be performed and I obtained the various certifications the laboratory has achieved, such as the AMLR certification. Thiele also furnished records of technician training. These records are also provided in Appendix III.
3. During the week of September 12-16, 2011, I was present at the site during various investigations including SPT tests, Shelby tube sampling, and CPT testing. I also observed the installation of two groundwater monitoring wells. Following paragraphs provide additional detailed observations. I have previously prepared ITR signoff forms for each major activity that I will complete, and request other observers to complete certifying compliance with standard procedures.

4. I observed several 40-foot deep and 80-foot deep "Geotech Borings" being implemented by the Thiele drilling crew. The holes were advanced with a hollow stem auger to the completed depths. Periodically, Shelby tube samples or SPT samples were obtained, generally at 5-foot intervals, separated by augered hole advance. The selection of the sampling method was at the judgment of the driller, based on the cohesiveness of the sample and the auger performance during drilling. Soils that could be sampled with a Shelby tube were cohesive enough to remain in the tube when it was extracted from the ground. When low plasticity sands or silts were encountered, the method was switched to SPT testing and sampling.
5. The overall quality of the drilling methods and the care taken with all the procedures were commendable. Extreme care was taken to withdraw the SPT sampler so as to prevent loosening of sands at the bottom of the hole. An appropriate weight drilling mud was introduced into the hollow stem auger to prevent loosening of the foundation caused by withdrawal of the sampler.
6. It is my opinion that the SPT data obtained was of good quality because of the care taken with performing the tests and the calibration of the equipment prior to testing.
7. Because the scope of the contract did not include continuous sampling and testing, but only periodic testing at 5-foot intervals, there is not a continuous record of each hole. Logging of the holes was based entirely on observations of the Shelby and SPT samples because the hole was advanced using an auger hole between sampling intervals. The level of detail of the logging was minimal because of the speed of completion of the hole and the fact that the scope of the contract did not include a provision for a person responsible for logging.
8. Partly as a result of the minimal logging done, I recommend every sample of the cohesive soils obtained with the Shelby tube be tested for dry unit weight, water content, and Atterberg limit to allow computation of liquidity indices. This value will provide good indications of saturated consistency. I also recommend measuring the water content of every SPT sample obtained.
9. During the investigation, I recommended switching from the use of a pocket penetrometer to a torvane device for logging of cohesive soils. In my opinion, a torvane device is far more useful than the pocket penetrometer that is commonly used.



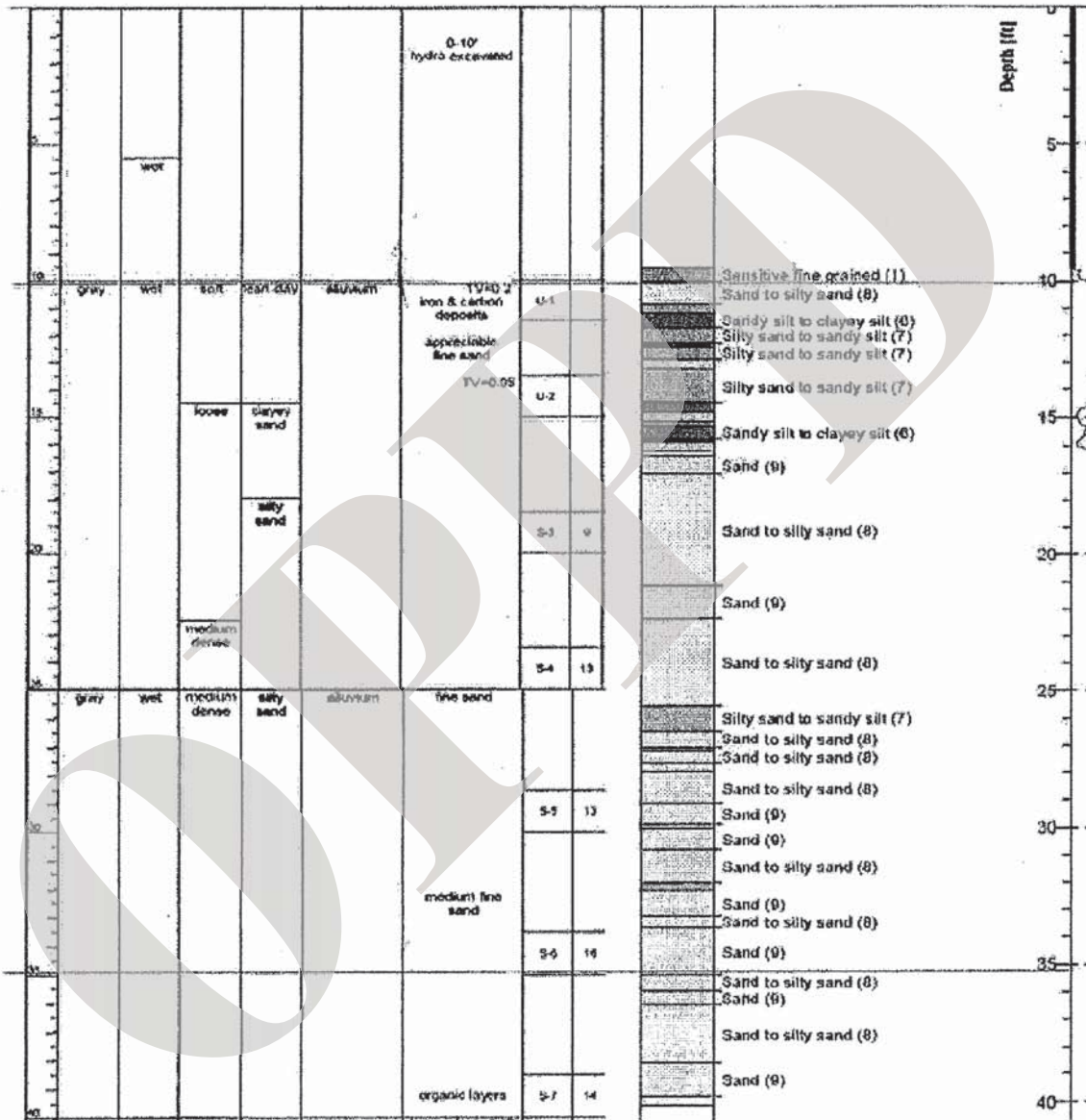
10. I observed the installation of several groundwater monitoring wells in addition to the "Geotech Borings. The methods observed appeared satisfactory, but more than expected amounts of sand were required to backfill the hole. It seems likely that some caving of the hole occurred regardless of the care taken by the drill crew. The methods required to investigate for utilities included a vacuum jetting process that removed a significant amount of soil from the upper 10 feet. It appears likely that some caving of the holes occurred, but because a high quality sand was used to backfill around the screened portion of the hole, and a good bentonite seal was installed above the screened interval, the readings obtained should be reliable.
11. I also observed several CPT holes during the week. The CPT equipment appeared to be of good quality and I reviewed the calibration of the device prior to starting the testing. Unfortunately, the device malfunctioned at the beginning of the testing because the wire spool that tracks the depth had jumped off track. When reviewing the records of the CPT tests, the record of depths was obviously in error in the initial hole. Recognizing the problem, Thiele performed a corrected test at the CPT location 2. Thiele is commended for this diligence in recognizing the problem early and proceeding to correct it to obtain quality data.
12. A couple of CPT holes had to be terminated before the full planned depth because of high penetration resistance of some more dense sand horizons. Because the CPT equipment could not be anchored as normally done with screw anchors, limited push capacity, limited to the weight of the drill rig, was available. At the judgment of the driller, several holes were aborted.
13. The SPT data and the CPT data correlated well. For example, refer to the following page for an illustration. The example shows B-2 overlain with CPT-1, which are immediately next to one another.
14. I coordinated with Pat Poepfel on assigning laboratory testing of the SPT and Shelby tube samples obtained during the investigation. More than a normal amount of testing was recommended because the contract's scope did not include a requirement for highly detailed logging of the test holes. Additional samples will be obtained in subsequent additional "Geotech Borings" and during installation of the inclinometers and a similar detail of testing is recommended for those samples.

Prepared by:



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SPT Hole B-2 and CPT Hole C-1



QA/QC Report 1 - Geotechnical Investigation - Fort Calhoun Nuclear Facility
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