MACTEC

engineering and constructing a better tomorrow

December 21, 2009

Mr. Richard Baker
Project Manager
Bechtel Power Corporation
5275 Westview Drive
Frederick, MD 21703-8306

Subject: **Final Data Report Transmittal, Revision 0**
Geotechnical Exploration and Testing, Supplement 2
Dominion Power
North Anna 3 Project
Mineral, Louisa County, Virginia
MACTEC Project No. 6468-09-2473

Dear Mr. Baker:

MACTEC Engineering and Consulting, Inc., is pleased to submit this Final Data Report Revision 0, for Geotechnical Exploration and Laboratory Testing, Supplement 2, associated with the North Anna 3 Project located in Louisa County, Virginia.

Please do not hesitate to contact us if you have any questions or if we may be of further service.

Sincerely,

MACTEC Engineering and Consulting, Inc.

Stephen J. Criscenzo
Project Manager

D. Steven Copley
D. Steven Copley, PE
Project Principal Engineer
Virginia Registration No. 019387

COMMONWEALTH OF VIRGINIA
D. STEVEN COPLEY
No. 019387
12-21-2009
PROFESSIONAL ENGINEER

MACTEC Engineering and Consulting, Inc. NC License F-0653
3301 Atlantic Avenue • Raleigh, NC 27604 • Phone: 919.876.0416 • Fax: 919.831.8136
www.mactec.com

COVER SHEET

FINAL DATA REPORT
Revision 0

GEOTECHNICAL EXPLORATION AND TESTING
SUPPLEMENT 2
DOMINION POWER
NORTH ANNA NUCLEAR POWER STATION
NORTH ANNA 3 PROJECT
MINERAL, LOUISA COUNTY, VIRGINIA

December 16, 2009

Prepared By:

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

MACTEC PROJECT No. 6468-09-2473

Prepared For:

Bechtel Power Corporation
Subcontract No. 25161-500-HC4-CY00-00001

FINAL DATA REPORT
Revision 0

GEOTECHNICAL EXPLORATION AND TESTING SUPPLEMENT 2 DOMINION POWER NORTH ANNA NUCLEAR POWER STATION NORTH ANNA 3 PROJECT MINERAL, LOUISA COUNTY, VIRGINIA

December 16, 2009

VOLUME 1

Prepared By:

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

MACTEC PROJECT No. 6468-09-2473

Prepared For:

Bechtel Power Corporation
Subcontract No. 25161-500-HC4-CY00-00001

CONTENTS:

FINAL DATA REPORT Rev 0
NORTH ANNA 3 PROJECT, SUPPLEMENT 2
TABLE OF CONTENTS

DRAFT DATA REPORT Rev DRAFT
NORTH ANNA 3 PROJECT, SUPPLEMENT 2
TABLE OF CONTENTS (CONTINUED)

Tables

Figure

Appendix

SECTION 1
OVERVIEW

1.1 Introduction

In 2006, MACTEC Engineering and Consulting, Inc. (MACTEC) was retained by Dominion Nuclear North Anna, LLC (Dominion) to obtain information on subsurface materials and conditions for use in the preparation of the Combined Operating License (COL) Application for North Anna Unit 3. The results from this previous investigation work scope were included in a report titled: Data Report - Geotechnical Exploration and Testing, Revision 0, dated January 23, 2007 (referenced as 2007 Data Report). In 2009, MACTEC was retained by Bechtel Power Corporation (Bechtel) to obtain supplemental information on subsurface materials and conditions for use in the preparation of a potential COL Application for North Anna Unit 3. The COL Application, to be prepared by others, will be submitted to the U.S. Nuclear Regulatory Commission (NRC) for approval to locate a future nuclear electric power generation facility at the existing North Anna Power Station.

This report provides results for activities associated with the authorized scope of work designated by Bechtel as: Subsurface Investigation and Laboratory Testing (Nuclear Safety Related), executed on August 23, 2009.

A site location map for this phase of the project is included as Figure 1.

MACTEC executed its services in accordance with Bechtel Subcontract Number 25161-500-HC4-CY00-00001. The field work covered by this supplemental report commenced on September 1, 2009 and was completed on October 2, 2009. The Scope of Work was defined in Exhibit D of MACTEC Subcontract with Bechtel, and is briefly described below:

- Preparing and submitting a Quality Assurance Project Document, Health and Safety Plan, and detailed Work Plan;
- Obtain permits necessary for performing the work;
- Furnishing all the supervision, labor, equipment, tools, supplies, and materials necessary to perform the specified work at the locations specified by Bechtel;
- Providing geotechnical engineers and/or geologists in the field under the direction of qualified geotechnical engineers and/or geologists with the experience in geotechnical investigations to oversee and log the investigation work;
- Providing a site manager responsible for oversight of all required field activities;
- Providing Quality Assurance (QA) observation of the field and laboratory work activities and submitting QA records;
- Locating work items by survey methods;
- Providing water to work areas for drilling and testing;
- Performing Standard Penetration Tests (SPT) and obtaining samples using a split-barrel sampler;
- Performing SPT energy measurements;
- Obtaining rock cores using “H” and “N” size rotary coring methods;
- Collecting, labeling and transporting soil samples and rock cores to a designated sample storage area;
- Transporting designated samples to appropriate laboratories for testing purposes;
- Backfilling drilled holes with cement/bentonite grout using the tremie method;

- Performing down-hole geophysical logging;
- Performing down-hole acoustic televiewer logging;
- Performing Suspension P-S logging;
- Restoring the work areas;
- Performing laboratory testing on soil and rock samples;
- Preparing Draft and Final Data Reports containing the data generated by the subsurface investigation and laboratory testing activities;
- Performing all work under MACTEC's approved Health and Safety Program.

Sampling and testing related to the geotechnical exploration are considered to be tasks that could affect design, construction or operation of safety-related systems, structures and components. This work was performed under a Quality Assurance program that meets the requirements of 10 CFR Part 50 Appendix B and 10 CFR 21(Reporting of Defects and Noncompliance).

1.2 Personnel

MACTEC completed field work for this project under the direction of Bechtel's Site Coordinator, Mr. Thomas Cameron and Dominion's Site Coordinator, Mr. Raj Harnal. Dominion NSS personnel provided utility clearance at boring locations and other site support. Technical support was provided Mr. John Davie (Bechtel) and Mr. Sammy Jabbour (Bechtel). Primary MACTEC personnel and their responsibilities were as follows:

Stephen J. Criscenzo	Project Manager
Scott Auger	Project Coordinator
D. Steven Copley, P.E.	Principal Professional
J. Allan Tice, P.E.	Principal Professional
J. Shane Johnson	Site Manager, Report Preparation
Michael P. Lear	Lead Geologist, Site Safety, Report Preparation
Rodney Clark	Rig Geologist
Kristen Lloyd	Rig Geologist
Chris Baldwin	Rig Geologist
Bill Mabie	Rig Geologist
Adam Mwembeshi	Rig Geologist
Floyd Cox	Drilling Coordinator
R. Keith Pendley	Drilling Coordinator
Mitch Conner	Laboratory Services Manager (MACTEC Raleigh Lab)
Mike Hamlett	Laboratory Services Manager (MACTEC Charlotte Lab)
John Martin	Quality Assurance Representative

The organizations that conducted on-site work or laboratory testing of samples as part of this effort are listed in Table 1.

1.3 Organization of Report

This report and its appendices are organized in the following sequence: the transmittal letter; table of contents, which includes lists of tables and figures; text; tables; and figures. The data are in Appendices and are as follows:

Appendix A – Survey Data

Appendix B – Geotechnical Field Data
- Boring Logs
- SPT Energy Measurement Reports

Appendix C – Geophysical Test Data

Appendix D – Laboratory Test Data
- Soil Index Test Data
- Strength Test Data (Rock)

1.4 Quality Assurance

Quality-related activities conducted by MACTEC and its subcontractors during the work presented in this report were in accordance with the MACTEC Quality Assurance Manual and the MACTEC Quality Assurance Project Document. The MACTEC QA program complies with NQA-1-1994, including Subpart 2.20, and the requirements of 10 CFR 50 Appendix B.

SECTION 2
TEST METHODS

2.1 Surveying

The surveying for the project was conducted in two phases by MACTEC's contract surveyor, McKim & Creed of Raleigh, North Carolina. The initial phase was to stake preliminary test locations based on initial coordinates provided on the Bechtel Boring Plan (Drawing No. 500-CY-0010-00001), Rev 0. Boring locations were staked using RTK-GPS when possible. When tree canopy or other obstructions occurred, coordinate traverse points were established using RTK-GPS. Conventional survey was then used to stake planned boring locations from the established traverse points. Wood stakes tied with flagging were used to mark the surveyed locations. After completing an initial assessment of test locations and potential utility and access conflicts, some borings were relocated with concurrence of Bechtel and Dominion personnel.

The second phase of surveying was conducted after completion of the field testing. The surveyor (McKim & Creed) returned to the site and determined locations and elevations of the actual exploration points. The RTK-GPS and conventional survey using a Trimble 5603 DR200+ total station was used to locate the as-drilled boring locations from the traverse points established during the initial phase.

The final survey was performed by Dennis Batzel and Nick Thames and reviewed by William J. Egan, Jr., Land Surveyor, Virginia License No. 002548 of the Raleigh Office of McKim & Creed, P.A. The survey was performed using a Trimble 5700 L1/L2 Real Time Kinematic (RTK) GPS system and Trimble 5603 DR200+ total station. Data was collected and reviewed in Trimble Survey Controller (GPS) and TDS Ranger (total station) data collectors analyzed using Trimble Geomatics Office and Autodesk Land Desktop software. Field notes of occupations and differential leveling were kept as a backup of the data collectors. The equipment was tested prior to and following the survey to ensure the equipment was functioning within the required parameters.

The origin for the as-drilled survey was Control Monument No. 7, a brass disk embedded in concrete. The horizontal positions and vertical values for this point were determined from the submission of 10.5 hours of static GPS observation data to the National Geodetic Survey's (NGS) Online Positioning User Service (OPUS). The static data was collected using the GPS RTK base receiver operating on Control Monument No. 7 from 29 to 30 November 2006. After the OPUS solutions were converted to US Feet (1 meter = 39.37 inches), the position and vertical values for both days were averaged to determine the horizontal position of Control Monument No. 7 within the Virginia State Plane Coordinate System (VSPCS), South Zone, NAD 83 (CORS 96) (EPOCH 2002) and its orthometric height (elevation) relative to NAVD 88 (GEOID 83).

The as-drilled survey locations were provided to Bechtel for their use in creating an as-built drawing of the exploration. The as-built survey locations were also used as input to final boring logs and other tables reporting locations. A complete copy of the surveyor's report can be found in Appendix A. This report includes as-drilled survey data for the Supplement 2 boring locations.

2.2 Utility Location

Representatives of MACTEC used preliminary survey locations and physical features to mark the locations planned for borings. These preliminary locations were provided to Dominion personnel for utility clearance.

Dominion's process for location of underground utilities included notifying Virginia Miss Utility at least 48 hours prior to drilling. After the required 48 hours, Dominion personnel conducted a scan for underground utilities in the vicinity of the staked boring location. Dominion personnel used electromagnetic and ground-penetrating radar methods to check the planned exploration locations for the presence of underground utilities. The planned locations were adjusted as required by Dominion to provide the necessary utility clearances.

After Dominion's scan for utilities was complete, "soft dig" techniques were utilized to assure that there were no utilities present in the top eight feet. Dominion personnel used an air driven probe and a vacuum truck to extend a hole a nominal depth of eight feet below (or to refusal if it occurred above eight feet) existing grades. After completion of the "soft dig" excavation, Dominion personnel signed off utility clearance. The "soft dig" excavation was backfilled with soil cuttings and marked with a wood stake. This method precluded soil sampling to the depth of the "soft dig" hole.

2.3 Drilling Equipment/Methods

MACTEC utilized the following drilling equipment to complete the specified work:

Rig Serial Number	Hammer Serial Number	Owner	Drill Rig	Carrier Type	Driller	Auto Hammer	Rock Core Sizes
269354	MEC-12	MACTEC	CME-45c Track (RAL)	Track	D. Rhodes	Y	NQ
163745	MEC-21	MACTEC	CME-55 Track (RAL)	Track	T. Hahn / F. Cox	Y	HQ
337153	MEC-05	MACTEC	CME-550x (ATL)	ATV	R. Landeros	Y	NQ
331145	MEC-02	MACTEC	CME-55LC Track (RAL)	Track	D. White	Y	HQ
72425	MEC-425	MACTEC	CME-55 Trailer Rig (RAL)	Trailer	P. Pitts	Y	NQ

Table 2.1 summarizes information about the borings. Borings were advanced in soil using rotary wash-drilling techniques until encountering SPT refusal (defined as the physical inability to advance the hole using wash-drilling techniques or 50 blows for one inch or less of penetration, whichever occurred first). Bits used to advance borings to SPT refusal were 2-7/8" or 3-7/8" diameter tricone roller bits with a side discharge. Soil samples from the geotechnical borings were obtained at 2.5-foot and 5-foot intervals as described in Section 2.5. Once SPT refusal was encountered, a steel casing was set, and the holes were advanced using wire-line rock coring equipment and procedures described in ASTM D 2113-08. Rock coring was accomplished utilizing either "HQ" or "NQ" sized core barrels with a split triple tube. Four-inch-diameter casing was used to stabilize the upper portions of the "HQ" sized borings as necessary. Three-inch-diameter casing was used to stabilize the upper portion of the "NQ" sized borings as

necessary. The water introduced into the borehole during drilling and coring was obtained from Lake Anna.

Specific equipment used at each borehole is included on the boring logs included in Appendix B.1

The boreholes were backfilled with a cement-bentonite grout prior to demobilizing from the site. As required in Technical Scope of Work Section 3.13, the grout was placed by pumping through a tremie pipe inserted to the bottom of the borehole. The drillers used the grout mixture specified in Technical Scope of Work Section 3.13 (8 gallons of water and 2.5 pounds of bentonite per 94-pound sack of cement). A stake or other marker was placed at each completed boring location for later survey use. The as-drilled horizontal coordinates and elevations for each boring are included on Table 2.1, in Appendix A and on the boring logs in Appendix B.1.

2.4 SPT Energy Measurements

The drill rigs utilized on this project used automatic hammers for performing SPT testing. SPT energy measurements were conducted for each of the drill rigs performing SPT soil sampling. Energy measurements were recorded during SPT sampling at the depth intervals shown in Appendix B.2. The length of the drill rod string, including the instrumented drill rod insert for each sample, was generally four feet longer than the depth of the sample being collected.

The energy measurements were performed with a Pile Driving Analyzer (PDA) Model PAK and calibrated accelerometers and strain gauges. A section of drill rod, two feet long and of the same diameter as the drill rod used to advance the boring and instrumented with dedicated strain gauges, was inserted at the top of the drill rod string immediately below the SPT automatic hammer. The inserted rod was also instrumented with two piezoresistive accelerometers that were bolted to the outside of the rod.

The work was conducted 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 were interpreted by the PDA according to the Case Method equation. The EFV method of energy calculation is recommended in ASTM D 4633-05. The maximum energy transmitted to the drill rod string (as measured at the location of the strain gauges and accelerometers) was calculated by the PDA using the following EFV method equation:

$$EFV = \int F(t) * V(t) * dt$$

Where: EFV = Transferred energy (EFV equation), or Energy of FV
F(t) = Calculated force at time t
V(t) = Calculated velocity at time t
dt = time differential (integral taken with respect to time)

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 were tabulated and averaged to obtain the average measured energy at each depth tested. The ratio of the average measured energy to the theoretical potential energy of the SPT system (140 lb. weight with the specified 30-inch fall) is the energy transfer ratio (ETR).

The average ETR measured for each rig ranged from 81.0% to 87.4% of the theoretical potential energy. These ETR values are within the range of typical values for automatic hammers. The ETR values (as a percent of the theoretical value) are shown in Appendix B.2.

2.5 Sampling in Geotechnical Borings

2.5.1 Standard Penetration Test Sampling

SPT sampling in the geotechnical borings was generally conducted on 2.5-foot centers from the ground surface to a depth of 15 feet. The SPT sampling interval below 15 feet was 5 feet to the depth of boring termination or to SPT refusal. No sampling was done in the zone where the "soft dig" utility clearance method, as described in Section 2.2, was performed. The sampling equipment and methods are described in ASTM D 1586-08a. Automatic hammers were used to perform the SPT tests. The split-barrel sampler was typically driven 18 inches in soil with blows recorded for each six-inch interval of penetration. The weight of the hammers used at the site ranged from 138.6 to 139.5 pounds, meeting ASTM requirements. In very hard soils or weathered rock, driving was terminated after 50 blows and the actual penetration was recorded, (e.g., 50 blows/0.3 feet). At selected locations where low penetration was encountered, the sampler was over-driven to collect additional sample.

The split-barrel sampler was opened at the drill site and the recovered materials were visually described, classified, and photographed by MACTEC's rig geologist or engineer. A selected portion of the sample was placed in a glass sample jar with a moisture-proof lid. Sample jars were labeled, placed in cardboard boxes, and transported to the on-site secure sample storage facility at the end of each work day.

2.5.2 Rock Core Sampling

The Technical Scope of Work defined SPT refusal as 50 blows for 6 inches or less of penetration. For purposes of determining the depth at which to begin rock coring procedures, refusal to soil drilling was defined as physical inability to advance the hole using wash drilling procedures. In practice, the sampler was typically struck with 50 blows and the actual penetration measured and recorded on the boring logs. Rock coring was completed in accordance with ASTM D 2113-08.

Rock recovered by the coring process was carefully removed from the inner barrel and placed in wooden core boxes with wooden blocks used to mark ends of runs. When core recovery was less than 100%, the rig geologist placed foam, PVC, or wood spacers in the core box to stabilize the core laterally. Filled core boxes were taken to the on-site secure sample storage facility. Photographs of the cores were taken in the field.

The rig geologist visually described the core and noted the presence of joints and factures, distinguishing mechanical breaks from natural breaks where possible. The rig geologist also calculated percent recovery and Rock Quality Designation (RQD) prior to moving the core from the drill site. Field boring logs and photographs were used to document the drilling operations and recovered materials, and are retained in the MACTEC Document Control Center (DCC).

2.5.3 Intact Soil Sampling

No intact soil samples were obtained during the specified scope of work.

2.6 Boring Logs

The soil descriptions on the boring logs in Appendix B.1 are based on the field descriptions (ASTM D 2488-09a) by the rig geologist or engineer modified according to ASTM 2487-06e1 where lab tests results are available. The rock core descriptions on the boring logs in Appendix B.1 are based on the rig geologist's or rig engineer's description. In addition to classification and logging of the bedrock lithology, rock discontinuities were described and logged, and the Rock Quality Designation (RQD) was measured and recorded for each core run according to ASTM D 6032-08. The water depths on the boring logs are from observations during drilling. Because water was introduced during rotary and core drilling, the water depths on the boring logs may not represent the stabilized water depths. The boring logs in Appendix B.1 were prepared using Version 8 of the computer program "gINT".

2.7 Sampling in Geotechnical Test Pits

No test pits were completed during the specified scope of work.

2.8 Cone Penetrometer Testing

No cone penetrometer testing was completed during the specified scope of work.

2.9 Field Electrical Resistivity Testing

No field resistivity testing was completed during the specified scope of work.

2.10 Geophysical Down-hole Testing

Down-hole geophysical and televiewer logging was performed in two borings (M-10 (DH) and M-30 (DH)) as indicated on the Bechtel Boring Location Plan (Drawing No. 500-CY-0010-00001, Rev 0). P-S suspension logging was conducted in the same boreholes. GEOVision, a MACTEC subcontractor, conducted the down-hole geophysical logging in accordance with ASTM D 5753-05. The results are found in the report from GEOVision contained in Appendix C.1. The GEOVision report consists of two volumes – a text and graphical volume presented in Appendix C.1, and an electronic set of data and charts presented only on DVD and not included in paper copies of this Geotechnical Data Report. The down-hole geophysical logs performed in the selected borings are described below.

2.10.1 Natural Gamma

Gamma logs record the amount of natural gamma radiation emitted by the soil and rocks surrounding the boring.

2.10.2 Long and Short Normal Resistivity

Normal-resistivity logs record the electrical resistivity of the borehole environment and surrounding soil, rocks and water as measured by variably spaced potential electrodes on the logging probe. Typical spacing for potential electrodes is 16 inches for short-normal resistivity and 64 inches for long normal resistivity. Normal resistivity logs are affected by bed thickness, borehole diameter and borehole fluid, and can only be collected in water or mud filled open holes.

2.10.3 Three Arm Caliper

Caliper logs record borehole diameter. Changes in borehole diameter are related to boring construction, such as casing or drilling bit size, and to fracturing or caving along the borehole wall. Because borehole diameter commonly affects log response, the caliper log may be useful in the analysis of other geophysical logs.

2.10.4 Borehole Acoustic Televiewer Logging

Televiewer logging was conducted in accordance with GEOVison procedures as included in the MACTEC Work Plan. The acoustic televiewer measures amplitude and travel time of the reflected acoustic signal and produces a magnetically oriented photographic image of the acoustic reflectivity of the boring wall. The acoustic televiewer is limited to open boreholes filled with water or drilling mud.

2.10.5 Suspension P-S Velocity Logging

Suspension P-S velocity logging was conducted in borings M-10 (DH) and M-30 (DH) in accordance with GEOVision procedures as contained in the MACTEC Work Plan. Measurements of compression (P) and shear (S) wave velocity were made at 1-meter intervals or less.

SECTION 3
SAMPLE STORAGE

Consistent with MACTEC's QAPD Requirements, a temporary on-site secure sample storage facility was established. The storage facility was a lockable climate controlled trailer. The trailer was a ground supported 20-foot-long by 8-foot wide Mobile-Mini Open Bay Security Office with high security door system and exterior security bars over each window.

Samples were transported daily from the field to the temporary on-site secure sample storage facility by the rig geologists/engineers. The SPT samples were transported in accordance with ASTM D 4220-95(2007) for Group B samples. The SPT samples were transported in their compartmentalized cardboard box each labeled to show the contents therein. The rock cores were transported in their wooden core boxes, kept horizontal and each labeled to show the contents. A sample inventory log was kept at the temporary on-site secure sample storage facility. All samples entering the temporary on-site secure sample storage facility were logged in by the Rig Geologist/Engineer or Site Manager/ Lead Geologist.

Samples were reviewed by the Lead Geologist and transported from the temporary on-site secure sample storage facility to the long term on-site sample storage facility located at the plant's warehouse. The long term sample storage facility was located within the "A Level" area of the plant's warehouse facility. The "A Level" has limited access and is climate controlled. Samples were stored in either a 12-foot square area surrounded by a 6-foot high chain link fence, or in an adjacent "fixed" secured area provided by the plant. Locking gates were provided in both areas.

A MACTEC Chain-Of-Custody form was completed for all samples removed from the temporary on-site secure sample storage facility. A Dominion representative received samples at the long term on-site sample storage facility on November 2, 2009.

SECTION 4
LABORATORY TESTING – GEOTECHNICAL

Laboratory testing was conducted on disturbed soil samples and on rock cores obtained during the subsurface investigation. All testing was performed in accordance with the current ASTM standards or other standards where applicable. Selection of the samples to be tested and the tests to be performed on the samples was done by Bechtel engineers. Bechtel provided a Geotechnical Laboratory Test Assignment Sheet (Assignment 01) dated September 21, 2009 for geotechnical soil and rock laboratory testing.

Some of the rock cores on which tests were assigned contained fractures or geometric characteristics that made them unsuitable to test. This information was reported to the Bechtel on-site Technical Representative. A representative of MACTEC and the Bechtel on-site Technical Representative determined the rock core interval closest to the assigned depth interval suitable for testing. Replacement rock core test intervals were assigned by Bechtel. A revised copy of the Geotechnical Laboratory Assignment Sheet (Assignment 01, Rev 1) dated September 28, 2009 showing revised rock core depths is included in Appendix D.

Testing of soil samples and rock core were conducted in MACTEC's laboratories in Raleigh and Charlotte, North Carolina, respectively.

The following tests were assigned and performed:

4.1 Index Tests - Soil

- Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass - ASTM D 2216-05
- Particle-Size Analysis of Soils - ASTM D 422-63(2007) (for analysis including hydrometer)
- Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis - ASTM D 6913-(2004)e1 (for analysis not including hydrometer)
- Liquid Limit, Plastic Limit, and Plasticity Index of Soils - ASTM D 4318-05
- Classification of Soils for Engineering Purposes (Unified Soil Classification System) – ASTM D 2487-06e1
- Description and Identification of Soils (Visual-Manual Procedure) – ASTM D 2488-09a

4.2 Strength Tests - Rock

- Specimen Preparation – ASTM D 4543-08
- Compressive Strength – ASTM D 7012-07e1

4.3 Reporting

The geotechnical laboratory test reports, consisting of individual test data and results sheets as required by the testing standard, are contained in Appendix D. Summaries of the test results in Appendix D are shown in Table 3.1 for soil and Table 4.1 for rock.

SECTION 5
WATER SAMPLING, FIELD AND LABORATORY TESTING

No water sampling or testing was completed during the specified scope of work.

FINAL DATA REPORT
Revision 0
GEOTECHNICAL EXPLORATION AND TESTING
SUPPLEMENT 2
DOMINION POWER
NORTH ANNA NUCLEAR POWER STATION
NORTH ANNA 3 PROJECT
MINERAL, LOUISA COUNTY, VIRGINIA

December 16, 2009

VOLUME 1

TABLES

Prepared By:

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

MACTEC PROJECT No. 6468-09-2473

Prepared For:

Bechtel Power Corporation
Subcontractor No. 25161-500-HC4-CY00-00001

TABLE 1.1
ORGANIZATIONS PERFORMING WORK AT THE SITE OR IN THE LABORATORY

Organization	Function
MACTEC Engineering and Consulting, Inc.	• Underground Utility Clearance (Not Used) • Geotechnical Borings with SPT Tests and Rock Coring • SPT Energy Measurement on Drill Rigs • Logging of Geotechnical Borings • Undisturbed Sampling (Not Used) • Bulk Sampling (Not Used) • Boring Abandonment • Site Coordination • Geotechnical Laboratory Testing for Soil Samples and Rock Core
GEOVision	• Down-hole Geophysical Logging • P-S Suspension Logging
McKim&Creed, P.A.	• Surveying of Boring Locations

Original Prepared By: JSJ 12/16/09 (Rev 0)

Original Checked By: SJC 12/16/09 (Rev 0)

TABLE 2.1
TESTING SUMMARY - BORINGS
North Anna 3 Project, Supplement 2
MACTEC Project Number 6468-09-2473

Boring Number	**Boring Type**			**Equipment**		**Depth**		**As-Built Coordinates/Elevations**			**In-Situ Testing**					
	SPT	Core	UD Tubes	Drill Rig	Hammer ID	Proposed (ft)	Actual (ft)	Northing (US ft)	Easting (US ft)	Ground Surface Elevation (ft)	P-S Suspension	Televiewer and Deviation	Natural Gamma	Resistivity	Caliper	Spontaneous Potential
M-1	X	X	NA	CME 550X (ATL)	MEC-05	150	151.1	3,909,611.0	11,685,483.5	314.1	NA	NA	NA	NA	NA	NA
M-2	X	X	NA	CME 550X (ATL)	MEC-05	150	153.4	3,909,531.0	11,685,586.0	315.3	NA	NA	NA	NA	NA	NA
M-3	X	X	NA	CME 55LC Track (RAL)	MEC-02	150	152.6	3,909,538.5	11,685,678.5	313.9	NA	NA	NA	NA	NA	NA
M-4	X	X	NA	CME 550X (ATL)	MEC-05	150	154.0	3,909,456.0	11,685,694.5	321.8	NA	NA	NA	NA	NA	NA
M-6	X	X	NA	CME 55 Track (RAL)	MEC-21	150	150.4	3,909,401.0	11,685,759.5	327.8	NA	NA	NA	NA	NA	NA
M-7	X	X	NA	CME 55 Trailer (RAL)	MEC-425	150	151.5	3,909,504.0	11,685,835.5	326.0	NA	NA	NA	NA	NA	NA
M-8	X	X	NA	CME 45C Track (RAL)	MEC-12	150	150.6	3,909,413.5	11,685,847.0	329.3	NA	NA	NA	NA	NA	NA
M-9	X	X	NA	CME 550X (ATL)	MEC-05	150	153.6	3,909,333.5	11,685,946.0	327.3	NA	NA	NA	NA	NA	NA
M-10 (DH)	X	X	NA	CME 55LC Track (RAL)	MEC-02	200	201.9	3,909,243.5	11,685,962.0	323.6	X	X	X	X	X	X
M-11	X	NA	NA	CME 55 Trailer (RAL)	MEC-425	150	148.7	3,909,351.5	11,686,038.5	325.9	NA	NA	NA	NA	NA	NA
M-12	X	X	NA	CME 45C Track (RAL)	MEC-12	150	151.2	3,909,723.0	11,685,560.0	307.0	NA	NA	NA	NA	NA	NA
M-13	X	X	NA	CME 55LC Track (RAL)	MEC-02	150	151.6	3,909,519.5	11,686,025.0	326.8	NA	NA	NA	NA	NA	NA
M-14	X	NA	NA	CME 55LC Track (RAL)	MEC-02	60	60.3	3,909,451.5	11,686,111.0	323.8	NA	NA	NA	NA	NA	NA
M-15	X	NA	NA	CME 45C Track (RAL)	MEC-12	60	60.0	3,909,531.0	11,686,166.0	311.3	NA	NA	NA	NA	NA	NA
M-16	X	X	NA	CME 55 Track (RAL)	MEC-21	60	61.9	3,909,989.5	11,685,801.5	284.6	NA	NA	NA	NA	NA	NA
M-17	X	X	NA	CME 55 Trailer (RAL)	MEC-425	150	151.9	3,909,775.0	11,686,213.5	306.2	NA	NA	NA	NA	NA	NA
M-18	X	NA	NA	CME 45C Track (RAL)	MEC-12	60	60.4	3,909,608.0	11,686,213.5	304.2	NA	NA	NA	NA	NA	NA
M-19	X	X	NA	CME 550X (ATL)	MEC-05	150	151.4	3,910,052.5	11,685,855.5	280.4	NA	NA	NA	NA	NA	NA
M-20	X	X	NA	CME 45C Track (RAL)	MEC-12	150	151.0	3,909,793.5	11,686,067.5	302.6	NA	NA	NA	NA	NA	NA
M-21	X	X	NA	CME 55 Track (RAL)	MEC-21	150	151.8	3,909,811.0	11,686,269.5	303.9	NA	NA	NA	NA	NA	NA
M-27	X	X	NA	CME 55 Trailer (RAL)	MEC-425	150	151.4	3,909,426.0	11,685,937.5	330.2	NA	NA	NA	NA	NA	NA
M-28	X	X	NA	CME 45C Track (RAL)	MEC-12	150	150.0	3,909,635.5	11,685,672.0	308.2	NA	NA	NA	NA	NA	NA
M-29	X	X	NA	CME 550X (ATL)	MEC-05	150	151.2	3,909,710.5	11,685,460.0	309.3	NA	NA	NA	NA	NA	NA
M-30(DH)	X	X	NA	CME 55 Track (RAL)	MEC-21	200	201.7	3,909,695.0	11,685,381.5	313.3	X	X	X	X	X	X
M-31	X	X	NA	CME 55 Track (RAL)	MEC-21	150	151.5	3,909,799.0	11,685,459.5	306.9	NA	NA	NA	NA	NA	NA
M-32	X	X	NA	CME 55 Track (RAL)	MEC-21	60	62.2	3,909,875.5	11,685,526.5	313.2	NA	NA	NA	NA	NA	NA
M-33	X	NA	NA	CME 55LC Track (RAL)	MEC-02	60	64.9	3,909,983.5	11,685,614.5	303.8	NA	NA	NA	NA	NA	NA
M-34	X	X	NA	CME 55LC Track (RAL)	MEC-02	60	63.0	3,910,122.0	11,685,736.0	280.9	NA	NA	NA	NA	NA	NA

NOTES:
NA = Not Applicable
ft bgs = feet below ground surface
Horizontal Coordinates (Northing and Easting) = NAD83 (2007), Virginia State Plane Coordinate System (VSPCS) South Zone, NAD 83 (CORS 96), (EPOCH 2002), U.S. Survey Feet
Elevations = North American Vertical Datum of 1988 (NAVD88), U.S. Survey Feet

Original Prepared by: JSJ (Rev 0)

Original Checked by: DSC (Rev 0)

Original Prepared By: JSJ (Rev 0)
Original Checked By: DSC (Rev 0)

TABLE 3.1
SUMMARY OF SOIL INDEX TEST RESULTS
SPLIT-BARREL SAMPLES
NORTH ANNA 3 PROJECT, SUPPLEMENT 2
MACTEC PROJECT NO. 6468-09-2473

Boring Number	Sample Number	Depth (ft)	Gravel (%)	Sand (%)	Fines (%)	Silt (%)	0.005 mm Clay (%)	USCS Symbol	Natural Moisture (%)	LL (%)	PI (%)	G_s
M-10 (DH)	SS-2	11.7-13.2	0.0	57.5	42.5	30.2	12.3	SM	48.5	59	9	
M-10 (DH)	SS-4	19.2-20.7	0.0	61.9	38.1	29.4	8.7	SM	35.9	54	6	
M-10 (DH)	SS-5	24.2-25.7	0.0	61.3	38.7	28.4	10.3	SM	53.7	59	12	
M-10 (DH)	SS-6	29.2-30.7	0.0	56.6	43.4	31.9	11.5	SM	66.7	51	7	
M-10 (DH)	SS-8	39.1-40.6	0.0	53.5	46.5	42.4	4.1	SM	30.6	42	6	
M-10 (DH)	SS-10	49.1-50.6	0.0	79.9	20.1			SM[1]	16.4			
M-10 (DH)	SS-12	59.1-60.6	0.7	77.2	22.1			SM[1]	15.1			
M-10 (DH)	SS-15	74.1-75.6	0.0	72.6	27.4			SM[1]	29.9			
M-10 (DH)	SS-17	84.1-85.6	0.0	79.0	21.0			SM[1]	15.1			
M-30 (DH)	SS-1	8.7-10.2	0.6	72.3	27.1			SM[1]	17.0			
M-30 (DH)	SS-3	13.7-15.2	0.0	64.0	36.0			SM[1]	19.8			
M-30 (DH)	SS-5	23.7-25.2	0.0	82.0	18.0			SM[1]	18.5			
M-30 (DH)	SS-7	33.7-35.2	0.0	77.1	22.9			SM[1]	14.8			

1 Classification is based on quantitative and qualitative (visual inspection) information.

LL= Liquid Limit, PI = Plasticity Index, G_s = Specific Gravity

(shaded) Test not assigned

Orig Prepared By: JSJ (Rev 0)
Orig Checked By: DSC (Rev 0)

TABLE 4.1
SUMMARY OF LABORATORY TEST RESULTS - ROCK
UNCONFINED COMPRESSIVE STRENGTH TEST RESULTS
NORTH ANNA 3 PROJECT, SUPPLEMENT 2

Boring Number	Run Number	Lab Sample ID	Sample Top Depth (feet)	Sample Length (L) (inches)	Sample Diameter (D) (inches)	L/D Ratio	Unit Weight (pcf) (1)	Moisture Content (%)	Type of Break (2)	Unconfined Compressive Strength (psi)	Young's Modulus (ksi x1000)	Specific Gravity
M-10 (DH)	R-7	RS-1	117.45	5.15	2.41	2.1	160.1		S	7960		
M-10 (DH)	R-10	RS-2	133.75	5.09	2.41	2.1	161.9		S	19640(4)		
M-10 (DH)	R-15	RS-3	153.70	5.08	2.41	2.1	163.5		C	33830(4)		
M-10 (DH)	R-20	RS-4	177.60	5.14	2.39	2.2	163.3		S	20880(4)		
M-10 (DH)(3)	R-24	RS-5	196.70	5.18	2.39	2.2	163.7		C	30780		
M-30 (DH)(3)	R-4	RS-6	57.00	5.18	2.40	2.2	162.8		C	28650		
M-30 (DH)	R-18	RS-7	95.40	5.06	2.39	2.1	162.7		C	23700		
M-30 (DH)(3)	R-26	RS-8	134.90	5.26	2.39	2.2	163.7		S	26200		
M-30 (DH)	R-34	RS-9	166.90	5.06	2.40	2.1	164.6		C/S	24820		
M-30 (DH)	R-40	RS-10	197.05	5.16	2.40	2.2	162.6		C	33040		

(1) As-tested Wet Unit Weight.
(2) Types of Breaks: COL=Columnar; C=Cone; S=Shear; C/S=Cone/Shear
(3) Core samples did not meet the dimensional tolerances for straightness or perpendicularity per ASTM D 4543-08.
(4) Test duration exceeded 15 minute maximum time as indicated by ASTM D 7012-07e1.
(5) Shaded cells indicate that information not obtained.
NA = Not Applicable

FINAL DATA REPORT
Revision 0
GEOTECHNICAL EXPLORATION AND TESTING
SUPPLEMENT 2
DOMINION POWER
NORTH ANNA NUCLEAR POWER STATION
NORTH ANNA 3 PROJECT
MINERAL, LOUISA COUNTY, VIRGINIA

December 16, 2009

VOLUME 1

FIGURE

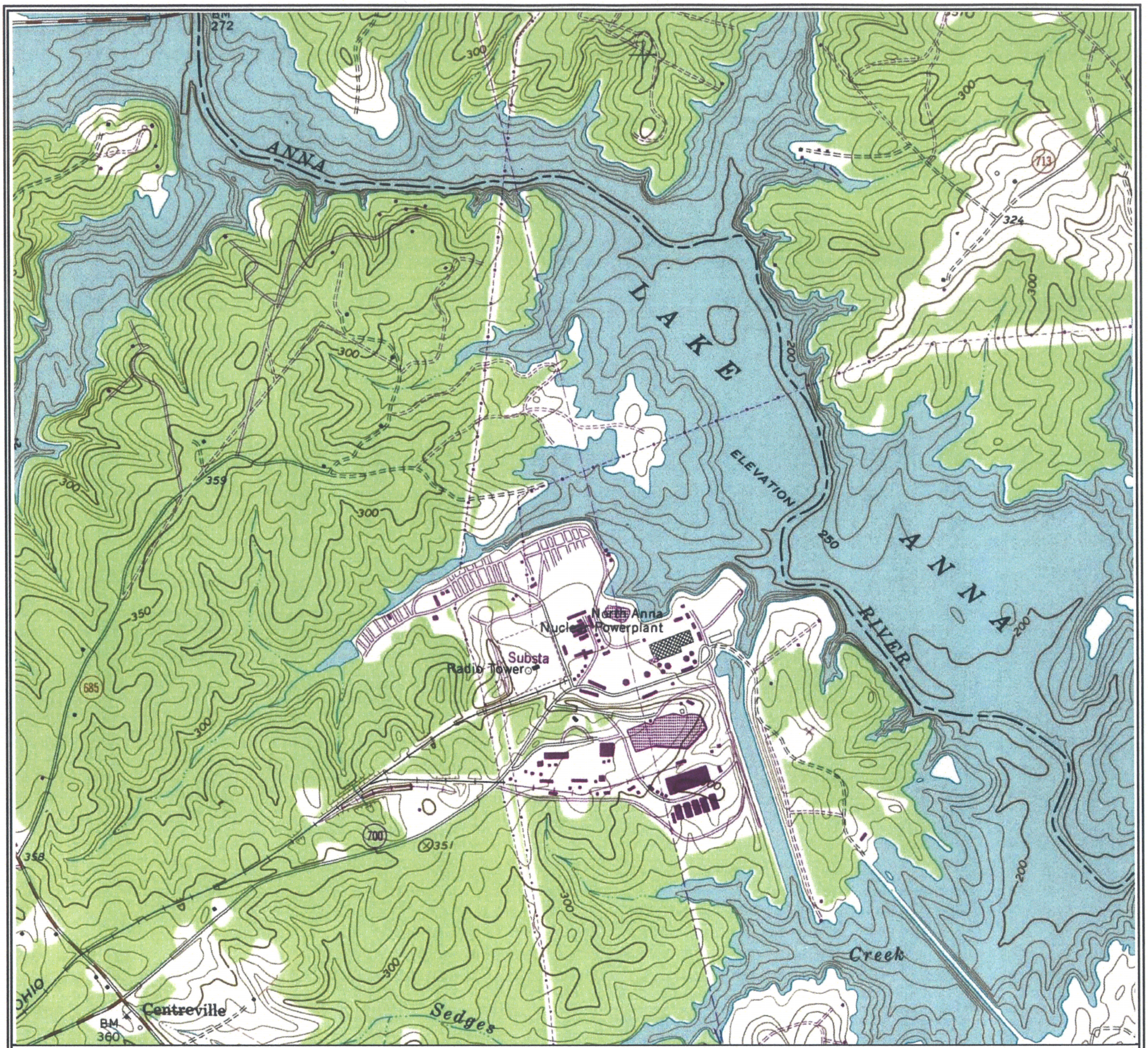
Prepared By:

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

MACTEC PROJECT No. 6468-09-2473

Prepared For:

Bechtel Power Corporation
Subcontractor No. 25161-500-HC4-CY00-00001

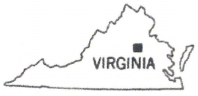


LAKE ANNA WEST, VA.
(FORMERLY CONTRARY CREEK)
38077-A7-TF-024

1973
PHOTOREVISED 1983
DMA 5460 III SE–SERIES V834

CONTOUR INTERVAL 10 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

NORTH



QUADRANGLE LOCATION

NOTE: SITE LOCATION IS APPROXIMATE

MACTEC
MACTEC ENGINEERING AND CONSULTING, INC.
3301 ATLANTIC AVENUE
RALEIGH, NORTH CAROLINA

SITE VICNITY MAP
NORTH ANNA 3 PROJECT
MINERAL, VIRGINIA

DRAWN:	DATE: November 2009	FIGURE
ENG CHECK:	SCALE: 1" = 2000'	1
APPROVAL:	JOB: 6468-09-2473	

FINAL DATA REPORT
Revision 0
GEOTECHNICAL EXPLORATION AND TESTING
SUPPLEMENT 2
DOMINION POWER
NORTH ANNA NUCLEAR POWER STATION
NORTH ANNA 3 PROJECT
MINERAL, LOUISA COUNTY, VIRGINIA

December 16, 2009

VOLUME 1

APPENDIX A
Survey Report

Prepared By:

MACTEC ENGINEERING AND CONSULTING, INC.
RALEIGH, NORTH CAROLINA

MACTEC PROJECT No. 6468-09-2473

Prepared For:

Bechtel Power Corporation
Subcontractor No. 25161-500-HC4-CY00-00001

MACTEC

DOCUMENTATION OF TECHNICAL REVIEW
SUBCONTRACTOR WORK PRODUCT

Project Name: NORTH ANNA 3 PROJECT

Project Number: 6468-09-2473

Project Manager: Steve Criscenzo

Project Principals: Al Tice and Steve Copley

The report described below has been prepared by the named subcontractor retained in accordance with the MACTEC QAPD. The work and report have been reviewed by a MACTEC technically qualified person. Comments on the work or report, if any, have been satisfactorily addressed by the subcontractor. The attached report is approved in accordance with section QS-7 of MACTEC's QAPD.

The information and date contained in the attached report are hereby released by MACTEC for project use.

REPORT: Surveyor's Report for 29 Soil Borings, As-Drilled Location Survey – North Anna Nuclear Power Plant, dated October 23, 2009, Revised November 19, 2009

SUBCONTRACTOR: McKim & Creed, P.A.

DATE OF ACCEPTANCE: November 23, 2009

TECHNICAL REVIEWER:

D. Steven Copley, P.E., Principal Professional

PRINCIPAL PROFESSIONAL:

D. Steven Copley 11-23-09

DCN - NAP 295

MACTEC
3301 Atlantic Avenue, Raleigh, NC 27604

McKIM&CREED

ENGINEERS

SURVEYORS

PLANNERS

October 23, 2009
Revised November 19, 2009

Mr. Scott Auger, P.E., PMP
MACTEC Engineering and Consulting, Inc.
3301 Atlantic Avenue
Raleigh, NC 27604

Ref: **Surveyor's Report for 29 Soil Borings, As-Drilled Location Survey – North Anna Nuclear Power Plant**

Dear Mr. Auger:

McKim & Creed, P.A. performed an as-drilled survey of 29 soil borings (M1-M4, M6-M21, M25, M27-M34), on the dates of October 6th, 7th and 8th, 2009. The survey was performed in accordance with the specifications stipulated in *"Work Order & PO NO 200913023, North Anna 3 Project, MACTEC Project No. 6468092473-12"*, dated August 24, 2009 including the QA requirements in Section 2.0 of the Bechtel Technical Specification, and Attachment 1 – Survey Controls from the MACTEC Geotechnical Work Plan. As required by the Bechtel Technical Specification, Section 2.2, as-drilled boring locations shown in this report have a horizontal accuracy to the nearest 0.5 foot and a vertical accuracy to the nearest 0.1 foot.

The survey was performed using a Trimble 5700 L1/L2 Real Time Kinematic (RTK) GPS system and Trimble 5603 DR200+ total station. Data was collected and reviewed in Trimble Survey Controller (GPS) and TDS Ranger (total station) data collectors analyzed using Trimble Geomatics Office and Autodesk Land Desktop softwares. Hard copy field notes of occupations and results were kept as a backup of the data collectors. The equipment was tested for functionality prior to and following conducting the survey to ensure the equipment was functioning within the required parameters.

The origin for the stakeout survey was Control Monument No. 7, a brass disk embedded in concrete. The horizontal positions and vertical values for this point were determined from the submission of 10.5 total hours of static GPS observation data to the National Geodetic Survey's (NGS) Online Positioning User Service (OPUS). The static data was collected using the GPS RTK base receiver operating on Control Monument No. 7 from 29 through 30 November

Venture IV Building
Suite 500
1730 Varsity Drive
Raleigh, NC 27606
919.233.8091
Fax 919.233.8031
www.mckimcreed.com

2006. After the OPUS solutions were converted to US Feet (1 meter = 39.37 inches), the position and vertical values for both days were averaged to determine the horizontal position of Control Monument No. 7 within the Virginia State Plane Coordinate System (VSPCS), South Zone, NAD 83 (CORS 96) (EPOCH 2002) and its orthometric height (elevation) relative to NAVD 88 (GEOID 03). Final coordinates:

Monument 7	Jan 07 OPUS Position
Northing	3,909,874.97 usft
Easting	11,685,943.52 usft
Orthometric Height	303.76 usft

The base station for the RTK system was positioned on Monument No. 7 during all RTK sessions. An additional 5 hours of static data was collected in August 2009 to verify the location of monument 7 and ensure that it had remained stable since the original observations. RTK checks were made on the existing monuments A and B using coordinate values provided on Boring Location Plan 9-CY-0010-00001. Checks were performed in the morning and afternoon of each survey session. Fixed height poles were used with all the GPS units to ensure vertical accuracy. Checks were performed in the morning and the afternoon. Additionally, over four hours of static GPS observations were made on GPS Control Point 105 as a check on the integrity of the overall control network. Final coordinates:

Point 105	Oct 09 NAD83 Position
Northing	3,910,088.59 usft
Easting	11,685,845.35 usft
Orthometric Height	279.45 usft

Also, RTK GPS observations to existing monuments A and B were performed. Their positions in the coordinate system established for this survey are:

Monument A	Oct 09 NAD83 Position
Northing	3,909,133.04 usft
Easting	11,686,566.77 usft
Orthometric Height	327.68 usft

Monument B	Oct 09 NAD83 Position
Northing	3,909,594.84 usft
Easting	11,686,608.38 usft
Orthometric Height	329.08 usft

All points located conventionally by the total station were set from RTK 3-minute observed control points. Every occupation of RTK control points with the total station was checked using the backsight confirmation routine of the data collector. The backsights were taken in the direct and reversed position. This ensured accurate instrument and target/prism pole height and relative accuracy between points. Elevations of the as-drilled positions were measured from natural ground at the drill site.

A closed level loop was run through the control points to provide additional validation of elevations.

Based upon the methods employed and the quality of the data collected, the undersigned certifies that the relative accuracy of the data set resulting from this survey meets the accuracy requirements stipulated by MACTEC, Inc. and Bechtel Corp. for the final horizontal location of exploration points.

COMMONWEALTH OF VIRGINIA
WILLIAM J. EGAN, JR.
Lic. No. 002548
11/19/09
LAND SURVEYOR

Regards,

Bill Egan, PE LS
Project Manager

Encl:
1 – Tabular As-Drilled Position Data

2– OPUS solution (Point 105)

As-Drilled Boring Locations
North Anna Nuclear Power Plant

Borehole Designation	Drilled Northing (Y)	Drilled Easting (X)	Ground Elev.
M-01	3909611.0	11685483.5	314.1
M-02	3909531.0	11685586.0	315.3
M-03	3909538.5	11685678.5	313.9
M-04	3909456.0	11685694.5	321.8
M-06	3909401.0	11685759.5	327.8
M-07	3909504.0	11685835.5	326.0
M-08	3909413.5	11685847.0	329.3
M-09	3909333.5	11685946.0	327.3
M-10 (DH)	3909243.5	11685962.0	323.6
M-11	3909351.5	11686038.5	325.9
M-12	3909723.0	11685560.0	307.0
M-13	3909519.5	11686025.0	326.8
M-14	3909451.5	11686111.0	323.8
M-15	3909531.0	11686166.0	311.3
M-16	3909989.5	11685801.5	284.6
M-17	3909775.0	11686213.5	306.2
M-18	3909608.0	11686213.5	304.2
M-19	3910052.5	11685855.5	280.4
M-20	3909793.5	11686067.5	302.6
M-21	3909811.0	11686269.5	303.9
M-25	***M-25 NOT BORED		
M-27	3909426.0	11685937.5	330.2
M-28	3909635.5	11685672.0	308.2
M-29	3909710.5	11685460.0	309.3
M-30 (DH)	3909695.0	11685381.5	313.3
M-31	3909799.0	11685459.5	306.9
M-32	3909875.5	11685526.5	313.2
M-33	3909983.5	11685614.5	303.8
M-34	3910122.0	11685736.0	280.9

Note: All locations based on VA State Plane Coordinates NAD83 (CORS96 Epoch 2002) Zone 4502 South (US Feet) horizontal and NAVD88 (Geoid03) vertical.

△ 105

FILE: 75812803.DAT 000129896

NGS OPUS SOLUTION REPORT

```
All computed coordinate accuracies are listed as peak-to-peak values.
For additional information: www.ngs.noaa.gov/OPUS/Using_OPUS.html#accuracy

      USER: dclark@mckimcreed.com                    DATE: October 16, 2009
RINEX FILE: 7581280t.09o                             TIME: 12:05:14 UTC

  SOFTWARE: page5  0909.08 master28.pl 081023      START: 2009/10/07  19:45:00
 EPHEMERIS: igr15523.eph [rapid]                    STOP: 2009/10/07  21:51:00
  NAV FILE: brdc2800.09n                        OBS USED:  5200 /  5260   :  99%
  ANT NAME: TRM41249.00     NONE             # FIXED AMB:    28 /    32   :  88%
ARP HEIGHT: 2                                OVERALL RMS: 0.017(m)

 REF FRAME: NAD_83(CORS96)(EPOCH:2002.0000)        ITRF00 (EPOCH:2009.7668)

         X:      1063036.293(m)   0.101(m)          1063035.560(m)   0.101(m)
         Y:     -4914753.745(m)   0.115(m)         -4914752.290(m)   0.115(m)
         Z:      3910676.131(m)   0.106(m)          3910676.007(m)   0.106(m)

       LAT:   38  3 34.09066      0.079(m)        38  3 34.11903     0.079(m)
     E LON:  282 12 17.19696      0.076(m)       282 12 17.18019     0.076(m)
     W LON:   77 47 42.80304      0.076(m)        77 47 42.81981     0.076(m)
    EL HGT:           52.964(m)   0.163(m)                51.645(m)  0.163(m)
 ORTHO HGT:           85.291(m)   0.171(m) [NAVD88 (Computed using GEOID03)]

                        UTM COORDINATES    STATE PLANE COORDINATES
                         UTM (Zone 18)       SPC (4502 VA S)
Northing (Y)  [meters]    4216102.812        1191797.409
Easting (X)   [meters]     254761.637        3561852.824
Convergence   [degrees]   -1.72405501         0.42774663
Point Scale                1.00034078         1.00001825
Combined Factor            1.00033247         1.00000994

US NATIONAL GRID DESIGNATOR: 18STH5476116102(NAD 83)

                          BASE STATIONS USED
PID       DESIGNATION                        LATITUDE    LONGITUDE DISTANCE(m)
DH7954 LOY8 LOYOLA 8 COOP CORS ARP        N381658.691 W0772709.468   38944.9
AJ2122 CORB CORBIN CORS ARP               N381207.828 W0772224.571   40226.0
DL2310 LOYO LOYOLA O CORS ARP             N380300.626 W0772051.173   39304.8

                 NEAREST NGS PUBLISHED CONTROL POINT
DF6890      BOGGS AZ                      N380441.006 W0774624.011    2821.5

This position and the above vector components were computed without any knowledge by the
National Geodetic Survey regarding the equipment or field operating procedures used.
```

Δ105

```
FILE: 75812800.DAT 000129895

                        NGS OPUS SOLUTION REPORT
                        ========================

All computed coordinate accuracies are listed as peak-to-peak values.
For additional information: www.ngs.noaa.gov/OPUS/Using_OPUS.html#accuracy

      USER: dclark@mckimcreed.com                 DATE: October 16, 2009
RINEX FILE: 7581280m.09o                          TIME: 12:05:09 UTC


 SOFTWARE: page5  0909.08 master50.pl 081023     START: 2009/10/07  12:57:00
 EPHEMERIS: igr15523.eph [rapid]                   STOP: 2009/10/07  15:08:00
  NAV FILE: brdc2800.09n                       OBS USED:  5367 /  5484   :  98%
  ANT NAME: TRM41249.00     NONE             # FIXED AMB:    27 /    30   :  90%
ARP HEIGHT: 2                               OVERALL RMS: 0.012(m)


 REF FRAME: NAD_83(CORS96)(EPOCH:2002.0000)           ITRF00 (EPOCH:2009.7660)

        X:      1063036.240(m)   0.040(m)         1063035.507(m)   0.040(m)
        Y:     -4914753.674(m)   0.100(m)        -4914752.219(m)   0.100(m)
        Z:      3910676.085(m)   0.015(m)         3910675.961(m)   0.015(m)

      LAT:   38  3 34.09110      0.051(m)       38  3 34.11947      0.051(m)
    E LON:  282 12 17.19545      0.060(m)      282 12 17.17868      0.060(m)
    W LON:   77 47 42.80455      0.060(m)       77 47 42.82132      0.060(m)
   EL HGT:          52.872(m)    0.074(m)               51.554(m)   0.074(m)
 ORTHO HGT:          85.199(m)    0.090(m) [NAVD88 (Computed using GEOID03)]

                        UTM COORDINATES    STATE PLANE COORDINATES
                         UTM (Zone 18)         SPC (4502 VA S)
Northing (Y)  [meters]    4216102.826          1191797.422
Easting (X)   [meters]     254761.600          3561852.788
Convergence   [degrees]   -1.72405527           0.42774638
Point Scale                1.00034078           1.00001825
Combined Factor            1.00033248           1.00000996

US NATIONAL GRID DESIGNATOR: 18STH5476116102(NAD 83)


                           BASE STATIONS USED
PID       DESIGNATION                       LATITUDE    LONGITUDE DISTANCE(m)
DH7954 LOY8 LOYOLA 8 COOP CORS ARP       N381658.691 W0772709.468    38944.9
AJ2122 CORB CORBIN CORS ARP              N381207.828 W0772224.571    40226.0
DL2310 LOYO LOYOLA O CORS ARP            N380300.626 W0772051.173    39304.9

                    NEAREST NGS PUBLISHED CONTROL POINT
DF6890      BOGGS AZ                     N380441.006 W0774624.011     2821.5

This position and the above vector components were computed without any knowledge by the
National Geodetic Survey regarding the equipment or field operating procedures used.
```