Document No. EPA-RPT-021C

Kingston Ash Recovery Project
Non-Time-Critical Removal Action

River System Sampling and Analysis Plan
Task Completion Technical Memorandum
Groundwater Sampling

Prepared by:
Jacobs

for the Tennessee Valley Authority

Revision	Description	Date
00	Issued for TVA Review	May 10, 2011
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02	Issued final	May 4, 2012

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Table of Contents

1. PURPOSE 1
2. BACKGROUND 1
3. SAMPLING AND ANALYSIS ACTIVITIES 1
   3.1 Monitoring Well Installation and Sampling 3
   3.2 Direct Push Sampling 4
   3.3 Groundwater Sampling and Aquifer Testing 5
4. SUMMARY OF CHANGES 6
5. ANALYTICAL DATA REVIEW 7
6. DATA QUALITY SUMMARY 8
7. DATA SUMMARY 9

List of Tables

Table 1. Applicable Standard Operating Procedures, Industry Standards, and Other Work Control Documents 1
Table 2. Geoprobe® Sampling 4
Table 3. Data Review Summary 8
Table 4. Summary of Surface Water Data Quality 9
Table 5. Summary of Data from Permanent Groundwater Wells 10
Table 6. Summary of Data from Temporary Well Locations 14
Table 7. Summary of Data from Geoprobe Locations 16

List of Figures (Attached)

Figure 1: Groundwater Sampling and Aquifer Testing Locations

Appendices

Appendix A: Boring Logs
Appendix B: Well Construction Diagrams
Appendix C: Geochemical and Geotechnical Lab Results

List of Acronyms

ASTM	American Society for Testing and Materials
COC	chain-of-custody
DQO	data quality objective
EDD	electronic data deliverable
EE/CA	Engineering Evaluation/Cost Estimate
EPA	U.S. Environmental Protection Agency
FCN	Field Change Notice
ft	foot
GEL	GEL Laboratories
GPS	global positioning system
KIF	Kingston Fossil Plant
MDL	method detection limit
mg/L	milligram per liter
NAD	North American Datum
ND	not detected
pCi/L	picocurie per liter
PVC	polyvinyl chloride
QC	quality control
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
TDS	total dissolved solid
TM	Technical Memorandum
TSS	total suspended solid
TVA	Tennessee Valley Authority
TWP	temporary well point

1. PURPOSE

The purpose of this Technical Memorandum (TM) is to summarize the completion of the groundwater task as described in the approved *Kingston Ash Recovery Project Non-Time Critical Removal Action for the River System Sampling and Analysis Plan* (SAP), Rev. 3, May 24, 2010, Document No. EPA-AO-021. This TM is one of a series being prepared to summarize the field work and data collection activities as SAP tasks are completed. The TM series is intended to provide interim presentations of data that will become the basis for the nature and extent of contamination section of the River System Engineering Evaluation/Cost Estimate (EE/CA) Report. No data evaluation or conclusions are presented.

2. BACKGROUND

The data quality objective (DQO) problem statement for groundwater is:

> Naturally-occurring metals (e.g., arsenic, chromium, mercury, selenium) and radionuclides (e.g., radium-226, thorium-228) within the ash may be mobilized as a result of infiltration of precipitation, and may be transported downgradient in the groundwater to the Emory River, where exposure to humans or ecological receptors (fish, benthos) may occur.

Section 2.2.6 of the SAP presents the design of the groundwater sampling study.

Stratigraphy, water level measurements, flow rates, geochemical attenuation properties, concentrations of ash-related constituents in groundwater, and concentrations within the mixing zones of groundwater and the river were the targeted data collected to determine if the flux of ash-related constituents from groundwater to the Emory River could potentially result in unacceptable risk to human or ecological receptors. These data support the development of a computer model to facilitate groundwater transport analysis. The model's purpose is described in the second paragraph of Background and Purpose, Appendix C of the SAP. A separate report on the groundwater model results will be available around the end of June 2011.

3. SAMPLING AND ANALYSIS ACTIVITIES

This phase of the overall work effort included: 1) drilling, 2) borehole logging, 3) geochemical and geotechnical sampling, 4) well installation and development, and 5) groundwater sampling and analysis, and 6) aquifer testing. Table 1 summarizes applicable sampling procedures and field testing methods.

Table 1. Applicable Standard Operating Procedures, Industry Standards, and Other Work Control Documents

Document Number	Document Title	Author
ASTM D 1586 – 08a	Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils	ASTM
ASTM D 1587 – 08	Standard Practice for Thin-Walled Tube Sampling of Soils for Geotechnical Purposes	ASTM
ASTM D 2488 – 09a	Standard Practice for Description and Identification of Soils (Visual –Manual) Procedure	ASTM
ASTM D 4050 – 96	(Reapproved 2008) Standard Test Method for (Field Procedure) for Withdrawal and Injection Well Tests for Determining Hydraulic Properties of Aquifer Systems	ASTM

Table 1. Applicable Standard Operating Procedures, Industry Standards, and Other Work Control Documents (continued)

Document Number	Document Title	Author
ASTM D 4220 – 95	(Reapproved 2007) Standard Practices for Preserving and Transporting Soil Samples	ASTM
ASTM D 4448 – 01	(Reapproved 2007) Standard Guide for Sampling Ground-Water Monitoring Wells	ASTM
ASTM D 4793 – 09	Standard Test Method for Sequential Batch Extraction of Waste with Water	ASTM
ASTM D2937	Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method	ASTM
ASTM D6836	Standard Test Methods for Determination of the Soil Water Characteristic Curve for Desorption Using Hanging Column, Pressure Extractor, Chilled Mirror Hygrometer, or Centrifuge	ASTM
ASTM D4404 - 10	Standard Test Method for Determination of Pore Volume and Pore Volume Distribution of Soil and Rock by Mercury Intrusion Porosimetry	ASTM
ASTM D2216 - 10	Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass	ASTM
ASTM D5126 / D5126M - 90(2010)e1	Standard Guide for Comparison of Field Methods for Determining Hydraulic Conductivity in the Vadose Zone	ASTM
EPA/600/R-98/058	Application of the Electromagnetic Borehole Flowmeter	EPA
WP-1016	Well Installation, Sampling, and Logging	TVA
WP-1056	Non-Time-Critical Geoprobe® Sampling	TVA
TVA-KIF-SOP-02, Revision 1	Standard Operating Procedure For: Groundwater Sampling	TVA
TVA-KIF-SOP-04	Standard Operating Procedure For: Soil Sampling For Inorganic Analyses	TVA
TVA-KIF-SOP-06	Standard Operating Procedure For: Field Documentation	TVA
TVA-KIF-SOP-07, Revision 2	Standard Operating Procedure For: Sample Labeling, Packing, and Shipping	TVA
TVA-KIF-SOP-08, Revision 1	Standard Operating Procedure For: Decontamination of Equipment	TVA
TVA-KIF-SOP-12	Standard Operating Procedure For: Management of Investigation-Derived Waste	TVA
TVA-KIF-SOP-14, Revision 2	Standard Operating Procedure For: Hydrolab Standardization	TVA
TVA-KIF-SOP-18	Standard Operating Procedure For: Management And Implementation of EQuIS™-Based Chain of Custody	TVA
TVA-KIF-SOP-26	Standard Operating Procedure For: Photography Management	TVA
TVA-KIF-SOP-39	Standard Operating Procedure For: Monitoring Well and Piezometer Installation and Completion	TVA
TVA-KIF-SOP-42	Standard Operating Procedure For: Slug Testing	TVA
TVA-KIF-SOP-46	Standard Operating Procedure For: Groundwater Monitoring Well Abandonment	TVA
TVA-KIF-SOP-47	Standard Operating Procedure For: Groundwater and Leachate Sampling Using Direct-Push System	TVA

Note: For definitions, see the Acronyms section.

3.1 Monitoring Well Installation and Sampling

To support the groundwater modeling, three new permanent monitoring wells were installed to collect data on upgradient stratigraphy, hydraulic conductivity, water level elevations, and dissolved aqueous-phase concentrations in residuum and bedrock groundwater. Six new Temporary Well Points (TWPs) were installed within the Dredge Cell, Ash Pond, Stilling Pond, and Ash Processing Area to collect additional data on hydraulic conductivity, ash and soil contaminant attenuation capacity, and dissolved aqueous phase concentrations in alluvium and bedrock. Two new temporary boreholes were installed in the Lateral Expansion Area and the Ash Processing Area. Seven TWPs were planned; six of which were installed. TWP-22 was not installed due to insufficient overburden thickness and water yield. See Figure 1 for groundwater sampling and aquifer testing locations. Previously installed monitoring wells, newly installed permanent monitoring wells, TWP sampling locations, and borings/Geoprobe® sampling locations are also presented on Figure 1.

From April 22 through September 31, 2010, a combination of hollow stem auger and rotosonic drilling methods were used to install the boreholes, TWPs, and permanent wells. Soil samples were collected continuously (split spoon, Shelby tubes, Rotosonic core) every 2 feet and documented on a boring log, in accordance with TVA-KIF-SOP-39 *Monitoring Well and Piezometer Installation and Completion*. Bedrock cores were taken at TWP-24, TWP-25, and TWP-26. Rock cores and cuttings were examined to determine rock type and recorded on a field boring log (boring logs are presented as Appendix A). Permanent monitoring wells and temporary well points were installed and developed in accordance with TVA-KIF-SOP-39. Well diagrams are presented in Appendix B.

Shelby tube samples from drilling activities were analyzed by Daniel B. Stephens & Associates for vertical hydraulic conductivity, porosity, and geotechnical analyses. Mineralogocial characterization and geochemical analyses were conducted by Pittsburgh Mineral &Environmental Technology, Inc. Results are presented in Appendix C.

Difficulties were encountered during the drilling and installation activities at location TWP-04. A summary of actions performed is presented below:

- Initial location TWP-04B required re-drilling and a localized offset due to auger and drill rig mechanical issues.

- Off-set location TWP-04A was drilled and a well was installed. After the well was set at TWP-04A, grout breached the polyvinyl chloride (PVC) casing and filled the well to approximately 7 feet below ground surface. The cause of this breach has not been determined. TWP-04A was abandoned in accordance with TVA-KIF-SOP-46 *Groundwater Monitoring Well Abandonment*.

- The third and final offset location resulted in successful installation of TWP-04.

Permanent groundwater monitoring wells and TWPs were developed using surge-block techniques and purged using low-flow development techniques. Temperature, pH, turbidity, and specific conductance were measured and used to assist in determining well development in accordance with TVA-KIF-SOP-39 *Monitoring Well and Piezometer Installation and Completion*. Open boreholes TWP-25 and TWP-26 were constructed with a well casing installed from the ground surface to the top of the bedrock zone. Development of the open boreholes was performed by setting the submersible pump to approximately 1 foot above the bottom of the well casing, not within the open bedrock zone, to avoid possible borehole collapse. The open boreholes were not surged. Development water was containerized and disposed of in the Ash Pond in accordance with TVA-KIF-SOP-12 *Management of Investigation-Derived Waste*.

3.2 Direct Push Sampling

Direct push technology (Geoprobe®) was utilized to collect porewater in contact with ash (previously referred to in the SAP as groundwater and aqueous-phase constituent concentrations of groundwater in contact with the ash) from the borehole in support of Data Quality Objectives for Environmental Media, Appendix A of the SAP.

Samples of porewater in contact with ash were collected within the Dredge Cell, Lateral Expansion Area, and Ash Processing Area at a total of 11 locations (see Figure 1). Four locations were sampled within the Ash Processing Area (GP-07, GP-08, GP-09, and GP-10). Five locations were sampled on the Dredge Cell (GP-11, GP-12, GP-13, GP-14, and GP-15). Two locations sampled within the Lateral Expansion Area (GP-16 and GP-18). Since the Geoprobe® locations involved ash only, no formal logs were prepared. Table 2 summarizes the Geoprobe® elevations and sampling intervals.

Table 2. Geoprobe® Sampling

Sample Point ID	Coordinates (U.S. State Plane NAD 1927)			Sample Collection Date	Sampling Interval (below ground surface)
	Northing (feet)	Easting (feet)	Elevation (approximate)		
GP-07	553718.10	2439135.66	774.22 ft	9/30/2010	13.55 to 17.55 ft
GP-08	554285.84	2438941.65	769.10 ft	10/6/2010	12.55 to 17.85 ft
GP-09	554075.91	2439517.60	777.89 ft	10/5/2010	13.55 to 17.55 ft
GP-10	554915.52	2439572.79	776.31 ft	10/4/2010	14.45 to 18.45 ft
GP-11	555887.17	2439242.71	806.69 ft	10/14/2010	48.00 to 52.00 ft
GP-12	555240.43	2439956.60	807.50 ft	10/20/2010	49.85 to 53.85 ft
GP-13	556183.67	2440981.43	784.23 ft	10/12/2010	32.00 to 40.00 ft
GP-14	557530.21	2440495.73	755.16 ft	9/27/2010	12.25 to 16.25 ft
GP-15	557053.07	2441030.44	735.00 ft	9/28/2010	13.28 to 17.28 ft
GP-16	556624.33	2441998.71	766.85 ft	9/29/2010	10.84 to 14.28 ft
GP-18	555244.84	2442156.58	760.72 ft	10/21/2010	9.40 to 13.40 ft

Notes:

Geoprobe® sample location coordinates were collected with a Trimble® GeoXH GPS unit (sub-foot real-time accuracy)

For definitions, see the Acronyms section.

Field sampling activities began on September 23, 2010 and concluded on October 21, 2010. Sample collection was performed using a Geoprobe® 54DT in accordance with Work Package 1056: Non-Time Critical Geoprobe Sampling. Sampling activities and field descriptions were logged in accordance with TVA-KIF-SOP-06 *Field Documentation.* Depending on subsurface material characteristics, an open or closed Macro-Core® sampler with an acetate liner was advanced in 3 or 4 foot increments. Ash consistency and moisture content were logged in the field logbook. Advancement of the Macro-Core® sampler was performed until a saturated zone suitable for sampling was achieved. In order to prevent cross contamination of porewater in contact with ash and native soils, historic data from well installations were utilized to ensure that cores were not advanced into native soils. Once the saturated zone within the ash was encountered, the Geoprobe was offset 2 feet and the stainless steel Screen Point 15 sampler was deployed into the saturated zone for sample collection in accordance with TVA-KIF-SOP-47 *Groundwater Leachate Sampling Using Direct Push Technologies*. Screen depth and water level were recorded at each location in the field logbook. See Table 2 for sampling details.

Porewater samples were collected using a Geotech Geopump peristaltic pump model 900-1280 with new tubing (Teflon/silicon) at each site. Porewater was collected based on hierarchy of the bottle set according to the availability of collectable water for the following constituents at each location: dissolved metals (field-filtered with 0.45 micron filter), total suspended solids (TSS), total dissolved solids (TDS), anions, ammonia, and radionuclides. The hierarchy of the bottle set was based upon groundwater modeling data needs. GP-13 did not produce enough porewater to collect a full bottle set; only dissolved metals were collected.

Equipment was decontaminated prior to sampling commencement at each location in accordance with TVA-KIF-SOP-08 *Decontamination of Equipment*.

Following sample collection, a standardized HACH® Hydrolab® DS5x, in accordance with TVA-KIF-SOP-14 *Hydrolab Standardization*, was used to measure water quality parameters for temperature, pH, dissolved oxygen, oxidation reduction potential, and specific conductance per SAP. Water quality parameters were not collected at locations GP-10, GP-13, and GP-16 due to an insufficient volume of porewater.

Each borehole was abandoned and filled to ground surface with bentonite chips (Tennessee Department of Environment and Conservation Rule 1200-4-9.16) following sampling.

Samples were shipped to TestAmerica (TestAmerica-Nashville) of Nashville, Tennessee, for metals, TSS, TDS, anions, and ammonia analysis. All radionuclide samples were shipped to GEL Laboratories (GEL) of Charleston, South Carolina. Quality assurance samples were collected per the *Quality Assurance Project Plan for the Tennessee Valley Authority Kingston Ash Recovery Project* hereinafter referred to as the TVA-KIF-QAPP (matrix spike, matrix spike duplicate, and equipment blanks).

3.3 Groundwater Sampling and Aquifer Testing

Groundwater sampling and aquifer testing were performed to estimate hydraulic conductivity and concentrations of ash-related constituents in the groundwater. Groundwater sampling or aquifer testing purposes varied at each monitoring location. Table 3.1 of the SAP summarizes the monitoring locations and the specific sampling or testing performed at each location. Appendix D of the SAP further defines the specific sampling or testing performed at each location.

Aquifer testing included water level measurements, hydraulic head pressure measurements, borehole flowmeter measurements, and aquifer (slug) tests. Water level measurements were measured in the newly installed and existing monitoring wells and piezometers; using a water level meter per TVA-KIF-SOP-02 *Groundwater Sampling.* Additional aquifer testing for characteristics such as porosity, hydraulic conductivity, and geochemical parameters was conducted only at selected monitoring locations (see Attachment C of the SAP), utilizing American Society for Testing Materials methods.

Water level measurements, groundwater parameters, and groundwater samples were collected between September 23 and October 12, 2010. On January 20, 2011, wells AD1, AD2, and AD3 were re-sampled for dissolved radiological constituents, as these samples were not filtered during the initial sampling event. See Appendix D of SAP for the required analysis and details.

TVA Engineering Services tested the nine new wells and temporary well points, five existing wells, and three previously installed piezometers to determine groundwater flow characteristics using pumping, slug, and electromagnetic borehole flowmeter techniques in single well and multiple well tests. Data are to be included in the groundwater model report. Locations of previously existing wells along with newly installed wells, TWPs, and boreholes, are shown on Figure 1.

Groundwater analytical results are summarized below in Section 7, Data Summary, of this TM.

4. SUMMARY OF CHANGES

Field Change Notices (FCNs) were prepared to document deviations from the SAP. FCNs are summarized in the following paragraphs.

FCN-001: This change added soil samples for metals analysis (antimony, arsenic, barium, beryllium, cadmium, chromium, cobalt, copper, lead, mercury, nickel, selenium, silver, thallium, vanadium, and zinc) that were collected from the center of the screened interval in wells GW-01, GW-02, TWP-04, TWP-05, and TWP-06. The purpose of this change was to characterize metals that might be present in soil within the screened zone of the aquifer and affect groundwater quality in a well. Samples were collected using stainless steel split spoons. Quality control (QC) samples were collected, including one equipment rinsate and one duplicate sample.

FCN-002: This change added three samples of ash and one of lime, to obtain permeability characteristics of compacted ash and lime-treated ash. Results of the permeability characteristics samples were used in determining hydraulic conductivity within the groundwater model, in lieu of column leaching tests.

FCN-003: This change specified the use of rotosonic drilling and open borehole installation techniques. Per the SAP, TWPs were proposed to be installed using hollow-stem auger techniques. Use of rotosonic drilling techniques reduced vibrations that were undesirable within the Dredge Cell dikes.

FCN-004: This change added 35 locations to the water level measurement data set. The SAP specified four locations for water level measurements. The addition of 35 locations provides for better definition of the boundary conditions for site groundwater model.

FCN-005: This change altered equipment rinsate frequency from one rinsate per duration of project to one rinsate sample for each type of equipment used. Due to changes in types of drilling equipment used (see FCN-003), additional sampling was needed.

FCN-006: This changed the material of construction for GW-01 and GW-03 from 6.25 inch steel outer casing to Schedule 40 PVC (6.25 inch diameter) in order to minimize potential metals contamination during groundwater sampling.

FCN-007: This change addresses several aspects of the Geoprobe® sampling tasks as summarized below.

- The SAP-proposed groundwater sample from alluvium at GP-9, GP-12, and GP-15 were eliminated, as Geoprobe® equipment will not adequately seal off the alluvium from the overlying ash porewater. A sufficient number of monitoring wells provide adequate locations for groundwater samples from the alluvium. Several SAP-proposed Geoprobe® locations could not be safely accessed as they were in the Stilling Pond or Ash Pond. A Geoprobe® rig could not be safely mobilized to these locations (e.g., barge). Permanent monitoring wells and TWPs generated sufficient data to represent porewater in ash below the ponds and meet DQOs. Samples at proposed locations GP-17, GP-19, GP-20, and GP-21 were eliminated.

- Ash samples for column test leaching to be collected during the Geoprobe® investigation were not necessary, as the column testing with lime-treated and untreated ash samples collected from the Dredge Cell generated sufficient data to meet DQOs.

- Geoprobe® sample locations were not surveyed by a licensed land surveyor as stated in the SAP. The locations are not permanent and will not be used for subsequent data collection. Handheld GPS units were used to record the elevation and coordinates at each location.

- Table 3-1 of the SAP cites 15 locations, Appendix D of the SAP cites 18 locations, and Section 2.0 of the SAP cites 16 locations. The total number of locations sampled by Geoprobe® is 11. These locations were: GP-7, GP-8, GP-9, GP-10, GP-11, GP-12, GP-13, GP-14, GP-15, GP-16, and GP-18.

- Section 5.0 of the SAP proposed that boring logs would be completed for Geoprobe® locations. Boring logs were not prepared for these locations as the borings were through ash only and did not encounter alluvium. Boring descriptions of the ash were documented in the field logbook.

FCN-011: This change added strontium to the SAP analyte list in support of ecological evaluations. Strontium is an indicator of potential exposure of organisms to ash.

KRP-CN-001: This change addresses several aspects of the monitoring well installation that were not documented in-progress by FCNs, but have been compiled in a change notice from field logbook records.

- Due to the drilling company's inability to acquire plastic liners, decontaminated stainless steel split spoons were used for sampling in lieu of plastic liners. Equipment rinsate samples were collected and analyzed to determine the effectiveness of the decontamination process.

- A rotary drill rig and water and polymer-based drilling fluid were used at GW-01 and GW-03 instead of an air rotary drill rig. The access road to these well locations would not safely allow access of the larger air rotary rig. The polymer-based fluid had less potential to impact subsequent flow measurements.

- A 20-foot section of Schedule 40 PVC screen was installed instead of 10 feet of Schedule 40 PVC screen at GW-01 and GW-03 in order to maximize the amount of data collected with the borehole flow meter.

5. ANALYTICAL DATA REVIEW

TVA's contracted laboratories were required to submit three types of data deliverables: a limited (Level 1) data package containing sample results and batch QC sample results; a fully documented (Level 4) data package including raw data for all analyses; and electronic data deliverables (EDDs) for storage in TVA's EarthSoft EQuIS® database.

EDDs were subjected to completeness and correctness testing during loading to TVA's EQuIS database; once loaded to the EQuIS database, the data were subjected to verification. As defined in the TVA-KIF-QAPP, data verification involved comparison of the data loaded in the EQuIS database to the results reported in the Level 1 data package. In addition, data verification included review of the batch QC summary forms for compliance with the applicable methods and for data usability with respect to the project DQOs and the TVA-KIF-QAPP.

Following receipt of the Level 4 data package, data were subjected to validation. As defined in the TVA-KIF-QAPP, data validation included review of raw data and associated QC summary forms for compliance with the applicable methods and for data usability with respect to the appropriate guidance documents. As stated in the TVA-KIF-QAPP: "Initially, 100% of the chemical analysis data will be reported in full documentation data packages for independent data validation. Depending on the nature and frequency of issues identified during data validation, the percentage of data undergoing full data

validation may be reduced to a lesser percentage (such as 20%) or data verification may be substituted. The reduction in full data validation may be matrix specific, laboratory specific, or analyte specific. If after the percentage of full data validation has decreased, a trend in frequency of reporting issues, method non-compliances, or data usability issues is identified, data validation will be conducted for specific data points or the percentage of full data validation percentage may be increased until the issues have been minimized to their initial frequency." Data validation expands upon the completeness, correctness, and usability assessment performed during verification to include evaluation of instrumental QC analyses, review of sample preparation information, and recalculation of reported results from raw data.

TestAmerica-Nashville has analyzed aqueous samples for TVA since March 2009; aqueous data from TestAmerica-Nashville is considered to be a mature data stream. A mature data stream will primarily undergo verification. GEL is new to the project having been contracted during 2010; therefore, 100% of data generated from GEL were validated. Table 3 summarizes the data from the three laboratories.

Table 3. Data Review Summary

Laboratory	Matrix	No. COCs	No. Normal and Field Duplicates by Lab	No. of Equipment Blanks by Lab	No. Analytical Results	Percentage Final-Verified	Percentage Validated
TestAmerica-Nashville	Groundwater	12	19	2	757	50%	50%
	Porewater	12	12	1	409		
GEL	Groundwater	12	17	3	360	0%	100%
	Porewater	11	11	1	216		
	Total Count	**47**	**34***	**4***	**1,742**	**-**	**-**

Notes:

*"Total Count" for normal, field duplicate and equipment blank samples is the number of discrete samples sent to each lab. Each sample requiring metals speciation (Frontier) and/or radiological (GEL) analyses in addition to metals analysis (TAN) was split, with each split counted in this table as one sample per receiving lab ("Number of Samples by Lab").

For definitions, see the Acronyms section.

6. DATA QUALITY SUMMARY

Data verification and/or validation was performed based on the sample results, summary QC data, and raw data provided by the laboratory. Data verification and validation includes a review of the following QC measures (where applicable):

- Sample condition upon laboratory receipt;
- Initial calibration linearity (data validation only);
- Field and equipment blank analysis results than the method detection limit (MDL);
- Blank analysis results greater than the MDL (data validation only);
- Sample preparation and holding times;
- Initial calibration verification/continuing calibration verification standard recoveries (data validation only);
- Inductively coupled plasma interference check standard results (data validation only);
- MDLs and linear ranges (data validation only);
- Internal standard recoveries (data validation only);
- Matrix spike/matrix spike duplicate;
- Laboratory and field duplicate precision;

- Quantitation of positive results (data validation only);
- Laboratory control sample/laboratory control sample duplicate recoveries and precision;
- Total vs. dissolved sample precision;
- Analytical sequence (data validation only);
- Reporting limit standard recoveries (data validation only); and
- MDL verification standards (data validation only).

The data met the DQOs defined for this task and are acceptable for use. Table 4 summarizes the data quality based on the review performed and as compared to the data quality measures identified in the TVA-KIF-QAPP. The text of the data validation reports for the samples included in this TM will be included in the EE/CA Report.

Table 4. Summary of Surface Water Data Quality

Laboratory	Matrix	Analytical Results (Total) Count)	Acceptable (No Qualification)		Acceptable (Estimated)		Blank Qualified		Rejected	
TestAmerica -Nashville	Groundwater	757	618	82%	130	17%	7	1%	2	<1%
	Porewater	409	351	86%	56	14%	2	<1%	0	0%
GEL	Groundwater	360	355	99%	2	<1%	3	1%	0	0%
	Porewater	216	214	99%	1	<1%	1	<1%	0	0%

Notes:

[a]Acceptable, No Qualification – Qualification of data was not warranted based on a review of the applicable QC measures.

[b]Acceptable, Estimated – Quantitation or detection limit is approximate due to limitations or bias identified during a review of the applicable QC measures.

[c]Blank Qualified – Result is considered "not-detected" because it was detected in an associated blank at a similar level.

[d]Rejected – Unreliable result or detection limit; analyte may or may not be present in sample.

[e]Rejected results were due to dissolved metals results that were significantly greater than the associated total metals results. Therefore, both results were rejected.

For definitions, see the Acronyms section.

Results for geotechnical and geochemical sampling are included as Appendix C.

7. DATA SUMMARY

Summary statistics are provided in Tables 5 through 7. Table 5 summarizes data from permanent groundwater wells; Table 6 summarizes data from temporary well locations; and, Table 7 summarizes data from boring and Geoprobe® locations.

Table 5. Summary of Data from Permanent Groundwater Wells

Analyte	Units	Detection Limit Range	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Aluminum, Dissolved	mg/L	0.05 / 0.05	0.114	0.234	GW-01	10/05/2010	3 / 13	0.164
Aluminum, Total	mg/L	0.05 / 0.05	0.0611	0.252	22	09/29/2010	7 / 10	0.1649
Ammonia, as N	mg/L	0.1 / 0.205	0.121	1.08	22	12/15/2010	9 / 13	0.5248
Antimony, Dissolved	mg/L	0.00033 / 0.00033	ND	ND			0 / 13	0
Antimony, Total	mg/L	0.00033 / 0.00033	ND	ND			0 / 10	0
Arsenic, Dissolved	mg/L	0.00033 / 0.00033	0.00037	0.00254	GW-01	10/05/2010	7 / 13	0.001054
Arsenic, Total	mg/L	0.00033 / 0.00033	0.0004	0.00334	AD2	12/16/2010	5 / 10	0.0013
Barium, Dissolved	mg/L		0.0255	0.0834	GW-03	10/12/2010	13 / 13	0.04554
Barium, Total	mg/L		0.0262	0.0592	AD-1	12/16/2010	10 / 10	0.04091
Beryllium, Dissolved	mg/L	0.00033 / 0.00033	0.00056	0.00066	6AR	09/28/2010	2 / 13	0.00061
Beryllium, Total	mg/L	0.00033 / 0.00033	0.00034	0.00059	6AR	12/15/2010	3 / 11	0.00045
Boron, Dissolved	mg/L		0.0228	1.44	GW-02	10/12/2010	13 / 13	0.6501
Boron, Total	mg/L		0.128	1.13	22	12/15/2010	10 / 10	0.6773
Cadmium, Dissolved	mg/L	0.00033 / 0.00033	0.00219	0.00237	6AR	09/28/2010	2 / 13	0.00228
Cadmium, Total	mg/L	0.00033 / 0.00033	0.00212	0.0024	6AR	11/29/2010	3 / 11	0.002237
Calcium, Dissolved	mg/L		4.29	178	AD-3	09/23/2010	13 / 13	59.82
Calcium, Total	mg/L		4.47	179	AD-3	12/17/2010	10 / 10	67.61
Chloride	mg/L	1 / 1.85	1.24	10.8	AD-2	12/16/2010	12 / 13	5.73
Chromium, Dissolved	mg/L	0.00033 / 0.0005	0.00042	0.00154	GW-01	10/05/2010	3 / 13	0.0008233
Chromium, Total	mg/L	0.00033 / 0.0005	0.00043	0.00043	22	09/29/2010	1 / 10	0.00043
Cobalt, Dissolved	mg/L	0.00033 / 0.00033	0.00034	0.105	6AR	12/15/2010	9 / 13	0.0249
Cobalt, Total	mg/L	0.00033 / 0.00033	0.00124	0.106	6AR	11/29/2010	10 / 12	0.0331

Table 5. Summary of Data from Permanent Groundwater Wells (continued)

Analyte	Units	Detection Limit Range	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Copper, Dissolved	mg/L	0.00033 / 0.00033	0.00072	0.00072	GW-01	10/05/2010	1 / 13	0.00072
Copper, Total	mg/L	0.00033 / 0.00033	0.00033	0.00037	22	09/29/2010	2 / 10	0.00035
Fluoride	mg/L	0.1 / 0.1	0.124	0.496	GW-01	10/05/2010	11 / 13	0.2771
Iron, Dissolved	mg/L	0.025 / 0.025	0.0396	1.75	AD-2	12/16/2010	9 / 13	0.4996
Iron, Total	mg/L		0.0575	2.92	AD-2	12/16/2010	10 / 10	0.6658
Lead, Dissolved	mg/L	0.00033 / 0.0005	ND	ND			0 / 13	0
Lead, Total	mg/L	0.00033 / 0.00033	0.00033	0.00127	AD-2	12/16/2010	2 / 10	0.0008
Magnesium, Dissolved	mg/L		0.639	22.6	AD-3	09/23/2010	13 / 13	11.13
Magnesium, Total	mg/L		1.07	23.4	AD-3	12/17/2010	10 / 10	12.09
Manganese, Dissolved	mg/L	0.00033 / 0.00154	0.078	34.2	6AR	12/15/2010	12 / 13	7.205
Manganese, Total	mg/L		0.0985	33.2	6AR	12/15/2010	10 / 10	8.666
Mercury, Dissolved	mg/L	0.00015 / 0.0002	ND	ND			0 / 13	0
Mercury, Total	mg/L	0.00015 / 0.0002	ND	ND			0 / 10	0
Molybdenum, Dissolved	mg/L	0.00033 / 0.00033	0.00033	0.00261	GW-01	10/05/2010	5 / 12	0.00093
Molybdenum, Total	mg/L	0.00033 / 0.00033	0.00034	0.00235	AD-2	12/16/2010	5 / 9	0.000778
Nickel, Dissolved	mg/L	0.00033 / 0.001	0.00087	0.0438	6AR	12/15/2010	9 / 13	0.01069
Nickel, Total	mg/L	0.00033 / 0.00033	0.00114	0.0443	6AR	11/29/2010	9 / 11	0.01544
Nitrate-Nitrite Nitrogen	mg/L	0.1 / 0.1	ND	ND			0 / 10	0
Potassium, Dissolved	mg/L		0.763	5.6	AD-2	12/16/2010	13 / 13	2.983
Potassium, Total	mg/L		0.744	5.48	AD2-	12/16/2010	10 / 10	3.057
Selenium, Dissolved	mg/L	0.00033 / 0.00033	ND	ND			0 / 13	0
Selenium, Total	mg/L	0.00033 / 0.00033	ND	ND			0 / 10	0
Silver, Dissolved	mg/L	0.00033 / 0.00033	ND	ND			0 / 13	0
Silver, Total	mg/L	0.00033 / 0.00033	ND	ND			0 / 10	0
Sodium, Dissolved	mg/L		3.57	115	GW-01	10/05/2010	13 / 13	30.76

Table 5. Summary of Data from Permanent Groundwater Wells (continued)

Analyte	Units	Detection Limit Range	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Sodium, Total	mg/L		6.76	92.9	AD-1	12/16/2010	10 / 10	26.27
Strontium, Dissolved	mg/L		0.115	0.948	AD-3	12/17/2010	13 / 13	0.4355
Strontium, Total	mg/L		0.117	0.978	AD-3	12/17/2010	10 / 10	0.4894
Sulfate	mg/L		23.6	267	AD-3	12/17/2010	13 / 13	149.6
Thallium, Dissolved	mg/L	0.0005 / 0.00065	0.00058	0.00058	22	09/29/2010	1 / 13	0.00058
Thallium, Total	mg/L	0.0005 / 0.0005	0.0006	0.0006	AD-3	09/23/2010	1 / 10	0.0006
Total Dissolved Solids	mg/L		155	698	AD-3	09/23/2010	13 / 13	346.8
Total Inorganic Carbon	mg/L		15.1	76.1	AD-3	09/23/2010	10 / 10	42.7
Total Kjeldahl Nitrogen	mg/L	0.1 / 0.1	0.197	1.27	22	09/29/2010	8 / 10	0.6724
Total Suspended Solids	mg/L	1 / 1	1.3	14	22	09/29/2010	7 / 13	5.143
Vanadium, Dissolved	mg/L	0.001 / 0.001	0.00834	0.00834	GW-01	10/05/2010	1 / 13	0.00834
Vanadium, Total	mg/L	0.001 / 0.001	ND	ND			0 / 10	0
Zinc, Dissolved	mg/L	0.0083 / 0.0083	0.0333	0.0374	6AR	12/15/2010	2 / 13	0.03535
Zinc, Total	mg/L	0.0083 / 0.0083	0.0327	0.0378	6AR	12/15/2010	2 / 10	0.03525
Actinium-228	pCi/L	12.2 / 17.9	ND	ND			0 / 10	0
Americium-241	pCi/L	11.6 / 31.9	ND	ND			0 / 10	0
Bismuth-214	pCi/L	5.95 / 31.2	28.6	86.1	AD-2	01/20/2011	9 / 10	46.86
Cesium-137	pCi/L	2.9 / 4.17	ND	ND			0 / 10	0
Cobalt-60	pCi/L	3.42 / 4.36	ND	ND			0 / 10	0
Lead-212	pCi/L	6.57 / 11.5	ND	ND			0 / 10	0
Lead-214	pCi/L	6.56 / 45.6	14.7	91.8	AD-2	01/20/2011	10 / 10	49.86
Potassium-40	pCi/L	22.9 / 60	ND	ND			0 / 10	0
Radium-226	pCi/L	0.468 / 0.738	0.629	1.58	GW-02	10/12/2010	6 / 10	0.9413
Radium-228	pCi/L	0.471 / 1.41	0.75	0.843	22	09/29/2010	3 / 10	0.782
Thallium-208	pCi/L	3.52 / 5.78	ND	ND			0 / 10	0

Table 5. Summary of Data from Permanent Groundwater Wells (continued)

Analyte	Units	Detection Limit Range	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Thorium-228	pCi/L	0.0324 / 0.154	ND	ND			0 / 10	0
Thorium-230	pCi/L	0.0236 / 0.102	0.107	0.107	AD-2	09/22/2010	1 / 10	0.107
Thorium-232	pCi/L	0.0408 / 0.0881	ND	ND			0 / 10	0
Thorium-234	pCi/L	126 / 274	ND	ND			0 / 10	0
Uranium-234	pCi/L	0.0565 / 0.171	0.0923	0.92	AD-3	09/23/2010	4 / 10	0.4871
Uranium-235	pCi/L	0.0531 / 0.145	ND	ND			0 / 10	0
Uranium-238	pCi/L	0.0355 / 0.12	0.0709	0.439	GW-01	10/05/2010	5 / 10	0.2494

Note: For definitions, see the Acronyms section.

Table 6. Summary of Data from Temporary Well Locations

Analyte	Units	Detection Limit Range	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Aluminum, Dissolved	mg/L	0.05 / 0.05	0.921	1.18	TWP-26	10/04/2010	2 / 6	1.051
Ammonia, as N	mg/L		0.418	2.44	TWP-04	10/06/2010	6 / 6	0.9565
Antimony, Dissolved	mg/L	0.00033 / 0.00033	0.00035	0.00063	TWP-04	10/06/2010	3 / 6	0.0004567
Arsenic, Dissolved	mg/L	0.00033 / 0.00033	0.00076	0.594	TWP-04	10/06/2010	5 / 6	0.1468
Barium, Dissolved	mg/L		0.0947	0.544	TWP-25	10/07/2010	6 / 6	0.2511
Beryllium, Dissolved	mg/L	0.00033 / 0.00033	ND	ND			0 / 6	0
Boron, Dissolved	mg/L		0.0347	2.75	TWP-04	10/06/2010	6 / 6	1.18
Cadmium, Dissolved	mg/L	0.00033 / 0.00033	ND	ND			0 / 6	0
Calcium, Dissolved	mg/L		12.5	156	TWP-04	10/06/2010	6 / 6	54.58
Chloride	mg/L		1.5	5.31	TWP-24	10/06/2010	6 / 6	3.48
Chromium, Dissolved	mg/L	0.00033 / 0.0005	0.00033	0.00064	TWP-25	10/07/2010	2 / 6	0.000485
Cobalt, Dissolved	mg/L	0.00033 / 0.00033	0.00077	0.00983	TWP-06	09/30/2010	3 / 6	0.004027
Copper, Dissolved	mg/L	0.00033 / 0.00033	0.00034	0.00034	TWP-25	10/07/2010	1 / 6	0.00034
Fluoride	mg/L		0.247	1.78	TWP-26	10/04/2010	6 / 6	0.661
Iron, Dissolved	mg/L	0.025 / 0.025	1.16	52.3	TWP-06	09/30/2010	4 / 6	16.84
Lead, Dissolved	mg/L	0.00033 / 0.0005	ND	ND			0 / 6	0
Magnesium, Dissolved	mg/L	0.25 / 0.25	4.3	47.2	TWP-04	10/06/2010	4 / 6	17.19
Manganese, Dissolved	mg/L	0.00033 / 0.00033	0.00104	11	TWP-06	09/30/2010	5 / 6	2.868
Mercury, Dissolved	mg/L	0.00015 / 0.0002	ND	ND			0 / 6	0
Molybdenum, Dissolved	mg/L	0.00033 / 0.00127	0.00161	0.61	TWP-04	10/06/2010	5 / 6	0.202
Nickel, Dissolved	mg/L	0.00033 / 0.001	0.00123	0.00123	TWP-05	10/07/2010	1 / 6	0.00123
Potassium, Dissolved	mg/L		1.73	10.7	TWP-25	10/07/2010	6 / 6	5.565
Selenium, Dissolved	mg/L	0.00033 / 0.00033	ND	ND			0 / 6	0
Silver, Dissolved	mg/L	0.00033 / 0.00033	ND	ND			0 / 6	0
Sodium, Dissolved	mg/L		11.6	104	TWP-26	10/04/2010	6 / 6	43.75
Strontium, Dissolved	mg/L		0.151	3.4	TWP-04	10/06/2010	6 / 6	1.052

Table 6. Summary of Data from Temporary Well Locations (continued)

Analyte	Units	Detection Limit Range	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Sulfate	mg/L		1.91	387	TWP-04	10/06/2010	6 / 6	79.76
Thallium, Dissolved	mg/L	0.0005 / 0.0005	ND	ND			0 / 6	0
Total Dissolved Solids	mg/L		120	722	TWP-04	10/06/2010	6 / 6	301.3
Total Suspended Solids	mg/L		20.6	127	TWP-05	10/07/2010	6 / 6	60.13
Vanadium, Dissolved	mg/L	0.001 / 0.001	0.00263	0.00705	TWP-26	10/04/2010	2 / 6	0.00484
Zinc, Dissolved	mg/L	0.0083 / 0.0083	0.013	0.013	TWP-24	10/06/2010	1 / 6	0.013
Actinium-228	pCi/L	12.7 / 15.6	ND	ND			0 / 6	0
Americium-241	pCi/L	11.9 / 28.7	ND	ND			0 / 6	0
Bismuth-214	pCi/L	5.95 / 12.4	17.7	53.8	TWP-06	09/30/2010	5 / 6	36.2
Cesium-137	pCi/L	3.03 / 4.23	ND	ND			0 / 6	0
Cobalt-60	pCi/L	3.25 / 3.99	ND	ND			0 / 6	0
Lead-212	pCi/L	6.5 / 8.96	ND	ND			0 / 6	0
Lead-214	pCi/L	6.02 / 16.7	12.4	53.7	TWP-06	09/30/2010	4 / 6	36.35
Potassium-40	pCi/L	43.7 / 54.3	ND	ND			0 / 6	0
Radium-226	pCi/L	0.216 / 0.645	0.283	1.02	TWP-04	10/06/2010	3 / 6	0.706
Radium-228	pCi/L	0.586 / 1.12	ND	ND			0 / 6	0
Thallium-208	pCi/L	3.46 / 4.57	ND	ND			0 / 6	0
Thorium-228	pCi/L	0.0806 / 0.0938	ND	ND			0 / 6	0
Thorium-230	pCi/L	0.0411 / 0.0553	0.0778	0.0944	TWP-25	10/07/2010	2 / 6	0.0861
Thorium-232	pCi/L	0.0379 / 0.111	ND	ND			0 / 6	0
Thorium-234	pCi/L	128 / 250	ND	ND			0 / 6	0
Uranium-234	pCi/L	0.0576 / 0.148	0.483	1.01	TWP-04	10/06/2010	2 / 6	0.7465
Uranium-235	pCi/L	0.0568 / 0.108	ND	ND			0 / 6	0
Uranium-238	pCi/L	0.0818 / 0.133	0.174	0.849	TWP-04	10/06/2010	3 / 6	0.4933

Note: For definitions, see the Acronyms section.

Table 7. Summary of Data from Geoprobe Locations

Analyte	Units	Detection Limit Range	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Aluminum, Dissolved	mg/L	0.05 / 0.05	0.064	57.1	GP-18	10/21/2010	5 / 11	11.57
Ammonia, as N	mg/L	0.1 / 0.329	0.495	5.36	GP-15	09/28/2010	9 / 10	1.869
Antimony, Dissolved	mg/L	0.00033 / 0.00033	0.00068	0.0225	GP-13	10/12/2010	10 / 11	0.004059
Arsenic, Dissolved	mg/L		0.00393	0.915	GP-12	10/20/2010	11 / 11	0.2987
Barium, Dissolved	mg/L		0.0271	6.8	GP-18	10/21/2010	11 / 11	0.6949
Beryllium, Dissolved	mg/L	0.00033 / 0.00033	ND	ND			0 / 11	0
Boron, Dissolved	mg/L		1.2	12.2	GP-18	10/21/2010	11 / 11	4.272
Cadmium, Dissolved	mg/L	0.00033 / 0.00033	ND	ND			0 / 11	0
Calcium, Dissolved	mg/L		92.5	578	GP-14	09/27/2010	11 / 11	292.5
Chloride	mg/L		2.99	31.4	GP-09	10/05/2010	10 / 10	10.92
Chromium, Dissolved	mg/L	0.00033 / 0.00033	0.00033	0.00051	GP-13	10/12/2010	8 / 11	0.0004025
Cobalt, Dissolved	mg/L	0.00033 / 0.00033	0.00035	0.00423	GP-08	10/06/2010	9 / 11	0.00253
Copper, Dissolved	mg/L	0.00033 / 0.00033	0.00041	0.0093	GP-18	10/21/2010	4 / 11	0.002915
Fluoride	mg/L	0.1 / 0.1	0.168	2.96	GP-18	10/21/2010	10 / 10	1.091
Iron, Dissolved	mg/L	0.025 / 0.025	0.0351	126	GP-08	10/06/2010	8 / 11	49.06
Lead, Dissolved	mg/L	0.00033 / 0.00033	0.00033	0.00033	GP-18	10/21/2010	1 / 11	0.00033
Magnesium, Dissolved	mg/L	0.25 / 0.25	18	68.8	GP-15	09/28/2010	10 / 11	40.93
Manganese, Dissolved	mg/L	0.00033 / 0.00033	0.136	4.47	GP-10	10/04/2010	10 / 11	1.962
Mercury, Dissolved	mg/L	0.00015 / 0.00015	ND	ND			0 / 10	0
Molybdenum, Dissolved	mg/L		0.0074	3.01	GP-15	09/28/2010	11 / 11	0.5139
Nickel, Dissolved	mg/L		0.00046	0.0691	GP-07	09/30/2010	11 / 11	0.02629
Potassium, Dissolved	mg/L		0.338	47.9	GP-08	10/06/2010	11 / 11	18.4
Selenium, Dissolved	mg/L	0.00033 / 0.00033	0.00035	0.0196	GP-18	10/21/2010	7 / 11	0.00561
Silver, Dissolved	mg/L	0.00033 / 0.00033	ND	ND			0 / 11	0
Sodium, Dissolved	mg/L	0.25 / 1.06	1.77	25.8	GP-09	10/05/2010	10 / 11	11.07
Strontium, Dissolved	mg/L		1.84	15.8	GP-18	10/21/2010	11 / 11	4.382

Table 7. Summary of Data from Geoprobe Locations (continued)

Analyte	Units	Detection Limit Range	Minimum Detected Result	Maximum Detected Result	Location of Maximum Detected Result	Date of Maximum Detected Result	Number of Detections / Samples	Mean of Detections
Sulfate	mg/L		1.45	1560	GP-14	09/27/2010	10 / 10	758.9
Thallium, Dissolved	mg/L	0.0005 / 0.0005	0.00051	0.00178	GP-13	10/12/2010	6 / 11	0.0008817
Total Dissolved Solids	mg/L		412	2430	GP-14	09/27/2010	10 / 10	1210
Total Suspended Solids	mg/L		2480	249000	GP-11	10/14/2010	10 / 10	30812
Vanadium, Dissolved	mg/L	0.001 / 0.001	0.001	0.15	GP-13	10/12/2010	9 / 11	0.02518
Zinc, Dissolved	mg/L	0.0083 / 0.0083	0.0996	0.745	GP-08	10/06/2010	6 / 11	0.3371
Actinium-228	pCi/L	`	ND	ND			0 / 10	0
Americium-241	pCi/L	10.5 / 23.7	ND	ND			0 / 10	0
Bismuth-214	pCi/L	6.01 / 8.8	9.24	24.7	GP-10	10/04/2010	4 / 10	15.66
Cesium-137	pCi/L	2.87 / 3.73	ND	ND			0 / 10	0
Cobalt-60	pCi/L	2.8 / 3.73	ND	ND			0 / 10	0
Lead-212	pCi/L	5.89 / 8.67	ND	ND			0 / 10	0
Lead-214	pCi/L	6.53 / 17.4	19.8	19.8	GP-10	10/04/2010	1 / 10	19.8
Potassium-40	pCi/L	26.2 / 56.3	59.7	91	GP-10	10/04/2010	1 / 10	91
Radium-226	pCi/L	0.346 / 0.707	0.617	2.28	GP-18	10/21/2010	3 / 10	1.253
Radium-228	pCi/L	0.508 / 1.22	0.773	3.74	GP-18	10/21/2010	2 / 10	2.257
Thallium-208	pCi/L	3.16 / 4.49	ND	ND			0 / 10	0
Thorium-228	pCi/L	0.0433 / 0.152	0.298	0.298	GP-18	10/21/2010	1 / 10	0.298
Thorium-230	pCi/L	0.0283 / 0.113	0.185	0.185	GP-18	10/21/2010	1 / 10	0.185
Thorium-232	pCi/L	0.0334 / 0.106	ND	ND			0 / 10	0
Thorium-234	pCi/L	112 / 223	ND	ND			0 / 10	0
Uranium-234	pCi/L		0.225	6	GP-11	10/14/2010	10 / 10	1.617
Uranium-235	pCi/L	0.0702 / 0.13	0.304	0.347	GP-15	09/28/2010	2 / 10	0.3255
Uranium-238	pCi/L		0.341	6.45	GP-11	10/14/2010	10 / 10	1.64

Note: For definitions, see the Acronyms section.

Figures

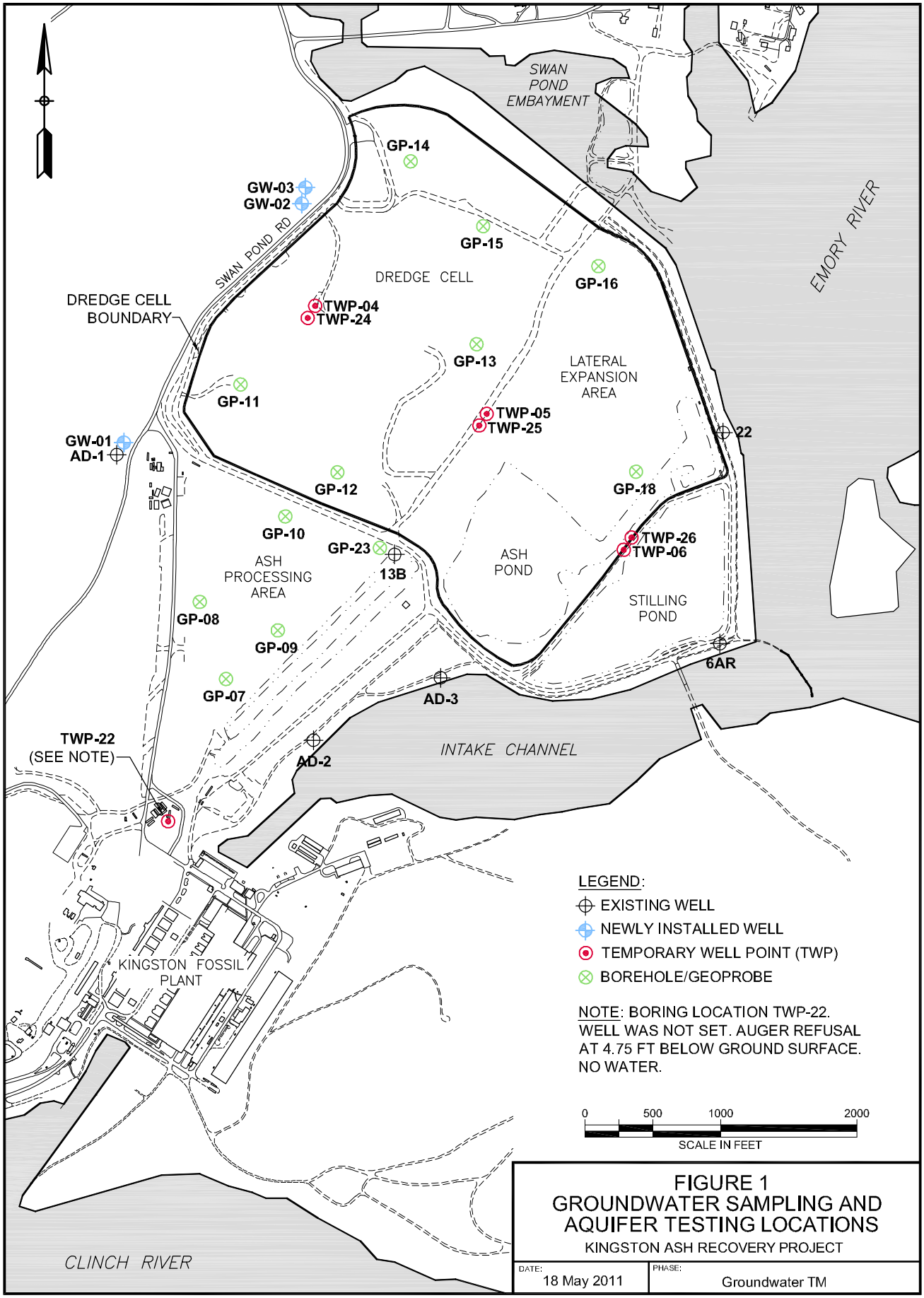

FIGURE 1
GROUNDWATER SAMPLING AND AQUIFER TESTING LOCATIONS
KINGSTON ASH RECOVERY PROJECT

DATE: 18 May 2011
PHASE: Groundwater TM

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APPENDIX A

Boring Logs

GP-16

Drilling Company:	Tri-State Drilling	Start Date:	042910	Logged By:
Driller:	S.Snow	End Date:	043010	R.Josefczyk, R.Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	5 10 9 13	2.1	0.0			ASH (FA) dark gray (5Y4/1) silt sized particles, 10% gravel, homogenous, well sorted, slightly moist
	5 9 7 7	2.0	0.0			
	4 6 7 8	2.0	0.0	5		
	2 4 4 6	2.0	0.0			
	3 4 4 4	2.0	0.0			ASH (FA) dark gray (5Y4/1) silt and clay sized particles, homogenous, well sorted, slightly moist
	2 3 3 1	2.0	0.0	10		
	woh woh 1 woh	2.0	0.0			
	woh woh woh 3	1.7	0.0	15		
	woh woh 1 1	2.0	0.0			ASH (FA)dark gray (5Y5/1) and black (5Y2.51) silt sized and very fine sand sized particles, wet
	2 1 2 1	1.7	0.0			ASH (FA) dark gray (5Y4/1) clay with silt sized particles, wet
	woh woh woh 1	1.7	0.0	20		
	1 1 1 1	1.9	0.0			
	wot	1.2	0.0	25		SILTY CLAY (CL) dark yellowish brown (10YR3/6)
	wot wot woh woh	1.7	0.0			CLAY (CL)dark yellowish brown (10YR4/6) lean clay
	2 3 3 6	2.0	0.0			SILTY CLAY (CL) dark yellowish brown (10YR4/6) very uniform
	3 3 3 3	2.0	0.0	30		
	2 2 3 2	1.5	0.0			
		1.3	0.0	35		shelby tube collected-no visual description
	3 1 1 1	1.1	0.0			SILTY CLAY (CL) dark yellowish brown (10YR4/6) very uniform
	woh woh 1 1	1.2	0.0			

Notes:

2-inch split spoons used for SPT
wot = weight of tools
woh = weight of hammer
FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
hatched sample = geochemical analysis

Drill Rig:	Central Mining Equipment 75
Drilling Method:	Hollow Stem Augers
Total Depth (ft bgs):	61.1ft bgs
1st Water Encountered (ft bgs):	6.3 ft bgs
Water Level after 24 hr (ft bgs):	NA

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

GP-16

Drilling Company: Tri-State Drilling	Start Date: 042910	Logged By:	
Driller: S.Snow	End Date: 043010	R.Josefczyk, R.Lee	

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	woh woh 1 1	1.4	0.0			SAND(SC) dark yellowish brown (10YR4/6)very fine sand, some silt, clay
	2 1 1 1	1.75	0.0			
	woh 1 1 2	1.2	0.0	45		
	2 2 1 2	1.4	0.0			
	2 2 3 2	1.6	0.0			
				50		
	3 4 2 2	1.7	0.0			
	woh 1 1 4	1.3	0.0			SAND (SW) olive brown (5YR4/3) very fine SAND (SW) yellowish brown (10YR5/6) very fine SAND (SW) pale yellow (2.5Y7/4) medium grained
	4 4 7 12	1.7	0.0	55		SAND (SW) light gray (2.5Y7/2) medium grained SAND (SW) light gray (2.5Y7/2) medium grained
		0	0.0			drilled through
		0	0.0			shelby tube collected-no visual description
	5 9 8 24	1.1	0.0	60		SAND (SW) yellowish brown (10YR5/6) very fine
						shale dark grayish brown (2.5R4/2) auger refusal at 61.1 ft bgs
				65		
				70		
				75		

Notes:

2-inch split spoons used for SPT
wot = weight of tools
woh = weight of hammer
FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
hatched sample = geochemical analysis

Drill Rig:	Central Mining Equipment 75
Drilling Method:	Hollow Stem Augers
Total Depth (ft bgs):	61.1ft bgs
1st Water Encountered (ft bgs):	6.3 ft bgs
Water Level after 24 hr (ft bgs):	NA

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

GP-16A

Drilling Company: Tri-State Drilling	Start Date: 050310	Logged By:	
Driller: S.Snow	End Date: 050410	R. Josefczyk, R. Lee	

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
				5, 10, 15, 20, 25		Augered to 28' no sample. See boring log GP-16 for description of 0'-28' bgs
	3 5 7 10	2.2	0.0	30		SILTY CLAY (CL) yellowish brown (10YR5/6)
	3 3 3 7	2.2	0.0			
				35		drilled through to keep boring stable- no SPT, no visual description

Notes:

3-inch stainless steel split spoons used for SPT
augered through 0-28 ft bgs
wot = weight of tools
woh = weight of hammer
FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable

Drill Rig:	Central Mining Equipment 75
Drilling Method:	Hollow Stem Auger
Total Depth (ft bgs):	52 ft bgs
1st Water Encountered (ft bgs):	NA
Water Level after 24 hr (ft bgs):	NA

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

GP-16A

Drilling Company:	Tri-State Drilling	Start Date:	050310	Logged By:
Driller:	S.Snow	End Date:	050410	R. Josefczyk, R. Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	woh woh 1 1	NR	0.0			no recovery
	5 3 3 2	1.2	0.0			SAND (SW) yellowish brown (10YR5/6) fine with minor silt
	4 2 2 1	1.3	0.0	45		
	NA	1.55	0.0			shelby tube collected-no visual description
	21 10 8 5	1.9	0.0			SAND (SW) yellowish brown (10YR5/6) fine with trace silt
	5 4 4 8	1.4	0.0	50		
				55		
				60		
				65		
				70		
				75		

Notes:

3-inch stainless steel split spoons used for SPT
augered through 0-28 ft bgs
wot = weight of tools
woh = weight of hammer
FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable

Drill Rig:	Central Mining Equipment 75
Drilling Method:	Hollow Stem Auger
Total Depth (ft bgs):	52 ft bgs
1st Water Encountered (ft bgs):	NA
Water Level after 24 hr (ft bgs):	NA

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

GP-23

Drilling Company:	Tri-State Drilling	Start Date:	042610	Logged By:
Driller:	S.Snow	End Date:	042810	R. Josefczyk, R. Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	50/5	1.0	0.0			GRAVEL (GC)
	13 30 28 17	2.0	0.0			ASH (FA) dark gray (5Y4/1) yellowish red (5YR4/6) SILT intermixed
	2 4 15 18	1.2	0.0	5		CLAY (CH) yellowish red (5YR4/6) fat clay with chert GRAVEL (fill)
						ASH (FA) dark gray (5Y4/1)and GRAVEL
	6 24 10 9	2.0	0.0			CLAY (CH) yellowish red (5YR4/6) fat clay with chert gravel (fill)
						ASH (FA) very dark gray (2.5Y3/1) silt
	4 5 7 9	1.3	0.0			ASH (FA) very dark gray (2.5Y3/1) silt with shale chips
				10		CLAY (CH) yellowish red (5YR4/6) fat clay with chert gravel (fill)
	2 2 7 17	1.8	0.0			GRAVEL (GC)
	10 13 18 25	2.0	0.0			CLAY (CH) yellowish red (5YR4/6) fat clay with chert gravel (fill)
						ASH (FA) very dark gray (2.5Y3/1) silt
	NA	poor	0.0	15		CLAY (CH) yellowish red (5YR4/6) fat clay with chert gravel (fill)
						ASH (FA) dark gray (5Y4/1) silty sand
	17 37 46 66	2.0	0.0			ASH (FA) dark gray (5Y4/1) silty sand very moist 1 cm rounded rock fragments fining downward
	NA	NR				ASH (FA)dark gray (5Y4/1) silty sand becoming more uniform
				20		shelby tube collected-no visual description
	33 45 29 38	1.4	0.0			ASH (FA) dark gray (5Y4/1) fine to medium sand very homogenous moist
	8 11 10 9	2.0	0.0			shelby tube collected-no visual description
						ASH (FA) dark gray (5Y4/1) fine to medium sand very dense
	3 5 8 8	1.7	0.0	25		BOTTOM ASH (BA) dark gray (5Y4/1) medium to coarse sand with minor gravel 2-3 cm
	4 6 7 7	2.0	0.0			ASH (FA) dark gray (5Y4/1) fine sand with lenses of coarse sand and gravel
	3 3 2 3	1.5	0.0			BOTTOM ASH (BA) dark gray (5Y4/1) medium to coarse sand with some gravel throughout upto 1 cm
				30		
	4 3 2 2	0.2	0.0			ASH (FA) dark gray (5Y4/1)basket failed. Poor recovery.
	NA	NR				drilled through- boring too unstable to sample
	NA	1.7	0.0	35		shelby tube collected-no visual description
	3 3 3 5	1.8	0.0			ASH (FA) SAND very dark gray (10YR3/1) fine sand, no gravel, no fines, uniform
	3 3 2 3	2.0	0.0			ASH (FA) fine sand very dark gray (10YR3/1)

Notes:

wot = weight of tools
woh = weight of hammer
FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
hatched sample = geochemical analysis
solid sample = shelby tube

Drill Rig: Central Mining Equipment 75
Drilling Method: Hollow Stem Auger
Total Depth (ft bgs): 69.0 ft bgs
1st Water Encountered (ft bgs):
Water Level after 24 hr (ft bgs):

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

GP-23

Drilling Company:	Tri-State Drilling	Start Date:	042610	Logged By:
Driller:	S.Snow	End Date:	042810	R. Josefczyk, R. Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	1 1 1 1	2.0	0.0			ASH (FA) fine sand very dark gray (10YR3/1) with silt
	1 1 1	2.0	0.0			ASH (FA) fine sand very dark gray (10YR3/1) with<5% gravel
	1 1 1 1	1.7	0.0	45		ASH (FA) fine sand very dark gray (5YR3/1) with<5% gravel
	woh	1.7	0.0			
	1 1 1	2.0	0.0			
	2 2 4 5	2.0	0.1 0.0 0.3	50		CLAY (CH) (2.5Y3/3) dark olive brown and (5Y2.5/1) black fat clay
	wot woh woh 4	1.4	0.0			CLAY (CH) (2.5Y3/3) dark olive brown and (5Y2.5/1) black fat clay bioturbated, minor organics
■	NA	1.85	0.0	55		CLAY (CH) (2.5Y3/3) dark olive brown and (5Y2.5/1) black fat clay, trace organics, interspersed chert nodules (5%), trace manganese reduced fragments.
						CLAY (CH) fat clay gray (5/5/1)
	woh woh 3 3	1.8	0.0			shelby tube collected-no visual description
						CLAY (CH) olive gray (5Y4/2) fat clay with oxidized manganese fragments, very linear and platy
	3 3 4 3	2.0	0.0			SAND (SW) fine to medium (slough)
				60		CLAY (CL) strong brown (7.5YR5/8) lean
	woh woh woh 2	2.0	0.0			CLAY (CH) strong brown (7.5YR5/8) fat clay
						CLAY (CH) dark gray (10YR4/1) fat clay
	wot wot woh woh	2.0	0.0			CLAY (CH) dark gray (10YR4/1) fat clay <5% silt
	woh woh 3 10	1.8	0.0	65		CLAY (CH) dark gray (10YR4/1) fat clay grading to lean clay at 1 ft no gravel
	15 7 9 7	2.0	0.0			SILTY SAND (SM) silty fine sand dark gary (10YR4/1) no organics well sorted
■	NA	poor	0.0			SAND (SM) fine grained silty sand well sorted very consistent grayish brown (2.5Y5/2)
	100/5	0.7	0.0			shelby tube collected-no visual description
				70		SAND (SW) fine to medium sand greenish brown (2.5Y5/2)
						limestone (2.5Y5/2) gray
				75		

Notes:

wot = weight of tools
woh = weight of hammer
FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
hatched sample = geochemical analysis
solid sample = shelby tube

Drill Rig: Central Mining Equipment 75
Drilling Method: Hollow Stem Auger
Total Depth (ft bgs): 69.0 ft bgs
1st Water Encountered (ft bgs):
Water Level after 24 hr (ft bgs):

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

GW-01

Drilling Company:	Tri-State Drilling	Start Date: 082410	Logged By:
Driller:	G.Akins, S.Snow	End Date: 090310	R.Josefczyk, R.Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
				5, 10, 15, 20, 25		See boring log GW-01A for description of 0'-28' bgs
				30, 35		shale dark grayish brown (2.5YR4/2) with thin interspersed beds of limestone

Notes:

No SPT or recovery applicable due to Rotary drilling with fluids

Drill Rig:	CME 55 & Diedrich D-50
Drilling Method:	Hollow Stem Auger and Rotary with Fluids
Total Depth (ft bgs):	55.0 ft bgs
1st Water Encountered (ft bgs):	4 ft bgs
Water Level after 24 hr (ft bgs):	

Tennessee Valley Authority

Kingston Fossil Plant

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Harriman, TN, 37748

GW-01

Drilling Company:	Tri-State Drilling	Start Date: 082410	Logged By:
Driller:	G.Akins, S.Snow	End Date: 090310	R.Josefczyk, R.Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
				45		
				50		
				55		
				60		
				65		
				70		
				75		

Notes:

No SPT or recovery applicable due to Rotary drilling with fluids

Drill Rig: CME 55 & Diedrich D-50
Drilling Method: Hollow Stem Auger and Rotary with Fluids
Total Depth (ft bgs): 55.0 ft bgs
1st Water Encountered (ft bgs): 4 ft bgs
Water Level after 24 hr (ft bgs):

Tennessee Valley Authority

Kingston Fossil Plant

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Harriman, TN, 37748

GW-01A

Drilling Company: Tri-State Drilling	Start Date: 060210	Logged By:	
Driller: S.Snow	End Date: 060210	R.Josefczyk	

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	2 1 3 4	1.4	0.0			topsoil SILTY CLAY (CL)brown (10YR4/3) with minor shale fragments
	2 1 1 2	1.7	0.0			SILTY CLAY (CL)brown (10YR4/3) with minor shale fragments shale reddish brown (5YR4/4) wet
	woh woh 2 2	1.7	0.0	5		shale reddish brown (5YR4/4) wet SILTY CLAY (CL) strong brown (7.5YR4/6) with shale fragments
	3 6 7 11	2.0	0.0			SILTY CLAY dark brown (10YR3/3) with shale fragments SILTY CLAY (CL) dark yellowish brown (10YR4/4) with shale fragments and orangish-red mottling
	4 9 15 23	2.3	0.0			
	2 2 3 5	1.7	0.0	10		SILTY CLAY (CL) dark yellowish brown (10YR4/4) with shale and sandstone fragments and orangish-red mottling SILTY CLAY (CL) brown (10YR5/3) with orangish-red mottling, manganese nodules, wet
	2 3 2 4	1.5	0.0			SILTY CLAY (CL) brown (10YR5/3) with orangish-red mottling, manganese nodules, minow shale fragments, wet
	2 1 1 3	0.8	0.0	15		SILTY CLAY (CL) brown (10YR5/3) with orangish-red mottling, manganese nodules, minow shale and sandstone fragments, wet
	100/3	0.6	0.0			SILTY CLAY (CL) brown (10YR5/3) with some shale fragments, wet
	woh 1 1 2	1.9	0.0	20		SILTY CLAY (CL) very dark grayish brown (10YR 3/2) with some shale fragments, wet SILTY CLAY (CL) very dark grayish brown (10YR 3/2) with some shale fragments, wet
	NA	1.98	0.0			CLAY and SILT (CL) dark yellowish brown (10YR4/4) SILTY CLAY (CL) very dark grayish brown (10YR 3/2) with some shale fragments, wet
	17 33 59 100/5	1.9	0.0			shelby tube collected-no visual description
	78 100/3	1.1	0.0	25		shale very dark gray (10YR3/1), weathered, relect bedding present shale very dark gray (10YR3/1), weathered
	100/5	0.7	0.0			shale black (2.5Y2.5/1) bottom 0.2 dry, weathered shale very dark gray (7.5YR3/1)
	100/5	0.6	0.0			
	100/3	0.6	0.0	30		shale very dark gray (7.5YR3/1) shale black (2.5Y2.5/1) auger refusal at 30.5 ft bgs
				35		

Notes:

Drill Rig:	Central Mining Equipment 75
Drilling Method:	Hollow Stem Augers
Total Depth (ft bgs):	30.5 ft bgs
1st Water Encountered (ft bgs):	4 ft bgs
Water Level after 24 hr (ft bgs):	

Tennessee Valley Authority

Kingston Fossil Plant

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Harriman, TN, 37748

GW-02

Drilling Company:	Tri-State Drilling	Start Date:	080910	Logged By:
Driller:	G.Akins	End Date:	082310	R.Josefczyk, R.Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	6 6 5 6	1.6	0.0			gravel (GP) fill
	5 6 7 5	1.4	0.0			gravel (GP) fill SILTY CLAY (CL) dark yellowish brown (10YR4/4) with less than 10% gravel, damp.
	2 4 4 3	1.2	0.0	5		SILTY CLAY (CL) dark yellowish brown (10YR4/4) with less than 10% gravel, damp.
	3 5 8 8	1.8	0.0			SILTY CLAY (CL) dark yellowish brown (10YR4/4) and yellowish brown (10YR5/4) with less than 10% gravel, damp.
	2 5 7 9	1.8	0.0			SILTY CLAY (CL) dark yellowish brown (10YR4/4) and light brownish gray (10YR6/2) with less than 10% gravel, damp.
	NA	1.0	0.0	10		shelby tube
	5 7 7 10	2.2	0.0			SILTY CLAY (CL) yellowish red (5YR4/6) manganese staining, with approximately 25% sandstone gravel.
	8 9 15 21	1.9	0.0			CLAY (CL) brown (7.5 YR4/4) minor silt
				15		shale dark grayish brown (2.5YR4/2) weathered, friable
	5 13 17 7	1.9	0.0			slough shale dark grayish brown (2.5YR4/2) weathered, friable
	7 7 6 9	1.4	0.0			sandstone olive brown (2.5Y4/3) fine-medium grained shale dark grayish brown (2.5YR4/2) weathered
	9 50/4"	1.2	0.0	20		auger refusal at 20 ft bgs
				25		
				30		
				35		

Notes:

NA = not applicable
solid sample = shelby tube
2-inch steel split spoons used for SPT

Drill Rig:	Central Mining Equipment 55
Drilling Method:	Hollow Stem Auger
Total Depth (ft bgs):	20 ft bgs
1st Water Encountered (ft bgs):	17 ft bgs
Water Level after 24 hr (ft bgs):	NA

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

GW-03

Drilling Company:	Tri-State Drilling	Start Date: 082310	Logged By:
Driller:	G.Akins, S.Snow	End Date: 090110	R.Josefczyk, R.Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
				5, 10		See boring log GW-02 for description of 0'-13' bgs
				15		shale dark grayish brown (2.5YR4/2)
				20, 25, 30, 35		shale dark grayish brown (2.5YR4/2) with thin interspersed layers of limestone

Notes:

No SPT or recovery applicable due to Rotary drilling with fluids

Drill Rig: CME 55 & Diedrich D-50
Drilling Method: Hollow Stem Auger & Rotary with fluids
Total Depth (ft bgs): 45.1ft bgs
1st Water Encountered (ft bgs):
Water Level after 24 hr (ft bgs):

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

GW-03

Drilling Company:	Tri-State Drilling	Start Date: 082310	Logged By:
Driller:	G.Akins, S.Snow	End Date: 090110	R.Josefczyk, R.Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
				45		
				50		
				55		
				60		
				65		
				70		
				75		

Notes:

No SPT or recovery applicable due to Rotary drilling with fluids

Drill Rig: CME 55 & Diedrich D-50
Drilling Method: Hollow Stem Auger & Rotary with fluids
Total Depth (ft bgs): 45.1ft bgs
1st Water Encountered (ft bgs):
Water Level after 24 hr (ft bgs):

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

TWP-04

Drilling Company: Tri-State Drilling	Start Date: 052710	Logged By:	
Driller: S.Snow	End Date: 060110	R. Josefczyk & R. Lee	

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
				5, 10, 15, 20, 25, 30, 35		See boring logTWP-04B for description of 0'-30' bgs and boring log TWP-04A for description of 30'-81' bgs

Notes:

3-inch stainless steel split spoon used for SPT

Drill Rig: Central Mining Equipment 75
Drilling Method: Hollow Stem Auger and Casing Advacer
Total Depth (ft bgs): 74.1 ft bgs
1st Water Encountered (ft bgs):
Water Level after 24 hr (ft bgs):

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

TWP-04

Drilling Company:	Tri-State Drilling	Start Date:	052710	Logged By:
Driller:	S.Snow	End Date:	060110	R. Josefczyk & R. Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
				45		
				50		
				55		
				60		
				65		
				70		
	17 33 43 43	2.0	0.0			COARSE SAND (GW) and GRAVEL dark grayish brown (10YR4/2)
						sandstone and shale bedrock greenish gray (GLEY 1 5/1)
				75		auger refusal at 74.1

Notes:

3-inch stainless steel split spoon used for SPT

Drill Rig: Central Mining Equipment 75
Drilling Method: Hollow Stem Auger and Casing Advacer
Total Depth (ft bgs): 74.1 ft bgs
1st Water Encountered (ft bgs):
Water Level after 24 hr (ft bgs):

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

TWP-04A

Drilling Company:	Tri-State Drilling	Start Date:	050710	Logged By:
Driller:	S.Snow	End Date:	051110	R.Josefczyk, R.Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
						see boring log TWP-04B for description of 0'-30' bgs
				5		
				10		
				15		
				20		
				25		
				30		
	3 1 0 3	1.6	0.0			BOTTOM ASH (BA) very dark gray (10YR3/1)
	2 2 4 3	1.6	0.0			ASH (FA) very dark gray (10YR3/1)silt and clay sized particles
	2 0 0 1	0.6	0.0	35		
	4 3 2 3	1.9	0.0			
	4 5 3 5	1.9	0.0			

Notes:

wot = weight of tools
woh = weight of hammer
FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
hatched sample = geochemical analysis
solid sample = shelby tube

Drill Rig:	Central Mining Equipment 75
Drilling Method:	Hollow Stem Auger, Casing Advancer
Total Depth (ft bgs):	80 ft bgs
1st Water Encountered (ft bgs):	6 ft bgs
Water Level after 24 hr (ft bgs):	

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

TWP-04A

Drilling Company:	Tri-State Drilling	Start Date:	050710	Logged By:
Driller:	S.Snow	End Date:	051110	R.Josefczyk, R.Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	3 2 1 1	1.8	0.0			ASH (FA) dark gray (10YR4/1) clay sized particles ASH (FA) very dark gray (10YR3/1)silt sized particles
	4 2 1 1	1.5	0.0			ASH (FA) very dark gray (10YR3/1) clay sized particles, very dense
	3 2 1 1	1.3	0.0	45		SILT (ML) olive brown (2.5Y4/3) with mottled black silt ASH (FA) alternating layers of very dark gray (10YR3/1) clayey ash and silty ash
	2 1 0 1	2.0	0.0			ASH (FA) very dark gray (10YR3/1) clay sized particles
	woh woh woh 1	1.9	0.0			
	1 1 1 1	1.9	0.0	50		ASH (FA) dark gray (10YR4/1) clay sized particles
	woh woh woh 3	2.0	0.0			
	4 2 2 2	1.2	0.0	55		CLAY (CL) olive brown (2.5Y5/4) ASH (FA) dark gray (10YR4/1) clay sized particles
	1 3 4 6	1.9	0.0			CLAY (CH) dark gray (GLEY 1 4/1) and olive brown (2.5Y4/3)intermixed fat clay, some gravel 1-2cm varies from angular to round
	2 3 3 4	1.5	0.0			CLAY (CH) dark gray (GLEY 1 4/1) and olive brown (2.5Y4/3) intermixed, fat
	NA	2.0	0.0	60		shelby tube collected-no visual description
	8 6 8 12	2.2	0.0			CLAY (CH) dark gray (GLEY1 4/1) CLAY (GC) yellowish brown (10YR5/6) and gray (10YR6/11) with 50% GRAVEL, some sandstone up to 4 cm, angular
	5 11 16 21	2.2	0.0	65		fat CLAY (CH) gray (10YR6/1) intermixed with CLAY () yellowish brown (10YR5/6), no silt, no sand, no gravel.
	3 5 6 7	2.3	0.0			CLAY (CH) yellowish brown (10YR5/6) and gray (10YR6/1) with 50% GRAVEL, some sandstone up to 4 cm, angular
	11 18 28 24	2.0	0.0			CLAY (CH) gray (10YR6/1) fat, intermixed with yellowish brown (10YR5/6) fat clay
	NA	2.0	0.0	70		CLAYEY SILT (ML) gray (2.5Y5/1) SILTY SAND (SM) gray (2.5Y5/1) fine, well sorted, no gravel shelby tube collected-no visual description
	11 10 13 10	1.3	0.0			CLAYEY SILTY GRAVEL (GC) gray (2.5Y5/1), angular gravel, abundant chert
	30 32 40 50/3	1.4	0.0	75		CLAYEY SILT (ML) gray (2.5Y4/1) with minor rock fragments CLAYEY GRAVEL (GC) dark gray (2.5Y4/1) large, angular gravel in a fat clay matrix, some fine grained SAND
	81 100	0.7	0.0			SAND (SW) dark gray (2.5Y4/1) fine grained CLAY (CL) dark grayish brown (10YR3/2) fat clay with some gravel
	37 100	NR	0.0			SAND (SW) greenish gray (GLEY1 6/1) medium grained

Notes:

wot = weight of tools
woh = weight of hammer
FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
hatched sample = geochemical analysis
solid sample = shelby tube

Drill Rig:	Central Mining Equipment 75
Drilling Method:	Hollow Stem Auger, Casing Advancer
Total Depth (ft bgs):	80 ft bgs
1st Water Encountered (ft bgs):	6 ft bgs
Water Level after 24 hr (ft bgs):	

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

TWP-04A

Drilling Company: Tri-State Drilling	Start Date: 050710	Logged By:	
Driller: S.Snow	End Date: 051110	R.Josefczyk, R.Lee	

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	11 45 31 53	1.5	0.0			NO RECOVERY sandstone, brown (2.5Y6/1) fine to medium grained quartz shale, olive brown (2.5Y4/3) and strong brown (7.5YR4/4) laminated auger refusal
				85		
				90		
				95		
				100		
				105		
				110		
				115		

Notes:

wot = weight of tools
woh = weight of hammer
FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
hatched sample = geochemical analysis
solid sample = shelby tube

Drill Rig:	Central Mining Equipment 75
Drilling Method:	Hollow Stem Auger, Casing Advancer
Total Depth (ft bgs):	80 ft bgs
1st Water Encountered (ft bgs):	6 ft bgs
Water Level after 24 hr (ft bgs):	

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

TWP-04B

Drilling Company: Tri-State Drilling	Start Date: 050510	Logged By:	
Driller: S.Snow	End Date: 050510	R.Josefczyk, R.Lee	

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	2 1 1 3	1.9	0.0			ASH (FA) very dark gray (10YR3/1) silty, some organics, dry
	2 4 5 6	2.3	0.0			ASH (FA) very dark gray (10YR3/1) silty, dry
	2 4 4 3	2.0	0.0	5		ASH (FA) very dark gray (10YR3/1) fine sand sized particles, no silt, dry
	2 1 1 1	1.9	0.0			ASH (FA) very dark gray (10YR3/1) fine sand sized particles, moist
	1 0 1 1	1.7	0.0			
				10		
	1 1 0 1	1.5	0.0			
	woh woh woh 1	1.6	0.0			
	woh woh 3 4	1.7	0.0	15		ASH (FA) very dark gray (10YR3/1) fine sand sized particles, very wet
	5 7 16 13	2.0	0.0			ASH (FA) very dark gray (10YR3/1) fine sand sized particles mix with medium sand sized particles, well sorted, <5% gravel, very wet
	woh 4 10 10	1.75	0.0			ASH (FA) very dark gray (10YR3/1) medium grained sand sized particles, wet
				20		BOTTOM ASH (BA) very dark gray (10YR3/1)medium to coarse grained sand sized particles
	7 8 12 15	2.0	0.1			ASH (FA) very dark gray (10YR3/1)silt sized particles, wet
	9 9 10 10	1.8	0.2			
	woh 5 6 7	1.8	0.0	25		
	1 1 3 3	1.95	0.0			ASH (FA) very dark gray (10YR3/1) fine sand sized particles, grading to silty sandy ASH (FA) in lower 0.7 feet
	1 3 3 2	1.3	0.0			ASH (FA) very dark gray (10YR3/1) fine, homgenous sand sized particles, wet
				30		ASH (FA) very dark gray (10YR3/1)silty clay sized particles, wet
				35		

Notes:

2-inch steel split spoons used for STP

Drill Rig:	Central Mining Equipment 75
Drilling Method:	Hollow Stem Auger
Total Depth (ft bgs):	30 ft bgs
1st Water Encountered (ft bgs):	NA
Water Level after 24 hr (ft bgs):	NA

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

TWP-05

Drilling Company: Tri-State Drilling	Start Date: 051410	Logged By:	
Driller: S.Snow	End Date: 052010	R.Josefczyk, R.Lee	

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	4 6 6 8	2.0	0.0			ASH (FA) dark gray (10YR4/1) with some limestone gravel
						ASH (FA) dark gray (10YR4/1) silt sized texture, dry
	5 4 4 4	2.0	0.0			
	2 3 7 10	2.0	0.0	5		ASH (FA) dark gray (10YR4/1) with trace limestone gravel
						ASH (FA) dark gray (10YR4/1) silt sized texture, dry
	5 11 14 16	2.0	0.0			ASH (FA) dark grayish brown (10YR4/2) silt sized texture, with trace gravel, dry
	9 14 14 18	2.0	0.0			ASH (FA) dark gray (10YR4/1) silt sized texture, dry
				10		ASH (FA) dark grayish brown (10YR4/2) silt sized texture, with trace gravel, dry
	9 11 12 13	2.3	0.0			ASH (FA) dark gray (10YR4/1) silt sized texture, dry
	6 7 8 10	2.0	0.0			ASH (FA) dark grayish brown (10YR4/2) silt sized texture, with trace gravel, dry
						ASH (FA) dark grayish brown (10YR4/2) silt sized texture, dry
	5 6 7 7	2.0	0.0	15		ASH (FA) dark gray (10YR4/1) silt sized texture, dry
	3 3 3 4	2.0	0.0			ASH (FA) dark grayish brown (10YR4/2) silt sized texture, dry
						ASH (FA) dark gray (10YR4/1) silt sized texture, moist
	2 2 2 1	2.0	0.0			ASH (FA) dark gray (10YR4/1) clayey, moist
						ASH (FA) dark gray (10YR4/1) silt sized texture, dry
				20		ASH (FA) dark gray (10YR4/1) silt sized texture, slightly moist
	woh woh woh 4	2.0	0.0			
						ASH (FA) dark gray (10YR4/1) clayey, moist
	2 4 6 6	1.5	0.0			BOTTOM ASH (BA) dark grayish brown (10YR4/2) med sized sand texture, with trace organics, moist
	5 5 5 5	1.5	0.0	25		BOTTOM ASH (BA) dark gray (10YR4/1) med sized sand texture, wet
						GRAVEL (GC) gray (10YR6/1) angular, fabric on the bottom, very moist
	3 3 3 3	1.5	0.0			ASH (FA) dark gray (10YR4/1) clayey silty, wet
						ASH (FA) dark gray (10YR4/1) clayey, wet
	2 1 1 3	1.8	0.0			ASH (FA) dark gray (10YR4/1) clayey, trace gravel
				30		ASH (FA) dark gray (10YR4/1) clayey, wet
	woh 1 0 1	2.0	0.0			
	woh woh woh woh	2.0	0.0			
	woh woh woh woh	2.0	0.0	35		
	woh woh woh 1	2.0	0.0			
	wot wot 2 1	2.2	0.0			

Notes:

wot = weight of tools
woh = weight of hammer
FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
hatched sample = geochemical analysis
solid sample = shelby tube

Drill Rig:	Central Mining Equipment 75
Drilling Method:	Hollow Stem Auger & Casing Advancer
Total Depth (ft bgs):	86 ft bgs
1st Water Encountered (ft bgs):	15.9 ft bgs
Water Level after 24 hr (ft bgs):	

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

TWP-05

Drilling Company:	Tri-State Drilling	Start Date:	051410	Logged By:
Driller:	S.Snow	End Date:	052010	R.Josefczyk, R.Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	wot wot 4 3	2.0	0.0			
	wot wot wot 1	0.75	0.0			
	3 3 3 4	1.9	0.0	45		
	4 1 1 2	2.0	0.0			
	wot wot wot wot	2.0	0.0			
				50		
	woh 3 3 4	2.0	0.0			
	6 4 4 4	2.0	0.0			BOTTOM ASH (BA) very dark gray (10YR3/1) medium to coarse grained sand sized particles, wet
						ASH (FA)very dark gray (10YR3/1) clayey, wet
	4 4 5 4	1.6	0.0	55		ASH (FA) dark gray (10YR4/1) clayey, wet
	2 1 4 2	1.7	0.0			BOTTOM ASH (BA) very dark gray (10YR3/1)silty medium grained sand sized particles, <% gravel,wet
						ASH (FA) dark gray (10YR4/1) clayey, wet
	wot 2 2 1	1.5	0.0			
				60		CLAYEY SILTY (CL) light olive brown (2.5Y5/4) wet
						ASH (FA) dark gray (10YR4/1) silty, wet
	wot 3 4 7	2.2	0.0			SILTY CLAY (CL) yellowish brown (10YR5/6) dry
	woh 2 5 8	2.3	0.0			
	5 7 11 10	2.2	0.0	65		SLITY SANDY CLAY (ML) yellowish brown (10YR5/6), fine sand, dry
	NA	2.08				shelby tube collected-no visual description
	7 6 6 7	0.9	0.0			SANDY SILT(GM) yellowish brown (10YR5/4) fine grained sand, with 70% gravel, geotextile present
				70		SANDY SILT(ML) yellowish brown (10YR5/4) fine grained sand
	4 4 5 4	2.0	0.0			SAND (SW) yellowish brown(10YR5/4) silty, fine grained sand with minor clay, 50% gravel, moist
	4 3 2 4	2.0	0.0			SAND (SW) yellowish brown (10YR5/4) silty, fine grained sand with minor clay, moist
	4 4 3 3	2.0	0.0	75		SAND (SW) dark gray (10YR4/1) silty, fine grained sand with minor clay, moist
	NA	2.0				SAND(SW) yellowish brown (10YR5/4) silty, fine grained sand, with minor clay, wet
						shelby tube collected-no visual description
	11 12 12 16	1.1	0.0			SAND (SW) brownish gray (2.5YR6/2) fine grained sand,

Notes:

wot = weight of tools
woh = weight of hammer
FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
hatched sample = geochemical analysis
solid sample = shelby tube

Drill Rig:	Central Mining Equipment 75
Drilling Method:	Hollow Stem Auger & Casing Advancer
Total Depth (ft bgs):	86 ft bgs
1st Water Encountered (ft bgs):	15.9 ft bgs
Water Level after 24 hr (ft bgs):	

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

TWP-05

Drilling Company: Tri-State Drilling	Start Date: 051410	Logged By:	
Driller: S.Snow	End Date: 052010	R.Josefczyk, R.Lee	

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	21 10 12 13	1.2	0.0			with trace silt SAND (SW) yellowish brown (10YR5/6) fine grained
	19 20 20 27	1.3	0.0			
	9 19 44 40	1.4	0.0	85		sandstone greenish gray (GLEY 1 5/1) fine grained with interbedded greenish gray (GLEY 1 5/1) shale
						auger refusal at 86.0 ft bgs
				90		
				95		
				100		
				105		
				110		
				115		

Notes:

wot = weight of tools
woh = weight of hammer
FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
hatched sample = geochemical analysis
solid sample = shelby tube

Drill Rig:	Central Mining Equipment 75
Drilling Method:	Hollow Stem Auger & Casing Advancer
Total Depth (ft bgs):	86 ft bgs
1st Water Encountered (ft bgs):	15.9 ft bgs
Water Level after 24 hr (ft bgs):	

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

TWP-06

Drilling Company: Tri-State Drilling	Start Date: 052010	Logged By:	
Driller: S.Snow	End Date: 052510	R.Josefczyk, R.Lee	

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	NA	NA	0.0			BOTTOM ASH (BA) very dark gray (10YR3/1) dry
	2 8 11 8	1.95	0.0			
	4 7 7 5	1.9	0.0	5		ASH (FA) very dark gray (10YR3/1)silty texture, <10% limestone gravel
	5 4 2 3	1.45	0.0			BOTTOM ASH (BA) very dark gray (10YR3/1)silty texture, with varying amounts of gravel
	7 24 26 24	1.9	0.0			ASH (FA) very dark gray (10YR3/1)silty texture, <10% limestone gravel, dry
				10		BOTTOM ASH (BA) very dark gray (10YR3/1)silty texture, 50% limestone gravel, wet
	6 19 20 18	2.0	0.0			ASH (FA) very dark gray (10YR3/1)silty texture, moist
	8 11 12 11	2.0	0.0			BOTTOM ASH (BA) very dark gray (10YR3/1)silty texture, abundant limestone gravel, dry
	5 4 1 1	1.75	0.0	15		BOTTOM ASH (BA) very dark gray (10YR3/1) medium to coarse sized sand texture, abundant limestone gravel, wet
	woh woh woh woh	2.0	0.0			BOTTOM ASH (BA) very dark gray (10YR3/1) medium to coarse sized sand texture, <%5 limestone gravel, dry
	woh woh woh woh	0.3	0.0			ASH (FA) very dark gray (10YR3/1) silty texture, <%5 limestone gravel, minor clay and sand wet
				20		ASH (FA) very dark gray (10YR3/1)silty texture, with medium yellowish red (5YR4/6) clay, dry
	woh woh 2 4	1.0	0.0			BOTTOM ASH (BA) very dark gray (10YR3/1) medium to coarse sized sand texture, <%5 limestone gravel, dry
						ASH (FA) very dark gray (10YR3/1)silty texture, dry
	2 1 1 0	1.6	0.0			BOTTOM ASH (BA) very dark gray (10YR3/1)silty sandy texture, 50% limestone gravel, very wet
	2 2 2 2	1.2	0.0	25		ASH (FA) very dark gray (10YR3/1)silty sandy texture, <10% gravel wet
						ASH (FA) very dark gray (10YR3/1)silty texture, wet
	woh 2 1 0	2.0	0.0			BOTTOM ASH (BA) very dark gray (10YR3/1) coarse sandy texture, some limestone gravel, wet
						ASH (FA) dark gray (10YR4/1)silty texture, minor clay, wet
	1 1 1 2	2.0	0.0			BOTTOM ASH (BA) dark gray (10YR4/1) coarse sandy texture, wet
				30		ASH (FA) dark gray (10YR4/1)silty texture, wet
	2 1 1 2	2.0	0.0			ASH (FA) dark gray (10YR4/1) clayey texture, wet
	2 1 1 3	2.0	0.0			
	2 2 1 1	2.0	0.0	35		
						ASH (FA) dark gray (10YR4/1)silty texture, wet
	wot woh 2 1	2.0	0.0			ASH (FA) dark gray (10YR4/1)silty texture, minor clay, wet
						SILT (ML) black (10YR2/1) with intermixed clay olive (5Y5/3)
	woh woh woh 3	2.0	0.0			CLAY (CL) olive (5Y5/3)

Notes:

wot = weight of tools
woh = weight of hammer
FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
hatched sample = geochemical analysis
solid sample = shelby tube

Drill Rig:	Central Mining Equipment 75
Drilling Method:	Hollow Stem Auger
Total Depth (ft bgs):	63.2 ft bgs
1st Water Encountered (ft bgs):	
Water Level after 24 hr (ft bgs):	11.36 ft bgs

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

TWP-06

Drilling Company: Tri-State Drilling	Start Date: 052010	Logged By:	
Driller: S.Snow	End Date: 052510	R.Josefczyk, R.Lee	

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	NA	2.0	0.0			shelby tube collected-no visual description
	woh woh woh woh	0.15	0.0			BOTTOM ASH (BA) very dark gray (10YR3/1) 100% gravel (slough)
	wot wot wot wot	0.25	0.0	45		ASH (FA) dark gray (2.5YR4/1)silty texture, minor clay, wet (slough)
	woh woh woh 1	1.2	0.0			BOTTOM ASH (BA) very dark gray (10YR3/1) 75% gravel, wet (slough)
						SILTY CLAY (ML) light brownish gray (10YR5/8) with yellowish brown (10YR5/8) staining, wet
	NA	NR	0.0	50		drilled through, no recovery* (see notes)
	2 4 4 4	2.1	0.0			BOTTOM ASH (BA) very dark gray (10YR3/1) 100% gravel (slough)
	woh woh woh 3	2.1	0.0	55		SILTY CLAY (ML) light brownish gray (10YR5/8) with yellowish brown (10YR5/8) staining, trace fine sand, wet
						SAND (SM) with minor clay and silt, yellowish brown (10YR5/6)
	NA	2.0	0.0			SAND (SM) with minor silt, dark gray (2.5YR4/1)
						shelby tube collected-no visual description
	woh woh 4 5	2.3	0.0			SAND with SILT (SM)dark gray (2.5YR4/1) fine to medium grained, minor silt, wet
				60		
	wot	2.0	0.0			SAND with SILT (SM)dark gray (2.5YR4/1) fine to medium grained, minor silt, with lenses of clay yellowish brown (10YR5/8), wet
	33 43	0.9	0.0			sandstone
						shale
						auger refusal at 63.2 ft bgs
				65		
				70		
				75		

Notes:

wot = weight of tools
woh = weight of hammer
FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
hatched sample = geochemical analysis
solid sample = shelby tube

Drill Rig:	Central Mining Equipment 75
Drilling Method:	Hollow Stem Auger
Total Depth (ft bgs):	63.2 ft bgs
1st Water Encountered (ft bgs):	
Water Level after 24 hr (ft bgs):	11.36 ft bgs

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

TWP-22

Drilling Company: Tri-State Drilling	Start Date: 042310	Logged By:	
Driller: F.Jones	End Date: 042310	R.Josefczyk & R. Lee	

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	8 5 10 11	1.8	0.0			GRAVEL (GP) light gray (N7/1)
						SILTY SANDY CLAY (CL) dark yellowish brown (10 YR3/6) grading to greenish black (10GY2.5/1) dry
	6 25 26 50/3"	2.0	0.0			CLAY (CL) and SILTY SAND (SC) intermixed, yellowish brown (10YR4/3) dry
						SHALE greenish gray (10GY5/1) friable, dry
	25 58 100/2"	1.6	0.0	5		auger refusal at 4.75"
				10		
				15		
				20		
				25		
				30		
				35		

Notes:

2-inch split spoons used for SPT

Drill Rig:	Central Mining Equipment 45B
Drilling Method:	Hollow Stem Auger
Total Depth (ft bgs):	4.75 ft bgs
1st Water Encountered (ft bgs):	NA
Water Level after 24 hr (ft bgs):	NA

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

TWP-24

Drilling Company: Tri-State Drilling	Start Date: 072910	Logged By:	
Driller: S.Snow	End Date: 080210	R.Josefczyk, R.Lee	

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
				5, 10, 15, 20, 25, 30, 35		see boring log TWP-04B for description of 0'-30' bgs and boring log TWP-04B for description of 30'-69' bgs

Notes:

FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
2-inch steel split spoons used for SPT

Drill Rig: Diedrich D-50
Drilling Method: HSA, Casing Advancer, Coring
Total Depth (ft bgs): 97.18 ft bgs
1st Water Encountered (ft bgs):
Water Level after 24 hr (ft bgs):

Tennessee Valley Authority

Kingston Fossil Plant

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Harriman, TN, 37748

TWP-24

Drilling Company:	Tri-State Drilling	Start Date:	072910	Logged By:
Driller:	S.Snow	End Date:	080210	R.Josefczyk, R.Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
				45		
				50		
				55		
				60		
				65		
				70		CLAY (CL) yellowish brown (10YR5/4) soft
	10 8 6 7	2.2	0.0			SAND (SW) very dark grayish brown (10YR3/2) medium grained
	6 6 12 11	1.5	0.0			CLAY (CL) black (2.5Y2.5/1) soft
						SAND (SW) dark grayish brown (10YR4/2) coarse grained and gravel
	9 10 11 12	1.2	0.0			SAND (SW) dark grayish brown (10YR4/2) coarse grained and gravel
				75		
	7 4 11 29	1.4	0.0			SAND (SW) olive green (5Y4/2) fine to medium grained
						SAND (SW) dark greenish gray (gley 1 4/1) coarse grained and gravel
	30 32 44 50/5"	0	0.0			SAND (SW) dark grayish brown (10YR4/2)coarse grained and gravel

Notes:

FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
2-inch steel split spoons used for SPT

Drill Rig:	Diedrich D-50
Drilling Method:	HSA, Casing Advancer, Coring
Total Depth (ft bgs):	97.18 ft bgs
1st Water Encountered (ft bgs):	
Water Level after 24 hr (ft bgs):	

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

TWP-24

Drilling Company: Tri-State Drilling	Start Date: 072910	Logged By:	
Driller: S.Snow	End Date: 080210	R.Josefczyk, R.Lee	

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	Run 1	0.3	0.0			SAND (SW) dark greenish gray (gley 1 4/1) coarse grained and gravel no recovery limestone dark gray (2.5Y4/1) begin coring chert no recovery shale reddish brown (5YR4/4) with interbedded limestone dark gray (2.54/1) shale reddish brown (5YR4/4)
	Run 2	3.8	0.0	85		
	Run 3	4.1	0.0	90		
	Run 4	4.5	0.0	95		
				100		
				105		
				110		
				115		

Notes:

FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
2-inch steel split spoons used for SPT

Drill Rig: Diedrich D-50
Drilling Method: HSA, Casing Advancer, Coring
Total Depth (ft bgs): 97.18 ft bgs
1st Water Encountered (ft bgs):
Water Level after 24 hr (ft bgs):

Tennessee Valley Authority

Kingston Fossil Plant

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Harriman, TN, 37748

TWP-25

Drilling Company:	Maine Drilling / Tri-State Drilling	Start Date: 072610	Logged By:
Driller:	D.Chamblee / S.Snow	End Date: 080510	R.Josefczyk, R.Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	NA	5.0	0.0			ASH (FA) dark gray (10YR4/1) clay and silt sized particles, dry
				5		
	NA	4.6	0.0			ASH (FA) dark gray (10YR4/1) clay and silt sized particles, (drilling with water)
				10		
	NA	2.3	0.0			ASH (FA) dark gray (10YR4/1) clay and silt sized particles
				15		
						BOTTOM ASH (BA) grayish brown (10YR4/2)
						ASH (FA) dark gray (10YR4/1) clay and silt sized particles
	NA	4.5	0.0			ASH (FA) dark gray (10YR4/4)fine sand sized particles
						BOTTOM ASH (BA)grayish brown (10YR4/2)
				20		
						ASH (FA) dark gray (10YR4/1) clay and silt sized particles
	NA	3.9	0.0			
						ASH (FA) dark gray (10YR4/4)fine sand sized particles, <5% gravel
				25		
						ASH (FA) dark gray (10YR4/1) clay and silt sized particles, <5% gravel
	NA	4.5	0.0			
				30		
						BOTTOM ASH (BA)grayish brown (10YR4/2)
	NA	5.3	0.0			ASH (FA) dark gray (10YR4/1) clay and silt sized particles
				35		
	NA	4.8	0.0			

Notes:

FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
Runs 1 through 4 were in exclusively grout from 5" PVC

Drill Rig:	Geoprobe 8140 DT & Deidrich D-50
Drilling Method:	Rotosonic and coring
Total Depth (ft bgs):	115.5 ft bgs
1st Water Encountered (ft bgs):	
Water Level after 24 hr (ft bgs):	26 ft bgs

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

TWP-25

Drilling Company: Maine Drilling / Tri-State Drilling		Start Date: 072610	Logged By:
Driller: D.Chamblee / S.Snow		End Date: 080510	R.Josefczyk, R.Lee

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	NA	4.2	0.0			
				45		
	NA	5.0	0.0			
				50		No Recovery
	NA	0	0.0			
				55		ASH (FA) dark gray (10YR4/1) fine sand sized particles, <5% gravel
	NA	3.2	0.0			
				60		ASH (FA) dark gray (10YR4/1) silt sized particles
	NA	3.5	0.0			SILTY CLAY (CL) olive brown (2.5YR5/4) intermixed light yellowish brown (2.5YR6/3)
				65		
	NA	3.9	0.0			SAND (SC) dark yellowish brown (10YR4/4) intermixed with light yellow (2.5YR6/4) fine sand
				70		SILTY SAND (SM) gray (5Y5/1) some clay
	NA	3.4	0.0			SAND (SW) gray (5Y5/1) fine grained
				75		SAND (SW) olive gray (5Y5/2) fine grained, well sorted
	NA	3.4	0.0			

Notes:

FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
Runs 1 through 4 were in exclusively grout from 5" PVC

Drill Rig:	Geoprobe 8140 DT & Deidrich D-50
Drilling Method:	Rotosonic and coring
Total Depth (ft bgs):	115.5 ft bgs
1st Water Encountered (ft bgs):	
Water Level after 24 hr (ft bgs):	26 ft bgs

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

TWP-25

Drilling Company: Maine Drilling / Tri-State Drilling	Start Date: 072610	Logged By:	
Driller: D.Chamblee / S.Snow	End Date: 080510	R.Josefczyk, R.Lee	

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	NA	4.4	0.0			
				85		SAND (SW) olive gray (5Y4/2) fine to medium grained, minor gravel
						sandstone greenish gray (Gley 1 5/1)
						shale greenish gray (Gley 1 5/1)
	NA	4.1	0.0			
	Run 5	5.0	0.0	90		
						shale black (Gley 1 2.5/N)
	Run 6	1.0	0.0			limestone dark gray (2.5Y4/1)
						shale black (Gley 1 2.5/N) vertically bedded with interbedded limestone beds dark gray (2.5Y4/1), approximately 1 inch thick
	Run 7	4.7	0.0	95		shale black (Gley 1 2.5/N) vertically bedded with interbedded limestone beds dark gray (2.5Y4/1), approximately 1 inch thick
	Run 8	2.5	0.0	100		
						shale black (Gley 1 2.5/N) vertically bedded, friable
	Run 9	3.1	0.0	105		
	Run 10	4.1	0.0	110		
	Run 11	2.9	0.0			
				115		

Notes:

FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable
Runs 1 through 4 were in exclusively grout from 5" PVC

Drill Rig:	Geoprobe 8140 DT & Deidrich D-50
Drilling Method:	Rotosonic and coring
Total Depth (ft bgs):	115.5 ft bgs
1st Water Encountered (ft bgs):	
Water Level after 24 hr (ft bgs):	26 ft bgs

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

TWP-26

Drilling Company: Maine Drilling / Tri-State Drilling	Start Date: 072010 / 072710	Logged By:	
Driller: W.Casteel, D.Chamblee / S.Snow	End Date: 072310 / 072810	R.Josefczyk, R. Lee, and M.Martin	

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	NA	NR	0.0			No Recovery
	NA	0.6	0.0	5		ASH (FA) black (10YR2/1) silt and fine sand sized particles, 10% gravel
	NA	4.35	0.0	10		BOTTOM ASH (FA) black (10YR2/1) silt and very coarse sand sized particles, 10% gravel, very uniform
	NA	5.6	0.0	15		BOTTOM ASH (BA) very dark gray (10YR3/1) very coarse sand sized particles, some silt, 10% gravel, very uniform
						ASH (FA) very dark gray (10YR3/1)fine sand sized particles
						ASH (FA) gray (10YR5/1) silt and fine sand sized particles
	NA	NR	0.0	20		No Recovery
	NA	NR	0.0	25		
	NA	0.85	0.0	30		BOTTOM ASH (BA) dark grayish brown (10YR4/2) very coarse sand and gravel sized particles
	NA	3.25	0.0	35		ASH (FA) gray (10YR5/1) silt sized particles

Notes:

FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable

Drill Rig: Geoprobe 8140 DT and Diedrich D-50
Drilling Method: Rotosonic and coring
Total Depth (ft bgs): 113 ft bgs
1st Water Encountered (ft bgs):
Water Level after 24 hr (ft bgs):

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

TWP-26

Drilling Company: Maine Drilling / Tri-State Drilling	Start Date: 072010 / 072710	Logged By:	
Driller: W.Casteel, D.Chamblee / S.Snow	End Date: 072310 / 072810	R.Josefczyk, R. Lee, and M.Martin	

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	NA	5.2	0.0			SILT (ML) greenish brown (2.5Y5/2) <5% gravel
						SILT (ML) greenish brown (2.5Y5/2) and yellowish brown (10YR5/6) <5% gravel
				45		SAND (SW) dark yellowish brown (10YR3/6) very fine
	NA	4.0	0.0			SAND (SW) dark yellowish brown (10YR3/6) very fine, <5% gravel, <5% coarse materials
						SILTY SAND (SM) gray (10YR5/1) fine sand, very well sorted with minor silt
				50		
	NA	4.5	0.0			SAND (SM) gray (10YR5/1) fine sand with lenses of dark yellowish brown (10YR3/6) clayey silt (approx 10%) <5% small gravel
				55		SAND (SW) gray (10YR5/1) fine sand
	NA	3.1	0.0			SAND (SW) grayish brown (2.5YR 5/2) fine to medium grained sand
				60		
	NA	0.4	0.0			SAND (SW) grayish brown (2.5YR 5/2) fine to medium grained sand with large cobbles of compacted sand
				65		
	NA	4.5	0.0			SAND (SW) grayish brown (2.5YR 5/2) fine to medium grained sand (poor recovery)
				70		
	NA	NR	0.0			No Recovery
				75		
	NA	NR	0.0			

Notes:

FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable

Drill Rig:	Geoprobe 8140 DT and Diedrich D-50
Drilling Method:	Rotosonic and coring
Total Depth (ft bgs):	113 ft bgs
1st Water Encountered (ft bgs):	
Water Level after 24 hr (ft bgs):	

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

TWP-26

Drilling Company: Maine Drilling / Tri-State Drilling	Start Date: 072010 / 072710	Logged By:	
Driller: W.Casteel, D.Chamblee / S.Snow	End Date: 072310 / 072810	R.Josefczyk, R. Lee, and M.Martin	

Sample	Blow Counts	Recovery (ft)	PID (ppm)	Depth (ft bgs)	Lithology	Description
	NA	5.7	0.0			CLAY (GC) gray (10YR5/1) with 45% conglomerate (slough)
						shale, bluish gray (GLEY 2 2.5/1),
				85		shale, greenish black (GLEY 2 2.5/1)
	NA	4.0	0.0			
	Run 2	2.1	0.0	90		limestone dark greenish gray (N 4/1) fine grained, with black fine partings
						shale very dark gray (N 3/1) platy, wavy shale bedding, trace reddish black staining/oxidation
						limestone dark greenish gray (N 4/1) fine grained, some vertical calcite filled fractures
	Run 3	4.9	0.0	95		shale very dark gray (N 3/1) competent, unweathered, platy, calcite veins,apparent, shale bedding planes completely overturned
						shale very dark gray (N 3/1) platy, wavy shale bedding, 0.25-0.125 inch thick light pinkish calcite veins
	Run 4	5.0	0.0			limestone dark greenish gray (N 4/1) fine grained, some vertical and horizontal calcite filled fractures
				100		shale very dark gray (N 3/1) platy, wavy shale bedding, 0.25-0.125 inch thick light pinkish calcite veins
	Run 5	3.2	0.0			
				105		limestone dark greenish gray (N 4/1) fine grained, thin bedded (approximately 0.01'-0.03' thick) with very fine clay/shale between bedrock partings
						shale very dark gray (N 3/1) platy, wavy shale bedding, 0.25-0.125 inch thick light pinkish calcite veins
	Run 6	4.7	0.0			
				110		
	Run 7	0.8	0.0			limestone coarse grained, crystalline textured, red staining red (10R4/8) thin bedded (10mm-30mm) thin shale lenses in partings, calcite veins (1mm-3mm)
						shale very dark gray (N 3/1) platy, wavy shale bedding, 0.25-0.125 inch thick light pinkish calcite veins
				115		limestone coarse grained, crystalline textured, red staining red (10R4/8) thin bedded (10mm-30mm) thin shale lenses in partings, calcite veins (1mm-3mm)

Notes:

FA = fly ash
BA = bottom ash
NR = no recovery
NA = not applicable

Drill Rig: Geoprobe 8140 DT and Diedrich D-50
Drilling Method: Rotosonic and coring
Total Depth (ft bgs): 113 ft bgs
1st Water Encountered (ft bgs):
Water Level after 24 hr (ft bgs):

Tennessee Valley Authority

Kingston Fossil Plant

KIF

Harriman, TN, 37748

APPENDIX B

Well Construction Diagrams

MONITORING WELL INSTALLATION FIELD LOG

CLIENT:	FACILITY ID:	WELL NO.:
Tennessee Valley Authority	Kingston Fossil Plant / KIF	GW-01
GEOLOGIST: R. Josefczyk & R. Lee	DRILLING METHOD: Hollow Stem Auger & Rotary with Fluids	LOCATION/COORDINATES: 2438382.699E, 555459.854N
WEATHER: Sunny TEMPERATURE: 92° F	DRILLING COMPANY: Tri-State Drilling, Chattanooga, TN	DATE/TIME 082410 090310
DRILLER(s): G. Akins & S. Snow	DRILL RIG(s): CME 55 & Diedrich D-50	STARTED: 0845 COMPLETED: 1050

LITHOLOGIC DESCRIPTION*	ELEVATION/ DEPTH	PID(ppm)	BLOWS/ft.
SEE GW-01A BORING LOG FOR DETAILS 0.0' - 13.0' BGS	0 – 10		
PREDOMINANTLY SHALE with THIN LAYERS OF INTERSPERSED LIMESTONE 13.0' - 55.0' BGS	10 – 55.0		
*For Further Lithology Detail, See Attached Boring Log	55.0 – 60		

WELL CONSTRUCTION

Depth (feet BGS) Details

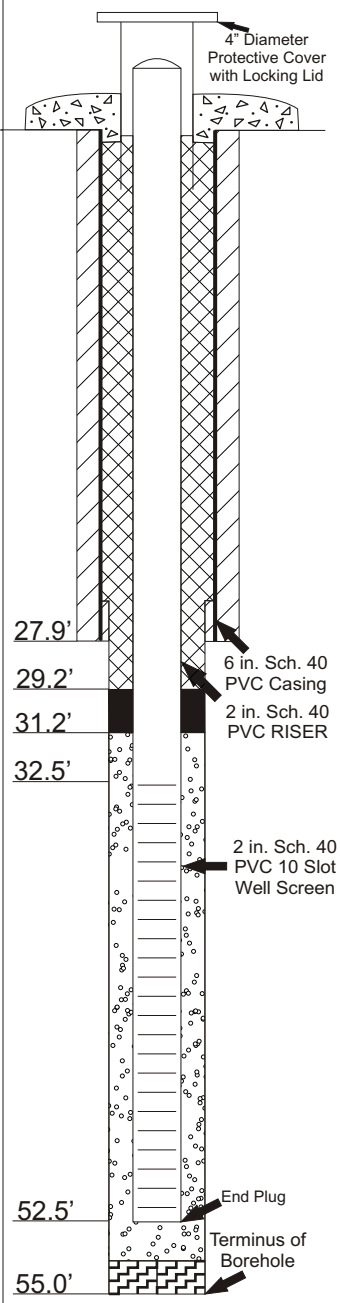

Diagram Not To Scale

MATERIALS INVENTORY

BENTONITE SEAL: TOP: 29.2 Ft. BGS	BOTTOM: 31.2 Ft. BGS
FILTER PACK GRAINSIZE: #2 Sand	
FILTER PACK: TOP: 31.2 Ft. BGS	BOTTOM: 55.0 Ft. BGS
GROUT QUANTITY: Approximately 69 & 38 Gallons	
GROUT: TOP: 0.0 Ft.	BOTTOM: 29.2 Ft. BGS
GROUT TYPE: 5% Bentonite Cement by Weight	
SCREEN TYPE: Sch. 40 PVC	
WELL SCREEN: Inches In Diameter: 2"	Linear feet 20.0'
SLOT SIZE: 10 Slot	
WELL CASING: Inches In Diameter: 2"	Linear feet 32.5'
To Ground Surface	
CASING TYPE: Sch. 40 PVC	
TOP OF CASING (AGS): 3.465 Ft.	
BOREHOLE (In. DIAMETER) 6" Nominal	
BOTTOM OF BOREHOLE (FT BGS): 55.0 Ft.	
ELEVATION (FT ABOVE MSL): 777.837 Ft.	

SLOUGH | FIRST STAGE GROUT | SECOND STAGE GROUT | SAND | CEMENT PAD | BENTONITE

MONITORING WELL INSTALLATION FIELD LOG

CLIENT:	FACILITY ID:	WELL NO.:
Tennessee Valley Authority	Kingston Fossil Plant / KIF	GW-02
GEOLOGIST: R. Josefczyk & R. Lee	DRILLING METHOD: Hollow Stem Auger	LOCATION/COORDINATES: 2439721.211E, 557337.716N
WEATHER: Partly Cloudy TEMPERATURE: 95° F	DRILLING COMPANY: Tri-State Drilling, Chattanooga, TN	DATE/TIME 080910 082310
DRILLER(s): G. Akins	DRILL RIG(s): CME 55	STARTED: 1014 COMPLETED: 1600

LITHOLOGIC DESCRIPTION*	ELEVATION/ DEPTH	PID(ppm)	BLOWS/ft.
GRAVEL(Fill) 0.0' - 2.4' BGS	0		
SILTY CLAY 2.4' - 13.0' BGS	5		
CLAY with Minor SILT 13.0' - 14.1' BGS	10		
CLAY with WEATHERED SHALE 14.1' - 20.0' BGS	15		
	20		

*For Further Lithology Detail, See Attached Boring Log

WELL CONSTRUCTION

Depth (feet BGS) Details

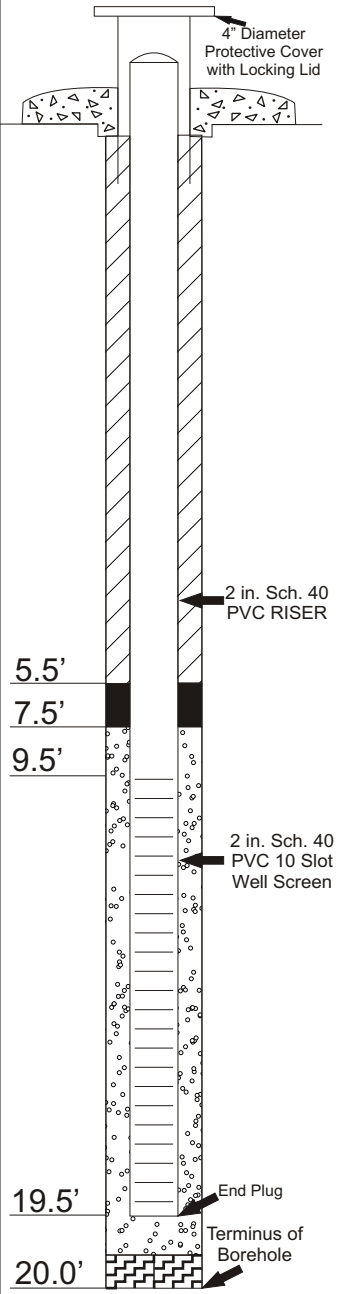

Diagram Not To Scale

MATERIALS INVENTORY

BENTONITE SEAL:	TOP: 5.5 Ft. BGS; BOTTOM: 7.5 Ft. BGS
FILTER PACK GRAINSIZE:	#2 Sand
FILTER PACK:	TOP: 7.5 Ft. BGS; BOTTOM: 20.0 Ft. BGS
GROUT QUANTITY:	Approximately 5 Gallons
GROUT:	TOP: 0.0 Ft.; BOTTOM: 5.5 Ft. BGS
GROUT TYPE:	5% Bentonite Cement by Weight
SCREEN TYPE:	Sch. 40 PVC
WELL SCREEN:	Inches In Diameter: 2"; Linear Feet 10.0'
SLOT SIZE:	10 Slot
WELL CASING:	Inches In Diameter: 2"; Linear Feet 10.0' To Ground Surface
CASING TYPE:	Sch. 40 PVC
TOP OF CASING (AGS):	3.247 Ft.
BOREHOLE (In. DIAMETER)	8"
BOTTOM OF BOREHOLE (FT BGS):	20.0 Ft.
ELEVATION (FT ABOVE MSL):	766.543 Ft.

SLOUGH | FIRST STAGE GROUT | SECOND STAGE GROUT | SAND | CEMENT PAD | BENTONITE

MONITORING WELL INSTALLATION FIELD LOG

CLIENT: Tennessee Valley Authority	FACILITY ID: Kingston Fossil Plant / KIF	WELL NO.: GW-03
GEOLOGIST: R. Josefczyk & R. Lee	DRILLING METHOD: Hollow Stem Auger & Rotary with Fluids	LOCATION/COORDINATES: 2439734.358E, 557353.636N
WEATHER: Sunny TEMPERATURE: 90° F	DRILLING COMPANY: Tri-State Drilling, Chattanooga, TN	DATE/TIME STARTED #1: 082310 - 0900 COMPLETED #1: 082310 - 1600
DRILLER(s): G. Akins & S. Snow	DRILL RIG(s): CME 55 & Diedrich D-50	STARTED #2: 082410 - 1600 COMPLETED #2: 090110 - 0956

LITHOLOGIC DESCRIPTION*	ELEVATION/ DEPTH	PID (ppm)	BLOWS/ft.
SEE GW-02 BORING LOG FOR DETAILS 0.0' - 13.0' BGS	0, 10		
PREDOMINANTLY SHALE with THIN LAYERS OF INTERSPERSED LIMESTONE 13.0' - 45.1' BGS	20, 30, 40		
*For Further Lithology Detail, See Attached Boring Log	50, 60		

WELL CONSTRUCTION

Depth (feet BGS) Details

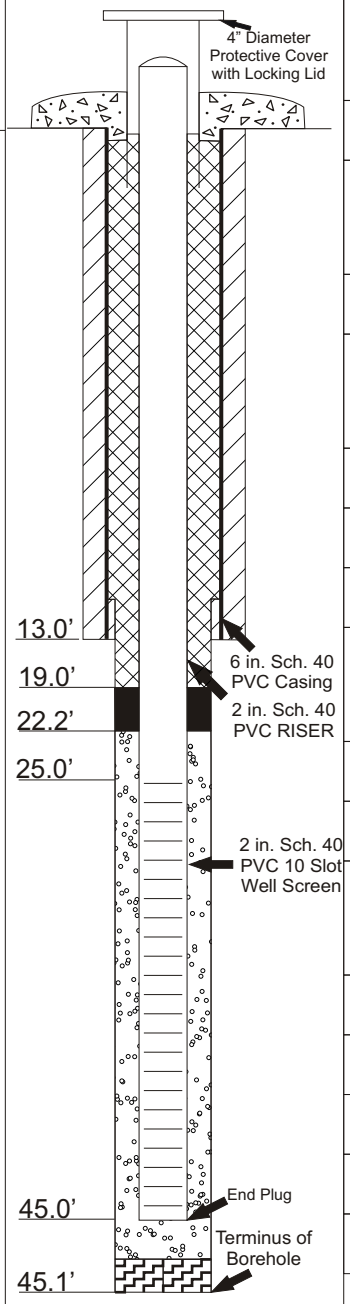

Diagram Not To Scale

MATERIALS INVENTORY

BENTONITE SEAL:	TOP: 19.0 Ft. BGS; BOTTOM: 22.2 Ft. BGS
FILTER PACK GRAINSIZE:	#2 Sand
FILTER PACK:	TOP: 22.2 Ft. BGS; BOTTOM: 45.0 Ft. BGS
GROUT QUANTITY:	Approximately 52 & 25 Gallons
GROUT:	TOP: 0.0 Ft.; BOTTOM: 19.0 Ft. BGS
GROUT TYPE:	5% Bentonite Cement by Weight
SCREEN TYPE:	Sch. 40 PVC
WELL SCREEN:	Inches In Diameter: 2"; Linear Feet 20.0'
SLOT SIZE:	10 Slot
WELL CASING:	Inches In Diameter: 2"; Linear Feet 25.0'; To Ground Surface
CASING TYPE:	Sch. 40 PVC
TOP OF CASING (AGS):	3.184 Ft.
BOREHOLE (In. DIAMETER)	6" Nominal
BOTTOM OF BOREHOLE (FT BGS):	45.1 Ft.
ELEVATION (FT ABOVE MSL):	766.632 Ft.

SLOUGH | FIRST STAGE GROUT | SECOND STAGE GROUT | SAND | CEMENT PAD | BENTONITE

MONITORING WELL INSTALLATION FIELD LOG

CLIENT:	FACILITY ID:	WELL NO.:
Tennessee Valley Authority	Kingston Fossil Plant / KIF	TWP-04
GEOLOGIST: R. Josefczyk & R. Lee	DRILLING METHOD: Hollow Stem Auger & Casing Advancer	LOCATION/COORDINATES: 2439792.803E, 556466.750N
WEATHER: Sunny / TEMPERATURE: 88° F	DRILLING COMPANY: Tri-State Drilling, Chattanooga, TN	DATE/TIME: 052710 (STARTED: 1602) / 060110 (COMPLETED: 1200)
DRILLER(s): S. Snow	DRILL RIG(s): CME 75	

LITHOLOGIC DESCRIPTION*	ELEVATION/ DEPTH	PID(ppm)	BLOWS/ft.
Lithologic Description Based on Adjacent Well TWP-04A, Except as Noted Below	0		
ASH 0.0' - 16.8' BGS	10		
BOTTOM ASH 16.8' - 21.1' BGS	20		
ASH 21.1' - 30.0' BGS			
BOTTOM ASH 30.0' - 32.5' BGS	30		
ASH 32.5' - 58.0' BGS	40		
	50		
CLAY 58.0' - 69.5' BGS	60		
CLAYEY SILT 69.5' - 74.0' BGS			
CLAYEY GRAVEL 74.0'-74.2'BGS			
SAND 74.2' - 78.0' BGS	70		
SANDSTONE 78.0' - 78.4' BGS			
SHALE 78.4' - 79.5' BGS	80		
ONLY TWP-04 DESCRIPTION: COARSE SAND and GRAVEL 72.0' - 74.0' BGS	90		
	100		

*For Further Lithology Detail, See Attached Boring Log

WELL CONSTRUCTION

Depth (feet BGS) / Details

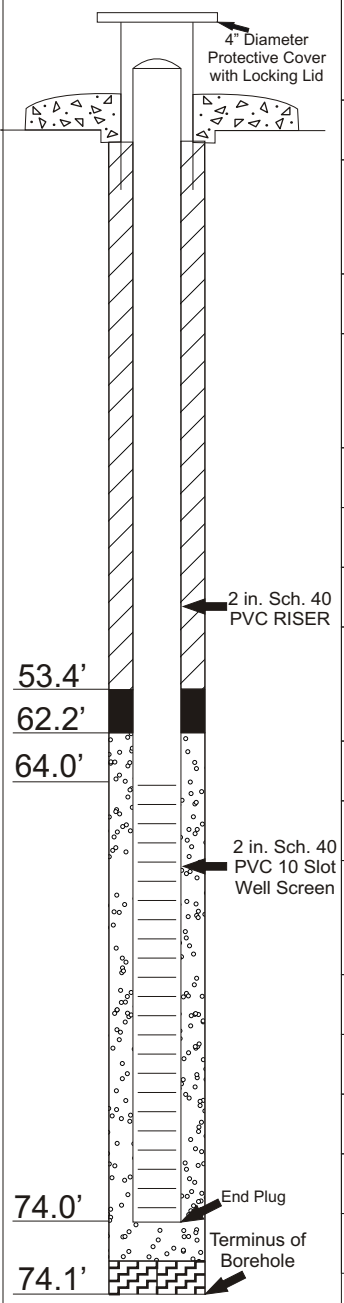

Diagram Not To Scale

MATERIALS INVENTORY

BENTONITE SEAL: TOP: 53.4 Ft. BGS	BOTTOM: 62.2 Ft. BGS
FILTER PACK GRAINSIZE: #2 Sand	
FILTER PACK: TOP: 62.2 Ft. BGS	BOTTOM: 74.1 Ft. BGS
GROUT QUANTITY: Approximately 46 Gallons	
GROUT: TOP: 0.0 Ft.	BOTTOM: 53.4 Ft. BGS
GROUT TYPE: 5% Bentonite Cement by Weight	
SCREEN TYPE: Sch. 40 PVC	
WELL SCREEN: Inches In Diameter: 2"	Linear Feet 10.0'
SLOT SIZE: 10 Slot	
WELL CASING: Inches In Diameter: 2"	Linear Feet 64.0' To Ground Surface
CASING TYPE: Sch. 40 PVC	
TOP OF CASING (AGS): 3.240 Ft.	
BOREHOLE (In. DIAMETER) 5" Nominal	
BOTTOM OF BOREHOLE (FT BGS): 74.1 Ft.	
ELEVATION (FT ABOVE MSL): 782.913 Ft.	

SLOUGH | FIRST STAGE GROUT | SECOND STAGE GROUT | SAND | CEMENT PAD | BENTONITE

MONITORING WELL INSTALLATION FIELD LOG

CLIENT:	FACILITY ID:	WELL NO.:
Tennessee Valley Authority	Kingston Fossil Plant / KIF	TWP-05
GEOLOGIST: R. Josefczyk & R. Lee	DRILLING METHOD: Hollow Stem Auger & Casing Advancer	LOCATION/COORDINATES: 2441056.620E, 555670.828N
WEATHER: Mostly Cloudy TEMPERATURE: 72° F	DRILLING COMPANY: Tri-State Drilling, Chattanooga, TN	DATE/TIME STARTED: 051410 1425 COMPLETED: 052010 1103
DRILLER(s): S. Snow	DRILL RIG(s): CME 75	

LITHOLOGIC DESCRIPTION*	ELEVATION/ DEPTH	PID(ppm)	BLOWS/ft.
ASH 0.0' - 60.5' BGS	0, 10, 20, 30, 40, 50		
SILTY CLAY 60.5' - 64.0' BGS	60		
SANDY CLAY 64.0' - 68.0' BGS			
SANDY SILT 68.0' - 70.0' BGS	70		
SAND 70.0' - 85.1' BGS			
SANDSTONE & SHALE 85.1' - 86.0' BGS	80, 90, 100		

*For Further Lithology Detail, See Attached Boring Log

WELL CONSTRUCTION

Depth (feet BGS) Details

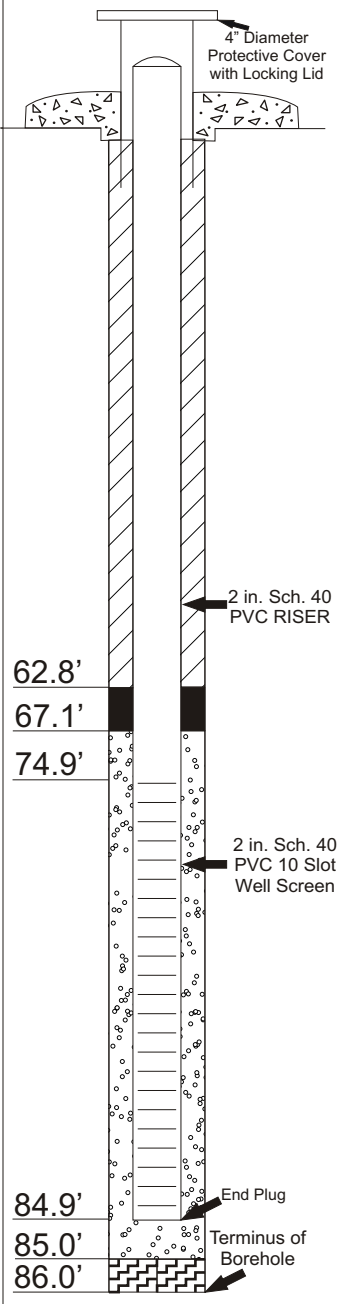

Diagram Not To Scale

MATERIALS INVENTORY

BENTONITE SEAL:	TOP: 62.8 Ft. BGS; BOTTOM: 67.1 Ft. BGS
FILTER PACK GRAINSIZE:	#2 Sand
FILTER PACK:	TOP: 67.1 Ft. BGS; BOTTOM: 86.0 Ft. BGS
GROUT QUANTITY:	Approximately 102 Gallons
GROUT:	TOP: 0.0 Ft.; BOTTOM: 62.8 Ft. BGS
GROUT TYPE:	5% Bentonite Cement by Weight
SCREEN TYPE:	Sch. 40 PVC
WELL SCREEN:	Inches In Diameter: 2"; Linear Feet 10.0'
SLOT SIZE:	10 Slot
WELL CASING:	Inches In Diameter: 2"; Linear Feet 74.9'; To Ground Surface
CASING TYPE:	Sch. 40 PVC
TOP OF CASING (AGS):	2.986 Ft.
BOREHOLE (In. DIAMETER)	5" Nominal
BOTTOM OF BOREHOLE (FT BGS):	86.0 Ft.
ELEVATION (FT ABOVE MSL):	789.010 Ft.

SLOUGH | FIRST STAGE GROUT | SECOND STAGE GROUT | SAND | CEMENT PAD | BENTONITE

MONITORING WELL INSTALLATION FIELD LOG

CLIENT: Tennessee Valley Authority	FACILITY ID: Kingston Fossil Plant / KIF	WELL NO.: TWP-06
GEOLOGIST: R. Josefczyk & R. Lee	DRILLING METHOD: Hollow Stem Auger	LOCATION/COORDINATES: 2442123.765E, 554760.469N
WEATHER: Clear TEMPERATURE: 84° F	DRILLING COMPANY: Tri-State Drilling, Chattanooga, TN	DATE/TIME 052010 052510
DRILLER(s): S. Snow	DRILL RIG(s): CME 75	STARTED: 1135 COMPLETED: 1130

LITHOLOGIC DESCRIPTION*	ELEVATION/ DEPTH	PID(ppm)	BLOWS/ft.
ASH 0.0' - 36.8' BGS	0, 10, 20, 30		
SILTY CLAY 36.8' - 38.0' BGS			
CLAY 38.0' - 42.0' BGS	40		
POOR RECOVERY 42.0'-46.0' BGS			
SILTY CLAY 46.0' - 48.0' BGS			
POOR RECOVERY 48.0'-52.5' BGS	50		
SILTY CLAY 52.5' - 53.2' BGS			
SAND 53.2' - 62.5' BGS			
SANDSTONE 62.5' - 62.7' BGS	60		
SHALE 62.7' - 63.2' BGS			
	70		

*For Further Lithology Detail, See Attached Boring Log

WELL CONSTRUCTION

Depth (feet BGS) Details

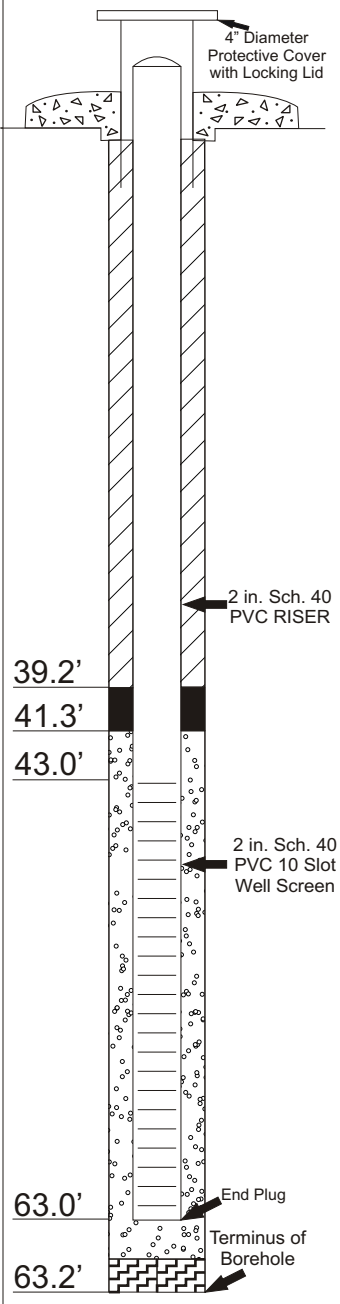

Diagram Not To Scale

MATERIALS INVENTORY

BENTONITE SEAL: TOP: 39.2 Ft. BGS	BOTTOM: 41.3 Ft. BGS
FILTER PACK GRAINSIZE: #2 Sand	
FILTER PACK: TOP: 41.3 Ft. BGS	BOTTOM: 63.0 Ft. BGS
GROUT QUANTITY: Approximately 81 Gallons	
GROUT: TOP: 0.0 Ft.	BOTTOM: 39.2 Ft. BGS
GROUT TYPE: 5% Bentonite Cement by Weight	
SCREEN TYPE: Sch. 40 PVC	
WELL SCREEN: Inches In Diameter: 2"	Linear Feet 20.0'
SLOT SIZE: 10 Slot	
WELL CASING: Inches In Diameter: 2"	Linear Feet 43.0' To Ground Surface
CASING TYPE: Sch. 40 PVC	
TOP OF CASING (AGS): 2.716 Ft.	
BOREHOLE (In. DIAMETER) 5" Nominal	
BOTTOM OF BOREHOLE (FT BGS): 63.2 Ft.	
ELEVATION (FT ABOVE MSL): 766.959 Ft.	

SLOUGH | FIRST STAGE GROUT | SECOND STAGE GROUT | SAND | CEMENT PAD | BENTONITE

MONITORING WELL INSTALLATION FIELD LOG

CLIENT:	FACILITY ID:	WELL NO.:
Tennessee Valley Authority	Kingston Fossil Plant / KIF	TWP-24
GEOLOGIST: R. Josefczyk & R. Lee	DRILLING METHOD: Hollow Stem Auger, Casing Advancer, Coring	LOCATION/COORDINATES: 2439786.537E, 556447.091N
WEATHER: Thunderstorms TEMPERATURE: 93° F	DRILLING COMPANY: Tri-State Drilling, Chattanooga, TN	DATE/TIME STARTED: 072910 1647 COMPLETED: 080210 1757
DRILLER(s): S. Snow	DRILL RIG(s): Diedrich D-50	

LITHOLOGIC DESCRIPTION*	ELEVATION/ DEPTH	PID(ppm)	BLOWS/ft.
SEE TWP-04A and TWP-04B FOR DESCRIPTION 0.0' - 69.0' BGS	0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100		
CLAY 69.0' - 69.7' BGS			
SAND 69.7' - 71.0' BGS			
CLAY 71.0' - 71.45' BGS			
SAND 71.45' - 77.0' BGS			
NO RECOVERY 77.0' - 79.4' BGS			
LIMESTONE 79.4' - 79.6' BGS			
CHERT 79.6' - 82.18' BGS			
SHALE with INTERBEDDED LIMESTONE 82.18' - 87.18' BGS			
SHALE 87.18' - 97.18' BGS			
*For Further Lithology Detail, See Attached Boring Log			

WELL CONSTRUCTION

Depth (feet BGS) Details

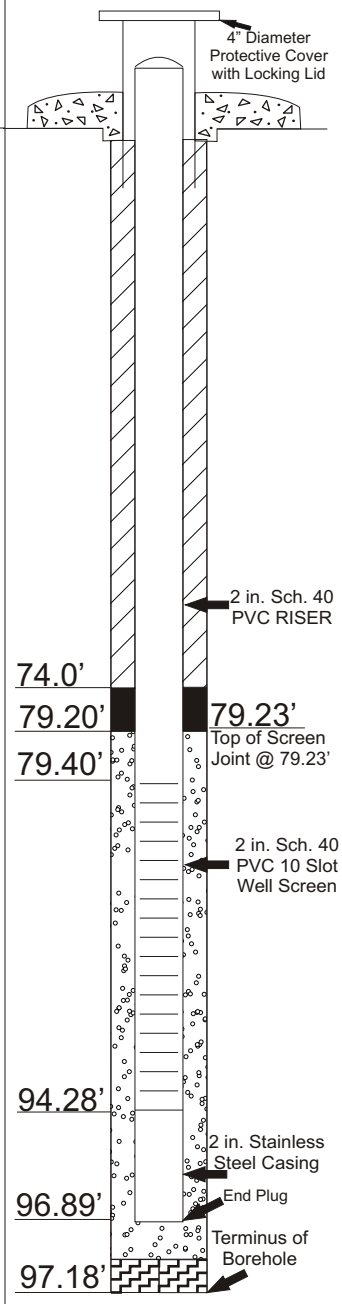

Diagram Not To Scale

MATERIALS INVENTORY

BENTONITE SEAL: TOP: 74.0 Ft. BGS	BOTTOM: 79.20 Ft. BGS
FILTER PACK GRAINSIZE: #2 Sand	
FILTER PACK: TOP: 79.20 Ft. BGS	BOTTOM: 97.18 Ft. BGS
GROUT QUANTITY: Approx. 35 Gallons	
GROUT: TOP: 0.0 Ft.	BOTTOM: 74.0 Ft. BGS
GROUT TYPE: 5% Bentonite Cement by Weight	
SCREEN TYPE: Sch. 40 PVC	
WELL SCREEN: Inches In Diameter: 2"	Linear Feet 15.0'
SLOT SIZE: 10 Slot	
WELL CASING: Inches In Diameter: 2"	Linear Feet 82.47' To Ground Surface
CASING TYPE: Sch. 40 PVC	
TOP OF CASING (AGS): 2.806 Ft.	
BOREHOLE (In. DIAMETER) 4" Nominal	
BOTTOM OF BOREHOLE (FT BGS): 97.18 Ft.	
ELEVATION (FT ABOVE MSL): 783.208 Ft.	

SLOUGH | FIRST STAGE GROUT | SECOND STAGE GROUT | SAND | CEMENT PAD | BENTONITE

MONITORING WELL INSTALLATION FIELD LOG

CLIENT: Tennessee Valley Authority	FACILITY ID: Kingston Fossil Plant / KIF	WELL NO.: TWP-25
GEOLOGIST: R. Josefczyk & R. Lee	DRILLING METHOD: Rotosonic & Coring	LOCATION/COORDINATES: 2441047.078E, 555658.059N
WEATHER: Cloudy TEMPERATURE: 90° F	DRILLING COMPANY: Tri-State Drilling & Major Drilling	DATE/TIME STARTED #1: 072610 - 1308 COMPLETED #1: 072810 - 1210 STARTED #2: 080310 - 1355 COMPLETED #2: 080510 - 1710
DRILLER(s): S. Snow & D. Chamblee	DRILL RIG(s): Geoprobe 8140 DT & Diedrich D-50	

LITHOLOGIC DESCRIPTION*	ELEVATION/ DEPTH	PID(ppm)	BLOWS/ft.
ASH 0.0' - 50.0' BGS	0, 10, 20, 30, 40, 50		
NO RECOVERY 50.0' - 55.0' BGS			
ASH 55.0' - 61.9' BGS	60		
SILTY CLAY 61.9' - 66.2' BGS			
SAND 66.2' - 70.0' BGS			
SILTY SAND 70.0' - 72.7' BGS	70		
SAND 72.7' - 85.3' BGS	80		
SANDSTONE 85.3' - 85.5' BGS			
SHALE 85.5' - 91.5' BGS			
LIMESTONE 91.5' - 91.8' BGS	90		
SHALE 91.8' - 115.5' BGS	100, 110		
*For Further Lithology Detail, See Attached Boring Log	120		

WELL CONSTRUCTION

Depth (feet BGS) Details

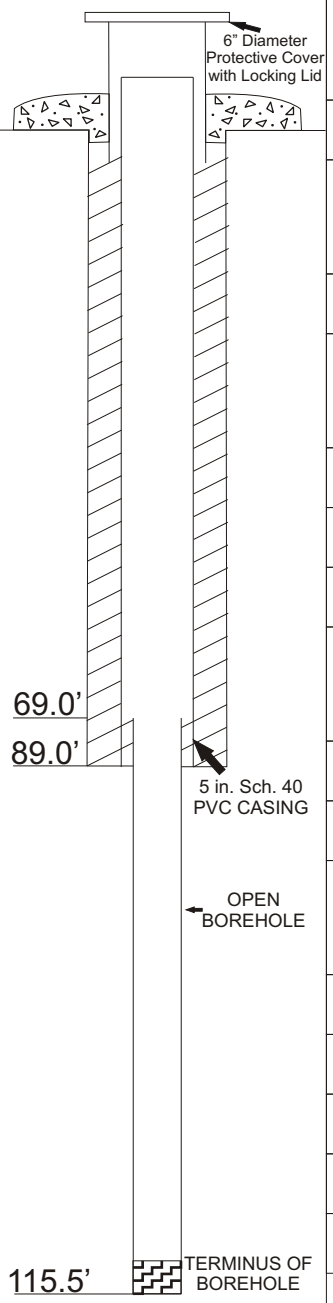

Diagram Not To Scale

MATERIALS INVENTORY

BENTONITE SEAL: TOP: Not Applicable	BOTTOM: Not Applicable
FILTER PACK GRAINSIZE: Not Applicable	
FILTER PACK: TOP: Not Applicable	BOTTOM: Not Applicable
GROUT QUANTITY: Approximately 141 Gallons	
GROUT: TOP: 0.0 Ft.	BOTTOM: 89.0 Ft. Bgs
GROUT TYPE: 5% Bentonite Cement by Weight	
SCREEN TYPE: Not Applicable	
WELL SCREEN: Inches In Diameter: Not Applicable	Linear Feet N/A
SLOT SIZE: Not Applicable	
WELL CASING: Inches In Diameter: 5"	Linear Feet 89.0' To Ground Surface
CASING TYPE: Sch. 40 PVC	
TOP OF CASING (AGS): .050 Ft.	
BOREHOLE (In. DIAMETER) 4" Nominal	
BOTTOM OF BOREHOLE (FT BGS): 115.5 Ft.	
ELEVATION (FT ABOVE MSL): 788.926 Ft.	

SLOUGH | FIRST STAGE GROUT | SECOND STAGE GROUT | SAND | CEMENT PAD | BENTONITE

MONITORING WELL INSTALLATION FIELD LOG

CLIENT:	FACILITY ID:	WELL NO.:
Tennessee Valley Authority	Kingston Fossil Plant / KIF	TWP-26
GEOLOGIST: R. Josefczyk, R. Lee, & M. Martin	DRILLING METHOD: Rotosonic & Coring	LOCATION/COORDINATES: 2442112.667E, 554745.915N
WEATHER: Partly Cloudy TEMPERATURE: 86° F	DRILLING COMPANY: Major Drilling & Tri-State Drilling	DATE/TIME STARTED #1: 072010 - 1409 COMPLETED #1: 072310 - 1000 STARTED #2: 072710 - 1539 COMPLETED #2: 072910 - 1412
DRILLER(s): W. Casteel, D. Chamblee, & S. Snow	DRILL RIG(s): Geoprobe 8140 DT & Diedrich D-50	

LITHOLOGIC DESCRIPTION*	ELEVATION/ DEPTH	PID(ppm)	BLOWS/ft.
NO RECOVERY 0.0' - 5.0' BGS	0		
ASH 5.0' - 10.0' BGS			
BOTTOM ASH 10.0' - 17.5' BGS	10		
ASH 17.5' - 20.0' BGS	20		
NO RECOVERY 20.0' - 30.0' BGS			
BOTTOM ASH 30.0' - 35.0' BGS	30		
ASH 35.0' - 40.0' BGS			
SILT 40.0' - 44.8' BGS	40		
SAND 44.8' - 70.0' BGS	50		
	60		
NO RECOVERY 70.0' - 80.0' BGS	70		
CLAY 80.0' - 83.0' BGS	80		
PREDOMINANTLY SHALE with THIN LAYERS OF INTERSPERSED LIMESTONE 83.0' - 113.0'BGS	90		
	100		
	110		
*For Further Lithology Detail, See Attached Boring Log	120		

WELL CONSTRUCTION

Depth (feet BGS) Details

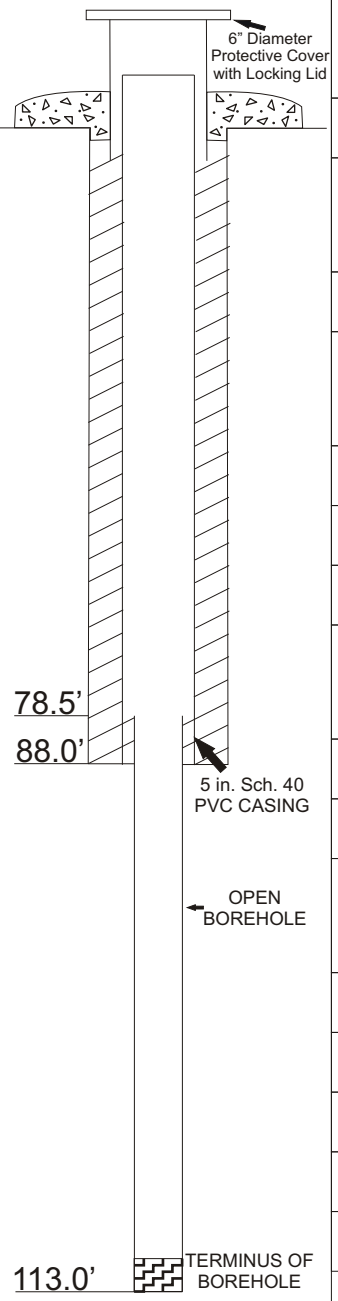

Diagram Not To Scale

MATERIALS INVENTORY

BENTONITE SEAL: TOP: Not Applicable	BOTTOM: Not Applicable
FILTER PACK GRAINSIZE: Not Applicable	
FILTER PACK: TOP: Not Applicable	BOTTOM: Not Applicable
GROUT QUANTITY: Approximately 140 Gallons	
GROUT: TOP: 0.0 Ft.	BOTTOM: 88.0 Ft. BGS
GROUT TYPE: 5% Bentonite Cement by Weight	
SCREEN TYPE: Not Applicable	
WELL SCREEN: Inches In Diameter: Not Applicable	Linear Feet N/A
SLOT SIZE: Not Applicable	
WELL CASING: Inches In Diameter: 5"	Linear Feet 88.0' To Ground Surface
CASING TYPE: Sch. 40 PVC	
TOP OF CASING (AGS): 3.343 Ft.	
BOREHOLE (In. DIAMETER) 4" Nominal	
BOTTOM OF BOREHOLE (FT BGS): 113.0 Ft.	
ELEVATION (FT ABOVE MSL): 767.125 Ft.	

SLOUGH | FIRST STAGE GROUT | SECOND STAGE GROUT | SAND | CEMENT PAD | BENTONITE

APPENDIX C

Geochemical and Geotechnical Lab Results

Chemical and Mineralogical Characterization of Core Samples from Kingston Fossil Plant. Randolph W. Shannon. Pittsburgh Mineral & Environmental Technology, Inc. August 11, 2010

Laboratory Report for Tennessee Valley Authority Kingston Ash Recovery Project. Daniel B. Stephens & Associates, Inc. August 6, 2010

Laboratory Report for Tennessee Valley Authority Kingston Ash Recovery Project. Daniel B. Stephens & Associates, Inc. September 14, 2010

Pittsburgh Mineral & Environmental Technology, Inc.

August 11, 2010

J. Mark Boggs
TVA WT 9D-K
400 West Summit Hill Drive
Knoxville, TN 37902

Dear Mr. Boggs:

The report summarizes and concludes PMET's work on the mineralogical and geochemical analysis of nine core samples from the Kingston Fossil Plant in Tennessee. Please contact us if you require additional information or further services on this project. We appreciate this opportunity to work with you and look forward to serving your future needs.

Sincerely,

Randolph W. Shannon
Laboratory Manager

Attachment

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www.pmet-inc.com

PREPARED FOR:

TENNESSEE VALLEY AUTHORITY

CHEMICAL AND MINERALOGICAL CHARACTERIZATION OF CORE SAMPLES FROM KINGSTON FOSSIL PLANT

By

Randolph W. Shannon

Project 0M35
August 11, 2010

TABLE OF CONTENTS

BACKGROUND AND OBJECTIVE	Page 1
SAMPLE RECEIVED	Page 2
DISCUSSION OF RESULTS	Page 3
APPENDIX	Page 19

BACKGROUND AND OBJECTIVE

On April 20, 2010 pursuant to a request from Mr. Matthew Williams, PE of the Tennessee Valley Authority (TVA) PMET, Inc. submitted a proposal for soil analysis of nine drill core samples from the Kingston Fossil Plant.

The laboratory work was summarized in PMET's quotation to Mr. Williams and included the following:

Mineralogical Characterization

1. quantitative bulk mineralogy by x-ray diffraction and Rietveld whole pattern refinement
2. polarized light microscopy of polished sections

Chemical Characterization

3. percent free iron oxide per Chao & Zhou
4. cation exchange capacity
5. exchangeable cations
6. calcite equivalent soluble salts
7. soil pH

SAMPLES RECEIVED

The drill core samples were received in five separate shipments under chain-of-custody from Ramona Josefczyk at the Kingston Fossil Ash Recovery Operations. A copy of the chain-of-custody documents is attached to this report.

Each sample was logged in the PMET, Inc. chain-of-custody file and RFA logbook and given a unique identification number. The sample identification and COC is shown in the table below.

Table 1
Sample Identification

PMET I.D.	TVA KIF-	COC#	Received
5575-1	GP23-16-38-SL-042610	TVA-MWI-042610	04/28/10
5575-2	GP16-28.0-32.0-SL-050310	TVA-MWI-050310	05/06/10
5575-3	GP16-42.0-52.0-SL-050410	TVA-MWI-505310	05/06/10
5575-4	TWP04A-58-68-SL-051010	TVA-MWI-051010A	05/14/10
5575-5	TWP04A-72-78-SL-051010	TVA-MWI-051010A	05/14/10
5575-6	TWP05-78-85-SL-051810	TVAMWI0518Y10A	05/24/10
5575-7	TWP05-61-66-SL-051710	TVAMWI0518Y10A	05/24/10
5575-8	TWP06-38-51-SL-052010	TVAMWI0520Y10A	05/27/10
5575-9	TWP06-51-60-SL-052410	TVAMWI0524Y10A	05/27/10

DISCUSSION OF RESULTS

Sample Preparation

The samples were received in quart jars at ambient temperature. The sample material was removed to stainless steel pans and dried at 50°C to determine moisture content.

Table 2
Moisture Content

Sample I.D.	As-received Wt.	Dry Wt.	% Moisture
5575-1	6711.8	5204.5	22.5%
5575-2	7156.6	5851.0	18.2%
5575-3	7821.3	6315.8	18.7%
5575-4	7139.7	5855.5	18.0%
5575-5	4524.6	3797.0	16.1%
5575-6	7356.0	6081.3	17.3%
5575-7	7779.1	6491.8	16.6%
5575-8	5543.8	4419.9	20.3%
5575-9	8012.2	6597.4	17.7%

The dried material was deagglomerated using a large ceramic mortar and pestle. The sample material was split into analytical aliquots using a rotary riffle splitter. The reject material was returned to the original container.

Mineralogical Characterization

Sample material for x-ray diffraction was pulverized in a tungsten carbide ring and puck mill. The pulped material was then spiked with calcium fluoride. The samples were scanned from 5° to 58° two-theta using a Siemens D500 diffractometer operating at 35ma and 45 kv. The diffractograms were analyzed for phase composition using Bruker AXS proprietary search/match software. The phases were quantified using Bruker AXS proprietary Rietveld whole pattern refinement software. The amorphous content was calculated using a ratio of the fluorite spike to the analytical result. An image of each diffractogram with the Rietveld refinement result is attached to this report. The results of mineralogical analysis are shown in Table 3 below.

The results show that the soil samples consist of mostly quartz with trace amounts of feldspar and plagioclase in a micaceous silt to clay matrix. The clay contains small amounts of crystalline kaolinite and mica with large amounts of non-crystalline amorphous clay material. A clay analysis was not requested for this project. There may be small amounts of glass along with the clay in the amorphous fraction.

Sample 5575-1 is an exception to the general character of the soil samples. This sample appears to mostly contain common fly ash minerals and a high concentration of amorphous glassy phases, which is also typical of fly ash. There are also iron sulfides present, which are usually found in uncombusted coal.

Table 3
Results of X-ray Diffraction Analysis
Weight Percent

Mineral Phase	**Nominal Atomic Formula**	**5575-1**	**5575-8**
Quartz	SiO_2	5.5	55.8
K-feldspar	$KAlSi_3O_8$	0.0	1.4
Plagioclase	$(Na,Ca)AlSi_3O_8$	0.0	1.2
Muscovite	$KAl_2Si_3AlO_{10}(OH)_2$	0.0	6.7
Kaolinite	$Al_2Si_2O_5(OH)_4$	0.0	4.0
Anatase	TiO_2	0.0	0.4
Hematite	Fe_2O_3	3.4	0.3
Magnetite	Fe_3O_4	4.4	0.2
Mullite	$Al_6Si_2O_{13}$	17.3	1.1
Pyrite	FeS_2	2.0	0.2
Marcasite	FeS_2	1.3	0.0
Amorphous	Glass/clay	66.1	28.7

Table 3 (cont.)
Results of X-ray Diffraction Analysis
Weight Percent

Mineral Phase	**Nominal Atomic Formula**	**5575-2**	**5575-3**	**5575-4**	**5575-5**
Quartz	SiO_2	63.3	77.5	59.7	81.4
K-feldspar	$KAlSi_3O_8$	1.3	0.4	5.3	1.4
Plagioclase	$(Na,Ca)AlSi_3O_8$	0.2	0.0	1.6	0.6
Muscovite	$KAl_2Si_3AlO_{10}(OH)_2$	5.9	2.4	6.1	1.4
Kaolinite	$Al_2Si_2O_5(OH)_4$	3.5	0.7	3.1	1.1
Anatase	TiO_2	0.2	0.0	0.2	0.1
Hematite	Fe_2O_3	0.4	0.2	0.3	0.0
Amorphous	Glass/clay	25.2	18.8	23.7	14.0

Table 3 (cont.)
Results of X-ray Diffraction Analysis
Weight Percent

Mineral Phase	**Nominal Atomic Formula**	**5575-6**	**5575-7**	**5575-9**
Quartz	SiO_2	76.7	67.5	72.3
K-feldspar	$KAlSi_3O_8$	1.2	2.1	1.4
Plagioclase	$(Na,Ca)AlSi_3O_8$	0.7	0.7	1.2
Muscovite	$KAl_2Si_3AlO_{10}(OH)_2$	1.8	4.9	3.9
Kaolinite	$Al_2Si_2O_5(OH)_4$	2.1	2.6	2.2
Anatase	TiO_2	0.3	0.3	0.2
Hematite	Fe_2O_3	0.0	0.3	0.2
Amorphous	Glass/clay	17.2	21.6	18.6

A mineralogical analysis of the sample material was also conducted using optical microscopy of polished cross sections. The sample material was deslimed and mounted in epoxy to obtain polished sections. The sections were examined using an ore microscope with reflected light and an air objective with a polarizer. Images of opaque materials were recorded with a digital camera and are shown at the end of this report.

The optical microscopy analysis found that ash particles were present in most samples. The table below contains estimates of the volume of opaque materials contained in the sample. Estimation was based on method derived from Williams,H., Turner,F.J., Gilbert,C.M., 1982, Petrography, p.593-597.

Table 4
Optical Microscopy Results
Opaque Mineral Content
Estimated Volume %

Mineral Phase	**5575-1**	**5575-2**	**5575-3**	**5575-4**	**5575-5**	**5575-6**	**5575-7**	**5575-8**	**5575-9**
Anatase	-	0.2	0.05	0.15	0.1	0.1	0.1	0.1	0.4
Iron oxide spheres	10	00.1	0.02	0.2	0.05	0.1	0.3	0.5	0.2
Iron fragments	-	0.01	-	0.03	-	-	-	0.05	-
Pyrite/Marcasite	2.5	0.02	-	-	-	-	-	0.7	-
Graphite	-	0.01	-	-	-	-	-	0.03	0.05
Glassy ash	80	-	0.02	15	-	0.01	1	11	1
Ceramic stone	-	-	-	-	0.1	-	-	-	-

Geochemical Analysis

A five hundred gram aliquot was split from the head sample for geochemical analysis. This sample was submitted to Activation Laboratories, LTD for chemical analysis under chain-of-custody. The results are summarized in Table 4 below. A copy of the original report of results from Activation Labs is attached at the end of this report.

Table 4
Results of Chemical Analysis

PMET I.D.	Soil	Free FeOx	CEC	Exchangeable Cations meq/100g				
	pH	%	meq/100g	Na	Mg	Al	K	Ca
5575-1	6.02	0.0741	0.4	<0.1	<0.1	<0.1	<0.1	0.7
5575-2	5.12	0.0232	0.4	<0.1	0.2	0.1	<0.1	0.5
5575-3	4.69	0.0187	0.1	<0.1	<0.1	<0.1	<0.1	0.1
5575-4	7.15	0.0625	0.2	<0.1	0.5	<0.1	<0.1	1.0
5575-5	6.40	0.0503	<0.1	<0.1	<0.1	<0.1	<0.1	0.2
5575-6	5.75	0.0498	<0.1	<0.1	<0.1	<0.1	<0.1	0.2
5575-7	5.39	0.0406	<0.1	<0.1	0.1	0.2	<0.1	0.2
5575-8	6.09	0.1390	0.3	<0.1	0.4	<0.1	<0.1	0.5
5575-9	4.90	0.1140	<0.1	<0.1	0.1	<0.1	<0.1	0.2

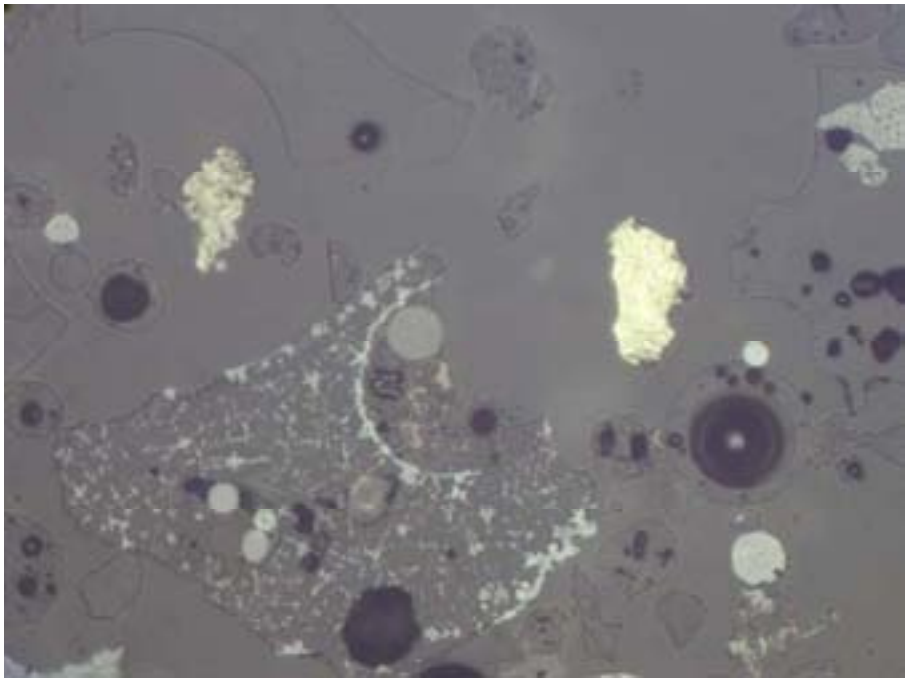
Table 4 (cont.)
Results of Chemical Analysis

PMET I.D.	Saturation Extract Soluble Salts					
	Ca	Mg	Na	K	Al	Mn
	mg/L	mg/L	mg/L	mg/L	%	ppm
5575-1	138	7.91	1.29	4.94	<0.01	0.99
5575-2	10.4	2.57	0.75	1.14	0.02	0.88
5575-3	8.23	1.85	0.51	1.05	0.05	0.94
5575-4	6.24	2.36	8.91	0.63	<0.01	0.09
5575-5	3.56	0.66	2.76	1.26	0.05	0.15
5575-6	<0.1	0.4	1.0	0.9	0.07	0.05
5575-7	<0.1	0.1	0.5	0.4	<0.01	0.30
5575-8	3.7	10.0	2.2	5.3	<0.01	1.48
5575-9	1.0	0.4	4.1	1.5	<0.01	0.07

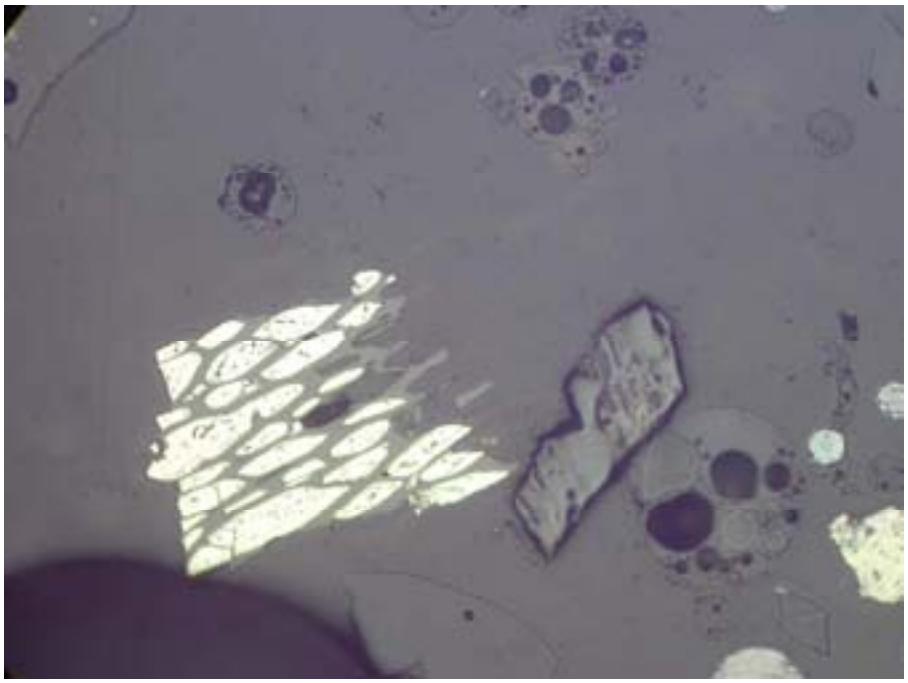
Table 4 (cont.)
Results of Chemical Analysis

PMET I.D.	Saturation Extract Soluble Salts						
	BO_3^{-3}	Cl^{-1}	NO_3^{-1} (as N)	SO_4^{-2}	$CaCO_3$	CO_3^{-2}	HCO_3^{-1}
	μg/L	μg/g	μg/g	μg/g	mg/L	mg/L	mg/L
5575-1	<500	3.56	0.23	1900	7	<1	7
5575-2	<500	3.22	0.17	185	<2	<1	2
5575-3	<500	2.72	0.07	153	<2	<1	1
5575-4	<500	1.81	<0.05	96.1	15	<1	15
5575-5	<500	2.18	0.05	65.5	5	<1	5
5575-6	<500	3.93	0.18	26.5	6	<1	6
5575-7	600	2.35	0.12	9.54	5	<1	5
5575-8	8100	2.88	0.07	315	8	<1	8
5575-9	<500	1.42	0.09	38.2	5	<1	5

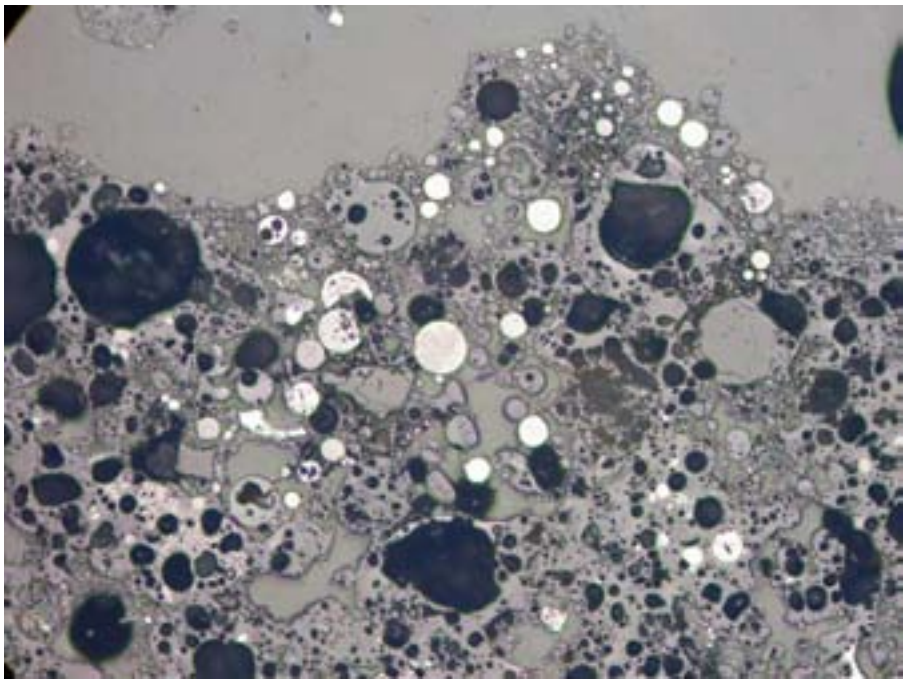
Polarized Light Microscopy Optical Images



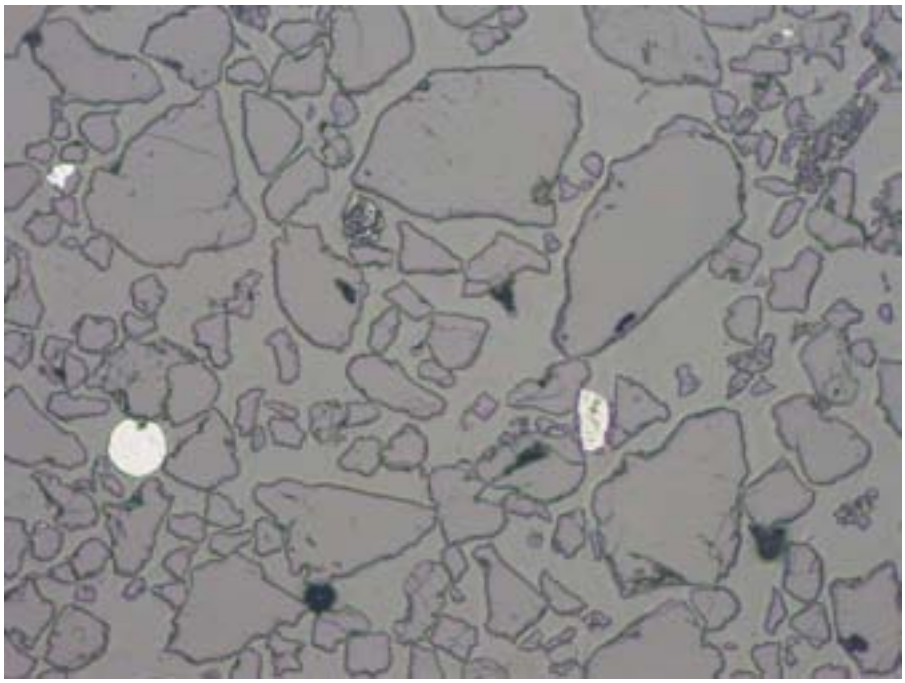
Light Optical Image Figure 1 Scale 1cm = 600µ
5575-1 Ash particles with iron oxide and glass spheres (center), marcasite grains (yellow)



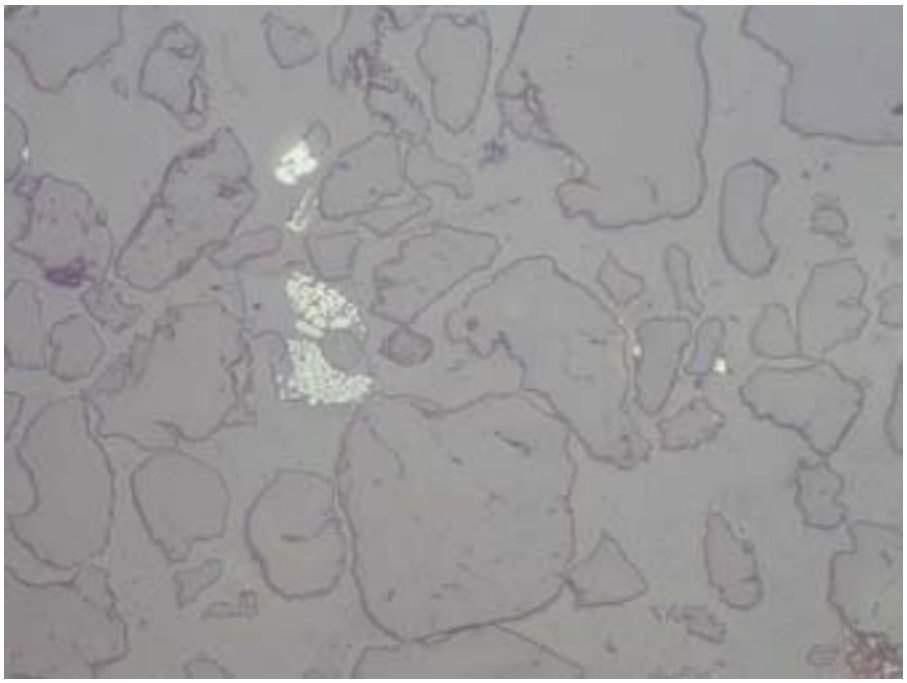
Light Optical Image Figure 2 Scale 1cm = 600µ
5575-1 Pyrite replacement in wood structure (light yellow), ash particles with spherical voids, rock fragment (right center)



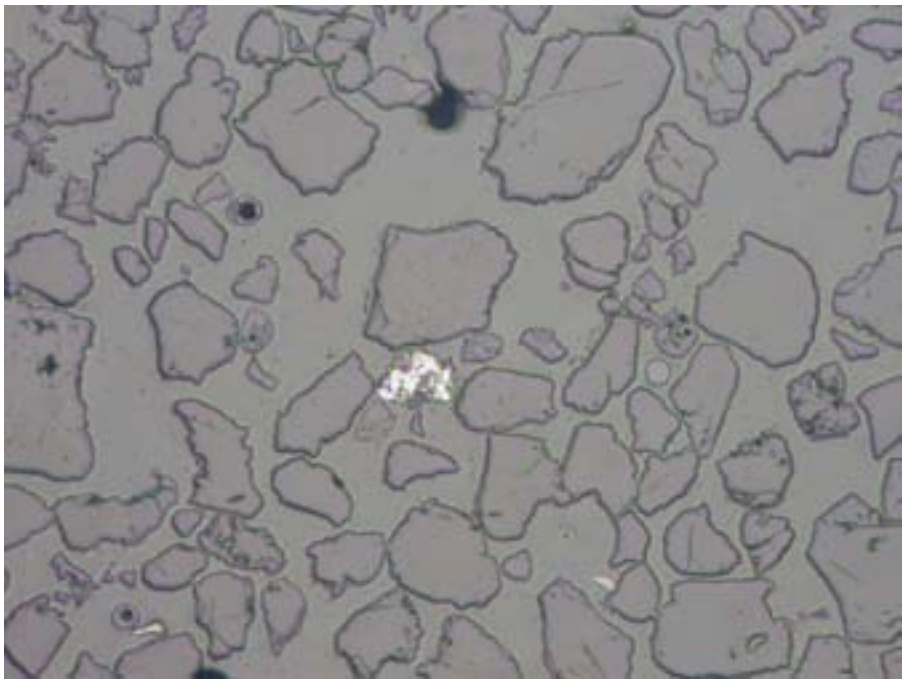
Light Optical Image Figure 3 Scale 1cm = 1300μ
5575-1 Composite ash particle with spherical voids (black),
glass spheres (gray), and iron oxide spheres (white)



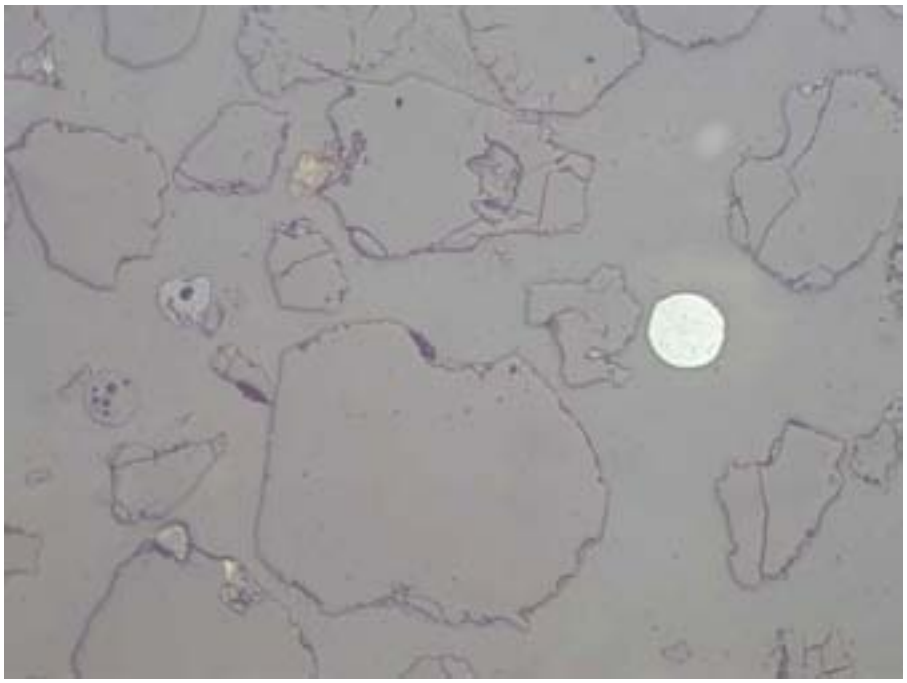
Light Optical Image Figure 4 Scale 1cm = 1300μ
5575-2 Anatase grain (right center)
spherical iron oxide (left center)
with optically transparent minerals (gangue)



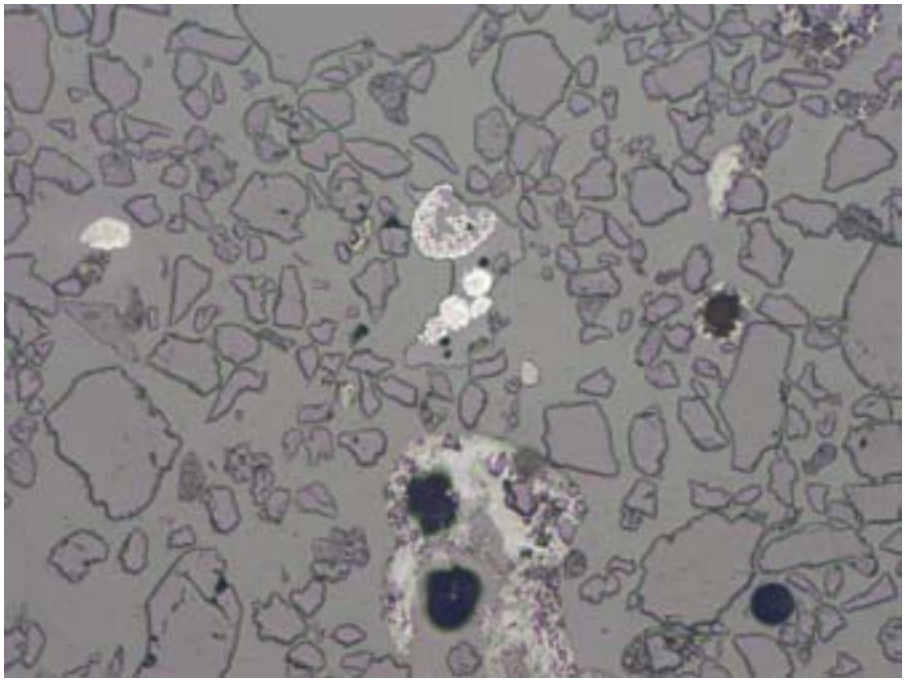
Light Optical Image Figure 5 Scale 1cm = 600μ
5575-2 Anatase grain (top center),
glassy ash particles (center), gangue



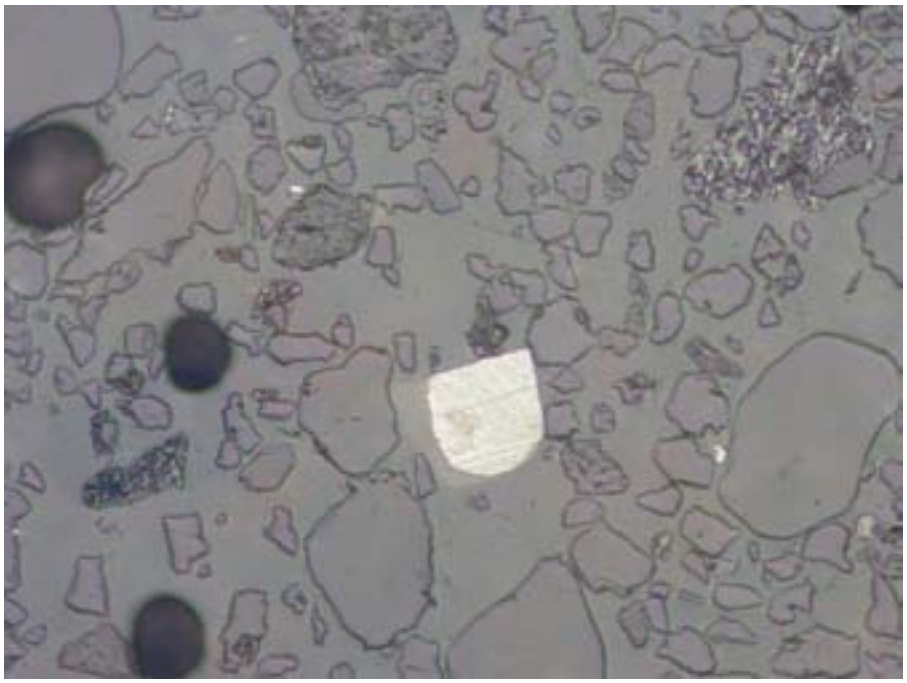
Light Optical Image Figure 6 Scale 1cm = 1300μ
5575-3 Anatase grain (center),
spherical ash particles (right center, left center), gangue



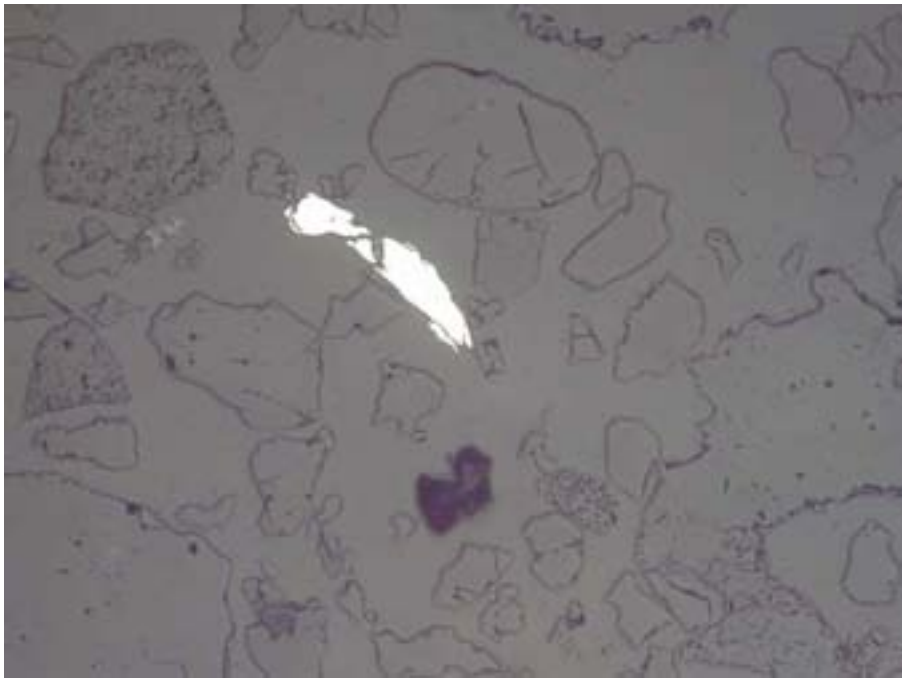
Light Optical Image Figure 7 Scale 1cm = 600μ
5575-4 Spherical iron oxide, gangue



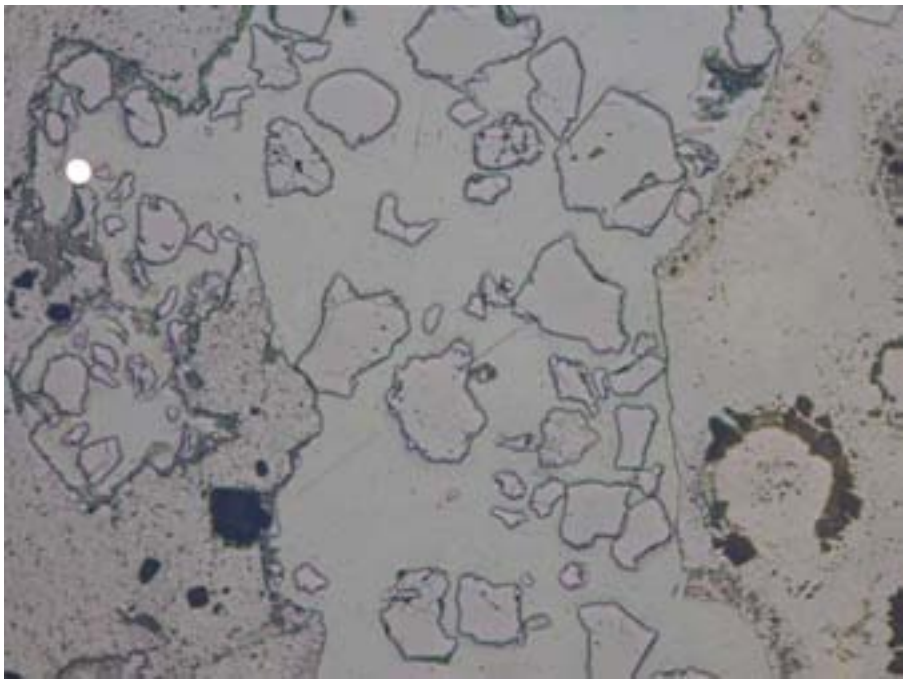
Light Optical Image Figure 18 Scale 1cm = 1300μ
5575-4 Ash particles and spherical iron oxide, gangue



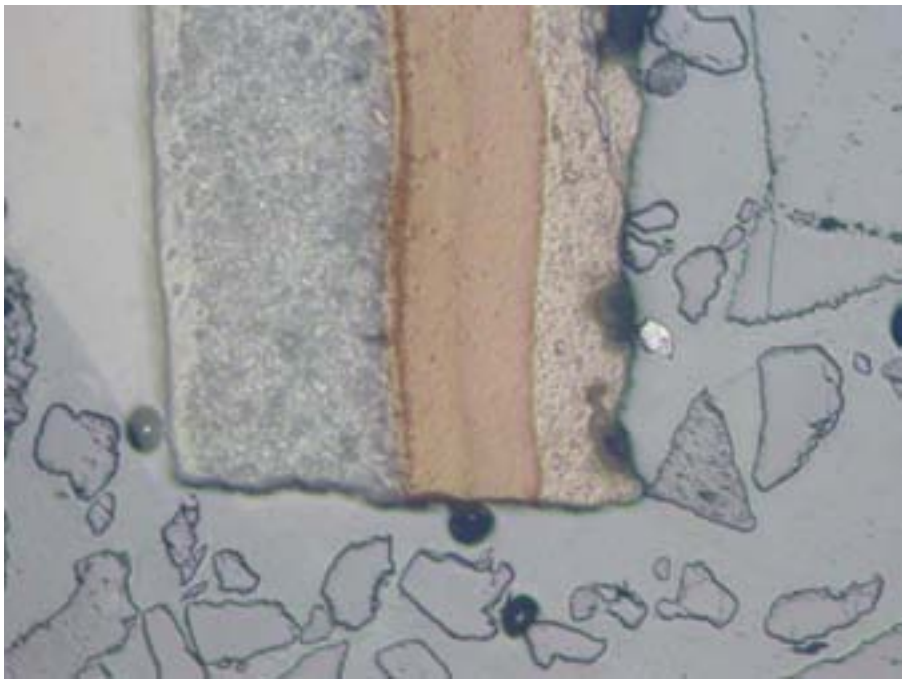
Light Optical Image Figure 9 Scale 1cm = 600μ
5575-4 Anatase particle (center),
ash sphere (top center), gangue



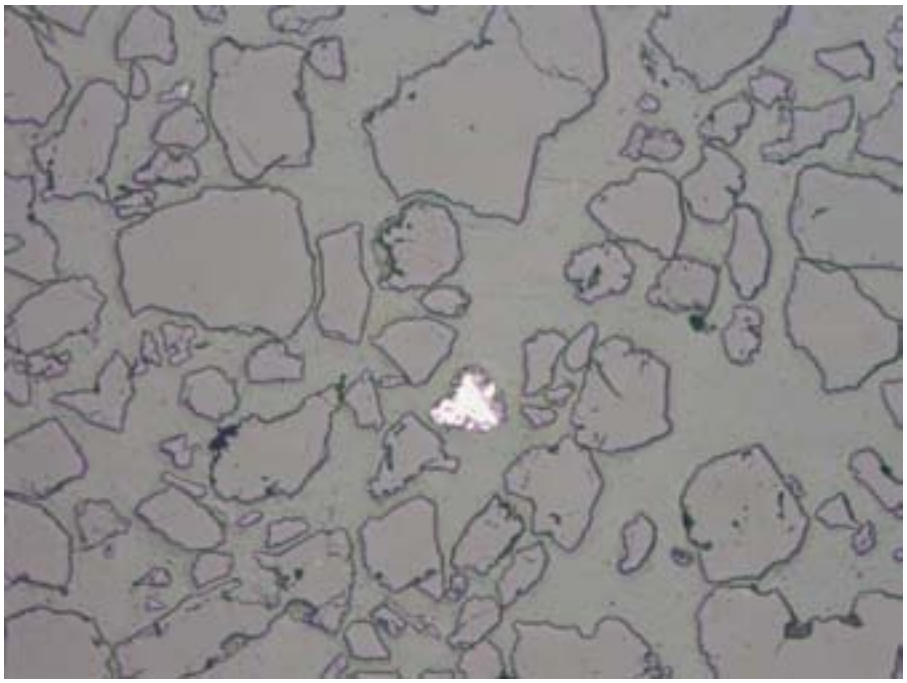
Light Optical Image Figure 10 Scale 1cm = 600μ
5575-4 Iron fragment, gangue



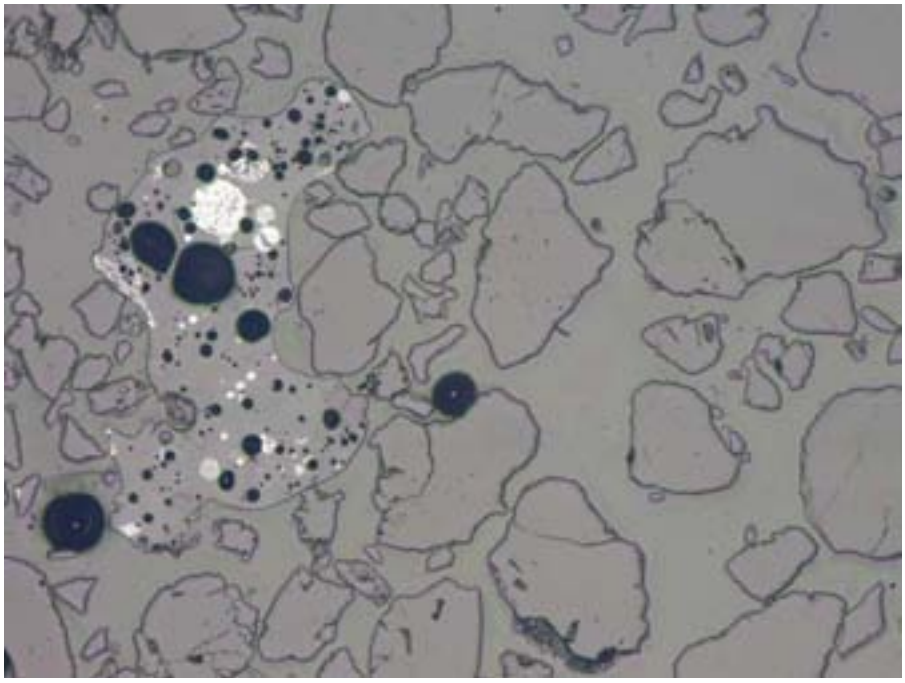
Light Optical Image Figure 11 Scale 1cm = 1300μ
5575-5 Iron oxide sphere (top left),
large glass particle with spherical voids (right), gangue



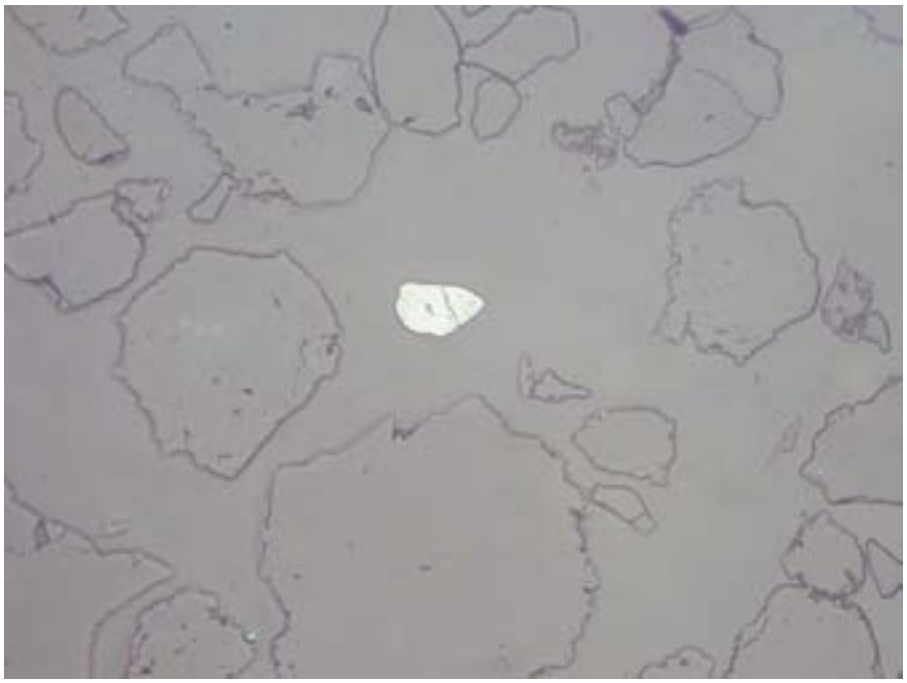
Light Optical Image Figure 12 Scale 1cm = 1300μ
5575-5 Large ceramic composite fragment,
spherical hematite particle (right center), gangue



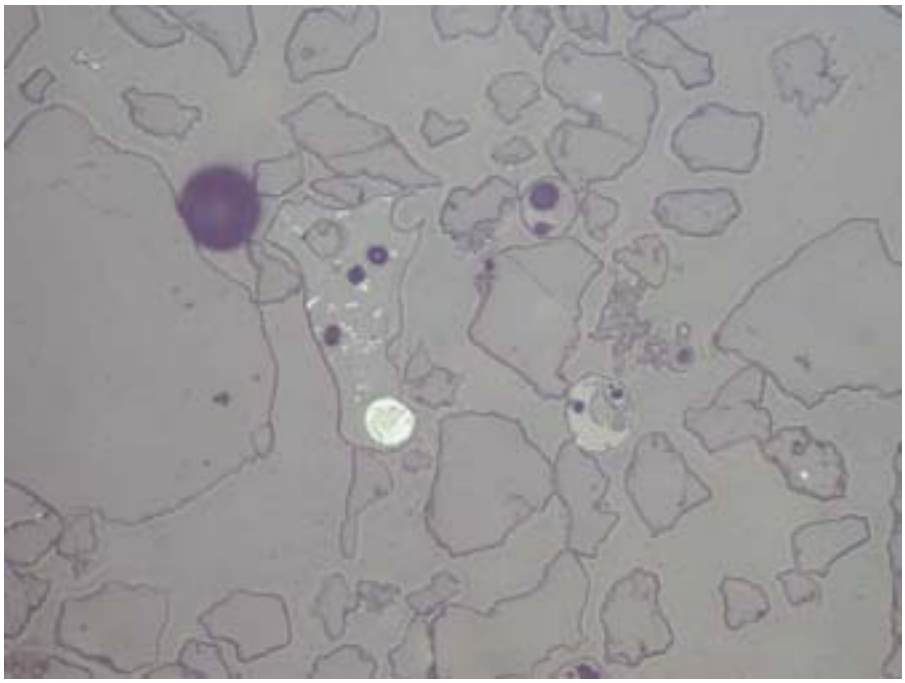
Light Optical Image Figure 13 Scale 1cm = 1300μ
5575-6 Anatase particle, gangue



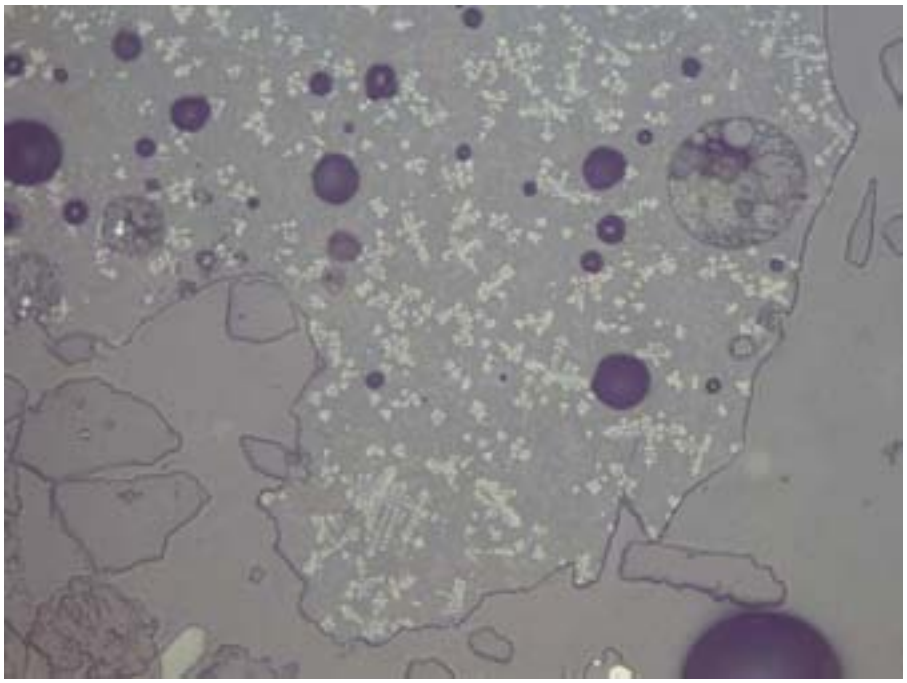
Light Optical Image Figure 14 Scale 1cm = 1300μ
5575-7 Large ash particle with iron oxide spheres and voids, gangue



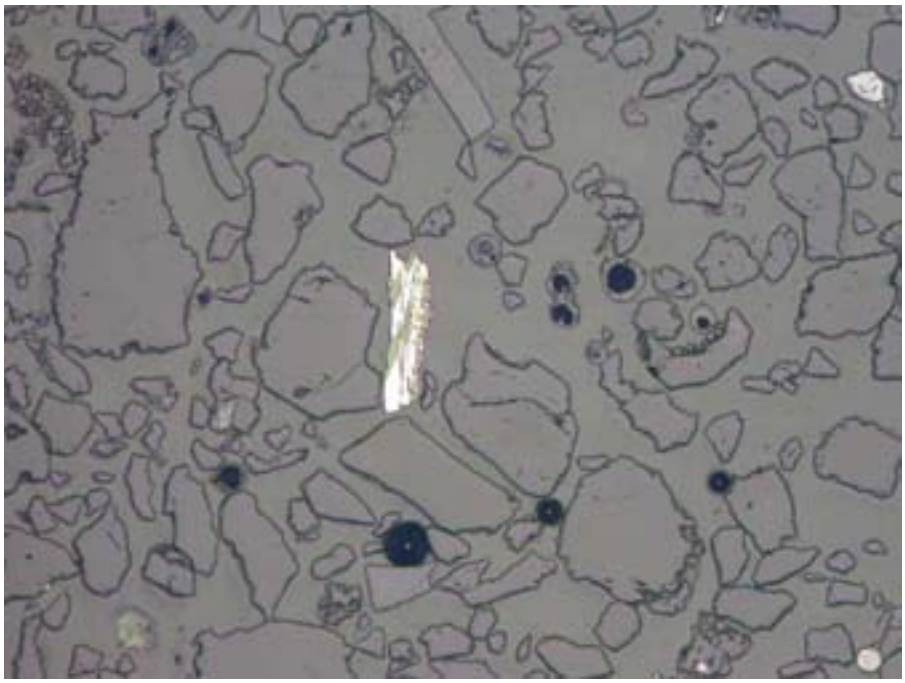
Light Optical Image Figure 15 Scale 1cm = 600μ
5575-7 Anatase particle, gangue



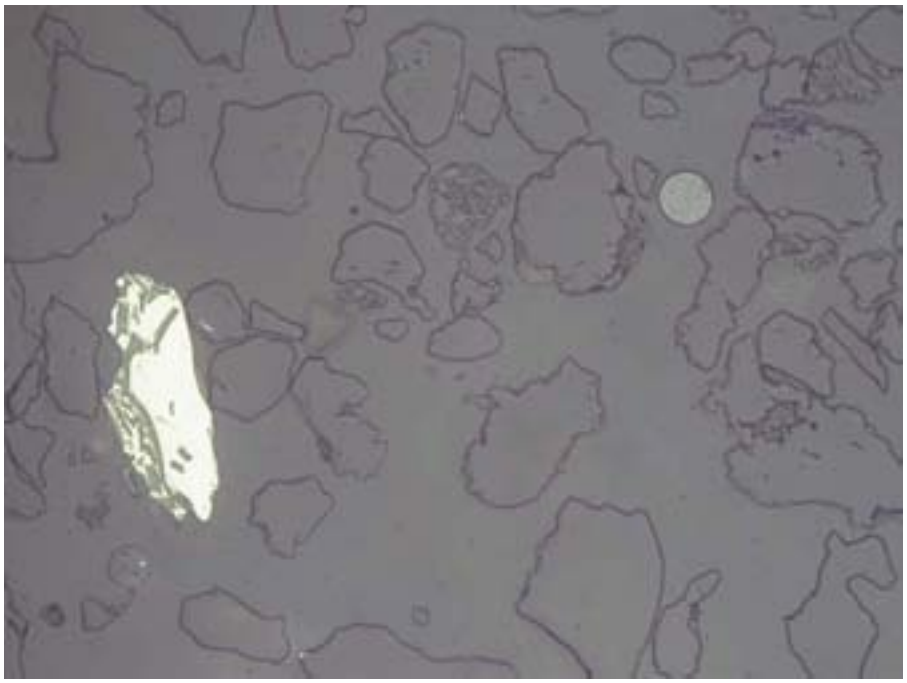
Light Optical Image Figure 16 Scale 1cm = 600μ
5575-8 Glassy ash particle containing magnetite crystallites, iron oxide spheres, and voids (center),
glass sphere (center right), gangue



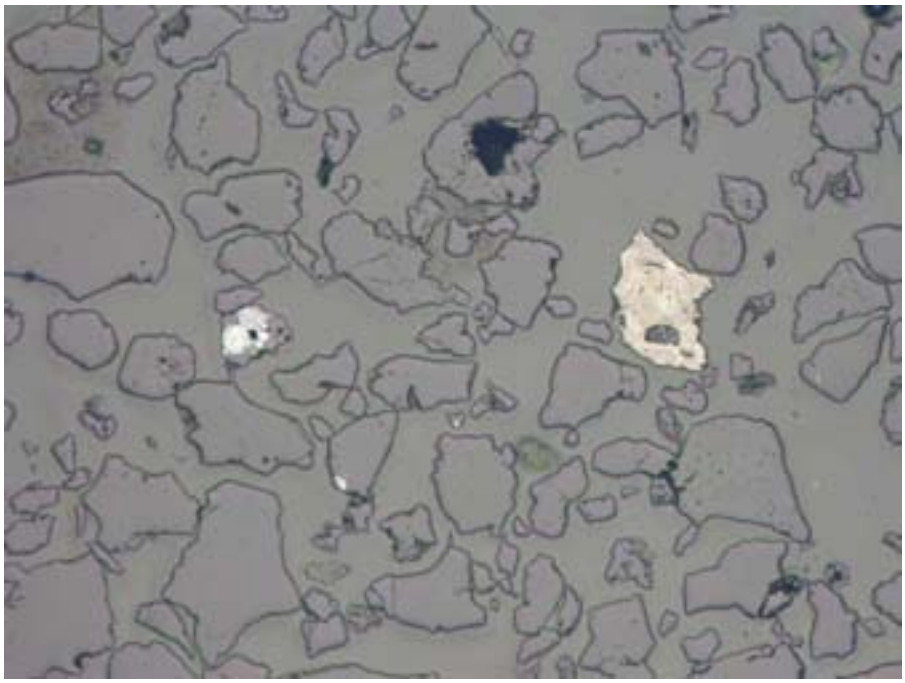
Light Optical Image Figure 17 Scale 1cm = 600μ
5575-8 Large glassy ash particle containing magnetite crystals (light gray), voids, and ash-filled void (top right), gangue



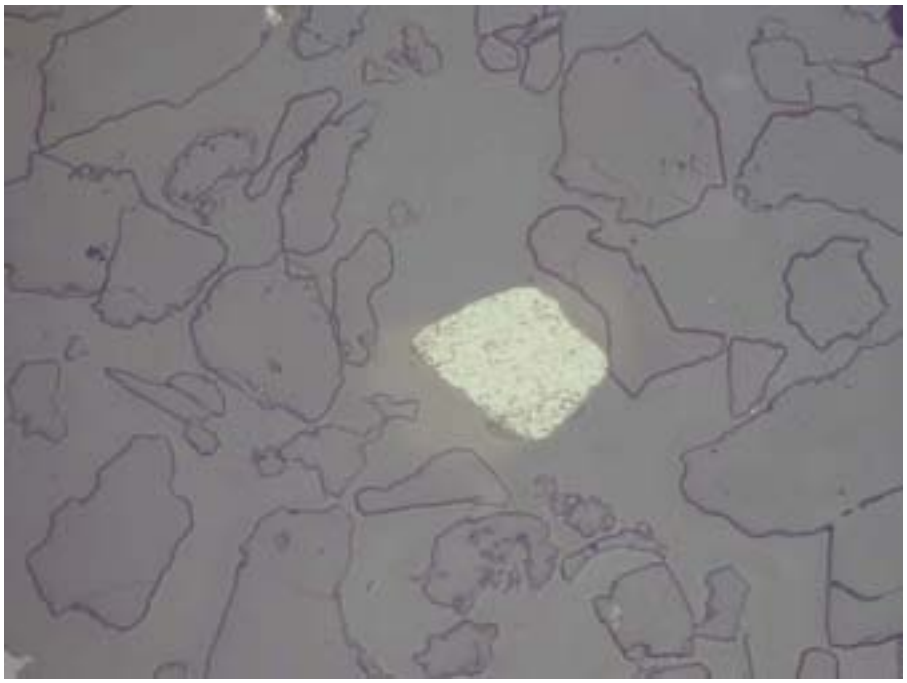
Light Optical Image Figure 18 Scale 1cm = 600μ
5575-8 Elongated pyrite (center), ash spheres (center right), gangue



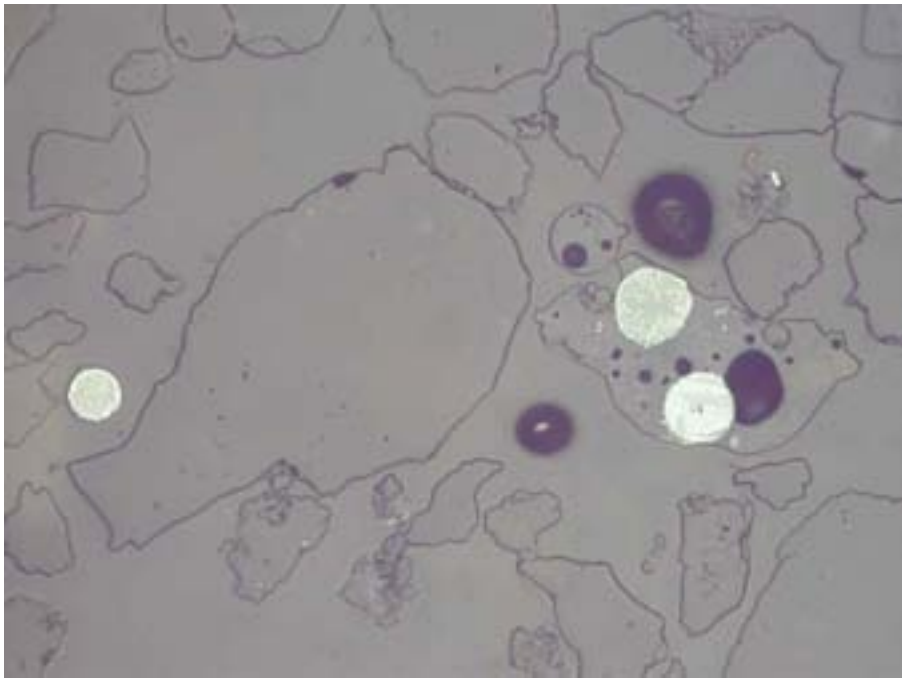
Light Optical Image Figure 19 Scale 1cm = 600μ
5575-8 Large pyrite particle (left), spherical iron oxide (rght), gangue



Light Optical Image Figure 20 Scale 1cm = 1300μ
5575-9 Large graphite particle with ash-filled void (center right), ash particle with iron oxide crystals (center left)
gangue



Light Optical Image Figure 21 Scale 1cm = 600μ
5575-9 Large anatase grain, gangue



Light Optical Image Figure 22 Scale 1cm = 600μ
5575-9 Ash particle with spherical voids and iron oxide spheres (center right), iron oxide sphere (center left), gangue

APPENDIX

Optical microscope scale

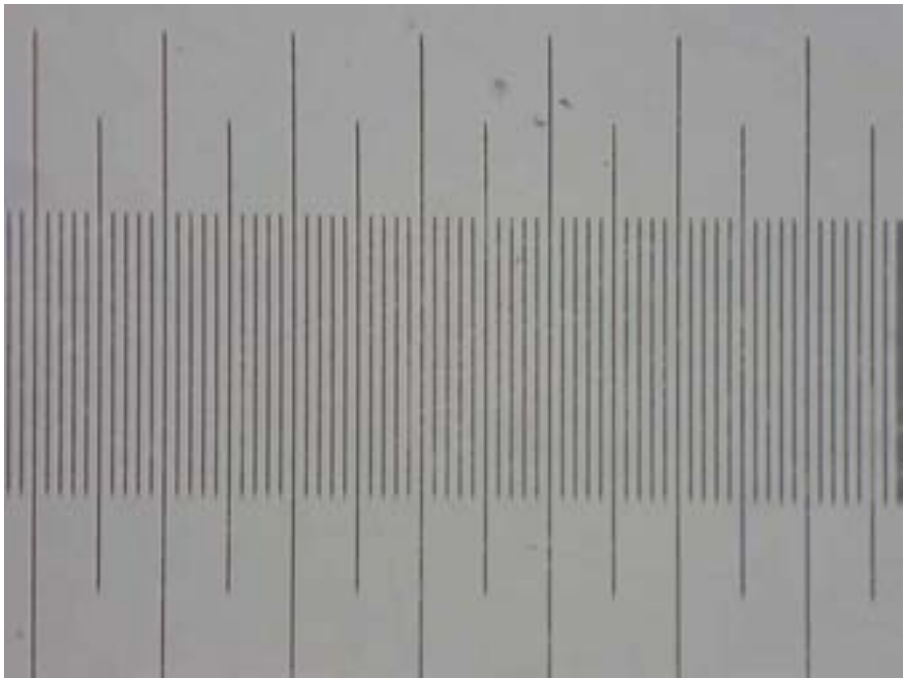


Figure 1
Scale: Reflected light, 20X air objective, 0.64 zoom, polarized

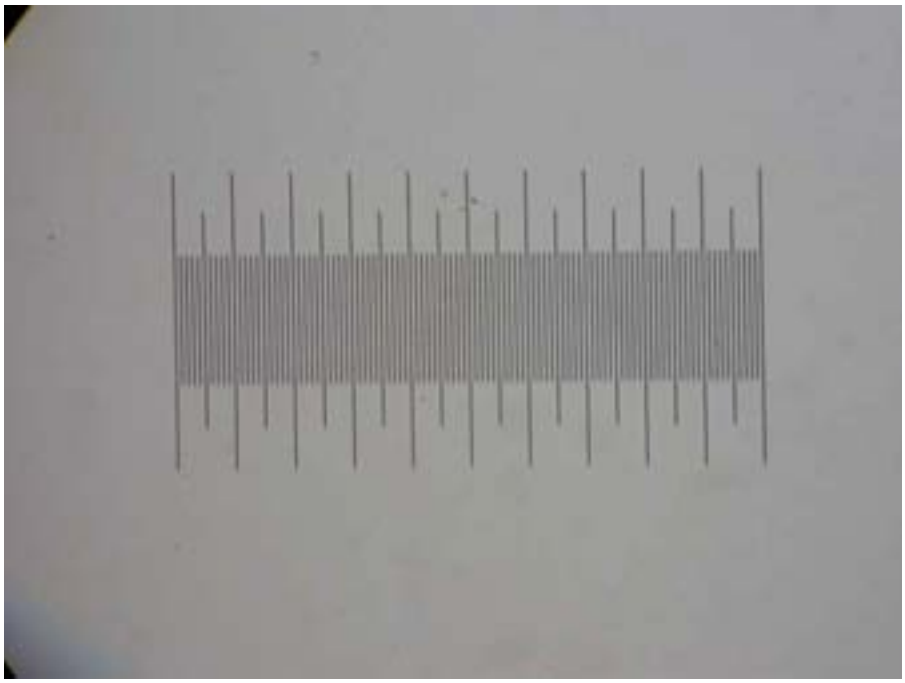
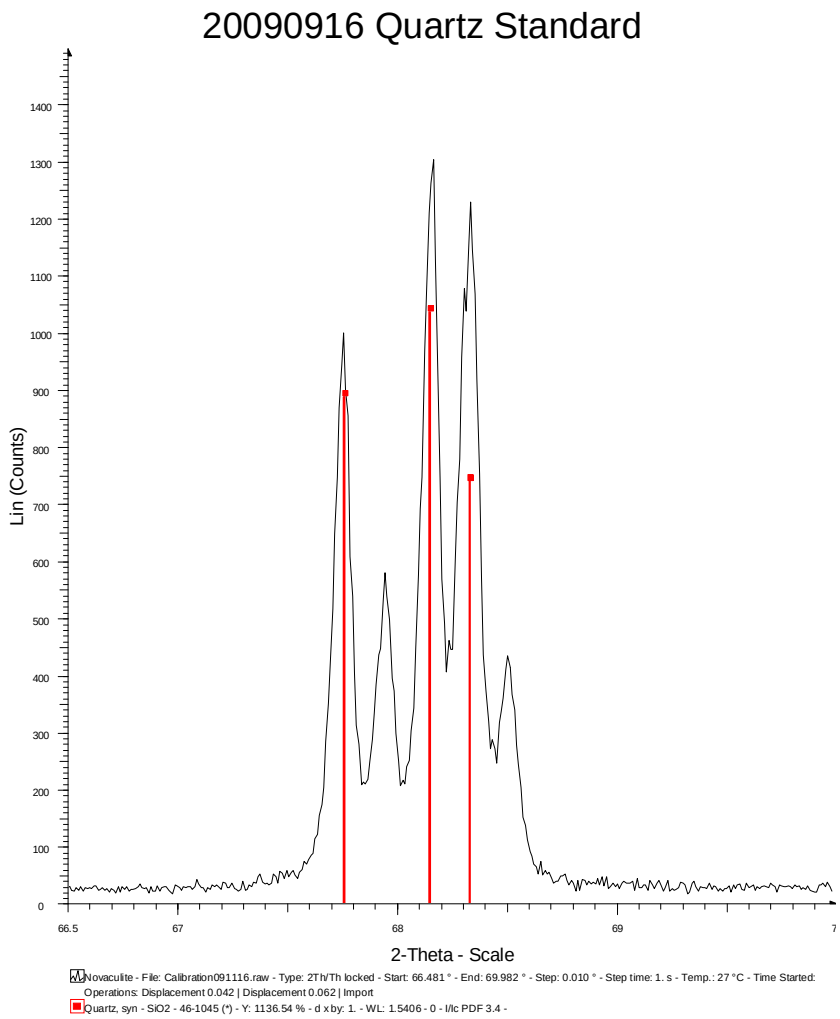


Figure 2
Scale: Reflected light, 10X air objective, 1.56 zoon, polarized

XRD Calibration Standard



Pittsburgh Mineral & Environmental Technology, Inc.

Standard Field Sampling Protocol for Geochemical Testing of Soils

1. Client must provide a representative sample consisting of drill core splits. Splits may consist of half or quartered core length or interval segments.

2. For sieve analysis one separate five-gallon bucket of material is required.

3. For geochemical properties a one to two kilogram sample is required.

4. As-is material should be removed immediately to a wide mouth polyethylene bottle and sealed with a screw cap to prevent sample reaction with atmospheric gases.

5. Sample container must be labeled with identification that is identical to the chain-of-custody log.

PMET Lab Sampling Protocol for Geochemical Testing

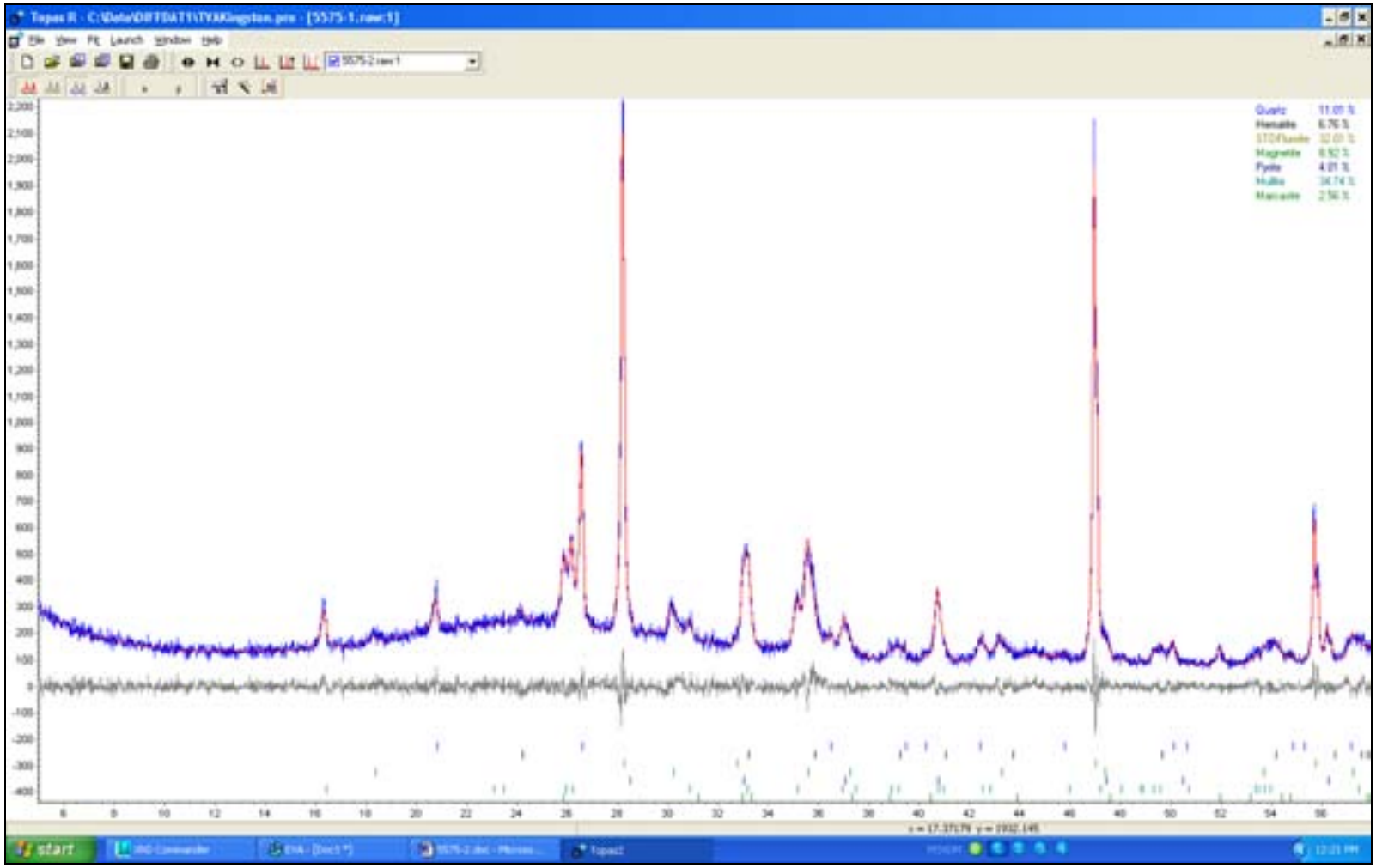
1. PMET lab personnel will verify samples with chain-of-custody document, inspect containers for integrity, and log samples into PMET chain-of-custody logbook.

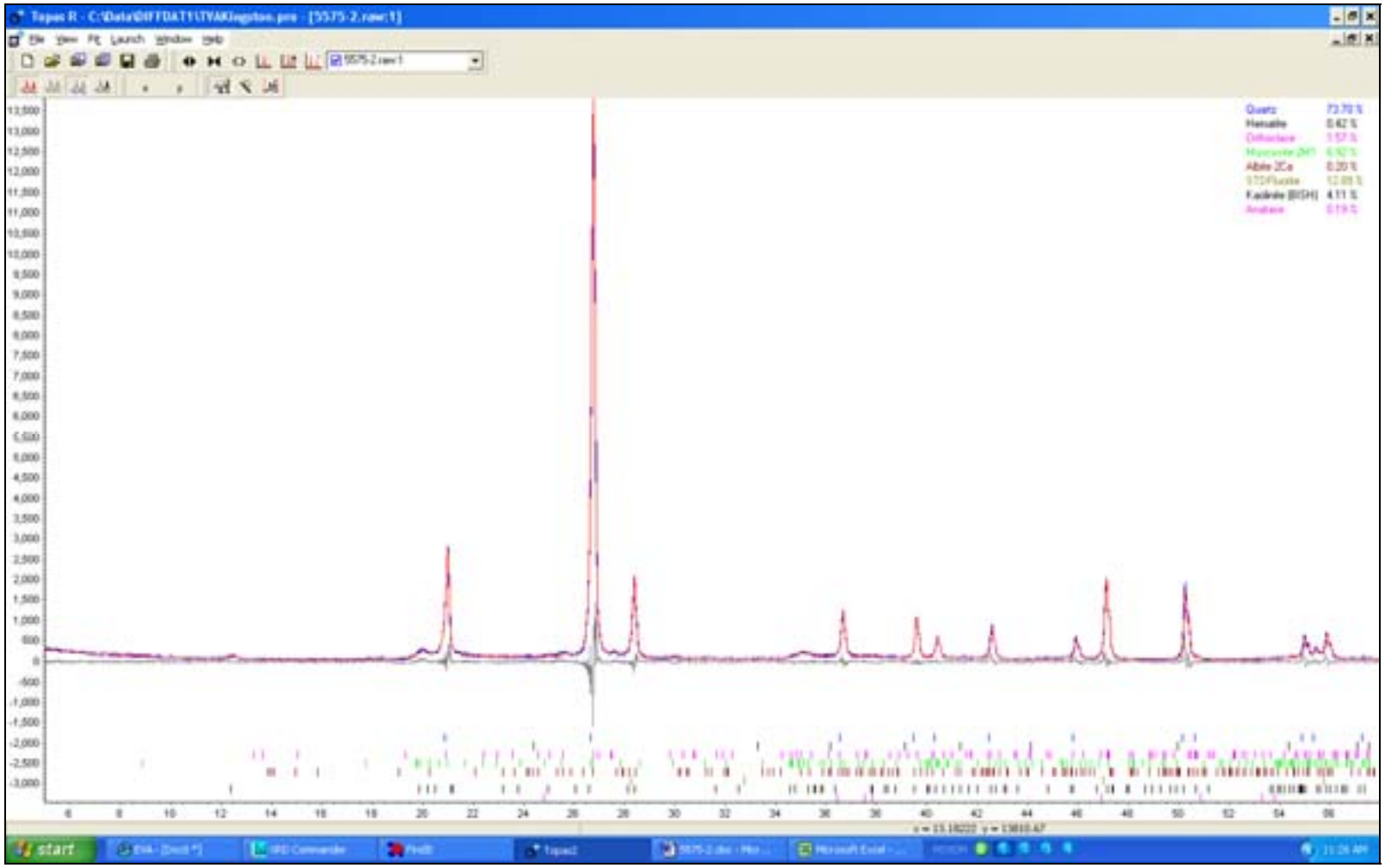
2. Moisture content will be determined by drying in tared pans at 45°C.

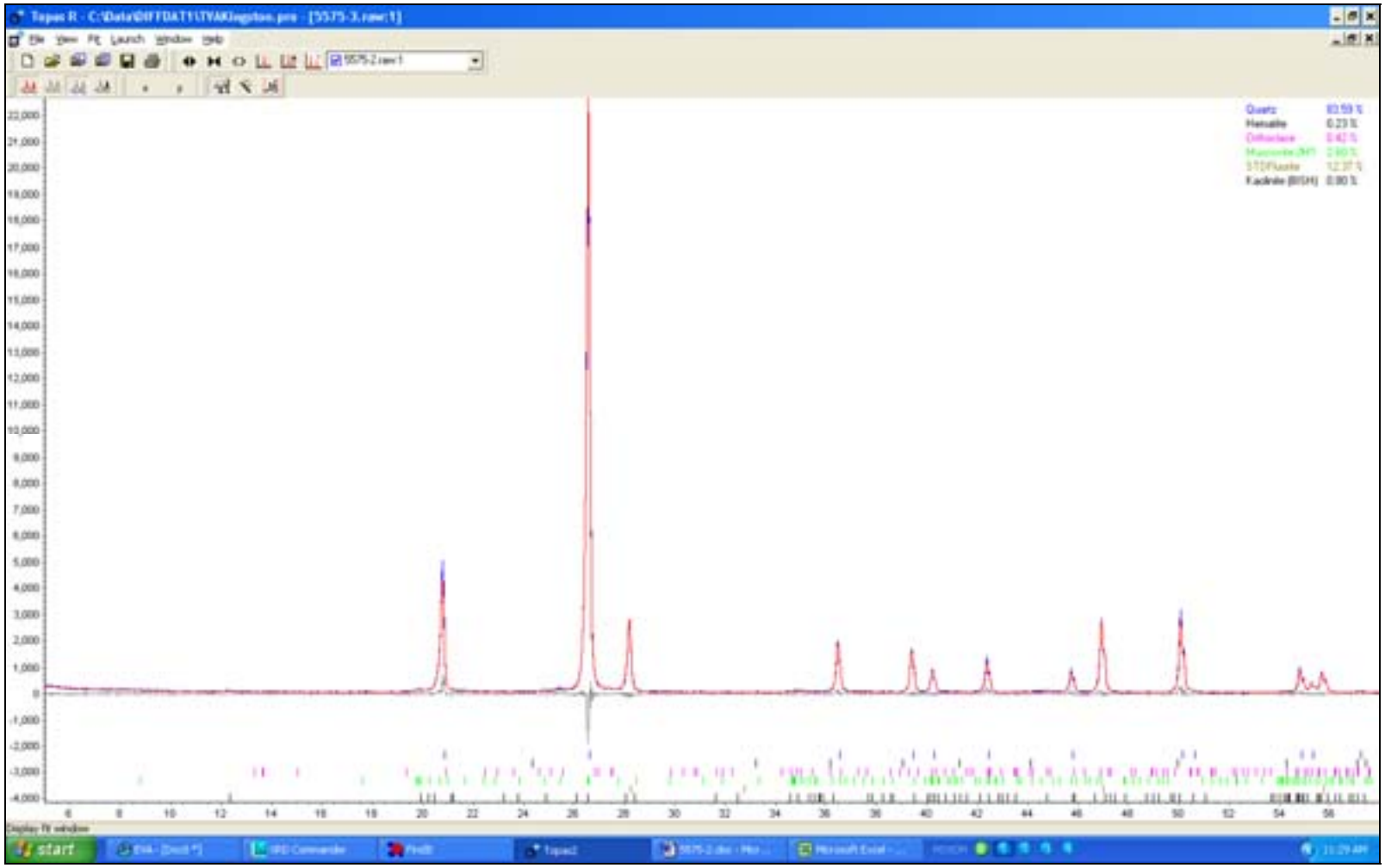
3. Rock fragments over one inch will be removed by screening.

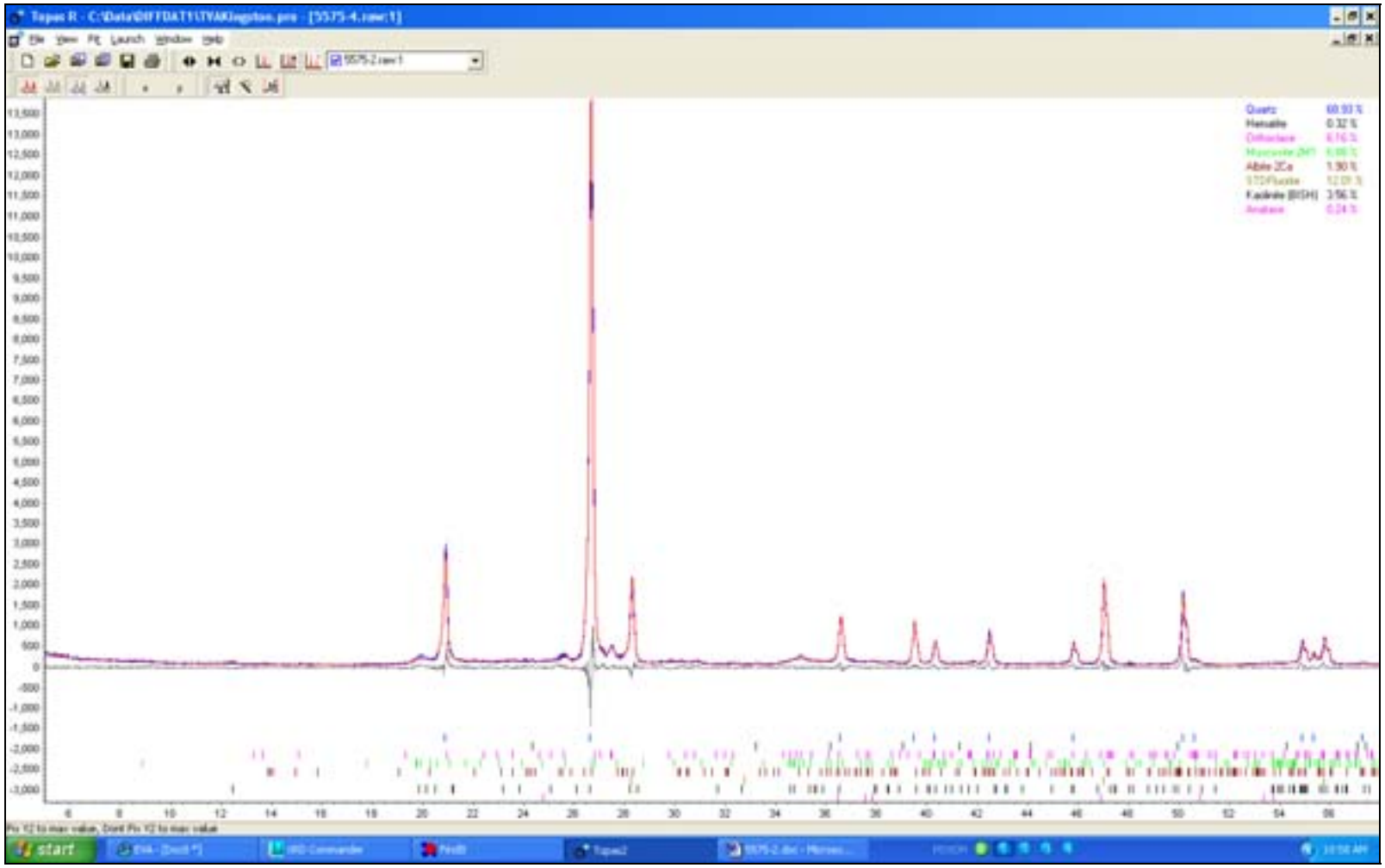
4. Sample will be stage crushed to –10 mesh and blended and split for analysis using a rotary riffle splitter.

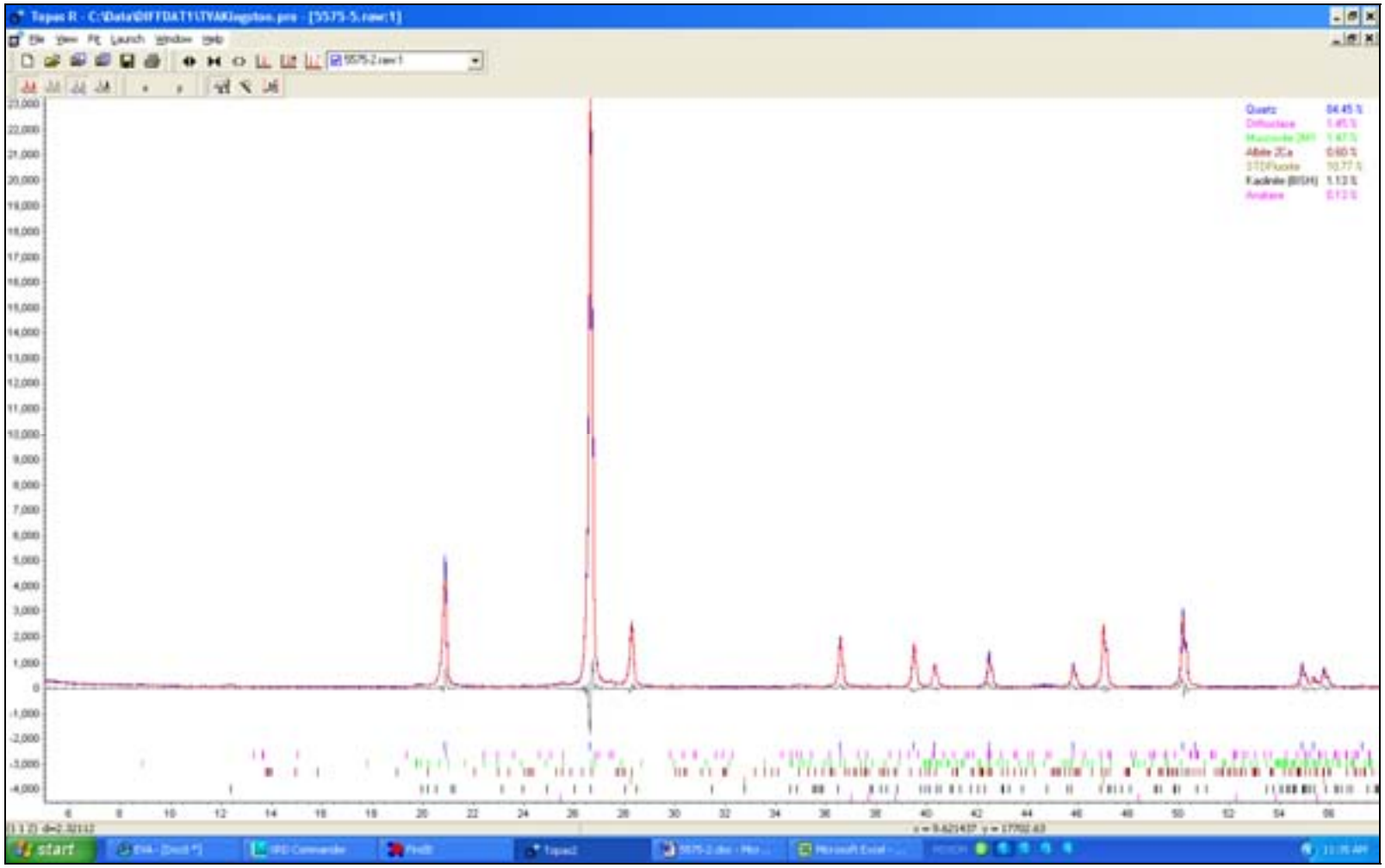
Randolph W. Shannon, Laboratory Manager

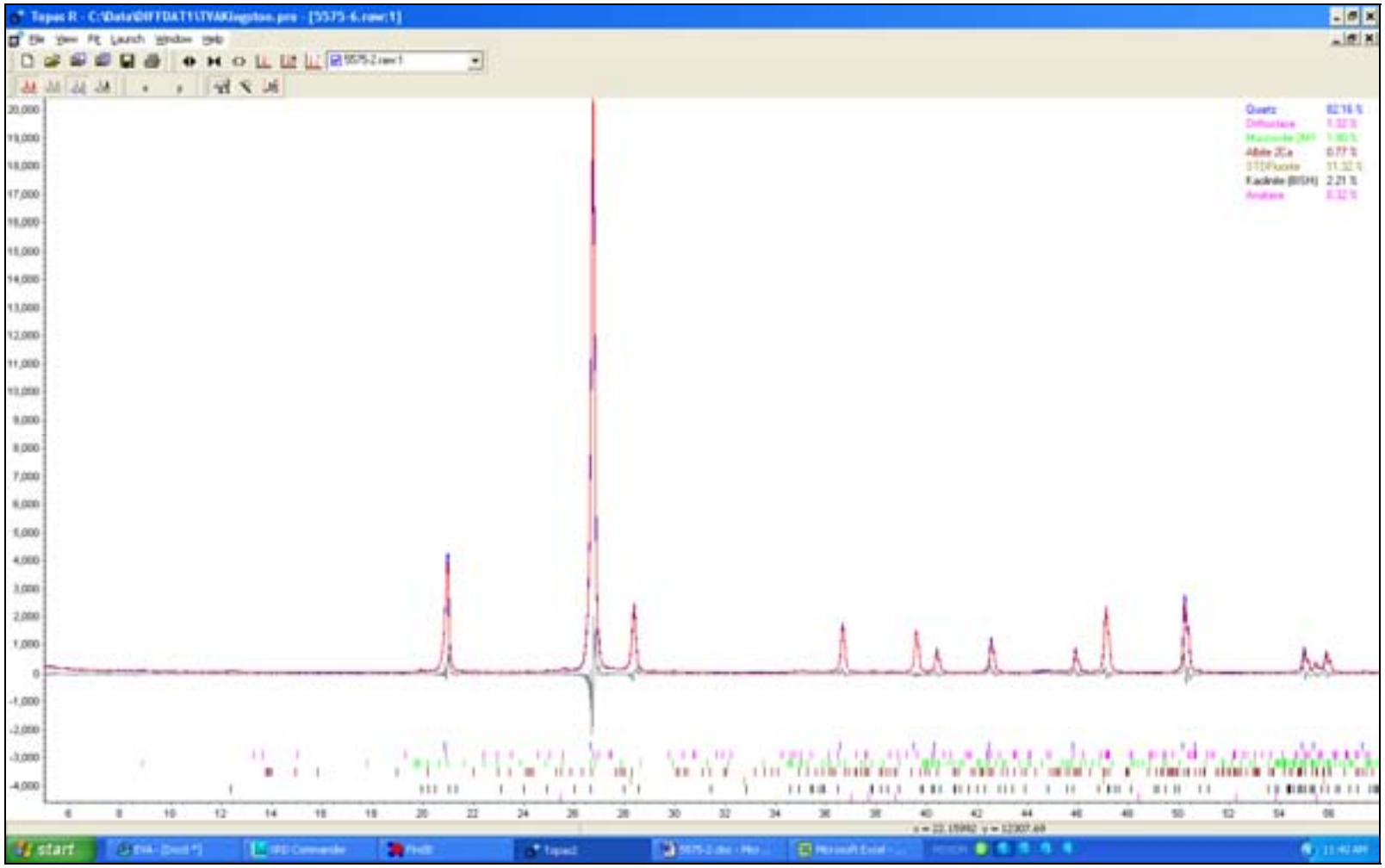

Quartz 11.01 %
Hematite 6.76 %
STD/Fluorite 32.01 %
Magnetite 6.92 %
Pyrite 4.01 %
Mullite 36.74 %
Maccaite 2.56 %

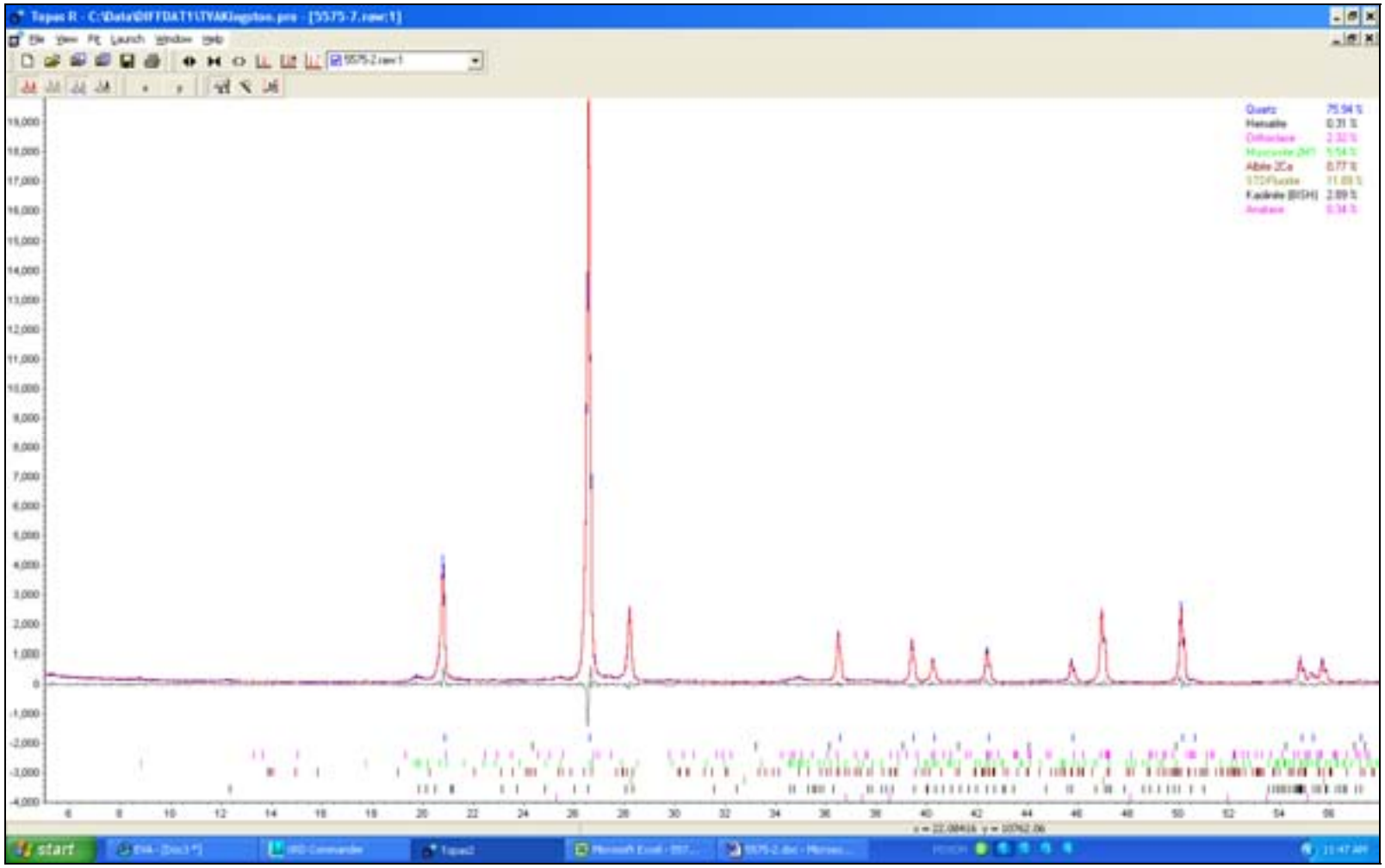


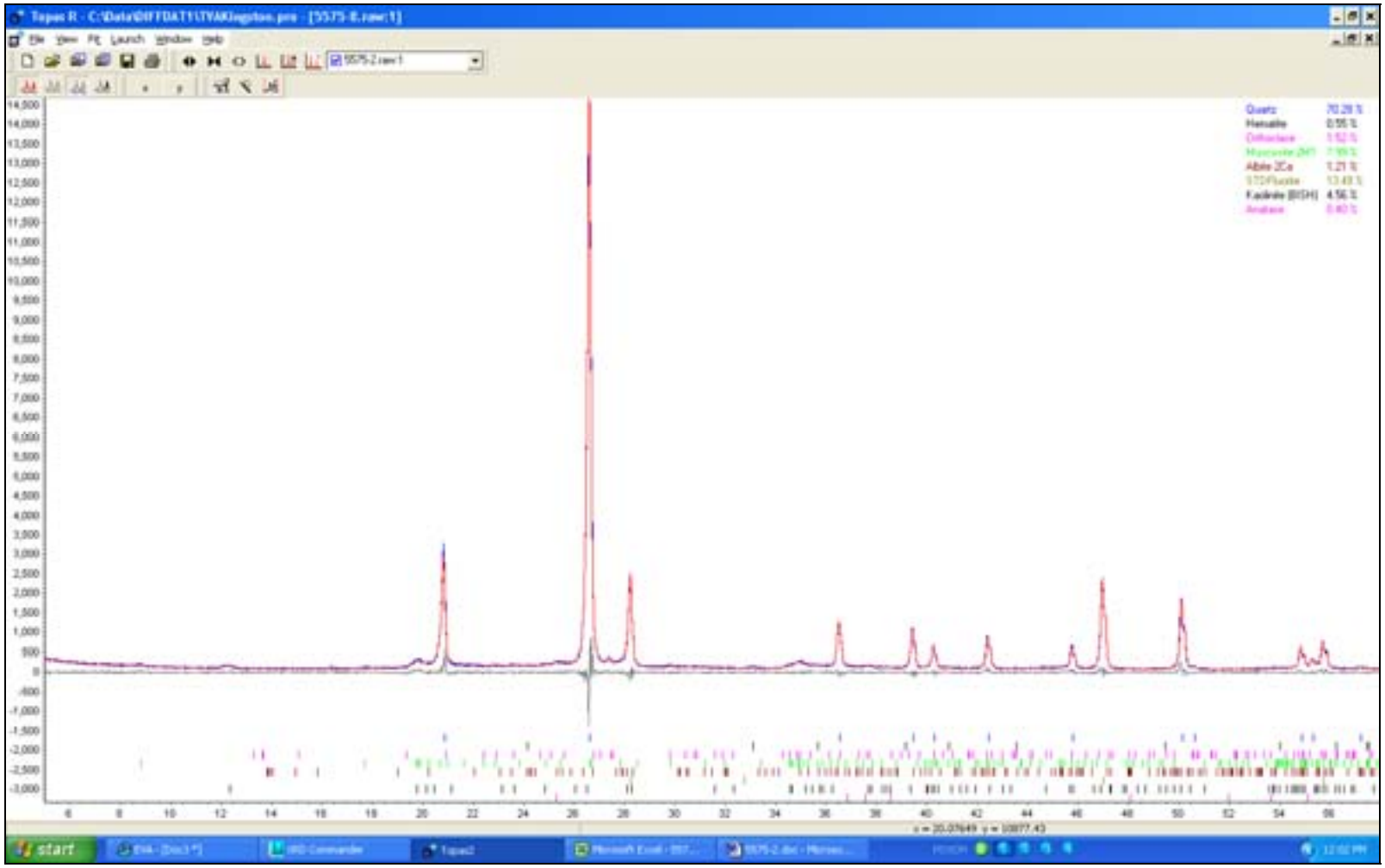


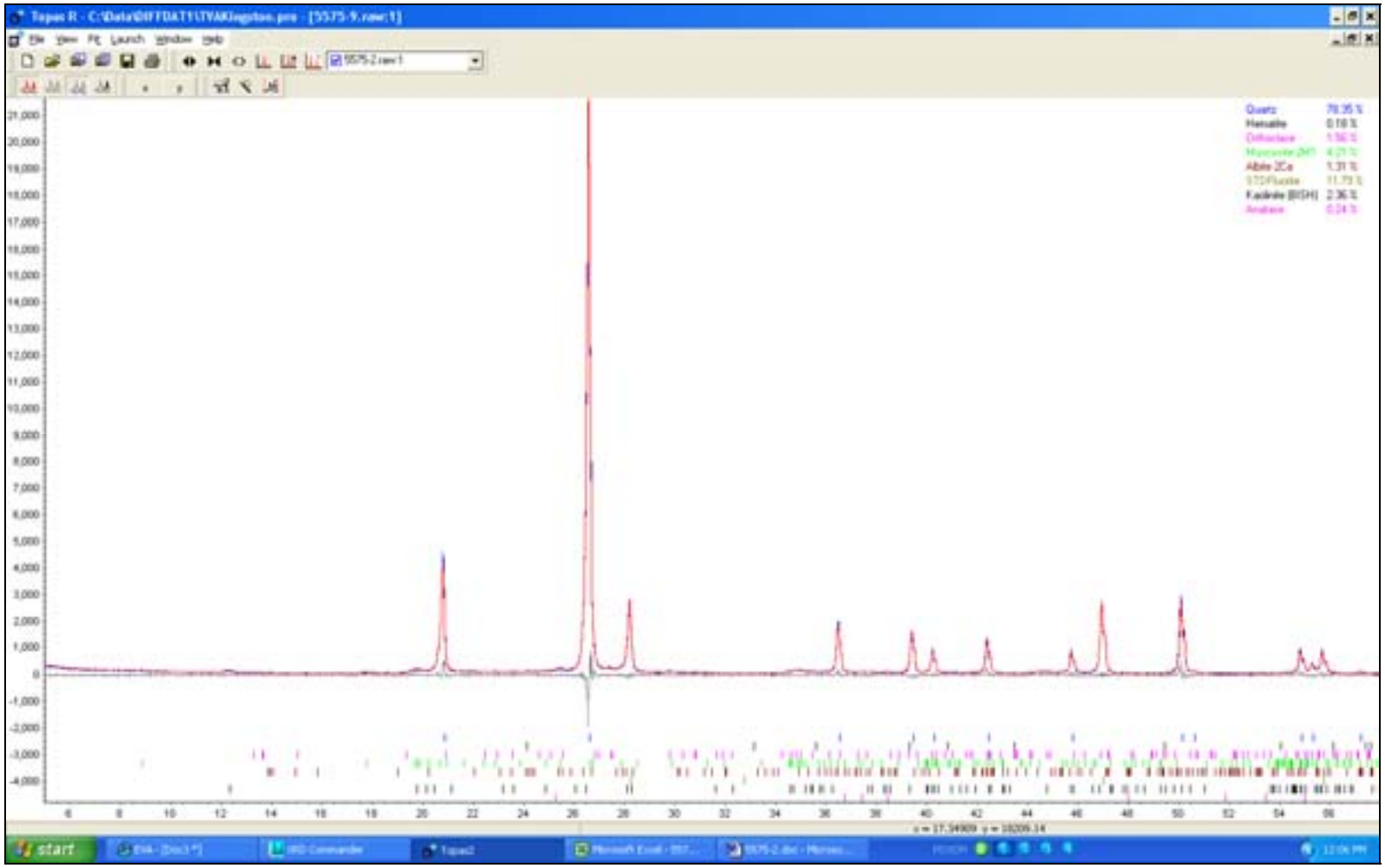

Quartz
Hematite
Albite 2Ca
Fluorite
Anatase


Quartz
Albite 2Ca
Faujasite (BISH)


Quartz
Albite 2Ca
Kaolinite (BISH) 2.21 %


Quartz 75.94 %
Hematite 0.31 %
Diffraction 2.32 %
Muscovite 2M1 5.54 %
Albite 2Ca 0.77 %
Fluorite 11.69 %
Kaolinite [001H] 2.89 %
Anatase 0.34 %
start





Laboratory Report for

Tennessee Valley Authority

Kingston Ash Recovery Project

August 6, 2010

Daniel B. Stephens & Associates, Inc.

5840 Osuna Road NE • Albuquerque, New Mexico 87109

August 6, 2010

J. Mark Boggs
Tennessee Valley Authority
400 Summit Hill Drive, WT 9D-K
Knoxville, TN 37902-1401
(865) 632-6941

Re: DBS&A Laboratory Report for Tennessee Valley Authority Kingston Ash Recovery Project

Dear Mr. Boggs:

Enclosed is the final report for the Tennessee Valley Authority Kingston Ash Recovery Project samples. Please review this report and provide any comments as samples will be held for a maximum of 30 days. After 30 days samples will be returned or disposed of in an appropriate manner.

All testing results were evaluated subjectively for consistency and reasonableness, and the results appear to be reasonably representative of the material tested. However, DBS&A does not assume any responsibility for interpretations or analyses based on the data enclosed, nor can we guarantee that these data are fully representative of the undisturbed materials at the field site. We recommend that careful evaluation of these laboratory results be made for your particular application.

The testing utilized to generate the enclosed final report employs methods that are standard for the industry. The results do not constitute a professional opinion by DBS&A, nor can the results affect any professional or expert opinions rendered with respect thereto by DBS&A. You have acknowledged that all the testing undertaken by us, and the final report provided, constitutes mere test results using standardized methods, and cannot be used to disqualify DBS&A from rendering any professional or expert opinion, having waived any claim of conflict of interest by DBS&A.

We are pleased to provide this service to Tennessee Valley Authority and look forward to future laboratory testing on other projects. If you have any questions about the enclosed data, please do not hesitate to call.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.
SOIL TESTING & RESEARCH LABORATORY

Joleen Hines
Laboratory Supervising Manager
Enclosure

Daniel B. Stephens & Associates, Inc.
Soil Testing & Research Laboratory
5840 Osuna Rd. NE
Albuquerque, NM 87109
505-889-7752
FAX 505-889-0258

Summaries

Summary of Tests Performed

Laboratory Sample Number	Initial Soil Properties[1]			Saturated Hydraulic Conductivity[2]			Moisture Characteristics[3]								Particle Size[4]			Specific Gravity[5]		Air Perm-eability	Atterberg Limits	Proctor Compaction
	G	VM	VD	CH	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K_{unsat}	DS	WS	H	F	C			
GP-16A, 46-48	X	X		X								X						X				
GP-16, 34-36	X	X		X								X						X				
GP-23, 34-36	X	X		X								X						X				
GP-23, 54-56	X	X			X							X						X				
GW-01, 20-22	X	X			X							X						X				
TWP-04A, 60-62	X	X										X						X				
TWP-04A, 70-72	X	X		X								X						X				
TWP-05, 66-68	X	X			X							X						X				
TWP-05, 76-78	X	X			X							X						X				
TWP-06, 40-42	X	X		X								X						X				
TWP-06, 54-56	X	X		X								X						X				

[1] G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method

[2] CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

[3] HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box, EP = Effective Porosity, WHC = Water Holding Capacity, Kunsat = Calculated Unsaturated Hydraulic Conductivity

[4] DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer

[5] F = Fine (<4.75mm), C = Coarse (>4.75mm)

Notes

Sample TWP-04A, 60-62 pulled away from the wall of the testing ring (decreased in volume) during the saturated hydraulic conductivity (Ksat) test. This anomalous behavior created an annulus and therefore, wall flow. Since the rigid wall Ksat method was no longer appropriate due to the wall flow and since the structural integrity of the sample had increased slightly; the sample was taken out of the rigid wall apparatus and was placed in a flexible membrane for Ksat testing via the flexible wall apparatus. This test was also unsuccessful. Even though the integrity of the sample had increased slighlty, it was still not strong enough to withhold structural change under standard confining pressures. Thus, we are unable to report a saturated hydraulic conductivity result for sample TWP-04A, 60-62.

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

Sample Number	Moisture Content: As Received, Gravimetric (%, g/g)	Moisture Content: As Received, Volumetric (%, cm^3/cm^3)	Moisture Content: Remolded, Gravimetric (%, g/g)	Moisture Content: Remolded, Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
GP-16A, 46-48	16.2	28.2	---	---	1.75	2.03	33.9
GP-16, 34-36	23.0	38.3	---	---	1.66	2.05	37.1
GP-23, 34-36	43.1	48.5	---	---	1.12	1.61	54.8
GP-23, 54-56	25.0	39.9	---	---	1.59	1.99	40.2
GW-01, 20-22	18.8	34.1	---	---	1.81	2.15	33.8
TWP-04A, 60-62	25.4	39.8	---	---	1.57	1.96	40.7
TWP-04A, 70-72	18.8	30.1	---	---	1.60	1.90	39.2
TWP-05, 66-68	19.6	34.1	---	---	1.74	2.08	34.5
TWP-05, 76-78	16.3	30.2	---	---	1.85	2.15	30.0
TWP-06, 40-42	20.6	35.3	---	---	1.71	2.06	35.5
TWP-06, 54-56	18.1	32.1	---	---	1.78	2.10	33.2

NA = Not analyzed

--- = This sample was not remolded

Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K_{sat} (cm/sec)	Oversize Corrected K_{sat} (cm/sec)	Method of Analysis	
			Constant Head	Falling Head
GP-16A, 46-48	3.5E-04	NA	X	
GP-16, 34-36	5.6E-04	NA	X	
GP-23, 34-36	5.6E-04	NA	X	
GP-23, 54-56	<1.08E-08*	NA		X
GW-01, 20-22	5.2E-07	NA		X
TWP-04A, 60-62	NA	NA		
TWP-04A, 70-72	1.8E-03	NA	X	
TWP-05, 66-68	4.1E-07	NA		X
TWP-05, 76-78	3.4E-06	NA		X
TWP-06, 40-42	4.5E-04	NA	X	
TWP-06, 54-56	5.2E-04	NA	X	

* =Outflow was not detected after 13 days of testing. The sample appeared saturated upon removal from the permeameter. Results above are based on flow into sample. Reported conductivity is near the limit of the testing apparatus; the result is less than or equal to the reported conductivity.

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NR = Not requested
NA = Not applicable

Summary of Specific Gravity Tests

	<4.75mm Material		>4.75mm Material		Bulk Sample
Sample Number	Specific Gravity	Percent of Bulk Sample	Specific Gravity	Percent of Bulk Sample	Specific Gravity
GP-16A, 46-48	2.65	100.0	---	0.0	2.65
GP-16, 34-36	2.65	100.0	---	0.0	2.65
GP-23, 34-36	2.49	99.8	---	0.2	2.49*
GP-23, 54-56	2.67	100.0	---	0.0	2.67
GW-01, 20-22	2.74	50.0	NA	50.0	2.74*
TWP-04A, 60-62	2.65	98.6	---	1.4	2.65*
TWP-04A, 70-72	2.63	100.0	---	0.0	2.63
TWP-05, 66-68	2.66	100.0	---	0.0	2.66
TWP-05, 76-78	2.65	100.0	---	0.0	2.65
TWP-06, 40-42	2.66	100.0	---	0.0	2.66
TWP-06, 54-56	2.66	100.0	---	0.0	2.66

--- = Unnecessary since specified fraction <5% of composite mass

* = Based on specific gravity of material < 4.75 mm

NA = Coarse specific gravity test not appropriate for shale or shale-like material.

Summary of Moisture Retention (-15 Bar Point, Effective Porosity)

Sample Number	Calculated Total Porosity (%)	-15 Bar Point Volumetric Water Content (%, cm^3/cm^3)	Effective Porosity (%, cm^3/cm^3)	Oversize Corrected: Calculated Total Porosity (%)	Oversize Corrected: -15 Bar Point Volumetric Water Content (%, cm^3/cm^3)	Oversize Corrected: Effective Porosity (%, cm^3/cm^3)
GP-16A, 46-48	33.9	3.5	30.4	NA	NA	NA
GP-16, 34-36	37.1	3.8	33.3	NA	NA	NA
GP-23, 34-36	54.8	1.7	53.1	NA	NA	NA
GP-23, 54-56	40.2	20.8	19.4	NA	NA	NA
GW-01, 20-22	33.8	6.9	26.9	NA	NA	NA
TWP-04A, 60-62	40.7	9.6	31.1	NA	NA	NA
TWP-04A, 70-72	39.2	3.2	35.9	NA	NA	NA
TWP-05, 66-68	34.5	9.1	25.4	NA	NA	NA
TWP-05, 76-78	30.0	7.3	22.7	NA	NA	NA
TWP-06, 40-42	35.5	8.8	26.7	NA	NA	NA
TWP-06, 54-56	33.2	6.1	27.2	NA	NA	NA

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NA = Not applicable
NR = Not requested

Laboratory Data and Graphical Plots

Initial Properties

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

Sample Number	Moisture Content: As Received, Gravimetric (%, g/g)	Moisture Content: As Received, Volumetric (%, cm^3/cm^3)	Moisture Content: Remolded, Gravimetric (%, g/g)	Moisture Content: Remolded, Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
GP-16A, 46-48	16.2	28.2	---	---	1.75	2.03	33.9
GP-16, 34-36	23.0	38.3	---	---	1.66	2.05	37.1
GP-23, 34-36	43.1	48.5	---	---	1.12	1.61	54.8
GP-23, 54-56	25.0	39.9	---	---	1.59	1.99	40.2
GW-01, 20-22	18.8	34.1	---	---	1.81	2.15	33.8
TWP-04A, 60-62	25.4	39.8	---	---	1.57	1.96	40.7
TWP-04A, 70-72	18.8	30.1	---	---	1.60	1.90	39.2
TWP-05, 66-68	19.6	34.1	---	---	1.74	2.08	34.5
TWP-05, 76-78	16.3	30.2	---	---	1.85	2.15	30.0
TWP-06, 40-42	20.6	35.3	---	---	1.71	2.06	35.5
TWP-06, 54-56	18.1	32.1	---	---	1.78	2.10	33.2

NA = Not analyzed

--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GP-16A, 46-48
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

	As Received	Remolded
Test Date:	13-Jul-10	---
Field weight of sample* (g):	412.21	
Tare weight, ring (g):	75.48	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	289.88	
Sample volume (cm^3):	165.99	
Measured particle density (g/cm^3):	2.64	
Gravimetric Moisture Content (% g/g):	16.2	
Volumetric Moisture Content (% vol):	28.2	
Dry bulk density (g/cm^3):	1.75	
Wet bulk density (g/cm^3):	2.03	
Calculated Porosity (% vol):	33.9	
Percent Saturation:	83.3	

Laboratory analysis by: K. Wright
Data entered by: M. Vigil
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GP-16, 34-36
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

	As Received	Remolded
Test Date:	13-Jul-10	---
Field weight of sample* (g):	587.56	
Tare weight, ring (g):	133.17	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	369.43	
Sample volume (cm^3):	222.06	
Measured particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	23.0	
Volumetric Moisture Content (% vol):	38.3	
Dry bulk density (g/cm^3):	1.66	
Wet bulk density (g/cm^3):	2.05	
Calculated Porosity (% vol):	37.1	
Percent Saturation:	103.0	

Laboratory analysis by: K. Wright
Data entered by: M. Vigil
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GP-23, 34-36
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

	As Received	Remolded
Test Date:	13-Jul-10	---
Field weight of sample* (g):	492.27	
Tare weight, ring (g):	129.62	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	253.36	
Sample volume (cm^3):	225.35	
Measured particle density (g/cm^3):	2.49	
Gravimetric Moisture Content (% g/g):	43.1	
Volumetric Moisture Content (% vol):	48.5	
Dry bulk density (g/cm^3):	1.12	
Wet bulk density (g/cm^3):	1.61	
Calculated Porosity (% vol):	54.8	
Percent Saturation:	88.4	

Laboratory analysis by: K. Wright
Data entered by: M. Vigil
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GP-23, 54-56
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

	As Received	Remolded
Test Date:	13-Jul-10	---
Field weight of sample* (g):	576.85	
Tare weight, ring (g):	124.91	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	361.41	
Sample volume (cm^3):	226.76	
Measured particle density (g/cm^3):	2.67	
Gravimetric Moisture Content (% g/g):	25.0	
Volumetric Moisture Content (% vol):	39.9	
Dry bulk density (g/cm^3):	1.59	
Wet bulk density (g/cm^3):	1.99	
Calculated Porosity (% vol):	40.2	
Percent Saturation:	99.3	

Laboratory analysis by: K. Wright
Data entered by: M. Vigil
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GW-01, 20-22
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

	As Received	Remolded
Test Date:	16-Jul-10	---
Field weight of sample* (g):	891.40	
Tare weight, ring (g):	208.78	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	574.50	
Sample volume (cm^3):	317.35	
Measured particle density (g/cm^3):	2.74	
Gravimetric Moisture Content (% g/g):	18.8	
Volumetric Moisture Content (% vol):	34.1	
Dry bulk density (g/cm^3):	1.81	
Wet bulk density (g/cm^3):	2.15	
Calculated Porosity (% vol):	33.8	
Percent Saturation:	100.8	

Laboratory analysis by: K. Wright
Data entered by: M. Vigil
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-04A, 60-62
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

	As Received	Remolded
Test Date:	16-Jul-10	---
Field weight of sample* (g):	573.29	
Tare weight, ring (g):	130.10	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	353.41	
Sample volume (cm^3):	225.77	
Measured particle density (g/cm^3):	2.64	
Gravimetric Moisture Content (% g/g):	25.4	
Volumetric Moisture Content (% vol):	39.8	
Dry bulk density (g/cm^3):	1.57	
Wet bulk density (g/cm^3):	1.96	
Calculated Porosity (% vol):	40.7	
Percent Saturation:	97.6	

Laboratory analysis by: K. Wright
Data entered by: M. Vigil
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-04A, 70-72
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

	As Received	Remolded
Test Date:	13-Jul-10	---
Field weight of sample* (g):	382.34	
Tare weight, ring (g):	72.90	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	260.41	
Sample volume (cm^3):	163.05	
Measured particle density (g/cm^3):	2.63	
Gravimetric Moisture Content (% g/g):	18.8	
Volumetric Moisture Content (% vol):	30.1	
Dry bulk density (g/cm^3):	1.60	
Wet bulk density (g/cm^3):	1.90	
Calculated Porosity (% vol):	39.2	
Percent Saturation:	76.8	

Laboratory analysis by: K. Wright
Data entered by: C. Krous
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-05, 66-68
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

	As Received	Remolded
Test Date:	13-Jul-10	---
Field weight of sample* (g):	600.99	
Tare weight, ring (g):	133.42	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	390.88	
Sample volume (cm^3):	224.95	
Measured particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	19.6	
Volumetric Moisture Content (% vol):	34.1	
Dry bulk density (g/cm^3):	1.74	
Wet bulk density (g/cm^3):	2.08	
Calculated Porosity (% vol):	34.5	
Percent Saturation:	98.9	

Laboratory analysis by: K. Wright
Data entered by: C. Krous
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-05, 76-78
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

	As Received	Remolded
Test Date:	13-Jul-10	---
Field weight of sample* (g):	457.59	
Tare weight, ring (g):	95.05	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	311.70	
Sample volume (cm^3):	168.52	
Measured particle density (g/cm^3):	2.64	
Gravimetric Moisture Content (% g/g):	16.3	
Volumetric Moisture Content (% vol):	30.2	
Dry bulk density (g/cm^3):	1.85	
Wet bulk density (g/cm^3):	2.15	
Calculated Porosity (% vol):	30.0	
Percent Saturation:	100.7	

Laboratory analysis by: K. Wright
Data entered by: C. Krous
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-06, 40-42
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

	As Received	Remolded
Test Date:	13-Jul-10	---
Field weight of sample* (g):	360.46	
Tare weight, ring (g):	61.94	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	247.52	
Sample volume (cm^3):	144.65	
Measured particle density (g/cm^3):	2.65	
Gravimetric Moisture Content (% g/g):	20.6	
Volumetric Moisture Content (% vol):	35.3	
Dry bulk density (g/cm^3):	1.71	
Wet bulk density (g/cm^3):	2.06	
Calculated Porosity (% vol):	35.5	
Percent Saturation:	99.4	

Laboratory analysis by: K. Wright
Data entered by: C. Krous
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-06, 54-56
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

	As Received	Remolded
Test Date:	13-Jul-10	---
Field weight of sample* (g):	522.75	
Tare weight, ring (g):	109.23	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	350.20	
Sample volume (cm^3):	197.26	
Measured particle density (g/cm^3):	2.66	
Gravimetric Moisture Content (% g/g):	18.1	
Volumetric Moisture Content (% vol):	32.1	
Dry bulk density (g/cm^3):	1.78	
Wet bulk density (g/cm^3):	2.10	
Calculated Porosity (% vol):	33.2	
Percent Saturation:	96.6	

Laboratory analysis by: K. Wright
Data entered by: C. Krous
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Saturated Hydraulic Conductivity

Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K_{sat} (cm/sec)	Oversize Corrected K_{sat} (cm/sec)	Method of Analysis	
			Constant Head	Falling Head
GP-16A, 46-48	3.5E-04	NA	X	
GP-16, 34-36	5.6E-04	NA	X	
GP-23, 34-36	5.6E-04	NA	X	
GP-23, 54-56	<1.08E-08*	NA		X
GW-01, 20-22	5.2E-07	NA		X
TWP-04A, 60-62	NA	NA		
TWP-04A, 70-72	1.8E-03	NA	X	
TWP-05, 66-68	4.1E-07	NA		X
TWP-05, 76-78	3.4E-06	NA		X
TWP-06, 40-42	4.5E-04	NA	X	
TWP-06, 54-56	5.2E-04	NA	X	

* =Outflow was not detected after 13 days of testing. The sample appeared saturated upon removal from the permeameter. Results above are based on flow into sample. Reported conductivity is near the limit of the testing apparatus; the result is less than or equal to the reported conductivity.

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NR = Not requested
NA = Not applicable

Saturated Hydraulic Conductivity
Constant Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Collection vessel tare* (g):	10.94
Sample number:	GP-16A, 46-48	*Sample length* (cm):	5.44
Project Name:	Kingston Ash Recovery Project	*Sample diameter* (cm):	6.23
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2):	30.51

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm^3)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
15-Jul-10	10:41:36	23.0	4.4	15.57	4.6	507	3.7E-04	3.4E-04
15-Jul-10	10:50:03							
Test # 2:								
15-Jul-10	11:14:28	23.0	4.1	14.41	3.5	413	3.7E-04	3.4E-04
15-Jul-10	11:21:21							
Test # 3:								
15-Jul-10	12:35:25	23.0	3.7	14.84	3.9	499	3.8E-04	3.5E-04
15-Jul-10	12:43:44							

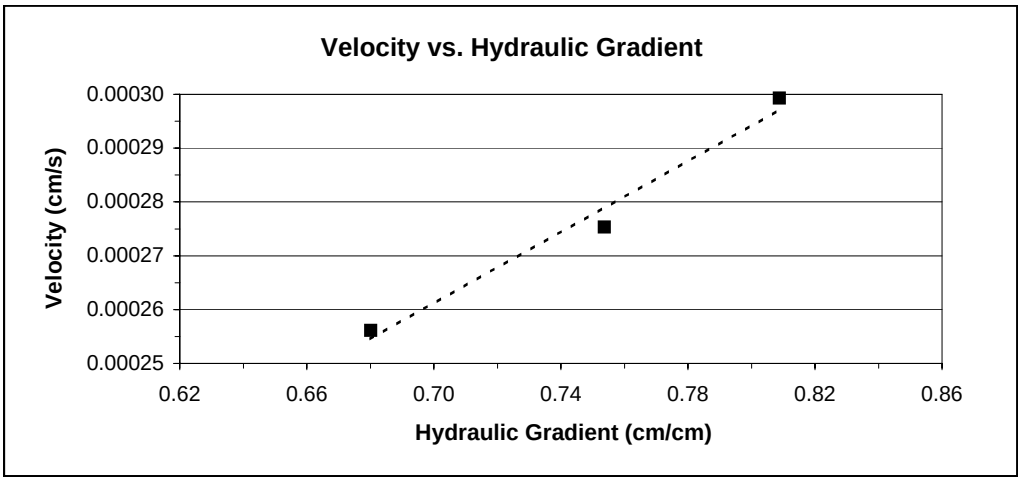
***Average Ksat* (cm/sec):** **3.5E-04**

***Oversize Corrected Ksat* (cm/sec):** **NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not applicable



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Saturated Hydraulic Conductivity
Constant Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Collection vessel tare* (g):	10.94
Sample number:	GP-16, 34-36	*Sample length* (cm):	7.58
Project Name:	Kingston Ash Recovery Project	*Sample diameter* (cm):	6.11
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2):	29.31

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm^3)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
18-Jul-10	10:27:28	23.0	6.3	16.15	5.2	356	6.0E-04	5.6E-04
18-Jul-10	10:33:24							
Test # 2:								
18-Jul-10	10:53:57	23.0	6.1	15.25	4.3	302	6.0E-04	5.6E-04
18-Jul-10	10:58:59							
Test # 3:								
18-Jul-10	11:18:13	23.0	5.8	16.15	5.2	387	6.0E-04	5.6E-04
18-Jul-10	11:24:40							

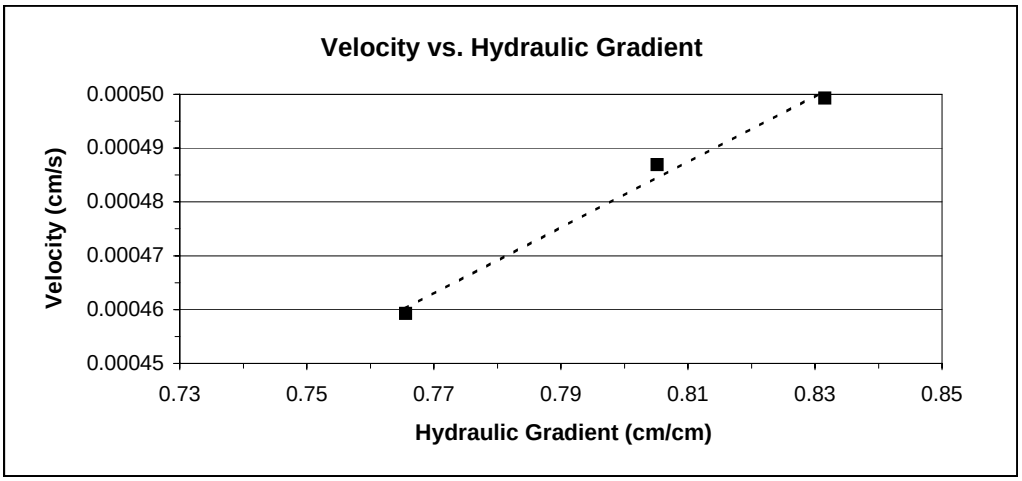
***Average Ksat* (cm/sec):** **5.6E-04**

***Oversize Corrected Ksat* (cm/sec):** **NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not applicable



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Saturated Hydraulic Conductivity
Constant Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Collection vessel tare* (g):	11.02
Sample number:	GP-23, 34-36	*Sample length* (cm):	7.61
Project Name:	Kingston Ash Recovery Project	*Sample diameter* (cm):	6.14
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2):	29.63

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm^3)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
15-Jul-10	10:41:52	23.0	7.3	20.79	9.8	560	6.1E-04	5.7E-04
15-Jul-10	10:51:12							
Test # 2:								
15-Jul-10	11:14:46	23.0	7.1	18.88	7.9	473	6.0E-04	5.6E-04
15-Jul-10	11:22:39							
Test # 3:								
15-Jul-10	12:35:43	23.0	6.8	19.66	8.6	552	5.9E-04	5.5E-04
15-Jul-10	12:44:55							

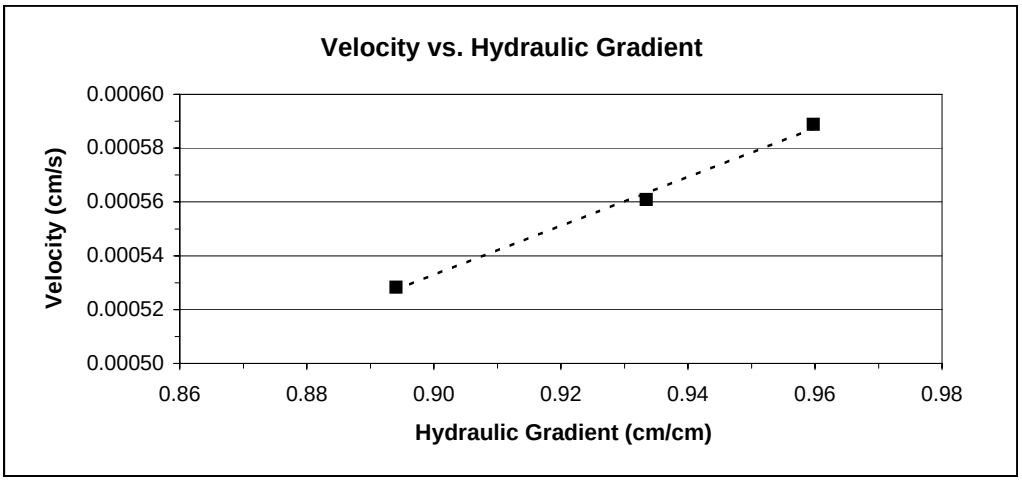
***Average Ksat* (cm/sec):** **5.6E-04**

***Oversize Corrected Ksat* (cm/sec):** **NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not applicable



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Saturated Hydraulic Conductivity
Falling Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Backpressure* (psi)*:*	2.0
Sample number:	GP-23, 54-56	*Offset* (cm)*:*	2.8
Project Name:	Kingston Ash Recovery Project	*Sample length* (cm)*:*	7.60
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2)*:*	29.84
		Reservoir x-sectional area (cm^2)*:*	0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
21-Jul-10	15:44:45	23.0	96.8	234.6	60345	1.2E-08	1.1E-08
22-Jul-10	8:30:30	23.0	95.85	233.7			
Test # 2:							
22-Jul-10	8:30:30	23.0	95.85	233.7	352680	1.1E-08	1.1E-08
26-Jul-10	10:28:30	22.5	90.7	228.5			
Test # 3:							
26-Jul-10	10:28:30	22.5	90.7	228.5	100095	1.1E-08	1.1E-08
27-Jul-10	14:16:45	23.0	89.25	227.1			

Average Ksat* (cm/sec)*: **≤1.1E-08***

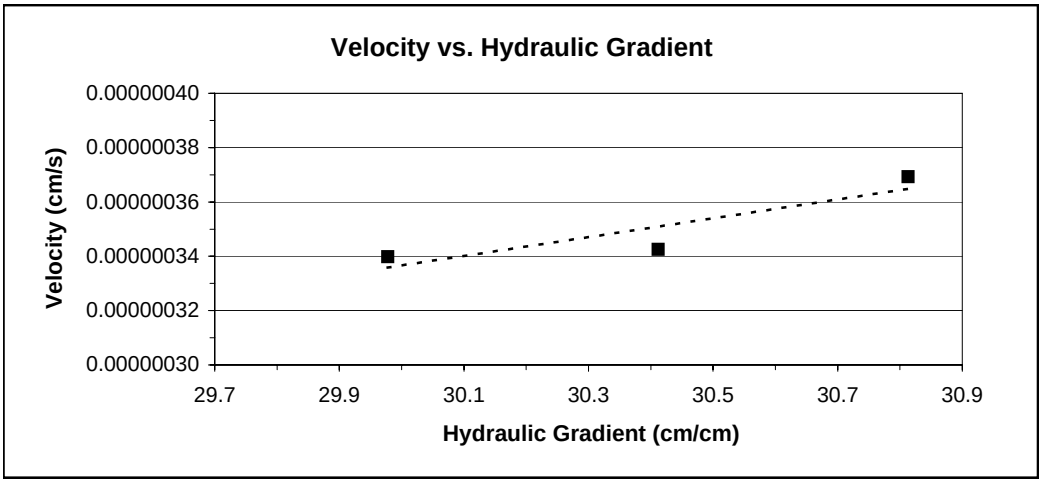
Oversize Corrected Ksat* (cm/sec)*: **NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not analyzed

* = Outflow was not detected after 13 days of testing. The sample appeared saturated upon removal from the permeameter. Results above are based on flow into sample. Reported conductivity is near the limit of the testing apparatus; the result is less than or equal to the reported conductivity.



Laboratory analysis by: K. Wright
Data entered by: K. Wright
Checked by: J. Hines

Saturated Hydraulic Conductivity
Falling Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Backpressure* (psi)*:*	0.0
Sample number:	GW-01, 20-22	*Offset* (cm)*:*	2.8
Project Name:	Kingston Ash Recovery Project	*Sample length* (cm)*:*	7.57
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2)*:*	41.90
		Reservoir x-sectional area (cm^2)*:*	0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
21-Jul-10	9:25:30	23.0	49.1	46.3	2040	5.4E-07	5.0E-07
21-Jul-10	9:59:30	23.0	48.7	45.9			
Test # 2:							
21-Jul-10	9:59:30	23.0	48.7	45.9	3390	5.7E-07	5.3E-07
21-Jul-10	10:56:00	23.0	48	45.2			
Test # 3:							
21-Jul-10	11:43:30	23.0	47.65	44.9	5730	5.5E-07	5.1E-07
21-Jul-10	13:19:00	23.0	46.55	43.8			

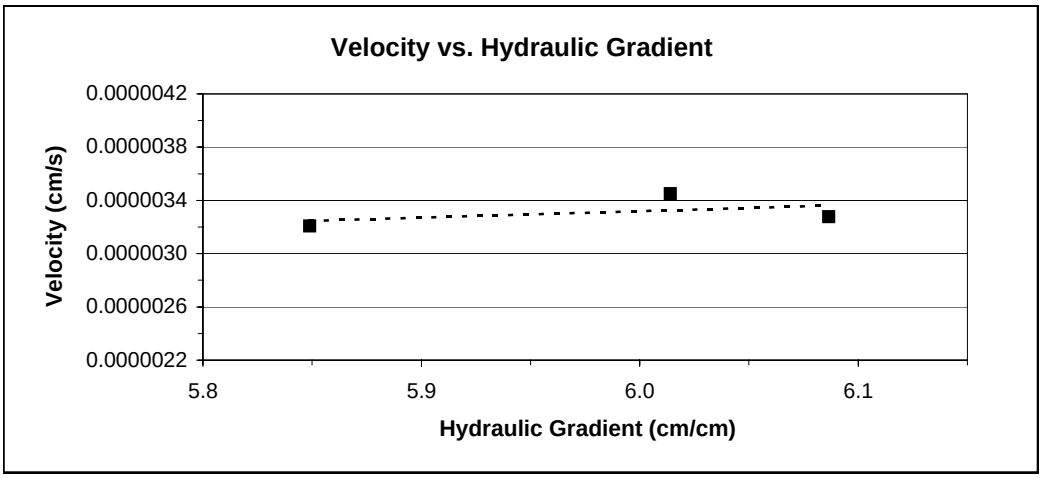
Average Ksat* (cm/sec)*: **5.2E-07**

Oversize Corrected Ksat* (cm/sec)*: **NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not applicable



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Saturated Hydraulic Conductivity
Constant Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Collection vessel tare* (g):	10.93
Sample number:	TWP-04A, 70-72	*Sample length* (cm):	5.36
Project Name:	Kingston Ash Recovery Project	*Sample diameter* (cm):	6.22
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2):	30.42

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm^3)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
15-Jul-10	10:41:16	23.0	1.3	18.31	7.4	485	2.1E-03	1.9E-03
15-Jul-10	10:49:21							
Test # 2:								
15-Jul-10	11:14:16	23.0	1.2	15.70	4.8	372	1.9E-03	1.8E-03
15-Jul-10	11:20:28							
Test # 3:								
15-Jul-10	12:35:10	23.0	1	15.92	5.0	464	1.9E-03	1.8E-03
15-Jul-10	12:42:54							

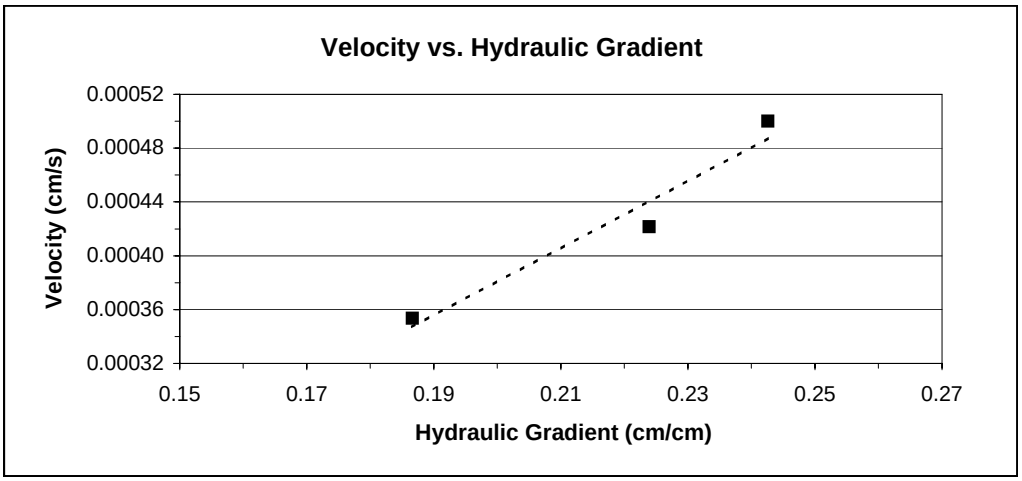
***Average Ksat* (cm/sec):** **1.8E-03**

***Oversize Corrected Ksat* (cm/sec):** **NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not applicable



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Saturated Hydraulic Conductivity
Falling Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Backpressure* (psi)*:*	0.0
Sample number:	TWP-05, 66-68	*Offset* (cm)*:*	2.7
Project Name:	Kingston Ash Recovery Project	*Sample length* (cm)*:*	7.59
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2)*:*	29.64
		Reservoir x-sectional area (cm^2)*:*	0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
18-Jul-10	8:23:30	23.0	53.9	51.2	86700	4.4E-07	4.1E-07
19-Jul-10	8:28:30	23.0	44.15	41.5			
Test # 2:							
19-Jul-10	8:28:30	23.0	44.15	41.5	10950	4.6E-07	4.3E-07
19-Jul-10	11:31:00	23.0	43	40.3			
Test # 3:							
19-Jul-10	11:31:00	23.0	43	40.3	76390	4.3E-07	4.0E-07
20-Jul-10	8:44:10	23.0	36.2	33.5			

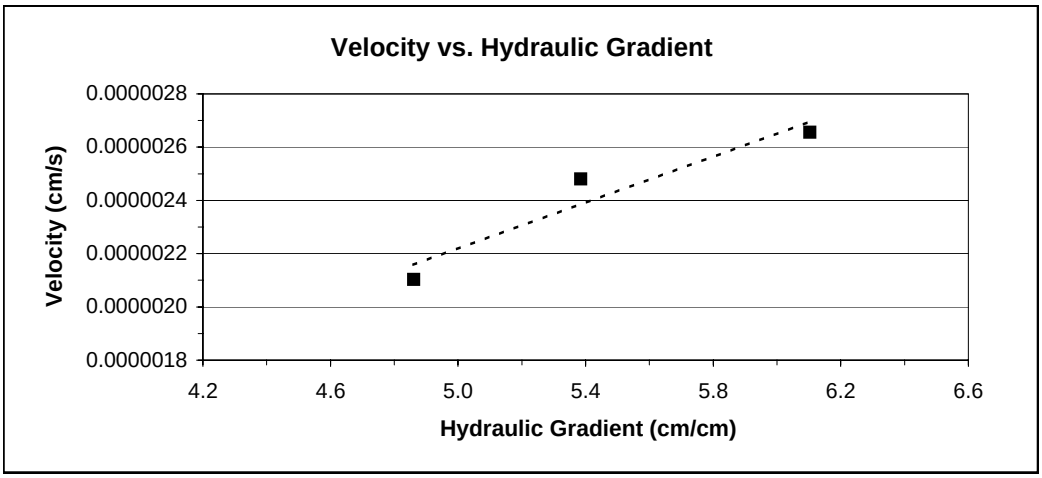
Average Ksat* (cm/sec)*: **4.1E-07**

Oversize Corrected Ksat* (cm/sec)*: **NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not applicable



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Saturated Hydraulic Conductivity
Falling Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Backpressure* (psi)*:*	0.0
Sample number:	TWP-05, 76-78	*Offset* (cm)*:*	1.0
Project Name:	Kingston Ash Recovery Project	*Sample length* (cm)*:*	5.63
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2)*:*	29.94
		Reservoir x-sectional area (cm^2)*:*	0.70

Date	Time	Temp (°C)	Reservoir head (cm)	Corrected head (cm)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:							
21-Jul-10	9:25:55	23.0	33.15	32.2	1745	3.7E-06	3.5E-06
21-Jul-10	9:55:00	23.0	31.6	30.6			
Test # 2:							
21-Jul-10	9:55:00	23.0	31.6	30.6	3645	3.5E-06	3.2E-06
21-Jul-10	10:55:45	23.0	28.8	27.8			
Test # 3:							
21-Jul-10	10:55:45	23.0	28.8	27.8	2825	3.8E-06	3.6E-06
21-Jul-10	11:42:50	23.0	26.6	25.6			

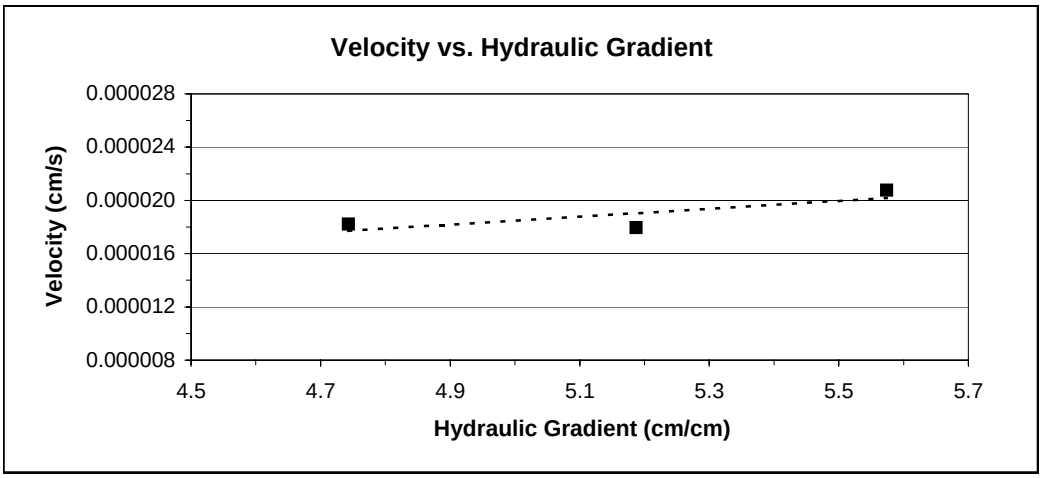
Average Ksat* (cm/sec)*: **3.4E-06**

Oversize Corrected Ksat* (cm/sec)*: **NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not applicable



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Saturated Hydraulic Conductivity
Constant Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Collection vessel tare* (g):	10.96
Sample number:	TWP-06, 40-42	*Sample length* (cm):	4.74
Project Name:	Kingston Ash Recovery Project	*Sample diameter* (cm):	6.24
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2):	30.54

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm^3)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
15-Jul-10	10:41:43	23.0	4.5	18.65	7.7	534	5.0E-04	4.6E-04
15-Jul-10	10:50:37							
Test # 2:								
15-Jul-10	11:14:36	23.0	4.2	16.86	5.9	447	4.9E-04	4.5E-04
15-Jul-10	11:22:03							
Test # 3:								
15-Jul-10	12:35:32	23.0	4	17.50	6.5	528	4.8E-04	4.5E-04
15-Jul-10	12:44:20							

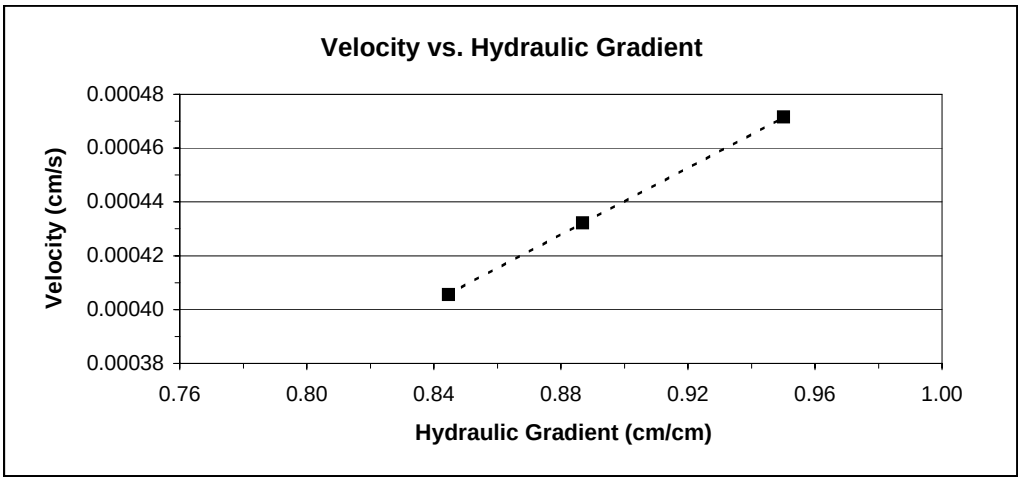
***Average Ksat* (cm/sec):** **4.5E-04**

***Oversize Corrected Ksat* (cm/sec):** **NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not applicable



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Saturated Hydraulic Conductivity
Constant Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Collection vessel tare* (g):	10.92
Sample number:	TWP-06, 54-56	*Sample length* (cm):	6.58
Project Name:	Kingston Ash Recovery Project	*Sample diameter* (cm):	6.18
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2):	30.00

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm^3)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
15-Jul-10	10:42:06	23.0	6.4	20.62	9.7	584	5.7E-04	5.3E-04
15-Jul-10	10:51:50							
Test # 2:								
15-Jul-10	11:14:55	23.0	6.1	18.56	7.6	497	5.5E-04	5.1E-04
15-Jul-10	11:23:12							
Test # 3:								
15-Jul-10	12:35:51	23.0	5.8	19.21	8.3	577	5.4E-04	5.1E-04
15-Jul-10	12:45:28							

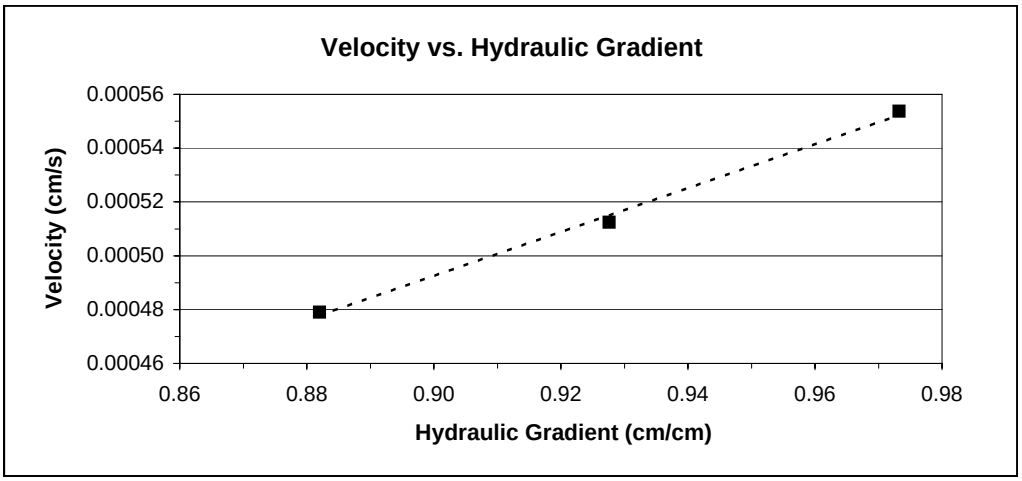
***Average Ksat* (cm/sec):** **5.2E-04**

***Oversize Corrected Ksat* (cm/sec):** **NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not applicable



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Specific Gravity

Summary of Specific Gravity Tests

	<4.75mm Material		>4.75mm Material		Bulk Sample
Sample Number	Specific Gravity	Percent of Bulk Sample	Specific Gravity	Percent of Bulk Sample	Specific Gravity
GP-16A, 46-48	2.65	100.0	---	0.0	2.65
GP-16, 34-36	2.65	100.0	---	0.0	2.65
GP-23, 34-36	2.49	99.8	---	0.2	2.49*
GP-23, 54-56	2.67	100.0	---	0.0	2.67
GW-01, 20-22	2.74	50.0	NA	50.0	2.74*
TWP-04A, 60-62	2.65	98.6	---	1.4	2.65*
TWP-04A, 70-72	2.63	100.0	---	0.0	2.63
TWP-05, 66-68	2.66	100.0	---	0.0	2.66
TWP-05, 76-78	2.65	100.0	---	0.0	2.65
TWP-06, 40-42	2.66	100.0	---	0.0	2.66
TWP-06, 54-56	2.66	100.0	---	0.0	2.66

--- = Unnecessary since specified fraction <5% of composite mass

* = Based on specific gravity of material < 4.75 mm

NA = Coarse specific gravity test not appropriate for shale or shale-like material.

Data for Specific Gravity for Sample: GP-16A, 46-48

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GP-16A, 46-48
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	100.00	
Percent of Bulk Sample (% g/g):	100.00	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	95.95	94.22
Weight of pycnometer filled w/soil (g):	146.03	144.43
Weight of pycnometer filled w/soil & water (g):	376.30	374.63
Weight of pycnometer filled w/water (g):	345.15	343.37
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.64	2.65
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.64	2.65
Average Specific Gravity at 20°C (g/g):	2.65	
Average Particle Density at 20°C (g/cm^3):	2.64	

ASTM C127 (>4.75mm Fraction)

Test Date:	---	
Percent of Test Sample (% g/g):	0.00	
Percent of Bulk Sample (% g/g):	0.00	
Tare Weight (g):	---	--- = Test unnecessary since specified fraction <5% of composite mass.
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Correction Factor, K:	---	
Average Specific Gravity (Apparent) at 20°C:*	---	
Average Particle Density (Apparent) at 20°C (g/cm^3)*:*	---	
Specific Gravity (Apparent) at 20°C*:	**2.65**	** Weighted harmonic average, if more than one fraction used.*
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.64	

Laboratory analysis by: K. Wright
Data entered by: K. Wright
Checked by: J. Hines

Data for Specific Gravity for Sample: GP-16, 34-36

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GP-16, 34-36
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	100.00	
Percent of Bulk Sample (% g/g):	100.00	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	94.22	95.42
Weight of pycnometer filled w/soil (g):	145.76	146.42
Weight of pycnometer filled w/soil & water (g):	375.70	376.34
Weight of pycnometer filled w/water (g):	343.57	344.58
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.65	2.65
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.65	2.65
Average Specific Gravity at 20°C (g/g):	2.65	
Average Particle Density at 20°C (g/cm^3):	2.65	

ASTM C127 (>4.75mm Fraction)

Test Date:	---	
Percent of Test Sample (% g/g):	0.00	
Percent of Bulk Sample (% g/g):	0.00	
Tare Weight (g):	---	--- = Test unnecessary since specified fraction <5% of composite mass.
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Correction Factor, K:	---	
Average Specific Gravity (Apparent) at 20°C:*	---	
Average Particle Density (Apparent) at 20°C (g/cm^3)*:*	---	
Specific Gravity (Apparent) at 20°C*:	**2.65**	** Weighted harmonic average, if more than one fraction used.*
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.65	

Laboratory analysis by: K. Wright
Data entered by: K. Wright
Checked by: J. Hines

Data for Specific Gravity for Sample: GP-23, 34-36

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GP-23, 34-36
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	99.80	
Percent of Bulk Sample (% g/g):	99.80	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	93.36	90.53
Weight of pycnometer filled w/soil (g):	143.86	143.44
Weight of pycnometer filled w/soil & water (g):	372.79	371.50
Weight of pycnometer filled w/water (g):	342.52	339.80
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.50	2.49
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.49	2.49
Average Specific Gravity at 20°C (g/g):	2.49	
Average Particle Density at 20°C (g/cm^3):	2.49	

ASTM C127 (>4.75mm Fraction)

Test Date:	---	
Percent of Test Sample (% g/g):	0.20	
Percent of Bulk Sample (% g/g):	0.20	
Tare Weight (g):	---	--- = Test unnecessary since specified fraction <5% of composite mass.
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Correction Factor, K:	---	
Average Specific Gravity (Apparent) at 20°C:*	---	
Average Particle Density (Apparent) at 20°C (g/cm^3)*:*	---	
Specific Gravity (Apparent) at 20°C*:	**2.49**	** Weighted harmonic average, if more than one fraction used.*
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.49	

Laboratory analysis by: K. Wright
Data entered by: K. Wright
Checked by: J. Hines

Data for Specific Gravity for Sample: GP-23, 54-56

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GP-23, 54-56
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	100.00	
Percent of Bulk Sample (% g/g):	100.00	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	93.08	94.81
Weight of pycnometer filled w/soil (g):	146.17	146.91
Weight of pycnometer filled w/soil & water (g):	375.49	376.68
Weight of pycnometer filled w/water (g):	342.30	344.04
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.67	2.68
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.67	2.68
Average Specific Gravity at 20°C (g/g):	2.67	
Average Particle Density at 20°C (g/cm^3):	2.67	

ASTM C127 (>4.75mm Fraction)

Test Date:	---	
Percent of Test Sample (% g/g):	0.00	
Percent of Bulk Sample (% g/g):	0.00	
Tare Weight (g):	---	--- = Test unnecessary since specified fraction <5% of composite mass.
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Correction Factor, K:	---	
Average Specific Gravity (Apparent) at 20°C:*	---	
Average Particle Density (Apparent) at 20°C (g/cm^3)*:*	---	
Specific Gravity (Apparent) at 20°C*:	**2.67**	** Weighted harmonic average, if more than one fraction used.*
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.67	

Laboratory analysis by: K. Wright
Data entered by: K. Wright
Checked by: J. Hines

Data for Specific Gravity for Sample: GW-01, 20-22

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GW-01, 20-22
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	50.02	
Percent of Bulk Sample (% g/g):	50.02	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	92.90	93.70
Weight of pycnometer filled w/soil (g):	142.47	143.81
Weight of pycnometer filled w/soil & water (g):	373.72	374.70
Weight of pycnometer filled w/water (g):	342.16	342.94
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.75	2.73
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.75	2.73
Average Specific Gravity at 20°C (g/g):	2.74	
Average Particle Density at 20°C (g/cm^3):	2.74	

ASTM C127 (>4.75mm Fraction)

Test Date:	NA	
Percent of Test Sample (% g/g):	49.98	NA = Coarse specific gravity test not appropriate for shale or shale-like material.
Percent of Bulk Sample (% g/g):	49.98	
Tare Weight (g):	NA	
Saturated Surface Dry (SSD) mass in Air & Tare (g):	NA	
Saturated Apparent mass in Water & Tare (g):	NA	
Oven Dry (OD) mass in Air & Tare (g):	NA	
Observed Temperature (°C):	NA	
Density of water at observed temperature (g/m^3):	NA	
SSD Specific Gravity (g/g):	NA	
Apparent Specific Gravity (g/g):	NA	
OD Specific Gravity (g/g):	NA	
Percent Absorption (%):	NA	
Correction Factor, K:	NA	
Average Specific Gravity (Apparent) at 20°C:*	NA	
Average Particle Density (Apparent) at 20°C (g/cm^3)*:*	NA	
Specific Gravity (Apparent) at 20°C*:	**2.74**	** Weighted harmonic average, if more than one fraction used.*
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.74	

Laboratory analysis by: K. Wright
Data entered by: K. Wright
Checked by: J. Hines

Data for Specific Gravity for Sample: TWP-04A, 60-62

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-04A, 60-62
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	98.56	
Percent of Bulk Sample (% g/g):	98.56	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	94.25	92.80
Weight of pycnometer filled w/soil (g):	144.63	146.01
Weight of pycnometer filled w/soil & water (g):	374.78	375.19
Weight of pycnometer filled w/water (g):	343.42	342.08
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.65	2.65
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.65	2.65
Average Specific Gravity at 20°C (g/g):	2.65	
Average Particle Density at 20°C (g/cm^3):	2.64	

ASTM C127 (>4.75mm Fraction)

Test Date:	---	
Percent of Test Sample (% g/g):	1.44	
Percent of Bulk Sample (% g/g):	1.44	
Tare Weight (g):	---	--- = Test unnecessary since specified fraction <5% of composite mass.
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Correction Factor, K:	---	
Average Specific Gravity (Apparent) at 20°C:*	---	
Average Particle Density (Apparent) at 20°C (g/cm^3)*:*	---	
Specific Gravity (Apparent) at 20°C*:	**2.65**	** Weighted harmonic average, if more than one fraction used.*
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.64	

Laboratory analysis by: K. Wright
Data entered by: K. Wright
Checked by: J. Hines

Data for Specific Gravity for Sample: TWP-04A, 70-72

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-04A, 70-72
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	100.00	
Percent of Bulk Sample (% g/g):	100.00	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	92.29	92.22
Weight of pycnometer filled w/soil (g):	144.12	143.44
Weight of pycnometer filled w/soil & water (g):	373.56	373.15
Weight of pycnometer filled w/water (g):	341.43	341.39
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.63	2.63
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.63	2.63
Average Specific Gravity at 20°C (g/g):	2.63	
Average Particle Density at 20°C (g/cm^3):	2.63	

ASTM C127 (>4.75mm Fraction)

Test Date:	---	
Percent of Test Sample (% g/g):	0.00	
Percent of Bulk Sample (% g/g):	0.00	
Tare Weight (g):	---	--- = Test unnecessary since specified fraction <5% of composite mass.
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Correction Factor, K:	---	
Average Specific Gravity (Apparent) at 20°C:*	---	
Average Particle Density (Apparent) at 20°C (g/cm^3)*:*	---	
Specific Gravity (Apparent) at 20°C*:	**2.63**	** Weighted harmonic average, if more than one fraction used.*
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.63	

Laboratory analysis by: K. Wright
Data entered by: K. Wright
Checked by: J. Hines

Data for Specific Gravity for Sample: TWP-05, 66-68

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-05, 66-68
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	100.00	
Percent of Bulk Sample (% g/g):	100.00	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	93.56	92.11
Weight of pycnometer filled w/soil (g):	143.72	143.25
Weight of pycnometer filled w/soil & water (g):	374.14	373.28
Weight of pycnometer filled w/water (g):	342.86	341.36
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.66	2.66
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.65	2.66
Average Specific Gravity at 20°C (g/g):	2.66	
Average Particle Density at 20°C (g/cm^3):	2.65	

ASTM C127 (>4.75mm Fraction)

Test Date:	---	
Percent of Test Sample (% g/g):	0.00	
Percent of Bulk Sample (% g/g):	0.00	
Tare Weight (g):	---	--- = Test unnecessary since specified fraction <5% of composite mass.
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Correction Factor, K:	---	
Average Specific Gravity (Apparent) at 20°C:*	---	
Average Particle Density (Apparent) at 20°C (g/cm^3)*:*	---	
Specific Gravity (Apparent) at 20°C*:	**2.66**	** Weighted harmonic average, if more than one fraction used.*
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.65	

Laboratory analysis by: K. Wright
Data entered by: K. Wright
Checked by: J. Hines

Data for Specific Gravity for Sample: TWP-05, 76-78

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-05, 76-78
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	100.00	
Percent of Bulk Sample (% g/g):	100.00	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	94.39	93.51
Weight of pycnometer filled w/soil (g):	143.90	145.76
Weight of pycnometer filled w/soil & water (g):	374.47	375.26
Weight of pycnometer filled w/water (g):	343.65	342.75
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.65	2.65
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.65	2.65
Average Specific Gravity at 20°C (g/g):	2.65	
Average Particle Density at 20°C (g/cm^3):	2.64	

ASTM C127 (>4.75mm Fraction)

Test Date:	---	
Percent of Test Sample (% g/g):	0.00	
Percent of Bulk Sample (% g/g):	0.00	
Tare Weight (g):	---	--- = Test unnecessary since specified fraction <5% of composite mass.
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Correction Factor, K:	---	
Average Specific Gravity (Apparent) at 20°C:*	---	
Average Particle Density (Apparent) at 20°C (g/cm^3)*:*	---	
Specific Gravity (Apparent) at 20°C*:	**2.65**	** Weighted harmonic average, if more than one fraction used.*
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.64	

Laboratory analysis by: K. Wright
Data entered by: K. Wright
Checked by: J. Hines

Data for Specific Gravity for Sample: TWP-06, 40-42

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-06, 40-42
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	100.00	
Percent of Bulk Sample (% g/g):	100.00	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	91.07	90.89
Weight of pycnometer filled w/soil (g):	141.85	142.83
Weight of pycnometer filled w/soil & water (g):	371.87	372.59
Weight of pycnometer filled w/water (g):	340.22	340.17
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.65	2.66
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.65	2.66
Average Specific Gravity at 20°C (g/g):	2.66	
Average Particle Density at 20°C (g/cm^3):	2.65	

ASTM C127 (>4.75mm Fraction)

Test Date:	---	
Percent of Test Sample (% g/g):	0.00	
Percent of Bulk Sample (% g/g):	0.00	
Tare Weight (g):	---	--- = Test unnecessary since specified fraction <5% of composite mass.
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Correction Factor, K:	---	
Average Specific Gravity (Apparent) at 20°C:*	---	
Average Particle Density (Apparent) at 20°C (g/cm^3)*:*	---	
Specific Gravity (Apparent) at 20°C*:	**2.66**	** Weighted harmonic average, if more than one fraction used.*
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.65	

Laboratory analysis by: K. Wright
Data entered by: K. Wright
Checked by: J. Hines

Data for Specific Gravity for Sample: TWP-06, 54-56

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-06, 54-56
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	19-Jul-10	
Percent of Test Sample (% g/g):	100.00	
Percent of Bulk Sample (% g/g):	100.00	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	93.36	93.26
Weight of pycnometer filled w/soil (g):	144.97	145.25
Weight of pycnometer filled w/soil & water (g):	374.80	374.82
Weight of pycnometer filled w/water (g):	342.59	342.30
Observed temperature (°C):	22.40	22.40
Density of water at observed temperature (g/cm^3):	0.9977	0.9977
Specific Gravity (g/g):	2.66	2.67
Correction factor, K:	0.9995	0.9995
Specific Gravity at 20°C (g/g):	2.66	2.67
Average Specific Gravity at 20°C (g/g):	2.66	
Average Particle Density at 20°C (g/cm^3):	2.66	

ASTM C127 (>4.75mm Fraction)

Test Date:	---	
Percent of Test Sample (% g/g):	0.00	
Percent of Bulk Sample (% g/g):	0.00	
Tare Weight (g):	---	--- = Test unnecessary since specified fraction <5% of composite mass.
Saturated Surface Dry (SSD) mass in Air & Tare (g):	---	
Saturated Apparent mass in Water & Tare (g):	---	
Oven Dry (OD) mass in Air & Tare (g):	---	
Observed Temperature (°C):	---	
Density of water at observed temperature (g/m^3):	---	
SSD Specific Gravity (g/g):	---	
Apparent Specific Gravity (g/g):	---	
OD Specific Gravity (g/g):	---	
Percent Absorption (%):	---	
Correction Factor, K:	---	
Average Specific Gravity (Apparent) at 20°C:*	---	
Average Particle Density (Apparent) at 20°C (g/cm^3)*:*	---	
Specific Gravity (Apparent) at 20°C*:	**2.66**	** Weighted harmonic average, if more than one fraction used.*
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.66	

Laboratory analysis by: K. Wright
Data entered by: K. Wright
Checked by: J. Hines

Effective Porosity

Summary of Moisture Retention (-15 Bar Point, Effective Porosity)

Sample Number	Calculated Total Porosity (%)	-15 Bar Point Volumetric Water Content (%, cm^3/cm^3)	Effective Porosity (%, cm^3/cm^3)	Oversize Corrected: Calculated Total Porosity (%)	Oversize Corrected: -15 Bar Point Volumetric Water Content (%, cm^3/cm^3)	Oversize Corrected: Effective Porosity (%, cm^3/cm^3)
GP-16A, 46-48	33.9	3.5	30.4	NA	NA	NA
GP-16, 34-36	37.1	3.8	33.3	NA	NA	NA
GP-23, 34-36	54.8	1.7	53.1	NA	NA	NA
GP-23, 54-56	40.2	20.8	19.4	NA	NA	NA
GW-01, 20-22	33.8	6.9	26.9	NA	NA	NA
TWP-04A, 60-62	40.7	9.6	31.1	NA	NA	NA
TWP-04A, 70-72	39.2	3.2	35.9	NA	NA	NA
TWP-05, 66-68	34.5	9.1	25.4	NA	NA	NA
TWP-05, 76-78	30.0	7.3	22.7	NA	NA	NA
TWP-06, 40-42	35.5	8.8	26.7	NA	NA	NA
TWP-06, 54-56	33.2	6.1	27.2	NA	NA	NA

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass
NA = Not applicable
NR = Not requested

Moisture Retention Data

Dew Point Potentiometer

(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GP-16A, 46-48
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3*):* 33.88
Measured particle density (g/cm^3)*:* 2.64

Initial sample bulk density (g/cm^3)*:* 1.75
Fraction of bulk sample used (<2.00mm fraction) (%)*:* 100.00

Dry weight of dew point potentiometer sample* (g)*:* 153.46
Tare weight, jar (g)*:* 113.12

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content† (% vol)
Dew point potentiometer:	14-Jul-10	14:10	154.39	10504	4.03
	14-Jul-10	15:50	154.25	16419	3.40

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	10504	---	---	---	---
	16419	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3)*:* 3.5

Effective Porosity* (% cm^3/cm^3)*: **30.4**
Oversize Corrected Effective Porosity* (% cm^3/cm^3)*: **NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ Volume adjustments are applicable at this matric potential (see comment #1).

NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer

(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GP-16, 34-36
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3*):* 37.13
Measured particle density (g/cm^3)*:* 2.65

Initial sample bulk density (g/cm^3)*:* 1.66
Fraction of bulk sample used (<2.00mm fraction) (%)*:* 100.00

Dry weight of dew point potentiometer sample* (g)*:* 162.10
Tare weight, jar (g)*:* 116.40

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content† (% vol)
Dew point potentiometer:	20-Jul-10	15:50	163.16	15093	3.85
	20-Jul-10	15:00	162.95	26413	3.09

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	15093	---	---	---	---
	26413	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3)*:* 3.8

Effective Porosity* (% cm^3/cm^3)*: **33.3**
Oversize Corrected Effective Porosity* (% cm^3/cm^3)*: **NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ Volume adjustments are applicable at this matric potential (see comment #1).

NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer

(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GP-23, 34-36
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3*):* 54.83
Measured particle density (g/cm^3)*:* 2.49

Initial sample bulk density (g/cm^3)*:* 1.12
Fraction of bulk sample used (<2.00mm fraction) (%)*:* 99.80

Dry weight of dew point potentiometer sample* (g)*:* 158.40
Tare weight, jar (g)*:* 112.19

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content† (% vol)
Dew point potentiometer:	14-Jul-10	15:30	159.79	4997	3.38
	15-Jul-10	9:15	159.03	16317	1.52

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	4997	---	---	---	---
	16317	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3)*:* 1.7

Effective Porosity* (% cm^3/cm^3)*: **53.1**
Oversize Corrected Effective Porosity* (% cm^3/cm^3)*: **NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ Volume adjustments are applicable at this matric potential (see comment #1).

NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer

(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GP-23, 54-56
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3*):* 40.22
Measured particle density (g/cm^3)*:* 2.67

Initial sample bulk density (g/cm^3)*:* 1.59
Fraction of bulk sample used (<2.00mm fraction) (%)*:* 100.00

Dry weight of dew point potentiometer sample* (g)*:* 152.17
Tare weight, jar (g)*:* 113.30

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content† (% vol)
Dew point potentiometer:	14-Jul-10	16:00	157.19	16215	20.57
	14-Jul-10	14:37	156.65	24883	18.35

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	16215	---	---	---	---
	24883	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3)*:* 20.8

Effective Porosity* (% cm^3/cm^3)*: **19.4**
Oversize Corrected Effective Porosity* (% cm^3/cm^3)*: **NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ Volume adjustments are applicable at this matric potential (see comment #1).

NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer

(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GW-01, 20-22
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3*):* 33.81
Measured particle density (g/cm^3)*:* 2.74

Initial sample bulk density (g/cm^3)*:* 1.81
Fraction of bulk sample used (<2.00mm fraction) (%)*:* 46.80

Dry weight of dew point potentiometer sample* (g)*:* 143.65
Tare weight, jar (g)*:* 114.29

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content† (% vol)
Dew point potentiometer:	20-Jul-10	16:05	146.07	14685	6.96
	20-Jul-10	15:15	145.55	34979	5.46

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	14685	---	---	---	---
	34979	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3)*:* 6.9

Effective Porosity* (% cm^3/cm^3)*: **26.9**
Oversize Corrected Effective Porosity* (% cm^3/cm^3)*: **NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ Volume adjustments are applicable at this matric potential (see comment #1).

NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer

(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-04A, 60-62
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3*):* 40.75
Measured particle density (g/cm^3)*:* 2.64

Initial sample bulk density (g/cm^3)*:* 1.57
Fraction of bulk sample used (<2.00mm fraction) (%)*:* 92.78

Dry weight of dew point potentiometer sample* (g)*:* 157.31
Tare weight, jar (g)*:* 113.20

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content† (% vol)
Dew point potentiometer:	14-Jul-10	14:12	160.28	13257	9.79
	14-Jul-10	14:50	160.21	16215	9.54

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	13257	---	---	---	---
	16215	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3)*:* 9.6

Effective Porosity* (% cm^3/cm^3)*: **31.1**
Oversize Corrected Effective Porosity* (% cm^3/cm^3)*: **NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ Volume adjustments are applicable at this matric potential (see comment #1).

NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer

(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-04A, 70-72
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3*):* 39.17
Measured particle density (g/cm^3)*:* 2.63

Initial sample bulk density (g/cm^3)*:* 1.60
Fraction of bulk sample used (<2.00mm fraction) (%)*:* 100.00

Dry weight of dew point potentiometer sample* (g)*:* 170.23
Tare weight, jar (g)*:* 117.83

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content† (% vol)
Dew point potentiometer:	20-Jul-10	16:20	171.29	15093	3.24
	20-Jul-10	15:33	171.05	28350	2.51

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	15093	---	---	---	---
	28350	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3)*:* 3.2

Effective Porosity* (% cm^3/cm^3)*: **35.9**
Oversize Corrected Effective Porosity* (% cm^3/cm^3)*: **NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ Volume adjustments are applicable at this matric potential (see comment #1).

NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer

(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-05, 66-68
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3*):* 34.48
Measured particle density (g/cm^3)*:* 2.65

Initial sample bulk density (g/cm^3)*:* 1.74
Fraction of bulk sample used (<2.00mm fraction) (%)*:* 100.00

Dry weight of dew point potentiometer sample* (g)*:* 154.97
Tare weight, jar (g)*:* 112.20

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content† (% vol)
Dew point potentiometer:	14-Jul-10	14:40	157.21	15399	9.08

Volume Adjusted Data[1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change[2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	15399	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3)*:* 9.1

Effective Porosity* (% cm^3/cm^3)*: **25.4**
Oversize Corrected Effective Porosity* (% cm^3/cm^3)*: **NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ Volume adjustments are applicable at this matric potential (see comment #1).

NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer

(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-05, 76-78
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3*):* 29.97
Measured particle density (g/cm^3)*:* 2.64

Initial sample bulk density (g/cm^3)*:* 1.85
Fraction of bulk sample used (<2.00mm fraction) (%)*:* 100.00

Dry weight of dew point potentiometer sample* (g)*:* 162.57
Tare weight, jar (g)*:* 113.23

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content† (% vol)
Dew point potentiometer:	14-Jul-10	16:05	164.52	14481	7.31
	14-Jul-10	14:50	164.44	19682	7.01

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	14481	---	---	---	---
	19682	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3)*:* 7.3

Effective Porosity* (% cm^3/cm^3)*: **22.7**
Oversize Corrected Effective Porosity* (% cm^3/cm^3)*: **NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ Volume adjustments are applicable at this matric potential (see comment #1).

NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer

(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-06, 40-42
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3*):* 35.47
Measured particle density (g/cm^3)*:* 2.65

Initial sample bulk density (g/cm^3)*:* 1.71
Fraction of bulk sample used (<2.00mm fraction) (%)*:* 100.00

Dry weight of dew point potentiometer sample* (g)*:* 167.58
Tare weight, jar (g)*:* 117.89

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content† (% vol)
Dew point potentiometer:	14-Jul-10	15:40	170.11	16113	8.71
	14-Jul-10	15:00	169.95	21824	8.17

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	16113	---	---	---	---
	21824	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3)*:* 8.8

Effective Porosity* (% cm^3/cm^3)*: **26.7**
Oversize Corrected Effective Porosity* (% cm^3/cm^3)*: **NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ Volume adjustments are applicable at this matric potential (see comment #1).

NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Moisture Retention Data

Dew Point Potentiometer

(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: TWP-06, 54-56
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3*):* 33.23
Measured particle density (g/cm^3)*:* 2.66

Initial sample bulk density (g/cm^3)*:* 1.78
Fraction of bulk sample used (<2.00mm fraction) (%)*:* 100.00

Dry weight of dew point potentiometer sample* (g)*:* 158.62
Tare weight, jar (g)*:* 112.15

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content† (% vol)
Dew point potentiometer:	14-Jul-10	13:47	160.23	14175	6.16
	14-Jul-10	14:30	160.15	18254	5.86

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	14175	---	---	---	---
	18254	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3)*:* 6.1

Effective Porosity* (% cm^3/cm^3)*: **27.2**
Oversize Corrected Effective Porosity* (% cm^3/cm^3)*: **NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ Volume adjustments are applicable at this matric potential (see comment #1).

NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Laboratory Tests and Methods

Tests and Methods

Dry Bulk Density:	ASTM D7263
Moisture Content:	ASTM D7263
Calculated Porosity:	ASTM D7263
Saturated Hydraulic Conductivity:	
Constant Head: (Rigid Wall)	ASTM D 2434 (modified apparatus)
Falling Head: (Rigid Wall)	Klute, A. and C. Dirkson. 1986. Hydraulic Conductivity and Diffusivity: Laboratory Methods.Chp. 28, pp. 200-203, in A. Klute (ed.), Methods of Soil Analysis, American Society of Agronomy, Madison, WI
Water Potential (Dewpoint Potentiometer) Method:	ASTM D6836
Specific Gravity Fine	ASTM D854
Effective Porosity:	Corey, A. T. 1994, Reprinted 2003, Chp. 2.3.3, pp. 41-42, in A. T. Corey, Mechanics of Immiscible Fluids in Porous Media, Water Resources Publications, LLC., Highlands Ranch, Colorado, U.S.A.; Stephens, D.B.,1997, Hydrology Journal (1998) 6:6156-165, A Comparison of Estimated and Calculated Effective Porosity.

Laboratory Report for

Tennessee Valley Authority

Kingston Ash Recovery Project

September 14, 2010

Daniel B. Stephens & Associates, Inc.

5840 Osuna Road NE • Albuquerque, New Mexico 87109

September 14, 2010

J. Mark Boggs
Tennessee Valley Authority
400 Summit Hill Drive, WT 9D-K
Knoxville, TN 37902-1401
(865) 632-6941

Re: DBS&A Laboratory Report for Tennessee Valley Authority Kingston Ash Recovery Project

Dear Mr. Boggs:

Enclosed is the final report for the Tennessee Valley Authority Kingston Ash Recovery Project sample. Please review this report and provide any comments as samples will be held for a maximum of 30 days. After 30 days samples will be returned or disposed of in an appropriate manner.

All testing results were evaluated subjectively for consistency and reasonableness, and the results appear to be reasonably representative of the material tested. However, DBS&A does not assume any responsibility for interpretations or analyses based on the data enclosed, nor can we guarantee that these data are fully representative of the undisturbed materials at the field site. We recommend that careful evaluation of these laboratory results be made for your particular application.

The testing utilized to generate the enclosed final report employs methods that are standard for the industry. The results do not constitute a professional opinion by DBS&A, nor can the results affect any professional or expert opinions rendered with respect thereto by DBS&A. You have acknowledged that all the testing undertaken by us, and the final report provided, constitutes mere test results using standardized methods, and cannot be used to disqualify DBS&A from rendering any professional or expert opinion, having waived any claim of conflict of interest by DBS&A.

We are pleased to provide this service to Tennessee Valley Authority and look forward to future laboratory testing on other projects. If you have any questions about the enclosed data, please do not hesitate to call.

Sincerely,

DANIEL B. STEPHENS & ASSOCIATES, INC.
SOIL TESTING & RESEARCH LABORATORY

Joleen Hines
Laboratory Supervising Manager
Enclosure

Daniel B. Stephens & Associates, Inc.
Soil Testing & Research Laboratory
5840 Osuna Rd. NE
Albuquerque, NM 87109
505-889-7752
FAX 505-889-0258

Summaries

Summary of Tests Performed

Laboratory Sample Number	Initial Soil Properties[1]			Saturated Hydraulic Conductivity[2]			Moisture Characteristics[3]								Particle Size[4]			Specific Gravity[5]		Air Perm-eability	Atterberg Limits	Proctor Compaction
	G	VM	VD	CH	FH	FW	HC	PP	FP	DPP	RH	EP	WHC	K_{unsat}	DS	WS	H	F	C			
GW-02, 10-11	X	X		X								X						X	X			

[1] G = Gravimetric Moisture Content, VM = Volume Measurement Method, VD = Volume Displacement Method

[2] CH = Constant Head Rigid Wall, FH = Falling Head Rigid Wall, FW = Falling Head Rising Tail Flexible Wall

[3] HC = Hanging Column, PP = Pressure Plate, FP = Filter Paper, DPP = Dew Point Potentiometer, RH = Relative Humidity Box, EP = Effective Porosity, WHC = Water Holding Capacity, Kunsat = Calculated Unsaturated Hydraulic Conductivity

[4] DS = Dry Sieve, WS = Wet Sieve, H = Hydrometer

[5] F = Fine (<4.75mm), C = Coarse (>4.75mm)

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

Sample Number	Moisture Content: As Received, Gravimetric (%, g/g)	Moisture Content: As Received, Volumetric (%, cm^3/cm^3)	Moisture Content: Remolded, Gravimetric (%, g/g)	Moisture Content: Remolded, Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
GW-02, 10-11	16.6	28.5	---	---	1.71	2.00	36.3

NA = Not analyzed

--- = This sample was not remolded

Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K_{sat} (cm/sec)	Oversize Corrected K_{sat} (cm/sec)	Method of Analysis	
			Constant Head	Falling Head
GW-02, 10-11	3.7E-04	NA	X	

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

Summary of Specific Gravity Tests

	<4.75mm Material		>4.75mm Material		Bulk Sample
Sample Number	Specific Gravity	Percent of Bulk Sample	Specific Gravity	Percent of Bulk Sample	Specific Gravity
GW-02, 10-11	2.69	80.6	2.72	19.4	2.70

--- = Unnecessary since specified fraction <5% of composite mass

* = Based on specific gravity of material < 4.75 mm

Summary of Moisture Retention (Effective Porosity)

Sample Number	Calculated Total Porosity (%, cm^3/cm^3)	-15 Bar Point Volumetric Water Content (%, cm^3/cm^3)	Effective Porosity (%, cm^3/cm^3)	Oversize Corrected: Calculated Total Porosity (%, cm^3/cm^3)	Oversize Corrected: -15 Bar Point Volumetric Water Content (%, cm^3/cm^3)	Oversize Corrected: Effective Porosity (%, cm^3/cm^3)
GW-02, 10-11	36.3	6.7	29.6	NA	NA	NA

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not applicable

NR = Not requested

Laboratory Data and Graphical Plots

Initial Properties

Summary of Initial Moisture Content, Dry Bulk Density Wet Bulk Density and Calculated Porosity

Sample Number	Moisture Content: As Received, Gravimetric (%, g/g)	Moisture Content: As Received, Volumetric (%, cm^3/cm^3)	Moisture Content: Remolded, Gravimetric (%, g/g)	Moisture Content: Remolded, Volumetric (%, cm^3/cm^3)	Dry Bulk Density (g/cm^3)	Wet Bulk Density (g/cm^3)	Calculated Porosity (%)
GW-02, 10-11	16.6	28.5	---	---	1.71	2.00	36.3

NA = Not analyzed

--- = This sample was not remolded

Data for Initial Moisture Content, Bulk Density, Porosity, and Percent Saturation

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GW-02, 10-11
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

	As Received	Remolded
Test Date:	26-Aug-10	---
Field weight of sample* (g):	816.70	
Tare weight, ring (g):	228.70	
Tare weight, pan/plate (g):	0.00	
Tare weight, other (g):	0.00	
Dry weight of sample (g):	504.09	
Sample volume (cm^3):	294.16	
Measured particle density (g/cm^3):	2.69	
Gravimetric Moisture Content (% g/g):	16.6	
Volumetric Moisture Content (% vol):	28.5	
Dry bulk density (g/cm^3):	1.71	
Wet bulk density (g/cm^3):	2.00	
Calculated Porosity (% vol):	36.3	
Percent Saturation:	78.6	

Laboratory analysis by: K. Wright
Data entered by: C. Krous
Checked by: J. Hines

Comments:

* Weight including tares
NA = Not analyzed
--- = This sample was not remolded

Saturated Hydraulic Conductivity

Summary of Saturated Hydraulic Conductivity Tests

Sample Number	K_{sat} (cm/sec)	Oversize Corrected K_{sat} (cm/sec)	Method of Analysis	
			Constant Head	Falling Head
GW-02, 10-11	3.7E-04	NA	X	

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NR = Not requested

Saturated Hydraulic Conductivity
Constant Head Method

Job name:	Tennessee Valley Authority	*Type of water used:*	TAP
Job number:	LB10.0147.00	*Collection vessel tare* (g):	11.03
Sample number:	GW-02, 10-11	*Sample length* (cm):	7.24
Project Name:	Kingston Ash Recovery Project	*Sample diameter* (cm):	7.19
Container Type:	Shelby Tube	*Sample x-sectional area* (cm^2):	40.61

Date	Time	Temp (°C)	Head (cm)	Q + Tare (g)	Q (cm^3)	Elapsed time (sec)	Ksat (cm/sec)	Ksat @ 20°C (cm/sec)
Test # 1:								
1-Sep-10	9:48:01	22.2	6.5	15.89	4.9	350	3.8E-04	3.6E-04
1-Sep-10	9:53:51							
Test # 2:								
1-Sep-10	10:18:40	22.2	6.3	15.87	4.8	355	3.9E-04	3.7E-04
1-Sep-10	10:24:35							
Test # 3:								
1-Sep-10	10:58:07	22.3	6.1	14.72	3.7	279	3.9E-04	3.7E-04
1-Sep-10	11:02:46							

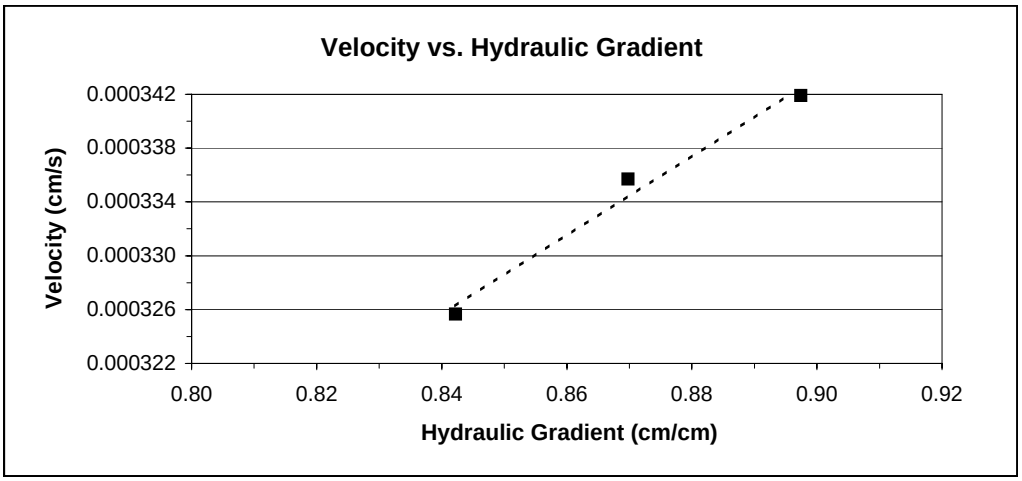
***Average Ksat* (cm/sec):** **3.7E-04**

***Oversize Corrected Ksat* (cm/sec):** **NA**

Comments:

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not analyzed



Laboratory analysis by: K. Wright

Data entered by: K. Wright

Checked by: J. Hines

Specific Gravity

Summary of Specific Gravity Tests

	<4.75mm Material		>4.75mm Material		Bulk Sample
Sample Number	Specific Gravity	Percent of Bulk Sample	Specific Gravity	Percent of Bulk Sample	Specific Gravity
GW-02, 10-11	2.69	80.6	2.72	19.4	2.70

--- = Unnecessary since specified fraction <5% of composite mass

* = Based on specific gravity of material < 4.75 mm

Data for Specific Gravity for Sample: GW-02, 10-11

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GW-02, 10-11
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

ASTM D854 (<4.75mm Fraction)

Test Date:	1-Sep-10	
Percent of Test Sample (% g/g):	80.64	
Percent of Bulk Sample (% g/g):	80.64	
	Trial 1	*Trial 2*
Weight of pycnometer filled w/air (g):	93.36	90.52
Weight of pycnometer filled w/soil (g):	145.91	141.44
Weight of pycnometer filled w/soil & water (g):	375.63	371.82
Weight of pycnometer filled w/water (g):	342.55	339.82
Observed temperature (°C):	22.00	22.00
Density of water at observed temperature (g/cm^3):	0.9978	0.9978
Specific Gravity (g/g):	2.70	2.69
Correction factor, K:	0.9996	0.9996
Specific Gravity at 20°C (g/g):	2.70	2.69
Average Specific Gravity at 20°C (g/g):	2.69	
Average Particle Density at 20°C (g/cm^3):	2.69	

ASTM C127 (>4.75mm Fraction)

Test Date:	3-Sep-10
Percent of Test Sample (% g/g):	19.36
Percent of Bulk Sample (% g/g):	19.36
Tare Weight (g):	0.0
Saturated Surface Dry (SSD) mass in Air & Tare (g):	63.23
Saturated Apparent mass in Water & Tare (g):	37.09
Oven Dry (OD) mass in Air & Tare (g):	58.59
Observed Temperature (°C):	22.0
Density of water at observed temperature (g/m^3):	0.9978
SSD Specific Gravity (g/g):	2.42
Apparent Specific Gravity (g/g):	2.73
OD Specific Gravity (g/g):	2.24
Percent Absorption (%):	7.3
Correction Factor, K:	0.9996
Average Specific Gravity (Apparent) at 20°C:*	2.72
Average Particle Density (Apparent) at 20°C (g/cm^3)*:*	2.72
Specific Gravity (Apparent) at 20°C*:	**2.70**
Particle Density (Apparent) at 20°C (g/cm^3)* :	2.70

** Weighted harmonic average, if more than one fraction used.*

Laboratory analysis by: K. Wright
Data entered by: C. Krous
Checked by: J. Hines

Effective Porosity

Summary of Moisture Retention (Effective Porosity)

Sample Number	Calculated Total Porosity (%, cm^3/cm^3)	-15 Bar Point Volumetric Water Content (%, cm^3/cm^3)	Effective Porosity (%, cm^3/cm^3)	Oversize Corrected: Calculated Total Porosity (%, cm^3/cm^3)	Oversize Corrected: -15 Bar Point Volumetric Water Content (%, cm^3/cm^3)	Oversize Corrected: Effective Porosity (%, cm^3/cm^3)
GW-02, 10-11	36.3	6.7	29.6	NA	NA	NA

--- = Oversize correction is unnecessary since coarse fraction < 5% of composite mass

NA = Not applicable

NR = Not requested

Moisture Retention Data

Dew Point Potentiometer

(Effective Porosity)

Job Name: Tennessee Valley Authority
Job Number: LB10.0147.00
Sample Number: GW-02, 10-11
Project Name: Kingston Ash Recovery Project
Container Type: Shelby Tube

Initial sample calculated total porosity (cm^3*):* 36.29
Assumed particle density (g/cm^3)*:* 2.65

Initial sample bulk density (g/cm^3)*:* 1.71
Fraction of bulk sample used (<2.00mm fraction) (%)*:* 47.20

Dry weight of dew point potentiometer sample* (g)*:* 165.04
Tare weight, jar (g)*:* 114.81

	Date	Time	Weight* (g)	Water Potential (-cm water)	Moisture Content† (% vol)
Dew point potentiometer:	3-Sep-10	15:00	169.21	14787	6.72
	3-Sep-10	14:25	169.08	19172	6.51

Volume Adjusted Data [1]

	Water Potential (-cm water)	Adjusted Volume (cm^3)	% Volume Change [2] (%)	Adjusted Density (g/cm^3)	Adjusted Calc. Porosity (%)
Dew point potentiometer:	14787	---	---	---	---
	19172	---	---	---	---

Moisture content at -15 bars (% cm^3/cm^3)*:* 6.7

Effective Porosity* (% cm^3/cm^3)*: **29.6**
Oversize Corrected Effective Porosity* (% cm^3/cm^3)*: **NA**

Comments:

[1] Applicable if the sample experienced volume changes during testing. 'Volume Adjusted' values represent the volume change measurements obtained after the pressure plate point. "---" indicates no volume changes occurred.

[2] Represents percent volume change from original sample volume. A '+' denotes measured sample swelling, a '-' denotes measured sample settling, and '---' denotes no volume change occurred.

* Weight including tares

† Adjusted for >2.00mm (#10 sieve) material not used in DPP testing. Assumed moisture content of material >2.00mm is zero, and assumed density of water is 1.0 g/cm^3.

‡‡ Volume adjustments are applicable at this matric potential (see comment #1).

NA Not Applicable

Laboratory analysis by: D. O'Dowd
Data entered by: C. Krous
Checked by: J. Hines

Laboratory Tests and Methods

Tests and Methods

Dry Bulk Density:	ASTM D7263
Moisture Content:	ASTM D7263
Calculated Porosity:	ASTM D7263
Saturated Hydraulic Conductivity:	
Constant Head: (Rigid Wall)	ASTM D 2434 (modified apparatus)
Water Potential (Dewpoint Potentiometer) Method:	ASTM D6836
Specific Gravity Fine	ASTM D854
Specific Gravity Coarse	ASTM C127
Effective Porosity:	Corey, A. T. 1994, Reprinted 2003, Chp. 2.3.3, pp. 41-42, in A. T. Corey, Mechanics of Immiscible Fluids in Porous Media, Water Resources Publications, LLC., Highlands Ranch, Colorado, U.S.A.; Stephens, D.B.,1997, Hydrology Journal (1998) 6:6156-165, A Comparison of Estimated and Calculated Effective Porosity.