Attachment 1

Sampling and Analysis Plan

19.4 Ground Water Contamination (40 CFR 270.14 (c) (4))

PZ-1 was completed using 2" PVC, screw thread casing on 10-19-87 and is 29 feet deep with a 0.01" screened interval between 16 to 26 feet. PZ-1 top portion of the casing was split, possibly during the pre-closure activities. February 1992 records indicated contamination to PZ-1 from the surface. Roberts/Schornick & Associates, Inc. (RSA) responded to the release and removed all contaminates from PZ-1 and the surrounding surface. Fluids were recycled into the wood preserving process. In accordance with 40 CFR 265.93 (d)(7), the Oklahoma State Department of Health (OSDH) (August 13, 1992) approved RSA Groundwater Assessment Technical Workplan.

After approval from DEQ and Oklahoma Water Resources (OWRB), PZ-1 casing was filled with bentonite pellets to 10 feet and cement grout to 2 feet below the land surface and the remaining 2 feet to the land surface backfilled with compacted uncontaminated soil during February 15, 1995. Based on PZ-1 casing fractures, it is highly probable that the product is from the soil contamination depicted in Figures 4.6, 4.7, and 4.8. PZ-4, 6, and 7 receive contamination which occurred during the PZ-1's release and these wells are maintained to remove contaminated fluids. The contaminated fluids are recycled into the wood preserving process and monthly reports are submitted to DEQ listing the amount of fluids removed and recycled from these wells (Table 2 and 3)(Appendices D, E, and J. PZ-2, 8, 9, 10, CW-1, CW-2, and CW-3 analytical results indicate no

contamination and the contaminants are being mitigated by the fluids removal from PZ-4, 5, 6, and 7 (Appendices F and G).

The amount of ground water removed from PZ-4, 5, 6, and 7 indicated that the shallow aquifers are unable to provide a minimum amount of water for any type of Beneficial Uses (Appendix P, pages 42 and 43 refer to the prior renewal application) Appendices D, F, G, and J. Hydrograph for PZ-4 show a gradual rise in water levels over an approximate 3 months time interval (Figure 5.17 refer to the prior renewal application). Removal of all water in the monitor wells is performed routinely. Since August 1998, the monitor well which derived the most amounts of water was PZ-6, 288 gallons with 24 removal days in December 2013. Between 2013-2022, PZ-6 yield and removed 276 gallons 12 times. The monitor well which derived the least amount of water was PZ-4 with average approximately 1.5 gallons with 12-14 removal days from 2013 to 2022, PZ-7 approximately 2.5 gallons with 12-14 removal days from 2013 to 2022 (Table 3) The recent water level results' Appendices F, G, and J, indicated that surrounding shallow ground water flow direction is being influenced toward the direction of these wells (Appendix G) Since 2013-2022 approximately 2,500 to 3,000 gallons of water have been removed from PZ-4, 5, 6, and 7 (Table 3).

19.5 Ground Water Monitoring Program (40 CFR 270.14(c)(5))

The existing monitoring program consists of twelve (12) monitor wells with adequate depth, to allow the detection of contamination when hazardous waste or constituents have migrated from the HWM units to the shallowest aquifer. The area, east of the southern portion of the HWM surface impoundment unit has detect migration of a PCP plume in both the upper and lower portion of the shallowest aquifer by three monitor wells (PZ-4, 6, and 7) occasionally PZ-5 samples contained PCP August 2016, September 2016 and August 2021.

The monitor well PZ-3 is located hydraulically upgradient of the two HWM units as demonstrated by Figures 5.13 and 5.13a (refer to the prior renewal application). PZ-2 monitor well is located hydraulically downgradient and at the point of compliance for the waste pile HWM unit. PZ-2, PZ-8,PZ-9, PZ-10, CW-1, CW-2, and CW-3 monitor wells are located hydraulically downgradient and CW-1, CW-2, and CW-3 at the point of compliance for the surface impoundment HWM unit. The replacement for the plugged PZ-1 monitor well are PZ-6 and PZ-7, east of the southern portion of the HWM surface impoundment unit. PZ-6 was constructed to monitor the deeper portion of the shallow aquifer while PZ-7 was constructed to monitor the upper portion of the shallow aquifer.

The monitor well completion diagrams are provided in Appendix C and comply with the requirements listed 40 CFR 264.97(refer to Appendix C for the completion details). The replacement wells for PZ-1 were constructed in a manner which conforms with the plugged well except the inside casings are stainless steel and the concrete surface pads will be three (3) feet squared. During the quarterly sampling events (July 1995) which was designed to establish an adequate data base to detect changes in the groundwater quality, concentration of PCP (54 part per billion (ppb)) was detected in PZ-7 which exceed the MCL of 1 ppb. Later sampling (August 1995) confirm the presence of PCP (3 ppb) in PZ-7(Table 19.2). As required by 40 CFR 265.93(d)(2), (3) three additional monitor wells (PZ-8, 9, and 10) were located downgradient of PZ-7 to determine the extent of the plume. Sampling of these wells has determined that the plume of the upper portion of the shallow aquifer is localized to the immediate area of PZ-7 (Table D and E). Monitor well, PZ-6, which was constructed to monitor the deeper portion of the shallow aquifer, detect PCP concentration (210 ppb) which also exceed the MCL of 1 ppb. Later sampling of PZ-6 (October 1995) confirm the presence of PCP (37,500 ppb) (Table 19.2 refer to the prior renewal application). Monitor Well PZ-4, which was constructed to monitor the deeper portion of the shallowest aquifer, detect PCP concentration (390 ppb) and additional sampling of PZ-4 (January 1997) confirm the presence of PCP (1,280 ppb) (Table 19.2 refer to the prior renewal application). As required by 40 CFR 265.93(d)(2), BAEC completed CW-1, CW-2, and CW-3 for MBWP and determine the extent of the plume is localized to the immediate area of PZ-4, PZ-5, PZ-6, and PZ-7. MBWP is currently dewatering PZ-4, PZ-5, PZ-6 and 7 to prevent the migration of PCP Plume.

The sampling and analysis procedures provide a consistent and a reliable indication of the ground water quality below the HWM units. The nine (9) monitor wells and later 12 twelve wells were sampled according to RCRA sampling protocol.

19.6 Compliance Monitoring Program (40 CFR 270.14(c)(7)

The Compliance Monitoring Program was established with the completion of the three CWs. The sampling and analysis procedures provide a consistent and a reliable indication of the ground water quality, down gradient of the surface impoundment HWMU. The ground water from one compliance well, CW-2 will be sampled according to 2013 Post-Closure sampling protocol. The ground water parameters to be monitored will include the following compound listed in 40 CFR Part 261 for PCP with a concentration limit of 1 μg/L and Naphthalene with a

concentration limit of 2 µg/L The ground water will be sampled for the purpose of characterizing the chemical quality of the shallow ground water down gradient of the surface impoundments. Well depth measurements will also be taken before sampling in the ground water monitor wells. The well depth measurements provide information necessary to assess the condition of the well (i.e., if the wells are experiencing silt buildup), to provide ground water elevation, and to provide the necessary purge volumes during ground water sampling events. In addition, during each purging and sampling event, the sampling personnel will make an initial visual inspection of the top and bottom of the fluid column using a transparent bailer. In additional, two installed monitor wells also will be sampled and the collected samples will be submitted to the laboratory for analysis. Chain of custody will be maintained between the sampling and the analysis (refer to Appendix S and T for the Quality Assurance Plans).

All portions of sampling and test equipment which contacts the interior of the well casing or the probe will be thoroughly cleaned before use. This includes water level indicators, bailers, submersible pumps, probes, tubing, and other equipment, or portions thereof, which are to be immersed. The procedure for initial equipment cleaning is as follows:

* Clean with tap water and phosphate-free laboratory grade detergent, brush if necessary
* Rinse thoroughly with tap water
* Rinse thoroughly with deionized water
* Equipment cleaned prior to field use will be re-cleaned after transfer to the sampling site unless carefully Wrapped for transport

Nondedicated testing equipment (i.e., water level indicator, bailer, etc.) which contact the interior well casing will be field cleaned between each well by washing thoroughly in phosphate-free detergent and rinsing with deionized water. Any necessary deviation from these procedures will be completely documented in the permanent record of the sampling episode and the field sheet.

Upon arrival at each monitor well, the sampling personnel will inspect the well's condition and note any evidence of tampering or damage. Each well will be unlocked and an electronic water level indicator will be used to measure the depth to water and well depth. The water level data will be referenced to a surveyed mark in the top of the inner casing. The data will be used to construct

potentiometric surface contour maps and to calculate the static volume of water within the casing that will be removed prior to ground water sampling. Prior to purging each monitor well, the top six (6) inches of ground water surface and the bottom six (6) inches of base of the water column will be inspected for immiscible phase organics and odors.

The water standing in a well, prior to sampling, may not be representative of the in-situ ground water quality. Therefore, the standing water in the well and filter pack must be removed so that formation water can replace the stagnant water. At a minimum, three (3) casing volumes (including filter pack pore water) must be removed before sampling can begin. The depth-to-water, well depth, and filter pack interval (assume a porosity of 30%) can be used to calculate the volume of ground water to be removed from each well. The following equations will be used to calculate the volume of ground water to withdraw:

(1) $v_c = \pi r_c^2 h_c (7.48)(3)$

where:
- v_c = volume of water in casing storage, gallons
- r_c = radius of casing, feet
- h_c = length of water column in casing, feet
- 7.48 = conversion factor from cubic feet to gallon
- 3 = 3 casing volumes, and

(2) $v_s = a\, r_s^2\, h_s - \pi r_c^2\, h_{es} (7.48)(3)(0.30)$
- v_s = volume of water in sand pack interval, gallons
- r_s = radius of drilled borehole, feet
- h_s = length of sand pack interval, feet
- r_c = radius of casing, feet
- h_{es} = length of casing/screen in sand pack interval, feet
- 0.30 = estimated porosity of sand pack

Adding the three (3) casing ground water volumes, to the three (3) sands pore water volumes, equal the amount of water that must be purged from the well prior to sampling. Purging will be accomplished by bailing with pre-cleaned, dedicated, Teflon bailers. All bailers will be fitted with clean, dedicated, monofilament line. During purging the pH, specific conductance, and temperature of the purged ground water will be taken and recorded to insure that the water quality in the well

has stabilized. If significant variations in any of these field measurements are observed, additional purging will be required. In addition, the water's physical characteristics (i.e., odor, turbidity, and color) will be observed and noted. Evacuated water will be containerized in five (5) gallon plastic buckets, which will be marked as to contents and source.

In those wells which bail dry, purging will cease and the well will be allowed a reasonable time to recover. After recovery, the well will be evacuated a second time. This will be repeated until the required volume is recovered. If a well is incapable of yielding three (3) casing volumes in a reasonable time, then the well will be evacuated to dryness and allowed to recover until it can provide a representative sample within 48 hours. Several wells especially PZ-8, 9, 10 are very slow to recovered due to the removal of ground water adjacent to these wells

Ground water samples from the monitor wells will be collected with pre-cleaned, dedicated, bailers, lowered into the well on clean, dedicated, monofilament line. The first bailer will be used to rinse the bailer and poured to waste if the well recharge enough to yield for sampling of ground water. Each ground water sample will be carefully poured directly into the appropriate sample bottles. The first aliquot will be retained for field determination of pH, temperature, and specific conductance (units to be reported in umhos/cm). Subsequent aliquots will be used to fill the sample bottles utilizing the following collection order:

* Naphthalene
* Pentachlorophenol (PCP)

All sample bottles will be laboratory-cleaned and preserved by the testing analytical laboratory. A final aliquot will be retained for a second determination of field pH, temperature, and specific conductance if there is enough groundwater for sampling. The results of these duplicate field measurements (i.e., first and last aliquots) will be used as a check to assure ground water stability during sample collection. All samples will be packed in ice immediately after being collected, and placed under chain-of-custody control. Samples will be submitted to Environmental Testing, Inc. located in Oklahoma City, Oklahoma.

The first and last aliquot collected during ground water sampling events, will be retained for field determination of ph, temperature, and specific conductance. Certain chemical and physical parameters in water can change significantly within a short time of sample acquisition. These parameters cannot be accurately

measured in a laboratory more than a few hours after collection, therefore, parameters will be measured on-site with portable equipment. These parameters are:

* pH
* Specific Conductance
* Temperature

These parameters will be measured in unfiltered, unpreserved, cleaned glass containers separate from those intended for laboratory analysis. The tested samples will be disposed in the same manner as other purged fluid. All field measurements will be recorded on the sampling sheet. All samples will be packed in ice immediately after being collected, and placed under chain-of-custody control. Samples will be submitted to Environmental Testing, Inc. located in Oklahoma City, Oklahoma. The laboratory will provide all sample containers, and any necessary chemical preservatives.

The groundwater samples from Compliance Wells (CW) 2 will be analyzed for Pentachlorophenol (PCP) and Naphthalene in accordance with Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, EPA Publication SW-846 (Method Number 8270).

Analysis data will be evaluated utilizing A Ground Water Information Tracking System with Statistical Analysis Capability (GRITS/STAT v4.2) (EPA/625/11-91/002). The normality tests used are: the Skewness Coefficient, the Shapiro-Wilk Test (for sample sets less than 50), and the Shapiro-Francia Test (for sample sets more than or equal to 50). The Variance will be evaluated by either Levene's Test or the utilization of Box plots. The combined Shewhart-CUSUM Chart will monitor constituent levels for trends or sudden changes. The ANOVA method will accommodate both Parametric and Non parametric analysis. The Intervals including the Tolerance Intervals on Compliance Limits and Confidence Interval will be based on the analytical results. In addition, the background well will be evaluated with compliance well utilizing the T-Test and Wilcoxon Rank-Sum Test.

19.7 Corrective Action Program (40 CFR 270.14(c)(8)

After PCP was detected in PZ-4, 6, and 7, MBWP initiated dewatering of these wells to prevent the migration of PCP Plume. Since later testing of the surrounding groundwater with PZ-5, 8, 9, and 10 indicated the extent of the plume

is localized to the immediate area of PZ-4, PZ-6, and PZ-7. Monitor Wells PZ-2, PZ-3, PZ-4, PZ-5, PZ-6, PZ-7, PZ-8, PZ-9, PZ-10, CW-1, CW-2, and CW-3 will be measured annually for water elevation. The water elevation of the wells will be utilized to determine the groundwater flow rate and direction in the uppermost aquifer and to verify the effectiveness of mitigating the PCP plume. MBWP will be continuing to remove groundwater from PZ-4, PZ-5, PZ-6, and PZ-7.

In April 2000, MBWP sampled PZ-5 and PZ-8, annually and analysis indicated no detectable concentrations of Naphthalene and PCP. Analytical results of samples collected from PZ 4, 6, and 7 indicated an initial decrease in the PCP concentrations (Table 19.7 refer to the prior renewal application) During February and August 2005, sampling was conducted of 9 monitor wells and two borings and indicated PCP plume is being contained by the dewatering of these wells (Appendix V and W refer to the prior renewal application).

Appendix A

Quality Assurance Project Plan

for

Since 1948

Mixon Brothers Wood Preserving, Inc.

March 2, 2023

Black and Associates
Environmental Consultants, Inc.
1908 W. Boyd
Norman, Oklahoma 73069-4830
(405)360-2852

Appendix A

Table of Contents

Since 1948

Mixon Brothers Wood Preserving, Inc.

Black and Associates Environmental Consultants, Inc.

Appendix A

List of Attachments

Attachment 1. Black and Associates Chain of Custody dated August 16, 2022

Attachment 2. Sample Preservation
Table 1. Recommendation for Sampling and Preservation of Samples according to measurement.

Attachment 3. Black and Associates Letter dated August 16, 2022

Attachment 4. Instruction Manuals for pH and specific conductivity meters

Attachment 5. Black and Associates Project Log dated August 16, 2022

Since 1948

Mixon Brothers Wood Preserving, Inc.

Black and Associates Environmental Consultants, Inc.

Black and Associates
Environmental Consultants, Inc.
1908 W. Boyd
Norman, Oklahoma 73069-4830
Telefax (405)360-2880
(405)360-2852

Jerry J. Black, President
Registered and Court Qualified
Environmental Professional

K. C. Yiin, Vice President
Registered Professional
Engineer

QUALITY ASSURANCE PROJECT PLAN

A. SAMPLING AND ANALYSIS PROCEDURES

Field sampling methods and analytical procedures used will follow the descriptions in "Standard Methods, 17th Edition" (1989), "Handbook for Analytical Quality Control in Water and Wastewater Laboratories" (EPA-600/4-79-019) (March 1979), "Methods for Chemical Analysis of Water and Wastes" (EPA-600/4-79-20) (March 1979), "Site Characterization for Subsurface Remediations" (CERI-89-224)(September 1989), "Ground Water" (EPA/625/6-87/016)(March 1987), "Ground Water, Volume II: Methodology" (EPA/625/6-90/016b)(July 1991), "Ground-Water Monitoring Technical Enforcement Guidance Document", (OSWER Directive 9950.1, 1986), "A Guide to the Selection of Materials For Monitoring Well Construction and Ground-water Sampling" (EPA-600/2-84-024)(January 1984), "Microbiological Methods for Monitoring the Environment (EPA/600/8-78-017)(December 1978),"Biological Field and Laboratory Methods" (EPA-670/4-73-001)(July 1973),"Practical Guide for Ground-Water Sampling" (EPA/600/2-85/104)(September 1985), "Test Methods for Evaluating Solid Waste" (SW-846, 1986), "Subsurface Characterization and Monitoring Techniques",(EPA/625/R-93/003a)(May 1993), "Description and Sampling of Contaminated Soils" (EPA/625/12-91/002)(November 1991), "Air Monitoring Instrumentation" S.P. Maslansky et al, 1993, Van Nostrand Reinhold, N.Y., (ISBN 0-442-00973-9), United States Geological Survey (USGS) National Field Manual for the collection of Water Quality Data (NFM), and the Oklahoma Water Resources Board "Quality Assurance Plan for Water Quality Division Enforcement, Monitoring and Permitting Activities" (September 1985).

Both pH and Specific Conductance are measured with a digital Conductance/Temperature and pH Tester. The digital Conductance/Temperature Meter is an Oakton Con 11 Series Conductivity/TDS/°C Meter and the waterproof pH Tester is Oakton Waterproof pHTestr 30.

B. SAMPLING CUSTODY

The custody program provides a written record (Attachment One) which allows a sample to be traced from the time of collection to when the data from the laboratory is presented to the legal council or the client.

Field Procedures: Following collection, the samples are labeled immediately and directly on the sample container; which is then recorded on the field Project log sheet (Attachment Five)with the following information: sampling code number, date of collection, location and site description, type of sample, and any preservatives, if any were added to the sample. A complete sample preservation document is presented in Attachment 2 for reference purposes.

Transfer Procedures: Many of the parameters' concentrations will be analyzed and determined by a commercial laboratory. Only the commercial laboratories which are specifically certified for those parameters through the Oklahoma Department of Environmental Quality (ODEQ) Laboratory Certification Program and participated in the US EPA Water Pollution Performance Evaluation Studies will be considered for such contracts.

Due to the contracted laboratory service, it is necessary to transfer collected samples from field personnel to laboratory personnel. Prior to the delivery of samples to the designated commercial laboratory, Black & Associates Environmental Consultants, Inc.', (BAEC) field personnel will prepare a formal letter specifically outlining the requested analytical parameters of each sample to be tested; in addition to the standard chain of custody paper. A typical example of such a formal letter is presented in Attachment Three. The signed original copy of the custody paper and a copy of the standard request letter will both be returned to the custody of BAEC's file system.

C. CALIBRATION PROCEDURES AND FREQUENCY

The guidelines given in the manufacturer's user manual for both pH and Specific Conductivity calibration are to be followed precisely.

The Quality Control of the check procedures, frequency of check, and control limits for both pH and Specific Conductivity are listed in the following table for reference purposes.

PARAMETER	CHECK PROCEDURE	FREQUENCY OF CHECK	CONTROL LIMITS
pH	Check against standard buffer solutions (4.0, 7.0, and 10.0).	Prior to each field trip.	0.01 SU*
	Check against standard reference 7.0 buffer solution and within the expected pH value range of the sample.	At each sampling station or point.	0.01 SU*
Specific Conductivity	Check against lower, mid, & upper range standards	Prior to each field trip.	2% Full Scale*
	Check against mid range standard	At each sampling station or point.	2% Full Scale*

"*" : Measured or tested at 77 degree of Fahrenheit.
"SU" : Standard Unit in pH measurement

The instruction manuals of the tester are presented as Attachment 4 in the Quality Assurance Plan for reference purposes.

D. PERFORMANCE AND SYSTEM AUDITS AND FREQUENCY

Laboratory and Field Procedures: Evaluation of equipment performance involves checking the precision and accuracy of the systems with the periodic calibration of equipment. Calibration of equipment will be according to the procedures described in the manufacturer's user manual. Field/Equipment blanks will be used at least 5 % of the overall sampling, with Trip Blanks for each mobilization.

E. PREVENTATIVE MAINTENANCE PROCEDURES AND SCHEDULES

The manufacturer recommended maintenance procedures and schedules are to be followed exactly for each testing probe.

Attachment One

CHAIN OF CUSTODY

RETURN THIS PAGE TO: **Black and Associates**
Environmental Consultants, Inc.
1908 W. Boyd
Norman, Oklahoma 73069-4830
(405)360-2852

Sample Number	Date Collected	Time Collected
08152022 A-E	August 15, 2022	

Site I.D. (station)

Mixon Brothers Wood Preserving Inc. RCRA Site

Sample Collector	Witness(es)
J. J. Black	

Remarks:

Received on Ice (4°C) 0.8 + 0.4 = 1.2

I hereby certify that I received this sample and disposed of as noted below:

RECEIPT OF SAMPLE	Received From	Dated Received	Time Rec'd
	Jerry J. Black	August 16, 2022	14:20 hrs.
	Disposition of Sample	**Signature**	
	ETL for analysis	Stephanie Saul	

I hereby certify that I received this sample and disposed of it as noted below:

RECEIPT OF SAMPLE	Received From	Dated Received	Time Rec'd
			hrs.
	Disposition of Sample	**Signature**	

Attachment Two

SAMPLE PRESERVATION

Complete and unequivocal preservation of samples, either domestic sewage, industrial wastes, or natural waters, is a practical impossibility. Regardless of the nature of the sample, complete stability for every constituent can never be achieved. At best, preservation techniques can only retard the chemical and biological changes that inevitably continue after the sample is removed from the parent source. The changes that take place in a sample are either chemical or biological. In the former case, certain changes occur in the chemical structure of the constituents that are a function of physical conditions. Metal cations may precipitate as hydroxides or form complexes with other constituents; cations or anions may change valence states under certain reducing or oxidizing conditions; other constituents may dissolve or volatilize with the passage of time. Metal cations may also adsorb onto surfaces (glass, plastic, quartz, etc.), such as, iron and lead. Biological changes taking place in a sample may change the valence of an element or a radical to a different valence. Soluble constituents may be converted to organically bound materials in cell structures, or cell lysis may result in release of cellular material into solution. The well known nitrogen and phosphorus cycles are examples of biological influence on sample composition. Therefore, as a general rule, it is best to analyze the samples as soon as possible after collection. This is especially true when the analyte concentration is expected to be in the low ug/l range.

Methods of preservation are relatively limited and are intended generally to (1) retard biological action, (2) retard hydrolysis of chemical compounds and complexes, (3) reduce volatility of constituents, and (4) reduce absorption effects. Preservation methods are generally limited to pH control, chemical addition, refrigeration, and freezing.

The recommended preservative for various constituents is given in Table 1. These choices are based on the accompanying references and on information supplied by various Quality Assurance Coordinators. As more data become available, these recommended holding times will be adjusted to reflect new information. Other information provided in the table is an estimation of the volume of sample required for the analysis, the suggested type of container, and the maximum recommended holding times for samples properly preserved.

Attachment Two (Continued)

TABLE 1

RECOMMENDATION FOR SAMPLING AND PRESERVATION OF SAMPLES ACCORDING TO MEASUREMENT[1]

Measurement	Vol. Req. (ml)	Container[2]	Preservative	Holding Time[3]
100 Physical Properties				
Color	50	P,G	Cool, 4°C	24 Hrs.
Conductance	100	P,G	Cool, 4°C	24 Hrs.[4]
Hardness	100	P,G	Cool, 4°C HNO_3 to pH < 2	6 Mos.[5]
Odor	200	G only	Cool, 4°C	24 Hrs.
pH	25	P,G	Det. on site	6 Hrs.
Residue				
Filterable	100	P,G	Cool, 4°C	7 Days
Non-Filterable	100	P,G	Cool, 4°C	7 Days
Total	100	P,G	Cool, 4°C	7 Days
Volatile	100	P,G	Cool, 4°C	7 Days
Settleable Matter	1000	P,G	None Req.	24 Hrs.
Temperature	1000	P,G	Det. on site	No Holding
Turbidity	100	P,G	Cool, 4°C	7 Days
200 Metals				
Dissolved	200	P,G	Filter on site HNO_3 to pH < 2	6 Mos.[5]
Suspended	200		Filter on site	6 Mos.
Total	100	P,G	HNO_3 to pH < 2	6 Mos.[5]

TABLE 1 (CONT)

Measurement	Vol. Req. (ml)	Container[2]	Preservative	Holding Time[3]
Mercury				
Dissolved	100	P,G	Filter on site HNO_3 to pH < 2	38 Days (Glass) 13 Days (Hard Plastic)
Total	100	P,G	HNO_3 to pH < 2	38 Days (Glass) 13 Days (Hard Plastic)
300 Inorganics, Non-Metallics				
Acidity	100	P,G	None Req	24 Hrs.
Alkalinity	100	P,G	Cool, 4°C	24 Hrs.
Bromide	100	P,G	Cool, 4°C	24 Hrs.
Chloride	50	P,G	None Req	7 Days
Chlorine	200	P,G	Det. on site	No Holding
Cyanides	500	P,G	Cool, 4°C NaOH to pH 12	24 Hrs.
Fluoride	300	P,G	None Req.	7 Days
Iodide	100	P,G	Cool, 4°C	24 Hrs.
Nitrogen				
Ammonia	400	P,G	Cool,4°C H_2SO_4 to pH < 2	24 Hrs.
Kjeldahl, Total	500	P,G	Cool, 4°C H_2SO_4 to pH < 2	24 Hrs.[4]
Nitrate plus Nitrite	100	P,G	Cool, 4°C H_2SO_4 to pH < 2	24 Hrs.[4]
Nitrate	100	P,G	Cool, 4°C	24 Hrs.
Nitrite	50	P,G	Cool, 4°C	48 Hrs.

TABLE 1 (CONT)

Measurement	Vol. Req. (ml)	Container[2]	Preservative	Holding Time[3]
Dissolved Oxygen				
Probe	300	G only	Det. on site	No Holding
Winkler	300	G only	Fix on site	4-8 Hours
Phosphorus				
Ortho-phosphate, Dissolved	50	P,G	Filter on site Cool, 4°C	24 Hrs.
Hydrolyzable	50	P,G	Cool, 4°C H_2SO_4 to pH < 2	24 Hrs.[6]
Total	50	P,G	Cool, 4°C H_2SO_4 to pH < 2	24 Hrs.[6]
Total, Dissolved	50	P,G	Filter on site Cool, 4°C H_2SO_4 to pH < 2	24 Hrs.[6]
Silica	50	P only	Cool, 4°C	7 Days
Sulfate	50	P,G	Cool, 4°C	7 Days
Sulfide	500	P,G	2 ml zinc acetate	24 Hrs.
Sulfite	50	P,G	Det. on site	No Holding
400 Organics				
BOD	1000	P,G	Cool, 4°C	24 Hrs.
COD	50	P,G	H_2SO_4 to pH < 2	7 Days[9]
Oil & Grease	1000	G only	Cool, 4°C H_2SO_4 or HCl to pH < 2	24 Hrs.
Organic carbon	25	P,G	Cool, 4°C H_2SO_4 or HCl to pH < 2	24 Hrs.
Phenolics	500	G only	Cool, 4°C H_3PO_4 to pH < 4 1.0 g $CuSO_4$/l	24 Hrs.
MBAS	250	P,G	Cool, 4°C	24 Hrs.

TABLE 1 (CONT)

Measurement	Vol. Req. (ml)	Container[1]	Preservative	Holding Time[2]
NTA	50	P,G	Cool, 4°C	24 Hrs.

1. More specific instructions for preservation and sampling are found with each procedure as detailed in this manual. A general discussion on sampling water and industrial wastewater may be found in ASTM, Part 31, p. 72–82 (1976) Method D-3370.

2. Plastic (P) or Glass (G). For metals, polyethylene with a polypropylene cap (no liner) is preferred.

3. It should be pointed out that holding times listed above are recommended for properly preserved samples based on currently available data. It is recognized that for some sample types, extension of these times may be possible while for other types, these times may be too long. Where shipping regulations prevent the use of the proper preservation technique or the holding time is exceeded, such as the case of a 24-hour composite, the final reported data for these samples should indicate the specific variance.

4. If the sample is stabilized by cooling, it should be warmed to 25°C for reading, or temperature correction made and results reported at 25°C.

5. Where HNO_3 cannot be used because of shipping restrictions, the sample may be initially preserved by icing and immediately shipped to the laboratory. Upon receipt in the laboratory, the sample must be acidified to a pH < 2 with HNO_3 (normally 3 ml 1:1 HNO_3/liter is sufficient). At the time of analysis, the sample container should be thoroughly rinsed with 1:1 HNO_3 and the washings added to the sample (volume correction may be required).

6. Data obtained from National Enforcement Investigations Center-Denver, Colorado, support a four-week holding time for this parameter in Sewerage Systems. (SIC 4952).

Attachment Three

Black and Associates
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K. C. Yiin, Vice President
Registered Professional
Engineer

August 16, 2022

To: Environmental Testing, Inc.

From: Jerry J. Black

RE: Mixon Brothers Ground Water Monitoring (RCRA Annual Sampling)

Please send analysis results to: Mixon Brothers Wood Preserving, Inc., P.O. Box 327, Idabel, Oklahoma, 74745. Also, please send a copy of results to J. J. Black.

Please analyze 08152022 A-E for pentachlorophenol (Phenols by EPA Method 8041, 1 µg/L) and naphthalene (Semivolatile Organic Compounds by EPA Method 8270 SIM, 2 µg/L).

08152022 A-E are liquid samples.

Attachment Four

This Instruction Manual is also available for download on our Web-site: eutechinst.com or 4oakton.com

EUTECH INSTRUMENTS
Technology Made Easy ...

OAKTON

INSTRUCTION MANUAL

pHTestr 10, 20, 30, 10BNC, Spear

Large Screen
Waterproof pH / Temperature Tester
Double Junction

Introduction

Thank you for selecting our microprocessor waterproof pH tester with USA or NIST buffer set selection. You have one of five models:

- pHTestr10
- pHTestr20
- pHTestr30
- pHTestr10BNC
- pHSpear

This manual provides a step-by-step guide to operate the testers.

Before you begin:

Condition your pHTestr 10, 20, 30 electrodes by immersing it in electrode storage solution or tap water for at least 30 minutes before use. DO NOT use de-ionized water.

Ensure that your pHSpear electrode is always soaked in the electrode storage solution or tap water via its protective cap.

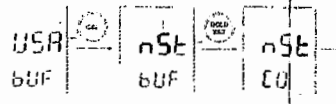
Note: For pHTestr10BNC, please refer to the pH electrode's instruction manual.

pH Buffer Set Selection

Your tester features USA (pH 4.01, pH 7.00 and pH 10.01) or NIST (pH 4.01, pH 6.86, and pH 9.18) standards. Select either one to suit your requirements.

1. While pressing the HOLD/ENT button, switch on the tester by pressing the ON/OFF button.
2. Release the HOLD/ENT button. The display will flash either USA or NIST.
3. Press CAL button to toggle between the two buffer set standards.
4. Press the HOLD/ENT button to confirm the selection of the buffer set.

With meter powered off, press HOLD/ENT and ON/OFF at the same time. First release ON/OFF button, then HOLD/ENT button.



After buffer selection, whole LCD segment lits up and goes back to measurement mode.

Figure 1: Buffer Selection Sequence

pH Calibration

Calibration should be done regularly, preferably once a week. You can calibrate up to three points using either the USA or the NIST buffer set standards.

1. Press ON/OFF button to switch unit on.
2. Dip electrode about 2 to 3 cm into the pH standard buffer solution.
3. Press the CAL button to enter calibration mode. The 'CAL' indicator will be shown. The upper display will show the measured reading based on the last calibration while the lower display will indicate the pH standard buffer solution.

Note: All testers have dual display during calibration mode
Note: To abort calibration, press the 'CAL' button.

4. Allow about 2 minutes for the tester reading to stabilize before pressing the HOLD/ENT button to confirm the first calibration point. The upper display will be calibrated to the pH standard buffer solution and the lower display will then be toggling in between readings of the next pH standard buffer solution.
5. Repeat with other buffers if necessary. Rinse electrode in tap water before dipping into next buffer.

Note: The calibration mode allows you to perform up to three calibration points before returning to the measurement mode automatically. However, if you opted to have only one or two calibration points, simply skip the remaining calibration points by exiting to the measurement mode by pressing the CAL button.

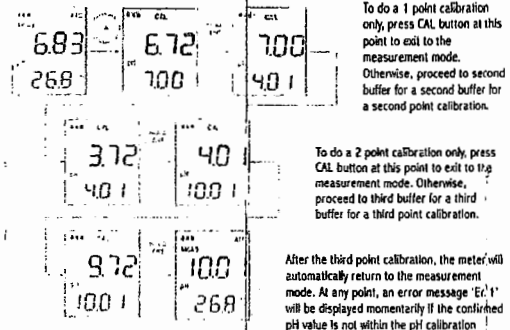


Figure 2: Example of pH Calibration Sequence

pH Measurement

1. Press the ON/OFF button to switch the tester on.
2. Dip the electrode about 2 to 3 cm into the test solution. Stir and let the reading stabilize. For pHSpear, pierce the penetrating tip electrode through your semi solid sample as per the desired depth. Rotate left and right several times and tilt to ensure sample contact.
3. Note the pH value or press HOLD/ENT button to freeze the reading. To release the reading, press HOLD/ENT again.
4. Press ON/OFF to turn off tester. If you do not press a button for 8.5 minutes, the tester will automatically shut off to conserve batteries.

HOLD Function

This feature lets you freeze the display for a delayed observation

1. Press HOLD/ENT button to freeze the measurement. A 'HOLD' indicator will be displayed and the measurement will be frozen.
2. Press HOLD/ENT again to release the measurement. The 'HOLD' indicator will not be displayed anymore indicating the held measurement is released.

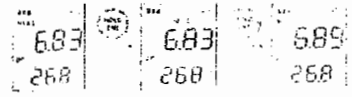


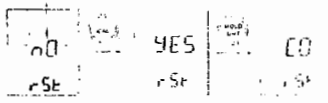
Figure 4: Example of HOLD Function

User Reset

You can reset the pH calibration to the factory default by using the user reset function. Buffer set selection and temperature user calibration (pHTestr30) are not affected by the user reset function.

1. Switch off the tester.
2. While pressing the 'CAL' button, press and release the ON/OFF button to enter the 'User Reset' selection menu. The screen will display 'rSt' on the bottom display with a flashing 'nO' selection.
3. Use the 'CAL' button to toggle between 'nO' and 'YES' selection.
   - nO deactivates reset selection
   - YES activates the reset selection
4. Press the HOLD/ENT button to confirm the selection made.
5. If you have selected 'YES', the unit will show 'CO' momentarily and proceed to the measurement mode with the calibration reset back to factory default value.
6. If 'nO' is selected, the unit will proceed to the measurement mode without any calibration reset performed.

With meter powered off, press CAL and ON/OFF at the same time. First release ON/OFF button, then CAL button.



After reset, whole LCD segment lits up and goes back to measurement mode.

Figure 5: User Reset Sequence

ATC - Automatic Temperature Compensation (Only for pHTestr 10, pHTestr 20 and pHTestr 30)

Through its in-built temperature sensor, the measurement error due to the changes in electrode sensitivity due to changes in temperature is compensated to give the actual pH reading of the sample measured.

MTC - Manual Temperature Compensation (Only for pHTestr 10BNC, pH Spear)

The MTC range is 0 to 50.0 °C (32.0 to122.0 °F). User reset will set temperature to default value 25°C or 77°F.

While in the measurement mode,

1. Press the HOLD/ENT button to bring the tester to the 'HOLD' mode.
2. Press the CAL button continuously to switch to the °C or °F mode setting selection screen.
3. Release the CAL button to confirm your mode selection and the display will go to the manual temperature calibration mode with the upper display flashing. The upper display shows the adjustable temperature value and the lower display shows the last set temperature offset.
4. Press the HOLD/ENT button to set the upper display to the temperature value of your sample.
5. Once the setting is reached, release the HOLD/ENT button. The new value is automatically confirmed and returns to the measurement mode if no button is pressed after 5 seconds.

Notes: To exit this program without confirming the calibration, press the CAL button before the automatic confirmation takes place.

Temperature Calibration (Only for pHTestr 30)

From the measurement mode,

1. Press the HOLD/ENT button to bring the tester to the 'HOLD' mode.
2. Press the CAL button for 3 seconds to switch to the °C or °F mode setting selection screen. Pressing the CAL button continuously for 3 seconds allows you to toggle in between the °C and °F mode setting selection screen.
3. Release the CAL button to confirm your mode selection and the display will go to the temperature calibration mode with the upper display flashing. The upper display shows the current measured temperature reading based on the last set offset and the lower display shows the current measured temperature reading based on factory default calibration.
4. Dip the tester into a solution of known temperature and allow time for the in built temperature sensor to stabilize.
5. Press the HOLD/ENT button to set the upper display to the temperature value of the solution.
6. Once the new temperature setting is reached, the new value is automatically confirmed and returns to the measurement mode if no button is pressed after 5 seconds.

Notes: To exit this program without confirming the calibration, press the CAL button before the automatic confirmation takes place.

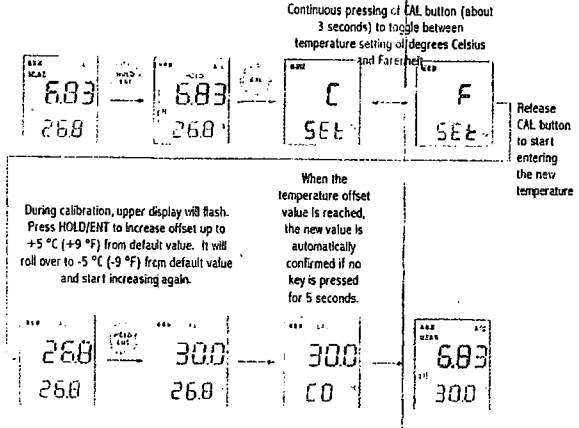


Figure 6: Temperature Calibration Sequence (Only for pHTestr 30DI)

Electrode Maintenance

1. Rinse the electrode with tap water or electrode storage solution after each measurement. Care has to be taken not to damage the sensor's glass electrode especially while rinsing the pHSpear penetrating tip electrode.
2. In aggressive chemicals, dirty or viscous solutions, and solutions with heavy metals or proteins, take readings quickly and rinse electrode immediately afterward. For the pHSpear, the remnants of the semi solid samples on the penetrating electrode can be removed by rubbing it with some table salt and then rinsing. Mild detergent can be used to wash the penetrating electrode clean.
3. If possible, keep a small piece of paper or sponge in the electrode cap – moistened with clean water or electrode storage solution (NOT de-ionized water) – and close the cap over the electrode. For pHSpear, ensure that the electrode is kept soaked in electrode storage solution or tap water via its protective cap.

Changing Batteries

1. Open battery compartment lid (with attached lanyard loop).
2. Remove old batteries; replace with fresh ones. Note polarity

Self-Diagnostic Messages

Low battery Indicator		3 Bars indicates Battery is full (100%)
		2 Bars indicates 50% of the battery life is left
		1 Bar indicates 25% of the battery life is left
		Blinking battery casing indicates the need to replace batteries with fresh ones as specified by manufacturer
Over range / Under range signal	Or / Ur (Still)	Electrode is not in contact with solution or electrode is failing.
		Replacement sensor is not connected properly to the tester during sensor replacement
		Measured pH value or temperature value (pHTesr30) exceeds its specified maximum or minimum value
	ATC / Or / Ur (Blinking)	Blinking 'ATC', 'Or' or 'Ur' indicates that there is a short or open circuit at the built in temperature sensor
Error Message	Er.0	Temperature calibration error of attempting to calibrate tester to a value which is out of range or under range
	Er.1	pH calibration error of attempting to confirm a calibration value which is not within the specified calibration window

Electrode Replacement

You can replace the electrode module at the fraction of the cost of a new tester. When the tester fails to calibrate or gives fluctuating readings in calibration standards, you need to change the electrode.

1. With dry hands, grip the ribbed tester collar with electrode facing you. Twist the collar counter clockwise (see picture A). Save the ribbed tester collar and O-ring for later use.
2. Pull the old electrode module away from the tester.
3. Align the four tabs on the new module so that they match the four slots on the tester (see picture B).
4. Gently push the module onto the slots to sit it in position. Push the smaller O-ring fully onto the new electrode module. Push the collar over the module and thread it into place by firmly twisting clockwise.

Note: It is necessary that you recalibrate your tester prior to measurement after an electrode replacement.

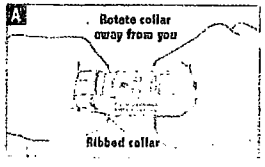


Figure 7: Removal of collar from tester

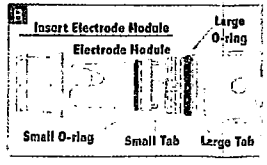


Figure 8: Example of electrode module fitting alignment

Applications

Water quality testing • pools • spas • aquariums • aquaculture • hydroponics • ecology studies • water and wastewater treatment • boilers • steam generators • car washes • sanitation plants • labs • food sectors and more!

Warranty

The waterproof testers are warranted to be free from manufacturing defects for 1 year and electrode module for 6 months, unless otherwise specified. If repair, adjustment or replacement is necessary and has not been the result of abuse or misuse within the time period specified, please return the tester - freight prepaid - and correction will be made without charge. Out of warranty products will be repaired on a charge basis.

Return of Items

Authorization must be obtained from your distributor before returning items for any reason. When applying for authorization, please include information regarding the reason the item(s) are to be returned.

Note: We reserve the right to make improvements in design, construction and appearance of products without notice. Prices are subject to change without notice.

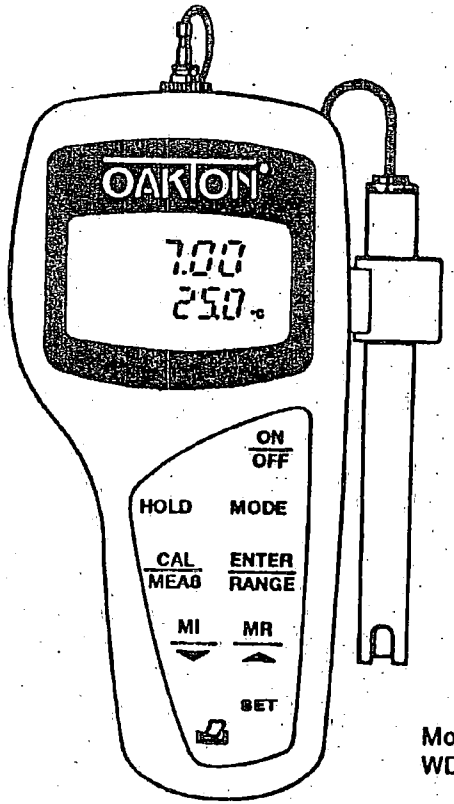
Accessories

Item	Eutech Instruments Order Code	Oakton Instruments Order Code
pHTestr 10,20,30 replacement sensor	PHSENSOR03DI	WD-35624-38
pHTestr10BNC replacement sensor	PHSENSORBNC	OKPHW/PSENBNC
pHSpear replacement sensor	PHSENSOR04	WD-35634-50

Tester Specifications

Large Screen Testers	pHTestr10	pHTestr20	pHTestr30	pHTestr 10BNC	pHSpear
pH Range	-1.0 to 15.0 pH	-1.00 to 15.00 pH			
Resolution	0.1 pH	0.01 pH			
Relative Accuracy	0.1 pH	0.01 pH			
Calibration Points	Up to 3 points	Up to 3 points			
Buffer Set Standard Selection	USA - 4.0/7.0/10.0 NIST - 4.0/6.9/9.2	USA - 4.01/7.00/10.01 NIST - 4.01/6.86/9.18			
Calibration Window (USA Buffer Set Standard)	+/-1.0 pH (pH 4.0 & pH 10.0), +/-1.5 pH (pH 7.0)	+/-1.00 pH (pH 4.01 & pH 10.01). +/-1.50 pH (pH 7.00)			
Calibration Window (NIST Buffer Set Standard)	+/-1.0 pH (pH 4.0 & pH 9.2), +/-1.2 pH (pH 6.9)	+/-1.00 pH (pH 4.01 & pH 9.18), +/-1.25 pH (pH 6.86)			
Temperature	No Display	0-50.0°C or 32.0-122.0°F			
Temperature Compensation	ATC			MTC	
Temperature Resolution	No	0.1 °C / °F			
Temperature Accuracy	No	0.5 °C / 0.9 °F		No	
Temperature Calibration Window	No	+/- (5°C /9 °F) from default value		0-50.0°C or 32.0-122.0°F (MTC)	
Auto Off	After 8.5 minutes from last key press				
User reset	Yes				
Non Volatile Memory Backup	Yes				
LCD Display	Dual				
Power Requirement	4 x 1.5V "A 76" micro Alkaline Batteries				
Battery life	More than 500 hrs				
Operating Temperature	0 – 50 °C				
Tester Dimensions	6.5 "L x 1.5"dia. (165 x 38 mm)				9.75 "L x 1.5"dia. (247 x 38 mm)
Weight	3.25 oz (90 gm)				
Penetrating electrode total length	Not applicable				91 mm
Shaft length	Not applicable				31 mm
Penetrating electrode upper diameter	Not applicable				12 mm
Shaft diameter	Not applicable				7 mm

OAKTON® WD-35607-10,-20,-30
Hand-Held Conductivity Meters



Model shown:
WD-35607-30

Printed in U.S.A. 0795-R5

OAKTON®

Table of Contents

1. Introduction

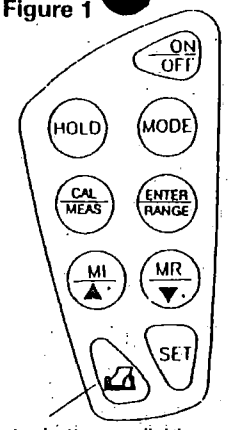
Thank you for selecting the OAKTON® WD-35607-10, -20, and -30 conductivity meters. These meters have advanced microprocessor programming to give you state of the art features at a low price.

The primary display shows the measured conductivity reading in µS and mS or the TDS value in ppt and ppm (models WD-35607-20, -30 only). The secondary display shows the temperature of the reading in °C. Both displays show error messages, keypad and program functions. Included with your meter is an epoxy platinum probe with built-in temperature sensor and cable, a built-in four position probe attachment and a built-in meter stand.

CAUTION: Please read this manual before operation to ensure satisfactory operation of your meter.

2. Keypad Functions

Figure 1



See Figure 1, right.

The keypad is easy to use.

Keypad functions

ON/OFF Powers and shuts off the meter. Meter goes into measurement mode when turned on.

HOLD Freezes the measured readings. To activate, press HOLD while in the conductivity or TDS measurement mode. To release, press HOLD again.

MODE Select one of three measurement modes: COND (conductivity), TDS (total dissolved solids) (WD-35607-20, -30 only), and TEMP (temperature).

CAL/MEAS Toggles the unit between Measurement and Calibration modes.

ENTER/RANGE In Measurement mode; selects range or sets units to auto ranging. In Calibration mode; confirms your values.

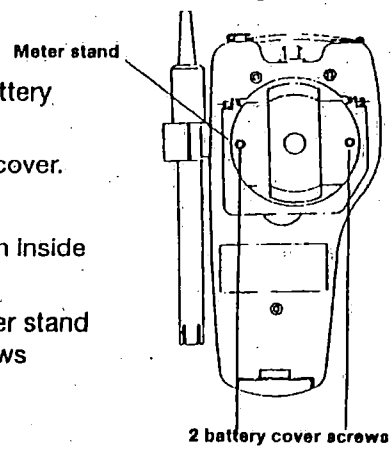
MI/▲ or MR/▼ In Measurement mode; MI inputs values to memory, MR recalls stored values from memory. In Calibration mode and Setup programs; scrolls up or down to the calibration or set up values you want.

SET Enters the SETUP programs.

PRINT (WD-35607-30 only). Sends data to RS-232 output port.

3. Preparation

Figure 2

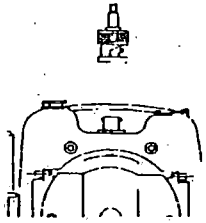


Inserting the batteries (included)

1. Use a Phillips screwdriver to remove the two screws holding the battery cover. See Figure 2, right.
2. Lift meter stand to expose battery cover.
3. Remove battery cover.
4. Insert batteries. Follow the diagram inside the cover for correct polarity.
5. Replace the battery cover and meter stand into its original position using the screws removed earlier.

Connecting Probe and Temperature Sensor

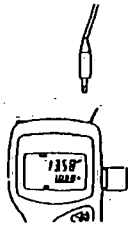
Figure 3



Note: Keep connector dry and clean. Do not touch connector with soiled hands.

1. Slide the probe connector over the BNC connector on the meter. Make sure the connector slot aligns with the posts of the socket. See Figure 3, right.
2. Rotate the connector clockwise until it locks. Do not force.

Figure 4



Temperature sensor. The temperature sensor uses a phono jack to connect with the socket on the meter. Insert the jack into socket as shown in Figure 4, right.

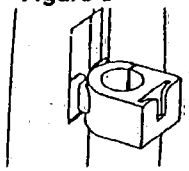
Inserting conductivity/temperature probe into the electrode holder

The meter includes one probe holder. Do not use excessive force when inserting probe into the holder.

1. Slide the end of the probe (sensor side) into the hole of the holder up to the probe cap.

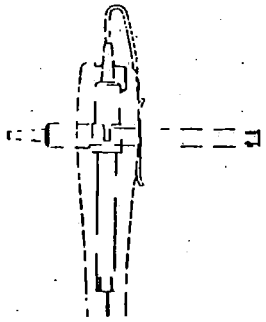
Attaching the electrode holder to the meter

Figure 5



1. Place the probe holder with the flange facing the slot on the meter. See Figure 5, at right.

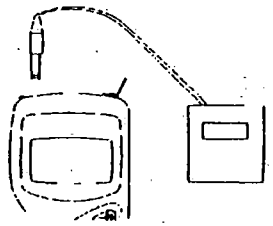
Figure 6



2. Gently slide the holder flange in the slot. Make sure holder is fixed properly into slot. Turn the probe holder as shown in Figure 6, at right, for one-hand operation. Return probe holder to its original position when not in use.

Connecting the optional AC adapter

Figure 7



1. Insert the AC jack as shown in Figure 7, at right. This helps conserve batteries but is not required for operation.
2. **Switch off the meter before plugging the adapter into the power source.** This protects the memory in your meter.
3. Press the ON/OFF button to switch the power ON.

4. Calibration

Choosing Standard Solutions

For best results, select a conductivity or TDS standard near the sample value you are measuring. Alternatively use a calibration solution value that is approximately 2/3 the full scale (F.S.) value of the measurement range you plan to use. For example in the 0 to 1999 µS range, use a 1413 µS solution for calibration.

Calibrating the meter in conductivity range also calibrates the corresponding TDS range. A calibration value in the TDS mode of a particular range replaces a prior calibration value in the corresponding conductivity mode if both fall in the same range and vice versa. The following table lists the corresponding ranges.

Conductivity range	TDS range
0.00 –19.99 µS	0.00 –9.99 ppm
0.0 –199.9 µS	10.0 –99.9 ppm
0 –1999 µS	100 –999 ppm
0.00 –19.99 mS	1.00 –9.99 ppt
0.0 –199.9 mS	10.0 –99.9 ppt 100 –200 ppt

You can calibrate to separate points in each of the five ranges. If you are measuring values in more than one range you should calibrate at multiple standard values to cover those ranges.

Erasing Calibrated Values

You do not need to erase previous calibration information when recalibrating. New calibration data will replace the old information automatically. However old calibration data will be retained in ranges that you do not recalibrate. You can clear ALL calibration data using the Reset Function (see page 14, Program P2.2).

Conductivity Calibration

Note on temperature coefficients: These meters are factory set to a temperature coefficient of 2% per °C. For most applications this will provide good results. See Program P1.1 (page 11) to set temperature coefficient to a different value. See Addendum 3 "Calculating Temperature Coefficients", page 35 for information on determining appropriate temperature coefficients.

1. Turn on the meter.

All the LCD segments display for a few seconds. The LCD switches to the conductivity measurement mode.

2. Press MODE to select conductivity mode. The COND indicator should show at the bottom of the display.

3. Pour a small volume of your calibration standard into a clean container. There should be enough standard solution to immerse the tip of the conductivity cell about 1/2".

4. Rinse your probe with deionized water, then in a small amount of calibration standard.

5. Immerse the probe into the container of standard solution, and press CAL. The CAL indicator will flash in the upper right corner of the display.

6. Use the MI/▲ or MR/▼ to scroll the display to the correct value of your calibration standard. Be sure to use the value for the normalization temperature for which your meter is set.(usually 25°C or 20°C).

NOTE: At any time during the calibration, you may exit the Calibration mode and return to Measurement mode by pressing the CAL/MEAS button. The meter will keep old calibration data and will be unharmed.

7. Press ENTER to store calibration. Return to the MEAS mode to confirm.

8. Repeat steps 1-7 for other ranges.

TDS calibration using conversion factors

TDS values are related to conductivity. You can calibrate the meter using conductivity standards as described above and then program the meter with a given conversion factor. Enter the conversion factor using the Conversion Factor program (see page 15, Program P3.0).

Select the conductivity to TDS conversion factor for your solution. Addenda 1 on page 34 lists some commonly used conversion factors. You can calculate the TDS conversion factor for other solutions as shown in Addendum 2, page 35.

TDS calibration using TDS standards

Note on temperature coefficients: These meters are factory set to a temperature coefficient of 2% per °C. For most applications this will provide good results. See Program P1.1 (page 11) to set temperature coefficient to a different value. See Addendum 3, "Calculating Temperature Coefficients", page 35 for information on determining appropriate temperature coefficients.

1. Turn on the meter.

All the LCD segments display for a few seconds. The LCD switches to the conductivity measurement mode.

2. Press MODE to select TDS mode. The TDS indicator should show at the bottom of the display.

3. Pour a small volume of your calibration standard into a clean container. There should be enough standard solution to immerse the tip of the conductivity cell about 1/2".

4. Rinse your probe with deionized water, then in a small amount of calibration standard.

5. Immerse the probe into the container of standard solution, and CAL. The CAL indicator will flash in the upper right corner of the display.

6. Use the MI/▲ or MR/▼ to scroll the display to the correct value of your calibration standard. Be sure to use the value for the normalization temperature for which your meter is set.(usually 25°C or 20°C).

NOTE: At any time during the calibration, you may exit the Calibration mode and return to Measurement mode by pressing the CAL/MEAS button. The meter will keep old calibration data and will be unharmed.

7. Press ENTER to store calibration. Return to the MEAS mode to confirm.

8. Repeat steps 1-7 for other ranges.

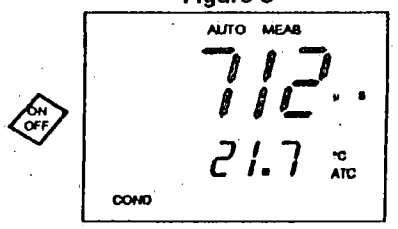
5. Measurement

Measurements With Automatic Temperature Compensation

1. Switch on the meter.

The MEAS annunciator together with the auto-ranging annunciator (AUTO) displays on the top center of the LCD. See Figure 8, right.

Figure 8



2. Rinse the electrode with deionized or distilled water before use to remove any impurities adhering to the electrode body. Shake or air dry.

useful for [redacted] iostic purposes.

To exit from the program after you confirm your choice or to abort from SETUP, press CAL/MEAS to return to MEAS. **Make sure you press ENTER to confirm your option in each program.** Exiting the calibration mode without pressing enter will cause the meter to disregard your new setting and retain the old setting.

NOTE: Press CAL/MEAS to exit SETUP at any time.

Setup programs at a glance

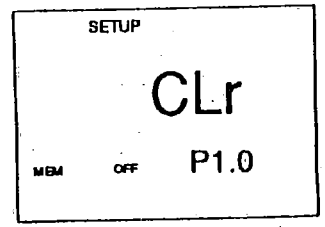
Program	Function	Options Setting	Default
P1.0	Memory clear	ON, OFF	OFF
P1.1	% Temperature Coefficient 0-10%	Select value 0-10%/°C	----- (no cal)
P1.2	Calibration status display	Indication only	----- (no cal)
P2.0	Ready On/Off	ON, OFF	ON
P2.1	Auto-Off	ON, OFF	ON
P2.2	Reset	ON, OFF	OFF
P2.3	Temperature Normalization	Select 20°C or 25°C	---- (no cal)
P2.4	Cell constant selection	Select cell constant	-------
P3.0	Conductivity to TDS conversion factor	Select value only 0.40 to 1.0	---- (no cal)
P3.1	TDS Units	ppm and ppt or mg/l, g/l	---- (no cal)
P4.0	Baud rate	2.4, 4.8, 9.6, 19.2 Kbps	9.6 Kbps
P4.1	Parity	1, 2, 0	2
P4.2	Stop bit	1, 2	1

7. Using Setup Programs

Program 1- Stored Values Programs

P1.0: Memory Clear

Figure 10

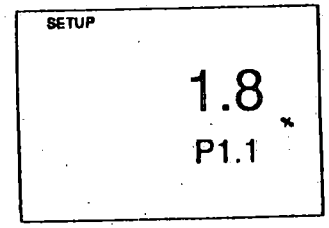


The memory clear option can clear all memory values, but does not affect calibration. Toggle the annunciator ON using MI/▲ or MR/▼, and press ENTER to confirm the selection and clear memory. See Figure 10, right.

NOTE: Data cannot be selectively deleted. All 16 readings in memory will be cleared.

P1.1: Temperature Coefficient Adjustment

Figure 11



The temperature coefficient is the amount of change in conductivity per degree centigrade, and is expressed in percent per °C. Select the appropriate temperature coefficient, from 0.0 to 10.0 %/°C, depending on the type of solution measured. See Figure 11, right.

Press MI/▲ or MR/▼ to increase or decrease the temperature coefficient. Press enter when the value matches the temperature coefficient of your solution.

If you do not know the temperature coefficient of your liquid you can determine the correct value using the procedure in Addendum 3 "Calculating Temperature Coefficients", page 35.

P1.2: Calib[redacted]n Status Display

P1.2 is a view only program to show correct calibration sections. See Figure 12, right.

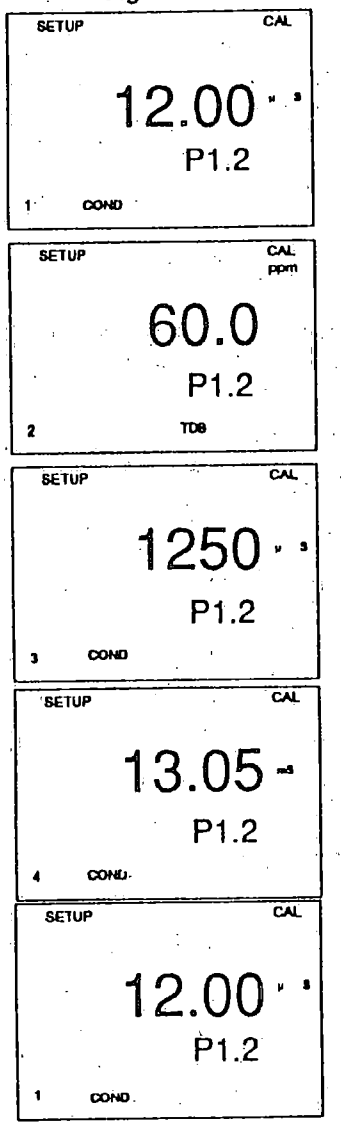
The meter can store calibration data for each of its 5 ranges, one value in each measurement range. The secondary display shows P1.2. The measurement range number (1, 2, 3, 4 and 5) is indicated in the lower left corner of the display. The calibration values and units are shown in the larger display. Press MI/▲ or MR/▼ to view the calibration data for ranges 1 to 5. Ranges that have not been calibrated will display "----".

The display will indicate "ppm", "ppt", "µ S", or "m S" depending upon whether the range was calibrated in conductivity or TDS mode (35607-20, -30 only). Only one parameter can be calibrated in each conductivity range. The last calibration replaces the prior calibration for each range.

NOTE: The 2nd range was calibrated in the TDS mode at the value of 60.0 ppm. The mode annunciators related to the TDS calibration (ppm, TDS, or conductivity) are displayed.

To exit the SETUP mode, press CAL/MEAS. Press ENTER to leave P1.2 and scroll into the next SETUP parameter.

Figure 12



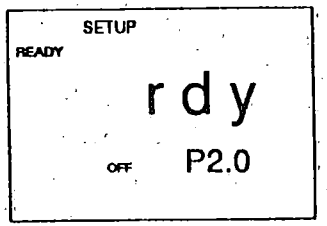
NOTE: **If the "Conductivity to TDS conversion factor", Program P3.0, page 15 is changed, ranges that have been calibrated for TDS will display "----".** The meter functions using the previous TDS calibration values and the new TDS factor but some loss of accuracy results. These ranges should be recalibrated for maximum accuracy.

Program 2 - General Operation Programs

P2.0: Ready mode selection

When the READY function is ON, the READY indicator displays readings are stabilized. Switch READY options ON or OFF by pressing the MI/▲ or MR/▼ as indicated by ON or OFF in the display, followed by ENTER. See Figure 13, left.

Figure 13



Under the factory default, the option is ON.

ON READY annunciator appears when variation is within 1 digit per 15 seconds.

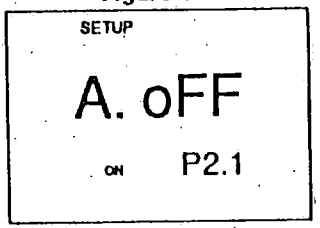
OFF READY annunciator does not appear.

Pressing ENTER will confirm the setting either (ON or OFF) and advance the setup to the next program. See also the READY function under "5. Measurement", page 7.

P2.1: Auto-Off selection

To conserve power, the meter has an AUTO-OFF feature. The AUTO-OFF function automatically turns off the instrument power 20 minutes after the last button is pressed. You can switch the AUTO-OFF function OFF by using MI/▲ or MR/▼ to display OFF, and press ENTER. See Figure 14, right.

Figure 14



Under default condition, the AUTO-OFF function is ON.

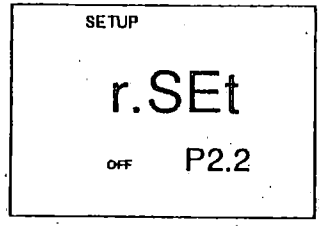
ON Meter switches off automatically 20 minutes after the last keyed operation

OFF Meter operates continuously until manually switched off with the ON/OFF button.

Pressing ENTER will confirm the setting (ON or OFF) and advance the setup to the next program.

P2.2: Reset

Figure 15



P2.2 allows you to reset and erase both conductivity and TDS calibrations. Toggle the annunciator ON by pressing MI/▲ or MR/▼, and ENTER. The meter automatically switches off. You need to power ON the instrument before proceeding with any other functions. See Figure 15, right.

ON Erases the meters calibration points.

OFF Lets the meter retain current calibrations.

Pressing ENTER confirms the selection (ON/OFF) and advances the meter to the next program.

P2.3: Temperature Normalization 20 or 25°C

The conductivity of solution varies greatly with temperature. The automatic temperature compensation (ATC) of the conductivity meters adjusts conductivity measurements to factor out the conductivity changes in the readings caused by temperature. Readings are usually referenced to or normalized at a standard temperature (20°C or 25°C), and ATC gives the corrected readout of the equivalent conductivity or TDS of the solution normalized at 20° or 25°C. This feature allows conductivity readings from various temperatures to be compared.

Use MI/▲ or MR/▼ to toggle the setting of the temperature normalization to 20 or 25°C shown on the display. Press ENTER to select the normalization temperature.

Under the default condition, the meter normalizes all readings to 25°C. See Figures 16 and 17, below.

Pressing ENTER confirms the normalization temperature setting (20°C or 25°C) and advances the meter to the next program.

Figure 16

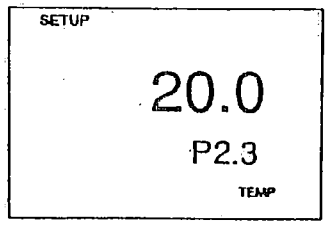
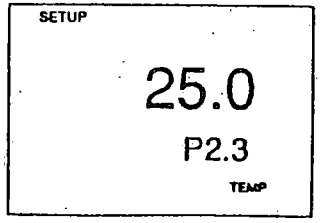


Figure 17



P2.4: Cell Constant Selection

Select the nominal cell constant depending on the electrode you use. The standard electrode included with the meter has a nominal cell constant of 1.0. With this program, you can use an electrode with K=0.1, for low conductivity measurements below 20 µS, or an electrode with K=10.0, for high conductivity measurements above 20 mS. The table below shows the displayable measurement ranges.

Table 1

Nominal cell constant	Ranges available
K = 0.1	0.000 – 1.999 µS
K = 1.0	00.0 – 19.99 µS
K = 10.0	0.00 – 199.9 µS
	0 – 1999 µS
	0.0 – 19.99 mS
	0.0 – 199.9 mS
	0 – 1999 mS

While in program P2.4, press the MI/▲ or MR/▼ key to toggle to the correct electrode cell constant. Press ENTER to confirm. The display shows the selected cell constant. Press CAL/MEAS to skip P2.4.

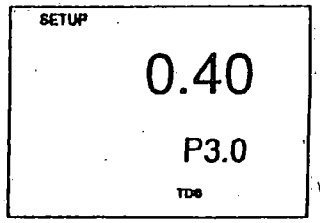
Program 3 - TDS Programs (models 19820-20 and -30 only)

P3.0: Conductivity to TDS Conversion Factor

You can adjust the Conductivity-to-TDS conversion factor from 0.4 to 1.0. The Conductivity to TDS conversion factor for a particular solution is a multiplication factor that relates the measurement of conductivity in µS/cm (or mS/cm) to its equivalent reading in ppm (or ppt). This factor is unique for a specific solution. The default setting is 0.5.

Press MI/▲ or MR/▼ to increase or decrease the Conductivity-to-TDS conversion factor. Any values less than 0.4 or more than 1.0 causes an error. Press enter when the value matches the Conductivity-to-TDS conversion factor of your solution. See Figure 18, right.

Figure 18

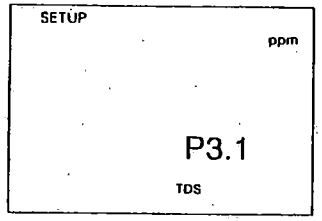


If you do not know the conversion factor for your solution see the table in Addendum 1, page 34. Many Conductivity Calibration Solutions will list

conversion factors on their labels. For the highest accuracy in your specific **sample** solution, see the method and calculation given in Addendum 2, page 35.

P3.1: TDS Units ppm/ppt or mg/l and g/l

Figure 19

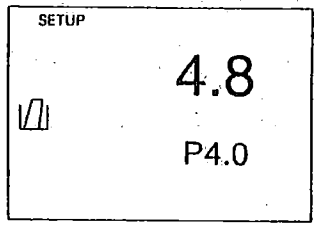


Select either of two units for the TDS measurement: ppm or mg/l, and ppt or g/l.

In default, the TDS measurement unit "ppm" shows on the display. To select the TDS measurement in mg/l, select the TDS units using MI/▲ or MR/▼ to display units preferred. See Figure 19, right. Press ENTER to confirm the selection, and the meter advances into the next program. The meter always displays ppm and ppt units or mg/l and g/l per your selection in program P3.1 and depending on the measurement range.

Program 4 - Communication Programs (model WD-35607-30 only)

Figure 20

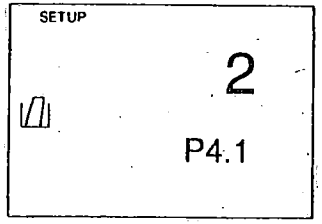


This program allows you to set up communication parameters of the 19820-30 enabling proper communication with the printer or computer of choice.

P4.0: Baud Rate

Select a baud rate of 2.4, 4.8, 9.6, or 19.2 kbps to match the data receiving device. Under default conditions, the baud rate is set to 9600 bps. See Figure 20, right.

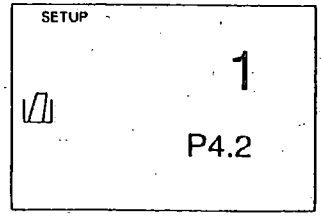
Figure 21



P4.1: Parity

Parity check allows the receiving unit to monitor the integrity of the data which the meter transmits. To accommodate for the variances in standards used, three different parity options are provided. The default parity is even (2). You may also select odd parity (1) or no parity (0). The parity setting must match the receiving device. See Figure 21, right.

Figure 22



P4.2: Stop Bit

The default is (2) stop bits. The number of stop bits selected in sending and receiving devices must be matched for best results (in terms of speed). See Figure 22, page 16.

8. Setup with optional printer and RS-232 output

For models WD-35607-30 only.

Meters with RS-232 provide a unidirectional output for transmitting readings to a printer or computer. The data is supplied in ASCII format. ASCII format allows data to be output to most printers or imported to most popular software programs.

A. Using the meter with a printer

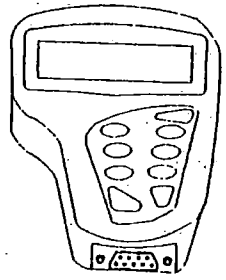
Minimum printer requirements to print data:

1. A printer with a serial interface. You will need a 9 pin to 25 pin converter. Choose a converter with a 25 pin male connector on one side and a 9 pin male connector on the other.

2. Printer must have the option to receive 8 data bits; even (2), odd (1) or none (0) parity bits; and 1 or 2 stop bits.

Note: To print data, connect the meter directly to the printer. You do not need to connect the meter to a computer.

Figure 23



Connecting the cable to the meter

1. Carefully open the port cover at the heel of the meter. Do not use excessive force. See Figure 23, right.

2. Noting the orientation of the RS-232 connector, plug the male connector into the RS-232 port on the meter.

3. Tighten the two screws on the sides of the male RS-232 connector.

Connecting the cable to the printer

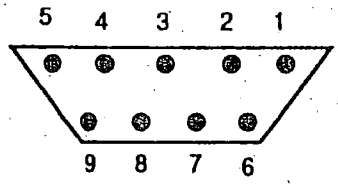
1. Locate the cable port on the printer. If the printer has a 9 pin connector, attach the cable as described above in steps 2-3.

2. If the printer has a 25 pin connector, you must use a 25 pin to 9 pin converter. Attach the cable (with converter) as described in steps 2-3 above.

NOTE: For the meter and printer to properly communicate and transfer data, the pin configuration on both units must match. To determine this, compare the pin configuration of your printer (see the printer manual) with the pin configuration of this meter (see below). Since there is no industry standard for the pin configuration on printers, you might need to configure the pins.

The meter has a 9 pin female RS-232 connector with this configuration:

Pin number	description
1	-
2	Transmit Data
3	-
4	DSR (Data Set Ready)
5	GND (Ground)
6	-
7	CTS (Clear to send)
8	-
9	-



If the printer has a 25 pin connector, use a 25 pin to 9 pin converter. Use the following configuration:

Pin number of meter	Pin number of printer
2 (TXD)	3 (RXD)
4 (DSR)	20 (DTR)
5 (GND)	7 (GND)
7 (CTS)	4 (RTS)

Abbreviations:

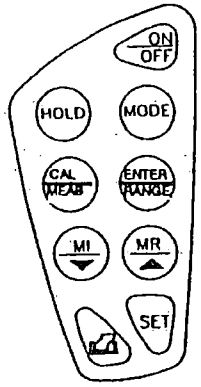
(TXD) = Transmit data **(RXD)** = Receive data
(DSR) = Data set ready **(DTR)** = Data terminal ready
(GND) = Ground **(CTS)** = Clear to send
(RTS) = Request to send

Printing data

Press PRINT (printer icon) on the meter to send data to the printer. See Figure 24, right.

"Or" on the LCD, printer, or computer screen means the probe is shorted or is immersed in a solution that is too high in conductivity for that range.

Figure 24

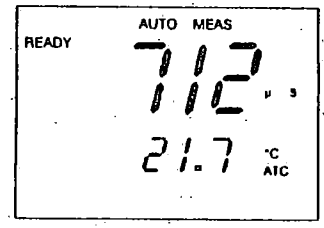


B. Using the meter with a printer to download stored memory

The meter only prints measurements that are on the display, either "live" or stored measurements. To print stored measurements, first recall measurements from memory. To recall a measurement from memory, the meter must be in the MEAS function (not CAL), and in the same measurement mode it was in when the measurement was stored.

Examples: To recall a measurement stored as a conductivity value, the meter must be in the MEAS conductivity function. See Figure 25, right.

Figure 25



1. To send readings in memory to printer, set up the meter as described above.
2. While the meter is in the MEAS function, press MR/▼ to display the last measurement value stored in memory.
3. Press PRINT to print the last value.
4. Press MR/▼ again to recall the second-to-last measured value stored in memory.
5. Press PRINT to print the second-to-last value.
6. Repeat steps 5 and 6 above until all stored values are printed.
7. To print other measurement values stored in memory, press CAL/MEAS to return to measurement mode.
8. Select the next measurement mode (COND or TDS) for the rest of the measurement values stored in memory.
9. Repeat step 2 through 6 above until all values stored in the same measurement function are printed.

C. Using the meter with a computer and the OAKTON Datalog ASSIST Software.

Minimum Computer Requirements to run software:

- IBM® PC/XT/AT® or 100% compatible (DOS 3.0 or later)
- 640K RAM memory
- Monitor
- RS-232 serial port
- 3 1/2" or 5 1/4" floppy disk drive
- Reads double-sided, high-density disks

The OAKTON Datalog Assist Software is a very basic data acquisition software that provides a convenient way to capture data for future analysis. Data is stored in the ASCII format. This allows the data to be

transferred a variety of popular software programs.

Both the 3 1/2" and 5 1/4" disks includes these files:

ONDATA EXE: the data acquisition software

README.BAT Batch file that will display the contents of the README.DOC file

README DOC: Contains information on the contents of the disk and any software updates that occur after the printing of this manual

DEMO.BAS a simple BASIC language communication program.

To verify that your disk contains these files, type "DIR" at the DOS prompt for directory. Data files also appear on the directory as they are created.

If you are run **ONDATA.EXE** from the floppy disk and do not specify a file name, the received data is saved to a file called **ONDATA** in ASCII format on the floppy.

Installing the OAKTON Datalog Assist Software

NOTE: Prior to installing the software you should backup the diskette.

1. Turn on your computer.

2. Insert either the 3 1/2" or 5 1/4" disk provided with the meter into the floppy disk drive of your computer. Be sure "write protect" on disk is off or unlocked on the 3 1/2 disk only.

3. Create a directory on your hard drive called ONDATA. To do this type "MD ONDATA" from the C: prompt.

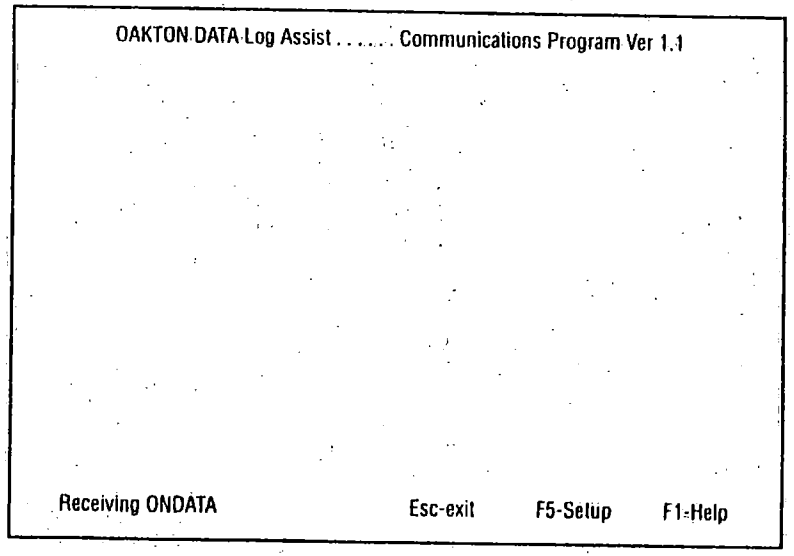
4. Change into the ONDATA directory by typing "CD ONDATA"

5. Copy the entire contents of the OAKTON Datalog ASSIST software disk to the ONDATA directory by typing "COPY A:*.*"

You may type "READ ME" at the DOS prompt to get information on updates to the software and about the files on the OAKTON Datalog ASSIST software disc.

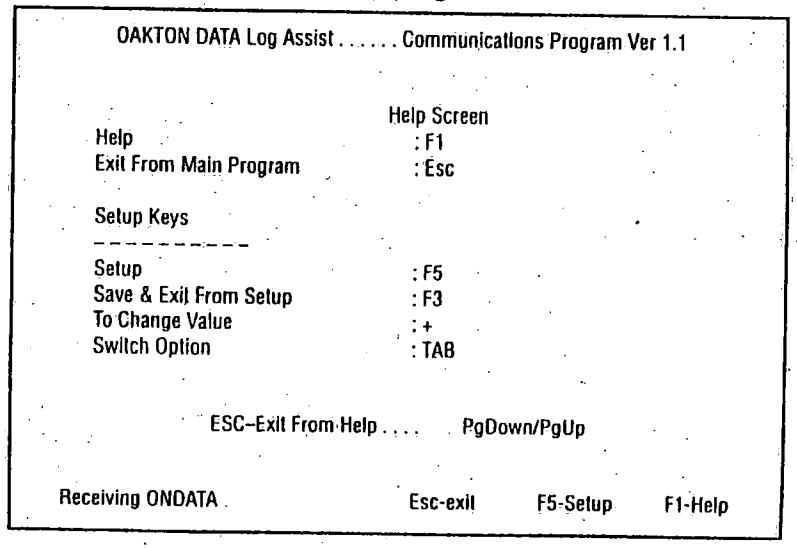
Starting the Data Log Assist Software

From the ONDATA directory type "ONDATA". The following screen will appear.



Getting Help

Push F1 to enter the Help program. The first screen of Help explains the function keys used in the Setup program.



Use the "Page Up" or "Page Down" to advance to the second screen of **Help**. This screen indicates the proper file name extensions you must use when naming files (done in the **Setup** program) that import into other software programs. No extension is needed if you are not importing the data into another program.

```
OAKTON DATA Log Assist . . . . . Communications Program Ver 1.1

                        Help Screen
File Name Length
----------
Maximum length of file name is 12 characters
File Name Extension Format
----------
Lotus® 123®          : use File name with [.PRN] extension
Excel®               : use File name with [.CSV] extension
WordStar®            : use File name with [.DOC] extension
Norton Editor®       : no extension required.
Note: This program uses computer date and time. Please
      set your computer date and time before executing
      this program.
                ESC-Exit From Help . . . .  PgDown/PgUp
Receiving ONDATA              Esc-exit   F5-Setup   F1-Help
```

Push **Esc** to exit the **Help** program.

Setting the communication parameters

The meter is capable of different communication configurations for baud rate, parity bits and stop bits. The values chosen for these parameters for the meter must match those chosen for the computer.

1. Push **F5** to enter the **Setup** program. You will see the following screen:

```
OAKTON DATA Log Assist . . . . . Communications Program Ver 1.1

                        Setup

Select Baud Rate        : 9600
Select Parity Bit       : EVEN (2)
Select Stop Bit         : 1
Select Com Port         : 1
Enter file name         :

          To change value  : +
          Switch option    : TAB
          Save & Exit      : F3

Receiving ONDATA              Esc-exit   F5-Setup   F1-Help
```

2. Set each parameter to the same value as the value chosen in the Setup program of the meter or vice versa. To set these parameters in the meter, see Program P4.0, page 16 for complete instructions.

The cursor will flash under the parameter that is currently selected. You can change the value of the currently selected parameter by using the "+" key.

The following settings are available.

Baud rate: 2400, 4800, 9600, 19200

Parity bit: NONE (0), ODD (1), EVEN (2).

Stop bit: 1, 2

Com port (the communication port the cable is hooked to on the computer): 1, 2

3. After choosing a value for a parameter, push the "**TAB**" key to move to the next line. Continue until all parameters (baud rate, parity bit, stop bit and com port) are chosen. Push "**TAB**" to move to the next line, "Enter file name".

4. Enter a file name. If the data is imported into another software program, use the proper file extension as shown on the second screen of **HELP**. The entire file name, including the period and three-letter exten-

sion (for example ".PRN" for Lotus® 1-2-3®), can be a maximum of 12 characters. If the data is not imported into another software program, then a file extension is not required. Push "enter" to enter the file name.

5. Push **F3** to save the parameters and the file name, and to exit the **Setup** program. The file name is now listed in the directory either on disk if you are working from the disk, or on the hard rive if the software was copied to the hard drive.

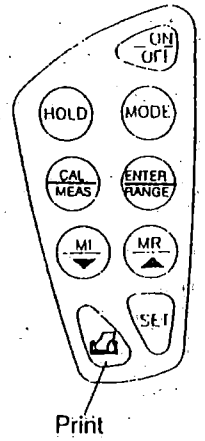
IMPORTANT: If you exit this program by pressing **Esc** instead of **F3**, all information just selected is lost. All parameters and the file name convert back to those that were shown when you first entered the **Setup** program.

6. No matter which key (either **F3** or **Esc**) you pressed to exit, the **Setup** dialog box will disappear. The **ONDATA** screen appears and a blinking "Receiving (your new file name here)" will appear in the bottom left corner. ESC, EXIT, F5-Setup, and F1 Help will display across the rest of the bottom of the screen.

D. Sending data to the computer

1. Press PRINT on the meter to send data to the computer. See Figure 26, below.

Figure 26



2. The data appears on the ONDATA screen as follows:

```
OAKTON DATA Log Assist..... Communications Program Ver 1.1

COND: 1990     Temp: 25.0   Date: 01-19-1993     Time: 13:50:10

Receiving ONDATA                    Esc-exit   F5-Setup   F1-Help
```

Note: If your meter is set for TDS measurement the screen will show "TDS:" instead of "COND:"

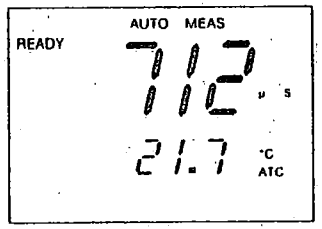
3. Continue to push PRINT on the meter to send data to the computer.

4. When all data has been collected, push **Esc** to quit the **ONDATA** program and store the data under the file name.

E. Using the meter with a computer and the OAKTON Datalog Assist Software to download stored memory

The meter only sends measurements to the computer that are on the display, either "live" or stored measurements. To download stored measurements, first recall measurements from memory. To recall a measurement from memory, the meter must be in the MEAS mode (not CAL), and in the same measurement mode it was in when the measurement was stored. Date and time of measurement are not stored. When downloading stored measurements, the date and time on screen will be the current date and time. Examples: To recall a measurement stored as a conductivity value, the meter must be in the MEAS function. To recall a measurement stored as a TDS value, the meter must be in the MEAS TDS mode. See Figure 27, right.

Figure 27



1. To download stored readings in memory to a computer, set up the meter and computer as described in Section 9 C of this manual.

2. While the meter is in the MEAS function, press MR/▼ to display the last measured value stored in memory for that measurement mode.

3. Press PRINT to print the last value.

4. Press MR/▼ again to recall the second-to-last measured value stored in memory.

5. Press PRINT to print the second-to-last value.

6. Repeat 4 and 5 above until all measurement values stored are printed.

7. To print other measurement values stored in memory that are in other measurement modes, press CAL/MEAS to return to measurement mode.

8. Select the next measurement mode (COND or TDS) for the measurement values stored in memory.

9. Repeat steps 2 through 5 above until all values stored in the same measurement mode are downloaded.

10. Repeat steps 7 through 9 above until all measurement values stored in memory are downloaded.

11. All values are numbered in the order they were stored in memory, regardless of measurement mode. For example, MEM: 093.5 µS can be followed by MEM: 165 ppm, then MEM 2: 93.5 µS. When recalling in conductivity mode, only MEM 2: 93.5 µS and MEM 0: 93.5 µS will be recalled and downloaded to the file in the PC. Tab to ppm mode to

recall, and down loaded to the file in the PC MEM: 1, 165 pp

12. Press ESC to store the data under the file name and exit from the OAKTON DATALOG ASSIST SOFTWARE with DOS.

F. Viewing a data file

1. You can view a data file using any text viewer that can open an ASCII file including the "TYPE" and "EDIT" commands included with most DOS programs. At the DOS prompt, type "TYPE", followed by a space, and your data file name at the DOS prompt. The contents of the file appears, but you will not be able to change data.

2. To view a data file and change any information in the file, type "EDIT", followed by a space, and the file name at the DOS prompt. The contents of the file appears. Use the arrow keys on the computer to move the cursor around.

3. Press ENTER to go into FILE. Select the exit option. If you made changes to the file, the computer will ask if you want to save the change. Tab to **Y** for yes or **N** for no.

G. Printing Errors

If the LCD shows ERR, or the meter prints garbage, or prints nothing:

Printer or computer might not be connected properly; check cable connections. Also, the dip switch setting could be set wrong. Check dip switches for baud rate, data bits, and parity on the printer.

9. Probe Care and Maintenance

Keep the conductivity probe clean. Rinse the probe twice, and gently swirl it while you take readings. For best accuracy, soak a dry probe for at least 5 to 10 minutes or longer before calibration. Wash the probe with deionized or tap water before storing it. Never scratch the platinum portions with a hard substance. Do not strike the probe against any hard surface.

Do not make continuous contact with your solutions. Readings will rise over a period of time while you soak your probe.

Do not immerse the probe in oily solutions. Clean the electrode thoroughly by stirring it in mild detergent bath. Wipe the probe with a soft tissue paper. Wash thoroughly in tap water and then in deionized water. Recalibrate the meter after cleaning the probe.

10. Temperature Calibration

The meter allows two types of temperature calibrations called "single point" and "two point" calibrations. Single point calibration is more commonly used. A two point calibration is needed only if you are using a replacement probe. The built-in temperature sensor included in the probe is factory calibrated, and does not require two point calibration.

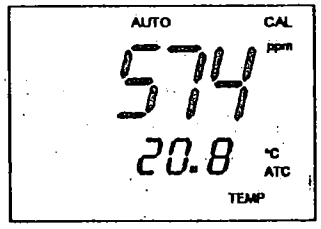
Use a temperature standard in the solution with your probe. Compare the value to a known standard or from the value of an NIST thermometer, to check if temperature calibration is needed.

1. Press MODE and select temperature mode (TEMP). Make sure you are in MEAS before you begin calibration.

2. Press CAL.

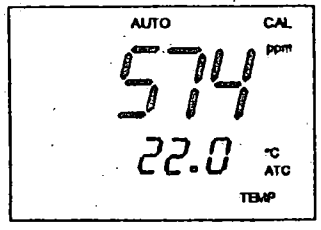
Pressing CAL brings you into the calibration mode. See Figure 28, right.

Figure 28



3. When both the reference thermometer and the meter temperature display stabilizes, press MI/▲ or MR/▼ to adjust the meter reading to agree with your temperature standard. For example, in Figure 29, right, the desired temperature reading corresponding to a temperature work standard is 22.0°C. Use the MI/▲ to increase the temperature reading to 22.0°C.

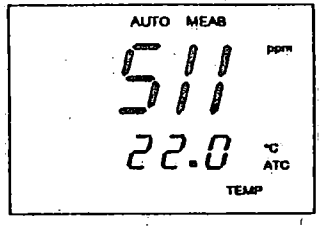
Figure 29



NOTE: Temperature calibration with the probe is restricted to +/- 5°C from the initial value displayed during calibration.

4. Press ENTER/RANGE to confirm the selected temperature. The meter reverts to the measurement mode. See Figure 30, right. The meter is now precalibrated for accurate readings and automatic temperature compensation.

Figure 30



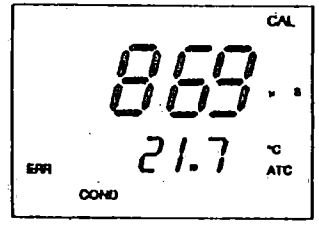
NOTE: In this example, Figure 30, the new TDS value changes and reflects the TDS value at the new temperature range if your temperature coefficient is not zero.

Errors in Calibration

When an error occurs during the calibration procedure, the display shows an ERR.

See Figure 31, right.

Figure 31



For conductivity and TDS measurements, the display shows "ERR" when you try to change the slope by more than ±20%. "ERR" displayed warns you of improper probe use, a bad calibration solution, or bad calibration technique.

For temperature calibration, the "ERR" displays once the calibrated value input exceeds the initial display value by 5°C.

11. Zero Adjustment

Zero Adjustment

For models 19820-10, -20, -30:

Zero adjustment is necessary only if the meter does not show zero when the probe is dry and in air. Make sure the probe is washed with deionized water, and air dried.

Zeroing the Meter

1. Connect a clean, air dried conductivity probe to the meter. Use both BNC socket and the phono socket.

2. Press CAL/MEAS and then turn ON the meter.

3. Release the ON key, and then the CAL/MEAS key. A blinking "ECO.3" displays.

4. Press ENTER/RANGE three times.

5. 0.00 µS displays indicating the beginning of zero adjustment for your first range.

6. Press ENTER.

7. A 5 digit number appears. This number will be close to 20,000. A "2" appears in the secondary display.

8. Wait for 10 seconds and press ENTER.

You completed the Zero Adjustment for your first range.

9. 0.0 µS displays. You are now at the beginning of your second range.

10. Press ENTER to zero adjust your second range.

Press CAL/MEAS instead of ENTER to skip to another range.

12. Error Messages

LCD Display	Indicates	Cause	Solution
Err. 1 (in primary display)	Memory write error	Instrument too old (>10 years). Hardware failure.	Return if necessary.*
Err. 2 (in primary display)	Memory checksum error	Batteries too weak. Hardware failure.	Press ENTER, then turn off meter. Change batteries Recalibrate. Return.*
Err annunciator	Unrecognized input from keypad	Wrong input in selected mode.	Release key. Select valid operations depending on mode.
CAL & Err annunciators blink	Calibration error	Wrong value input at calibration. Dirty probe.	Check value, clean probe. See "Probe Care and Maintenance", page 27.
Printer & Err annunciators blink	Not able to print	Printer is off. Cable is faulty.	Check cable connections & printer settings.
Err. 3	ADC error	Faulty hardware.	Return.*
Err. 4	Keypad stuck error	Faulty hardware.	Return.*

For conductivity and TDS measurements, "ERR" on the display shows whenever the calibration value input into the meter is different from the initial value displayed by more than 20%. "ERR" displayed warns you of improper probe use, a bad calibration solution, or bad calibration technique.

You will see the errors in the primary display (the row of larger digits). To eliminate the errors, switch off the meter and switch it ON again. All keys become inactive. If error persists, or the meter shows incorrect values, return the meter.*

* See "Warranty" and "Return of Items".

13. Troubleshooting

Problem	Cause	Solution
Power on but no display	a) Batteries not in place. b) Batteries not in correct polarity. c) Weak batteries.	a) Insert batteries. b) Re-Insert batteries in correct polarity. c) Replace batteries or attach AC adapter.
Unstable reading	a) Dirty probe. b) Low conductivity. c) External noise pickup. d) Broken probe.	a) Clean the probe and recalibrate. b) Avoid atmospheric contact with solution. c) Move away from noise. d) Replace probe.
Not able to calibrate	a) Dirty/ Oily probe. b) Incorrect TDS factor (in TDS mode). c) Incorrect probe cell constant.	a) Clean probe. See "Probe Care & Maintenance", page 27. b) Set the correct TDS factor prior to TDS calibration. c) Replace probe.
"Or" on LCD, printer or computer screen	a) Probe is shorted b) Probe in too high conductivity solution for range	a) Check probe. b) Use different solution.

14. Specifications

	Conductivity	TDS	Temperature
Ranges:	0.00 –19.99 µS	0.00 –9.99 ppm	0–80°C
	0.0 –199.9 µS	10.0 –99.9 ppm	(Epoxy platinum probe)
	0 –1999 µS	100 –999 ppm	0–100°C
	0.00 –19.99 mS	1.00 –9.99 ppt	(Glass/Platinum probe)
	0.0 –199.9 mS	10.0 –99.9 ppt	
		100 –200 ppt	
Resolution:	0.01 µS	0.01 ppm	0.1°C
	0.1 µS	0.1 ppm	
	1 µS	1 ppm	
	0.01 mS	0.01 ppt	
	0.1 mS	0.1 ppt	
		1 ppt	

Cell constant: 1 with probe supplied. Cell constant of 0.1 is best for very low ranges (<10 µS) and a cell constant pf 10 is best for higher ranges (100 mS).

Specifications continued

Temperature compensation: auto or manual

Temperature Coefficient Adjustment: 0.0 to 10.0% per °C

Power: Four 1.5V batteries (AAA), approx. 60 hrs. or 9 VDC unregulated AC adapter

Operating temperature: 0 –50°C

Dimensions: meter: 7.5"L x 3.5"W x 1.75"H, boxed: 9.2"L x 8.5"W x 2.75"H, probe only: 1/2"Dia. x 5"L with 2.5 ft cable

Weight: meter: 1 lb (0.5 kg), probe: 0.35 lb (0.2 kg), complete kit: 2 lbs (0.9 kg)

Accuracy: Conductivity/TDS ±1% FS in all 3 lower ranges, ±1% FS accuracy within ±20% of calibration value in the higher ranges. Better accuracies are possible in the very high and very low ranges if 10 and 0.1 cell constant probes (respectively) are used.

Temperature: ±0.5°C

15. Accessories

WD-59002-51 110 VAC Adapter

WD-59002-56 220 VAC Adapter

WD-35615-09 RS-232 Cable 9 pin

WD-35615-06 Replacement Electrode Holder

See Addendum 1, Page 34 for TDS values for the solutions below.

WD-01489-41 23 µS Cal. Standard, 1 qt

WD-01489-85 84 µS Cal. Standard, 500 ml

WD-01489-43 447 µS Cal. Standard, 1 qt

WD-01489-70 1413 µS Cal. Standard, 500 ml

WD-00653-15 1500 µS Cal. Standard, 1 pint

WD-01489-44 2070 µS Cal. Standard, 1 qt

WD-01482-71 2764 µS Cal. Standard, 500 ml

WD-00653-89 8974 µS Cal. Standard, 1 pint

WD-01481-52 12880 µS Cal. Standard, 500 ml

WD-00653-50 15,000 µS Cal. Standard, 1 pint

WD-00653-80 80 mS Cal. Standard, 1 pint

WD-19850-00 447 µS Cal. Standard, 20 single use pouches

WD-19850-10 1413 µS Cal. Standard, 20 single use pouches

Accessories continued

WD-19850-20 2764 µS Cal. Standard, 20 single use pouches

WD-19850-30 15,000 µS Cal. Standard, 20 single use pouches

WD-19820-50 Replacement platinum/epoxy conductivity probe with built-in temperature sensor. Cell constant = 1.0.

WD-19820-53 Replacement platinum/epoxy conductivity probe with built-in temperature sensor. Cell constant = 0.1.

WD-19820-54 Replacement platinum/epoxy conductivity probe with built-in temperature sensor. Cell constant = 10.

Call your OAKTON distributor for replacement probes.

16. Warranty

This product is warranted to be free from defects in material and workmanship for a period of one year from date of purchase. If repair or adjustment is necessary and has not been the result of abuse or misuse within the one year period, please return—freight prepaid—and correction will be made without charge.

Out-of-warranty products will be repaired on a charge basis.

17. Return of Items

Authorization must be obtained from your OAKTON Distributor before returning items for any reason. When applying for authorization, please include data regarding the reason the items are to be returned.

NOTE: We reserve the right to make improvements in design, construction, and appearance of our products without notice.

Addendum 1: Conductivity to TDS Conversion Factors

1. Factor– the conductivity to ppm TDS conversion factor. Multiply conductivity by this factor to get ppm TDS for the type of TDS reading needed. Enter this factor into your Cole-Parmer TDS/conductivity meter in Setup, Program 3. The meter automatically gives the most accurate TDS readings.

2. 442– a formulation that most closely represents the conductivity to ppm relationship, on average, for naturally occurring fresh water.

3. TDS Your Material– These columns are for you to write in your application specific conductivity to ppm values and conversion factors for future reference. See page 35.

Factor = actual TDS ÷ Actual Conductivity @ 25°C

Conductivity	TDS KCl		TDS NaCl		TDS 442 [2]		TDS Your Material [3]	
at 25°C	ppm Value	Factor [1]	ppm Value	Factor [1]	ppm Value	Factor [1]	ppm Value	Factor
23 µS	11.60	0.5044	10.69	0.4652	14.74	0.6409		
84 µS	40.38	0.5048	38.04	0.4755	50.50	0.6563		
447 µS	225.6	0.5047	215.5	0.4822	300.0	0.6712		
1413 µS	744.7	0.5270	702.1	0.4969	1000	0.7078		
1500 µS	757.1	0.5047	737.1	0.4914	1050	0.7000		
2070 µS	1045	0.5047	1041	0.5030	1500	0.7246		
2764 µS	1382	0.5000	1415	0.5119	2063	0.7463		
8974 µS	5101	0.5685	4487	0.5000	7608	0.8478		
12880 µS	7447	0.5782	7230	0.5613	11,367	0.8825		
15000 µS	8759	0.5839	8532	0.5688	13,455	0.8970		
80 mS	52,168	0.6521	48,384	0.6048	79,688	0.9961		

Addendum 2: Calculating TDS Conversion Factor

The meter can be calibrated using TDS calibration standard solutions. The calibration standard only needs to give the TDS value at a standard temperature such as 25°C. To determine to the conductivity-to-TDS conversion factor use the following formula:

Factor = actual TDS ÷ Actual Conductivity @ 25°C

Definitions:

Actual TDS: Value from the solution bottle label or as a standard you make using high purity water and precisely weighed salts.

Actual Conductivity: Value measured using a properly calibrated Cole-Parmer Conductivity/TDS/Temperature meter.

Both the Actual TDS and the Actual Conductivity values must be in the same magnitude of units. For example, if the TDS value is in ppm the conductivity value must be in µS; if the TDS value is in ppt the conductivity value must be in mS.

Check this number by multiplying the conductivity reading by the factor in the above formula and the result is the TDS in ppm.

Addendum 3: Calculating Temperature Coefficients

To determine the temperature coefficient of your sample solution use this formula:

$$TC = 100 \times \frac{C_{T2} - C_{T1}}{C_{T1}(T_2 - 25) - C_{T2}(T_1 - 25)}$$

TC = Temperature coefficient

C_{T1} = Conductivity at Temp. 1 C_{T2} = Conductivity at Temp. 2

T_1 = Temp. 1 T_2 = Temp. 2, 25 = 25°C

NOTE: A controlled temperature water bath is ideal for this procedure.

1. Immerse the probe into a sample of solution and adjust the temperature coefficient to 0% (that is, no compensation) by entering setup program P1.1 and pressing the MR/▼ button until the upper display shows 0.0 and press ENTER. Press CAL/MEAS to come back to conductivity measurements.
2. Wait for 5 minutes. Note T_1 and C_{T1} (conductivity at t_1).
3. Condition the sample and probe to a temperature (T_2 °C) that is about 5°C to 10°C different from T_1, and note the conductivity reading C_{T2}.

NOTE: R[illegible] your results for future reference in the back of this manual. Ideally T_1 and T_2 should bracket your measurement temperature, and should not differ by more than 5°C.

4. Enter the Temperature Coefficient in the meter. While in program P1.1, use MI/▲ or MR/▼.

5. Scroll to a required value from 0.0 to 10.0%/°C as determined in the procedure outlined above or in "4. Calibration", page 5.

6. Once this value is displayed, press ENTER to confirm the value. This coefficient will now be applied to all the meter readings.

Addendum 4: Calibration Tips

You only need **one** calibration for measurement throughout the entire range of the meter. If a range was not calibrated, the meter automatically detects the closest range calibrated and uses that calibration information. However, only the ranges that were calibrated have maximum accuracy.

If you are measuring in ranges greater than 20 mS or conductivity lower than 100 µS, **calibrate** the meter at least once a week to get specified ±1% F.S. accuracy. If you are measuring in the mid ranges and you washed the probe in deionized water and stored it dry, calibrate the meter at least once a month. Wet the probe for 10 minutes before calibrating or taking readings to saturate the probe surface and minimize drift. If you make measurements at extreme temperatures, calibrate the meter at least once a week.

Use only the conductivity/TDS probe specified for these meters. If you do not, you must measure the solution temperature separately and manually enter the solution temperature.

This manual printed on recycled paper.

Attachment Five

Black and Associates
Environmental Consultants, Inc.

Mayer Brothers Wood Preserving, Inc.

Project Log

Project: RCRA Compliance Well Sampling Date: 08/15/2022
Time started: 0706 Wind speed: 0 direction: 190
Temperature: 75°F Cloud cover: Clear
Time ended: 1633 Wind speed: 8 direction: 200
Temperature: 100°F Cloud cover: Clear
Personnel: JJB

CW/PZ Well #	Level to Water (feet)	Volume (gallons)	Total Depth (feet)	PH (SU)	Temp. (°C)	Specific Conductance	Sample Number and Time
PZ-2	13.45	0.85	16.17	7.36 --- 7.43	37.0 --- 37.9	1.899 --- 1.428	08152022 B 1145-1200
PZ-5	19	0.85	30.14	7.08 --- 7.01	25.6 --- 25.2	2.550 --- 2.584	08152022 E 1350-1400
PZ-9	18.53	0.21	17.29	6.91 ---	25.1 ---	3.710 ---	1045
CW-2	19.60	0.85	32.98	6.80 --- 6.72	27.3 --- 23.8	3,040 --- 5,110	08152022 A 1250-1300
Field Blank		2.06		6.25	36.2	7.04	08152022 C 1542-1612
Trip Blank		0.85		6.05	38.3	14.72	08152022 D 0830

BAEC & MBWP PH 4, 7, & 10 OK 0745-0805
BAEC & MBWP Conductivity 447,1413, and 2764 OK 0805-0829
PZ-9 only contained 6 oz. of water and therefore not enough for testing for Pentachlorophenol and Naphthalene.

Appendix L

Environmental Testing, Inc.'s Quality Manual

QUALITY MANUAL

FOR

ENVIRONMENTAL
TESTING, INC.

4619 N. Santa Fe • Oklahoma City • OK 73118 • (405) 488-2400

Responsible Parties

Approved by:

Russell Britten
President

James Vandersee
Vice-President

Keith Hopcus
Technical Director

Scott Haas
Quality Manager

This version of the Quality Manual will become effective on the first business day following the date shown below.

Version: 6.0		**Date:**	**10/29/2021**

SECTION 2 - TABLE OF CONTENTS

SECTION 3 – INTRODUCTION AND SCOPE

The purpose of this *Quality Manual* is to specify the quality system for Environmental Testing, Inc. (ETI). The *Quality Manual* defines the policies, procedures, and documentation that assure analytical services continually meet a defined standard of quality that is designed to provide clients with data of known and documented quality and, where applicable, demonstrate regulatory compliance.

POLICY
The Quality Manual sets the standard under which all laboratory operations are performed including ETI's organization, objectives, and operating philosophy.

3.1 Scope of Testing

ETIs scope of analytical testing services includes those listed in section 25.1 of this Manual. All relevant certifications which encompass this scope are prominently displayed on the laboratory premises.

3.2 Table of Contents, References and Appendices

The table of contents is in Section 2 of this Manual. This *Quality Manual* uses the references from the 2009 TNI Standard, Volume 1, Module 2, Section 3.2.

3.3 Glossary and Acronyms Used

Quality control terms are generally defined within the section that describes the activity.

Glossary

2009 TNI Standard, Volume 1, Module 2, Section 3.

Acronyms

A list of acronyms used in this document and their definitions are:

ASTM	–	American Society for Testing and Materials
Blk	–	Blank
°C	–	Degrees Celsius
CAS	–	Chemical Abstract Service
CCV	–	Continuing Calibration Verification
CDOC	–	Continuing Demonstration of Capability
COC	–	Chain of Custody
DO	–	Dissolved Oxygen
DOC	–	Demonstration of Capability
EPA	–	Environmental Protection Agency
ETI	–	Environmental Testing, Inc.
GC/MS	–	Gas Chromatography/Mass Spectrometry
ICP	–	Inductively Coupled Plasma

ICV	–	Initial Calibration Verification
LCS	–	Laboratory Control Sample
LIMS	–	Laboratory Information Management System
LFB	–	Laboratory Fortified Blank
MDL	–	Method Detection Limit
mg/kg	–	Milligrams per Kilogram
mg/L	–	Milligrams per Liter
MS	–	Matrix Spike
MSD	–	Matrix Spike Duplicate
NELAC	–	National Environmental Laboratory Accreditation Conference
NELAP	–	National Environmental Laboratory Accreditation Program
NIST	–	National Institute of Standards and Technology
ODEQ	–	Oklahoma Department of Environmental Quality
PT	–	Proficiency Test(ing)
QA	–	Quality Assurance
QC	–	Quality Control
QS	–	Quality System
QM	–	*Quality Manual* or Quality Manager
RCRA	–	Resource Conservation and Recovery Act
RL	–	Reporting Level
RPD	–	Relative Percent Difference
RSD	–	Relative Standard Deviation
SOPs	–	Standard Operating Procedures
SVOC	–	Semi-Volatile Organic Compound
TCLP	–	Toxicity Characteristic Leaching Procedure
TNI	–	The NELAC Institute
µg/L	–	Micrograms per Liter
VOC	–	Volatile Organic Compound

SECTION 4 – ORGANIZATIONAL ROLES AND RESPONSIBILITIES

POLICY
ETI is a legally identifiable organization. Through application of the policies and procedures outlined in this document, ETI establishes that it is impartial and that personnel are free from undue commercial, financial, or other undue pressures that might influence their technical judgment. ETI is responsible for carrying out testing activities that meet the requirements of its current certification standard and that meet the needs of the client.

4.1 Laboratory Organizational Structure

Policy
The organizational structure indicated minimizes the potential for conflicting or undue interests that might influence the technical judgment of analytical personnel.

Multiple laboratories are operated at the same physical address under the same management. This document applies only to analyses performed by ETI under the accreditations or certifications referenced by this document. Samples received for testing under ETI's accreditation are separated from other samples and are logged and processed on a separate database instance from the other laboratories. Any analyses subcontracted for Environmental Testing, Inc. to any other laboratory are clearly reported as such. Appropriate accreditation information is also reported withsubcontracted analyses.

ETI is a full service commercial environmental laboratory that is locally owned and operated. ETI was incorporated in April 2000 and officially opened for business in August of that same year. ETI is primarily certified by the Oklahoma Department of Environmental Quality as Lab #7211 and Louisiana Department of Environmental Quality LELAP Certificate 10002. The Federal tax ID is available upon request, if applicable. ETI operates in Oklahoma City, Oklahoma.

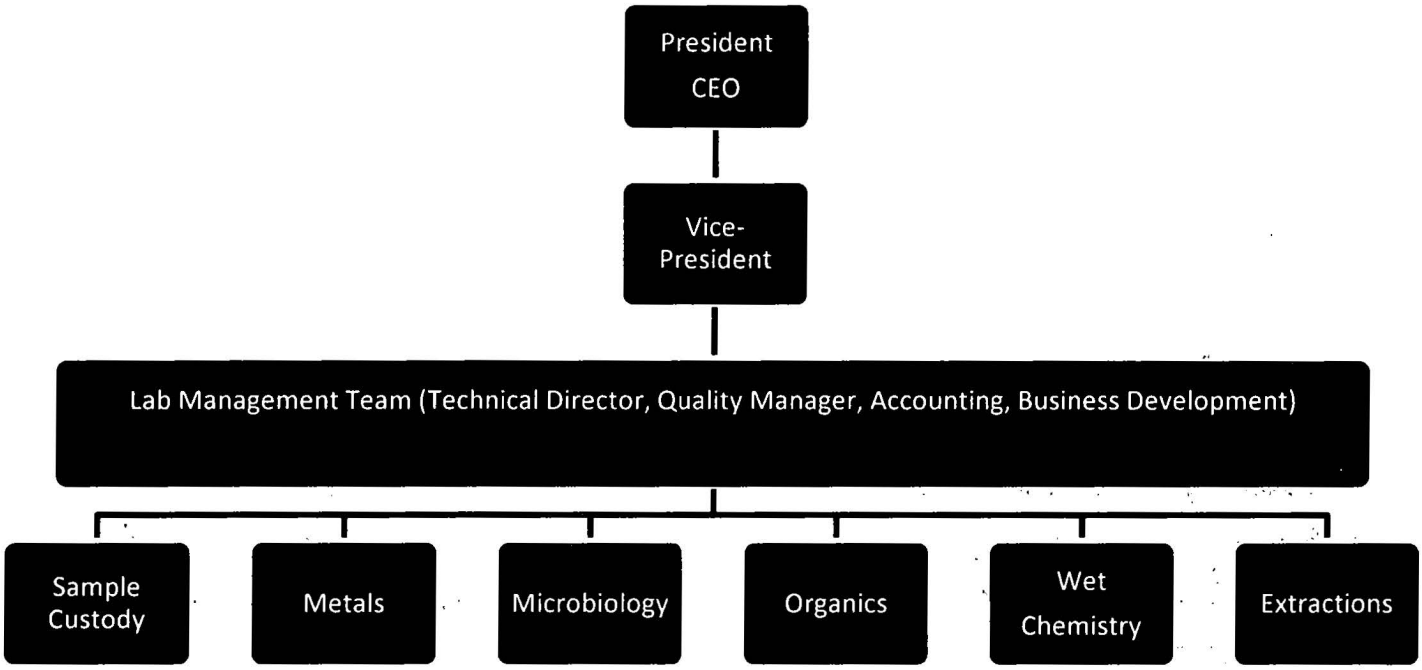


Figure 1 – Organization Chart

4.2 Responsibility and Authority

MANAGEMENT includes the titles, President/CEO, Vice President, Technical Director, and the Quality Manager.

Policy
Management has overall responsibility for the technical operations and authority needed to generate the required quality of laboratory operations.

Policy
Management's commitment to quality and to the Quality System is stated in the Quality Policy, which is upheld through the application of related policies and procedures.

Policy
Management is responsible for documenting the quality of all data reported by the laboratory.

Policy
Management ensures that all environmental testing activities are carried out in such a way to meet the requirements of the NELAC Standard and any accrediting authorities granting ETI laboratory certification, or all data is documented as non-certified.

Policy
Management ensures technical competence of personnel who are responsible for operating equipment, performing tests, evaluating results, or signing reports, and limits authority to perform laboratory functions to those appropriately trained and/or

supervised. This includes all laboratory operations carried out at ETI's permanent facilities, as well as any work carried out in a mobile or temporary laboratory setting.

Policy
ETI only uses personnel who are employed by, or under contract to ETI.

Procedure
The assignment of responsibilities, authorities, and interrelationships of the personnel who manage, perform, or verify work affecting the quality of environmental tests is documented in Figure 1. Job descriptions not listed in section 17 are listed in section 25.2.

Management bears specific responsibility for maintenance of the Quality System. This includes defining roles and responsibilities to personnel, approving documents, providing required training, providing a procedure for confidential reporting of data integrity issues, and periodically reviewing data, procedures, and documentation.

Management ensures that audit findings and corrective actions are completed within required time frames. See section 25.6.

When the Technical Director is absent, the Quality Manager acts as the Technical Director. When the Quality Manager is absent, the Technical Director acts as the Quality Manager. In the event that both the Technical Director and the Quality Manager are absent, the Laboratory Director will function as both the Technical Director and Quality Manager. In the event the Laboratory Director, Technical Director, and Quality Manager are all absent, ETI is closed.

Designated alternates are appointed by management during the absence of the President/CEO, Technical Director or the Quality Manager, and always if the absence is more than 15 days.

The primary accrediting authority(ies) are notified in writing in the event the Technical Director's absence exceeds 65 consecutive calendar days.

Management is responsible for defining the minimal level of education, qualifications, experience, and skills necessary for all positions in the laboratory and assuring that technical staff have demonstrated capabilities in their tasks.

Training is kept up to date as described in Section 17.4 by periodic review of training records and through employee performance review.

SECTION 5 – QUALITY SYSTEMS

ETI's Quality System is documented in this *Quality Manual* and associated quality system documents. Together they describe the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of the organization for ensuring quality in its work processes, products, and services.

5.1 Quality Policy

Quality Policy Statement

The objective of the quality system and the commitment of management is to consistently provide our customers with data of known and documented quality that meets their requirements. Our policy is to use good professional practices, to maintain quality, to uphold the highest quality of service, and to comply with the NELAC Standard. ETI ensures that personnel are free from any commercial, financial, and other undue pressures, which might adversely affect the quality of work. This policy is implemented and enforced through the unequivocal commitment of management, at all levels, to the Quality Assurance (QA) principles and practices outlined in this Manual. However, the primary responsibility for quality rests with each individual within the laboratory organization. Every laboratory employee must ensure that the generation and reporting of quality analytical data is a fundamental priority. Every laboratory employee is required to familiarize themselves with the quality documentation and to implement the policies and procedures in their work. All employees are trained annually on ethical principles and procedures surrounding the data that is generated. ETI maintains a strict policy of client confidentiality.

5.2 Quality Manual

Policy

Management ensures that ETI's policies and objectives for quality are documented by reference or by inclusion in the *Quality Manual*, and that the *Quality Manual* is communicated to, understood by, and implemented by all personnel concerned.

Policy

Where the *Quality Manual* documents laboratory requirements, a separate SOP or policy is not required.

Procedure

All employees sign a form, kept with their training records by the Technical Director, which states that they have read and understood the *Quality Manual*, including the quality policy.

The *Quality Manual* is maintained current and up-to-date by the Technical Director and the Quality Manager.

SECTION 6 – DOCUMENT MANAGEMENT

This Section describes procedures for document management, which includes controlling, distributing, reviewing, and accepting modifications. The purpose of document management is to preclude the use of invalid and/or obsolete documents.

ETI manages three types of documents, 1) controlled, 2) approved, and 3) obsolete.

A CONTROLLED DOCUMENT is one that is uniquely identified, issued, tracked, and kept current as part of the quality system. Controlled documents may be internal documents or external documents.

APPROVED means reviewed, and either signed and dated, or acknowledged in writing or secure electronic means by the issuing authority(ies).

OBSOLETE DOCUMENTS are documents that have been superseded by more recent versions.

POLICY
All documents that affect the quality of laboratory data are managed appropriate to the scope and depth required.

6.1 Controlled Documents

Policy
Documents will be reviewed and approved for use by Management prior to issue.

Procedure
Documents shall be reviewed and revised as necessary and on a periodic schedule not to exceed two years. Each document shall be reviewed to verify suitability for the intended use and conformance to the quality system requirements.

Approved copies of documents are available at all locations where operations are essential to the effective functions of the laboratory.

A SharePoint document library is used to control documents distributed to laboratory employees. Appropriate access levels to this library are determined and assigned by management. Each document has a unique identifying number and effective date. Approval status is shown in the library as part of the document record. All documents are reviewed and signed by the either the Vice-President or the Technical Director and the Quality Manager. After final review, the document is published to the library and approved for use by the Quality Manager. Previous versions are retained in the library history files. Hardcopies of internally produced documents (particularly Standard Operating Procedures) are uncontrolled. The controlled version shall reside in the SharePoint document library. A document specific certification statement is supplied in conjunction with the issued document. Once the document is read by the employee who it is issued to, the certification statement is signed and returned to the Technical Director to be filed in their respective training file.

Controlled internal documents are uniquely identified with 1) effective date, 2) revision identification, 3) page number, 4) the total number of pages (or a mark to indicate the end of the document), and 5) the electronic signatures of the issuing authority (i.e. management).

A master list of controlled internal documents is maintained that includes distribution, location, and revision dates. A master list of controlled external documents is also maintained that includes title, author, copyright date, and date of publication, and location. The controlled document list is maintained by the Technical Director. The controlled document list is updated at the time of issue.

6.1.1 Document Changes to Controlled Documents

6.1.1.1 Paper Document Changes

ETI no longer controls paper copies of documents.

6.1.1.2 Electronic Document Changes

Suggested changes to electronic documents are presented to the Technical Director for review and approval. Such changes,once approved, are made by management on the controlled file and accompanied by the respective member of management's electronic signature . If changes are made in this manner, these changes will be included in the subsequent revision upon the next review.

Where practicable, the altered text or new text in the draft is identified during the revision or review process to provide for easy identification of the modifications.

6.2 Obsolete Documents

Policy
All invalid or obsolete documents are removed from general distribution, or otherwise prevented from unintended use.

Procedure
Obsolete documents retained for legal use or historical knowledge preservation are appropriately marked and retained.

Obsolete documents are identified as being obsolete by management. All copies of the obsolete document are collected from employees according to the distribution log, and each obsolete document is clearly marked "Obsolete" on the front cover or destroyed. At least one copy of any obsolete document is kept on file as required by regulations or client.

Electronic copies of obsolete documents are marked "Obsolete" and restricted to management access only. They are retained as required by regulations or clientele.

6.3 Standard Operating Procedures

STANDARD OPERATING PROCEDURES (SOPs) are used to ensure consistency of application of common procedures, are written procedures that describe in detail how to accurately reproduce laboratory processes, and are of two types: 1) test method SOPs, which have specifically required details, and 2) general use SOPs which document the more general organizational procedures.

SOPs do not have to be formal documents with predefined section headings and contents. They can be less formal descriptions of procedures described in the *Quality Manual* or other documents.

Policy
Copies of all SOPs are accessible to all personnel.

Procedure
Each SOP indicates the effective date, the revision number, and the approval signature(s) of the Quality Manager and Vice-President or Technical Director

6.3.1 Test Method SOPs

Policy
ETI has SOPs for all test methods within its scope, and for procedures that are part of the Quality System that accurately reflect how the analytical process is performed. SOPs, active and obsolete, are maintained by the Quality Manager on the laboratory SharePoint server. Where equipment manuals or published methods accurately reflect laboratory procedures in detail, a separate SOP is not required.

Policy
Any deviation from a test method is documented, including both a description of the change made and a technical justification. The deviation from a test method is reported to the client.

Procedure
Each Test Method SOP includes or references (as applicable) the following:

a) identification of the test method;
b) applicable matrix or matrices;
c) detection limit;
d) scope and application, including components to be analyzed;
e) summary of the test method;
f) definitions;
g) interferences;
h) safety;
i) equipment and supplies;
j) reagents and standards;
k) sample collection, preservation, shipment and storage;
l) quality control, including acceptance criteria (5.4.10.6);
m) calibration and standardization;
n) procedure;
o) data analysis and calculations;
p) method performance;
q) pollution prevention;
r) data assessment and acceptance criteria for quality control measures;
s) corrective actions for out-of-control ;
t) contingencies for handling out-of-control or unacceptable data;
u) waste management;
v) references; and,
w) any tables, diagrams, flowcharts and validation data.

SECTION 7 – REVIEW OF REQUESTS, TENDERS AND CONTRACTS

POLICY

The review of all new work assures that oversight is provided so that requirements are clearly defined, ETI has adequate resources and capability, and the test method is applicable to the customer's needs. This process assures that all work will be given adequate attention without shortcuts that may compromise data quality.

Contracts for new work may be formal bids, signed documents, verbal, or electronic.

PROCEDURE

7.1 Procedure for the Review of Work Requests

The President/CEO or the Technical Director determines if ETI has the necessary accreditations, resources, including schedule, equipment, deliverables, subcontract laboratories, and personnel to meet the work request.

Management informs the client of the results of the review if it indicates any potential conflict, deficiency, lack of accreditation, or inability of the lab to the complete the work satisfactorily.

The client is informed of any deviation from the contract including the test method or sample handling processes. All differences between the request and the final contract are resolved and recorded before any work begins. It is necessary that the contract be acceptable to both ETI and the client.

ETI will also inform the client of any suspension, revocation, or voluntary withdraw of accreditation.

The review process is repeated when there are amendments to the original contract by the client. The participating personnel are given copies of the amendments.

7.2 Documentation of Review

Records are maintained for every contract or work request, when appropriate. This includes pertinent discussions with a client relating to the client's requirements or the results of the work during the period of execution of the contract.

SECTION 8 – SUBCONTRACTING OF TESTS

A SUBCONTRACT LABORATORY is any laboratory that ETI transfers samples to for analysis.

POLICY

When subcontracting analytical services, ETI assures work requiring accreditation is placed with an appropriately accredited laboratory or one that meets applicable statutory and regulatory requirements for performing the tests. The client is informed of this arrangement.

PROCEDURE

A list of subcontractors is maintained by the Technical Director.

A copy of the certificate and analyte list for subcontractors may be maintained as evidence of compliance.

ETI notifies the client of the intent to subcontract the work by e-mail or in writing. When possible, ETI gains the approval of the client to subcontract their work prior to implementation, preferably in writing.

The laboratory performing the subcontracted work is identified in the final report. ETI assumes responsibility to the client for the subcontractor's work, except in the case where a client or a regulating authority specified which subcontractor is to be used.

SECTION 9 – PURCHASING SERVICES AND SUPPLIES

POLICY
ETI ensures that purchased supplies and services that affect the quality of environmental tests are of the required or specified quality by using approved suppliers and products. ETI verifies disposable volumetric vials, containers, and pipettes. All new lots of consumables that are used for the extraction or analysis of samples that could affect the quality of data shall be checked for accuracy and contamination. Each lot of each type of vial, pipette, container, etc. used for volumetric measurement shall be verified. This is accomplished by measuring the weight of DI water required to fill the container to the respective measurement typically used by the laboratory. This is recorded in the respective department's consumable logbook.

POLICY
ETI has procedures for purchasing, receiving, and storage of supplies that affect the quality of environmental tests.

PROCEDURE
The Technical Director reviews and approves the supplier of services and supplies and approves technical content of purchasing documents prior to ordering.

Evaluation of suppliers is accomplished by ensuring the supplier ships the product or material ordered and that the material is of the appropriate quality by signing packing slips or other supply receipt documents. The purchasing documents contain the data that adequately describe the services and supplies ordered.

ETI maintains a list of approved suppliers.

Procedure for Purchases

When laboratory supplies are needed, a purchase request is submitted to a member of management for approval prior to ordering. A member of management then initiates the order and purchases the requested laboratory supplies.

Procedure for Receipt of Supplies

Supplies received are reconciled against the packing list and inspected for damage. Reagents and chemical standards are checked-in and given a unique identification number by the Vice-President, Quality Manager or designee, dated and initialed, and distributed to the appropriate individuals, departments or storage areas.

Procedure for Verification of Supplies

Disposable volumetric containers are verified by checking and documenting one per lot of all vials, pipettes, and containers which are used for volumetric measurements.

Procedure for Storage of Supplies

Supplies are stored according to manufacturer's recommendation, laboratory SOP, or test method specifications.

SECTION 10 – SERVICE TO THE CLIENT

ETI collaborates with clients and/or their representatives in clarifying their requests and in monitoring of the laboratory performance related to their work. Each request is reviewed to determine the nature of the request and ETI's ability to comply with the request within the confines of prevailing statutes and/or regulations without risk to the confidentiality of other clients.

10.1 Client Confidentiality

Policy
ETIs confidentiality policy is to not divulge or release any information to a third party without proper authorization.

Policy
All electronic data (storage or transmissions) are kept confidential, based on technology and laboratory limits, as required by client or regulation.

Procedure
ETI sends reports and data by three methods U.S. Postal service, electronic facsimile and e-mail. ETI sends reports to the address(es), fax number(s), or e-mail(s) supplied by the client listed on the COC. Only the client listed on the COC has the authority to request ETI to send reports and/or data to a third party.

ETI cannot be responsible for the confidentiality of the above means of data transmission.

SECTION 11 – CLIENT FEEDBACK

The purpose of this section is to assure that customer complaints are addressed and corrected.

POLICY
ETI reviews all complaints and determines appropriate action.

PROCEDURE
All customer complaints are documented by the person receiving the complaint and addressed by the President/CEO, Technical Director, and Quality Manager or a combination of the aforementioned. If it is determined that a complaint is without merit, this decision will be recorded. If it is determined that the complaint has merit, a corrective action is initiated and the client is contacted. See Section 13 for corrective action procedures.

ETI will also actively seek feedback from our customers. This will be accomplished by the inclusion of a live link survey found on the ETI company website. This survey will offer customers an anonymous vehicle to provide both positive an dnegative feedback in a platform that is both accessible and user-friendly. Survey results will be automatically, electronically delivered to ETI management staff. Results will be discussed and appropriate action taken. Decisions made regarding feedback received shall be recorded.

SECTION 12 – CONTROL OF NON-CONFORMING WORK

NON-CONFORMING WORK is work that does not meet acceptance criteria or requirements. Non-conformances can include unacceptable quality control results (see Section 24 Assuring the Quality of Results) or departures from standard operating procedures or test methods. Requests for departures from laboratory procedures are approved by the Technical Director and documented.

POLICY

The policy for control of non-conforming work is to identify the non-conformance, determine if it will be permitted, and take appropriate action. All employees have the authority to stop work on samples when any aspect of the process does not conform to laboratory requirements.

PROCEDURE

The responsibilities and authorities for the management of non-conforming work are detailed below. The procedure for investigating and taking associated corrective actions of non-conforming work are described in Section 13.

ETI evaluates the significance of the nonconforming work, and takes corrective action immediately including documentation. The client is notified if their data has been impacted. Resumption of work after non-conformance is authorized by Management.

Procedure for Managing Nonconforming Work

Employees immediately notify Management of any nonconformance. A member of Management reviews the significance of non-conformance and develops a course of action. This may include halting of work and withholding of test reports as necessary. If data are questionable, customers are notified with the ETI final report.

SECTION 13 – CORRECTIVE ACTION

CORRECTIVE ACTION is the action taken to eliminate the causes of an existing nonconformity, defect, or other undesirable situation in order to prevent recurrence.

POLICY

Deficiencies cited in external assessments, internal quality audits, data reviews, complaints, or managerial reviews are documented and require corrective action. Corrective actions taken are appropriate for the magnitude of the problem and the degree of risk.

PROCEDURE

The Quality Manager is responsible for initiating corrective action on routine data reviews. The Quality Manager is responsible for monitoring and recording corrective actions.

All deficiencies are investigated and a corrective action plan is developed and implemented as necessary. The implementation is monitored for effectiveness.

Specific corrective action protocols specified in test methods may over-ride general corrective action procedures specified in this manual.

13.1 Selection and Implementation of Corrective Actions

ROOT CAUSE is the condition or event that, if corrected or eliminated, would prevent the recurrence of a deficiency.

Policy
Once an exceedance or non-conformance is noted, the first action is an investigation to determine the root cause. Records are maintained of non-conformances requiring corrective action to show that the root cause(s) was investigated, and includes the results of the investigation.

Where uncertainty arises regarding the best approach for analysis of the cause of exceedances that require corrective action, Management will recommend corrective actions to be initiated.

The Quality Manager ensures that corrective actions are discharged within the agreed upon time frame.

13.2 Monitoring of Corrective Action

Policy
The Quality Manager will monitor implementation and documentation of the corrective action to verify that the corrective actions were effective.

Procedure
See the Corrective Actions SOP (ETICD-SOP-2).

13.3 Technical Corrective Action

CAUSE ANALYSIS in corrective action investigates the root cause of the problem.

Policy
Sample data associated with a failed quality control are evaluated for the need to be reanalyzed or qualified.

Procedure
Unacceptable quality control results are documented, and if the evaluation requires cause analysis, the cause and solution are recorded.

The analyst is responsible for initiating or recommending corrective actions and ensuring that exceedances of quality control acceptance criteria are documented. Analysts routinely implement corrective actions for data with unacceptable QC measures. First level correction may include re-analysis without further assessment. If the test method SOP addresses the specific actions to take, they are followed. Otherwise, corrective actions start with assessment of the cause of the problem.

Management reviews corrective action reports and suggest improvements, alternative approaches, and procedures where needed. To the extent possible, samples will be reported only if all quality control measures are acceptable. If a quality control measure is found to be out of control, and the data is to be reported, all samples associated with the failed quality control are reported with appropriate data qualifiers. If the data reported are affected adversely by the nonconformance, the client is notified in writing.

The discovery of a non-conformance for results that have already been reported to the client must be immediately evaluated for significance of the non-conformance, its acceptability to the client, and determination of the appropriate corrective action.

13.4 Exceptionally Permitting Departures from Documented Policies and Procedures

Policy

ETI allows the release of non-conforming data only with approval by the President/CEO or the Technical Director or their designee on a case-by-case basis. Planned departures from procedures or policies do not require audits or investigations.

Procedure

Permitted departures for non-conformances, such as QC failures, are fully documented and include the reason for the departure, the affected SOP(s), the impact of the departure on the data, and the data.

SECTION 14 – PREVENTIVE ACTION

PREVENTIVE ACTION, rather than corrective action, aims at minimizing or eliminating inferior data quality or other non-conformance through scheduled maintenance and review, before the non-conformance occurs. Preventive action includes actions taken to prevent problems.

All employees shall have the authority to recommend preventive action. In addition, potential preventative actions will be discussed as an agenda item during the annual management review.

The Quality Manager shall document all recommended preventive actions, evaluate the suitability and/or effectiveness of the recommendation, record the decision, and develop an implementation plan including follow-up monitoring for any changes deemed appropriate.

Implementation of preventive action is verbally communicated between management and analysts. This action may be documented in the method specific SOP if found to be effective.

SECTION 15 – CONTROL OF RECORDS

RECORDS are a subset of documents, usually data recordings that include annotations, such as daily refrigerator temperatures posted to a laboratory form, lists, spreadsheets, or analyst notes on a chromatogram. Records may be on any form of media, including electronic and hard copy. Records allow for the historical reconstruction of laboratory activities related to sample-handling and analysis.

POLICY
ETI maintains a record system appropriate to its needs, records all laboratory activities, and complies with applicable standards or regulations as required.

PROCEDURE
ETI retains all original observations, calculations and derived data, calibration records, and a copy of the test report for a minimum of five years.

Records of all procedures to which a sample is subjected while in the possession of ETI are kept.

15.1 Records, Management and Storage

Policy
Records, including electronic records, are easy to retrieve, legible, and protected from deterioration or damage; held secure and in confidence; and are available to accrediting authorities and authorized clientele for a minimum of five years from generation of the last entry in the records.

Policy
ETI maintains a record management system for control of laboratory notebooks, field notes, instrument logbooks, standards logbooks, and records for data reduction, validation, storage, and reporting.

Original observations, data, and calculations are recorded at the time they are made.

Policy
When mistakes occur in records or changes need to be made, including but not limited to logbooks, chain of custodies, and bench sheets, a single line is drawn through the mistake along with the date and initials of the person making the correction or change. The correction is entered alongside the crossed out and initialed mistake. Scribbling out and whiting out are not allowed. The original crossed out data must still be legible.

Policy
When corrections are made for reasons other than transcription errors, the reason for the correction should be documented as close to the correction as possible.

Policy
Archived information and access logs are protected against fire, theft, loss, environmental deterioration, vermin, and in the case of electronic records, electronic or magnetic sources.

Policy

In the event that ETI transfers ownership or goes out of business, records are maintained or transferred according to the clients' instructions.

Procedure
All electronic records are backed-up automatically by the server. Access to protected records is limited to laboratory management or their designees to prevent unauthorized access or amendment.

Procedures for identification, collection, access, filing, storage, and disposal of records are found below.

Procedure
The Chain-of-Custody (COC) begins the record management process at ETI. When samples arrive at ETI, a COC is filled out and signed by both the party relinquishing the samples to the laboratory and a member of the ETI team. The date and time are also recorded in their respective locations on the COC. A unique work order number is written on each COC which corresponds to the unique sample number given to each sample submitted.

One copy of the COC is placed in a three-ring binder and stored on-site organized by month. Another copy is placed in a file folder that is numbered with the work order number and filed alphabetically according to client name. This file remains active until the project is complete. All chromatograms and pertinent data that are not recorded in a bound logbook are also placed in the same file.

Once the project is complete, the file is submitted to a member of management for report and invoice generation. The generated report is then reviewed by another member of the management team and then sent to the client via email or or other appropriate method.

Supporting documentation for the work order are scanned and filed electronically by work order Hardcopies are disposed of in a confidential manner.

Electronic files are retained for a period of five years and then deleted.

15.2 Legal Chain of Custody Records

EVIDENTIARY SAMPLE DATA not applicable.

Policy
ETI does not accept samples accompanied by or requiring evidentiary legal chain of custody.

See the SOP for Sample Login (ETICD-SOP-67).

SECTION 16 – AUDITS AND MANAGEMENT REVIEW

AUDITS measure laboratory performance and verify compliance with accreditation/ certification and project requirements. Audits specifically provide management with an on-going assessment of the quality system. They are also instrumental in identifying areas where improvement in the quality system will increase the reliability of data. Audits are of four main types: internal, external, performance, and system.

Should any audit show evidence that casts doubt on the validity of the results produced by ETI, clients whose results could have been directly affected by such findings are notified as soon as possible after the findings.

Notification of clients for events that cast doubt on the validity of the results is completed within 5 business days.

16.1 Internal Audits

Policy
ETI conducts internal audits all of its quality systems activities, including data integrity, environmental testing activities, and the use of trained and qualified personnel at least annually. Personnel may not audit their own activities except when it can be demonstrated that an effective audit will be carried out.

Procedure
An internal audit schedule shall be maintained by the quality manager such that all elements of the management system, including testing and/or calibration activities are reviewed at least annually.

It is the responsibility of the Quality Manager to plan and organize audits as required by the schedule and requested by management.
The area audited, the audit findings, and corrective actions are recorded.

All investigations that result in findings of inappropriate activity are documented and include any disciplinary actions involved, corrective actions taken, and all appropriate notifications of clients.

Discovery of potential issues are handled in a confidential manner until a follow up evaluation, full investigation, or other appropriate actions are taken and all issues clarified.

Clients are notified within one week (5 business days), in writing when possible, when audit findings cast doubt on the validity of the data.

Audits are reviewed after completion to assure that corrective actions were implemented and effective.

16.2 External Audits

Policy
It is ETI's policy to cooperate and assist with all external audits, whether performed by clients or an accrediting authority.

Policy
ETI makes all items identified in the 2009 TNI Standard Volume 1, Module 2: Quality Systems General Requirements, available for on-site inspection or data audit.

Policy
All external audits are fully documented and tracked to closure.

Procedure
Management ensures that all areas of ETI are accessible to auditors as applicable and that appropriate personnel are available to assist in conducting the audit.

Any findings related to an external audit follow corrective action procedures.

Management ensures that corrective actions are carried out within the timeframe specified by the auditor(s).

16.3 Performance Audits

Performance audits may be Proficiency Test Samples, internal single-blind samples, double-blind samples through a provider or client, or anything that tests the performance of the analyst and method.

The policy and procedures for Proficiency Test Samples are discussed in Section 23.7.

16.4 System Audits and Management Reviews

Policy
The Technical Director and Quality Manager review the quality system and maintain records of review findings and actions.

Procedure
The quality system is reviewed annually, and findings are recorded. The Technical Director and Quality Manager assure that actions are performed within agreed time frames.

The quality system is reviewed annually by the Technical Director and Quality Manager, and based on the suitability of policies and procedures, changes and amendments are made and documented. The review procedure will include the following points of interest:

a) The suitability of policies and procedures;
b) Reports from managerial and supervisory personnel;
c) The outcome of recent internal audits;
d) Corrective and preventive actions;
e) Assessments by external bodies;
f) The results of interlaboratory comparisons or proficiency tests;
g) Changes in the volume and type of the work;
h) Client feedback;
i) Complaints;

j) Other relevant factors, such as quality control activities, resources and staff training.

Findings from management reviews are recorded. These records ensure that corrective actions are completed in an appropriate time frame.

All documentation from audits are maintained for a period of no less than 5 years.

SECTION 17 – PERSONNEL, TRAINING, AND DATA INTEGRITY

17.1 Job Descriptions

Policy
Job descriptions are available for all positions that manage, perform, or verify work affecting data quality, and are located in Section 25.2.

ETI maintains sufficient personnel with the necessary education, training, technical knowledge, and experience for their assigned functions.

All personnel are responsible for complying with all quality assurance and quality control requirements that pertain to their technical function.

Procedure
Job descriptions include the specific tasks, minimum education and qualifications, skills, and experience required for each position.

17.1.1 Laboratory Director

The Laboratory Director is in charge of all laboratory activities, and is the highest level manager. The Laboratory Director signs the *Quality Manual*. The Laboratory Director is responsible for the oversight of daily laboratory operations, including the assignment of lab staff to duties and monitoring performance of testing.

At ETI the President/CEO also serves as the Laboratory Director.

17.1.2 Technical Director(s)

Day to day supervision of technical laboratory operations is the responsibility of the Technical Director(s) who are full-time members of the staff and who assure reliable data through the following activities: monitoring quality control, corroborating the analysis performed, and signing demonstrations of capability.

The Technical Director(s) certify that personnel with appropriate educational and/or technical background perform all tests for which ETI is accredited.

The minimum educational requirements for Technical Director(s) are a bachelors degree in the chemical, environmental, biological sciences, physical sciences or engineering, with at least 24 college semester credit hours in chemistry and at least two years of experience in the environmental laboratory industry.

17.1.3 Quality Manager

The Quality Manager has the authority and responsibility for ensuring that the quality system is implemented and followed.

The Quality Manager has direct access to the Laboratory Director and is independent of operations where the Quality Manager has oversight.

The Quality Manager:

- is the focal point for the quality system and has oversight of quality control data.
- has general knowledge of the analytical methods employed.
- evaluates data objectively and performs assessments without managerial influence.
- arranges for, or conducts, internal audits annually; and,
- notifies laboratory management of deficiencies (or opportunities for continuous improvement) and monitors corrective actions.
- keeps the *Quality Manual* current.
- signs the demonstrations of capability.

The minimum educational requirements for Quality Manager are a bachelors degree in the chemical, environmental, biological sciences, physical sciences or engineering, with at least 24 college semester credit hours in chemistry and at least two years of experience in the environmental laboratory industry.

17.2 Data Integrity and Ethics

DATA INTEGRITY is the result of the processes that together assure valid data of known and documented quality.

Data integrity and ethics procedures in the laboratory include training, signed, and dated integrity documentation for all laboratory employees, periodic monitoring of data integrity, and documented data integrity procedures.

Policy
Technical managers uphold the spirit and intent by supporting integrity procedures, by enforcing data integrity procedures.

Policy
Data integrity procedures and evidence of inappropriate actions are reviewed annually or through regularly scheduled internal audits, and are updated by management.

Policy
The mechanism for confidential reporting of ethics and data integrity issues is (1) unrestricted access to senior management, (2) an assurance that personnel will not be treated unfairly for reporting instances of ethics and data integrity breaches, and (3) anonymous reporting.

Policy
Employees are required to understand, through training and review of quality systems documents, that any infractions of the laboratory data integrity procedures will result in a detailed investigation that could lead to very serious consequences such as immediate termination, or civil/criminal prosecution.

Policy
Any potential data integrity issue is handled confidentially until a follow-up evaluation, full investigation, or other appropriate actions have been completed and the issues clarified. Inappropriate activities are documented, including disciplinary actions, corrective actions, and notifications of clients, if applicable. These documents are maintained for a minimum of 5 years.

Procedure
Any determination for detailed investigation of data integrity issues must be communicated to senior management. Allegations are investigated and remain confidential to the extent necessary.

Documentation for all investigations that result in findings of inappropriate activity include any disciplinary actions involved, corrective actions taken, and all appropriate notifications of clients.

Data integrity procedures are reviewed annually and are periodically monitored through in-depth data review, records review, or other thorough check processes.[162]

17.3 Data Integrity and Ethics Training

Policy
Data integrity training is provided for all employees initially upon hire and annually thereafter. Key topics covered will include the organizational mission and its relationship to the critical need for honesty and full disclosure in analytical reporting, how and when to report data integrity issues, and record keeping.

ProcedureAttendance at an initial data integrity training (part of new employee orientation) and the annual refresher training is recorded with a signature attendance sheet or other form of documentation that demonstrates all staff have participated and understand their obligations related to data integrity. The Technical Director keeps a signed copy of the 'Laboratory Ethics and Code of Conduct Agreement' in each employees' training file. This document is inked with each employee's printed name, initials, signature, and date upon agreement to the form. In addition all employees must print, sign, initial, and date the ETI Signature Log.

Data integrity training includes discussion regarding all data integrity procedures, data integrity training documentation, in-depth data monitoring and data integrity procedure documentation. Data integrity training requires emphasis on the importance of proper written narration on the part of all analysts with respect to

those cases where analytical data may be useful, but are in one sense or another partially deficient. Training records regarding data integrity and ethics are signed and dated by senior management.

When contracted technical or support personnel are used, management is responsible for ensuring that they are trained to ETI's quality system and data integrity procedures, competent to perform the assigned tasks, and appropriately supervised.

Topics covered are provided in writing and provided to all trainees.

17.4 General Training

Policy
All personnel are appropriately trained and competent in their assigned tasks before they contribute to functions that can affect data quality. It is management's responsibility to assure personnel are trained.

Policy
Only trained personnel are authorized to perform specific tasks.

Policy
Training records are kept on individual training forms.

Procedure
New staff members are given introductory training and orientation upon arrival. Training is documented of all who attended.

Attendance at training sessions is documented.

The initial training for a new task contains the following steps:

- All documentation involved with a new and unfamiliar task is read and understood by the trainee.
- Training is under the direct supervision of a qualified senior analyst. During the time the analyst is training, the trainee may sign laboratory notebooks or logbooks, but laboratory notebooks must be cosigned by the senior analyst, who is responsible for the data generated.
- The trainee demonstrates competency in the new task before they can operate independently. The competency for a test method is accomplished by a demonstration of capability as indicated in Section 19. Approval of competency is noted by the initials or signature of the qualified senior analyst on the training form.
- Each step of the training process is documented.

Ongoing training will consist of the following:

- The analyst attests, through signature that they have read, understood, and agreed to perform the latest version of the *Quality Manual* and any method SOP's that the analyst performs.
- Annually, the analyst shows continued proficiency in each method they perform.

- Other training as determined by management.
- Proof of acceptable on-going training is documented by acceptable performance of bi-annual proficiency samples.

SECTION 18 – ACCOMMODATIONS & ENVIRONMENTAL CONDITIONS

POLICY
Laboratory facilities are designed and organized to facilitate testing of environmental samples. Environmental conditions are monitored to ensure that conditions do not invalidate results or adversely affect the required quality of any measurement.

POLICY
Particular care is taken when sampling and environmental tests are undertaken at sites other than ETI's permanent laboratory facility.

POLICY
Any field analyses conducted by a member of ETI's staff must be performed in accordance with the quality system.

POLICY
Environmental tests are stopped when the environmental conditions jeopardize the results.

POLICY
Access to, and use of areas affecting the quality of the environmental tests is controlled by restriction of areas to authorized personnel only.

POLICY
The laboratory work spaces are adequate for their use, and appropriately clean to support environmental testing and ensure an unencumbered work area.

PROCEDURE
Laboratory space is arranged to minimize cross-contamination between incompatible areas of the laboratory.

ETI separates volatiles to help prevent contamination from extractions and other areas where compounds of interest are used. The volatile room has its own heating and cooling system. See the ETI floor plan in section 25.4 for complete spatial arrangement.

If the laboratory environment is required to be controlled by method or regulation, the adherence is recorded.

ETI contracts janitorial services. At ETI's request, no services are performed in the actual laboratory areas. This insures there are no accidental instrument changes or mishaps. Therefore, each employee is responsible for keeping their work area clean and clutter free.

SECTION 19 – TEST METHODS AND METHOD VALIDATION

POLICY
ETI uses methods for environmental testing which meet the needs of our clients and that are appropriate for the environmental tests undertaken. These methods are published in international, national, or regional standards, if possible, and will be the latest valid edition or latest revision if appropriate.

POLICY
A method is validated before it is put into use. All methods are published or documented.

19.1 Demonstration of Capability (DOC)

A DEMONSTRATION OF CAPABILITY (DOC) is a procedure to establish the ability of the analyst to generate data of acceptable accuracy and precision.

WORK CELLS consist of analysts with specifically defined tasks who together perform the method. Work cells together meet specified acceptance criteria and demonstrations of capability.

Policy
ETI confirms that it is capable of generating data of acceptable accuracy and precision on all methods before employing them.

ProcedureThe DOC is documented using the initial demonstration of capability (IDC) – continuing demonstration of capability (CDOC) database or equivalent.

A DOC is performed for each analyte whenever the method, analysts, analytes, or instrument type is changed.
A member of the management team certifies that technical staff members in their area of expertise are trained and authorized to perform all tests for which we are accredited by reviewing and approving the submitted DOC.

The process for DOC is documented in Section 25.3.

19.2 On-Going (or Continued) Proficiency

After the demonstration of capability is completed, on-going proficiency is maintained and demonstrated at least annually through the analysis of either single-blind samples, performing another DOC, or use of four consecutive laboratory control samples compared to pre-determined acceptance limits for precision and accuracy. This is documented in the training file of each analyst.

19.3 Initial Test Method Evaluation

For chemical analyses, the INITIAL TEST METHOD EVALUATION involves the determination of the Limit of Detection (LOD), confirmation of the Limit of Quantitation (LOQ), an evaluation of precision and bias, and an evaluation of the selectivity of the method.

19.3.1 Limit of Detection (LOD)

The LIMIT OF DETECTION (LOD) is an estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte-and matrix specific and may be laboratory-dependent. (NELAC Glossary 2003).

19.3.2 Limit of Quantitation (LOQ)

The LIMIT OF QUANTITATION (LOQ) is an estimate of the minimum amount of a substance that can be reported with a specified degree of confidence. (NELAC Glossary 2003).

Policy
If an LOD study is not performed, concentrations less than the Limit of Quantitation are not reported. If results are not reported outside of the calibration range (low), the LOD determination is not required.

Policy
The lowest calibration standard is less than or equal to the LOQ.

Policy
The LOQ will always be greater than the LOD.

Procedure
LODs are determined from a quality system matrix using all sample processing steps, and are verified annually or when there is a change in the test method or instruments which affects sensitivity.

ETI establishes the LOQ to be equal to or above the lowest calibration point for all methods which utilize a series of calibration standards. For methods which do not use calibration standards ETI uses a combination of method suggestions and practical equipment limitations to establish the LOQ.

The LOQ is verified using a quality systems matrix sample spiked at 1-2 times the determined LOQ that returns a concentration within the acceptance criteria for accuracy, according to the requirements of the method or client data quality objectives. When no guidance is given for the acceptance criteria for an LOQ verification, use 50-150% of the true value. The LOQ is verified initially prior to sample analysis and at least annually.

19.3.3 Precision and Bias

PRECISION is the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves. Precision is usually expressed as standard deviation, variance, or range, in either absolute or relative terms.

BIAS is the systematic error that contributes to the difference between the mean of a significant number of test results and the accepted reference value.

PolicyPrecision and bias are determined for standard and non-standard methods.

Procedure

Precision and bias are determined for standard methods through the performance of a Demonstration of Capability.

ETI evaluates precision and bias during the initial DOC for each analyst and each method and continually evaluates precision and bias by the analysis of bi-annual proficiency tests.

Precision and bias using non-standard, modified standard or laboratory-developed methods are compared to the criteria established by the client (when requested), the method, or the laboratory.

Replicate spikes in a quality system matrix are analyzed according the procedures outlined in the 2009 TNI Standard, Volume 1, Module 4, Section 1.7.

19.3.4 Selectivity

SELECTIVITY is the capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances (EPA-QAD).

Policy
ETI evaluates selectivity through procedures defined in the test method SOPs. These include but are not limited to ICP inter-element interference checks, sample blanks, second column confirmations, and mass spectral confirmation.

19.4 Estimation of Uncertainty

ESTIMATION OF UNCERTAINTY consists of the sum (combining the components) of the uncertainties of the numerous steps of the analytical process, including, but not limited to, sample plan variability, spatial and temporal sample variation, sample heterogeneity, calibration/calibration check variability, extraction variability, and weighing variability.

Procedure
ETI estimates uncertainty using the standard deviation calculated from routine quality control samples.

ETI uses method guidelines for establishing uncertainty estimates.

19.5 Laboratory-Developed or Non-Standard Method Validation

Policy
Laboratory developed, modified standard methods, and non-standard methods require method validation.

Procedure

METHOD VALIDATION is the confirmation by examination and the provision of objective evidence that the particular requirements for a specific intended use are fulfilled (NELAC 2003).

Policy

Where applicable, ETI validates non-standard methods, laboratory-designed/developed methods, standard methods used outside their published scope, and amplifications and modifications of standard methods to confirm that the methods are fit for the intended use.

Policy
The range and accuracy of the values obtainable from validated methods (e.g. the uncertainty of the results, detection limit, selectivity of the method, linearity, limit of repeatability and/or reproducibility, robustness against external influences and/or cross-sensitivity against interference from the matrix of the sample/test object), is assessed for the intended use and whether it is relevant to the clients' needs.

Procedure
ETI's method validation procedures include, at a minimum, the steps described in the 2009 TNI Standard Volume 1, Module 4, Section 1.5. ETI records method validation results, the procedure used for the validation, and a statement as to whether the method is fit for the intended use.

19.6 Control of Data

Policy
All calculations and all relevant data are subject to appropriate checks in a systematic manner.

PolicyCommercial off-the-shelf software (e. g. word processing, database and statistical Programs) used within the designed application range is considered sufficiently validated when in-house programming is not used.

Procedure
ETI assures that computers and software are protected, maintained, and secure through measures such as documentation, locked access, and control of the laboratory environment.

The Technical Director retains custody of all software packages, documentation, and licenses.

The laboratory procedure to insure that reported data are free from transcription and calculation errors is found in Section 23.8.

The laboratory procedure that all quality control measures are reviewed and evaluated before data are reported is found in Section 23.8.

The laboratory procedure to address manual calculations, including manual integrations is found below.

Transcription and calculation errors are minimized through the use of spreadsheets, data review, and through periodic review of the data reduction processes.

Quality control results are reviewed by the analyst and by a member of management. The results are evaluated for consistency, trend, or feasibility before data are released to the client.

Manual integrations are addressed on an individual basis in the method specific SOP.

ETI assures that computers, user-developed computer software, automated equipment, or microprocessors used for the acquisition, processing, recording, reporting, storage, or retrieval of environmental test data are:

a) documented in sufficient detail and validated as being adequate for use;

b) protected for integrity and confidentiality of data entry or collection, data storage, data transmission and data processing;

c) maintained to ensure proper functioning and are provided with the environmental and operating conditions necessary to maintain the integrity of environmental test data; and

d) held secure including the prevention of unauthorized access to, and the unauthorized amendment of, computer records.

SECTION 20 – EQUIPMENT

20.1 General Equipment Requirements

PolicyETI provides all the necessary equipment required for the correct performance of the scope of environmental testing presented in this *Quality Manual*.

PolicyAll equipment and software used for testing and sampling is capable of achieving the accuracy required and complies with the specifications of the environmental test method as specified in the laboratory SOP.

Policy
Equipment is operated only by authorized personnel.

PolicyThe laboratory procedure for safe handling, transport, storage, and use of measuring equipment to ensure proper functioning and in order to prevent contamination or deterioration is found in the respective equipment manual.

Procedure
Up-to-date instructions on the use and maintenance of equipment (including any relevant manuals provided by the manufacturer of the equipment) are readily available for use by laboratory personnel.

All equipment is calibrated or checked before being placed into use to ensure that it meets laboratory specifications and the relevant standard specifications.

Test equipment, including hardware and software, are safeguarded from adjustments which would invalidate the test results measures by limiting access to the equipment and using password protection where possible.

Equipment that has been subject to overloading, mishandling, given suspect results, or been shown to be defective or outside specifications is taken out of service, isolated to prevent its use, or clearly labeled as being out of service until it has been shown to function properly. If it is shown that previous tests are affected, then procedures for non-conforming work are followed.

When equipment is needed for a test that is outside of permanent control of the laboratory, the lab ensures the equipment meets the requirements of this manual prior to its use by inspecting or otherwise testing it.

Each item of equipment and the software used for testing and significant to the results is uniquely identified and records of equipment and software are maintained. This information includes the following:

a) identity of the equipment and its software;
b) manufacturer's name, type identification, serial number or other unique identifier;
c) checks that equipment complies with specifications of applicable tests;
d) current location;
e) manufacturer's instructions, if available, or a reference to their location;

f) dates, results and copies of reports and certificates of all calibrations, adjustments, acceptance criteria, and the due date of next calibration;

g) maintenance plan where appropriate, and maintenance carried out to date; documentation on all routine and non-routine maintenance activities and reference material verifications;

h) any damage, malfunction, modification or repair to the equipment;

i) date received and date placed into service (if available); and

j) condition when received, if available (new, used, reconditioned).

See the ETI Equipment Log for specific equipment information.

20.2 Support Equipment

SUPPORT EQUIPMENT includes, but is not limited to: balances, ovens, refrigerators, freezers, incubators, water baths, temperature measuring devices, volumetric dispensing devices, and thermal/pressure sample preparation devices.

Policy
All support equipment is maintained in proper working order and records are kept of all repair and maintenance activities, including service calls.

Procedure
All raw data records are retained to document equipment performance. These records include logbooks, data sheets, or equipment computer files.

All support equipment is calibrated or verified annually over the entire range of use using NIST traceable references where available. The results the calibration of support equipment are within specifications or (1) the equipment is removed from service until repaired, or (2) records are maintained of correction factors required to correct all measurements.

Support equipment such as balances, ovens, refrigerators, freezers, and water baths are checked with a NIST traceable reference if available, each day prior to use, to ensure they are operating within the expected range for the application for which the equipment is to be used.

Mechanical volumetric dispensing equipment, including burettes (except Class A glassware), is checked for accuracy quarterly.

Glass micro-liter syringes have a certificate attesting to the established accuracy. If the certificate of accuracy for glass micro-liter syringes is not available, the accuracy of the syringe is demonstrated upon receipt and documented.

Acceptance criteria for support equipment are listed on the respective support equipment logs.

20.2.1 Support Equipment Maintenance

Regular maintenance of support equipment, such as balances and fume hoods is conducted at least annually.

ETI contracts planned maintenance of measuring equipment such as thermometers, balances, and weights.

Maintenance on other support equipment, such as ovens, refrigerators, and thermometers is conducted on an as needed basis.

Records of maintenance to support equipment are documented in Instrument Maintenance Logs..

20.2.2 Support Equipment Calibration

Calibration requirements for analytical support equipment are found in the table below. For analytical instrumentation, the calibration requirements are found in the method specific SOPs.

Table 20.2, Calibration And Maintenance

Instrument	Activity	Frequency	Documentation
Balance	1. Clean 2. Check alignment 3. Service Contract	1. Before use 2. Before use 3. Annually	Worksheet/log book Post annual service date on balance
ASTM Class 1Weights	1. Only use for the intended purpose 2. Use plastic forceps to handle 3. Keep in case 4. Re-calibrate	Once every year	Keep certificate
Thermometers: 1. Glass and electronic 2. Dial thermometers	Service Contract	1. Annually for glass and electronic	Keep certificate
pH electrometers	Calibration: 1. pH buffer aliquot are used only once 2. Buffers used for calibration will bracket the pH of the media, reagent, or sample tested.	Before use	Logbook
pH probe	Maintenance: Use manufacturer's specifications	As needed	Maintenance Logbook
Spectrophotometer.	Maintenance: Use manufacturer's specifications	As needed	Maintenance Logbook
Automatic or digital type pipettes	Calibrate for accuracy and precision using reagent water and analytical balance	Quarterly	Logbook
Refrigerators, Freezers, and BOD incubators	1. Thermometers are immersed in liquid to the appropriate immersion line 2. The thermometers are graduated in increments of 1°C or less	Temperatures are recorded each day in use	Worksheet
Microbiological incubators, and water baths	1. Thermometers in each unit are immersed in liquid to the appropriate immersion line 2. The thermometers will be graduated in increments of 0.5°C (0.2°C increments for tests which are incubated at 44.5°C) or less	Temperature of incubators and water baths will be recorded twice a day for each day in use with readings separated by at least four hours	Worksheet
DO electrometer	Calibrate as specified in SOP	Before use	Worksheet/log book
DO probe	Maintenance as specify by manufacturer	As needed	Worksheet/log book

20.3 Analytical Equipment

20.3.1 Maintenance for Analytical Equipment

Policy
All equipment is properly maintained, inspected, and cleaned.

Procedure
Maintenance of analytical instruments and other equipment may include regularly scheduled preventive maintenance or maintenance on an as-needed basis due to instrument malfunction and is documented in Instrument Maintenance Logs, which become part of ETI's permanent records.

20.3.2 Initial Instrument Calibration

Initial instrument calibration and continuing instrument calibration verification are an important part of ensuring data of known and documented quality. If more stringent calibration requirements are included in a mandated method or by regulation, those calibration requirements override any requirements outlined here or in laboratory SOPs. Generally, instrument calibrations are provided in test methods.

Policy
All initial instrument calibrations are verified with a standard obtained from a second source traceable to a national standard when commercially available. If a second source is not available, a standard prepared from a separate lot may be used as long as the manufacturer can demonstrate the lot was prepared independently from other lots purchased.

Policy
If the reference or mandated method does not specify the number of calibration standards to use, the minimum number of calibration standards is five, not including blanks or a zero standard.

Policy
Any samples that are analyzed after an unacceptable initial calibration are re-analyzed or the data are reported with qualifiers, appropriate to the scope of the unacceptable condition.

Policy
Quantitation is always determined from the initial calibration unless the test method or applicable regulations require quantitation from the continuing calibration.

Policy
The lowest calibration standard is the lowest concentration for which quantitative results can be reported without qualification. The lowest calibration standard is equal to the Limit of Quantitation and is greater than the limit of detection.

Policy
The highest calibration standard is the highest concentration for which quantitative results can be reported.

Policy

Data reported that are greater than the highest calibration standard without dilution are considered to be an estimate and are reported with a qualifier code and explained in the case narrative.

Policy
All calibrations are peer reviewed before data is reported using the respective calibration. The review process is documented using the curve review form.
Procedure
Initial instrument calibration includes calculations, integrations, acceptance criteria, and associated statistics referenced in the test method SOP.

When initial instrument calibration procedures are referenced in the test method, the referenced material is retained by the laboratory and are available for review.

Sufficient raw data records are collected to allow reconstruction of the initial instrument calibration. These include, at a minimum, calibration date, test method, instrument, analysis date, analyte names, analysts signature or initials, concentration and response, calibration curve or response factor, or unique equation or coefficient used to reduce instrument responses to concentration.
Calibration date and expiration date (when recalibration is due) is recorded for equipment requiring calibration, where practicable.

Acceptance criteria are listed in the method specific SOP. Such criteria are appropriate to the calibration technique employed.

Corrective actions are performed when the initial calibration results are outside acceptance criteria. Calibration points are not dropped from the middle of the curve unless the cause is determined and documented. If the cause cannot be determined, the calibration curve is re-prepared. If the low or high calibration point is dropped from the curve, the working curve is adjusted and sample results outside the curve are qualified.

In the event that an interior calibration point fails for one or more target analytes, the calibration point in question may be reprepared and reanalyzed once. In this instance all the target analytes must be replaced with the reanalyzed standard values.

Results that are less than the lower calibration standard are considered to have increased uncertainty, and are either reported with a qualifier code and/or explained in the case narrative.

Results that are greater than the highest calibration standard are either diluted to within the calibration range, or considered to be an estimate; and are reported with a qualifier code and/or explained in the case narrative.

For instrumentation where single point calibration is recommended by manufacturer's instructions, such as with some ICP and ICP/MS technologies (with a zero and single point calibration), the following apply:

a) For single point plus zero blank calibrations, the zero point and the single point standard are analyzed prior to the analysis of samples, and the linear range of the instrument established by analyzing a series of standards, one of which is at the lowest quantitation level.Zero blank and single point calibration standards are analyzed with each analytical batch for methods where they are specified.

c) A standard corresponding to the limit of quantitation is analyzed with each analytical batch and must meet established acceptance criteria when using single point plus zero blank calibrations.The linearity of single point plus zero blank calibrations is verified at a frequency established by the method or the manufacturer.

20.3.3 Continuing Instrument Calibration

Policy
The validity of the initial calibration is verified prior to sample analysis by use of a continuing instrument calibration verification (CCV) standard.

Policy
Corrective action is initiated for continuing instrument calibration verification results that are outside of acceptance criteria.

A preparation batch is composed of one (1) to twenty (20) environmental samples of the same quality systems matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be twenty-four (24) hours.

An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) which are analyzed together as a group. An analytical batch can include prepared samples originating from various quality system matrices and can exceed twenty (20) samples.

Procedure
Continuing instrument calibration verification is performed at the beginning and end of each analytical batch, except for instances when an internal standard is used. For methods employing internal standards, only one verification is performed at the beginning of the analytical batch.

Continuing instrument calibration verification is performed whenever it is expected that the analytical system may be out of calibration or might not meet verification acceptance criteria.

Continuing instrument calibration verification is performed when the time period for calibration or the most recent calibration verification has expired.

Continuing instrument calibration verification is performed for all analytical systems that have a calibration verification requirement.

Calibration is verified for each compound, element, or other discrete chemical species.

The calculations and associated statistics for continuing instrument calibration are included or referenced in the test method SOP.

Sufficient raw data records are retained to allow reconstruction of the continuing instrument calibration verification. Continuing instrument calibration verification records connect the continuing verification date to the initial instrument calibration.

See the method specific SOP for continuing instrument calibration verification acceptance criteria.

20.3.4 Unacceptable Continuing Instrument Calibration Verifications

If routine corrective action for continuing instrument calibration verification fails to produce a second consecutive (immediate) calibration verification within acceptance criteria, then a new calibration is performed or acceptable performance is demonstrated after corrective action with two consecutive calibration verifications.

For any samples analyzed on a system with an unacceptable calibration, some results may be useable if qualified and under the following conditions:

a) If the acceptance criteria are exceeded high (high bias) and the associated samples are below detection, then those sample results that are non-detects may be reported as non-detects.

b) If the acceptance criteria are exceeded low (low bias) and there are samples that exceed the maximum regulatory limit, then those exceeding the regulatory limit may be reported.

SECTION 21 – MEASUREMENT TRACEABILITY

Measurement quality assurance comes in part from traceability of standards to certified materials.

POLICY
All equipment used that affects the quality of test results are calibrated prior to use and on a continuing basis. These calibrations are traceable to national standards of measurement where available.

POLICY
Measurements from laboratory equipment provide the uncertainty required by test method or client.

POLICY
If traceability of measurements to SI units is not possible or not relevant, evidence for correlation of results through inter-laboratory comparisons, proficiency testing, or independent analysis is provided.

PROCEDURE
All equipment that affects the quality of test results are calibrated according to the minimum frequency suggested by the manufacturer, by regulation, by method, or as needed.

Clients can verify that required uncertainty is achieved by reviewing the internal quality control data, if requested.

21.1 Reference Standards

REFERENCE STANDARDS are standards of the highest quality available at a given location, from which measurements are derived.

Policy
Reference Standards, such as ASTM Class 1 weights, are used for calibration only and for no other purpose unless it is shown that their performance as reference standards will not be invalidated.

Procedure
Reference standards, such as ASTM Class 1 weights, are calibrated by an entity that can provide traceability to national or international standards.
The following reference standards are sent out to be calibrated to a national standard:

a) Class 1 weights are sent out for calibration every year.
b) Reference thermometers are calibrated every year.

21.2 Reference Materials

REFERENCE MATERIALS are substances that have concentrations that are sufficiently well established to use for calibration or as a frame of reference.

Policy

Reference materials, where commercially available, are traceable to national standards of measurement, or to Certified Reference Materials, usually by a Certificate of Analysis.

Policy
Internal reference materials, such as working standards or intermediate stock solutions, are checked as far as technically and economically possible.

Procedure
Purchased Reference Materials require a Certificate of Analysis where available. Otherwise, purchased reference materials are verified by application to a certified reference material, inter-laboratory comparison, and/or demonstration of capability.

Internal Reference Materials, such as working standards and intermediate stock solutions, are checked with inter-laboratory comparison studies, independent analysis, demonstration of capability, or proficiency tests

a) Internal thermometers are verified annually.
b) Weights used to evaluate balances are verified annually.

21.3 Transport and Storage of Reference Standards and Materials

Policy
ETI handles and transports reference standards and materials in a way that protects their integrity.

Procedure
Reference standard and material integrity is protected by separation from incompatible materials and/or minimizing exposure to degrading environments or materials.

Reference standards and materials are stored according to manufacturer's recommendations and separately from working standards or samples.

21.4 Labeling of Reference Standards, Reagents, and Materials

Policy
Reference standards and materials are tracked from purchase, receipt, and storage through disposal.

Policy
Expiration dates can be extended if the reference standard or material's integrity is verified. This verification can be made with a second source standard which is not expired or through manufacturers continuing ongoing stability study.

Policy
Reagent quality is verified during routine blank analyses.

Procedure
Records for all standards, reagents, reference materials, and media include:

1. the manufacturer/vendor name (or traceability to purchased stocks or neat compounds)
2. the manufacturer's Certificate of Analysis or purity (if supplied)
3. the date of receipt
4. reference to the method of preparation
5. date of preparation
6. recommended storage conditions
7. an expiration date after which the material shall not be used (unless its reliability is verified by the laboratory). It may be documented elsewhere if referenced.
8. preparer's initials (if prepared)

In methods where the purity of reagents is not specified, analytical reaqent grade is used. If the purity is specified, that is the minimum acceptable grade. Purity is verified and documented according to Section 9, Purchasing, Services, and Supplies.

All containers of standards, reagents, or materials, whether original or prepared, are labeled with an expiration date.

All containers of prepared standards and reference materials have a preparation date and unique identifier assigned by the LIMS. .

Standard preparation records are kept in the LIMS and allow for traceability to purchased stocks or neat compounds, reference to the method of preparation, date of preparation, expiration date, and preparer's initials.

Prepared reagents are verified to meet the requirements of the test method through routine quality control measures.

SECTION 22 – SAMPLE MANAGEMENT

POLICY
ETI's sample management plan protects both our clients as well as the laboratory itself.

22.1 Sample Receipt

Policy
Laboratory management ensures all acceptance criteria are verified and logged into LIMS and are properly labeled and stored.

Procedure
When samples are received at ETI, their condition is documented in the LIMS system, they are given unique identifiers, and they are logged into the sample tracking system.

22.2 Sample Acceptance

Policy
The minimum conditions a sample must meet on receipt are: Temperature, pH, preservative type, bottle type, sample integrity, holding time, and documentation (Sample ID, date and time of collection, collector's name, preservation type, sample type, and comments). See section 25.5 of this document for the ETI Sample Acceptance Policy which is made available to all clientele including sample collection personnel.

If these conditions are not met, the client is contacted prior to any further processing and correspondence is documented on the sample receipt form. If there is a chance, due to the inability to make contact with clientele, the holding times of samples will not be met, ETI will proceed with the analysis to meet holding time requirements and continue trying to make successful contact.

Procedure
The laboratory checks samples for the conditions above, where appropriate, to evaluate sample acceptance.

The following preservation checks are performed and documented upon receipt:

Thermal preservation:

a) For samples that require preservation at ≤6 °C, the acceptable range is "from just above freezing to 6 °C".
b) Samples that are delivered to the lab the same day as they are collected are likely not to have reached a fully chilled temperature. This is acceptable if there is evidence that chilling has begun.
c) Record on the receipt form if ice is present and the temperature.

Chlorine checks:

d) Microbiological samples from chlorinated water systems do not require a chlorine check if:

- Sufficient sodium thiosulfate is present (to neutralize 15 mg/L chlorine for wastewater).
- One container from each batch of containers is checked for efficacy of the sodium thiosulfate for 15 mg/L chlorine for wastewater.
- Chlorine residual is checked in the field and documented.

pH checks:

e) The pH of samples requiring acid/base preservation is checked upon sample receipt or upon initiation of analysis.

The sample acceptance policy is available to sample collection personnel, and emphasizes the need for use of water resistant ink, use of appropriate containers, adherence to holding times, sample volume requirements, and what to do with compromised samples.

Any forms submitted with samples are maintained in the order file.

If the checks performed upon sample receipt indicate the criteria are not met, then 1) the sample is rejected as agreed with the client, 2) the decision to proceed is documented and agreed upon with the client, 3) the condition is noted on the Chain of Custody form and/or sample receipt form, and 4) the data are qualified in the report.

22.3 Sample Identification

Policy
Samples, including subsamples, extracts, and digestates, are uniquely identified in a permanent chronological record (such as a sample receipt log book or database) to prevent mix-up and to document receipt of all sample containers. This unique identification number accompanies the sample and all associated documentation, sample preparation, analysis, and remains intact through sample disposal.

Procedure
Samples are assigned sequential numbers that reference more detailed information kept in the Chain of Custody binder located in the main hallway.

The following information is collected in the order file.

a) Client or project name
b) Date and time of sampling
c) Date and time of receipt at lab
d) Unique laboratory identification number
e) Unique field identification number (may be same as lab #)
f) Initials of recorder
g) Analyses requested
h) Comments regarding rejection (if any).

22.4 Sample Storage

Procedure
Storage conditions are monitored for any required criteria, verified, and the verification recorded in a log including continuous temperature monitoring with data loggers. The data from the continuous temperature data loggers must be downloaded and saved to the server every day following a day where temperatures were not recorded manually to ensure that temperatures were within compliance. Samples are stored in accordance with the same criteria as mentioned in section 22.2 a) and b). All thermometers and data loggers should be placed in the appropriate media to achieve accurate temperatures (example: sand, water, glycol, etc.).
Samples are held secure, as required. Samples are stored apart from standards, reagents, food or potentially contaminating sources, and such that cross-contamination is minimized. All portions of samples, including extracts, digestates, leachates, or any product of the sample is maintained according to the required conditions.

22.5 Sample Disposal

Policy
Samples are disposed of according to Federal, State and local regulations. Procedures are available for the disposal of samples, digestates, leachates, and extracts.

Procedure
Non-hazardous aqueous samples are disposed of in the sanitary sewer system. Solid samples are disposed of in the solid waste drum. Non-aqueous liquids are disposed of in the non-aqueous liquid drum. Non-hazardous digestates are disposed of in the sanitary sewer system. Leachates are disposed of in the sanitary sewer system. Extracts are disposed of in the solvent vial waste drum. Hazardous aqueous samples and digestates, as determined by flagging capabilities in the LIMS system, are segregated and combined. This combined waste is then tested and if it exceeds any of the TCLP limits, it is treated as hazardous waste.

Samples submitted to the laboratory with "Hold" status will be retained for 30 days from the date of receipt unless otherwise requested by the client.

22.6 Sample Transport

Policy
Samples that are transported under the responsibility of ETI, where necessary, are done so safely and according to storage conditions. This includes moving bottles within the laboratory. Specific safety operations are addressed outside of this document.

22.7 Sampling Records

Policy
Sampling plans are based, whenever it is reasonable or requested by the client, on appropriate statistical sampling methods.

Sampling by ETI staff is done explicitly by the direction of the client or according to regulatory requirements. If the client requires deviations, additions, or exclusions from the documented sampling procedure, these deviations are recorded in detail with the associated logbooks and in all documents containing environmental test results. These deviations are communicated to the appropriate personnel.

Test method SOPs direct analysts and technicians in the correct procedure for sub-sampling to ensure validity of environmental tests and calibration results.

Sub-sampling within the laboratory is performed according to test method SOPs and the Sub-sampling SOP.

Relevant sampling data are recorded, including, 1)the sampling procedure used, 2) the identification of the sampler, 3) environmental conditions (if relevant), 4) the sampling location, and 5) the statistics upon which the sampling procedures are based.

SECTION 23 – QUALITY OF TEST RESULTS

23.1 Essential Quality Control Procedures

Policy
All essential quality control elements are collected and assessed on a continuing basis.

Policy
The qualities of test results are recorded in such a way that trends are detectable, and where practicable, are statistically evaluated.

ETI utilizes LIMS to keep track of these values and statistical evaluations can be generated upon request. ETI updates control limits on a bi-annual basis. This happens in January and July. Both are completed by the end of the month respectively. The process of generating, updating, evaluating and storing the control limits is described in the SOP for Control Chart Generation.

Policy
For test methods that do not provide acceptance criteria for an essential quality control element or where no regulatory criteria exist, acceptance criteria are developed. Control limits are developed using the mean, plus or minus 3 standard deviations; or static limits such as +/- 20 percent. These limits can be found in the method specific SOP and/or SOP for Quality Control.

Policy
The quality control procedures specified in test methods are followed by laboratory personnel. The most stringent of control procedures is used in cases where multiple controls are offered. If it is not clear which is the most stringent, that mandated by test method or regulation is followed.

Procedure
To monitor the validity of environmental tests performed, review includes any one or combination of the techniques below:

a) use of certified reference materials or cultures and/or internal quality control using secondary reference materials;
b) participation in proficiency testing programs;
c) replicate testing using the same or different methods;
d) retesting of retained samples; and/or
e) correlation of results for different characteristics of a sample.

Written procedures to monitor quality controls including acceptance criteria are located in the test method SOPs, except where noted, and include such procedures as:

a) use of laboratory control samples and blanks to serve as positive and negative controls for chemistry methods;
b) use of laboratory control samples to monitor test variability of laboratory results;

c) use of calibrations, continuing calibrations, certified reference materials and/or PT samples to monitor accuracy of the test method;

d) measures to monitor test method capability, such as limit of detection, limit of quantitation, and/or range of test applicability, such as linearity;

e) use of regression analysis, internal/external standards, or statistical analysis to reduce raw data to final results;

f) use of reagents and standards of appropriate quality;

g) procedures to ensure the selectivity of the test method;

h) measures to assure constant and consistent test conditions, such as temperature, humidity, rotation speed, etc., when required by test method;

i) use of sterility checks for equipment, media and dilution water for microbiology; and

j) use of positive and negative culture controls for microbiology.

23.2 Internal Quality Control Practices

Analytical data generated with QC samples that fall within prescribed acceptance limits indicate the test method is IN CONTROL.

QC samples that fall outside QC limits indicate the test method is OUT OF CONTROL (non-conforming) and that corrective action is required or that the data are qualified.

Policy
Detailed QC procedures and QC limits are included in text method standard operating procedures (SOPs), or where unspecified in the SOPs, are detailed elsewhere.

Policy
All QC measures are assessed and evaluated on an on-going basis, so that trends are detected.

ProcedureThe following general controls are used:
Positive and Negative Controls such as:

a) Blanks (negative)

b) Laboratory control sample (positive)

c) Sterility checks and control cultures (positive and negative).

Selectivity is assured through:

a) absolute and relative retention times in chromatographic analyses;

b) two-column confirmation when using non-specific detectors;

c) use of acceptance criteria for mass-spectral tuning (found in test method SOPs);

d) use of the correct method according to its scope assessed during method validation; and

e) use of reference cultures (positive and negative) from a recognized manufacturer (where applicable).

Consistency, Variability, Repeatability, and Accuracy are assured through:

a) proper installation and operation of instruments according to manufacturer's recommendations or according to the processes used during method validation;

b) monitoring and controlling environmental conditions (temperature, access, proximity to potential contaminants);

c) selection and use of reagents and standards of appropriate quality; and

d) cleaning glassware appropriate to the level required by the analysis. Cleaning procedures not provided in test method SOPs are provided in a separate SOP.

e) following SOPs and documenting any deviation, assessing for impact, and treating data appropriately;

f) testing to define the variability and/or repeatability of the laboratory results, such as replicates;

g) use of measures to assure the accuracy of the test method, including calibration and/or continuing calibrations, use of certified reference materials, proficiency test samples, or other measures;

h) use of duplicate plate counts on positive samples (microbiology only).

Acceptance or rejection criteria are created according to laboratory policy where no method or regulatory criteria exist. Acceptance criteria define the boundary for the appropriate response from laboratory personnel, such as corrective action, reporting with qualifiers, reanalysis, review, and others.

Test Method Capability is assured through:

a) establishment of the limit of detection where appropriate;

b) establishment of the limit of quantitation or reporting level; and/or

c) establishment of the range of applicability such as linearity;

Data reduction is assured to be accurate by:

a) selection of appropriate formulae to reduce raw data to final results such as regression;

b) periodic review of data reduction processes to assure applicability;

c) microbiological calculations, data reduction, and statistical interpretations specified by each test method.

The following tables summarize the key elements of a quality control system for a laboratory performing chemistry and microbiology testing.

Table 23.2-1 Essential Quality Control Elements for Chemistry			
Item	**Frequency**	**Acceptance Criteria**	**Corrective action**
Negative Control (Method Blank)	1/batch	Method specific or reporting limit	Qualify data and take corrective action
Positive Control (Laboratory Control Sample)	1/batch	Method specific or determined by laboratory	Reprocess, reanalyze, or qualify data.
Matrix Spike; Matrix Spike Duplicates	Per method requirement	Method specific or determined by laboratory	Corrective action and/or qualify data.
Surrogate spikes	Per method requirement	Method specific or determined by laboratory	Corrective action and/or qualify data
Matrix Duplicates	Per method requirement	Method specific or determined by laboratory	Corrective action and/or qualify data
Continuing Calibration Verification	Per method requirement	Method specific or determined by the laboratory	Reanalyze standard immediately; Corrective action
Initial calibration Verification	Start of each analytical run	Method specific or determined by laboratory	Reanalyze standard immediately; Corrective action

Table 23.2-2 Essential Quality Control Requirements for Microbiology – All Methods

Item	Frequency	Acceptance Criteria	Corrective action
Sterility blank	Each lot of media prior to first use	No growth	Investigate cause
Sterility check containers	One container (bottle) for each lot or batch sterilized (NSGM)	No growth	Investigate cause
Sterility check dilution water	One per batch of dilution water (NSGM)	No growth	Investigate cause
Positive control[1]	Each lot is tested by manufacturer for positive control.		
Negative control[1]	Each lot is tested by manufacturer for negative control.		
Duplicate colony counts (For numeric results only)	Monthly on one positive sample for each month performed.	Same analyst <5% difference between counts Two analysts <10% difference between counts	Investigate cause Qualify data

1) Microorganisms may be single use preparations or cultures maintained by documented procedures that demonstrate the continued purity and viability of the organism.

Table 23.2-3 Essential Quality Control Requirements for Microbiology – Filtration Methods Only

Item	Frequency	Acceptance Criteria	Corrective action
Sterility blank media	Each lot of media prior to first use	No growth	Investigate cause
Sterility check equipment	Beginning of each run - 1 for every 10 samples -	No growth	Investigate cause Qualify data
Sterility check filters	One filter for each new lot of membrane filters (NSGM)	No growth	Investigate cause
Target organism verification (D.3.4.b)	Method specific	Confirmation of reaction	Investigate cause

Table 23.2-4 Essential Quality Control Requirements for Microbiology – Pour Plate Methods Only			
Item	**Frequency**	**Acceptance Criteria**	**Corrective action**
Sterility blank media	Each lot of media prior to first use minimum one plate per batch	1 col/plate	Investigate cause

23.3 Method Blanks

Policy
Contaminated blanks are identified according to the acceptance limits in the test method SOPs or laboratory documentation.
Policy
Samples associated with a contaminated blank are evaluated as to the appropriate corrective action for the samples (e.g. reprocessing or data qualifying codes).

Procedure
ETI identifies a blank as contaminated when analyte results are greater than the reporting limit AND greater than 1/10 of that found in any sample, or where the contamination affects the sample results according to test method requirements or client objectives.

When a blank is determined to be contaminated, the cause must be investigated and measures taken to minimize or eliminate the problem.

Data that are unaffected by the blank contamination (non-detects or other analytes) are reported unqualified.

Sample data that are suspect due to the presence of a contaminated blank are reanalyzed or qualified.

23.4 Laboratory Control Samples

LABORATORY CONTROL SAMPLES (LCS) are prepared from analyte free water, and spiked with verified and known amounts of analytes for the purpose of establishing precision or bias measurements.

Policy
Laboratory control samples are analyzed at a frequency mandated by method, regulation, or client request, whichever is more stringent.
Procedure
The results of laboratory control samples (LCS) are calculated in percent recovery or other appropriate statistical technique that allows comparison to established acceptance criteria. The laboratory documents or references the calculation in the test method SOPs.

The individual LCS is compared to the acceptance criteria as published in the mandated test method, or where there are no established criteria, the laboratory established limits.

23.5 Matrix Spikes and Matrix Spike Duplicates

MATRIX SPIKES (MS and MSD [duplicates]) are environmental samples fortified with a known amount of analyte to help assess the affect of the matrix on method performance.

Policy
The MS/MSD results are used to help assess precision and the effect of the sample matrix on method performance.

Procedure
The laboratory procedure for MS/MSD includes spiking appropriate analytes at appropriate concentrations, calculating percent recoveries and relative percent difference (RPD), and evaluating and reporting the results.

Laboratory Control Spike (LCS) / Laboratory Control Spike Duplicates (LCSDs) will be substituted for MS/MSDs when insufficient sample material is provided to prepare MS / MSD samples.

See the SOP for Data import and entry into LIMS for MS/MSD reporting and qualifying criteria.

23.6 Surrogate Spikes

SURROGATES are substances with chemical properties and behaviors similar to the analytes of interest used to assess method performance in individual samples.

Policy
Surrogates are added to all samples (in test methods where surrogate use is appropriate) prior to sample preparation or extraction.

Procedure
Surrogate recovery results are compared to the acceptance criteria as published in the mandated test method.

Where there are no established criteria, the laboratory uses static +/- 20% for waters and +/- 30% for solids as surrogate control limits.

For surrogate results outside established criteria, data are evaluated to determine the impact. Corrective actions include reanalysis, qualification of data, and/or client discussion as appropriate.

23.7 Proficiency Test Samples or Interlaboratory Comparisons

Policy
ETI participates in proficiency test (PT) samples twice per year.

Policy
ETI institutes corrective action procedures for failed PT samples.

Policy
ETI does not share PT samples with other laboratories, does not communicate with other laboratories regarding current PT sample results, and does not attempt to obtain the assigned value of any PT sample from the PT provider.

Procedure
Proficiency Testing (PT) or Proficiency Evaluation (PE) samples are treated as typical samples in the normal production process where possible, including the same preparation, calibration, quality control and acceptance criteria, sequence of analytical steps, number of replicates, and sample log-in. PT samples are not analyzed multiple times unless routine environmental samples are analyzed multiple times. Proficiency test results and all associated raw data is filed and maintained by the Technical Director.

23.8 Data Review

Policy
The laboratory reviews all data generated in the laboratory for compliance with method, laboratory and, where appropriate, client requirements.

Policy
All data review is documented and retained for the required period of time.
ProcedureInitially, the analyst reviews data for acceptability of quality control measures and accuracy of the final result(s).
After the initial review, data is entered into the LIMS by either electronic data transfer or manually. After data has been entered into LIMS, a second reviewer considers all manual transfers and calculations of data in detail and spot checks all electronic transfers of data.
Final reports are compared to raw data either directly or through several review steps.
Logbooks or LIMS are used to record the information for traceability of the analysis. The bench sheets include quality control measurements. Data are recorded on the logbooks promptly, at the time of the analysis, in ink.
Analysts review sample data and the QC information at the time of analysis and indicate if the QC parameters meet the acceptance criteria by marking the logbook. The analyst's initials or signature along with date are inked on the logbook to indicate that they have performed the steps indicated and that the analysis meets acceptance criteria or has exceptions that are noted in the comments section of the bench sheet.
When the analyst has finished the primary analysis review, another person in the laboratory, designated by management, checks the logbook for the following: All required information has been recorded on the logbook. QC criteria have been met or exceptions recorded. Manual calculations are checked for accuracy.
When these checks have been completed, the reviewer's initials or signature along with the date are inked on the Log book to document the review has been performed.
Once the requested analysis on a specific project has been completed, the client project file is submitted to management for reporting. A member of management approves the work order and generates and reviews a PDF of the report using the reporting module in LIMS. A second member of management then reviews the PDF and all associated data and documents the secondary review by initialing and dating the bottom of the sample receipt form. Once this approval is complete, the report is

then issued to the respective client by one or more of the following: e-mail, fax, or hardcopy.

SECTION 24 – REPORTING OF RESULTS

POLICY
The result of each test carried out is reported accurately, clearly, unambiguously, and objectively and complies with all specific instructions contained in the test method.

POLICY
Data are reported without qualification if they are greater than the lowest calibration standard, lower than the highest calibration standard, and without compromised sample or method integrity.

24.1 Test Reports

Policy
The report format has been designed to accommodate each type of test performed and to minimize the potential for misunderstanding or misuse.

Procedure
Each test report generated contains the following information (unless not required by the client):

a) a title, such as Test Report or Analytical Results;
b) the name and address of the laboratory, the location of the laboratory if different from the address, and the phone number and name of a contact person;
c) unique identification of the test report, such as an order number, on each page and a pagination system that ensures that each page is recognized as part of the test report and a clear identification of the end of the report, such as 3 of 10;
d) the name and address of the client if applicable;
e) the identification of the test method used;
f) an unambiguous identification of the sample(s), including the client identification code;
g) the date of sample receipt when it is critical to the validity and application of the results, date and time of sample collection, dates the tests were performed, the time of sample preparation and analysis if the required holding time for either activity is less than or equal to 72 hours;
h) reference to the sampling plan and procedures used by the laboratory where these are relevant to the validity or application of the results;
i) the test results with failures identified, units of measurement, an indication of whether results are calculated on a dry weight or wet weight basis;
j) the name, function, and signature or an equivalent electronic identification of the person authorizing the test report, and the date of issue;
k) a statement to the effect that the results relate only to the samples;
l) at the laboratory's discretion, a statement that the report shall not be reproduced except in full without written approval of the laboratory;
m) certification that the results are in compliance with the ODEQ and/or NELAC/NELAP standards if accredited to be in compliance, or provide reasons and/or justification if they do not comply.

24.2 Supplemental Test Report Information

When necessary for interpretation of the results or when requested by the client, test reports include the following additional information:

a) deviations from, additions to, or exclusions from the test method, information on specific test conditions, such as environmental conditions, and any non-standard conditions that may have affected the quality of the results, and any information on the use and definitions of data qualifiers;

b) a statement of compliance/non-compliance when requirements of the quality systems are not met, including identification of test results that did not meet EPA sample acceptance requirements, such as holding time, preservation, etc.;

c) where applicable and when requested by the client, a statement on the estimated uncertainty of the measurement;

d) where appropriate and needed, opinions and interpretations

e) When opinions and interpretations are included, the basis upon which the opinions and interpretations are documented. Opinions and interpretations are clearly marked as such in the test report.

f) additional information which may be required by specific methods or client;

g) qualification of results with values outside the working range.

For test reports that contain the results of sampling, the following is provided if necessary for the interpretation of the results:

a) the date of sampling;

b) unambiguous identification of the material sampled;

c) the locations of the sampling, including diagrams, sketches, or photographs;

d) a reference to the sampling plan and procedures used;

e) details of any environmental conditions during sampling that may affect the interpretations of the test results;

f) any standard or other specification for the sampling method or procedure, and deviations, additions to or exclusions from the specification concerned.

24.3 Environmental Testing Obtained from Subcontractors

Test results obtained from test performed by subcontractors are clearly identified on the test report by subcontractor name and/or accreditation number.

The test results from subcontractors are reported in writing or electronically. A copy of the subcontractors report is to be made available to the client if requested.

A copy or original report from the subcontract laboratory is retained in the specific ETI order file.

24.4 Electronic Transmission of Results

Policy
All test results transmitted by telephone, fax, telex, e-mail, or other electronic means comply with the requirements of this *Quality Manual* and associated procedures to protect the confidentiality and proprietary rights of the client.

24.5 Amendments to Test Reports

Policy
Material amendments to a test report after it has been issued are made only in the form of another document or data transfer. All supplemental reports meet all the requirements for the initial report and the requirements of this *Quality Manual*.

Procedure
When a laboratory report must be revised, it is clearly identified as revised. This is Accomplished by adding the word "REVISED" into the work order memo tab within the reporting module of LIMS.

When it is necessary to issue a complete new report, the new report is uniquely identified and contains a reference to the original that it replaces.

SECTION 25 – APPENDICES

25.1 Scope of Analytical Testing

ETI's scope of analytical testing are shown on our accreditation certificate.

25.2 Job Descriptions Not Listed in Section 17.1

25.2.1 Sample Custodian

The sample custodian is responsible for determining acceptability of samples, sample receipt, login, distribution of samples throughout the laboratory, and other functions deemed necessary by management.

25.2.2 Organic Analyst

Organic analysts are responsible for collection of chromatographic data, calculations, review of data, entry of quality control and results in LIMS, and other functions deemed necessary by management. Minimum educational requirement for organic analysts is a four year science degree.

25.2.3 Metals Analyst

Metals analysts are responsible for collection of data, calculations, entry of quality control and results in LIMS, and other functions deemed necessary by management. Minimum educational requirement for metals analysts is a four year science degree.

25.2.4 Microbiology Analyst

Microbiology analysts are responsible for collection of data, calculations, entry of quality control and results in LIMS, and other functions deemed necessary by management. Minimum educational requirement for microbiology analysts is a four year science degree.

25.2.5 Wet Chemistry Analyst

Wet chemistry analysts are responsible for collection of data, calculations, entry of quality control and results in LIMS, and other functions deemed necessary by management. Minimum educational requirement for wet chemistry analysts is a four year science degree.

25.2.6 Analyst Assistant

Analyst assistants are responsible for collection of data and calculations under the supervision of a qualified analyst, and other functions deemed necessary by management.

25.2.7 Extraction Technician

Extraction technicians are responsible for setting up extractors, concentrating extracts, other sample preparatory techniques, and other functions deemed necessary by management.

25.3 Procedure for DOC & CDOC

25.3.1 DOC

A quality control sample is prepared using stock standards that are prepared independently from those used in instrument calibration.

The analyte(s) is diluted in a volume of clean quality system matrix sufficient to prepare four aliquots at the concentration specified, or if unspecified, to a concentration of 1-4 times the limit of quantitation.

At least four aliquots are prepared and analyzed according to the test method either concurrently or over a period of days.

Using all of the results, the mean recovery is calculated in the appropriate reporting units and the standard deviations of the population sample (in the same units) for each parameter of interest. When it is not possible to determine mean and standard deviations, such as for pass/fail and logarithmic values, the performance is assessed against established and documented criteria.

Compare the information from above to the corresponding acceptance criteria for precision and accuracy in the test method (if applicable) or in laboratory generated acceptance criteria (if there are not established mandatory criteria). If all parameters meet the acceptance criteria, the analysis of actual samples may begin. If any one of the parameters do not meet the acceptance criteria, the performance is unacceptable for that parameter.

When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst must locate and correct the source of the problem and repeat the test for all parameters which failed to meet the acceptance criteria.

Acceptance criteria for each analyte is equal to ETI's laboratory control limits for the respective analyte, this must be passed for each of the four runs for the DOC determination.

Once the DOC is completed successfully, continuing DOC is demonstrated through the acceptable analysis of bi-annual proficiency samples.

For analyses which do not lend themselves to spiking with known amounts of analyte such as temperature, pH, microbiological testing, etc., and where not required by mandatory test method or regulation, the DOC consists of 4 samples analyzed in conjunction with an analyst approved by the Technical Director.

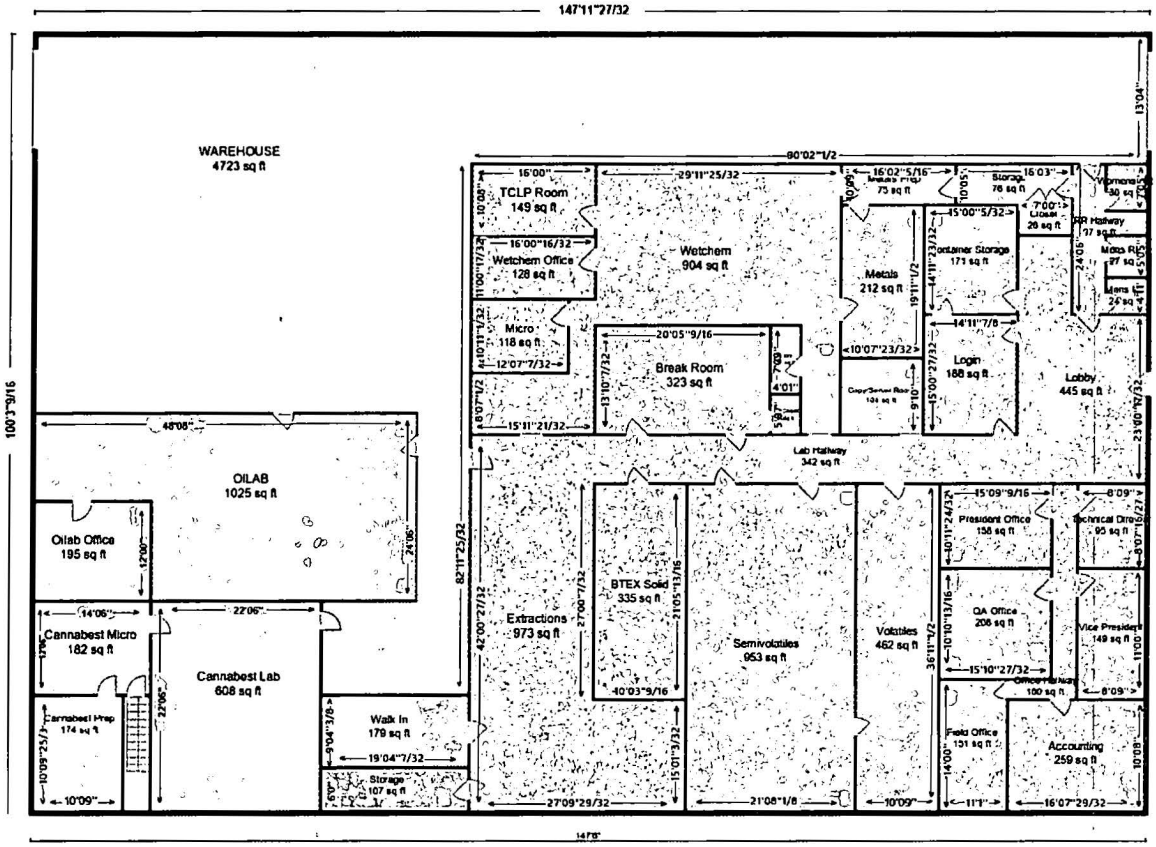
25.3.2 CDOC

In the instance there is one analyst within one department; bi-annual PT samples will be sufficient to demonstrate CDOCs. A passing PT will be sufficient for a passing CDOC.

For analysts who work in a work cell where multiple analysts are asked to perform the same analyses, CDOCs will be prepared and analyzed in conjunction with proficiency rounds. When one analyst from a work cell performs the preparation and analysis of a proficiency sample, all other members of the work cell are required to prepare and analyze four passing LCS replicates. Tracking to ensure these CDOCs are completed annually will be completed and monitored by the Technical Director.

25.4 Floor Plan

ETI-CBL-OIL Floorplan



25.5 ETI Sample Acceptance Policy

ETICD-DC-21
Version: 3.0

ENVIRONMENTAL
TESTING, INC.

Sample Acceptance Policy

Providing data that meets your project requirements is our top priority. Our sample receipt specialists begin evaluating your samples as soon as they arrive. Samples are checked for a variety of factors that may influence test results including appropriate containers, required, physical and/or chemical preservatives, amount of sample, and holding time constraints. This information is documented and included in your final report.

If conditions are discovered that may impact the validity of your test results, your samples will be placed on hold and you will be notified as soon as possible via email. Sample analysis will proceed once you acknowledge the potential issues and authorize us to continue via email or in writing.

The final data report will include flags, where appropriate, to indicate data that may have been impacted by the sampling process.

Holding Time Issues

Tests that have a short holding time (shorter than 48 hours) will be analyzed regardless of any issues noted during login to protect the integrity of the sample and the results will be flagged if applicable.

We will do our best to accommodate tests with holding times greater than 48 hours that are received with less than 72 hours of holding time remaining. However, the analysis may not be able to be completed within holding time. We will notify you if this is the case and proceed with the analysis as soon as possible without waiting on a response from you. Results will be flagged if applicable. *You will be billed for any test completed under either of these conditions.*

Sample Receipt Temperature

ETI is accredited to standards adopted in 2009 by the National Environmental Laboratory Accreditation Conference (NELAC) through participation in the National Environmental Laboratory Accreditation Program (NELAP). As part of our accreditation, we are required to document the temperature of all samples that require thermal preservation upon receipt. We will also document whether or not the samples are received on ice as evidence that the chilling process has started. For samples received on the same day they are collected, evidence that the cooling process has started is all that is required. All samples received on a later date should be received on ice at $\leq 6°$ C (approximately 43° F).

Sample Chain of Custody

Good sample chain of custody is also critical to data validity and should include sample identification, location, date and time of collection, sampler identification, information regarding preservation, sample type and any

special instructions. All information should be recorded in indelible ink and any labels that are used should be durable (water resistant).

Sample Material for Quality Assurance / Quality Control

ETI maintains a quality assurance/quality control program to evaluate the data we generate. As part of this program, we routinely analyze sample duplicates and samples spiked with the analyte of interest (matrix spike and matrix spike duplicates). We rely on extra sample material provided by our clients to support this portion of our quality program. We would appreciate one set of triplicate samples for each batch of twenty samples that you collect. If you are willing to help us with this, just let us know and we will provide extra containers. This is especially important for aqueous samples for extractable organic analyses. These including TPH-DRO, Semi-Volatiles, Pesticides, Herbicides, and PCBs.

Resources

We are happy to provide bottle kits for your project at no additional cost when picked up at our office. We stock new containers that are traceable by lot number for all the tests that we offer. Certificates of analysis are available for these containers upon request. For complete traceability, we recommend that you record these lot numbers in your sampling records. If you need this information included with your final report, simply provide it along with your Chain of Custody and we will be happy to incorporate it.

Shipping options are available on request.

We can also provide training in proper sampling techniques. Just let us know what you need, and we will tailor a solution for you.

For more information, contact us by email at info@etilab.com or (405) 488-2400.

25.6 Required Time Frames for Corrective Actions

All corrective actions must be completed within a reasonable timeframe. ETI has established the following goals for completion.

- Corrective Actions for Internal Audits - 30 days.
- Corrective Actions for failed Proficiency Tests - 60 days.
- All other Corrective Actions - 30 days.

25.7 Changes From Previous Revision

- Changed the document identification fields to the SharePoint fields. Version 5.0 (the newest version) is equivalent to Revision 9 in the old numbering system.
- Revised the language relating to other laboratories located with ETI (4.1)
- Revised subcontract laboratory (8)
- Updated the report delivery process (15.1)
- Updated the DOC documentation process (19.1)
- Revised standard tracking process (21.4)
- New floor plan and sample acceptance policy
- Various grammatical corrections

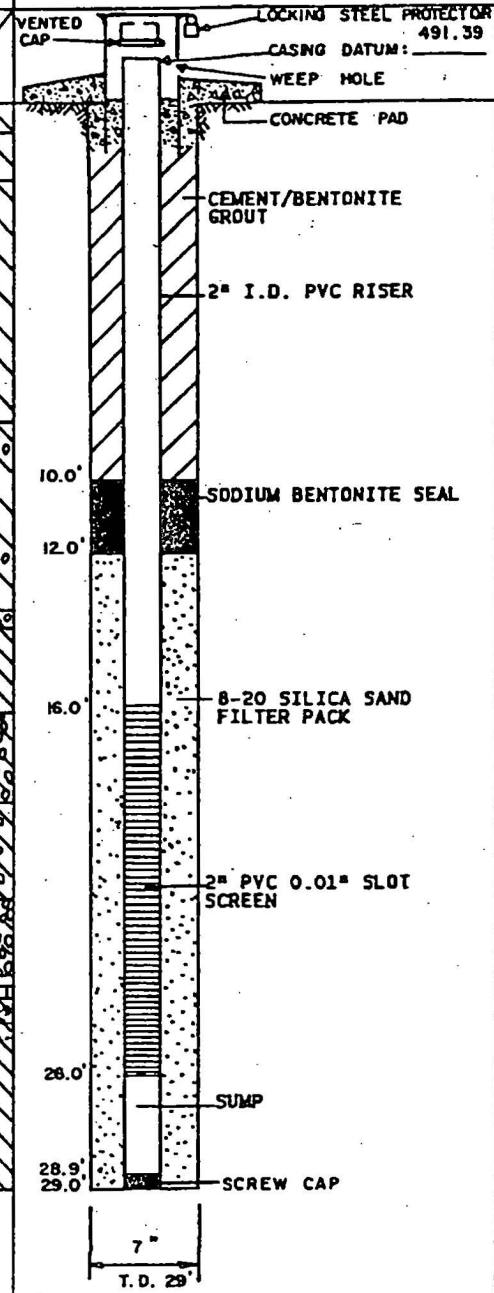
Appendix C

Monitor Well Logs
and
Multi-Purpose Completion Reports

GEOL. UNIT	DEPTH (Feet)	DESCRIPTION	USC	SAMPLE INTERVAL	"N" VALUE	GRAPHIC LOG
	0	GROUND SURFACE : 488.30				
	0.9	SILTY CLAY: DARK GRAY BROWN, 2.5 y4/2, MOIST, 5% ORGANICS, 30% SILT, 65% CLAY	CL	0		
	2.0	SILTY CLAY: BROWN-YELLOW, 6/6, MOIST, HIGH PLASTICITY, Fe NODULES (2%), 5% ORGANICS, 20% SILT, 73% CLAY	CH	3.8		
	5	SILTY CLAY: LIGHT GRAY 10 yr 7/1, Fe OXIDE NODULES (2%), MOIST, MED. PLASTICITY, 20% SILT, 75% CLAY, Mn OXIDE NODULES (2%) BELOW 7.1'.	CL	5		
1-11-88	8.6			5.0		
	10	GRAVELLY SILTY CLAY: YELLOW BROWN 10 yr 5/8, LIGHT GRAY MOTTLING, MOIST STIFF, Mn AND Fe OXIDE NODULES (10%), 20% SILT, 70% CLAY	CL	10		
	13.6			8.0		
	14.0	CLAYEY GRAVEL: YELLOW 10 yr 6/8, 60% LIMESTONE GRAVEL, 40% CLAY	GC			
	15	CLAY: YELLOW OLIVE GRAY 5y 6/2, STRATIFIED, MOIST, MED. PLASTICITY	CL	15		
	16.2	CLAYEY GRAVEL: BROWN-YELLOW 10yr 6/8, 60% FOSSILIFEROUS LIMESTONE AND CHERT GRAVEL, 40% CLAY, VERY MOIST	GC	8.0		
	18.7	GRAVELLY CLAY: BROWN YELLOW 10yr 6/8, STRATIFIED, MOIST, MEDIUM PLASTICITY, 40% LIMESTONE AND CHERT GRAVEL, 60% CLAY	CL	20		
	20			2.7		
	21.3	CLAYEY GRAVEL: BROWN-YELLOW 10yr 6/8, 60% FOSSILIFEROUS LIMESTONE GRAVEL, 40% CLAY (WEATHERED LIMESTONE)	GC			
	23.3					
	23.8	LIMESTONE: GRAY, MASSIVE, FOSSILIFEROUS, MICRITIC		25		
	25			2.0		
		CLAY: BLACK, STRATIFIED, VERY MOIST, HIGH PLASTICITY, MINOR (2%) GYPSUM (WEATHERED SHALE)	CH	27		
	29.0			1.0		
				29		
	30	BOREHOLE TERMINATED AT 29.0'.				
	35	NO VISUAL SOIL DISCOLORATION OBSERVED.				
		SLICKENSIDED SURFACES WET.				

CME SAMPLER

WELL COMPLETION DETAIL



DEPTH (Feet)

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER, (TONS/FT.²)

WELL NUMBER PZ - 1

JOB NUMBER 87014

DATE DRILLED 10-19-87
DRILLING METHOD HSA-CME SAMPLER
DRILLED BY SHEPHERD ENGR.
LOGGED BY M.T.
CHECKED BY BJS

PAGE 1 OF 1

ROBERTS/SCHORNICK & ASSOCIATES, INC.
Environmental Consultants
868 Copperwind Drive - Suite A
Norcross, Georgia 30092
(404) 921-1405

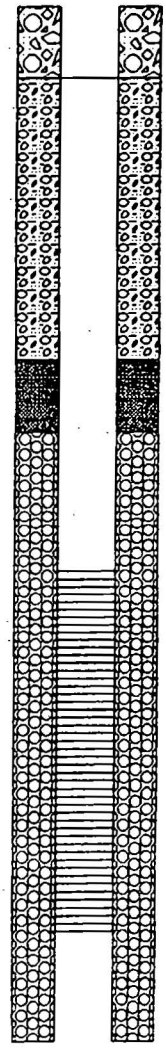
BLACK & ASSOCIATES
ENVIRONMENTAL CONSULTANTS, INC.

MONITOR WELL NUMBER: Mixon PZ-1

MONITOR WELL LOG

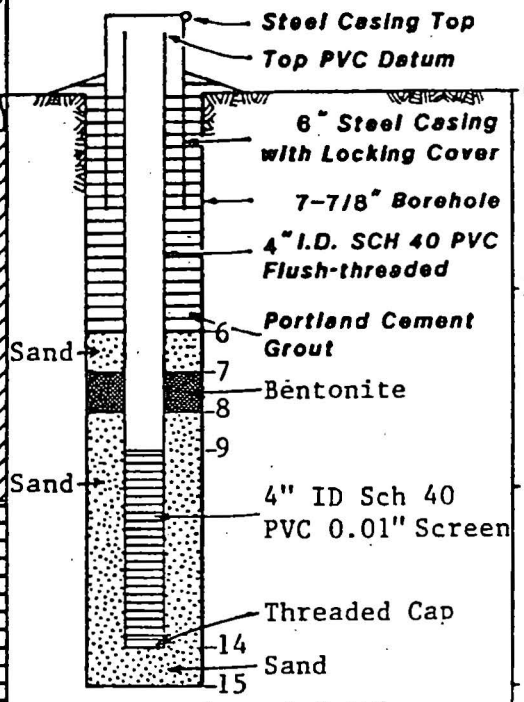
PROJECT NAME: Mixon Brothers Wood Preserving, Inc.
LOCATION: SENWNW 31-7S-24E (McCurtain County)
RIG TYPE & METHOD:
DATE BEGAN:
DATE COMPLETED:
TOTAL DEPTH: 29.0 FEET
GROUND SURFACE ELEVATION: 488.30
SHEET 1 OF 1

SAMPLE INTERVAL	DEPTH (FEET)	REMARKS: Inside 2" I.D. PVC Screen & Riser; Sodium Bentonite Seal (29.0' - 11'); Cement grout (12' - 1'); Compacted uncontaminated soil (1' - 0') LITHOLOGY DESCRIPTION	LITHOLOGY	WELL COMPLETION DATA
	0	Compacted unconotaminated soil		
		Cement grout		
	5			
	10	Sodium Bentonite granules		
	15			
	20			
	25			



Elev. (Feet)	Depth (Feet)	Description	USC	Sample Interval	% Recovery	Graphic Log
	0	**Ground Surface**				
	0.9	CLAY: brown, silty clay loam mottled, damp, plastic, abundant roots.	CL-ML	NO 2		
	5	CLAY: brownish-gray to reddish-gray, mottled, silty and sandy clay with up to 8% subrounded gravel, roots not present below about 5', common black FeO-MnO concretions in lower soil horizon.	CL	NO 4 NO 6 NO 8 NO 10		
	10.3	LIMESTONE: White, gray, and brownish-gray, fine to medium crystalline, massive to argillacious, fossiliferous lime, wackestone; upper 5.5' weathered, interval from 10.3 to 11.5 is clayey gravel with limestone fragments.	LS	NO 11.5 16.5	100%	
	18.3	SHALE: Grayish-green to green, homogenous, shale with horizontal partings less than 0.25", fissile, trace of pyrite, sparce occurrence of fossils at base, basal zone slighty calcareous. Thin lime wackestone beds from 22'6" - 22'7" and 28'1"-28'3".	SH	21.5 27 32	55% 0% 72% 97%	
	33.5	LIMESTONE: Brownish-gray, fine- to medium-crystalline, argillacous fossiliferous lime wackestone, individual beds are 3" to 5" thick separated by shale partings; very argillacious intervals from 35'4"-35'6"; 36'4"-37'3"; and 39'6"-39'9"	LS	37 40	90% 86%	

Well Completion Detail



Boring Terminated @ 15'

NOTES:

A) Evidence of water staining down to 17 feet.

B) No saturated zones were observed in this well.

C) 0'-0.9' A Soil horizon
0.9'-10.3' B Soil Horizon

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Norman, Oklahoma 73070
405•321-3895

Monitoring Well Record PZ-2

Location Mixon Brothers, Idabel, Oklahoma

Coordinates _____

Installation Date 01/07/86 to 01/09/86

Drilled By Winnek Logged By RLH

Elev. (Feet)	Depth (Feet)	Description	USC	Sample Interval	% Recovery	Graphic Log	Well Completion Detail	Depth (Feet)
	40	SHALE: Green shale.	SH					40
	41.2	LIMESTONE: Brownish-gray to gray, fine- to medium-crystalline, massive to argillacous, fossiliferous lime wackestone, rare styolites, common wavy, irregular shale partings. Shales and very argillaceous limestones occur at intervals from: 42'5"-42'8"; 43'-43'5"; 44'-44'1" 44'6"-45'1"; 46'-46'4"; 47'1" - 47'9"; 48'3"-50'; 42'6"-55'; and 56'2"-60'.	LS	45	98%			45
	50			50	100%			50
	55			55	98%			55
	60			60	92%			60
	61.5	SHALE: Gray-green to dark green shale, horizontal partings less than 0.25 inches, homogeneous, trace of pyrite; fossils in upper 3" (calcareous).	SH	65	55%			65
	70			70	92%			70
	75			75	97%			75
	80			80	93%			80

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Monitoring Well Record PZ-2

Location Mixon Brothers, Idabel, Oklahoma

Coordinates _____ _____

Installation Date 01/07/86 to 01/09/86

Drilled By Winnek Logged By RLH

Elev. (Feet)	Depth (Feet)	Description	USC	Sample Interval	% Recovery	Graphic Log	Well Completion Detail	Depth (Feet)
	80	SHALE: Green shale	SH					80
	81.2	LIMESTONE: Brownish-gray, fine to medium-crystalline, fossiliferous lime wackestone.	LS	85	85%			
	84.9 85	SHALE: Green shale.	SH		62%			85
	87.8	LIMESTONE: Brownish-gray to gray, fine- to medium-crystalline massive to argillacous, fossiliferous lime wackestone, rare styolites.	LS	95				90
	94.2 95	SHALE: Gray-green to dark green shale with horizontal parting less than 0.25 inches thick.	SH	97.5				95
	100			100				100
				102.5				
	105			105				105
				107.5				
	110			110				110
				112.5				
	115			115				115
				117.5				
	120			120				120

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Monitoring Well Record PZ-2

Location Mixon Brothers, Idabel, Oklahoma
Coordinates _____ _____
Installation Date 01/07/86 to 01/09/86
Drilled By Winnek **Logged By** RLH

Elev. (Feet)	Depth (Feet)	Description	USC	Sample Interval	% Recovery	Graphic Log	Well Completion Detail	Depth (Feet)
	120	SHALE: Green shale.	SH	122.5				120
	123	LIMESTONE: Gray to brownish gray, fine- to medium crystalline fossiliferous lime wackestone.	LS	125				125
	125			127.5				
	130			130				130
				132.5				
	135			135				135
	136.5	SHALE: Green shale.	SH	137.5				
				140				140
	140	SHALE AND LIMESTONE: interbedded green shale and lime wackestone.	SH-LS	142.5				
	142.5	SHALE: Green shale.	SH	145				145
	145	LIMESTONE: Gray fossiliferous lime wackestone.	LS	147.5				
	147.5	SHALE: Green shale.	SH	150				150
	150	Boring Terminated @ 150'						

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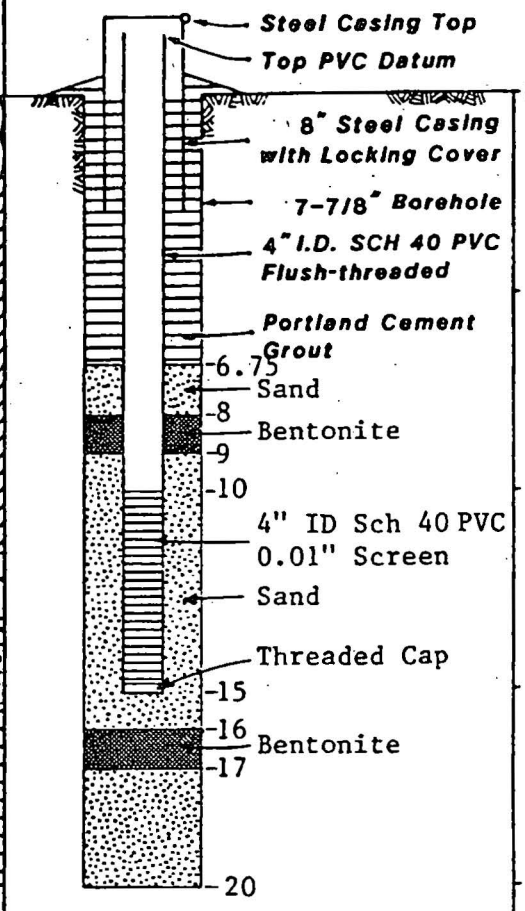
Monitoring Well Record PZ-2

Location Mixon Brothers, Idabel, Oklahoma
Coordinates _____ _____
Installation Date 01/07/86 to 01/09/86
Drilled By Winnek **Logged By** RLH

Elev. (Feet)	Depth (Feet)	Description	USC	Sample Interval	% Recovery	Graphic Log
	0	*Ground Surface*				
		CLAY: Dark brown, silty clay loam, orange-brown, mottled, abundant roots, damp, plastic, trace gravel.	CL-ML	NO 2	80%	
	2.0	CLAY: Brownish-gray to reddish-gray, mottled, silty and sandy clay, subrounded gravel up to 10%, damp, plastic, common black FeO-MnO concentrations up to ½".	CL	NO 4	45%	
	5			NO 6	75%	
				NO 8	85%	
	10			NO 10	70%	
	10.5	CLAY: Gray clay weathered lime wackestone with fossils.		NO 11.5	100%	
	11.5	CLAYEY GRAVEL: weathered limestone, gray to orange-gray mottled clayey gravel with common fossil and angular limestone fragments; clay occurs between limestone gravel.	GC	Continuous Core		
	15					
	15.3	LIMESTONE: Light gray to brownish-gray, fine- to medium-crystalline, massive to argillacious fossiliferous lime wackestone; a thin green shale bed occurs @ 17'2" to 17'8".	LS			
	20	Boring Terminated @ 20'				



NOTES:

No saturated zones were observed; water staining noted in interval from 15.3 to 17.3 feet.

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Monitoring Well Record PZ-3

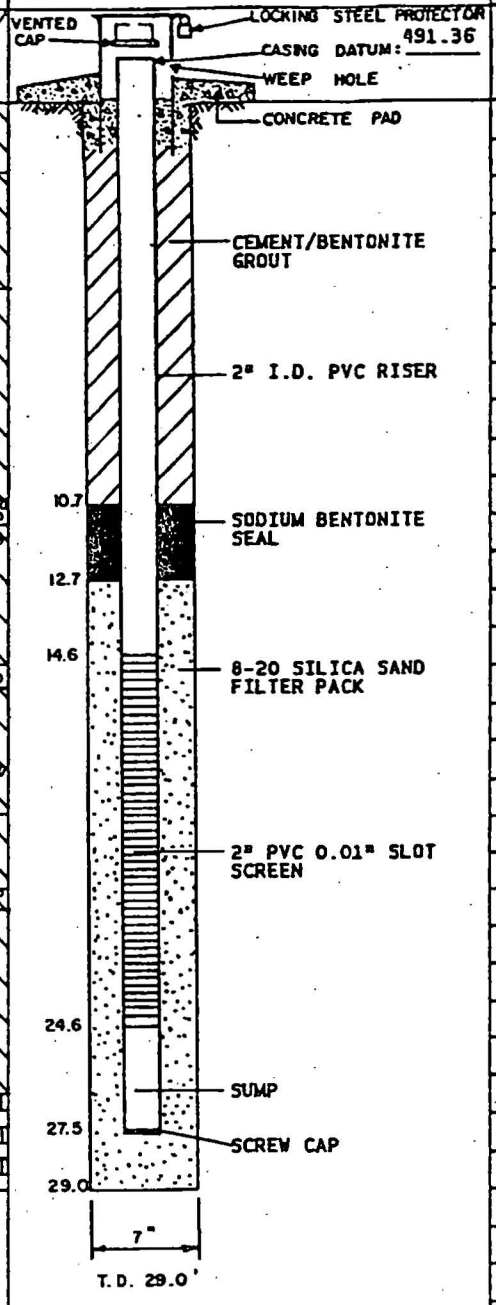
Location Mixon Brothers, Idabel, Oklahoma

Coordinates _____ _____

Installation Date 01-10-86

Drilled By Winnek Logged By RLH

GEOL UNIT	DEPTH (Feet)	DESCRIPTION	USC	SAMPLE INTERVAL	"N" VALUE	GRAPHIC LOG
	0	GROUND SURFACE : 488.79				
	0 – 1.9	SILTY CLAY: DARK BROWN 10yr 3/3, STIFF, NON-STRATIFIED, MED. PLASTICITY, 10% ORGANICS, 30% SILT, 60% CLAY	CL	0 – 4.0		
	1.9 – 5	SILTY CLAY: LIGHT GRAY 10yr 7/1, YELLOW RED MOTTLING, HIGH PLASTICITY, NON-STRATIFIED, 5% ORGANICS, 20% SILT, 75% CLAY	CH	4.0 – 5		
1-11-88	5 – 10	SILTY CLAY: LIGHT BROWNISH-GRAY 10yr 6/2, MOTTLED WITH BROWNISH-YELLOW 10yr 6/8, Mn AND Fe OXIDE NODULES, SOME CHERT GRAVEL, HIGH PLASTICITY, (WEATHERED LIMESTONE) 5% GRAVEL, 15% SILT, 80% CLAY, VERY MOIST.	CL I CH	5 – 8.0		
	10 – 10.8	GRAVELLY CLAY: LIGHT GRAY 10yr 6/8, WITH BROWN YELLOW MOTTLING, CHERT AND LIMESTONE GRAVEL (40%), 60% CLAY, MOIST	CL	8.0 – 10		
	10.8 – 11.3	SILTY CLAY: LIGHT GRAY 10yr 7/1, MOTTLED WITH BROWNISH-YELLOW 10yr 6/8, CHERT GRAVEL 16.3' - 16.6', SLICKENSIDED FROM 15' - 19', BECOMES BLOCKY FROM 11.3' - 19.0', 10% GRAVEL, 15% SILT, 75% CLAY, COLOR CHANGE AT 15' TO OLIVE GRAY 10yr 5/6, (WEATHERED LIMESTONE), VERY MOIST.	CL I CH	10 – 15	SAMPLER CME	
	15 – 19.0		CL I CH	15 – 20		
	19.0 – 21.5	SILTY CLAY: LIGHT OLIVE GRAY 5y 6/2, MOTTLED WITH YELLOW BROWN 10yr 5/6, PARTINGS PRESENT, HIGH PLASTICITY, 10% SILT, 90% CLAY, VERY MOIST (WEATHERED SHALE), CHERTY GRAVEL 21'-21.5'	CH CL	20 – 25		
	21.5 – 26.5	SILTY CLAY: LIGHT OLIVE GRAY 5y 6/2, MOTTLED WITH YELLOWISH BROWN 10yr 5/6, HIGH PLASTICITY, VERY MOIST, 10% SILT, 90% CLAY BLOCKY, PARTINGS PRESENT, MINOR GYPSUM AT 25' TO 26.5' (WEATHERED SHALE)	CH	25 – 27		
	26.5 – 29.0	LIMESTONE: WHITE 2.5 yn-8, MASSIVE, FOSSILIFEROUS, DRY		27 – 29	NX CORE 50% REC.	
	29.0	BOREHOLE TERMINATED AT 29.0'				
	30	NO VISUAL SOIL DISCOLORATION OBSERVED.				
	35	NOTE: SLICKENSIDED SURFACES WET. DRY 48 HRS. FOLLOWING WELL COMPLETION.				



DEPTH (Feet): 0, 5, 10, 15, 20, 25, 30, 35

CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
L LABORATORY TEST LOCATION
+ PENETROMETER, (TONS/FT.²)

WELL NUMBER PZ - 4

JOB NUMBER 87014

DATE DRILLED 10-19-87
DRILLING METHOD HSA-CME. SAMPLER
DRILLED BY SHEPHERD ENGR.
LOGGED BY BJS
CHECKED BY MT

PAGE 1 OF 1

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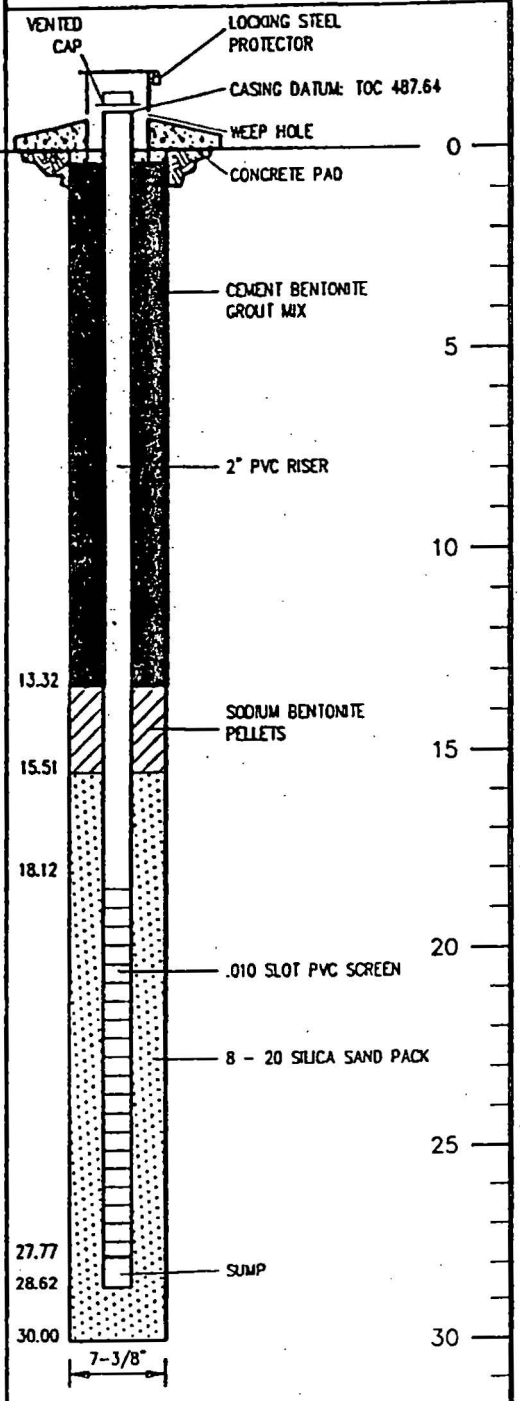
RSA FORM 9/87

WELL COMPLETION RECORD

GEOLOG. UNIT	DEPTH (FEET)	LITHOLOGIC DESCRIPTION	UNIFIED SOIL CLASSIFICATION	GRAPHIC LOG	SAMPLE INTERVAL	"N" VALUE
		GROUND SURFACE: 486.12				
	0	SILTY CLAY: 60% CLAY, 30% SILT, 10% ORGANIC, WET, MEDIUM PLASTIC, BROWN TO DARK GRAY 5Y4/3	OL		1	2.9
	0.8		CH			
		SILTY CLAY: 70% CLAY, 20% SILT, 10% ORGANIC, LIGHT BROWN TO DARK YELLOW MOTTLED, 10YR3/2 TO 10YR4/3, SOME RED IRON STAINING, BLACK ORGANIC MATTER AND ROOTS, MEDIUM TO HIGH PLASTIC, MOIST, NON-STARTIFIED, MODERATLY FIRM TO STIFF			2	NR
	5				3	5.0
	6.8	SILTY CLAY: VARIGATED BROWN TO YELLOW 2.5Y6/6 TO 2.5Y7/8, 70% CLAY, 30% SILT, BLACK IRON NODULES (1/4 INCH) THROUGHOUT, HIGH PLASTIC, STIFF, MOIST	CL		4	
					5	
	10				6	5.0
	10.2	CLAYEY LIMESTONE GRAVEL: 40% LIMESTONE GRAVEL, 40% CLAY, 20% SILT, MOTTLED BLACK TO GRAY WHITE, BROWN, GRAVEL 1/8 TO 1" IN DIAMETER, LIMESTONE GRAVEL IS SUBROUND, CLAY MATRIX HAS HIGH PLASTICITY, SLIGHTLY MOIST	GC			
	11.8		CH		7	
		SLIGHT SILTY CLAY: VARIGATED GRAY AND ORANGE/BROWN, 2.5Y7/0 AND 2.5Y7/8, STIFF, MOIST, VERY FINE SANDY LENSES,			8	
	14.8		GC			
	15	70% CLAY, 20% SILT, 10% SAND	CH		9	2.4
	15.1	CLAYEY LIMESTONE GRAVEL: DENSE, MICRO CRYSTALINE, ANGULAR TO SUBROUND LIMESTONE GRAVEL, BROWN CLAY				
	17.4	SILTY CLAY: 80% CLAY, 20% SILT, BROWN TO OLIVE BROWN, 2.5Y5/6, HIGH PLASTIC, MEDIUM STIFF TO STIFF, MOIST	CH			NR
		SILTY GRAVELLY CLAY: BROWN 10YR5/6, 70% CLAY, 20% SILT, 10% LIME GRAVEL, HIGH PLASTIC, STIFF, MOIST, SCATTERED SUBROUNDED LIMESTONE GRAVEL 1/4" IN DIAMETER				
	20				10	0.6
						NR
	24.8					
	25	LIMESTONE: LIGHT GRAY TO GRAY, 7.5YR7/0 TO 7.5YR6/0, MEDIUM CRYSTALINE, HARD TO DENSE, SLIGHTLY SHALEY, MICRO FOSSILIFEROUS	LIMESTONE		11	0.6
	25.6		CH			NR
		SILTY GRAVELLY CLAY: 70-80% CLAY, 20-30% SILT, 5-15% LIMESTONE GRAVEL, BROWN TO REDDISH BROWN, 10YR5/8 TO 7.5YR4/6,				
	28.5	SILTY, SOME SCATTERED LIMESTONE GRAVEL IMBEDDED, STIFF, MEDIUM PLASTIC, MOIST	LIMESTONE			
	30	LIMESTONE: LIGHT GRAY TO GRAY, 7.5YR7/0 TO 7.5YR6/0, MEDIUM CRYSTALINE, HARD TO DENSE, SLIGHTLY SHALEY, MICRO FOSSILIFEROUS				
		TOTAL DEPTH 30.0'				
		BOREHOLE OVM READING = 0.1 ppm				
		GROUNDWATER NOT ENCOUNTERED DURING DRILLING				
	35					

WELL COMPLETION DETAIL



CME CONTINUOUS AUGER SAMPLER
STANDARD PENETRATION TEST
UNDISTURBED SAMPLE
WATER TABLE (24 HOURS)
WATER TABLE (TIME OF BORING)
LABORATORY TEST LOCATION
PENETROMETER (TONS/SQ. FT.)

JOB NAME/NUMBER MIXON BRO.'s/ 92004.01

BORING NUMBER PZ-5 (BH-1)

DATE DRILLED 1-27-92
DRILLING METHOD HSA
DRILLED BY PSI
LOGGED BY SCP
CHECKED BY DHC
DRAWN BY: REC

ROBERTS/SCHORNICK & ASSOCIATES, INC.
ENVIRONMENTAL CONSULTANTS
3700 W. ROBINSON
NORMAN, OKLAHOMA 73072
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BLACK & ASSOCIATES
ENVIRONMENTAL CONSULTANTS, INC

MONITOR WELL NUMBER: PZ-6

MONITOR WELL LOG

PROJECT NAME Mixon Brothers Wood Preserving, Inc.
LOCATION NENWNW 31-7S-24E (East of Surface Impoundment HWM unit)
RIG TYPE & METHOD Auger, hollow stem
DATE BEGAN 07/27/95
DATE COMPLETED 07/27/95
TOTAL DEPTH 30 FEET
GROUND SURFACE ELEVATION 485
SHEET 1 OF 1

REMARKS:
BOREHOLE DIAMETER: 8.25 (0-TD); SCREEN (0.02")
CASING: 2" Schedule Stainless steel;
CEMENT: Concrete (2-+0.4'); 5% Bent. + Portland Cement (2-15'); Bentonite Pellets (15-18')

SAMPLE INTERVAL | DEPTH (FEET) | LITHOLOGY DESCRIPTION | LITHOLOGY | WELL COMPLETION DATA

0
Sl. moist gray (10YR 5/1) w/ stringers of yellowish brown (10YR 5/6) SILTY CLAY w/ some calcareous gravel and very fine sand at base, plastic and non calcareous

5
Sl. moist yellowish brown (10YR 5/4) w/ some light gray (10YR 6/1) @ base SILTY CLAY w/mod. amount of gravel (1-5 cm) and mod amount of sand (fine @ top and v coarse @ base), plastic and non calcareous @ top to sl. calcareous @ base

10
Moist yellowish brown (10YR 5/8) interbedded w/white (10YR 8/1) SILTY SAND, fine to med and poorly sorted, interbedded w/ fossilized limestone (3-5 cm) and gravel (2 cm), friable and calcareous

Sl. moist dark gray (10YR 4/1) interbedded w/ w/yellowish brown (10YR 5/8) SILTY CLAY w/ some fine sand and limestone (5 cm) @ ~12 -12 5', mod plastic and friable w/ limestone and calcareous

15
Sl. moist brownish yellow (10YR 6/6) w/ some black organic area @ 14' SILTY CLAY w/ small amount of fine sand, plastic and sl. calcareous to calcareous @ base

V. sl. moist brownish yellow (10YR 6/8) fossilized LIMESTONE w/ sand and gravel, sl. friable and calcareous

20
Sl. moist dark gray (10YR 4/1) interbedded w/ yellowish brown (10YR 5/8) SILTY CLAY w/ some fine sand and limestone, friable and calcareous

Moist light gray (10YR 6/1) LIMESTONE w/ some friable gravelly coarse sand and calcareous

25
V. sl. moist brownish yellow (10YR 6/6) and gray (10YR 6/1) SILTY CLAY, sl. plastic and calcareous

V. sl. moist gray (10YR 5/1) fossilized LIMESTONE AND calcareous

30
V. sl. moist gray (10YR 5/1) SILTY CLAY w/ some fine sand, sl. plastic and calcareous

/

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MONITOR WELL NUMBER: PZ-7

MONITOR WELL LOG

PROJECT NAME: Mixon Brothers Wood Preserving, Inc.
LOCATION: NENWNW 31-7S-24E (Southeast of Surface Impoundment HWM unit)
RIG TYPE & METHOD: Auger
DATE BEGAN: 05/23/95
DATE COMPLETED: 05/23/95
TOTAL DEPTH: 14.25 FEET
GROUND SURFACE ELEVATION:
SHEET: 1 OF: 1

SAMPLE INTERVAL | DEPTH (FEET)

REMARKS:
BOREHOLE DIAMETER: 6"(0-TD); SCREEN (0.02")
CASING: 2" Schedule Stainless steel;
CEMENT: Concrete (2-+0.4'); 5% Bent. + Portland Cement (2-5.42'); Bentonite Pellets (5.42-8.25')

LITHOLOGY DESCRIPTION

0
Sli moist light olive green (2.5YR 5/4) to moist grayish brown (2.5YR 5/2) at the base SILTY CLAY w/a small amount of med to coarse poorly sorted sand; plastic and non calcareous to sli calcareous at base.

Sli moist light brownish gray (2.5YR 6/2) at top to moist gray (2.5YR 6/0), SILTY CLAY w/small amount of 0.5 cm gravel in the middle and at the base, plastic and non calcareous.

5
Moist light gray (2.5YR 7/0) SILTY CLAY, w/some very coarse poorly sorted sand; plastic and non calcareous.

Moist gray (10YR 6/0); SILTY CLAY, w/small amount of med to coarse poorly sorted sand; plastic and non calcareous.

10
Moist gray (10YR 6/0) and yellowish brown (10YR 5/6); fine SANDY CLAY w/black (10YR 6/1) roots; plastic, and non calcareous.

Very moist to saturated brownish yellow (10YR 6/6); SILTY CLAY, plastic and non calcareous.

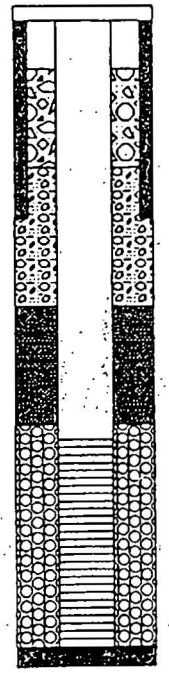
15
Sli moist brownish yellow (10YR 6/6); SILTY CLAY; plastic and non calcareous.

Moist gray (10YR 6/1); SILTY CLAY w/small amount of non calcareous gray (10YR 6/1), limestone and dark brown (10YR 3/3) calcareous gravel; plastic and non calcareous.

20
Moist gray (10YR 6/1) LIMESTONE; very sli friable and non calcareous.

LITHOLOGY

WELL COMPLETION DATA



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ENVIRONMENTAL CONSULTANTS INC.

MONITOR WELL NUMBER:	MONITOR WELL LOG
PZ-8	

PROJECT NAME: Mixon Brothers Wood Preserving, Inc.
LOCATION NENWNW 31-7S-24E (Southeast of Surface Impoundment HWM unit)
RIG TYPE & METHOD Hollow Stem Auger
DATE BEGAN: 10/4/95
DATE COMPLETED: 10/4/95
TOTAL DEPTH: 13.5 FEET
GROUND SURFACE ELEVATION 483.85 (TIC 486.72)
SHEET: 1 OF 1

REMARKS:
BOREHOLE DIAMETER: 6.25"(0-TD); SCREEN (0.01")
CASING: 2" Schedule Stainless steel;
CEMENT: Concrete (2-+0.46'); 5% Bent. + Portland Cement (2-4.5'); Bentonite Pellets (4.5-6.5')

SAMPLE INTERVAL | DEPTH (FEET) | LITHOLOGY DESCRIPTION | LITHOLOGY | WELL COMPLETION DATA

0
Slt moist light olive green (2.5YR 5/4) to moist grayish brown (2.5YR 5/2) at the base SILTY CLAY w/a small amount of med to coarse poorly sorted sand, plastic and non calcareous to slt calcareous at base

5
Slt moist light brownish gray (2.5YR 6/2) at top to moist gray (2.5YR 6/0), SILTY CLAY w/small amount of 0.5 cm gravel in the middle and at the base, plastic and non calcareous

Moist light gray (2.5YR 7/0) SILTY CLAY, w/some very coarse poorly sorted sand, plastic and non calcareous

10
Moist gray (10YR 6/0), SILTY CLAY, w/small amount of med to coarse poorly sorted sand, plastic and non calcareous

Moist gray (10YR 6/0) and yellowish brown (10YR 5/6), Fine SILTY SAND w/black (10YR 6/1) roots, plastic, and non calcareous

15
Slt moist brownish yellow (10YR 6/6) and gray (10YR 6/1), SILTY CLAY w/small amount of non calcareous gray (10YR 6/1) limestone and dark brown (10YR 3/3) calcareous gravel, plastic and non calcareous

Dry gray (10YR 6/1) and light red (2.5YR 6/6), LIMESTONE, very slt friable and non calcareous

20

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ENVIRONMENTAL CONSULTANTS INC.

MONITOR WELL NUMBER: PZ-9

MONITOR WELL LOG

PROJECT NAME: Mixon Brothers Wood Preserving, Inc.
LOCATION: NENWNW 31-7S-24E (Southeast of Surface Impoundment HWM unit)
RIG TYPE & METHOD: Hollow Stem Auger
DATE BEGAN: 10/4/95
DATE COMPLETED: 10/4/95
TOTAL DEPTH: 14.5 FEET
GROUND SURFACE ELEVATION: 484.39 (TIC 487.33)
SHEET: 1 OF 1

REMARKS:
BOREHOLE DIAMETER: 6.25"(0-TD); SCREEN (0.01")
CASING: 2" Schedule Stainless steel;
CEMENT: Concrete (2-+0.41'); 5% Bent. + Portland Cement (2-5.5'); Bentonite Pellets (5.5-8')

LITHOLOGY DESCRIPTION

SAMPLE INTERVAL | DEPTH (FEET) | LITHOLOGY | WELL COMPLETION DATA

0
Sli moist light olive green (2.5YR 5/4) to moist grayish brown (2.5YR 5/2) at the base SILTY CLAY w/a small amount of med to coarse poorly sorted sand, plastic and non calcareous to sli calcareous at base

Sli moist light brownish gray (2.5YR 6/2) at top to moist gray (2.5YR 6/0), SILTY CLAY w/small amount of 0.5 cm gravel in the middle and at the base, plastic and non calcareous

5
Moist light gray (2.5YR 7/0) SILTY CLAY, w/some very coarse poorly sorted sand, plastic and non calcareous

Moist gray (10YR 6/0), SILTY CLAY, w/small amount of med to coarse poorly sorted sand, plastic and non calcareous

10
Moist to very moist yellowish brown (10YR 5/6), Fine SILTY SAND w/black (10YR 6/1) roots, plastic, and non calcareous

Sli moist brownish yellow (10YR 6/6) and gray (10YR 6/1), SILTY CLAY w/small amount of non calcareous gray (10YR 6/1) limestone and dark brown (10YR 3/3) calcareous gravel, plastic and non calcareous

15
Dry gray (10YR 6/1) and brownish yellow (10YR 6/6), LIMESTONE, very sli friable and non calcareous

20

BLACK & ASSOCIATES
ENVIRONMENTAL CONSULTANTS INC.

MONITOR WELL NUMBER:	MONITOR WELL LOG
PZ-10	

PROJECT NAME Mixon Brothers Wood Preserving, Inc.
LOCATION NENWNW 31-7S-24E (Southeast of Surface Impoundment HWM unit)
RIG TYPE & METHOD Hollow Stem Auger
DATE BEGAN 10/4/95
DATE COMPLETED 10/4/95
TOTAL DEPTH 13.5 FEET
GROUND SURFACE ELEVATION 484.3 (TIC 487.22)
SHEET 1 OF 1

REMARKS:
BOREHOLE DIAMETER: 6.25"(0-TD); SCREEN (0.01")
CASING: 2" Schedule Stainless steel;
CEMENT: Concrete (2-+0.41'); 5% Bent. + Portland Cement (2-4'); Bentonite Pellets (4-6')

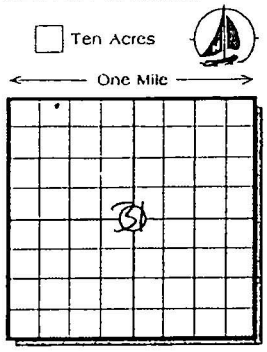
SAMPLE INTERVAL	DEPTH (FEET)	LITHOLOGY DESCRIPTION	LITHOLOGY	WELL COMPLETION DATA
	0	Sli moist light olive green (2.5YR 5/4) to moist grayish brown (2.5YR 5/2) at the base SILTY CLAY w/a small amount of med to coarse poorly sorted sand, plastic and non calcareous to sli calcareous at base		
	5	Sli moist light brownish gray (2.5YR 6/2) at top to moist gray (2.5YR 6/0) SILTY CLAY w/small amount of 0.5 cm gravel in the middle and at the base, plastic and non calcareous		
		Sli moist light gray (2.5YR 7/0) SILTY CLAY, w/some very coarse poorly sorted sand, plastic and non calcareous		
	10	Moist gray (10YR 6/0) SILTY CLAY, w/small amount of med to coarse poorly sorted sand, plastic and non calcareous.		
		Moist yellowish brown (10YR 5/6) Fine SILTY SAND w/black (10YR 6/1) roots, plastic, and non calcareous		
	15	Sli moist brownish yellow (10YR 6/6) and gray (10YR 6/1) SILTY CLAY w/small amount of non calcareous gray (10YR 6/1) limestone and dark brown (10YR 3/3) calcareous gravel, plastic and non calcareous		
		Dry gray (10YR 6/1) and brownish yellow (10YR 6/6) LIMESTONE, very sli friable and non calcareous		
	20			

MULTI-PURPOSE COMPLETION REPORT

OKLAHOMA WATER RESOURCES BOARD
600 N HARVEY AVE., P.O. BOX 150
OKLAHOMA CITY, OK 73101-0150

Please Plot Well Location

☐ Ten Acres



LEGAL DESCRIPTION

DO NOT WRITE IN THIS SPACE
1/4 1/4 1/4 of Sec. 31 Twp. 7S Rge. 24E

County McCurtain Well No: CW-1
Well Owner Mixon Bros. Wood Preserving, Inc. Phone 580 286-9494
Address P.O. Box 327, Idabel, Zip 74745
Finding Location approx 110' NE of PZ-5

TYPE OF WORK

☒ Geotechnical Boring ☐ Fresh Water Obs. Well ☐ Reconditioning ☐ De-watering
☐ Groundwater Heat Pump Well ☐ Site Assessment Obs. Well ☐ Groundwater Well Test Hole ☐ Other:
☒ Monitoring Well ☐ Plugging ☐ Groundwater Well

GROUNDWATER WELL PERMITTED USE

☐ Domestic* (No Permitting Required) ☐ Non-Domestic: (OWRB Permitting Required) Specify Purpose(s)

NOTE: If this groundwater well is for other than domestic use*, provide OWRB Groundwater Permit No:

*Domestic Use is use of water for household purposes or for farm and domestic animals up to the normal grazing capacity of the land and for the irrigation of land not to exceed three (3) acres.

DRILLING METHOD

☐ Hand Auger ☐ Fluid Rotary ☐ Rev. Rotary ☐ Other:
☐ Cable Tool ☒ H.S. Auger ☐ D.W. Rev. Rotary
☐ Air Rotary ☐ S.S. Auger

NEW BORING OR WELL CONSTRUCTION DATA

Date: Started 7-6-99 Date: Completed 7-8-99
Operator Jerry J. Black Operator No. OP-0020
Type of Construction: ☐ Open Hole ☒ Cased Hole ☐ Temporary ☒ Permanent
Hole Diameter 13" inches From 0 feet to 18.5 feet
Hole Diameter 6 5/8" inches From 17.5 feet to 30' feet

SURFACE CASING RECORD:
Surface Casing Diameter 4"x4"x56" +4" cap inches From -2.01 feet to +2.65 feet

CASING RECORD:
Well Casing Diameter 8" inches From 0 feet to -18.53 feet
Well Casing Diameter 2" inches From 20 feet to +2.67 feet

SCREEN OR PERFORATION RECORD:
Type and Slot Size 0.01 stainless steel From 19.67 feet to 29.67 feet
Type and Slot Size From feet to feet

FILTER PACK:
Type and Size 5/12 lca Sand 10/20 From 30' feet to 17.5 feet
Type and Size From feet to feet

SEAL:
Cement Grout Surface Seal Installed? ☒ Yes ☐ No
Type of Surface Seal Concrete From 0 feet to 2' feet
Type of Annular Seal Portland Cement w/6% bent From 2' feet to 15.5 feet
Type of Filter Pack Seal bents 1/4-1/2 chips 6% bent From 15.5 feet to 17.5 feet

TYPE OF COMPLETION: ☒ Above Ground ☐ Flush Mounted ☐ Pitless Adapter

SURFACE PAD: Size: 3 feet X 3 feet X 4 inches

PLUGGING DATA

☐ Non-Contaminated ☐ Contaminated Date Plugged
Backfilled From feet to feet Type
Grouted From feet to feet Type
Cement Grouted From feet to feet Tremied? ☐ Yes ☐ No

RECONDITIONING WORK

Replaced Casing/Screen From feet to feet
Deepened Well From feet to feet
Redeveloped Well by

LITHOLOGIC LOG

MATERIAL	ENCOUNTERED FROM FEET	ENCOUNTERED TO FEET	INDICATE SATURATION
Brown silty loam	0	3.5	Dry
Brn gray, Red, yellow and yellowish clay	3.5	12.25	Dry
white, yellow & ~~yellowish~~ silt & limestone	12.25	15.5	Moist
yellowish brn clay	15.5	22	sl. moist
yellowish brn & yellow silt	22	24	Dry
Gray limesto	24	28	Dry
Brn & yellowish brn gray	28	-30	sl. moist

HYDROLOGIC DATA

First Water Zone Encountered 12.25 feet Approximate Yield 1.5 gal/day (GPM) Flowing Artesian? ☐ Yes ☒ No

Measured Water Level 29.15 feet below land surface. After Drilling 7-19-99 hours

WELL LOCATION

Distance from the nearest possible source of pollution. (A minimum of 50 feet is required if the well is up-gradient, 75 feet if the well is level, and 100 feet if the well is down gradient.)

Distance approx 175 feet from ype or source close to improvements

Elevation of source from well. ☐ Up-gradient ☐ Level ☒ Down-gradient

Has this well been disinfected after completion of work? ☐ Yes ☒ No

If this well is a replacement well, has old well been abandoned properly? ☐ Yes ☐ No ☒ Not a replacement well

CERTIFICATION

The work described above was done under my supervision. This report is correct to the best of my knowledge.

Name Jerry J. Black DPC No. 0015

Address 1908 W. Boyd, Norman, OK 73069 Phone 405 360-2852

SIGNATURE Date 8-29-99

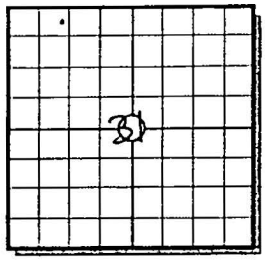
MULTI-PURPOSE COMPLETION REPORT

OKLAHOMA WATER RESOURCES BOARD
600 N HARVEY AVE., P.O. BOX 150
OKLAHOMA CITY, OK 73101-0150

Please Plot Well Location

☐ Ten Acres

← One Mile →



LEGAL DESCRIPTION

DO NOT WRITE IN THIS SPACE
1/4 1/4 1/4

of Sec. 31 Twp. 7S Rge. 24E

County McCurtain Well No: CW-2

Well Owner Mixon Bros. Wood Preserving Inc Phone 580 286-9494

Address P.O. Box 327, Idabel Zip 74745

Finding Location 140' ESE of PZ-5.

TYPE OF WORK

☒ Geotechnical Boring
☐ Groundwater Heat Pump Well
☒ Monitoring Well
☐ Fresh Water Obs. Well
☐ Site Assessment Obs. Well
☐ Plugging
☐ Reconditioning
☐ Groundwater Well Test Hole
☐ Groundwater Well
☐ De-watering
☐ Other:

GROUNDWATER WELL PERMITTED USE

☐ Domestic* (No Permitting Required)
☐ Non-Domestic: (OWRB Permitting Required) Specify Purpose(s)

NOTE: If this groundwater well is for other than domestic use*, provide OWRB Groundwater Permit No:

*Domestic Use is use of water for household purposes or for farm and domestic animals up to the normal grazing capacity of the land and for the irrigation of land not to exceed three (3) acres.

DRILLING METHOD

☐ Hand Auger
☐ Cable Tool
☐ Air Rotary
☐ Fluid Rotary
☒ H.S. Auger
☐ S.S. Auger
☐ Rev. Rotary
☐ D.W. Rev. Rotary
☐ Other:

NEW BORING OR WELL CONSTRUCTION DATA

Date: Started 7-6-99 Date: Completed 7-8-99

Operator Jerry J. Black Operator No. OP-0020

Type of Construction: ☒ Open Hole ☒ Cased Hole ☐ Temporary ☒ Permanent

Hole Diameter 13" inches From 0 feet to 18.5 feet

Hole Diameter 6 5/8" inches From 17.5 feet to 30 feet

SURFACE CASING RECORD: 4 1/4" cap

Surface Casing Diameter 4" x 4" x 56" inches From -1.56 feet to +2.75 feet

CASING RECORD:

Well Casing Diameter 8" inches From 0 feet to -18.36 feet

Well Casing Diameter 2" inches From ~~-20~~ -19.55 feet to +2.76 feet

SCREEN OR PERFORATION RECORD:

Type and Slot Size 0.01 stainless steel From 19.55 feet to 29.55 feet

Type and Slot Size From feet to feet

FILTER PACK:

Type and Size silca 10/20 sand From 30' feet to 17.5 feet

Type and Size From feet to feet

SEAL:

Cement Grout Surface Seal Installed? ☒ Yes ☐ No

Type of Surface Seal Concrete From 0 feet to 2 feet

Type of Annular Seal Portland cement w/6% bent From 15.5 feet to 2 feet

Type of Filter Pack Seal bent. chips 1/4-1/2 From 15.5 feet to 17.5 feet

TYPE OF COMPLETION: ☒ Above Ground ☐ Flush Mounted ☐ Pitless Adapter

SURFACE PAD: Size: 3 feet X 3 feet X 4" inches

PLUGGING DATA

☐ Non-Contaminated ☐ Contaminated Date Plugged

Backfilled From feet to feet Type

Grouted From feet to feet Type

Cement Grouted From feet to feet Tremied? ☐ Yes ☐ No

RECONDITIONING WORK

Replaced Casing/Screen From feet to feet

Deepened Well From feet to feet

Redeveloped Well by

LITHOLOGIC LOG

MATERIAL	ENCOUNTERED FROM FEET	ENCOUNTERED TO FEET	INDICATE SATURATION
Brn silty loam	0	2.5	Dry
Yellowish-brn silty clay	2.5	12	sl. moist
gray & brnish yellow silt interbedded w/ limestone	12	13.5	V. moist
Brown & gray clay	13.5	23	sl. moist
brn, yellowish brn & w/ silt	23	25.75	sl. Moist
Gray limestone	25.75	28	Dry
Brn clay	28	30	sl. moist

HYDROLOGIC DATA

First Water Zone Encountered 12 feet Approximate Yield 6.0 GPM/day Flowing Artesian? ☐ Yes ☒ No

Measured Water Level 12.88 feet below land surface. After Drilling 7-19-99 hours

WELL LOCATION

Distance from the nearest possible source of pollution. (A minimum of 50 feet is required if the well is up-gradient, 75 feet if the well is level, and 100 feet if the well is down gradient.)

Distance approx 250' feet from ype or source closed impoundments

Elevation of source from well. ☐ Up-gradient ☐ Level ☒ Down-gradient

Has this well been disinfected after completion of work? ☐ Yes ☒ No

If this well is a replacement well, has old well been abandoned properly? ☐ Yes ☒ No ☐ Not a replacement well

CERTIFICATION

The work described above was done under my supervision. This report is correct to the best of my knowledge.

Name Jerry J. Black DPC No. 0015

Address 1908 W. Boyd, Norman, OK 73069 Phone 405 360-2852

SIGNATURE Date 8-29-99

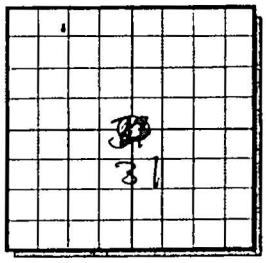
MULTI-PURPOSE COMPLETION REPORT

OKLAHOMA WATER RESOURCES BOARD
600 N HARVEY AVE., P.O. BOX 150
OKLAHOMA CITY, OK.73101--0150

Please Plot Well Location

☐ Ten Acres

One Mile



LEGAL DESCRIPTION

DO NOT WRITE IN THIS SPACE
1/4 1/4 1/4

of Sec. 31 Twp. 7 S Rge. 24E

County Mc Curtain Well No: CW-3

Well Owner Mixon Brothers Wood Preserving Phone 580 286-9494

Address P. O. Box 327, Idabel Zip 74745

Finding Location approx 230' SSE of PZ-5

TYPE OF WORK

- ☒ Geotechnical Boring
- ☐ Groundwater Heat Pump Well
- ☒ Monitoring Well
- ☐ Fresh Water Obs. Well
- ☐ Site Assessment Obs. Well
- ☐ Plugging
- ☐ Reconditioning
- ☐ Groundwater Well Test Hole
- ☐ Groundwater Well
- ☐ De-watering
- ☐ Other:

GROUNDWATER WELL PERMITTED USE

☐ Domestic* (No Permitting Required)

☐ Non-Domestic: (OWRB Permitting Required) Specify Purpose(s)

NOTE: If this groundwater well is for other than domestic use*, provide OWRB Groundwater Permit No:

*Domestic Use is use of water for household purposes or for farm and domestic animals up to the normal grazing capacity of the land and for the irrigation of land not to exceed three (3) acres.

DRILLING METHOD

- ☐ Hand Auger
- ☐ Cable Tool
- ☐ Air Rotary
- ☐ Fluid Rotary
- ☒ H.S. Auger
- ☐ S.S. Auger
- ☐ Rev. Rotary
- ☐ D.W. Rev. Rotary
- ☐ Other:

NEW BORING OR WELL CONSTRUCTION DATA

Date: Started 7-6-99 Date: Completed 7-8-99

Operator Jerry J. Blazek Operator No. OP-0020

Type of Construction: ☒ Open Hole ☒ Cased Hole ☐ Temporary ☒ Permanent

Hole Diameter 13" inches From 0 feet to 18 feet

Hole Diameter 6 5/8" inches From 17 feet to 30' feet

SURFACE CASING RECORD: +4⅛" cap

Surface Casing Diameter 4"x4"x56 inches From -2.07 feet to +2.60' feet

CASING RECORD:

Well Casing Diameter 8" inches From 0 feet to 17.4 feet

Well Casing Diameter 2" inches From -20 feet to -2.64 feet

SCREEN OR PERFORATION RECORD:

Type and Slot Size Stainless steel 0.01 From ~~30~~ 19.77 feet to ~~40~~ 29.77 feet

Type and Slot Size From feet to feet

FILTER PACK:

Type and Size silica sand 10/20 From 17.5 feet to 30 feet

Type and Size From feet to feet

SEAL:

Cement Grout Surface Seal Installed? ☒ Yes ☐ No

Type of Surface Seal concrete From 0 feet to -2 feet

Type of Annular Seal Portland Cement w/ 6% bent. From 15.5 feet to -2 feet

Type of Filter Pack Seal Dent chip 1/4-1/2 From -15.5 feet to -17.5 feet

TYPE OF COMPLETION: ☒ Above Ground ☐ Flush Mounted ☐ Pitless Adapter

SURFACE PAD: Size: 3 feet X 3 feet X 4 inches

PLUGGING DATA

☐ Non-Contaminated ☐ Contaminated Date Plugged

Backfilled From feet to feet Type

Grouted From feet to feet Type

Cement Grouted From feet to feet Tremied? ☐ Yes ☐ No

RECONDITIONING WORK

Replaced Casing/Screen From feet to feet

Deepened Well From feet to feet

Redeveloped Well by

LITHOLOGIC LOG

MATERIAL	ENCOUNTERED FROM FEET	ENCOUNTERED TO FEET	INDICATE SATURATION
Brown clayey silt	0	3.0	Dry
yellowish brn & gray Clay	3.0	10.0	sl. moist Saturation @ 9.5'
gray & yellow clay	10	12.25	sl. moist
~~brownish yellow~~ brownish yellow, gray, lt yellowish brn clay	12.25	22	sl. moist except saturation @ 19.1'
yellowish brn silt interbedded w/ limestone	22	25.	Dry
gray limestone	25	28.5	Dry
Brn clay	28.5	30	sl. moist

HYDROLOGIC DATA

First Water Zone Encountered 9.5' feet Approximate Yield 6.5 GPM DAY Flowing Artesian? ☐ Yes ☒ No

Measured Water Level 13.04 feet below land surface. After Drilling 7-19-99 hours

WELL LOCATION

Distance from the nearest possible source of pollution. (A minimum of 50 feet is required if the well is up-gradient, 75 feet if the well is level, and 100 feet if the well is down gradient.)

Distance approx 845 feet from ype or source closed impoundment

Elevation of source from well. ☐ Up-gradient ☐ Level ☒ Down-gradient

Has this well been disinfected after completion of work? ☐ Yes ☒ No

If this well is a replacement well, has old well been abandoned properly? ☐ Yes ☐ No ☒ Not a replacement well

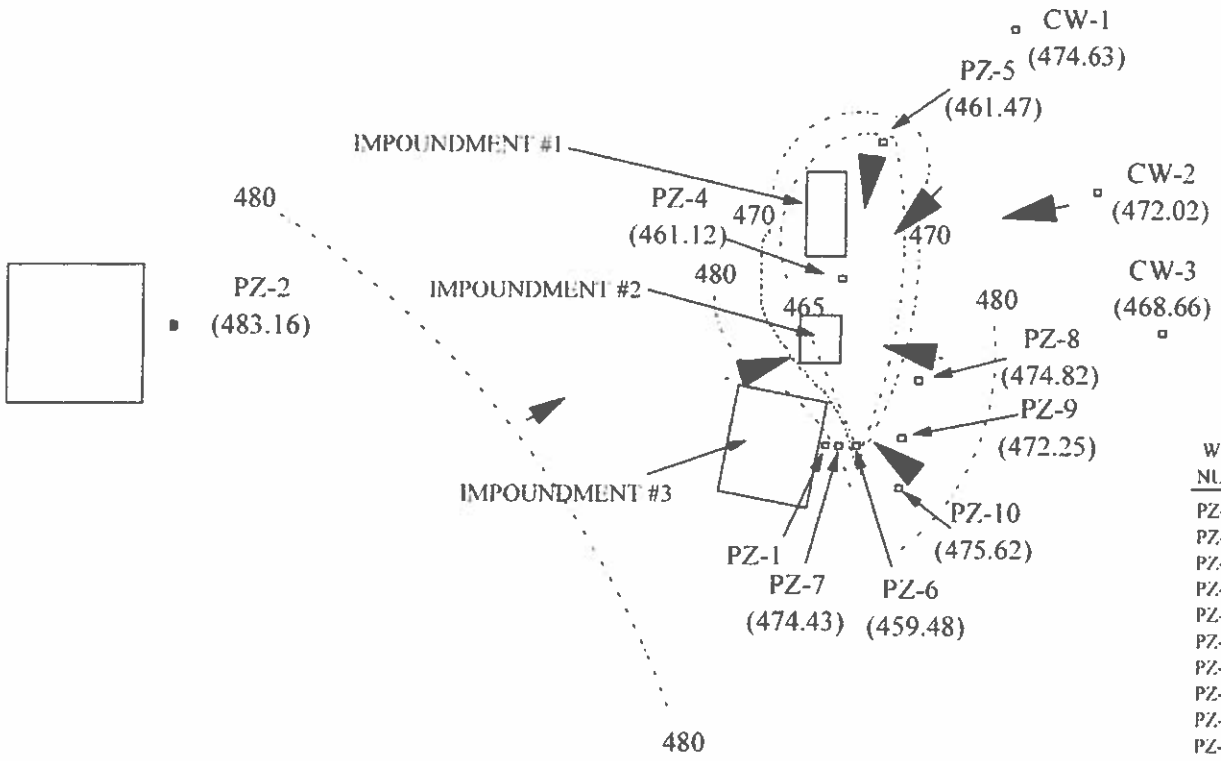
CERTIFICATION

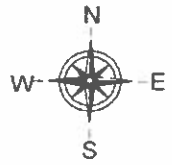
The work described above was done under my supervision. This report is correct to the best of my knowledge.

Name Jerry J. Black D/PC No. 0015

Address 1908 W. Boyd, Norman, OK 73069 Phone 405 360-2852

SIGNATURE Date 8-30-99





SCALE

0' 25' 50' 100' 150'

MONITOR WELL DATA

WELL NUMBER	TOP CASING ELEV., FEET AMSL	GROUND ELEV., FEET AMSL
PZ-1	plugged	488.80
PZ-2	495.26	493.13
PZ-3	497.53	496.22
PZ-4	488.92	487.26
PZ-5	487.67	486.12
PZ-6	487.88	485.18
PZ-7	489.03	487.49
PZ-8	486.72	483.85
PZ-9	487.35	484.39
PZ-10	487.22	484.30
CW-1	488.63	486.04
CW-2	487.32	484.52
CW-3	484.86	482.22

Mixon Brothers
Wood Preserving, Inc.

Post-Closure Operations Permit
Number 007336258PC

PZ-3
(484.83)

LEGEND

PZ-3 (484.43) :MONITOR WELL LOCATION AND :GROUNDWATER ELEVATION, FEET AMSL, 12/30/2024

Flow Direction

470 Contour of groundwater potentiometric surface, feet AMSL, 12/30/2024