Rentokil Initial Environmental Services, LLC
Creola, Alabama
EPA I.D. Number ALD 021 257 951

FACT SHEET

A draft renewal of the Alabama Hazardous Waste Management and Minimization Act (AHWMMA) permit has been prepared for the Rentokil Initial Environmental Services, LLC (RIES). This hazardous waste facility is located in Creola, Alabama. This fact sheet has been prepared to briefly advise the public of the principal permitting, legal and policy issues of the draft permit.

I. PERMIT PROCESS

The purpose of the permitting process is to allow the State and the public to evaluate RIES's ability to comply with the hazardous waste management requirements of the AHWMMA, as amended. RIES must comply with hazardous waste management conditions set forth in the permit during the effective period of the permit, which is ten (10) years from the last permit renewal (August 8, 2008).

II. PROCEDURES FOR REACHING A FINAL DECISION

The Alabama Department of Environmental Management (ADEM or Department) is proposing to issue RIES a permit for post-closure care for the surface impoundment which has been closed as a single landfill unit with wastes and contaminated soils remaining in-place.

ADEM Admin. Code r. 335-14-8-.08(6)(b)1. requires that the public be given a 45-day comment period for each draft permit. The comment period will begin on April 12, 2019, which is the date of publication of the public notice in major local newspaper(s) of general circulation, and will end on May 29, 2019. The public notice will also be broadcast over local radio station(s).

Any person interested in commenting on the application or draft permit must do so within the 45-day comment period discussed above.

All persons wishing to comment on any of the permit conditions or the permit application should submit their comments in writing to the Alabama Department of Environmental Management, Permits and Services Division, 1400 Coliseum Blvd. (zip 36110-2059), P.O. Box 301463 (zip 36130-1463) Montgomery, Alabama, ATTENTION: Mr. Russell A. Kelly.

ADEM will consider all written comments received during the comment period while making a permit decision for this facility. When the Department makes its final permit decision, notice will be given to the applicant and each person who has submitted written comments or requested notice of the final permit decision.

III. FACILITY DESCRIPTION

RIES has applied for a renewal of the permit under the requirements of AHWMMA for post-closure care including corrective action for groundwater contamination. A predecessor company of RIES previously operated a tank truck terminal on Highway 43 North in Creola, Alabama (the "Site"). Wastewater generated from the cleaning of tankers contained a variety of industrial chemicals and was managed in various surface impoundments until February 1985. The wastewater managed in surface impoundments was determined to be hazardous due to presence of "P" listed waste (P020 dinoseb, and P022 carbon disulfide) and "U" listed waste (U211 carbon

tetrachloride, and U044 chloroform). All surface impoundments were closed in November 1986 as a single landfill with approved cap and cover and also a leachate collection system. Chemical constituents were present in groundwater above the Department's regulatory action limits; therefore, RIES operated a groundwater pump and treat system until 2018. In January 2019 RIES started an Air Sparge, and Soil Vapor Extraction system. The old pump and treat system will be maintained as stand by in case it is needed. RIES maintains the closed RCRA landfill under Post Closure Permit ALD 021257951 and Underground Injection Control (UIC) Permit ALSI 9949364. The proposed permit will contain provisions for post-closure care for the landfill and an enhanced corrective action system and approach to address the groundwater contamination.

Additional provisions have been included in the permit as a result of the changes made to AHWMMA to incorporate the requirements of the 1984 Hazardous and Solid Waste Amendments (HSWA) to RCRA. These requirements are included in accordance with ADEM Admin. Code r. 335-14-5-.06(12), which addresses corrective action for Solid Waste Management Units (SWMUs). This rule requires a RCRA Facility Assessment (RFA) of all SWMUs to be conducted at the facility. The RFA for RIES has been completed on September 26, 2018 and SWMUs have been identified. All SWMUs are recommended for further sampling and corrective action if necessary.

IV. TECHNICAL CONTACT

Naveen C. Sharma
Engineering Services Section
Industrial Hazardous Waste Branch, Land Division
Alabama Department of Environmental Management
1400 Coliseum Blvd (zip 36110-2059)
P.O. Box 301463 (zip 36130-1463)
Montgomery, Alabama
(334) 270-5608

PART I

STANDARD AND GENERAL FACILITY CONDITIONS

I.A. EFFECT OF PERMIT

Issuance of this permit does not authorize any injury to persons or property, any invasion of other private rights, or any infringement of state or local law or regulations. Compliance with the terms of this permit does not constitute a defense to any action brought under the AHWMMA, or any other law governing protection of public health or the environment, for any imminent and substantial endangerment to human health, welfare, or the environment.

I.B. SEVERABILITY

The provisions of this permit are severable and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances and the remainder of this permit shall not be affected thereby.

I.C. DUTIES AND REQUIREMENTS

1. Duty to Comply

   The Permittee shall comply with all conditions of this permit, except to the extent and for the duration such noncompliance is authorized by an emergency permit. Any permit noncompliance, other than noncompliance authorized by an emergency permit, constitutes a violation of the AHWMMA, and is grounds for enforcement action, permit termination, revocation and reissuance, modification, or denial of a permit renewal application.

2. Duty to Reapply

   a. If the Permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the Permittee must apply for and obtain a new permit.

   b. The Permittee must submit an application for a new permit for both post-closure and Solid Waste Management Unit (SWMU) corrective action at least 180 calendar days before the expiration of this permit. The Permittee must reapply in order to fulfill the 30-year post-closure care period required by ADEM Admin. Code Rule 335-14-5-.07(8)(a)1. The Department may shorten or extend the post-closure care period applicable to the hazardous waste facility in accordance with ADEM Admin. Code Rules 335-14-5-.07(8)(a)2. and 335-14-8-.03(1)(b).

3. Need to Halt or Reduce Activity Not A Defense

It shall not be a defense for the Permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

4. Duty to Mitigate

In the event of noncompliance with this permit, the Permittee shall take all reasonable steps to minimize releases to the environment, and shall carry out such measures as are reasonable to prevent significant adverse impacts on human health or the environment.

5. Proper Operation and Maintenance

The Permittee shall, at all times, properly operate and maintain all facilities and systems of treatment, monitoring, and control (and related appurtenances) which are installed or used by the Permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance (O&M) includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of this permit.

6. Permit Actions

This permit may be modified, revoked and reissued, or terminated for cause as specified in ADEM Admin. Code Rules 335-14-8-.04(2), 335-14-8-.04(3) and 335-14-8-.04(4). The filing of a request for a permit modification, revocation and reissuance, or termination, or the notification of planned changes or anticipated noncompliance on the part of the Permittee does not stay any permit condition.

7. Property Rights

Issuance of this permit does not convey any property rights of any sort, nor any exclusive privilege.

8. Duty to Provide Information

The Permittee shall furnish to the Department, within a reasonable time as determined by the Department, any relevant information which the Department may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit, or to determine compliance with this permit. The Permittee shall also furnish to the Department, upon request, copies of records required to be kept by this permit.

9. Inspection and Entry

The Permittee shall allow duly designated officers and employees of the Department or their authorized representative, upon the presentation of credentials and other documents as may be required by law to:

a. Enter at reasonable times upon the Permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit; and,

d. Sample or monitor, at reasonable times, for the purposes of assuring permit compliance or as otherwise authorized by the AHWMMA, any substances or parameters at any location. The Permittee shall have the opportunity to split samples during sampling.

10. Monitoring and Records

a. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity. The method used to obtain a representative sample of the waste to be analyzed must be the appropriate method from ADEM Admin. Code Rule 335-14-2-Appendix I or the methods specified in Appendix B of the permit application. Laboratory methods must be those specified in Test Methods for Evaluating Solid Waste: Physical/Chemical Methods SW-846 (latest edition), Methods for Chemical Analysis of Water and Wastes (EPA-600/4-79-020), Standard Methods for the Examination of Water and Wastewater (latest edition), the methods specified in Appendix B of the permit application, or an alternative method approved by ADEM. [ADEM Admin. Code Rule 335-14-8-.03(1)(j)1.]

b. The Permittee shall maintain at the facility records of all monitoring information including all calibration and maintenance records, all original strip chart recordings for continuous monitoring instrumentation, the certification required by 335-14-5-.05(4)(b)9., records of all data used to prepare documents required by this permit, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least three (3) years from the date of the sample, measurement, report or record, or until corrective action is completed, whichever date is later. This period may be extended by the Department at any time and is automatically extended during the course of any unresolved enforcement action regarding this facility. [ADEM Admin. Code Rules 335-14-5-.05(5)(b) and 335-14-8-.03(1)(j)2.]

c. The Permittee shall maintain at the facility records for all groundwater monitoring wells, piezometers and associated groundwater surface elevations throughout the post-closure care period. These records shall include the surveyed location, surveyed elevation, surveyed elevation

reference point, total depth, screened interval, construction details, well log, and all other pertinent information for each well and piezometer.

d. Records for monitoring information shall include:

i. The date(s), exact place, and times of sampling or measurements;

ii. The individual(s) who performed the sampling or measurements;

iii. The date(s) analyses were performed;

iv. The individual(s) who performed the analyses;

v. The analytical techniques or methods used; and,

vi. The results of such analyses.

e. The following documents and information shall be maintained throughout the post-closure care period at the facility.

i. Complete copy of this permit and the permit application.

ii. Operating record as required by ADEM Admin. Code Rule 335-14-5-.05(4) and this permit.

iii. Copies of all plans, reports, inspection schedules, inspection logs as required by ADEM Admin. Code Rule 335-14-5 and this permit.

11. Signatory Requirements

All applications, reports or information submitted to the Department shall be signed and certified in accordance with ADEM Admin. Code Rules 335-14-8-.02(2) and 335-14-8-.03(1)(k).

12. Reporting Requirements

a. Planned Changes

The Permittee shall give notice to the Department as soon as possible of any planned physical alterations or additions to the permitted facility and any solid waste management units identified under Part IV of this permit.

b. Anticipated Noncompliance

The Permittee shall give advance notice to the Department of any planned changes in the permitted facility or activity that may result in noncompliance with permit requirements.

c. Transfer of Permits

This permit may be transferred to a new owner or operator only if it is modified or revoked and reissued pursuant to ADEM Admin. Code Rule 335-14-8-.04(1) or ADEM Admin. Code Rule 335-14-8-.04(3)(a)1.(vii). Before transferring ownership or operation of the facility during its post-closure period, the Permittee shall notify the new owner or operator, in writing, of the requirements of ADEM Admin. Code Rules 335-14-5 and 335-14-8 and this permit.

d. Monitoring Reports

Monitoring results shall be reported at the intervals specified elsewhere in this permit.

e. Compliance Schedules

Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of this permit shall be submitted to the Department no later than 14 calendar days following each schedule date.

f. Twenty-Four Hour Reporting

i. The Permittee shall report to the Department any noncompliance with this permit that may endanger human health or the environment. Any such information shall be reported orally at telephone number (334) 271-7700 within 24 hours from the time the Permittee becomes aware of the circumstances. This report shall include, but is not limited to, the following:

(I) Information concerning the release of any hazardous waste which may endanger public drinking water supplies; and,

(II) Information concerning the release or discharge of any hazardous waste, or hazardous waste constituents, or of a fire or explosion at the facility, which could threaten the environment or human health outside the facility.

ii. The description of the occurrence and its cause shall include:

(I) Name, address, and telephone number of the owner or operator;

(II) Name, address, telephone number, and EPA Identification Number of the facility;

(III) Date, time, and type of incident;

(IV) Name and quantity of material(s) involved;

(V) The extent of injuries, if any;

(VI) An assessment of actual or potential hazards to the environment and human health outside the facility, where this is applicable; and,

(VII) Estimated quantity and disposition of recovered material that resulted from the accident.

iii. A written submission shall also be provided within 5 calendar days of the time that the Permittee becomes aware of the circumstances. The written submission shall contain a description of the noncompliance and its cause; the periods of noncompliance (including exact dates and times); whether the noncompliance has been corrected, and if not, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.

g. Other Noncompliance

The Permittee shall report to the Department all instances of noncompliance not otherwise required by Permit Conditions I.C.12.d., I.C.12.e., or I.C.12.f. at the time any other reports required by this permit are submitted. The reports shall contain the information required by Permit Condition I.C.12.f.

h. Other Information

Where the Permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Department, it shall promptly submit such facts or information. In addition, upon request, the Permittee shall furnish to the Department any information related to compliance with this permit.

13. Certification of Construction

The Permittee may not commence treatment, storage or disposal of hazardous waste or contaminated media at any new or modified portion of the facility until the Permittee has submitted to the Department by certified mail or hand-delivery a letter (together with the certification by the construction quality assurance officer required by ADEM Admin. Code Rule 335-14-5-.02(10)(d) and any other certifications required by this permit or ADEM Admin. Code Rule 335-14) signed by the Permittee and a professional engineer registered in the State of Alabama stating that the facility has been constructed or modified in compliance with this permit where appropriate; and,

a. The Department has inspected the modified or newly constructed facility and finds it is in compliance with the conditions of this permit; or

b. The Department has either waived the inspection or has not notified the Permittee, within 15 calendar days of the notification from the Permittee, of its intent to inspect. [ADEM Admin. Code Rule 335-14-8-.03(1)(1)2.]

14. The Permittee shall assure that all measures necessary to maintain and/or achieve compliance with all applicable requirements of ADEM Admin. Code Rules 335-14 are taken during the active life of the facility, and throughout the post-closure care period, corrective action period, and the term of this permit.

15. In the event that circumstances beyond the Permittee's control arise to prevent achievement of any deadline set forth by this permit, the Permittee may immediately, upon the occurrence thereof, request an extension by sending a written request to the Department explaining the need for the extension. The Department may, after consideration of the circumstances, grant the extension. Requests for extensions may require a permit modification pursuant to ADEM Admin. Code Rule 335-14-8-.04(2) or (3).

I.D. DEFINITIONS

For the purposes of this permit, terms used herein shall have the same meaning as those in ADEM Admin. Code Rules 335-14-1, 335-14-2, 335-14-5, and 335-14-8, unless this permit specifically provides otherwise. Where terms are not defined in the regulations or this permit, a standard dictionary reference or the generally accepted scientific or industrial meaning of the term shall define the meaning associated with such terms.

"Area of concern" (AOC), for the purposes of this permit, includes any area having a probable release of a hazardous waste or hazardous constituent which is not from a solid waste management unit and is determined by the Department to pose a current or potential threat to human health or the environment. Such areas of concern may require investigations and remedial action as required under Section 3005(c)(3) of the Resource Conservation and Recovery Act and ADEM Admin. Code Rule 335-14-8-.03(3)(b)2. in order to ensure adequate protection of human health and the environment.

"Contamination," for the purposes of this permit, refers to the presence of any hazardous constituent in a concentration that exceeds the naturally occurring concentration of that constituent in the immediate vicinity of the facility (*i.e.*, areas not affected by the facility).

"Extent of contamination," for the purposes of this permit, is defined as the horizontal and vertical areas in which the concentrations of hazardous constituents in the environmental media being investigated are above detection limits or background concentrations indicative of the region, whichever is appropriate as determined by the Department.

"Hazardous constituents," for the purposes of this permit, are those substances listed in ADEM Admin. Code Rule 335-14-2-Appendix VIII and/or ADEM Admin. Code Rule 335-14-5-Appendix IX and include hazardous constituents released from solid waste, hazardous waste, and hazardous waste constituents that are reaction by-products.

"Land Use Controls," for the purposes of this permit, are as defined by ADEM Admin. Code Rule 335-15-1-.02.

"Method detection limit" (MDL), for the purposes of this permit, means the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix type containing the analyte.

"Mixed waste," for the purposes of this permit, means a solid waste that is a mixture of hazardous waste (as defined in ADEM Admin. Code Rule 335-14-2-.01(3)) and radioactive waste (as defined in 10 CFR 61.2). The radioactive component of mixed waste is subject to regulation by the Atomic Energy Act (AEA)/Nuclear Regulatory Commission (NRC). The non-radioactive chemically hazardous component of mixed waste is subject to regulation by the AHWMMA and ADEM Admin. Code Rule 335-14.

"Operating day," for the purposes of this permit, means any day on which hazardous waste is treated, stored, or disposed of in a unit. For example, each day that a hazardous waste storage unit contains hazardous waste is an operating day; as is each day that a disposal unit contains or receives hazardous waste, or each day that hazardous waste is treated in a treatment unit.

"Release," for the purposes of this permit, includes any spilling, leaking, pouring, emitting, emptying, discharging, injecting, escaping, leaching, pumping, or disposing into the environment of any hazardous waste or hazardous constituent.

"Solid waste management unit" (SWMU), for the purposes of this permit, includes any unit that has been used for the treatment, storage or disposal of solid waste at any time, irrespective of whether the unit is or ever was intended for the management of solid waste. RCRA-regulated hazardous waste management units are also solid waste management units. SWMUs include areas that have been contaminated by routine and systematic releases of hazardous waste or hazardous constituents, excluding one-time accidental spills that are immediately remediated and cannot be linked to solid waste management activities (*e.g.*, product or process spills).

"Storm event," for the purposes of this permit, is defined as a 1-year, 24-hour storm event or rainfall that measures 1-inch or greater in 1 hour or less. Rainfall measurements may be taken at the site, or the closest official weather monitoring station may be used.

I.E. EXPIRATION AND CONTINUATION OF PERMIT

This permit and all conditions herein will remain in effect beyond this permit's expiration date if the Permittee has submitted a new application as required by Permit Condition I.C.2. and, through no fault of the Permittee, the Department has not issued a new permit.

I.F. WASTE MINIMIZATION

1. Certification Requirements

Pursuant to ADEM Admin. Code Rule 335-14-5-.05(4)(b)9. the Permittee must certify, no less often than annually, that:

a. The Permittee has a program in place to reduce the volume and toxicity of hazardous waste to the degree determined by the Permittee to be economically practicable; and,

b. The proposed method of treatment, storage or disposal is the most practicable method available to the Permittee and that it minimizes the present and future threat to human health and the environment.

2. Recording Requirements

The Permittee shall maintain copies of this certification in the facility operating record as required by ADEM Admin. Code Rule 335-14-5-.05(4).

I.G. COST ESTIMATES

1. The Permittee shall maintain detailed written cost estimates, in current dollars, at the location specified in Permit Condition I.C.10.e. and on file with ADEM in accordance with ADEM Admin. Code Rules 335-14-5-.08(3), (5), and (10).

2. All cost estimates must be updated annually as required by ADEM Admin. Code Rule 335-14-5-.08(3)(b), (5)(b), and (10)(b).

3. The cost estimate shall be maintained and submitted in the form designated by the Department.

4. The Permittee must update the cost estimate no later than 30 calendar days after the Department has approved a modification to the Closure Plan, Post-Closure Plan, or Corrective Action Plan, or any other plan required or referenced by this permit, if the change in the plan results in an increase in the amount of the cost estimate.

I.H. FINANCIAL ASSURANCE

1. The Permittee shall demonstrate continuous compliance with ADEM Admin. Code Rule 335-14-5-.08 by providing documentation of financial assurance in at least the amount that equals or exceeds the cost estimate. Changes in financial assurance mechanisms must be approved by the Department.

2. The Permittee shall submit itemized statements for all capital expenditures and a complete, revised post-closure cost estimate to the Department when requesting approval for a reduction in the financial assurance mechanism.

I.I. PERMIT MODIFICATIONS

The Permittee shall request a permit modification whenever changes in operating plans or facility design affect any plan (*e.g.*, closure, groundwater monitoring, post-closure, or corrective action) required or referenced by this permit. The Permittee must submit a written request for a permit modification pursuant to the requirements of ADEM Admin. Code Rule 335-14-8-.04(2) at least 60 calendar days prior to the proposed change in facility design or operation.

I.J. REPORTS, NOTIFICATIONS, AND SUBMISSIONS TO THE DEPARTMENT

All reports, notifications, or other submissions that are required by this permit should be sent via certified mail or given to:

Chief, Land Division
Alabama Department of Environmental Management
P.O. Box 301463 (Zip 36130-1463)
1400 Coliseum Boulevard (Zip 36110-2059)
Montgomery, Alabama

and

Director, RCRA Division US EPA Region-4
Atlanta Federal Center
61 Forsyth Street SW
Atlanta Georgia-30303-3104

PART II

POST-CLOSURE CARE

II.A. POST-CLOSURE CARE PERIOD

The post-closure care period shall extend for a period of 30 years from the date of initial permit issuance (September 29, 1989), unless shortened or extended pursuant to ADEM Admin. Code Rule 335-14-5-.07(8). The post-closure care period shall automatically extend through the end of the compliance period specified in Part III of this permit.

II.B. POST-CLOSURE PROCEDURES AND USE OF PROPERTY

1. Post-Closure Activities

   The Permittee shall conduct post-closure care activities, in accordance with Part B Section 1.7 of the permit application and as required by ADEM Admin. Code Rules 335-14-5-.07 and 335-14-5-.14(11)(d), for each hazardous waste management unit listed in Table II.1 Post-closure care shall commence upon the effective date of this permit and shall continue throughout the post-closure care period.

2. Security

   The Permittee shall comply with the security provisions of ADEM Admin. Code Rules 335-14-5-.02(5) and as described in Part B Section 1.3 of the permit application.

3. Disturbance of Closed Unit(s)

   The Permittee shall not allow the disturbance of the integrity of the final cover, liners, any components of the containment system, or the function of the facility's monitoring systems during the post-closure care period for any unit identified in Table II.1.

4. The Permittee shall:

   a. Maintain the integrity and effectiveness of the final cover, including making repairs to the cap, as necessary, to correct the effects of settling, subsidence, erosion, or other events;

   b. Maintain and monitor the groundwater monitoring system and comply with all other applicable requirements of ADEM Admin. Code Rule 335-14-5-.06 and Part III of this permit;

   c. Prevent run-on and run-off from eroding or otherwise damaging the final cover; and,

   d. Protect and maintain surveyed benchmarks used in complying with the surveying and recordkeeping requirements of ADEM Admin. Code Rule 335-14-5-.14(10).

II.C. INSPECTIONS

1. The Permittee shall inspect the components, structures, and equipment at the site in accordance with the inspection schedule as described in Part B Section 1.4 and Table 1-3 of the permit application, the post-closure care plan as described in Part B Section 1.7 of the permit application, and as required by ADEM Admin. Code Rule 335-14-5-.07.

2. Monitoring and Inspection

   The Permittee shall inspect the closed hazardous waste management unit listed in Table II.1 at least quarterly and after storms to detect any evidence of deterioration or improper operation as described in Part B Section 1.4 of the permit application and as required under ADEM Admin. Code Rules 335-14-5-.07 and 335-14-5-.14. The inspections shall specifically include evaluation of the following items:

   a. Integrity of the final cover (erosion, ponding, subsidence, cracking, *etc.*);

   b. Growth and stabilization of vegetative cover;

   c. Run-on and run-off control system;

   d. Groundwater monitoring wells; and,

   e. Survey benchmarks

TABLE II.1

POST-CLOSURE CARE UNITS

UNIT NAME	UNIT DESCRIPTION	DESCRIPTION OF UNIT*	LOCATION OF UNIT*
SWMU-2 Middle Pond	Surface Impoundment	Part B, Section1.6 and Attachment A	Part B Plate-1
SWMU-3 South Pond	Surface Impoundment	Part B, Section1.6 and Attachment A	Part B Plate-1

Two Surface Impoundments closed as single Landfill.

* Location in permit application containing description (text) and location (figure) of unit.

PART III

GROUNDWATER MONITORING AND CORRECTIVE ACTION

III.A. REQUIRED PROGRAM(S)

1. Groundwater monitoring shall consist of the General Groundwater Monitoring Program of Permit Condition III.B. and the Groundwater Monitoring Program contained in Permit Conditions III.D, and III.E.

2. The Permittee shall commence groundwater monitoring as required by this permit not later than 120 calendar days after the effective date of this permit.

III.B. GENERAL GROUNDWATER MONITORING PROGRAM

1. Well Location, Installation and Construction

   The Permittee shall install and/or maintain a groundwater monitoring system to comply with the requirements of ADEM Admin. Code Rules 335-14-5-.06(8), 335-14-5-.06(9), 335-14-5-.06(10), and 335-14-5-.06(11) as applicable and as specified below:

   a. The Permittee shall maintain all groundwater monitoring wells at the facility as identified in Table III.1 of this permit, at the locations specified on Figure B-1 of the permit application, and any other groundwater monitoring wells specified by Permit Conditions III.B.1.d., and III.B.1.e.

      i. All groundwater monitoring wells shall be maintained in accordance with the plans and specifications presented in Appendix B of the permit application and in accordance with ADEM Admin. Code Rule 335-14-5-.06.

      ii. A groundwater monitoring well shall not be removed from any monitoring program specified in this permit without an approved permit modification pursuant to Permit Condition I.I.

      iii. If a groundwater monitoring well is damaged, the Permittee shall notify the Department within 72 hours in writing, which includes a description of the well repair activities to be conducted. The well repair procedures must be approved by the Department prior to implementation. Within 30 calendar days after the well is repaired, the Permittee shall submit a written notification to the Department that the well repair activities were conducted in accordance with the approved procedures.

      iv. If a groundwater monitoring well is deleted from the monitoring program(s) required by this permit in accordance with Permit Conditions III.B.1.a.ii., and I.I., it shall be abandoned within 90 calendar days after deletion using procedures to be approved by the Department. Within 30 calendar days after the well is abandoned, the Permittee shall submit a written notification to the Department that the well abandonment activities were conducted in accordance with the approved procedures.

b. Groundwater monitoring wells POC-1RU, POC-5RU, POC-10RU, and POC-13RU shall define the point of compliance for the surface impoundments closed as a landfill.

c. The Permittee shall maintain groundwater monitoring well TW-16SRU as the background monitoring well for the entire facility as specified in Appendix B of the permit application.

d. The Permittee shall install and maintain additional groundwater monitoring wells as necessary to assess changes in the rate and extent of any plume of contamination or as otherwise deemed necessary to maintain compliance with ADEM Admin. Code Rules 335-14-5-.06(6), 335-14-5-.06(8), 335-14-5-.06(9), 335-14-5-.06(10), and 335-14-5-.06(11), as applicable. A plan in the form of a permit modification request specifying the design, location and installation of any additional monitoring wells should be submitted to the Department at least 90 calendar days prior to installation which, at a minimum, shall include:

   i. Well construction techniques including casing depths and proposed total depth of well(s);

   ii. Well development method(s);

   iii. A complete description of well construction materials;

   iv. A schedule of implementation for construction; and,

   v. Provisions for determining the lithologic characteristics, hydraulic conductivity, grain size distribution, and porosity for the applicable aquifer unit(s) at the location of the new well(s).

e. The Permittee shall include newly installed wells BDY-28RU, BDY-28RM, BDY-29RU, BDY-29RM, BKG-16SRU, POC-1RU, POC-5RU, POC-10RU, POC-13RU, EFF-31RU, EFF-31RM, EFF-101U, EFF-101M, EFF-102U, EFF-103U, EFF-103M, EFF-2RU, EFF-33U, EFF-33M, EFF-34U, EFF-34M, EFF-35U, EFF-35M, EFF-36U, EFF-36M, EFF-37U, EFF-37M, in the groundwater monitoring system.

f. The Permitte shall abandon wells TW-27S, TW-28S, TW-30S, TW-7, TW-13, TW-17, TW-26, TW-29, TW-31S, TW-31M, TW-1, TW-2, TW-5, TW-11, TW-3, TW-10, TW-12, TW-14, TW-15R, TW-18, TW-19, TW-16S, TW-4S, AND TW-6S, using procedures described in Section 4.2.1 of the CMI Plan within 90 calendar days after the effective date of this permit. Within 45 calendar days after the abandonment of these wells is completed, the Permittee shall submit a report to the Department which includes a detailed description of the well abandonment activities conducted.

2. General Groundwater Monitoring Requirements

   a. The Permittee shall determine the groundwater surface elevation from all monitoring wells listed in Table III.1. of this permit at least semi-annually and each time a sampling event is conducted. The results of these determinations should be submitted in accordance with Permit Condition III.B.6. Elevation data should be recorded and reported as MSL and referenced to an appropriate NGVD benchmark.

   b. The Permittee shall determine the groundwater flow rate and direction in the underlying aquifer(s) at least annually and submit the results in accordance with Permit Condition III.B.6.

   c. The Permittee shall determine background concentrations of hazardous constituents and other chemical parameters required to be monitored by this permit in accordance with Appendix B, Section 2.1 of the permit application and ADEM Admin. Code Rule 335-14-5-.06(8)(g).

3. Groundwater Protection Standard

   a. The groundwater protection standard, as required under ADEM Admin. Code Rule 335-14-5-.06(3), shall consist of Table III.3 of this permit which lists the hazardous constituents and their respective concentration limits.

   b. The groundwater protection standard applies to all hazardous waste or hazardous constituent releases as deemed appropriate by the Department to protect human health and the environment.

4. Compliance Period

   a. The compliance period, during which the groundwater protection standard specified in Permit Condition III.B.3. applies, shall begin at the time of the first sampling event of the compliance monitoring program (Permit Condition III.D.), or the corrective action monitoring program (Permit Condition III.E.), whichever is earlier.

   b. The compliance period shall continue (after beginning pursuant to Permit Condition III.B.4.a.) until the groundwater protection standard as defined by Permit Condition III.B.3.a. has not been exceeded for a period of three consecutive years.

   c. If the Permittee is engaged in a corrective action program pursuant to Permit Condition III.E., then the compliance period shall continue as required by ADEM Admin. Code Rule 335-14-5-.06(7)(c) until the groundwater protection standard has not been exceeded for a period of three consecutive years after corrective action has been terminated and this permit has been modified, in accordance with Permit Condition I.I., to implement a compliance monitoring program pursuant to Permit Condition III.D. or a detection monitoring program pursuant to Permit Condition III.C., as required by ADEM Admin. Code Rule 335-14-5-.06(11)(f).

5. Sampling and Analysis Procedures

The Permittee shall use the following techniques and procedures when obtaining and analyzing samples from the groundwater monitoring wells described in Permit Condition III.B.1. to provide a reliable indication of the quality of the groundwater as required under ADEM Admin. Code Rules 335-14-5-.06(8)(d), (e), and (g):

a. Samples shall be collected, preserved, and shipped (when shipped off-site for analysis) in accordance with the procedures specified in Appendix B, of the permit application.

b. Samples shall be analyzed according to the procedures specified in Appendix B of the permit application, the most recent edition of SW-846 or other appropriate methods approved by the Department. Analytical method detection limits shall be less than, or equal to, the concentration limits specified in Table III.3.

c. Samples shall be tracked and controlled using the chain-of-custody procedures specified in Appendix B of the permit application.

d. Statistical analyses used to evaluate the groundwater monitoring data shall be as described in Attachment B of the permit application and ADEM Admin. Code Rule 335-14-5-.06(8)(h).

e. All samples taken in accordance with this permit shall not be filtered prior to analysis.

6. Recordkeeping and Reporting

a. The Permittee shall keep and maintain all monitoring, testing, and analytical data obtained in accordance with Permit Conditions III.B., III.C., III.D., and III.E. as required by Permit Condition I.C.10.

b. The Permittee shall submit to the Department a written report to include all analytical sampling data, established background values, statistical evaluations, groundwater elevations, associated potentiometric maps, and the annual groundwater flow rate and direction determinations. The analytical method and the MDL for each constituent must be integrated into all reports of analysis. The report shall be submitted within 60 calendar days after the first sampling event and on a semi-annual basis thereafter. Copies of this report shall be kept at the facility in accordance with Permit Conditions I.C.10.c. and I.C.10.e.

c. The Permittee shall submit progress reports to the Department describing implementation of groundwater monitoring and/or corrective action activities at the site as required by Part III of this permit on a quarterly basis. The first progress report shall be submitted to the Department within 90 calendar days after the effective date of this permit. The progress reports shall continue until such time as the required monitoring and/or corrective action systems and activities required by this permit are fully constructed and operational. In the event that additional monitoring and/or corrective action requirements are imposed through a permit modification, the quarterly reporting requirement shall resume, commencing upon the effective date of the permit modification and

continuing until the required monitoring and/or corrective action systems and activities are again fully constructed and operational.

III.C. DETECTION MONITORING PROGRAM (RESERVED)

III.D. COMPLIANCE MONITORING PROGRAM (RESERVED)

III.E. CORRECTIVE ACTION MONITORING PROGRAM

The requirements of this Condition are applicable to the surface impoundments closed as a landfill. Except as specified otherwise in this permit, the Corrective Action Monitoring Program shall be implemented in accordance with Section 4.4, Appendix B of the permit application and ADEM Admin. Code Rule 335-14-5-.06(11).

1. Monitoring Systems

   In addition to the point of compliance and background monitoring well systems identified in Permit Conditions III.B.1.b. and III.B.1.c., the Permittee shall:

   a. Maintain groundwater monitoring wells BDY-32U, BDY-32M, BDY-32L, BDY-28RU, BDY-28RM, BDY-29RU, and BDY-29RM as boundary wells for the entire facility as specified in Table III.1 of this permit and as shown on Figure B-1 of the permit application.

   b. Maintain groundwater monitoring wells EFF-31RU, EFF-31RM, EFF-101U, EFF-101M, EFF-102U, EFF-103U, EFF-103M, EFF-2RU, EFF-33U, EFF-33M, EFF-34U, EFF-34M, EFF-35U, EFF-35M, EFF-36U, EFF-36M, EFF-37U, EFF-37M, EFF-1, EFF-3, EFF-21UR, EFF-21M, EFF-21L, EFF-22U, EFF-22M, EFF-22L, EFF-23U, EFF-23M, EFF-23L, EFF-24U, EFF-24M, EFF-24LR, EFF-25U, EFF-25M, and EFF-25L as effectiveness wells as specified in Table III.1 of this permit and as shown on Figure B-1 of the permit application.

   c. Maintain wells RW-4, and RW-5 as recovery wells as specified in Table III.1 of this permit and as shown on Figure 2.3 of the permit application.

   d. Maintain wells POC-1RU, POC-5RU, POC-10RU, and POC-13RU as point of compliance wells as specified in Table III.1 of this permit and as shown on Figure B-1 of the permit application.

2. Corrective Action Program

   a. The Permittee shall conduct a Corrective Action Program, as described in Appendix A of the permit application, to remove or treat in place all hazardous constituents that exceed their respective groundwater protection standards as described in Table III.3 of this permit at the point of compliance, between the point of compliance and the down-gradient facility property boundary, and beyond the facility boundary in accordance with ADEM Admin. Code Rule 335-14-5-.06(11)(e)2.

   b. Pursuant to ADEM Admin. Code Rules 335-14-5-.06(11)(c) and 335-14-5-.06(11)(e)3., the Permittee shall continue to implement the corrective action

program as described in Appendix-A of the permit application within 120 calendar days after the effective date of this permit.

c. The Permittee shall handle or treat groundwater in accordance with Appendix A of the permit application and with the applicable requirements of NPDES, and UIC permit numbers ALD068951, and ALS19949364 as issued by the Department.

3. Monitoring Requirements

In addition to the general groundwater monitoring requirements specified in Permit Condition III.B.2., the Permittee shall:

a. Sample all effectiveness monitoring wells shown in Table III.1 of this permit and analyze for the constituents listed in Table III.2 of this permit on a semi-annual basis as per schedule included in Table 4-1 of Appendix A of the permit application and continuing through the end of the compliance period.

b. Sample all background, point of compliance, effectiveness, and boundary monitoring wells shown in Table III.1 of this permit and analyze for the constituents listed in Table III.2 of this permit on an annual basis as per schedule included in Table 4-1 of Appendix A of the permit application and continuing through the end of the compliance period.

c. Sample all background, point of compliance, effectiveness, and boundary monitoring wells shown in Table III.1 of this permit and analyze for temperature (degrees F or C), specific conductance (Mhos/cm), and pH (standard units) each time the well is sampled. Sample all effectiveness monitoring wells shown in Table III.1 of this permit and analyze for Monitored Natural Attenuation (MNA) parameters (nitrate, sulfide, chloride, carbon dioxide [gas], hydrogen [gas], and BTEX). The data obtained should be submitted as raw data in the reports required by Permit Condition III.B.6.

d. When evaluating the monitoring results to determine the effectiveness of the corrective measures, in accordance with Permit Condition III.E.4., the Permittee shall:

i. Determine if the corrective action system effectively addresses the entire plume of contamination;

ii. Determine if the concentration of the hazardous constituents are decreasing (pH increasing or decreasing toward neutrality, as applicable) in the effectiveness wells specified in Permit Condition III.A.1.;

iii. Determine if hazardous waste or hazardous constituents are being released into the environment; and,

iv. Determine if hazardous constituents have been detected in the boundary wells specified in Permit Condition III.A.1.

4. Reporting and Response Requirements

In addition to the recordkeeping and reporting requirements specified in Permit Condition III.B.6.:

a. The Permittee shall report the effectiveness of the corrective action program semi-annually, as required under ADEM Admin. Code Rule 335-14-5-.06(11)(g). These reports shall be submitted to the Department as per schedule included in Table B-3 of Appendix B of the permit application and continue until corrective action is completed. The Permittee must provide data from groundwater monitoring along with an analysis of that data and any conclusions regarding the effectiveness of the program in accordance with Permit Condition III.E.3.d. If the analysis of the data warrants any change to the corrective action program, the Permittee must include these revisions in the semi-annual report, which will be followed-up within 90 calendar days with an application for permit modification in accordance with Permit Condition I.I.

b. If corrective action is terminated under Permit Condition III.B.4.c., the Permittee must sample all background, point of compliance, effectiveness and boundary sampling locations for the compounds listed in ADEM Admin. Code Rule 335-14-5-Appendix IX. Based upon the sampling results, the Permittee may petition the Department, in accordance with Permit Condition I.I., for a permit modification to implement either a detection monitoring program or a compliance monitoring program.

TABLE III.1

MONITORING WELL DESIGNATIONS

WELL ID	WELL STATUS	WELL TYPE	LONGITUDE (degrees)	LATITUDE (degrees)	MONITORING
BKG-16SRU	New	BKG Well	88.038296	30.912394	Annual Monitoring for VOCs, Metals & Dinoseb
POC-1RU	New	POC Well	88.039054	30.910551	
POC-5RU	New	POC Well	88.039422	30.911156	
POC-10RU	New	POC Well	88.039203	30.909915	
POC-13RU	New	POC Well	88.039772	30.910392	
BDY-32U	TW-32U	BDY Well	88.041566	30.910161	
BDY-32M	TW-32M	BDY Well	88.041571	30.910131	
BDY-32L	TW-32L	BDY Well	88.041562	30.910203	
BDY-28RU	New	BDY Well	88.036726	30.909286	
BDY-28RM	New	BDY Well	88.036625	30.909304	
BDY-29RU	New	BDY Well	88.038890	30.906274	
BDY-29RM	New	BDY Well	88.038945	30.906279	
EFF-101U	New	New Injection Test EFF Well	88.039221	30.911880	Semi-Annual Monitoring for VOCs and Metals and Annual Monitoring for Dinoseb
EFF-101M	New	New Injection Test EFF Well	88.039175	30.911828	
EFF-102U	New	New Injection Test EFF Well	88.038236	30.910338	
EFF-103U	New	New Injection Test EFF Well	88.038246	30.910281	
EFF-103M	New	New AS/SVE EFF Well	88.038279	30.910290	
EFF-2RU	New	Replacement Well	88.038840	30.911007	
EFF-33U	New	EFF Well Based on VAP	88.037979	30.910255	Semi-Annual Monitoring for VOCs and Metals and Annual Monitoring for Dinoseb
EFF-33M	New	EFF Well Based on VAP	88.037938	30.910277	
EFF-34U	New	EFF Well Based on VAP	88.038537	30.909499	
Eff-34M	New	EFF Well Based on VAP	88.038590	30.909527	
EFF-35U	New	EFF Well Based on VAP	88.041058	30.909640	
EFF-35M	New	EFF Well Based on VAP	88.041122	30.909617	
EFF-36U	New	EFF Well Based on VAP	88.039049	30.908686	
EFF-36M	New	EFF Well Based on VAP	88.039042	30.908780	
EFF-37U	New	EFF Well Based on VAP	88.040950	30.908893	
EFF-37M	New	EFF Well Based on VAP	88.040997	30.908902	
EFF-1	FIW-1	EFF Well Retained	88.038099	30.912306	
EFF-3	FIW-3	EFF Well Retained	88.038471	30.912000	
EFF-21UR	TW-21UR	EFF Well Retained	88.037604	30.910997	Semi-Annual Monitoring for VOCs and Metals, Annual Monitoring for Dinoseb, And MNA Parameters (nitrate, sulfide, chloride, carbon dioxide[gas], hydrogen [gas], and BTEX
EFF-21M	TW-21M	EFF Well Retained	88.037617	30.910994	
EFF-21L	TW-21L	EFF Well Retained	88.037617	30.910983	
EFF-22U	TW-22U	EFF Well Retained	88.040598	30.910938	
EFF-22M	TW-22M	EFF Well Retained	88040623	30.910921	
EFF-22L	TW-22L	EFF Well Retained	88.040642	30.910902	
EFF-23U	TW-23U	EFF Well Retained	88.040641	30.909032	
EFF-23M	TW-23M	EFF Well Retained	88.040626	30.909065	
EFF-23L	TW-23L	EFF Well Retained	88.040635	30.909101	
EFF-24U	TW-24U	EFF Well Retained	88.039252	30.907993	
EFF-24M	TW-24M	EFF Well Retained	88.039220	30.907993	
EFF24LR	TW-24LR	EFF Well Retained	88.039265	30.908024	
EFF-25U	TW-25U	EFF Well Retained	88.037388	30.908760	
EFF-25M	TW-25M	EFF Well Retained	88.037362	30.908760	
EFF-25L	TW-25L	EFF Well Retained	88.037337	30.908757	
EFF-31M	TW-31M	EFF Well Retained	88.041628	30.908613	
MCN-4D	TW-4D	Upper Miocene PRG Well	88.039117	30.911791	Not Sampled Routinely (Sampled as needed
MCN-6D	TW-6D	Upper Miocene PRG Well	88.039325	30.910327	
MCN-8	TW-8	Upper Miocene PRG Well	88.038569	30.911298	
MCN-16D	TW-16D	Upper Miocene PRG Well	88.038266	30.912410	
MCN-27D	TW-27D	Upper Miocene PRG Well	88.036033	30.912285	
MCN-28D	TW-28D	Upper Miocene PRG Well	88.036696	30.909318	
MCN-30D	TW-30D	Upper Miocene PRG Well	88.037308	30.911114	
MCN-31D	TW-31D	Upper Miocene PRG Well	88.041615	30.908624	

Table III.1 (cont'd)

WELL ID	WELL STATUS	WELL TYPE	LONGITUDE	LATITUDE	MONITORING
R4	RCY	Recovery well Retained	88.040037	30.908741	
R5	RCY	Recovery well Retained	88.039920	30.908802	

POC - Point of Compliance Wells
EFF - Effectiveness Monitoring Wells
PRG - Program Monitoring Wells
BKG - Background Wells
BDY - Boundary Monitoring Wells
MCN - Miocene Wells
RCY – Recovery Wells
UNK - Unknown
VOC - Volatile Organic Compounds
U – Indicates that the well is screened in the upper section of the semi-confined aquifer
M – Indicates that the well is screened in the middle section of the semi-confined aquifer
L - Indicates that the well is screened in the lower section of the semi-confined aquifer

TABLE III.2

GROUNDWATER QUALITY MONITORING CONSTITUENTS*

HAZARDOUS CONSTITUENT	UNIT**
2-Butanone	Middle Pond, and South Pond
Benzene	Middle Pond, and South Pond
Cadmium	Middle Pond, and South Pond
Carbon Disulfide	Middle Pond, and South Pond
Carbon Tetrachloride	Middle Pond, and South Pond
Chloroform	Middle Pond, and South Pond
Chromium	Middle Pond, and South Pond
1,1 Dichloroethane	Middle Pond, and South Pond
1,2 Dichloroethane	Middle Pond, and South Pond
Dinoseb	Middle Pond, and South Pond
Lead	Middle Pond, and South Pond
Mercury	Middle Pond, and South Pond
1,1,1,2 Tetrachloroethane	Middle Pond, and South Pond
Tetrachloroethene	Middle Pond, and South Pond

* The constituents listed herein are the subset of the Groundwater Protection Standard listed in Table III.3 for which monitoring is required.

** Identifies the unit(s) at which the given constituent must be monitored.

TABLE III.3

GROUNDWATER PROTECTION STANDARD

HAZARDOUS CONSTITUENT	UNIT*	CONCENTRATION LIMIT (mg/L)
2-Butanone	Middle Pond, and South Pond	0.7
Benzene	Middle Pond, and South Pond	0.005
Cadmium	Middle Pond, and South Pond	0.005
Carbon Disulfide	Middle Pond, and South Pond	0.1
Carbon Tetrachloride	Middle Pond, and South Pond	0.005
Chloroform	Middle Pond, and South Pond	0.08
Chromium	Middle Pond, and South Pond	0.1
1,1 Dichloroethane	Middle Pond, and South Pond	0.081
1,2 Dichloroethane	Middle Pond, and South Pond	0.005
Dinoseb	Middle Pond, and South Pond	0.007
Lead	Middle Pond, and South Pond	0.015
Mercury	Middle Pond, and South Pond	0.002
1,1,1,2 Tetrachloroethane	Middle Pond, and South Pond	0.00043
Tetrachloroethene	Middle Pond, and South Pond	0.005

* Identifies the unit(s) at which the given constituent must be monitored.

PART IV

SOLID WASTE MANAGEMENT UNIT IDENTIFICATION AND EVALUATION

IV.A. APPLICABILITY

The Conditions of this Part apply to:

1. The solid waste management units (SWMUs) and areas of concern (AOCs) identified in Table IV.1, which require investigation and/or remediation;

2. The SWMUs identified in Table IV.2, which require no further investigation under this permit at this time;

3. Any additional SWMUs or AOCs discovered during the course of groundwater monitoring, field investigations, environmental audits, or other means; and,

4. Contamination beyond the facility boundary, if applicable. The Permittee shall implement corrective actions beyond the facility boundary where necessary to protect human health and the environment, unless the Permittee demonstrates to the satisfaction of the Department that, despite the Permittee's best efforts, as determined by the Department, the Permittee was unable to obtain the necessary permission to undertake such actions. The Permittee is not relieved of all responsibility to clean up a release that has migrated beyond the facility boundary where off-site access is denied. On-site measures to address such releases will be determined on a case-by-case basis. Assurances of financial responsibility for completion of such off-site corrective action will be required.

IV.B. NOTIFICATION AND ASSESSMENT REQUIREMENTS FOR NEWLY IDENTIFIED SWMUs AND AOCs

1. The Permittee shall notify the Department in writing, within 15 calendar days of discovery, of any additional AOC(s) as described under Permit Condition IV.A.3. The notification shall include, at a minimum, the location of the AOC(s) and all available information pertaining to the nature of the release (*e.g.,* media affected, hazardous constituents released, magnitude of release, *etc.*). If the Department determines that further investigation of an AOC is required, the permit will be modified in accordance with ADEM Admin. Code Rule 335-14-8-.04(2).

2. The Permittee shall notify the Department in writing, within 15 calendar days of discovery, of any additional SWMUs as described under Permit Condition IV.A.3.

3. The Permittee shall prepare and submit to the Department, within 90 calendar days of notification, a SWMU Assessment Report (SAR) for each SWMU identified under Permit Condition IV.B.2. At a minimum, the SAR shall provide the following information:

   a. Location of unit(s) on a topographic map of appropriate scale such as required under ADEM Admin. Code Rule 335-14-8-.02(5)(b)19.

b. Designation of type and function of unit(s).

c. General dimensions, capacities and structural description of unit(s) (supply any available plans/drawings).

d. Dates that the unit(s) was operated.

e. Specification of all wastes that have been managed at/in the unit(s) to the extent available. Include any available data on hazardous constituents in the wastes.

f. All available information pertaining to any release of hazardous waste or hazardous constituents from such unit(s) (to include groundwater data, soil analyses, air, and/or surface water data).

4. Based upon the results of the SAR, the Department shall determine the need for further investigations at the SWMUs covered in the SAR. If the Department determines that such investigations are needed, the Permittee shall initiate an investigation as outlined in Permit Condition IV.D.1 immediately upon receiving notification of the Department's determination.

IV.C. NOTIFICATION REQUIREMENTS FOR NEWLY DISCOVERED RELEASES AT PREVIOUSLY IDENTIFIED SWMUs or AOCs

1. The Permittee shall notify the Department in writing of any newly discovered release(s) of hazardous waste or hazardous constituents discovered during the course of groundwater monitoring, field investigations, environmental audits, or other means, within 15 calendar days of discovery. Such newly discovered releases may be from SWMUs or AOCs identified in Permit Condition IV.A.2 or SWMUs or AOCs identified in Permit Condition IV.A.3 for which further investigation was not required.

2. If the Department determines that further investigation of the SWMUs or AOCs is needed, the Permittee shall initiate an investigation as outlined in Permit Condition IV.D. immediately upon receiving notification of the Department's determination.

IV.D. RCRA FACILITY INVESTIGATION (RFI)

1. The Permittee must perform a RCRA Facility Investigation (RFI) for any SWMU and AOC identified by the Department in accordance with Permit Conditions IV.A.1, IV.B.4, and IV.C.2.

2. The RFI must completely identify the concentration of hazardous constituents released from each SWMU and AOC and fully delineate the area where such hazardous constituents have come to be located.

3. The RFI must fully characterize the nature and extent of contamination released from each SWMU or AOC under investigation.

4. The RFI must be performed in a manner consistent with the most recent edition of the Alabama Environmental Investigation and Remediation Guidance.

5. Except as provided by Permit Condition IV.D.6., the RFI must be completed within 180 calendar days from the effective date of this permit or, for SWMUs or AOCs identified pursuant to Permit Condition IV.B. and C., within 180 calendar days from the receipt of notification from the Department that an RFI is required. If, prior to the effective date of this permit, the Department has approved a work plan that includes a schedule for completing the RFI, the RFI shall be completed in accordance with the approved schedule.

6. RFI Schedule of Compliance

    a. For RFIs expected to require greater than 180 calendar days to complete, the Permittee may submit a schedule of compliance subject to Departmental approval and/or modification.

    b. Submittal of an RFI Schedule of Compliance does not delay or otherwise postpone the Permittee's obligation to initiate the RFI.

    c. The Schedule of Compliance must include:

        i. A detailed narrative discussion, which explains why the RFI cannot be completed within 180 days; and,

        ii. A detailed and chronological listing of milestones with estimated durations that provides sufficient information to track the progress of the investigation.

    d. The RFI Schedule of Compliance shall be reviewed by the Department in accordance with Permit Condition IV.G.

    e. The Permittee shall complete the RFI in accordance with the approved RFI Schedule of Compliance.

7. RFI Progress Reports

    a. For an RFI being conducted in accordance with the approved RFI Schedule of Compliance, the Permittee must submit progress reports on a monthly basis.

    b. The RFI Progress Reports must include:

        i. A description of the RFI activities completed during the reporting period;

        ii. Summaries of any problems or potential problems encountered during the reporting period;

        iii. Actions taken to rectify problems;

        iv. Changes in relevant personnel;

        v. Projected work for the next reporting period;

vi. Any proposed revisions to the RFI Schedule of Compliance. Modifications of the RFI Schedule of Compliance are subject to approval by the Department; and,

vii. A summary of any data collected during the reporting period, including:

A. The location of each sampling point identified on a site map;

B. The concentration of each hazardous constituent detected at each sampling point; and,

C. Submittal of RFI Progress Reports, work plans, or other documents during the RFI does not alter the approved RFI Schedule of Compliance.

8. RFI Reports

a. The Permittee shall prepare and submit to the Department an RFI Report within 60 calendar days from the completion of investigation activities in accordance with the approved RFI Schedule of Compliance, if applicable.

b. The RFI Report must provide a detailed description of all required elements of the investigation as described in the most recent edition of the Alabama Environmental Investigation and Remediation Guidance.

c. The RFI Report shall be reviewed by the Department in accordance with Permit Condition IV.G.

IV.E. SELECTION OF CORRECTIVE MEASURES AND PERMIT MODIFICATION

1. The Permittee shall develop and submit to the Department a Corrective Measures Implementation (CMI) Plan for any areas of the Permittee's site where hazardous constituents have come to be located at concentrations exceeding those appropriate for the protection of human health and the environment. The CMI Plan must include all applicable elements of the proposed remedy pursuant to the most recent edition of the Alabama Environmental Investigation and Remediation Guidance.

2. The CMI Plan shall be submitted to the Department within 120 calendar days following the Permittee's submittal of the RFI Report indicating that hazardous constituents have come to be located at any area of the Permittee's facility, or beyond the facility, at concentrations exceeding those appropriate for the protection of human health and the environment, or within 120 calendar days following notification from the Department that a CMI Plan is required, whichever occurs earlier.

3. The CMI Plan shall be submitted along with a request for permit modification pursuant to ADEM Admin. Code R. 335-14-8-.04(2), and shall include any applicable fees pursuant to ADEM Admin. Code R. 335-1-6. This modification will serve to incorporate the proposed final remedy, including all procedures necessary to implement and monitor the remedy, into this permit.

4. Within 120 calendar days after this Permit has been modified in accordance with Permit Condition IV.E.3., the Permittee shall demonstrate financial assurance for completing the approved remedy.

IV.F. INTERIM MEASURES (IM)

1. IM Work Plan(s)

   a. Upon notification by the Department, the Permittee shall prepare and submit an Interim Measures (IM) Work Plan for any SWMU or AOC that the Department determines is necessary. IM are necessary in order to minimize or prevent further migration of contaminants and limit human and environmental exposure to contaminants while long-term corrective measures are evaluated and, if necessary, implemented. The IM Work Plan shall be submitted within 30 calendar days of such notification and shall include the elements listed in Permit Condition IV.F.1.b. Such IM may be conducted concurrently with investigations required under the terms of this permit. The Permittee may initiate IM by submitting an IM Work Plan for approval and reporting in accordance with the requirements under Permit Condition IV.F.

   b. The IM Work Plan shall ensure that the IM are designed to mitigate any current or potential threat(s) to human health or the environment and is consistent with and integrated into any long-term solution at the facility. The IM Work Plan shall include: the IM objectives, procedures for implementation (including any designs, plans, or specifications), and schedules for implementation.

   c. The IM Work Plan must be approved by the Department, in writing, prior to implementation. The Department shall specify the start date of the IM Work Plan schedule in the letter approving the IM Work Plan.

   d. The IM Report shall be reviewed by the Department in accordance with Permit Condition IV.G.

2. IM Implementation

   a. The Permittee shall implement the IM in accordance with the approved IM Work Plan.

   b. The Permittee shall give notice to the Department as soon as possible of any planned changes, reductions or additions to the IM Work Plan.

   c. Final approval of corrective action required under ADEM Admin. Code Rule 335-14-5-.06(12), which is achieved through IM, shall be in accordance with ADEM Admin. Code Rule 335-14-8-.04(2) and Permit Condition IV.E.

3. IM Reports

   a. If the time required for completion of IM is greater than one year, the Permittee shall provide the Department with Progress Reports at intervals specified in the approved work plan. The Progress Reports shall, at a minimum, contain the following information:

i. A description of the portion of the IM completed;

ii. Summaries of any deviations from the IM Work Plan during the reporting period;

iii. Summaries of any problems or potential problems encountered during the reporting period;

iv. Projected work for the next reporting period; and,

v. Copies of laboratory/monitoring data.

b. The Permittee shall prepare and submit the IM Report to the Department within 90 calendar days of completion of IM conducted under Permit Condition IV.F. The IM Report shall, at a minimum, contain the following information:

i. A description of IM implemented;

ii. Summaries of results;

iii. Summaries of all problems encountered;

iv. Summaries of accomplishments and/or effectiveness of IM; and,

v. Copies of all relevant laboratory or monitoring data, *etc.*, in accordance with Permit Condition I.C.10.

IV.G. SUBMITTALS

1. All work plans, reports, schedules, and other documents ("submittals") required by this permit shall be subject to approval by the Department to assure that such submittals and schedules are consistent with the requirements of this Permit and with applicable regulations and guidance. The Permittee shall revise all submittals and schedules as directed by the Department.

2. The Department will review all submittals in accordance with the conditions of this permit. The Department will notify the Permittee in writing of any submittal that is disapproved, and the basis therefore. If the Department disapproves a submittal, the Department shall: (1) notify the Permittee in writing of the submittal's deficiencies and specify a due date for submission of a revised submittal, (2) revise the submittal and notify the Permittee of the revisions, or (3) conditionally approve the submittal and notify the Permittee of the conditions. Permit Condition IV.H. shall apply only to submittals that have been disapproved and revised by the Department, or that have been disapproved by the Department, then revised and resubmitted by the Permittee, and again disapproved by the Department.

3. All submittals shall be submitted within the time frame specified by the Department and in accordance with the approved schedule of compliance. Extensions of the due date for submittals may be granted by the Department based on the Permittee's demonstration that sufficient justification for the extension exists.

4. All submittals required by this permit shall be signed and certified in accordance with ADEM Admin. Code Rule 335-14-8-.02(2).

5. Two (2) copies of all submittals shall be provided by the Permittee to the Department in accordance with Permit Condition I.J.

IV.H. DISPUTE RESOLUTION

Notwithstanding any other provision in this permit, in the event the Permittee disagrees, in whole or in part, with the Department's revision of a submittal or disapproval of any revised submittal required by this Part, the following may, at the Permittee's discretion, apply:

1. In the event that the Permittee chooses to invoke the provisions of this section, the Permittee shall notify the Department in writing within 30 calendar days of receipt of the Department's revision of a submittal or disapproval of a revised submittal. Such notice shall set forth:

   a. The specific matters in dispute;

   b. The position the Permittee asserts should be adopted as consistent with the requirements of this permit;

   c. The basis for the Permittee's position; and,

   d. Any matters considered necessary for the Department's determination.

2. The Department and the Permittee shall have an additional 30 calendar days from the Department's receipt of the notification provided for in Permit Condition IV.H.1. to meet or confer to resolve any disagreement.

3. In the event agreement is reached, the Permittee shall submit and implement the revised submittal in accordance with and within the time frame specified in such agreement.

4. If agreement is not reached within the 30-day period, the Department will notify the Permittee in writing of his/her decision on the dispute, and the Permittee shall comply with the terms and conditions of the Department's decision in the dispute. For the purposes of this provision in this permit, the responsibility for making this decision shall not be delegated below the Land Division Chief.

5. With the exception of those conditions under dispute, the Permittee shall proceed to take any action required by those portions of the submission and of this permit that the Department determines are not affected by the dispute.

Table IV.1

The following Solid Waste Management Unit(s) (SWMU) and/or Area(s) of Concern (AOC) numbers and descriptions correspond with those noted in the RCRA Facility Assessment (RFA) Report. Where discrepancies exist, the permit will take precedence.

List of SWMUs and AOCs requiring a RCRA Facility Investigation (RFI):

SWMU/AOC NUMBER	SWMU/AOC NAME	UNIT COMMENT	POTENTIALLY AFFECTED MEDIA

There are no required RFI activities at this time

Table IV.2

The following Solid Waste Management Unit(s) (SWMU) and/or Area(s) of Concern (AOC) numbers and descriptions correspond with those noted in the RCRA Facility Assessment (RFA) Report. Where discrepancies exist, the permit will take precedence.

List of SWMUs and AOCs requiring no further action at this time:

SWMU/AOC NUMBER	SWMU/AOC NAME	UNIT COMMENT	POTENTIALLY AFFECTED MEDIA
SWMU-5	Former Pump House	No release	None
SWMU-6	Former Flow lines	No release	None
SWMU-7	Chemical Drain	No release	None
SWMU-8	Organic Sump	No release	None
SWMU-9	Organic Holding Tank # 3	No release	None
SWMU-10	Caustic Sump	No release	None
SWMU-11	Caustic Holding Tank # 4	No release	None
SWMU-12	Acid Sump	No release	None
SWMU-13	Acid Holding Tank # 5	No release	None
SWMU-14	Drainage Ditch	RFI indicated no impact on soil	Soil & groundwater
SWMU-16	Stainless Steel Tank Trailers	No release	None
SWMU-17	Leachate Storage Tank	No release	None
AOC-A	Truck Parking Pad	No release	None
AOC-B	Former N, S, E, W Monitoring Wells	No release	None
AOC-C	Final Rinse Tanks	No release	None
AOC-D	10,000 Diesel UST	No release	None

Table IV.3

The following Solid Waste Management Unit(s) (SWMU) and/or Area(s) of Concern (AOC) numbers and descriptions correspond with those noted in the RCRA Facility Assessment (RFA) Report. Where discrepancies exist, the permit will take precedence.

List of SWMUs and AOCs regulated by Parts II, III, IV, and V of this permit.

SWMU/AOC NUMBER	SWMU/AOC NAME	UNIT COMMENT	POTENTIALLY AFFECTED MEDIA
SWMU-1	North Pond	Additional carbon tetrachloride contamination recently discovered from past truck washing activities	Groundwater
SWMU-2	Middle Pond	Waste in place with a RCRA cap landfill	Soil & Groundwater
SWMU-3	South Pond	Waste in place under same RCRA cap	Soil & Groundwater
SWMU-4	Old Pond Area	Additional carbon tetrachloride contamination recently discovered from past truck washing activities	Groundwater
SWMU-15	Underground Waste Water Storage Tank	Proceed with corrective action per Corrective Action Plan	Soil & Groundwater
SWMU-18	Truck Wash Rack	Proceed with corrective action per Corrective Action Plan	Soil & Groundwater
AOC-E	Fuel Island Release	Proceed with corrective action per Corrective Action Plan	Soil & Groundwater

PART V

CORRECTIVE MEASURES IMPLEMENTATION

V.A. APPLICABILITY

The conditions of this Part apply to SWMUs and AOCs identified in Table V.1.

V.B. GENERAL CONDITIONS

1. The Permittee is required to perform corrective measures for the SWMUs and AOCs identified in Condition V.A. The approved remedy for these defined units, waterway areas, or land parcels, includes any and all actions set forth in this permit and in the approved Interim Measures Plans, Corrective Measures Studies (CMSs), and Corrective Measures Implementation (CMI) Plans approved by the Department, as noted below:

Applicable SWMU/AOC	CMS/CMI	Approval Date
North Pond	CMI Plan	XXXXXX
Old Pond Area	CMI Plan	XXXXXX
SWMU-15	CMI Plan	April 19, 2017
SWMU-18	CMI Plan	April 19, 2017
AOC-E	CMI Plan	April 19, 2017

2. Remedial Cleanup Levels

   Upon approval, pursuant to Condition IV.E. of this permit, of a CMI Plan designating applicable cleanup level(s), the cleanup level(s) for the areas specific to the CMI Plan will be deemed to be a condition of this permit.

3. Groundwater Monitoring and Remediation

   Where required pursuant to Conditions V.B.1., and V.C. of this permit, the Permittee shall comply with the general groundwater monitoring requirements of Part III of this permit.

4. Land Use Controls

   Where required pursuant to Conditions V.B.1. and V.C. of this permit, the Permittee shall establish appropriate land use controls to achieve protection of human health and the environment. The Permittee shall comply with Conditions V.B.5. and V.B.6. of this permit when implementing corrective measures requiring land use controls. Where the owner of such property will not allow a deed restriction to be imposed, the Permittee shall notify the Department within 14 calendar days of receipt of written notification by the property owner. In such cases, the Department may allow the Permittee to propose an alternate area-specific land use control, subject to the Department's review and approval.

5. Survey Plat

For corrective measures where residual concentrations of contaminants will remain in-place at levels greater than those appropriate for unrestricted land use, or for corrective measures that rely on land use controls, the Permittee must:

a. Within 90 calendar days following the effective date of a permit modification addressing remedy selection, submit to the local zoning authority, or the authority with jurisdiction over local land use, and to the Department, a survey plat indicating the location and dimensions of the SWMUs, AOCs, and capped or partially remediated areas with respect to permanently surveyed benchmarks, the locations of sampling points, and the concentrations of hazardous constituents detected. This plat must be prepared and certified by a professional land surveyor registered in the State of Alabama. The plat must be filed with the local zoning authority or the authority with jurisdiction over local land use and must contain a note, prominently displayed, which states the Permittee's obligation to limit the property to the specified non-residential uses.

b. Maintain the survey plat as described in Condition V.B.5.a. of this permit and in the CMS Report until the Permittee has demonstrated, to the satisfaction of the Department, that the levels of hazardous constituents in all contaminated media are within limits appropriate for unrestricted residential land uses.

6. Notice to Title of Real Property

No later than the submission of the survey plat required in Condition V.B.5., the Permittee must:

a. Record in the probate judges office of the county in which the property is located or a portion thereof a deed, restrictive covenant or some other instrument that is normally examined during a title search that will in perpetuity notify any potential purchaser of the property that:

i. The land is contaminated with hazardous constituents in concentrations that exceed residential standards;

ii. The use of the property is restricted by this permit for certain residential, municipal, or industrial purposes and may lead to an increased risk of exposure to hazardous constituents depending upon the activities initiated at the site. Such activities may yield an increased level of human health risk to the owner;

iii. The potential purchaser or entity that desires to work in the contaminated area should notify the Permittee before mobilizing to the area covered by the institutional control.

b. Submit to the Department a certification, signed by the Permittee in accordance with Permit Condition I.C.11., that the notice specified in this part has been performed. This certification must include a copy of the document in which the notation has been placed.

c. Maintain the deed notice described in Permit Condition V.B.6. until the Permittee has demonstrated, to the satisfaction of the Department, that the levels of hazardous constituents in all contaminated media are within limits appropriate for unrestricted residential land uses.

7. Security

Security measures, where required by Conditions V.B.1. and V.C. of this permit, will be conducted in accordance with ADEM Admin. Code R. 335-14-5-.02(5) and as prescribed in the approved CMI Plan.

8. Inspection

Where corrective measures addressed in Conditions V.B.1. include provisions to cap in place or partially remediate properties or land areas, whether owned or not owned by the Permittee, the Permittee shall specify inspection protocols on a scheduled basis to ensure continued integrity of the remedy and to ensure that land use remains appropriately restricted per the deed notice established pursuant to Permit Condition V.B.6. Inspection provisions shall be as prescribed in the approved CMI Plan

V.C. AREA SPECIFIC CONDITIONS (RESERVED)

V.D. CORRECTIVE MEASURES IMPLEMENTATION (CMI) REPORTS

1. CMI Progress Reports

If the time required to complete implementation of a specific set of corrective measures, as described in the CMI Plan approved by the Department, is greater than 180 calendar days, the Permittee shall provide ADEM with progress reports according to the schedule approved by ADEM in the CMI Plan. The progress reports shall, at a minimum, contain the following information:

a. A description of the portion of CMI completed;

b. Summaries of and deviations from the approved CMI during the reporting period;

c. Summaries of current and potential problems, including recommended solutions and alternatives as well as corrective actions undertaken;

d. Any monitoring data (soil, air, dust, water) collected for any reason during the construction period for the purposes of monitoring potential for human and ecological exposure; and,

e. Projected work for the next period and impacts to the approved schedule.

2. Final CMI Reports

Upon completion of construction of corrective measures systems, implementation of land use controls, interim removal actions, or other short-term activities required by this permit and/or the approved CMI Plan, the Permittee shall submit to the Department a Final CMI Report containing, at a minimum, the following:

a. A description of activities completed;

b. For cap and cover remedies, as-built construction drawings presenting the final in-place three-dimensional location of contaminated material. A plan view of the remediated areas shall be presented in addition to a cross section of the in-place capped areas;

c. Hazardous waste manifests indicating the handling of any excavated material that has been shipped off-site to a Department-approved, certified landfill;

d. For remedies involving land use controls, a copy of the survey plat and notice to deed required by Condition V.B. of this permit;

e. Monitoring data (soil, air, dust, water) collected for any reason during the construction period for the purposes of monitoring potential for human and ecological exposure; and,

f. Certification, prepared in accordance with ADEM Admin. Code Rule 335-14-8-02 (2)(d) by the Permittee and an independent professional engineer registered in the State of Alabama, that the corrective measures implementation phase (*i.e.*, construction) required by this permit is complete and that the approved system and/or facilities are ready for operation in accordance with the intended design (*i.e.*, CMI Plan).

3. Corrective Measures (CM) Effectiveness Reports

a. For corrective measures that have been fully implemented and where the corrective measures system must operate for a period of time to achieve cleanup goals or levels, the Permittee shall submit CM Effectiveness Reports on a semi-annual basis, unless otherwise approved by the Department, beginning 180 calendar days following the Department's approval of the Final CMI Report. The CM Effectiveness Reports shall include, at a minimum, the following:

i. A detailed narrative presenting an evaluation of the effectiveness of the selected remedy;

ii. Summaries of compliance with and progress toward achieving cleanup goals;

iii. Any significant revisions, adjustments, or proposed modifications to the selected remedy;

iv. Tabulated environmental sampling and monitoring data including, but not limited to, groundwater quality, elevation data, and a graphical representation of all constituents detected during each sampling event from recovery wells, monitoring wells, drinking water wells, and other locations;

v. Chain of custody, field reports, and laboratory data sheets to include the date of collection, the date the sample was extracted, and the date of sample analysis for samples collected during the reporting period;

vi. Any monitoring data (soil, air, dust, water) collected for any reason during the post-construction period for the purposes of monitoring potential for human and ecological exposure;

vii. Isoconcentration maps depicting the distribution of parameters for each sampling event;

viii. Time versus concentration plots for each monitoring parameter for each recovery well and a representative number of effectiveness wells;

ix. Tabulated volumetric data on groundwater pumped and pumping rates (monthly and cumulative) for each recovery well;

x. Records of any groundwater recovery system operation time, including shutdown periods, not including any minor (less than 24 hours) shutdowns for repairs, maintenance, etc.;

xi. Potentiometric surface maps;

xii. Description of land use during the reporting period at the designated area requiring corrective measures; and,

xiii. Findings of the Permittee's investigation into the continued effectiveness of institutional controls per Condition V.C.

b. If, at any time, the Permittee determines that any remedy selection specified in Condition V.B or V.C. of this permit no longer satisfies the applicable requirements of ADEM Admin. Code R. 335-14-5-.06(12) or this permit for releases of hazardous waste or hazardous constituents originating from SWMUs or AOCs, the Permittee must, within 90

calendar days, submit an application for a permit modification, pursuant to Permit Condition I.I, to make any appropriate changes to the CMI Plan.

c. The application for changes in the CMI Plan, including changes in inspection and monitoring provisions of the CMI Plan, shall be submitted as an application for a permit modification pursuant to the requirements of ADEM Admin. Code R. 335-14-8-.04.

4. Final Report of Corrective Measures

Within 90 calendar days following attainment of cleanup levels or goals as outlined in this Permit and the approved CMI Plan, the Permittee shall submit to the Department a Final Report of Corrective Measures (FRCM). The FRCM shall contain a certification by the Permittee and an independent professional engineer registered in the State of Alabama that all remedial measures required by this permit and the approved CMI Plan have been completed. The FRCM shall outline any procedures and schedules for dismantling of corrective measures systems, groundwater monitoring or recovery systems, removal of land use controls, and any other remedial systems or controls required by this permit or the approved CMI Plan.

Table V.1.

The following Solid Waste Management Unit(s) (SWMUs) and/or Area(s) of Concern (AOCs) numbers and descriptions correspond with those noted in the RCRA Facility Assessment (RFA) Report. Where discrepancies exist, the permit will take precedence.

List of SWMUs and AOCs requiring Corrective Measures.

SWMU/AOC NUMBER	SWMU/AOC NAME	UNIT COMMENT	POTENTIALLY AFFECTED MEDIA
SWMU-1	North Pond	Additional carbon tetrachloride contamination recently discovered from past truck washing activities	Groundwater
SWMU-4	Old Pond Area	Additional carbon tetrachloride contamination recently discovered from past truck washing activities	Groundwater
SWMU-15	Underground Waste Water Storage Tank	Proceed with corrective action per Corrective Action Plan	Soil & Groundwater
SWMU-18	Truck Wash Rack	Proceed with corrective action per Corrective Action Plan	Soil & Groundwater
AOC-E	Fuel Island Release	Proceed with corrective action per Corrective Action Plan	Soil & Groundwater

PART VI

SUMMARY OF DEADLINES

The summary information provided herein is intended only as a guide to the requirements of this permit. It is not intended to be all inclusive, nor is it intended to be used as a substitute for the full text of this permit.

PERMIT CONDITION	ITEM	DUE DATE
I.C.2.b.	Reapply for a renewal	180 calendar days from the expiration of the current permit.
I.C.12.	Give notice to the Department of any planned physical alterations or additions to the permitted facility and any solid waste management units.	As soon as possible
I.C.12.	Report any noncompliance with this permit that may endanger human health or the environment.	Orally within 24 hours from the time the Permittee becomes aware of the circumstances. Written submission shall also be provided within 5 calendar days of the time that the Permittee becomes aware of the circumstances
I.F.	Waste Minimization Certification	Annually
I.G.	Update cost estimates	No later than 30 calendar days after the Department has approved a modification to the Closure Plan, Post-Closure Plan, or Corrective Action Plan, or any other plan required or referenced by this permit, if the change in the plan results in an increase in the amount of the cost estimate and annually as required by ADEM Admin. Code Rules 335-14-5-.08(3)(b), (5)(b), and (10)(b)
I.I.	Submit a written request for a permit modification pursuant to the requirements of ADEM Admin. Code Rule 335-14-8-.04(2).	At least 60 calendar days prior to a proposed change in facility design or operation.
II.C.2	Inspect closed unit(s).	At least quarterly, after storms, and in accordance with the inspection schedule.
III.B.1.a.iii.	Notification of damaged groundwater monitoring wells.	Immediately in writing. The well must be repaired within 30 calendar days of damage, and repair report must be submitted within 30 calendar days of repair.
III. B.1.d.	Install additional groundwater monitoring wells	As necessary to assess changes in the rate and extent of any plume of contamination, or as otherwise deemed necessary. Note: a permit modification request must be submitted within 90 calendar days prior to installation of additional groundwater monitoring well(s).

PERMIT CONDITION	ITEM	DUE DATE
III.B.1.f.	Abandon wells listed in permit condition III.B.1.f.	Within 90 calendar days after the effective date of this permit. Submit report within 45 calendar days after the abandonment of these wells
III. B.2.a.	Determine groundwater surface elevation.	At least semi-annually and each time a well is sampled.
III. B.2.b.	Determine groundwater flow rate and direction.	At least annually.
III. B.6.b.	Submit groundwater monitoring report	Within 60 calendar days of the first sampling event and semi-annually thereafter.
III.B.6.c.	Submit Progress reports	Within 90 calendar days after the effective date of this permit and quarterly thereafter. See permit condition for start/stop/resume provisions.
III.E.3.a.	Sample all effectiveness wells and analyze for the constituents listed in Table III.3 of this permit.	Semi-annually, as per schedule included in Table B-1 of Appendix B of the permit application and continue until corrective action is completed.
III. E.3.b.	Sample all point of compliance wells and background wells and analyze for the constituents listed in Table III.3 of this permit.	Annually, as per schedule included in Table B-1 of Appendix B of the permit application and continue until corrective action is completed.
III. E.3.c.	Sample and analyze for temperature (degrees F or C), specific conductance (Mhos/cm), pH (standard units), and MNA parameters at all background and point of compliance monitoring well locations.	Each time the well is sampled.
III.E.4.a.	Semi-annual corrective action effectiveness reports.	Within 60 calendar days of each semi-annual anniversary of this permit after corrective action is initiated, and until corrective action is completed.
IV.B.1.	Notify the Department, in writing, of the discovery of any additional AOCs	Within 15 calendar days of discovery
IV.B.2.	Notify the Department, in writing, of the discovery of any additional SWMUs	Within 15 calendar days of discovery
IV.B.3.	Submit a SWMU Assessment Report (SAR) for each SWMU identified under IV.B.2.	Within 90 calendar days of notification.

PERMIT CONDITION	ITEM	DUE DATE
IV.C.1.	Notify the Department, in writing, of any newly discovered release(s) of hazardous waste or hazardous constituents from SWMUs or AOCs discovered during the course of groundwater monitoring, field investigations, environmental audits, or other means.	Within 15 calendar days of discovery
IV.D.7.a.	Submit RFI progress reports.	Monthly beginning in the second month following the initiation of the RFI
IV.D.8.a.	Submit RFI Report	Within 60 calendar days from the completion of investigation activities.
IV.E.2.	Submit CMI Plan	Within 120 calendar days following the Permittee's submittal of the RFI Report indicating that hazardous constituents have come to be located at any area of the Permittee's facility, or beyond the facility, at concentrations exceeding those appropriate for the protection of human health and the environment, or within 120 days following notification from the Department that a CMI Plan is required, whichever occurs earlier.
IV.E.4.	Demonstrate financial assurance for completing the approved remedy.	Within 120 calendar days after this Permit has been modified in accordance with Permit Condition IV.E.3
IV.F.1.a.	Submit IM Work Plan	Within 30 calendar days upon notification by the Department.
IV.F.3.b.	Submit IM Report	Within 90 calendar days of completion of IM
V.B.5.a.	Submit to the local zoning authority, or the authority with jurisdiction over local land use, and to the Department, a survey plat indicating the location and dimensions of the SWMUs, AOCs, and capped or partially remediated areas with respect to permanently surveyed benchmarks, the locations of sampling points, and the concentrations of hazardous constituents detected	Within 90 calendar days following the effective date of a permit modification addressing remedy selection.
V.D.3.a.	Begin submitting semi-annual CM Effectiveness Reports	180 calendar days following the Department's approval of the Final CMI Report
V.D.4.	Submit a Final Report of Corrective Measures (FRCM)	Within 90 calendar days following attainment of cleanup levels or goals

OMB# 2050-0024; Expires 05/31/2020

United States Environmental Protection Agency
RCRA SUBTITLE C SITE IDENTIFICATION FORM

1. Reason for Submittal (Select only one.)

☐	Obtaining or updating an EPA ID number for an on-going regulated activity that will continue for a period of time. (Includes HSM activity)
☐	Submitting as a component of the Hazardous Waste Report for _____ (Reporting Year)
	☐ Site was a TSD facility and/or generator of > 1,000 kg of hazardous waste, > 1 kg of acute hazardous waste, or > 100 kg of acute hazardous waste spill cleanup in **one or more months of the reporting year** (or State equivalent LQG regulations)
☐	Notifying that regulated activity is no longer occurring at this Site
☐	Obtaining or updating an EPA ID number for conducting Electronic Manifest Broker activities
☑	Submitting a new or revised Part A Form

2. Site EPA ID Number

A	L	D	0	2	1	2	5	7	9	5	1

3. Site Name

Rentokil Initial Environmental Services, LLC

4. Site Location Address

Street Address **10565 Highway 43**		
City, Town, or Village **Creola**		County **Mobile**
State **Alabama**	Country **United States**	Zip Code **36525**

5. Site Mailing Address ☐ Same as Location Address

Street Address **10565 Highway 43**		
City, Town, or Village **Creola**		
State **Alabama**	Country **United States**	Zip Code **36525**

6. Site Land Type

☑ Private ☐ County ☐ District ☐ Federal ☐ Tribal ☐ Municipal ☐ State ☐ Other

7. North American Industry Classification System (NAICS) Code(s) for the Site (at least 5-digit codes)

A. (Primary) **531120**	C.
B.	D.

8. Site Contact Information

☑ Same as Location Address

First Name **Lawrence**	MI **W**	Last Name **Noble**
Title **Site Supervisor**		
Street Address		
City, Town, or Village		
State	Country	Zip Code
Email **larry.noble@arcadis.com**		
Phone **251-675-7073**	Ext	Fax **251-675-4406**

9. Legal Owner and Operator of the Site

A. Name of Site's Legal Owner

☐ Same as Location Address

Full Name Rentokil Initial Environmental Services, LLC	Date Became Owner (mm/dd/yyyy) 12/31/1990
Owner Type ☑ Private ☐ County ☐ District ☐ Federal ☐ Tribal ☐ Municipal ☐ State ☐ Other	
Street Address 1125 Berkshire Boulevard, Suite 150	
City, Town, or Village Wyomissing	
State Pennsylvania / Country **United States** / Zip Code 19610	
Email bruce.gelting@rentokil.com	
Phone 610-372-9750 / Ext **26950** / Fax	
Comments	

B. Name of Site's Legal Operator

☐ Same as Location Address

Full Name Rentokil Initial Environmental Services, LLC	Date Became Operator (mm/dd/yyyy) 12/31/1990
Operator Type ☑ Private ☐ County ☐ District ☐ Federal ☐ Tribal ☐ Municipal ☐ State ☐ Other	
Street Address **1125 Berkshire Boulevard, Suite 150**	
City, Town, or Village **Wyomissing**	
State **Pennsylvania** / Country **United States** / Zip Code **19610**	
Email bruce.gelting@rentokil.com	
Phone **610-372-9750** / Ext **26950** / Fax	
Comments	

10. Type of Regulated Waste Activity (at your site)

Mark "Yes" or "No" for all current activities (as of the date submitting the form); complete any additional boxes as instructed.

A. Hazardous Waste Activities

☑ Y ☐ N	1. Generator of Hazardous Waste—If "Yes", mark only one of the following—a, b, c	
☑	a. LQG	-Generates, in any calendar month (includes quantities imported by importer site) 1,000 kg/mo (2,200 lb/mo) or more of non-acute hazardous waste; or - Generates, in any calendar month, or accumulates at any time, more than 1 kg/mo (2.2 lb/mo) of acute hazardous waste; or - Generates, in any calendar month or accumulates at any time, more than 100 kg/mo (220 lb/mo) of acute hazardous spill cleanup material.
☐	b. SQG	100 to 1,000 kg/mo (220-2,200 lb/mo) of non-acute hazardous waste and no more than 1 kg (2.2 lb) of acute hazardous waste and no more than 100 kg (220 lb) of any acute hazardous spill cleanup material.
☐	c. VSQG	Less than or equal to 100 kg/mo (220 lb/mo) of non-acute hazardous waste.
If "Yes" above, indicate other generator activities in 2 and 3, as applicable.		
☐ Y ☑ N	2. Short-Term Generator (generates from a short-term or one-time event and not from on-going processes). If "Yes", provide an explanation in the Comments section.	
☐ Y ☑ N	3. Mixed Waste (hazardous and radioactive) Generator	
☐ Y ☑ N	4. Treater, Storer or Disposer of Hazardous Waste—Note: A hazardous waste Part B permit is required for these activities.	
☐ Y ☑ N	5. Receives Hazardous Waste from Off-site	
☐ Y ☑ N	6. Recycler of Hazardous Waste	
☐	a. Recycler who stores prior to recycling	
☐	b. Recycler who does not store prior to recycling	
☐ Y ☑ N	7. Exempt Boiler and/or Industrial Furnace—If "Yes", mark all that apply.	
☐	a. Small Quantity On-site Burner Exemption	
☐	b. Smelting, Melting, and Refining Furnace Exemption	

B. Waste Codes for Federally Regulated Hazardous Wastes. Please list the waste codes of the Federal hazardous wastes handled at your site. List them in the order they are presented in the regulations (e.g. D001, D003, F007, U112). Use an additional page if more spaces are needed.

D001	**D018**	**D019**	**D022**	**D028**	**F003**	**F039**
P020	**P022**	**U211**				

C. Waste Codes for State Regulated (non-Federal) Hazardous Wastes. Please list the waste codes of the State hazardous wastes handled at your site. List them in the order they are presented in the regulations. Use an additional page if more spaces are needed.

11. Additional Regulated Waste Activities (NOTE: Refer to your State regulations to determine if a separate permit is required.)

A. Other Waste Activities

☐ Y ☑ N	1. Transporter of Hazardous Waste—If "Yes", mark all that apply.
☐	a. Transporter
☐	b. Transfer Facility (at your site)
☐ Y ☑ N	2. Underground Injection Control
☐ Y ☑ N	3. United States Importer of Hazardous Waste
☐ Y ☑ N	4. Recognized Trader—If "Yes", mark all that apply.
☐	a. Importer
☐	b. Exporter
☐ Y ☑ N	5. Importer/Exporter of Spent Lead-Acid Batteries (SLABs) under 40 CFR 266 Subpart G—If "Yes", mark all that apply.
☐	a. Importer
☐	b. Exporter

B. Universal Waste Activities

☐ Y ☑ N	1. Large Quantity Handler of Universal Waste (you accumulate 5,000 kg or more) - If "Yes" mark all that apply. Note: Refer to your State regulations to determine what is regulated.
☐	a. Batteries
☐	b. Pesticides
☐	c. Mercury containing equipment
☐	d. Lamps
☐	e. Other (specify) _____
☐	f. Other (specify) _____
☐	g. Other (specify) _____
☐ Y ☑ N	2. Destination Facility for Universal Waste Note: A hazardous waste permit may be required for this activity.

C. Used Oil Activities

☐ Y ☑ N	1. Used Oil Transporter—If "Yes", mark all that apply.
☐	a. Transporter
☐	b. Transfer Facility (at your site)
☐ Y ☑ N	2. Used Oil Processor and/or Re-refiner—If "Yes", mark all that apply.
☐	a. Processor
☐	b. Re-refiner
☐ Y ☑ N	3. Off-Specification Used Oil Burner
☐ Y ☑ N	4. Used Oil Fuel Marketer—If "Yes", mark all that apply.
☐	a. Marketer Who Directs Shipment of Off-Specification Used Oil to Off-Specification Used Oil Burner
☐	b. Marketer Who First Claims the Used Oil Meets the Specifications

12. Eligible Academic Entities with Laboratories—Notification for opting into or withdrawing from managing laboratory hazardous wastes pursuant to 40 CFR 262 Subpart K.

☐ Y ☑ N	A. Opting into or currently operating under 40 CFR 262 Subpart K for the management of hazardous wastes in laboratories—If "Yes", mark all that apply. Note: See the item-by-item instructions for definitions of types of eligible academic entities.
☐	1. College or University
☐	2. Teaching Hospital that is owned by or has a formal written affiliation with a college or university
☐	3. Non-profit Institute that is owned by or has a formal written affiliation with a college or univer-
☐ Y ☑ N	B. Withdrawing from 40 CFR 262 Subpart K for the management of hazardous wastes in laboratories.

13. Episodic Generation

☐ Y ☑ N	Are you an SQG or VSQG generating hazardous waste from a planned or unplanned episodic event, lasting no more than 60 days, that moves you to a higher generator category. If "Yes", you must fill out the Addendum for Episodic Generator.

14. LQG Consolidation of VSQG Hazardous Waste

☐ Y ☑ N	Are you an LQG notifying of consolidating VSQG Hazardous Waste Under the Control of the Same Person pursuant to 40 CFR 262.17(f)? If "Yes", you must fill out the Addendum for LQG Consolidation of VSQGs hazardous waste.

15. Notification of LQG Site Closure for a Central Accumulation Area (CAA) (optional) OR Entire Facility (required)

☐ Y ☑ N	LQG Site Closure of a Central Accumulation Area (CAA) or Entire Facility.
	A. ☐ Central Accumulation Area (CAA) ☐ Entire Facility
	B. Expected closure date: _____ mm/dd/yyyy
	C. Requesting new closure date: _____ mm/dd/yyyy
	D. Date closed : _____ mm/dd/yyyy ☐ 1. In compliance with the closure performance standards 40 CFR 262.17(a)(8) ☐ 2. Not in compliance with the closure performance standards 40 CFR 262.17(a)(8)

16. Notification of Hazardous Secondary Material (HSM) Activity

☐ Y ☑ N	A. Are you notifying under 40 CFR 260.42 that you will begin managing, are managing, or will stop managing hazardous secondary material under 40 CFR 260.30, 40 CFR 261.4(a)(23), (24), or (27)? If "Yes", you must fill out the Addendum to the Site Identification Form for Managing Hazardous Secondary Material.
☐ Y ☑ N	B. Are you notifying under 40 CFR 260.43(a)(4)(iii) that the product of your recycling process has levels of hazardous constituents that are not comparable to or unable to be compared to a legitimate product or intermediate but that the recycling is still legitimate? If "Yes", you may provide explanation in Comments section. You must also document that your recycling is still legitimate and maintain that documentation on site.

17. Electronic Manifest Broker

☐ Y ☑ N	Are you notifying as a person, as defined in 40 CFR 260.10, electing to use the EPA electronic manifest system to obtain, complete, and transmit an electronic manifest under a contractual relationship with a hazardous waste generator?

18. Comments (include item number for each comment)

19. Certification I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fines and imprisonment for knowing violations. **Note: For the RCRA Hazardous Waste Part A permit Application, all owners and operators must sign (see 40 CFR 270.10(b) and 270.11)**.

Signature of legal owner, operator or authorized representative	Date (mm/dd/yyyy)
	2/6/2018
Printed Name (First, Middle Initial Last) **Bruce A. Gelting**	Title **General Counsel**
Email **bruce.gelting@rentokil.com**	

Signature of legal owner, operator or authorized representative	Date (mm/dd/yyyy)
Printed Name (First, Middle Initial Last)	Title
Email	

United States Environmental Protection Agency

HAZARDOUS WASTE PERMIT PART A FORM

1. Facility Permit Contact

First Name	**Lawrence**	MI	**W**	Last Name	**Noble**
Title	**Site Supervisor**				
Email	**larry.noble@arcadis.com**				
Phone	**251-675-7073**	Ext		Fax	**251-675-4406**

2. Facility Permit Contact Mailing Address

Street Address	**10565 Highway 43**		
City, Town, or Village	**Creola**		
State **Alabama**	Country	United States	Zip Code 36525

3. Facility Existence Date (mm/dd/yyyy)

6/1/1971

4. Other Environmental Permits

A. Permit Type	B. Permit Number	C. Description
R	**A L D 0 2 1 2 5 7 9 5 1**	**Part B Post Closure**
U	**A L S I 9 9 4 9 3 6 4**	**UIC Permit**

5. Nature of Business

Real Estate Holding Company - Environmental Restoration Activities.

6. Process Codes and Design Capacities

Line Number		A. Process Code			B. Process Design Capacity		C. Process Total Number of Units	D. Unit Name
					(1) Amount	(2) Unit of Measure		
0	1	D	8	0	1.25	B	001	

7. Description of Hazardous Wastes (Enter codes for Items 7.A, 7.C and 7.D(1))

Line No.		A. EPA Hazardous Waste No.				B. Estimated Annual Qty of Waste	C. Unit of Measure	D. Processes								
								(1) Process Codes								(2) Process Description (if code is not entered in 7.D1))
0	1	P	0	2	0	0	NA	D	8	0						Section 11
0	1	P	0	2	2	0	NA	D	8	0						

8. Map

Attach to this application a topographical map, or other equivalent map, of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all spring, rivers, and other surface water bodies in this map area. See instructions for precise requirements.

9. Facility Drawing

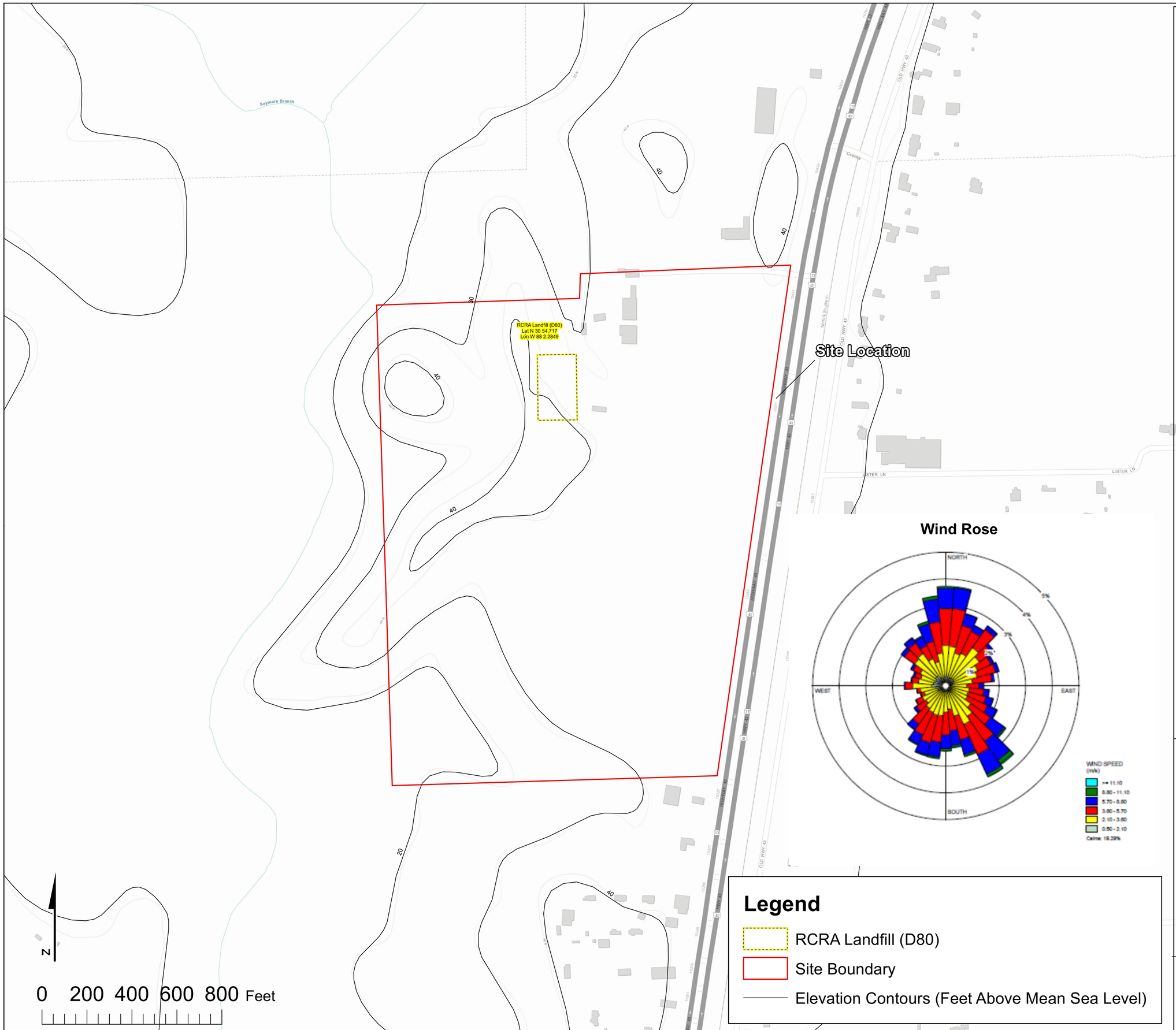
All existing facilities must include a scale drawing of the facility. See instructions for more detail.

10. Photographs

All existing facilities must include photographs (aerial or ground-level) that clearly delineate all existing structures; existing storage, treatment, and disposal areas; and sites of future storage, treatment, or disposal areas. See instructions for more detail.

11. Comments

Closed landfill under post-closure care.



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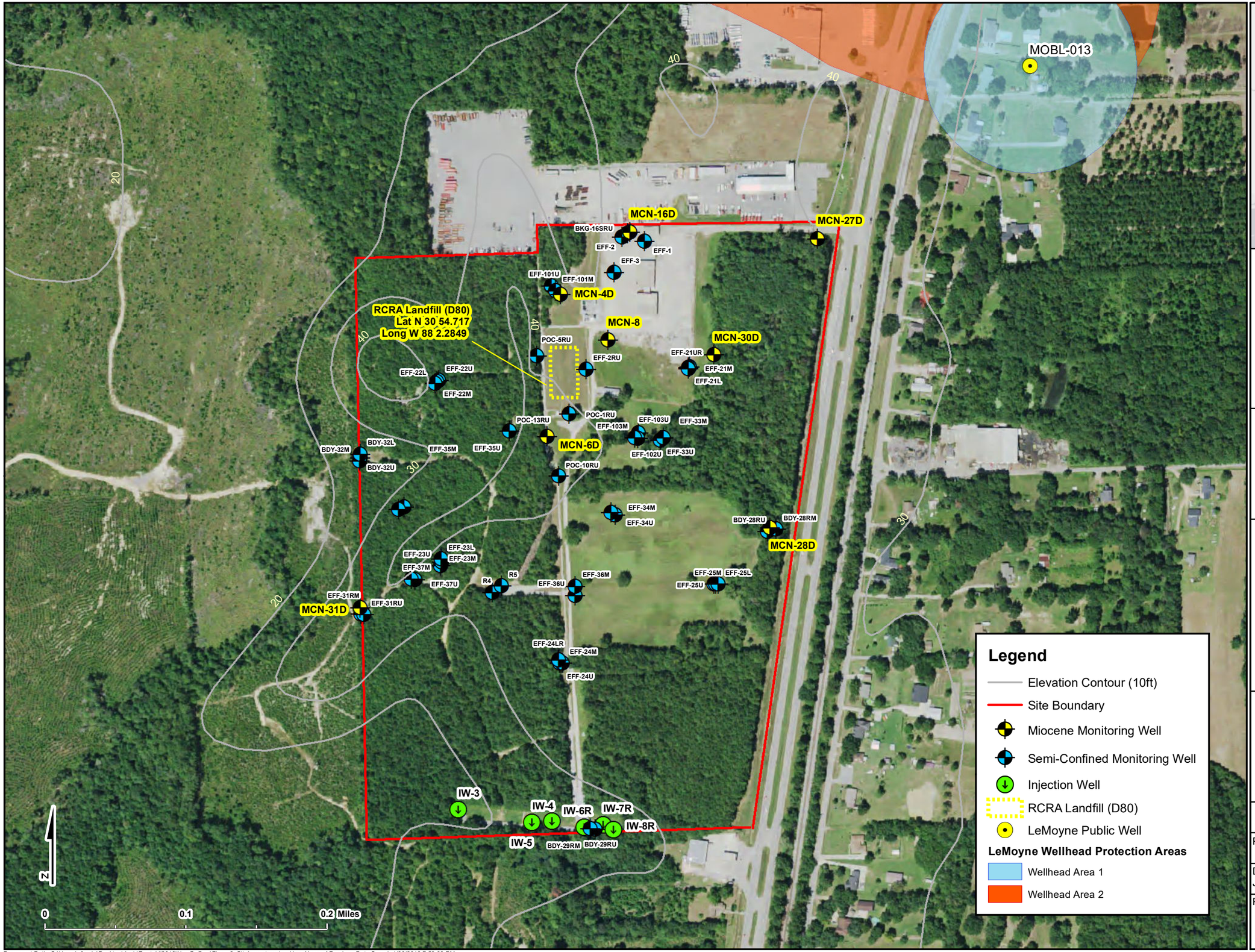
Topographic Map
USEPA Form 8700-23
Item 8

Rentokil Initial Environmental Services, LLC
10565 Highway 43 North
Creola, AL 36525

ARCADIS
10352 PLAZA AMERICANA DRIVE
BATON ROUGE, LA 70816
TEL: 225-292-1004
FAX: 225-218-9677
WWW.ARCADIS-US.COM

PROJECT MANAGER:	CHECKED BY: PM
DRAWING BY: JWC	DATE: January 2018
PROJECT NUMBER: 03648005.2017	FIGURE NUMBER: 1



Site Layout Map - USEPA Form 8700-23 Item 8/9/10

Rentokil Initial Environmental Services, LLC
10565 Highway 43 North
Creola, AL 36525

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Legend

- Elevation Contour (10ft)
- Site Boundary
- Miocene Monitoring Well
- Semi-Confined Monitoring Well
- Injection Well
- RCRA Landfill (D80)
- LeMoyne Public Well

LeMoyne Wellhead Protection Areas

- Wellhead Area 1
- Wellhead Area 2

PROJECT MANAGER:	CHECKED BY: PM
DRAWING BY: JWC	DATE: January 2018
PROJECT NUMBER: 03648005.2017	FIGURE NUMBER: 2

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SWMU and AOC List

SWMU 1 - North Pond
SWMU 2 - Middle Pond
SWMU 3 - South Pond
SWMU 4 - Old Pond Area
SWMU 5 - Former Pump House
SWMU 6 - Former Flow Lines
SWMU 7 - Chemical Drain
SWMU 8 - Organic Sump
SWMU 9 - Organic Holding Tank No. 3
SWMU 10 - Caustic Sump
SWMU 11 - Caustic Holding Tank No. 4
SWMU 12 - Acid Sump
SWMU 13 - Acid Holding Tank No. 5
SWMU 14 - Drainage Ditch
SWMU 15 - Underground Wastewater Storage Tanks
SWMU 16 - Stainless Steel Tank Trailers
SWMU 17 - Leachate Storage Tank

AOC A - Truck Parking Pad
AOC B - Former N, S, E, and W Monitoring Wells
AOC C - Final Rinse Tanks
AOC D - 10,000 Gallon Diesel UST
AOC E - Fuel Island Release

Site SWMUs & AOCs
USEPA Form 8700-23
Item 8/9/10

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PROJECT MANAGER:	CHECKED BY: PM
DRAWING BY: JWC	DATE: January 2018
PROJECT NUMBER: 03648005.2017	FIGURE NUMBER: 3

Legend

- RCRA Landfill (D80)
- Storm Water Ditch
- Storm Water Flow Direction
- Former Monitoring Well
- Elevation Contour (10ft)
- Site Boundary
- Site Boundary / Fence
- SWMUs & AOCs
- Miocene Monitoring Well
- Semi-Confined Monitoring Well

0 0.025 0.05 Miles

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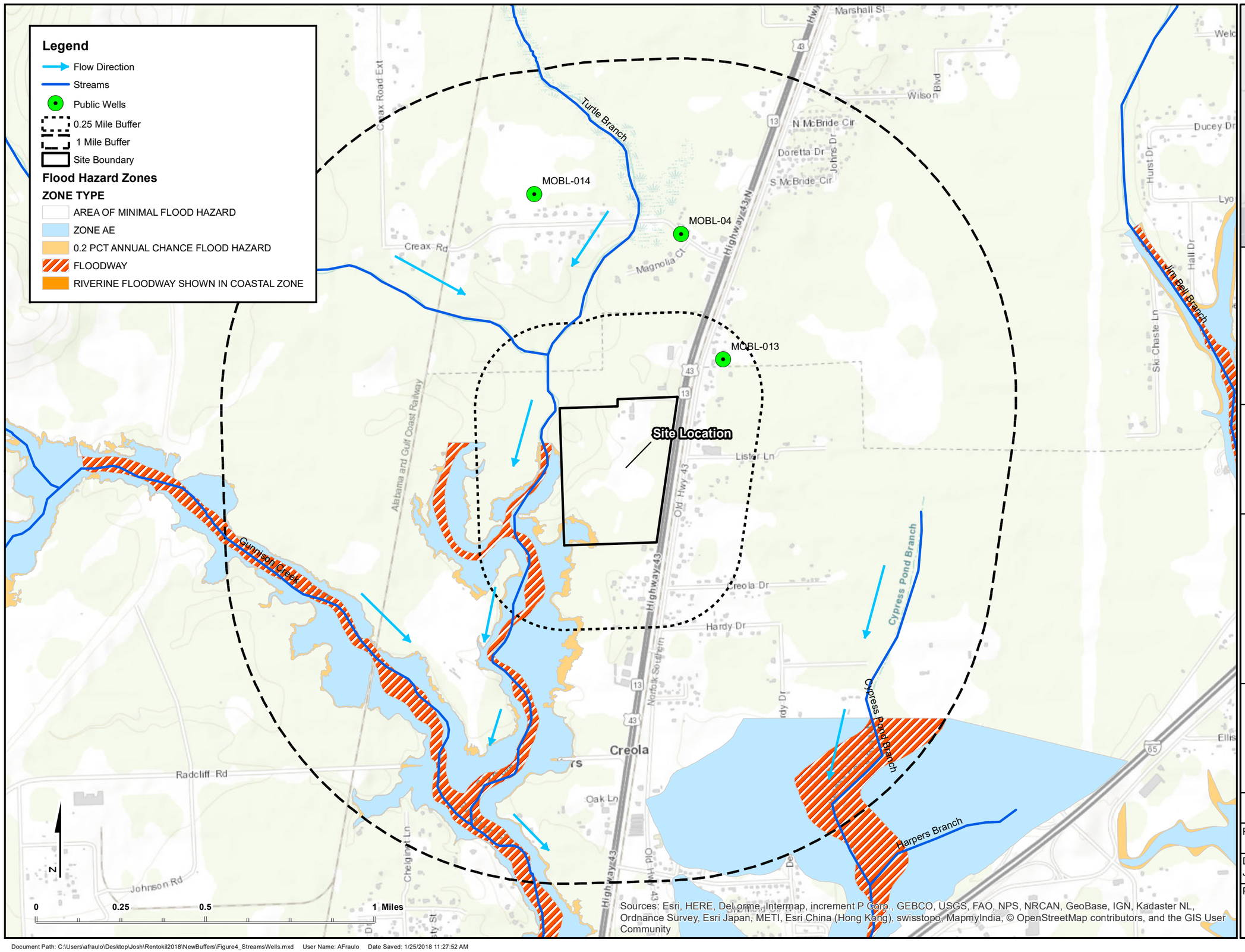

Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

Streams and Wells
USEPA Form 8700-23
Item 8

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PROJECT MANAGER:	CHECKED BY: PM
DRAWING BY: JWC	DATE: November 2017
PROJECT NUMBER: 03648005.2017	FIGURE NUMBER: 4

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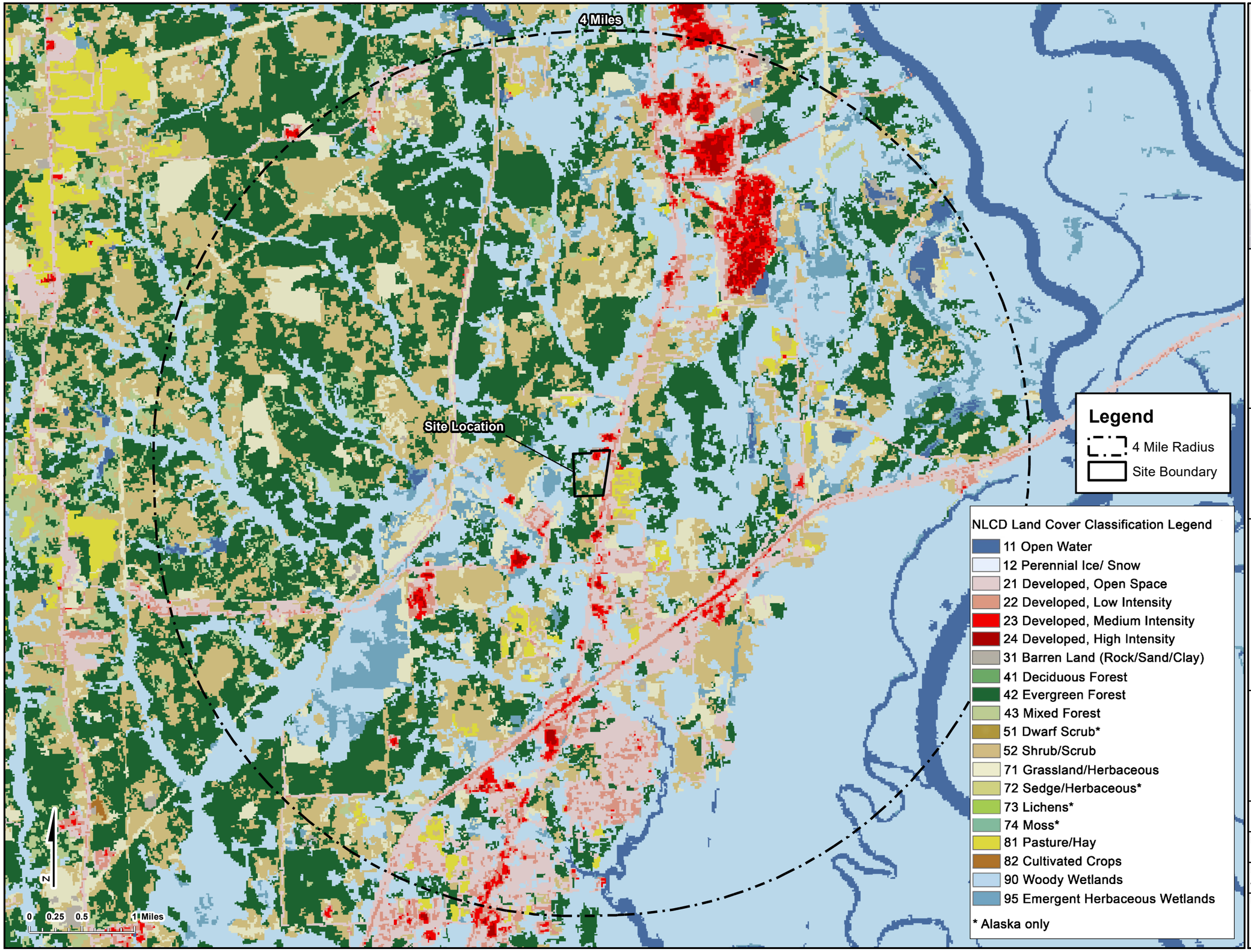

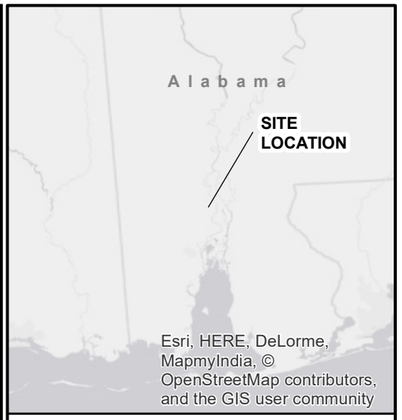

USGS Land Use Map

Rentokil Initial Environmental Services, LLC
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ARCADIS
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PROJECT MANAGER:	CHECKED BY: PM
DRAWING BY: JWC	DATE: January 2018
PROJECT NUMBER: 03648005.2017	FIGURE NUMBER: 5

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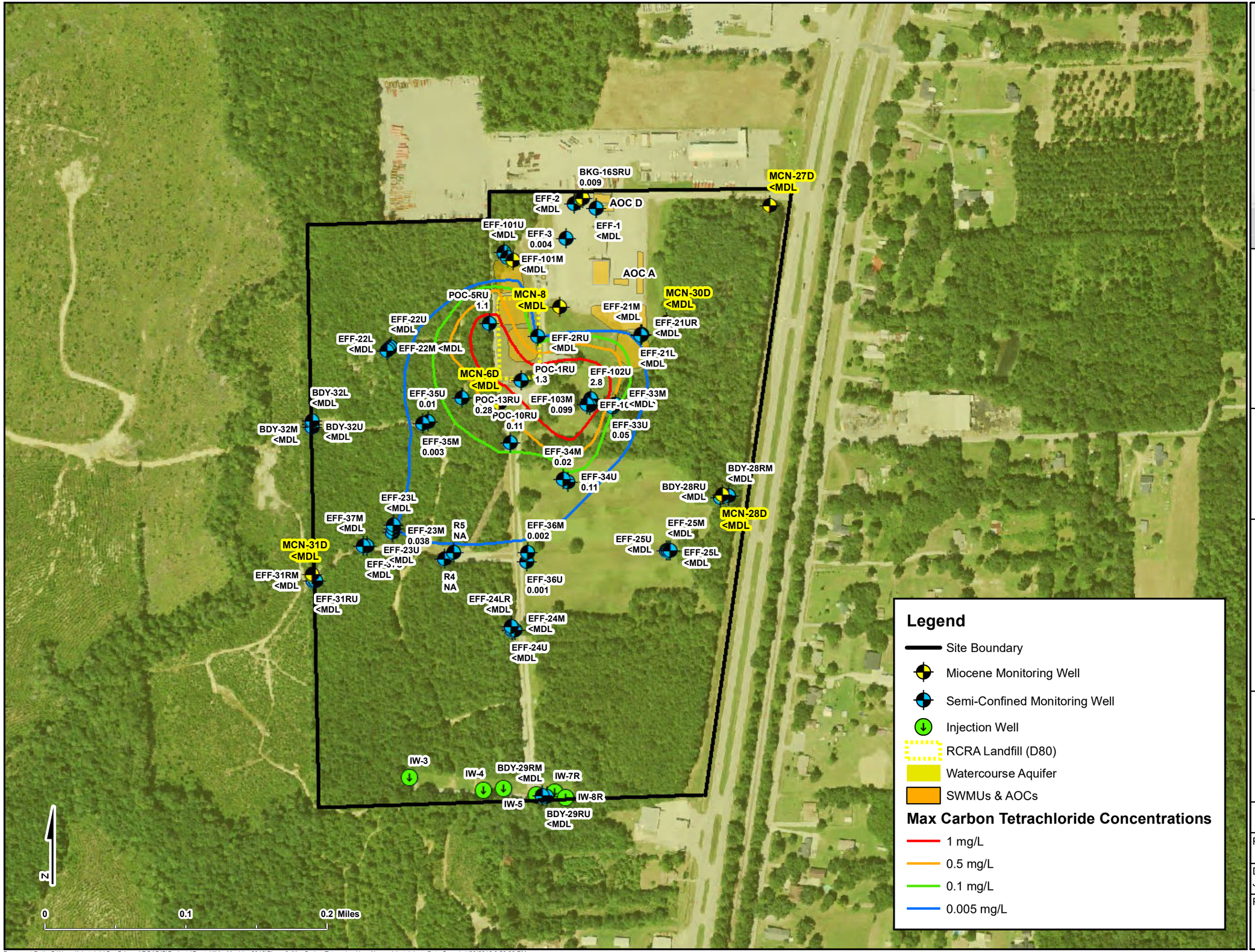

Maximum Carbon Tetrachloride Concentrations in Groundwater 2017

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DRAWING BY: JWC	DATE: January 2018
PROJECT NUMBER: 03648005.2017	FIGURE NUMBER: 6

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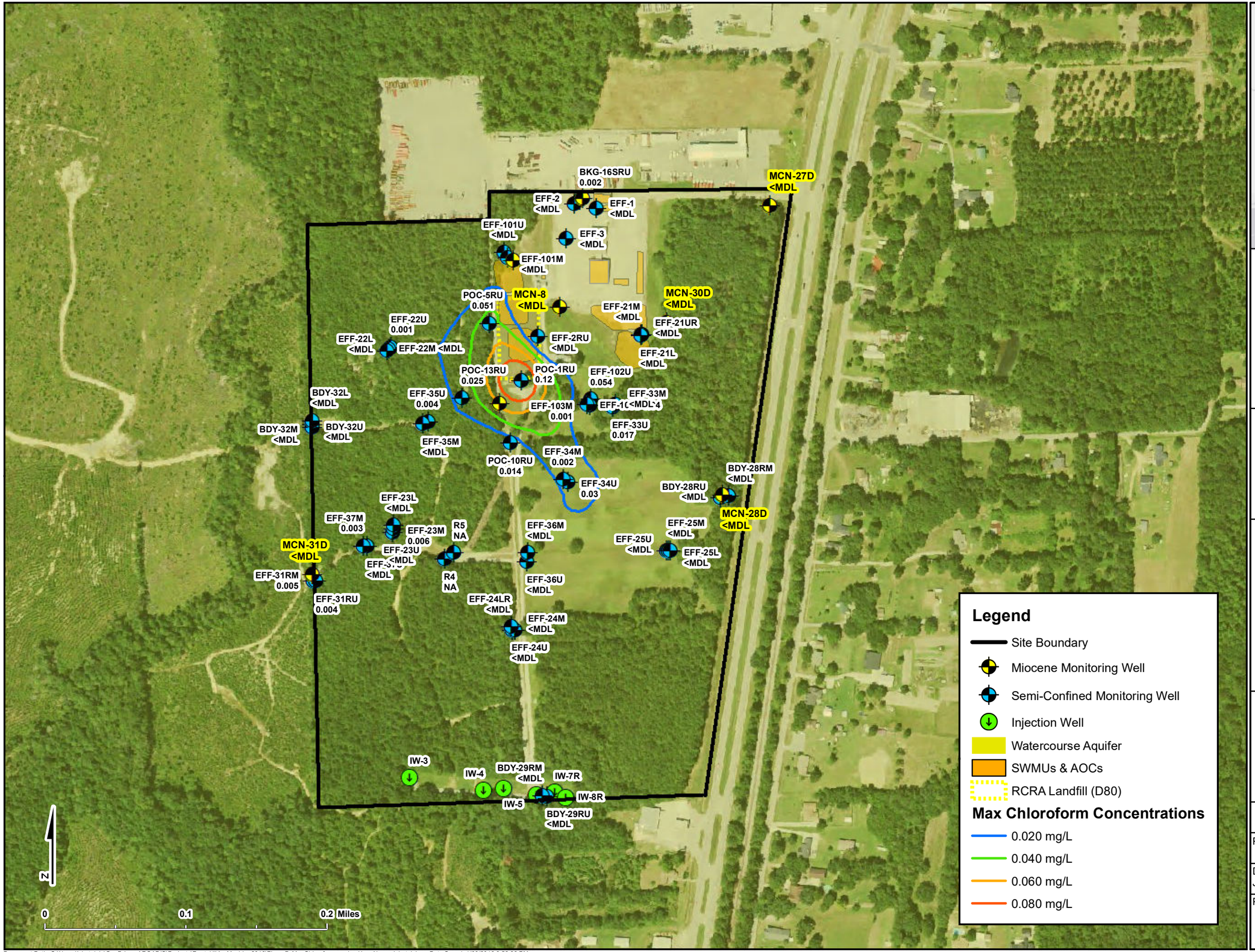

Legend

- Site Boundary
- Miocene Monitoring Well
- Semi-Confined Monitoring Well
- Injection Well
- Watercourse Aquifer
- SWMUs & AOCs
- RCRA Landfill (D80)

Max Chloroform Concentrations

- 0.020 mg/L
- 0.040 mg/L
- 0.060 mg/L
- 0.080 mg/L

Maximum Chloroform Concentrations in Groundwater 2017

Rentokil Initial Environmental Services, LLC
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DRAWING BY: JWC	DATE: January 2018
PROJECT NUMBER: 03648005.2017	FIGURE NUMBER: 7

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ARCADIS Design & Consultancy for natural and built assets

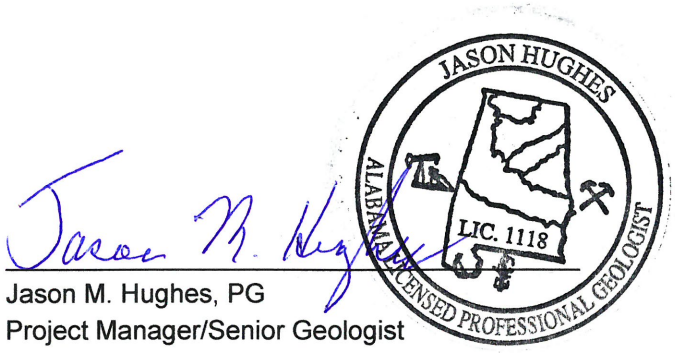
Rentokil Initial

PART B POST-CLOSURE PERMIT RENEWAL APPLICATION

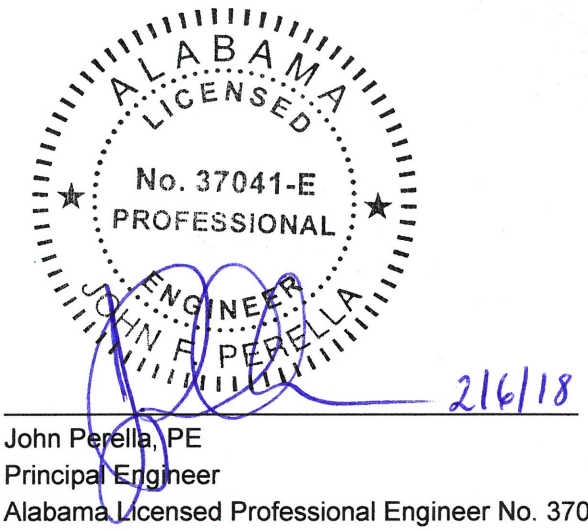
Creola, Alabama

USEPA ID No. ALD 021 257 951

February 7, 2018



Jason M. Hughes, PG
Project Manager/Senior Geologist
Alabama Licensed Professional Geologist No. 1118



John Perella, PE
Principal Engineer
Alabama Licensed Professional Engineer No. 37041-E

PART B POST-CLOSURE PERMIT RENEWAL APPLICATION

Creola, Alabama
USEPA ID No. ALD 021 257 951

Prepared for:

Rentokil Initial Environmental Services, LLC

Prepared by:
Arcadis U.S., Inc.
1728 3rd Avenue North
Suite 300
Birmingham
Alabama 35203
Tel 205 930 5700

Project Number:

03648005.2017.00001

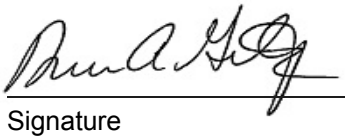
Date:

February 7, 2018

CERTIFICATION

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signed:



Signature

Bruce A. Gelting

Printed Name

General Counsel North America

Title

February 6, 2018

Date

CONTENTS

TABLES

PLATES

APPENDICES

ACRONYMS AND ABBREVIATIONS

ADEM	Alabama Department of Environmental Management
AOC	Area of Concern
BDY	Boundary (well)
BKG	Background (well)
CATS	Corrective Action Treatment System
gpm	gallon per minute
RCRA	Resource Conservation and Recovery Act
RIES	Rentokil Initial Environmental Services, LLC
SWMU	Solid Waste Management Unit

1 GENERAL INFORMATION

The following information has been prepared in accordance with the requirements of the Alabama Department of Environmental Management (ADEM) Administrative Code 335-14.

1.1 Description of the Facility

A predecessor company of Rentokil Initial Environmental Services, LLC (RIES) previously operated a tank truck terminal on Highway 43 North in Creola, Alabama (the "Site"). Wastewater generated from the cleaning of trailers that contained a variety of industrial materials was managed in various surface impoundments until February 1985. Initially, two impoundments on the east side of the property were used to store wastewater. These impoundments were closed under ADEM supervision in 1981 due to inadequate capacity. Three new impoundments were constructed following ADEM guidelines to replace the two closed impoundments. The three surface impoundments were closed in November 1986 under a closure plan approved by the U.S. Environmental Protection Agency and ADEM. The Site layout is shown on **Plate 1**.

The facility currently maintains a closed Resource Conservation and Recovery Act (RCRA) landfill that contains waste from the impoundments that were closed in 1986. Construction details for the RCRA landfill are provided in the *Closure Plan* from Waste Control Management, Inc., to ADEM dated November 15, 1985. The on-site landfill is constructed with a 2-foot compacted clay liner overlain by a synthetic liner and leachate collection system. Excavated material from closure of surface impoundments in 1986 was placed in the landfill and covered with a 2-foot, low-permeability clay cap, then an 18-inch soil covering and natural grass vegetation. The exact volume is not known for sediments from the closed impoundments placed in the RCRA landfill in 1986. The recorded deed on file with the Mobile County, Alabama, Office of Probate indicates that approximately 5,000 cubic yards of waste is contained within the RCRA landfill, and this volume is assumed to be equivalent to the volume of sediments removed from the closed impoundments. The Site landfill, Solid Waste Management Units (SWMUs), and Areas of Concern (AOCs) are shown on **Plate 2**.

Constituents are present in groundwater above the ADEM groundwater protection standards listed in the Post-Closure Permit at the facility; therefore, corrective measures were implemented to control, capture, and treat groundwater at the Site. RIES operates a groundwater pump and treat system and maintains the closed RCRA landfill under Post-Closure Permit ALD 021257951 and the treated groundwater is discharged under Underground Injection Control Permit ALSI 9949364 dated January 25, 2018.

The Corrective Action Program was implemented in June 1990 to remove and treat groundwater containing primarily carbon tetrachloride and chloroform, the primary constituents of concern, from the semi-confined aquifer beneath the Site. The initial groundwater pump and treat system was replaced by the current Corrective Action Treatment System (CATS), which began operating in June 1999. The CATS consists of an extraction well and backup well, a fluidized bed air stripper, a settling tank equipped with a filter wall, bag and cartridge filters, and a carbon adsorption unit. Treated groundwater is injected back into the semi-confined aquifer through six injection wells located along the south property line and downgradient of the zone of groundwater treatment. Enhancements to the Corrective Action Program and

monitoring program will be implemented in accordance with the Corrective Action Plan (provided as **Appendix A**) and as approved in the ADEM Final Permit Determination dated April 19, 2017.

1.2 Waste Analysis

The impoundments that are the subject of the Post-Closure Permit were in service from 1981 to 1985. During that period, the surface impoundments received wastewater produced by internal cleaning of chemical transport trailers. Chemical analysis of the water in each of the impoundments (ponds) prior to the closure of the impoundments is summarized in **Table 1-1**. A summary of chemical analyses of rainwater which accumulated in the ponds prior to closure is presented in **Table 1-2**. The laboratory analytical report for the leachate sample from the landfill leachate collection system is included in the Corrective Action Plan in **Appendix A**.

The water removed from the ponds was determined to be hazardous due to the presence of the "P" listed compounds Dinoseb and carbon disulfide.

1.3 Security Procedures

The impoundments were closed in place by placing sediments and soil in the on-site landfill. The landfill is constructed with a clay cap with a minimum compacted thickness of 2 feet. A layer of topsoil over the clay supports the growth of grass cover. Therefore, there is no exposure to waste at the facility. A 6-foot-high chain-link fence topped with three strands of barbed wire surrounds the portion of the property containing the closed landfill. Access gates to the landfill and groundwater treatment area are kept locked to limit the entry to authorized personnel only. In addition, the front gate to the property is locked when the property is not occupied.

1.4 Inspection Schedule

The landfill cap, leachate collection system, leachate storage tank, monitoring wells, and security fence will be inspected on a routine basis. A summary of the inspection schedule is included in **Table 1-3**. Inspections will be documented in accordance with recordkeeping requirements, and corrective actions noted during inspections will be implemented as soon as practicable after each inspection. The treatment system (air stripper, blower, pumps, controls, bag and cartridge filters, influent pipeline, effluent pipeline, and injection wells) will be checked daily only while the CATS is in operation.

1.5 Contingency Plan

A Contingency Plan required by Rule 335-14-5-.04 is included as **Appendix B**. The Emergency Response Plan is also included in Appendix B.

1.6 Facility Location Information

The facility is not located within the 100-year floodplain as indicated on **Plate 3**.

1.7 Post Closure Plan

The closure of the surface impoundments was undertaken through placement of wastes in the onsite landfill that is closed in-place; therefore, post-closure care is required in accordance with ADEM Administrative Code 335-14. The activities to be conducted during the post-closure period are discussed below.

1.7.1 Groundwater Monitoring

A Groundwater Monitoring, Sampling, and Analysis Plan is provided as **Appendix C**. This plan discusses the groundwater monitoring system and the procedures to be used to collect groundwater samples and perform the analyses including quality assurance and quality control procedures. In addition, the statistical analyses procedures used to evaluate the data are discussed in this plan.

A determination of the elevation of the groundwater surface at each monitoring well will be made at the time of each sampling. Groundwater flow rate and direction will be determined on a semiannual basis. In addition, each monitoring well will be inspected monthly and at the time of sampling. If it is determined that any well is damaged, ADEM will be notified in writing. At that time, it will be determined if any repairs are required or a replacement well may need to be installed.

1.7.2 Cap Integrity

The clay cap surface of the closed RCRA landfill will be visually inspected on a quarterly basis (**Table 1-3**) and immediately following any storm event to ensure that its integrity is maintained. The surface will be inspected to ensure an adequate vegetative cover to reduce erosion effects. The slope will be visually examined to ensure that run-on or run-off is not damaging the final cover. If the inspection determines that corrective action is required, immediate steps will be initiated as necessary to repair the effects of settling, subsidence, or erosion. The quarterly inspection will also include the surveyed benchmarks to ensure that they are properly maintained to determine the exact location of the closed impoundments. The items included in **Table 1-3** will be inspected in accordance with the Permit and schedule provided .

1.7.3 Notification List

During the post-closure care period, the following individuals are designated as the persons to contact about the facility. For written communication, all three contacts should be included.

SITE OWNER CONTACT

BRUCE A. GELTING – GENERAL COUNSEL NORTH AMERICA

RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC

1125 BERKSHIRE BOULEVARD, SUITE 150

WYOMISSING, PENNSYLVANIA 19610

PROJECT CONTACT

JASON HUGHES – PROJECT MANAGER/SENIOR GEOLOGIST

ARCADIS U.S., INC.

1728 3RD AVENUE NORTH, SUITE 300

BIRMINGHAM, ALABAMA 35203

PHONE NUMBER: 205-930-5965

For access to the facility please contact Lawrence Noble:

FACILITY CONTACT

LAWRENCE W. NOBLE - SUPERVISOR, RENTOKIL CREOLA SITE OPERATIONS

ARCADIS U.S., INC.

10565 HIGHWAY 43 NORTH

CREOLA AL 36525

PHONE NUMBER: 251-583-3887

The contact individuals may change with time and this plan will be updated accordingly, as required.

1.7.4 Cost Estimate

The cost estimate for post-closure care is found in Appendix 3 of the Corrective Action Plan (**Appendix A)**. The estimated total cost for the 30-year period is $9,449,700, which includes the Corrective Action Program. The Permittee will demonstrate continuous compliance with ADEM Administrative Code Rule 335-14-5-.08 by providing documentation of financial assurance in at least the amount that equals or exceeds the cost estimate. Changes in financial assurance mechanisms must be approved by ADEM.

1.7.5 Post-Closure Certification

The owner or operator will submit to ADEM a certificate of completion of post-closure care within 60 days of completion of the post-closure activities. This document will certify that the post-closure care for the hazardous waste disposal unit was performed in accordance with the specifications in the approved post-closure plan. The certification will be signed by the owner or operator and an independent Alabama Registered Professional Engineer.

Documentation supporting the independent registered professional engineer's certification will be furnished upon request until ADEM releases the owner or operator from the financial assurance requirements for post-closure care.

1.8 Deed Recordation

A copy of the deed record filed in accordance with 335-14-5-.07(10) is included as **Appendix D**.

1.9 Post-Closure Cost Estimate and Financial Assurance Documentation

The most recent post-closure cost estimate prepared in accordance with 335-14-5-.08(5) is included in Appendix 3 of the Corrective Action Plan (**Appendix A)**. A copy of the financial assurance documentation under 335-14-5-.08(6) is included in **Appendix E**.

1.10 Topographic Map

A topographic map showing the applicable features required by 335-14-8-.02(5)(b)19 is included as **Plate 1**. **Plate 1** also reflects the current monitoring well system. **Plate 2** shows the SWMUs and AOCs for the Site and topographic contours.

2 ADDITIONAL INFORMATION

2.1 Summary of Groundwater Monitoring Data

A CD-ROM containing all Site monitoring data from 2007 through 2017 is provided as **Appendix F**. The data are presented in one Excel workbook, with each sample and monitoring date included. Semiannual and annual groundwater data have been submitted in reports to ADEM during the current permit period.

2.2 Aquifer Identification

Groundwater at the Creola Site occurs principally in two distinct aquifers: 1) the semi-confined aquifer; and 2) the upper Miocene aquifer. The semi-confined aquifer is the uppermost water-bearing unit and the upper Miocene is found beneath the semi-confined aquifer. Regionally, the Geological Survey of Alabama maps the uppermost aquifer as the Watercourse aquifer.

The semi-confined aquifer is the uppermost aquifer at the Site and consists of sand grading with depth to sand and gravel. The aquifer is overlain by sandy, silty clay that locally acts as an upper semi-confining unit. A zone of aeration exists above the zone of saturation beneath the location of the former surface impoundments and property to the south. However, the surficial silty clay thickens to the north and west, eliminating the zone of aeration and confining the aquifer. The surficial silty clay again thins at the far western boundary of the Site. The water surface in the semi-confined aquifer is generally at 14 feet above mean sea level. Prior to the implementation of the CATS, the direction of groundwater movement was to the south and southwest. Hydraulic conductivity values calculated from aquifer test data range from 230 to 450 feet per day for the semi-confined aquifer. Based on an assumed porosity of 26%, typical for the area, the groundwater velocity was calculated to be 1 foot per day across the Site prior to the operation of the CATS.

Since the startup of a groundwater pump and treat Corrective Action Program beginning in June 1990, an extensive cone of depression has developed in the semi-confined aquifer in response to groundwater pumping. The cone of depression captures all groundwater between the extraction wells and the east, west, and south property boundaries. Groundwater in the northern portion of the Site continues to flow in a south-southwest direction before the flow direction is influenced by the pumping wells. During the October 2017 monitoring event, the hydraulic gradient from background well BKG-16SRU, located at the north property boundary, to recovery well 5 was 0.003 foot per foot toward the south-southwest. The semi-confined aquifer has an estimated hydraulic conductivity of 260 feet per day and an estimated effective porosity of 25%. The calculated groundwater flow velocity on the property from BKG-16SRU toward the recovery wells is approximately 3 feet per day. The groundwater flow velocity on the southern part of the property from well BDY-29 toward the recovery well is approximately 0.6 foot per day.

The production of water from domestic wells tapping the semi-confined aquifer ranges from less than 10 gallons per minute (gpm) to about 50 gpm. All known domestic wells in the area are upgradient of the Creola facility.

The water-bearing unit below the semi-confined aquifer is the upper Miocene aquifer. A confining clay layer (e.g., aquitard) separates the semi-confined and upper Miocene aquifers. The upper Miocene aquifer consists of sand and gravel more than 40 feet thick, based on drilling data collected to date. A sandy clay considered to be the top of the Miocene ranges from 17 to 30 feet in thickness and forms the upper confining layer. Water in this zone is under artesian conditions with a potentiometric surface of approximately 12 feet above mean sea level. Groundwater elevation data collected over the past 10 years indicate that the highest groundwater elevation is found in well MCN-30D on the east side of the property, with an apparent groundwater flow direction generally to the northeast at a slight gradient between wells MCN-30D and MCN-27D and flow directions generally ranging from southwest to northwest to the west of well MCN-30D.

The two wells supplying the LeMoyne Water System are developed in the Miocene aquifer at a depth of 105 to 135 feet below land surface. One well, located 1,700 feet east of the Site, produces 250 gpm. The other well is located 3,000 feet to the north. Both of these wells are generally upgradient from the closed surface impoundments, although a slight flow gradient in the upper Miocene aquifer toward the nearest LeMoyne well has been observed at the Site.

Long-term groundwater monitoring data indicate that there is a head differential of approximately 2.5 feet between the potentiometric surface of the confined aquifer and the semi-confined aquifer (**Appendix A**). This trend has been consistent for almost 30 years of data. The depth to water in the semi-confined and upper Miocene aquifers varies over time in response to regional rainfall and recharge. Persistent droughts often result in a decrease of water levels of approximately 8 feet.

2.3 Constituent Plume

The extent of constituents in groundwater above groundwater protection standards is shown in **Appendix A** (Corrective Action Plan). The constituent present in the highest concentration in the semi-confined aquifer is carbon tetrachloride. **Figure 3-2** of **Appendix A** presents the maximum extent of carbon tetrachloride in the semi-confined aquifer.

2.4 Groundwater Monitoring Program

A detailed Groundwater Monitoring, Sampling, and Analysis Plan for compliance monitoring and corrective action groundwater monitoring is presented in **Appendix C**.

2.5 Corrective Action Program

The ongoing Corrective Action Program for groundwater at the RIES facility in Creola, Alabama, is described in **Appendix A**.

TABLES

Table 1-1
Summary of Wastewater Analyses Prior to Removal
Part B Post Closure Permit Renewal Application
Renotkil Initial Environmental Services, LLC
Cerola, Alabama

Parameter	Units	Sample ID			
		North Pond (10/19/1984)	Middle Pond (10/19/1984)	South Pond (10/19/1984)	Composite (11/05/1984)
Chemical Oxygen Demand	mg/L	752	496	585	- -
Total Suspended Solids	mg/L	10	9	15	- -
Oil/Grease	mg/L	50	46	9	- -
Carbon Tetrachloride	ppb	- -	- -	- -	2,100
Methylene Chloride	ppb	- -	- -	- -	5
Chloroform	ppb	- -	- -	- -	46
Toluene	ppb	- -	- -	- -	5
Benzene	ppb	- -	- -	- -	1
Trichloroethylene	ppb	- -	- -	- -	1
Mineral Spirits	ppb	- -	- -	- -	nd
Naptha	ppb	- -	- -	- -	nd
Carbon Disulfide	ppb	- -	- -	- -	10

Acronym:
nd - not detected

Notes:
- - not analyzed

*Table reproduced from initial Post-Closure permit application prepared by WCM Group

Table 1-2
Summary of Storm Water Analyses Prior to Removal
Part B Post Closure Permit Renewal Application
Rentokil Initital Environmental Services, LLC
Creola, Alabama

Parameter	Units	Sample ID		
		North Pond (8/19/1984)	Middle Pond (8/19/1984)	South Pond (8/19/1984)
Chemical Oxygen Demand	mg/L	281	84	99
Total Suspended Solids	mg/L	79	439	133
Oil/Grease	mg/L	<1	<1	<1
Dinoseb	ppb	1,835	125	145
Carbon Disulfide	ppb	<0.5	<0.5	<0.5
Carbon Tetrachloride	ppb	- -	22	- -

Notes:

- - not analyzed

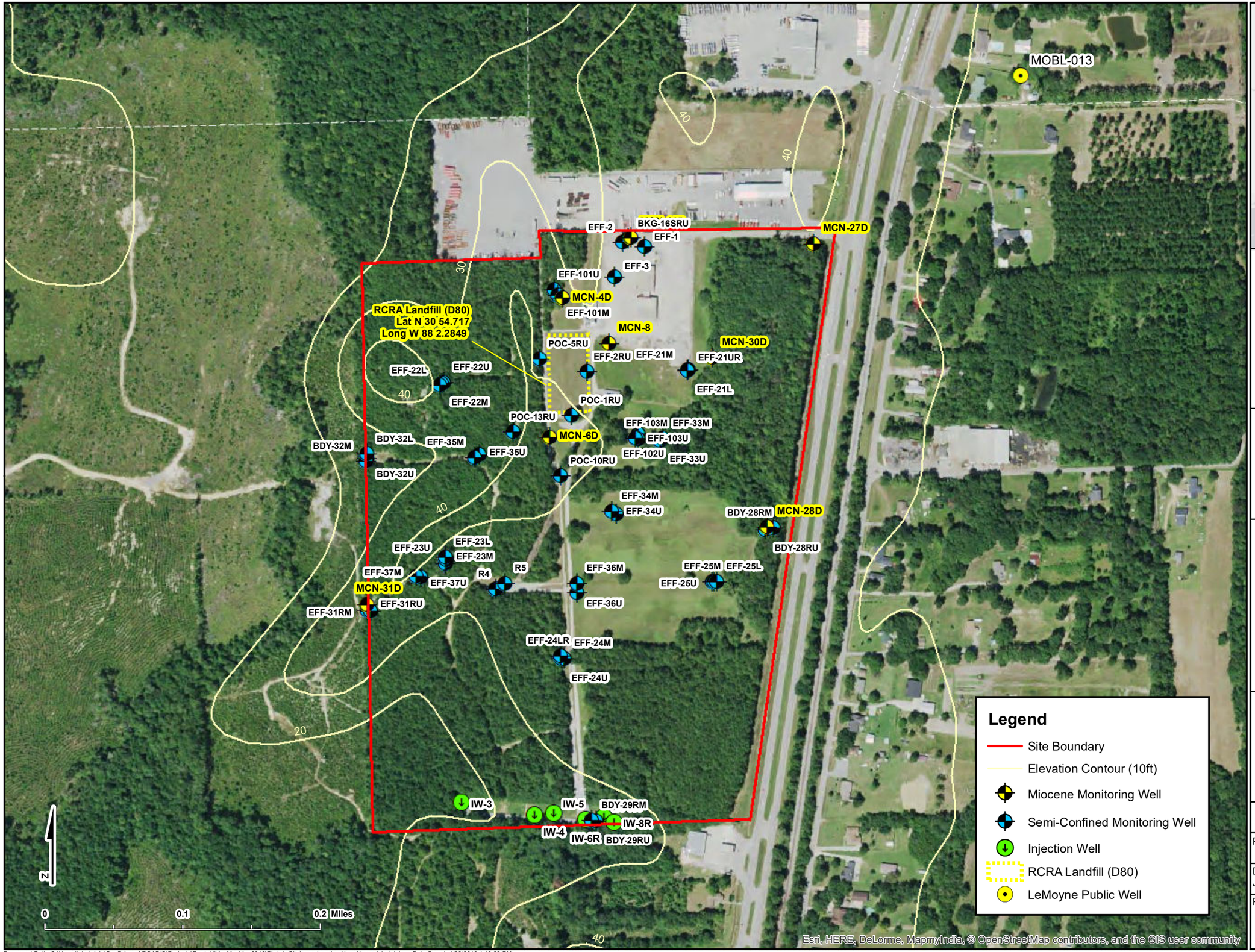
*Table reproduced from initial Post-Closure permit application prepared by WCM Group

Table 1-3
Inspection Schedule
Part B Post Closure Permit Renewal Application
Rentokil Initital Environmental Services, LLC
Creola, Alabama

ARCADIS Design & Consultancy for natural and built assets

Item to Inspect	Frequency	Maintenance / Remedial Measures
Landfill Cap -Vegetation -Slope	Quarterly	Mowing, replant grass, fertilize, Stabilize eroded areas, replace topsoil
Monitoring Wells	Monthly	Repair damage to above ground protective casing, concrete pads, repaint, replace locks, notify ADEM if damaged below land surface, and replace well.
Leachate Collection System	Daily	If leachate accumulates, pump to AST and dispose offsite within 90 days If damage to underground system notify ADEM prior to repair.
Leachate Storage Tank Aboveground Storage Tank (AST)	Daily	Check AST for leaks, secondary containment for rainfall, pump out rainfall to maintain capacity.
Surveyed Benchmark	Quarterly	Should benchmark be damaged or destroyed, notify ADEM and have replaced by surveyor.
Fence	Weekly	Repair or replace any damaged sections of fence, including barbed wire.
Treatment Equipment - air sparge SVE System - airstripper - blower, pumps, controls - bag and cartridge filters - settling basin	 Daily Daily Daily Daily Quarterly	 -Check system operation -Check packing, replace as needed -Repair and replace as needed -Check back pressure and replace as needed -Check for accumulated iron, remove as needed
Influent Pipeline	Daily	Check for leaks, "pig" as necessary
Effluent Pipeline	Daily	Check for leaks
Extraction Wells	Weekly	Monitor flow rate, redevelop as needed
Injection Wells	Daily	Monitor flow, adjust as needed, redevelop as needed

PLATES



Legend

- Site Boundary
- Elevation Contour (10ft)
- Miocene Monitoring Well
- Semi-Confined Monitoring Well
- Injection Well
- RCRA Landfill (D80)
- LeMoyne Public Well

Site Layout Map

Rentokil Initial Environmental Services, LLC
10565 Highway 43 North
Creola, AL 36525

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WWW.ARCADIS-US.COM

PROJECT MANAGER:	CHECKED BY: PM
DRAWING BY: JWC	DATE: January 2018
PROJECT NUMBER: 03648005.2017	FIGURE NUMBER: **Plate 1**

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SWMU and AOC List

SWMU 1 - North Pond
SWMU 2 - Middle Pond
SWMU 3 - South Pond
SWMU 4 - Old Pond Area
SWMU 5 - Former Pump House
SWMU 6 - Former Flow Lines
SWMU 7 - Chemical Drain
SWMU 8 - Organic Sump
SWMU 9 - Organic Holding Tank No. 3
SWMU 10 - Caustic Sump
SWMU 11 - Caustic Holding Tank No. 4
SWMU 12 - Acid Sump
SWMU 13 - Acid Holding Tank No. 5
SWMU 14 - Drainage Ditch
SWMU 15 - Underground Wastewater Storage Tanks
SWMU 16 - Stainless Steel Tank Trailers
SWMU 17 - Leachate Storage Tank

AOC A - Truck Parking Pad
AOC B - Former N, S, E, and W Monitoring Wells
AOC C - Final Rinse Tanks
AOC D - 10,000 Gallon Diesel UST
AOC E - Fuel Island Release

Site SWMUs and AOCs

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PROJECT MANAGER:	CHECKED BY: PM
DRAWING BY: JWC	DATE: January 2018
PROJECT NUMBER: 03648005.2017	FIGURE NUMBER: Plate 2

Legend
- RCRA Landfill (D80)
- Former Monitoring Well
- Elevation Contour (10ft)
- Site Boundary
- Site Boundary / Fence
- SWMUs & AOCs
- Miocene Monitoring Well
- Semi-Confined Monitoring Well

N

0 0.025 0.05 Miles

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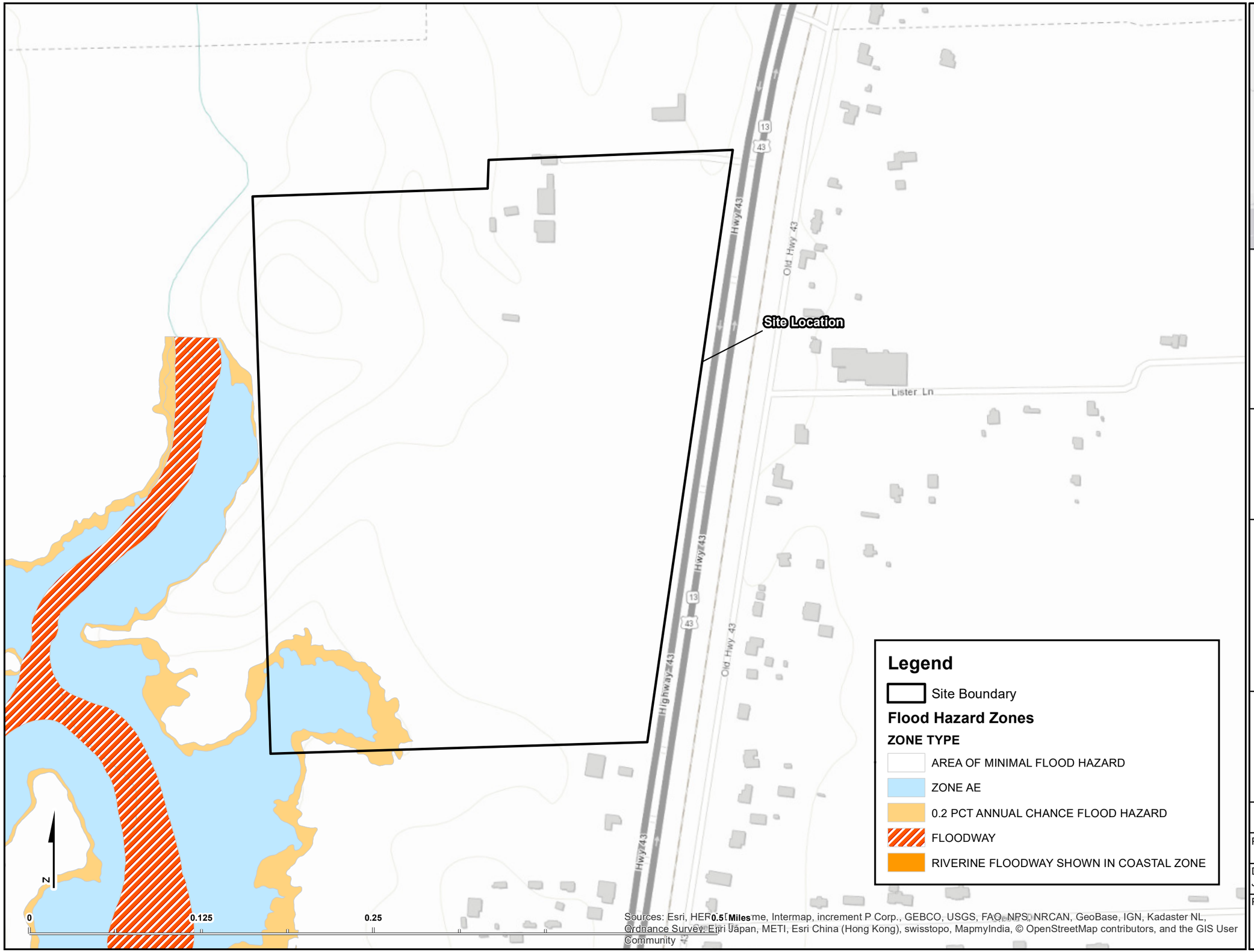

Flood Insurance Rate Map

Rentokil Initial Environmental Services, LLC
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PROJECT MANAGER:	CHECKED BY: PM
DRAWING BY: JWC	DATE: January 2018
PROJECT NUMBER: 03648005.2017	FIGURE NUMBER: **Plate 3**

APPENDIX A

Corrective Action Plan

ARCADIS Design & Consultancy for natural and built assets

Rentokil Initial

CORRECTIVE ACTION PLAN

Creola, Alabama

USEPA ID No. ALD 021 257 951

February 7, 2018

CORRECTIVE ACTION PLAN

Creola, Alabama
USEPA ID No. ALD 021 257 951

Prepared for:
Rentokil Initial Environmental Services, LLC

Prepared by:
Arcadis U.S., Inc.
1728 3rd Avenue North
Suite 300
Birmingham, Alabama 35203
Tel 205 930 5700
Fax 205 930 5707

Our Ref.:
03648005.2017.00001

Date:
February 7, 2018

Jennifer Martin Tilton
Senior Hydrogeologist

Jason Hughes, PG
Senior Geologist
Alabama Licensed Professional Geologist No. 1118

John Perella, PE
Principal Engineer
Alabama Licensed Professional Engineer No. 37041-E

CONTENTS

TABLES

FIGURES

APPENDICES

ACRONYMS AND ABBREVIATION

ADEM	Alabama Department of Environmental Management
Arcadis	Arcadis U.S., Inc.
AS	air sparging
AST	aboveground storage tank
ASU	air-stripping unit
BDY	Boundary (well)
bgs	below ground surface
BKG	Background (well)
CAP	Corrective Action Plan
CATS	Corrective Action Treatment System
CF	chloroform
COC	constituent of concern
CT	carbon tetrachloride
CVOC	chlorinated VOC
DO	dissolved oxygen
EFF	Effectiveness (well)
FID	flame ionization detector
ft/day	foot/feet per day
GAC	granular activated carbon
gpm	gallon per minute
GWPS	Groundwater Protection Standard
HAPs	hazardous air pollutants
HDPE	high density polyethylene
HMI	human-machine interface
HRSC	High Resolution Site Characterization
HSA	hollow-stem auger
Landfill	closed RCRA landfill
lbs	pounds
mg/L	milligram per liter

MNA	monitored natural attenuation
OMM	operation, maintenance, and monitoring
ORP	oxidation reduction potential
PELA	PE LaMoreaux and Associates
PLC	programmable logic controller
POC	Point of Compliance (well)
psi	pound per square inch
PVC	polyvinyl chloride
RCRA	Resource Conservation and Recovery Act
RIES	Rentokil Initial Environmental Services, LLC
ROI	radius of influence
scfm	standard cubic feet per minute
SDR	standard dimensional ratio
SVE	soil vapor extraction
TOC	total organic carbon
UIC	Underground Injection Control
USEPA	U.S. Environmental Protection Agency
UST	underground storage tank
VAP	Vertical Aquifer Profiling
VGAC	vapor-phase GAC
VOC	volatile organic compound
ZVI	Zero Valent Iron

1 INTRODUCTION

Rentokil Initial Environmental Services, LLC (RIES) owns the property located at 10565 Highway 43 North, Creola, Alabama (the "Site"; **Figure 1-1**) that includes a closed Resource Conservation and Recovery Act (RCRA) landfill (Landfill). The Site currently uses a groundwater-remediation system that controls and treats groundwater with identified constituents and is currently enhancing the Corrective Action Program to include remedial injections and air sparging (AS) and soil vapor extraction (SVE), both pursuant to an Alabama Hazardous Wastes Management and Minimization Act Post-Closure Permit (the RCRA Permit). RIES performs regulatory-required monitoring and reporting for both the Landfill and the groundwater corrective action systems in accordance with the RCRA Permit. The Site is listed under U.S. Environmental Protection Agency (USEPA) identification number ALD 021 257 951.

The Site Corrective Action Plan (CAP) was approved by the Alabama Department of Environmental Management (ADEM) with the Final Permit Determination issued on April 19, 2017. Arcadis U.S., Inc. (Arcadis) implemented the CAP to focus corrective actions to expedite remediation of identified constituents of concern (COCs), specifically carbon tetrachloride (CT) and chloroform (CF), present in saturated soil and groundwater at the Site. The activities included in this CAP were approved in the Final Permit Determination (ADEM 2017) and are consistent with those discussed during meetings between the ADEM and Arcadis on September 2 and October 23, 2015, and the information provided in the High Resolution Site Characterization (HRSC) Report submitted to ADEM on April 10, 2015 (Arcadis 2015a).

The CAP includes the following:

- Background information, current status of the Corrective Action Treatment System (CATS), enhanced corrective actions, and summary of the HRSC findings obtained in January 2015.
- The existing groundwater monitoring well network and sampling program.
- A phased remediation of groundwater using zero valent iron (ZVI).
- AS/SVE design parameters and implementation.
- Existing extraction well operation.
- CATS optimization and contingency plans.
- Updated schedule and reporting.

2 BACKGROUND

The Site was previously used as a truck washing facility. Based on historical documents, truck washing operations began in the early 1970s and continued until facility closure in 1986. **Figure 2-1** shows the locations of several of the truck washing operational areas. Much of the detailed Site history is provided in the PE LaMoreaux and Associates Inc. (PELA) No. 456400 report (PELA 1985). The two former "old" wastewater ponds shown on **Figure 2-1** were reportedly closed in place in 1981, and the three former wastewater ponds along the western portion of the property were closed in 1986. While the wastewater ponds were reportedly lined, it is suspected that the wastewater leached through the bottom of the ponds and migrated downward during the period of use. The wastewater reached the underlying water table and

migrated laterally away from the ponds as perched wastewater/groundwater within shallow permeable soils (PELA 1985). The downward and lateral transport of waste materials from the former ponds resulted in the current distribution of CT and CF in groundwater across much of the wastewater processing area. Sediments from the three western ponds were placed in the Landfill in 1986, and the Landfill has not received any wastes since 1986.

The primary source areas historically identified for the existing COCs in groundwater were as follows:

- Two surface impoundments operated from 1971 to 1979 (Old Ponds North and South; closed in-place).
- Three impoundments (North, Middle, and South Ponds) operated from 1980 to 1985 following closure of the Old Ponds.
- The Landfill, containing consolidated wastes from the North, Middle, and South Ponds. Site records suggest the Landfill is approximately 26 feet deep, with a clay cap, 60-millimeter-thick high-density polyethylene liner, and a leachate collection system.

As part of the HRSC sampling activities conducted in 2015, Arcadis completed vertical and horizontal characterization of COCs at the Site within the vicinity of the former truck washing operational and disposal areas that were the most likely origin of COC releases into the soil and groundwater. COC characterization included hydraulic profiling of the upper aquifer soil strata that contribute to the primary transport of COCs. Hydraulic profiling results, coupled with Vertical Aquifer Profiling (VAP) samples, were used to identify contaminant plume concentrations and distributions. The findings of these activities confirmed that COC impacts are present in the vicinity of all of the above potential source locations, noting that the existing source-zone impacts are not interpreted to have originated from one discrete area, but are defined by their distribution across a broader general area in which dissolved CT and CF concentrations are observed. A complete summary of the findings from these activities and the nature of contaminant distribution and transport is provided in **Section 3**. Site COCs, as listed in the RCRA Permit, are provided in **Table 2-1**. The current monitoring well network for the Site is provided on **Figure 2-2**.

2.1 Site Geochemistry

Iron appears to be abundant at the Site based on observation of subsurface soils collected from soil borings. Based on a 2000 Geological Survey of Alabama report, *Water in alluvium and low terrace deposits in areas close to the Mobile River basin (the Site is located within the Mobile River basin), commonly contains iron in excess of 0.3 mg/L.* When coupled with the naturally low groundwater pH observed at the Site (approximately 3.75 to 5 standard units), pH-sensitive ferric iron dissolves to form ferrous iron in groundwater. This natural iron dissolution mechanism has been widely documented in the CATS operation, maintenance, and monitoring (OMM) activities (see **Section 2.2**).

Review of the historical records containing the list of materials treated through the truck washing station and disposed in the lagoons identified a variety of chemical compounds including different acids, organics, and sulfur and nitrogen compounds. These compounds infiltrated into the groundwater from the ponds, creating conditions whereby chemical degradation occurred through biological or chemical processes. The current location, distribution, and concentrations of CT and CF at the Site are a function of these degradation processes.

The discharge of organic compounds to the underlying hydrogeology fostered the development of anaerobic groundwater conditions, which served to mobilize labile iron present within the native soils. Sulfur-based materials (e.g., sulfuric acid, liquid sulfur, sodium sulfite, and bisulfate) in the presence of these reduced groundwater conditions were subsequently used as electron acceptors and reduced to free sulfide. The reaction between ferrous iron and sulfide in groundwater results in rapid iron sulfide generation, which forms a black precipitate. This precipitate has been observed in both current and historical soil borings in proximity to the waste-disposal lagoons. Groundwater samples collected in these areas were also noted to be discolored. These observations are supported by the Arcadis geochemical samples collected in January 2015 (Arcadis 2015a) that indicate that groundwater in these areas had highly elevated iron concentrations (up to 120 milligrams per liter [mg/L]). Currently, the organic carbon concentrations in groundwater beneath the lagoons are low or below detection limits, indicating that historical organics released from the disposal lagoons have been effectively consumed in the degradation processes.

While these geochemical conditions have contributed to the identified fouling challenges in the CATS, the presence of iron sulfide and historical organic compounds have been advantageous in enhancing both the abiotic and biotic degradation of CT and CF. For example, historical concentrations of CT observed in the North Well, adjacent to the North Pond, indicate that CT concentrations were observed as high as approximately 88,000 micrograms per liter in 1984 (PELA 1985), roughly an order of magnitude higher than those CT concentrations detected during the January 2015 HRSC sampling event. The historical existence of organic carbon and iron sulfide has served as reactants for both biotic (via dissolved hydrogen electron donor derived from organic carbon fermentation) and abiotic (via direct contact between CT and CF and iron sulfide) transformation mechanisms. This is supported by the considerable decline in dissolved-phase volatile organic compound (VOC) concentrations observed in more recent groundwater samples collected at the Site. The susceptibility of both CT and CF to biotic/abiotic transformation mechanisms and the current presence of iron sulfide precipitates in the subsurface indicate that these mechanisms can be used in future remedial efforts to expedite treatment of the COCs.

2.2 Current CATS Status

The existing Corrective Action Program was implemented at the facility beginning in June 1990. The CATS is the active remedial operation at the Site pending implementation of the Phase II enhanced corrective actions, and it is designed to capture COCs present in groundwater migrating to the south/southwest of the identified source areas. The system has been upgraded on several occasions and requires constant maintenance and repair. Extracted groundwater treated via the CATS is conveyed to a series of injection wells positioned south of the plume. Groundwater monitoring demonstrates that the groundwater plume has been contained on site. A potentiometric surface of the groundwater at the Site is provided on **Figure 2-3** and shows plume capture at the extraction well.

The CATS includes two groundwater-extraction wells (R-4 and R-5) that are located approximately 600 feet south of the Landfill. Because of iron fouling issues in the pumps, groundwater extraction is alternated between these two recovery wells. The groundwater flow rate from the operating well is up to 225 gallons per minute (gpm). The extracted groundwater is conveyed via aboveground piping to the treatment system. An air-stripping unit (ASU) is used for primary treatment of the CT and CF present in groundwater. The groundwater is discharged under gravity flow from the ASU into a 10,000-gallon clear

well settling basin for primary iron treatment. Storm water that collects in the CATS secondary containment is pumped into the clear well and treated with the groundwater. Following primary iron treatment, the groundwater is pumped out of a sump in the clear well through a series of filters ranging in media size (200, 25, and 3 microns) for secondary iron removal. The groundwater is then routed through granular activated carbon (GAC) for secondary treatment of the dissolved VOCs. After the secondary treatment with GAC, the treated water is reinjected in the groundwater through wells located approximately 1,500 feet south of the treatment system. **Figure 2-4** presents a process flow diagram of the remediation system.

Landfill leachate management is conducted periodically at the Site. The Landfill has a leachate-collection system whereby leachate is routed via gravity flow through piping near the bottom of the Landfill to a sump located near the southern end of the Landfill. Accumulated leachate in the sump is pumped using an in-line transfer pump directly to an aboveground storage tank (AST). Leachate collected in the AST has historically been pumped into a vacuum truck or totes and disposed off site by licensed and permitted transporters and disposal facilities, respectively.

3 HIGH RESOLUTION SITE CHARACTERIZATION SUMMARY

Arcadis submitted an HRSC Work Plan to ADEM on December 18, 2014 (revised January 6, 2015) for review and approval (Arcadis 2015b). The HRSC Work Plan was developed to perform a subsurface assessment evaluating sources of constituents that have been detected routinely in groundwater monitoring wells at concentrations above the Groundwater Protection Standards (GWPS) identified in the RCRA Permit. The HRSC Work Plan was approved by ADEM on January 12, 2015. The work was conducted in accordance with the HRSC Work Plan, and the HRSC Report was submitted to ADEM on April 10, 2015.

3.1 Objectives

The primary objective of the HRSC was to map the vertical and lateral extent of principal COC source concentrations in former operational areas, including possible source areas surrounding and below the Landfill and former ponds previously used to store wastewater. Further, the HRSC was intended to delineate the source areas that are continuing to contribute COC mass to the groundwater plume. Information collected during the HRSC also included detailed mapping of site lithology, hydrostratigraphy, and permeability.

A secondary objective was to evaluate distribution of concentrations of Dinoseb in the vicinity of former monitoring well TW-13, where this constituent has been detected sporadically.

The HRSC Report provided a description of the field investigation activities, the analytical results of the collected soil, groundwater, and landfill leachate samples, and an evaluation of the investigation findings relative to the known conditions. VAP was conducted to achieve the objectives and was performed using a Geoprobe® screen-point sampling device attached to the drive rods and advanced to the target depth via direct-push drilling methods. The collected groundwater samples were analyzed for VOCs by an on-site mobile laboratory using USEPA Test Method 8265. In addition to the primary and secondary objectives, the HRSC was successful in providing information to better understand and assess current Site conditions relative to ongoing remedial operations. The VAP locations are depicted on **Figure 3-1**.

3.2 HRSC Findings Summary

The HRSC investigation found source concentrations of COCs in the former truck washing operational areas. Also, comparison of a leachate sample to groundwater samples adjacent to the Landfill indicate that the Landfill is not leaking; therefore, the Landfill is not a COC source area. Further, Dinoseb is contained in the vicinity of former well TW-13 at relatively low concentrations, slightly exceeding the GWPS.

Site hydrostratigraphy, combined with release locations in the operational areas, has resulted in the identified CT and CF spatial distribution. Elevated concentrations of CT and CF were detected in the upper portion of the semi-confined aquifer from the top of the saturated zone at approximately 25 feet below ground surface (bgs) to 40 feet bgs. The upper portion of the semi-confined aquifer from 25 to 40 feet bgs consists of lower-permeability silt, sand, and clay intervals. Elevated COC concentrations in the upper portion of the semi-confined aquifer are the source of CT and CF detected in the higher-permeability sand immediately underlying the less-permeable, upper clayey sand zone. Based on the historical groundwater data and lithologic composition of the saturated zone from 25 to 40 feet bgs, a slow mass-transfer rate of elevated COC concentrations to the underlying permeable sand unit is occurring.

It should be noted that although source COC concentrations are present in the former operational areas and COC transport is occurring in the shallow groundwater, the CATS maintains hydraulic control of the groundwater to prevent off-site migration of COCs, and the enhanced Phased II corrective action will address the source COC concentrations. The permitted groundwater-monitoring system defines the lateral and vertical extent of COCs in groundwater. The maximum horizontal extent of CT based on the HRSC findings (combining monitoring well sample and VAP results) is provided on **Figure 3-2**. The vertical distribution of CT as described above is depicted on **Figure 3-3**. Because CF is a daughter product from the degradation of CT, the horizontal distribution of CF is also provided on **Figure 3-4**.

3.3 Hydrostratigraphy Summary

Lithology at the Site can be generally categorized as a fining-up grain size sequence typical of many fluvial meandering river deposits associated with the Mobile River (**Figure 3-3**). The following describes the hydrostratigraphy identified in the semi-confined aquifer as identified in the HRSC Report:

- **Lower Sand and Gravel**: A basal sand and gravel overlies a sandy clay to about 90 feet bgs. The basal sand and gravel represent the lowest hydrostratigraphic unit in the semi-confined aquifer. A sandy clay underlies the lower sand and gravel and represents a significant continuous confining unit across the Site. Contact between the sand and gravel and underlying sandy clay is sharp. The lower sand and gravel has a higher hydraulic conductivity, estimated at 70 to 90 feet per day (ft/day) from hydraulic profiling measurements, than the overlying units; therefore, the largest volume of water is advected through this unit.
- **Middle Sand**: The lower sand and gravel grades upward to a sand that comprises the largest vertical thickness of the semi-confined aquifer. The transition is gradational; there are no sharp contacts between the sand and gravel and the overlying middle sand. While this unit is thicker than the

underlying sand and gravel, it has a lower hydraulic conductivity (30 to 50 ft/day) as determined by hydraulic profiling.

- **Upper Clayey Sand**: The middle sand grades upward to finer-grained sediments consisting of a sequence of clayey sand interbedded with silt and sand layers/lenses. The clayey sand is the uppermost saturated unit in the semi-confined aquifer. Hydraulic conductivity of this unit is low (3 to 20 ft/day) relative to the underlying sand and sand and gravel. Comparatively little groundwater flow occurs in this unit relative to the underlying sand and sand and gravel.
- **Unsaturated Sandy Clay**: Above the upper interbedded clayey sand and extending to the surface is a sandy clay. The sandy clay is typically unsaturated throughout the Site.

While hydraulic properties of the semi-confined aquifer are the dominant control on distribution of the COCs, groundwater-quality characteristics control the potential for degradation to occur. Overall, ambient groundwater quality is not conducive to biotic degradation of CT or CF. The groundwater is acidic with a pH range between 4 and 5.5 standard units, the organic carbon content in samples collected is less than 1 mg/L, and indigenous microbial populations are very low. Unlike the historical conditions discussed in **Section 2**, which encouraged the biological degradation of CT to CF and to simple carbon end products, the lack of available organic carbon limits biotic degradation. What anaerobic dechlorination occurred in the former pond areas is suspected to have slowed as organics that leached from the ponds were consumed and exhausted following pond closure. Comparatively, the sustained presence of iron sulfide mineral precipitates within the vicinity of the former pond areas is expected to contribute to ongoing abiotic transformation mechanisms. Because these reactions require direct contact between the COCs and the mineral species, reactions are likely most significant near the former lagoon areas and less significant where limited iron sulfide species are present.

3.4 Distribution of High COC Concentrations

Principal COC source mass is near the top of the semi-confined aquifer in the upper finer-grained (lower hydraulic conductivity) interbedded upper clayey sand at a depth between 25 and 40 feet bgs in the area of the former washing operations (e.g., washing racks, wastewater holding tanks, and the Old Ponds). **Figures 3-2** through **3-4** provide an assessment of the vertical and horizontal distribution of CT and CF in the groundwater.

There is no evidence that these COCs originate from a current source(s); rather, it appears the COCs occupy this area through the following process:

- COCs were originally released to soils in the vicinity of the former truck wash racks, former waste liquid holding tanks, and the Old Ponds as part of former facility operations. There is no evidence that releases from these sources continued after Site operations ceased in 1985.
- Historical COC migration occurred vertically through the vadose zone in the identified areas, encountering the groundwater table at a depth of 20 to 25 feet bgs. The COCs continued to slowly infiltrate vertically downward, migrated horizontally in the interbedded clayey sand, and discharged to the underlying sand depth between 35 and 45 feet bgs. The low hydraulic conductivity of the interbedded upper clayey sand is responsible for the persistent occurrence of the high concentrations of CT and CF in the vicinity of the former facility operational area. The combination of a strong

upward gradient throughout the semi-confined aquifer and the low hydraulic conductivity of the upper clayey sands relative to the underlying middle sand and lower sand and gravel sequences both contribute to the observed shallow groundwater COC mass retention.

- COCs infiltrate downward between the clayey sand and middle sand at a reduced rate of mass flux. The increased hydraulic conductivity of the middle sand compared to the upper clayey sand results in increased flushing of groundwater through the zone. This translates to horizontal COC transport within the middle sands at a flow rate approximately an order of magnitude greater than the overlying interbedded clayey sand. The much higher hydraulic conductivity of this unit is responsible for the wider distribution of reduced COC concentrations in deeper groundwater at the Site relative to the source area (i.e., horizontal migration is the dominant migration route).

The lower basal sand and gravel zones beneath the “middle sand” layer have either no detectable or only trace concentrations of COCs. The low mass transfer rate of COCs from the upper clayey sand to the middle sand and the high horizontal advective rate in the middle sand prevent relatively higher COC concentrations from reaching the underlying sand and gravel layers. While the lower basal sand and gravel have the highest hydraulic conductivities, very little COC mass reaches this unit before it is removed in the hydraulic-containment system (i.e., existing groundwater-extraction wells). Currently, it is estimated that a considerable fraction of groundwater captured by CATS contains CT or CF at concentrations less than the GWPS. The purpose of the approved Phase II enhanced corrective actions is to remediate these source areas, which have lower hydraulic conductivity that the CATS is not currently addressing.

4 MONITORING WELL SYSTEM

The groundwater monitoring network was upgraded and modified with the ADEM Final Permit Determination issued on April 19, 2017. The monitoring well network was modified to effectively monitor site conditions and groundwater quality improvements improvement through time. The groundwater monitoring system, as approved in the Final Permit Determination (ADEM 2017), is shown in **Table 4-1.**

Groundwater monitoring of the well network will be conducted as identified in **Table 4-1**, the Groundwater Monitoring, Sampling, and Analysis Plan (Appendix C of the RCRA Permit Application), and the Final Permit Determination (ADEM 2017). All Boundary (BDY), Background (BKG), and Point of Compliance (POC) wells will be sampled on an annual basis and monitored for the presence of VOCs, metals, and Dinoseb. All Effectiveness (EFF) wells will be sampled on a semiannual basis and monitored for the presence of VOCs and metals, with Dinoseb analyzed annually. Monitored natural attenuation (MNA) sampling is performed in EFF wells. MNA monitoring includes the collection of samples for analysis of VOCs, metals, nitrate, sulfide, carbon dioxide (gas), hydrogen (gas) chloride, and petroleum-related compounds (benzene, toluene, ethylbenzene, and xylene). The analytical parameters and sampling schedule will be evaluated, and modifications will be recommended, as part of the ongoing corrective action reporting process.

In addition to the routine monitoring outlined above, newly installed wells are being sampled on a semiannual basis to establish trends. The monitoring will be completed in support of a groundwater monitoring effectiveness evaluation that will be conducted once four rounds of samples are collected from

the newly installed wells. The monitoring effectiveness evaluation will be conducted using the following criteria.

4.1 Trend Analyses

Time-series plots and intrawell Shewhart-Cumulative Sum control charts will be used annually to evaluate trends of CT and CF concentrations for EFF wells. CT and CF are referenced in this section because they represent the primary COCs; however, all VOCs and associated daughter products will be evaluated, if detected. Time-series plots will also provide for visual interpretations of trends. Trends will be evaluated only for wells where CT or CF was detected for a sufficient number of sampling events (four consecutive events above the laboratory method detection limit) to develop valid trends.

4.2 Spatial Analysis

Spatial analyses of the distribution of CT and CF throughout the Site and correlation of concentrations between monitoring wells may be performed to re-evaluate/identify the optimum number and location of BDY and EFF wells in the network. Spatial analyses may include “spatial tolerance” metrics to estimate the efficacy of the network when selected wells are removed sequentially from the network and/or groundwater modeling shows additional monitoring wells are needed where data gaps are predicted to exist. Monitoring wells may be removed from routine sample collection (not water level measurements) where analysis shows CT and CF concentrations are predicted as highly unlikely to increase.

4.3 Temporal Analysis

Temporal analyses of the distribution of CT and CF in monitoring wells at the Site may be performed to re-evaluate/identify the optimum frequency of sampling events at BDY and EFF wells in the network. Techniques developed by the USEPA and the Air Force Center for Environmental Excellence (AFCEE; 2005) will be used for temporal analyses.

4.4 Reporting

Semiannual groundwater monitoring and corrective action reporting will continue. The reports will include data from groundwater monitoring, analysis of data, remedial actions, and conclusions regarding the effectiveness of the monitoring program. If the analysis of the data warrants any change to the remedial action and monitoring programs, recommendations for revisions will be included in the semiannual report.

The semiannual reports will include:

- Site history or reference to previously submitted site history.
- Descriptions of remedial measures activities over the preceding 6 months.
- Groundwater monitoring activities, including:
    - Sample locations and dates.
    - Analytical methods.

  - Method reporting limits for each constituent reported.
- A map of the groundwater monitoring system.
- Potentiometric surface maps.
- Isoconcentration maps.
- Tables of well concentrations with comparison to the current remedial goal.

5 CORRECTIVE ACTION OPTIMIZATION

Following the completion of the HRSC Report, viable remedial technologies were evaluated in order to select the most appropriate and cost-effective remedy for the Site. Technologies that were not retained included alternative source treatment approaches (enhanced biodegradation and in situ chemical oxidation) and ZVI-based reactive barrier walls. These technologies could advance the Site to closure, but were not cost effective compared to the proposed remedial approach described below.

The proposed remedial approach includes a combination of: (1) targeted source-zone treatment to reduce elevated CT and CF concentrations through in-situ injections and eliminate flux to downgradient groundwater; and (2) continued containment of the groundwater plume on site through installation of an AS barrier with SVE. The combined approach achieves short-term CT/CF mass reduction and enhancement of the plume containment. Source-zone treatment will reduce the concentrations of CT and CF in groundwater. The containment component of the remedy will continue to be implemented until source treatment is achieved and residual COC concentrations can be managed via more passive means (e.g., MNA). AS/SVE will be used as the containment remedy because it reduces or eliminates the current fouling challenges and annual operation costs of the CATS while providing an effective means to capture and reduce residual COC concentrations currently present outside the source treatment. Phase I testing activities demonstrated that both targeted source-zone treatment and AS/SVE are feasible and will obtain remedial goals.

5.1 Phase I Corrective Action Evaluation

The two retained technologies were tested at the Site in accordance with the Phase I approach provided in the CAP that was approved in the Final Permit Determination (ADEM 2017). Phase I established initial design parameters for each of the technologies for the Phase II selected remedy. Phase I of the in-situ source treatment was conducted as direct-push injections using ZVI and organic carbon. A pilot test was also conducted as part of Phase I to evaluate the use of AS/SVE for containment. Information gathered during Phase I was used to validate design parameters for both components of the Phase II remedy. The results from Phase I pilot testing of the in-situ injection and AS/SVE technologies were presented in the Phase I Corrective Action Evaluation Report submitted to ADEM on December 7, 2017 (Arcadis 2017).

5.2 Phase II Corrective Action

Phase II Corrective Action includes confirmation of the reagent and final footprint for the Phase II in-situ treatment and selection of AS/SVE as the containment technology. Arcadis estimates that implementation of the multi-technology approach will significantly reduce COC concentrations at the Site within 10 years.

With the significant reduction in COC concentrations resulting from the Phase II remedy, Arcadis estimates that any remaining COC impacts can be successfully managed via MNA.

5.3 Phase II Source-Area Injections

Phase II source-area treatment consists of the injection of a ZVI/organic carbon reagent, delivered as a substrate-slurry, to enhance long-term in-situ biological and abiotic chlorinated VOC (CVOC) degradation processes. It is expected that the combined ZVI-organic carbon reagent will provide sustained reactivity and treatment over a duration of 2 to 5 years. Based on the Phase I results, EHC® is the selected reagent for Phase II implementation.

The area targeted for EHC® injection is presented on **Figure 5-1**, an area of approximately 125,000 square-feet. Injections will be performed within this overall footprint, with specific target areas based on the results of the HRSC investigation, recent groundwater monitoring activities, and Phase I implementation. The overall objective of the EHC® injection program is to reduce CVOC source mass on site, thus reducing the timeframe associated with downgradient migration of CVOCs.

5.3.1 Phase II Design Approach

Direct-push injection was selected as the preferred delivery method for Phase II based on the solid-phase nature of the reagent considered (which prevents injection well-based delivery approaches) and the adaptability of this technique to observations in the field during implementation. This injection methodology was validated by the positive Phase I results.

The ZVI particles achieve treatment by facilitating direct abiotic dechlorination of CT and CF. ZVI particles also support CT and CF biodegradation via three key mechanisms: scavenging competing electron acceptors (specifically oxygen and sulfate) in groundwater; supporting an increase in pH within the treatment area to levels amenable to biological dechlorination; and serving as a sustained source of dissolved hydrogen for use as an electron donor. The organic carbon component of the reagent will also supplement the existing total organic carbon (TOC) concentrations in groundwater and provide a lasting source of electron donor to sustain ongoing CT and CF biodegradation. Based on the successful implementation of Phase I, the ZVI/organic carbon material proposed for application within the Phase II injection area is EHC™, manufactured by Adventus Corporation. The safety data sheet for EHC® ISCR Reagent is provided in **Appendix A**.

5.3.2 Phase II Injection Deployment

The target treatment areas for Phase II EHC™ injection encompass areas with CT concentrations close to or greater than 1 part per million, based on the VAP samples collected during the HRSC investigation as well as recent groundwater monitoring events. The area for EHC® injection is presented on **Figure 5-1**. This injection footprint is consistent with the original injection footprint presented in the Phase II CAP, and also includes expansion downgradient to include the area of high CT concentrations in the vicinity of wells EFF-102/103, as well as the area immediately west of the RCRA landfill (**Figure 5-1**). Combined, these areas are estimated to be approximately 125,000 square feet in size. The EHC® injections will target a vertical interval between approximately 20 and 35 feet bgs, which includes the more permeable sands within the semi-confined alluvial aquifer. This interval coincides with the zone where the primary CT and

CF source areas (e.g., >1 mg/L) were observed. Based on the VAP data, the precise interval of injection is expected to vary somewhat across the injection area. Additional sampling activities planned prior to injection will be used to confirm the target interval at various locations across the Site.

Approximately 300 to 400 individual direct-push injection points will be advanced within the Phase II EHC® injection area in accordance with the Site Underground Injection Control (UIC) permit (the UIC Permit). Prior to implementing direct-push injections, five existing monitoring wells (i.e., EFF-102U, EFF-103M, EFF-33U, EFF-21RU, and POC-5RU) and up to twelve new temporary observation wells will be sampled for COCs, including CT and CF, to confirm baseline concentrations. Based on the baseline groundwater analytical results, the number of injection points may be refined to achieve adequate coverage of the Phase II injection area. The proposed injection points will be spaced in an offset grid pattern with approximately 20-foot on-center spacing over the accessible portion of the Phase II injection area (**Figure 5-1**). This spacing assumes a 10-foot radius of influence (ROI) from each EHC® injection point. Because of the size of the injection area, an adaptive approach will be used to accommodate the natural variability in lithologic conditions, VOC concentrations, injection performance, and site access across the injection area. This could include minor adjustments of a few feet to the injection spacing, injection slurry volume, and injection depth based on field conditions.

The EHC® slurry will be injected at 2- to 4-foot intervals across the targeted horizon, resulting in approximately two to four injection intervals per point. The total number of injection intervals per point will be determined for each injection area based on lithologic and VOC concentration data from previous VAP sampling, existing monitoring wells, and temporary observation points that will be installed prior to EHC® injection. For all injection points, the target objective is to achieve distribution of EHC® from the top of the groundwater surface (around 20 feet bgs) to the base of high VOC zone (around 35 feet bgs for most locations). Each injection will be completed using a top-down approach, with injection tooling advanced to the subsequent deeper interval following delivery of the interval-specific target volume. Analysis of the Phase I data showed that the top-down injection approach proved to be the most effective for EHC® delivery to the target source zone. The slurry will be injected through a pressure-activated injection tip that directs the slurry horizontally outward and into the formation using pump pressure, a progressive cavity pump, or piston pump that is capable of handling solids and producing up to 500 pounds per square inch (psi) of pressure.

The application rate of EHC® will be approximately 0.002 kilogram of EHC® per kilogram of soil (0.25% by soil weight). Assuming a 10-foot ROI, bulk soil density of 110 pounds (lbs) per cubic foot, and a 4-foot-thick treatment interval, a total of approximately 250 to 300 lbs of EHC® will be applied at each injection interval. The EHC® will be applied as a 30% EHC® by weight slurry. The EHC® will be mixed with approximately 50 to 100 gallons of water using a mixing tank with a paddle mixer (or equivalent) to create the slurry for injection. The total slurry volume injected at each interval will be approximately 100 to 150 gallons.

The actual slurry volume, EHC® loading, and target injection intervals may be adapted from the specifications above as necessary to meet technical objectives given the expected natural variability in field conditions. In addition, field crews will carefully monitor the injection area during implementation for surfacing of the injection slurry. If surfacing of injection slurry is observed, injection at that interval will be discontinued. Field monitoring activities during injection will also include periodic grab sampling at monitoring wells within the injection area to evaluate changes in groundwater geochemistry indicative of

reagent arrival (i.e., visual indications, decreases in oxidation-reduction potential [ORP], increased pH). These data will be used to confirm the influence of injection across the Site and provide a basis for modification to the injection point density, as needed.

5.3.3 Performance Monitoring

Post-injection monitoring data will be used to evaluate reagent distribution, geochemical conditions, and treatment performance within the Phase II EHC® injection area.

The performance monitoring program consists of the collection of groundwater samples from five existing monitoring wells as discussed in **Section 5.3.2** (i.e., EFF-102U, EFF-103M, EFF-33U, EFF-21UR, and POC-5RU) and up to twelve newly installed temporary observation points on a monthly basis for 4 months and bi-monthly for the subsequent 2 months following injection activities. The new observation points (OBS-10 through OBS-21) will be installed in six sets of two points in each selected location. They will be constructed of flush-threaded, 2-inch-diameter Schedule 40 polyvinyl chloride (PVC) well casings with 10- to 15-foot-long PVC well screens with machined 10-slot openings installed between 20 and 35 feet bgs. During installation, a continuous core will be collected from one of the two temporary observation points at each location. Visual observation of the lithology will be combined with previous VAP data to determine the screened intervals for each point. **Figure 5-2** shows the approximate locations of the new temporary observation wells.

Following installation, baseline and post-injection groundwater samples collected from existing monitoring wells and new temporary observation points will be analyzed for VOCs and natural attenuation parameters, including total and dissolved iron, sulfate, methane, and TOC. Routine field parameters (i.e., ORP, pH, dissolved oxygen [DO], turbidity, temperature, and specific conductance) will also be collected. The reduction of CT and CF concentrations will be the primary indicator for a successful EHC® application. **Figure 5-2** shows the locations of the wells included in the performance monitoring program for Phase II. **Table 5-1** summarizes the injection performance monitoring.

5.4 Phase II Air Sparge and Soil Vapor Extraction

Remedial alternatives evaluated in the modified CAP (Arcadis 2016) include the installation of an AS/SVE curtain to treat dissolved-phase CT and CF in the downgradient plume. Air sparging has been demonstrated to be effective at treating VOCs in groundwater at numerous sites in Alabama's Coastal Plain aquifers. Similar to the CATS, the AS/SVE curtain would be placed downgradient of the source area and would treat CT and CF at the curtain barrier. Because of the iron fouling issues associated with operation of the CATS and the location of the source mass in terms of the subsurface and within the interior of the site, an AS/SVE curtain represents a more efficient and effective long-term plume treatment and containment alternative than continued operation of the CATS. The proposed location of the AS/SVE curtain is shown on **Figure 5-1**. The proposed AS/SVE curtain location will be approximately perpendicular to groundwater flow. The AS/SVE containment curtain layout was also evaluated with respect to groundwater flow prior to the installation of the CATS in 1990 to be certain the layout will continue to capture flow after the eventual shutdown of the CATS.

5.4.1 Well Installations

The locations of the AS/SVE Phase II wells are shown on **Figure 5-3**. The Phase II AS/SVE well curtain will consist of 32 AS wells and 16 SVE wells. The AS/SVE performance monitoring network will consist of 4 proposed performance monitoring wells and 2 existing monitoring wells (see **Section 5.4.4**). AS, SVE, and proposed temporary observation monitoring wells will be installed using hollow-stem auger (HSA) techniques.

5.4.2 Air Sparge Wells

AS wells shall be 2 inches in diameter (designated AS-1 through AS-32) and installed in the approximate locations shown on **Figure 5-3** using HSA drilling methods. The AS wells will be installed to a depth of approximately 53 feet bgs. The screened interval of the AS wells will be between 51 and 53 feet bgs. The AS wells will be constructed with approximately 50 feet of 2-inch-diameter Schedule 40 PVC casing and 2 feet of 0.01-inch-slotted PVC well screen. The sand pack around the screen will be 20/30 sand filter pack to approximately 6 inches above the top of screen, a 6-inch fine sand seal (30/65 sand) will be installed atop the 20/30 sand pack. A 2-foot bentonite seal will be installed atop the fine sand seal and a cement seal installed to the surface. Construction details of AS wells are shown on **Figure 5-4** and well head completions are shown on **Figure 5-5**.

5.4.3 SVE Wells

SVE wells shall be 4 inches in diameter (designated SVE-1 through SVE-16) and installed in the approximate locations as shown on **Figure 5-3**. SVE wells will be installed to a depth of 25 feet bgs and will be constructed with 10 feet of 4-inch-diameter Schedule 40 PVC casing and 15 feet of 0.01-inch-slotted PVC well screen. The sand pack around the screen will be 20/30 sand filter pack to approximately 6 inches above the top of screen, a 6-inch fine sand seal (30/65-sand) will be installed atop the 20/30 sand pack. A 2-foot bentonite seal will be installed atop the fine sand seal and a cement seal installed to the surface. Construction details of SVE wells are shown on **Figure 5-4** and well head completions are shown on **Figure 5-5.**

5.4.4 AS/SVE Performance Wells

Four temporary observation wells (ASPM-01U, ASPM-01M, ASPM-02U and ASPM-02M) and two existing monitoring wells (POC-10RU and POC-13RU) will be used to monitor the performance of the AS/SVE system. The temporary observation wells will be installed as part of the AS/SVE installation. Locations of the four temporary observation wells and two existing monitoring wells, to be monitored as part of the AS/SVE performance system, are shown on **Figure 5-3**.

ASPM-01U and ASPM-02U will be installed in the upper zone and drilled to a depth of 35 feet bgs and constructed with 20 feet of 2-inch-diameter, 0.01-inch-slotted PVC well screen. ASPM-01M and ASPM-02M will be installed in the middle zone and drilled to a depth of 50 feet bgs with 10 feet of 2-inch-diameter, 0.01-inch-slotted PVC well screen. Performance wells will be installed using HSA techniques and constructed with 2-inch-diameter Schedule 40 PVC casing and 0.01-inch-slotted PVC well screen. The annular space around the screened interval will be filled with a 20/30 sand filter pack to approximately 1 foot above the top of the screen. A 2-foot bentonite seal will be installed at the top of the

sand pack, and cement grout will be installed to the surface. Construction details for the temporary observation wells are shown on **Figure 5-4**.

5.4.5 Air Sparge System Design

The AS curtain consists of 32 wells in four zones and will be operated in a cyclic mode which enhances the overall performance of the system by reducing the potential for channeling air. The AS system will utilize four zones (eight wells each) operating on a cycle of 12 hours on and 12 hours off with two zones operating at a time. Based on startup and initial operation data, this cycle time may be changed.

Based on results of the 2017 pilot test, the AS system is expected to operate at a design flow rate of up to 8 standard cubic feet per minute (scfm) per well which will result in an ROI up to 15 feet. Steady state well head pressure of approximately 13 to 15 psi is expected. AS wells will be spaced on 20-foot centers to provide up to a 5-foot overlap of ROI between wells. The proposed locations for the equipment container and piping network are shown on **Figure 5-3**. The AS system will be constructed with automated valves to control zone operation. Typically, only two AS zones will be operated at a time; however, if the AS wells are operated at lower flow rates, additional zones may be operated concurrently.

Calculations were performed assuming two zones operating at maximum flow rate for all wells at the zones the farthest from the equipment compound with a safety factor of 1.25 applied to the calculated pipeline head loss only. Maximum total flow rate of approximately 128 scfm was utilized in the calculations. Utilizing the maximum flow rates in these calculations allows for potential expansion if required in the future.

The air compressor shall have sufficient capacity to inject air at pressures that allow overcoming the sum of the hydrostatic pressure and the air-entry pressure of the formation. The compressor is sized based on these maximum hydrostatic air pressures. System design calculations are presented in **Appendix B**.

5.4.6 Air Sparge Piping and Equipment

The AS system will utilize a rotary screw compressor to provide compressed air to the AS wells. A receiver tank will be utilized to provide surge capacity to limit frequent cycling of the compressor. An integrated refrigerated air dryer will be utilized to reduce moisture in compressed air and extend performance of system instruments. As described above, the compressed air line effluent of the receiver tank will manifold into zones, each controlled by motorized valves.

Piping from the equipment container to the remote cabinets will be constructed of high density polyethylene (HDPE) standard dimensional ratio (SDR) 11 piping. The piping layout for the AS system is provided on **Figure 5-3**. The AS system will utilize individual 2-inch pipelines from the equipment container to the AS remote cabinets for each AS zone. As stated previously, the AS system will utilize four zones. From the remote cabinet to AS wells will be individual 1-inch HDPE SDR-11 pipelines to each respective AS well.

Each remote cabinet will be used to operate 16 AS wells but will be constructed with 20 AS well connections; unused connections will be spares. Inside the remote cabinets, each individual AS well will have a dedicated airflow meter, pressure gauge, needle valve, and shut-off valve located on the manifold.

A Kaeser AS 30T Air Center rotary screw compressor or equivalent capable of delivering the design flow rate and pressure of 128 scfm at approximately 38 psi will be utilized as the AS compressor.

Additional details are provided in the design drawings (**Appendix C**).

5.4.7 Soil Vapor Extraction System Design

An SVE system is incorporated into the AS system design. Air will be extracted from 16 SVE wells operating in two zones (however, both zones will operate continuously).

Based on results of the 2017 pilot test, each SVE well is expected to operate at a design flow rate of up to 50 scfm per well, which will result in an ROI up to 25 feet. Steady state well head vacuum of approximately 30 inches of water column is expected. SVE wells will be spaced on 40-foot centers to provide up to a 5-foot overlap of ROI between wells.

Calculations were performed assuming both SVE zones operating a maximum flow rate for all wells with a safety factor of 1.15 applied to the calculated pipeline head loss only. Maximum total flow rate of approximately 800 scfm was utilized in the calculations. Utilizing the maximum flow rates in these calculations allows for potential expansion if required in the future.

System design calculations are presented in **Appendix B**.

5.4.8 Soil Vapor Extraction Piping and Equipment

The SVE system will utilize a positive displacement blower to provide vacuum to the SVE wells. The SVE influent will manifold into two zones, each controlled by a manual valve.

The piping layout for the SVE system is provided on **Figure 5-3**. The SVE system will utilize individual 6-inch Schedule 80 PVC pipelines from the equipment container to the SVE remote cabinets for each SVE zone. As stated previously, the SVE system will utilize two zones. From the remote cabinet to SVE wells will be individual 2-inch Schedule 40 PVC pipelines to each respective SVE wells.

Each remote cabinet will be used to operate 8 SVE wells but will be constructed with 10 SVE well connections; unused connections will be spares. Inside the remote cabinets, each individual SVE well will have a dedicated airflow meter, vacuum gauge, gate valve, and shut-off valve located on the manifold.

A Tuthill 7018-21L2 CP Series 2 lobe positive displacement blower or equivalent capable of delivering the design flow rate and pressure of 800 scfm at approximately 142 inches of water column will be utilized as the SVE blower. The blower will be equipped with a variable frequency drive to adjust blower speed and maintain the appropriate vacuum and flow rate to save power and maintain the desired area of influence.

Additional details are provided in the design drawings (**Appendix C**).

5.4.9 Soil Vapor Extraction Condensate Water Recovery and Disposal

Water collected in the air/water separator will be pumped to a 400-gallon poly tank located inside the equipment container. Water will be transferred to the existing CATS (if operating) or sampled for waste characterization and profiling for proper management and disposal. Based on operational experience and pilot test results, the collection of significant amounts of water during operation of the SVE system is not expected.

5.4.10 SVE System Air Treatment

Based on air data collected during the 2017 pilot test, total daily hazardous air pollutants (HAPs) discharged by the SVE system are expected to be approximately 4.25 lbs/day. SVE system air discharge calculations are provided in **Appendix B**. Vapor-phase granular activated carbon (VGAC) units have been incorporated into the SVE system for treatment of SVE system effluent vapors. VGAC units are sized for an adequate residence time and air velocity of less than 50 feet per minute. Two Carbon Supply Inc. CSI-V3000 (or equivalent) 3,000 lb VGAC units will be installed in series to provide air treatment. Based on operational experience in Alabama with similar sized systems, an ADEM air permit likely will not be required; however, ADEM Form 448 (Air Division Remediation Approval Form) will be submitted to ADEM for review.

The VGAC units will be maintained at the site for at least 30 days and remain operational until analytical sampling of the influent air (prior to treatment) indicates that air emissions of total HAPs are consistently below the limits specified by the ADEM Air Division. A discharge stack of at least 15 feet in height will be installed away from any potential Site receptors. Spent GAC will be profiled and will be regenerated and recycled or disposed off site at a licensed facility, as required.

5.4.11 Control Systems

To maintain maximum runtime, programmable logic controllers (PLC) will be used to provide system monitoring and control. A computer-based human-machine interface (HMI) running control software will be connected to the on-site PLC and will allow the user to perform the following actions:

- Start and stop the system automatically based on alarm conditions;
- Reset alarms;
- View the alarm history;
- Stop the AS compressor if the SVE system falls below a preset vacuum;
- Start and stop the AS compressor and SVE blower; and
- View system data, such as pressures and air flows.

The control systems will be equipped with a high-temperature alarm, low-vacuum alarm, and high-pressure alarm that will shut down the compressor and blower if the system is operating outside of preset values. Additional alarms, such as valve position and motor failure to start, will also be used to shut down the compressors, if required.

The PLC will be programmed to allow cyclic operation of the individual air sparge zones. Hour and amperage meters will be installed for the major components to provide analysis of system runtime.

The HMI will utilize an internet connection to allow for remote control and monitoring of the systems. The HMI will also notify the operator through email or text message if a failure/alarm condition occurs.

The control panels will be located inside the equipment container and the main electrical disconnect will be located outside the container so that it is easily accessible. The control panels will be UL-certified and housed in properly rated National Electrical Manufacturers Association enclosures.

Additional details are provided in the design drawings (**Appendix C**).

5.4.12 AS/SVE System Construction and Implementation

An Alabama-licensed drilling contractor will install all AS, SVE, and temporary observation wells. The drilling contractor will be responsible for obtaining any required well construction permits. Arcadis will obtain any electrical, mechanical, structural, and/or building permits required by the local municipality, county, and/or State of Alabama to perform this work. Installation of AS/SVE wells will require approximately 3 weeks, and installation of equipment and infrastructure on site will require approximately 5 weeks. Additionally, the procurement, construction, and delivery of a fully operational equipment container will require approximately 16 weeks. Arcadis expects that the Phase II AS/SVE system well installation, construction, and implementation will be completed between February and June 2018.

5.4.13 AS/SVE System Startup

Prior to the AS/SVE system startup, the AS/SVE system will be commissioned. During commissioning, the system will be tested to confirm that all equipment operates as intended. Motors will be checked for rotation, system instruments will be checked for proper operation, and all system interlocks and alarms will be tested. Initial operation of equipment will be conducted in accordance with the manufacturer's recommendations.

Following system commissioning, AS/SVE system startup activities will commence and take place over a 3-day period. The following activities will be conducted at least daily during startup:

- System compound readings including electric meter reading, compressor operating hours, flow, temperature, and pressure throughout the system will be recorded;
- Flow rate and pressure at each AS and SVE well will be recorded and adjusted;
- Depth to water, DO concentration, pressure and observations will be recorded from performance monitoring wells including POC-10RU, POC-13RU, PM-01U, PM-01M, PM-02U and PM-02M;
- Headspace monitoring will be conducted with a flame ionization detector (FID) for upper zone monitoring wells with an exposed screen interval to the Vadose Zone (i.e., temporary wells PM-01U and PM-02U);
- Volume of recovered fluids from the SVE system will be recorded;
- Monitoring of SVE system influent, VGAC midpoint and effluent (discharge) utilizing a, FID will be performed; and
- Noise caused by the remediation system will be evaluated to ensure that noise abatement devices are functioning properly.

During system startup, fine tuning and adjustments (e.g., SVE and AS air flow rates, operating time cycles) will be made to the systems as needed, based on the data collected. These fine-tuning adjustments are intended to maximize the performance of the remediation system.

Vapor analytical samples will be collected once during startup from the SVE system influent, VGAC midpoint, and effluent (discharge) and analyzed for VOCs using USEPA Method TO-15.

If condensate or water is recovered in the SVE system air/water separator during startup it will be sampled and characterized for the development of a waste profile.

5.4.14 AS/SVE System Operation, Maintenance, and Monitoring

Arcadis personnel will conduct OM&M of the proposed remediation system as required to keep the equipment operating efficiently. OM&M events will be conducted weekly for the first 3 weeks of operation following startup and monthly thereafter. During each OM&M event, personnel will inspect equipment and conduct routine preventive maintenance. Monitoring data and system adjustments will be made, as needed.

The following activities will be performed during the weekly and monthly OM&M events:

- System compound readings including electric meter reading, compressor operating hours, flow, temperature, and pressure throughout the system will be recorded;
- Flow rate and pressure at each AS and SVE well will be recorded;
- Depth to water, DO concentration, pressure and observations will be recorded from performance monitoring wells including POC-10RU, POC-13RU, ASPM-01U, ASPM-01M, ASPM-02U and ASPM-02M;
- Headspace monitoring will be conducted with an FID for upper zone monitoring wells with an exposed screen interval to the Vadose Zone (ASPM-01U and ASPM-02U) for the first quarter; after data are collected, wells and frequency will be evaluated;
- Volume of recovered fluids from the SVE system will be recorded;
- SVE system influent, VGAC midpoint, and effluent (discharge) will be monitored utilizing an FID;
- Vapor samples will be collected from the SVE system influent, VGAC midpoint, and effluent (discharge) for analysis by EPA Method TO-15 for VOCs; and
- Preventive and corrective maintenance will be performed as required.

During OM&M visits, fine tuning and adjustments will be made to the system as needed, based on the data collected. The field data collected during each event, modifications to the operational profile of the remedial system, and repairs to the system will be provided on a Site-specific OM&M checklist.

Analytical results of the SVE system influent, VGAC midpoint, and effluent (discharge) will utilized to determine mass recovery and condition of the VGAC vessels (i.e. if GAC replacement is required). Based on analytical data collected during the first quarter of operation, a reduction to a quarterly sampling frequency may be requested. Further, based on analytical data collected, operation of the VGAC units may not be required to meet discharge limits for air. If analytical data collected from the SVE system influent show concentrations of HAPs below discharge limits for 3 consecutive months, removal of the VGAC units will be requested at that time.

5.5 Existing Extraction Well and CATS Operation

The selected Phase II containment technology will be AS/SVE; therefore, the CATS will not be required once the Phase II AS/SVE system is fully operational. As presented in the Final Permit Determination (ADEM 2017), the CATS will operate until the Phase II AS/SVE plume containment curtain and in-situ source treatment are implemented, constructed, and fully operational and demonstrated to be effective via performance monitoring of the EFF and BDY monitoring well systems. Operation of the CATS will be suspended but the CATS will remain at the Site should it be needed for contingency following implementation and effectiveness monitoring of the Phase II corrective actions.

During Phase II implementation and construction, the CATS will be used to continually pump groundwater from two 80-foot-deep extraction wells (RW-4 and RW-5) to maintain hydraulic control of the COC plume. Two extraction wells are required due to elevated iron concentrations in the groundwater; when production from one well decreases due to iron fouling, the other well is brought online to maintain hydraulic capture while the other extraction well is rehabilitated.

During pumping activities, elevated dissolved iron levels present in the Site groundwater, in combination with probable dewatering of the well screen, are leading to the generation and accumulation of iron oxide solids within the extraction well conveyance piping and CATS. These solids require routine maintenance in order to maintain proper flow from the extraction pump and within the conveyance piping. Routine maintenance activities and frequencies will continue during Phase II construction and implementation to include:

- Removing and acid rinsing extraction well pumps every 6 months.
- Pigging extraction well conveyance line every 2 months to remove accumulated solids using a permanently installed pigging system; following extraction well conveyance line pigging, precipitated iron is mobilized into the treatment system, requiring more frequent filter change outs.
- Periodic replacement of 60-foot section of pipe due to iron fouling that the permanent pigging system cannot access.
- Frequent bag filter replacements due to inefficient precipitated iron removal in upstream process operations; the current replacement frequency is:
    - First Stage (200-micron bag filters) – replaced every 4 to 5 days.
    - Second Stage (25-micron bag filters) – replaced every 6 to 10 days.
    - Third Stage (3-micron cartridge filters) – replaced every 10 to 14 days.

5.6 Leachate Collection System

The leachate from the Landfill will continue to be managed as currently approved in the RCRA Permit. Leachate is collected in a system that holds the leachate until it is pumped to the on-site AST. After being transferred to the AST, the leachate is then transferred off site for disposal. The accumulation volumes of the leachate vary based on seasonal rainfall. The secondary containment structure for the leachate tank was recently repaired and upgraded in January 2018 to include repair of two hairline cracks in the

concrete containment and recoating of the exterior, interior, and floor with an epoxy chemical resistant coating. The results of the most recent leachate characterization are provided in **Appendix D**.

6 CONTINGENCY PHASE II MODIFICATIONS

In addition to the Phase II corrective actions, the remedial system may be modified under a contingency correction action. The contingencies discussed in the following sections were approved in the Final Permit Determination issued on April 19, 2017. These contingencies will only be implemented if the combined multi-technology corrective action approach described in **Section 5** is determined to be ineffective. Implementation of any contingency proposed in **Section 6** will require notification to ADEM and modification of the RCRA Permit.

6.1 Treatment System Modifications

The treatment system may be modified under a contingency scenario to include chemical amendments, if necessary. In addition, changes may be made to the treatment process.

6.1.1 Chemical Amendments

To address iron oxide issues in the groundwater treatment system discussed in **Section 5.3.1**, chemical amendments may be injected in the process stream. The amendments that will be commonly used include sequestering agents, biomass-dispersing surfactant, and/or biocides that are safe for injection through injection wells at relatively low concentrations. Given the complex nature of iron fouling and the high concentration of iron oxide present at the Site, field testing of chemical amendments will be conducted to provide a cost-effective amendment injection and dosing strategy. Prior to testing the chemical amendments, the existing UIC Permit will be modified to include the selected chemical amendments and the dosing concentrations.

This process includes using chemical-feed pumps to inject amendments in the water treatment process stream at desired locations. The amendments will be delivered to the Site and stored in either 55-gallon drums or 340-gallon totes inside the existing treatment system secondary containment. Several field tests will be conducted in order to obtain the optimum amendment formulations and concentrations. Each test will be operated for approximately 2 weeks. The change in pressures over time in the particulate filters and the GAC and the water flow rate will be monitored during the testing period. These data will be used to determine the optimum amendment formulation and dosing.

6.1.2 Process Changes

To further enhance the groundwater treatment process, the following changes may be implemented as necessary:

- Install pressure and differential pressure transmitters throughout the process stream. The pressure transmitters could be viewed remotely via telemetry. This modification will inform the system operator when particulate filter changes are necessary.

- Install a pH transmitter to the process stream. This addition will allow remote monitoring of the pH of the groundwater prior to injection.
- Install up to three cameras that can be viewed remotely through the Internet. The cameras would be installed in locations that can easily observe the Landfill and both of the secondary containment structures. These cameras would eliminate the need for Site visits during weekends to view the fence line of the Landfill.
- Install a parallel water stream between the ASU and the GAC. This stream would include particulate filters similar to the existing particulate filters and would allow additional flexibility in system operation.

6.2 Groundwater Extraction in High-Concentration Areas

Groundwater extraction could be conducted from up to six contingency extraction wells that could be installed as necessary to extract groundwater in the high-concentration CT and CF areas identified during the 2015 groundwater investigation. These extraction wells would be located in the former Wash Rack Area, the former underground storage tank (UST) area, and near the locations of VAP-7, VAP-15, VAP-16, and VAP-29 (**Figures 3-2** and **3-4**). The groundwater data collected during the 2015 investigation indicated that these areas have elevated concentrations of CT and CF. Extraction wells would recover groundwater at significantly higher CT and CF concentrations and lower flow rates compared to recovery wells RW-4 and RW-5 and may be sufficient to capture the dissolved-phase CT and CF at the Site.

Contingency extraction wells would be operated for a period of up to 1 year while RW-4 and RW-5 are operating. The flow rate from RW-4 or RW-5 would be reduced by the amount of groundwater being extracted from the proposed well. For example, if the total flow rate from the contingency extraction well is 30 gpm, the flow rate from the existing hydraulic containment wells would be reduced by 30 gpm. During this period, data would be collected and evaluated in order to determine whether dissolved-phase CT and CF plumes are being captured. If it is determined that the contingency extraction wells are containing the dissolved-phase plume, RW-4 and RW-5 will be shut off and the existing treatment system would be used to treat the groundwater. Initially, the treated water would continue to be discharged into the six existing injection wells; however, as discussed below, additional injection wells may be installed to enhance groundwater containment.

RW-4 and RW-5 will be maintained and kept ready to be restarted if monitoring data show that the dissolved-phase CT and CF are not hydraulically contained with the contingency extraction wells.

6.2.1 Aquifer Tests

Aquifer testing would be conducted on the contingency extraction wells. The aquifer tests would include step drawdown tests and groundwater pumping tests that would be conducted for up to 72 hours. The data collected from the aquifer tests will be used to calculate the specific capacity and efficiency of the extraction well, the hydraulic conductivity and transmissivity of the aquifer, and the projected capture zone. These parameters will be used to optimize the performance of each contingency well. During the aquifer tests, groundwater will be pumped from extraction wells and treated using the existing treatment system. Observation wells would be installed approximately 10 and 25 feet from the extraction wells.

These wells would be used to monitor the drawdown during the aquifer tests. In addition, appropriate samples would be collected from the groundwater extraction wells and the monitoring wells.

6.2.2 Contingency Extraction Well Details

To target shallow high-concentration CT and CF areas, extraction wells may be installed in the Wash Rack, UST, VAP-07, and VAP-15 areas. The wells would be constructed of 6-inch-diameter PVC and would be screened from approximately 25 to 40 feet bgs. The top of the screened interval of these extraction wells would be installed approximately 5 feet below the groundwater surface to reduce the potential of iron oxide forming in the unsaturated screened interval. Based on the lithology observed during the 2015 investigation, Arcadis projects that the groundwater extraction rate from each of these wells will be up to 15 gpm.

To target high concentrations of CF in the intermediate zone, extraction wells may be installed near VAP-16 and VAP-29. The wells would be constructed of 6-inch-diameter PVC. The screened interval of the proposed extraction well near VAP-16 would be from 35 to 50 feet bgs. The extraction well near VAP-29 would be screened from approximately 40 to 50 feet bgs. Arcadis projects that the groundwater extraction rate from each of these wells will be up to 10 gpm.

6.3 Contingency Groundwater Injection Wells

To further enhance hydraulic containment of dissolved-phase CT and CF at the Site, injection wells may be installed at strategic locations around the dissolved-phase plume. The injection wells would be installed to increase and enhance hydraulic recovery of COCs at the extraction locations discussed in **Section 6.2.2**. The contingency injection wells would be installed after it is determined that hydraulic containment is achieved using the contingency extraction wells. Up to four injection wells would be installed for each operating contingency extraction well at the locations provided in **Section 6.2.2**. The exact locations of contingency injections wells are unknown at this time because the locations would be based on data collected from the contingency extraction wells and adjacent monitoring wells. Based on the transmissivities of the upper and intermediate zones, it is anticipated that injection wells would be installed within a 50-foot radius of each extraction well. All proposed injection well locations would be provided to the ADEM for review in a work plan, and the existing RCRA and UIC Permits would be modified accordingly to include the number, locations, and construction of the contingency injection wells.

6.4 Air Sparging and Soil Vapor Extraction in High-Concentration Areas

The AS and/or SVE technologies may be implemented in the high dissolved-phase concentration areas of the Site. The AS and/or SVE system would be designed based on the results of the pilot tests discussed in **Section 5.2**. The number of AS and SVE wells would be based on the estimated ROI and the area of groundwater to be treated. An AS system would be used in conjunction with a SVE system. Air extracted with the SVE system would be treated using an appropriate technology (i.e., GAC, thermal oxidation, catalytic oxidation, or a condensation process) under an appropriate air permit. In addition, SVE wells may be installed in the high-concentration areas to treat CT- and CF-affected soil in the vadose zone.

7 SCHEDULE AND REPORTING

The following schedule is presented for completion of the Phase II CAP. This schedule assumes work will begin on January 1, 2018. ADEM will be notified in writing at least 15 days prior to implementing the field activities. The CAP certification of completion report is anticipated to be submitted to the ADEM by December 2018.

Phase II Corrective Action Schedule

Month and Year	In-Situ Source Treatment	AS/SVE	CATS	RCRA Permit Corrective Action
December 2017	Design & Procurement	Design	Operate & Maintain	Corrective Action Compliance. Implement Phase II in accordance with April 19, 2017, Permit Modification
January 2018		Design, and procurement of AS/SVE equipment	Operate & Maintain	
February 2018	Logistics, Mobilization, Procure EHC™ & Field Readiness	AS/SVE well installation & submittal of ADEM Form 448	Operate & Maintain	Corrective Action Compliance. Implement Phase II in accordance with April 19, 2017, modification Submit Permit Renewal Application (February 2018)
March 2018		Construction & installation of infrastructure and AS/SVE equipment	Operate & Maintain	
April 2018	On-site injections & effectiveness/ performance monitoring		Operate & Maintain	
May 2018			Operate & Maintain	
June 2018		AS/SVE curtain fully operational	Operate & Maintain	
July 2018	Effectiveness/ performance monitoring	Operate and maintain AS/SVE curtain; effectiveness/ performance monitoring	CATS will be suspended and maintained should it be needed as contingency per **Section 6**.	
August 2018				Renewed RCRA Permit Issued
September 2018				Corrective Action Compliance. Continue Phase II in accordance with renewed permit. Corrective Action Construction Completion Certification Report.
October 2018				
November 2018				
December 2018				

8 COST ESTIMATE

Feasibility costs were developed for the implementation of the proposed corrective actions. The costs are provided for the Phase I and Phase II source area injection activities based on the current layouts presented on **Figure 5-1**. Separate costs have been provided for each of the possible containment strategies, AS/SVE barrier wall presented on **Figure 5-1,** and the contingency source-zone treatment and modified CATS presented on **Figure 5-2**, if needed. Additionally, the costs associated with groundwater monitoring, annual inspections, and post-closure maintenance have been included to provide complete life-cycle cost developed in accordance with USEPA guidance (USEPA 2000), engineering experience with comparable sites, and previous project costs. The probable cost estimates were prepared with an anticipated accuracy range of plus 30 percent to minus 50 percent. All of the cost tables are provided in **Appendix E**.

9 REFERENCES

ADEM. 2017. Final Permit Determination. April 19.

AFCEE. 2005. *Geostatistical Temporal/Geospatial (GTS) Algorithm Software for Optimization of Long-Term Monitoring Networks*. Version 0.6, developed by the AFCEE. June.

Arcadis. 2015a. High Resolution Site Characterization Report. April 10.

Arcadis. 2015b. High-Resolution Site Characterization Work Plan. January 6.

Arcadis. 2017. Phase I Corrective Action Evaluation Report. December 7.

USEPA. 2000. A Guide to Developing and Documenting Cost Estimates During the Feasibility Study. OSWER 9355.0-75. July.

PELA. 1985. Groundwater Assessment On Site of Redwing Facility (PELA NO. 456400), February.

TABLES

Table 2-1
Constituents of Concern and Groundwater Protection Standards
Corrective Action Plan
Rentokil Initial Environmental Services, LLC
Creola, Alabama

Hazardous Constituent	Unit	Concentration Limit (mg/L)
2-Butanone	Entire Facility	0.7
Benzene	Entire Facility	0.005
Cadmium	Entire Facility	0.005
Carbon Disulfide	Entire Facility	0.1
Carbon Tetrachloride	Entire Facility	0.005
Chloroform	Entire Facility	0.08
Chromium	Entire Facility	0.1
1, 1 Dichloroethane	Entire Facility	0.081
1,2 D1chloroethane	Entire Facility	0.005
Dinoseb	Entire Facility	0.007
Lead	Entire Facility	0.015
Mercury	Entire Facility	0.002
1,1,1,2 Tetrachloroethane	Entire Facility	0.00043
Tetrachloroethene	Entire Facility	0.005

From Table III.3 of the Post-Closure Permit Final Permit Determination dated April 19, 2017.

Table 4-1
Monitoring Well Network
Corrective Action Plan
Rentokil Initial Environmental Services, LLC
Creola, Alabama

ARCADIS Design & Consultancy for natural and built assets

Well ID	Well Status	Well Type	Longitude	Latitude	Well Depth (ft)	Screen Interval	Ground Elevation (ft MSL)	Top of the Riser (ft MSL)	Monitoring
BKG-16SRU	New	BKG Well	88.038296	30.912394	35.00	15.00	37.70	37.70	Annual Monitoring for VOCs, Metals, and Dinoseb
POC-1RU	New	POC Well	88.039054	30.910551	35.00	15.00	41.20	44.44	
POC-5RU	New	POC Well	88.039422	30.911156	35.00	15.00	42.80	46.49	
POC-10RU	New	POC Well	88.039203	30.909915	35.00	15.00	41.78	45.08	
POC-13RU	New	POC Well	88.039772	30.910392	35.00	15.00	37.30	41.07	
BDY-32U	TW-32U	BDY Well	88.041566	30.910161	40.00	15.00	22.71	25.71	
BDY-32M	TW-32M	BDY Well	88.041571	30.910131	85.00	15.00	22.94	25.94	
BDY-32L	TW-32L	BDY Well	88.041562	30.910203	132.00	15.00	26.52	26.52	
BDY-28RU	New	BDY Well	88.036726	30.909286	45.00	15.00	35.30	39.09	
BDY-28RM	New	BDY Well	88.036625	30.909304	60.00	15.00	33.60	37.51	
BDY-29RU	New	BDY Well	88.038890	30.906274	45.00	15.00	29.10	32.61	
BDY-29RM	New	BDY Well	88.038945	30.906279	60.00	15.00	28.80	32.45	
MCN-6D	TW-6D	Upper Miocene PRG Well	88.039325	30.910327	160.00	30.00	41.74	42.63	
MCN-8	TW-8	Upper Miocene PRG Well	88.038569	30.911298	155.00	30.00	35.30	36.34	
EFF-101U	New	New Injection Test EFF Well	88.039221	30.911880	35.00	10.00	36.50	39.93	Semiannual Monitoring for VOCs and Metals and Annual Monitoring for Dinoseb
EFF-101M	New	New Injection Test EFF Well	88.039175	30.911828	50.00	10.00	36.30	39.76	
EFF-102U	New	New Injection Test EFF Well	88.038236	30.910338	35.00	10.00	38.20	41.83	
EFF-103U	New	New Injection Test EFF Well	88.038246	30.910281	50.00	10.00	38.80	42.48	
EFF-103M	New	New AS/SVE EFF Well	88.038279	30.910290	35.00	10.00	38.80	42.74	
EFF-2RU	New	Replacement Well	88.038840	30.911007	50.00	10.00	37.20	40.90	
EFF-33U	New	EFF Well Based on VAP	88.037979	30.910255	35.00	10.00	37.00	41.13	Semiannual Monitoring for VOCs and Metals and Annual Monitoring for Dinoseb Semiannual Monitoring for Corrective Action Effectiveness MNA Parameters (nitrate, sulfide, chloride, carbon dioxide[gas], hydrogen [gas], and BTEX) per USEPA Region 4 *Suggested Practices for Evaluation of a Site for Natural Attenuation of Chlorinated Solvents.*
EFF-33M	New	EFF Well Based on VAP	88.037938	30.910277	50.00	10.00	36.50	40.30	
EFF-34U	New	EFF Well Based on VAP	88.038537	30.909499	35.00	10.00	39.80	43.82	
EFF-34M	New	EFF Well Based on VAP	88.038590	30.909527	50.00	10.00	40.10	44.15	
EFF-35U	New	EFF Well Based on VAP	88.040185	30.910160	35.00	10.00	39.50	43.23	
EFF-35M	New	EFF Well Based on VAP	88.040249	30.910137	50.00	10.00	39.70	42.72	
EFF-36U	New	EFF Well Based on VAP	88.039049	30.908686	35.00	10.00	39.40	42.89	
EFF-36M	New	EFF Well Based on VAP	88.039042	30.908780	45.00	10.00	39.30	43.09	
EFF-37U	New	EFF Well Based on VAP	88.040950	30.908893	45.00	10.00	47.90	51.75	
EFF-37M	New	EFF Well Based on VAP	88.040997	30.908902	55.00	10.00	50.20	53.36	
EFF-1	FIW-1	EFF Well Retained	88.038099	30.912306	35.00	10.00	UNK	39.19	
EFF-3	FIW-3	EFF Well Retained	88.038471	30.912000	37.00	10.00	UNK	37.54	

Table 4-1
Monitoring Well Network
Corrective Action Plan
Rentokil Initial Environmental Services, LLC
Creola, Alabama

Well ID	Well Status	Well Type	Longitude	Latitude	Well Depth (ft)	Screen Interval	Ground Elevation (ft MSL)	Top of the Riser (ft MSL)	Monitoring
EFF-21UR	TW-21UR	EFF Well Retained	88.037604	30.910997	16.00	5.00	37.80	42.66	Semiannual Monitoring for VOCs and Metals and Annual Monitoring for Dinoseb Semiannual Monitoring for Corrective Action Effectiveness MNA Parameters (nitrate, sulfide, chloride, carbon dioxide[gas], hydrogen [gas], and BTEX) per USEPA Region 4 *Suggested Practices for Evaluation of a Site for Natural Attenuation of Chlorinated Solvents.*
EFF-21M	TW-21M	EFF Well Retained	88.037617	30.910994	54.00	10.00	37.80	40.65	
EFF-21L	TW-21L	EFF Well Retained	88.037617	30.910983	93.00	10.00	37.80	40.72	
EFF-22U	TW-22U	EFF Well Retained	88.040598	30.910938	36.0	10.00	43.42	47.61	
EFF-22M	TW-22M	EFF Well Retained	88.040623	30.910921	67.00	10.00	44.44	47.75	
EFF-22L	TW-22L	EFF Well Retained	88.040642	30.910902	48.38	10.00	44.70	48.38	
EFF-23U	TW-23U	EFF Well Retained	88.040641	30.909032	33.00	10.00	41.65	44.21	
EFF-23M	TW-23M	EFF Well Retained	88.040626	30.909065	58.00	10.00	41.37	45.05	
EFF-23L	TW-23L	EFF Well Retained	88.040635	30.909101	86.00	10.00	41.95	45.77	
EFF-24U	TW-24U	EFF Well Retained	88.039252	30.907993	27.50	10.00	38.65	42.18	
EFF-24M	TW-24M	EFF Well Retained	88.039220	30.907993	62.00	10.00	38.62	42.42	
EFF24LR	TW-24LR	EFF Well Retained	88.039265	30.908024	92.00	15.00	38.95	42.08	
EFF-25U	TW-25U	EFF Well Retained	88.037388	30.908760	27.00	10.00	38.12	41.34	
EFF-25M	TW-25M	EFF Well Retained	88.037362	30.908760	68.00	10.00	38.17	41.19	
EFF-25L	TW-25L	EFF Well Retained	88.037337	30.908757	82.00	10.00	38.17	41.46	
EFF-31RM	TW-31M	Replacement Well	88.041612	30.908559	55.00	10.00	46.00	49.65	
EFF-31 RU	TW-31S	Replacement Well	88.041572	30.908552	45.00	10.00	45.80	49.70	
MCN-4D	TW-4D	Upper Miocene PRG Well	88.039117	30.911791	140.00	25.00	35.69	36.20	Annual sampling for Metals and VOCs is required if the “M” or “L” well (as designated in the “Well ID” column) in the nearest EFF well cluster indicates VOC and/or metal concentration in groundwater at or above the GWPS
MCN-16D	TW-16D	Upper Miocene PRG Well	88.038266	30.912410	120.00	20.00	38.59	42.06	
MCN-27D	TW-27D	Upper Miocene PRG Well	88.036033	30.912285	150.50	40.00	41.70	44.55	
MCN-28D	TW-28D	Upper Miocene PRG Well	88.036696	30.909318	130.00	30.00	34.70	37.81	
MCN-30D	TW-30D	Upper Miocene PRG Well	88.037308	30.911114	150.00	30.00	38.23	40.48	
MCN-31D	TW-31D	Upper Miocene PRG Well	88.041615	30.908624	169.00	30.00	46.61	49.61	
R4	RCY	Recovery Well Retained	88.040037	30.908741	81.00	70.00	34.70	36.70	Constituents listed in Table III.3
R5	RCY	Recovery Well Retained	88.039920	30.908802	85.00	70.00	36.50	37.72	

Abbreviations:

BDY - Boundary Monitoring Wells
BKG - Background Wells
EFF - Effectiveness Monitoring Wells
MCN - Miocene Wells
POC - Point of Compliance Wells
PRG - Program Monitoring Wells
RCY – Recovery Wells
VOC - Volatile Organic Compounds
L - Indicates that the well is screened in the lower section of the semi-confined aquifer
M – Indicates that the well is screened in the middle section of the semi-confined aquifer
U – Indicates that the well is screened in the upper section of the semi-confined aquifer

Table 5-1
Injection Performance Monitoring
Corrective Action Plan
Rentokil Initial Environmental Services, LLC
Creola, Alabama

ARCADIS Design & Consultancy for natural and built assets

Sampling Event	Monitoring Well Identification	Screened Interval (feet bgs)	Parameters		
			VOCs	NAPs[1]	Field Parameters[2]
Pre-Injection/Baseline[3]	OBS-10	25-35[4]	X	X	X
	OBS-11	25-35[4]	X	X	X
	OBS-12	25-35[4]	X	X	X
	OBS-13	25-35[4]	X	X	X
	OBS-14	25-35[4]	X	X	X
	OBS-15	25-35[4]	X	X	X
	OBS-16	25-35[4]	X	X	X
	OBS-17	25-35[4]	X	X	X
	OBS-18	25-35[4]	X	X	X
	OBS-19	25-35[4]	X	X	X
	OBS-20	25-35[4]	X	X	X
	OBS-21	25-35[4]	X	X	X
	POC-5RU	20-35	X	X	X
	EFF-21UR[5]	11-16	X	X	X
	EFF-33U[5]	25-35	X	X	X
	EFF-102U[5]	25-35	X	X	X
	EFF-103M[5]	25-35	X	X	X
During Injection[6]	OBS-10	25-35[4]			X
	OBS-11	25-35[4]			X
	OBS-12	25-35[4]			X
	OBS-13	25-35[4]			X
	OBS-14	25-35[4]			X
	OBS-15	25-35[4]			X
	OBS-16	25-35[4]			X
	OBS-17	25-35[4]			X
	OBS-18	25-35[4]			X
	OBS-19	25-35[4]			X
	OBS-20	25-35[4]			X
	OBS-21	25-35[4]			X
Post-Injection (four monthly events, one bi-monthly event)[7]	OBS-10	25-35[4]	X	X	X
	OBS-11	25-35[4]	X	X	X
	OBS-12	25-35[4]	X	X	X
	OBS-13	25-35[4]	X	X	X
	OBS-14	25-35[4]	X	X	X
	OBS-15	25-35[4]	X	X	X
	OBS-16	25-35[4]	X	X	X
	OBS-17	25-35[4]	X	X	X
	OBS-18	25-35[4]	X	X	X
	OBS-19	25-35[4]	X	X	X
	OBS-20	25-35[4]	X	X	X
	OBS-21	25-35[4]	X	X	X
	POC-5RU	20-35	X	X	X
	EFF-21UR[5]	11-16	X	X	X
	EFF-33U[5]	25-35	X	X	X
	EFF-102U[5]	25-35	X	X	X
	EFF-103M[5]	25-35	X	X	X

Notes:

[1]Natural attenuation parameters (NAPs) include total organic carbon (TOC), sulfate, total and dissolved iron, and methane.

[2]Field parameters include oxidation-reduction potential (ORP), pH, dissolved oxygen (DO), turbidity, temperature, and specific conductance.

[3]Pre-injection/baseline sampling will be performed during the spring 2018 semiannual (permit compliance) monitoring event, preliminarily scheduled to occur during April 2018.

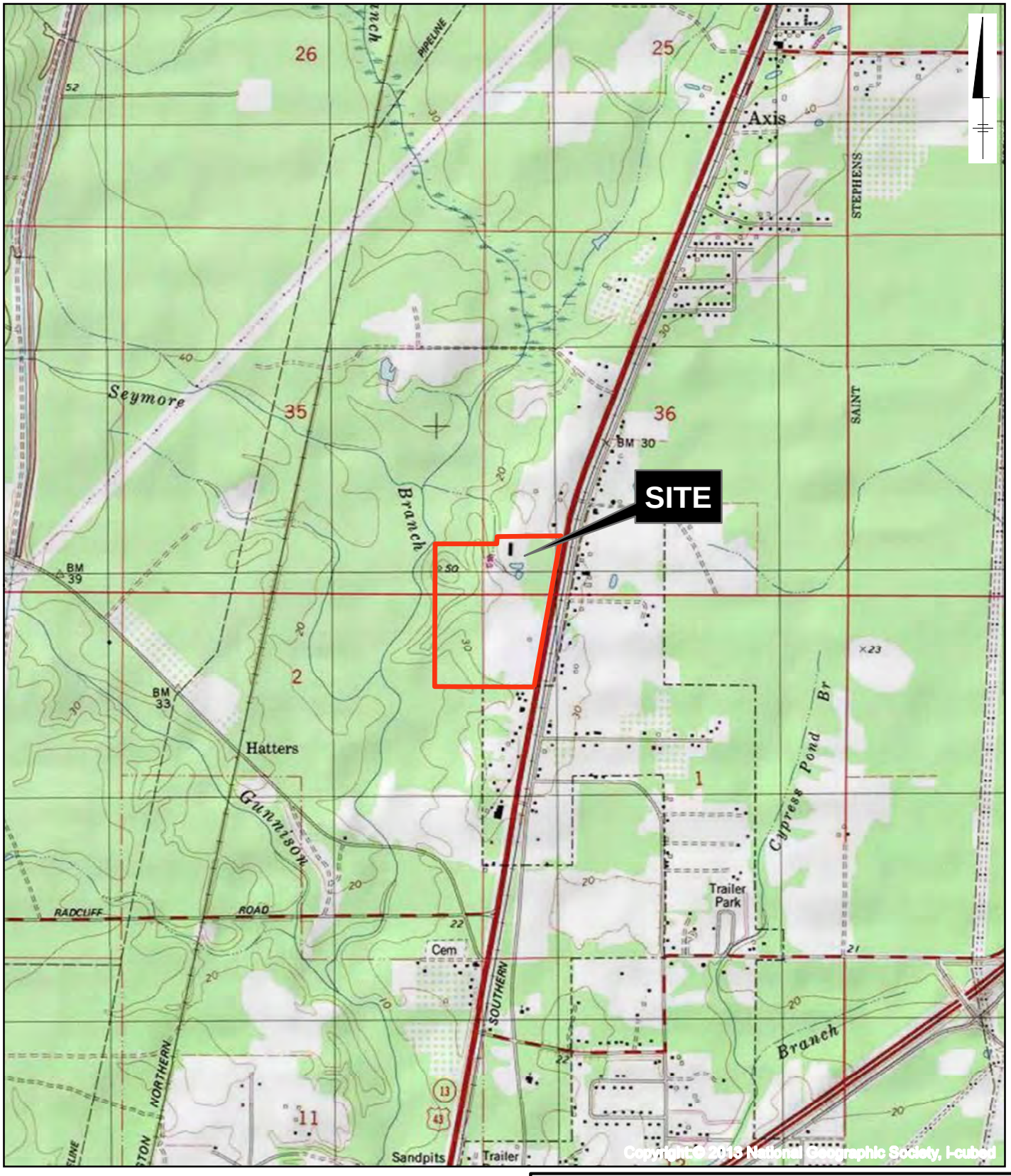
[4]The final placement of the well screens for the newly installed temporary (OBS) wells will be determined during the time of drilling and will be based on the relative depth to water and primary carbon tetrachloride/chloroform impacts observed during VAP sampling.

[5]Well already included in the semiannual (permit compliance) monitoring events.

[6]Grab sampling to be performed during injection.

[7]Post-injection monitoring to occur monthly during the 4 months following the injection event (anticipated: July 2018, August 2018, September 2018, and October 2018) and bi-monthly through the end of 2018 (anticipated: December 2018). One of the monthly post-injection events should be scheduled to occur during the same fall 2018 (permit compliance) monitoring event, pre-scheduled during October 2018.

FIGURES



0 2,000 4,000

Feet

Legend

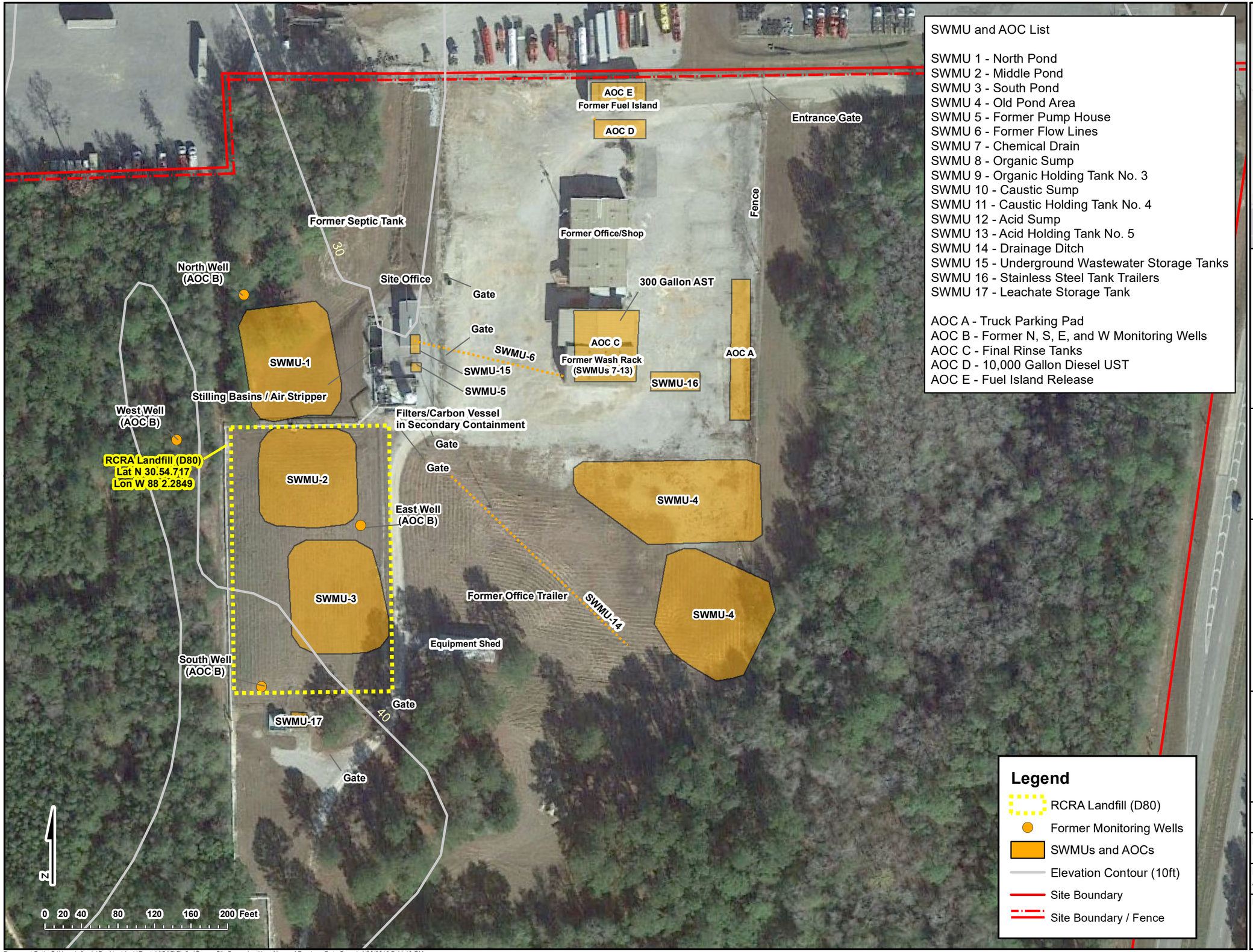
Property Boundary

RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC
CREOLA, AL

SITE LOCATION

ARCADIS

FIGURE
1-1



SWMU and AOC List

SWMU 1 - North Pond
SWMU 2 - Middle Pond
SWMU 3 - South Pond
SWMU 4 - Old Pond Area
SWMU 5 - Former Pump House
SWMU 6 - Former Flow Lines
SWMU 7 - Chemical Drain
SWMU 8 - Organic Sump
SWMU 9 - Organic Holding Tank No. 3
SWMU 10 - Caustic Sump
SWMU 11 - Caustic Holding Tank No. 4
SWMU 12 - Acid Sump
SWMU 13 - Acid Holding Tank No. 5
SWMU 14 - Drainage Ditch
SWMU 15 - Underground Wastewater Storage Tanks
SWMU 16 - Stainless Steel Tank Trailers
SWMU 17 - Leachate Storage Tank

AOC A - Truck Parking Pad
AOC B - Former N, S, E, and W Monitoring Wells
AOC C - Final Rinse Tanks
AOC D - 10,000 Gallon Diesel UST
AOC E - Fuel Island Release

Former Site Operational Areas

Rentokil Initial Environmental Services, LLC
10565 Highway 43 North
Creola, AL 36525

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BATON ROUGE, LA 70816
TEL: 225-292-1004
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Legend

- RCRA Landfill (D80)
- Former Monitoring Wells
- SWMUs and AOCs
- Elevation Contour (10ft)
- Site Boundary
- Site Boundary / Fence

PROJECT MANAGER:	CHECKED BY: PM
DRAWING BY: JWC	DATE: January 2018
PROJECT NUMBER: 03648005.2017	FIGURE NUMBER: 2-1

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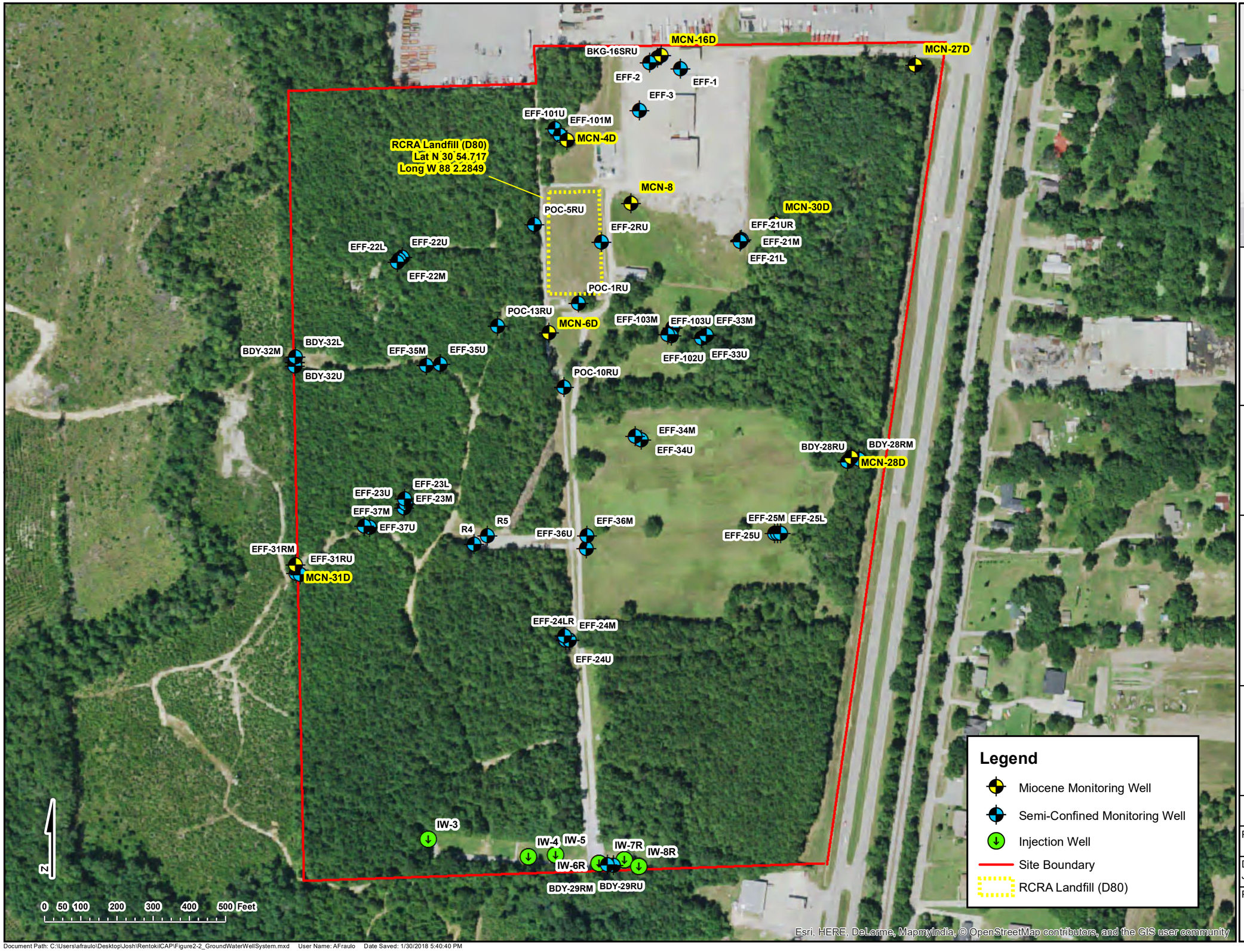

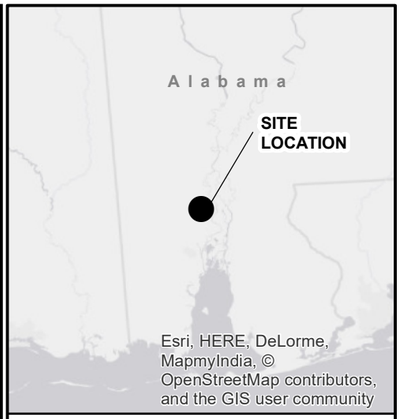

Groundwater Well System

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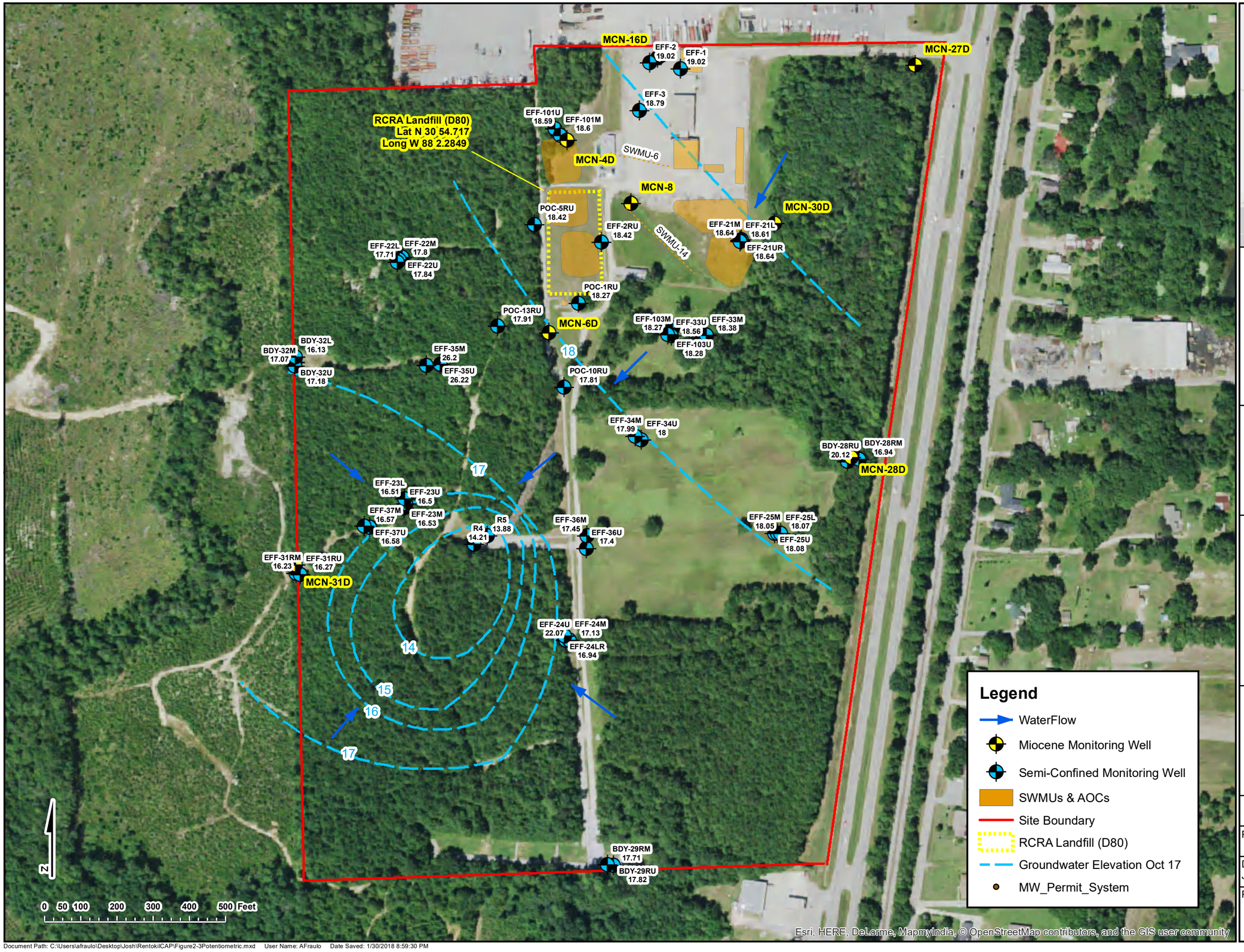

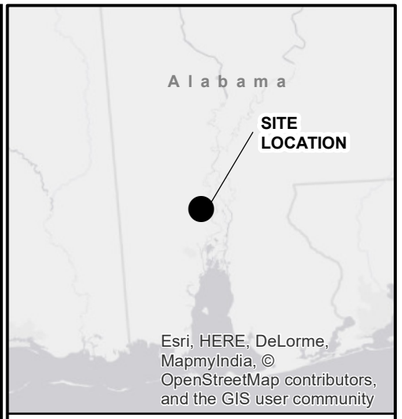

Potentiometric Surface October 2017

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PROJECT NUMBER: 03648005.2017	FIGURE NUMBER: 2-3

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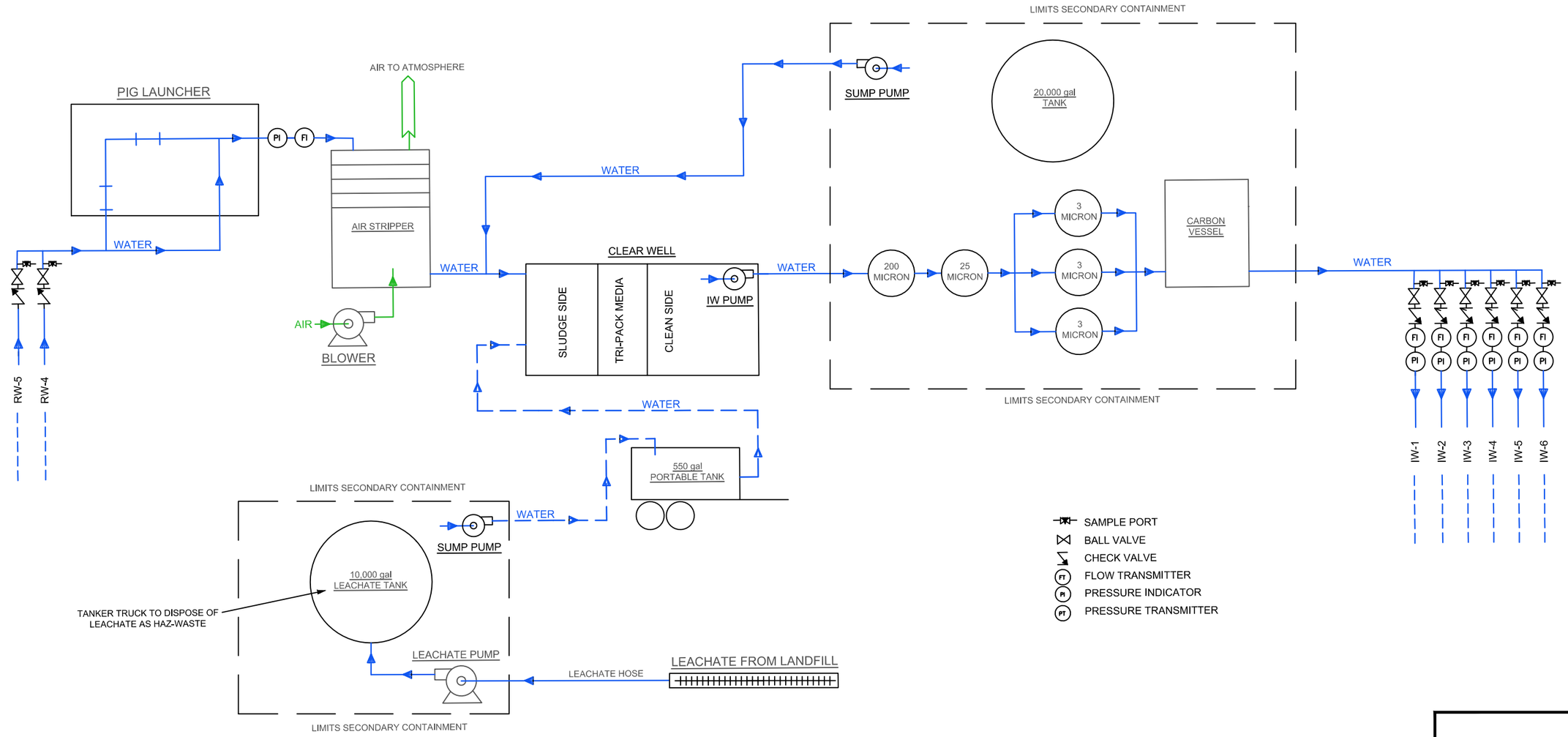

Professional Engineer

P.E.'s N□mber	State	Date Signed

NOT TO SCALE

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Project Mgr.
Designed by (KMW)
Drawn by (ALH)
Checked by (KMW)

ARCADIS

RENTOKIL • CREOLA, ALABAMA
REMEDIATION SYSTEM DRAWINGS

REMEDIATION SYSTEM PROCESS & FLOW DIAGRAM

ARCADIS Project No.
RENTOKIL.0000

Date
AUGUST 2015

ARCADIS
3522 Thomasville Rd
Tallahassee, FL 32309

2-4

CITY: DIV/GROUP: DB: LD: PIC: PM: TM: LYR:ON=*;OFF=*REF*
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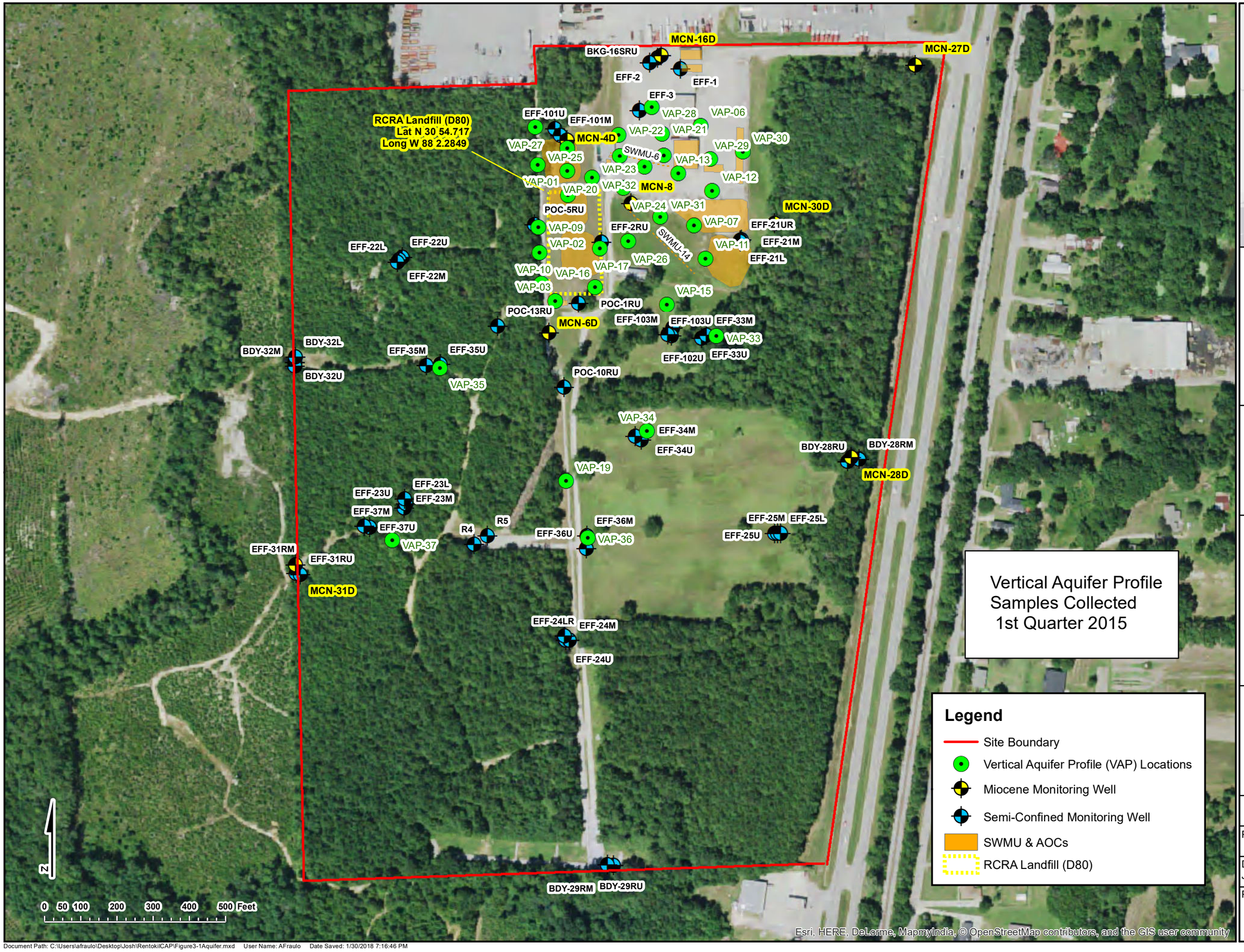

Vertical Aquifer Profile Samples Collected 1st Quarter 2015

Legend

- Site Boundary
- Vertical Aquifer Profile (VAP) Locations
- Miocene Monitoring Well
- Semi-Confined Monitoring Well
- SWMU & AOCs
- RCRA Landfill (D80)

Vertical Aquifer Profile Sample Locations

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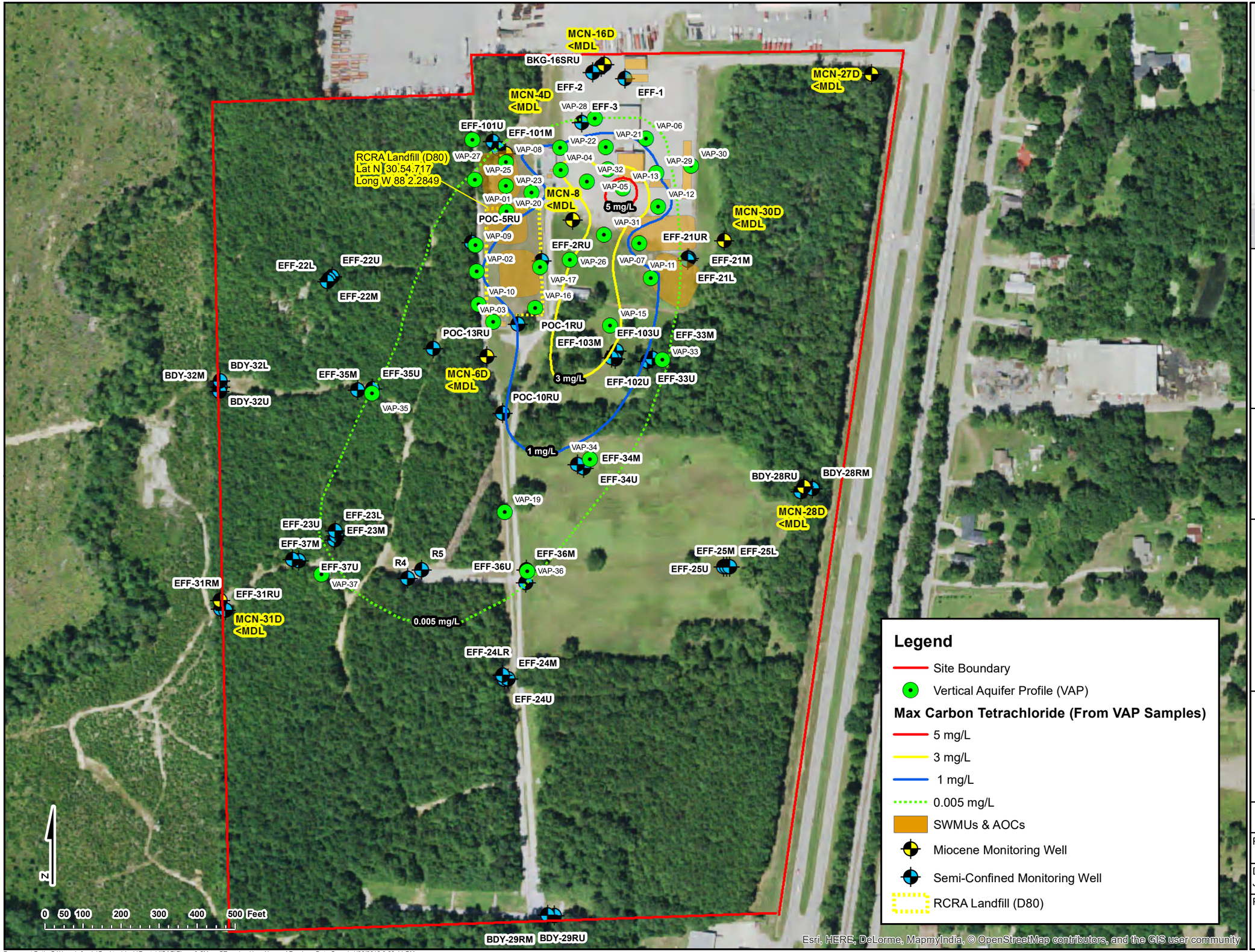

Legend

- Site Boundary
- Vertical Aquifer Profile (VAP)

Max Carbon Tetrachloride (From VAP Samples)

- 5 mg/L
- 3 mg/L
- 1 mg/L
- 0.005 mg/L
- SWMUs & AOCs
- Miocene Monitoring Well
- Semi-Confined Monitoring Well
- RCRA Landfill (D80)

Maximum Carbon Tetrachloride Concentrations in Groundwater 2015

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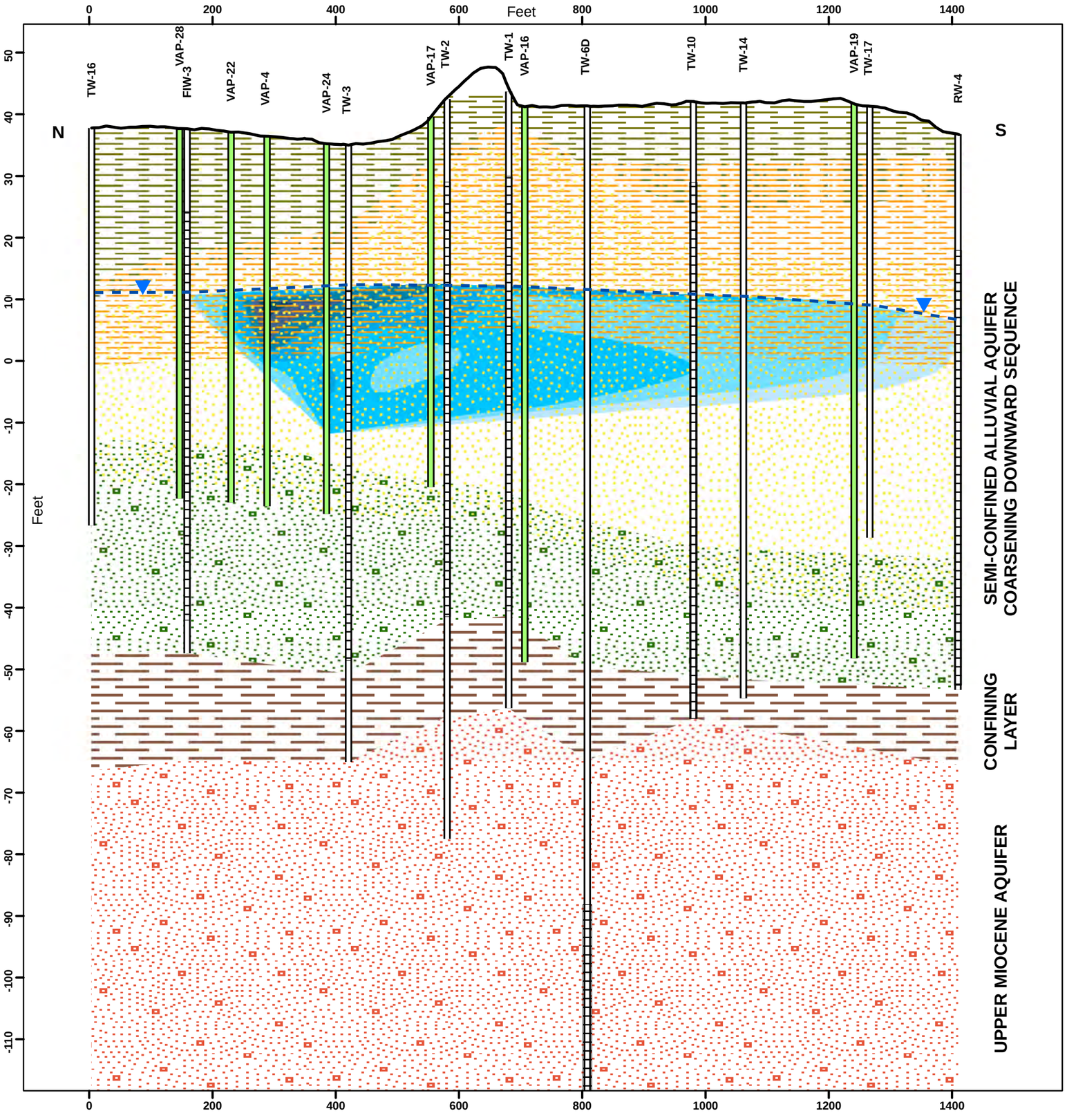


Legend

Groundwater Table - Semi-Confined Aquifer

Wells

Type

- Vertical Aquifer Profile
- Existing Well
- Existing Well Screen Interval

Hydrostratigraphic Units

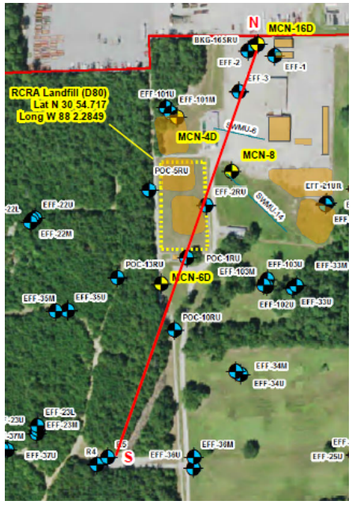
Explanation

- SANDY CLAY - SEMI-CONFINED ALLUVIAL AQUIFER
- CLAYEY SAND - SEMI-CONFINED ALLUVIAL AQUIFER
- SAND - SEMI-CONFINED ALLUVIAL AQUIFER
- SAND & GRAVEL - SEMI-CONFINED ALLUVIAL AQUIFER
- LOWER SANDY CLAY - CONFINING LAYER
- SAND AND GRAVEL - UPPER MIOCENE AQUIFER

Carbon Tetrachloride Isoconcentrations

micrograms per liter (ug/L)

- 4,000 - 4,700
- 3,000 - 4,000
- 2,000 - 3,000
- 1,000 - 2,000
- 500 - 1,000
- 100 - 500
- 5 - 100



SEE iNSERT FOR LINE OF CROSS-SECTION
CARBON TETRACHLORIDE MCL = 5 ug/L
VERTICAL EXAGGERATION = 10

RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC

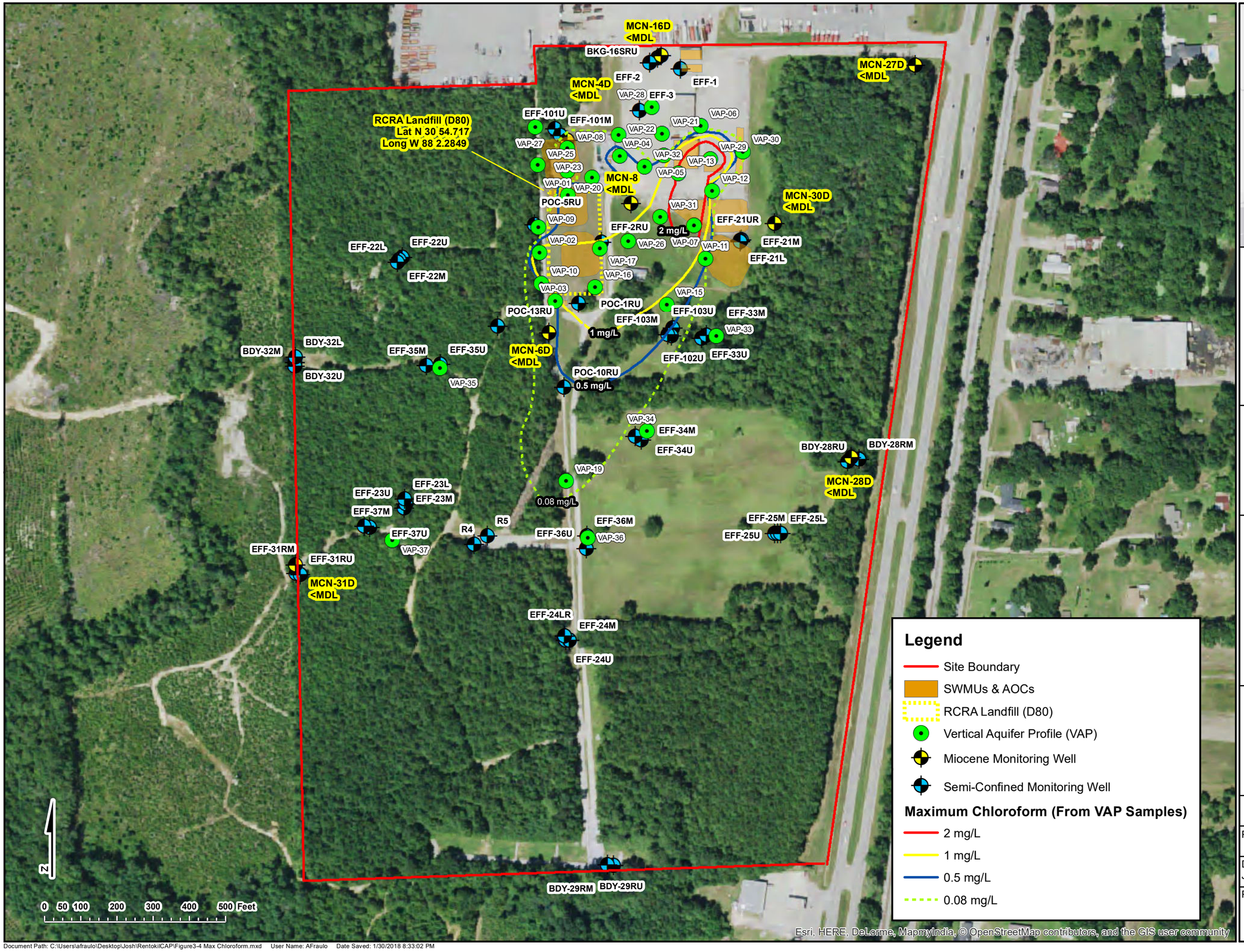
CREOLA, AL

CORRECTIVE ACTION PLAN

HYDROSTRATIGRAPHIC CROSS SECTION N-S

ARCADIS

FIGURE 3-3



Maximum Chloroform Concentrations in Groundwater 2015

Rentokil Initial Environmental Services, LLC
10565 Highway 43 North
Creola, AL 36525

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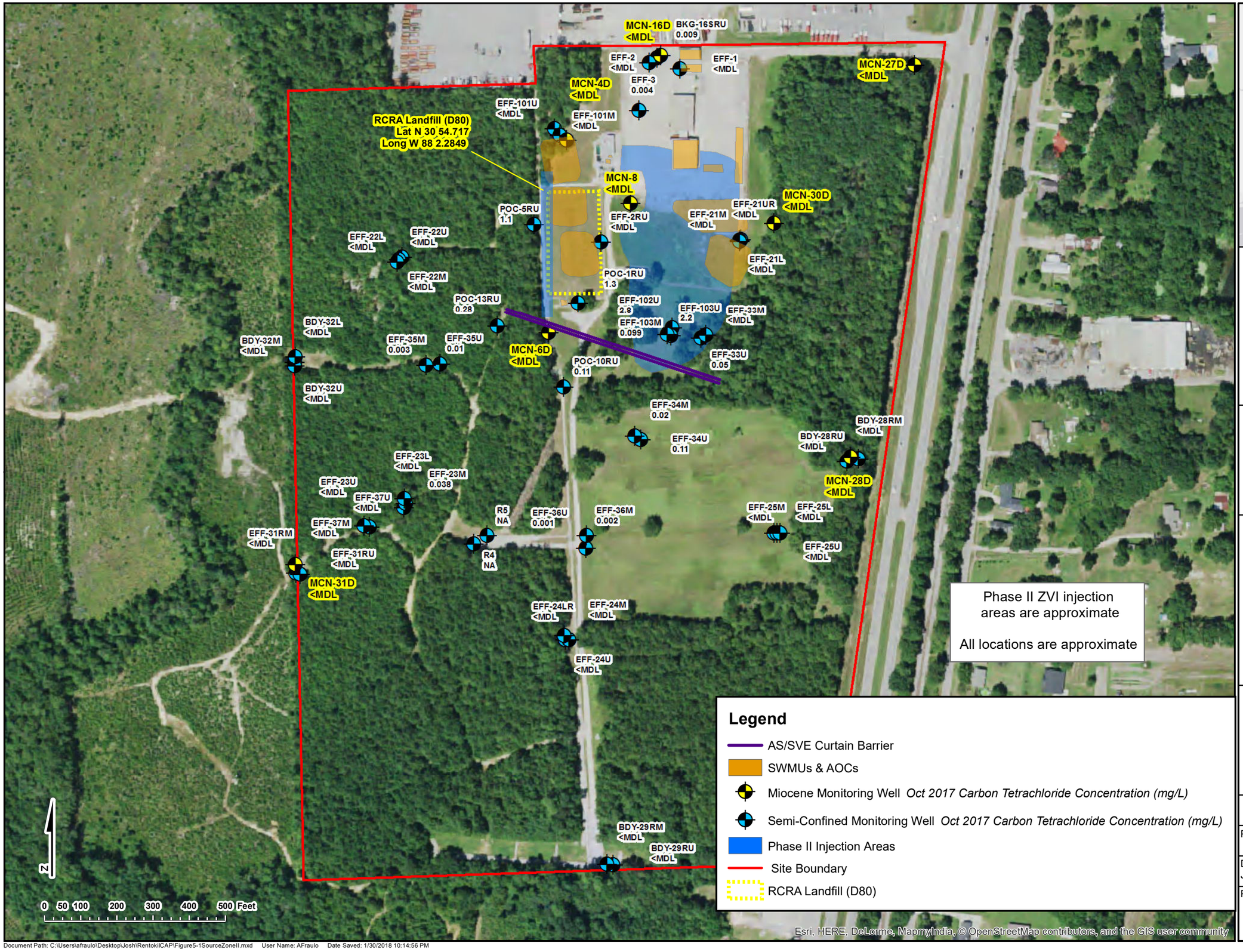

Source Zone Phase II Treatment Area

Rentokil Initial Environmental Services, LLC
10565 Highway 43 North
Creola, AL 36525

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PROJECT NUMBER: 03648005.2017	FIGURE NUMBER: 5-1

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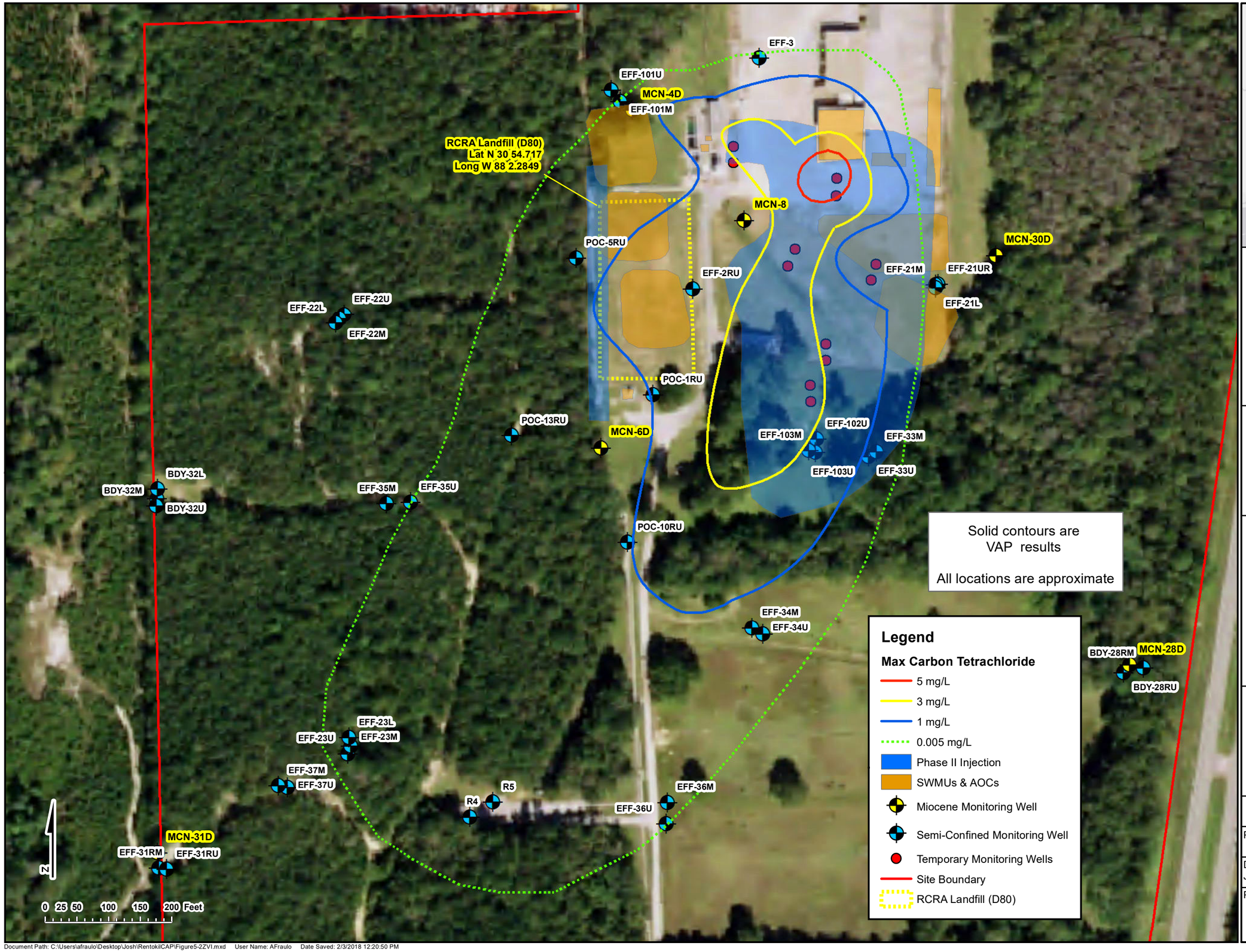

ZVI and Organic Carbon Source Area Injection

Rentokil Initial Environmental Services, LLC
10565 Highway 43 North
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DRAWING BY: JWC	DATE: January 2018
PROJECT NUMBER: 03648005.2017	FIGURE NUMBER: 5-2

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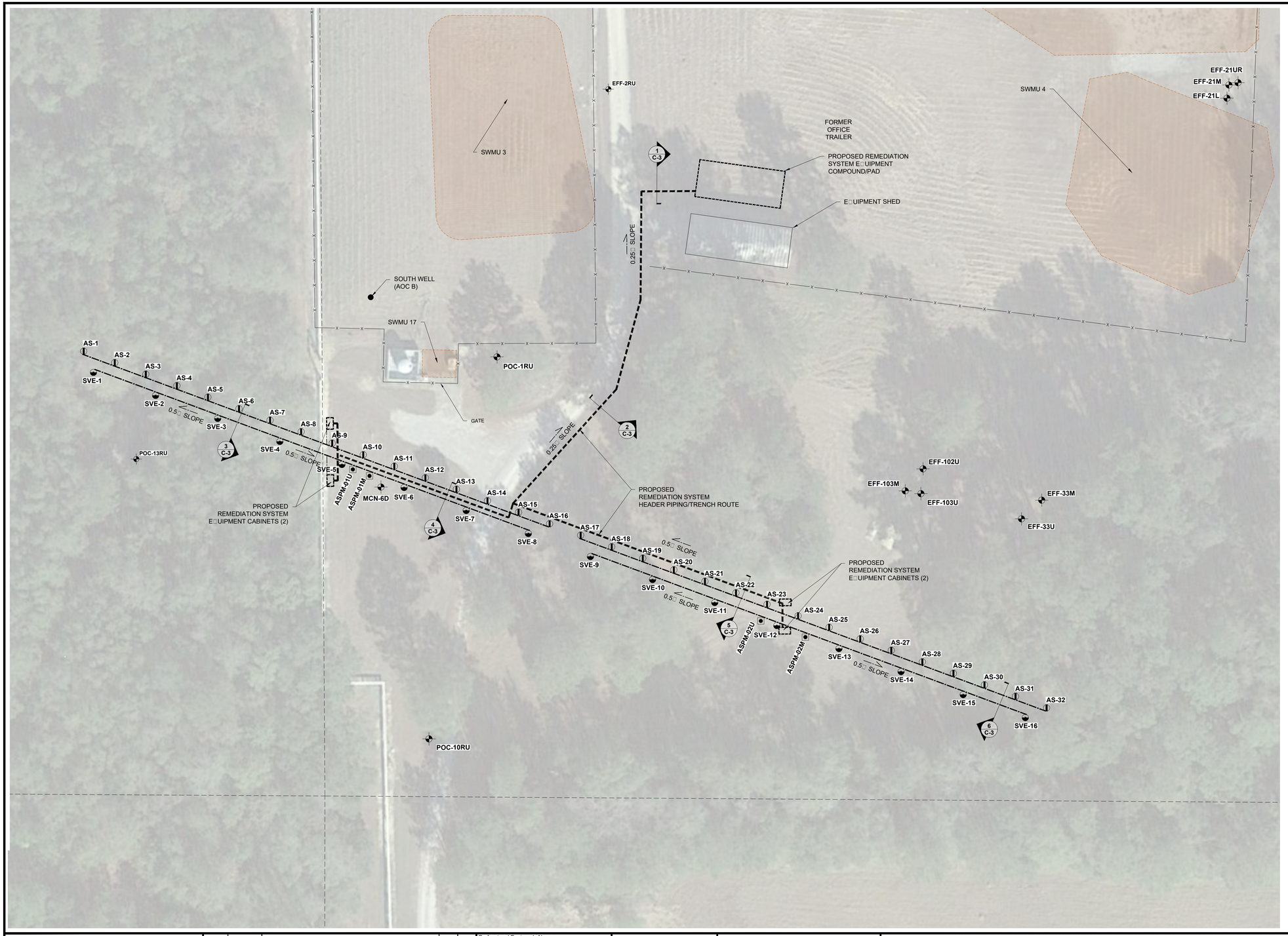

LEGEND

- MIOCENE MONITOR WELL
- SEMI-CONFINING MONITOR WELL
- FENCE
- SITE BOUNDARY
- SWMU / AOC
- AS — PROPOSED AIR SPARGE (AS) WELL LOCATION
- SVE — PROPOSED SOIL VAPOR EXTRACTION (SVE) WELL LOCATION
- ASPM-01M — PROPOSED PERFORMANCE WELL LOCATION
- PROPOSED MAIN FEED PIPING
- PROPOSED INDIVIDUAL WELL PIPING

0 30' 60' 90'
1"=30'

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No.	Date	Revisions	By	Ckd
0	12/2017	INITIAL REMEDIATION SYSTEM DESIGN	JP	JP

Professional Engineer's Name: **JOHN F. PERELLA, PE**
Professional Engineer's No.: 37041-E
State: AL | Date Signed: | Project Mgr.: JH
Designed by: ZV | Drawn by: BO | Checked by: JP

ARCADIS
ARCADIS U.S., INC.
ALABAMA CERTIFICATE OF AUTHORIZATION NUMBER 1822

RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC - 10565 HIGHWAY 43 NORTH, CREOLA, MOBILE COUNTY, ALABAMA
AIR SPARGE / SOIL VAPOR EXTRACTION REMEDIATION SYSTEM

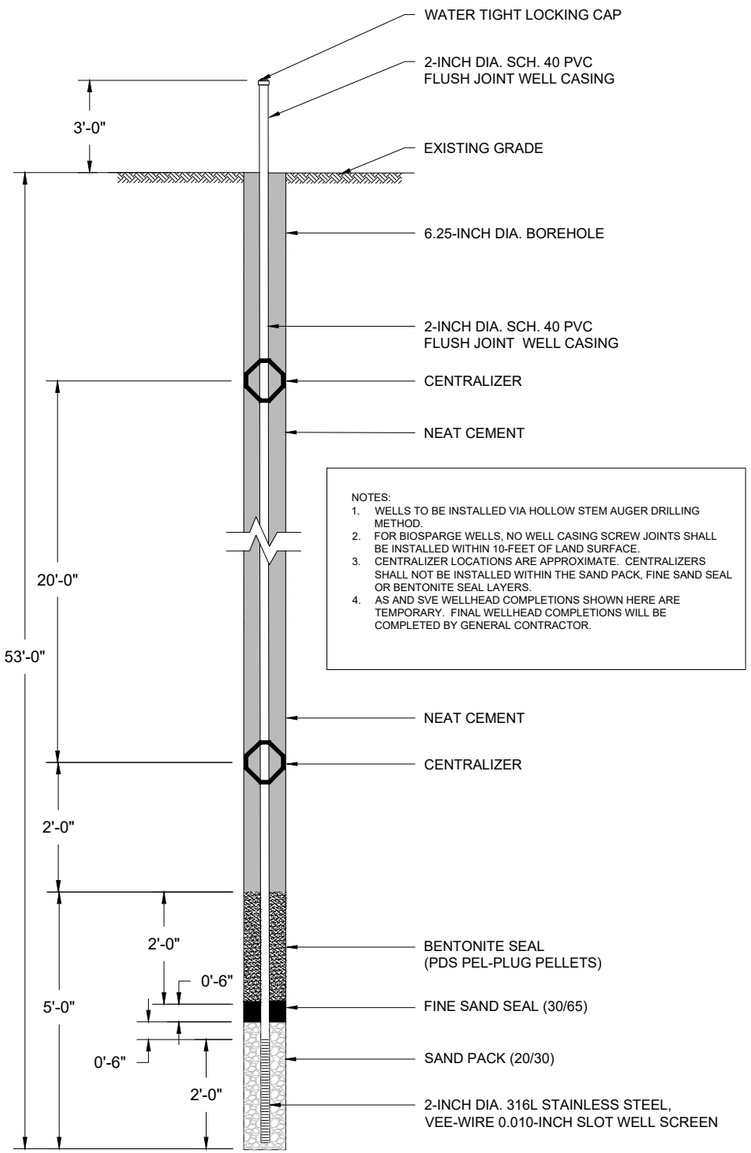
AIR SPARGE (AS) / SOIL VAPOR EXTRACTION (SVE) REMEDIATION SYSTEM LAYOUT

CONSTRUCTION DRAWINGS

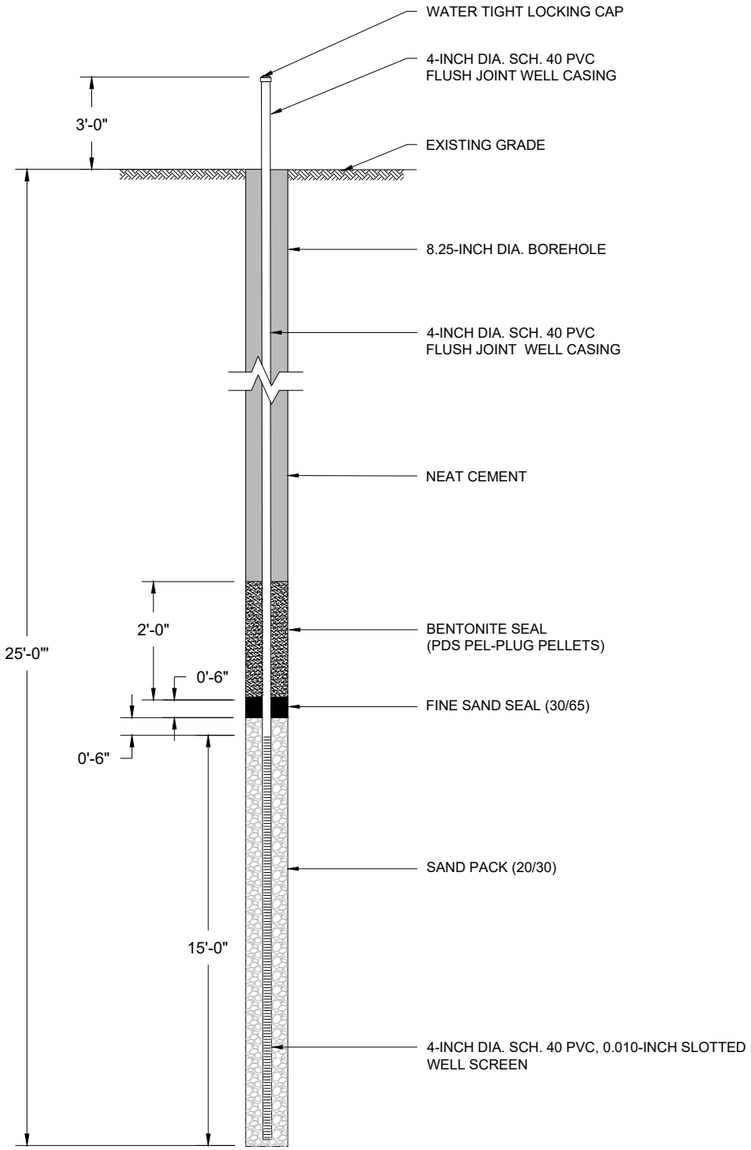
ARCADIS Project No. 03648010.0001.00500
Date JANUARY 2018

ARCADIS
3109 W. MARTIN L. KING JR. DR.
SUITE 350
TAMPA, FL 33607
TEL. 813.903.3100

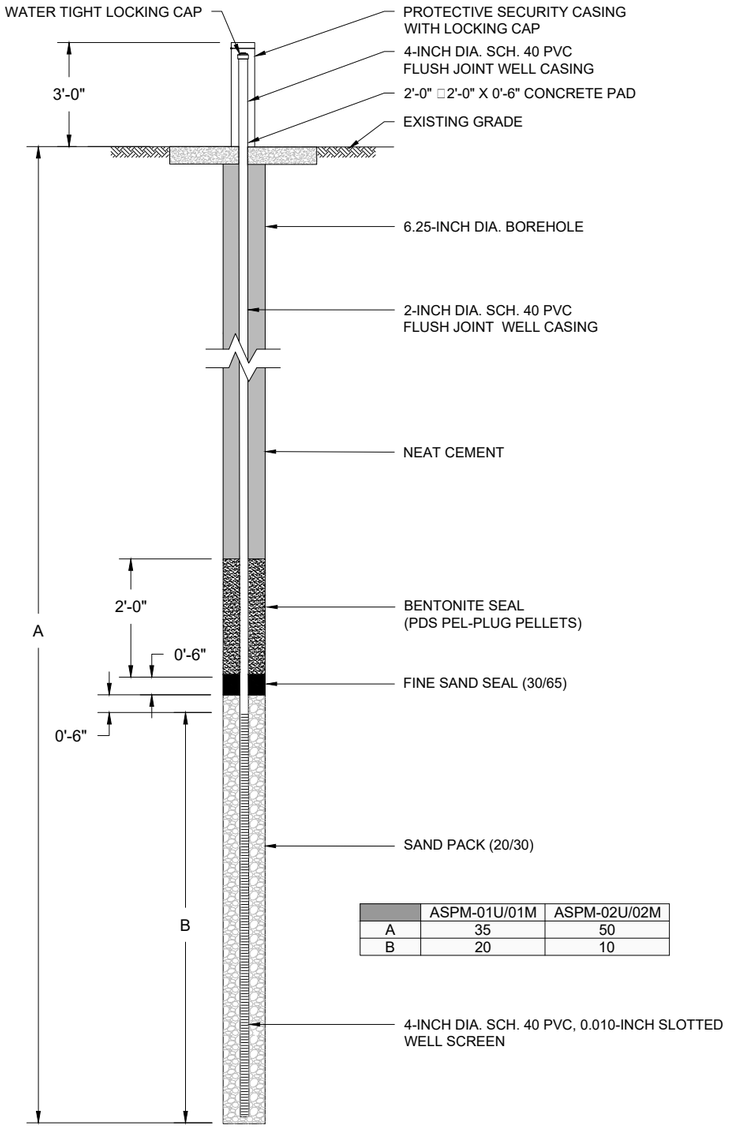
5-3



AIR SPARGE WELL
(AS-1 THROUGH AS-32)



SOIL VAPOR EXTRACTION WELL
(SVE-1 THROUGH SVE-16)



	ASPM-01U/01M	ASPM-02U/02M
A	35	50
B	20	10

PERFORMANCE MONITORING WELL
(ASPM-01U/01M & ASPM-02U/02M)

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Professional Engineer's Name: JOHN F. PERELLA, PE
Professional Engineer's No.: 37041-E

State	Date Signed	Project Mgr.
AL		JH
Designed by	Drawn by	Checked by
ZV	BO	JP

ARCADIS U.S., INC.
ALABAMA CERTIFICATE OF AUTHORIZATION NUMBER 1822

RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC - 10565 HIGHWAY 43 NORTH, CREOLA, MOBILE COUNTY, ALABAMA
AIR SPARGE / SOIL VAPOR EXTRACTION REMEDIATION SYSTEM

AIR SPARGE & SOIL VAPOR EXTRACTION WELL DETAILS

CONSTRUCTION DRAWINGS

ARCADIS Project No.
03648010.0001.00500

Date
JANUARY 2018

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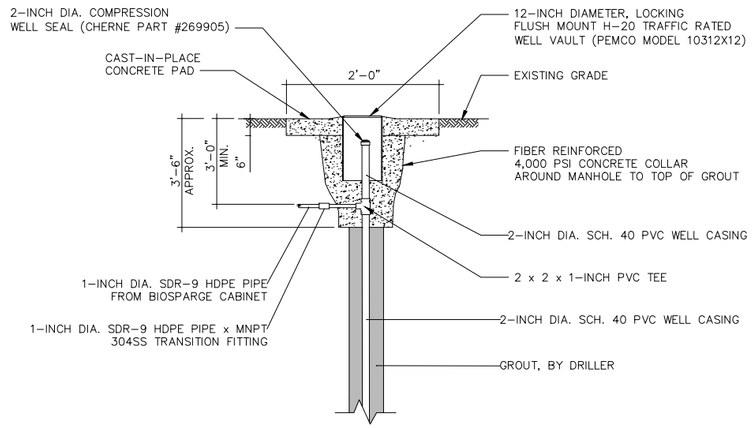
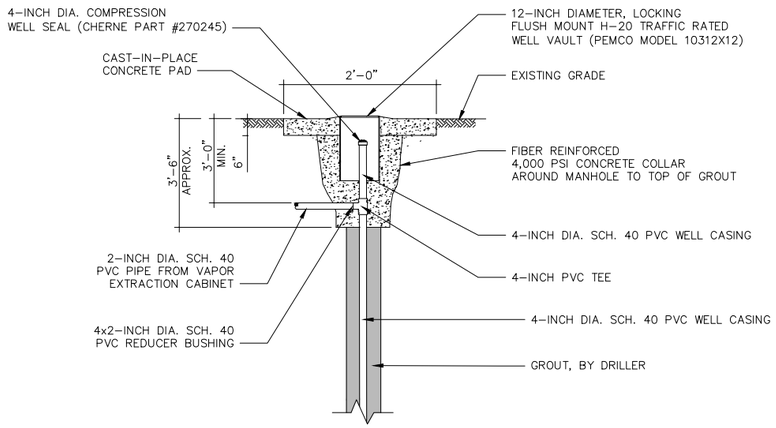


A C–2 BIOSPARGE WELL HEAD DETAIL

NOTES:
1. CENTER MANHOLE IN 2'–0" X 2'–0" X 6"D CAST–IN–PLACE CONCRETE PAD.
2. CONCRETE SHALL BE 28–DAY CONCRETE STRENGTH = 4,000 PSI (MIN.).



B C–2 VAPOR EXTRACTION WELL HEAD DETAIL

NOTES:
1. CENTER MANHOLE IN 2'–0" X 2'–0" X 6"D CAST–IN–PLACE CONCRETE PAD.
2. CONCRETE SHALL BE 28–DAY CONCRETE STRENGTH = 4,000 PSI (MIN.).

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name: JOHN F. PERELLA, PE
Professional Engineer's No.: 37041-E

State	Date Signed	Project Mgr.
AL		JH
Designed by	Drawn by	Checked by
ZV	BO	JP

ARCADIS U.S., INC.
ALABAMA CERTIFICATE OF AUTHORIZATION NUMBER 1822

RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC - 10565 HIGHWAY 43 NORTH, CREOLA, MOBILE COUNTY, ALABAMA
AIR SPARGE / SOIL VAPOR EXTRACTION REMEDIATION SYSTEM

AIR SPARGE & SOIL VAPOR EXTRACTION WELLHEAD COMPLETION DETAILS

CONSTRUCTION DRAWINGS

ARCADIS Project No.
03648010.0001.00500

Date
JANUARY 2018

ARCADIS
3109 W. MARTIN L. KING JR. DR.
SUITE 350
TAMPA, FL 33607
TEL. 813.903.3100

5-5

APPENDIX A

Safety Data Sheet for EHC® ISCR Reagent

SAFETY DATA SHEET
EHC® ISCR Reagent

SDS # : EHC-C
Revision date: 2016-02-18
Format: NA
Version 2

1. PRODUCT AND COMPANY IDENTIFICATION

Product Identifier

Product Name EHC® ISCR Reagent

Other means of identification

Alternate Commercial Name EHC Fine, EHC Granular, EHC 50%

Recommended use of the chemical and restrictions on use

Recommended Use: Bioremediation product for the remediation of contaminated soil and groundwater

Restrictions on Use: Not for drinking water purification treatment.

Manufacturer/Supplier

PeroxyChem LLC
2005 Market Street
Suite 3200
Philadelphia, PA 19103
Phone: +1 267/ 422-2400 (General Information)
E-Mail: sdsinfo@peroxychem.com

Emergency telephone number

For leak, fire, spill or accident emergencies, call:
1 800 / 424 9300 (CHEMTREC - U.S.A.)
1 703 / 527 3887 (CHEMTREC - Collect - All Other Countries)
1 303/ 389-1409 (Medical - U.S. - Call Collect)

2. HAZARDS IDENTIFICATION

Classification

OSHA Regulatory Status
This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Combustible dust

GHS Label elements, including precautionary statements

EMERGENCY OVERVIEW

Warning

Hazard Statements
May form combustible dust concentrations in air

Precautionary Statements - Prevention
Dry or powdered ingredients are combustible. Dispersal of finely divided dust from products into air may form mixtures that are ignitable or explosive. Minimize airborne dust generation and eliminate sources of ignition.

Hazards not otherwise classified (HNOC)
No hazards not otherwise classified were identified.

Other Information
CONTAINMENT HAZARD: Any vessel that contains wet EHC must be vented due to potential pressure build up from fermentation gases

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical name	CAS-No	Weight %
Iron	7439-89-6	18-48
Organic amendment	Proprietary	52-82
Soybean oil	8001-22-7	2
Viscosity modifier	Proprietary	0-5

Synonyms are provided in Section 1.

4. FIRST AID MEASURES

Eye Contact — In case of contact, immediately flush skin with plenty of water. Get medical attention if irritation develops and persists.

Skin Contact — Wash off with soap and water.

Inhalation — Remove person to fresh air. If signs/symptoms continue, get medical attention.

Ingestion — Rinse mouth with water and afterwards drink plenty of water or milk. Call a poison control center or doctor immediately for treatment advice. Never give anything by mouth to an unconscious person.

Most important symptoms and effects, both acute and delayed — Inhalation of dust in high concentration may cause irritation of respiratory system.

Indication of immediate medical attention and special treatment needed, if necessary — Treat symptomatically

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media — Dry chemical, CO2, sand, earth, water spray or regular foam.

Unsuitable extinguishing media — Do not use a solid water stream as it may scatter and spread fire.

Specific Hazards Arising from the Chemical — Avoid generating dust; fine dust dispersed in air in sufficient concentrations, and in the presence of an ignition source is a potential dust explosion hazard. Combustible material

Explosion data
Sensitivity to Mechanical Impact — Not sensitive.
Sensitivity to Static Discharge — Not sensitive.

Protective equipment and precautions for firefighters — As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions Avoid dust formation. Avoid dispersal of dust in the air (i.e., cleaning dust surfaces with compressed air.). For personal protection see Section 8.

Other Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Use only non-sparking tools.

Environmental Precautions Recover the product in solid form, if possible. Do not flush into surface water or sanitary sewer system.

Methods for Containment Cover powder spill with plastic sheet or tarp to minimize spreading and keep powder dry.

Methods for cleaning up Sweep or vacuum up spillage and return to container. The waste may be recovered and recycled.

7. HANDLING AND STORAGE

Handling Minimize dust generation and accumulation. Keep away from open flames, hot surfaces and sources of ignition. Refer to Section 8.

Storage Keep tightly closed in a dry and cool place. Keep away from open flames, hot surfaces and sources of ignition. Any vessel that contains wet EHC must be vented due to potential pressure build up from fermentation gases.

Incompatible products Oxidizing agents. Strong acids.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies. Local nuisance dust standards apply.

Appropriate engineering controls

Engineering measures It is recommended that all dust control equipment such as local exhaust ventilation and material transport systems involved in the handling of this product contain explosion relief vents or an explosion suppression or an oxygen-deficient environment. Ensure that dust-handling systems (such as exhaust ducts, dust collectors, vessels, and processing equipment) are designed in a manner to prevent the escape of dust into the work area (i.e., there is no leakage from the equipment). Use only appropriately classified electrical equipment and powered industrial trucks.

Individual protection measures, such as personal protective equipment

Eye/Face Protection Safety glasses with side-shields.

Skin and Body Protection Wear suitable protective clothing. Protective shoes or boots.

Hand Protection Use gloves if extended exposure is anticipated

Respiratory Protection Whenever dust in the worker's breathing zone cannot be controlled with ventilation or other engineering means, workers should wear respirators or dust masks approved by NIOSH/MSHA, EU CEN or comparable organization to protect against airborne dust.

Hygiene measures Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and immediately after handling the product.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance	Tan, Brown, flakes,
Physical State	Solid
Color	Brown, Tan
Odor	odorless
Odor threshold	Not applicable
pH	5.6 (as aqueous solution)
Melting point/freezing point	Decomposes
Boiling Point/Range	Not applicable
Flash point	Not applicable No information available
Evaporation Rate	No information available
Flammability (solid, gas)	Combustible material
Flammability Limit in Air	
Upper flammability limit:	No information available
Lower flammability limit:	No information available
Vapor pressure	No information available
Vapor density	No information available
Density	0.80 g/mL
Specific gravity	No information available
Water solubility	practically insoluble
Solubility in other solvents	No information available
Partition coefficient	No information available
Autoignition temperature	No information available
Decomposition temperature	No information available
Viscosity, kinematic	No information available (Solid)
Viscosity, dynamic	No information available
Explosive properties	Low level dust explosion hazard
K_{st}	19 bar-m/sec: St1 Class dust
Oxidizing properties	No information available
Molecular weight	No information available
Bulk density	No information available

10. STABILITY AND REACTIVITY

None under normal use conditions

Chemical Stability Stable.

Possibility of Hazardous Reactions May react with water to release flammable hydrogen gas.

Hazardous polymerization Hazardous polymerization does not occur.

Conditions to avoid Heat, flames and sparks.

Incompatible materials Strong acids. Oxidizing agents.

Hazardous Decomposition Products Burning produces obnoxious and toxic fumes.

11. TOXICOLOGICAL INFORMATION

Product Information

LD50 Oral	Iron: 98.6 g/kg (rat)
LD50 Dermal	No information available
LC50 Inhalation	Iron: > 100 mg/m^3 6 hr (rat)
Serious eye damage/eye irritation	Not expected to be irritating based on the components.
Skin corrosion/irritation	Not expected to be irritating based on the components.
Sensitization	As a precaution the product should be treated as a sensitizer.

Information on toxicological effects

Symptoms Inhalation of dust may cause shortness of breath, tightness of the chest, a sore throat and cough.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Not expected to be irritating based on the components.
corrosivity Not applicable.
Chronic toxicity No known chronic effects of components present at greater than 1%.

Carcinogenicity Contains no ingredient listed as a carcinogen.

Mutagenicity No known mutagenic or teratogenic effects.

Neurological effects Contains no ingredient listed as a mutagen

Reproductive toxicity This product does not contain any known or suspected reproductive hazards.

STOT - single exposure No information available.
STOT - repeated exposure No information available.

Aspiration hazard No information available.

12. ECOLOGICAL INFORMATION

Ecotoxicity

Ecotoxicity effects Contains no substances known to be hazardous to the environment or that are not degradable in waste water treatment plants

Chemical name	Toxicity to algae	Toxicity to fish	Toxicity to Microorganisms	Toxicity to daphnia and other aquatic invertebrates
Iron		96 h LC50: = 13.6 mg/L (Morone saxatilis) static		

Persistence and degradability No data is available on the product itself. The organic components are biodegradable and can be expected to contribute to BOD.

Bioaccumulation Does not bioaccumulate.

Mobility Is not likely mobile in the environment due its low water solubility.

Other Adverse Effects None known.

13. DISPOSAL CONSIDERATIONS

Waste disposal methods Recovery/recycling recommended. Dispose of in accordance with local regulations.

Contaminated Packaging Empty remaining contents. Dispose of in accordance with local regulations.

14. TRANSPORT INFORMATION

DOT NOT REGULATED

15. REGULATORY INFORMATION

U.S. Federal Regulations

SARA 313
Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

SARA 311/312 Hazard Categories

Acute health hazard	Yes
Chronic health hazard	No
Fire hazard	No
Sudden release of pressure hazard	No
Reactive Hazard	No

Clean Water Act
This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

CERCLA/EPCRA
This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material

International Inventories

Component	TSCA (United States)	DSL (Canada)	EINECS/ELINCS (Europe)	ENCS (Japan)	China (IECSC)	KECL (Korea)	PICCS (Philippines)	AICS (Australia)	NZIoC (New Zealand)
Iron 7439-89-6 (18-48)	X	X	X		X	X	X	X	X
Organic amendment (52-82)		X	X		X		X	X	X
Soybean oil 8001-22-7 (2)	X	X	X		X	X	X	X	X
Viscosity modifier (0-5)	X	X	X	X	X	X	X	X	X

CANADA

WHMIS Statement
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the SDS contains all the information required by the CPR.

WHMIS Hazard Class Non-controlled

16. OTHER INFORMATION

NFPA	**Health Hazards** 1	**Flammability** 1	**Stability** 0	**Special Hazards** -
HMIS	**Health Hazards** 1	**Flammability** 1	**Physical hazard** 0	**Personal Protection** -

NFPA/HMIS Ratings Legend Severe = 4; Serious = 3; Moderate = 2; Slight = 1; Minimal = 0

References Refer to NFPA 654, *Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids* , for safe handling.

Revision date: 2016-02-18
Revision note *** Indicates updated section
Issuing Date: 2015-07-14

Disclaimer

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Prepared By:

PeroxyChem

End of Safety Data Sheet

APPENDIX B

System Design Calculations

AIR SPARGE WELL INJECTION PRESSURE

PROJECT NAME: Rentokil Creola
PROJECT #: 13283027.00200
DATE: 12/18/2017

DESIGNED BY: ZV
REVIEWED BY: JP

$$P_{injection}\ (P_i) = P_{hydrostatic}\ (P_h) + P_{capillary}\ (P_c)$$

$P_h = (\rho)(g)(h)$ (P_h) = Pressure required to overcome the hydrostatic pressure of the overlying groundwater table.

Where:
ρg= specific weight of water (62.4 lbf/ft^3)
h= height of water column

minimum depth to water =	21.00	ft
depth of injection point =	50.0	ft
height of water column =	29.0	ft
P_h =	12.6	psi

$P_{capillary}$ (P_c) = Pressure required to overcome the capillary pressure of the aquifer matrix and is dependent upon the geology.

P_c = typically ranges from 0.43 to 4.3 psi for silty fine grained sediments, and 0.04 to 0.4 psi for course grained sediments

P_c = 3.5 psi (based on fine to medium sand aquifer matrix)

$P_i = P_h + P_c$ = 16.1 psi

Pc Values obtained from *In-Situ Treatment Technology (Second Edition), ARCADIS, 2001, chapter 5 air sparging*

ARCADIS Design & Consultancy for natural and built assets

AIRSPARGE MAXIMUM HEAD LOSS WORKSHEET

PROJECT NAME: Rentokil Creola
PROJECT #: 13283027.00200
DATE: 12/18/2017

DESIGNED BY: ZV
REVIEWED BY: JP

DESCRIPTION	SIZE (inches)	NUMBER OF FITTINGS	EQUIVALENT LENGTH PER FITTING (feet of pipe)	TOTAL EQUIVALENT LENGTH (feet of pipe)	FLOW RATE (scfm)	FRICTION FACTOR in-WC/ft	FRICTION LOSS psi
Well to Manifold							
Straight Pipe	1	1	180	180	8	0.041	0.267
Standard Tee - Branch	1	1	5.3	5.3	8	0.041	0.008
90 Elbow	1	4	2.7	10.8	8	0.041	0.016
Manifold							
Straight Pipe	1	1	20.0	20.0	8	0.041	0.030
Union	1	2	0.3	0.6	8	0.041	0.001
Standard Tee - Branch	1	1	5.3	5.3	8	0.041	0.008
90 Elbow	1	2	2.7	5.4	8	0.041	0.008
Flow meter	1	1	--	--		--	2.5
Gate Valve	1	1	0.7	0.7	8	0.041	0.001
Manifold to compound							
Straight pipe	2	1	440	440	64	0.096	1.526
90 Elbow	2	4	5.2	20.8	64	0.096	0.072
Check Valve	2	1	17.2	17.2	64	0.096	0.060
Expansion(1/2)	2	1	6.0	6.0	64	0.096	0.021
Compressor System							
Straight pipe	2	1	20.0	20.0	128	0.410	0.296
90 Elbow	2	4	7.8	31.2	128	0.410	0.462
Dryer	1	1	--	--	128	--	3.0
Filter combo	1	1	--	--	128	--	5.0
Flow meter	1	1	--	--	128	--	4.0

TOTAL SYSTEM PRESSURE DROP (psi)	=	17.28
Factor of Safety (25%)	=	4.32
DESIGN WELL HEAD INJECTION PRESSURE (psi)	=	16.07
TOTAL DESIGN PRESSURE (psi)	=	**37.67**

Footnotes:

scfm - standard cubic feet per minute
in-WC/ft - inches of water per foot
psi - pounds per square inch

Friction factors obtained from EG&G Rotron & Ingersoll -Rand Condensed Air Power Data
Equivalent lengths for fittings from reference: Ingersoll-Rand Company, Cameron Hydraulic Data 1965.
Filter and flow meter losses provided by manufacturer data.

ARCADIS Design & Consultancy for natural and built assets

VAPOR EXTRACTION HEAD LOSS WORKSHEET

PROJECT NAME: Rentokil Creola
PROJECT #: 13283027.00200
DATE: 12/18/2017

DESIGNED BY: ZV
REVIEWED BY: JP

1 Design Calculation - based on pilot test - 50 SCFM at 40 in-WC at well head

DESCRIPTION	SIZE (inches)	NUMBER OF FITTINGS	EQUIVALENT LENGTH PER FITTING (feet of pipe)	TOTAL EQUIVALENT LENGTH (feet of pipe)	FLOW RATE (scfm)	FRICTION FACTOR in-WC/ft	FRICTION LOSS in-WC
SVE Well to Manifold							
Straight Pipe	2	1	200.0	200.0	50	0.050	10.00
Standard Tee - Through	2	1	3.5	3.5	50	0.050	0.18
90 Elbow	2	4	5.2	20.8	50	0.050	1.04
Gate Valve	2	1	1.4	1.4	50	0.050	0.07
Expansion	2	0	6.0	0.0	50	0.050	0.00
Reducer	2	0	3.0	0.0	50	0.050	0.00
SVE Manifold							
Straight Pipe	2	1	10.0	10.0	50	0.050	0.50
90 Elbow	2	2	5.2	10.4	50	0.050	0.52
Gate Valve	2	1	1.4	1.4	50	0.050	0.07
Expansion	2	1	6.0	6.0	50	0.050	0.30
Standard Tee - Branch	6	1	30.3	30.3	400	0.021	0.64
Standard Tee - Through	6	6	10.1	60.6	400	0.021	1.27
SVE Manifold to Compound							
Straight Pipe	6	1	450.0	450.0	400	0.021	9.45
Standard Tee - Branch	6	0	30.3	0.0	400	0.021	0.00
Standard Tee - Through	6	0	10.1	0.0	400	0.021	0.00
90 Elbow	6	4	15.2	60.8	400	0.021	1.28
Butterfly Valve	6	0	22.7	0.0	400	0.021	0.00
SVE System - Vacuum Side							
90 Elbow	6	4	15.2	60.8	800	0.056	3.40
Standard Tee - Branch	6	0	30.3	0.0	800	0.056	0.00
Standard Tee - Through	6	3	10.1	30.3	800	0.056	1.70
Straight Pipe	6	1	50.0	50.0	800	0.056	2.80
Particulate Filter	6	1	--	--	800	--	5.0
Moisture Separator	6	1	--	--	800	--	8.0
VGAC #1	6	1	--	--	800	--	20.0
VGAC #2	6	1	--	--	800	--	20.0
Flow Meter	6	1	--	--	800	--	2.0
SVE System - Pressure Side							
90 Elbow	6	3	15.2	45.6	800	0.056	2.55
Straight Pipe	6	1	20.0	20.0	800	0.056	1.12
Standard Tee - Through	6	1	10.1	10.1	800	0.056	0.57
SVE Silencer	6	1	--	--	800	--	3.0
Flow Meter	6	1	--	--	800	--	2.0

TOTAL SYSTEM FRICTION LOSSES (in-WC)	=	97.45
Factor of Safety (15%)	=	14.62
DESIGN WELL HEAD VACUUM (in-WC)	=	30.00
TOTAL DESIGN PRESSURE (in-WC)	=	**142**
Total Suction Side Losses (in-WC)	=	**87.77**
Total Discharge Side Losses (in-WC)	=	**9.24**

Footnotes:

scfm - standard cubic feet per minute
in-WC/ft - inches of water column per foot
in-WC - inches of water column

Friction factors obtained from EG&G Rotron & Ingersoll -Rand Condensed Air Power Data
Equivalent lengths for fittings from reference: Ingersoll-Rand Company, Cameron Hydraulic Data 1965.
Filter, moisture separator, and flow meter losses provided by manufacter data.

ARCADIS Design & Consultancy for natural and built assets

ESTIMATED VOC EMISSIONS RATE & TREATMENT

PROJECT NAME: Rentokil Creola
PROJECT #: 13283027.00200
DATE: 12/18/2017

DESIGNED BY: ZV
REVIEWED BY: JP

INPUT:

Design Flow Rate: 800 scfm
Emission Data: 59.05 mg/m^3

EMISSIONS RATE CALCULATION:

lb/day VOC = (Conc.) X (Mass Conversion) X (Flowrate) X (Flowrate Conversion)

lb/day VOC = (0.78 mg/m^3)X(0.000001 Kg/mg)X(2.204 lbs/Kg)X(720 scfm)X(0.028 m^3/ft^3)X(1440 min/day)

lb/day VOC = 4.25

CARBON USAGE CALCULATION:

$$\text{Carbon Mass} = \frac{\text{(Total VOC Emissions Rate) x (Treatment Time)}}{\text{Adsorption Efficiency}}$$

Assumptions:

Adsorption Efficiency = 0.10 (conservative rule of thumb)

Carbon Canister: CSI / V 3000

Height:	8'-1"
Diameter:	5'-0"
Connection:	10" Flange
Mass of Carbon:	3,000 lbs per unit
Number of Units:	2
Total Carbon Mass:	6,000 lbs
Flow Rate Capacity:	800 scfm
Max Vacuum Rating	28.0 in-Hg

Primary Carbon Estimated Lifespan

Lifespan = Mass of Carbon/(Emission Rate/Adsorption Eff)
Primary Carbon Lifespan: 70 Days

Footnotes:

scfm - standard cubic feet per minute
mg/m^3 - milligrams per cubic meter
VOCs - volatile organic compounds
USEPA - United States Environmental Protection Agency
lb/day - pounds per day
HAPs - hazardous air pollutants
lbs - pounds
in-WC - inches of water column
Kg/mg - kilograms per milligrams
lbs/Kg - pounds per kilogram
m^3/ft^3 - cubic meter per cubic feet
min/day - minutes per day

Influent vapor concentration:

Date Collected:		8/17/17 15:05	
Analyte	**Molecular Weight (g/mol)**	**Influent (ppbV)**	**Influent[2] ($\mu g/m^3$)**
1,1-Dichloroethane	96.94	71 U	281 U
1,2-Dichloroethane	96.94	71 U	281 U
2-Butanone (MEK)	72.11	350 U	1,032 U
Benzene	78.11	71 U	227 U
Carbon disulfide	76.13	180 U	560 U
Carbon tetrachloride	153.81	8,500	53,440
Chloroform	119.37	290	1,415
Ethylbenzene	106.17	71 U	308 U
Tetrachloroethene	165.85	71 U	481 U
Toluene	92.14	110 U	414 U
Xylenes, Total	106.16	140 U	608 U
		Total	**59,047**

Footnotes:
1 - SVE system effluent flow
2 - Conversion from ppmV to $\mu g/m^3$ by: $\mu g/m^3$ = (ppmV x 12.187 x molecular weight) / (standard temperature (°C) + 273.15 (Kelvin))
All columns highlighted in blue are
g/mol - grams per mole
$\mu g/m^3$ - micrograms per cubic meter
ppbV - parts per billion by volume
U - Concentration is below the laboratory method detection limit

APPENDIX C

System Design Drawings

CONSTRUCTION DRAWINGS

AIR SPARGE / SOIL VAPOR EXTRACTION REMEDIATION SYSTEM

RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC
10565 HIGHWAY 43 NORTH
CREOLA, MOBILE COUNTY, ALABAMA

JANUARY 2018

ARCADIS

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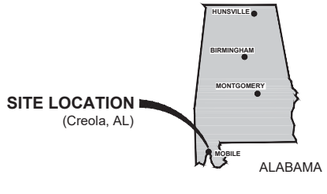
813.903.3100

LOCATION MAP
NOT TO SCALE



INDEX TO DRAWINGS

SURVEY LEGEND & ABBREVIATIONS:

= CATCH BASIN
= MANHOLE
= LIGHT POLE
= WATER METER
= WATER VALVE
= CATCH BASIN INLET
= UTILITY POLE
= RISER
= FIRE HYDRANT
= HANDHOLE
= SIGN

= 0.5' CURB
= 2.00' CURB & GUTTER
= CHAIN LINK FENCE
I.D. = IDENTIFICATION
EL. = ELEVATION
INV. = INVERT
A/C = AIR CONDITIONER
SAN. = SANITARY
P.R.M. = PERMANENT REFERENCE MONUMENT
= CONCRETE

LEGEND

NEW AIR SPARGE AND VACUUM EXTRACTION CONVEYANCE PIPELINES
PROPOSED AIR SPARGE WELL LOCATIONS
PROPOSED SOIL VAPOR EXTRACTION WELL LOCATIONS

SITE HEALTH AND SAFETY

1. CONTRACTOR SHALL COMPLY WITH ALL APPLICABLE LOCAL, STATE, AND FEDERAL HEALTH AND SAFETY CODES AT ALL TIMES.
2. ALL EMPLOYEES OF THE CONTRACTOR WHO MAY COME IN CONTACT WITH CONTAMINATED SOIL OR GROUNDWATER SHALL BE CURRENT WITH THEIR 40-HOUR HAZWOPER TRAINING AND 8-HOUR REFRESHER.
3. IT IS THE CONTRACTOR'S RESPONSIBILITY TO PREPARE AND HAVE ON-SITE AT ALL TIMES A SITE-SPECIFIC HEALTH AND SAFETY PLAN (HASP) THAT COVERS THEIR EMPLOYEES.
4. THE CONTRACTOR SHALL ABIDE BY ARCADIS HASPS AND APPLICABLE TECO/PGS HEALTH AND SAFETY PROTOCOLS/GUIDELINES.
5. THE CONTAMINANTS OF CONCERN INCLUDE CARBON TETRACHLORIDE AND CHLOROFORM THAT HAVE BEEN DETECTED IN THE SITE'S GROUNDWATER. ADDITIONAL SITE INFORMATION MAY BE PROVIDED UPON REQUEST.
6. IT IS CONTRACTOR'S RESPONSIBILITY FOR EDUCATING ITS SUPERVISORS, EMPLOYEES, AND SUBCONTRACTORS OF ALL HEALTH AND SAFETY REQUIREMENTS. CONTRACTOR IS RESPONSIBLE FOR WORKER SAFETY AND MAINTENANCE OF TRAFFIC DURING CONSTRUCTION.
7. AT A MINIMUM, ALL ON-SITE CONTRACTOR PERSONNEL SHALL BE IN LEVEL D WHICH IS DEFINED AS HARD HAT, STEEL-TOED SHOES, AND SAFETY GLASSES.
8. CONTRACTOR SHALL PROVIDE SAFETY SIGNS FOR TRENCHING.
9. EXCLUSION ZONES SHALL BE CLEARLY SECTIONED OFF USING, BUT NOT RESTRICTED TO, DELINEATORS, CAUTION TAPE, AND FENCING.

GENERAL NOTES

1. DETERMINING THE ACTUAL LOCATION OF ANY EXISTING UTILITY IS THE CONTRACTORS RESPONSIBILITY. BEFORE COMMENCING WORK, IT IS THE CONTRACTOR'S RESPONSIBILITY TO CONTACT THE VARIOUS UTILITY COMPANIES WHICH MAY HAVE BURIED OR AERIAL UTILITIES WITHIN OR NEAR THE CONSTRUCTION AREA. (PROVIDE 48 HOURS MINIMUM NOTICE TO ALL UTILITY COMPANIES PRIOR TO BEGINNING INSTALLATION/CONSTRUCTION). THE CONTRACTOR IS FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT OCCUR DUE TO CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES. THE OWNER AND ENGINEER ASSUME NO LIABILITY FOR ANY DAMAGES SUSTAINED OR COSTS INCURRED BECAUSE OF THE CONTRACTOR'S OPERATIONS IN THE VICINITY OF EXISTING UTILITIES OR STRUCTURES, NOR FOR TEMPORARY BRACING AND SHORING OF SAME. SCHEDULE AND EXECUTE ALL WORK INVOLVING EXISTING UTILITIES TO MINIMIZE INTERRUPTION OF SERVICES. WHENEVER SUCH INTERRUPTION IS NECESSARY FOR COMPLETION OF THE WORK, NOTIFY THE ENGINEER AND THE OWNER AT LEAST 48 HOURS IN ADVANCE. ALL WORK TO REPAIR/RESTORE UTILITY SERVICE SHALL BE PERFORMED AS REQUIRED BY THE APPROPRIATE UTILITY. IF IT IS NECESSARY TO SHORE, BRACE, OR SWING A UTILITY, CONTACT THE UTILITY COMPANY OR DEPARTMENT AFFECTED AND OBTAIN THEIR PERMISSION REGARDING THE METHOD TO USE FOR SUCH WORK. ALL COSTS RELATED TO SERVICE, MAINTENANCE, INTERRUPTION, REPAIR, RELOCATION AND RESTORATION ARE TO BE INCLUDED IN THE CONTRACTOR'S BID. ANY DELAY OR INCONVENIENCE CAUSED TO THE CONTRACTOR BY THE VARIOUS UTILITIES SHALL BE INCIDENTAL TO THE CONTRACT, AND NO EXTRA COMPENSATION SHALL BE PAID.
2. FIELD CONDITIONS MAY NECESSITATE SLIGHT ALIGNMENT AND/OR GRADE DEVIATIONS FROM THOSE WHICH ARE INDICATED ON THE PLANS. ANY DEVIATIONS OR ADJUSTMENTS SHALL FIRST BE APPROVED BY THE ENGINEER BEFORE BEING PERFORMED.
3. THE CONTRACTOR IS RESPONSIBLE FOR ALL CONSTRUCTION STAKING TO INCLUDE HORIZONTAL AND VERTICAL CONTROL FOR ALIGNMENT OF WORK. ALL SURVEY WORK TO ESTABLISH THE HORIZONTAL AND VERTICAL CONTROL SHALL BE UNDER THE GUIDANCE AND DIRECT SUPERVISION OF AN ALABAMA REGISTERED PROFESSIONAL SURVEYOR.
4. THE ENGINEER CANNOT GUARANTEE THAT TEMPORARY BENCH MARKS (TBM'S) OR OTHER SURVEY CONTROL POINTS WILL NOT BE DISTURBED PRIOR TO CONSTRUCTION. BEFORE COMMENCING WORK, THE CONTRACTOR SHALL SATISFY HIMSELF AS TO THE ACCURACY OF ALL SURVEY OR EXISTING SITE INFORMATION AS INDICATED IN THE DRAWINGS OR SPECIFICATIONS. SHOULD THE CONTRACTOR DISCOVER ANY ERRORS, INACCURACIES OR OMISSIONS IN THE SURVEY DATA, HE SHALL IMMEDIATELY NOTIFY THE ENGINEER. BEFORE BEGINNING WORK, TAKE CARE TO PRESERVE ALL CONTROL STAKES, BENCH MARKS, REFERENCE POINTS AND PROPERTY CORNERS. THE OWNER WILL GRANT NO CLAIM FOR DAMAGES OR LOSS OF TIME BY THE CONTRACTOR DUE TO LOSS OR DISTURBANCE OF SURVEY CONTROL POINTS. CONTROL STAKES, BENCH MARKS, REFERENCE POINTS AND PROPERTY CORNERS DISTURBED BY THE CONTRACTOR'S WORK SHALL BE REPLACED BY AN ALABAMA REGISTERED PROFESSIONAL SURVEYOR WHO WILL BE SELECTED BY AND PAID BY THE CONTRACTOR. THE OWNER WILL NOT MAKE FINAL PAYMENT TO THE CONTRACTOR UNTIL ALL DISTURBED OR DESTROYED PROPERTY CORNERS AND PERMANENT BENCH MARKS HAVE BEEN REPLACED BY THE ALABAMA REGISTERED SURVEYOR. THE SURVEYOR SHALL CERTIFY THAT SUCH MARKERS HAVE BEEN REPLACED IN ACCORDANCE WITH THE STATE OF REQUIREMENTS.

GENERAL NOTES (Cont.)

5. ALL TREES, SHRUBS, ETC., ALONG THE LINES OF CONSTRUCTION SHALL BE PROTECTED AS MUCH AS POSSIBLE.
6. RESTORE ALL PRIVATE AND PUBLIC PROPERTY AFFECTED BY THIS WORK TO A CONDITION EQUAL TO OR BETTER THAN EXISTED BEFORE COMMENCING CONSTRUCTION WORK, UNLESS SPECIFICALLY EXEMPTED BY THE DRAWINGS. RESTORATION WORK INCLUDES, BUT IS NOT LIMITED TO PAVEMENT, BASE, SUBGRADE, CONCRETE CURBS, THERMOPLASTIC TRAFFIC MARKINGS, SIDEWALKS, SODDING, ETC. THE CONTRACTOR SHALL RECONSTRUCT ALL FACILITIES TO PRE-CONSTRUCTION GRADES AND DIMENSIONS, THE ACQUISITION OF SUCH ADDITIONAL INFORMATION SHALL BE THE CONTRACTOR'S RESPONSIBILITY, AND AT HIS EXPENSE. RECONSTRUCT ALL FACILITIES TO PRE-CONSTRUCTION GRADES AND DIMENSIONS, UNLESS OTHERWISE NOTED. WATER, FERTILIZE AND SUPPLY ALL ITEMS AND CARE NECESSARY TO MAINTAIN THE HEALTH OF ALL NEW VEGETATION AND VEGETATION REPLACEMENT, AT NO EXPENSE TO THE OWNER, IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.
7. PROVIDE ANY TEMPORARY CONTROLS AND/OR STRUCTURES REQUIRED TO MAINTAIN SUITABLE AND SAFE WORKING CONDITIONS AT ALL TIMES. SUCH ITEMS SHALL BE REMOVED ONCE THAT PORTION OF WORK HAS BEEN COMPLETED.
8. STORE CONSTRUCTION EQUIPMENT AND MATERIALS ONLY IN THOSE AREAS APPROVED BY THE ENGINEER. SECURITY OF CONSTRUCTION EQUIPMENT AND MATERIALS IS THE RESPONSIBILITY OF THE CONTRACTOR. PUBLIC RIGHTS-OF-WAY MAY NOT BE UTILIZED FOR STORAGE OF EQUIPMENT OR MATERIALS WITHOUT PRIOR WRITTEN APPROVAL FROM THE ENTITY WHICH OWNS THE RIGHT-OF-WAY.
9. UPON COMPLETION OF THE PROJECT, PROVIDE AN AS-BUILT SURVEY OF ALL IMPROVEMENTS IN AUTOCAD FORMAT UTILIZING THE CONSTRUCTION PLANS AS A BASIS. THE AS-BUILT SURVEY MUST BE PREPARED BY AN ALABAMA REGISTERED SURVEYOR. AS A MINIMUM, AS-BUILT DRAWINGS FOR PIPELINE CONSTRUCTION SHALL SHOW CONSTRUCTED HORIZONTAL AND VERTICAL LOCATIONS OF ALL BENDS, FITTINGS AND VALVES, AND ELEVATIONS AT ALL LOCATIONS WHERE PROPOSED DESIGN ELEVATIONS ARE SHOWN ON THE DRAWINGS. THE AS-BUILT SURVEY SHALL BE TIED INTO THE STATE PLANE COORDINATE SYSTEM.
10. SPECIAL EMPHASIS ON EXCAVATION SAFETY AND TRENCH CONSTRUCTION:
    a. OSHA'S EXCAVATION SAFETY STANDARDS 29, CFR PART 1926.650-652 SUBPART P, IS CONSIDERED AS COMPLIMENTARY TO THESE CONTRACT DOCUMENTS. IF THERE IS ANY DUPLICATION, REDUNDANCY OR CONFLICT BETWEEN THE STIPULATIONS OF THESE CONTRACT DOCUMENTS AND THOSE STANDARDS, THE MOST STRINGENT REQUIREMENT SHALL GOVERN.
    b. IT IS THE CONTRACTOR'S RESPONSIBILITY TO ENSURE THAT EXCAVATIONS DO NOT ENDANGER WORKMEN, EXISTING STRUCTURES, UTILITIES, OR OTHER FACILITIES. IF SUCH CONDITIONS OCCUR WHICH MAY ENDANGER WORKMEN, EXISTING STRUCTURES, UTILITIES, OR OTHER FACILITIES, IMMEDIATELY INSTALL AND MAINTAIN ADEQUATE SHEETING AND BRACING PER OSHA SPECIFICATIONS. CEASE ALL WORK UNTIL THE SHEETING AND BRACING HAS BEEN PROPERLY AND COMPLETELY INSTALLED. INSTALL THE SHEETING AND BRACING IN A MANNER THAT WILL ALLOW REMOVAL WITHOUT INJURING OR ENDANGERING WORKMEN, THE WORK, ADJACENT STRUCTURES, ETC. PROMPTLY AND COMPLETELY FILL ALL VOIDS CAUSED BY THE WITHDRAWAL OF SHEETING WITH SAND AND COMPACT TO A DEGREE EQUAL TO THE SURROUNDING SOIL. REMOVE THE SHEETING AS THE WORK PROGRESSES OR, AT THE DISCRETION OF THE ENGINEER, CUT THE SHEETING OFF BELOW FINISHED GRADE AND LEAVE IN PLACE.
11. THE CONTRACTOR SHALL MAINTAIN ACCESS TO PRIVATE PROPERTY AT ALL TIMES.
12. ALL DISTURBED GRASSED AREAS SHALL BE FULLY RESTORED WITH SOD TO MATCH THAT WHICH EXISTED PRIOR TO CONSTRUCTION. ANY SOD LAID ON AN INCLINE SHALL BE PROPERLY PINNED.
13. COUNTY ROADWAY PAVEMENT IS NOT TO BE OPEN-CUT OR DISTURBED. ANY DISTURBED SIDEWALKS SHALL BE RESTORED IN FULL PANEL SECTIONS.

GENERAL NOTES FOR UTILITY CONSTRUCTION

1. UNDER NO CIRCUMSTANCES SHALL PIPE BE LAID IN A WET TRENCH OR STRUCTURES BE CONSTRUCTED IN A WET EXCAVATION.
2. THE PIPE SHALL BE INSTALLED TO THE GRADE AND ELEVATIONS SHOWN ON THE CONSTRUCTION DRAWINGS. DETAILED CONSTRUCTION LOGS SHALL BE MAINTAINED BY THE CONTRACTOR AND FURNISHED TO THE ENGINEER.
3. IF NECESSARY, USE TEMPORARY SHEETING OR TRENCH BOXES TO MINIMIZE THE SIZE OF THE EXCAVATIONS AND TO PROTECT ADJACENT EXISTING ROADWAYS, UTILITIES AND OTHER FACILITIES. THERE SHALL BE NO ADDITIONAL COST TO THE OWNER.
4. BACKFILL ALL TRENCHES WITHIN PUBLIC RIGHT-OF-WAY AT THE END OF EACH DAYS WORK. NO TRENCH SHALL BE LEFT OPEN OVERNIGHT. THE ENDS OF ALL PIPE SHALL BE PLUGGED AT THE CLOSE OF EACH DAYS WORK.
5. PERFORM SURFACE RESTORATION IMMEDIATELY FOLLOWING SUCCESSFUL PRESSURE TESTING, INCLUDING ROADWAY, DRIVEWAY, LANDSCAPING, GRASSING OR OTHER. RESHAPE DITCHES TO EXISTING CONTOURS. GRASSING SHALL BE WHERE EXISTING GRASS HAS BEEN DAMAGED BY CONSTRUCTION.
6. NO MACHINE EXCAVATION SHALL BE PERFORMED WITHIN 5 FEET OF A GAS MAIN.
7. CONTRACTOR SHALL CONTACT ALABAMA ONE CALL BY CALLING 811 OR 1-800-292-8525 AT LEAST 48 HOURS PRIOR TO EXCAVATION. ALL PROPOSED CONSTRUCTION SHALL BE WHITE-LINE PAINTED PRIOR TO CONTACTING ALABAMA ONE CALL.

EROSION CONTROL NOTES

1. ALL CONSTRUCTION ACTIVITIES SHALL INCORPORATE BEST MANAGEMENT PRACTICES TO CONTROL EROSION, SEDIMENTATION, AND THE POTENTIAL FOR DOWNSTREAM WATER QUALITY DEGRADATION. CONSTRUCTION PRACTICES INCLUDE:
    c. CONSTRUCT TEMPORARY SEDIMENTATION BASINS OR EARTHEN BERMS AT DOWN-GRADIENT ENDS OF NEWLY GRADED AREAS TO PROVIDE FOR SEDIMENT AND TURBIDITY REMOVAL.
    d. LIMIT SITE CLEARING TO THOSE AREAS REQUIRED FOR A PARTICULAR PHASE OF CONSTRUCTION. EXISTING TREES AND VEGETATION TO REMAIN WHEREVER POSSIBLE.
    e. TURBIDITY BARRIERS, HAY BALES AND OTHER EROSION CONTROL MEASURES SHALL REMAIN IN PLACE UNTIL CONSTRUCTION ACTIVITIES ARE COMPLETE AND THE POTENTIAL FOR EROSION IS ELIMINATED.
2. DO NOT EMPLOY SILT FENCES IN A MANNER TO CAUSE THEM TO ACT AS A DAM ACROSS PERMANENTLY FLOWING WATERCOURSES. USE SILT FENCES AT UPLAND LOCATIONS, AND TURBIDITY BARRIERS IN PERMANENT WATER BODIES, REGARDLESS OF WATER DEPTH.

SUBMITTALS

1. CONTRACTOR SHALL PROVIDE SUBMITTAL DOCUMENTS FOR APPROVAL BY THE ENGINEER PRIOR TO PURCHASE. DOCUMENTS SHALL BE PRESENTED IN A SINGLE BINDER WITH TAB SEPARATION BASED ON EQUIPMENT. PROVIDE SPECIFICATIONS, FEATURES AND DRAWING CONNECTION CUT-SHEETS FOR ALL EQUIPMENT, MATERIALS AND APPURTENANCES PER THE CONTRACT DOCUMENTS.

CONSTRUCTION SCHEDULE

1. THE CONTRACTOR SHALL CONFIRM A CONSTRUCTION SCHEDULE WITH THE ENGINEER'S PROJECT MANAGER AT LEAST 14 DAYS PRIOR TO ANY WORK AT THE SITE.
2. THE PROPOSED CONSTRUCTION SCHEDULE SHALL BE PRESENTED IN A TIMELINE FORMAT SHOWING ESTIMATED START DATE, DURATION, AND COMPLETION TIMES FOR EACH ACTIVITY. ANY DEVIATION FROM THE ORIGINALLY PROPOSED SCHEDULE MUST BE COMMUNICATED TO THE ENGINEER'S PROJECT MANAGER WITHIN 24 HOURS.

AS-BUILT DRAWINGS

1. THE CONTRACTOR SHALL MAINTAIN DURING THE CONSTRUCTION FIELD MARK-UP RED LINE DRAWINGS SHOWING ACTUAL DETAILS, DIMENSIONS, AND OTHER PERTINENT FEATURES THAT VARY FROM THE ORIGINAL DESIGN.
2. UPON COMPLETION OF THE PROJECT, PROVIDE AN AS-BUILT SURVEY OF ALL IMPROVEMENTS IN AUTOCAD FORMAT UTILIZING THE CONSTRUCTION PLANS AS A BASIS. THE AS-BUILT SURVEY MUST BE PREPARED BY AN ALABAMA SURVEYOR. AS A MINIMUM AS BUILT DRAWINGS FOR PIPELINE CONSTRUCTION SHALL SHOW CONSTRUCTED HORIZONTAL AND VERTICAL LOCATIONS OF ALL BENDS, FITTINGS AND VALVES AND ELEVATIONS. AT ALL LOCATIONS WHERE PROPOSED DESIGN ELEVATIONS ARE SHOWN ON THE DRAWINGS. THE AS-BUILT SURVEY WILL BE TIED INTO THE STATE PLANE COORDINATE SYSTEM.

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name: JOHN F. PERELLA, PE
Professional Engineer's No.: 37041-E

State	Date Signed	Project Mgr.
AL		JH
Designed by	Drawn by	Checked by
ZV	BO	JP

ARCADIS
ARCADIS U.S., INC.
ALABAMA CERTIFICATE OF AUTHORIZATION NUMBER 1822

RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC - 10565 HIGHWAY 43 NORTH, CREOLA, MOBILE COUNTY, ALABAMA
AIR SPARGE / SOIL VAPOR EXTRACTION REMEDIATION SYSTEM

GENERAL NOTES AND SPECIFICATIONS I

CONSTRUCTION DRAWINGS

ARCADIS Project No.
03648010.0001.00500

Date
JANUARY 2018

ARCADIS
3109 W. MARTIN L. KING JR. DR.
SUITE 350
TAMPA, FL 33607
TEL. 813.903.3100

G-1

GENERAL PIPELINE REQUIREMENTS

1. TRENCHES SHALL BE INSTALLED VIA TRADITIONAL OPEN TRENCHING METHODS.
2. CONTRACTION SHALL MAINTAIN 36" MINIMUM COVER OVER PROPOSED CONVEYANCE PIPELINES AND ELECTRICAL CONDUITS, UNLESS OTHERWISE NOTED ON THE PLANS.
3. A MINIMUM HORIZONTAL CLEARANCE OF 36" AND VERTICAL CLEARANCE OF 18" SHALL BE MAINTAINED BETWEEN PROPOSED FACILITIES AND ALL EXISTING INFRASTRUCTURE.
4. AIR SPARGE (AS) INJECTION AND VACUUM EXTRACTION (VE) WELLS SHOWN ON THE CONSTRUCTION DRAWINGS WILL BE INSTALLED BY AN ALABAMA LICENSED DRILLING CONTRACTOR.
5. CONTRACTOR SHALL INSTALL A CONTINUOUS 3-INCH WIDE DETECTABLE METAL TAPE (TERRA TAPE OR EQUAL), 1FT ABOVE THE PIPE IN ALL TRENCHES. TAPE SHALL BE MARKED AND COLOR CODED TO IDENTIFY THE PIPE USE.
6. IF THERE ARE ANY DISCREPANCIES BETWEEN SPECIFICATIONS AND CONSTRUCTION DRAWINGS, THE ENGINEER SHALL BE CONSULTED TO RESOLVE THE DISCREPANCY.
7. ALL MATERIALS NOT SPECIFICALLY DESCRIBED, BUT REQUIRED FOR A COMPLETE AND PROPER INSTALLATION OF THE WORK, SHALL BE NEW, FIRST QUALITY OF THEIR RESPECTIVE KIND AND AS SELECTED BY THE CONTRACTOR SUBJECT TO THE APPROVAL OF THE ENGINEER.
8. ALL MATERIALS SHALL BE PROPERLY STORED TO PREVENT DAMAGE. ANY DAMAGED MATERIALS WILL BE REPLACED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE PROJECT.
9. INSTALLATION OF ALL PIPE AND FITTINGS SHALL COMPLY WITH THE PIPE MANUFACTURER'S RECOMMENDED PROCEDURES.

AIR SPARGE INJECTION (PRESSURE) PIPING REQUIREMENTS

1. BS INJECTION (PRESSURE) PIPELINES AND FITTINGS SHALL BE HIGH DENSITY PE 4710 POLYETHYLENE, CONFORMING TO ASTM D3350, PRESSURE CLASS 200 IRON PIPE SIZE (IPS) OUTSIDE DIAMETER, DR11. PIPE SHALL BE MANUFACTURED BY JM MANUFACTURING, PERFORMANCE PIPE OR APPROVED EQUAL, MEETING THE REQUIREMENTS OF ASTM F714.
2. WHERE PE PIPE IS JOINED TO PE PIPE, JOINING SHALL BE ACCOMPLISHED BY USE OF THERMAL BUTT FUSION METHOD. THIS METHOD SHALL BE PERFORMED IN ACCORDANCE WITH WRITTEN REQUIREMENTS OF THE PE PIPE MANUFACTURER, PLASTIC PIPE INSTITUTE AND ASTM D2620 AS APPLICABLE. PERSONNEL PERFORMING THERMAL BUTT FUSION SHALL BE THOROUGHLY TRAINED IN HEAT FUSION JOINING METHODS AND SHALL HAVE EXTENSIVE EXPERIENCE IN THIS WORK. IF REQUESTED, CERTIFICATIONS SHALL BE PROVIDED TO THE ENGINEER.
3. WHERE PE PIPE TERMINATES INSIDE REMOTE CABINETS AND AT INDIVIDUAL BS WELLS, TRANSITIONS FITTINGS SHALL BE USED. TRANSITION FITTING SHALL BE MANUFACTURED BY POLY-CAM, INC. TRANSITION JOINT SHALL MEET THE REQUIREMENTS OF ASTM D2513 CATEGORY. THREADED TRANSITION SHALL BE MANUFACTURED OF TYPE 304 STAINLESS STEEL AND MEET THE REQUIREMENTS OF ASTM A249. HDPE SHALL BE PE 4710 AND MEET THE REQUIREMENTS OF ASTM 714.
   HDPE PIPE END: INSTALL TRANSITION FITTING SO AS TO COMPLY WITH THE PIPE MANUFACTURER'S RECOMMENDED PROCEDURES. ALL FIELD WELDS SHALL BE ACCOMPLISHED IN ACCORDANCE WITH PLASTIC PIPE INSTITUTE'S WELDING PROCEDURE FOR BUTT FUSION.
   THREADED FITTING: USE PIPE JOINT SEALANT OR TEFLON TAPE. ALWAYS USE STRAP WRENCHES. DO NOT USE PIPE WRENCH. ALWAYS USE 2 WRENCHES WHEN CONNECTING, OVER TIGHTEN MAY CAUSE OVALITY OR DAMAGE.

VACUUM EXTRACTION PIPING REQUIREMENTS

1. VACUUM EXTRACTION PIPELINES SHALL UTILIZE SLOPE AS NOTED ON THE PLANS. INDIVIDUAL VACUUM EXTRACTION PIPELINES (2") TO VE WELLS SHALL BE SLOPED TO DRAIN TO THE RESPECTIVE VE WELL. MAIN VACUUM EXTRACTION PIPELINE TO REMOTE CABINET (6") SHALL BE SLOPED TO DRAIN IN THE DIRECTION OF THE BLOWER BUILDING, UNLESS OTHERWISE NOTED ON THE PLANS.

VE PIPELINE MAIN - TO REMOTE CABINETS

1. VE PIPELINE FROM BLOWER BUILDING TO REMOTE CABINETS. SHALL BE POLYVINYL CHLORIDE (PVC), SCHEDULE 80 IPS OUTSIDE DIAMETER, TYPE 1, GRADE 1. PIPE SHALL BE MANUFACTURED BY GEORG FISHER, HARVEL, SPEARS OR APPROVED EQUAL, MEETING THE REQUIREMENTS OF ASTM D1784 AND D1785.
2. VE FEEDER PIPE AND FITTING PVC JOINTS SHALL BE GLUED USING PVC CEMENT MEETING THE REQUIREMENTS OF ASTM D2855 HEAVY WEIGHT, HEAVY BODY CEMENT.

VE FEEDERS - TO VE WELLS

1. VE FEEDER FROM REMOTE CABINET TO VE WELLS AND NECESSARY FITTINGS SHALL BE POLYVINYL CHLORIDE (PVC) SCHEDULE 40 IPS OUTSIDE DIAMETER, TYPE I, GRADE I. PIPE SHALL BE MANUFACTURED BY GEORG FISHER, HARVEL, SPEARS OR APPROVED EQUAL, MEETING ASTM D1784 AND D1785.
2. VE FEEDER PIPE AND FITTING PVC JOINTS SHALL BE GLUED USING PVC CEMENT MEETING THE REQUIREMENTS OF ASTM D2855 HEAVY WEIGHT, HEAVY BODY CEMENT.

PRESSURE TESTING

1. RESTRAINT -THE PIPELINE TEST SECTION MUST BE RESTRAINED AGAINST MOVEMENT IN THE EVENT OF CATASTROPHIC FAILURE. JOINTS MAY BE EXPOSED FOR LEAKAGE EXAMINATION PROVIDED THAT RESTRAINT IS MAINTAINED.
2. THE TESTING EQUIPMENT CAPACITY AND THE PIPELINE TEST SECTION SHOULD BE SUCH THAT THE TEST SECTION CAN BE PRESSURIZED AND EXAMINED FOR LEAKS WITHIN TEST DURATION TIME LIMITS. LOWER CAPACITY TESTING AND PRESSURIZING EQUIPMENT MAY REQUIRE A SHORTER TEST SECTION.
3. TEST EQUIPMENT AND THE PIPELINE TEST SECTION SHOULD BE EXAMINED BEFORE PRESSURE IS APPLIED TO ENSURE THAT CONNECTIONS ARE TIGHT, NECESSARY RESTRAINTS ARE IN PLACE AND SECURE, AND COMPONENTS THAT SHOULD BE ISOLATED OR DISCONNECTED ARE ISOLATED OR DISCONNECTED. ALL LOW PRESSURE FILLING LINES AND OTHER ITEMS NOT SUBJECT TO THE TEST PRESSURE SHOULD BE DISCONNECTED OR ISOLATED.
4. IF LEAKS ARE DISCOVERED, DEPRESSURIZE THE TEST SECTION BEFORE REPAIRING LEAKS. CORRECTLY MADE FUSION JOINTS DO NOT LEAK. LEAKAGE AT A BUTT FUSION JOINT MAY INDICATE IMMINENT CATASTROPHIC RUPTURE. DEPRESSURIZE THE TEST SECTION IMMEDIATELY IF BUTT FUSION LEAKAGE IS DISCOVERED. LEAKS AT FUSION JOINTS REQUIRE THE FUSION JOINT TO BE CUT OUT AND REDONE.
5. IF THE PRESSURE LEAK TEST IS NOT COMPLETED DUE TO LEAKAGE, EQUIPMENT FAILURE, ETC., THE TEST SECTION SHOULD BE DE-PRESSURIZED AND REPAIRS MADE. ALLOW THE TEST SECTION TO REMAIN DEPRESSURIZED FOR AT LEAST EIGHT (8) HOURS BEFORE RETESTING.
6. THE CONTRACTOR SHALL PROVIDE PIPE TESTING RECORDS TO THE ENGINEER. THESE RECORDS MUST INCLUDE FINAL APPROVAL SIGNATURES BY THE ENGINEER OR DESIGNATED ENGINEER REPRESENTATIVE.

BS PIPING PRESSURE TESTING PROCEDURE

1. THE BS PIPING TEST PROCEDURE CONSISTS OF INITIAL EXPANSION, AND TEST PHASES. FOR THE INITIAL EXPANSION PHASE, THE TEST SECTION IS PRESSURIZED TO EXPANSION PRESSURE (60 PSI) AND AIR PRESSURE IS MAINTAINED AT THE EXPANSION PRESSURE FOR FOUR (4) HOURS. FOR THE TEST PHASE, THE PRESSURE IN THE PIPING IS REDUCED BY 10 PSI. THIS IS THE TARGET TEST PRESSURE (50 PSI). IF THE TARGET TEST PRESSURE REMAINS STEADY (WITHIN 5% OF THE TARGET TEST PRESSURE) FOR ONE HOUR, LEAKAGE IS NOT INDICATED.

VE PIPING PRESSURE TESTING PROCEDURE

1. THE VE PIPING TEST PROCEDURE WILL BE PERFORMED UNDER VACUUM CONDITIONS. THE TEST SECTION WILL BE INITIALLY PRESSURIZED TO 12 IN-HG AND MAINTAINED AT THAT VACUUM FOR TWO (2) HOURS. FOR THE TEST PHASE, THE VACUUM IN THE PIPING IS REDUCED BY 2 IN-HGI. THIS IS THE TARGET TEST VACUUM (10 IN-HG). IF THE TARGET TEST VACUUM REMAINS STEADY (WITHIN 5% OF THE TARGET TEST VACUUM) FOR ONE HOUR, LEAKAGE IS NOT INDICATED.

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: — USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name: **JOHN F. PERELLA, PE**
Professional Engineer's No.: 37041-E

State	Date Signed	Project Mgr.
AL		JH
Designed by	**Drawn by**	**Checked by**
ZV	BO	JP

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ALABAMA CERTIFICATE OF AUTHORIZATION NUMBER 1822

RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC - 10565 HIGHWAY 43 NORTH, CREOLA, MOBILE COUNTY, ALABAMA
AIR SPARGE / SOIL VAPOR EXTRACTION REMEDIATION SYSTEM

GENERAL NOTES AND SPECIFICATIONS II

CONSTRUCTION DRAWINGS

ARCADIS Project No.
03648010.0001.00500

Date
JANUARY 2018

ARCADIS
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G-2

SWMU AND AOC LIST	
SWMU / AOC ID	SWMU / AOC DESCRIPTION
SWMU 1	North Pond
SWMU 2	Middle Pond
SWMU 3	South Pond
SWMU 4	Old Pond Area
SWMU 5	Former Pump House
SWMU 6	Former Flow Lines
SWMU 7	Chemical Drain
SWMU 8	Organic Sump
SWMU 9	Organic Holding Tank No. 3
SWMU 10	Caustic Sump
SWMU 11	Caustic Holding Tank No. 4
SWMU 12	Acid Sump
SWMU 13	Acid Holding Tank No. 5
SWMU 14	Drainage Ditch
SWMU 15	Underground Wastewater Storage Tanks
SWMU 16	Stainless Steel Tank Trailers
SWMU 17	Leachate Storage Tank
AOC A	Truck Parking Pad
AOC B	Former N, S, E, & W Monitor Wells
AOC C	Final Rinse Tanks
AOC D	10,000 Gallon Diesel UST
AOC E	Fuel Island Release

0 150' 300' 450'
1"=150'

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd
0	12/2017	INITIAL REMEDIATION SYSTEM DESIGN	JP	JP

Professional Engineer's Name: JOHN F. PERELLA, PE
Professional Engineer's No.: 37041-E

State	Date Signed	Project Mgr.
AL		JH
Designed by	Drawn by	Checked by
ZV	BO	JP

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SITE LAYOUT

CONSTRUCTION DRAWINGS

ARCADIS Project No.
03648010.0001.00500

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JANUARY 2018

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C-1

CITY: BB, FL DIV/GROUP: EN DB: B.OLIVA LD: J.PERELLA PIC: PM: TM: LYR:ON=*;OFF=*REF*
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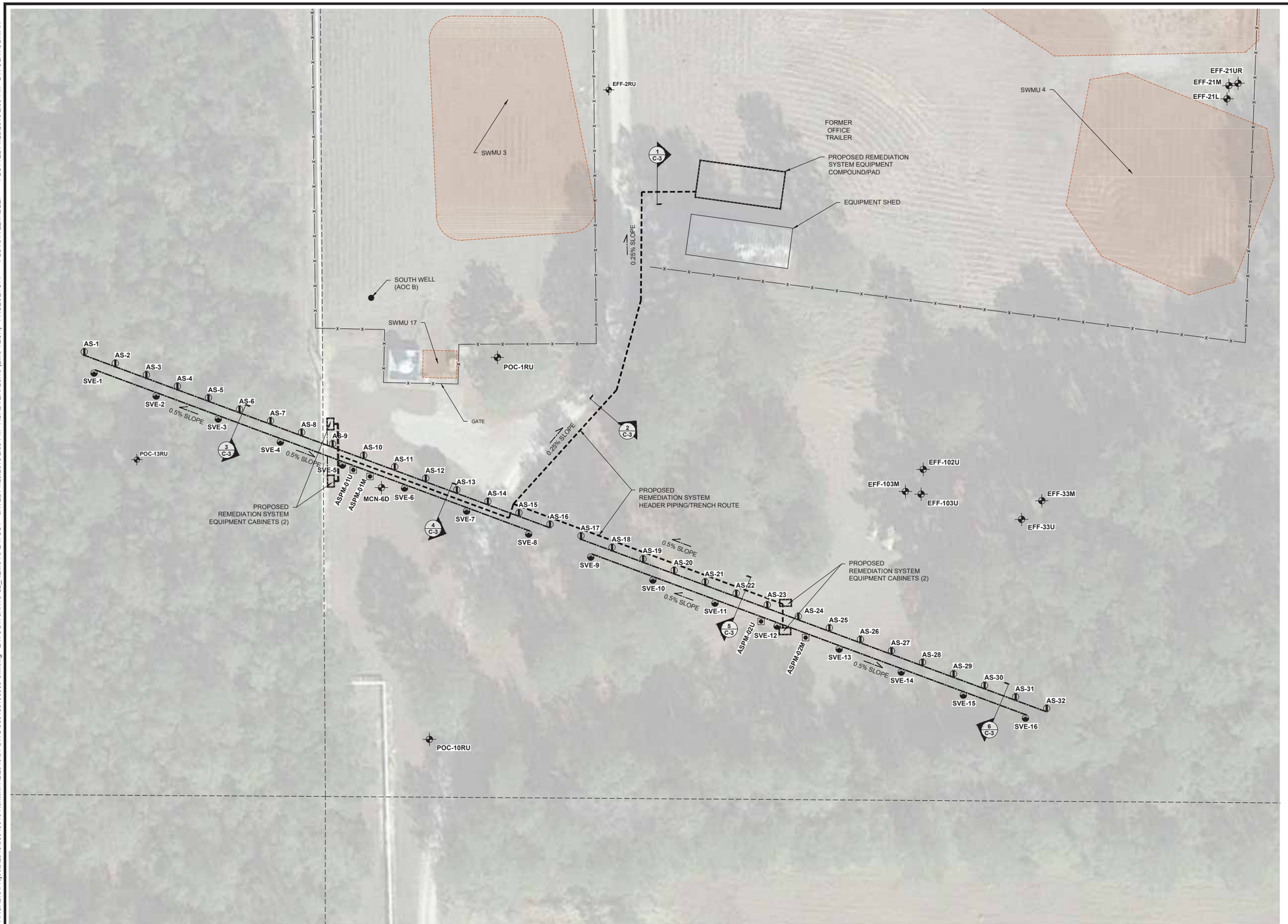

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LEGEND

- MIOCENE MONITOR WELL
- SEMI-CONFINING MONITOR WELL
- FENCE
- SITE BOUNDARY
- SWMU / AOC
- AS — PROPOSED AIR SPARGE (AS) WELL LOCATION
- SVE — PROPOSED SOIL VAPOR EXTRACTION (SVE) WELL LOCATION
- ASPM-01M — PROPOSED PERFORMANCE WELL LOCATION
- PROPOSED MAIN FEED PIPING
- PROPOSED INDIVIDUAL WELL PIPING

0 30' 60' 90'
1"=30'

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd
0	12/2017	INITIAL REMEDIATION SYSTEM DESIGN	JP	JP

Professional Engineer's Name: **JOHN F. PERELLA, PE**
Professional Engineer's No.: 37041-E

State	Date Signed	Project Mgr.
AL		JH
Designed by	**Drawn by**	**Checked by**
ZV	BO	JP

ARCADIS U.S., INC.
ALABAMA CERTIFICATE OF AUTHORIZATION NUMBER 1822

RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC - 10565 HIGHWAY 43 NORTH, CREOLA, MOBILE COUNTY, ALABAMA
AIR SPARGE / SOIL VAPOR EXTRACTION REMEDIATION SYSTEM

AIR SPARGE (AS) / SOIL VAPOR EXTRACTION (SVE) REMEDIATION SYSTEM LAYOUT

CONSTRUCTION DRAWINGS

ARCADIS Project No.
03648010.0001.00500

Date
JANUARY 2018

ARCADIS
3109 W. MARTIN L. KING JR. DR.
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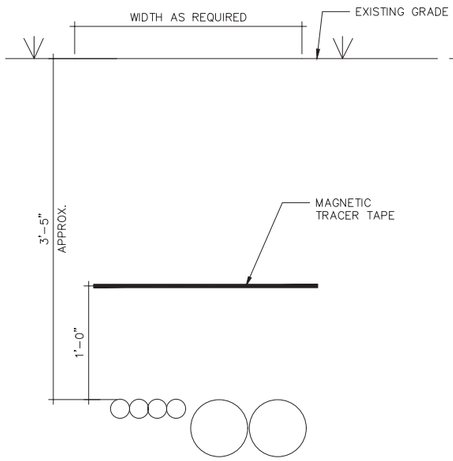
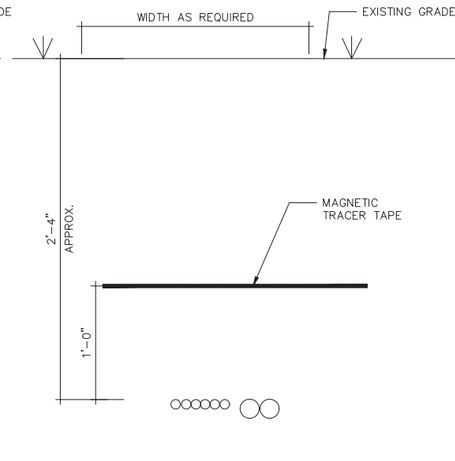
TAMPA, FL 33607
TEL. 813.903.3100

C-2



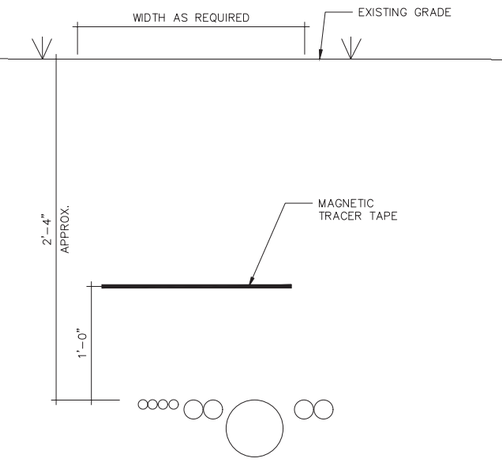
(4) 2"ø SDR-11 HDPE, AIR SPARGE RC FEED (AS RC-1, 2)
(2) 6"ø SCH 80 PVC, VAPOR EXTRACTION RC FEED (VE RC-1, 2)

1 C-2 SECTION
SCALE: 1-1/2" = 1'-0"



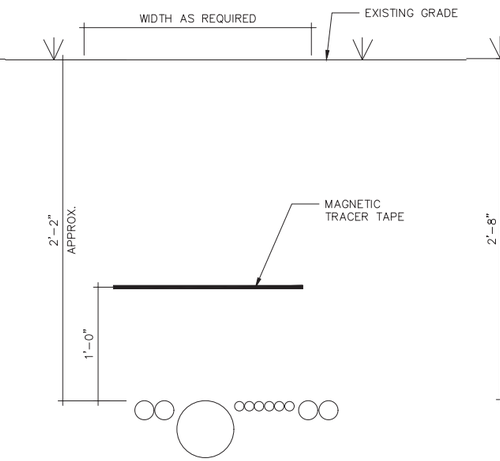
(6) 1"ø SDR-11 HDPE AIR SPARGE (AS-1,2,3,4,5,6)
(3) 2"ø SCH 40 PVC, VAPOR EXTRACTION (VE-1,2,3)

3 C-2 SECTION
SCALE: 1-1/2" = 1'-0"



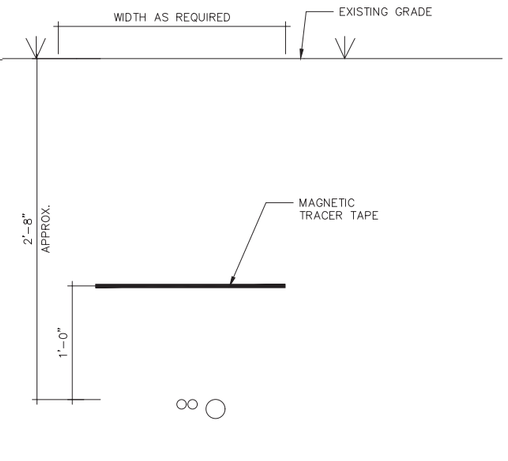
(4) 1"ø SDR-11 HDPE, AIR SPARGE (AS-13,14,15,16)
(2) 2"ø SDR-11 HDPE, BIOSPARGE RC FEED (BS RC-1)
(1) 6"ø SCH 80 PVC, VAPOR EXTRACTION RC FEED (VE RC-1)
(2) 2"ø SCH 40 PVC, VAPOR EXTRACTION (VE-7,8)

4 C-2 SECTION
SCALE: 1-1/2" = 1'-0"



(2) 2"ø SDR-11 HDPE, AIR SPARGE RC FEED (BS RC-2)
(1) 6"ø SCH 80 PVC, VAPOR EXTRACTION RC FEED (VE RC-2)
(6) 1"ø SDR-11 HDPE, AIR SPARGE (AS-17,18,19,20,21,22)
(3) 2"ø SCH 40 PVC, VAPOR EXTRACTION (VE-9,10,11)

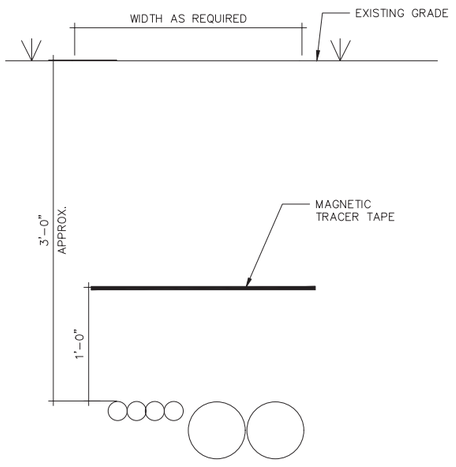
5 C-2 SECTION
SCALE: 1-1/2" = 1'-0"



(2) 1"ø SDR-11 HDPE, AIR SPARGE (AS-31,32)
(1) 2"ø SCH 40 PVC, VAPOR EXTRACTION (VE-16)

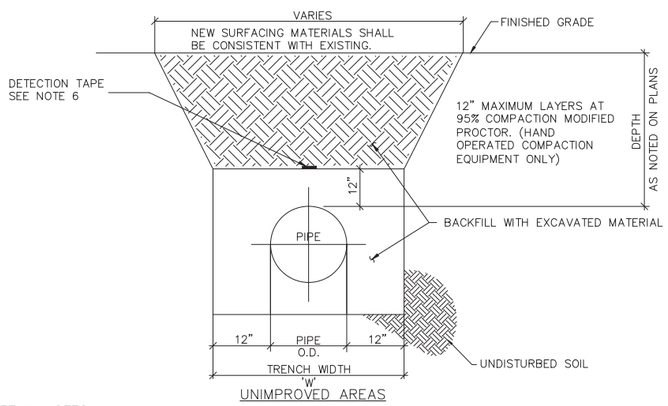
6 C-2 SECTION
SCALE: 1-1/2" = 1'-0"

NOTE:
1. TRENCH SECTIONS DO NOT SHOW ALL PIPE TRANSITIONS.
2. TRENCH DEPTH SHOWN IN DETAILS IS APPROXIMATE BASED ON PROPOSED SLOPE AND TRENCH LAYOUT ELEVATION PLANS.



(4) 2"ø SDR-11 HDPE, AIR SPARGE RC FEED (AS RC-1, 2)
(2) 6"ø SCH 80 PVC, VAPOR EXTRACTION RC FEED (VE RC-1, 2)

2 C-2 SECTION
SCALE: 1-1/2" = 1'-0"

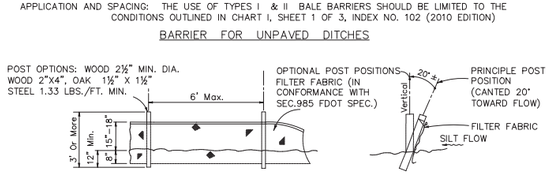


UNIMPROVED AREAS

GENERAL TRENCH DETAIL NOTES:

1. IT IS THE CONTRACTOR'S RESPONSIBILITY TO ENSURE THAT EXCAVATIONS DO NOT ENDANGER WORKMEN, EXISTING STRUCTURES, UTILITIES, OR OTHER FACILITIES. COMPLY WITH OSHA'S EXCAVATION SAFETY STANDARDS 29, CFR PART 1926.650-652 SUBPART P, IF THERE IS A CONFLICT BETWEEN THE STANDARD AND THESE DRAWINGS, THE MORE STRINGENT REQUIREMENT SHALL GOVERN.
2. SHEETING OR A TRENCH BOX SHALL BE UTILIZED AS REQUIRED TO MEET SAFETY STANDARDS.
3. COMPACTION PERCENTAGES SHOWN REFER TO MODIFIED PROCTOR MAXIMUM DRY DENSITY (ASTM D1557).
4. COMPACT WITH HAND OPERATED COMPACTING EQUIPMENT (HAND COMPACTED) ONLY.
5. VERIFY COMPACTION BY FIELD TESTING AT LEAST ONCE EVERY 100 FEET OF TRENCH. COMPACTION TESTING DOCUMENTATION WILL BE PROVIDED TO THE ENGINEER.
6. MAINTAIN TRENCH WIDTH "W" TO THIS LEVEL.
7. TRENCH WIDTH "W" = PIPE O.D. PLUS 2'-0". IN TRENCHES WHERE MULTIPLE CONDUITS ARE LAID SIDE BY SIDE, THE TRENCH SHALL BE 2'-0" WIDER THAN THE ENTIRE CONDUIT GALLERY CONFIGURATION.
8. PLACE 3" WIDE IDENTIFICATION/WARNING TAPE 12-INCHES OVER CENTER OF PIPE.
9. VERIFY THAT THERE ARE NO SHARP OR DELITERIOUS OBJECTS THAT MAY DAMAGE THE PIPE FOR A MINIMUM DEPTH OF 6-INCHES BELOW THE BOTTOM OF THE PIPE BARREL FOR THE FULL WIDTH OF THE TRENCH.
10. A MINIMUM OF 24" COVER SHALL BE MAINTAINED OVER PIPING/CONDUITS UNLESS OTHERWISE NOTED ON THE PLANS.

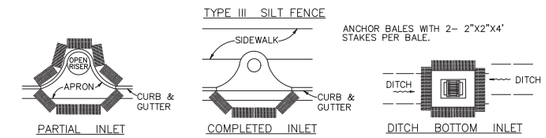
TRENCH/RESTORATION DETAILS
N.T.S.



APPLICATION AND SPACING: THE USE OF TYPES I & II BALE BARRIERS SHOULD BE LIMITED TO THE CONDITIONS OUTLINED IN CHART I, SHEET 1 OF 3, INDEX NO. 102 (2010 EDITION)

BARRIER FOR UNPAVED DITCHES

NOTE: SILT FENCE TO BE PAID FOR UNDER THE CONTRACT UNIT PRICE FOR STAKED SILT FENCE (LF).



PROTECTION AROUND INLETS OR SIMILAR STRUCTURES

NOTES:
1. EROSION CONTROL DEVICES SHALL BE PROPERLY MAINTAINED THROUGHOUT CONSTRUCTION TO PREVENT THE INFILTRATION OF PROJECT SITE SOILS INTO A PUBLIC DRAINAGE SYSTEM.
2. FOR ADDITIONAL DETAILS, REFER TO F.D.O.T. INDEX #102, 103, AND 104 (2010 EDITION).
3. SEE PLANS FOR LOCATION OF PROPOSED EROSION CONTROL DEVICES.

EROSION CONTROL DEVICES
N.T.S.

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name: JOHN F. PERELLA, PE
Professional Engineer's No.: 37041-E

State	Date Signed	Project Mgr.
AL		JH
Designed by	Drawn by	Checked by
ZV	BO	JP

ARCADIS
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ALABAMA CERTIFICATE OF AUTHORIZATION NUMBER 1822

RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC - 10565 HIGHWAY 43 NORTH, CREOLA, MOBILE COUNTY, ALABAMA
AIR SPARGE / SOIL VAPOR EXTRACTION REMEDIATION SYSTEM

TRENCH SECTIONS & EROSION CONTROL DETAILS

CONSTRUCTION DRAWINGS

ARCADIS Project No.
03648010.0001.00500
Date
JANUARY 2018
ARCADIS
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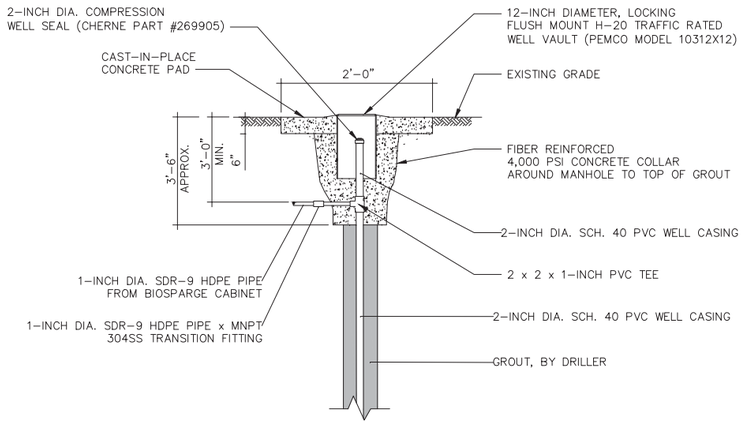
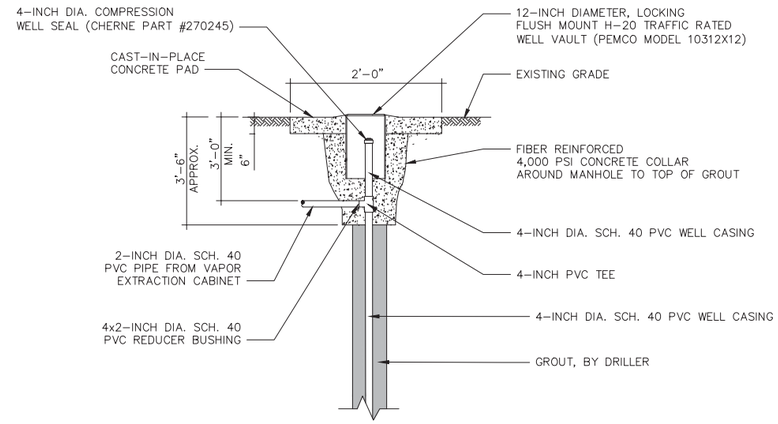
C-3



A C–2 BIOSPARGE WELL HEAD DETAIL

NOTES:
1. CENTER MANHOLE IN 2'–0" X 2'–0" X 6"D CAST–IN–PLACE CONCRETE PAD.
2. CONCRETE SHALL BE 28–DAY CONCRETE STRENGTH = 4,000 PSI (MIN.).



B C–2 VAPOR EXTRACTION WELL HEAD DETAIL

NOTES:
1. CENTER MANHOLE IN 2'–0" X 2'–0" X 6"D CAST–IN–PLACE CONCRETE PAD.
2. CONCRETE SHALL BE 28–DAY CONCRETE STRENGTH = 4,000 PSI (MIN.).

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name: **JOHN F. PERELLA, PE**
Professional Engineer's No.: 37041-E

State	Date Signed	Project Mgr.
AL		JH
Designed by	Drawn by	Checked by
ZV	BO	JP

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AIR SPARGE / SOIL VAPOR EXTRACTION REMEDIATION SYSTEM

AIR SPARGE & SOIL VAPOR EXTRACTION WELLHEAD COMPLETION DETAILS

CONSTRUCTION DRAWINGS

ARCADIS Project No.
03648010.0001.00500

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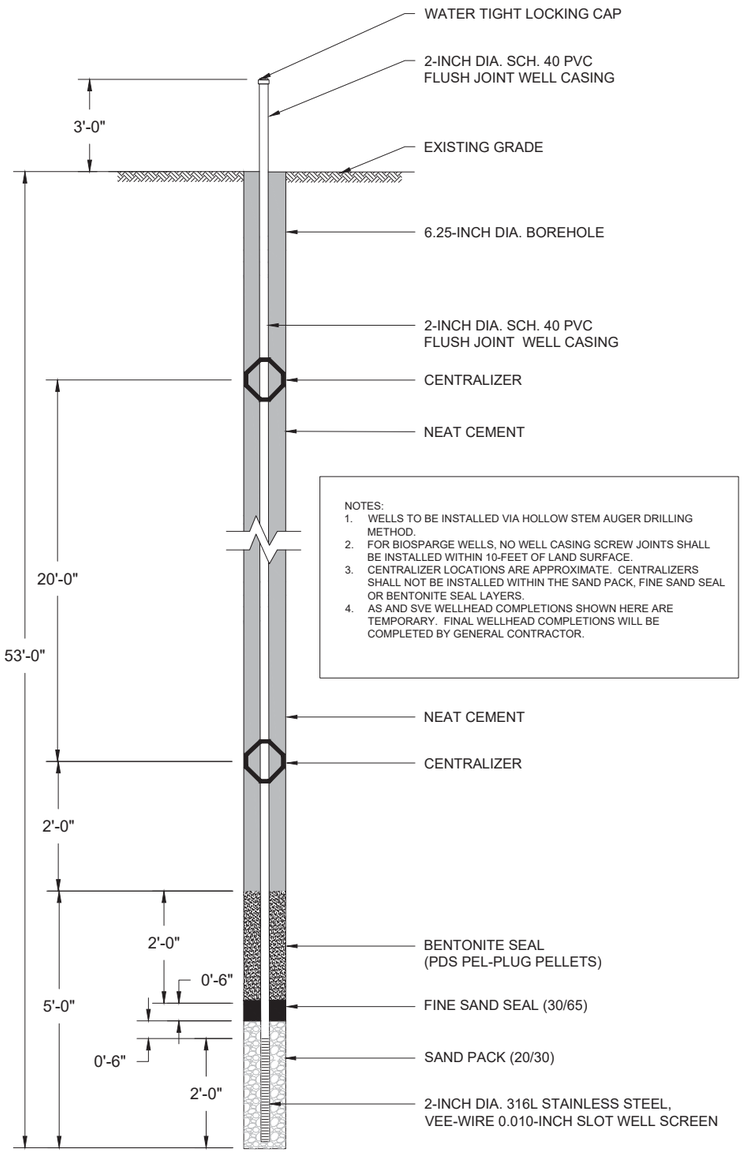
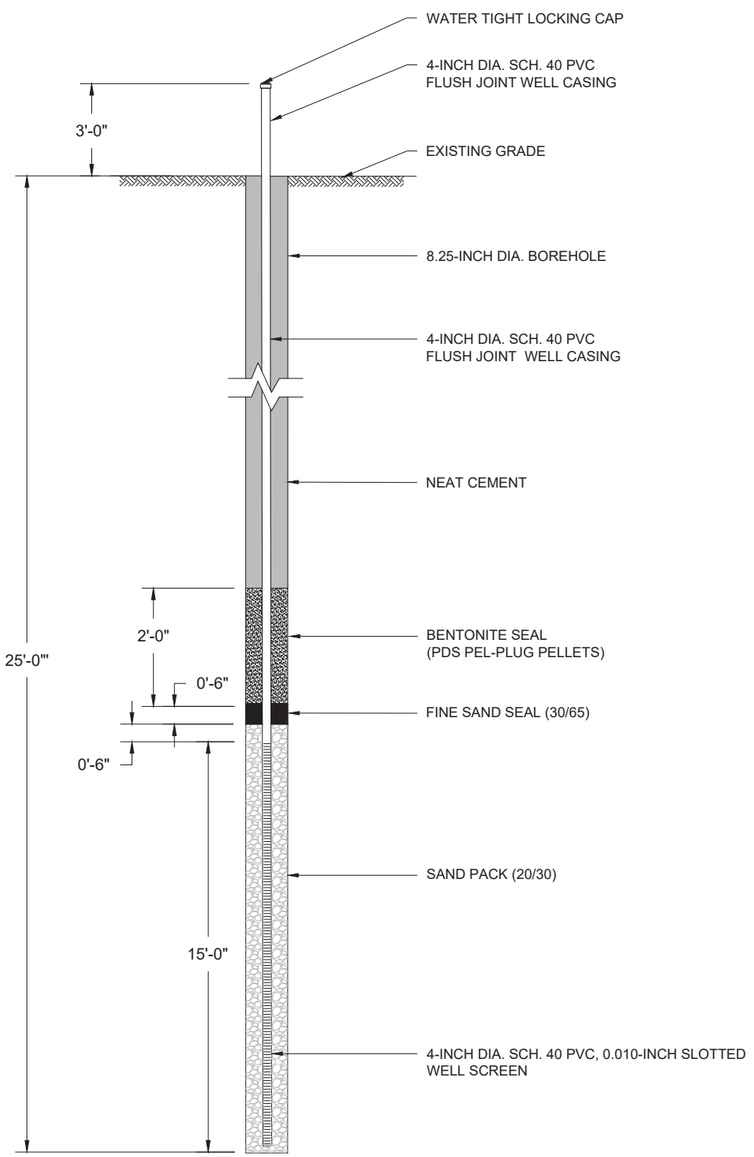
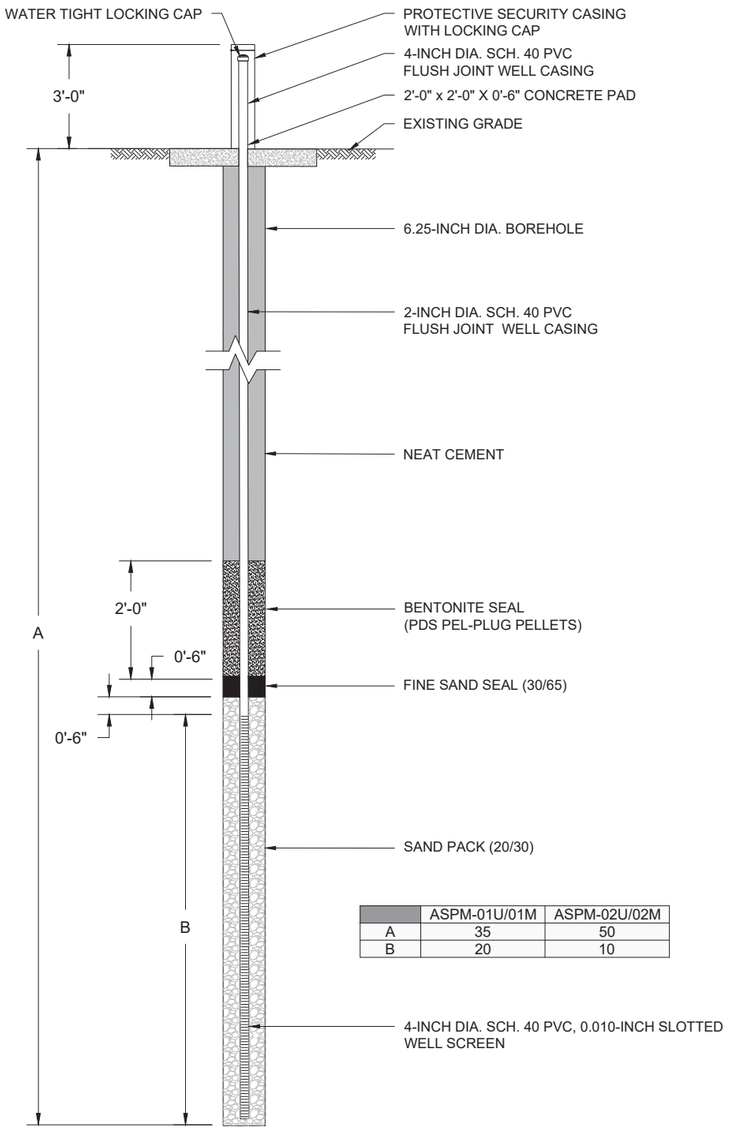


AIR SPARGE WELL
(AS-1 THROUGH AS-32)



SOIL VAPOR EXTRACTION WELL
(SVE-1 THROUGH SVE-16)



	ASPM-01U/01M	ASPM-02U/02M
A	35	50
B	20	10

PERFORMANCE MONITORING WELL
(ASPM-01U/01M & ASPM-02U/02M)

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Professional Engineer's Name: **JOHN F. PERELLA, PE**
Professional Engineer's No.: 37041-E

State	Date Signed	Project Mgr.
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AIR SPARGE / SOIL VAPOR EXTRACTION REMEDIATION SYSTEM

AIR SPARGE & SOIL VAPOR EXTRACTION WELL DETAILS

CONSTRUCTION DRAWINGS

ARCADIS Project No.
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C-5

EV

REMOTE MANIFOLD CABINETS

1. REMOTE MANIFOLD CABINETS ARE UTILIZED TO DISTRIBUTE PIPELINES TO INDIVIDUAL BS OR VE WELLS.
2. REMOTE CABINET PIPING MANIFOLDS WILL BE DELIVERED TO THE SITE COMPLETE. PRESSURE TESTING WILL BE COMPLETED PRIOR TO DELIVERY AND DOCUMENTATION PROVIDED TO THE ENGINEER.
3. REMOTE CABINETS SHALL BE WEATHERPRO OUTDOOR PAD MOUNT, TYPE 3R ENCLOSURE WITH OPEN BOTTOM AS MANUFACTURED BY HOFFMAN (PENTAIR) OR APPROVED EQUAL. CABINETS SHALL BE CONSTRUCTED OF PAINTED (WHITE) 14 GAUGE GALVANIZED STEEL.
4. REMOTE CABINETS WILL BE SECURED TO PRE-CAST CONCRETE PAD AT ALL CABINET MOUNTING HOLES UTILIZING KB-T2 3/8" X 5" 304SS EXPANSION ANCHORS AS MANUFACTURED BY HILTI OR APPROVED EQUAL.
5. PRECAST PADS SHALL UTILIZE PIPE WINDOW TO ALLOW ACCESS FOR FIELD PIPING INTO CABINET.

VE REMOTE CABINET PIPING AND APPURTENANCES

1. FLEXIBLE HOSE SHALL BE UTILIZED BETWEEN FIELD PIPING AND MANIFOLD PIPING. FLEXIBLE HOSE SHALL BE CONTITECH HD INDUSTRIAL VACUUM HOSE AS MANUFACTURED BY CONTINENTAL HOSE OR APPROVED EQUAL.
2. HOSE FITTING SHALL BE CLAMPED USING SERIES 94166 STAINLESS STEEL T-BOLT AND LOCKOUT NUT WITH 0.75" BAND AS MANUFACTURED BY CLAMPCO OR APPROVED EQUAL..
3. KING NIPPLE TRANSITION FITTINGS SHALL BE SCH 80 PVC AND MANUFACTURED BY SPEARS OR APPROVED EQUAL.
4. MANIFOLD PIPING SHALL BE CONSTRUCTED OF SCH 80 PVC. UNIONS SHALL BE UTILIZED AT KEY POINTS TO ALLOW FOR EASY DISASSEMBLY OF MANIFOLD AND ACCESS TO INSTRUMENTATION AND VALVES.
5. HEADER PIPING MATERIALS MAY BE PAINTED STEEL, PVC OR APPROVED ALTERNATIVE.
6. VACUUM GAUGES ARE ¼" BACK MOUNT, LIQUID FILLED, BRASS INTERNALS, 2.5" SS CASING, SERIES 212/213 AS MANUFACTURED BY WIKA OR APPROVED EQUAL.
7. FLOW ELEMENT SHALL BE SERIES DS-300 PITOT TUBE WITH MAGNEHELIC GAGE MODEL 2000 AS MANUFACTURED BY DWYER OR APPROVED EQUAL. DIFFERENTIAL FLOW MAGNEHELIC SHALL UTILIZE A RANGE OF 0 - 20 IN-W.C.. PRO.VIDE ONE (1) MAGNEHELIC GAGE IN EACH CABINET LOOSE FOR CONNECTION TO PITOT TUBE BY THE OPERATOR, AND TWO (2) MAGNEHELIC GAGES AS SPARES
8. BLOW OFF BALL VALVES SHALL BE 2-PIECE BRASS BALL VALVE WITH 400 PSI CWP RATING AS MANUFACTURED BY NIBCO, APOLLO OR APPROVED EQUAL.
9. FLOW CONTROL VALVE SHALL BE BRASS BODY, NON-RISING STEM, AND FULL PORT GATE VALVE RATE AT 200PSI CWP AS MANUFACTURED BY NIBCO, APOLLO OR APPROVED EQUAL.
10. ALL PIPE LEGS WILL BE LABELED ACCORDING TO THE RESPECTIVE BS WELL OPERATED, I.E. VE-1, VE-2, ETC. TAGS SHALL BE 1.5" DIAMETER ALUMINUM ROUND TAGS, STAMPED OR ETCHED WITH THE REQUIRED LABEL. LETTERING ON TAG WILL BE CONTRASTING COLOR TO TAG COLOR. USE BLUE TAGS AND WHITE LETTERING.

BS REMOTE CABINET PIPING AND APPURTENANCES

1. FLEXIBLE HOSE SHALL BE UTILIZED BETWEEN FIELD PIPING AND MANIFOLD PIPING. FLEXIBLE HOSE SHALL BE CONTITECH GORILLA HOSE AS MANUFACTURED BY CONTINENTAL HOSE OR APPROVED EQUAL.
2. HOSE FITTING SHALL BE BANDED USING PERFORMED SMOOTH ID 316SS 5/8" X 0.030" CLAMPS AS MANUFACTURED BY BAND-IT OR APPROVED EQUAL.
3. KING NIPPLE TRANSITION FITTINGS SHALL BE BRASS AND MANUFACTURED BY BAND-IT, DIXON OR APPROVED EQUAL. ON ONE END OF EVERY HOSE SECTION A SWIVEL NUT FITTING MUST BE UTILIZED FOR ALLOW EASY DISASSEMBLY OF HOSE.
4. MANIFOLD PIPING SHALL BE CONSTRUCTED OF SCH 40 GALVANIZED PIPING. UNIONS SHALL BE UTILIZED AT KEY POINTS TO ALLOW FOR EASY DISASSEMBLY OF MANIFOLD AND ACCESS TO INSTRUMENTATION AND VALVES.
5. HEADER PIPING MATERIALS MAY BE PAINTED STEEL, COPPER OR APPROVED ALTERNATIVE.
6. PRESSURE GAUGES ARE ¼" BACK MOUNT, LIQUID FILLED, BRASS INTERNALS, 2.5" SS CASING, SERIES 212/213 AS MANUFACTURED BY WIKA OR APPROVED EQUAL.
7. FLOW INDICATORS SHALL BE SERIES RM RATE-MASTER POLYCARBONATE FLOWMETER MODEL RMB-56-BV AS MANUFACTURED BY DWYER OR APPROVED EQUAL. FLOW INDICATOR SHALL UTILIZE A RANGE OF 50 - 500 SCFH, SHALL HAVE 5" SCALE AND FLOW CONTROL VALVE.
8. AIR SHUT OFF BALL VALVES SHALL BE 2-PIECE BRASS BALL VALVE WITH 400 PSI CWP RATING AS MANUFACTURED BY NIBCO, APOLLO OR APPROVED EQUAL.
9. CHECK VALVES SHALL BE CLASS 125 BRONZE CHECK VALVE WITH BUNA-N SEAT DISC AS MANUFACTURED BY NIBCO, APOLLO OR APPROVED EQUAL.
10. PRESSURE REGULATORS FOR ZONE PRESSURE CONTROL SHALL BE 1-INCH PARKER P3NR HI FLOW REGULATORS WITH 160PSI GAUGE OR APPROVED EQUAL.
11. ALL PIPE LEGS WILL BE LABELED ACCORDING TO THE RESPECTIVE BS WELL OPERATED, I.E. AS-1, AS-2, ETC. TAGS SHALL BE 1.5" DIAMETER ALUMINUM ROUND TAGS, STAMPED OR ETCHED WITH THE REQUIRED LABEL. LETTERING ON TAG WILL BE CONTRASTING COLOR TO TAG COLOR. USE BLUE TAGS AND WHITE LETTERING.

EQUIPMENT REQUIREMENTS

1. AIR SPARGE COMPRESSOR (AC-200) SHALL BE KAESER AS 30 T AIR CENTER (30HP/480V) OR APPROVED EQUIVALENT. CAPABLE OF OPERATING CONTINUOUSLY @ 128 SCFM AND 38 PSI.
2. VAPOR EXTRACTION BLOWER (B-110) SHALL BE TUTHILL 7018-21L2 CP SERIES 2 LOBE (80HP/480V) OR APPROVED EQUIVALENT. CAPABLE OF OPERATING CONTINUOUSLY @ 850 SCFM AND 132 IN-H2O VAC AND 10 IN-H2O DISCHARGE PRESSURE.
3. COMPRESSORS AND BLOWERS MUST UTILIZE NOISE ABATEMENT ENCLOSURES AND/OR SILENCERS THAT REDUCE NOISE LEVEL AT THE EXTERIOR OF THE ENCLOSURE AT 1 METER ON ALL SIDES AND WITHIN THE CONTROL ROOM AND/OR INSIDE THE EQUIPMENT ENCLOSURE TO 80DB OR LESS.
4. COMPRESSORS SHALL UTILIZE CONDENSATE MANAGEMENT SYSTEMS (CF-260) FOR THE COLLECTION AND FILTRATION OF COMPRESSOR CONDENSATE. CONDENSATE MANAGEMENT SYSTEMS SHALL BE KAESER KCF-100 OR APPROVED EQUIVALENT.
5. ALL COMPRESSOR EXHAUST SHALL BE DUCTED TO THE EXTERIOR OF THE EQUIPMENT ENCLOSURE. DUCTING SHALL BE EASILY REMOVED SO THAT COMPRESSOR ENCLOSURE PANELS CAN BE ACCESSED FOR MAINTENANCE. DUCTING SHALL BE INSTALLED IN A FASHION TO MINIMIZE EXHAUST LEAKS INTO THE EQUIPMENT ENCLOSURE.
6. CONDENSATE HOLDING TANK (T-160) SHALL BE 400 GALLON CAPACITY MODEL 1740000N AS MANUFACTURED BY SNYDER INDUSTRIES OR APPROVED EQUIVALENT.
7. PRESSURE REGULATOR FOR BIOSPARGE ZONE PRESSURE CONTROL SHALL BE 1-INCH PARKER P3NR HI FLOW REGULATORS WITH 160 PSI GAUGE OR APPROVED EQUIVALENT.
8. ELECTRIC ACTUATORS FOR BIOSPARGE ZONE CONTROL SHALL BE FLOWSERVE WORCHESTER CONTROLS SERIES 75 MODEL 10-4-75-W-M1-120A OR APPROVED EQUIVALENT. VALVES SHALL BE DOMESTICALLY MANUFACTURED BRASS BODY VALVE WITH STAINLESS STEEL BALL AND STEM RATED FOR 600PSI. GLASS-FILED REINFORCED TEFLON SEATS AND STEAM PACKING.
9. PRESSURE GAUGES SHALL BE ¼" BACK MOUNT, LIQUID FILLED, BRASS INTERNALS, 2.5" SS CASING, SERIES 212/213 AS MANUFACTURED BY WIKA OR APPROVED EQUIVALENT.
10. VACUUM GAUGES SHALL BE ¼" BACK MOUNT, LIQUID FILLED, BRASS INTERNALS, 2.5" SS CASING, SERIES 212/213 AS MANUFACTURED BY WIKA OR APPROVED EQUIVALENT.
11. VAPOR PHASE GRANULAR ACTIVATED CARBON VESSELS SHALL HAVE A MINIMUM GAC CAPACITY OF 3,000 POUNDS. VESSELS SHALL BE CAPABLE OF OPERATING UNDER VACUUM CONDITIONS AND OPERATE AT A FLOW RATE OF APPROXIMATELY 800 SCFM WITH LOSS OF APPROXIMATELY 20 IN-WC WITH SYSTEM OPERATING AT FULL LOAD. VESSELS SHALL BE CARBON SUPPLY, INC. (CSI) MODEL CSI V-3000 OR APPROVED EQUAL.

EV/GC

PIPE SUPPORTS, PIPE WRAPS, PIPE INSULATION AND PIPE PENETRATIONS

1. GALVANIZED CARBON STEEL PIPING THROUGH CONCRETE OR BELOW GRADE SHALL BE WRAPPED WITH 3M SCOTCHWRAP TYPE 51 ALL WEATHER OR APPROVED EQUIVALENT.
2. EXHAUST PIPING FOR VAPOR EXTRACTION BLOWER INSIDE THE ENCLOSURE, SHALL BE INSULATED TO PREVENT POTENTIAL TOUCH POINT BURNS AND TO REDUCE HEAT LOAD WITHIN THE ENCLOSURE. PIPE INSULATION SHALL BE OWENS CORNING FIBERGLAS PIPE INSULATION AND SHALL BE 2-INCHES THICK.

EQUIPMENT, PIPING AND APPURTENANCES INSTALLATION

1. ALL EQUIPMENT SHALL BE INSTALLED LEVEL.
2. THE EQUIPMENT AND PIPING INSTALLERS PROVIDED BY THE CONTRACTOR SHALL BE THOROUGHLY TRAINED AND EXPERIENCED IN THE NECESSARY CRAFTS AND FAMILIAR WITH THE SPECIFICATION PROVIDE HERE.
3. CONSTRUCTION DRAWINGS SHOW GENERAL ARRANGEMENT, DIRECTION AND SIZE OF EQUIPMENT AND PIPING AND ARE NOT INTENDED TO SHOW EVERY OFFSET, VALVE AND FITTING OR EVERY STRUCTURAL DIFFICULTY THAT MAY BE ENCOUNTERED. INSTALL THE PIPING AND APPURTENANCES TO SUIT, AND IN ACCORDANCE WITH THE PIPING AND INSTRUMENTATION DIAGRAM PROVIDED IN THE CONSTRUCTION DRAWING PACKAGE. VERIFY ALL MEASUREMENTS AT THE SITE.
4. INSTALL ALL PIPING IN STRICT ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS AND AS APPROVED BY THE ENGINEER.
5. THE CONTRACTOR SHALL PROVIDE ADEQUATE PIPE SUPPORTS FOR BOTH HORIZONTAL AND VERTICALLY MOUNTED PIPES.
6. PRESSURE GAUGES, FLOW METERS AND OTHER INSTRUMENTATION SHALL BE INSTALLED IN LOCATIONS THAT ARE EASILY READABLE AND ACCESSIBLE FOR MAINTENANCE.
7. LABELING OF EQUIPMENT AND PIPING SHALL INCLUDE, BUT NOT LIMITED TO, FLOW DIRECTION ARROWS, EQUIPMENT IDENTIFICATION PLACARDS AND SAFETY PLACARDS.
8. ALL PIPE FITTINGS AND MATERIALS SHALL BE CAREFULLY INSPECTED IN THE FIELD BEFORE INSTALLATION. CRACKED, BROKEN, WARPED, OUT-OF-ROUND, AND DAMAGED PIPE JOINTS, INCLUDING DAMAGED PIPELINING OR COATINGS OR SPECIALS, AS DETERMINED BY THE ENGINEER, SHALL NOT BE INSTALLED. SUCH REJECTED PIPE OR OTHER MATERIALS SHALL BE CLEARLY TAGGED IN SUCH A MANNER AS TO NOT DEFACE OR DAMAGE IT, AND THE PIPE SHALL THEN BE REMOVED FROM THE SITE BY THE CONTRACTOR AT HIS OWN EXPENSE.

PIPING AND APPURTENANCES

1. PIPING MATERIALS AND PIPING APPURTENANCES ARE IDENTIFIED ON THE PIPING AND INSTRUMENTATION DIAGRAMS THAT ARE INCLUDED IN THE CONSTRUCTION DRAWINGS. ADDITIONAL SPECIFICATIONS ARE PROVIDED IN THIS SECTION. IF THERE ARE ANY DISCREPANCIES BETWEEN THESE SPECIFICATIONS AND THE CONSTRUCTION DRAWINGS, THE ENGINEER SHALL BE CONSULTED TO RESOLVE THE DISCREPANCY.
2. ABOVE GRADE PIPING MATERIALS FOR VAPOR EXTRACTION SYSTEM SHALL BE TYPE 1, GRADE 1, SCHEDULE 80 PVC PIPE AND FITTINGS CONFORMING TO ASTM D1784 AND D1785, UNLESS OTHERWISE NOTED ON THE DRAWINGS.
3. PIPE AND FITTING PVC JOINTS SHALL BE GLUED USING PVC CEMENT MEETING THE REQUIREMENTS OF ASTM D2855 HEAVY WEIGHT, HEAVY BODY CEMENT.
4. ABOVE GRADE PIPING MATERIALS FOR AIR SPARGE SYSTEM SHALL BE SCHEDULE 40 GALVANIZED CARBON STEEL PIPE AND FITTINGS CONFORMING TO ASTM A53 GRADE A, UNLESS OTHERWISE NOTED ON THE DRAWINGS.
5. ABOVE GRADE HOSE BETWEEN PIPING AND VAPOR PHASE GRANULAR ACTIVATED CARBON VESSELS SHALL BE TIGERFLEX WST-SLR AS MANUFACTURED BY KURIYAMA OF AMERICA OR APPROVED EQUIVALENT.
6. HOSE SHALL BE CLAMPED TO FITTINGS USING SERIES 94166 STAINLESS STEEL T-BOLT AND LOCKOUT NUT WITH 0.75" BAND AS MANUFACTURED BY CLAMPCO OR APPROVED EQUIVALENT.
7. FLANGE CONNECTIONS SHALL BE ANSI CLASS 150 FLANGES UNLESS OTHERWISE NOTED. JOIN FLANGES WITH FULL FACED GASKETS, 1/8 INCH THICK. GASKET MATERIAL SHALL BE VITON. PROVIDE MACHINE MADE OR DIE STAMPED GASKETS WITH INSIDE AND OUTSIDE EDGES CONCENTRIC. OVERSIZE BOLT HOLES TO PREVENT CRIMPING OF GASKET WHEN INSTALLED.
8. PVC CHECK VALVES FOR LIQUID SERVICE SHALL BE IPEX VR SERIES PISTON CHECK
9. ALL VALVES SHALL BE PROVIDED WITH VITON O-RING SEALS AND SHUTTER.

CITY: BB, FL DIV/GROUP: EN DB: B.OLIVA LD: J.PERELLA PIC: PM: TM: LYR:ON=*;OFF=*REF*
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No.	Date	Revisions	By	Ckd

Professional Engineer's Name: JOHN F. PERELLA, PE
Professional Engineer's No.: 37041-E
State: AL | Date Signed: | Project Mgr.: JH
Designed by: ZV | Drawn by: BO | Checked by: JP

ARCADIS U.S., INC.
ALABAMA CERTIFICATE OF AUTHORIZATION NUMBER 1822

RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC - 10565 HIGHWAY 43 NORTH, CREOLA, MOBILE COUNTY, ALABAMA
AIR SPARGE / SOIL VAPOR EXTRACTION REMEDIATION SYSTEM

MECHANICAL NOTES

CONSTRUCTION DRAWINGS

ARCADIS Project No. 03648010.0001.00500
Date JANUARY 2018
ARCADIS
3109 W. MARTIN L. KING JR. DR.
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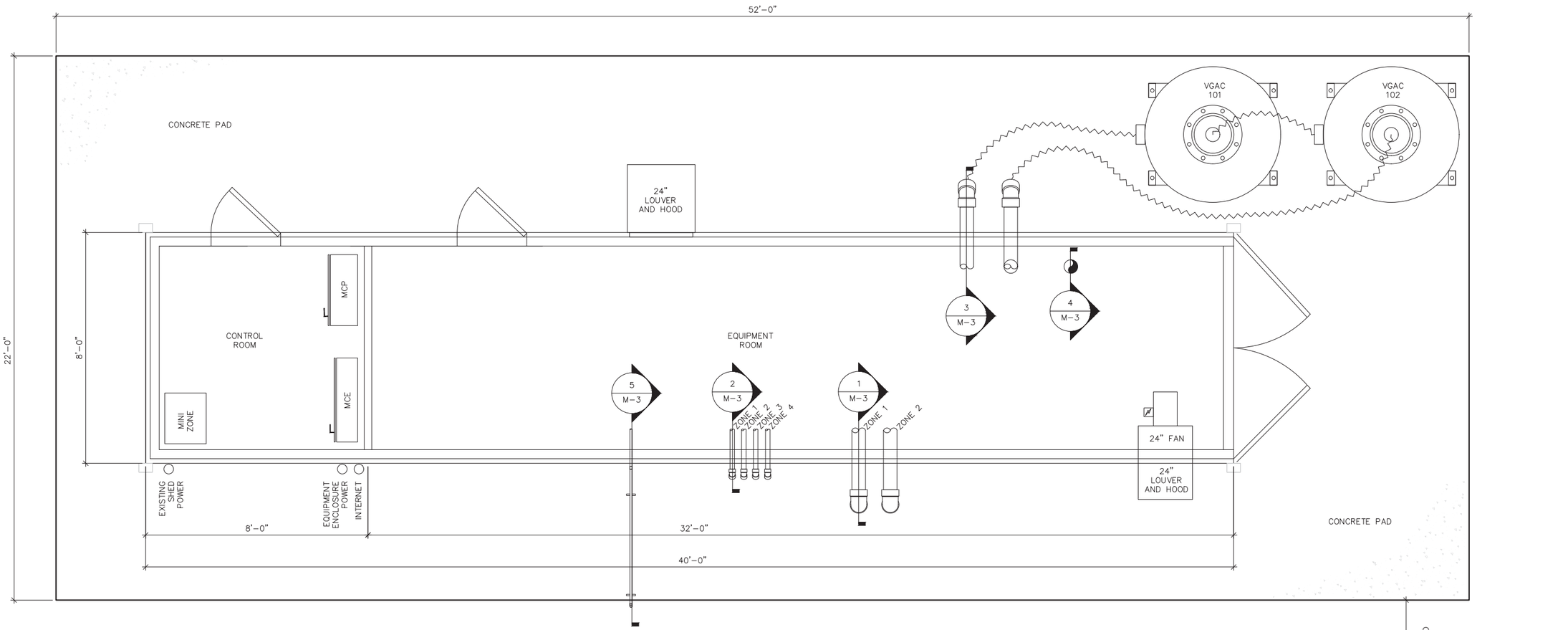
TAMPA, FL 33607
TEL. 813.903.3100

M-1



NOTE:

1. VENTILATION SHOWN HERE IS PRELIMINARY. ADDITIONAL VENTILATION MAY BE REQUIRED.
2. PIPE AND CONDUIT LOCATIONS ARE PRELIMINARY. COORDINATE ACTUAL LOCATION WITH EQUIPMENT VENDORS.

EQUIPMENT ENCLOSURE / PAD LAYOUT

0 2' 4'
SCALE: 1/2"=1'-0"

CITY: BB, FL DIV/GROUP: EN DB: B.OLIVA LD: J.PERELLA PIC: PM: TM: LYR:ON=*;OFF=*REF*
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No.	Date	Revisions	By	Ckd

Professional Engineer's Name: JOHN F. PERELLA, PE		
Professional Engineer's No.: 37041-E		
State: AL	Date Signed:	Project Mgr.: JH
Designed by: ZV	Drawn by: BO	Checked by: JP

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AIR SPARGE / SOIL VAPOR EXTRACTION REMEDIATION SYSTEM

MECHANICAL DETAILS I

CONSTRUCTION DRAWINGS

ARCADIS Project No.
03648010.0001.00500

Date
JANUARY 2018

ARCADIS
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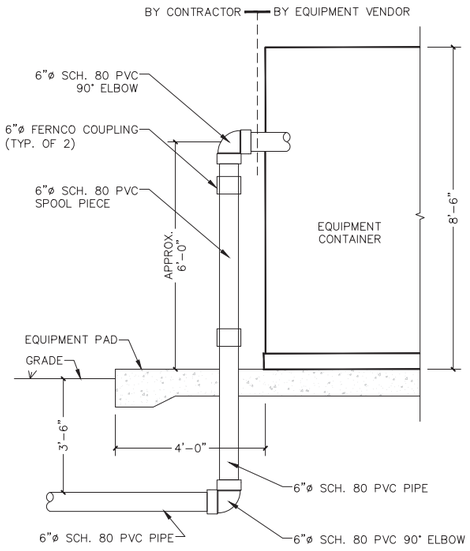
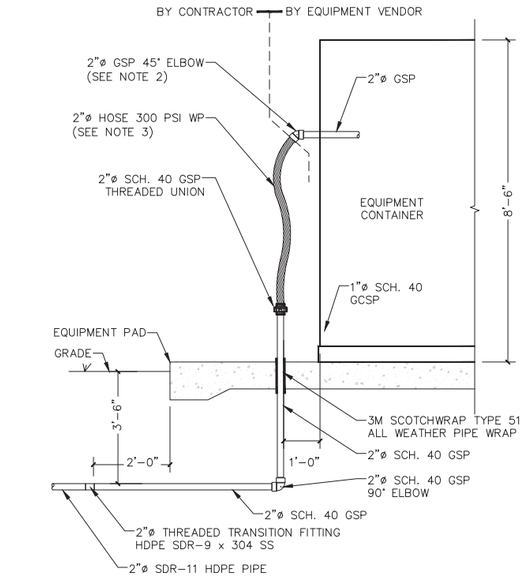
M-2



1 M-2 VE INFLUENT CONNECTION DETAIL

NOT TO SCALE

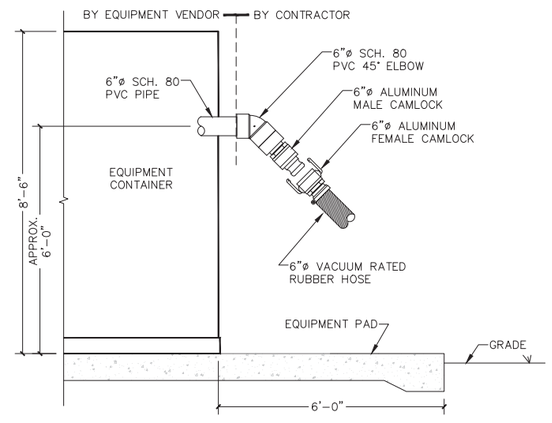
NOTE–VE INFLUENT CONNECTION DETAIL:
1. 6"ø SCH. 80 PVC PIPE THROUGH EQUIPMENT CONTAINER SHALL BE PROVIDED LONG BY THE EQUIPMENT VENDOR TO BE CUT TO FIT IN THE FILED BY THE CONTRACTOR.
2. ALL PENETRATIONS THROUGH EQUIPMENT CONTAINER SHALL BE WATER TIGHT.



2 M-2 BIOSPARGE CONNECTION DETAIL

NOT TO SCALE

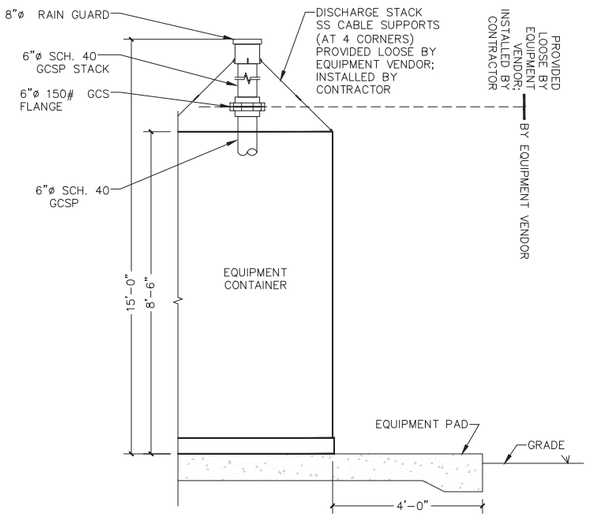
NOTE–BIOSPARGE CONNECTION DETAIL:
1. ALL PENETRATIONS THROUGH EQUIPMENT CONTAINER SHALL BE WATER TIGHT.
2. THE EQUIPMENT VENDOR SHALL PROVIDE THE 45° ELBOW ON THE EXTERIOR OF THE EQUIPMENT CONTAINER. THE CONTRACTOR IS RESPONSIBLE FOR PROCUREMENT AND INSTALLATION OF NECESSARY PIPE AND FITTINGS FROM SAID 45° FITTING TO THE BIOSPARGE WELLS.
3. FLEX HOSE PROVIDED BY THE CONTRACTOR SHALL BE PROPERLY CUT TO FIT WITH NO KINKS OR EXCESSIVE LOOPS OR SAG. KING NIPPLES SHALL BE BRONZE OR ALUMINUM BRONZE. CRIMPS SHALL BE USED TO SECURE HOSE TO KING NIPPLE. SCREW CLAMPS ARE NOT ACCEPTABLE.
4. GSP RISER SECTIONS SHALL BE SLEEVED TO PROTECT PIPE FROM CONTACT WITH CONCRETE. GSP RISERS SHALL BE POURED IN PLACE. COORDIANTE SPACING WITHH EQUIPMENT VENDOR.



3 M-2 VE VGAC CONNECTION DETAIL

NOT TO SCALE

NOTE–VE VGAC CONNECTION DETAIL:
1. 6"ø SCH. 80 PVC PIPE THROUGH EQUIPMENT CONTAINER SHALL BE PROVIDED LONG BY THE EQUIPMENT VENDOR TO BE CUT TO FIT IN THE FILED BY THE CONTRACTOR.
2. ALL PENETRATIONS THROUGH EQUIPMENT CONTAINER SHALL BE WATER TIGHT.



4 M-2 VE DISCHARGE STACK DETAIL

NOT TO SCALE

NOTE–VE DISCHARGE STACK DETAIL:
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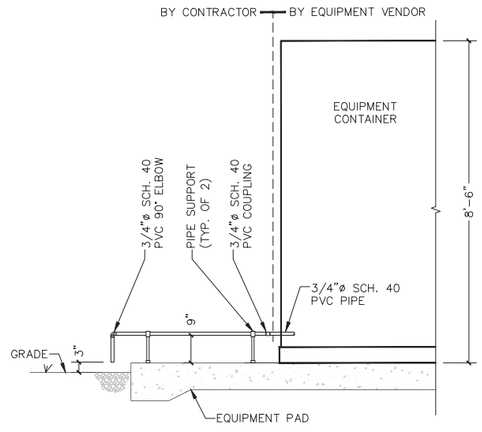

5 M-2 COMPRESSOR CONDENSTATE DRAIN DETAIL

NOT TO SCALE

NOTE–COMPRESSOR CONDENSATE DRAIN DETAIL:
1. ALL PENETRATIONS THROUGH EQUIPMENT CONTAINER SHALL BE WATER TIGHT.
2. PIPE SUPPORTS SHALL BE CONSTRUCTED OF 1–7/8" 304 STAINLESS STEEL UNISTRUT, 304 STAINLESS STEEL HARDWARE AND PIPE CLAMPS.
3. PIPE SUPPORT SHALL BE SECURED TO THE CONCRETE PAD WITH HILTI KWIK BOLT KB–T2 EXPANSION ANCHORS 1/4" x 4" 304 STAINLESS STEEL.

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No.	Date	Revisions	By	Ckd

Professional Engineer's Name: JOHN F. PERELLA, PE
Professional Engineer's No.: 37041-E

State	Date Signed	Project Mgr.
AL		JH
Designed by: ZV	Drawn by: BO	Checked by: JP

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ALABAMA CERTIFICATE OF AUTHORIZATION NUMBER 1822

RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC - 10565 HIGHWAY 43 NORTH, CREOLA, MOBILE COUNTY, ALABAMA
AIR SPARGE / SOIL VAPOR EXTRACTION REMEDIATION SYSTEM

MECHANICAL DETAILS II

CONSTRUCTION DRAWINGS

ARCADIS Project No. 03648010.0001.00500
Date JANUARY 2018

ARCADIS
3109 W. MARTIN L. KING JR. DR.
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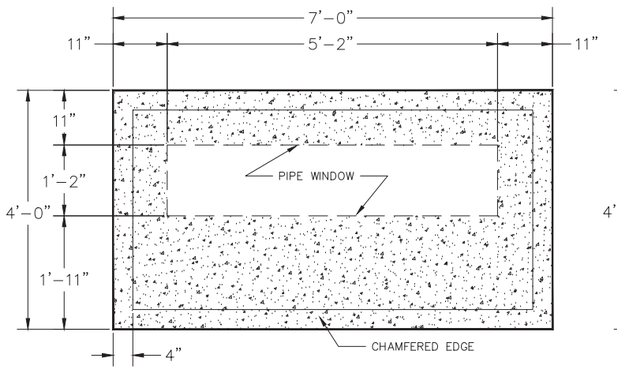
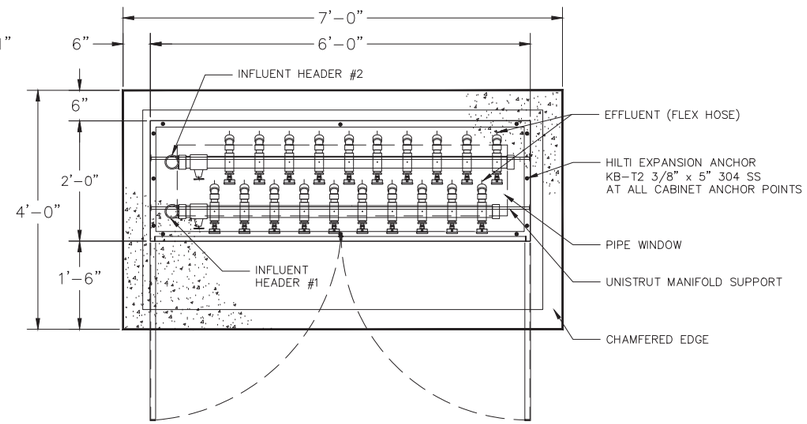
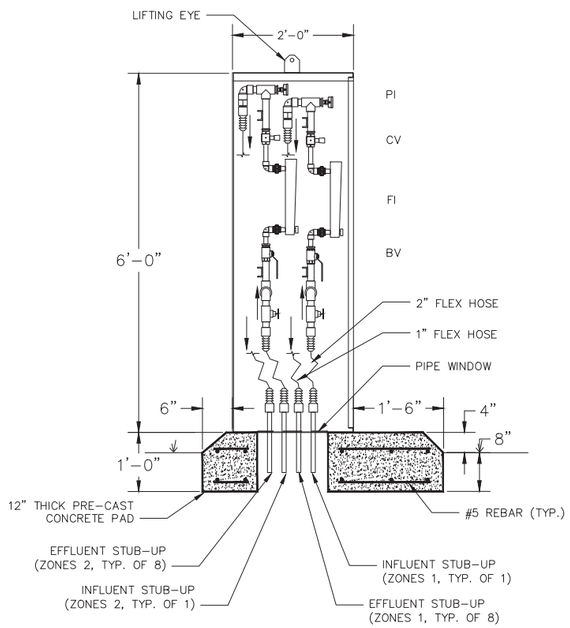
M-3



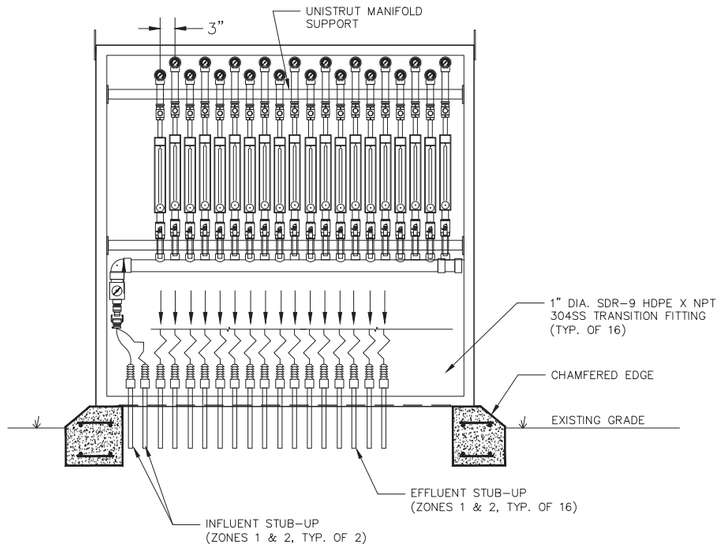
CONCRETE PAD TOP VIEW



TOP VIEW

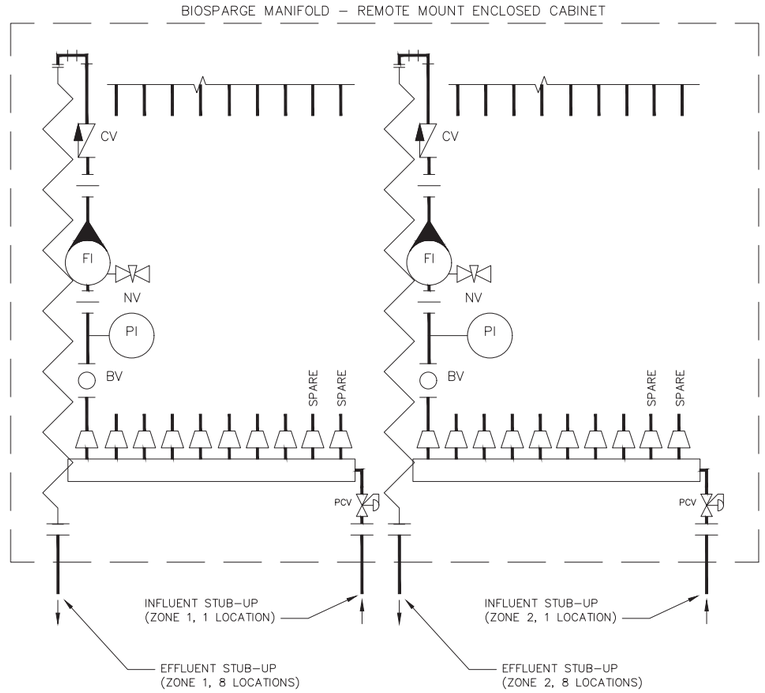


SIDE ELEVATION



FRONT ELEVATION

TYPICAL AIR SPARGE MANIFOLD CABINET



CABINET INSTRUMENTATION DETAIL

NOTES:
1. ALL DIMENSIONS, PIPING, AND APPURTENANCES ARE APPROXIMATE, FINAL DIMENSIONS MUST BE APPROVED BY THE ENGINEER.
2. PIPE WINDOW SHALL BE UTILIZED FOR ALL PIPING FROM FIELD TO CABINET.
3. CABINET SHALL MEET ALL LOCAL WIND LOAD AND WIND BLOWN PROJECTILE REQUIREMENTS.
4. CABINET SHALL BE CONSTRUCTED OF PAINTED GALVANIZED STEEL OR 304 STAINLESS STEEL.
5. REMOTE CABINETS SHALL BE WEATHERPROOF OUTDOOR PAD MOUNT, TYPE 3R ENCLOSURES WITH OPEN BOTTOM AS MANUFACTURED BY HOFFMAN (PENTAIR) OR ENGINEER APPROVED EQUAL.
6. CABINET ANCHORS SHALL BE HILTI KWIK BOLT KB-TZ EXPANSION ANCHORS, 3/8" X 5" 304 STAINLESS STEEL (OR ENGINEER APPROVED EQUAL) AT ALL CABINET ANCHOR POINTS.
7. CONCRETE PAD SHALL BE 28-DAY CONCRETE STRENGTH = 4,000 PSI (MIN.).
8. CONCRETE PAD SHALL BE CHAMFERED ON ALL EDGES.
9. CONCRETE PAD REINFORCING SHALL BE DEFORMED BILLET STEEL CONFORMING TO ASTM A-615, GRADE 60 (MIN.).

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No.	Date	Revisions	By	Ckd

Professional Engineer's Name: JOHN F. PERELLA, PE
Professional Engineer's No.: 37041-E
State: AL | Date Signed: | Project Mgr.: JH
Designed by: ZV | Drawn by: BO | Checked by: JP

ARCADIS
ARCADIS U.S., INC.
ALABAMA CERTIFICATE OF AUTHORIZATION NUMBER 1822

RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC - 10565 HIGHWAY 43 NORTH, CREOLA, MOBILE COUNTY, ALABAMA
AIR SPARGE / SOIL VAPOR EXTRACTION REMEDIATION SYSTEM

AIR SPARGE REMOTE CABINET DETAILS

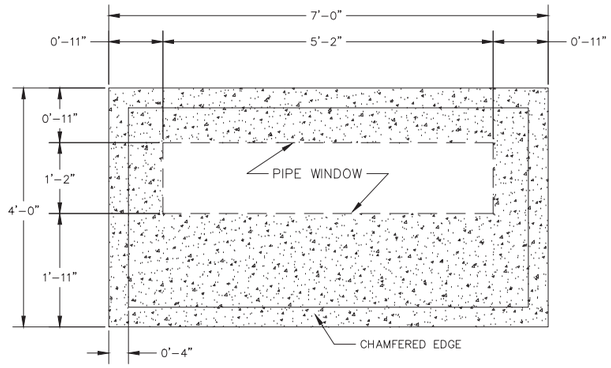
CONSTRUCTION DRAWINGS

ARCADIS Project No.
03648010.0001.00500

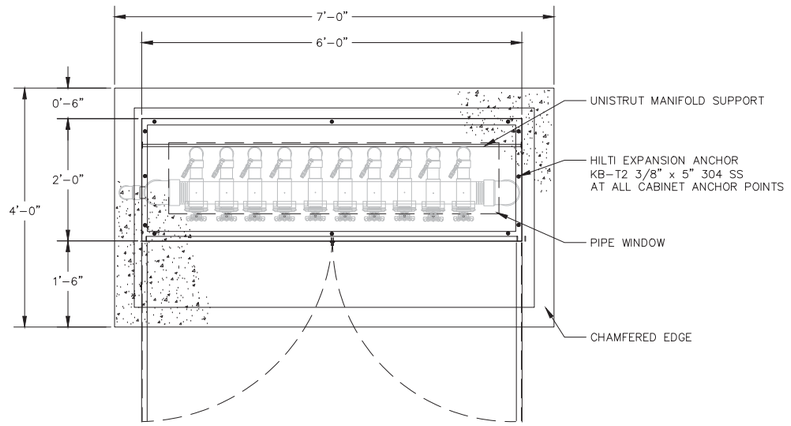
Date
JANUARY 2018

ARCADIS
3109 W. MARTIN L. KING JR. DR.
SUITE 350
TAMPA, FL 33607
TEL. 813.903.3100

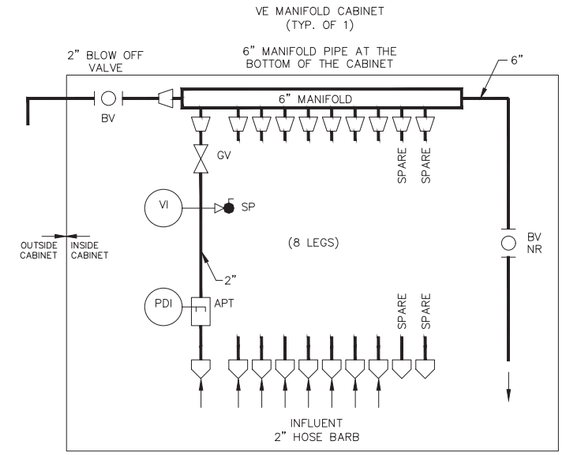
M-4



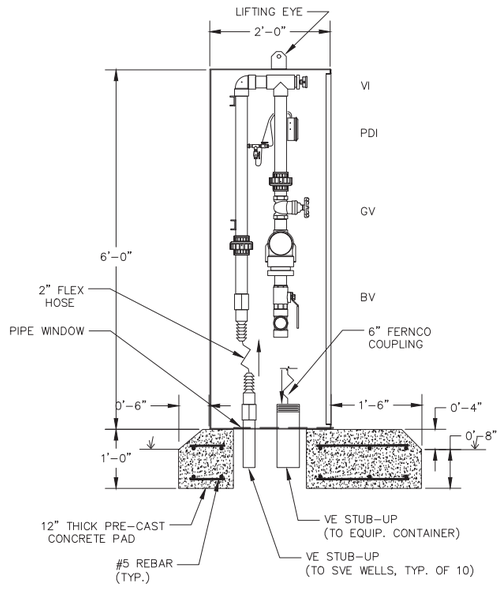
CONCRETE PAD TOP VIEW



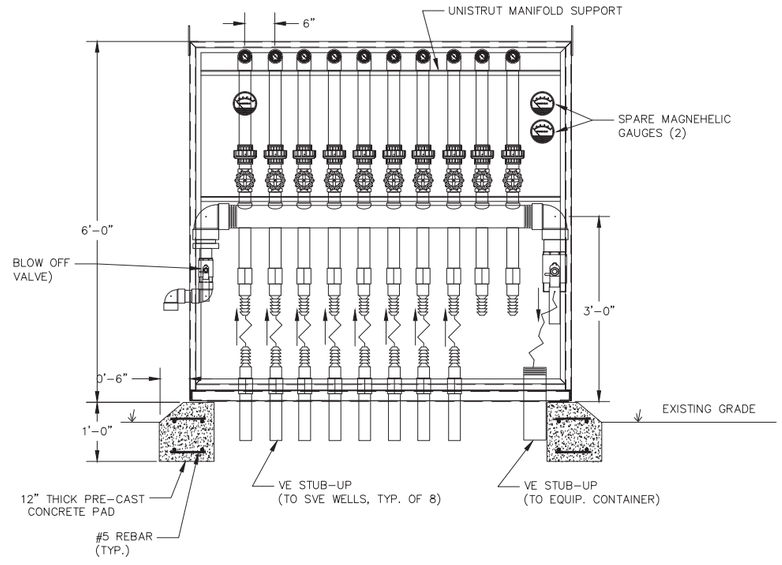
TOP VIEW



CABINET INSTRUMENTATION DETAIL



SIDE ELEVATION



FRONT ELEVATION

TYPICAL VE MANIFOLD CABINET

NOTES:
1. ALL DIMENSIONS, PIPING, AND APPURTENANCES ARE APPROXIMATE, FINAL DIMENSIONS MUST BE APPROVED BY THE ENGINEER.
2. PIPE WINDOW SHALL BE UTILIZED FOR ALL PIPING FROM FIELD TO CABINET.
3. CABINET SHALL MEET ALL LOCAL WIND LOAD AND WIND BLOWN PROJECTILE REQUIREMENTS.
4. CABINET SHALL BE CONSTRUCTED OF PAINTED GALVANIZED STEEL OR 304 STAINLESS STEEL.
5. REMOTE CABINETS SHALL BE WEATHERPRO OUTDOOR PAD MOUNT, TYPE 3R ENCLOSURES WITH OPEN BOTTOM AS MANUFACTURED BY HOFFMAN (PENTAIR) OR ENGINEER APPROVED EQUAL.
6. CABINET ANCHORS SHALL BE HILTI KWIK BOLT KB-TZ EXPANSION ANCHORS, 3/8" X 5" 304 STAINLESS STEEL (OR ENGINEER APPROVED EQUAL) AT ALL CABINET ANCHOR POINTS.
7. CONCRETE PAD SHALL BE 28-DAY CONCRETE STRENGTH = 4,000 PSI (MIN.).
8. CONCRETE PAD SHALL BE CHAMFERED ON ALL EDGES.
9. CONCRETE PAD REINFORCING SHALL BE DEFORMED BILLET STEEL CONFORMING TO ASTM A-615, GRADE 60 (MIN.).
10. FLOW ELEMENT SHALL BE SERIES DS-300 PITOT TUBE WITH MAGNEHELIC GAGE MODEL 2000 AS MANUFACTURED BY DWYER OR APPROVED EQUAL. DIFFERENTIAL FLOW MAGNEHELIC SHALL UTILIZE A RANGE OF 0 – 20 IN-W.C.. PROVIDE ONE (1) MAGENEHELIC GAGE IN THE CABINET LOOSE FOR CONNECTION TO PITOT TUBE BY THE OPERATOR, AND TWO (2) MAGNEHELIC GAGES AS SPARES IN EACH REMOTE CABINET. PROVIDE PITOT TUBE FOR EACH VE LEG.

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name: JOHN F. PERELLA, PE
Professional Engineer's No.: 37041-E
State: AL | Date Signed: | Project Mgr.: JH
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AIR SPARGE / SOIL VAPOR EXTRACTION REMEDIATION SYSTEM

SOIL VAPOR EXTRACTION REMOTE CABINET DETAILS

CONSTRUCTION DRAWINGS

ARCADIS Project No.
03648010.0001.00500

Date
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ARCADIS
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CITY: BB, FL DIV/GROUP: EN DB: B.OLIVA LD: J.PERELLA PIC: PM: TM: LYR:ON=*;OFF=*REF*
C:\Users\bolivaOneDrive - ARCADIS\Projects\2018\03648010-Rentokil AL\2018\01-DWG\M5_VE Cab Details.dwg LAYOUT: M5_VE CAB DETAILS SAVED: 1/26/2018 11:43 AM ACADVER: 20.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 1/26/2018 11:43 AM BY: OLIVA, BRIAN

FOUNDATIONS

1 ALL FOUNDATION WORK SHALL BE PER IBC, CHAPTER 18.

2 THE CONTRACTOR SHALL PROVIDE ADEQUATE PROTECTION TO EXISTING UNDERGROUND UTILITIES. VERIFY UTILITIES LOCATION BEFORE PROCEEDING WITH FOUNDATION EXCAVATION.

3 SLAB AND FOUNDATIONS PARAMETERS:
A) MINIMUM DEPTH OF FOUNDATION BEARING = AS SHOWN
B) MINIMUM ALLOWABLE NET SOIL PRESSURE = 1,500 PSF (ASSUMED, CONTRACTOR SHALL VERIFY)
C) MODULUS OF SUBGRADE REACTIONS FOR SLABS-ON-GRADE = 100 PSI/IN

CONCRETE

1 CONCRETE 28-DAY COMPRESSIVE STRENGTH: 4000 PSI, TYPE I/II CEMENT.

2 REINFORCEMENT: ASTM A615, GRADE 60, OR ASTM A706, GRADE 60 WHERE REINFORCEMENT IS TO BE WELDED.

3 CONCRETE COVER FOR REINFORCING:

A)	SURFACES CAST AGAINST SUBGRADE	3" MIN
B)	TOP SURFACES OF SLABS WHERE PVC WATERSTOP IS REQUIRED IN WALLS	3" MIN
C)	FORMED SURFACES IN CONTACT WITH WEATHER, SOIL, OR LIQUID	2" MIN
D)	BOTTOM SURFACES OF SLABS OVER	2" MIN
E)	SURFACES NOT IN CONTACT WITH WEATHER, SOIL, OR LIQUID	1 1/2" MIN

4 CONSTRUCTION JOINTS SHALL BE LOCATED AS SHOWN ON THE DRAWINGS. WHERE NOT SHOWN, CONSTRUCTION JOINTS SHALL BE LOCATED AT NO MORE THAN 40' ON CENTER. CONSTRUCTION JOINT LOCATIONS SHALL BE AS APPROVED BY THE ENGINEER.

5 EQUIPMENT SUPPORTS, ANCHORAGES, OPENINGS, RECESSES AND REVEALS NOT SHOWN ON THE STRUCTURAL DRAWINGS BUT REQUIRED BY OTHER CONTRACT DOCUMENTS, SHALL BE PROVIDED FOR PRIOR TO PLACING CONCRETE.

6 AT ALL TYPICAL CURBS, EQUIPMENT PADS, AND PIPE SUPPORT PIERS, REINFORCING DOWELS SHOWN MAY BE REPLACED WITH MATCHING DOWELS SET IN EPOXY IN DRILLED HOLES AS SPECIFIED. DOWELS LOCATED CLOSER THAN 3" FROM ANY EDGE OF CONCRETE SHALL NOT BE REPLACED WITH DRILLED DOWELS.

7 WHERE DRILLED EPOXY DOWELS ARE SHOWN TO BE PLACED INTO HARDENED CONCRETE, ADJUST THE DOWEL LOCATIONS AS NEEDED TO AVOID DRILLING THROUGH ANY REINFORCING BARS. IF THE DOWEL LOCATION NEEDS TO BE MODIFIED, CONTACT THE ENGINEER.

8 FOUNDATION SLAB, EXTEND BEYOND WHERE NEEDED, THEY SHALL BE TERMINATED AT A VERTICAL CONSTRUCTION JOINT AS APPROVED BY THE ENGINEER.

9 DOWELS, ANCHOR BOLTS, PIPES, AND OTHER EMBEDDED ITEMS SHALL BE HELD SECURELY IN POSITION WHILE CONCRETE IS BEING PLACED.

10 CONDUITS AND PIPES SHALL NOT BE EMBEDDED IN OR PASS THROUGH COLUMNS OR BEAMS UNLESS INDICATED OTHERWISE OR AUTHORIZED BY ENGINEER.

11 ALL EXPOSED CORNERS SHALL HAVE A 3/4" CHAMFER OR A 1/2" RADIUS TOOLED CORNER. C-12 LAP SPLICES SHALL BE IN ACCORDANCE WITH THE TABLE SHOWN ON THIS DRAWING.

STRUCTURAL STEEL

1 DETAIL, FABRICATE, AND ERECT STRUCTURAL STEEL IN ACCORDANCE WITH AISC SPECIFICATION FOR STRUCTURAL STEEL BUILDING, LATEST EDITION.

2 STEEL MATERIAL:
A) STRUCTURAL TUBING, ASTM A 500, GRADE B
B) STRUCTURAL PIPE, ASTM A 53, GRADE B
C) W SHAPES, AND PLATES, ASTM A 36 U.O.N.
D) ALL OTHER SHAPES AND PLATES, ASTM A 36 U.O.N.

3 PROVIDE MIN. 3/4" DIAMETER ASTM A 325 TYPE I HIGH STRENGTH BOLTS (UON).

4 PROVIDE TYPICAL STEEL BEAM CONNECTIONS FOR A CAPACITY OF NOT LESS THAN HALF THE TOTAL UNIFORM LOAD CAPACITY TABULATED IN THE AISC TABLES FOR ALLOWABLE LOADS OF BEAMS.

5 DO NOT PAINT STEEL SURFACES WHICH ARE TO BE WELDED OR ENCASED IN CONCRETE.

6 ALL GROOVE AND BUTT WELDS SHALL BE FULL PENETRATION (UON).

7 FILLET WELD SIZES SHALL BE THE MINIMUM SIZE REQUIRED BY AISC CODE FOR PLATE SIZES TO BE CONNECTED AND SHALL BE APPLIED TO THE ENTIRE JOINT CONTACT LENGTH, BUT NOT LESS THAN 3/16".

GENERAL

1 THESE NOTES ARE GENERAL AND SUPPLEMENTAL TO THE SPECIFICATIONS. THESE NOTES APPLY TO THE ENTIRE PROJECT UNLESS MODIFIED OR NOTED OTHERWISE IN THE CONTRACT DOCUMENTS.

2 TYPICAL DETAILS, SHOWN ON THIS SHEET SHALL BE USED WHEN REFERRED TO, OR WHEN NO DETAILS ARE SHOWN ON THE DRAWINGS.

3 DESIGN IS IN ACCORDANCE WITH AND CONSTRUCTION SHALL COMPLY WITH THE 2015 INTERNATIONAL BUILDING CODE EXCEPT WHERE OTHER APPLICABLE CODES AND THE CONTRACT DOCUMENTS ARE MORE RESTRICTIVE.

4 LIVE LOADS:
FLOOR LIVE LOAD = 250 PSF
ROOF LIVE LOAD = 30 PSF (U.O.N)

5 WIND DESIGN FOR PIPE SUPPORT:
ULTIMATE DESIGN WIND SPEED = 148 MPH
EXPOSURE CATEGORY = C
RISK CATEGORY = III
ENCLOSURE CLASSIFICATION = OPEN

6 SEISMIC LOAD:
A. IMPORTANCE FACTOR = 1.25
B. RISK CATEGORY = III
C. SITE CLASS = D
D. SPECTRAL RESPONSE ACCELERATION COEFFICIENT
S/s = 11%
S/1 = 6.1%
F. SEISMIC DESIGN CATEGORY = B

7 ALL DIMENSIONS INDICATED (*) ARE TO BE VERIFIED EITHER BY FIELD MEASUREMENTS FOR EXISTING STRUCTURES OR BY SHOP DRAWINGS FOR EQUIPMENT FURNISHED. STRUCTURAL DIMENSIONS NOT SHOWN BUT CONTROLLED BY OR RELATED TO EQUIPMENT SHALL BE VERIFIED BY THE CONTRACTOR WITH THE MANUFACTURER PRIOR TO CONSTRUCTION.

8 EQUIPMENT ANCHOR BOLT SIZES, TYPES, AND PATTERNS SHALL BE VERIFIED WITH THE MANUFACTURER. ALL BOLT PATTERNS SHALL BE TEMPLATED TO INSURE ACCURACY OF PLACEMENT.

9 STRUCTURAL DRAWINGS SHALL BE USED IN COORDINATION WITH DRAWINGS OF ALL OTHER DISCIPLINES AND MANUFACTURER'S SHOP DRAWINGS.

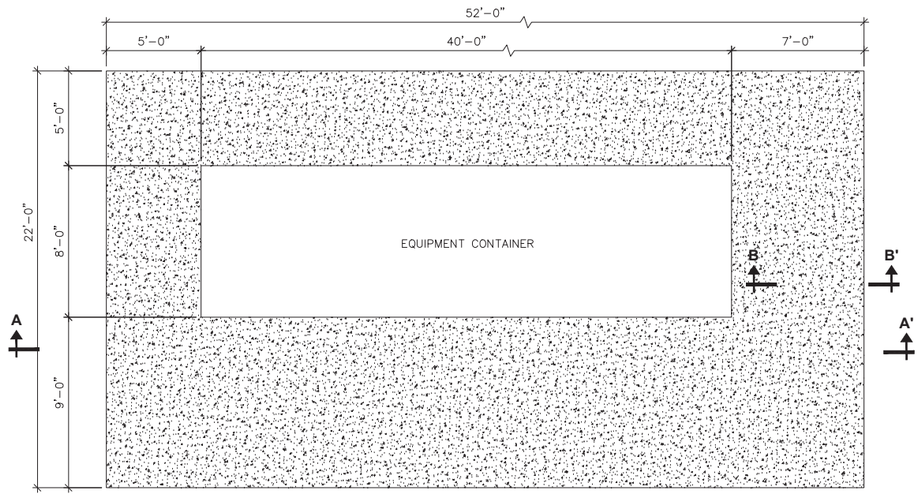
10 IF A CONFLICT IS FOUND BETWEEN DIFFERENT PORTIONS OF THE CONTRACT DOCUMENTS, THE CONTRACTOR SHALL NOTIFY THE ENGINEER IMMEDIATELY. CONTINUED CONSTRUCTION OF THE AREA IN CONFLICT SHALL BE AT THE CONTRACTOR'S OWN RISK UNTIL THE CONFLICT IS RESOLVED BY THE ENGINEER.

11 STRUCTURES HAVE BEEN DESIGNED FOR OPERATIONAL LOADS ON THE COMPLETED STRUCTURE. DURING CONSTRUCTION, THE STRUCTURES SHALL BE PROTECTED BY BRACING AND TEMPORARY SUPPORTS WHEREVER EXCESSIVE CONSTRUCTION LOADS MAY OCCUR. OVERSTRESSING OF ANY STRUCTURAL ELEMENT IS PROHIBITED.

12 NO BACKFILL SHALL BE PLACED AGAINST ANY WALL UNLESS ALL SUPPORTING ELEMENTS OF THE STRUCTURE HAVE BEEN CONSTRUCTED AND HAVE REACHED THE SPECIFIED MINIMUM CONCRETE STRENGTH.

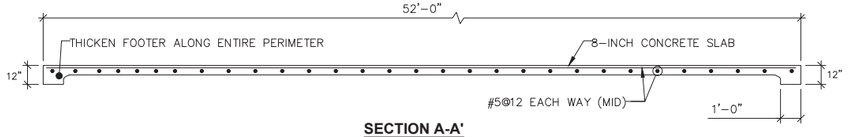
13 NO COLD WEATHER CONSTRUCTION OR HOT WEATHER CONSTRUCTION, AS DEFINED IN SPECIFICATIONS, IS PERMITTED WITHOUT WRITTEN APPROVAL OF THE ENGINEER.

14 OPENINGS AND PENETRATIONS: THE CONTRACTOR SHALL SUBMIT COMPOSITE DRAWINGS INDICATING ALL FLOOR OPENINGS AND PENETRATIONS THROUGH STRUCTURAL MEMBERS REQUIRED TO ACCOMMODATE ALL OTHER WORK. THE CONTRACTOR SHALL FOLLOW THE TYPICAL FRAMING DETAILS AT OPENINGS AND REINFORCEMENT DETAILS AT PENETRATIONS THROUGH STRUCTURAL MEMBERS. ACCORDINGLY, THE CONTRACTOR SHALL SUBMIT SHOP DETAILS TO THE ENGINEER FOR REVIEW.



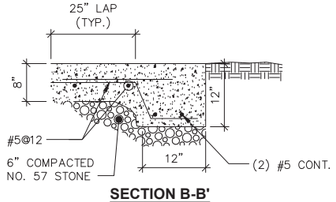
PLAN

NOTES:
1. APPROX. EQ. WEIGHT = 8'x40'
2. APPROX. EQ. WEIGHT = 15,000 LBS.



SECTION A-A'

NOTES:
1. PROVIDE SAW CUT CONSTRUCTION JOINTS AT 12'-0" MAX.
2. CONCRETE PADS SHALL REST ON UNDISTURBED SOIL OR COMPACTED SELECT FILL, PLACED IN 6-INCH LIFTS AND COMPACTED TO 98% OF THE MODIFIED PROCTOR.
3. SELECT FILL SHALL BE WELL GRADED, CRUSHED AGGREGATE, FREE OF ORGANIC MATERIAL.
4. VERIFY COMPACTION BY FIELD TESTING AT A MINIMUM OF FOUR (4) LOCATIONS. COMPACTION TESTING DOCUMENTATION WILL BE PROVIDED TO THE ENGINEER PRIOR TO CONCRETE POUR.

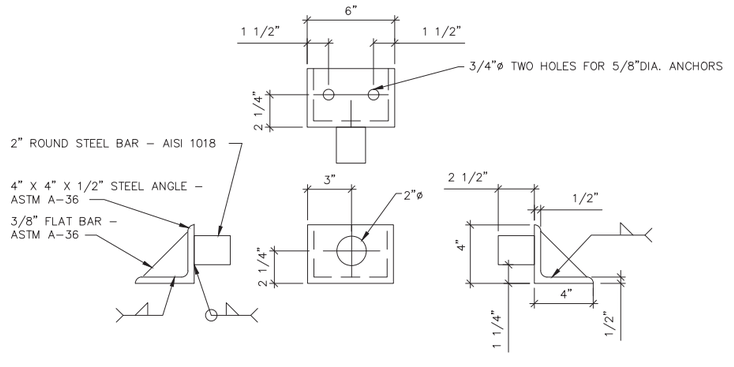


SECTION B-B'

TYPICAL CONCRETE PAD DETAIL (1)

GAC VESSEL AND CONDENSATE TANK ANCHORS

1. GAC VESSELS SHALL BE ANCHORED TO CONCRETE EQUIPMENT PAD USING BASE PLATE HOLES AT FOUR (4) CORNERS. INSTALL 1/2" DIAMETER STAINLESS STEEL EXPANSION ANCHOR (HILTI KWIK BOLT 3 OR EQUIVALENT) WITH MINIMUM 3-1/2" EMBEDMENT.
2. CONDENSATE TANK SHALL BE ANCHORED TO CONCRETE EQUIPMENT PAD USING 1/4" DIAMETER STAINLESS STEEL CABLE AT FOUR (4) ANCHOR LOCATIONS ON TANK. USE ALL STAINLESS STEEL HARDWARE AND STAINLESS STEEL TURNBUCKLES ON CABLE FOR TIGHTENING CABLE TO ANCHOR. USE 1/2" DIAMETER STAINLESS STEEL EYE ANCHOR WITH MINIMUM 3-1/2" EMBEDMENT. IF CONCRETE EPOXY USED FOR EYE ANCHOR, USE HILTI RE-500 V3 EPOXY OR EQUIVALENT.



NOTES:
1. CONTAINER ANCHOR PLATE WILL BE PROVIDED BY THE EQUIPMENT VENDOR AND INSTALLED BY THE CONTRACTOR.
2. CONTAINER ANCHOR PLATES SHALL BE SECURED TO THE CONCRETE EQUIPMENT PAD USING 5/8" DIAMETER STAINLESS STEEL EXPANSION ANCHOR (HILTI KWIK BOLT 2 OR EQUIVALENT) WITH 4-INCH EMBEDMENT.
3. FOUR (4) ANCHOR PLATES REQUIRED PER CONTAINER (ONE AT EACH CORNER)

CONTAINER ANCHOR PLATE DETAIL (2)

NOT TO SCALE

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: _____ USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd
0	12/2017	CONSTRUCTION DRAWINGS	C.H.	J.P.

Professional Engineer's Name: JOHN F. PERELLA, PE
Professional Engineer's No.: 37041

State	Date Signed	Project Mgr.
AL		(MGR)
Designed by: VV	Drawn by: BO	Checked by: AS

ARCADIS
ARCADIS U.S., INC.
FLORIDA CERTIFICATE OF AUTHORIZATION NUMBER 7917

RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC • 10565 HIGHWAY 43 NORTH, CREOLA, MOBILE COUNTY, ALABAMA
AS/SVE REMEDIATION SYSTEM DESIGN DRAWINGS

STRUCTURAL AND MECHANICAL DETAILS

ARCADIS Project No. 03648010.0001.00500
Date DECEMBER 2017

ARCADIS
1500 GATEWAY BLVD.
SUITE 200
BOYNTON BEACH, FL 33426
TEL. 561.697.7000

S-1

GC/EV

52 1200 — DRAWOUT TYPE POWER CIRCUIT BREAKER NUMBER INDICATES CURRENT RATING

DISCONNECT SWITCH WITH FUSING WHERE NOTED

100/30 (FRAME SIZE)/(TRIP SIZE) — 3 POLE THERMAL-MAGNETIC MOLDED CASE CIRCUIT BREAKER

100/30 2P — 2 POLE THERMAL-MAGNETIC CIRCUIT BREAKER

SST 800/800 (FRAME SIZE)/(SENSOR RATING) — DRAWOUT POWER CIRCUIT BREAKER WITH RMS TYPE SOLID STATE TRIP UNIT EO DENOTES ELECTRICALLY OPERATED

EO (600P) — DENOTES PLUG RATING WHEN LESS THAN SENSOR RATING IS REQUIRED

SST 800/600 (400P) — FIXED MOUNTED POWER OR MOLDED CASE CIRCUIT BREAKER WITH RMS TYPE SOLID STATE TRIP UNIT

AC COMBINATION FULL VOLTAGE NON-REVERSING STARTER

7A MCP (CONTINUOUS AMP RATING)/(MOTOR CIRCUIT PROTECTOR) — MAGNETIC BREAKER

MAGNETIC MOTOR STARTER

OVERLOAD RELAY

600/5 3 — CURRENT TRANSFORMER, RATIO AND QUANTITY DENOTED

POTENTIAL TRANSFORMER

TRANSFORMER- SIZE AS NOTED ON THE THE DRAWINGS

SHIELDED ISOLATION TRANSFORMER

DELTA/WYE TRANSFORMER CONNECTION W/GROUND

LA — LIGHTNING ARRESTOR

CL 2 — FUSE- VOLTAGE AS REQUIRED AND SIZE NOTED ON THE DRAWINGS. CL DENOTES CURRENT LIMITING TYPE. NUMBER INDICATES QUANTITY WHEN LESS THAN 3.

PFD — PFD DENOTES PULL FUSE DISCONNECT TYPE

MMD — MICROPROCESSOR BASED METERING DEVICE

A AS — AMMETER - AMMETER SWITCH

V VS — VOLTMETER - VOLTMETER SWITCH

VFD-B — VARIABLE FREQUENCY DRIVE - VFD -B WHEN INDICATED DENOTES WITH STARTING AND FULL SPEED BYPASS

ST — SHUNT TRIP

OD — OVERLOAD DEVICE

OT — OVER-TEMPERATURE DEVICE

PUSH-BUTTON STATION

PUSH-BUTTON STATION WITH LOCK-OUT FEATURE

SELECTOR SWITCH

INDICATING LIGHT

CS — CONTROL STATION

L O R — LOCAL-OFF-REMOTE SELECTOR SWITCH CONTROL STATION

F 60/40 — DISCONNECT SWITCH - 480V 3POLE UNFUSED OR FUSED F DENOTES FUSING, ONLY WHERE INDICATED FIRST NUMBER DENOTES SWITCH AMP RATING SECOND NUMBER DENOTES FUSE SIZE WHEN PROVIDED.

J OR (J) — JUNCTION BOX; SIZE AS REQUIRED BY N.E.C.

T OR (T) — TERMINAL BOX; SIZE AS REQUIRED BY N.E.C. AND TO ACCOMMODATE ALL TERMINATIONS ON TERMINAL BLOCKS. TERMINATIONS TO INCLUDE SPARE WIRING.

PB OR (PB) — PULL BOX; SIZE AS REQUIRED BY N.E.C.

HT — HEAT TRACE INDIVIDUAL CONNECTION JUNCTION BOX AND DIGITAL ELECTRONIC CONTROLLER. REFER TO SPECIFICATION SECTION 40 41 13 FOR MORE INFORMATION

R RV M — MOTOR STARTER/CONTROLLER (NON-COMBINATION - COMBINATION - MANUAL) RV DENOTES REDUCED VOLTAGE, R DENOTES REVERSING

M 5 — ELECTRIC MOTOR (NUMBER INDICATES HORSEPOWER).

5 — ELECTRIC NON-MOTOR LOAD (NUMBER INDICATES KVA).

30 — POWER RECPT. WITH DISCONNECT-600V, 3 PHASE, 4 WIRE NUMBER DENOTES AMPERE RATING

(30) — POWER RECPT. 600V, 3 PHASE, 4 WIRE

S_{2P} — 600V, 2-POLE, NON-FUSED ROTARY DISCONNECT SWITCH 30A RATED, NEMA 4X ENCLOSURE

S_{3P} — 600V, 3-POLE, NON-FUSED ROTARY DISCONNECT SWITCH 30A RATED, NEMA 4X ENCLOSURE

MS — 20A TWO OR THREE POLE MANUAL STARTER,

MV — MOTORIZED VALVE WITH CONTROLLER BY VENDOR

SV OR (SV) — SOLENOID VALVE

S P D — SURGE SUPPRESSION DEVICE

PS 123 — INSTRUMENT DEVICE: LETTERS IDENTIFY DEVICE FUNCTION, NUMBERS WHERE INDICATED DENOTE LOOP NUMBER

DENOTES EQUIPMENT TO BE DEMOLISHED

ELECTRIC UTILITY SOURCE

ELECTRIC SERVICE

I-2 — DUPLEX CONVENIENCE RECEPTACLE, 2 POLE, 3 WIRE, 120 VOLTS A.C. 20 AMP RECEPTACLE DESIGNATIONS, FIRST NUMBER DENOTES PANEL, SECOND NUMBER DENOTES CIRCUIT NUMBER. GF-DENOTES GROUND FAULT TYPE. SS-DENOTES SURGE SUPPRESSION TYPE WP-DENOTES WEATHERPROOF ENCLOSURE

GF/SS

SINGLE CONVENIENCE RECEPTACLE, 2 POLE, 3 WIRE; 120 VOLTS AC. 20 AMP UNLESS NOTED OTHERWISE ON DRAWINGS.

POWER RECEPTACLE, 2 POLE, 3 WIRE 250 VOLTS A.C. 20 AMP UNLESS NOTED OTHERWISE ON DRAWINGS.

QUAD DEDICATED 120VAC RECEPTACLE

PU — PAGING UNIT

LS — PAGING UNIT SPEAKER

S^a — SINGLE POLE SWITCH - LOWER CASE LETTER DENOTES SWITCHING.

S_2 — TWO POLE SWITCH

S_3 — THREE-WAY SWITCH

S_4 — FOUR-WAY SWITCH

S_{M2} — MANUAL MOTOR STARTER - NUMBER DENOTES NUMBER OF POLES WHEN MORE THAN ONE.

S_V — VARIABLE SPEED FAN SWITCH

LP1-2 — BRANCH CIRCUIT HOME RUN TO PANELBOARD LETTERS AND NUMERALS INDICATE PANEL AND CIRCUIT NUMBER. AS A MINIMUM, ALL WIRING SHALL BE 3#12 AWG IN 3/4" CONDUIT. #10 AWG WIRE SHALL BE USED FOR RUNS BETWEEN PANEL AND FIRST LIGHTING FIXTURE OR RECEPTACLE EXCEEDING 50 FEET, UNLESS OTHERWISE NOTED ON DRAWING.

J LP1-2 10 — LETTERS AND NUMBERS INDICATE PANEL AND CIRCUIT NUMBER (LP1-2). CROSS LINES INDICATE NUMBER OF CONDUCTORS. HALF HASH MARKS INDICATES NEUTRAL. NUMBER (10) DENOTES WIRE SIZE WHEN NOT #12 AWG. CONTINUE CONDUIT AND WIRE RUN FROM BOX TO DEVICE IN ROOM OR AREA AS NOTED BY BRANCH CIRCUIT NUMBER. #10 AWG WIRING SHALL BE USED FOR RUNS BETWEEN PANEL AND FIRST LIGHTING FIXTURE OR RECEPTACLE EXCEEDING 50 FEET, UNLESS OTHERWISE NOTED ON DRAWING.

C12 — INDICATES HOMERUN AND CONDUIT TAG

120/208V PANELBOARD

277/480V PANELBOARD

INDICATES NEW EQUIPMENT/EXPOSED CONDUIT

CONDUIT TURNING DOWN

CONDUIT TURNING UP

CONDUIT CAPPED

INDICATES EXISTING EQUIPMENT/CONDUIT

INDICATES CONDUIT UNDERGROUND OR CONCEALED IN CEILING, WALLS, BELOW OR IN FLOOR SLAB

EMH — ELECTRICAL MANHOLE

EHH — ELECTRICAL HANDHOLE

CMH — COMMUNICATION MANHOLE

CHH — COMMUNICATION HANDHOLE

ATS — AUTOMATIC TRANSFER SWITCH

GROUND TEST POINT

GROUND ROD

GROUND GRID CABLE CONNECTION

GROUND

#4/0 GROUND CABLE BURIED 2'-6" BELOW GRADE UNLESS OTHERWISE NOTED

ABBREVIATIONS:

A	AMPERES
AC	ALTERNATING CURRENT
AFF	ABOVE FINISHED FLOOR
AFG	ABOVE FINISHED GRADE
AL	ALUMINUM
ATS	AUTOMATIC TRANSFER SWITCH
AUX	AUXILIARY
AWG	AMERICAN WIRE GAUGE
BKR	BREAKER
BLDG	BUILDING
C, CND	CONDUIT
CB	CIRCUIT BREAKER
CBV	CABLE BY VENDOR, INSTALLED BY CONTRACTOR
CKT	CIRCUIT
CLG	CEILING
CTRL	CONTROL
CP	CONTROL PANEL
CPT	CONTROL POWER TRANSFORMER
CS	CONTROL STATION
CT	CURRENT TRANSFORMER
CU	COPPER
DC	DIRECT CURRENT
DN	DOWN
DISC	DISCONNECT
DPDT	DOUBLE POLE DOUBLE THROW
DS	DISCONNECT SWITCH
DWG	DRAWING
EC	EMPTY CONDUIT
EL, ELEV	ELEVATION
EMT	ELECTRICAL METALLIC TUBING
EXIST	EXISTING
FFE	FINISHED FLOOR ELEVATION
FS	FLOW SWITCH
FT	FEET OR FOOT
FUT	FUTURE
FVNR	FULL VOLTAGE NON-REVERSING
GALV	GALVANIZED
GEC	GROUNDING ELECTRODE CONDUCTOR
G, GND	GROUND
GFI	GROUND FAULT INTERRUPTER
HH	HAND HOLE
HOA	HAND/OFF/AUTO
HTR	HEATER
HZ	HERTZ
ID	INTERIOR DIAMETER
ITB	INSTRUMENT TERMINAL BOX
JB	JUNCTION BOX
KAIC	THOUSAND AMPERES INTERRUPTING CURRENT
KCMIL	THOUSAND CIRCULAR MILS
KVA	THOUSAND VOLT AMPERES
KW	KILOWATTS
LA	LIGHTNING ARRESTOR
LC	LIGHTING CONTACTOR
LCP	LOCAL CONTROL PANEL
LS	LEVEL SWITCH
LTG	LIGHTING
LV	LOW VOLTAGE
mA	MILLIAMPERE
MCC	MOTOR CONTROL CENTER
MCP	MOTOR CIRCUIT PROTECTOR
MFR	MANUFACTURER
MH	MANHOLE
MIN	MINIMUM
MTG	MOUNTING
MTS	MANUAL TRANSFER SWITCH
NA	NON-AUTOMATIC
N/A	NOT APPLICABLE
NC	NORMALLY CLOSED
NO	NORMALLY OPEN
NEC	NATIONAL ELECTRIC CODE
NIC	NOT IN CONTRACT
NTS	NOT TO SCALE
OFCI	OWNER FURNISHED, CONTRACTOR INSTALLED
OL	OVERLOAD RELAY
PB	PUSH BUTTON
PLC	PROGRAMMABLE LOGIC CONTROLLER
PNL	PANEL
PR	PAIR
PS	PRESSURE SWITCH
PT	POTENTIAL TRANSFORMER
PVC	POLYVINYL CHLORIDE
REC	RECEPTACLE
RGS	RIGID GALVANIZED STEEL
REQ'D	REQUIRED
SEC	SECONDARY
SP	SPARE
SPD	SURGE PROTECTION DEVICE
SS	STAINLESS STEEL
SV	SOLENOID VALVE
SWBD	SWITCHBOARD
SWGR	SWITCHGEAR
TC	TRAY CABLE (CABLE SCHEDULE)
TC	TIME CLOCK
TEMP	TEMPERATURE
TEW	THERMOCOUPLE EXTENSION WIRE
TS	TEMPERATURE SWITCH
TYP	TYPICAL
UG	UNDERGROUND
UON	UNLESS OTHERWISE NOTED
UPS	UNINTERRUPTIBLE POWER SUPPLY
VAC	VOLTS ALTERNATING CURRENT
VFCI	VENDOR FURNISHED, CONTRACTOR INSTALLED
VFD	VARIABLE FREQUENCY DRIVE
WP	WEATHERPROOF
XFMR	TRANSFORMER
XP	EXPLOSION PROOF

GENERAL NOTES (APPLIES TO ALL SHEETS):

1. THE SYMBOLS AND ABBREVIATIONS LIST ON THIS SHEET IS A COMPREHENSIVE STANDARD GUIDE INTENDED FOR GENERAL USE ON ALL PROJECTS. THEREFORE NOT ALL THE SYMBOLS AND ABBREVIATIONS CONTAINED IN THIS LIST ARE NECESSARILY USED ON THIS PARTICULAR PROJECT AND SHOULD BE USED FOR CLARIFICATION ONLY.
2. THE CONTRACTOR SHALL READ AND UNDERSTAND THE ENTIRE SET OF CONSTRUCTION DOCUMENTS. THIS INCLUDES BUT IS NOT LIMITED TO THE PLANS AND SPECIFICATIONS FOR ALL DISCIPLINES. THIS WILL ENSURE THAT HE UNDERSTANDS THE FULL SCOPE OF WORK AND IS ABLE TO CONVEY THE REQUIRED MATERIALS AND METHODS OF INSTALLATION TO THE HIS ESTIMATORS, SUPPLIERS AND INSTALLERS.
3. CONTRACTOR SHALL VISIT PROJECT SITE AND MAKE HIMSELF/HERSELF AWARE OF ALL EXISTING CONDITIONS PRIOR TO SUBMITTING A BID FOR THIS WORK.
4. PROVIDE MEANS TO FURNISH AND INSTALL.
5. COORDINATE ANY AND ALL WORK WITH OTHER TRADES PRIOR TO INSTALLATION IN ORDER TO AVOID CONFLICTS DURING CONSTRUCTION.
6. THESE DRAWINGS ARE DIAGRAMMATIC IN NATURE. DO NOT SCALE FROM THESE DRAWINGS.
7. WHERE JOB CONDITIONS REQUIRE CHANGES FROM THE CONTRACT DOCUMENTS THAT DO NOT CHANGE THE SCOPE OF INSTALLATION OR NATURE OF THE WORK REQUIRED, THE CONTRACTOR SHALL MAKE SUCH CHANGES WITHOUT ANY ADDITIONAL COST TO THE OWNER. NO OTHER CHANGES MAY BE MADE WITHOUT WRITTEN CONSENT FROM THE ENGINEER AND OWNER.
8. ALL WORK SHALL BE DONE IN ACCORDANCE WITH THE REQUIREMENTS OF THE ENFORCED EDITION OF THE NATIONAL ELECTRIC CODE, NATIONAL ELECTRIC SAFETY CODE, LIFE SAFETY CODE AND ALL OTHER LOCAL AND STATE CODES AND REGULATIONS. THE CONTRACTOR SHALL OBTAIN AND PAY FOR ALL PERMITS AND INSPECTIONS REQUIRED BY THE AUTHORITY HAVING JURISDICTION.
9. MOUNTING HEIGHTS INDICATED ARE TO THE CENTER OF THE DEVICE U.O.N.
10. DETAILS SHOWN ON ANY DRAWING APPLY TO ALL EQUIPMENT AND MATERIAL ON THE PROJECT.
11. EQUIPMENT LOCATIONS SHOWN ARE APPROXIMATE. EXTEND CONDUIT & WIRE TO INSTALLED LOCATIONS AT NO ADDITIONAL COST TO THE OWNER.
12. ELECTRICAL SYSTEMS SHALL BE COMPLETE AND OPERABLE AT PROJECT COMPLETION.

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING:

USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name: KEFF S. KURELLA, PE
Professional Engineer's No.: 32324-E

State	Date Signed	Project Mgr.
AL		JH
Designed by: WH	Drawn by: WH	Checked by: KK

ARCADIS
ARCADIS U.S., INC.
ALABAMA CERTIFICATE OF AUTHORIZATION NUMBER 1822

RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC - 10565 HIGHWAY 43 NORTH, CREOLA, MOBILE COUNTY, ALABAMA
AIR SPARGE / SOIL VAPOR EXTRACTION REMEDIATION SYSTEM

NOTES, SYMBOLS AND ABREVIATIONS

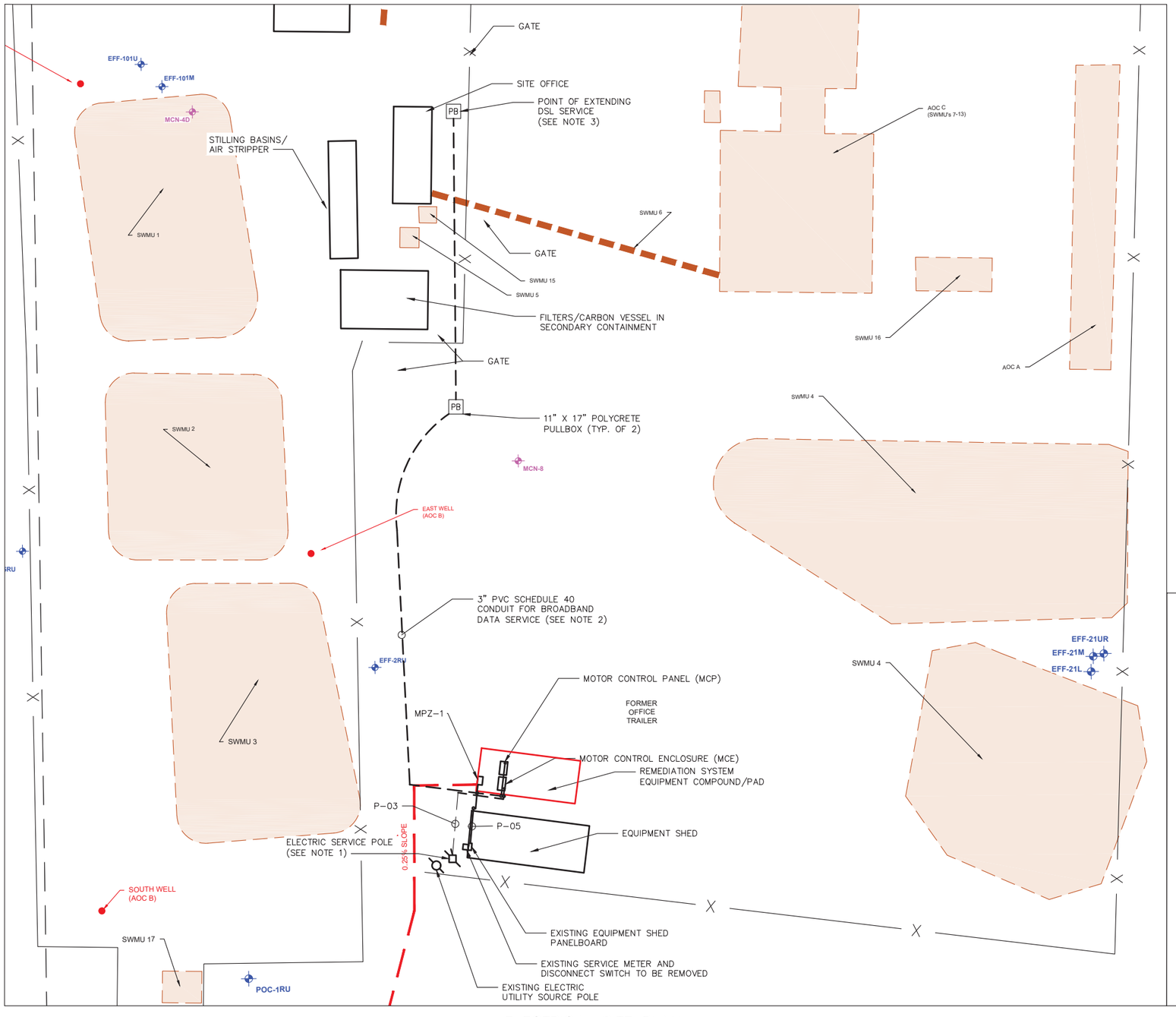
CONSTRUCTION DRAWINGS

ARCADIS Project No. 03648010.0001.00500

Date JANUARY 2018

ARCADIS
3109 W. MARTIN L. KING JR. DR.
SUITE 350
TAMPA, FL 33607
TEL. 813.903.3100

E-1



ELECTRICAL SITE PLAN

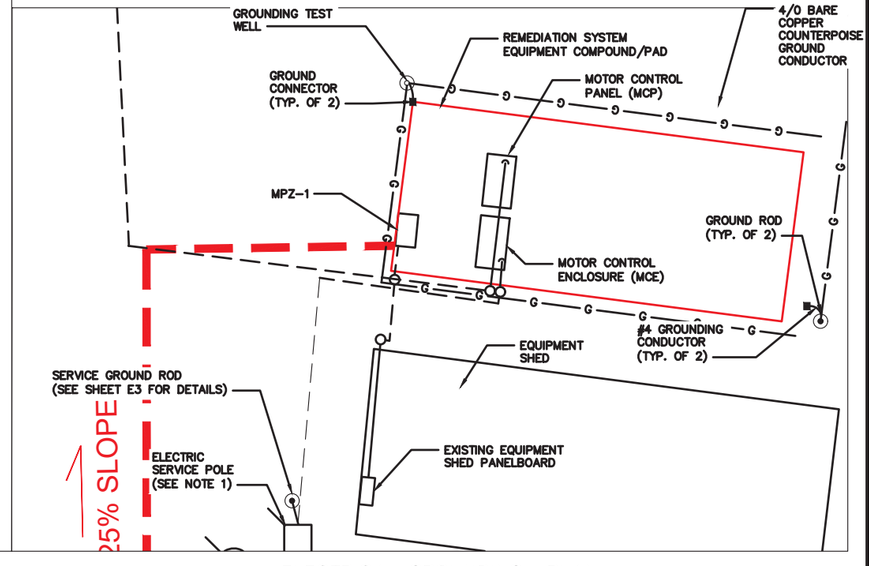
0 30' 60'

SCALE: 1" = 30'

N

NOTES:

1. CONTRACTOR SHALL COORDINATE WITH ALABAMA POWER TO ESTABLISH NEW ELECTRIC SERVICE FOR REMEDIATION SYSTEM.
2. CONTRACTOR SHALL COORDINATE WITH AT&T TO ESTABLISH NEW DSL BROADBAND INTERNET SERVICE FOR REMEDIATION SYSTEM.
3. CONTRACTOR SHALL COORDINATE WITH AT&T TO EXTEND EXISTING DSL BROADBAND SERVICE TO NEW REMEDIATION SYSTEM.



ELECTRICAL GROUNDING PLAN

0 5' 10'

SCALE: 1" = 10'

SCALE: AS SHOWN'

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING:

USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name: **KEFF S. KURELLA, PE**

Professional Engineer's No.: 32324-E

State	Date Signed	Project Mgr.
AL		JH
Designed by	**Drawn by**	**Checked by**
WH	WH	KK

ARCADIS

ARCADIS U.S., INC.
ALABAMA CERTIFICATE OF AUTHORIZATION NUMBER 1822

RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC - 10565 HIGHWAY 43 NORTH, CREOLA, MOBILE COUNTY, ALABAMA

AIR SPARGE / SOIL VAPOR EXTRACTION REMEDIATION SYSTEM

ELECTRICAL SITE AND GROUNDING PLAN

CONSTRUCTION DRAWINGS

ARCADIS Project No. 03648010.0001.00500

Date JANUARY 2018

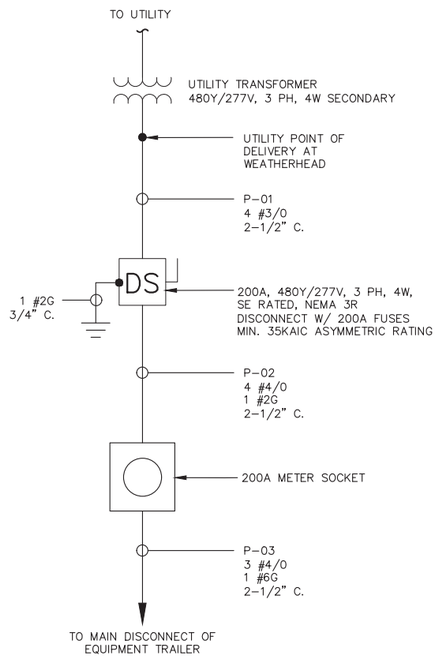
ARCADIS
3109 W. MARTIN L. KING JR. DR.
SUITE 350
TAMPA, FL 33607
TEL. 813.903.3100

E-2

MAIN PANEL LOAD CALC				
EQUIPMENT	(D) DUTY OR (S) STANDBY	HP/KVA	CONNECTED LOAD (A)	RUNNING LOAD (A)
AS AIR COMPRESSOR	D	30 HP/33.26 KVA	40.00	40.00
SVE BLOWER	D	50 HP/54.03 KVA	65.00	65.00
TRANSFER PUMP	D	1 HP/1.75 KVA	2.10	2.10
EXHAUST FAN	D	0.75 HP/1.33 KVA	1.60	1.60
LOW VOLTAGE CONTROL XFMR	D	15 KVA	15.63	15.63
SUBTOTAL (AMPS)			124.33	124.33
25% OF LARGEST MOTOR (AMPS)				16.25
LOAD PER NEC 430.24 (AMPS)	200 AMP SERVICE IS ADEQUATE			140.58

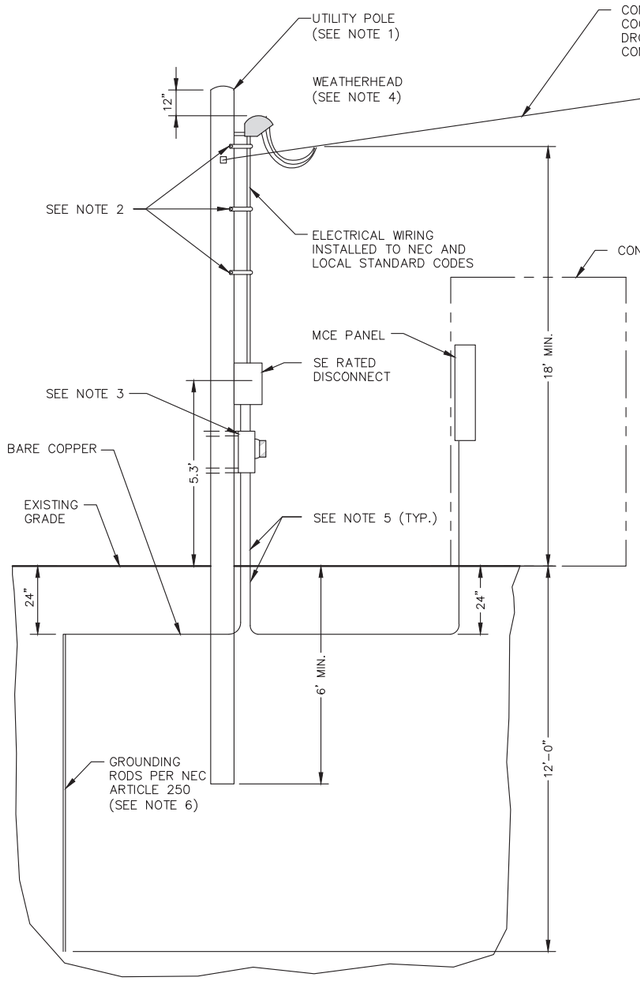
NOTES:

1. CONTRACTOR TO COORDINATE AND PROVIDE CONTAINER SERVICE SHOWN IN DETAIL 2 WITH POWER COMPANY.
2. CONTRACTOR SHALL INSTALL A SUFFICIENT NUMBER OF CONDUIT STRAPS TO PROPERLY SECURE CONDUIT TO POLE.
3. PROVIDE METER SOCKET USING PRE-APPROVED ALABAMA POWER EQUIPMENT, WITH DOUBLE LUGS ON SPLIT SERVICES, FURNISHED AND INSTALLED BY CONTRACTOR.
4. UTILITY POINT OF DELIVERY SHALL BE AT THE WEATHERHEAD. CONTRACTOR SHALL PROVIDE CABLES FROM CONTAINERS TO POINT OF DELIVERY.
5. ABOVE GROUND RACEWAYS SHALL BE TYPE RGS. BELOW GROUND RACEWAYS SHALL BE SCHEDULE 40 PVC. ALL TRANSITION ELBOWS FROM BELOW GROUND TO ABOVE GROUND SHALL BE PVC COATED RGS.
6. MINIMUM OF (2) ¾" x 10'-0" GROUND RODS SPACED 10'-0" APART. PROVIDE PVC TEST WELL FOR EACH ROD.



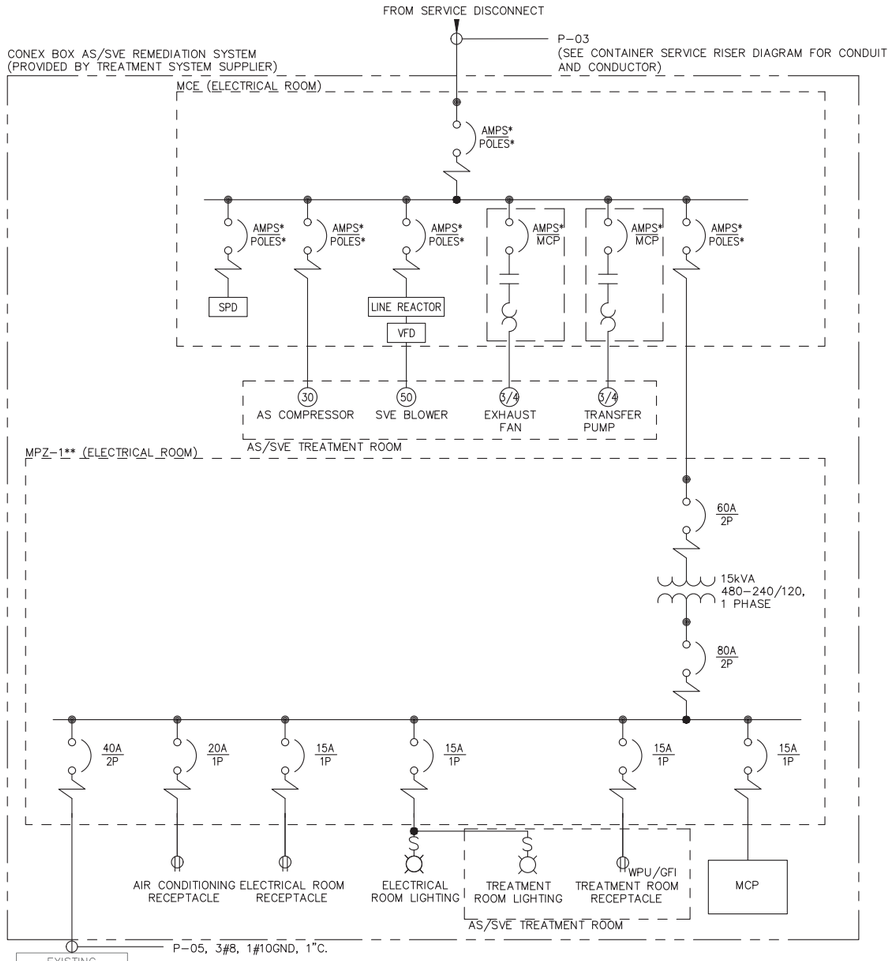
CONTAINER SERVICE RISER DIAGRAM

NOT TO SCALE



CONTAINER SERVICE POLE DETAIL

NOT TO SCALE



TREATMENT SYSTEM SINGLE LINE DIAGRAM

NOT TO SCALE

*SEE MCE BUILD OF MATERIAL AND THREE LINE DIAGRAM FOR BREAKER, MOTOR CIRCUIT PROTECTORS, AND STARTERS' MANUFACTURER, MODEL AND SIZES.
** MINI-POWER ZONE PROVIDED AND INSTALLED BY TREATMENT SYSTEM SUPPLIER.

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name: KEFF S. KURELLA, PE
Professional Engineer's No.: 32324-E

State	Date Signed	Project Mgr.
AL		JH
Designed by: WH	Drawn by: WH	Checked by: KK

ARCADIS

ARCADIS U.S., INC.
ALABAMA CERTIFICATE OF AUTHORIZATION NUMBER 1822

RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC - 10565 HIGHWAY 43 NORTH, CREOLA, MOBILE COUNTY, ALABAMA
AIR SPARGE / SOIL VAPOR EXTRACTION REMEDIATION SYSTEM

SINGLE LINE DIAGRAM

CONSTRUCTION DRAWINGS

ARCADIS Project No.: 03648010.0001.00500
Date: JANUARY 2018

ARCADIS
3109 W. MARTIN L. KING JR. DR.
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E-3

LEGEND

- FLEXIBLE HOSE
- CONTROL PANEL OR EQUIPMENT
- SOFTWARE LINK, SYSTEM FUNCTION CONNECTION OR COMMUNICATION LINK
- FO —— FO — FIBER OPTIC CONNECTION
- MAIN PROCESS LINE
- AUXILIARY SYSTEMS
- BUILDING/AREA EXTENTS
- ELECTRIC (ELECTRONIC) SIGNAL
- BALL VALVE
- BUTTERFLY VALVE
- GATE VALVE
- NEEDLE VALVE
- PISTON CHECK VALVE
- SPRING CHECK VALVE
- SWING CHECK VALVE
- BALL CHECK VALVE
- DIAPHRAGM VALVE
- SOLENOID OPERATED VALVE
- MOTOR OPERATED VALVE
- BLOCK & BLEED VALVE
- SAMPLE PORT
- PRESSURE REGULATING VALVE
- FLANGED CONNECTION/PIPE TRANSITION
- NON–FLANGED PIPE TRANSITION
- UNION
- REDUCER
- Y STRAINER
- PRESSURE RELIEF VALVE
- VACUUM RELIEF VALVE
- VENT
- CAMLOCK
- QUICK CONNECT
- HOSE BARB CONNECTION
- CAP
- EYE WASH/EMERGENCY SHOWER
- PARTICULATE FILTER
- COALESCING FILTER

- MOTOR
- VARIABLE FREQUENCY DRIVE
- SUBMERSIBLE WELL PUMP
- CENTRIFUGAL BLOWER
- CENTRIFUGAL PUMP
- ROTARY–LOBE BLOWER
- CHEMICAL METERING PUMP
- ROTARY SCREW COMPRESSOR
- SUMP PUMP
- THERMAL MASS FLOW METER
- MAGNETIC FLOW METER
- POSITIVE DISPLACEMENT FLOW METER
- AVERAGING PILOT TUBE FLOW METER
- ROTAMETER WITH VALVE
- STATIC MIXER
- SITE GLASS
- FILTER
- BELL FLOAT

INSTRUMENT SYMBOLS

	PRIMARY CONTROL PANEL NORMALLY ACCESSIBLE TO OPERATOR	FIELD MOUNTED	AUXILIARY PANEL OR RACK NORMALLY ACCESSIBLE TO OPERATOR
DISCRETE INSTRUMENTS	◯	◯	◯
SHARED DISPLAY, SHARED CONTROL	◯	◯	◯
COMPUTER FUNCTION INCLUDING DISTRIB. CNTL. SYS.	⬡	⬡	⬡
PROGRAMMABLE LOGIC CONTROLLER FUNCTION	◇	◇	◇

PIPELINE DESIGNATION

6"–S04P
- 6" — SIZE
- S04P — LINE TYPE
  - S — MATERIAL
  - 04 — PIPE

MATERIAL:

BRZ – BRASS/BRONZE
CIR – CAST IRON
CST – CARBON STEEL
CPR – COPPER
CVC – CHLORINATED POLYVINYL CHLORIDE
DIR – DUCTILE IRON
FRP – FIBERGLASS
GCS – GALVANIZED CARBON STEEL
HDPE– HIGH DENSITY POLYETHYLENE
LCS – LINED CARBON STEEL
PET – POLYETHYLENE

TYPE:

D = DUCT
H = HOSE
C = DOUBLE WALL CONTAINMENT PIPE
P = PIPE
T = TUBE

POP – POLYPROPYLENE
PVC – POLYVINYL CHLORIDE
RUB – RUBBER
S04 – 304 STAINLESS STEEL
S4L – 304L STAINLESS STEEL
S16 – 316 STAINLESS STEEL
S6L – 316L STAINLESS STEEL
TEF – TEFLON
VIT – VITON
TYG – TYGON

ALARMS:

1. AN ALARM THAT DISABLES ALL OR ANY PART OF THE SYSTEM WILL SEND A NOTIFICATION TO THE OPERATOR VIA THE SCADA SYSTEM.

INTERLOCKS:

1. TIMER CONTROL WILL OPERATE ONE OR TWO VALVES AT A TIME IN AN USER ADJUSTABLE CONDITION.
2. FAILURE OF VALVE TO ACTUATE WILL DISABLE BS COMPRESSOR.
3. HIGH HIGH IN KO TANK WILL DISABLE SVE BLOWER.
4. USER ADJUSTABLE LOW & HIGH VACUUM SET POINTS WILL DISABLE SVE BLOWER.
5. USER ADJUSTABLE DIFFERENTIAL PRESSURE SET POINT WILL DISABLE RESPECTIVE SVE BLOWER.
6. LSH WILL ACTIVATE THE TRANSFER PUMP. LSL WILL DISABLE THE TRANSFER PUMP.
7. FAILURE TO START WILL DISABLE SVE BLOWER AND BS COMPRESSOR.
8. ANY UPSET WHICH CAUSES AND SVE BLOWER TO SHUT DOWN WILL ALSO SHUT DOWN BS COMPRESSOR.
9. HIGH PRESSURE WILL DISABLE SVE BLOWER.
11. HIGH/HIGH LEVEL ALARM WILL DISABLE ALL EQUIPMENT.
12. HIGH OR LOW PRESSURE WILL DISABLE BS COMPRESSOR.
13. HIGH TEMPERATURE WILL DISABLE SVE BLOWER.
14. EMERGENCY STOP/KILL SWITCH WILL DISABLE ALL EQUIPMENT.
15. LOCALLY ADJUSTABLE TEMPERATURE SWITCH WILL OPERATE EXHAUST FAN.
16. EQUIPMENT CONTAINER EXHAUST FAN MUSTY OPERATE FOR SVE BLOWER TO OPERATE.
17. TEMPERATURE ABOVE DESIGNATED MAXIMUM WILL SEND ALARM TO OPERATOR.

INSTRUMENT IDENTIFICATION LETTERS

FIRST LETTER		SUCCEEDING LETTERS		
MEASURE OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A = ANALYSIS		ALARM		
B = BURNER, COMBUSTION		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C = USER'S CHOICE			CONTROL, CLOSED	
D = USER'S CHOICE	DIFFERENTIAL			
E = VOLTAGE		SENSOR (PRIMARY ELEMENT)		
F = FLOW RATE	RATIO (FRACTION)			
G = USER'S CHOICE		GLASS, VIEWING DEVICE		
H = HAND				HIGH
I = CURRENT (ELECTRICAL)		INDICATE		
J = POWER	SCAN			
K = TIME, TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L = LEVEL		LIGHT		LOW
M = USER'S CHOICE	MOMENTARY			MIDDLE,INTERMEDIATE
N = USER'S CHOICE		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
O = USER'S CHOICE		ORIFICE, RESTRICTION	OPEN	
P = PRESSURE, VACUUM		POINT (TEST) CONNECTION		
Q = QUANTITY	INTEGRATE, TOTALIZE			
R = RADIATION		RECORD	RUN	
S = SPEED, FREQUENCY	SAFETY	SWITCH	STOP	
T = TEMPERATURE			TRANSMIT	
U = MULTIVARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V = VIBRATION, MECH. ANALYSIS			VALVE, DAMPER, LOUVER	
W = WEIGHT, FORCE		WELL		
X = UNCLASSIFIED	X AXIS	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y = EVENT, STATUS OR PRESENCE	Y AXIS		RELAY,COMPUTE,CONVERT	
Z = POSITION, DIMENSION	Z AXIS	UNCLASSIFIED	DRIVE, ACTUATOR, FINAL CONTROL ELEMENT	

ABBREVIATIONS:

AC AIR COMPRESSOR
AD AIR DRYER
AI pH INDICATOR
AIT pH INDICATOR TRANSMITTER
AR AIR RECEIVER TANK
AS ANTI–SCALANT
C CENTER LINE
CAH CONDUCTIVITY ALARM HIGH
CFM CUBIC FEET PER MINUTE
CI CONDUCTIVITY INDICATOR
CIP CLEAN IN PLACE
CIT CONDUCTIVITY INDICATOR TRANSMITTER
CO CLEAN OUT
CTE CONDUCTIVITY TEMPERATURE ELEMENT
CY CUBIC YARDS
°C DEGREES CELSIUS
DPAL DIFFERENTIAL PRESSURE ALARM LOW
DPAH DIFFERENTIAL PRESSURE ALARM HIGH
DPIT DIFFERENTIAL PRESSURE INDICATOR TRANSMITTER
DPI DIFFERENTIAL PRESSURE INDICATOR
E ELECTRIC ACTUATOR
ECIP ELECTRODE CLEAN IN PLACE
EM ENVIRONMENTAL MEDIA
ELEV ELEVATION
F FILTER
FE FLOW ELEMENT
FI FLOW INDICATOR
FIT FLOW INDICATING TRANSMITTER
FMO FLOW MONITOR
FQ FLOW TOTALIZER
FT FOOT/ FEET
FT FLOW TRANSMITTER
FV FLOW VALVE
GAC GRANULATED ACTIVATED CARBON
GAL GALLONS
GPD GALLONS PER DAY
HAZ HAZARDOUS
HDPE HIGH DENSITY POLYETHYLENE
HOA HAND/ OFF/ AUTO
HR HOUR
HS HAND SWITCH
IN. INCHES
kg KILOGRAMS
KV TIMER VALVE
L LITER
LAH LEVEL ALARM HIGH
LAHH LEVEL ALARM HIGH HIGH
LAL LEVEL ALARM LOW
LE LEVEL ELEMENT
LP LIQUID PHASE
LS LEVEL SWITCH
LT LEVEL TRANSMITTER
M MOTOR
MAX MAXIMUM
uM MICROMETER
mg MILLIMETER
MIN MINIMUM
MMF MULTIMEDIA FILTER
NA NOT APPLICABLE
NC NORMALLY CLOSED
NO NORMALLY OPEN
NPT NATIONAL PIPE THREAD
% PERCENT
LB POUNDS
PAH PRESSURE ALARM HIGH
PAL PRESSURE ALARM LOW
PI PRESSURE INDICATOR
PIT PRESSURE INDICATOR TRANSMITTER
PSIG PRESSURE PER SQUARE FOOT GAUGE
PR PRESSURE RELIEF VALVE
PRV PRESSURE REGULATING VALVE
PSV PRESSURE SAFETY VALVE
PVR PRESSURE VACUUM RELIEF
QAPP QUALITY ASSURANCE PROJECTION PLAN
NaOH SODIUM HYDROXIDE
SP SAMPLE PORT
T TANK
TAH TEMPERATURE ALARM HIGH
TAHH TEMPERATURE ALARM HIGH HIGH
TI TEMPERATURE INDICATOR
TIT TEMPERATURE INDICATOR TRANSMITTER
TYP TYPICAL
TWV THREE WAY VALVE
V VALVE
VAH VACUUM ALARM HIGH
VAL VACUUM ALARM LOW
VE VACUUM ELEMENT
VIT VACUUM INDICATING TRANSMITTER
XLPE CROSS LINKED POLYETHYLENE
YI STATUS INDICATOR
ZX POSITION INDICATOR

NOTES:
1. ANY FIRST LETTER COMBINED WITH A MODIFIER REPRESENTS A NEW AND SEPARATE MEASURED VARIABLE. EXAMPLES: DP= DIFFERENTIAL PRESSURE; FQ= TOTALIZED OR INTEGRATED FLOW. EXCEPTION IS THE MODIFIER "J" FOR MULTIPOINT SCANNING.
2. FOR ANALYSIS NOT IDENTIFIED BY A SPECIFIC LETTER INTHE TABLE, USE FIRST LETTER "A" NEAR THE INSTRUMENT SYMBOL, SPECIFY THAT NATURE OF THE ANALYSIS. EXAMPLE: pH
3. MEANING OF A "USER'S CHOICE" LETTER SHALL BE CONSISTENT THROUGHOUT A PROJECT, AND SHALL BE SPECIFIED IN THE DRAWING LEGEND.

GENERAL NOTES:
1. ALL ANALOG SET POINTS SHALL BE FIELD ADJUSTED BY OPERATOR AT HMI INTERFACE.
2. ALARMS THAT SHUT DOWN TREATMENT EQUIPMENT MUST BE CLEARED BY OPERATOR BEFORE BEING RESTARTED.
3. THIS DRAWING IS PROVIDED FOR INFORMATIONAL PURPOSES ONLY.

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name: JOHN F. PERELLA, PE
Professional Engineer's No.: 37041-E

State	Date Signed	Project Mgr.
AL		JH
Designed by	Drawn by	Checked by
ZV	BO	JP

ARCADIS
ARCADIS U.S., INC.
ALABAMA CERTIFICATE OF AUTHORIZATION NUMBER 1822

RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC - 10565 HIGHWAY 43 NORTH, CREOLA, MOBILE COUNTY, ALABAMA
AIR SPARGE / SOIL VAPOR EXTRACTION REMEDIATION SYSTEM

PIPING AND INSTRUMENTATION DIAGRAM LEGEND

CONSTRUCTION DRAWINGS

ARCADIS Project No. 03648010.0001.00500
Date JANUARY 2018

ARCADIS
3109 W. MARTIN L. KING JR. DR.
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TAMPA, FL 33607
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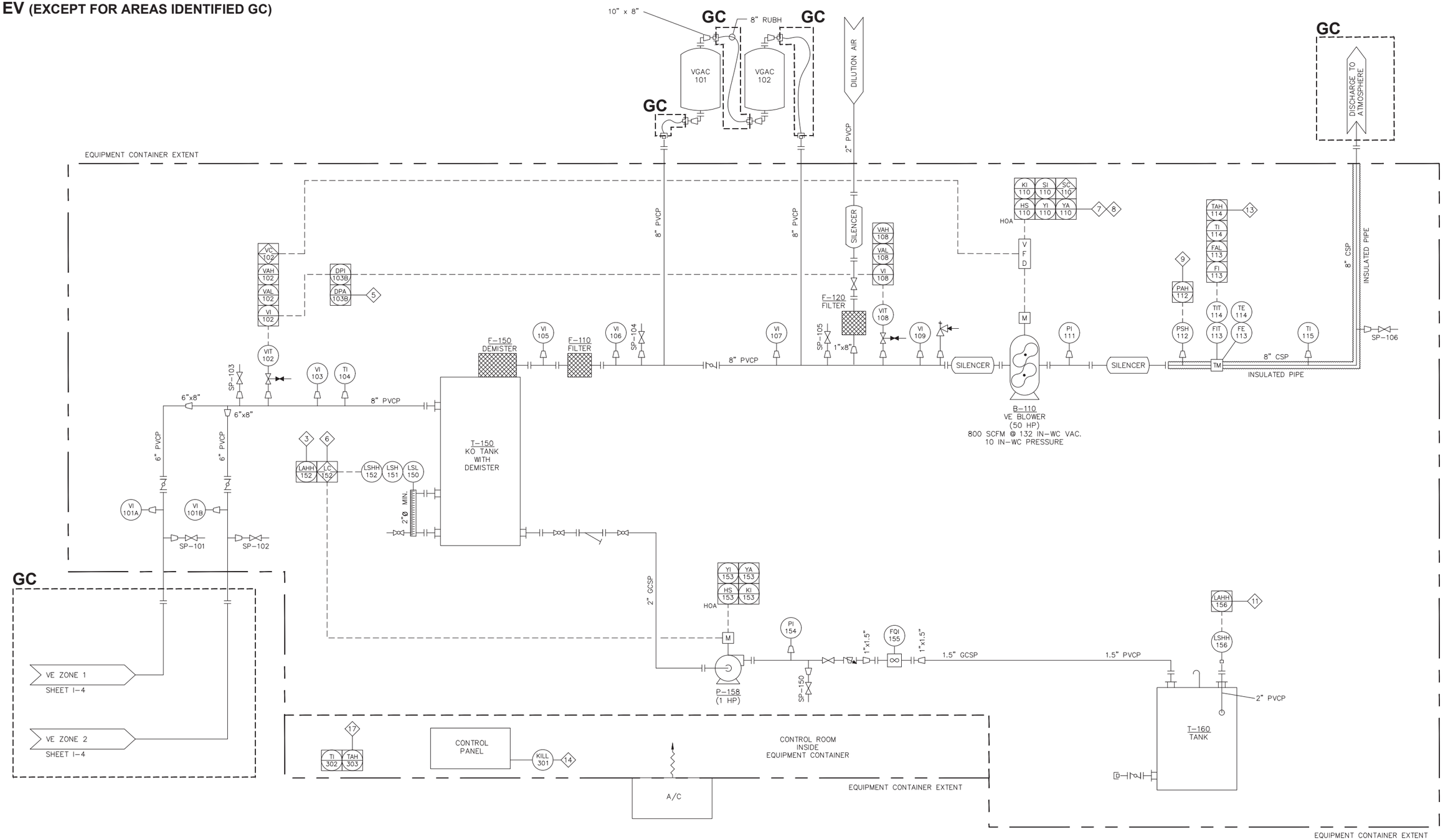
I-1

EV (EXCEPT FOR AREAS IDENTIFIED GC)



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Professional Engineer's Name: **JOHN F. PERELLA, PE**

Professional Engineer's No.: 37041-E

State	Date Signed	Project Mgr.
AL		JH
Designed by	Drawn by	Checked by
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ALABAMA CERTIFICATE OF AUTHORIZATION NUMBER 1822

RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC - 10565 HIGHWAY 43 NORTH, CREOLA, MOBILE COUNTY, ALABAMA

AIR SPARGE / SOIL VAPOR EXTRACTION REMEDIATION SYSTEM

PIPING AND INSTRUMENTATION DIAGRAM SOIL VAPOR EXTRACTION

CONSTRUCTION DRAWINGS

ARCADIS Project No. 03648010.0001.00500

Date JANUARY 2018

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I-2

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AIR COMPRESSOR EXHAUST VENTS TO EQUIPMENT CONTAINER EXTERIOR

EQUIPMENT CONTAINER EXTENT

LIMITS OF AIR COMPRESSOR PACKAGE

DUCT ALL EXHAUST

EXHAUST FAN

HOA 321 | YI 322 | YA 323

YA 201B | YI 201B

YA 201A | KI 201A | YI 201A | HS 201A

M

AC–200
ROTARY SCREW COMPRESSOR
30 HP 128 SCFM @ 38 PSI

RECEIVER TANK

PI 202 | PSH 203 | PAH 203 | TAH 204 | TSH 204

INTEGRATED REFRIGERATE AIR DRYER

AUTO DRAIN

1"x2"

PI 206 | TI 207

PAHH 208 | PAH 208 | PAL 208 | PIT 208

SP–201

SILENCER

FAH 209 | FAL 209 | FI 209 | FIT 209 | FE 209

TM

2" GCSP

1" GCSP

1/4" BRZP

1/4" PETT

KC 205 | HS 205 | S

CM–250
CONDENSATE MANIFOLD

1/2" PETT

CF–260
CONDENSATE FILTER

T–261
OIL HOLDING TANK

WATER DRAIN TO GROUND SURFACE

GC

TI 302 | TAH 303

GC

VENT TO ATMOSPHERE

HS 211 | ZI 211 | ZA 211 | KC 211

PI 210 | PRV–210 | MOV–211

2" HDPEP

BS REMOTE CABINET 1 – ZONE 1
SHEET I–4

HS 213 | ZI 213 | ZA 213 | KC 213

PI 212 | PRV–212 | MOV–213

BS REMOTE CABINET 1 – ZONE 2
SHEET I–4

HS 215 | ZI 215 | ZA 215 | KC 215

PI 214 | PRV–214 | MOV–215

BS REMOTE CABINET 2 – ZONE 3
SHEET I–4

HS 217 | ZI 217 | ZA 217 | KC 217

PI 216 | PRV–216 | MOV–217

BS REMOTE CABINET 2 – ZONE 4
SHEET I–4

EQUIPMENT CONTAINER EXTENT

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No.	Date	Revisions	By	Ckd

Professional Engineer's Name: **JOHN F. PERELLA, PE**
Professional Engineer's No.: 37041-E
State: AL | Date Signed: | Project Mgr.: JH
Designed by: ZV | Drawn by: BO | Checked by: JP

ARCADIS
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RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC - 10565 HIGHWAY 43 NORTH, CREOLA, MOBILE COUNTY, ALABAMA
AIR SPARGE / SOIL VAPOR EXTRACTION REMEDIATION SYSTEM

PIPING AND INSTRUMENTATION DIAGRAM AIR SPARGE

CONSTRUCTION DRAWINGS

ARCADIS Project No. 03648010.0001.00500
Date JANUARY 2018

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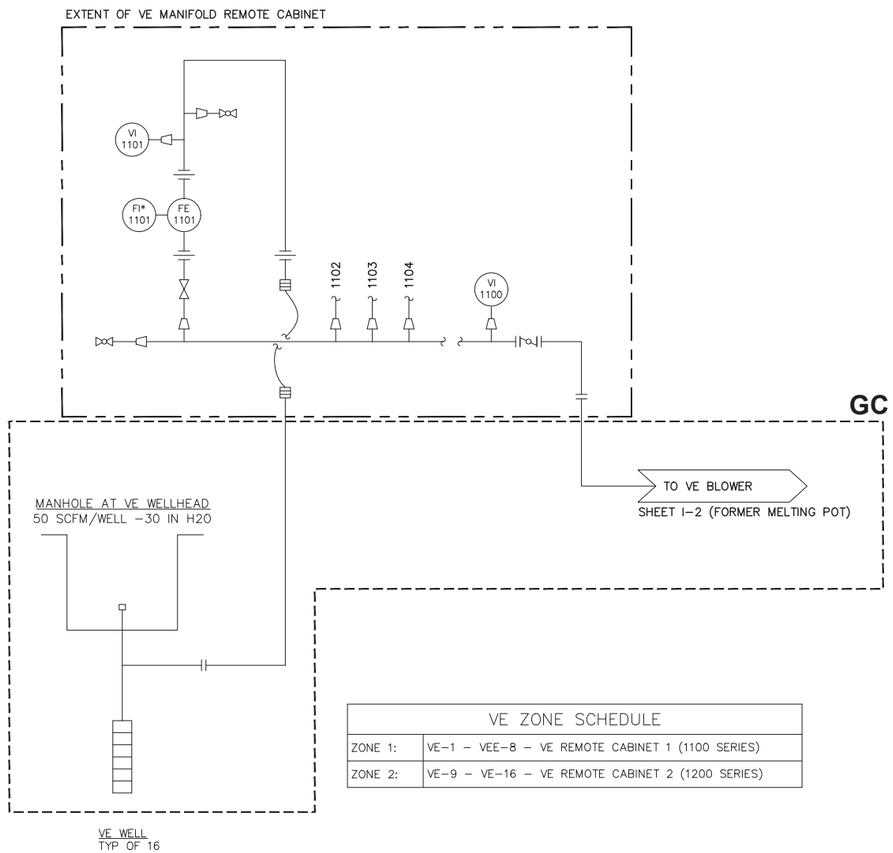
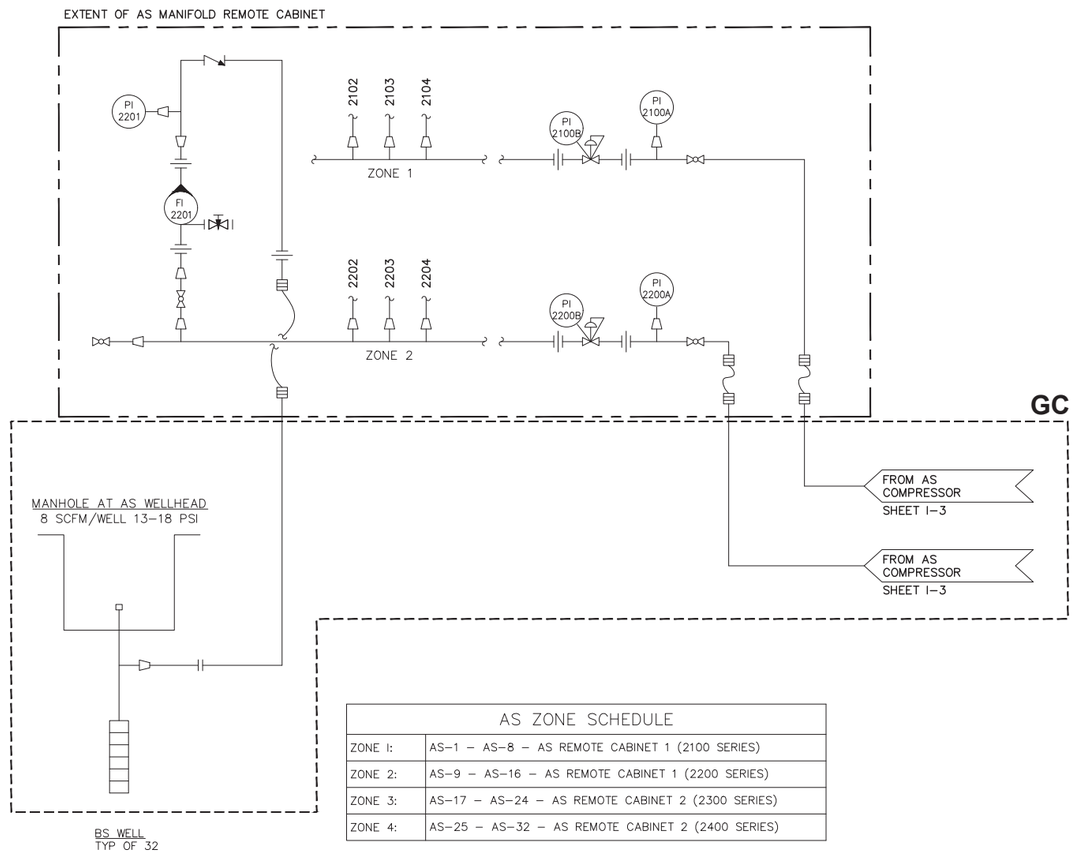
I-3

EV (EXCEPT FOR AREAS IDENTIFIED GC)



VE ZONE SCHEDULE	
ZONE 1:	VE-1 – VEE-8 – VE REMOTE CABINET 1 (1100 SERIES)
ZONE 2:	VE-9 – VE-16 – VE REMOTE CABINET 2 (1200 SERIES)

NOTE:
* FLOW INDICATOR FI-1101 IS MOVEABLE BETWEEN VE LEGS. EACH VE LEG HAS A FLOW ELEMENT (PITOT TUBE).



AS ZONE SCHEDULE	
ZONE 1:	AS-1 – AS-8 – AS REMOTE CABINET 1 (2100 SERIES)
ZONE 2:	AS-9 – AS-16 – AS REMOTE CABINET 1 (2200 SERIES)
ZONE 3:	AS-17 – AS-24 – AS REMOTE CABINET 2 (2300 SERIES)
ZONE 4:	AS-25 – AS-32 – AS REMOTE CABINET 2 (2400 SERIES)

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING:

USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name	JOHN F. PERELLA, PE	
Professional Engineer's No.	37041-E	
State: AL	Date Signed:	Project Mgr.: JH
Designed by: ZV	Drawn by: BO	Checked by: JP

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RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC - 10565 HIGHWAY 43 NORTH, CREOLA, MOBILE COUNTY, ALABAMA
AIR SPARGE / SOIL VAPOR EXTRACTION REMEDIATION SYSTEM

PIPING AND INSTRUMENTATION DIAGRAM REMOTE CABINET

CONSTRUCTION DRAWINGS

ARCADIS Project No.
03648010.0001.00500

Date
JANUARY 2018

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I-4

Rentokil Treatment System List of Instrumentation

Tag ID	Drawing	Equipment Description	Manufacturer	Model #	Comment
VIT-102	I-2	Vacuum Transmitter, range -250''wc. to +250''w.c, 4-20mA Hart	Rosemount	3051S-1CG-2A-2-E12-A-1A	
VIT-108	I-2	Vacuum Transmitter, range -250''wc. to +250''w.c, 4-20mA Hart	Rosemount	3051S-1CG-2A-2-E12-A-1A	
FIT-113/TT-114	I-2	Air Mass Flowmeter, 6'' PIPE, 18-36VDC Power, Integral Transmitter with Local Display and two outputs. (output 1 SCFM range 1000 SCFM, output 2 Temperature range 0-500Deg F)	Fluid Components International (FCI)	ST50-xxxxxxxxxxxxxx	
LS-150-151-152	I-2	Multi-Stage Switches, Vertical Mount, 2''NPT, Stainless Steel, SPDT, Top Switch N.C., Middle N.O., Bottom N.O. (Distance between switches TBD)	Innovative Solutions	L500 series	
LS-156	I-2	Full Size Stainless Steel Float Switch, SPDT, N.C. (Tank top Mount)	MADISON 800-4665383	M5600	
PSH-112	I-2	Multifunction Pressure Switch, nominal range -100''w.c., 120VAC	Ashcroft	L Series LPA-N4-G-B-25-XK3-100''w.c.	
FQI-155	I-2	Positive Displacement Flow Meter / Totalizer - 3/4'' x 7-1/2'', maximum continuous flow rate of 25 gpm	Badger	Model 35 (3/4'')	
PIT-208	I-3	Pressure Transmitter, range 0-150 PSI, 4-20mA Hart	Rosemount	3051TG2A-2B21A	
FIT-209	I-3	Compressed Air Monitor, 1'' NPT, Measuring range 0-130 SCFM, 4-20mA output, with connector cable.	IFM 800-441-8246	SD8001	
PSH-203	I-3	Pressure Switch - Included with Compressor Package	OEM	OEM	Included with Compressor Package
TSH-204	I-3	Temperature Switch - Included with Compressor Package	OEM	OEM	Included with Compressor Package

Rentokil Treatment System List of Motor Operated Valves

Tag ID	Drawing	Equipment Description	Manufacturer	Model #	Comment
MOV-211, 213, 215, 217	I-3	Electric Motor Operated Valve (1-inch Ball Valve, Brass Body, SS Ball and Stem rated for 600 psi)	Flowserve Worchester	Series 75 Model 10-4-75-W-M1-120A	

Rentokili Treatment System List of Gauges

Tag ID	Drawing	Equipment Description	Manufacturer	Model #	Comment
VI-101A, 101B, 103, 105, 106, 107, 109	I-2	Vacuum Gauges, 1/4'' MNPT, Brass Internals, 2.5'' SS Case, Liquid Filled 0 - 30 in-Hg	Wika	Series 212/213	
TI-104	I-2	Temperature Gauge, 1/2'' MNPT, All Stainless Steel Construction, Bimetal Thermometer, 3-inch Dial 0 - 140 F	Wika	Series TI.30 / TI.31	
PI-111	I-2	Pressure Gauge, 1/4'' MNPT, Brass internals, 2.5'' SS Case, Liquid Filled 0 - 200 in-H2O	Wika	Series 212/213	
TI-115	I-2	Temperature Gauge, 1/2'' MNPT, All Stainless Steel Construction, Bimetal Thermometer, 3-inch Dial 0 - 250 F	Wika	Series TI.30 / TI.31	
P-154	I-2	Pressure Gauge, 1/4'' MNPT, Brass internals, 2.5'' SS Case, Liquid Filled 0 - 30 psi	Wika	Series 212/213	
PI-202	I-3	Pressure Gauge - Included in Compressor Package	OEM	OEM	Included in Compressor Package
PI-206	I-3	Pressure Gauge, 1/4'' MNPT, Brass internals, 2.5'' SS Case, Liquid Filled 0 - 200 psi	Wika	Series 212/213	
TI-207	I-3	Temperature Gauge, 1/2'' MNPT, All Stainless Steel Construction, Bimetal Thermometer, 3-inch Dial 0 - 250 F	Wika	Series TI.30 / TI.31	
PI-210, 212, 214, 216	I-3	Pressure Gauge - Included with Pressure Regulating Valves 0 - 160 psi	Parker OEM	Parker OEM	Included with PRV
VI-1100	I-4	Vacuum Gauges, 1/4'' MNPT, Brass Internals, 2.5'' SS Case, Liquid Filled 0 - 30 in-Hg	Wika	Series 212/213	VE-RC1-Z1
VI-1101 - VI-1108	I-4	Vacuum Gauges, 1/4'' MNPT, Brass Internals, 2.5'' SS Case, Liquid Filled 0 - 120 in-H2O	Wika	Series 212/213	VE-RC1-Z1
FI-1101*	I-4	Magnehelic Gauge, 0 - 20 in-H2O Diff. Pressure	Dwyer	Model 2000	VE-RC1-Z1 Plus two spare*
FE-1101 - FE-1108	I-4	Pitot Tube	Dwyer	DS-300	VE-RC1-Z1
VI-1200	I-4	Vacuum Gauge, 1/4'' MNPT, Brass Internals, 2.5'' SS Case, Liquid Filled 0 - 30 in-HG	Wika	Series 212/213	VE-RC2-Z2
VI-1209 - VI-1216	I-4	Vacuum Gauges, 1/4'' MNPT, Brass Internals, 2.5'' SS Case, Liquid Filled 0 - 120 in-H2O	Wika	Series 212/213	VE-RC2-Z2
FI-1209*	I-4	Magnehelic Gauge, 0 - 20 in-H2O Diff. Pressure	Dwyer	Model 2000	VE-RC2-Z2 Plus two spare*
FE-1209 - FE-1216	I-4	Pitot Tube	Dwyer	DS-300	VE-RC2-Z2
PI-2100A	I-4	Pressure Gauge, 1/4'' MNPT, Brass internals, 2.5'' SS Case, Liquid Filled 0 - 160 psi	Wika	Series 212/213	AS-RC1-Z1
PI-2100B	I-4	Pressure Gauge - Included with Pressure Regulating Valves 0 - 160 psi	Parker OEM	Parker OEM	Included with PRV AS-RC1-Z1
PI-2101 - PI-2108	I-4	Pressure Gauge, 1/4'' MNPT, Brass internals, 2.5'' SS Case, Liquid Filled 0 - 100 psi	Wika	Series 212/213	AS-RC1-Z1
FI-2101 - FI-2108	I-4	Variable Area Polycarbonate Flowmeter, 5'' Scale, with Needle Valve 50 - 500 SCFH	Dwyer	Series RM Model RMB-56-BV	AS-RC1-Z1
PI-2200A	I-4	Pressure Gauge, 1/4'' MNPT, Brass internals, 2.5'' SS Case, Liquid Filled 0 - 160 psi	Wika	Series 212/213	AS-RC1-Z2
PI-2200B	I-4	Pressure Gauge - Included with Pressure Regulating Valves 0 - 160 psi	Parker OEM	Parker OEM	Included with PRV AS-RC1-Z2
PI-2209 - PI-2216	I-4	Pressure Gauge, 1/4'' MNPT, Brass internals, 2.5'' SS Case, Liquid Filled 0 - 100 psi	Wika	Series 212/213	AS-RC1-Z2
FI-2209 - PI-2216	I-4	Variable Area Polycarbonate Flowmeter, 5'' Scale, with Needle Valve 50 - 500 SCFH	Dwyer	Series RM Model RMB-56-BV	AS-RC1-Z2
PI-2300A	I-4	Pressure Gauge, 1/4'' MNPT, Brass internals, 2.5'' SS Case, Liquid Filled 0 - 160 psi	Wika	Series 212/213	AS-RC2-Z3
PI-2300B	I-4	Pressure Gauge - Included with Pressure Regulating Valves 0 - 160 psi	Parker OEM	Parker OEM	Included with PRV AS-RC2-Z3
PI-2317 - PI-2324	I-4	Pressure Gauge, 1/4'' MNPT, Brass internals, 2.5'' SS Case, Liquid Filled 0 - 100 psi	Wika	Series 212/213	AS-RC2-Z3
FI-2317 - FI-2324	I-4	Variable Area Polycarbonate Flowmeter, 5'' Scale, with Needle Valve 50 - 500 SCFH	Dwyer	Series RM Model RMB-56-BV	AS-RC2-Z3
PI-2400A	I-4	Pressure Gauge, 1/4'' MNPT, Brass internals, 2.5'' SS Case, Liquid Filled 0 - 160 psi	Wika	Series 212/213	AS-RC2-Z4
PI-2400B	I-4	Pressure Gauge - Included with Pressure Regulating Valves 0 - 160 psi	Parker OEM	Parker OEM	Included with PRV AS-RC2-Z4
PI-2425 - PI-2432	I-4	Pressure Gauge, 1/4'' MNPT, Brass internals, 2.5'' SS Case, Liquid Filled 0 - 100 psi	Wika	Series 212/213	AS-RC2-Z4
FI-2425 - FI-2432	I-4	Variable Area Polycarbonate Flowmeter, 5'' Scale, with Needle Valve 50 - 500 SCFH	Dwyer	Series RM Model RMB-56-BV	AS-RC2-Z4

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

No.	Date	Revisions	By	Ckd

Professional Engineer's Name: **JOHN F. PERELLA, PE**
Professional Engineer's No.: 37041-E
State: AL | Date Signed: | Project Mgr.: JH
Designed by: ZV | Drawn by: BO | Checked by: JP

ARCADIS U.S., INC.
ALABAMA CERTIFICATE OF AUTHORIZATION NUMBER 1822

RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC - 10565 HIGHWAY 43 NORTH, CREOLA, MOBILE COUNTY, ALABAMA
AIR SPARGE / SOIL VAPOR EXTRACTION REMEDIATION SYSTEM

INSTRUMENTATION AND GAUGES B.O.M.

CONSTRUCTION DRAWINGS

ARCADIS Project No. 03648010.0001.00500
Date: JANUARY 2018

ARCADIS
3109 W. MARTIN L. KING JR. DR.
SUITE 350
TAMPA, FL 33607
TEL. 813.903.3100

LEGEND

TB	*TERMINAL BLOCK*
(1)	*POWER TERMINAL BLOCK (TB) CONNECTION WITH TB NUMBER.*
1	*CONTROLS TERMINAL BLOCK (TB) CONNECTION WITH TB NUMBER.*
— — —	*DASHED LINES DENOTES WIRING TO FIELD DEVICES*

LINE NUMBER DESCRIPTION

0000

WIRING DIAGRAM SHEET NUMBER (1 or 2 digits) — *LINE NUMBER (Always 2 digits)*

WIRE NUMBER DESCRIPTION

00000

WIRING DIAGRAM SHEET NUMBER (1 or 2 digits) — *WIRE NUMBER (Always 1digit)*; *LINE NUMBER (Always 2digits)*

	*PANEL MAIN DISCONNECT*
	*COMBINATION MOTOR STARTER AND CIRCUIT PROTECTION*
	*PUSH TO TEST PILOT LIGHT*
	*GROUND*
	*PANEL CHASSIS GROUND*
	*PLUG-IN MOV (METAL OXIDE VARISTOR)*
	*SYMBOL TO IDENTIFY COMPONENT SPECIFICATIONS*
	*DEVICE ID NUMBER TO IDENTIFY PART NUMBER*
	*WIRE CONNECTION CONTINUATION REFERENCE.*
	*FIELD WIRING TO OTHER CABINETS WITH CONNECTION REFERENCE.*
CP	*CONTROL PANEL*
MCP	*MOTOR CIRCUIT PROTECTION*
	*DOOR MOUNTED*
	*REMOTE MOUNTED*

PANEL SPECIFICATIONS AND NOTES:

1. THE PANEL MANUFACTURER SHALL HAVE A MINIMUM OF 5 YEARS EXPERIENCE MANUFACTURING SYSTEMS SPECIFICALLY FOR WASTEWATER APPLICATIONS.
2. THE CONTROL PANEL SHALL BE MANUFACTURED AND FABRICATED BY A UL 508A LISTED INDUSTRIAL CONTROL PANEL MANUFACTURER AND SHALL MEET UL 508A SAFETY STANDARDS.
3. ENCLOSURE SHALL BE UL LISTED, NEMA TYPE AS INDICATED ON THE WIRING DIAGRAM, PROPERLY SIZED TO CONTAIN THE REQUIRED COMPONENTS WITH ADDITIONAL 35% FREE SPACE. THE ENCLOSURE SHALL BE CONSTRUCTED OF 14GA CARBON STEEL BODY AND DOOR WITH CONTINUOUS HINGE.
4. ENCLOSURE ACCESSORIES, WHERE APPLICABLE, SHALL INCLUDE THE FOLLOWINGS:

- INNER SWING PANEL TO MOUNT OPERATOR DEVICES, INNER PANEL SIZE SHALL COVER THE ENTIRE OPENING OF THE ENCLOSURE.
- WORK LIGHT, 12-INCH FLUORESCENT WITH A SAFETY LENS SHALL BE MOUNTED INSIDE THE TOP OF THE ENCLOSURE WITHOUT PENETRATING THE OUTSIDE OF THE PANEL. THE LIGHT SHALL BE OPERATED WITH A SWITCH ATTACHED TO THE DOOR THAT TURNS ON THE LIGHT WHEN THE DOOR IS OPEN.

5. ALL DEVICES WITHIN THE PANEL SHALL BE UL LISTED AND/ OR RECOGNIZED WHERE APPLICABLE AND SHALL BE MOUNTED AND WIRED IN ACCORDANCE WITH THE MOST CURRENT EDITION OF UL508 AND NFPA.
6. THE CONTROL PANEL SHALL BE FULLY TESTED BY THE FACTORY PRIOR TO SHIPMENT. IT SHALL INCLUDE TESTING OF BOTH POWER AND CONTROL DEVICES AS WELL AS ALL CONTROL FUNCTIONS.
7. PANEL LAYOUT AND BILL OF MATERIAL (B.O.M.) ARE FOR ESTIMATION ONLY. IT IS THE PANEL BUILDER RESPONSIBILITY TO PROVIDE FINAL PANEL LAYOUT AND FINAL BILL OF MATERIAL, AND SUBMIT TO ARCADIS FOR REVIEW AND APPROVAL PRIOR TO CONSTRUCTION.
8. REFER TO CONTROL TRANSFORMER NAMEPLATE FOR CONNECTIONS OF PRIMARY AND SECONDARY LEADS.
9. FOR COMBINATION MOTOR CONTROLLER WITH MOTOR CIRCUIT PROTECTION, FOLLOW MANUFACTURER'S INSTRUCTION FOR SELECTING CURRENT ELEMENTS AND SETTING THE INSTANTANEOUS TRIP CIRCUIT BREAKER.
10. FIELD WIRING CONNECTIONS SHALL BE ONLY TO TERMINALS PROVIDED.
11. SIGNAL WIRES SHALL NOT BE PLACED WITH NON-SIGNAL WIRES AFTER ENTRY INTO THE CABINET.
12. INCOMING WIRES SHALL STAY OUTSIDE AREAS OF POWER AND WHERE CONTROL COMPONENTS ARE PLACED, AND SHALL NOT BE ROUTED IN WIRE CHANNELS.
13. GROUNDING SHALL COMPLY WITH LOCAL REQUIREMENT AND NEC ARTICLE 250, GROUNDING AND BONDING.
14. OPERATOR CONTROL DEVICES SHALL BE 22MM, NEMA AND UL LISTED FOR TYPES 1, 12, 3R, 4 AND 4X. CONTACT BLOCKS SHALL BE COLOR CODED RATED AT 10AMP. CONNECTION SHALL BE SUITABLE FOR TWO 14AWG CONTROL WIRES.
15. CONTROL RELAYS AND TIME DELAY RELAYS SHALL BE DPDT RATED 10A@120VAC SOCKET MOUNT TYPE.
16. ALL COMPONENTS MOUNTED ON THE DOOR SHALL HAVE FINGER PROOF TERMINALS, OTHERWISE, THEY SHALL BE WIRED WITH INSULATED CONNECTORS TO PREVENT ACCIDENTAL SHOCK HAZARDS.
17. SELF ADHESIVE VINYL CLOTH PRINTED WIRE MARKERS SHALL BE PLACED AT BOTH ENDS OF EVERY WIRE. ALL COMPONENTS ON THE BACKPANEL SHALL BE IDENTIFIED INCLUDING RATING AND SIZE.
18. COMPONENTS ON THE DOOR OF THE ENCLOSURE SHALL BE IDENTIFIED WITH CUSTOM ENGRAVED PLASTIC LEGEND PLATES.
19. VOLTAGE IDENTIFICATION AND WARNING LABELS SHALL BE INSTALLED ON THE CABINET DOOR.

No.	Date	Revisions	By	Ckd
2	01-17-18	*INTERNAL REVIEW*	MS	WH
1	01-08-18	*DRAFT (NOT FOR CONSTRUCTION)*	MS	

THIS BAR REPRESENTS ONE INCH ON THE ORIGINAL DRAWING: USE TO VERIFY FIGURE REPRODUCTION SCALE

Professional Engineer's Name: **KEFF S. KURELLA, PE**
Professional Engineer's No.: 32324-E
State: AL | Date Signed: | Project Mgr.: JH
Designed by: ZV | Drawn by: BO | Checked by: KK

ARCADIS U.S., INC.
ALABAMA CERTIFICATE OF AUTHORIZATION NUMBER 1822

RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC - 10565 HIGHWAY 43 NORTH, CREOLA, MOBILE COUNTY, ALABAMA
AIR SPARGE / SOIL VAPOR EXTRACTION REMEDIATION SYSTEM

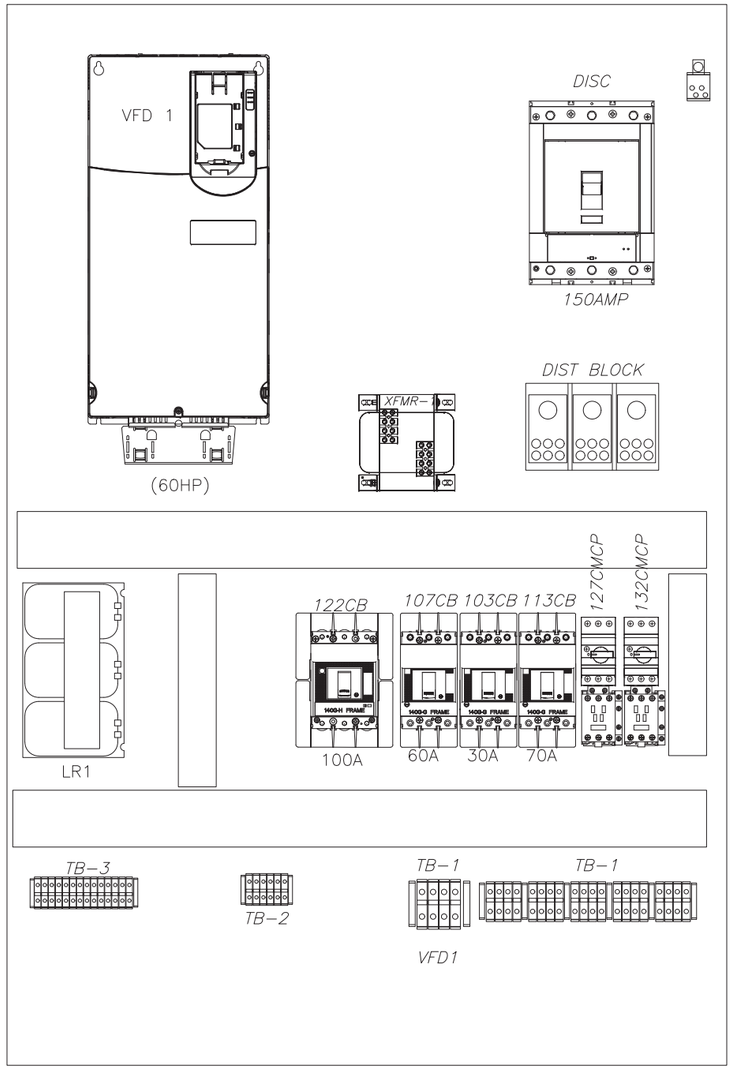
CONTROL PANEL (MCP, MCE) LEGEND, AND NOTES

CONSTRUCTION DRAWINGS

ARCADIS Project No. 03648010.0001.00500
Date JANUARY 2018

ARCADIS
3109 W. MARTIN L. KING JR. DR.
SUITE 350
TAMPA, FL 33607
TEL. 813.903.3100

I-6



PANEL LAYOUT

0 6 12 18 24

BILL OF MATERIAL (B.O.M.)

MCE B.O.M.				
QTY	DWG ID REF	MANUFACTURER	PART NUMBER	DESCRIPTION
1	MCE CABINET	SAGINAW OR EQUAL	CUSTON	FREE STANDING, SINGLE SOOR, NEMA3R, FLANGE DISCONNECT, 3 POINT LATCHES WITH FLOOR STAND ENCLOSURE (62"HX42"WX18"D). CARBON STEEL NEMA 3R.
1	MCE CABINET	SAGINAW OR EQUAL		BACK PLATE FOR ABOVE
1	FAN1, FAN2	SAGINAW OR EQUAL		(TWO) 120VAC, 6"X6", 30CFM FILTERED FAN KITS
1	FAN1, FAN2	SAGINAW OR EQUAL		(TWO) 6"X6" LOUVER
1	DISC-1	ALLEN BRADLEY	140G-J3F3-D15	140G - Molded Case Circuit Breaker, J frame, 35 kA, T/M - Thermal Magnetic, Rated Current 150 A
1	DISC-1	ALLEN BRADLEY	140G-K-FMX04	140G/1494V Product Handle Accessories/Operating Mechanisms, 140G Flex-Cable , Painted Metal Flange Handle , 4 ft ,
1	122CB	ALLEN BRADLEY	140G-G3C3-D10	140G - Molded Case Circuit Breaker, G frame, 35 kA, T/M - Thermal Magnetic, Rated Current 100 A
1	113CB	ALLEN BRADLEY	140G-G2C3-C70	140G - Molded Case Circuit Breaker, G frame, 25 kA, T/M - Thermal Magnetic, Rated Current 70 A
1	103CB	ALLEN BRADLEY	140G-G2C3-C30	140G - Molded Case Circuit Breaker, G frame, 25 kA, T/M - Thermal Magnetic, Rated Current 30 A
1	DIST BLOCK	ALLEN BRADLEY	1492-PD32127	1492 Power Block, Power Distribution Block, 3-Pole, Aluminum, 2 Openings Line Side, 12 Openings Load Side, 760 Amps
1	DIST BLOCK	ALLEN BRADLEY	1492-PBC3	1492 Power Block Cover 1492-PBC3: Power Block Cover
1	107CB	ALLEN BRADLEY	140G-G3C3-C60	140G - Molded Case Circuit Breaker, G frame, 35 kA, T/M - Thermal Magnetic, Rated Current 60 A
2	127CMCP, 132CMCP	ALLEN BRADLEY	103S-ATD3-CB25CC-V	IEC Combination Starter, 100-C09 , 120V 60Hz , 1 N.O. 1 N.C. , 140M-C2E (C-Frame), High Break , , Surge Suppressor Varistor
1	VF1	ALLEN BRADLEY	20G11ND077AA0NNNN	60HP, PowerFlex 755 AC Drive, with Embedded Ethernet/IP, Air Cooled, AC Input with DC Terminals, Open Type, 77 Amps, 60HP ND, 50HP HD, 480 VAC, 3 PH, Frame 5, Filtered, CM Jumper Removed, DB Transistor, Blank (No HIM)
1	LR-1	ALLEN BRADLEY	1321-3R80-B	Three-Phase Line Reactor, Open Style (AC Drive Reactors), 80 Amps, 0.4 mh
1	HIMs TO BE MOUNTED ON	ALLEN BRADLEY	20-HIM-C3S	IP66 (Nema 4x/12) Remote DPI Full Numeric LCD HIM. Includes 1202-C30 cable
1	MCP1	ALLEN BRADLEY	22-HIM-B1	PowerFlex Architecture Class HIM,Nema 1 Bezel Kit for DPI LCD HIMS
AS RQRD	TB-1	ALLEN BRADLEY	1492-J35	1492-J IEC Terminal Block, One-Circuit Feed-Through Block, 35 mm (# 14 - # 1/0 AWG), Standard Feedthrough, Gray (Standard)
AS RQRD	TB-1	ALLEN BRADLEY	1492-JG50	1492-J IEC Terminal Block, One-Circuit Feed-Through Ground Block, 50 mm, Standard Feedthrough, Green / Yellow Stripe (Standard)
AS RQRD	TB-2, 3	ALLEN BRADLEY	1492-J3	1492-J IEC Terminal Block, One-Circuit Feed-Through Block, 2.5 mm (# 24 AWG - # 12 AWG), Standard Feedthrough, Gray (Standard)
1	SPD	EATON	160M-480D, 3w	Surge Protection
1	XFMR-1	ALLEN BRADLEY	1497A-A6-M6-3-N	1497A - CCT, 250VA, 220x440V, 230x460V, 240x480V (50/60Hz) Primary, 2 Primary - 1 Secondary Fuse Blocks

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No.	Date	Revisions	By	Ckd
2	01-17-18	INTERNAL REVIEW	MS	WH
1	01-08-18	DRAFT (NOT FOR CONSTRUCTION)	MS	

Professional Engineer's Name: **KEFF S. KURELLA, PE**
Professional Engineer's No.: 32324-E

State	Date Signed	Project Mgr.
AL		JH
Designed by	Drawn by	Checked by
ZV	BO	KK

ARCADIS U.S., INC.
ALABAMA CERTIFICATE OF AUTHORIZATION NUMBER 1822

RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC - 10565 HIGHWAY 43 NORTH, CREOLA, MOBILE COUNTY, ALABAMA
AIR SPARGE / SOIL VAPOR EXTRACTION REMEDIATION SYSTEM

MOTOR CONTROL ENCLOSURE (MCE) LAYOUT AND B.O.M.

CONSTRUCTION DRAWINGS

ARCADIS Project No.
03648010.0001.00500

Date
JANUARY 2018

ARCADIS
3109 W. MARTIN L. KING JR. DR.
SUITE 350
TAMPA, FL 33607
TEL: 813.903.3100

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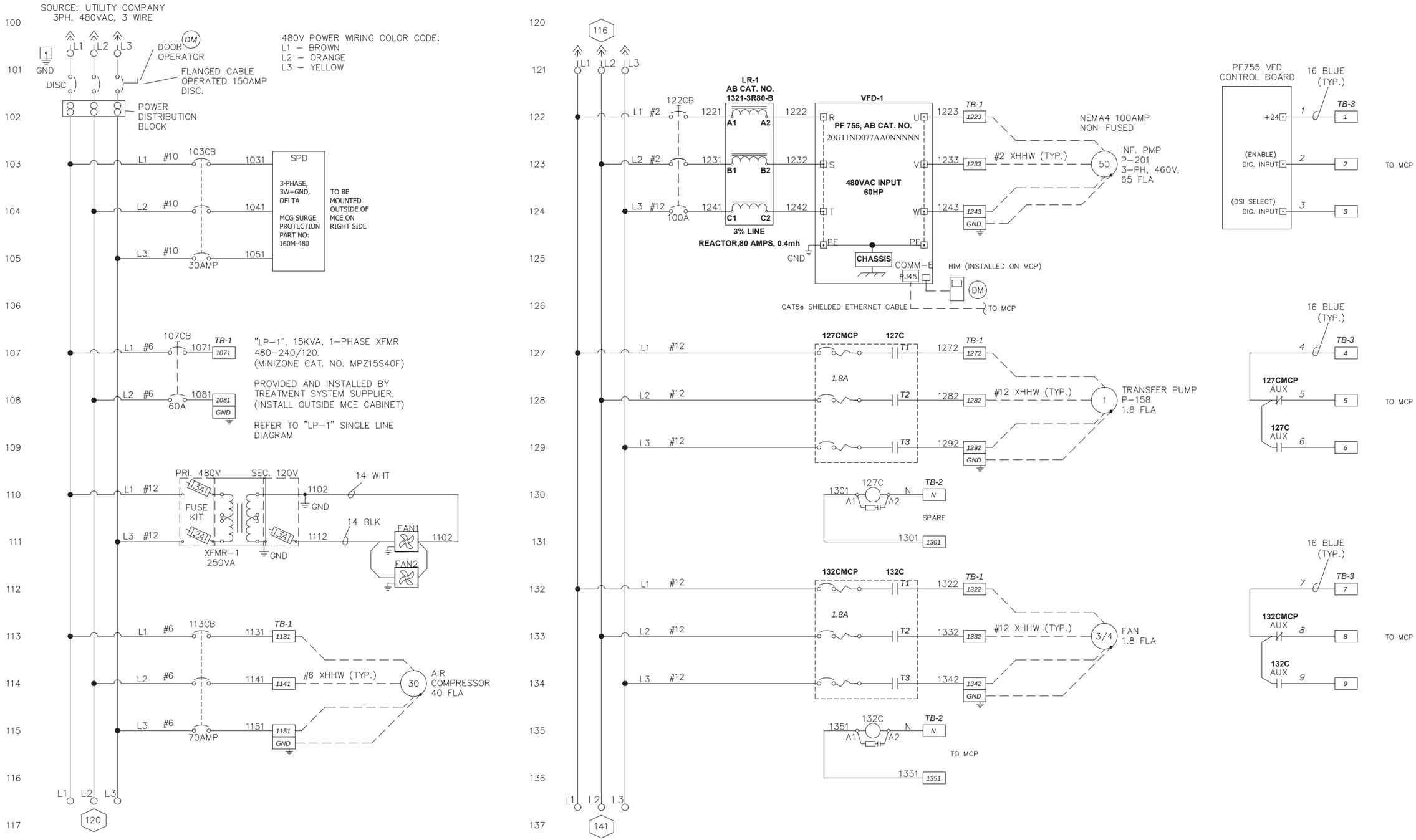

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AL		JH
Designed by	**Drawn by**	**Checked by**
ZV	BO	KK

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AIR SPARGE / SOIL VAPOR EXTRACTION REMEDIATION SYSTEM

MOTOR CONTROL ENCLOSURE (MCE) WIRING SCHEMATIC

CONSTRUCTION DRAWINGS

ARCADIS Project No.
03648010.0001.00500

Date
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3109 W. MARTIN L. KING JR. DR.
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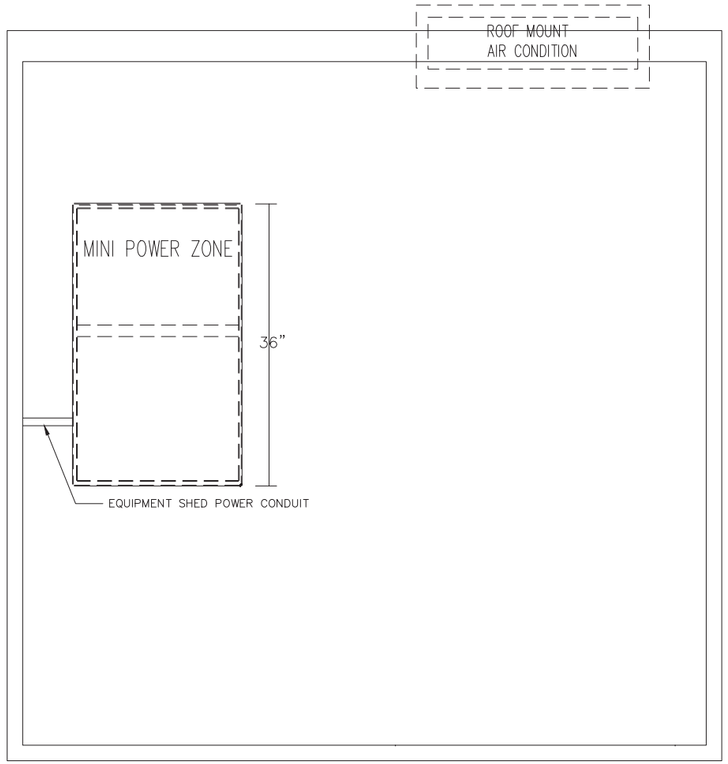
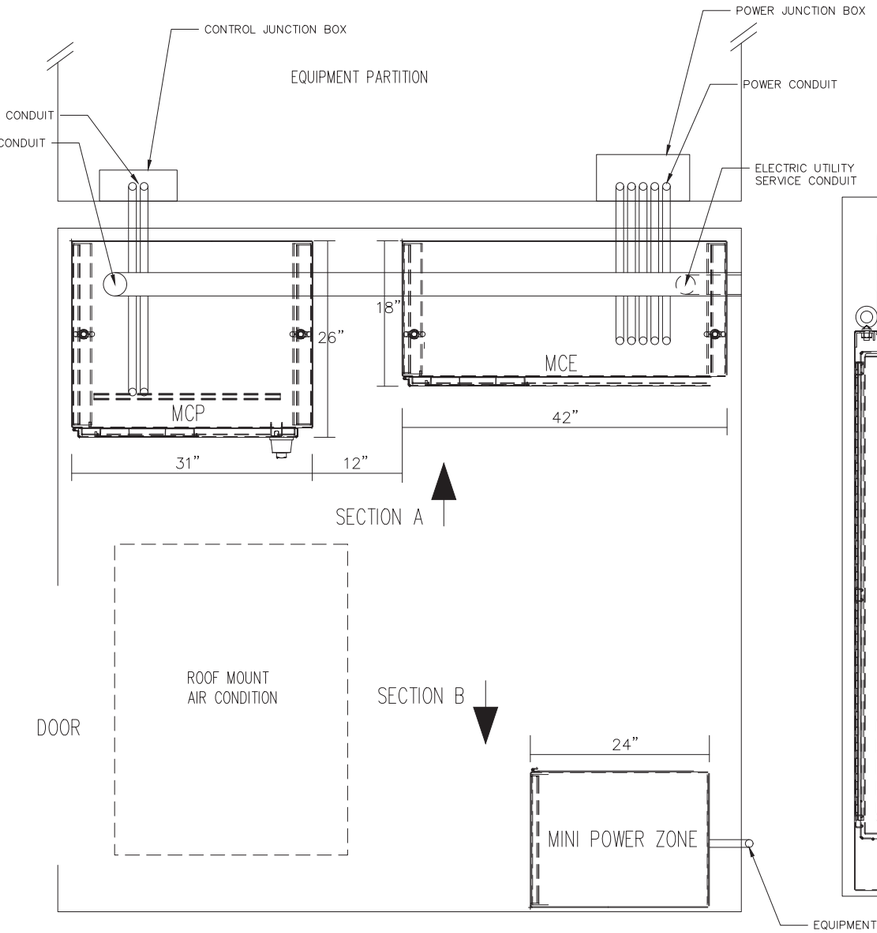
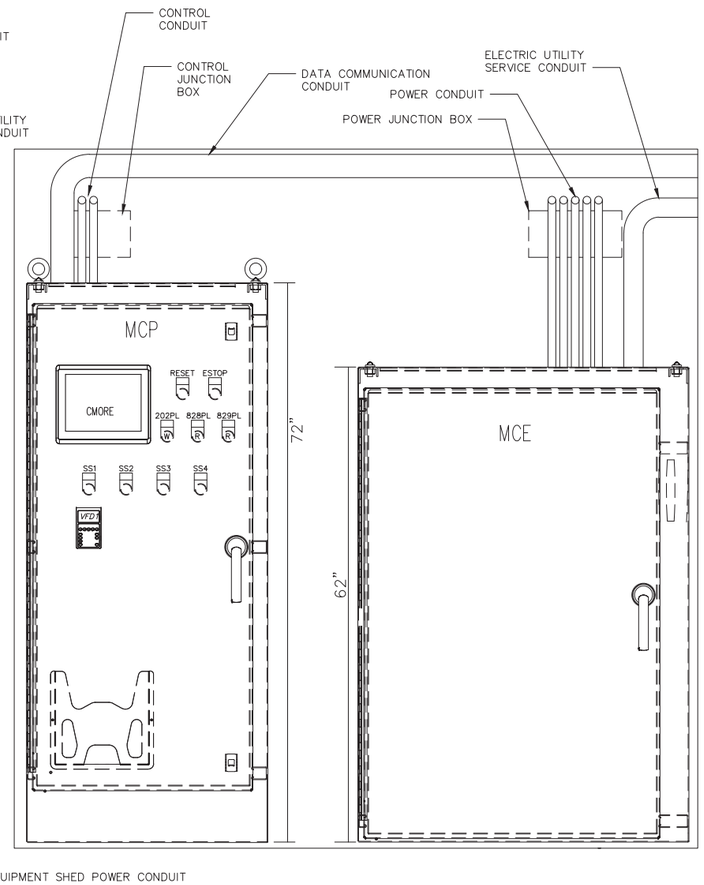


SECTION B



ELECTRICAL ROOM LAYOUT



SECTION A

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2	01-17-18	INTERNAL REVIEW	MS	WH
1	01-08-18	DRAFT (NOT FOR CONSTRUCTION)	MS	

Professional Engineer's Name: **KEFF S. KURELLA, PE**
Professional Engineer's No.: 32324-E

State	Date Signed	Project Mgr.
AL		JH
Designed by	Drawn by	Checked by
ZV	BO	KK

ARCADIS
ARCADIS U.S., INC.
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RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC - 10565 HIGHWAY 43 NORTH, CREOLA, MOBILE COUNTY, ALABAMA
AIR SPARGE / SOIL VAPOR EXTRACTION REMEDIATION SYSTEM

ELECTRICAL ROOM LAYOUT AND SECTIONS

CONSTRUCTION DRAWINGS

ARCADIS Project No.
03648010.0001.00500

Date
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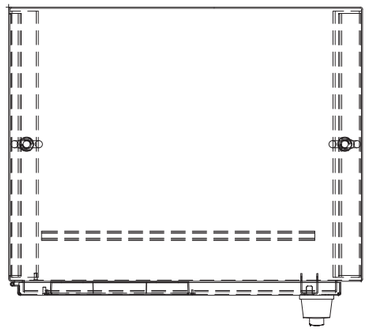
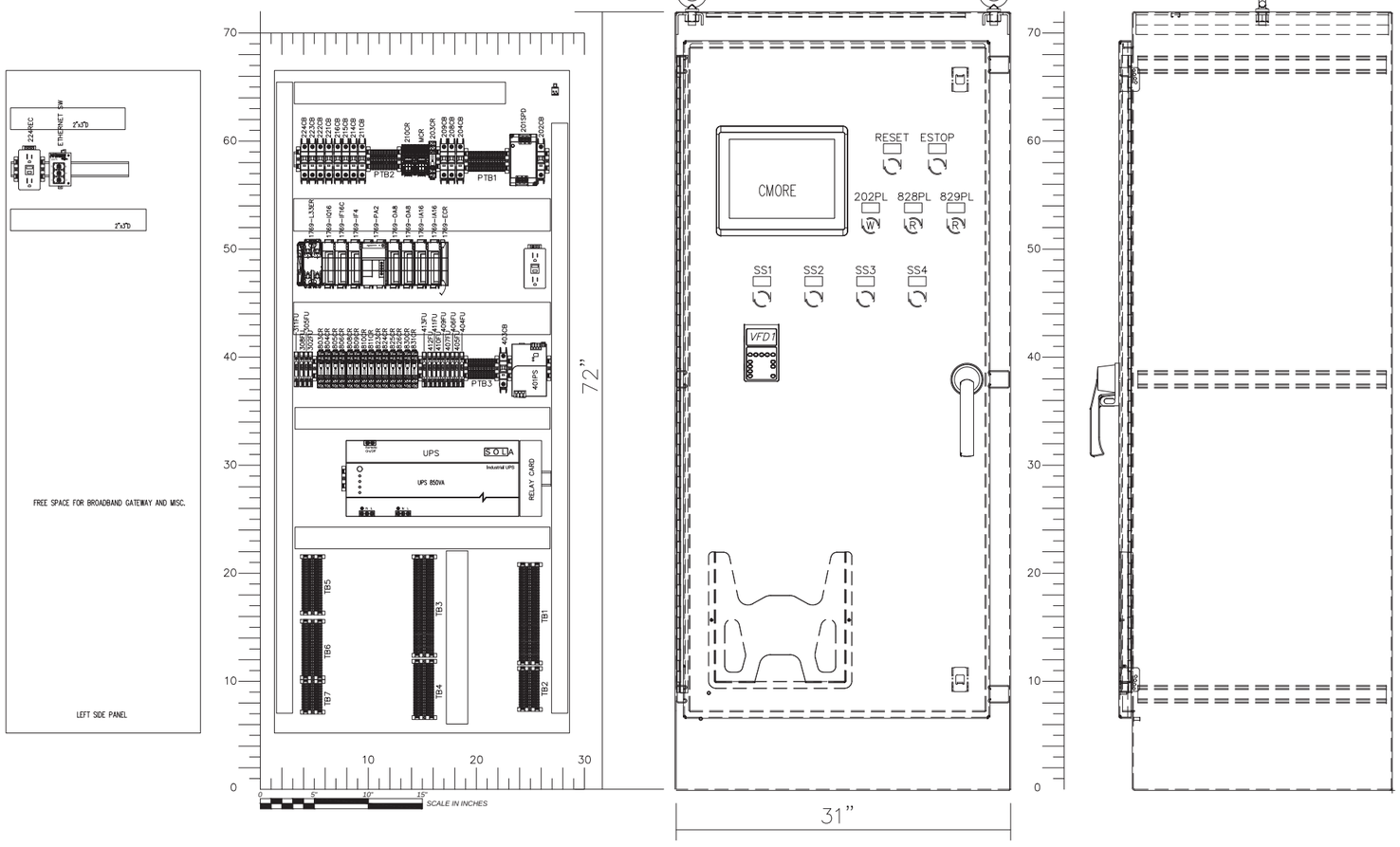


NOTE:

OTHER MISCELLANEOUS PARTS AND COMPONENTS MAY NOT BE SHOWN OR NOT INCLUDED IN THE BILL OF MATERIAL. IT IS THE PANEL BUILDER RESPONSIBILITY TO VERIFY PANEL LAYOUT, BILL OF MATERIAL, AND SUBMIT TO ARCADIS ANY CHANGES FOR REVIEW AND APPROVAL PRIOR TO CONSTRUCTION.

FREE STANDING, SINGLE DOOR TYPE NEMA12: 72"x31"x24"
HOFFMAN OR EQUAL



MCP PANEL B.O.M.

ID REF	QTY	MANUFACTURER	PART NUMBER	DESCRIPTION
	1	HOFFMAN		72" X 31" X 24" ENCLOSURE (NEMA 4)
	1	HOFFMAN		BACK PLATE FOR ENCLOSURE
	1	HOFFMAN		LEFT SIDE PANEL FOR ENCLOSURE
	1	HOFFMAN	LEDD1535	LED LIGHT KIT, 24VDC
	1	HOFFMAN	ALFSWD	DOOR SWITCH
201SPD	1	EATON	AG-PH-120-15-DIN	SURGE PROTECTIVE DEVICE, 120V
202CB	1	ALLEN BRADLEY	1489-M1C150	Minature Circuit Breaker, 1 Pole, 15 A
211, 214, 215, 216 CB	4	ALLEN BRADLEY	1489-M1C020	Minature Circuit Breaker, 1 Pole, 2 A
221, 222, 223, 224 CB	4	ALLEN BRADLEY	1489-M1C030	Minature Circuit Breaker, 1 Pole, 3 A
403CB	1	ALLEN BRADLEY	1489-M1C060	Minature Circuit Breaker, 1 Pole, 6 A
208CB, 209CB	2	ALLEN BRADLEY	1489-M1C080	Minature Circuit Breaker, 1 Pole, 8 A
204CB	1	ALLEN BRADLEY	1489-M1C100	Minature Circuit Breaker, 1 Pole, 10 A
202PL	1	ALLEN BRADLEY	800FM-P3MN3W	800F Pilot Light - Rd. Metal (IP66, 4/13, IP66), White
828PL	1	ALLEN BRADLEY	800FM-P4MN3R	800F Pilot Light - Rd. Metal (IP66, 4/13, IP66), Red
829PL	1	ALLEN BRADLEY	800FM-P4MN3A	800F Pilot Light - Rd. Metal (IP66, 4/13, IP66), Amber
PB1	1	ALLEN BRADLEY	800FM-FA2MX11E	800F Push Button - Metal, Flush, Black, Metal Latch Mount, 1 N.O. Contact(s), 1 N.C. Contact(s)
PB1	1	ALLEN BRADLEY	800FM-F2PX10	RESET PB WITH (2) N.O. CONTACT
224REC	1	TBD	----	15A GFCI RECEPT. WITH OUTDOOR COVER
410PS	1	ALLEN BRADLEY	1606-XLS120EA	1606-XLS120EA: Power Supply, 24-48V DC, 120 W, 120/240V AC / 110-300V DC Input Voltage
203CR, 803, 805, 807, 809, 810, 811, 823, 824, 825, 826, 830, 831	14	ALLEN BRADLEY	700-HK36A1	120VAC, SPDT, 16A RELAY
203CR, 803, 805, 807, 809, 810, 811, 823, 824, 825, 826, 830, 831	14	ALLEN BRADLEY	700-HN221	MINI 5-BLADE SOCKET, SCREW TERMINALS
203CR, 803, 805, 807, 809, 810, 811, 823, 824, 825, 826, 830, 831	14	ALLEN BRADLEY	700-AV3R	120VAC SURGE SUPRESSOR
UPS	1	SOLA	SDU-850	850 VA UPS
UPS	1	SOLA	RELAYCARD-SDU	SDU-850 Dry Contact Relay Kit, SDU Series
210CR	1	ALLEN BRADLEY	700-K22Z-D	00-K MCS Mini Contactors, Screw Type Terminals, System Control Voltage: 110V 50Hz/120V 60Hz , 2 N.O. / 2 N.C. Auxiliary Contacts
MCR	1	ALLEN BRADLEY	700-K40E-D	700-K MCS Mini Contactors, Screw Type Terminals, System Control Voltage: 110V 50Hz/120V 60Hz , 4 N.O. Auxiliary Contacts
210CR, MCR	2	ALLEN BRADLEY	100-KFSV136	100-K/104-K/700-K Suppressor Modules, Varistor Module, 56...136V AC / 78...178 DC, Front Mounted, Shipped In Package Quantities of 1
404, 405, 406, 407, 409, 410, 411, 412, 413 fu	9	ALLEN BRADLEY	1492-RAFB424	Spring Clamp Terminal Block,One-Circuit Fuse Block (1/4 x 1 1/4 Fuses),4 mm (# 22 AWG - # 10 AWG) or 2.5 mm (# 22 AWG - # 12 AWG),Red LED Indicator,Black (Standard),
302, 305, 308, 311 FU	4	ALLEN BRADLEY	1492-J6FB1120	1492-J IEC Terminal Block, One-Circuit Fuse Block (1/4 x 1 1/4" Fuses), 6 mm (# 22 AWG - # 10 AWG), With or Without Fuse Indication, Black with LED
---	AS REQ'D	ALLEN BRADLEY	1492-xxx	120VAC FUSED TERMINAL BLOCK, FUSE SIZES VARIED PER SCHEMATIC
---	AS REQ'D	ALLEN BRADLEY	1492-J6FB124	24 VDC FUSED TERMINAL BLOCK, FUSE SIZES VARIED PER SCHEMATIC
---	AS REQ'D	ALLEN BRADLEY	1492-J3	IEC TERMINAL BLOCK
---	AS REQ'D	ALLEN BRADLEY	1492-J3G	IEC GROUND TERMINAL BLOCK
---	AS REQ'D	ALLEN BRADLEY	1492-J3P	IEC PLUG IN DEVICE TERMINAL BLOCK
---	AS REQ'D	ALLEN BRADLEY	-	END ANCHOR
---	AS REQ'D	-	-	ALUMINUM DIN RAIL
---	AS REQ'D	-	-	WIRE DUCT (VARIES SIZES)
---	2	-	-	GROUND LUG
				PLC COMPONENTS
PS	1	ALLEN BRADLEY	1769-PA2	POWER SUPPLY
---	1	ALLEN BRADLEY	1769-L33ER	COMPACTLOGIX
---	1	ALLEN BRADLEY	1769-IQ16	16 DC INPUT MODULE
---	1	ALLEN BRADLEY	1769-IF16C	16 ANALOG INPUT
---	1	ALLEN BRADLEY	1769-IF4	4 CH. ANALOG INPUT MODULE
---	2	ALLEN BRADLEY	1769-OA8	8 CH. RELAY OUTPUT MODULE
---	2	ALLEN BRADLEY	1769-IA16	16 AC INPUT MODULE
---	1	ALLEN BRADLEY	1769-ECR	END CAP (RIGHT)
				OTHER MISC.
ETHERNET SW	1	N-TRON	306TX	UNMANAGED INDUSTRIAL ETHERNET SWITCH
OIT-215	1	AUTOMATION DIRECT	EA9-T8CL	C-more EA9 series touch screen HMI, 8in color TFT LCD, 800 x 600, SVGA, supports (3) serial, (1) Ethernet and (2) USB ports, (1) memory card slots, (1) audio line out.
OIT-215	1	AUTOMATION DIRECT	EA-AC	AC/DC Adapter for C-more EA7 and EA9 series; powered from a 100-240 VAC, 50/60 Hertz power source. Provides 24VDC at 1.5A.
BROADBAND ROUTER	1	BY INTERNET PROVIDER		

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2	01-17-18	INTERNAL REVIEW	MS	WH
1	01-08-18	DRAFT (NOT FOR CONSTRUCTION)	MS	

Professional Engineer's Name: **KEFF S. KURELLA, PE**
Professional Engineer's No.: 32324-E

State	Date Signed	Project Mgr.
AL		JH
Designed by	Drawn by	Checked by
ZV	BO	KK

ARCADIS
ARCADIS U.S., INC.
ALABAMA CERTIFICATE OF AUTHORIZATION NUMBER 1822

RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC - 10565 HIGHWAY 43 NORTH, CREOLA, MOBILE COUNTY, ALABAMA
AIR SPARGE / SOIL VAPOR EXTRACTION REMEDIATION SYSTEM

MAIN CONTROL PANEL (MCP) LAYOUT AND B.O.M.

CONSTRUCTION DRAWINGS

ARCADIS Project No.
03648010.0001.00500

Date
JANUARY 2018

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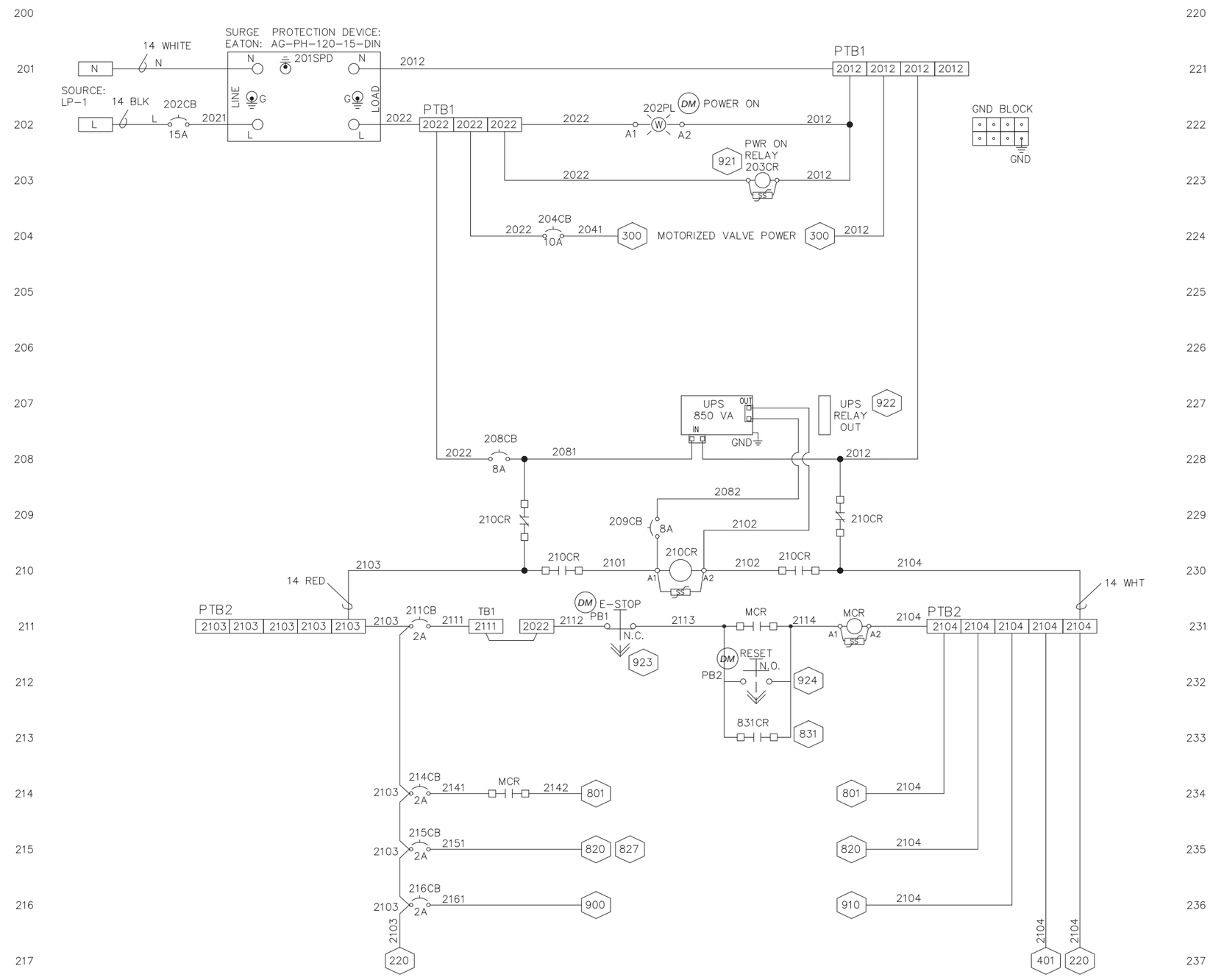
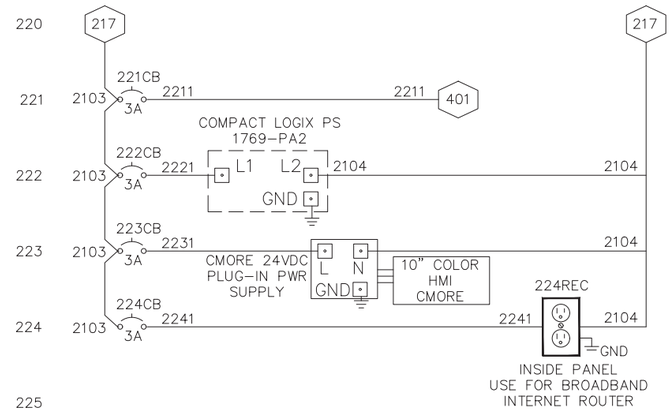
TEL. 813.903.3100

I-10





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1	01-08-18	DRAFT (NOT FOR CONSTRUCTION)	MS	
No.	Date	Revisions	By	Ckd

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Professional Engineer's No.: 32324-E
State: AL | Date Signed: | Project Mgr.: JH
Designed by: ZV | Drawn by: BO | Checked by: KK

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AIR SPARGE / SOIL VAPOR EXTRACTION REMEDIATION SYSTEM

MAIN CONTROL PANEL (MCP) WIRING SCHEMATIC

CONSTRUCTION DRAWINGS

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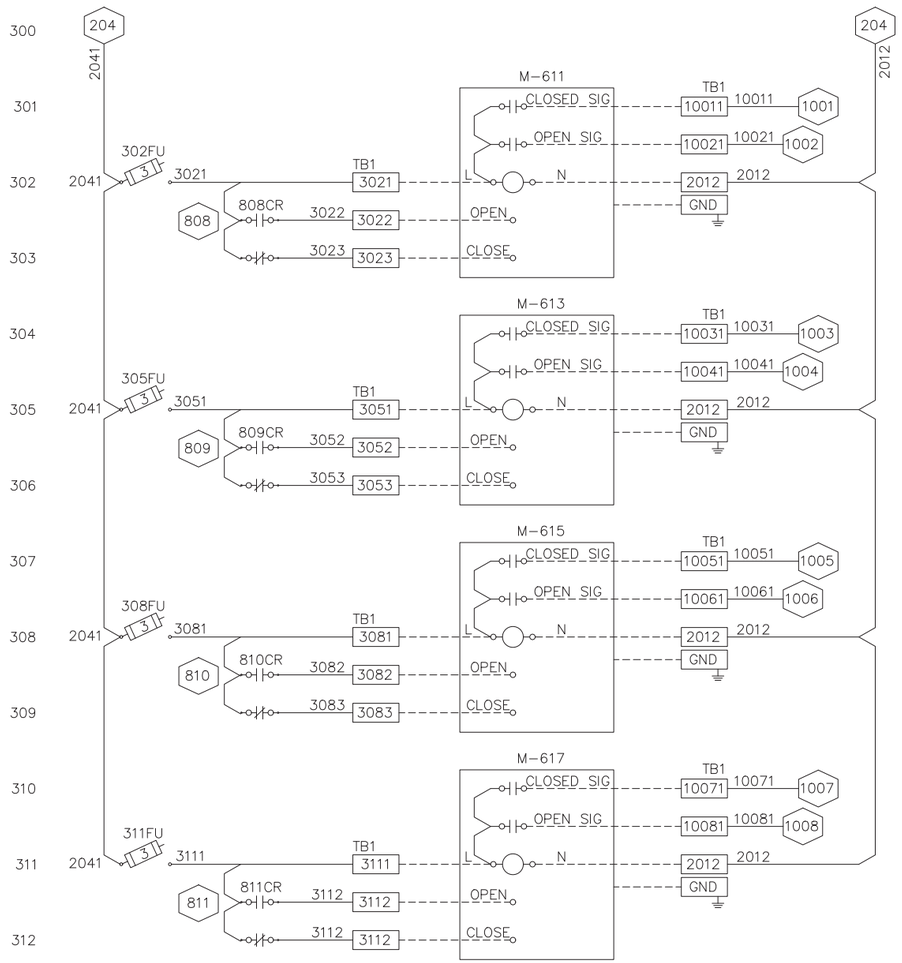

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Designed by: ZV | Drawn by: BO | Checked by: KK

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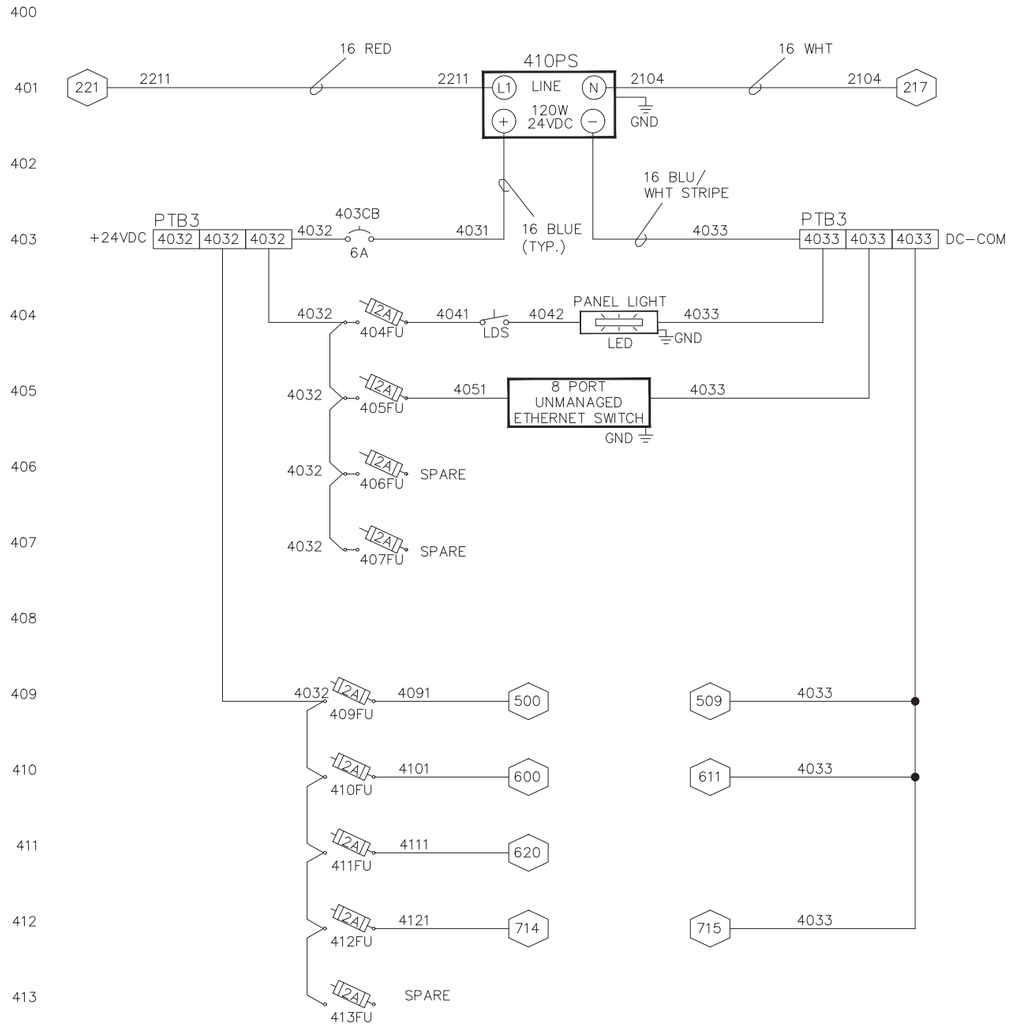

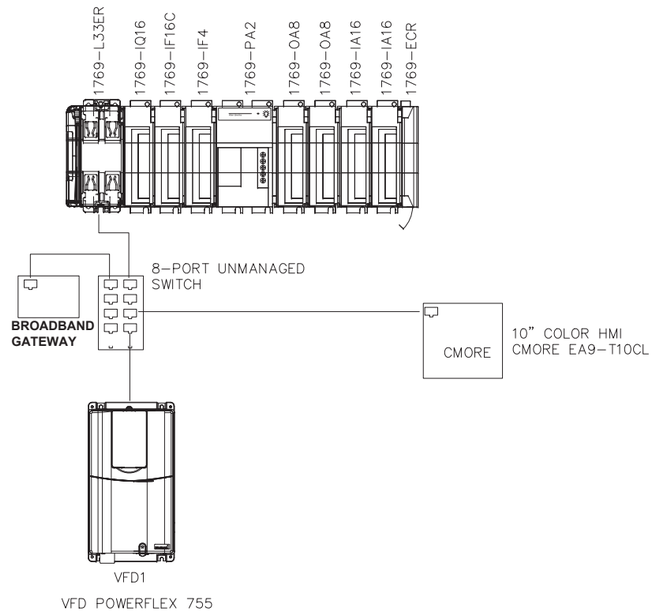

NETWORK DIAGRAM

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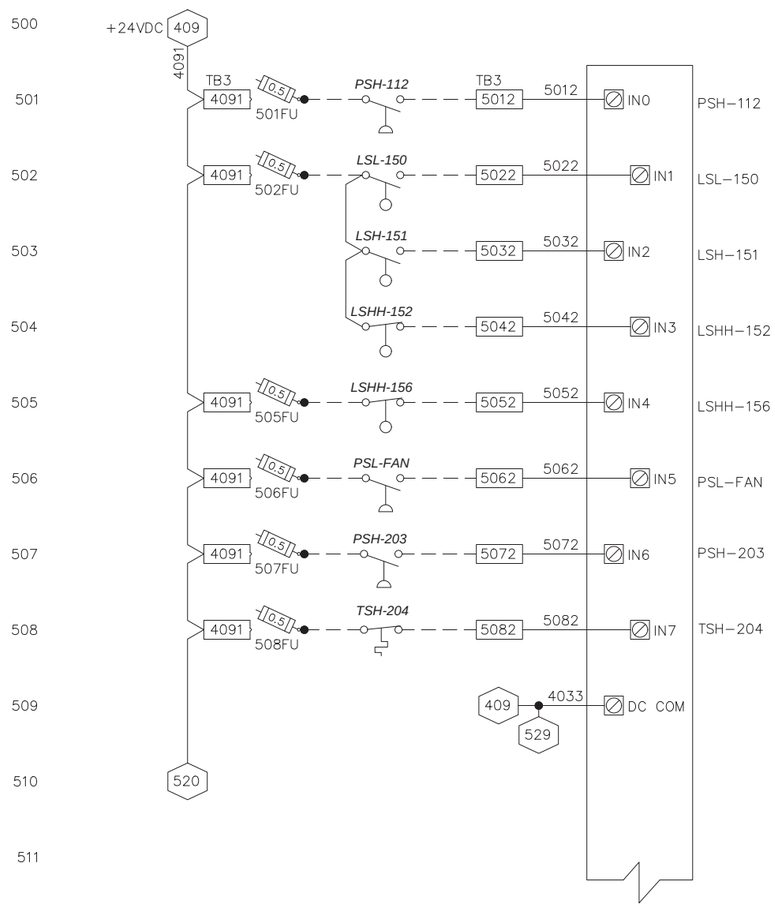

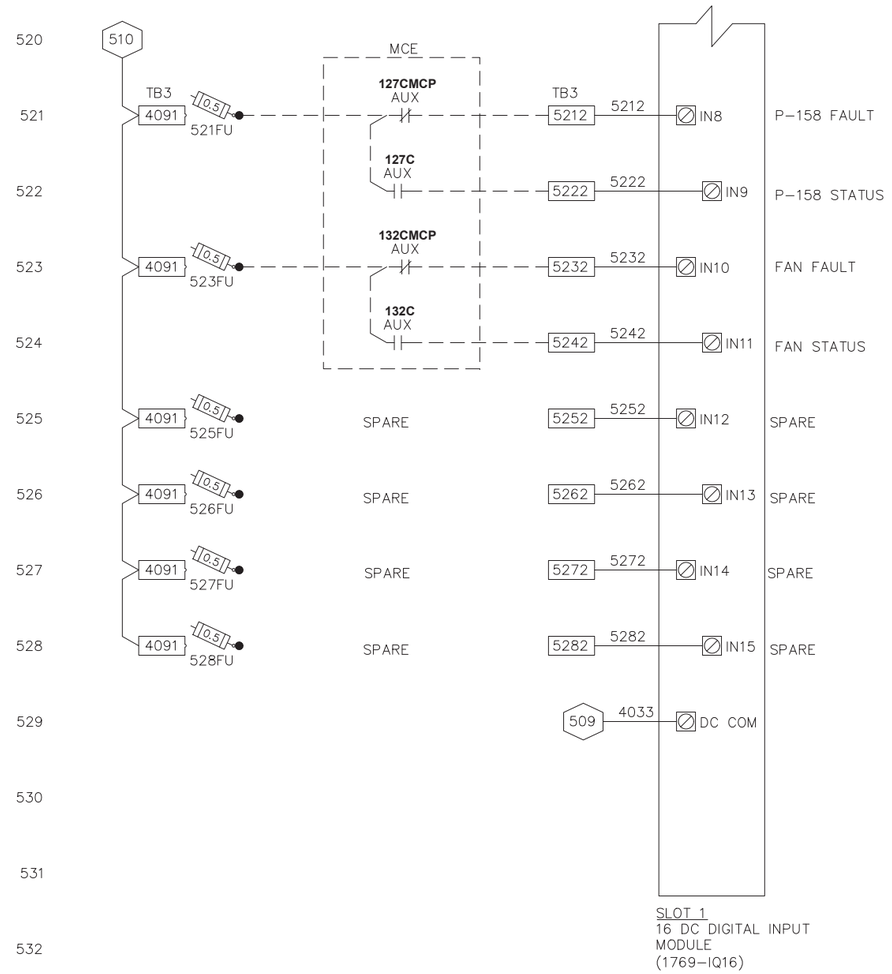

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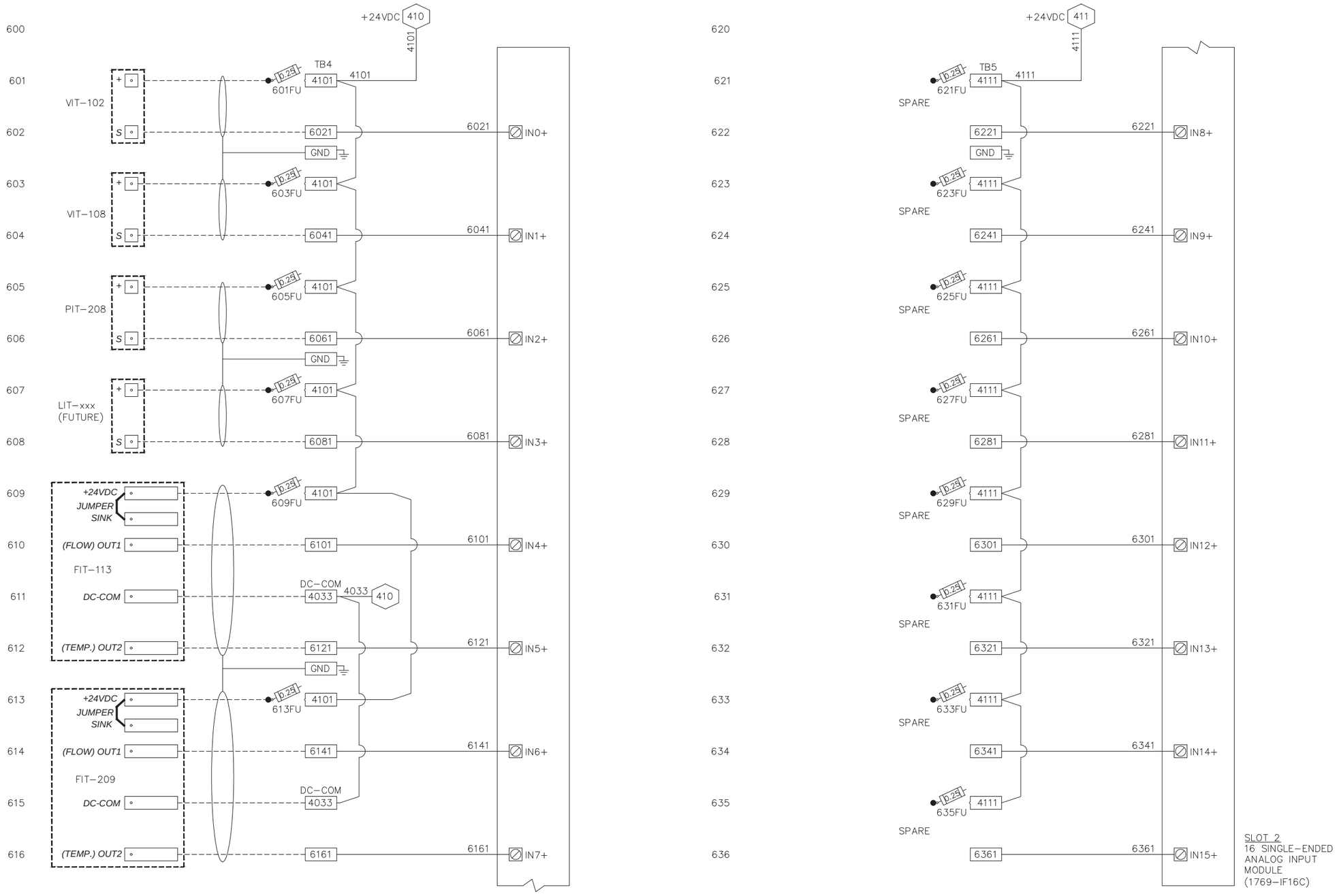

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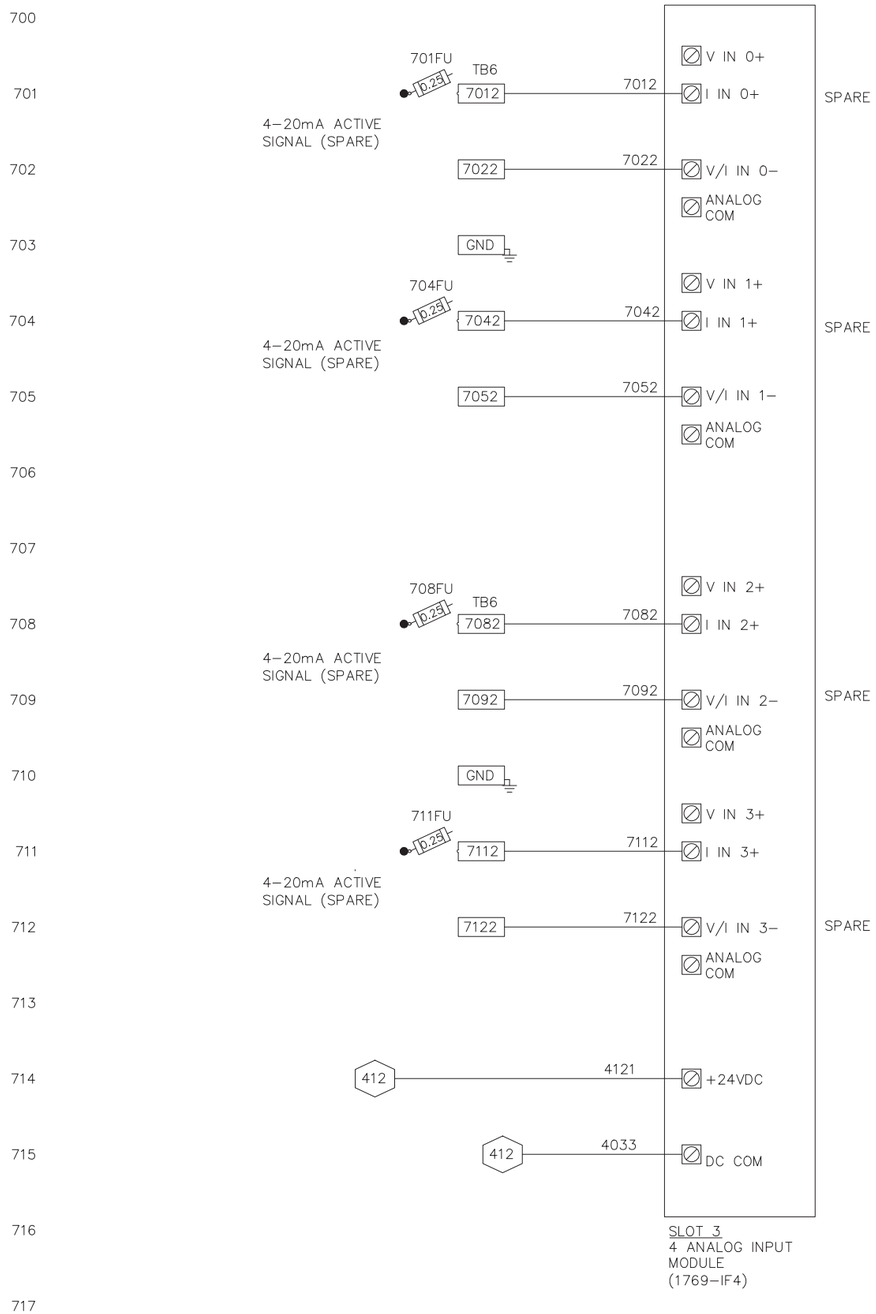

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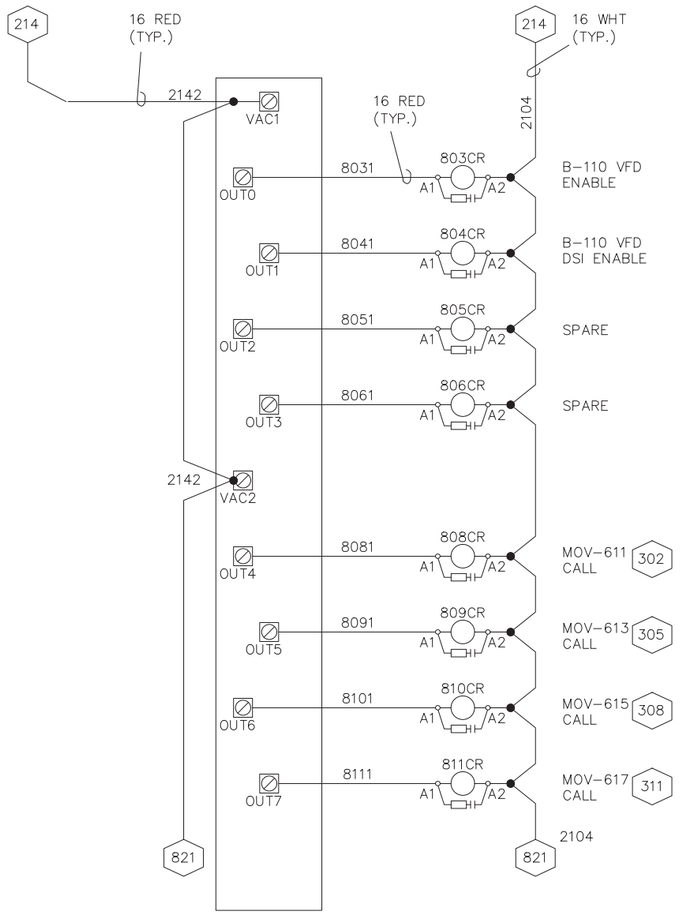
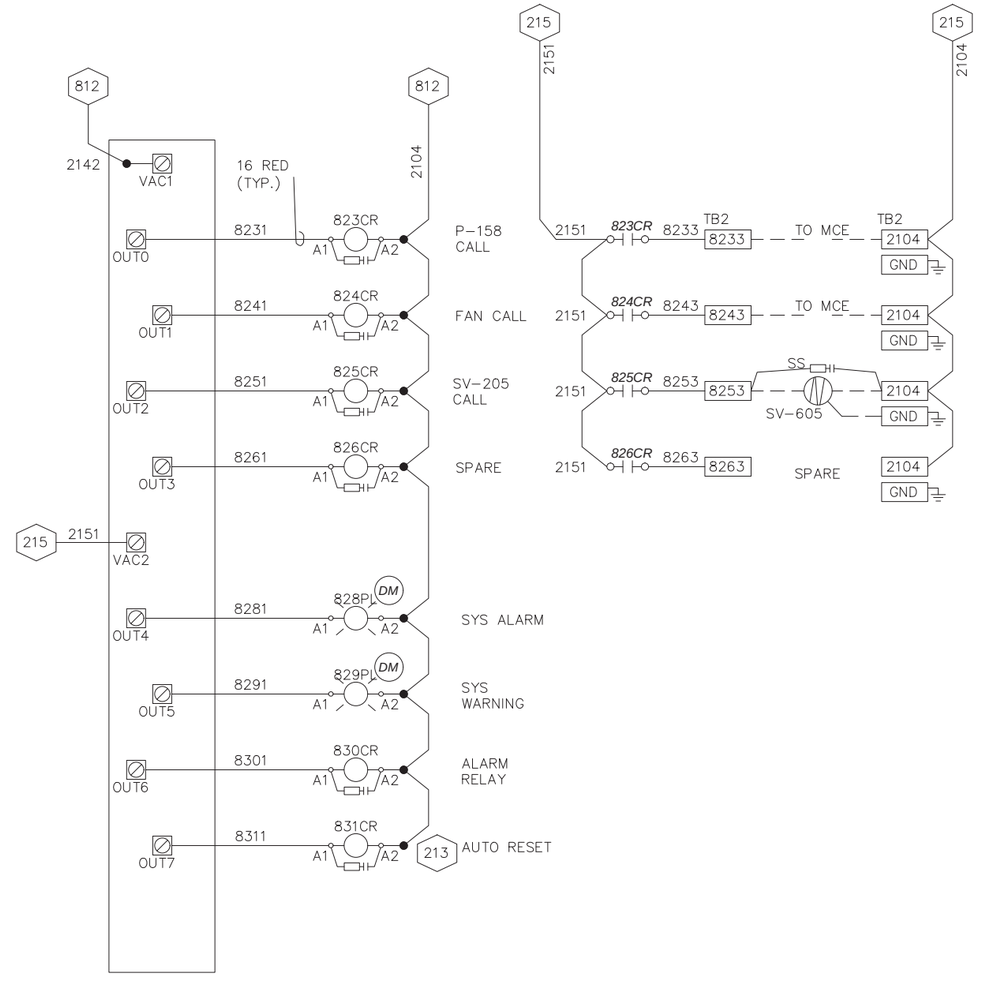


SLOT 4
8 AC DIGITAL OUTPUT
MODULE
(1769-OA8)



SLOT 5
8 AC DIGITAL OUTPUT
MODULE
(1769-OA8)

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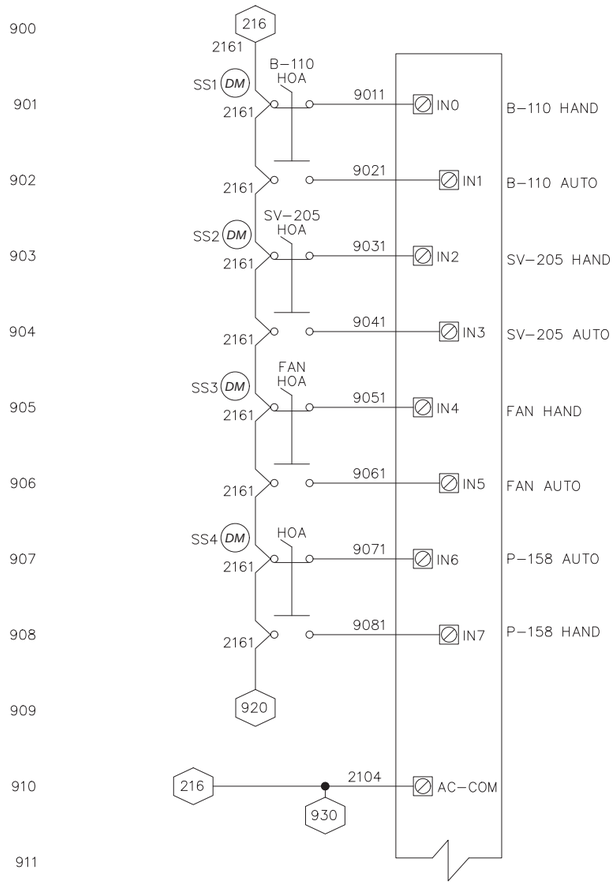

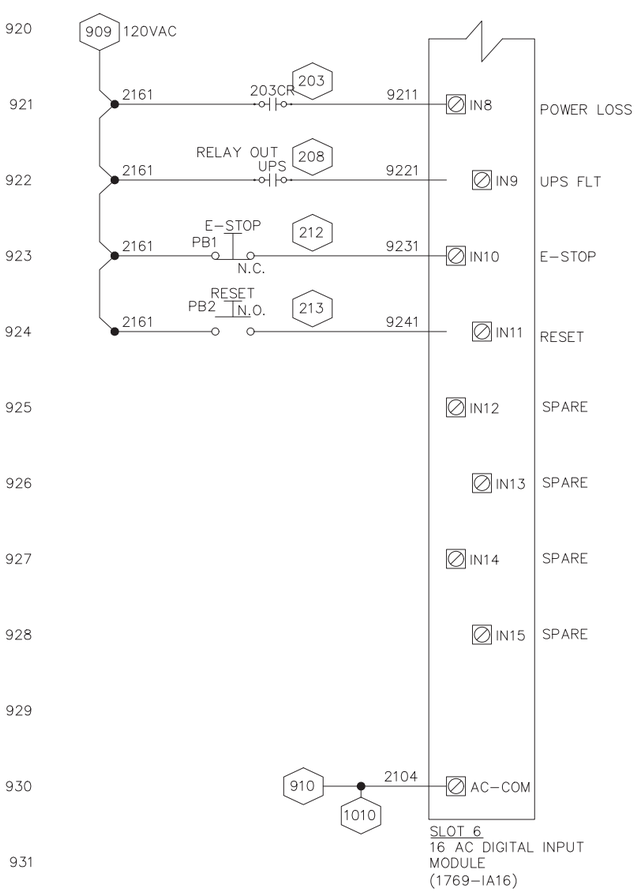

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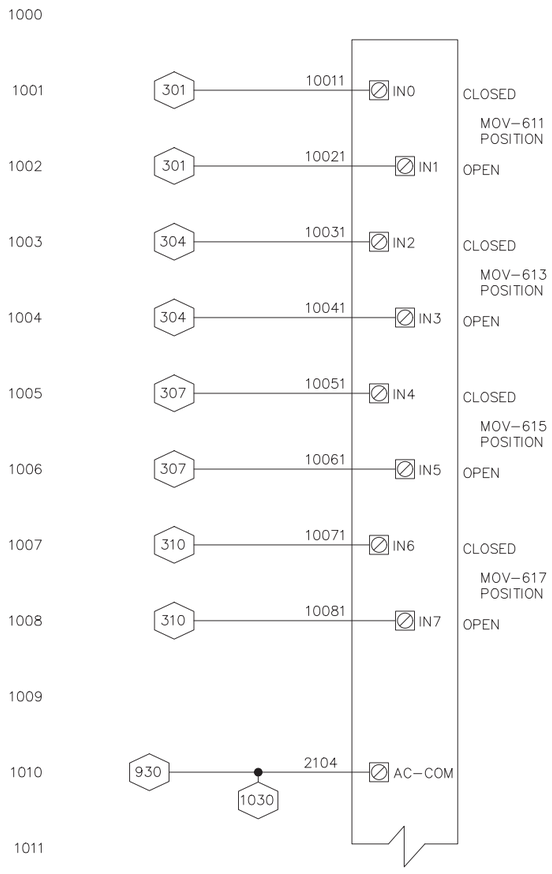

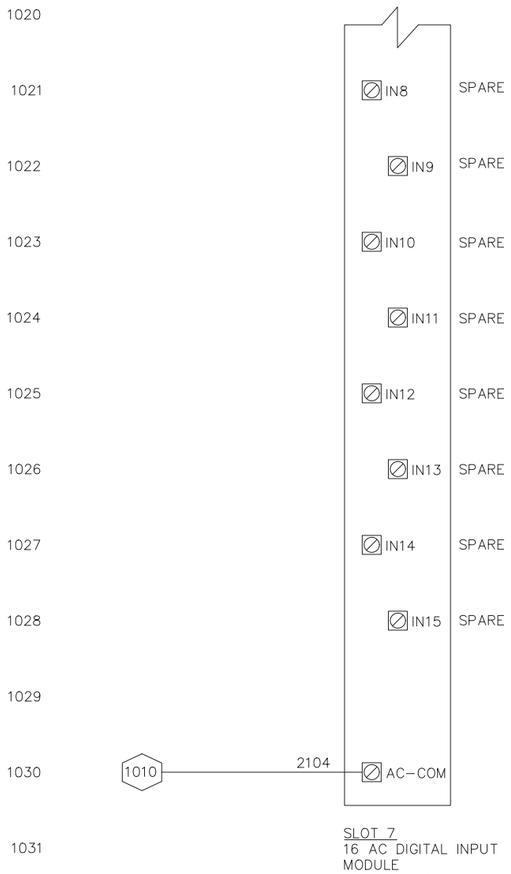

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I-19

APPENDIX D

Leachate Laboratory Analytical Results

LRS, Inc.

Laboratory Resources & Solutions, Inc.
163 5th Street
Ashville, AL 35953
(205) 683-6731
www.lab-resource.com

Analytical Data Report

Client: Greer Enterprises

Attention: Ms. Mary Barnhill

Project ID: Rentokil Leachate Tank
Creola, AL
Project # 80-150022

Laboratory Report Number: 15-317-0222

Date: 11/19/2015

Primary Data Review by:

Andy Parrish

Andy Parrish
Project Manager
Waypoint Analytical, Inc.
aparrish@waypointanalytical.com

Secondary Data Review by:

Wayne T. Gaston

Wayne Gaston
Project Manager
Laboratory Resources & Solutions, Inc.
wgaston@lab-resource.com

*Unless otherwise noted, all analysis on this report performed at Waypoint Analytical, Inc. 2790 Whitten Road Memphis, TN 38133. NELAC #460181

* Alabama #40750 Louisiana #04015 VA NELAP #460181 Texas #T104704180-11-6 Arkansas #88-0650 Mississippi California #09267CA NC #415 Oklahoma #9311 Virginia #00106 Kentucky #90047 Tennessee #TN02027 EPA #TN00012 Kentucky UST #41 Kansas #E-10396

* These results relate only to the items tested. This report may only be reproduced in full.

* Local support services for this project are provided by Laboratory Resources & Solutions, Inc. (LRS). All questions regarding this report should be directed to LRS, Inc. at (205) 683-6731.

2790 Whitten Road, Memphis, TN 38133
Main 901.213.2400 º Fax 901.213.2440
www.waypointanalytical.com

Sample Summary Table

Report Number: **15-317-0222**

Client Project Description: **Rentokil Leachate Tank**
Creola, AL
Project # 80-150022

Lab No	Client Sample ID	Matrix	Date Collected	Date Received	Method	Lab ID
98485	Leachate-001	Formulation	11/12/2015 10:40	11/13/2015	6010B	WTN
98485	Leachate-001	Formulation	11/12/2015 10:40	11/13/2015	7471A	WTN
98485	Leachate-001	Formulation	11/12/2015 10:40	11/13/2015	8082	WTN
98485	Leachate-001	Formulation	11/12/2015 10:40	11/13/2015	8260B	WTN
98485	Leachate-001	Formulation	11/12/2015 10:40	11/13/2015	8270C	WTN
98485	Leachate-001	Formulation	11/12/2015 10:40	11/13/2015	ASTM D-240-02	WTN
98485	Leachate-001	Formulation	11/12/2015 10:40	11/13/2015	ASTM E203-01	WLA

WLA: Waypoint Analytical - LA, Marrero, LA
WTN: Waypoint Analytical, Inc.

2790 Whitten Road, Memphis, TN 38133
Main 901.213.2400 ° Fax 901.213.2440
www.waypointanalytical.com

06532
Greer Enterprises
Ms. Mary Barnhill
PO Box 191466
Mobile , AL 36619

Project Information : Rentokil Leachate Tank
Creola, AL
Project # 80-150022

Report Date : 11/19/2015
Received : 11/13/2015

Andy Parrish
Project Manager

Report Number : **15-317-0222**

REPORT OF ANALYSIS

Lab No : **98485**
Sample ID : **Leachate-001**

Matrix: **Formulation**
Sampled: **11/12/2015 10:40**

Test	Results	Units	MQL	DF	Date / Time Analyzed	By	Analytical Method
BTU	<400	BTU/lb	400	1	11/14/15 14:41	KKM	ASTM D-240-02
Total Arsenic	<0.500	mg/Kg	0.500	1	11/16/15 13:59	BKN	6010B
Total Barium	<0.500	mg/Kg	0.500	1	11/16/15 13:59	BKN	6010B
Total Cadmium	<0.100	mg/Kg	0.100	1	11/16/15 13:59	BKN	6010B
Total Chromium	<0.250	mg/Kg	0.250	1	11/16/15 13:59	BKN	6010B
Total Lead	<0.300	mg/Kg	0.300	1	11/16/15 13:59	BKN	6010B
Mercury (Total)	<0.0133	mg/Kg	0.0133	1	11/14/15 14:57	KKM	7471A
Total Selenium	<0.500	mg/Kg	0.500	1	11/16/15 13:59	BKN	6010B
Total Silver	<0.250	mg/Kg	0.250	1	11/16/15 13:59	BKN	6010B

Qualifiers/ Definitions DF Dilution Factor MQL Method Quantitation Limit

Waypoint ANALYTICAL

2790 Whitten Road, Memphis, TN 38133
Main 901.213.2400 ° Fax 901.213.2440
www.waypointanalytical.com

06532
Greer Enterprises
Ms. Mary Barnhill
PO Box 191466
Mobile , AL 36619

Project Information : Rentokil Leachate Tank
Creola, AL
Project # 80-150022

Report Date : 11/19/2015
Received : 11/13/2015

Andy Parrish
Project Manager

Report Number : **15-317-0222**

REPORT OF ANALYSIS

Lab No : **98485**
Sample ID : **Leachate-001**

Matrix: **Formulation**
Sampled: **11/12/2015 10:40**

Analytical Method: 8082
Prep Method: 3580A **Prep Batch(es):** L264588 **Date/Time Prepped:** 11/17/2015 09:00:00

Test	Results	Units	MQL	DF	Date / Time Analyzed	By	Analytical Batch
Aroclor 1016	<1.00	mg/Kg	1.00	1	11/17/15 19:22	VIC	L264862
Aroclor 1221	<1.00	mg/Kg	1.00	1	11/17/15 19:22	VIC	L264862
Aroclor 1232	<1.00	mg/Kg	1.00	1	11/17/15 19:22	VIC	L264862
Aroclor 1242	<1.00	mg/Kg	1.00	1	11/17/15 19:22	VIC	L264862
Aroclor 1248	<1.00	mg/Kg	1.00	1	11/17/15 19:22	VIC	L264862
Aroclor 1254	<1.00	mg/Kg	1.00	1	11/17/15 19:22	VIC	L264862
Aroclor 1260	<1.00	mg/Kg	1.00	1	11/17/15 19:22	VIC	L264862
Surrogate: Decachlorobiphenyl	80.2		Limits: 17-141%	1	11/17/15 19:22	VIC	L264862
Surrogate: Tetrachloro-m-xylene	98.4		Limits: 20-122%	1	11/17/15 19:22	VIC	L264862

Analytical Method: 8260B
Prep Method: 5030A **Prep Batch(es):** L264824 **Date/Time Prepped:** 11/17/2015 09:31:00

Test	Results	Units	MQL	DF	Date / Time Analyzed	By	Analytical Batch
Acetone	<100	mg/Kg	100	100	11/17/15 16:58	HAL	L264853
Acetonitrile	<100	mg/Kg	100	100	11/17/15 16:58	HAL	L264853
Acrolein	<100	mg/Kg	100	100	11/17/15 16:58	HAL	L264853
Acrylonitrile	<100	mg/Kg	100	100	11/17/15 16:58	HAL	L264853
Benzene	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
Bromobenzene	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
Bromochloromethane	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
Bromodichloromethane	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
Bromoform	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853

Qualifiers/ Definitions DF Dilution Factor MQL Method Quantitation Limit

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Andy Parrish
Project Manager

Report Number : **15-317-0222**

REPORT OF ANALYSIS

Lab No : **98485**
Sample ID : **Leachate-001**

Matrix: **Formulation**
Sampled: **11/12/2015 10:40**

Analytical Method: 8260B
Prep Method: 5030A
Prep Batch(es): L264824
Date/Time Prepped: 11/17/2015 09:31:00

Test	Results	Units	MQL	DF	Date / Time Analyzed	By	Analytical Batch
Bromomethane	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
Methyl Ethyl Ketone (MEK)	<100	mg/Kg	100	100	11/17/15 16:58	HAL	L264853
n-Butylbenzene	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
sec-Butyl benzene	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
tert-Butyl benzene	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
Carbon Disulfide	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
Carbon Tetrachloride	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
Chlorobenzene	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
Chlorodibromomethane	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
Chloroethane	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
2-Chloroethylvinyl Ether	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
Chloroform	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
Chloromethane	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
2-Chlorotoluene	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
4-Chlorotoluene	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
1,2-Dibromo-3-Chloropropane	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
1,2-Dibromoethane	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
Dibromomethane	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
1,2-Dichlorobenzene	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
1,3-Dichlorobenzene	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
1,4-Dichlorobenzene	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
Dichlorodifluoromethane	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853

Qualifiers/ Definitions DF Dilution Factor MQL Method Quantitation Limit

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Sampled: **11/12/2015 10:40**

Analytical Method: 8260B
Prep Method: 5030A
Prep Batch(es): L264824
Date/Time Prepped: 11/17/2015 09:31:00

Test	Results	Units	MQL	DF	Date / Time Analyzed	By	Analytical Batch
1,1-Dichloroethane	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
1,2-Dichloroethane	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
1,1-Dichloroethene	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
cis-1,2-Dichloroethene	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
trans-1,2-Dichloroethene	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
1,2-Dichloroethene (Total)	<5.00	mg/Kg	5.00	100	11/17/15 16:58		L264853
1,2-Dichloropropane	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
1,3-Dichloropropane	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
2,2-Dichloropropane	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
1,1-Dichloropropene	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
cis-1,3-Dichloropropene	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
trans-1,3-Dichloropropene	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
Ethyl Acetate	<50.0	mg/Kg	50.0	100	11/17/15 16:58	HAL	L264853
Ethylbenzene	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
Hexachlorobutadiene	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
2-Hexanone	<100	mg/Kg	100	100	11/17/15 16:58	HAL	L264853
Iodomethane	<25.0	mg/Kg	25.0	100	11/17/15 16:58	HAL	L264853
Isopropylbenzene	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
4-Isopropyl toluene	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
Methyl tert-butyl ether (MTBE)	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
4-Methyl-2-Pentanone	<100	mg/Kg	100	100	11/17/15 16:58	HAL	L264853
Methylene Chloride	<50.0	mg/Kg	50.0	100	11/17/15 16:58	HAL	L264853

Qualifiers/ Definitions DF Dilution Factor MQL Method Quantitation Limit

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Analytical Method: 8260B
Prep Method: 5030A **Prep Batch(es):** L264824 **Date/Time Prepped:** 11/17/2015 09:31:00

Test	Results	Units	MQL	DF	Date / Time Analyzed	By	Analytical Batch
Naphthalene	<25.0	mg/Kg	25.0	100	11/17/15 16:58	HAL	L264853
n-Propylbenzene	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
Styrene	**9.27**	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
1,1,1,2-Tetrachloroethane	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
1,1,2,2-Tetrachloroethane	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
Tetrachloroethene	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
Toluene	<25.0	mg/Kg	25.0	100	11/17/15 16:58	HAL	L264853
1,2,3-Trichlorobenzene	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
1,2,4-Trichlorobenzene	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
1,1,1-Trichloroethane	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
1,1,2-Trichloroethane	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
Trichloroethene	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
Trichlorofluoromethane	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
1,2,3-Trichloropropane	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
1,2,4-Trimethylbenzene	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
1,3,5-Trimethylbenzene	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
Vinyl Acetate	<50.0	mg/Kg	50.0	100	11/17/15 16:58	HAL	L264853
Vinyl Chloride	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
o-Xylene	<5.00	mg/Kg	5.00	100	11/17/15 16:58	HAL	L264853
m,p-Xylene	<10.0	mg/Kg	10.0	100	11/17/15 16:58	HAL	L264853

Qualifiers/ Definitions DF Dilution Factor MQL Method Quantitation Limit

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Analytical Method: 8260B
Prep Method: 5030A **Prep Batch(es):** L264824 **Date/Time Prepped:** 11/17/2015 09:31:00

Test	Results	Units	MQL	DF	Date / Time Analyzed	By	Analytical Batch
Xylene (Total)	<5.00	mg/Kg	5.00	100	11/17/15 16:58		L264853
Surrogate: 4-Bromofluorobenzene	81.3		Limits: 40-140%	100	11/17/15 16:58	HAL	L264853
Surrogate: 1,2-Dichloroethane - d4	116		Limits: 40-140%	100	11/17/15 16:58	HAL	L264853
Surrogate: Toluene-d8	97.3		Limits: 40-140%	100	11/17/15 16:58	HAL	L264853

Analytical Method: 8270C
Prep Method: 3580A **Prep Batch(es):** L264586 **Date/Time Prepped:** 11/17/2015 08:30:00

Test	Results	Units	MQL	DF	Date / Time Analyzed	By	Analytical Batch
Acenaphthene	<100	mg/Kg	100	1	11/17/15 15:30	RQE	L264829
Acenaphthylene	<100	mg/Kg	100	1	11/17/15 15:30	RQE	L264829
Acetophenone	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
Aniline	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
Anthracene	<100	mg/Kg	100	1	11/17/15 15:30	RQE	L264829
Benzidine	<1000	mg/Kg	1000	1	11/17/15 15:30	RQE	L264829
Benzo(a)anthracene	<100	mg/Kg	100	1	11/17/15 15:30	RQE	L264829
Benzo(a)pyrene	<100	mg/Kg	100	1	11/17/15 15:30	RQE	L264829
Benzo(b)fluoranthene	<100	mg/Kg	100	1	11/17/15 15:30	RQE	L264829
Benzo(g,h,i)perylene	<100	mg/Kg	100	1	11/17/15 15:30	RQE	L264829
Benzo(k)fluoranthene	<100	mg/Kg	100	1	11/17/15 15:30	RQE	L264829
Benzoic Acid	<500	mg/Kg	500	1	11/17/15 15:30	RQE	L264829
Benzyl alcohol	<500	mg/Kg	500	1	11/17/15 15:30	RQE	L264829
Bis(2-Chloroethoxy)methane	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829

Qualifiers/ Definitions DF Dilution Factor MQL Method Quantitation Limit

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Andy Parrish
Project Manager

Report Number : **15-317-0222**

REPORT OF ANALYSIS

Lab No : **98485**
Sample ID : **Leachate-001**

Matrix: **Formulation**
Sampled: **11/12/2015 10:40**

Analytical Method: 8270C
Prep Method: 3580A
Prep Batch(es): L264586
Date/Time Prepped: 11/17/2015 08:30:00

Test	Results	Units	MQL	DF	Date / Time Analyzed	By	Analytical Batch
Bis(2-Chloroethyl)ether	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
Bis(2-Chloroisopropyl)ether	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
Bis(2-ethylhexyl)phthalate	<500	mg/Kg	500	1	11/17/15 15:30	RQE	L264829
4-Bromophenyl phenyl ether	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
Butyl benzyl phthalate	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
Carbazole	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
4-Chloro-3-methylphenol	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
4-Chloroaniline	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
2-Chloronaphthalene	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
2-Chlorophenol	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
4-Chlorophenyl phenyl ether	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
Chrysene	<100	mg/Kg	100	1	11/17/15 15:30	RQE	L264829
Dibenz(a,h)anthracene	<100	mg/Kg	100	1	11/17/15 15:30	RQE	L264829
Dibenzofuran	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
1,2-Dichlorobenzene	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
1,3-Dichlorobenzene	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
1,4-Dichlorobenzene	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
3,3'-Dichlorobenzidine	<500	mg/Kg	500	1	11/17/15 15:30	RQE	L264829
2,4-Dichlorophenol	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
2,6-Dichlorophenol	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
Diethyl phthalate	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
Dimethyl phthalate	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829

Qualifiers/ Definitions DF Dilution Factor MQL Method Quantitation Limit

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Prep Method: 3580A
Prep Batch(es): L264586
Date/Time Prepped: 11/17/2015 08:30:00

Test	Results	Units	MQL	DF	Date / Time Analyzed	By	Analytical Batch
3,3' Dimethylbenzidine	<500	mg/Kg	500	1	11/17/15 15:30	RQE	L264829
2,4-Dimethylphenol	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
Di-n-butyl phthalate	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
4,6-Dinitro-2-methylphenol	<500	mg/Kg	500	1	11/17/15 15:30	RQE	L264829
2,4-Dinitrophenol	<500	mg/Kg	500	1	11/17/15 15:30	RQE	L264829
2,4-Dinitrotoluene	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
2,6-Dinitrotoluene	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
Di-n-Octyl Phthalate	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
Fluoranthene	<100	mg/Kg	100	1	11/17/15 15:30	RQE	L264829
Fluorene	<100	mg/Kg	100	1	11/17/15 15:30	RQE	L264829
Hexachlorobenzene	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
Hexachlorobutadiene	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
Hexachlorocyclopentadiene	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
Hexachloroethane	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
Indeno(1,2,3-cd)pyrene	<100	mg/Kg	100	1	11/17/15 15:30	RQE	L264829
Isophorone	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
2-Methylnaphthalene	<100	mg/Kg	100	1	11/17/15 15:30	RQE	L264829
2-Methylphenol	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
3&4 Methylphenol	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
Naphthalene	<100	mg/Kg	100	1	11/17/15 15:30	RQE	L264829
2-Nitroaniline	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
3-Nitroaniline	<500	mg/Kg	500	1	11/17/15 15:30	RQE	L264829

Qualifiers/ Definitions DF Dilution Factor MQL Method Quantitation Limit

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Sampled: **11/12/2015 10:40**

Analytical Method: 8270C
Prep Method: 3580A
Prep Batch(es): L264586
Date/Time Prepped: 11/17/2015 08:30:00

Test	Results	Units	MQL	DF	Date / Time Analyzed	By	Analytical Batch
4-Nitroaniline	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
Nitrobenzene	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
2-Nitrophenol	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
4-Nitrophenol	<1000	mg/Kg	1000	1	11/17/15 15:30	RQE	L264829
N-Nitrosodimethylamine	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
N-Nitrosodiphenylamine	<500	mg/Kg	500	1	11/17/15 15:30	RQE	L264829
N-Nitrosodiethylamine	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
N-Nitroso-di-n-butylamine	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
N-Nitroso-di-n-propylamine	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
Pentachlorophenol	<500	mg/Kg	500	1	11/17/15 15:30	RQE	L264829
Phenanthrene	<100	mg/Kg	100	1	11/17/15 15:30	RQE	L264829
Phenol	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
Pyrene	<100	mg/Kg	100	1	11/17/15 15:30	RQE	L264829
Pyridine	<500	mg/Kg	500	1	11/17/15 15:30	RQE	L264829
1,2,4,5-Tetrachlorobenzene	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
2,3,4,6-Tetrachlorophenol	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
1,2,4-Trichlorobenzene	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
2,4,5-Trichlorophenol	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829

Qualifiers/ Definitions DF Dilution Factor MQL Method Quantitation Limit

2790 Whitten Road, Memphis, TN 38133
Main 901.213.2400 ° Fax 901.213.2440
www.waypointanalytical.com

06532
Greer Enterprises
Ms. Mary Barnhill
PO Box 191466
Mobile , AL 36619

Project Information : Rentokil Leachate Tank
Creola, AL
Project # 80-150022

Report Date : 11/19/2015
Received : 11/13/2015

Andy Parrish
Project Manager

Report Number : **15-317-0222**

REPORT OF ANALYSIS

Lab No : **98485**
Sample ID : **Leachate-001**

Matrix: **Formulation**
Sampled: **11/12/2015 10:40**

Analytical Method: 8270C
Prep Method: 3580A **Prep Batch(es):** L264586 **Date/Time Prepped:** 11/17/2015 08:30:00

Test	Results	Units	MQL	DF	Date / Time Analyzed	By	Analytical Batch
2,4,6-Trichlorophenol	<250	mg/Kg	250	1	11/17/15 15:30	RQE	L264829
Surrogate: 2-Fluorobiphenyl	88.3		Limits: 20-140%	1	11/17/15 15:30		L264829
Surrogate: 2-Fluorophenol	95.3		Limits: 10-140%	1	11/17/15 15:30		L264829
Surrogate: Nitrobenzene-d5	87.1		Limits: 20-140%	1	11/17/15 15:30		L264829
Surrogate: Phenol-d6	97.1		Limits: 10-140%	1	11/17/15 15:30		L264829
Surrogate: 4-Terphenyl-d14	91.8		Limits: 20-140%	1	11/17/15 15:30		L264829
Surrogate: 2,4,6-Tribromophenol	96.5		Limits: 10-140%	1	11/17/15 15:30		L264829

Qualifiers/ Definitions DF Dilution Factor MQL Method Quantitation Limit

5041 Taravella Road, Marrero, LA 70072
Main 504-371-8557 ° Fax 504-371-8560
www.waypointanalytical.com

11/18/2015

Waypoint Analytical - TN
Client Services
2790 Whitten Road
Memphis, TN, 38133

Ref: Analytical Testing
Report Number: 15-321-0202
Project Description: Export Batch ID: 2676L

Dear Client Services:
Waypoint Analytical Louisiana, Inc. received sample(s) on 11/17/2015 for the analyses presented in the following report.

The above referenced project has been analyzed per your instructions. Unless otherwise noted, the analyses were performed in our laboratory in accordance with Standard Methods, The Solid Waste Manual SW-846, EPA Methods for Chemical Analysis of Water and Wastes and /or 40 CFR part 136.

The EPA requires that water samples analyzed for pH, dissolved oxygen and total residual chlorine be analyzed in the field. Analyses reported which indicate "Field" for these parameters was analyzed by the client in the field. Results for solid samples are reported on an as received basis unless otherwise specified.

The analytical data has been validated using standard quality control measures performed as required by the analytical method. Quality Assurance, method validations, instrumentation maintenance and calibration for all parameters (NELAP and non-NELAP) were performed in accordance with guidelines established by the USEPA (including 40 CFR 136 Method Update Rule May 2012) and NELAC unless otherwise indicated. Any parameter for which the laboratory is not officially NELAP accredited is indicated by a '~' symbol. These are not included in the scope because NELAP accreditation is either not available or has not been applied for. Additional certifications may be held/are available for parameters, where NELAP accreditation is not required or applicable. A full list of certifications is available upon request.

Certain parameters (chlorine, pH, dissolved oxygen, sulfite...) are required to be analyzed within 15 minutes of sampling. Usually, but not always, any field parameter analyzed at the laboratory is outside of this holding time. Refer to sample analysis time for confirmation of holding time compliance.

All quality control measures undertaken in accordance with Waypoint Analytical Louisiana, Inc. CompQAP990807A and revisions under the terms of the Louisiana Environmental Laboratory Accreditation Program (Certificate #02041) are within acceptance ranges established that document with the exception of the items indicated and discussed in the Case Narrative.

The results are shown on the attached analysis sheet(s). Thank you for allowing Waypoint Analytical Louisiana, Inc. to serve you. Should I be of further assistance, if you have any questions or need additional information please do not hesitate to contact me or client services.

Sincerely,

Anthony J. Albert
Laboratory Director

Laboratory's liability in any claim relating to analyses performed shall be limited to, at laboratory's option, repeating the analysis in question at laboratory's expense, or the refund of the charges paid for performance of said analysis.

Certifications: Louisiana - LELAP #02041

5041 Taravella Road, Marrero, LA 70072
Main 504-371-8557 ° Fax 504-371-8560
www.waypointanalytical.com

Client: Waypoint Analytical - TN
Project: Export Batch ID: 2676L
Lab Report Number: 15-321-0202
Date: 11/18/2015

CASE NARRATIVE

Quality Control Report

Laboratory Control Sample, % recovery	93.4
Sample Result (74412), % wt.	96.6
Sample Duplicate Result (74412), % wt	96.2
Relative Percent Difference, %	0.4

5041 Taravella Road, Marrero, LA 70072
Main 504-371-8557 ° Fax 504-371-8560
www.waypointanalytical.com

00590
Waypoint Analytical - TN
Client Services
2790 Whitten Road
Memphis , TN 38133

Project Information : Export Batch ID: 2676L

Report Date : 11/18/2015

Report Number : **15-321-0202**

REPORT OF ANALYSIS

Received : 11/17/2015

Lab No : **74412**
Sample ID : **15-317-0222 (98485)**

Matrix: **Aqueous**
Sampled: **11/16/2015 13:43**

Test	Results	Units	MQL	DF	Date / Time Analyzed	By	Analytical Method
KF Water	**96.6**	% wt.	1.32	1	11/17/15 11:30	P F	ASTM E203-01 ~

Qualifiers/ Definitions DF Dilution Factor MQL Method Quantitation Limit

Waypoint ANALYTICAL

5041 Taravella Road, Marrero, LA 70072
Main 504-371-8557 ° Fax 504-371-8560
www.waypointanalytical.com

Cooler Receipt Form

Customer Number: **00590**
Customer Name: **Waypoint Analytical - TN**
Report Number: **15-321-0202**

Shipping Method

○ Fed Ex	○ US Postal	○ Lab	○ Other :	
● UPS	○ Client	○ Courier	Thermometer ID:	

Shipping container/cooler uncompromised?	● Yes	○ No	
Number of coolers received	1		
Custody seals intact on shipping container/cooler?	○ Yes	○ No	● Not Required
Custody seals intact on sample bottles?	○ Yes	○ No	● Not Required
Chain of Custody (COC) present?	● Yes	○ No	
COC agrees with sample label(s)?	● Yes	○ No	
COC properly completed	● Yes	○ No	
Samples in proper containers?	● Yes	○ No	
Sample containers intact?	● Yes	○ No	
Sufficient sample volume for indicated test(s)?	● Yes	○ No	
All samples received within holding time?	● Yes	○ No	
Cooler temperature in compliance?	● Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	● Yes	○ No	
Water - Sample containers properly preserved	● Yes	○ No	○ N/A
Water - VOA vials free of headspace	○ Yes	○ No	● N/A
Trip Blanks received with VOAs	○ Yes	○ No	● N/A
Soil VOA method 5035 – compliance criteria met	○ Yes	○ No	● N/A

☐ High concentration container (48 hr)
☐ Low concentration EnCore samplers (48 hr)
☐ High concentration pre-weighed (methanol -14 d)
☐ Low conc pre-weighed vials (Sod Bis -14 d)

Special precautions or instructions included?	○ Yes	● No

Comments:

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Nicole Lohman Date & Time: 11/17/2015 10:58:00

Waypoint ANALYTICAL

2790 Whitten Road, Memphis, TN 38133
Main 901.213.2400 ° Fax 901.213.2440
www.waypointanalytical.com

11/16/2015 13:43:58

Export Batch Report

Export Batch Id : **2676L** 74412

Created: 11/16/2015 13:43:26
Computer: MEMWHLIMS086
User: Cody Gardner

To: Waypoint Analytical - LA
5041 Taravella Road
Marrero, LA 70072

From: Waypoint Analytical, Inc.
2790 Whitten Road
Memphis, TN 38133
901-213-2400

Report No	Due Date	Customer Sample No	Rush	Lab No	Method No	Fee Code Description	Analyte Description
15-317-0222	11/18/2015	Leachate-001	☑	98485	ASTM E203-01	Karl Fischer Water	KF Water

15-321-0202
00590
11-17-2015
10:59:03
Waypoint Analytical - TN
Export Batch ID: 2676L

Sampled By	Method of Shipment	Blank / Cooler Temp.	
Client	UPS	2.0°C	
Remarks			
Relinquished By (sign)	Date / Time	Received By (sign)	Date / Time
C. Gardner	11/16/15	Nicole Lohman	11/17/15 1058
Relinquished By (sign)	Date / Time	Received By (sign)	Date / Time

2.0°C

Waypoint ANALYTICAL

2790 Whitten Road, Memphis, TN 38133
Main 901.213.2400 ° Fax 901.213.2440
www.waypointanalytical.com

Cooler Receipt Form

Customer Number: **06532**
Customer Name: **Greer Enterprises**
Report Number: **15-317-0222**

Shipping Method

● Fed Ex	○ US Postal	○ Lab	○ Other :	
○ UPS	○ Client	○ Courier	Thermometer ID:	#9

Shipping container/cooler uncompromised?	● Yes	○ No	
Number of coolers received	1		
Custody seals intact on shipping container/cooler?	● Yes	○ No	○ Not Required
Custody seals intact on sample bottles?	○ Yes	○ No	● Not Required
Chain of Custody (COC) present?	● Yes	○ No	
COC agrees with sample label(s)?	● Yes	○ No	
COC properly completed	● Yes	○ No	
Samples in proper containers?	● Yes	○ No	
Sample containers intact?	● Yes	○ No	
Sufficient sample volume for indicated test(s)?	● Yes	○ No	
All samples received within holding time?	● Yes	○ No	
Cooler temperature in compliance?	● Yes	○ No	
Cooler/Samples arrived at the laboratory on ice. Samples were considered acceptable as cooling process had begun.	● Yes	○ No	
Water - Sample containers properly preserved	○ Yes	○ No	● N/A
Water - VOA vials free of headspace	○ Yes	○ No	● N/A
Trip Blanks received with VOAs	○ Yes	○ No	● N/A
Soil VOA method 5035 – compliance criteria met	○ Yes	○ No	● N/A

☐ High concentration container (48 hr)
☐ Low concentration EnCore samplers (48 hr)
☐ High concentration pre-weighed (methanol -14 d)
☐ Low conc pre-weighed vials (Sod Bis -14 d)

Special precautions or instructions included?	○ Yes	● No

Comments:

Any regulatory non-compliance issues will be recorded on non-compliance report.

Signature: Danyale Love Date & Time: 11/13/2015 10:58:49

Chain of Custody Record

GREER ENTERPRISES, LLC
Specializing in Waste Management & Recycling

Client	Phone: (251) 679-1967
Greer Enterprises, LLC PO Box 191466 Mobile, AL 36619	Fax: (251) 679-1968 Requested TAT: TBD

Method of Delivery: ☐UPS ☐Fedex ☑Drop Off ☐Other (Specify in Comments)

Report to: Mary I. Barnhill — Project # 80-150022

Email To: maryG@greerllc.com — PO#

Project Name: Rentokil - Leachate Tank

Project Location: Creola, AL

Comments:

Sample ID	Matrix	Comp/Grab	Date	Time	# of cont.	Totals-VOCs	Totals-SVOCs	Totals-Metals	BTU Value	% Water	PCB's		
Leachate-001	L	Grab	11/12/15	10:40	3	✓	✓	✓	✓	✓	✓		

Analysis to be performed

	Date	Time
1. Relinquished By:	11/12/15	1054
2. Relinquished By: Mary I. Barnhill	11/12/15	1230
3. Relinquished By:	Date	Time

	Date	Time
1. Received By: Mary I. Barnhill	11/12/15	10:54
2. Received By: Megan Cowart	11/12/15	12:30
3. Received at Lab By:	Date	Time

Greer Enterprises
Rentokil Leachate Tank
15-317-0222
06532
11-13-2015
10:57:30

Custody seals intact on cooler. Cooler T=0°C 1902

APPENDIX E

Corrective Action Costs

MEMO

ARCADIS Design & Consultancy for natural and built assets

To:

Mr. Andrew Eversull

Arcadis Project Manager

Copies:

Ms. Pam McIlwain

Arcadis U.S., Inc.
2170 Highland Avenue South
Suite 250
Birmingham
Alabama 35205
Tel 205 930 5700
Fax 205 930 5707

From:

Jessica Gattenby, Arcadis Cost

Date:

July 3, 2017

Arcadis Project No.:

03648005.2017

Subject:

Estimated Closure Cost Review Rentokil Initial Environmental Services, LLC. 10565 Highway 43 North, Creola, Alabama

USEPA I.D. Number ALD 021 257 951

A review of the estimated closure cost for the above referenced project site (the “Site”) has been performed by ARCADIS-US, Inc. (ARCADIS). The previously determined 9.4 million dollar estimate to achieve closure based on the current corrective action plan does not require modification based on the ongoing Phase I implementation.

Appendix 3 **Proposed Remedial Alternatives and Associated Project Life-Cycle Cost**
Table C-1 **Creola, Alabama**

Remedial Alternative	Remedy Component	Description		Capital Cost ($)	Annual O&M Cost ($)	Periodic Cost ($)	Component Time Frame (Yrs)	Total Remedial Time Frame	Project Cost (Life-Cycle)[1] ($)	Present Value (Life-Cycle)[1] ($)
Proposed Remedial Approach	Monitor Well Network Modifications	Modification of the existing well network to improve groundwater monitoring. Modification include abandonment of wells with screend greater than 15 ft in length and installation of wells screened within the interval of impacts.	Remedy Initiation	$ 236,900	$ -	$ -	< 1	30	$ 236,900	$ 236,900
	ZVI Phase I & Design Testing	Completion of Phase I source area remediation including the continued operation of the CATS, groundwater moniotring and permit compliance for one year.	Remedy Initiation	$ 991,000	$ -	$ -	< 1		$ 991,000	$ 991,000
	ZVI Phase II	Expansion of ZVI treatment in the source area to address primary CT/CF footprint.	Active Remediation	$ 1,139,000	$ -	$ -	1		$ 1,139,000	$ 1,139,000
	AS/VE Barrier	Installation and operation of an air sparge barrier with vapor recovery along the down gradient edge of the hot spot area. ZVI treatment in the source area to redux mass and reduce cleanup timeframes. Includes the electrical cost associated with system operation.	Active Remediation	$ 954,000	$ 152,000	$ 125,000	5		$ 1,839,000	$ 1,812,900
	Active remediation Monitoring and Landfill Closure Moniotring	Continued groundwater monitoring, permit compliance and semi-annual reporting	Active Remediation	$ -	$ 151,400	$ -	5		$ 757,000	$ 737,400
	MNA Monitoring and Landfill Closure Monitoring	Transition to moniotred natural attenuation groundwater monitoring, permit compliance and semi-annual reporting	Active Remediation	$ -	$ 161,300	$ 53,800	10		$ 1,666,800	$ 1,584,400
	Post-Remedial Landfill Care and Groundwater Monitoring	Following source reduction and demonstrated plume containment, transition active remedy to MNA. Ongoing landfill maintenance, permitting and compliance monitoring.	Post-Remedy	$ -	$ 120,000	$ -	14		$ 1,680,000	$ 1,574,100
							Life Cycle TOTAL:		$ 8,309,700	$ 8,075,700

Appendix 3 **Proposed Remedial Alternatives and Associated Project Life-Cycle Cost**
Table C-1 **Creola, Alabama**

Remedial Alternative	Remedy Component	Description		Capital Cost ($)	Annual O&M Cost ($)	Periodic Cost ($)	Component Time Frame (Yrs)	Total Remedial Time Frame	Project Cost (Life-Cycle)[1] ($)	Present Value (Life-Cycle)[1] ($)
Contingency Remedy	Monitor Well Network Modifications	Modification of the existing well network to improve groundwater monitoring. Modification include abandonment of wells with screend greater than 15 ft in length and installation of wells screened within the interval of impacts.	Remedy Initiation	$ 236,900	$ -	$ -	< 1		$ 236,900	$ 236,900
	ZVI Phase I & Design Testing	Completion of Phase I source area remediation including the continued operation of the CATS, groundwater moniotring and permit compliance for one year.	Remedy Initiation	$ 991,000	$ -	$ -	< 1		$ 991,000	$ 991,000
	ZVI Phase II	Expansion of ZVI treatment in the source area to address primary CT/CF footprint.	Active Remediation	$ 1,139,000	$ -	$ -	1		$ 1,139,000	$ 1,139,000
	Modified CATS System	Modification of the existing CATS and operation.	Active Remediation	$ 718,000	$ 423,400	$ 144,000	5		$ 2,979,000	$ 2,916,900
	Active remediation Monitoring and Landfill Closure Moniotring	Continued groundwater monitoring, permit compliance and semi-annual reporting	Active Remediation	$ -	$ 151,400	$ -	5		$ 757,000	$ 737,400
	MNA Monitoring and Landfill Closure Monitoring	Transition to moniotred natural attenuation groundwater monitoring, permit compliance and semi-annual reporting	Active Remediation	$ -	$ 161,300	$ 53,800	10		$ 1,666,800	$ 1,584,400
	Post-Remedial Landfill Care and Groundwater Monitoring	Following source reduction and demonstrated plume containment, transition active remedy to MNA. Ongoing landfill maintenance, permitting and compliance monitoring.	Post-Remedy	$ -	$ 120,000	$ -	14		$ 1,680,000	$ 1,574,100
							Life Cycle TOTAL:		$ 9,449,700.00	$ 9,179,700

Notes:

1 Estimated costs in today's dollars
2 30-year Discount Rate of 0.88% based on the 2014 Rentokil Forward Rate of return
All costs are rounded to the nearest $100
All costs are based on an accuracy of +50/-30% (USEPA, 2000)
Post closure cost include leachate removal, cover maintenance, point of compliance monitoring and inspection
Cost include ARCADIS engineering and oversight along with reporting

Abbreviations:

AS/SVE	Air Sparge and Soil Vapor Extraction
CATS	Corrective Action Treatment System
MNA	Monitored Natural Attenuation
O&M	operation and maintenance
USEPA	United States Environmental Protection Agency
ZVI	Zero Valent Iron

Appendix 3 Phase I & Design Testing Cost
Table C-2 Creola, Alabama

Project Phase	Component	Description		Cost ($)	ADEM Fees ($)	Total Cost ($)
Prep	RCRA Permit Modification	Workplan to perform the modifications	Remedy Initiation	$ -	$ 29,000	**$ 29,000**
	UIC Permit Modification	Modification of the UIC permit to expand what can be injected at the site to include the reagants proposed as part of the revised remedy and air.		$ 42,000	$ 22,000	**$ 64,000**
Phase I	ZVI Source Remediation Phase I	Direct push injection of EHC™, a ZVI and organic carbon reagant, into two areas, the former North Pond and immediate area surrounding well cluster TW-2. Details of the planned injections are outlined in the workplan.		$ 152,000	$ -	**$ 152,000**
	Phase I Monitoring	Sampling of wells for VOCs, MEE, Sulfate/Sulfide and TOC and Iron by field kit as outlined in the workplan.		$ 22,000	$ -	**$ 22,000**
	Air-sparging / soil vapor extraction (AS/SVE) design parameter testing	Installation of 2 injection wells to 50 ft bgs, installation of 1 soil vapor extraction well to 20 ft bgs. Installation of 2 monitor wells to 50 ft bgs. Sampling of all wells for VOCs and metals. Operation of a rental SVE system as outlined in the workplan to perform pilot testing including monitoring and labratory analysis		$ 55,000	$ -	**$ 55,000**
	Monitor Well Abandonment	Abandonment of 23 wells that have screen intervals that exceed 15 ft in length at the request of ADEM	Active Remediation	$ 43,100	$ -	**$ 43,100**
	Monitor Well Installation	Installation of 3 monitor wells to 50 ft bgs. Sampling of developed wells for VOCs and Metals		$ 193,800	$ -	**$ 193,800**
	Corrective action treatment system (CATS) optimization assessment	no optimization beyond basic operation efficiencies. Operation of the system in the current configuration for 1 year. Covered under active remediation not phase I.		$ 51,200	$ -	**$ 51,200**
	Ongoing operation of the CATS	Continued operation of the CATS system for 1 yesr during Phase I implemetnation to maintain hydraulic control at the site.		$ 423,400	$ -	**$ 423,400**
	Performance Monitoring	Monitoring of wells as outlined in the report to evaluate the performance of the CATS and Source area treatment.		$ 55,500	$ -	**$ 55,500**
	Permit Compliance	Post Closure care of the landfill during active remediation		$ 65,900	$ -	**$ 65,900**
	Reporting	Completion of a summary report of the Pase I activities to include the desgin of the Phase II implementation and the planned method of treatment for the dilute plume.		$ 73,000	$ -	**$ 73,000**
						$ 1,227,900

ARCADIS
Infrastructure, environment, buildings

17-Mar-16

COSTS:		Rates	Permit Modifications Units/Hrs	Permit Modifications Cost	ZVI Phase I Units/Hrs	ZVI Phase I Cost	Phase I Monitoring Units/Hrs	Phase I Monitoring Cost
LABOR COSTS								
Program Manager		$ 333.54	1	$367	1	$267	1	$200
Senior Project Manager		$ 192.96	6	$1,138	4	$772	3	$521
Task Manager		$ 151.52	15	$2,273	10	$1,545	7	$1,000
Senior Expert		$ 326.64	15	$4,900	6	$1,960	0	$0
Project Advisor		$ 238.42	10	$2,384	0	$0	0	$0
Principal Sci/Eng/Arch/Designer		$ 194.30	28	$5,441	0	$0	0	$0
Senior Sci/Eng/Arch/Designer		$ 151.42	36	$5,451	0	$0	15	$2,271
Project Sci/Eng/Arch/Designer		$ 120.80	62	$7,490	40	$4,832	36	$4,349
Staff Sci/Eng/Arch/Designer		$ 104.69	87	$9,120	0	$0	18	$1,884
Sci/Eng/Arch/Designer 2		$ 93.47	0	$0	124	$11,591	0	$0
Technician III		$ 94.15	0	$0	0	$0	90	$8,474
Technician I		$ 56.96	0	$0	124	$7,063	0	$0
CADD/Drafter II		$ 72.58	31	$2,258	0	$0	0	$0
Project Assistant		$ 79.65	12	$929	3	$239	0	$0
Subtotals			**303**	**$41,750**	**312**	**$28,268**	**169**	**$18,699**
OTHER DIRECT COSTS								
Truck/car rental per day	day	$50	0	$0	7	$350	6	$300
Lodging	day/person	$150.00	0	$0	12	$1,800	0	$0
Meals (day work)	day/person	$25	0	$0	14	$350	0	$0
Decon area setup/supplies	day	$25	0	$0	0	$0	0	$0
Level D PPE	day/person	$15	0	$0	14	$210	6	$90
Miscellaneous (photographs, gas, tolls, supplies, etc.)	day	$20	0	$0	7	$140	0	$0
Copies	each	$0	225	$34	0	$0	0	$0
Shipping (Coolers)	each	$100	0	$0	0	$0	6	$600
Shipping (Reports)	each	$25	9	$225	0	$0	0	$0
Communications	day	$2	0	$0	14	$28	0	$0
200 micron Bag filter	each	$35	0	$0	0	$0	0	$0
25 micron bag filter	each	$45	0	$0	0	$0	0	$0
3 micron cartridge	each	$40	0	$0	0	$0	0	$0
Monthly Utilities (phone, telemetry , water, sewer etc)	month	$1,100.00	0	$0	0	$0	0	$0
Utilities - Electrical	month	$5,400	0	$0	0	$0	0	$0
Miscellanous Items (Fire extinguisher service, PLC softwar	annually	$1,915	0	$0	0	$0	0	$0
ADEM RCRA Permit Fees	ea	$1	29000	$29,000	0	$0	0	$0
ADEM UIC Permit Fees	ea	$1	22000	$22,000	0	$0	0	$0
Subtotals				**$51,259**		**$2,878**		**$990**
SUBCONTRACTOR EXPENSES								
VOCs (8260B)	each	$ 46.00		$0		$0		$828
BTEX/MtBE (8021)	each	$ 45.00		$0		$0		$0
TAL Metals (23), including Mercury and digestion (6010)	each	$ 80.00		$0		$0		$0
Sulfide, total	each	$ 33.00		$0		$0		$495
Total Organic Carbon (TOC)-single analysis	each	$ 21.00		$0		$0		$315
Full waste characterization	each	$ 613.00		$0		$0		$0
EPA TO-15 Full Scan	each	$ 115.00		$0		$0		$0
Light hydrocarbons (methane, ethane, ethene)	each	$ 48.00		$0		$0		$720
Well Abandonment Mob	each	$ 2,000.00		$0		$0		$0
2" Well Abandonment	lf	$ 15.00		$0		$0		$0
Drum rate (soil or liquid, 55-gallon incl. drum purchase)	each	$ 195.00		$0		$0		$0
Transportation (200 miles up to 14 drums) , non-haz	each load	$ 450.00		$0		$0		$0
Utility location	day	$ 1,880.00		$0		$0		$0
Granular Activated Carbon Changeout	lb	$ 2.00		$0		$0		$0
Pilot Test Extraction Trailer	week	$ 2,000.00		$0		$0		$0
Metals - Al, Ar, Br, Cr, Fe, Pb, Mn	each	$ 57.19		$0		$0		$0
Hollow stem auger mobilization (equipment, decon pad co	each	$ 5,000.00		$0		$0		$0
6 inch bore hole in residuum using HAS	LF	$ 18.00		$0		$0		$0
2" well materials PVC	foot	$ 7.70		$0		$0		$0
EHC-G	lb	$ 1.85		$0		$64,731		$0
EHC-G Delivery	each	$ 2,650.00		$0		$2,650		$0
Water transport	per/1000 gallons	$ 15.00		$0		$210		$0
30,000 ball Air Stripper changout low density	ea	$ 22,575.00		$0		$0		$0
Refurbish Pump	ea	$ 4,300.00		$0		$0		$0
Dinoseb	ea	$ 125.00		$0		$0		$0
Well Packer Installation (RW-4)	lump	$ 15,000.00		$0		$0		$0
Maintenance and Replacement Parts (4% EQ)	%	4%		$0		$0		$0
Vironex Mob/Demob	each	$ 5,500.00		$0		$5,500		$0
Hand auger clearing	each	$ 50.00		$0		$750		$0
Day Rate	day	$ 6,000.00		$0		$42,000		$0
Decontamination, drums, etc	lump	$ 2,500.00		$0		$2,500		$0
Injection Reporting	lump	$ 2,500.00		$0		$2,500		$0
Per Diem, per man	day	$ 230.00		$0		$0		$0
Daily rate for a 2-man cre with a track mounted	day	$ 1,525.00		$0		$0		$0
55 gall drum filled and staged	drum	$ 60.00		$0		$0		$0
Decontamination	week	$ 475.00		$0		$0		$0
Hollow stem auger mobilization (equipment, decon pad co	each	$ 3,500.00		$0		$0		$0
2 inch monitor well install	LF	$ 25.00		$0		$0		$0
Miscellaneous Laboratory Analysis	ea	$ 1.00		$0		$0		$0
Mobilization/ Demobilization	each	$ 1,800.00		$0		$0		$0
Recovery Well Pump Removal/Setting	each	$ 7,200.00		$0		$0		$0
Vegetation Maintenance	annually	$ 500.00		$0		$0		$0
Equipment Maintenance/Repair	annually	$ 4,635.00		$0		$0		$0
Jetting of Injection Wells/ Well Maintenance	annually	$ 5,000.00		$0		$0		$0
Sludge Basin cleanout, paint and media replacement	each	$ 7,000.00		$0		$0		$0
Subtotals				**$0**		**$120,841**		**$2,358**
Task Sub-Totals				**$93,009**		**$151,987**		**$22,047**

ARCADIS
Infrastructure, environment, buildings

17-Mar-16

COSTS:		Rates	AS/SVE Design Testing		Monitor Well Abandonment		Monitor Well Installation	
			Units/Hrs	Cost	Units/Hrs	Cost	Units/Hrs	Cost
LABOR COSTS								
Program Manager		$ 333.54	1	$300	0	$100	2	$567
Senior Project Manager		$ 192.96	9	$1,659	2	$289	9	$1,659
Task Manager		$ 151.52	12	$1,788	4	$591	22	$3,333
Senior Expert		$ 326.64	0	$0	0	$0	0	$0
Project Advisor		$ 238.42	0	$0	0	$0	0	$0
Principal Sci/Eng/Arch/Designer		$ 194.30	0	$0	0	$0	0	$0
Senior Sci/Eng/Arch/Designer		$ 151.42	61	$9,237	0	$0	13	$1,968
Project Sci/Eng/Arch/Designer		$ 120.80	38	$4,590	2	$242	26	$3,141
Staff Sci/Eng/Arch/Designer		$ 104.69	6	$628	8	$838	272	$28,476
Sci/Eng/Arch/Designer 2		$ 93.47	72	$6,730	24	$2,243	0	$0
Technician III		$ 94.15	40	$3,766	68	$6,402	233	$21,937
Technician I		$ 56.96	70	$3,987	0	$0	0	$0
CADD/Drafter II		$ 72.58	0	$0	0	$0	0	$0
Project Assistant		$ 79.65	0	$0	3	$239	0	$0
Subtotals			**308**	**$32,686**	**111**	**$10,944**	**576**	**$61,082**
OTHER DIRECT COSTS								
Truck/car rental per day	day	$50	7	$350	6	$300	40	$2,000
Lodging	day/person	$150.00	0	$0	0	$0	0	$0
Meals (day work)	day/person	$25	11	$275	6	$150	40	$1,000
Decon area setup/supplies	day	$25	0	$0	6	$150	0	$0
Level D PPE	day/person	$15	11	$165	6	$90	40	$600
Miscellaneous (photographs, gas, tolls, supplies, etc.)	day	$20	7	$140	6	$120	40	$800
Copies	each	$0	0	$0	0	$0	0	$0
Shipping (Coolers)	each	$100	6	$600	0	$0	21	$2,100
Shipping (Reports)	each	$25	0	$0	0	$0	0	$0
Communications	day	$2	8	$16	0	$0	0	$0
200 micron Bag filter	each	$35	0	$0	0	$0	0	$0
25 micron bag filter	each	$45	0	$0	0	$0	0	$0
3 micron cartridge	each	$40	0	$0	0	$0	0	$0
Monthly Utilities (phone, telemetry , water, sewer etc)	month	$1,100.00	0	$0	0	$0	0	$0
Utilities - Electrical	month	$5,400	0	$0	0	$0	0	$0
Miscellanous Items (Fire extinguisher service, PLC softwar	annually	$1,915	0	$0	0	$0	0	$0
ADEM RCRA Permit Fees	ea	$1	0	$0	0	$0	0	$0
ADEM UIC Permit Fees	ea	$1	0	$0	0	$0	0	$0
Subtotals				**$1,546**		**$810**		**$6,500**
SUBCONTRACTOR EXPENSES								
VOCs (8260B)	each	$ 46.00		$598		$0		$12,420
BTEX/MtBE (8021)	each	$ 45.00		$0		$0		$0
TAL Metals (23), including Mercury and digestion (6010)	each	$ 80.00		$800		$0		$6,400
Sulfide, total	each	$ 33.00		$0		$0		$0
Total Organic Carbon (TOC)-single analysis	each	$ 21.00		$0		$0		$0
Full waste characterization	each	$ 613.00		$613		$0		$6,130
EPA TO-15 Full Scan	each	$ 115.00		$1,840		$0		$0
Light hydrocarbons (methane, ethane, ethene)	each	$ 48.00		$0		$0		$0
Well Abandonment Mob	each	$ 2,000.00		$0		$2,000		$0
2" Well Abandonment	lf	$ 15.00		$0		$29,325		$0
Drum rate (soil or liquid, 55-gallon incl. drum purchase)	each	$ 195.00		$1,560		$0		$16,965
Transportation (200 miles up to 14 drums) , non-haz	each load	$ 450.00		$450		$0		$3,600
Utility location	day	$ 1,880.00		$1,880		$0		$3,760
Granular Activated Carbon Changeout	lb	$ 2.00		$0		$0		$0
Pilot Test Extraction Trailer	week	$ 2,000.00		$2,000		$0		$0
Metals - Al, Ar, Br, Cr, Fe, Pb, Mn	each	$ 57.19		$0		$0		$0
Hollow stem auger mobilization (equipment, decon pad cor	each	$ 5,000.00		$5,000		$0		$0
6 inch bore hole in residuum using HAS	LF	$ 18.00		$3,960		$0		$0
2" well materials PVC	foot	$ 7.70		$1,694		$0		$0
EHC-G	lb	$ 1.85		$0		$0		$0
EHC-G Delivery	each	$ 2,650.00		$0		$0		$0
Water transport	per/1000 gallons	$ 15.00		$0		$0		$0
30,000 ball Air Stripper changout low density	ea	$ 22,575.00		$0		$0		$0
Refurbish Pump	ea	$ 4,300.00		$0		$0		$0
Dinoseb	ea	$ 125.00		$0		$0		$0
Well Packer Installation (RW-4)	lump	$ 15,000.00		$0		$0		$0
Maintenance and Replacement Parts (4% EQ)	%	4%		$0		$0		$0
Vironex Mob/Demob	each	$ 5,500.00		$0		$0		$0
Hand auger clearing	each	$ 50.00		$0		$0		$0
Day Rate	day	$ 6,000.00		$0		$0		$0
Decontamination, drums, etc	lump	$ 2,500.00		$0		$0		$0
Injection Reporting	lump	$ 2,500.00		$0		$0		$0
Per Diem, per man	day	$ 230.00		$0		$0		$6,900
Daily rate for a 2-man cre with a track mounted	day	$ 1,525.00		$0		$0		$22,875
55 gall drum filled and staged	drum	$ 60.00		$0		$0		$4,740
Decontamination	week	$ 475.00		$0		$0		$3,800
Hollow stem auger mobilization (equipment, decon pad cor	each	$ 3,500.00		$0		$0		$10,500
2 inch monitor well install	LF	$ 25.00		$0		$0		$26,250
Miscellaneous Laboratory Analysis	ea	$ 1.00		$0		$0		$0
Mobilization/ Demobilization	each	$ 1,800.00		$0		$0		$0
Recovery Well Pump Removal/Setting	each	$ 7,200.00		$0		$0		$0
Vegetation Maintenance	annually	$ 500.00		$0		$0		$0
Equipment Maintenance/Repair	annually	$ 4,635.00		$0		$0		$0
Jetting of Injection Wells/ Well Maintenance	annually	$ 5,000.00		$0		$0		$0
Sludge Basin cleanout, paint and media replacement	each	$ 7,000.00		$0		$0		$0
Subtotals				**$20,395**		**$31,325**		**$124,340**
Task Sub-Totals				**$54,627**		**$43,079**		**$191,922**

ARCADIS
Infrastructure, environment, buildings

17-Mar-16

COSTS:		Rates	CATS Optimization Assessment		CATS Operation		Groundwater Moniotring	
			Units/Hrs	Cost	Units/Hrs	Cost	Units/Hrs	Cost
LABOR COSTS								
Program Manager		$ 333.54	1	$267	6	$2,001	1	$300
Senior Project Manager		$ 192.96	4	$849	31	$6,059	5	$888
Task Manager		$ 151.52	11	$1,682	80	$12,106	12	$1,758
Senior Expert		$ 326.64	7	$2,286	5	$1,699	0	$0
Project Advisor		$ 238.42	6	$1,431	0	$0	0	$0
Principal Sci/Eng/Arch/Designer		$ 194.30	28	$5,441	13	$2,526	0	$0
Senior Sci/Eng/Arch/Designer		$ 151.42	28	$4,240	52	$7,874	12	$1,817
Project Sci/Eng/Arch/Designer		$ 120.80	47	$5,678	104	$12,563	24	$2,899
Staff Sci/Eng/Arch/Designer		$ 104.69	67	$7,026	0	$0	48	$5,025
Sci/Eng/Arch/Designer 2		$ 93.47	0	$0	0	$0	0	$0
Technician III		$ 94.15	0	$0	1880	$177,003	208	$19,583
Technician I		$ 56.96	0	$0	0	$0	0	$0
CADD/Drafter II		$ 72.58	19	$1,387	0	$0	0	$0
Project Assistant		$ 79.65	8	$611	1	$80	0	$0
Subtotals			**226**	**$30,896**	**2173**	**$221,910**	**309**	**$32,270**
OTHER DIRECT COSTS								
Truck/car rental per day	day	$50	0	$0	0	$0	26	$1,300
Lodging	day/person	$150.00	0	$0	0	$0	0	$0
Meals (day work)	day/person	$25	0	$0	0	$0	0	$0
Decon area setup/supplies	day	$25	0	$0	0	$0	6	$150
Level D PPE	day/person	$15	0	$0	260	$3,900	32	$480
Miscellaneous (photographs, gas, tolls, supplies, etc.)	day	$20	0	$0	0	$0	0	$0
Copies	each	$0	225	$34	0	$0	0	$0
Shipping (Coolers)	each	$100	0	$0	0	$0	23	$2,300
Shipping (Reports)	each	$25	9	$225	0	$0	0	$0
Communications	day	$2	0	$0	0	$0	0	$0
200 micron Bag filter	each	$35	0	$0	126	$4,410	0	$0
25 micron bag filter	each	$45	0	$0	72	$3,240	0	$0
3 micron cartridge	each	$40	0	$0	288	$11,520	0	$0
Monthly Utilities (phone, telemetry , water, sewer etc)	month	$1,100.00	0	$0	12	$13,200	0	$0
Utilities - Electrical	month	$5,400	0	$0	12	$64,800	0	$0
Miscellanous Items (Fire extinguisher service, PLC softwa	annually	$1,915	0	$0	1	$1,915	0	$0
ADEM RCRA Permit Fees	ea	$1	0	$0	0	$0	0	$0
ADEM UIC Permit Fees	ea	$1	0	$0	0	$0	0	$0
Subtotals				**$259**		**$102,985**		**$4,230**
SUBCONTRACTOR EXPENSES								
VOCs (8260B)	each	$ 46.00		$0		$3,312		$5,152
BTEX/MtBE (8021)	each	$ 45.00		$0		$0		$1,260
TAL Metals (23), including Mercury and digestion (6010)	each	$ 80.00		$0		$4,800		$0
Sulfide, total	each	$ 33.00		$0		$0		$924
Total Organic Carbon (TOC)-single analysis	each	$ 21.00		$0		$0		$588
Full waste characterization	each	$ 613.00		$0		$0		$0
EPA TO-15 Full Scan	each	$ 115.00		$0		$0		$0
Light hydrocarbons (methane, ethane, ethene)	each	$ 48.00		$0		$0		$1,344
Well Abandonment Mob	each	$ 2,000.00		$0		$0		$0
2" Well Abandonment	lf	$ 15.00		$0		$0		$0
Drum rate (soil or liquid, 55-gallon incl. drum purchase)	each	$ 195.00		$0		$7,020		$0
Transportation (200 miles up to 14 drums) , non-haz	each load	$ 450.00		$0		$1,350		$0
Utility location	day	$ 1,880.00		$0		$0		$0
Granular Activated Carbon Changeout	lb	$ 2.00		$0		$20,000		$0
Pilot Test Extraction Trailer	week	$ 2,000.00		$0		$0		$0
Metals - Al, Ar, Br, Cr, Fe, Pb, Mn	each	$ 57.19		$0		$0		$6,119
Hollow stem auger mobilization (equipment, decon pad co	each	$ 5,000.00		$0		$0		$0
6 inch bore hole in residuum using HAS	LF	$ 18.00		$0		$0		$0
2" well materials PVC	foot	$ 7.70		$0		$0		$0
EHC-G	lb	$ 1.85		$0		$0		$0
EHC-G Delivery	each	$ 2,650.00		$0		$0		$0
Water transport	per/1000 gallons	$ 15.00		$0		$0		$0
30,000 ball Air Stripper changout low density	ea	$ 22,575.00		$0		$22,575		$0
Refurbish Pump	ea	$ 4,300.00		$0		$4,300		$0
Dinoseb	ea	$ 125.00		$0		$0		$3,625
Well Packer Installation (RW-4)	lump	$ 15,000.00		$15,000		$0		$0
Maintenance and Replacement Parts (4% EQ)	%	4%		$0		$9,000		$0
Vironex Mob/Demob	each	$ 5,500.00		$0		$0		$0
Hand auger clearing	each	$ 50.00		$0		$0		$0
Day Rate	day	$ 6,000.00		$0		$0		$0
Decontamination, drums, etc	lump	$ 2,500.00		$0		$0		$0
Injection Reporting	lump	$ 2,500.00		$0		$0		$0
Per Diem, per man	day	$ 230.00		$0		$0		$0
Daily rate for a 2-man cre with a track mounted	day	$ 1,525.00		$0		$0		$0
55 gall drum filled and staged	drum	$ 60.00		$0		$0		$0
Decontamination	week	$ 475.00		$0		$0		$0
Hollow stem auger mobilization (equipment, decon pad co	each	$ 3,500.00		$0		$0		$0
2 inch monitor well install	LF	$ 25.00		$0		$0		$0
Miscellaneous Laboratory Analysis	ea	$ 1.00		$5,000		$0		$0
Mobilization/ Demobilization	each	$ 1,800.00		$0		$1,800		$0
Recovery Well Pump Removal/Setting	each	$ 7,200.00		$0		$7,200		$0
Vegetation Maintenance	annually	$ 500.00		$0		$500		$0
Equipment Maintenance/Repair	annually	$ 4,635.00		$0		$4,635		$0
Jetting of Injection Wells/ Well Maintenance	annually	$ 5,000.00		$0		$5,000		$0
Sludge Basin cleanout, paint and media replacement	each	$ 7,000.00		$0		$7,000		$0
Subtotals				**$20,000**		**$98,492**		**$19,012**
Task Sub-Totals				**$51,155**		**$423,387**		**$55,512**

ARCADIS
Infrastructure, environment, buildings

17-Mar-16

COSTS:		Rates	Permit Compliance Units/Hrs	Permit Compliance Cost	Reporting Units/Hrs	Reporting Cost	TOTAL UNITS/HRS	TOTAL COST
LABOR COSTS								
Program Manager		$ 333.54	2	$534	2	$667	17	$5,570
Senior Project Manager		$ 192.96	9	$1,640	10	$1,988	91	$17,463
Task Manager		$ 151.52	22	$3,303	26	$3,970	220	$33,349
Senior Expert		$ 326.64	0	$0	22	$7,186	55	$18,030
Project Advisor		$ 238.42	0	$0	16	$3,815	32	$7,630
Principal Sci/Eng/Arch/Designer		$ 194.30	0	$0	38	$7,384	107	$20,791
Senior Sci/Eng/Arch/Designer		$ 151.42	6	$833	64	$9,691	287	$43,382
Project Sci/Eng/Arch/Designer		$ 120.80	22	$2,658	102	$12,322	503	$60,762
Staff Sci/Eng/Arch/Designer		$ 104.69	0	$0	187	$19,589	693	$72,586
Sci/Eng/Arch/Designer 2		$ 93.47	44	$4,113	0	$0	264	$24,677
Technician III		$ 94.15	0	$0	0	$0	2519	$237,165
Technician I		$ 56.96	832	$47,388	0	$0	1026	$58,438
CADD/Drafter II		$ 72.58	0	$0	67	$4,871	117	$8,516
Project Assistant		$ 79.65	3	$239	16	$1,248	45	$3,584
Subtotals			**938**	**$60,707**	**550**	**$72,729**	**5976**	**$611,942**
OTHER DIRECT COSTS								
Truck/car rental per day	day	$50	52	$2,600	0	$0	144	$7,200
Lodging	day/person	$150.00	0	$0	0	$0	12	$1,800
Meals (day work)	day/person	$25	0	$0	0	$0	71	$1,775
Decon area setup/supplies	day	$25	0	$0	0	$0	12	$300
Level D PPE	day/person	$15	104	$1,560	0	$0	473	$7,095
Miscellaneous (photographs, gas, tolls, supplies, etc.)	day	$20	52	$1,040	0	$0	112	$2,240
Copies	each	$0	0	$0	225	$34	675	$101
Shipping (Coolers)	each	$100	0	$0	0	$0	56	$5,600
Shipping (Reports)	each	$25	0	$0	9	$225	27	$675
Communications	day	$2	0	$0	0	$0	22	$44
200 micron Bag filter	each	$35	0	$0	0	$0	126	$4,410
25 micron bag filter	each	$45	0	$0	0	$0	72	$3,240
3 micron cartridge	each	$40	0	$0	0	$0	288	$11,520
Monthly Utilities (phone, telemetry , water, sewer etc)	month	$1,100.00	0	$0	0	$0	12	$13,200
Utilities - Electrical	month	$5,400	0	$0	0	$0	12	$64,800
Miscellanous Items (Fire extinguisher service, PLC softwa	annually	$1,915	0	$0	0	$0	1	$1,915
ADEM RCRA Permit Fees	ea	$1	0	$0	0	$0	29000	$29,000
ADEM UIC Permit Fees	ea	$1	0	$0	0	$0	22000	$22,000
Subtotals				**$5,200**		**$259**		**$176,915**
SUBCONTRACTOR EXPENSES								
VOCs (8260B)	each	$ 46.00		$0		$0	0	$22,310
BTEX/MtBE (8021)	each	$ 45.00		$0		$0	0	$1,260
TAL Metals (23), including Mercury and digestion (6010)	each	$ 80.00		$0		$0	0	$12,000
Sulfide, total	each	$ 33.00		$0		$0	0	$1,419
Total Organic Carbon (TOC)-single analysis	each	$ 21.00		$0		$0	0	$903
Full waste characterization	each	$ 613.00		$0		$0	0	$6,743
EPA TO-15 Full Scan	each	$ 115.00		$0		$0	0	$1,840
Light hydrocarbons (methane, ethane, ethene)	each	$ 48.00		$0		$0	0	$2,064
Well Abandonment Mob	each	$ 2,000.00		$0		$0	0	$2,000
2" Well Abandonment	lf	$ 15.00		$0		$0	0	$29,325
Drum rate (soil or liquid, 55-gallon incl. drum purchase)	each	$ 195.00		$0		$0	0	$25,545
Transportation (200 miles up to 14 drums) , non-haz	each load	$ 450.00		$0		$0	0	$5,400
Utility location	day	$ 1,880.00		$0		$0	0	$5,640
Granular Activated Carbon Changeout	lb	$ 2.00		$0		$0	0	$20,000
Pilot Test Extraction Trailer	week	$ 2,000.00		$0		$0	0	$2,000
Metals - Al, Ar, Br, Cr, Fe, Pb, Mn	each	$ 57.19		$0		$0	0	$6,119
Hollow stem auger mobilization (equipment, decon pad co	each	$ 5,000.00		$0		$0	0	$5,000
6 inch bore hole in residuum using HAS	LF	$ 18.00		$0		$0	0	$3,960
2" well materials PVC	foot	$ 7.70		$0		$0	0	$1,694
EHC-G	lb	$ 1.85		$0		$0	0	$64,731
EHC-G Delivery	each	$ 2,650.00		$0		$0	0	$2,650
Water transport	per/1000 gallons	$ 15.00		$0		$0	0	$210
30,000 ball Air Stripper changout low density	ea	$ 22,575.00		$0		$0	0	$22,575
Refurbish Pump	ea	$ 4,300.00		$0		$0	0	$4,300
Dinoseb	ea	$ 125.00		$0		$0	0	$3,625
Well Packer Installation (RW-4)	lump	$ 15,000.00		$0		$0	0	$15,000
Maintenance and Replacement Parts (4% EQ)	%	4%		$0		$0	0	$9,000
Vironex Mob/Demob	each	$ 5,500.00		$0		$0	0	$5,500
Hand auger clearing	each	$ 50.00		$0		$0	0	$750
Day Rate	day	$ 6,000.00		$0		$0	0	$42,000
Decontamination, drums, etc	lump	$ 2,500.00		$0		$0	0	$2,500
Injection Reporting	lump	$ 2,500.00		$0		$0	0	$2,500
Per Diem, per man	day	$ 230.00		$0		$0	0	$6,900
Daily rate for a 2-man cre with a track mounted	day	$ 1,525.00		$0		$0	0	$22,875
55 gall drum filled and staged	drum	$ 60.00		$0		$0	0	$4,740
Decontamination	week	$ 475.00		$0		$0	0	$3,800
Hollow stem auger mobilization (equipment, decon pad co	each	$ 3,500.00		$0		$0	0	$10,500
2 inch monitor well install	LF	$ 25.00		$0		$0	0	$26,250
Miscellaneous Laboratory Analysis	ea	$ 1.00		$0		$0	0	$5,000
Mobilization/ Demobilization	each	$ 1,800.00		$0		$0	0	$1,800
Recovery Well Pump Removal/Setting	each	$ 7,200.00		$0		$0	0	$7,200
Vegetation Maintenance	annually	$ 500.00		$0		$0	0	$500
Equipment Maintenance/Repair	annually	$ 4,635.00		$0		$0	0	$4,635
Jetting of Injection Wells/ Well Maintenance	annually	$ 5,000.00		$0		$0	0	$5,000
Sludge Basin cleanout, paint and media replacement	each	$ 7,000.00		$0		$0	0	$7,000
Subtotals				**$0**		**$0**		**$436,763**
Task Sub-Totals				**$65,907**		**$72,988**		
							SUBTOTAL COST	**$1,225,620**
							TOTAL COST	**$1,225,620**

		Incremental Cost	Extended Cost
UIC Permit Modification		**$93,009**	**$93,009**
Negotiation, Drafting and Agency Coordination	Module Tot	$93,009	$93,009

Task Repetitions Calculator:	
Year 1	1.00
Year 2	
Year 3	
Year 4	
Year 5	
Year 6	
Year 7	
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Year 21	
Year 22	
Year 23	
Year 24	
Year 25	
Year 26	
Year 27	
Year 28	
Year 29	
Year 30	
Total Reps:	1.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Negotiations & Design			**Project Management**	10% Labor		
Senior Expert	12	hrs	**Program Manager**	1.1	hrs	#
Project Advisor	8	hrs	**Senior Project Manager**	5.9	hrs	#
Principal	12	hrs	**Project Manager**	0	hrs	
Senior	16	hrs	**Task Manager**	15	hrs	#
Project	30	hrs				#
Staff	40	hrs				
Drafting	16	hrs				
PA	6	hrs				
UIC Paperwork			**Subcontracting**			
Senior Expert	1	hrs				
Project Advisor	1	hrs				
Principal	8	hrs				
Senior	16	hrs				
Project	20	hrs				
Staff	40	hrs				
Drafting	8	hrs				
PA	3	hrs				
Agency Coordination			**Expenses**			
Senior Expert	2	hrs	**ADEM RCRA Permit Fees**	$ 29,000		
Project Advisor	1	hrs	**ADEM UIC Permit Fees**	$ 22,000		
Principal	8	hrs				
Senior	4	hrs				
Project	12	hrs				
Staff	7	hrs				
Drafting	7	hrs				
PA	3	hrs				

Subtotal: 281

9 Number of Paper Copies 25 Pages per Copy

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Expert	hour	$326.64	15		$4,900		$4,900
Project Advisor	hour	$238.42	10		$2,384		$2,384
Principal Sci/Eng/Arch/Designer	hour	$194.30	28		$5,441		$5,441
Senior Sci/Eng/Arch/Designer	hour	$151.42	36		$5,451		$5,451
Project Sci/Eng/Arch/Designer	hour	$120.80	62		$7,490		$7,490
Staff Sci/Eng/Arch/Designer	hour	$104.69	87		$9,120		$9,120
CADD/Drafter II	hour	$72.58	31		$2,258		$2,258
Project Assistant	hour	$79.65	12		$929		$929
	hour						
Program Manager	hour	$333.54	1		$367		$367
Senior Project Manager	hour	$192.96	6		$1,138		$1,138
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	15		$2,273		$2,273
	hour						
	hour						
				Subtotal:	$41,750		

tors

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
				Subtotal:	$0		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
ADEM RCRA Permit Fees	ea	1.00	$ 29,000		$29,000		$29,000
ADEM UIC Permit Fees	ea	1.00	$ 22,000		$22,000		$22,000
Copies	each	$0.15	225		$34		$34
Shipping (Reports)	each	$25.00	9		$225		$225
				Subtotal:	$51,259		

		Incremental Cost	Extended Cost
ZVI Fracturing Pilot		**$151,987**	**$151,987**
EHC Direct Push Injection	Module Total:	$151,987	$151,987

Design/Execution Assumptions

Injection Events	1	
# of injection points	15	
Treatment area	10,603	sq. ft
Treatment Thickness	15	ft
Interval thickness	4	ft
ROI	15	ft
Nm	0.046	
V	973	gal
Total soil volume	159,043	CF
Soil density	110	LB/CF
Total target soil weight	17,494,744	LB
EHC demand	0.2%	lb EHC/lb soil
safety factor	0	
EHC demand	34989	lb
Per point	2333	lb
Per interval	583	lb
EHC density	44	lb/cf
	5.9	lb/gal
EHC Injection Loading	30%	by weight slurry
Intervals/Pt	4	
Total points	15	
Total EHC per interval	99	gallons
Total water per interval	231	gallons
Total slurry volume per interval	330	gallons
Total water volume	13,879	gallons
Total slurry volume	19,827	gal
Total EHC (crosscheck)	34,989	lb
Injection Rate	5	GPM
Points at once	1	
Injection time:	66	mins/interval
Injection time per day	10	hrs
Field Staff	2	

2	wks prep/coord	
12	hrs/day	

PREP TIME

1	Senior Expert	2	hrs/wk
1	Project Engineer/Geologist	10	hrs/wk
1	Engineer/Geologist I	10	hrs/wk
1	Field Technician	10	hrs/wk
1	Project Assistant	0	hrs/wk
1	Clerical/Word Processing	0	hrs/wk

Field Oversight

1	Senior Expert	1	hrs/wk
1	Project Engineer/Geologist	10	hrs/wk
1	Engineer/Geologist I	10	hrs/wk
1	Field Technician	10	hrs/wk
1	Project Assistant	1.5	hrs/wk
1	Clerical/Word Processing	0	hrs/wk

Project Management 10% Labor

1	Program Manager	0.8	hrs/wk	#
1	Senior Project Manager	4	hrs/wk	#
1	Project Manager	0	hrs/wk	
1	Task Manager	10.2	hrs/wk	#

264	mins/pt
7.0	days/event

Task Repetitions Calculator:

Year 1	1.00
Year 2	
Year 3	
Year 4	
Year 5	
Year 6	
Year 7	
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Total Reps:	1.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Expert	hour	$326.64	6		$1,960		$1,960
Project Sci/Eng/Arch/Designer	hour	$120.80	40		$4,832		$4,832
Sci/Eng/Arch/Designer 2	hour	$93.47	124		$11,591		$11,591
Technician I	hour	$56.96	124		$7,063		$7,063
Project Assistant	hour	$79.65	3		$239		$239
Clerical / Secretarial	hour	$67.37	0		$0		
Program Manager	hour	$333.54	0.8		$267		$267
Senior Project Manager	hour	$192.96	4		$772		$772
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	10.2		$1,545		$1,545
				Subtotal:	$28,268		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
EHC-G	lb	$1.85	34989		$64,731		$64,731
EHC-G Delivery	each	$2,650.00	1		$2,650		$2,650
Water transport	per/1000 gallon	$15.00	14		$210		$210
Vironex Mob/Demob	each	$5,500.00	1		$5,500		$5,500
Hand auger clearing	each	$50.00	15		$750		$750
Day Rate	day	$6,000.00	7.0		$42,000		$42,000
Decontamination, drums, etc	lump	$2,500.00	1		$2,500		$2,500
Injection Reporting	lump	$2,500.00	1		$2,500		$2,500
				Subtotal:	$120,841		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Truck/car rental per day	day	$50.00	7		$350		$350
Level D PPE	day/person	$15.00	14		$210		$210
Miscellaneous (photographs, gas, tolls, supp	day	$20.00	7		$140		$140
Meals (day work)	day/person	$25.00	14		$350		$350
Lodging	day/person	$150.00	12		$1,800		$1,800
Communications	day	$2.00	14		$28		$28
				Subtotal:	$2,878		

										Incremental Cost		Extended Cost
Pilot Monitoring										**$7,349**		**$22,047**
Monitoring Well Sampling									Module Total:	$7,349		$22,047
Analyses	Enter"Y" if analysis desired											
VOCs	Y											
SVOCs												
Metals					Assumes 1 event							
Dissolved CO2					**Change # of Events in Task Repetitions**							
Chlorides					Number of Wells	4						
Cations									10	Purge volume/well (gal)		
MEE	Y				Sampling Rate	3	hrs/well					
Nitrate/Nitrite					Total time per event	12	hrs		2	days		
Sulfate/Sulfide	Y				Number of technicians	1						
TOC	Y				Man-hrs per event	20	hrs		10	hrs/day		
Divalent Manganese												
Dissolved Hydrogen		1			wks prep/coord	1	Senior		5	hrs/wk		
Dehalococcoides so						1	project eng		12	hrs/wk		
						1	Staff eng		6	hrs/wk		
						1	technician		10	hrs/wk		
						1	day					
Field Kits	Enter"Y" if analysis desired											
Alkalinity												
Iron II (Fe 2+)	Y											
	Enter"Y" if analysis desired				Total Purge Volume Generated per event	40	gal					
						55	gal/drum					
Including field/trip blanks and/or MS/DS												
					Waste Management							
Processed through syste	Yes					1	drums					
Project Management	10%	of labor			Total drums for disposal	0	Haz percentage		0%			
					Total haz drums for disposal	0	Non-haz percentag		100%			
Program Manager	0.2				Haz T&D loads	0						
Senior Project Manager	0.9				Total non-haz drums for disposal	0						
Project Manager					Non-haz T&D loads	0						
Task Manager	2.2				Characterization samples	0						

Task Repetitions Calculator:	
Year 1	2.00
Year 2	1.00
Year 3	
Year 4	
Year 5	
Year 6	
Year 7	
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Total Reps:	3.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Sci/Eng/Arch/Designer	hour	$151.42	5		$757		$2,271
Project Sci/Eng/Arch/Designer	hour	$120.80	12		$1,450		$4,349
Staff Sci/Eng/Arch/Designer	hour	$104.69	6		$628		$1,884
Technician III	hour	$94.15	30		$2,825		$8,474
Program Manager	hour	$333.54	0.2		$67		$200
Senior Project Manager	hour	$192.96	0.9		$174		$521
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	2.2		$333		$1,000
	hour						
				Subtotal:	$6,233		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Drum Disposal							
Drum rate (soil or liquid, 55-gallon incl. drum purcha	each	$195.00	0		$0		
Transportation (200 miles up to 14 drums) , non-haz	each load	$450.00	0		$0		
55-gallon drum (soil or liquid, 55-gallon), haz	each	$0.00	0		$0		
Transportation (200 miles up to 14 drums), haz	each load	$0.00	0		$0		
Laboratory							
VOCs (8260B)	each	$46.00	6		$276		$828
SVOCs -Bis only	each	$71.49	0		$0		
Metals - Al, Ar, Br, Cr, Fe, Pb, Mn	each	$57.19	0		$0		
Permanent Gases (CO2, N2, O2)	each	$0.00	0		$0		
Chloride by IC	each	$0.00	0		$0		
Cations	each	$45.96	0		$0		
Light hydrocarbons (methane, ethane, ethene)	each	$48.00	5		$240		$720
Nitrate+Nitrite	each	$0.00	0		$0		
Sulfide, total	each	$33.00	5		$165		$495
Total Organic Carbon (TOC)-single analysis	each	$21.00	5		$105		$315
Divalent manganese	each	$0.00	0		$0		
Dissolved Hydrogen	each	$142.98	0		$0		
Dehalococcoides	each	$326.80	0		$0		
			0				
			0				
			0				
				Subtotal:	$786		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
PID per day	day	$0.00	0		$0	**Own**	
Interface probe IP-150' Solinist per day	day	$0.00	0		$0	**Own**	
Truck/car rental per day	day	$50.00	2		$100		$300
Level D PPE	day/person	$15.00	2		$30		$90
Miscellaneous (photographs, gas, tolls, supplies, etc	day	$20.00	0		$0		
Meals (day work)	day/person	$25.00	0		$0		
Shipping (Coolers)	each	$100.00	2		$200		$600
GPS Unit Garmine e Trex Vista	each	$0.00	0		$0		
Decon area setup/supplies	day	$25.00	0		$0	**Own**	
Submersible pump w/ control box per day	day	$0.00	2		$0	**Own**	$0
Horiba U-52 with flow-through cell per day	day	$0.00	2		$0	**Own**	$0
Generator per day	day	$0.00	2		$0	**Own**	$0
Bailer (24 per box)	each	$3.47	0		$0		
				Subtotal:	$330		

Sheet Total: **$55,002**

	Incremental Cost	Extended Cost
AS/SVE Pilot Test Well Installation	**$24,714**	**$24,714**
Module Total:	$24,714	$24,714

Enter"Y" if analysis desired

Analysis	Y
VOCs	Y
SVOCs	
PAHs	
Pesticides	
PCBs	
GRO	
DRO	
Oil/Grease	
TRPH	
Perchlorate	
Metals	Y
Mercury	
Hex Chrom	
Anions	

Including field/trip blanks and/or MS/DS

Number of sampling locations	5		6	inch borehole
Depth of borings	44	ft	220	LF
Production rate - hrs/ location	4			
Total time per event	20	hrs	3	days
Number of geologists	1			
Man-hrs per event	30	hrs	10	hrs/day
1 wks prep/coord	1	Senior	5	hrs/wk
	1	project eng	12	hrs/wk
	1	Staff eng	6	hrs/wk
	1	technician	10	hrs/wk
Samples / location	2		1	soil sample/ location
Total samples	10		1	water sample/ location

Number	Depth	
2	35	Shallow AS wells
2	65	Deep AS wells
1	20	SVE Well

Assume :

Cuttings/Solid Waste Generation	43	ft3	0.20	ft3/ft drilling (link to borehole di
	2	CY	202	gal/CY
	3	tons	55	gal/drum
	404	gal	1.4	ton/CY
	8	drums		

Assumes % of drums for ch 10%

Project Management	10% of labor	Total drums for disposal	8	Haz percentage	0%
		Total haz drums for disposal	0	Non-haz percentage	100%
Program Manager	0.2	Haz T&D loads	0		
Senior Project Manager	1	Total non-haz drums for disposal	8		
Project Manager		Non-haz T&D loads	1		
Task Manager	2.6	Characterization samples	1		

Task Repetitions Calculator:	
Year 1	1.00
Year 2	
Year 3	
Year 4	
Year 5	
Year 6	
Year 7	
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Total Reps:	1.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	Extended
Senior Sci/Eng/Arch/Designer	hour	$151.42	5		$757		$757
Project Sci/Eng/Arch/Designer	hour	$120.80	12		$1,450		$1,450
Staff Sci/Eng/Arch/Designer	hour	$104.69	6		$628		$628
Technician III	hour	$94.15	40		$3,766		$3,766
Program Manager	hour	$333.54	0.2		$67		$67
Senior Project Manager	hour	$192.96	1.0		$193		$193
Project Manager	hour	$167.99	0.0		$0		
Task Manager	hour	$151.52	2.6		$394		$394
				Subtotal:	$7,254		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	Extended
Utility location	day	$1,880.00	1		$1,880		$1,880
Hollow stem auger mobilization (equipment, de	each	$5,000.00	1		$5,000		$5,000
6 inch bore hole in residuum using HAS	LF	$18.00	220		$3,960		$3,960
2" well materials PVC	foot	$7.70	220		$1,694		$1,694
Permits	each well	$0.00	5		$0	**Per Contractor**	$0
Monitoring Well Flush Mount 2 inch	each	$75.00	5		$375		
Full waste characterization	each	$613.00	1		$613		$613
Drum rate (soil or liquid, 55-gallon incl. drum p	each	$195.00	8		$1,560		$1,560
Transportation (200 miles up to 14 drums) , no	each load	$450.00	1		$450		$450
55-gallon drum (soil or liquid, 55-gallon), haz	each	$0.00	0		$0		
Transportation (200 miles up to 14 drums), haz	each load	$0.00	0		$0		
VOCs (8260B)	each	$46.00	13		$598		$598
SVOCs (8270C/D)	each	$115.00	0		$0		
PAHs (8270D)	each	$72.00	0		$0		
Organochlorine Pesticides (8081)	each	$105.00	0		$0		
PCBs (8082)	each	$48.00	0		$0		
GRO (8015)	each	$38.00	0		$0		
DRO (8015)	each	$40.00	0		$0		
Oil and Grease (Water, 1664)	each	$0.00	0		$0		
TRPH (Water, 1664)	each	$0.00	0		$0		
Perchlorate, Soil (EPA 314.0M)	each	$95.00	0		$0		
TAL Metals (23), including Mercury and digest	each	$80.00	10		$800		$800
Mercury (Soil or water)	each	$18.00	0		$0		
Hexavalent chromium (Water, 7196)	each	$0.00	0		$0		
Anions (Br, Cl, F, PO4, SO4, NO3, NO2)	each	$24.00	0		$0		
				Subtotal:	$16,930		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	Extended
PID per day	day	$0.00	3		$0	**Own**	$0
Interface probe IP-150' Solinist per day	day	$0.00	3		$0	**Own**	$0
Truck/car rental per day	day	$50.00	3		$150		$150
Level D PPE	day/person	$15.00	3		$45		$45
Miscellaneous (photographs, gas, tolls, supplie	day	$20.00	3		$60		$60
Meals (day work)	day/person	$25.00	3		$75		$75
Shipping (Coolers)	each	$100.00	2		$200		$200
GPS Unit Garmine e Trex Vista	each	$0.00	1		$0	**Own**	$0
				Subtotal:	$530		

AS/SVE Pilot Test					$30,287		$30,287
AS/SVE Pilot Test				Module Total:	$30,287		$30,287

Assume costs for pilot test well install is included in construction costs.
1 day field setup
3 day test
4 air samples per day
Assume short term testing doesn't require GAC treatment

Days	4	days	
Hours per day	10	hrs	
Number of technicians	2		
Man-hrs	80	hrs	4 days

			PREP TIME		
4	wk prep/coord	1	Project Manager	1	hrs/mo
		1	Senior Engineer/Geologist	12	hrs/mo
Project Management	10% Labor	1	Project Engineer/Geologist	4	hrs/mo
Program Manager	0.7 hrs/wk	1	Engineer/Geologist I	6	hrs/mo
Senior Project Manager	3.6 hrs/wk	1	Field Technician	6	hrs/mo
Project Manager	0 hrs/wk	1	Project Assistant	0	hrs/mo
Task Manager	9.2 hrs/wk				
			Field Oversight		
1 wk		1	Project Manager	0	hrs/wk
		1	Senior Engineer/Geologist	8	hrs/wk
		1	Project Engineer/Geologist	10	hrs/wk
		1	Engineer/Geologist I	8	hrs/wk
		1	Field Technician	6	hrs/wk
		1	Project Assistant	0	hrs/wk

Task Repetitions Calculator:	
Year 1	1.00
Year 2	
Year 3	
Year 4	
Year 5	
Year 6	
Year 7	
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Total Reps:	1.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Project Manager	hour	$192.96	4		$772		$772
Senior Sci/Eng/Arch/Designer	hour	$151.42	56		$8,480		$8,480
Project Sci/Eng/Arch/Designer	hour	$120.80	26		$3,141		$3,141
Sci/Eng/Arch/Designer 2	hour	$93.47	72		$6,730		$6,730
Technician I	hour	$56.96	70		$3,987		$3,987
Project Assistant	hour	$79.65	0		$0		
Program Manager	hour	$333.54	1		$233		$233
Senior Project Manager	hour	$192.96	4		$695		$695
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	9		$1,394		$1,394
				Subtotal:	$25,431		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Pilot Test Extraction Trailer	week	$2,000.00	1		$2,000		$2,000
EPA TO-15 Full Scan	each	$115.00	16		$1,840		$1,840
				Subtotal:	$3,840		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
PID per day	day	$0.00	4		$0	Own	$0
Truck/car rental per day	day	$50.00	4		$200		$200
Level D PPE	day/person	$15.00	8		$120		$120
Interface probe IP-150' Solinist per day	day	$0.00	4		$0	Own	$0
Meals (day work)	day/person	$25.00	8		$200		$200
Miscellaneous (photographs, gas, tolls, supplie	day	$20.00	4		$80		$80
Shipping (Coolers)	each	$100.00	4		$400		$400
Communications	day	$2.00	8		$16		$16
				Subtotal:	$1,016		

	Incremental Cost	Extended Cost
Well Abandonment	**$43,079**	**$43,079**
Well Abandonment Module Total:	$43,079	$43,079

Design/Execution Assumptions

	23	2" wells
	0	4" wells
Number of wells to be abandoned during year x		
Total man hrs in the field to oversight	23	Total wells
Total man hrs onsite observation for well abandonment	60	hrs
	10	hr/day
	1,955	Total linear footage (feet):
2" Wells AvgDepth (ft): 85	1955	feet
	0	feet
4" Wells AvgDepth (ft): 0	0	feet
	0	feet
Well abandonment rate	4	wells/day
Number of Technicians	1	
Total days in the field for oversight	6	days

Task Repetitions Calculator:

Year 1	1.00
Year 2	
Year 3	
Year 4	
Year 5	
Year 6	
Year 7	
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Total Reps:	1.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

2 wks prep/coord

1	Senior Engineer	0	hrs/wk
1	Project Engineer/Geologist	1	hrs/wk
1	Staff Engineer	4	hrs/wk
1	Engineer/Geologist I	12	hrs/wk
1	Field Technician	4	hrs/wk
1	Project Assistant	1.5	hrs/wk

Project Management		10% Labor
Program Manager	0.3 hrs/wk	10%
Senior Project Manager	1.5 hrs/wk	30%
Project Manager	0 hrs/wk	0
Task Manager	3.9 hrs/wk	60%

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Sci/Eng/Arch/Designer	hour	$151.42	0		$0		
Project Sci/Eng/Arch/Designer	hour	$120.80	2		$242		$242
Staff Sci/Eng/Arch/Designer	hour	$104.69	8		$838		$838
Sci/Eng/Arch/Designer 2	hour	$93.47	24		$2,243		$2,243
Technician III	hour	$94.15	68		$6,402		$6,402
Project Assistant	hour	$79.65	3		$239		$239
Program Manager	hour	$333.54	0.3		$100		$100
Senior Project Manager	hour	$192.96	1.5		$289		$289
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	3.9		$591		$591
				Subtotal:	$10,944		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Well Abandonment Mob	each	$2,000.00	1		$2,000		$2,000
2" Well Abandonment	lf	$15.00	1955		$29,325		$29,325
4" Well Abandonment	lf	$20.00	0		$0		
				Subtotal:	$31,325		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Decon area setup/supplies	day	$25.00	6		$150		$150
Truck/car rental per day	day	$50.00	6		$300		$300
Water level indicator per day	day	$0.00	6		$0	Own	$0
Level D PPE	day/person	$15.00	6		$90		$90
Miscellaneous (photographs, gas, tolls, su	day	$20.00	6		$120		$120
Meals (day work)	day/person	$25.00	6		$150		$150
PID per day	day	$0.00	6		$0	Own	$0
				Subtotal:	$810		

Sheet Total: **$193,797**

								Incremental Cost		**Extended Cost**
Boundary Well Replacement								**$21,631**		**$21,631**
Monitoring Well Installation						Module Total:		$21,631		$21,631
Analyses	Enter"Y" if analysis desired							9450	Task Repetitions Calculator:	
VOCs	Y								Year 1	1.00
SVOCs									Year 2	
PAHs									Year 3	
Pesticides									Year 4	
PCBs			Number of sampling locations	4			6	inch borehole	Year 5	
GRO			Depth of borings	52.5	ft		210	LF	Year 6	
DRO			Production rate - hrs/ location	8					Year 7	
Oil/Grease			Total time per event	32	hrs		4	days	Year 8	
TRPH			Number of geologists	1					Year 9	
Perchlorate			Man-hrs per event	40	hrs		10	hrs/day	Year 10	
Metals	Y								Year 11	
Mercury		1	wks office support	1		Senior	1	hrs/wk	Year 12	
Hex Chrom				1		project eng	2	hrs/wk	Year 13	
Anions				1		Staff eng	8	hrs/wk	Year 14	
Including field/trip blanks and/or MS/DS				1		technician	4	hrs/wk	Year 15	
									Year 16	
Number Of wells	Depth		Samples / location	2					Year 17	
2	45		Total samples	8					Year 18	
2	60								Year 19	
0	90						*Assume :*		Year 20	
			Cuttings/Solid Waste Generation	41	ft3		0.20	ft3/ft drilling (link to borehole diameter)	Total Reps:	1.00
				2	CY		202	gal/CY	DO NOT INSERT ROWS INTO	
Additional time for sampling				3	tons		55	gal/drum	THE TASK REPS CALCULATOR	
VAP Sampling	0			404	gal		1.4	ton/CY		
Well Installation	32			8	drums					
VAP Drilling	0									
			Total drums for disposal	8		Haz percentage	0%			
Project Management	10% of labor		Total haz drums for disposal	0		Non-haz percentage	100%			
			Haz T&D loads	0						
Program Manager	0.2		Total non-haz drums for disposal	8		Assumes % of drums for	10%			
Senior Project Manager	0.8		Non-haz T&D loads	1		characaterization				
Project Manager			Characterization samples	1						
Task Manager	2.1									

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Sci/Eng/Arch/Designer	hour	$151.42	1		$151		$151
Project Sci/Eng/Arch/Designer	hour	$120.80	2		$242		$242
Staff Sci/Eng/Arch/Designer	hour	$104.69	8		$838		$838
Technician III	hour	$94.15	44		$4,143		$4,143
Program Manager	hour	$333.54	0.2		$67		$67
Senior Project Manager	hour	$192.96	0.8		$154		$154
Project Manager	hour	$167.99	0.0		$0		
Task Manager	hour	$151.52	2.1		$318		$318
				Subtotal:	$5,912		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Utility location	day	$1,880.00	1		$1,880		$1,880
			0				
Hollow stem auger mobilization (equipment, decon p	each	$3,500.00	1		$3,500		$3,500
2 inch monitor well install	LF	$25.00	210		$5,250		$5,250
VAP drilling	ft	$35.00	0		$0		
Water Sampling	hr	$425.00	0		$0		
55 gall drum filled and staged	drum	$60.00			$0		
Decontamination	week	$475.00	0.8		$380		$380
Monitoring Well Flush Mount 2 inch	each	$75.00	4		$300		
Full waste characterization	each	$613.00	1		$613		$613
Drum rate (soil or liquid, 55-gallon incl. drum purchas	each	$195.00	8		$1,560		$1,560
Transportation (200 miles up to 14 drums) , non-haz	each load	$450.00	1		$450		$450
55-gallon drum (soil or liquid, 55-gallon), haz	each	$0.00	0		$0		
Transportation (200 miles up to 14 drums), haz	each load	$0.00	0		$0		
VOCs (8260B)	each	$46.00	11		$506		$506
SVOCs (8270C/D)	each	$115.00	0		$0		
PAHs (8270D)	each	$72.00	0		$0		
Organochlorine Pesticides (8081)	each	$105.00	0		$0		
PCBs (8082)	each	$48.00	0		$0		
GRO (8015)	each	$38.00	0		$0		
DRO (8015)	each	$40.00	0		$0		
Oil and Grease (Water, 1664)	each	$0.00	0		$0		
TRPH (Water, 1664)	each	$0.00	0		$0		
Perchlorate, Soil (EPA 314.0M)	each	$95.00	0		$0		
TAL Metals (23), including Mercury and digestion (60	each	$80.00	8		$640		$640
Mercury (Soil or water)	each	$18.00	0		$0		
Hexavalent chromium (Water, 7196)	each	$0.00	0		$0		
Anions (Br, Cl, F, PO4, SO4, NO3, NO2)	each	$24.00	0		$0		
				Subtotal:	$15,079		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
PID per day	day	$0.00	4		$0		$0
Interface probe IP-150' Solinist per day	day	$0.00	4		$0		$0
Truck/car rental per day	day	$50.00	4		$200		$200
Level D PPE	day/person	$15.00	4		$60		$60
Miscellaneous (photographs, gas, tolls, supplies, etc	day	$20.00	4		$80		$80
Meals (day work)	day/person	$25.00	4		$100		$100
Shipping (Coolers)	each	$100.00	2		$200		$200
GPS Unit Garmine e Trex Vista	each	$0.00	1		$0		$0
				Subtotal:	$640		

VAP Sampling — **$86,491** — **$86,491**

Monitoring Well Installation — Module Total: $86,491 — $86,491

Analyses	Enter"Y" if analysis desired
VOCs	Y
SVOCs	
PAHs	
Pesticides	
PCBs	
GRO	
DRO	
Oil/Grease	
TRPH	
Perchlorate	
Metals	
Mercury	
Hex Chrom	
Anions	

Including field/trip blanks and/or MS/DS

Number Of wells	Depth
2	90
2	90
2	90

Field Activity	hrs	days
VAP Sampling	0	
Well Installation	0	
VAP Drilling	120	15
Project Management	10%	of labor
Program Manager	0.7	
Senior Project Manager	3.4	
Project Manager		
Task Manager	8.6	

Number of sampling locations	21		6	inch borehole	
Depth of borings	90	ft	1890	LF	
Production rate - hrs/ location	0				
Total time per event	120	hrs	15	days	
Number of geologists	1				
Man-hrs per event	150	hrs	10	hrs/day	
3 wks office support	1	Senior	2	hrs/wk	
	1	project eng	4	hrs/wk	
	1	Staff eng	8	hrs/wk	
	1	technician	4	hrs/wk	
Samples / location	2		3	5	# #
Total samples	162		90	9	5 8
					#
Cuttings/Solid Waste Generation	371	ft3	0.20	ft3/ft drilling (link to borehole diameter)	
	14	CY	202	gal/CY	
	20	tons	55	gal/drum	
	2828	gal	1.4	ton/CY	
	52	drums			
Total drums for disposal	52	Haz percentage	0%		
Total haz drums for disposal	0	Non-haz percentage	100%		
Haz T&D loads	0	Assumes % of drums for ch	10%		
Total non-haz drums for disposal	52				
Non-haz T&D loads	4				
Characterization samples	6				

Assume :

Task Repetitions Calculator:	
Year 1	1.00
Year 2	
Year 3	
Year 4	
Year 5	
Year 6	
Year 7	
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Total Reps:	1.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Sci/Eng/Arch/Designer	hour	$151.42	6		$909		$909
Project Sci/Eng/Arch/Designer	hour	$120.80	12		$1,450		$1,450
Staff Sci/Eng/Arch/Designer	hour	$104.69	174		$18,216		$18,216
Technician III	hour	$94.15	12		$1,130		$1,130
Program Manager	hour	$333.54	0.7		$233		$233
Senior Project Manager	hour	$192.96	3.4		$656		$656
Project Manager	hour	$167.99	0.0		$0		
Task Manager	hour	$151.52	8.6		$1,303		$1,303
				Subtotal:	$23,897		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Utility location	day	$1,880.00	1		$1,880		$1,880
Hollow stem auger mobilization (equipment, decon p	each	$3,500.00	0		$0		
Per Diem, per man	day	$230.00	30		$6,900		$6,900
Daily rate for a 2-man cre with a track mounted	day	$1,525.00	15		$22,875		$22,875
Water Sampling	hr	$425.00	0		$0		
55 gall drum filled and staged	drum	$60.00	52		$3,120		$3,120
Decontamination	week	$475.00	3		$1,425		$1,425
Monitoring Well Flush Mount 2 inch	each	$75.00	0		$0		
Full waste characterization	each	$613.00	6		$3,678		$3,678
Drum rate (soil or liquid, 55-gallon incl. drum purchas	each	$195.00	52		$10,140		$10,140
Transportation (200 miles up to 14 drums) , non-haz	each load	$450.00	4		$1,800		$1,800
55-gallon drum (soil or liquid, 55-gallon), haz	each	$0.00	0		$0		
Transportation (200 miles up to 14 drums), haz	each load	$0.00	0		$0		
VOCs (8260B)	each	$46.00	181		$8,326		$8,326
SVOCs (8270C/D)	each	$115.00	0		$0		
PAHs (8270D)	each	$72.00	0		$0		
Organochlorine Pesticides (8081)	each	$105.00	0		$0		
PCBs (8082)	each	$48.00	0		$0		
GRO (8015)	each	$38.00	0		$0		
DRO (8015)	each	$40.00	0		$0		
Oil and Grease (Water, 1664)	each	$0.00	0		$0		
TRPH (Water, 1664)	each	$0.00	0		$0		
Perchlorate, Soil (EPA 314.0M)	each	$95.00	0		$0		
TAL Metals (23), including Mercury and digestion (60	each	$80.00	0		$0		
Mercury (Soil or water)	each	$18.00	0		$0		
Hexavalent chromium (Water, 7196)	each	$0.00	0		$0		
Anions (Br, Cl, F, PO4, SO4, NO3, NO2)	each	$24.00	0		$0		
				Subtotal:	$60,144		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
PID per day	day	$0.00	15		$0		$0
Interface probe IP-150' Solinist per day	day	$0.00	15		$0		$0
Truck/car rental per day	day	$50.00	15		$750		$750
Level D PPE	day/person	$15.00	15		$225		$225
Miscellaneous (photographs, gas, tolls, supplies, etc.	day	$20.00	15		$300		$300
Meals (day work)	day/person	$25.00	15		$375		$375
Shipping (Coolers)	each	$100.00	8		$800		$800
GPS Unit Garmine e Trex Vista	each	$0.00	1		$0		$0
				Subtotal:	$2,450		

Effectiveness, POC and Background Well Replacement									$61,933		$61,933
Monitoring Well Installation							Module Total:		$61,933		$61,933
Analyses	Enter"Y" if analysis desired								28575		Task Repetitions Calculator:
VOCs	Y										Year 1 1.00
SVOCs											Year 2
PAHs											Year 3
Pesticides											Year 4
PCBs				Number of sampling locations	16			6	inch borehole		Year 5
GRO				Depth of borings	39.6875	ft		635	LF		Year 6
DRO				Production rate - hrs/ location	8						Year 7
Oil/Grease				Total time per event	128	hrs		16	days		Year 8
TRPH				Number of geologists	1						Year 9
Perchlorate				Man-hrs per event	160	hrs		10	hrs/day		Year 10
Metals	Y										Year 11
Mercury		4		wks office support	1	Senior		1	hrs/wk		Year 12
Hex Chrom					1	project eng		2	hrs/wk		Year 13
Anions					1	Staff eng		8	hrs/wk		Year 14
Including field/trip blanks and/or MS/DS					1	technician		4	hrs/wk		Year 15
											Year 16
Number Of wells	Depth			Samples / location	3						Year 17
11	35			Total samples	48						Year 18
5	50										Year 19
0	90							*Assume :*			Year 20
				Cuttings/Solid Waste Generation	125	ft3		0.20	ft3/ft drilling (link to borehole diameter)		Total Reps: 1.00
					5	CY		202	gal/CY		DO NOT INSERT ROWS INTO
					7	tons		55	gal/drum		THE TASK REPS CALCULATOR
VAP Sampling	0				1010	gal		1.4	ton/CY		
Well Installation	128				19	drums					
VAP Drilling	0										
				Total drums for disposal	19	Haz percentage		0%			
Project Management	10% of labor			Total haz drums for disposal	0	Non-haz percentage		100%			
				Haz T&D loads	0	Assumes % of drums for ch		10%			
Program Manager	0.6			Total non-haz drums for disposal	19						
Senior Project Manager	3.3			Non-haz T&D loads	2						
Project Manager				Characterization samples	2						
Task Manager	8.5										

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Sci/Eng/Arch/Designer	hour	$151.42	4		$606		$606
Project Sci/Eng/Arch/Designer	hour	$120.80	8		$966		$966
Staff Sci/Eng/Arch/Designer	hour	$104.69	32		$3,350		$3,350
Technician III	hour	$94.15	176		$16,570		$16,570
Program Manager	hour	$333.54	0.6		$200		$200
Senior Project Manager	hour	$192.96	3.3		$637		$637
Project Manager	hour	$167.99	0.0		$0		
Task Manager	hour	$151.52	8.5		$1,288		$1,288
				Subtotal:	$23,617		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Utility location	day	$1,880.00	0		$0		
Hollow stem auger mobilization (equipment, decon p	each	$3,500.00	1		$3,500		$3,500
2 inch monitor well install	LF	$25.00	635		$15,875		$15,875
VAP drilling	ft	$35.00	0		$0		
Water Sampling	hr	$425.00			$0		
55 gall drum filled and staged	drum	$60.00	19		$1,140		$1,140
Decontamination	week	$475.00	3.2		$1,520		$1,520
Monitoring Well Flush Mount 2 inch	each	$75.00	16		$1,200		
Full waste characterization	each	$613.00	2		$1,226		$1,226
Drum rate (soil or liquid, 55-gallon incl. drum purchas	each	$195.00	19		$3,705		$3,705
Transportation (200 miles up to 14 drums) , non-haz	each load	$450.00	2		$900		$900
55-gallon drum (soil or liquid, 55-gallon), haz	each	$0.00	0		$0		
Transportation (200 miles up to 14 drums), haz	each load	$0.00	0		$0		
VOCs (8260B)	each	$46.00	55		$2,530		$2,530
SVOCs (8270C/D)	each	$115.00	0		$0		
PAHs (8270D)	each	$72.00	0		$0		
Organochlorine Pesticides (8081)	each	$105.00	0		$0		
PCBs (8082)	each	$48.00	0		$0		
GRO (8015)	each	$38.00	0		$0		
DRO (8015)	each	$40.00	0		$0		
Oil and Grease (Water, 1664)	each	$0.00	0		$0		
TRPH (Water, 1664)	each	$0.00	0		$0		
Perchlorate, Soil (EPA 314.0M)	each	$95.00	0		$0		
TAL Metals (23), including Mercury and digestion (60	each	$80.00	52		$4,160		$4,160
Mercury (Soil or water)	each	$18.00	0		$0		
Hexavalent chromium (Water, 7196)	each	$0.00	0		$0		
Anions (Br, Cl, F, PO4, SO4, NO3, NO2)	each	$24.00	0		$0		
				Subtotal:	$35,756		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
PID per day	day	$0.00	16		$0		$0
Interface probe IP-150' Solinist per day	day	$0.00	16		$0		$0
Truck/car rental per day	day	$50.00	16		$800		$800
Level D PPE	day/person	$15.00	16		$240		$240
Miscellaneous (photographs, gas, tolls, supplies, etc	day	$20.00	16		$320		$320
Meals (day work)	day/person	$25.00	16		$400		$400
Shipping (Coolers)	each	$100.00	8		$800		$800
GPS Unit Garmine e Trex Vista	each	$0.00	1		$0		$0
				Subtotal:	$2,560		

Effectiveness Monitoring Well Installation								$23,741			$23,741
Monitoring Well Installation							Module Total:	$23,741			$23,741
Analyses	Enter"Y" if analysis desired							9225		Task Repetitions Calculator:	
VOCs	Y									Year 1	1.00
SVOCs										Year 2	
PAHs										Year 3	
Pesticides										Year 4	
PCBs			Number of sampling locations	5			6	inch borehole		Year 5	
GRO			Depth of borings	41	ft		205	LF		Year 6	
DRO			Production rate - hrs/ location	8						Year 7	
Oil/Grease			Total time per event	40	hrs		5	days		Year 8	
TRPH			Number of geologists	1						Year 9	
Perchlorate			Man-hrs per event	50	hrs		10	hrs/day		Year 10	
Metals	Y									Year 11	
Mercury		1	wks office support	1	Senior		2	hrs/wk		Year 12	
Hex Chrom				1	project eng		4	hrs/wk		Year 13	
Anions				1	Staff eng		8	hrs/wk		Year 14	
Including field/trip blanks and/or MS/DS				1	technician		1	hrs/wk		Year 15	
										Year 16	
Number Of wells	Depth		Samples / location	4						Year 17	
3	35		Total samples	20						Year 18	
2	50									Year 19	
0	90						*Assume :*			Year 20	
			Cuttings/Solid Waste Generation	40	ft3		0.20	ft3/ft drilling (link to borehole diameter)		Total Reps:	1.00
				2	CY		202	gal/CY		DO NOT INSERT ROWS INTO	
				3	tons		55	gal/drum		THE TASK REPS CALCULATOR	
VAP Sampling	0			404	gal		1.4	ton/CY			
Well Installation	40			8	drums						
VAP Drilling	0										
			Total drums for disposal	8	Haz percentage		0%				
Project Management	10% of labor		Total haz drums for disposal	0	Non-haz percentage		100%				
			Haz T&D loads	0	Assumes % of drums for ch		10%				
Program Manager	0.2		Total non-haz drums for disposal	8							
Senior Project Manager	1.1		Non-haz T&D loads	1							
Project Manager			Characterization samples	1							
Task Manager	2.8										

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Sci/Eng/Arch/Designer	hour	$151.42	2		$303		$303
Project Sci/Eng/Arch/Designer	hour	$120.80	4		$483		$483
Staff Sci/Eng/Arch/Designer	hour	$104.69	58		$6,072		$6,072
Technician III	hour	$94.15	1		$94		$94
Program Manager	hour	$333.54	0.2		$67		$67
Senior Project Manager	hour	$192.96	1.1		$212		$212
Project Manager	hour	$167.99	0.0		$0		
Task Manager	hour	$151.52	2.8		$424		$424
				Subtotal:	$7,655		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Utility location	day	$1,880.00	0		$0		
Hollow stem auger mobilization (equipment, decon p	each	$3,500.00	1		$3,500		$3,500
2 inch monitor well install	LF	$25.00	205		$5,125		$5,125
VAP drilling	ft	$35.00	0		$0		
Water Sampling	hr	$425.00	0		$0		
55 gall drum filled and staged	drum	$60.00	8		$480		$480
Decontamination	week	$475.00	1		$475		$475
Monitoring Well Flush Mount 2 inch	each	$75.00	5		$375		
Full waste characterization	each	$613.00	1		$613		$613
Drum rate (soil or liquid, 55-gallon incl. drum purchas	each	$195.00	8		$1,560		$1,560
Transportation (200 miles up to 14 drums) , non-haz	each load	$450.00	1		$450		$450
55-gallon drum (soil or liquid, 55-gallon), haz	each	$0.00	0		$0		
Transportation (200 miles up to 14 drums), haz	each load	$0.00	0		$0		
VOCs (8260B)	each	$46.00	23		$1,058		$1,058
SVOCs (8270C/D)	each	$115.00	0		$0		
PAHs (8270D)	each	$72.00	0		$0		
Organochlorine Pesticides (8081)	each	$105.00	0		$0		
PCBs (8082)	each	$48.00	0		$0		
GRO (8015)	each	$38.00	0		$0		
DRO (8015)	each	$40.00	0		$0		
Oil and Grease (Water, 1664)	each	$0.00	0		$0		
TRPH (Water, 1664)	each	$0.00	0		$0		
Perchlorate, Soil (EPA 314.0M)	each	$95.00	0		$0		
TAL Metals (23), including Mercury and digestion (60	each	$80.00	20		$1,600		$1,600
Mercury (Soil or water)	each	$18.00	0		$0		
Hexavalent chromium (Water, 7196)	each	$0.00	0		$0		
Anions (Br, Cl, F, PO4, SO4, NO3, NO2)	each	$24.00	0		$0		
				Subtotal:	$15,236		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
PID per day	day	$0.00	5		$0		$0
Interface probe IP-150' Solinist per day	day	$0.00	5		$0		$0
Truck/car rental per day	day	$50.00	5		$250		$250
Level D PPE	day/person	$15.00	5		$75		$75
Miscellaneous (photographs, gas, tolls, supplies, etc.	day	$20.00	5		$100		$100
Meals (day work)	day/person	$25.00	5		$125		$125
Shipping (Coolers)	each	$100.00	3		$300		$300
GPS Unit Garmine e Trex Vista	each	$0.00	1		$0		$0
				Subtotal:	$850		

		Incremental Cost	Extended Cost
CATS Optimization		**$51,155**	**$51,155**
System Testing, Analysis and Design	Module Total:	$51,155	$51,155

Planning

Senior Expert	4	hrs
Project Advisor	4	hrs
Principal	12	hrs
Senior	8	hrs
Project	15	hrs
Staff	20	hrs
Drafting	4	hrs
PA	2	hrs

Project Management 10% Labor

Program Manager	0.8	hrs	#
Senior Project Manager	4.4	hrs	#
Project Manager	0	hrs	
Task Manager	11.1	hrs	#

Analysis

Senior Expert	1	hrs
Project Advisor	1	hrs
Principal	8	hrs
Senior	16	hrs
Project	20	hrs
Staff	40	hrs
Drafting	8	hrs
PA	3	hrs

Subcontracting

Laboratory Analysis	$ 5,000
Packer Installation	1.00

Design

Senior Expert	2	hrs
Project Advisor	1	hrs
Principal	8	hrs
Senior	4	hrs
Project	12	hrs
Staff	7	hrs
Drafting	7	hrs
PA	3	hrs

Expenses

Task Repetitions Calculator:	
Year 1	1.00
Year 2	
Year 3	
Year 4	
Year 5	
Year 6	
Year 7	
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Year 21	
Year 22	
Year 23	
Year 24	
Year 25	
Year 26	
Year 27	
Year 28	
Year 29	
Year 30	
Total Reps:	1.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Subtotal: **210**

9 Number of Paper Copies 25 Pages per Copy

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Expert	hour	$326.64	7		$2,286		$2,286
Project Advisor	hour	$238.42	6		$1,431		$1,431
Principal Sci/Eng/Arch/Designer	hour	$194.30	28		$5,441		$5,441
Senior Sci/Eng/Arch/Designer	hour	$151.42	28		$4,240		$4,240
Project Sci/Eng/Arch/Designer	hour	$120.80	47		$5,678		$5,678
Staff Sci/Eng/Arch/Designer	hour	$104.69	67		$7,026		$7,026
CADD/Drafter II	hour	$72.58	19		$1,387		$1,387
Project Assistant	hour	$79.65	8		$611		$611
	hour						
Program Manager	hour	$333.54	1		$267		$267
Senior Project Manager	hour	$192.96	4		$849		$849
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	11		$1,682		$1,682
	hour						
	hour						
				Subtotal:	$30,896		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Miscellaneous Laboratory Analysis	ea	$1.00	5000.00		$5,000		$5,000
Well Packer Installation (RW-4)	lump	$15,000.00	1.00		$15,000		$15,000
				Subtotal:	$20,000		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Copies	each	$0.15	225		$34		$34
Shipping (Reports)	each	$25.00	9		$225		$225
				Subtotal:	$259		

		Incremental Cost	Extended Cost
CATS Operation		**$423,387**	**$423,387**
P&T O&M	Module Total	$423,387	$423,387

Design/Execution Assumptions

Specify frequency of O&M (ex. Monthly for 5 years)

	Full Time Operator		Technician Hours per day		8
O&M Events per year	208		Days per week		4
Carbon changeout	1	events per yea	Weeks per year		52
Amount of Carbon changeout	10000	lbs			
Recovery Line Cleaning events	4	events per year		209	days
Number of technicians	1			8	hrs/day
52 wks prep/coord	1	Senior Expert		0.1	hrs/wk
	1	Principle Engineer		0.25	hrs/wk
	1	Senior Engineer		1	hrs/wk
	1	Project Engineer		2	hrs/wk
	1	technician		4	hrs/wk
	1	project assistance		0.019230769	hrs/wk
Repair	1	events per year			

System Samples	Frequency
Discharge	12
Carbon Influent	12
Carbon Midpoint	0
Carbon Effluent	12
Pre-Bag filter	0
Pre-Coagulation	0
System Influent	12
Rwcovery Well (one)	12
Total	60
QC	12

Project Management		10% Labor	
Program Manager	6	hrs/wk	#
Senior Project Manager	31.4	hrs/wk	#
Project Manager	0	hrs/wk	0
Task Manager	79.9	hrs/wk	#

Filter Management	200 um	25um	3um
Changeout Frequency (days)	18	32	48
Units	6	6	36
Total Changouts	126	72	288
Drums	13	8	15

Task Repetitions Calculator:	
Year 1	1.00
Year 2	
Year 3	
Year 4	
Year 5	
Year 6	
Year 7	
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Total Reps:	1.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Description	**Unit**	**Unit Rate**	**Quantity**	**Surcharge**	**Revenue**	**Notes**	
Senior Expert	hour	$326.64	5		$1,699		$1,699
Principal Sci/Eng/Arch/Designer	hour	$194.30	13		$2,526		$2,526
Senior Sci/Eng/Arch/Designer	hour	$151.42	52		$7,874		$7,874
Project Sci/Eng/Arch/Designer	hour	$120.80	104		$12,563		$12,563
Technician III	hour	$94.15	1,880		$177,003		$177,003
Project Assistant	hour	$79.65	1		$80		$80
Program Manager	hour	$333.54	6		$2,001		$2,001
Senior Project Manager	hour	$192.96	31		$6,059		$6,059
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	80		$12,106		$12,106
				Subtotal:	$221,910		

Description	**Unit**	**Unit Rate**	**Quantity**	**Surcharge**	**Revenue**	**Notes**	
VOCs (8260B)	each	$46.00	72		$3,312		$3,312
Granular Activated Carbon Changeout	lb	$2.00	10000		$20,000		$20,000
TAL Metals (23), including Mercury and digestion (6010)	each	$80.00	60		$4,800		$4,800
Refurbish Pump	ea	$4,300.00	1		$4,300		$4,300
30,000 ball Air Stripper changout low density	ea	$22,575.00	1		$22,575		$22,575
Drum rate (soil or liquid, 55-gallon incl. drum purchase)	each	$195.00	36		$7,020		$7,020
Transportation (200 miles up to 14 drums) , non-haz	each load	$450.00	3		$1,350		$1,350
Maintenance and Replacement Parts (4% EQ)	%	4%	225000		$9,000		$9,000
Mobilization/ Demobilization	each	$1,800.00	1		$1,800		$1,800
Recovery Well Pump Removal/Setting	each	$7,200.00	1		$7,200		$7,200
Vegetation Maintenance	annually	$500.00	1		$500		$500
Equipment Maintenance/Repair	annually	$4,635.00	1		$4,635	**Annual Materials**	$4,635
Jetting of Injection Wells/ Well Maintenance	annually	$5,000.00	1		$5,000	**$123,477**	$5,000
Sludge Basin cleanout, paint and media replacement	each	$7,000.00	1		$7,000		$7,000
				Subtotal:	$98,492		

Description	**Unit**	**Unit Rate**	**Quantity**	**Surcharge**	**Revenue**	**Notes**	
Level D PPE	day/person	$15.00	260		$3,900		$3,900
200 micron Bag filter	each	$35.00	126		$4,410		$4,410
25 micron bag filter	each	$45.00	72		$3,240		$3,240
3 micron cartridge	each	$40.00	288		$11,520		$11,520
Monthly Utilities (phone, telemetry , water, sewer etc)	month	$1,100.00	12		$13,200	**Annual Utilities**	$13,200
Utilities - Electrical	month	$5,400.00	12		$64,800	**$78,000**	$64,800
Miscellanous Items (Fire extinguisher service, PLC softwar	annually	$1,915.00	1		$1,915		$1,915
				Subtotal:	$102,985		

a, AL **Sheet Total:** **$55,512**

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								Incremental Cost	Extended Cost
Semi-Annual Groundwater Monitoring								**$21,803**	**$21,803**
Monitoring Well Sampling							Module Total:	$21,803	$21,803

Analyses	Y" if analysis desirec							
VOCs	Y							
BTEX								
Metals	Y			Assumes 1 event				
Dissolved CO2				**Change # of Events in Task Repetitions**				
Chlorides			Number of Wells	46				
Cations						10	Purge volume/well (gal)	
MEE			Sampling Rate	2	hrs/well			
Nitrate/Nitrite			Total time per event	92	hrs	12	days	
Sulfate/Sulfide			Number of technicians	1				
TOC			Man-hrs per event	96	hrs	8	hrs/day	
Divalent Manganese								
Dissolved Hydrogen		3	wks prep/coord	1	Senior	2	hrs/wk	
Dehalococcoides so				1	project eng	4	hrs/wk	
				1	Staff eng	8	hrs/wk	
				1	technician	0	hrs/wk	
				1	day			
Field Kits	Y" if analysis desirec							
Alkalinity								
Iron II (Fe 2+)								
	Enter "Y" if analysis desired		Total Purge Volume Generated per event	460	gal			
				55	gal/drum			
Including field/trip blanks and/or MS/DS								
			Waste Management					
Processed through system	Yes			9	drums			
Project Management	10%	of labor	Total drums for disposal	0	Haz percentage	0%		
			Total haz drums for disposal	0	Non-haz percenta	100%		
Program Manager	0.4		Haz T&D loads	0				
Senior Project Manager	2.2		Total non-haz drums for disposal	0				
Project Manager			Non-haz T&D loads	0				
Task Manager	5.5		Characterization samples	0				

Task Repetitions Calculator:

Year 1	1.00
Year 2	
Year 3	
Year 4	
Year 5	
Year 6	
Year 7	
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Total Reps:	1.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Sci/Eng/Arch/Designer	hour	$151.42	6		$909		$909
Project Sci/Eng/Arch/Designer	hour	$120.80	12		$1,450		$1,450
Staff Sci/Eng/Arch/Designer	hour	$104.69	24		$2,513		$2,513
Technician III	hour	$94.15	96		$9,038		$9,038
Program Manager	hour	$333.54	0.4		$133		$133
Senior Project Manager	hour	$192.96	2.2		$425		$425
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	5.5		$833		$833
	hour						
				Subtotal:	$15,300		

tors

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Drum Disposal							
Drum rate (soil or liquid, 55-gallon incl. drum purchase)	each	$195.00	0		$0		
Transportation (200 miles up to 14 drums) , non-haz	each load	$450.00	0		$0		
55-gallon drum (soil or liquid, 55-gallon), haz	each	$0.00	0		$0		
Transportation (200 miles up to 14 drums), haz	each load	$0.00	0		$0		
Laboratory							
VOCs (8260B)	each	$46.00	50		$2,300		$2,300
BTEX/MtBE (8021)	each	$45.00	0		$0		
Metals - Al, Ar, Br, Cr, Fe, Pb, Mn	each	$57.19	49		$2,802		$2,802
Permanent Gases (CO2, N2, O2)	each	$0.00	0		$0		
Chloride by IC	each	$0.00	0		$0		
Cations	each	$45.96	0		$0		
Light hydrocarbons (methane, ethane, ethene)	each	$48.00	0		$0		
Nitrate+Nitrite	each	$0.00	0		$0		
Sulfide, total	each	$33.00	0		$0		
Total Organic Carbon (TOC)-single analysis	each	$21.00	0		$0		
Divalent manganese	each	$0.00	0		$0		
Dissolved Hydrogen	each	$142.98	0		$0		
Dehalococcoides	each	$326.80	0		$0		
			0				
			0				
			0				
				Subtotal:	$5,102		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
PID per day	day	$0.00	0		$0	Own	
Interface probe IP-150' Solinist per day	day	$0.00	0		$0	Own	
Truck/car rental per day	day	$50.00	12		$600		$600
Level D PPE	day/person	$15.00	15		$225		$225
Miscellaneous (photographs, gas, tolls, supplies, etc.)	day	$20.00	0		$0		
Meals (day work)	day/person	$25.00	0		$0		
Shipping (Coolers)	each	$100.00	5		$500		$500
GPS Unit Garmine e Trex Vista	each	$0.00	0		$0		
Decon area setup/supplies	day	$25.00	3		$75	Own	$75
Submersible pump w/ control box per day	day	$0.00	12		$0	Own	$0
Horiba U-52 with flow-through cell per day	day	$0.00	12		$0	Own	$0
Generator per day	day	$0.00	12		$0	Own	$0
Bailer (24 per box)	each	$3.47	0		$0		
				Subtotal:	$1,400		

Annual Groundwater Monitoring — $33,710 — $33,710

Monitoring Well Sampling — Module Total: $33,710 — $33,710

Analyses	Y" if analysis desirec
VOCs	Y
BTEX	Y
Metals	Y
Dissolved CO2	Y
Chlorides	Y
Cations	
MEE	Y
Nitrate/Nitrite	Y
Sulfate/Sulfide	Y
TOC	Y
Divalent Manganese	
Dissolved Hydrogen	
Dehalococcoides so	
Dinoseb	Y
Field Kits	Y" if analysis desirec
Alkalinity	
Iron II (Fe 2+)	Y

Enter "Y" if analysis desired

Including field/trip blanks and/or MS/DS

Processed through system: Yes

Project Management	10% of labor
Program Manager	0.5
Senior Project Manager	2.4
Project Manager	
Task Manager	6.1

Assumes 1 event

Change # of Events in Task Repetitions

Number of Wells	55			10	Purge volume/well (gal)
Sampling Rate	2	hrs/well			
Total time per event	110	hrs	14	days	
Number of technicians	1				
Man-hrs per event	112	hrs	8	hrs/day	
wks prep/coord	1	Senior	2	hrs/wk	
	1	project eng	4	hrs/wk	
	1	Staff eng	8	hrs/wk	
	1	technician	0	hrs/wk	
	1	day			

3

Total Purge Volume Generated per event: 550 gal; 55 gal/drum

Waste Management

Total drums for disposal	0	Haz percentage	0%		
Total haz drums for disposal	0	Non-haz percenta	100%		
Haz T&D loads	0				
Total non-haz drums for disposal	0				
Non-haz T&D loads	0				
Characterization samples	0				

MNA wells 28

Task Repetitions Calculator:

Year 1	1.00
Year 2	
Year 3	
Year 4	
Year 5	
Year 6	
Year 7	
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Total Reps:	1.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Sci/Eng/Arch/Designer	hour	$151.42	6		$909		$909
Project Sci/Eng/Arch/Designer	hour	$120.80	12		$1,450		$1,450
Staff Sci/Eng/Arch/Designer	hour	$104.69	24		$2,513		$2,513
Technician III	hour	$94.15	112		$10,545		$10,545
Program Manager	hour	$333.54	0.5		$167		$167
Senior Project Manager	hour	$192.96	2.4		$463		$463
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	6.1		$924		$924
	hour						
				Subtotal:	$16,970		

ors

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Drum Disposal							
Drum rate (soil or liquid, 55-gallon incl. drum purchase)	each	$195.00	0		$0		
Transportation (200 miles up to 14 drums) , non-haz	each load	$450.00	0		$0		
55-gallon drum (soil or liquid, 55-gallon), haz	each	$0.00	0		$0		
Transportation (200 miles up to 14 drums), haz	each load	$0.00	0		$0		
Laboratory							
VOCs (8260B)	each	$46.00	62		$2,852		$2,852
BTEX/MtBE (8021)	each	$45.00	28		$1,260		$1,260
Metals - Al, Ar, Br, Cr, Fe, Pb, Mn	each	$57.19	58		$3,317		$3,317
Permanent Gases (CO2, N2, O2)	each	$0.00	28		$0		$0
Chloride by IC	each	$0.00	28		$0		$0
Cations	each	$45.96	0		$0		
Light hydrocarbons (methane, ethane, ethene)	each	$48.00	28		$1,344		$1,344
Nitrate+Nitrite	each	$0.00	28		$0		$0
Sulfide, total	each	$33.00	28		$924		$924
Total Organic Carbon (TOC)-single analysis	each	$21.00	28		$588		$588
Divalent manganese	each	$0.00	0		$0		
Dissolved Hydrogen	each	$142.98	0		$0		
Dehalococcoides	each	$326.80	0		$0		
Dinoseb	ea	$125.00	29		$3,625		$3,625
			0				
			0				
				Subtotal:	$13,910		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
PID per day	day	$0.00	0		$0	Own	
Interface probe IP-150' Solinist per day	day	$0.00	0		$0	Own	
Truck/car rental per day	day	$50.00	14		$700		$700
Level D PPE	day/person	$15.00	17		$255		$255
Miscellaneous (photographs, gas, tolls, supplies, etc.)	day	$20.00	0		$0		
Meals (day work)	day/person	$25.00	0		$0		
Shipping (Coolers)	each	$100.00	18		$1,800		$1,800
GPS Unit Garmine e Trex Vista	each	$0.00	0		$0		
Decon area setup/supplies	day	$25.00	3		$75	Own	$75
Submersible pump w/ control box per day	day	$0.00	14		$0	Own	$0
Horiba U-52 with flow-through cell per day	day	$0.00	14		$0	Own	$0
Generator per day	day	$0.00	14		$0	Own	$0
Bailer (24 per box)	each	$3.47	0		$0		
				Subtotal:	$2,830		

	Incremental Cost	Extended Cost
Permit Compliance	**$65,907**	**$65,907**
Site Maintenance — Module Total:	$65,907	$65,907

Assume costs for landfill monitoring, stormwater maintenance and vegetative maintenance
Monthly inspection of landfill cap
Weekly storm water inspections and management of stromwater
Weekly maintenance, mowing and clearing

Technician Hours per day	8
Days per week (PC)	1
Weeks per year	52

Assume actions conducted by full time site operator in conjunction with CATS operation with assistance from additional personnel for 2 people tasks

Days	52	days
Hours per day	8	hrs
Number of technicians	2	
Man-hrs	832	hrs

52 days

0 wk prep/coord

PREP TIME

1	Project Manager	2	hrs/mo
1	Senior Engineer/Geologist	2	hrs/mo
1	Project Engineer/Geologist	4	hrs/mo
1	Engineer/Geologist I	8	hrs/mo
1	Field Technician	4	hrs/mo
1	Project Assistant	0	hrs/mo

Project Management 10% Labor

Program Manager	1.6	hrs/wk
Senior Project Manager	8.5	hrs/wk
Project Manager	0	hrs/wk
Task Manager	21.8	hrs/wk

11 wk

Field Oversight

1	Project Manager	0	hrs/wk
1	Senior Engineer/Geologist	0.5	hrs/wk
1	Project Engineer/Geologist	2	hrs/wk
1	Engineer/Geologist I	4	hrs/wk
1	Field Technician	0	hrs/wk
1	Project Assistant	0.27	hrs/wk

Task Repetitions Calculator:	
Year 1	1.00
Year 2	
Year 3	
Year 4	
Year 5	
Year 6	
Year 7	
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Total Reps:	1.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	Extended Cost
Senior Project Manager	hour	$192.96	0		$0		
Senior Sci/Eng/Arch/Designer	hour	$151.42	6		$833		$833
Project Sci/Eng/Arch/Designer	hour	$120.80	22		$2,658		$2,658
Sci/Eng/Arch/Designer 2	hour	$93.47	44		$4,113		$4,113
Technician I	hour	$56.96	832		$47,388		$47,388
Project Assistant	hour	$79.65	3		$239		$239
Program Manager	hour	$333.54	2		$534		$534
Senior Project Manager	hour	$192.96	9		$1,640		$1,640
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	22		$3,303		$3,303
				Subtotal:	$60,707		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes
				Subtotal:	$0	

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	Extended Cost
PID per day	day	$0.00	0		$0	Own	
Truck/car rental per day	day	$50.00	52		$2,600		$2,600
Level D PPE	day/person	$15.00	104		$1,560		$1,560
Interface probe IP-150' Solinist per day	day	$0.00	0		$0	Own	
Meals (day work)	day/person	$25.00	0		$0		
Miscellaneous (photographs, gas, tolls, supplies, etc.)	day	$20.00	52		$1,040		$1,040
Shipping (Coolers)	each	$100.00	0		$0		
Communications	day	$2.00	0		$0		
				Subtotal:	$5,200		

		Incremental Cost	Extended Cost
Results Reporting Phase I Activities		**$72,988**	**$72,988**
Negotiation, Drafting and Agency Coordination	Module Total:	$72,988	$72,988

Communication & Draft Report

Senior Expert	15	hrs
Project Advisor	10	hrs
Principal	20	hrs
Senior	40	hrs
Project	60	hrs
Staff	120	hrs
Drafting	40	hrs
PA	10	hrs

Project Management (10% Labor)

Program Manager	2	hrs	#
Senior Project Manager	10.3	hrs	#
Project Manager	0	hrs	
Task Manager	26.2	hrs	#

Draft Final Report

Senior Expert	5	hrs
Project Advisor	5	hrs
Principal	10	hrs
Senior	20	hrs
Project	30	hrs
Staff	60	hrs
Drafting	20	hrs
PA	3	hrs

Subcontracting

Final Report

Senior Expert	2	hrs
Project Advisor	1	hrs
Principal	8	hrs
Senior	4	hrs
Project	12	hrs
Staff	7	hrs
Drafting	7	hrs
PA	3	hrs

Expenses

Task Repetitions Calculator:	
Year 1	1.00
Year 2	
Year 3	
Year 4	
Year 5	
Year 6	
Year 7	
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Year 21	
Year 22	
Year 23	
Year 24	
Year 25	
Year 26	
Year 27	
Year 28	
Year 29	
Year 30	
Total Reps:	1.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Subtotal: **512**

9 Number of Paper Copies 25 Pages per Copy

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Expert	hour	$326.64	22		$7,186		$7,186
Project Advisor	hour	$238.42	16		$3,815		$3,815
Principal Sci/Eng/Arch/Designer	hour	$194.30	38		$7,384		$7,384
Senior Sci/Eng/Arch/Designer	hour	$151.42	64		$9,691		$9,691
Project Sci/Eng/Arch/Designer	hour	$120.80	102		$12,322		$12,322
Staff Sci/Eng/Arch/Designer	hour	$104.69	187		$19,589		$19,589
CADD/Drafter II	hour	$72.58	67		$4,871		$4,871
Project Assistant	hour	$79.65	16		$1,248		$1,248
	hour						
Program Manager	hour	$333.54	2		$667		$667
Senior Project Manager	hour	$192.96	10		$1,988		$1,988
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	26		$3,970		$3,970
	hour						
	hour						
				Subtotal:	$72,729		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
				Subtotal:	$0		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
ADEM RCRA Permit Fees	ea	1.00	$ -		$0		
ADEM UIC Permit Fees	ea	1.00	$ -		$0		
Copies	each	$0.15	225		$34		$34
Shipping (Reports)	each	$25.00	9		$225		$225
				Subtotal:	$259		

Appendix 3 AS/SVE Barrier Alternative Cost
Table C-3 Creola, Alabama

Project Phase	Component	Description		Capital Cost ($)	Annual OMM Costs ($)	Operating Period Yrs	Periodic Costs ($)	Total Cost ($)
Operations	ZVI Source Remediation Phase II	Direct push injection of EHC™, a ZVI and organic carbon reagant, into the source area. Details of the planned injections will be presented in the design report along with the results of the Phase I injections.	Active Remediation	$ 1,139,000	$ -		$ -	**$ 1,139,000**
	AS/SVE Barrier	Installation of the full scale AS/SVE Barrier. The prelimanry layout is provided. The final design will be presented in the design report along with the results of the pilot testing.		$ 954,000	$ -		$ 125,000	**$ 1,079,000**
	AS/SVE Operation	Operation of the AS/SVE system for five years until transition to MNA sampling is achieved. Includes labor and materials for operation.		$ -	$ 128,500	5	$ -	**$ 642,500**
	AS/SVE System Utilities	Utilitiy cost to operate the system including telephone, electricity and internet (for system notifications).		$ -	$ 23,500	5	$ -	**$ 117,500**
	Performance Monitoring	Monitoring of wells as outlined in the report to evaluate the performance of the CATS and Source area treatment.		$ -	$ 55,500	5	$ -	**$ 277,500**
	Permit Compliance	Post Closure care of the landfill during active remediation		$ -	$ 65,900	5	$ -	**$ 329,500**
	Reporting	Semi-annual corrective action reporting		$ -	$ 30,000	5	$ -	**$ 150,000**
								$ 3,735,000
	Periodic Cost include well abandonment and the cost to demolish the systems once the active remediaiont ends.							

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COSTS:		Rates	ZVI Phase II Units/Hrs	ZVI Phase II Cost	AS/SVE Barrier Installation Units/Hrs	AS/SVE Barrier Installation Cost	Additional Decommissioning Units/Hrs	Additional Decommissioning Cost
LABOR COSTS								
Program Manager		$ 333.54	3	$1,101	5	$1,668	1	$200
Senior Project Manager		$ 192.96	17	$3,319	26	$5,036	3	$579
Project Manager		$ 167.99	0	$0	0	$0	0	$0
Task Manager		$ 151.52	44	$6,621	66	$10,061	8	$1,152
Senior Expert		$ 326.64	11	$3,593	14	$4,573	0	$0
Project Advisor		$ 238.42	0	$0	0	$0	0	$0
Principal Sci/Eng/Arch/Designer		$ 194.30	0	$0	0	$0	0	$0
Senior Sci/Eng/Arch/Designer		$ 151.42	0	$0	39	$5,905	0	$0
Project Sci/Eng/Arch/Designer		$ 120.80	108	$13,046	78	$9,422	2	$242
Staff Sci/Eng/Arch/Designer		$ 104.69	0	$0	88	$9,213	8	$838
Sci/Eng/Arch/Designer 2		$ 93.47	622	$58,140	612	$57,205	32	$2,991
Technician III		$ 94.15	0	$0	510	$48,017	160	$15,064
Technician I		$ 56.96	622	$35,427	584	$33,263	0	$0
Designer		$ 105.57	0	$0	0	$0	0	$0
CADD/Drafter II		$ 72.58	0	$0	0	$0	0	$0
CADD/Drafter I		$ 63.12	0	$0	0	$0	0	$0
Project Coordinator		$ 135.36	0	$0	0	$0	0	$0
Project Assistant		$ 79.65	2	$159	10	$796	2	$159
Subtotals			**1429**	**$121,406**	**2033**	**$185,159**	**215**	**$21,224**
OTHER DIRECT COSTS								
Truck/car rental per day	day	$50	54	$2,700	101	$5,050	16	$800
Lodging	day/person	$150.00	106	$15,900	90	$13,500	15	$2,250
Meals (day work)	day/person	$25	108	$2,700	101	$2,525	16	$400
Decon area setup/supplies	day	$25	0	$0	0	$0	0	$0
Level D PPE	day/person	$15	108	$1,620	101	$1,515	16	$240
Miscellaneous (photographs, gas, tolls, supplies, etc.)	day	$20	54	$1,080	101	$2,020	16	$320
Copies	each	$0	0	$0	0	$0	0	$0
Shipping (Coolers)	each	$100	0	$0	50	$5,000	0	$0
Shipping (Reports)	each	$25	0	$0	0	$0	0	$0
Communications	day	$2	108	$216	50	$100	0	$0
200 micron Bag filter	each	$35	0	$0	0	$0	0	$0
25 micron bag filter	each	$45	0	$0	0	$0	0	$0
3 micron cartridge	each	$40	0	$0	0	$0	0	$0
Monthly Utilities (phone, telemetry , water, sewer etc)	month	$1,100.00	0	$0	0	$0	0	$0
Utilities - Electrical AS/SVE	month	$858	0	$0	0	$0	0	$0
Miscellanous Items (Fire extinguisher service, PLC softwa	annually	$1,915	0	$0	0	$0	0	$0
Subtotals				**$24,216**		**$29,710**		**$4,010**
SUBCONTRACTOR EXPENSES								
VOCs (8260B)	each	$ 46.00		$0		$0		$0
BTEX/MtBE (8021)	each	$ 45.00		$0		$0		$0
Sulfide, total	each	$ 33.00		$0		$0		$0
Total Organic Carbon (TOC)-single analysis	each	$ 21.00		$0		$0		$0
Full waste characterization	each	$ 613.00		$0		$12,260		$0
EPA TO-15 Full Scan	each	$ 115.00		$0		$1,380		$0
Light hydrocarbons (methane, ethane, ethene)	each	$ 48.00		$0		$0		$0
Well Abandonment Mob	each	$ 2,000.00		$0		$0		$2,000
2" Well Abandonment	lf	$ 15.00		$0		$0		$53,250
6" Well Abandonment	lf	$ 25.00		$0		$0		$21,500
Drum rate (soil or liquid, 55-gallon incl. drum purchase)	each	$ 195.00		$0		$36,660		$0
Transportation (200 miles up to 14 drums) , non-haz	each load	$ 450.00		$0		$6,300		$0
Trenching	lf	$ 50.00		$0		$171,500		$0
Piping, 4" HDPE	lf	$ 8.50		$0		$8,500		$0
Piping, 2" HDPE	lf	$ 7.00		$0		$14,350		$0
Piping, 1" HDPE	lf	$ 5.25		$0		$7,245		$0
Surveyor	day	$ 1,500.00		$0		$1,500		$0
Utility location	day	$ 1,880.00		$0		$3,760		$0
Misc valves and fittings	LS	$ 12,000.00		$0		$24,000		$0
PLC Remote Connection	each	$ 15,000.00		$0		$15,000		$0
Treatment Building	Each	$ 30,000.00		$0		$30,000		$0
Granular Activated Carbon Changeout	lb	$ 1.50		$0		$0		$0
Power Drop - Average Cost Assuming Some Transformer	ea	$ 7,500.01		$0		$7,500		$0
AS Wellhead Connections/Completions	ea	$ 550.00		$0		$37,950		$0
Claw Compressor (Zephyr C-DLR 300, 23 psi, 190 scfm,	ea	$ 20,000.00		$0		$20,000		$0
Heat Exchanger (<200 scfm)	ea	$ 2,000.00		$0		$2,000		$0
1-inch Motarized Valve	ea	100000%		$0		$2,000		$0
Air Flow Meter (0-30 scfm)	ea	$ 200.00		$0		$22,200		$0
SVE Wellhead Connections/Completions	ea	$ 450.00		$0		$18,900		$0
Concrete Pad, 2500 sqft	ea	$ 17,500.00		$0		$17,500		$0
SVE knockout tank	ea	$ 1,000.00		$0		$1,000		$0
Regenerative Blower (Rotron EN-858, 10 HP, 50 in-H2O	ea	$ 20,000.00		$0		$20,000		$0
4,000 lb vapor phase carbon vessel	ea	$ 12,000.00		$0		$24,000		$0
System Decommissioning Level 2 (complex systems - AS	each system	$ 15,000.00		$0		$0		$15,000
Demolition Crew (including labor and equipment)	days	$ 8,000.00		$0		$0		$8,000
Metals - Al, Ar, Br, Cr, Fe, Pb, Mn	each	$ 57.19		$0		$0		$0
12 inch bore hole in residuum using HSA rig	LF	$ 55.00		$0		$46,200		$0
Hollow stem auger mobilization (equipment, decon pad c	each	$ 5,000.00		$0		$10,000		$0
6 inch bore hole in residuum using HSA rig	LF	$ 18.00		$0		$62,100		$0
2" well materials PVC	foot	$ 7.70		$0		$26,565		$0
6" well materials Stainless Steel	foot	$ 60.00		$0		$50,400		$0
EHC-G	lb	$ 1.85		$625,729		$0		$0
EHC-G Delivery	each	$ 2,650.00		$23,850		$0		$0
Water transport	per/1000 gallons	$ 15.00		$2,025		$0		$0
Dinoseb	ea	$ 125.00		$0		$0		$0
Motor Control Center / Main Control Panel	Lump	$ 30,000.00		$0		$30,000		$0
Maintenance and Replacement Parts (4% EQ)	%	$ 0.04		$0		$0		$0
Vironex Mob/Demob	each	$ 5,500.00		$5,500		$0		$0
Hand auger clearing	each	$ 50.00		$7,250		$0		$0
Day Rate	day	$ 6,000.00		$324,000		$0		$0
Decontamination, drums, etc	lump	$ 2,500.00		$2,500		$0		$0
Injection Reporting	lump	$ 2,500.00		$2,500		$0		$0
Vegetation Maintenance	annually	$ 500.00		$0		$0		$0
Subtotals				**$993,354**		**$730,770**		**$99,750**
Task Sub-Totals				**$1,138,976**		**$945,639**		**$124,984**

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COSTS:		Rates	System Operation Units/Hrs	System Operation Cost	Groundwater Monitoring Units/Hrs	Groundwater Monitoring Cost	Permit Compliance Units/Hrs	Permit Compliance Cost
LABOR COSTS								
Program Manager		$ 333.54	15	$4,836	5	$1,501	8	$2,668
Senior Project Manager		$ 192.96	75	$14,472	23	$4,438	43	$8,201
Project Manager		$ 167.99	0	$0	0	$0	0	$0
Task Manager		$ 151.52	191	$28,940	58	$8,788	109	$16,516
Senior Expert		$ 326.64	26	$8,493	0	$0	0	$0
Project Advisor		$ 238.42	0	$0	0	$0	0	$0
Principal Sci/Eng/Arch/Designer		$ 194.30	52	$10,104	0	$0	0	$0
Senior Sci/Eng/Arch/Designer		$ 151.42	130	$19,685	60	$9,085	28	$4,164
Project Sci/Eng/Arch/Designer		$ 120.80	390	$47,112	120	$14,496	110	$13,288
Staff Sci/Eng/Arch/Designer		$ 104.69	0	$0	240	$25,126	0	$0
Sci/Eng/Arch/Designer 2		$ 93.47	0	$0	0	$0	220	$20,564
Technician III		$ 94.15	4200	$395,431	1040	$97,916	0	$0
Technician I		$ 56.96	0	$0	0	$0	4160	$236,940
Designer		$ 105.57	0	$0	0	$0	0	$0
CADD/Drafter II		$ 72.58	0	$0	0	$0	0	$0
CADD/Drafter I		$ 63.12	0	$0	0	$0	0	$0
Project Coordinator		$ 135.36	0	$0	0	$0	0	$0
Project Assistant		$ 79.65	26	$2,071	0	$0	15	$1,195
Subtotals			**5105**	**$531,144**	**1546**	**$161,350**	**4692**	**$303,535**
OTHER DIRECT COSTS								
Truck/car rental per day	day	$50	0	$0	130	$6,500	260	$13,000
Lodging	day/person	$150.00	0	$0	0	$0	0	$0
Meals (day work)	day/person	$25	0	$0	0	$0	0	$0
Decon area setup/supplies	day	$25	0	$0	30	$750	0	$0
Level D PPE	day/person	$15	520	$7,800	160	$2,400	520	$7,800
Miscellaneous (photographs, gas, tolls, supplies, etc.)	day	$20	0	$0	0	$0	260	$5,200
Copies	each	$0	0	$0	0	$0	0	$0
Shipping (Coolers)	each	$100	0	$0	115	$11,500	0	$0
Shipping (Reports)	each	$25	0	$0	0	$0	0	$0
Communications	day	$2	0	$0	0	$0	0	$0
200 micron Bag filter	each	$35	0	$0	0	$0	0	$0
25 micron bag filter	each	$45	0	$0	0	$0	0	$0
3 micron cartridge	each	$40	0	$0	0	$0	0	$0
Monthly Utilities (phone, telemetry , water, sewer etc)	month	$1,100.00	60	$66,000	0	$0	0	$0
Utilities - Electrical AS/SVE	month	$858	60	$51,500	0	$0	0	$0
Miscellanous Items (Fire extinguisher service, PLC softwa	annually	$1,915	5	$9,575	0	$0	0	$0
Subtotals				**$134,875**		**$21,150**		**$26,000**
SUBCONTRACTOR EXPENSES								
VOCs (8260B)	each	$ 46.00		$0		$25,760		$0
BTEX/MtBE (8021)	each	$ 45.00		$0		$6,300		$0
Sulfide, total	each	$ 33.00		$0		$4,620		$0
Total Organic Carbon (TOC)-single analysis	each	$ 21.00		$0		$2,940		$0
Full waste characterization	each	$ 613.00		$0		$0		$0
EPA TO-15 Full Scan	each	$ 115.00		$20,700		$0		$0
Light hydrocarbons (methane, ethane, ethene)	each	$ 48.00		$0		$6,720		$0
Well Abandonment Mob	each	$ 2,000.00		$0		$0		$0
2" Well Abandonment	lf	$ 15.00		$0		$0		$0
6" Well Abandonment	lf	$ 25.00		$0		$0		$0
Drum rate (soil or liquid, 55-gallon incl. drum purchase)	each	$ 195.00		$0		$0		$0
Transportation (200 miles up to 14 drums) , non-haz	each load	$ 450.00		$0		$0		$0
Trenching	lf	$ 50.00		$0		$0		$0
Piping, 4" HDPE	lf	$ 8.50		$0		$0		$0
Piping, 2" HDPE	lf	$ 7.00		$0		$0		$0
Piping, 1" HDPE	lf	$ 5.25		$0		$0		$0
Surveyor	day	$ 1,500.00		$0		$0		$0
Utility location	day	$ 1,880.00		$0		$0		$0
Misc valves and fittings	LS	$ 12,000.00		$0		$0		$0
PLC Remote Connection	each	$ 15,000.00		$0		$0		$0
Treatment Building	Each	$ 30,000.00		$0		$0		$0
Granular Activated Carbon Changeout	lb	$ 1.50		$30,000		$0		$0
Power Drop - Average Cost Assuming Some Transformer	ea	$ 7,500.01		$0		$0		$0
AS Wellhead Connections/Completions	ea	$ 550.00		$0		$0		$0
Claw Compressor (Zephyr C-DLR 300, 23 psi, 190 scfm,	ea	$ 20,000.00		$0		$0		$0
Heat Exchanger (<200 scfm)	ea	$ 2,000.00		$0		$0		$0
1-inch Motarized Valve	ea	100000%		$0		$0		$0
Air Flow Meter (0-30 scfm)	ea	$ 200.00		$0		$0		$0
SVE Wellhead Connections/Completions	ea	$ 450.00		$0		$0		$0
Concrete Pad, 2500 sqft	ea	$ 17,500.00		$0		$0		$0
SVE knockout tank	ea	$ 1,000.00		$0		$0		$0
Regenerative Blower (Rotron EN-858, 10 HP, 50 in-H2O	ea	$ 20,000.00		$0		$0		$0
4,000 lb vapor phase carbon vessel	ea	$ 12,000.00		$0		$0		$0
System Decommissioning Level 2 (complex systems - AS	each system	$ 15,000.00		$0		$0		$0
Demolition Crew (including labor and equipment)	days	$ 8,000.00		$0		$0		$0
Metals - Al, Ar, Br, Cr, Fe, Pb, Mn	each	$ 57.19		$0		$30,597		$0
12 inch bore hole in residuum using HSA rig	LF	$ 55.00		$0		$0		$0
Hollow stem auger mobilization (equipment, decon pad c	each	$ 5,000.00		$0		$0		$0
6 inch bore hole in residuum using HSA rig	LF	$ 18.00		$0		$0		$0
2" well materials PVC	foot	$ 7.70		$0		$0		$0
6" well materials Stainless Steel	foot	$ 60.00		$0		$0		$0
EHC-G	lb	$ 1.85		$0		$0		$0
EHC-G Delivery	each	$ 2,650.00		$0		$0		$0
Water transport	per/1000 gallons	$ 15.00		$0		$0		$0
Dinoseb	ea	$ 125.00		$0		$18,125		$0
Motor Control Center / Main Control Panel	Lump	$ 30,000.00		$0		$0		$0
Maintenance and Replacement Parts (4% EQ)	%	$ 0.04		$41,000		$0		$0
Vironex Mob/Demob	each	$ 5,500.00		$0		$0		$0
Hand auger clearing	each	$ 50.00		$0		$0		$0
Day Rate	day	$ 6,000.00		$0		$0		$0
Decontamination, drums, etc	lump	$ 2,500.00		$0		$0		$0
Injection Reporting	lump	$ 2,500.00		$0		$0		$0
Vegetation Maintenance	annually	$ 500.00		$2,500		$0		$0
Subtotals				**$94,200**		**$95,062**		**$0**
Task Sub-Totals				**$760,219**		**$277,562**		**$329,535**

ARCADIS
Infrastructure, environment, buildings

17-Mar-16

COSTS:		Rates	Reporting Units/Hrs	Reporting Cost	TOTAL UNITS/HRS	TOTAL COST
LABOR COSTS						
Program Manager		$ 333.54	4	$1,334	40	$13,308
Senior Project Manager		$ 192.96	21	$4,052	208	$40,098
Project Manager		$ 167.99	0	$0	0	$0
Task Manager		$ 151.52	54	$8,106	529	$80,184
Senior Expert		$ 326.64	55	$17,965	106	$34,624
Project Advisor		$ 238.42	40	$9,537	40	$9,537
Principal Sci/Eng/Arch/Designer		$ 194.30	100	$19,430	152	$29,534
Senior Sci/Eng/Arch/Designer		$ 151.42	110	$16,656	367	$55,496
Project Sci/Eng/Arch/Designer		$ 120.80	195	$23,556	1003	$121,161
Staff Sci/Eng/Arch/Designer		$ 104.69	336	$35,130	672	$70,306
Sci/Eng/Arch/Designer 2		$ 93.47	0	$0	1486	$138,899
Technician III		$ 94.15	0	$0	5910	$556,428
Technician I		$ 56.96	0	$0	5366	$305,630
Designer		$ 105.57	0	$0	0	$0
CADD/Drafter II		$ 72.58	136	$9,839	136	$9,839
CADD/Drafter I		$ 63.12	0	$0	0	$0
Project Coordinator		$ 135.36	0	$0	0	$0
Project Assistant		$ 79.65	38	$3,053	93	$7,434
Subtotals			**1088**	**$148,659**	**16107**	**$1,472,478**
OTHER DIRECT COSTS						
Truck/car rental per day	day	$50	0	$0	561	$28,050
Lodging	day/person	$150.00	0	$0	211	$31,650
Meals (day work)	day/person	$25	0	$0	225	$5,625
Decon area setup/supplies	day	$25	0	$0	30	$750
Level D PPE	day/person	$15	0	$0	1425	$21,375
Miscellaneous (photographs, gas, tolls, supplies, etc.)	day	$20	0	$0	431	$8,620
Copies	each	$0	1125	$169	1125	$169
Shipping (Coolers)	each	$100	0	$0	165	$16,500
Shipping (Reports)	each	$25	45	$1,125	45	$1,125
Communications	day	$2	0	$0	158	$316
200 micron Bag filter	each	$35	0	$0	0	$0
25 micron bag filter	each	$45	0	$0	0	$0
3 micron cartridge	each	$40	0	$0	0	$0
Monthly Utilities (phone, telemetry , water, sewer etc)	month	$1,100.00	0	$0	60	$66,000
Utilities - Electrical AS/SVE	month	$858	0	$0	60	$51,500
Miscellanous Items (Fire extinguisher service, PLC softwa	annually	$1,915	0	$0	5	$9,575
Subtotals				**$1,294**		**$241,255**
SUBCONTRACTOR EXPENSES						
VOCs (8260B)	each	$ 46.00		$0	0	$25,760
BTEX/MtBE (8021)	each	$ 45.00		$0	0	$6,300
Sulfide, total	each	$ 33.00		$0	0	$4,620
Total Organic Carbon (TOC)-single analysis	each	$ 21.00		$0	0	$2,940
Full waste characterization	each	$ 613.00		$0	0	$12,260
EPA TO-15 Full Scan	each	$ 115.00		$0	0	$22,080
Light hydrocarbons (methane, ethane, ethene)	each	$ 48.00		$0	0	$6,720
Well Abandonment Mob	each	$ 2,000.00		$0	0	$2,000
2" Well Abandonment	lf	$ 15.00		$0	0	$53,250
6" Well Abandonment	lf	$ 25.00		$0	0	$21,500
Drum rate (soil or liquid, 55-gallon incl. drum purchase)	each	$ 195.00		$0	0	$36,660
Transportation (200 miles up to 14 drums) , non-haz	each load	$ 450.00		$0	0	$6,300
Trenching	lf	$ 50.00		$0	0	$171,500
Piping, 4" HDPE	lf	$ 8.50		$0	0	$8,500
Piping, 2" HDPE	lf	$ 7.00		$0	0	$14,350
Piping, 1" HDPE	lf	$ 5.25		$0	0	$7,245
Surveyor	day	$ 1,500.00		$0	0	$1,500
Utility location	day	$ 1,880.00		$0	0	$3,760
Misc valves and fittings	LS	$ 12,000.00		$0	0	$24,000
PLC Remote Connection	each	$ 15,000.00		$0	0	$15,000
Treatment Building	Each	$ 30,000.00		$0	0	$30,000
Granular Activated Carbon Changeout	lb	$ 1.50		$0	0	$30,000
Power Drop - Average Cost Assuming Some Transformer	ea	$ 7,500.01		$0	0	$7,500
AS Wellhead Connections/Completions	ea	$ 550.00		$0	0	$37,950
Claw Compressor (Zephyr C-DLR 300, 23 psi, 190 scfm,	ea	$ 20,000.00		$0	0	$20,000
Heat Exchanger (<200 scfm)	ea	$ 2,000.00		$0	0	$2,000
1-inch Motarized Valve	ea	100000%		$0	0	$2,000
Air Flow Meter (0-30 scfm)	ea	$ 200.00		$0	0	$22,200
SVE Wellhead Connections/Completions	ea	$ 450.00		$0	0	$18,900
Concrete Pad, 2500 sqft	ea	$ 17,500.00		$0	0	$17,500
SVE knockout tank	ea	$ 1,000.00		$0	0	$1,000
Regenerative Blower (Rotron EN-858, 10 HP, 50 in-H2O	ea	$ 20,000.00		$0	0	$20,000
4,000 lb vapor phase carbon vessel	ea	$ 12,000.00		$0	0	$24,000
System Decommissioning Level 2 (complex systems - AS	each system	$ 15,000.00		$0	0	$15,000
Demolition Crew (including labor and equipment)	days	$ 8,000.00		$0	0	$8,000
Metals - Al, Ar, Br, Cr, Fe, Pb, Mn	each	$ 57.19		$0	0	$30,597
12 inch bore hole in residuum using HSA rig	LF	$ 55.00		$0	0	$46,200
Hollow stem auger mobilization (equipment, decon pad c	each	$ 5,000.00		$0	0	$10,000
6 inch bore hole in residuum using HSA rig	LF	$ 18.00		$0	0	$62,100
2" well materials PVC	foot	$ 7.70		$0	0	$26,565
6" well materials Stainless Steel	foot	$ 60.00		$0	0	$50,400
EHC-G	lb	$ 1.85		$0	0	$625,729
EHC-G Delivery	each	$ 2,650.00		$0	0	$23,850
Water transport	per/1000 gallons	$ 15.00		$0	0	$2,025
Dinoseb	ea	$ 125.00		$0	0	$18,125
Motor Control Center / Main Control Panel	Lump	$ 30,000.00		$0	0	$30,000
Maintenance and Replacement Parts (4% EQ)	%	$ 0.04		$0	0	$41,000
Vironex Mob/Demob	each	$ 5,500.00		$0	0	$5,500
Hand auger clearing	each	$ 50.00		$0	0	$7,250
Day Rate	day	$ 6,000.00		$0	0	$324,000
Decontamination, drums, etc	lump	$ 2,500.00		$0	0	$2,500
Injection Reporting	lump	$ 2,500.00		$0	0	$2,500
Vegetation Maintenance	annually	$ 500.00		$0	0	$2,500
Subtotals				**$0**		**$2,013,135**
Task Sub-Totals				**$149,953**		
					SUBTOTAL COST	**$3,726,868**
					TOTAL COST	**$3,726,868**

		Incremental Cost	Extended Cost
ZVI Phase II		**$1,138,976**	**$1,138,976**
EHC Direct Push Injection	Module Total:	$1,138,976	$1,138,976

Design/Execution Assumptions

Injection Events	1	
# of injection points	145	
Treatment area	102,494	sq. ft
Treatment Thickness	15	ft
Interval thickness	4	ft
ROI	15	ft
Nm	0.046	
V	973	gal
Total soil volume	1,537,417	CF
Soil density	110	LB/CF
Total target soil weight	169,115,860	LB
EHC demand	0.20%	lb EHC/lb soil
safety factor	0	
EHC demand	338232	lb
Per point	2333	lb
Per interval	583	lb
EHC density	44	lb/cf
	5.9	lb/gal
EHC Injection Loading	30%	by weight slurry
Intervals/Pt	4	
Total points	145	
Total EHC per interval	99	gallons
Total water per interval	231	gallons
Total slurry volume per interval	330	gallons
Total water volume	134,165	gallons
Total slurry volume	191,665	gal
Total EHC (crosscheck)	338,232	lb
Injection Rate	6	GPM
Points at once	1	
Injection time:	55	mins/interval
Injection time per day	10	hrs
Field Staff	2	

	1	wks prep/coord
	10	hrs/day
	9	Weeks in the field
	220	mins/pt
	54.0	days/event

PREP TIME			
	1	Senior Expert	2 hrs/wk
	1	Project Engineer/Geologist	18 hrs/wk
	1	Engineer/Geologist I	10 hrs/wk
	1	Field Technician	10 hrs/wk
	1	Project Assistant	2 hrs/wk
	1	Clerical/Word Processing	0 hrs/wk

Field Oversight			
	1	Senior Expert	1 hrs/wk
	1	Project Engineer/Geologist	10 hrs/wk
	1	Engineer/Geologist I	8 hrs/wk
	1	Field Technician	8 hrs/wk
	1	Project Assistant	0 hrs/wk
	1	Clerical/Word Processing	0 hrs/wk

Project Management			10% Labor	
	1	Program Manager	3.3 hrs/wk	#
	1	Senior Project Manager	17.2 hrs/wk	#
	1	Project Manager	0 hrs/wk	
	1	Task Manager	43.7 hrs/wk	#

Task Repetitions Calculator:	
Year 1	
Year 2	1.00
Year 3	
Year 4	
Year 5	
Year 6	
Year 7	
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Total Reps:	1.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Expert	hour	$326.64	11		$3,593		$3,593
Project Sci/Eng/Arch/Designer	hour	$120.80	108		$13,046		$13,046
Sci/Eng/Arch/Designer 2	hour	$93.47	622		$58,140		$58,140
Technician I	hour	$56.96	622		$35,427		$35,427
Project Assistant	hour	$79.65	2		$159		$159
Clerical / Secretarial	hour	$67.37	0		$0		
Program Manager	hour	$333.54	3.3		$1,101		$1,101
Senior Project Manager	hour	$192.96	17.2		$3,319		$3,319
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	43.7		$6,621		$6,621
				Subtotal:	$121,406		

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Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
EHC-G	lb	$1.85	338232		$625,729		$625,729
EHC-G Delivery	each	$2,650.00	9		$23,850		$23,850
Water transport	per/1000 gallon	$15.00	135		$2,025		$2,025
Vironex Mob/Demob	each	$5,500.00	1		$5,500		$5,500
Hand auger clearing	each	$50.00	145		$7,250		$7,250
Day Rate	day	$6,000.00	54.0		$324,000		$324,000
Decontamination, drums, etc	lump	$2,500.00	1		$2,500		$2,500
Injection Reporting	lump	$2,500.00	1		$2,500		$2,500
				Subtotal:	$993,354		

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Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Truck/car rental per day	day	$50.00	54		$2,700		$2,700
Level D PPE	day/person	$15.00	108		$1,620		$1,620
Miscellaneous (photographs, gas, tolls, suppl	day	$20.00	54		$1,080		$1,080
Meals (day work)	day/person	$25.00	108		$2,700		$2,700
Lodging	day/person	$150.00	106		$15,900		$15,900
Communications	day	$2.00	108		$216		$216
				Subtotal:	$24,216		

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Sheet Total: **$953,964**

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								Incremental Cost			**Extended Cost**
AS/SVE Barrier Well Installation AS Wells								**$182,941**			**$182,941**
j Well Installation						Module Total:		$182,941			$182,941
	Enter"Y" if analysis desired			Double Well	Single Well	Total Length				Task Repetitions Calculator:	
VOCs			Barrier Length	530		300	830	ft		Year 1	
SVOCs			Well Spacing	20		20				Year 2	1.00
PAHs			Total Wells	54		15	69			Year 3	
Pesticides										Year 4	
PCBs			Number ofAS Wells	69			6	inch borehole		Year 5	
GRO			Depth of borings	50	ft		3450	LF		Year 6	
DRO			Production rate - hrs/ location	4						Year 7	
Oil/Grease			Total time per event	276	hrs		35	days		Year 8	
TRPH			Number of geologists	1						Year 9	
Perchlorate			Man-hrs per event	350	hrs		10	hrs/day		Year 10	
Metals										Year 11	
Mercury		7	wks prep/coord	1	Senior		1	hrs/wk		Year 12	
Hex Chrom				1	project eng		2	hrs/wk		Year 13	
Anions				1	Staff eng		8	hrs/wk		Year 14	
Including field/trip blanks and/or MS/DS				1	technician		0	hrs/wk		Year 15	
										Year 16	
Number	Depth		Samples / location	0			1	soil sample/ location		Year 17	
54	50	Double Wall AS \	Total samples	0			1	water sample/ location		Year 18	
15	50	Single Wall AS well								Year 19	
0							*Assume :*			Year 20	
			Cuttings/Solid Waste Generation	677	ft3		0.20	ft3/ft drilling (link to borehole di		Total Reps:	1.00
				26	CY		202	gal/CY		DO NOT INSERT ROWS INTO	
				37	tons		55	gal/drum		THE TASK REPS CALCULATOR	
				5252	gal		1.4	ton/CY			
Assumes % of drums for ch	10%			96	drums						
Project Management	10%	of labor	Total drums for disposal	96	Haz percentage		0%				
			Total haz drums for disposal	0	Non-haz percentage		100%				
Program Manager	1.2		Haz T&D loads	0							
Senior Project Manager	6.5		Total non-haz drums for disposal	96							
Project Manager			Non-haz T&D loads	7							
Task Manager	16.5		Characterization samples	10							

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Sci/Eng/Arch/Designer	hour	$151.42	7		$1,060		$1,060
Project Sci/Eng/Arch/Designer	hour	$120.80	14		$1,691		$1,691
Staff Sci/Eng/Arch/Designer	hour	$104.69	56		$5,863		$5,863
Technician III	hour	$94.15	350		$32,953		$32,953
Program Manager	hour	$333.54	1.2		$400		$400
Senior Project Manager	hour	$192.96	6.5		$1,254		$1,254
Project Manager	hour	$167.99	0.0		$0		
Task Manager	hour	$151.52	16.5		$2,500		$2,500
				Subtotal:	$45,721		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Utility location	day	$1,880.00	1		$1,880		$1,880
Hollow stem auger mobilization (equipment, de	each	$5,000.00	1		$5,000		$5,000
6 inch bore hole in residuum using HSA rig	LF	$18.00	3450		$62,100		$62,100
2" well materials PVC	foot	$7.70	3450		$26,565		$26,565
Permits	each well	$0.00	69		$0	**Per Contractor**	$0
Monitoring Well Flush Mount 2 inch	each	$75.00	69		$5,175		
Full waste characterization	each	$613.00	10		$6,130		$6,130
Drum rate (soil or liquid, 55-gallon incl. drum p	each	$195.00	96		$18,720		$18,720
Transportation (200 miles up to 14 drums) , no	each load	$450.00	7		$3,150		$3,150
55-gallon drum (soil or liquid, 55-gallon), haz	each	$0.00	0		$0		
Transportation (200 miles up to 14 drums), haz	each load	$0.00	0		$0		
VOCs (8260B)	each	$46.00	0		$0		
SVOCs (8270C/D)	each	$115.00	0		$0		
PAHs (8270D)	each	$72.00	0		$0		
Organochlorine Pesticides (8081)	each	$105.00	0		$0		
PCBs (8082)	each	$48.00	0		$0		
GRO (8015)	each	$38.00	0		$0		
DRO (8015)	each	$40.00	0		$0		
Oil and Grease (Water, 1664)	each	$0.00	0		$0		
TRPH (Water, 1664)	each	$0.00	0		$0		
Perchlorate, Soil (EPA 314.0M)	each	$95.00	0		$0		
TAL Metals (23), including Mercury and digest	each	$80.00	0		$0		
Mercury (Soil or water)	each	$18.00	0		$0		
Hexavalent chromium (Water, 7196)	each	$0.00	0		$0		
Anions (Br, Cl, F, PO4, SO4, NO3, NO2)	each	$24.00	0		$0		
				Subtotal:	$128,720		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
PID per day	day	$0.00	35		$0	**Own**	$0
Interface probe IP-150' Solinist per day	day	$0.00	35		$0	**Own**	$0
Truck/car rental per day	day	$50.00	35		$1,750		$1,750
Level D PPE	day/person	$15.00	35		$525		$525
Miscellaneous (photographs, gas, tolls, supplie	day	$20.00	35		$700		$700
Meals (day work)	day/person	$25.00	35		$875		$875
Lodging	day/person	$150.00	31		$4,650		$4,650
GPS Unit Garmine e Trex Vista	each	$0.00	0		$0	**Own**	

Subtotal:	$8,500	

AS/SVE Barrier Well Installation SVE Wells					$159,692		$159,692
g Well Installation				Module Total:	$159,692		$159,692

	Enter"Y" if analysis desired			Double Well	Single Well	Total Length		Task Repetitions Calculator:	
VOCs			Barrier Length			830	ft	Year 1	
SVOCs			Well Spacing			20		Year 2	1.00
PAHs			Total Wells			42		Year 3	
Pesticides								Year 4	
PCBs			Number of SVE Wells	42		12	inch borehole	Year 5	
GRO			Depth of borings	20	ft	840	LF	Year 6	
DRO			Production rate - hrs/ location	3				Year 7	
Oil/Grease			Total time per event	126	hrs	16	days	Year 8	
TRPH			Number of geologists	1				Year 9	
Perchlorate			Man-hrs per event	160	hrs	10	hrs/day	Year 10	
Metals								Year 11	
Mercury		4	wks prep/coord	1	Senior	1	hrs/wk	Year 12	
Hex Chrom				1	project eng	2	hrs/wk	Year 13	
Anions				1	Staff eng	8	hrs/wk	Year 14	
Including field/trip blanks and/or MS/DS				1	technician	0	hrs/wk	Year 15	
								Year 16	
Number	Depth		Samples / location	0		1	soil sample/ location	Year 17	
0	0	Double Wall AS \	Total samples	0		1	water sample/ location	Year 18	
0	0	Single Wall AS well						Year 19	
42	20	SVE Well				*Assume :*		Year 20	
			Cuttings/Solid Waste Generation	660	ft3	0.79	ft3/ft drilling (link to borehole di	Total Reps:	1.00
				25	CY	202	gal/CY	DO NOT INSERT ROWS INTO	
				35	tons	55	gal/drum	THE TASK REPS CALCULATOR	
				5050	gal	1.4	ton/CY		
Assumes % of drums for ch	10%			92	drums				
Project Management	10%	of labor	Total drums for disposal	92	Haz percentage	0%			
			Total haz drums for disposal	0	Non-haz percentage	100%			
Program Manager	0.6		Haz T&D loads	0					
Senior Project Manager	3.1		Total non-haz drums for disposal	92					
Project Manager			Non-haz T&D loads	7					
Task Manager	7.9		Characterization samples	10					

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Sci/Eng/Arch/Designer	hour	$151.42	4		$606		$606
Project Sci/Eng/Arch/Designer	hour	$120.80	8		$966		$966
Staff Sci/Eng/Arch/Designer	hour	$104.69	32		$3,350		$3,350
Technician III	hour	$94.15	160		$15,064		$15,064
Program Manager	hour	$333.54	0.6		$200		$200
Senior Project Manager	hour	$192.96	3.1		$598		$598
Project Manager	hour	$167.99	0.0		$0		
Task Manager	hour	$151.52	7.9		$1,197		$1,197
				Subtotal:	$21,982		

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Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Utility location	day	$1,880.00	1		$1,880		$1,880
Hollow stem auger mobilization (equipment, de	each	$5,000.00	1		$5,000		$5,000
12 inch bore hole in residuum using HSA rig	LF	$55.00	840		$46,200		$46,200
6" well materials Stainless Steel	foot	$60.00	840		$50,400		$50,400
Permits	each well	$0.00	42		$0	**Per Contractor**	$0
Monitoring Well Flush Mount 2 inch	each	$75.00	42		$3,150		
racterization							
Full waste characterization	each	$613.00	10		$6,130		$6,130
Drum rate (soil or liquid, 55-gallon incl. drum p	each	$195.00	92		$17,940		$17,940
Transportation (200 miles up to 14 drums) , nc	each load	$450.00	7		$3,150		$3,150
55-gallon drum (soil or liquid, 55-gallon), haz	each	$0.00	0		$0		
Transportation (200 miles up to 14 drums), ha:	each load	$0.00	0		$0		
VOCs (8260B)	each	$46.00	0		$0		
SVOCs (8270C/D)	each	$115.00	0		$0		
PAHs (8270D)	each	$72.00	0		$0		
Organochlorine Pesticides (8081)	each	$105.00	0		$0		
PCBs (8082)	each	$48.00	0		$0		
GRO (8015)	each	$38.00	0		$0		
DRO (8015)	each	$40.00	0		$0		
Oil and Grease (Water, 1664)	each	$0.00	0		$0		
TRPH (Water, 1664)	each	$0.00	0		$0		
Perchlorate, Soil (EPA 314.0M)	each	$95.00	0		$0		
TAL Metals (23), including Mercury and digest	each	$80.00	0		$0		
Mercury (Soil or water)	each	$18.00	0		$0		
Hexavalent chromium (Water, 7196)	each	$0.00	0		$0		
Anions (Br, Cl, F, PO4, SO4, NO3, NO2)	each	$24.00	0		$0		
				Subtotal:	$133,850		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
PID per day	day	$0.00	16		$0	**Own**	$0
Interface probe IP-150' Solinist per day	day	$0.00	16		$0	**Own**	$0
Truck/car rental per day	day	$50.00	16		$800		$800
Level D PPE	day/person	$15.00	16		$240		$240
Miscellaneous (photographs, gas, tolls, supplie	day	$20.00	16		$320		$320
Meals (day work)	day/person	$25.00	16		$400		$400
Lodging	day/person	$150.00	14		$2,100		$2,100
GPS Unit Garmine e Trex Vista	each	$0.00	0		$0	**Own**	
				Subtotal:	$3,860		

AS/SVE Barrier Installation					$611,332		$611,332
AS/SVE Pilot Test				Module Total:	$611,332		$611,332

Assume costs for pilot test well install is included in construction costs.
1 day field setup
3 day test
4 air samples per day
Assume short term testing doesn't require GAC treatment

Days		50	total days
Hours per day	10	hrs	
Number of technicians	1		
Man-hrs		500	hrs

50 days

	4	wk prep/coord		**PREP TIME**	
			1	Senior Expert	1 hrs/mo
			1	Senior Engineer/Geologist	2 hrs/mo
Project Management	10%	Labor	1	Project Engineer/Geologist	4 hrs/mo
Program Manager	3.2	hrs/wk	1	Engineer/Geologist I	8 hrs/mo
Senior Project Manager	16.5	hrs/wk	1	Field Technician	6 hrs/mo
Project Manager	0	hrs/wk	1	Project Assistant	0 hrs/mo
Task Manager	42	hrs/wk			
				Field Oversight	
	10	wk	1	Project Manager	1 hrs/wk
			1	Senior Engineer/Geologist	2 hrs/wk
			1	Project Engineer/Geologist	4 hrs/wk
			1	Engineer/Geologist I	8 hrs/wk
20	Trench/AS well (LF)		1	Field Technician	6 hrs/wk
1000	AS Piping (LF) Assumes 2" header piping		1	Project Assistant	1 hrs/wk
25	Trench/SVE well (LF)				
1000	SVE Piping (LF) Assumes 4" header piping				
4430	Total Ft of Piping				
100	ft per day installation				
45	days of piping installation				
5	days of system installation				

Typical Equipment:	
SVE Blower	1
AS Compressor	1
Heat Exchanger	1
Motarized Vavles for Zone control	2
PLC/SCADA	1
Equipment Trailer/Building	1
Well Head Completions	111
Control Panel/Electircal Controls	1
Vapor Treatment	2

Task Repetitions Calculator:	
Year 1	
Year 2	1.00
Year 3	
Year 4	
Year 5	
Year 6	
Year 7	
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Total Reps:	1.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Expert	hour	$326.64	14		$4,573		$4,573
Senior Sci/Eng/Arch/Designer	hour	$151.42	28		$4,240		$4,240
Project Sci/Eng/Arch/Designer	hour	$120.80	56		$6,765		$6,765
Sci/Eng/Arch/Designer 2	hour	$93.47	612		$57,205		$57,205
Technician I	hour	$56.96	584		$33,263		$33,263
Project Assistant	hour	$79.65	10		$796		$796
Program Manager	hour	$333.54	3		$1,067		$1,067
Senior Project Manager	hour	$192.96	17		$3,184		$3,184
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	42		$6,364		$6,364
				Subtotal:	$117,457		

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Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Surveyor	day	$1,500.00	1		$1,500		$1,500
EPA TO-15 Full Scan	each	$115.00	12		$1,380		$1,380
Trenching	lf	$50.00	3430		$171,500		$171,500
Piping, 2" HDPE	lf	$7.00	2050		$14,350		$14,350
Piping, 1" HDPE	lf	$5.25	1380		$7,245		$7,245
Piping, 4" HDPE	lf	$8.50	1000		$8,500		$8,500
SVE Wellhead Connections/Completions	ea	$450.00	42		$18,900		$18,900
AS Wellhead Connections/Completions	ea	$550.00	69		$37,950		$37,950
uipment							
Regenerative Blower (Rotron EN-858, 10 HP,	ea	$20,000.00	1		$20,000		$20,000
SVE knockout tank	ea	$1,000.00	1		$1,000		$1,000
4,000 lb vapor phase carbon vessel	ea	$12,000.00	2		$24,000		$24,000
Claw Compressor (Zephyr C-DLR 300, 23 psi,	ea	$20,000.00	1		$20,000		$20,000
Heat Exchanger (<200 scfm)	ea	$2,000.00	1		$2,000		$2,000
1-inch Motarized Valve	ea	$1,000.00	2		$2,000		$2,000
Air Flow Meter (0-30 scfm)	ea	$200.00	111		$22,200		$22,200
250 cfm CatOx, variable HP	ea	$50,000.00	0		$0		
Motor Control Center / Main Control Panel	Lump	$30,000.00	1		$30,000		$30,000
PLC Remote Connection	each	$15,000.00	1		$15,000		$15,000
Concrete Pad, 2500 sqft	ea	$17,500.00	1		$17,500		$17,500
Treatment Building	Each	$30,000.00	1		$30,000		$30,000
Misc valves and fittings	LS	$12,000.00	2		$24,000		$24,000
Power Drop - Average Cost Assuming Some T	ea	$7,500.01	1		$7,500		$7,500
				Subtotal:	$476,525		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Lodging	day/person	$150.00	45		$6,750		$6,750
PID per day	day	$0.00	50		$0	Own	$0
Truck/car rental per day	day	$50.00	50		$2,500		$2,500
Level D PPE	day/person	$15.00	50		$750		$750
Interface probe IP-150' Solinist per day	day	$0.00	50		$0	Own	$0
Meals (day work)	day/person	$25.00	50		$1,250		$1,250
Miscellaneous (photographs, gas, tolls, supplie	day	$20.00	50		$1,000		$1,000
Shipping (Coolers)	each	$100.00	50		$5,000		$5,000
Communications	day	$2.00	50		$100		$100
				Subtotal:	$17,350		

	Incremental Cost	Extended Cost
Well & System Abandonment	**$124,984**	**$124,984**
Well Abandonment Module Total:	$124,984	$124,984

Design/Execution Assumptions

	71	2" wells	
	43	6" wells	
Number of wells to be abandoned during year x			
Total man hrs in the field to oversight	114	Total wells	
Total man hrs onsite for well abandonment & Decommissioning	160	hrs	10 hr/day

	4,410	Total linear footage (feet):	
2" Wells AvgDepth (ft): 50	3550	feet	System Abandonment
	0	feet	0 Extraction Wells
4" Wells AvgDepth (ft): 20	860	feet	1 System Components
	0	feet	1 Total Days

Well abandonment rate	8	wells/day
Number of Technicians	1	
Total days in the field for oversight	16	days

4 wks prep/coord	1	Senior Engineer	0	hrs/wk
	1	Project Engineer/Geologist	0.5	hrs/wk
	1	Staff Engineer	2	hrs/wk
	1	Engineer/Geologist I	8	hrs/wk
	1	Field Technician	0	hrs/wk
	1	Project Assistant	0.5	hrs/wk

Project Management		10% Labor	
Program Manager	0.6	hrs/wk	10%
Senior Project Manager	3	hrs/wk	30%
Project Manager	0	hrs/wk	0
Task Manager	7.6	hrs/wk	60%

Task Repetitions Calculator:

Year 1	
Year 2	
Year 3	
Year 4	
Year 5	
Year 6	
Year 7	1.00
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Total Reps:	1.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Sci/Eng/Arch/Designer	hour	$151.42	0		$0		
Project Sci/Eng/Arch/Designer	hour	$120.80	2		$242		$242
Staff Sci/Eng/Arch/Designer	hour	$104.69	8		$838		$838
Sci/Eng/Arch/Designer 2	hour	$93.47	32		$2,991		$2,991
Technician III	hour	$94.15	160		$15,064		$15,064
Project Assistant	hour	$79.65	2		$159		$159
Program Manager	hour	$333.54	0.6		$200		$200
Senior Project Manager	hour	$192.96	3		$579		$579
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	7.6		$1,152		$1,152
				Subtotal:	$21,224		

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Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
lonment							
Well Abandonment Mob	each	$2,000.00	1		$2,000		$2,000
2" Well Abandonment	lf	$15.00	3550		$53,250		$53,250
6" Well Abandonment	lf	$25.00	860		$21,500		$21,500
System Decommissioning Level 1 (well he	each system	$5,000.00	0		$0		
System Decommissioning Level 2 (compl	each system	$15,000.00	1		$15,000		$15,000
Demolition Crew (including labor and equi	days	$8,000.00	1		$8,000		$8,000
				Subtotal:	$99,750		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Lodging	day/person	$150.00	15		$2,250		$2,250
Truck/car rental per day	day	$50.00	16		$800		$800
Water level indicator per day	day	$0.00	16		$0	Own	$0
Level D PPE	day/person	$15.00	16		$240		$240
Miscellaneous (photographs, gas, tolls, su	day	$20.00	16		$320		$320
Meals (day work)	day/person	$25.00	16		$400		$400
PID per day	day	$0.00	15		$0	Own	$0
				Subtotal:	$4,010		

		Incremental Cost	Extended Cost
System Operation		**$152,044**	**$760,219**
System O&M	Module Total	$152,044	$760,219

Design/Execution Assumptions

Specify frequency of O&M (ex. Monthly for 5 years)

	Full Time Operator		Technician Hours per day	8	
O&M Events per year	104		Days per week	2	
Carbon changeout	1	events per yea	Weeks per year	52	
Amount of Carbon changeout	4000	lbs			
Recovery Line Cleaning events	4	events per year	105	days	
Number of technicians	1		8	hrs/day	

	52	wks prep/coord	1	Senior Expert	0.1 hrs/wk
			1	Principle Engineer	0.2 hrs/wk
			1	Senior Engineer	0.5 hrs/wk
System Samples	Frequency		1	Project Engineer	1.5 hrs/wk
			1	technician	0 hrs/wk
Carbon Influent	12		1	project assistance	0.1 hrs/wk
Carbon Midpoint	0				
Carbon Effluent	12	Repair	1	events per year	

Project Management		10% Labor		
Program Manager	2.9	hrs/wk	#	
Senior Project Manager	15	hrs/wk	#	
Project Manager	0	hrs/wk	0	
Task Manager	38.2	hrs/wk	#	

Total	24
QC	12

Task Repetitions Calculator:	
Year 1	
Year 2	1.00
Year 3	1.00
Year 4	1.00
Year 5	1.00
Year 6	1.00
Year 7	
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Total Reps:	5.00
DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR	

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Expert	hour	$326.64	5		$1,699		$8,493
Principal Sci/Eng/Arch/Designer	hour	$194.30	10		$2,021		$10,104
Senior Sci/Eng/Arch/Designer	hour	$151.42	26		$3,937		$19,685
Project Sci/Eng/Arch/Designer	hour	$120.80	78		$9,422		$47,112
Technician III	hour	$94.15	840		$79,086		$395,431
Project Assistant	hour	$79.65	5		$414		$2,071
Program Manager	hour	$333.54	3		$967		$4,836
Senior Project Manager	hour	$192.96	15		$2,894		$14,472
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	38		$5,788		$28,940
				Subtotal:	$106,229		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
EPA TO-15 Full Scan	each	$115.00	36		$4,140		$20,700
Granular Activated Carbon Changeout	lb	$1.50	4000		$6,000		$30,000
Maintenance and Replacement Parts (4% EQ)	%	4%	205000		$8,200		$41,000
Vegetation Maintenance	annually	$500.00	1		$500		$2,500
				Subtotal:	$18,840		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Level D PPE	day/person	$15.00	104		$1,560		$7,800
Monthly Utilities (phone, telemetry , water, sewer etc)	month	$1,100.00	12		$13,200	**Annual Utilities**	$66,000
Utilities - Electrical AS/SVE	month	$858.33	12		$10,300	**$23,500**	$51,500
Miscellanous Items (Fire extinguisher service, PLC softwar	annually	$1,915.00	1		$1,915		$9,575
				Subtotal:	$26,975		

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Sheet Total: $277,562

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	Incremental Cost	Extended Cost
Semi-Annual Groundwater Monitoring	$21,803	$109,014
Monitoring Well Sampling — Module Total:	$21,803	$109,014

Analyses	Y" if analysis desired
VOCs	Y
BTEX	
Metals	Y
Dissolved CO2	
Chlorides	
Cations	
MEE	
Nitrate/Nitrite	
Sulfate/Sulfide	
TOC	
Divalent Manganese	
Dissolved Hydrogen	
Dehalococcoides so	

Field Kits	Y" if analysis desired
Alkalinity	
Iron II (Fe 2+)	

Enter"Y" if analysis desired

Assumes 1 event
Change # of Events in Task Repetitions

Number of Wells	46			
			10	Purge volume/well (gal)
Sampling Rate	2	hrs/well		
Total time per event	92	hrs	12	days
Number of technicians	1			
Man-hrs per event	96	hrs	8	hrs/day
3 wks prep/coord	1	Senior	2	hrs/wk
	1	project eng	4	hrs/wk
	1	Staff eng	8	hrs/wk
	1	technician	0	hrs/wk
	1	day		
Total Purge Volume Generated per event	460	gal		
	55	gal/drum		

Including field/trip blanks and/or MS/DS

Processed through system: Yes

Waste Management

	9	drums		
Total drums for disposal	0	Haz percentage	0%	
Total haz drums for disposal	0	Non-haz percentage	100%	
Haz T&D loads	0			
Total non-haz drums for disposal	0			
Non-haz T&D loads	0			
Characterization samples	0			

Project Management	10% of labor
Program Manager	0.4
Senior Project Manager	2.2
Project Manager	
Task Manager	5.5

Task Repetitions Calculator:	
Year 1	
Year 2	1.00
Year 3	1.00
Year 4	1.00
Year 5	1.00
Year 6	1.00
Year 7	
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Total Reps:	5.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	Extended
Senior Sci/Eng/Arch/Designer	hour	$151.42	6		$909		$4,543
Project Sci/Eng/Arch/Designer	hour	$120.80	12		$1,450		$7,248
Staff Sci/Eng/Arch/Designer	hour	$104.69	24		$2,513		$12,563
Technician III	hour	$94.15	96		$9,038		$45,192
Program Manager	hour	$333.54	0.4		$133		$667
Senior Project Manager	hour	$192.96	2.2		$425		$2,123
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	5.5		$833		$4,167
	hour						
				Subtotal:	$15,300		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	Extended
Drum Disposal							
Drum rate (soil or liquid, 55-gallon incl. drum purchase)	each	$195.00	0		$0		
Transportation (200 miles up to 14 drums) , non-haz	each load	$450.00	0		$0		
55-gallon drum (soil or liquid, 55-gallon), haz	each	$0.00	0		$0		
Transportation (200 miles up to 14 drums), haz	each load	$0.00	0		$0		
Laboratory							
VOCs (8260B)	each	$46.00	50		$2,300		$11,500
BTEX/MtBE (8021)	each	$45.00	0		$0		
Metals - Al, Ar, Br, Cr, Fe, Pb, Mn	each	$57.19	49		$2,802		$14,012
Permanent Gases (CO2, N2, O2)	each	$0.00	0		$0		
Chloride by IC	each	$0.00	0		$0		
Cations	each	$45.96	0		$0		
Light hydrocarbons (methane, ethane, ethene)	each	$48.00	0		$0		
Nitrate+Nitrite	each	$0.00	0		$0		
Sulfide, total	each	$33.00	0		$0		
Total Organic Carbon (TOC)-single analysis	each	$21.00	0		$0		
Divalent manganese	each	$0.00	0		$0		
Dissolved Hydrogen	each	$142.98	0		$0		
Dehalococcoides	each	$326.80	0		$0		
			0				
			0				
			0				
				Subtotal:	$5,102		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	Extended
PID per day	day	$0.00	0		$0	**Own**	
Interface probe IP-150' Solinist per day	day	$0.00	0		$0	**Own**	
Truck/car rental per day	day	$50.00	12		$600		$3,000
Level D PPE	day/person	$15.00	15		$225		$1,125
Miscellaneous (photographs, gas, tolls, supplies, etc.)	day	$20.00	0		$0		
Meals (day work)	day/person	$25.00	0		$0		
Shipping (Coolers)	each	$100.00	5		$500		$2,500
GPS Unit Garmine e Trex Vista	each	$0.00	0		$0		
Decon area setup/supplies	day	$25.00	3		$75	**Own**	$375
Submersible pump w/ control box per day	day	$0.00	12		$0	**Own**	$0
Horiba U-52 with flow-through cell per day	day	$0.00	12		$0	**Own**	$0
Generator per day	day	$0.00	12		$0	**Own**	$0
Bailer (24 per box)	each	$3.47	0		$0		
				Subtotal:	$1,400		

Annual Groundwater Monitoring — $33,710 — $168,548

Monitoring Well Sampling — Module Total: $33,710 — $168,548

Analyses	Y" if analysis desired
VOCs	Y
BTEX	Y
Metals	Y
Dissolved CO2	Y
Chlorides	Y
Cations	
MEE	Y
Nitrate/Nitrite	Y
Sulfate/Sulfide	Y
TOC	Y
Divalent Manganese	
Dissolved Hydrogen	
Dehalococcoides so	
Dinoseb	Y
Field Kits	Y" if analysis desired
Alkalinity	
Iron II (Fe 2+)	Y

Enter "Y" if analysis desired

Including field/trip blanks and/or MS/DS

Processed through system: Yes

Project Management	10% of labor
Program Manager	0.5
Senior Project Manager	2.4
Project Manager	
Task Manager	6.1

Assumes 1 event

Change # of Events in Task Repetitions

Number of Wells	55			10	Purge volume/well (gal)
Sampling Rate	2	hrs/well			
Total time per event	110	hrs		14	days
Number of technicians	1				
Man-hrs per event	112	hrs		8	hrs/day
3 wks prep/coord	1	Senior		2	hrs/wk
	1	project eng		4	hrs/wk
	1	Staff eng		8	hrs/wk
	1	technician		0	hrs/wk
	1	day			
Total Purge Volume Generated per event	550	gal	*MNA wells*	28	
	55	gal/drum			

Waste Management

	10	drums	
Total drums for disposal	0	Haz percentage	0%
Total haz drums for disposal	0	Non-haz percentag	100%
Haz T&D loads	0		
Total non-haz drums for disposal	0		
Non-haz T&D loads	0		
Characterization samples	0		

Task Repetitions Calculator:

Year 1	
Year 2	1.00
Year 3	1.00
Year 4	1.00
Year 5	1.00
Year 6	1.00
Year 7	
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Total Reps:	5.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Sci/Eng/Arch/Designer	hour	$151.42	6		$909		$4,543
Project Sci/Eng/Arch/Designer	hour	$120.80	12		$1,450		$7,248
Staff Sci/Eng/Arch/Designer	hour	$104.69	24		$2,513		$12,563
Technician III	hour	$94.15	112		$10,545		$52,724
Program Manager	hour	$333.54	0.5		$167		$834
Senior Project Manager	hour	$192.96	2.4		$463		$2,316
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	6.1		$924		$4,621
	hour						
				Subtotal:	$16,970		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Drum Disposal							
Drum rate (soil or liquid, 55-gallon incl. drum purchase)	each	$195.00	0		$0		
Transportation (200 miles up to 14 drums) , non-haz	each load	$450.00	0		$0		
55-gallon drum (soil or liquid, 55-gallon), haz	each	$0.00	0		$0		
Transportation (200 miles up to 14 drums), haz	each load	$0.00	0		$0		
Laboratory							
VOCs (8260B)	each	$46.00	62		$2,852		$14,260
BTEX/MtBE (8021)	each	$45.00	28		$1,260		$6,300
Metals - Al, Ar, Br, Cr, Fe, Pb, Mn	each	$57.19	58		$3,317		$16,585
Permanent Gases (CO2, N2, O2)	each	$0.00	28		$0		$0
Chloride by IC	each	$0.00	28		$0		$0
Cations	each	$45.96	0		$0		
Light hydrocarbons (methane, ethane, ethene)	each	$48.00	28		$1,344		$6,720
Nitrate+Nitrite	each	$0.00	28		$0		$0
Sulfide, total	each	$33.00	28		$924		$4,620
Total Organic Carbon (TOC)-single analysis	each	$21.00	28		$588		$2,940
Divalent manganese	each	$0.00	0		$0		
Dissolved Hydrogen	each	$142.98	0		$0		
Dehalococcoides	each	$326.80	0		$0		
Dinoseb	ea	$125.00	29		$3,625		$18,125
			0				
			0				
				Subtotal:	$13,910		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
PID per day	day	$0.00	0		$0	Own	
Interface probe IP-150' Solinist per day	day	$0.00	0		$0	Own	
Truck/car rental per day	day	$50.00	14		$700		$3,500
Level D PPE	day/person	$15.00	17		$255		$1,275
Miscellaneous (photographs, gas, tolls, supplies, etc.)	day	$20.00	0		$0		
Meals (day work)	day/person	$25.00	0		$0		
Shipping (Coolers)	each	$100.00	18		$1,800		$9,000
GPS Unit Garmine e Trex Vista	each	$0.00	0		$0		
Decon area setup/supplies	day	$25.00	3		$75	Own	$375
Submersible pump w/ control box per day	day	$0.00	14		$0	Own	$0
Horiba U-52 with flow-through cell per day	day	$0.00	14		$0	Own	$0
Generator per day	day	$0.00	14		$0	Own	$0
Bailer (24 per box)	each	$3.47	0		$0		
				Subtotal:	$2,830		

			Incremental Cost	Extended Cost
Permit Compliance			**$65,907**	**$329,535**
Site Maintenance		Module Total:	$65,907	$329,535

Assume costs for landfill monitoring, stormwater maintenance and vegetative maintenance
Monthly inspection of landfill cap
Weekly storm water inspections and management of stromwater
Weekly maintenance, mowing and clearing
Assume actions conducted by full time site operator in conjunction with CATS operation with assistance from additional personnel for 2 people tasks

Technician Hours per day	8	
Days per week (PC)	1	
Weeks per year	52	
Days	52	days
Hours per day	8	hrs
Number of technicians	2	
Man-hrs	832	hrs
		52 days

Task Repetitions Calculator:	
Year 1	
Year 2	1.00
Year 3	1.00
Year 4	1.00
Year 5	1.00
Year 6	1.00
Year 7	
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Total Reps:	5.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Project Management — 10% Labor

Program Manager	1.6	hrs/wk
Senior Project Manager	8.5	hrs/wk
Project Manager	0	hrs/wk
Task Manager	21.8	hrs/wk

0 wk prep/coord

11 wk

PREP TIME

1	Project Manager	2	hrs/mo
1	Senior Engineer/Geologist	2	hrs/mo
1	Project Engineer/Geologist	4	hrs/mo
1	Engineer/Geologist I	8	hrs/mo
1	Field Technician	4	hrs/mo
1	Project Assistant	0	hrs/mo

Field Oversight

1	Project Manager	0	hrs/wk
1	Senior Engineer/Geologist	0.5	hrs/wk
1	Project Engineer/Geologist	2	hrs/wk
1	Engineer/Geologist I	4	hrs/wk
1	Field Technician	0	hrs/wk
1	Project Assistant	0.27	hrs/wk

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Project Manager	hour	$192.96	0		$0		
Senior Sci/Eng/Arch/Designer	hour	$151.42	6		$833		$4,164
Project Sci/Eng/Arch/Designer	hour	$120.80	22		$2,658		$13,288
Sci/Eng/Arch/Designer 2	hour	$93.47	44		$4,113		$20,564
Technician I	hour	$56.96	832		$47,388		$236,940
Project Assistant	hour	$79.65	3		$239		$1,195
Program Manager	hour	$333.54	2		$534		$2,668
Senior Project Manager	hour	$192.96	9		$1,640		$8,201
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	22		$3,303		$16,516
				Subtotal:	$60,707		

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Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
				Subtotal:	$0		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
PID per day	day	$0.00	0		$0	Own	
Truck/car rental per day	day	$50.00	52		$2,600		$13,000
Level D PPE	day/person	$15.00	104		$1,560		$7,800
Interface probe IP-150' Solinist per day	day	$0.00	0		$0	Own	
Meals (day work)	day/person	$25.00	0		$0		
Miscellaneous (photographs, gas, tolls, supplies, etc.)	day	$20.00	52		$1,040		$5,200
Shipping (Coolers)	each	$100.00	0		$0		
Communications	day	$2.00	0		$0		
				Subtotal:	$5,200		

		Incremental Cost	Extended Cost
Annual Corrective Action Report		**$29,991**	**$149,953**
Negotiation, Drafting and Agency Coordination	Module Total:	$29,991	$149,953

Compilation and Analysis				Project Management	10% Labor		
Senior Expert	4	hrs		Program Manager	0.8	hrs	#
Project Advisor	2	hrs		Senior Project Manager	4.2	hrs	#
Principal	4	hrs		Project Manager	0	hrs	
Senior	8	hrs		Task Manager	10.7	hrs	#
Project	12	hrs					#
Staff	30	hrs					
Drafting	10	hrs					
PA	2	hrs					

Draft Report			Subcontracting	
Senior Expert	5	hrs		
Project Advisor	5	hrs		
Principal	8	hrs		
Senior	10	hrs		
Project	15	hrs		
Staff	30	hrs		
Drafting	10	hrs		
PA	3	hrs		

Final Report			Expenses	
Senior Expert	2	hrs		
Project Advisor	1	hrs		
Principal	8	hrs		
Senior	4	hrs		
Project	12	hrs		
Staff	7	hrs		
Drafting	7	hrs		
PA	3	hrs		

Task Repetitions Calculator:	
Year 1	
Year 2	1.00
Year 3	1.00
Year 4	1.00
Year 5	1.00
Year 6	1.00
Year 7	
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Year 21	
Year 22	
Year 23	
Year 24	
Year 25	
Year 26	
Year 27	
Year 28	
Year 29	
Year 30	
Total Reps:	5.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Subtotal: 202

9 Number of Paper Copies 25 Pages per Copy

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Expert	hour	$326.64	11		$3,593		$17,965
Project Advisor	hour	$238.42	8		$1,907		$9,537
Principal Sci/Eng/Arch/Designer	hour	$194.30	20		$3,886		$19,430
Senior Sci/Eng/Arch/Designer	hour	$151.42	22		$3,331		$16,656
Project Sci/Eng/Arch/Designer	hour	$120.80	39		$4,711		$23,556
Staff Sci/Eng/Arch/Designer	hour	$104.69	67		$7,026		$35,130
CADD/Drafter II	hour	$72.58	27		$1,968		$9,839
Project Assistant	hour	$79.65	8		$611		$3,053
	hour						
Program Manager	hour	$333.54	1		$267		$1,334
Senior Project Manager	hour	$192.96	4		$810		$4,052
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	11		$1,621		$8,106
	hour						
	hour						
				Subtotal:	$29,732		

rs

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes
				Subtotal:	$0	

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
ADEM RCRA Permit Fees	ea	1.00	$ -		$0		
ADEM UIC Permit Fees	ea	1.00	$ -		$0		
Copies	each	$0.15	225		$34		$169
Shipping (Reports)	each	$25.00	9		$225		$1,125
				Subtotal:	$259		

Appendix 3 Modified CATS Alterative Cost
Table C-4 Creola, Alabama

Project Phase	Component	Description		Capital Cost ($)	Annual OMM Costs ($)	Operating Period Yrs	Periodic Costs ($)	Total Cost ($)
Operations	ZVI Source Remediation Phase II	Direct push injection of EHC™, a ZVI and organic carbon reagant, into the source area. Details of the planned injections will be presented in the design report along with the results of the Phase I injections.	Active Remediation	$ 1,139,000	$ -	$ -	$ -	**$ 1,139,000**
	Well Installation	Modification of the CATS to improve performance including the installation of injection wells upgradient, and an additional recover well located closer to the source area. The preliminary layout is provided. The final design will be presented in the design report along with the results of the pilot testing.		$ 84,000	$ -	$ -	$ 33,000	**$ 117,000**
	Optimization and Modifications to the CATS system	Modification of the CATS to improve performance including modifications to the treatment processes and acceptance of the leachate water into the system. The final design will be presented in the design report along with the results of the pilot testing.		$ 634,000	$ -	$ -	$ 111,000	**$ 745,000**
	CATS Operation	Operation of the CATS system for five years until transition to MNA sampling is achieved. Includes labor and expenses for operation. Expenses include waste removal, equipment maintenance, safety supplies etc.		$ -	$ 221,900	5	$ -	**$ 1,109,500**
	CATS Utilities	Utilitiy cost to operate the system including telephone, water, sewer, electricity and internet (for system notifications).		$ -	$ 78,000	5	$ -	**$ 390,000**
	CATS Materials	Material cost for filter changeouts, carbon changeouts and air striper media change outs.		$ -	$ 123,500	5	$ -	**$ 617,500**
	Performance Monitoring	Monitoring of wells as outlined in the report to evaluate the performance of the CATS and Source area treatment.		$ -	$ 55,500	5	$ -	**$ 277,500**
	Permit Compliance	Post Closure care of the landfill during active remediation		$ -	$ 65,900	5	$ -	**$ 329,500**
	Reporting	Semi-annual corrective action reporting		$ -	$ 30,000	5	$ -	**$ 150,000**
								$ 4,875,000

Periodic Cost include well abandonment and the cost to demolish the systems once the active remediaiont ends.

RIES, Creola, AL

ARCADIS
Infrastructure, environment, buildings

17-Mar-16

COSTS:		Rates	ZVI Phase II Units/Hrs	ZVI Phase II Cost	Additional Decommissioning Units/Hrs	Additional Decommissioning Cost	CATS Well Installation Units/Hrs	CATS Well Installation Cost	CATS Optimization Units/Hrs	CATS Optimization Cost	CATS Operation Units/Hrs	CATS Operation Cost
LABOR COSTS												
Program Manager		$ 333.54	3	$1,101	1	$167	0	$133	3	$867	30	$10,006
Senior Project Manager		$ 192.96	17	$3,319	3	$540	2	$347	14	$2,644	157	$30,295
Task Manager		$ 151.52	44	$6,621	7	$1,091	5	$697	35	$5,273	400	$60,532
Senior Expert		$ 326.64	11	$3,593	0	$0	0	$0	10	$3,266	26	$8,493
Project Advisor		$ 238.42	0	$0	0	$0	0	$0	13	$3,099	0	$0
Principal Sci/Eng/Arch/Designer		$ 194.30	0	$0	0	$0	0	$0	30	$5,829	65	$12,630
Senior Sci/Eng/Arch/Designer		$ 151.42	0	$0	4	$606	4	$606	52	$7,874	260	$39,370
Project Sci/Eng/Arch/Designer		$ 120.80	108	$13,046	8	$966	12	$1,450	120	$14,496	520	$62,816
Staff Sci/Eng/Arch/Designer		$ 104.69	0	$0	16	$1,675	34	$3,559	470	$49,205	0	$0
Sci/Eng/Arch/Designer 2		$ 93.47	622	$58,140	48	$4,487	0	$0	0	$0	0	$0
Technician III		$ 94.15	0	$0	110	$10,357	63	$5,931	0	$0	9400	$885,013
Technician I		$ 56.96	622	$35,427	0	$0	0	$0	0	$0	0	$0
CADD/Drafter II		$ 72.58	0	$0	0	$0	0	$0	48	$3,484	0	$0
Project Assistant		$ 79.65	2	$159	2	$159	0	$0	8	$637	5	$398
Subtotals			**1429**	**$121,406**	**199**	**$20,048**	**120**	**$12,724**	**802**	**$96,674**	**10863**	**$1,109,552**
OTHER DIRECT COSTS												
Truck/car rental per day	day	$50	54	$2,700	11	$550	7	$350	35	$1,750	0	$0
Lodging	day/person	$150.00	106	$15,900	10	$1,500	0	$0	33	$4,950	0	$0
Meals (day work)	day/person	$25	108	$2,700	11	$275	7	$175	35	$875	0	$0
Decon area setup/supplies	day	$25	0	$0	0	$0	0	$0	0	$0	0	$0
Level D PPE	day/person	$15	108	$1,620	11	$165	7	$105	35	$525	1300	$19,500
Miscellaneous (photographs, gas, tolls, supplies, etc.)	day	$20	54	$1,080	11	$220	7	$140	0	$0	0	$0
Copies	each	$0	0	$0	0	$0	0	$0	75	$11	0	$0
Shipping (Coolers)	each	$100	0	$0	0	$0	4	$400	0	$0	0	$0
Shipping (Reports)	each	$25	0	$0	0	$0	0	$0	3	$75	0	$0
Communications	day	$2	108	$216	0	$0	0	$0	0	$0	0	$0
200 micron Bag filter	each	$35	0	$0	0	$0	0	$0	0	$0	630	$22,050
25 micron bag filter	each	$45	0	$0	0	$0	0	$0	0	$0	360	$16,200
3 micron cartridge	each	$40	0	$0	0	$0	0	$0	0	$0	1440	$57,600
Monthly Utilities (phone, telemetry , water, sewer etc)	month	$1,100.00	0	$0	0	$0	0	$0	0	$0	60	$66,000
Utilities - Electrical	month	$5,400	0	$0	0	$0	0	$0	0	$0	60	$324,000
Miscellanous Items (Fire extinguisher service, PLC softwa	annually	$1,915	0	$0	0	$0	0	$0	0	$0	5	$9,575
Subtotals				**$24,216**		**$2,710**		**$1,170**		**$8,186**		**$514,925**
SUBCONTRACTOR EXPENSES												
VOCs (8260B)	each	$ 46.00		$0		$0		$598		$0		$16,560
BTEX/MtBE (8021)	each	$ 45.00		$0		$0		$0		$0		$0
TAL Metals (23), including Mercury and digestion (6010)	each	$ 80.00		$0		$0		$560		$0		$24,000
Sulfide, total	each	$ 33.00		$0		$0		$0		$0		$0
Total Organic Carbon (TOC)-single analysis	each	$ 21.00		$0		$0		$0		$0		$0
Full waste characterization	each	$ 613.00		$0		$0		$2,452		$0		$0
Light hydrocarbons (methane, ethane, ethene)	each	$ 48.00		$0		$0		$0		$0		$0
Drum rate (soil or liquid, 55-gallon incl. drum purchase)	each	$ 195.00		$0		$0		$7,410		$0		$35,100
Transportation (200 miles up to 14 drums) , non-haz	each load	$ 450.00		$0		$0		$1,800		$0		$6,750
Utility location	day	$ 1,880.00		$0		$0		$1,880		$0		$0
Granular Activated Carbon Changeout	lb	$ 2.00		$0		$0		$0		$0		$100,000
Metals - Al, Ar, Br, Cr, Fe, Pb, Mn	each	$ 57.19		$0		$0		$0		$0		$0
12 inch bore hole in residuum using HSA rig	LF	$ 55.00		$0		$0		$18,150		$0		$0
6" well materials Stainless Steel	foot	$ 60.00		$0		$0		$19,800		$0		$0
Development Rig	day	$ 1,502.00		$0		$0		$10,514		$0		$0
EHC-G	lb	$ 1.85		$625,729		$0		$0		$0		$0
EHC-G Delivery	each	$ 2,650.00		$23,850		$0		$0		$0		$0
Water transport	per/1000 gallons	$ 15.00		$2,025		$0		$0		$0		$0
Trenching, backfill and compaction	LF	$ 25.00		$0		$0		$0		$30,000		$0
2- inch HDPE SDR11 installed and fusion welded	LF	$ 2.50		$0		$0		$0		$7,500		$0
2" PVC Electrical conduit installation with #10 AWG (4 C	LF	$ 10.00		$0		$0		$0		$10,000		$0
30,000 ball Air Stripper changout low density	#N/A	$ 22,575.00		$0		$0		$0		$0		$112,875
Refurbish Pump	ea	$ 4,300.00		$0		$0		$0		$0		$21,500
Dinoseb	ea	$ 125.00		$0		$0		$0		$0		$0
Influent Aeration Tank	Lump	$ 25,000.00		$0		$0		$0		$25,000		$0
Aeration Tank Blower	Lump	$ 10,000.00		$0		$0		$0		$10,000		$0
Air Stripper - Recirculation Pump and Piping	Lump	1000000%		$0		$0		$0		$10,000		$0
Polymer Delivery System (Dynablend or equiv)	Each	$ 12,000.00		$0		$0		$0		$12,000		$0
Solids Storage Tank	Lump	$ 7,500.00		$0		$0		$0		$7,500		$0
Decant Recycle System (Pump and Controls)	Lump	$ 15,000.00		$0		$0		$0		$15,000		$0
Filter Press	Lump	$ 75,000.00		$0		$0		$0		$75,000		$0
Filter Press Feed Pump	Lump	$ 5,000.00		$0		$0		$0		$5,000		$0
Piping, valves, and appurtenances	Lump	$ 20,000.00		$0		$0		$0		$20,000		$0
Instrumentation	Lump	$ 15,000.00		$0		$0		$0		$15,000		$0
Motor Control Center / Main Control Panel	Lump	$ 30,000.00		$0		$0		$0		$30,000		$0
Taxes (5% of EQ)	%	$ 0.05		$0		$0		$0		$11,225		$0
Freight (2% of EQ)	%	$ 0.02		$0		$0		$0		$4,490		$0
Set Process Equipment (12% of EQ)	%	$ 0.12		$0		$0		$0		$26,940		$0
Process Piping (10% of EQ)	%	$ 0.10		$0		$0		$0		$22,450		$0
Painting (1.5% of EQ)	%	$ 0.02		$0		$0		$0		$3,368		$0
Electrical (25% of EQ)	%	$ 0.25		$0		$0		$0		$56,125		$0
Mobilization, Demobilization, Permits, and Temporary Co	lump	$ 25,000.00		$0		$0		$0		$25,000		$0
Well Packer Installation (RW-4)	lump	$ 15,000.00		$0		$0		$0		$15,000		$0
Influent, Solids Storage Tank, and Clarifier Foundations ar	lumpo	$ 30,000.00		$0		$0		$0		$30,000		$0
Contractor Profit (8% of PEC)	%	$ 0.08		$0		$0		$0		$37,328		$0
Contingencies (5% of DC)	%	$ 0.05		$0		$0		$0		$25,196		$0
Maintenance and Replacement Parts (4% EQ)	%	$ 0.04		$0		$0		$0		$0		$45,000
Vironex Mob/Demob	each	$ 5,500.00		$5,500		$0		$0		$0		$0
Hand auger clearing	each	$ 50.00		$7,250		$0		$0		$0		$0
Day Rate	day	$ 6,000.00		$324,000		$0		$0		$0		$0
Decontamination, drums, etc	lump	$ 2,500.00		$2,500		$0		$0		$0		$0
Injection Reporting	lump	$ 2,500.00		$2,500		$0		$0		$0		$0
55 gall drum filled and staged	drum	$ 60.00		$0		$0		$2,280		$0		$0
Decontamination	week	$ 475.00		$0		$0		$665		$0		$0
Hollow stem auger mobilization (equipment, decon pad co	each	$ 3,500.00		$0		$0		$3,500		$0		$0
Mobilization/ Demobilization	each	$ 1,800.00		$0		$0		$0		$0		$9,000
Recovery Well Pump Removal/Setting	each	$ 7,200.00		$0		$0		$0		$0		$36,000
Vegetation Maintenance	annually	$ 500.00		$0		$0		$0		$0		$2,500
Equipment Maintenance/Repair	annually	$ 4,635.00		$0		$0		$0		$0		$23,175
Jetting of Injection Wells/ Well Maintenance	annually	$ 5,000.00		$0		$0		$0		$0		$25,000
Sludge Basin cleanout, paint and media replacement	each	$ 7,000.00		$0		$0		$0		$0		$35,000
Well Abandonment Mob	each	$ 2,000.00		$0		$2,000		$0		$0		$0
6" Well Abandonment	lf	$ 25.00		$0		$8,250		$0		$0		$0
System Decommissioning Level 1 (well house, etc)	each system	$ 5,000.00		$0		$10,000		$0		$0		$0
System Decommissioning Level 2 (complex systems - AS,	each system	$ 15,000.00		$0		$45,000		$0		$0		$0
Demolition Crew (including labor and equipment)	days	$ 8,000.00		$0		$56,000		$0		$0		$0
Monitoring Well Flush Mount 2 inch	each	$ 75.00		$0		$0		$450		$0		$0
Subtotals				**$993,354**		**$121,250**		**$70,059**		**$529,122**		**$492,460**
Task Sub-Totals				**$1,138,976**		**$144,008**		**$83,953**		**$633,982**		**$2,116,937**

ARCADIS
Infrastructure, environment, buildings

17-Mar-16

COSTS:		Rates	Groundwater Monitoring Units/Hrs	Groundwater Monitoring Cost	Permit Compliance Units/Hrs	Permit Compliance Cost	Reporting Units/Hrs	Reporting Cost	TOTAL UNITS/HRS	TOTAL COST
LABOR COSTS										
Program Manager		$ 333.54	5	$1,501	8	$2,668	4	$1,334	53	$17,778
Senior Project Manager		$ 192.96	23	$4,438	43	$8,201	21	$4,052	279	$53,837
Task Manager		$ 151.52	58	$8,788	109	$16,516	54	$8,106	710	$107,624
Senior Expert		$ 326.64	0	$0	0	$0	55	$17,965	102	$33,317
Project Advisor		$ 238.42	0	$0	0	$0	40	$9,537	53	$12,636
Principal Sci/Eng/Arch/Designer		$ 194.30	0	$0	0	$0	100	$19,430	195	$37,889
Senior Sci/Eng/Arch/Designer		$ 151.42	60	$9,085	28	$4,164	110	$16,656	518	$78,361
Project Sci/Eng/Arch/Designer		$ 120.80	120	$14,496	110	$13,288	195	$23,556	1193	$144,113
Staff Sci/Eng/Arch/Designer		$ 104.69	240	$25,126	0	$0	336	$35,130	1096	$114,695
Sci/Eng/Arch/Designer 2		$ 93.47	0	$0	220	$20,564	0	$0	890	$83,190
Technician III		$ 94.15	1040	$97,916	0	$0	0	$0	10613	$999,217
Technician I		$ 56.96	0	$0	4160	$236,940	0	$0	4782	$272,367
CADD/Drafter II		$ 72.58	0	$0	0	$0	136	$9,839	184	$13,323
Project Assistant		$ 79.65	0	$0	15	$1,195	38	$3,053	70	$5,602
Subtotals			**1546**	**$161,350**	**4692**	**$303,535**	**1088**	**$148,659**	**20738**	**$1,973,949**
OTHER DIRECT COSTS										
Truck/car rental per day	day	$50	130	$6,500	260	$13,000	0	$0	497	$24,850
Lodging	day/person	$150.00	0	$0	0	$0	0	$0	149	$22,350
Meals (day work)	day/person	$25	0	$0	0	$0	0	$0	161	$4,025
Decon area setup/supplies	day	$25	30	$750	0	$0	0	$0	30	$750
Level D PPE	day/person	$15	160	$2,400	520	$7,800	0	$0	2141	$32,115
Miscellaneous (photographs, gas, tolls, supplies, etc.)	day	$20	0	$0	260	$5,200	0	$0	332	$6,640
Copies	each	$0	0	$0	0	$0	1125	$169	1200	$180
Shipping (Coolers)	each	$100	115	$11,500	0	$0	0	$0	119	$11,900
Shipping (Reports)	each	$25	0	$0	0	$0	45	$1,125	48	$1,200
Communications	day	$2	0	$0	0	$0	0	$0	108	$216
200 micron Bag filter	each	$35	0	$0	0	$0	0	$0	630	$22,050
25 micron bag filter	each	$45	0	$0	0	$0	0	$0	360	$16,200
3 micron cartridge	each	$40	0	$0	0	$0	0	$0	1440	$57,600
Monthly Utilities (phone, telemetry , water, sewer etc)	month	$1,100.00	0	$0	0	$0	0	$0	60	$66,000
Utilities - Electrical	month	$5,400	0	$0	0	$0	0	$0	60	$324,000
Miscellanous Items (Fire extinguisher service, PLC softwa	annually	$1,915	0	$0	0	$0	0	$0	5	$9,575
Subtotals				**$21,150**		**$26,000**		**$1,294**		**$599,651**
SUBCONTRACTOR EXPENSES										
VOCs (8260B)	each	$ 46.00		$25,760		$0		$0	0	$42,918
BTEX/MtBE (8021)	each	$ 45.00		$6,300		$0		$0	0	$6,300
TAL Metals (23), including Mercury and digestion (6010)	each	$ 80.00		$0		$0		$0	0	$24,560
Sulfide, total	each	$ 33.00		$4,620		$0		$0	0	$4,620
Total Organic Carbon (TOC)-single analysis	each	$ 21.00		$2,940		$0		$0	0	$2,940
Full waste characterization	each	$ 613.00		$0		$0		$0	0	$2,452
Light hydrocarbons (methane, ethane, ethene)	each	$ 48.00		$6,720		$0		$0	0	$6,720
Drum rate (soil or liquid, 55-gallon incl. drum purchase)	each	$ 195.00		$0		$0		$0	0	$42,510
Transportation (200 miles up to 14 drums) , non-haz	each load	$ 450.00		$0		$0		$0	0	$8,550
Utility location	day	$ 1,880.00		$0		$0		$0	0	$1,880
Granular Activated Carbon Changeout	lb	$ 2.00		$0		$0		$0	0	$100,000
Metals - Al, Ar, Br, Cr, Fe, Pb, Mn	each	$ 57.19		$30,597		$0		$0	0	$30,597
12 inch bore hole in residuum using HSA rig	LF	$ 55.00		$0		$0		$0	0	$18,150
6" well materials Stainless Steel	foot	$ 60.00		$0		$0		$0	0	$19,800
Development Rig	day	$ 1,502.00		$0		$0		$0	0	$10,514
EHC-G	lb	$ 1.85		$0		$0		$0	0	$625,729
EHC-G Delivery	each	$ 2,650.00		$0		$0		$0	0	$23,850
Water transport	per/1000 gallons	$ 15.00		$0		$0		$0	0	$2,025
Trenching, backfill and compaction	LF	$ 25.00		$0		$0		$0	0	$30,000
2- inch HDPE SDR11 installed and fusion welded	LF	$ 2.50		$0		$0		$0	0	$7,500
2" PVC Electrical conduit installation with #10 AWG (4 C	LF	$ 10.00		$0		$0		$0	0	$10,000
30,000 ball Air Stripper changout low density	#N/A	$ 22,575.00		$0		$0		$0	0	$112,875
Refurbish Pump	ea	$ 4,300.00		$0		$0		$0	0	$21,500
Dinoseb	ea	$ 125.00		$18,125		$0		$0	0	$18,125
Influent Aeration Tank	Lump	$ 25,000.00		$0		$0		$0	0	$25,000
Aeration Tank Blower	Lump	$ 10,000.00		$0		$0		$0	0	$10,000
Air Stripper - Recirculation Pump and Piping	Lump	1000000%		$0		$0		$0	0	$10,000
Polymer Delivery System (Dynablend or equiv)	Each	$ 12,000.00		$0		$0		$0	0	$12,000
Solids Storage Tank	Lump	$ 7,500.00		$0		$0		$0	0	$7,500
Decant Recycle System (Pump and Controls)	Lump	$ 15,000.00		$0		$0		$0	0	$15,000
Filter Press	Lump	$ 75,000.00		$0		$0		$0	0	$75,000
Filter Press Feed Pump	Lump	$ 5,000.00		$0		$0		$0	0	$5,000
Piping, valves, and appurtenances	Lump	$ 20,000.00		$0		$0		$0	0	$20,000
Instrumentation	Lump	$ 15,000.00		$0		$0		$0	0	$15,000
Motor Control Center / Main Control Panel	Lump	$ 30,000.00		$0		$0		$0	0	$30,000
Taxes (5% of EQ)	%	$ 0.05		$0		$0		$0	0	$11,225
Freight (2% of EQ)	%	$ 0.02		$0		$0		$0	0	$4,490
Set Process Equipment (12% of EQ)	%	$ 0.12		$0		$0		$0	0	$26,940
Process Piping (10% of EQ)	%	$ 0.10		$0		$0		$0	0	$22,450
Painting (1.5% of EQ)	%	$ 0.02		$0		$0		$0	0	$3,368
Electrical (25% of EQ)	%	$ 0.25		$0		$0		$0	0	$56,125
Mobilization, Demobilization, Permits, and Temporary Co	lump	$ 25,000.00		$0		$0		$0	0	$25,000
Well Packer Installation (RW-4)	lump	$ 15,000.00		$0		$0		$0	0	$15,000
Influent, Solids Storage Tank, and Clarifier Foundations ar	lumpo	$ 30,000.00		$0		$0		$0	0	$30,000
Contractor Profit (8% of PEC)	%	$ 0.08		$0		$0		$0	0	$37,328
Contingencies (5% of DC)	%	$ 0.05		$0		$0		$0	0	$25,196
Maintenance and Replacement Parts (4% EQ)	%	$ 0.04		$0		$0		$0	0	$45,000
Vironex Mob/Demob	each	$ 5,500.00		$0		$0		$0	0	$5,500
Hand auger clearing	each	$ 50.00		$0		$0		$0	0	$7,250
Day Rate	day	$ 6,000.00		$0		$0		$0	0	$324,000
Decontamination, drums, etc	lump	$ 2,500.00		$0		$0		$0	0	$2,500
Injection Reporting	lump	$ 2,500.00		$0		$0		$0	0	$2,500
55 gall drum filled and staged	drum	$ 60.00		$0		$0		$0	0	$2,280
Decontamination	week	$ 475.00		$0		$0		$0	0	$665
Hollow stem auger mobilization (equipment, decon pad co	each	$ 3,500.00		$0		$0		$0	0	$3,500
Mobilization/ Demobilization	each	$ 1,800.00		$0		$0		$0	0	$9,000
Recovery Well Pump Removal/Setting	each	$ 7,200.00		$0		$0		$0	0	$36,000
Vegetation Maintenance	annually	$ 500.00		$0		$0		$0	0	$2,500
Equipment Maintenance/Repair	annually	$ 4,635.00		$0		$0		$0	0	$23,175
Jetting of Injection Wells/ Well Maintenance	annually	$ 5,000.00		$0		$0		$0	0	$25,000
Sludge Basin cleanout, paint and media replacement	each	$ 7,000.00		$0		$0		$0	0	$35,000
Well Abandonment Mob	each	$ 2,000.00		$0		$0		$0	0	$2,000
6" Well Abandonment	lf	$ 25.00		$0		$0		$0	0	$8,250
System Decommissioning Level 1 (well house, etc)	each system	$ 5,000.00		$0		$0		$0	0	$10,000
System Decommissioning Level 2 (complex systems - AS,	each system	$ 15,000.00		$0		$0		$0	0	$45,000
Demolition Crew (including labor and equipment)	days	$ 8,000.00		$0		$0		$0	0	$56,000
Monitoring Well Flush Mount 2 inch	each	$ 75.00		$0		$0		$0	0	$450
Subtotals				**$95,062**		**$0**		**$0**		**$2,301,306**
Task Sub-Totals				**$277,562**		**$329,535**		**$149,953**		
									SUBTOTAL COST	**$4,874,906**
									TOTAL COST	**$4,874,906**

		Incremental Cost	Extended Cost
ZVI Phase II		**$1,138,976**	**$1,138,976**
EHC Direct Push Injection	Module Total:	$1,138,976	$1,138,976

Design/Execution Assumptions

Injection Events	1	
# of injection points	145	
Treatment area	102,494	sq. ft
Treatment Thickness	15	ft
Interval thickness	4	ft
ROI	15	ft
Nm	0.046	
V	973	gal
Total soil volume	1,537,417	CF
Soil density	110	LB/CF
Total target soil weight	169,115,860	LB
EHC demand	0.20%	lb EHC/lb soil
safety factor	0	
EHC demand	338232	lb
Per point	2333	lb
Per interval	583	lb
EHC density	44	lb/cf
	5.9	lb/gal
EHC Injection Loading	30%	by weight slurry
Intervals/Pt	4	
Total points	145	
Total EHC per interval	99	gallons
Total water per interval	231	gallons
Total slurry volume per interval	330	gallons
Total water volume	134,165	gallons
Total slurry volume	191,665	gal
Total EHC (crosscheck)	338,232	lb
Injection Rate	6	GPM
Points at once	1	
Injection time:	55	mins/interval
Injection time per day	10	hrs
Field Staff	2	

	1	wks prep/coord
	10	hrs/day
	9	Weeks in the field
	220	mins/pt
	54.0	days/event

PREP TIME			
	1	Senior Expert	2 hrs/wk
	1	Project Engineer/Geologist	18 hrs/wk
	1	Engineer/Geologist I	10 hrs/wk
	1	Field Technician	10 hrs/wk
	1	Project Assistant	2 hrs/wk
	1	Clerical/Word Processing	0 hrs/wk

Field Oversight			
	1	Senior Expert	1 hrs/wk
	1	Project Engineer/Geologist	10 hrs/wk
	1	Engineer/Geologist I	8 hrs/wk
	1	Field Technician	8 hrs/wk
	1	Project Assistant	0 hrs/wk
	1	Clerical/Word Processing	0 hrs/wk

Project Management			10% Labor	
	1	Program Manager	3.3 hrs/wk	#
	1	Senior Project Manager	17.2 hrs/wk	#
	1	Project Manager	0 hrs/wk	
	1	Task Manager	43.7 hrs/wk	#

Task Repetitions Calculator:	
Year 1	
Year 2	1.00
Year 3	
Year 4	
Year 5	
Year 6	
Year 7	
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Total Reps:	1.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Expert	hour	$326.64	11		$3,593		$3,593
Project Sci/Eng/Arch/Designer	hour	$120.80	108		$13,046		$13,046
Sci/Eng/Arch/Designer 2	hour	$93.47	622		$58,140		$58,140
Technician I	hour	$56.96	622		$35,427		$35,427
Project Assistant	hour	$79.65	2		$159		$159
Clerical / Secretarial	hour	$67.37	0		$0		
Program Manager	hour	$333.54	3.3		$1,101		$1,101
Senior Project Manager	hour	$192.96	17.2		$3,319		$3,319
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	43.7		$6,621		$6,621
				Subtotal:	$121,406		

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Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
EHC-G	lb	$1.85	338232		$625,729		$625,729
EHC-G Delivery	each	$2,650.00	9		$23,850		$23,850
Water transport	per/1000 gallon	$15.00	135		$2,025		$2,025
Vironex Mob/Demob	each	$5,500.00	1		$5,500		$5,500
Hand auger clearing	each	$50.00	145		$7,250		$7,250
Day Rate	day	$6,000.00	54.0		$324,000		$324,000
Decontamination, drums, etc	lump	$2,500.00	1		$2,500		$2,500
Injection Reporting	lump	$2,500.00	1		$2,500		$2,500
				Subtotal:	$993,354		

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Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Truck/car rental per day	day	$50.00	54		$2,700		$2,700
Level D PPE	day/person	$15.00	108		$1,620		$1,620
Miscellaneous (photographs, gas, tolls, suppl	day	$20.00	54		$1,080		$1,080
Meals (day work)	day/person	$25.00	108		$2,700		$2,700
Lodging	day/person	$150.00	106		$15,900		$15,900
Communications	day	$2.00	108		$216		$216
				Subtotal:	$24,216		

	Incremental Cost	Extended Cost
Well & System Abandonment	**$144,008**	**$144,008**
Well Abandonment Module Total:	$144,008	$144,008

Design/Execution Assumptions

	7	6" wells
	0	4" wells
Number of wells to be abandoned during year x		
Total man hrs in the field to oversight	7	Total wells
Total man hrs onsite for well abandonment & Decommissioning	110	hrs
	10	hr/day
	330	Total linear footage (feet):
2" Wells AvgDepth (ft): 47.142857	330	feet
	0	feet
4" Wells AvgDepth (ft): 0	0	feet
	0	feet
Well abandonment rate	2	wells/day
Number of Technicians	1	
Total days in the field for oversight	11	days

System Abandonment
2 Extraction Wells
3 System Components
7 Total Days

Task Repetitions Calculator:

Year 1	
Year 2	
Year 3	
Year 4	
Year 5	
Year 6	
Year 7	1.00
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Total Reps:	1.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

4 wks prep/coord

1	Senior Engineer	1 hrs/wk
1	Project Engineer/Geologist	2 hrs/wk
1	Staff Engineer	4 hrs/wk
1	Engineer/Geologist I	12 hrs/wk
1	Field Technician	0 hrs/wk
1	Project Assistant	0.5 hrs/wk

Project Management		10% Labor
Program Manager	0.5 hrs/wk	10%
Senior Project Manager	2.8 hrs/wk	30%
Project Manager	0 hrs/wk	0
Task Manager	7.2 hrs/wk	60%

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Sci/Eng/Arch/Designer	hour	$151.42	4		$606		$606
Project Sci/Eng/Arch/Designer	hour	$120.80	8		$966		$966
Staff Sci/Eng/Arch/Designer	hour	$104.69	16		$1,675		$1,675
Sci/Eng/Arch/Designer 2	hour	$93.47	48		$4,487		$4,487
Technician III	hour	$94.15	110		$10,357		$10,357
Project Assistant	hour	$79.65	2		$159		$159
Program Manager	hour	$333.54	0.5		$167		$167
Senior Project Manager	hour	$192.96	2.8		$540		$540
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	7.2		$1,091		$1,091
				Subtotal:	$20,048		

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Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
lonment							
Well Abandonment Mob	each	$2,000.00	1		$2,000		$2,000
6" Well Abandonment	lf	$25.00	330		$8,250		$8,250
4" Well Abandonment	lf	$20.00	0		$0		
System Decommissioning Level 1 (well hc	each system	$5,000.00	2		$10,000		$10,000
System Decommissioning Level 2 (compl	each system	$15,000.00	3		$45,000		$45,000
Demolition Crew (including labor and equi	days	$8,000.00	7		$56,000		$56,000
				Subtotal:	$121,250		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Lodging	day/person	$150.00	10		$1,500		$1,500
Truck/car rental per day	day	$50.00	11		$550		$550
Water level indicator per day	day	$0.00	11		$0	Own	$0
Level D PPE	day/person	$15.00	11		$165		$165
Miscellaneous (photographs, gas, tolls, su	day	$20.00	11		$220		$220
Meals (day work)	day/person	$25.00	11		$275		$275
PID per day	day	$0.00	10		$0	Own	$0
				Subtotal:	$2,710		

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Sheet Total: **$84,028**

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							Incremental Cost			**Extended Cost**
Injection Well Installation							**$68,837**			**$68,837**
Well Installation						Module Total:	$68,837			$68,837
Analyses	Enter"Y" if analysis desired						12150		Task Repetitions Calculator:	
VOCs	Y								Year 1	
SVOCs									Year 2	1.00
PAHs									Year 3	
Pesticides									Year 4	
PCBs			Number of sampling locations	6		12	inch borehole		Year 5	
GRO			Depth of borings	45	ft	270	LF		Year 6	
DRO			Production rate - hrs/ location	8					Year 7	
Oil/Grease			Total time per event	48	hrs	6	days		Year 8	
TRPH			Number of geologists	1					Year 9	
Perchlorate			Man-hrs per event	60	hrs	10	hrs/day		Year 10	
Metals	Y								Year 11	
Mercury		2	wks office support	1	Senior	1	hrs/wk		Year 12	
Hex Chrom				1	project eng	4	hrs/wk		Year 13	
Anions				1	Staff eng	8	hrs/wk		Year 14	
Including field/trip blanks and/or MS/DS				1	technician	1	hrs/wk		Year 15	
									Year 16	
Number Of wells	Depth		Samples / location	1					Year 17	
6	45		Total samples	6					Year 18	
0	60								Year 19	
0	90					*Assume :*			Year 20	
			Cuttings/Solid Waste Generation	212	ft3	0.79	ft3/ft drilling (link to borehole diameter)		Total Reps:	1.00
				8	CY	202	gal/CY		DO NOT INSERT ROWS INTO	
Additional time for sampling				12	tons	55	gal/drum		THE TASK REPS CALCULATOR	
VAP Sampling	0			1616	gal	1.4	ton/CY			
Well Installation	48			30	drums					
VAP Drilling	0									
			Total drums for disposal	30	Haz percentage	0%				
Project Management	10% of labor		Total haz drums for disposal	0	Non-haz percentage	100%				
			Haz T&D loads	0						
Program Manager	0.3		Total non-haz drums for disposal	30	Assumes % of drums for	10%				
Senior Project Manager	1.4		Non-haz T&D loads	3	characaterization					
Project Manager			Characterization samples	3						
Task Manager	3.5									

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Sci/Eng/Arch/Designer	hour	$151.42	2		$303		$303
Project Sci/Eng/Arch/Designer	hour	$120.80	8		$966		$966
Staff Sci/Eng/Arch/Designer	hour	$104.69	16		$1,675		$1,675
Technician III	hour	$94.15	62		$5,837		$5,837
Program Manager	hour	$333.54	0.3		$100		$100
Senior Project Manager	hour	$192.96	1.4		$270		$270
Project Manager	hour	$167.99	0.0		$0		
Task Manager	hour	$151.52	3.5		$530		$530
				Subtotal:	$9,682		

ctors

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
rance							
Utility location	day	$1,880.00	1		$1,880		$1,880
			0				
Hollow stem auger mobilization (equipment, decon p	each	$3,500.00	1		$3,500		$3,500
12 inch bore hole in residuum using HSA rig	LF	$55.00	270		$14,850		$14,850
6" well materials Stainless Steel	foot	$60.00	270		$16,200		$16,200
Development Rig	day	$1,502.00	6		$9,012		$9,012
55 gall drum filled and staged	drum	$60.00	30		$1,800		$1,800
Decontamination	week	$475.00	1.2		$570		$570
Monitoring Well Flush Mount 2 inch	each	$75.00	6		$450		$450
racterization							
Full waste characterization	each	$613.00	3		$1,839		$1,839
osal							
Drum rate (soil or liquid, 55-gallon incl. drum purchas	each	$195.00	30		$5,850		$5,850
Transportation (200 miles up to 14 drums) , non-haz	each load	$450.00	3		$1,350		$1,350
55-gallon drum (soil or liquid, 55-gallon), haz	each	$0.00	0		$0		
Transportation (200 miles up to 14 drums), haz	each load	$0.00	0		$0		
VOCs (8260B)	each	$46.00	9		$414		$414
SVOCs (8270C/D)	each	$115.00	0		$0		
PAHs (8270D)	each	$72.00	0		$0		
Organochlorine Pesticides (8081)	each	$105.00	0		$0		
PCBs (8082)	each	$48.00	0		$0		
GRO (8015)	each	$38.00	0		$0		
DRO (8015)	each	$40.00	0		$0		
Oil and Grease (Water, 1664)	each	$0.00	0		$0		
TRPH (Water, 1664)	each	$0.00	0		$0		
Perchlorate, Soil (EPA 314.0M)	each	$95.00	0		$0		
TAL Metals (23), including Mercury and digestion (60	each	$80.00	6		$480		$480
Mercury (Soil or water)	each	$18.00	0		$0		
Hexavalent chromium (Water, 7196)	each	$0.00	0		$0		
Anions (Br, Cl, F, PO4, SO4, NO3, NO2)	each	$24.00	0		$0		
				Subtotal:	$58,195		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
PID per day	day	$0.00	6		$0		$0
Interface probe IP-150' Solinist per day	day	$0.00	6		$0		$0
Truck/car rental per day	day	$50.00	6		$300		$300
Level D PPE	day/person	$15.00	6		$90		$90
Miscellaneous (photographs, gas, tolls, supplies, etc	day	$20.00	6		$120		$120
Meals (day work)	day/person	$25.00	6		$150		$150
Shipping (Coolers)	each	$100.00	3		$300		$300
GPS Unit Garmine e Trex Vista	each	$0.00	1		$0		$0
				Subtotal:	$960		

Extraction Well Installation — **$15,191** — **$15,191**

Well Installation — Module Total: $15,191 — $15,191

Analyses	Enter"Y" if analysis desired
VOCs	Y
SVOCs	
PAHs	
Pesticides	
PCBs	
GRO	
DRO	
Oil/Grease	
TRPH	
Perchlorate	
Metals	Y
Mercury	
Hex Chrom	
Anions	

1 wks office support

Including field/trip blanks and/or MS/DS

Number Of wells	Depth
1	60
0	50
0	90

eld/trip blanks and/or MS/DS

VAP Sampling	0
Well Installation	8
VAP Drilling	0
Project Management	10% of labor
Program Manager	0.1
Senior Project Manager	0.4
Project Manager	
Task Manager	1.1

Number of sampling locations	1		12	inch borehole
Depth of borings	60	ft	60	LF
Production rate - hrs/ location	8			
Total time per event	8	hrs	1	days
Number of geologists	1			
Man-hrs per event	10	hrs	10	hrs/day
	1	Senior	2	hrs/wk
	1	project eng	4	hrs/wk
	1	Staff eng	8	hrs/wk
	1	technician	1	hrs/wk
Samples / location	1			
Total samples	1			

			Assume :	
Cuttings/Solid Waste Generation	47	ft3	0.79	ft3/ft drilling (link to borehole diameter)
	2	CY	202	gal/CY
	3	tons	55	gal/drum
	404	gal	1.4	ton/CY
	8	drums		
Total drums for disposal	8	Haz percentage	0%	
Total haz drums for disposal	0	Non-haz percentage	100%	
Haz T&D loads	0	Assumes % of drums for ch	10%	
Total non-haz drums for disposal	8			
Non-haz T&D loads	1			
Characterization samples	1			

Task Repetitions Calculator:

Year 1	
Year 2	1.00
Year 3	
Year 4	
Year 5	
Year 6	
Year 7	
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Total Reps:	1.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Sci/Eng/Arch/Designer	hour	$151.42	2		$303		$303
Project Sci/Eng/Arch/Designer	hour	$120.80	4		$483		$483
Staff Sci/Eng/Arch/Designer	hour	$104.69	18		$1,884		$1,884
Technician III	hour	$94.15	1		$94		$94
Program Manager	hour	$333.54	0.1		$33		$33
Senior Project Manager	hour	$192.96	0.4		$77		$77
Project Manager	hour	$167.99	0.0		$0		
Task Manager	hour	$151.52	1.1		$167		$167
				Subtotal:	$3,042		

ctors

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
rance							
Utility location	day	$1,880.00	0		$0		
Hollow stem auger mobilization (equipment, decon p	each	$3,500.00	0		$0		
12 inch bore hole in residuum using HSA rig	LF	$55.00	60		$3,300		$3,300
6" well materials Stainless Steel	foot	$60.00	60		$3,600		$3,600
Development Rig	day	$1,502.00	1		$1,502		$1,502
55 gall drum filled and staged	drum	$60.00	8		$480		$480
Decontamination	week	$475.00	0.2		$95		$95
Monitoring Well Flush Mount 2 inch	each	$75.00	1		$75		
racterization							
Full waste characterization	each	$613.00	1		$613		$613
osal							
Drum rate (soil or liquid, 55-gallon incl. drum purchas	each	$195.00	8		$1,560		$1,560
Transportation (200 miles up to 14 drums) , non-haz	each load	$450.00	1		$450		$450
55-gallon drum (soil or liquid, 55-gallon), haz	each	$0.00	0		$0		
Transportation (200 miles up to 14 drums), haz	each load	$0.00	0		$0		
VOCs (8260B)	each	$46.00	4		$184		$184
SVOCs (8270C/D)	each	$115.00	0		$0		
PAHs (8270D)	each	$72.00	0		$0		
Organochlorine Pesticides (8081)	each	$105.00	0		$0		
PCBs (8082)	each	$48.00	0		$0		
GRO (8015)	each	$38.00	0		$0		
DRO (8015)	each	$40.00	0		$0		
Oil and Grease (Water, 1664)	each	$0.00	0		$0		
TRPH (Water, 1664)	each	$0.00	0		$0		
Perchlorate, Soil (EPA 314.0M)	each	$95.00	0		$0		
TAL Metals (23), including Mercury and digestion (60	each	$80.00	1		$80		$80
Mercury (Soil or water)	each	$18.00	0		$0		
Hexavalent chromium (Water, 7196)	each	$0.00	0		$0		
Anions (Br, Cl, F, PO4, SO4, NO3, NO2)	each	$24.00	0		$0		
				Subtotal:	$11,939		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
PID per day	day	$0.00	1		$0		$0
Interface probe IP-150' Solinist per day	day	$0.00	1		$0		$0
Truck/car rental per day	day	$50.00	1		$50		$50
Level D PPE	day/person	$15.00	1		$15		$15
Miscellaneous (photographs, gas, tolls, supplies, etc.	day	$20.00	1		$20		$20
Meals (day work)	day/person	$25.00	1		$25		$25
Shipping (Coolers)	each	$100.00	1		$100		$100
GPS Unit Garmine e Trex Vista	each	$0.00	1		$0		$0
				Subtotal:	$210		

	Incremental Cost	Extended Cost
CATS Optimization	**$633,982**	**$633,982**
System Testing, Analysis and Design	Module Total: $633,982	$633,982

Assumes 30 days in the field to install piping and make equipment updgrades

Task Repetitions Calculator:	
Year 1	1.00
Year 2	
Year 3	
Year 4	
Year 5	
Year 6	
Year 7	
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Year 21	
Year 22	
Year 23	
Year 24	
Year 25	
Year 26	
Year 27	
Year 28	
Year 29	
Year 30	
Total Reps:	1.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Engineering Support

Senior Expert	4	hrs
Project Advisor	6	hrs
Principal	12	hrs
Senior	20	hrs
Project	40	hrs
Staff	80	hrs
Drafting	20	hrs
PA	4	hrs

Project Management 10% Labor

Program Manager	2.6	hrs	#
Senior Project Manager	13.7	hrs	#
Project Manager	0	hrs	
Task Manager	34.8	hrs	#
			#

Field Implementation

Senior Expert	4	hrs
Project Advisor	5	hrs
Principal	10	hrs
Senior	20	hrs
Project	60	hrs
Staff	350	hrs
Drafting	8	hrs
PA	2	hrs

Subcontracting

Install Piping for Recovery/Injecti	3000	ft
Install Electrical Conduit	1000	ft
Trenching	1200	ft
Aeration Tank System	1	each
Recirculation Piping	1	each
Solids Management System	1	each

Asbuilts

Senior Expert	2	hrs
Project Advisor	2	hrs
Principal	8	hrs
Senior	12	hrs
Project	20	hrs
Staff	40	hrs
Drafting	20	hrs
PA	2	hrs

Expenses

Level D PPE	35	days
Truck Use	35	days
Meals	35	days
Lodging	33	days

Subtotal: 751

3 Number of Paper Copies 25 Pages per Copy

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	Extended Cost
Senior Expert	hour	$326.64	10		$3,266		$3,266
Project Advisor	hour	$238.42	13		$3,099		$3,099
Principal Sci/Eng/Arch/Designer	hour	$194.30	30		$5,829		$5,829
Senior Sci/Eng/Arch/Designer	hour	$151.42	52		$7,874		$7,874
Project Sci/Eng/Arch/Designer	hour	$120.80	120		$14,496		$14,496
Staff Sci/Eng/Arch/Designer	hour	$104.69	470		$49,205		$49,205
CADD/Drafter II	hour	$72.58	48		$3,484		$3,484
Project Assistant	hour	$79.65	8		$637		$637
	hour						
Program Manager	hour	$333.54	3		$867		$867
Senior Project Manager	hour	$192.96	14		$2,644		$2,644
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	35		$5,273		$5,273
	hour						
	hour						
				Subtotal:	$96,674		

ctors

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	Extended Cost
2- inch HDPE SDR11 installed and fusion v	LF	$2.50	3000.00		$7,500		$7,500
2" PVC Electrical conduit installation with #	LF	$10.00	1000.00		$10,000		$10,000
Trenching, backfill and compaction	LF	$25.00	1200.00		$30,000		$30,000
Influent Aeration Tank	Lump	$25,000.00	1.00		$25,000		$25,000
Aeration Tank Blower	Lump	$10,000.00	1.00		$10,000		$10,000
Air Stripper - Recirculation Pump and Pipin	Lump	$10,000.00	1.00		$10,000		$10,000
Polymer Delivery System (Dynablend or eq	Each	$12,000.00	1.00		$12,000		$12,000
Solids Storage Tank	Lump	$7,500.00	1.00		$7,500		$7,500
Decant Recycle System (Pump and Contro	Lump	$15,000.00	1.00		$15,000		$15,000
Filter Press	Lump	$75,000.00	1.00		$75,000		$75,000
Filter Press Feed Pump	Lump	$5,000.00	1.00		$5,000		$5,000
Piping, valves, and appurtenances	Lump	$20,000.00	1.00		$20,000		$20,000
Instrumentation	Lump	$15,000.00	1.00		$15,000		$15,000
Motor Control Center / Main Control Panel	Lump	$30,000.00	1.00		$30,000		$30,000
Influent, Solids Storage Tank, and Clarifier	lumpo	$30,000.00	1.00		$30,000		$30,000
Mobilization, Demobilization, Permits, and `	lump	$25,000.00	1.00		$25,000		$25,000
Well Packer Installation (RW-4)	lump	$15,000.00	1.00		$15,000		$15,000
Taxes (5% of EQ)	%	5%	$ 224,500		$11,225		$11,225
Freight (2% of EQ)	%	2%	$ 224,500		$4,490		$4,490
Set Process Equipment (12% of EQ)	%	12%	$ 224,500		$26,940		$26,940
Process Piping (10% of EQ)	%	10%	$ 224,500		$22,450		$22,450
Painting (1.5% of EQ)	%	2%	$ 224,500		$3,368		$3,368
Electrical (25% of EQ)	%	25%	$ 224,500		$56,125		$56,125
Contractor Profit (8% of PEC)	%	8%	$ 466,598		$37,328		$37,328
Contingencies (5% of DC)	%	5%	$ 503,925		$25,196		$25,196
				Subtotal:	$529,122		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	Extended Cost
Level D PPE	day/person	15.00	$ 35		$525		$525
PID per day	day	0.00			$0		
Copies	each	$0.15	75		$11		$11
Shipping (Reports)	each	$25.00	3		$75		$75
Truck/car rental per day	day	$50.00	35		$1,750		$1,750
Lodging	day/person	$150.00	33		$4,950		$4,950
Meals (day work)	day/person	$25.00	35		$875		$875
				Subtotal:	$8,186		

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		Incremental Cost	Extended Cost
CATS Operation		**$423,387**	**$2,116,937**
P&T O&M	Module Total	$423,387	$2,116,937

Design/Execution Assumptions

Specify frequency of O&M (ex. Monthly for 5 years)

	Full Time Operator		Technician Hours per day		8
O&M Events per year	208		Days per week		4
Carbon changeout	1	events per yea	Weeks per year		52
Amount of Carbon changeout	10000	lbs			
Recovery Line Cleaning events	4	events per year		209	days
Number of technicians	1			8	hrs/day
52 wks prep/coord	1	Senior Expert		0.1	hrs/wk
	1	Principle Engineer		0.25	hrs/wk
	1	Senior Engineer		1	hrs/wk
	1	Project Engineer		2	hrs/wk
	1	technician		4	hrs/wk
	1	project assistance		0.019230769	hrs/wk
Repair	1	events per year			

System Samples	Frequency
Discharge	12
Carbon Influent	12
Carbon Midpoint	0
Carbon Effluent	12
Pre-Bag filter	0
Pre-Coagulation	0
System Influent	12
Rwcovery Well (one)	12
Total	60
QC	12

Project Management		10% Labor	
Program Manager	6	hrs/wk	#
Senior Project Manager	31.4	hrs/wk	#
Project Manager	0	hrs/wk	0
Task Manager	79.9	hrs/wk	#

Filter Management	200 um	25um	3um
Changeout Frequency (days)	18	32	48
Units	6	6	36
Total Changouts	126	72	288
Drums	13	8	15

Task Repetitions Calculator:	
Year 1	
Year 2	1.00
Year 3	1.00
Year 4	1.00
Year 5	1.00
Year 6	1.00
Year 7	
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Total Reps:	5.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Expert	hour	$326.64	5		$1,699		$8,493
Principal Sci/Eng/Arch/Designer	hour	$194.30	13		$2,526		$12,630
Senior Sci/Eng/Arch/Designer	hour	$151.42	52		$7,874		$39,370
Project Sci/Eng/Arch/Designer	hour	$120.80	104		$12,563		$62,816
Technician III	hour	$94.15	1,880		$177,003		$885,013
Project Assistant	hour	$79.65	1		$80		$398
Program Manager	hour	$333.54	6		$2,001		$10,006
Senior Project Manager	hour	$192.96	31		$6,059		$30,295
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	80		$12,106		$60,532
				Subtotal:	$221,910		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
VOCs (8260B)	each	$46.00	72		$3,312		$16,560
Granular Activated Carbon Changeout	lb	$2.00	10000		$20,000		$100,000
TAL Metals (23), including Mercury and digestion (6010)	each	$80.00	60		$4,800		$24,000
Refurbish Pump	ea	$4,300.00	1		$4,300		$21,500
30,000 ball Air Stripper changout low density	ea	$22,575.00	1		$22,575		$112,875
Drum rate (soil or liquid, 55-gallon incl. drum purchase)	each	$195.00	36		$7,020		$35,100
Transportation (200 miles up to 14 drums) , non-haz	each load	$450.00	3		$1,350		$6,750
Maintenance and Replacement Parts (4% EQ)	%	4%	225000		$9,000		$45,000
Mobilization/ Demobilization	each	$1,800.00	1		$1,800		$9,000
Recovery Well Pump Removal/Setting	each	$7,200.00	1		$7,200		$36,000
Vegetation Maintenance	annually	$500.00	1		$500		$2,500
Equipment Maintenance/Repair	annually	$4,635.00	1		$4,635	**Annual Materials**	$23,175
Jetting of Injection Wells/ Well Maintenance	annually	$5,000.00	1		$5,000	**$123,477**	$25,000
Sludge Basin cleanout, paint and media replacement	each	$7,000.00	1		$7,000		$35,000
				Subtotal:	$98,492		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Level D PPE	day/person	$15.00	260		$3,900		$19,500
200 micron Bag filter	each	$35.00	126		$4,410		$22,050
25 micron bag filter	each	$45.00	72		$3,240		$16,200
3 micron cartridge	each	$40.00	288		$11,520		$57,600
Monthly Utilities (phone, telemetry , water, sewer etc)	month	$1,100.00	12		$13,200	**Annual Utilities**	$66,000
Utilities - Electrical	month	$5,400.00	12		$64,800	**$78,000**	$324,000
Miscellanous Items (Fire extinguisher service, PLC softwar	annually	$1,915.00	1		$1,915		$9,575
				Subtotal:	$102,985		

L **Sheet Total:** **$277,562**

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	Incremental Cost	Extended Cost
Semi-Annual Groundwater Monitoring	**$21,803**	**$109,014**
Monitoring Well Sampling — Module Total:	$21,803	$109,014

Analyses	Y" if analysis desired
VOCs	Y
BTEX	
Metals	Y
Dissolved CO2	
Chlorides	
Cations	
MEE	
Nitrate/Nitrite	
Sulfate/Sulfide	
TOC	
Divalent Manganese	
Dissolved Hydrogen	
Dehalococcoides so	

Assumes 1 event
Change # of Events in Task Repetitions

Number of Wells	46			
			10	Purge volume/well (gal)
Sampling Rate	2	hrs/well		
Total time per event	92	hrs	12	days
Number of technicians	1			
Man-hrs per event	96	hrs	8	hrs/day
3 wks prep/coord	1	Senior	2	hrs/wk
	1	project eng	4	hrs/wk
	1	Staff eng	8	hrs/wk
	1	technician	0	hrs/wk
	1	day		

Field Kits	Y" if analysis desired
Alkalinity	
Iron II (Fe 2+)	

Enter"Y" if analysis desired

Total Purge Volume Generated per event	460	gal
	55	gal/drum

Including field/trip blanks and/or MS/DS

Waste Management

Processed through system	Yes			9	drums	
Project Management	10% of labor	Total drums for disposal		0	Haz percentage	0%
		Total haz drums for disposal		0	Non-haz percentage	100%
Program Manager	0.4	Haz T&D loads		0		
Senior Project Manager	2.2	Total non-haz drums for disposal		0		
Project Manager		Non-haz T&D loads		0		
Task Manager	5.5	Characterization samples		0		

Task Repetitions Calculator:	
Year 1	
Year 2	1.00
Year 3	1.00
Year 4	1.00
Year 5	1.00
Year 6	1.00
Year 7	
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Total Reps:	5.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	Extended
Senior Sci/Eng/Arch/Designer	hour	$151.42	6		$909		$4,543
Project Sci/Eng/Arch/Designer	hour	$120.80	12		$1,450		$7,248
Staff Sci/Eng/Arch/Designer	hour	$104.69	24		$2,513		$12,563
Technician III	hour	$94.15	96		$9,038		$45,192
Program Manager	hour	$333.54	0.4		$133		$667
Senior Project Manager	hour	$192.96	2.2		$425		$2,123
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	5.5		$833		$4,167
	hour						
				Subtotal:	$15,300		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	Extended
Drum Disposal							
Drum rate (soil or liquid, 55-gallon incl. drum purchase)	each	$195.00	0		$0		
Transportation (200 miles up to 14 drums) , non-haz	each load	$450.00	0		$0		
55-gallon drum (soil or liquid, 55-gallon), haz	each	$0.00	0		$0		
Transportation (200 miles up to 14 drums), haz	each load	$0.00	0		$0		
Laboratory							
VOCs (8260B)	each	$46.00	50		$2,300		$11,500
BTEX/MtBE (8021)	each	$45.00	0		$0		
Metals - Al, Ar, Br, Cr, Fe, Pb, Mn	each	$57.19	49		$2,802		$14,012
Permanent Gases (CO2, N2, O2)	each	$0.00	0		$0		
Chloride by IC	each	$0.00	0		$0		
Cations	each	$45.96	0		$0		
Light hydrocarbons (methane, ethane, ethene)	each	$48.00	0		$0		
Nitrate+Nitrite	each	$0.00	0		$0		
Sulfide, total	each	$33.00	0		$0		
Total Organic Carbon (TOC)-single analysis	each	$21.00	0		$0		
Divalent manganese	each	$0.00	0		$0		
Dissolved Hydrogen	each	$142.98	0		$0		
Dehalococcoides	each	$326.80	0		$0		
			0				
			0				
			0				
				Subtotal:	$5,102		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	Extended
PID per day	day	$0.00	0		$0	Own	
Interface probe IP-150' Solinist per day	day	$0.00	0		$0	Own	
Truck/car rental per day	day	$50.00	12		$600		$3,000
Level D PPE	day/person	$15.00	15		$225		$1,125
Miscellaneous (photographs, gas, tolls, supplies, etc.)	day	$20.00	0		$0		
Meals (day work)	day/person	$25.00	0		$0		
Shipping (Coolers)	each	$100.00	5		$500		$2,500
GPS Unit Garmine e Trex Vista	each	$0.00	0		$0		
Decon area setup/supplies	day	$25.00	3		$75	Own	$375
Submersible pump w/ control box per day	day	$0.00	12		$0	Own	$0
Horiba U-52 with flow-through cell per day	day	$0.00	12		$0	Own	$0
Generator per day	day	$0.00	12		$0	Own	$0
Bailer (24 per box)	each	$3.47	0		$0		
				Subtotal:	$1,400		

Annual Groundwater Monitoring — $33,710 — $168,548

Monitoring Well Sampling — Module Total: $33,710 — $168,548

Analyses	Y" if analysis desired
VOCs	Y
BTEX	Y
Metals	Y
Dissolved CO2	Y
Chlorides	Y
Cations	
MEE	Y
Nitrate/Nitrite	Y
Sulfate/Sulfide	Y
TOC	Y
Divalent Manganese	
Dissolved Hydrogen	
Dehalococcoides so	
Dinoseb	Y
Field Kits	Y" if analysis desired
Alkalinity	
Iron II (Fe 2+)	Y

Enter "Y" if analysis desired

Including field/trip blanks and/or MS/DS

Processed through system: Yes

Project Management	10% of labor
Program Manager	0.5
Senior Project Manager	2.4
Project Manager	
Task Manager	6.1

Assumes 1 event

Change # of Events in Task Repetitions

Number of Wells	55			10	Purge volume/well (gal)
Sampling Rate	2	hrs/well			
Total time per event	110	hrs		14	days
Number of technicians	1				
Man-hrs per event	112	hrs		8	hrs/day
3 wks prep/coord	1	Senior		2	hrs/wk
	1	project eng		4	hrs/wk
	1	Staff eng		8	hrs/wk
	1	technician		0	hrs/wk
	1	day			
Total Purge Volume Generated per event	550	gal	*MNA wells*	28	
	55	gal/drum			

Waste Management

	10	drums	
Total drums for disposal	0	Haz percentage	0%
Total haz drums for disposal	0	Non-haz percentag	100%
Haz T&D loads	0		
Total non-haz drums for disposal	0		
Non-haz T&D loads	0		
Characterization samples	0		

Task Repetitions Calculator:

Year 1	
Year 2	1.00
Year 3	1.00
Year 4	1.00
Year 5	1.00
Year 6	1.00
Year 7	
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Total Reps:	5.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Sci/Eng/Arch/Designer	hour	$151.42	6		$909		$4,543
Project Sci/Eng/Arch/Designer	hour	$120.80	12		$1,450		$7,248
Staff Sci/Eng/Arch/Designer	hour	$104.69	24		$2,513		$12,563
Technician III	hour	$94.15	112		$10,545		$52,724
Program Manager	hour	$333.54	0.5		$167		$834
Senior Project Manager	hour	$192.96	2.4		$463		$2,316
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	6.1		$924		$4,621
	hour						
				Subtotal:	$16,970		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Drum Disposal							
Drum rate (soil or liquid, 55-gallon incl. drum purchase)	each	$195.00	0		$0		
Transportation (200 miles up to 14 drums) , non-haz	each load	$450.00	0		$0		
55-gallon drum (soil or liquid, 55-gallon), haz	each	$0.00	0		$0		
Transportation (200 miles up to 14 drums), haz	each load	$0.00	0		$0		
Laboratory							
VOCs (8260B)	each	$46.00	62		$2,852		$14,260
BTEX/MtBE (8021)	each	$45.00	28		$1,260		$6,300
Metals - Al, Ar, Br, Cr, Fe, Pb, Mn	each	$57.19	58		$3,317		$16,585
Permanent Gases (CO2, N2, O2)	each	$0.00	28		$0		$0
Chloride by IC	each	$0.00	28		$0		$0
Cations	each	$45.96	0		$0		
Light hydrocarbons (methane, ethane, ethene)	each	$48.00	28		$1,344		$6,720
Nitrate+Nitrite	each	$0.00	28		$0		$0
Sulfide, total	each	$33.00	28		$924		$4,620
Total Organic Carbon (TOC)-single analysis	each	$21.00	28		$588		$2,940
Divalent manganese	each	$0.00	0		$0		
Dissolved Hydrogen	each	$142.98	0		$0		
Dehalococcoides	each	$326.80	0		$0		
Dinoseb	ea	$125.00	29		$3,625		$18,125
			0				
			0				
				Subtotal:	$13,910		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
PID per day	day	$0.00	0		$0	Own	
Interface probe IP-150' Solinist per day	day	$0.00	0		$0	Own	
Truck/car rental per day	day	$50.00	14		$700		$3,500
Level D PPE	day/person	$15.00	17		$255		$1,275
Miscellaneous (photographs, gas, tolls, supplies, etc.)	day	$20.00	0		$0		
Meals (day work)	day/person	$25.00	0		$0		
Shipping (Coolers)	each	$100.00	18		$1,800		$9,000
GPS Unit Garmine e Trex Vista	each	$0.00	0		$0		
Decon area setup/supplies	day	$25.00	3		$75	Own	$375
Submersible pump w/ control box per day	day	$0.00	14		$0	Own	$0
Horiba U-52 with flow-through cell per day	day	$0.00	14		$0	Own	$0
Generator per day	day	$0.00	14		$0	Own	$0
Bailer (24 per box)	each	$3.47	0		$0		
				Subtotal:	$2,830		

			Incremental Cost	Extended Cost
Permit Compliance			**$65,907**	**$329,535**
Site Maintenance		Module Total:	$65,907	$329,535

Assume costs for landfill monitoring, stormwater maintenance and vegetative maintenance
Monthly inspection of landfill cap
Weekly storm water inspections and management of stromwater
Weekly maintenance, mowing and clearing
Assume actions conducted by full time site operator in conjunction with CATS operation with assistance from additional personnel for 2 people tasks

Technician Hours per day	8	
Days per week (PC)	1	
Weeks per year	52	
Days	52	days
Hours per day	8	hrs
Number of technicians	2	
Man-hrs	832	hrs
		52 days

Task Repetitions Calculator:	
Year 1	
Year 2	1.00
Year 3	1.00
Year 4	1.00
Year 5	1.00
Year 6	1.00
Year 7	
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Total Reps:	5.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Project Management — 10% Labor

Program Manager	1.6	hrs/wk
Senior Project Manager	8.5	hrs/wk
Project Manager	0	hrs/wk
Task Manager	21.8	hrs/wk

0 wk prep/coord

11 wk

PREP TIME

1	Project Manager	2	hrs/mo
1	Senior Engineer/Geologist	2	hrs/mo
1	Project Engineer/Geologist	4	hrs/mo
1	Engineer/Geologist I	8	hrs/mo
1	Field Technician	4	hrs/mo
1	Project Assistant	0	hrs/mo

Field Oversight

1	Project Manager	0	hrs/wk
1	Senior Engineer/Geologist	0.5	hrs/wk
1	Project Engineer/Geologist	2	hrs/wk
1	Engineer/Geologist I	4	hrs/wk
1	Field Technician	0	hrs/wk
1	Project Assistant	0.27	hrs/wk

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Project Manager	hour	$192.96	0		$0		
Senior Sci/Eng/Arch/Designer	hour	$151.42	6		$833		$4,164
Project Sci/Eng/Arch/Designer	hour	$120.80	22		$2,658		$13,288
Sci/Eng/Arch/Designer 2	hour	$93.47	44		$4,113		$20,564
Technician I	hour	$56.96	832		$47,388		$236,940
Project Assistant	hour	$79.65	3		$239		$1,195
Program Manager	hour	$333.54	2		$534		$2,668
Senior Project Manager	hour	$192.96	9		$1,640		$8,201
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	22		$3,303		$16,516
				Subtotal:	$60,707		

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Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
				Subtotal:	$0		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
PID per day	day	$0.00	0		$0	Own	
Truck/car rental per day	day	$50.00	52		$2,600		$13,000
Level D PPE	day/person	$15.00	104		$1,560		$7,800
Interface probe IP-150' Solinist per day	day	$0.00	0		$0	Own	
Meals (day work)	day/person	$25.00	0		$0		
Miscellaneous (photographs, gas, tolls, supplies, etc.)	day	$20.00	52		$1,040		$5,200
Shipping (Coolers)	each	$100.00	0		$0		
Communications	day	$2.00	0		$0		
				Subtotal:	$5,200		

		Incremental Cost	Extended Cost
Annual Corrective Action Report		**$29,991**	**$149,953**
Negotiation, Drafting and Agency Coordination	Module Total:	$29,991	$149,953

Compilation and Analysis				Project Management	10% Labor		
Senior Expert	4	hrs		Program Manager	0.8	hrs	#
Project Advisor	2	hrs		Senior Project Manager	4.2	hrs	#
Principal	4	hrs		Project Manager	0	hrs	
Senior	8	hrs		Task Manager	10.7	hrs	#
Project	12	hrs					#
Staff	30	hrs					
Drafting	10	hrs					
PA	2	hrs					

Draft Report			Subcontracting	
Senior Expert	5	hrs		
Project Advisor	5	hrs		
Principal	8	hrs		
Senior	10	hrs		
Project	15	hrs		
Staff	30	hrs		
Drafting	10	hrs		
PA	3	hrs		

Final Report			Expenses	
Senior Expert	2	hrs		
Project Advisor	1	hrs		
Principal	8	hrs		
Senior	4	hrs		
Project	12	hrs		
Staff	7	hrs		
Drafting	7	hrs		
PA	3	hrs		

Task Repetitions Calculator:	
Year 1	
Year 2	1.00
Year 3	1.00
Year 4	1.00
Year 5	1.00
Year 6	1.00
Year 7	
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Year 21	
Year 22	
Year 23	
Year 24	
Year 25	
Year 26	
Year 27	
Year 28	
Year 29	
Year 30	
Total Reps:	5.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Subtotal: 202

9 Number of Paper Copies 25 Pages per Copy

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Expert	hour	$326.64	11		$3,593		$17,965
Project Advisor	hour	$238.42	8		$1,907		$9,537
Principal Sci/Eng/Arch/Designer	hour	$194.30	20		$3,886		$19,430
Senior Sci/Eng/Arch/Designer	hour	$151.42	22		$3,331		$16,656
Project Sci/Eng/Arch/Designer	hour	$120.80	39		$4,711		$23,556
Staff Sci/Eng/Arch/Designer	hour	$104.69	67		$7,026		$35,130
CADD/Drafter II	hour	$72.58	27		$1,968		$9,839
Project Assistant	hour	$79.65	8		$611		$3,053
	hour						
Program Manager	hour	$333.54	1		$267		$1,334
Senior Project Manager	hour	$192.96	4		$810		$4,052
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	11		$1,621		$8,106
	hour						
	hour						
				Subtotal:	$29,732		

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Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes
				Subtotal:	$0	

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
ADEM RCRA Permit Fees	ea	1.00	$ -		$0		
ADEM UIC Permit Fees	ea	1.00	$ -		$0		
Copies	each	$0.15	225		$34		$169
Shipping (Reports)	each	$25.00	9		$225		$1,125
				Subtotal:	$259		

Appendix 3 Post Closure Cost
Table C-5 Creola, Alabama

Project Phase	Component	Description		Capital Cost ($)	Annual OMM Costs ($)	Operating Period Yrs	Periodic Costs ($)	Total Cost ($)
Post Closure	MNA Monitoring	Monitoring of wells as outlined in the report to evaluate the performance of the CATS and Source area treatment.	Post-Remedy	$ -	$ 65,400	10	$ 53,800	**$ 707,800**
	POC Monitoring	Monitoring of point of compliance wells for permit compliance following active remediation.		$ -	$ 24,100	15	$ -	**$ 361,500**
	Permit Compliance	Post Closure care of the landfill during active remediation		$ -	$ 65,900	25	$ -	**$ 1,647,500**
	Reporting	Semi-annual corrective action reporting		$ -	$ 30,000	25	$ -	**$ 750,000**
								$ 3,466,800

Periodic Cost include well abandonment and the cost to demolish the systems once the active remediaiont ends.

ARCADIS
Infrastructure, environment, buildings

RIES, Creola, AL
Post Closure Cost
17-Mar-16

COSTS:	Rates	MNA Groundwater Monitoring		Monitor Well Abandonment	
		Units/Hrs	Cost	Units/Hrs	Cost
LABOR COSTS					
Program Manager	$ 333.54	10	$3,335	1	$167
Senior Project Manager	$ 192.96	51	$9,841	3	$540
Task Manager	$ 151.52	128	$19,394	7	$1,076
Senior Expert	$ 326.64	0	$0	0	$0
Project Advisor	$ 238.42	0	$0	0	$0
Principal Sci/Eng/Arch/Designer	$ 194.30	0	$0	0	$0
Senior Sci/Eng/Arch/Designer	$ 151.42	120	$18,171	1	$114
Project Sci/Eng/Arch/Designer	$ 120.80	270	$32,616	3	$362
Staff Sci/Eng/Arch/Designer	$ 104.69	720	$75,377	12	$1,256
Sci/Eng/Arch/Designer 2	$ 93.47	0	$0	36	$3,365
Technician III	$ 94.15	2086	$196,398	132	$12,428
Technician I	$ 56.96	0	$0	0	$0
CADD/Drafter II	$ 72.58	0	$0	0	$0
Project Assistant	$ 79.65	0	$0	6	$478
Subtotals		**3385**	**$355,132**	**200**	**$19,786**
OTHER DIRECT COSTS					
Truck/car rental per day	day $50	260	$13,000	12	$600
Meals (day work)	day/person $25.00	0	$0	12	$300
Decon area setup/supplies	day $25	60	$1,500	12	$300
Level D PPE	day/person $15	320	$4,800	12	$180
Miscellaneous (photographs, gas, tolls, supplies, etc.)	day $20	0	$0	12	$240
Copies	each $0	0	$0	0	$0
Shipping (Coolers)	each $100	230	$23,000	0	$0
Shipping (Reports)	each $25	0	$0	0	$0
Subtotals			**$42,300**		**$1,620**
SUBCONTRACTOR EXPENSES					
VOCs (8260B)	each $ 46.00		$50,600		$0
BTEX/MtBE (8021)	each $ 45.00		$12,600		$0
Sulfide, total	each $ 33.00		$9,240		$0
Total Organic Carbon (TOC)-single analysis	each $ 21.00		$5,880		$0
Light hydrocarbons (methane, ethane, ethene)	each $ 48.00		$13,440		$0
Well Abandonment Mob	each $ 2,000.00		$0		$2,000
2" Well Abandonment	lf $ 15.00		$0		$30,375
Drum rate (soil or liquid, 55-gallon incl. drum purchase)	each $ 195.00		$54,600		$0
Transportation (200 miles up to 14 drums) , non-haz	each load $ 450.00		$13,500		$0
Metals - Al, Ar, Br, Cr, Fe, Pb, Mn	each $ 57.19		$60,050		$0
Dinoseb	ea $ 125.00		$36,250		$0
Subtotals			**$256,160**		**$32,375**
Task Sub-Totals			**$653,592**		**$53,781**

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Post Closure Cost
17-Mar-16

COSTS:	Rates	Compliance Groundwater Monitoring Units/Hrs	Compliance Groundwater Monitoring Cost	Permit Compliance Units/Hrs	Permit Compliance Cost
LABOR COSTS					
Program Manager	$ 333.54	9	$3,002	40	$13,342
Senior Project Manager	$ 192.96	44	$8,394	213	$41,005
Task Manager	$ 151.52	111	$16,819	545	$82,578
Senior Expert	$ 326.64	0	$0	0	$0
Project Advisor	$ 238.42	0	$0	0	$0
Principal Sci/Eng/Arch/Designer	$ 194.30	0	$0	0	$0
Senior Sci/Eng/Arch/Designer	$ 151.42	60	$9,085	138	$20,820
Project Sci/Eng/Arch/Designer	$ 120.80	150	$18,120	550	$66,439
Staff Sci/Eng/Arch/Designer	$ 104.69	360	$37,689	0	$0
Sci/Eng/Arch/Designer 2	$ 93.47	0	$0	1100	$102,819
Technician III	$ 94.15	2280	$214,663	0	$0
Technician I	$ 56.96	0	$0	20800	$1,184,700
CADD/Drafter II	$ 72.58	0	$0	0	$0
Project Assistant	$ 79.65	0	$0	75	$5,974
Subtotals		**3014**	**$307,771**	**23460**	**$1,517,676**
OTHER DIRECT COSTS					
Truck/car rental per day	$50	105	$5,250	1300	$65,000
Meals (day work)	$25.00	0	$0	0	$0
Decon area setup/supplies	$25	30	$750	0	$0
Level D PPE	$15	270	$4,050	2600	$39,000
Miscellaneous (photographs, gas, tolls, supplies, etc.)	$20	0	$0	1300	$26,000
Copies	$0	0	$0	0	$0
Shipping (Coolers)	$100	30	$3,000	0	$0
Shipping (Reports)	$25	0	$0	0	$0
Subtotals			**$13,050**		**$130,000**
SUBCONTRACTOR EXPENSES					
VOCs (8260B)	$ 46.00		$10,350		$0
BTEX/MtBE (8021)	$ 45.00		$0		$0
Sulfide, total	$ 33.00		$0		$0
Total Organic Carbon (TOC)-single analysis	$ 21.00		$0		$0
Light hydrocarbons (methane, ethane, ethene)	$ 48.00		$0		$0
Well Abandonment Mob	$ 2,000.00		$0		$0
2" Well Abandonment	$ 15.00		$0		$0
Drum rate (soil or liquid, 55-gallon incl. drum purchase)	$ 195.00		$11,700		$0
Transportation (200 miles up to 14 drums) , non-haz	$ 450.00		$6,750		$0
Metals - Al, Ar, Br, Cr, Fe, Pb, Mn	$ 57.19		$12,010		$0
Dinoseb	$ 125.00		$0		$0
Subtotals			**$40,810**		**$0**
Task Sub-Totals			**$361,631**		**$1,647,676**

Unit
day
day/person
day
day/person
day
each
each
each
each
each
each
lf
each
each load
each
ea

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Infrastructure, environment, buildings

RIES, Creola, AL
Post Closure Cost
17-Mar-16

COSTS:	Rates	Reporting Units/Hrs	Reporting Cost	TOTAL UNITS/HRS	TOTAL COST
LABOR COSTS					
Program Manager	$ 333.54	20	$6,671	80	$26,517
Senior Project Manager	$ 192.96	105	$20,261	415	$80,041
Task Manager	$ 151.52	268	$40,531	1059	$160,398
Senior Expert	$ 326.64	275	$89,825	275	$89,825
Project Advisor	$ 238.42	200	$47,685	200	$47,685
Principal Sci/Eng/Arch/Designer	$ 194.30	500	$97,152	500	$97,152
Senior Sci/Eng/Arch/Designer	$ 151.42	550	$83,282	868	$131,472
Project Sci/Eng/Arch/Designer	$ 120.80	975	$117,779	1948	$235,317
Staff Sci/Eng/Arch/Designer	$ 104.69	1678	$175,648	2770	$289,970
Sci/Eng/Arch/Designer 2	$ 93.47	0	$0	1136	$106,184
Technician III	$ 94.15	0	$0	4498	$423,488
Technician I	$ 56.96	0	$0	20800	$1,184,700
CADD/Drafter II	$ 72.58	678	$49,195	678	$49,195
Project Assistant	$ 79.65	192	$15,266	273	$21,718
Subtotals		**5440**	**$743,295**	**35498**	**$2,943,661**
OTHER DIRECT COSTS					
Truck/car rental per day	$50	0	$0	1677	$83,850
Meals (day work)	$25.00	0	$0	12	$300
Decon area setup/supplies	$25	0	$0	102	$2,550
Level D PPE	$15	0	$0	3202	$48,030
Miscellaneous (photographs, gas, tolls, supplies, etc.)	$20	0	$0	1312	$26,240
Copies	$0	5625	$844	5625	$844
Shipping (Coolers)	$100	0	$0	260	$26,000
Shipping (Reports)	$25	225	$5,625	225	$5,625
Subtotals			**$6,469**		**$193,439**
SUBCONTRACTOR EXPENSES					
VOCs (8260B)	$ 46.00		$0	0	$60,950
BTEX/MtBE (8021)	$ 45.00		$0	0	$12,600
Sulfide, total	$ 33.00		$0	0	$9,240
Total Organic Carbon (TOC)-single analysis	$ 21.00		$0	0	$5,880
Light hydrocarbons (methane, ethane, ethene)	$ 48.00		$0	0	$13,440
Well Abandonment Mob	$ 2,000.00		$0	0	$2,000
2" Well Abandonment	$ 15.00		$0	0	$30,375
Drum rate (soil or liquid, 55-gallon incl. drum purchase)	$ 195.00		$0	0	$66,300
Transportation (200 miles up to 14 drums) , non-haz	$ 450.00		$0	0	$20,250
Metals - Al, Ar, Br, Cr, Fe, Pb, Mn	$ 57.19		$0	0	$72,059
Dinoseb	$ 125.00		$0	0	$36,250
Subtotals			**$0**		**$329,344**
Task Sub-Totals			**$749,764**		
				SUBTOTAL COST	**$3,466,444**
				TOTAL COST	**$3,466,444**

											Incremental Cost	Extended Cost
Semi-Annual Groundwater Monitoring											**$26,117**	**$261,168**
Monitoring Well Sampling									Module Total:		$26,117	$261,168
Analyses	Enter"Y" if analysis desired											
VOCs	Y											
BTEX												
Metals	Y					Assumes 1 event						
Dissolved CO2						**Change # of Events in Task Repetitions**						
Chlorides					Number of Wells	45						
Cations									15	Purge volume/well (gal)		
MEE					Sampling Rate	2	hrs/well					
Nitrate/Nitrite					Total time per event	90	hrs		12	days		
Sulfate/Sulfide					Number of technicians	1						
TOC					Man-hrs per event	96	hrs		8	hrs/day		
Divalent Manganese												
Dissolved Hydrogen			3		wks prep/coord	1	Senior		2	hrs/wk		
Dehalococcoides so						1	project eng		4	hrs/wk		
						1	Staff eng		12	hrs/wk		
						1	technician		0.1	hrs/wk		
						1	day					
Field Kits	Enter"Y" if analysis desired											
Alkalinity												
Iron II (Fe 2+)												
	Enter"Y" if analysis desired				Total Purge Volume Generated per event	675	gal					
						55	gal/drum					
Including field/trip blanks and/or MS/DS												
					Waste Management							
Processed through syste	no					13	drums					
Project Management	10%	of labor			Total drums for disposal	13	Haz percentage		0%			
					Total haz drums for disposal	0	Non-haz percentag		100%			
Program Manager	0.5				Haz T&D loads	0						
Senior Project Manager	2.4				Total non-haz drums for disposal	13						
Project Manager					Non-haz T&D loads	1						
Task Manager	6				Characterization samples	13						

Task Repetitions Calculator:	
Year 1	
Year 2	
Year 3	
Year 4	
Year 5	
Year 6	
Year 7	1.00
Year 8	1.00
Year 9	1.00
Year 10	1.00
Year 11	1.00
Year 12	1.00
Year 13	1.00
Year 14	1.00
Year 15	1.00
Year 16	1.00
Year 17	
Year 18	
Year 19	
Year 20	
Total Reps:	10.00
DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR	

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Sci/Eng/Arch/Designer	hour	$151.42	6		$909		$9,085
Project Sci/Eng/Arch/Designer	hour	$120.80	12		$1,450		$14,496
Staff Sci/Eng/Arch/Designer	hour	$104.69	36		$3,769		$37,689
Technician III	hour	$94.15	96		$9,067		$90,667
Program Manager	hour	$333.54	0.5		$167		$1,668
Senior Project Manager	hour	$192.96	2.4		$463		$4,631
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	6		$909		$9,091
	hour						
				Subtotal:	$16,733		

actors

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Drum Disposal							
Drum rate (soil or liquid, 55-gallon incl. drum purcha	each	$195.00	13		$2,535		$25,350
Transportation (200 miles up to 14 drums) , non-haz	each load	$450.00	1		$450		$4,500
55-gallon drum (soil or liquid, 55-gallon), haz	each	$0.00	0		$0		
Transportation (200 miles up to 14 drums), haz	each load	$0.00	0		$0		
Laboratory							
VOCs (8260B)	each	$46.00	49		$2,254		$22,540
BTEX/MtBE (8021)	each	$45.00	0		$0		
Metals - Al, Ar, Br, Cr, Fe, Pb, Mn	each	$57.19	48		$2,745		$27,451
Permanent Gases (CO2, N2, O2)	each	$0.00	0		$0		
Chloride by IC	each	$0.00	0		$0		
Cations	each	$45.96	0		$0		
Light hydrocarbons (methane, ethane, ethene)	each	$48.00	0		$0		
Nitrate+Nitrite	each	$0.00	0		$0		
Sulfide, total	each	$33.00	0		$0		
Total Organic Carbon (TOC)-single analysis	each	$21.00	0		$0		
Divalent manganese	each	$0.00	0		$0		
Dissolved Hydrogen	each	$142.98	0		$0		
Dehalococcoides	each	$326.80	0		$0		
			0				
			0				
			0				
				Subtotal:	$7,984		

s

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
PID per day	day	$0.00	0		$0	**Own**	
Interface probe IP-150' Solinist per day	day	$0.00	0		$0	**Own**	
Truck/car rental per day	day	$50.00	12		$600		$6,000
Level D PPE	day/person	$15.00	15		$225		$2,250
Miscellaneous (photographs, gas, tolls, supplies, etc	day	$20.00	0		$0		
Meals (day work)	day/person	$25.00	0		$0		
Shipping (Coolers)	each	$100.00	5		$500		$5,000
GPS Unit Garmine e Trex Vista	each	$0.00	0		$0		
Decon area setup/supplies	day	$25.00	3		$75	**Own**	$750
Submersible pump w/ control box per day	day	$0.00	12		$0	**Own**	$0
Horiba U-52 with flow-through cell per day	day	$0.00	12		$0	**Own**	$0
Generator per day	day	$0.00	12		$0	**Own**	$0
Bailer (24 per box)	each	$3.47	0		$0		
				Subtotal:	$1,400		

Annual Groundwater Monitoring — $39,242 — $392,424

Monitoring Well Sampling — Module Total: $39,242 — $392,424

Analyses	Enter"Y" if analysis desired
VOCs	Y
BTEX	Y
Metals	Y
Dissolved CO2	Y
Chlorides	Y
Cations	
MEE	Y
Nitrate/Nitrite	Y
Sulfate/Sulfide	Y
TOC	Y
Divalent Manganese	
Dissolved Hydrogen	
Dehalococcoides so	
Dinoseb	Y
Field Kits	Enter"Y" if analysis desired
Alkalinity	
Iron II (Fe 2+)	Y
	Enter"Y" if analysis desired

Including field/trip blanks and/or MS/DS

			Assumes 1 event				
			Change # of Events in Task Repetitions				
			Number of Wells	54			
					15	Purge volume/well (gal)	
			Sampling Rate	2	hrs/well		
			Total time per event	108	hrs	14	days
			Number of technicians	1			
			Man-hrs per event	112	hrs	8	hrs/day
		3	wks prep/coord	1	Senior	2	hrs/wk
				1	project eng	5	hrs/wk
				1	Staff eng	12	hrs/wk
				1	technician	0.1	hrs/wk
				1	day		
			Total Purge Volume Generated per event	810	gal	*MNA wells*	28
				55	gal/drum		

Waste Management

Processed through syste	no		15	drums		
		Total drums for disposal	15	Haz percentage	0%	
		Total haz drums for disposal	0	Non-haz percentag	100%	
Project Management	10% of labor	Haz T&D loads	0			
Program Manager	0.5	Total non-haz drums for disposal	15			
Senior Project Manager	2.7	Non-haz T&D loads	2			
Project Manager		Characterization samples	15			
Task Manager	6.8					

Task Repetitions Calculator:

Year 1	
Year 2	
Year 3	
Year 4	
Year 5	
Year 6	
Year 7	1.00
Year 8	1.00
Year 9	1.00
Year 10	1.00
Year 11	1.00
Year 12	1.00
Year 13	1.00
Year 14	1.00
Year 15	1.00
Year 16	1.00
Year 17	
Year 18	
Year 19	
Year 20	
Total Reps:	10.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Sci/Eng/Arch/Designer	hour	$151.42	6		$909		$9,085
Project Sci/Eng/Arch/Designer	hour	$120.80	15		$1,812		$18,120
Staff Sci/Eng/Arch/Designer	hour	$104.69	36		$3,769		$37,689
Technician III	hour	$94.15	112		$10,573		$105,731
Program Manager	hour	$333.54	0.5		$167		$1,668
Senior Project Manager	hour	$192.96	2.7		$521		$5,210
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	6.8		$1,030		$10,303
	hour						
				Subtotal:	$18,781		

actors

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Drum Disposal							
Drum rate (soil or liquid, 55-gallon incl. drum purcha	each	$195.00	15		$2,925		$29,250
Transportation (200 miles up to 14 drums) , non-haz	each load	$450.00	2		$900		$9,000
55-gallon drum (soil or liquid, 55-gallon), haz	each	$0.00	0		$0		
Transportation (200 miles up to 14 drums), haz	each load	$0.00	0		$0		
Laboratory							
VOCs (8260B)	each	$46.00	61		$2,806		$28,060
BTEX/MtBE (8021)	each	$45.00	28		$1,260		$12,600
Metals - Al, Ar, Br, Cr, Fe, Pb, Mn	each	$57.19	57		$3,260		$32,598
Permanent Gases (CO2, N2, O2)	each	$0.00	28		$0		$0
Chloride by IC	each	$0.00	28		$0		$0
Cations	each	$45.96	0		$0		
Light hydrocarbons (methane, ethane, ethene)	each	$48.00	28		$1,344		$13,440
Nitrate+Nitrite	each	$0.00	28		$0		$0
Sulfide, total	each	$33.00	28		$924		$9,240
Total Organic Carbon (TOC)-single analysis	each	$21.00	28		$588		$5,880
Divalent manganese	each	$0.00	0		$0		
Dissolved Hydrogen	each	$142.98	0		$0		
Dehalococcoides	each	$326.80	0		$0		
Dinoseb	ea	$125.00	29		$3,625		$36,250
			0				
			0				
				Subtotal:	$17,632		

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Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
PID per day	day	$0.00	0		$0	**Own**	
Interface probe IP-150' Solinist per day	day	$0.00	0		$0	**Own**	
Truck/car rental per day	day	$50.00	14		$700		$7,000
Level D PPE	day/person	$15.00	17		$255		$2,550
Miscellaneous (photographs, gas, tolls, supplies, etc	day	$20.00	0		$0		
Meals (day work)	day/person	$25.00	0		$0		
Shipping (Coolers)	each	$100.00	18		$1,800		$18,000
GPS Unit Garmine e Trex Vista	each	$0.00	0		$0		
Decon area setup/supplies	day	$25.00	3		$75	**Own**	$750
Submersible pump w/ control box per day	day	$0.00	14		$0	**Own**	$0
Horiba U-52 with flow-through cell per day	day	$0.00	14		$0	**Own**	$0
Generator per day	day	$0.00	14		$0	**Own**	$0
Bailer (24 per box)	each	$3.47	0		$0		
				Subtotal:	$2,830		

	Incremental Cost	Extended Cost
Well Abandonment	**$53,781**	**$53,781**
Well Abandonment Module Total:	$53,781	$53,781

Design/Execution Assumptions

	45	2" wells
	0	4" wells
Number of wells to be abandoned during year x		
Total man hrs in the field to oversight	45	Total wells
Total man hrs onsite observation for well abandonment	120	hrs (10 hr/day)
	2,025	Total linear footage (feet):
2" Wells AvgDepth (ft): 45	2025	feet
	0	feet
4" Wells AvgDepth (ft): 0	0	feet
	0	feet
Well abandonment rate	4	wells/day
Number of Technicians	1	
Total days in the field for oversight	12	days

Task Repetitions Calculator:

Year 1	
Year 2	
Year 3	
Year 4	
Year 5	
Year 6	
Year 7	
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	1.00
Year 18	
Year 19	
Year 20	
Total Reps:	1.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

3 wks prep/coord

1	Senior Engineer	0.25	hrs/wk
1	Project Engineer/Geologist	1	hrs/wk
1	Staff Engineer	4	hrs/wk
1	Engineer/Geologist I	12	hrs/wk
1	Field Technician	4	hrs/wk
1	Project Assistant	2	hrs/wk

Project Management		10% Labor
Program Manager	0.5 hrs/wk	10%
Senior Project Manager	2.8 hrs/wk	30%
Project Manager	0 hrs/wk	0
Task Manager	7.1 hrs/wk	60%

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Sci/Eng/Arch/Designer	hour	$151.42	1		$114		$114
Project Sci/Eng/Arch/Designer	hour	$120.80	3		$362		$362
Staff Sci/Eng/Arch/Designer	hour	$104.69	12		$1,256		$1,256
Sci/Eng/Arch/Designer 2	hour	$93.47	36		$3,365		$3,365
Technician III	hour	$94.15	132		$12,428		$12,428
Project Assistant	hour	$79.65	6		$478		$478
Program Manager	hour	$333.54	0.5		$167		$167
Senior Project Manager	hour	$192.96	2.8		$540		$540
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	7.1		$1,076		$1,076
				Subtotal:	$19,786		

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Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
lonment							
Well Abandonment Mob	each	$2,000.00	1		$2,000		$2,000
2" Well Abandonment	lf	$15.00	2025		$30,375		$30,375
4" Well Abandonment	lf	$20.00	0		$0		
				Subtotal:	$32,375		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Decon area setup/supplies	day	$25.00	12		$300		$300
Truck/car rental per day	day	$50.00	12		$600		$600
Water level indicator per day	day	$0.00	12		$0	Own	$0
Level D PPE	day/person	$15.00	12		$180		$180
Miscellaneous (photographs, gas, tolls, su	day	$20.00	12		$240		$240
Meals (day work)	day/person	$25.00	12		$300		$300
PID per day	day	$0.00	12		$0	Own	$0
				Subtotal:	$1,620		

L

Sheet Total: **$361,631**

ws above this line

	Incremental Cost	Extended Cost
Annual Groundwater Monitoring	**$24,109**	**$361,631**
Monitoring Well Sampling — Module Total:	$24,109	$361,631

Analyses	Y" if analysis desirec
VOCs	Y
BTEX	
Metals	Y
Dissolved CO2	
Chlorides	
Cations	
MEE	
Nitrate/Nitrite	
Sulfate/Sulfide	
TOC	
Divalent Manganese	
Dissolved Hydrogen	
Dehalococcoides so	

Field Kits	Y" if analysis desirec
Alkalinity	
Iron II (Fe 2+)	

Enter"Y" if analysis desired

Including field/trip blanks and/or MS/DS

Processed through system: no

Assumes 1 event

Change # of Events in Task Repetitions

Number of Wells	13			
			15	Purge volume/well (gal)
Sampling Rate	4	hrs/well		
Total time per event	52	hrs	7	days
Number of technicians	2			
Man-hrs per event	112	hrs	8	hrs/day
2 wks prep/coord	1	Senior	2	hrs/wk
	1	project eng	5	hrs/wk
	1	Staff eng	12	hrs/wk
	2	technician	10	hrs/wk
	1	day		
Total Purge Volume Generated per event	195	gal		
	55	gal/drum		

Waste Management

	4	drums		
Total drums for disposal	4	Haz percentage	0%	
Total haz drums for disposal	0	Non-haz percentage	100%	
Haz T&D loads	0			
Total non-haz drums for disposal	4			
Non-haz T&D loads	1			
Characterization samples	4			

Project Management	10% of labor
Program Manager	0.6
Senior Project Manager	2.9
Project Manager	
Task Manager	7.4

Task Repetitions Calculator:	
Year 1	1.00
Year 2	1.00
Year 3	1.00
Year 4	1.00
Year 5	1.00
Year 6	1.00
Year 7	1.00
Year 8	1.00
Year 9	1.00
Year 10	1.00
Year 11	1.00
Year 12	1.00
Year 13	1.00
Year 14	1.00
Year 15	1.00
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Total Reps:	15.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	Extended
Senior Sci/Eng/Arch/Designer	hour	$151.42	4		$606		$9,085
Project Sci/Eng/Arch/Designer	hour	$120.80	10		$1,208		$18,120
Staff Sci/Eng/Arch/Designer	hour	$104.69	24		$2,513		$37,689
Technician III	hour	$94.15	152		$14,311		$214,663
Program Manager	hour	$333.54	0.6		$200		$3,002
Senior Project Manager	hour	$192.96	2.9		$560		$8,394
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	7.4		$1,121		$16,819
	hour						
				Subtotal:	$20,518		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	Extended
Drum Disposal							
Drum rate (soil or liquid, 55-gallon incl. drum purchase)	each	$195.00	4		$780		$11,700
Transportation (200 miles up to 14 drums) , non-haz	each load	$450.00	1		$450		$6,750
55-gallon drum (soil or liquid, 55-gallon), haz	each	$0.00	0		$0		
Transportation (200 miles up to 14 drums), haz	each load	$0.00	0		$0		
Laboratory							
VOCs (8260B)	each	$46.00	15		$690		$10,350
BTEX/MtBE (8021)	each	$45.00	0		$0		
Metals - Al, Ar, Br, Cr, Fe, Pb, Mn	each	$57.19	14		$801		$12,010
Permanent Gases (CO2, N2, O2)	each	$0.00	0		$0		
Chloride by IC	each	$0.00	0		$0		
Cations	each	$45.96	0		$0		
Light hydrocarbons (methane, ethane, ethene)	each	$48.00	0		$0		
Nitrate+Nitrite	each	$0.00	0		$0		
Sulfide, total	each	$33.00	0		$0		
Total Organic Carbon (TOC)-single analysis	each	$21.00	0		$0		
Divalent manganese	each	$0.00	0		$0		
Dissolved Hydrogen	each	$142.98	0		$0		
Dehalococcoides	each	$326.80	0		$0		
			0				
			0				
			0				
				Subtotal:	$2,721		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	Extended
PID per day	day	$0.00	0		$0	Own	
Interface probe IP-150' Solinist per day	day	$0.00	0		$0	Own	
Truck/car rental per day	day	$50.00	7		$350		$5,250
Level D PPE	day/person	$15.00	18		$270		$4,050
Miscellaneous (photographs, gas, tolls, supplies, etc.)	day	$20.00	0		$0		
Meals (day work)	day/person	$25.00	0		$0		
Shipping (Coolers)	each	$100.00	2		$200		$3,000
GPS Unit Garmine e Trex Vista	each	$0.00	0		$0		
Decon area setup/supplies	day	$25.00	2		$50	Own	$750
Submersible pump w/ control box per day	day	$0.00	7		$0	Own	$0
Horiba U-52 with flow-through cell per day	day	$0.00	7		$0	Own	$0
Generator per day	day	$0.00	7		$0	Own	$0
Bailer (24 per box)	each	$3.47	0		$0		
				Subtotal:	$870		

Annual Groundwater Monitoring — $10,489 — $0

Monitoring Well Sampling — Module Total: $10,489 — $0

Analyses	Y" if analysis desired
VOCs	Y
BTEX	
Metals	Y
Dissolved CO2	
Chlorides	
Cations	
MEE	
Nitrate/Nitrite	
Sulfate/Sulfide	
TOC	
Divalent Manganese	
Dissolved Hydrogen	
Dehalococcoides so	
Dinoseb	
Field Kits	Y" if analysis desired
Alkalinity	
Iron II (Fe 2+)	

Enter "Y" if analysis desired

Including field/trip blanks and/or MS/DS

Processed through system: no

Project Management	10% of labor
Program Manager	0.2
Senior Project Manager	1.1
Project Manager	
Task Manager	2.7

Assumes 1 event

Change # of Events in Task Repetitions

Number of Wells	11			15	Purge volume/well (gal)
Sampling Rate	3	hrs/well			
Total time per event	33	hrs	5	days	
Number of technicians	1				
Man-hrs per event	40	hrs	8	hrs/day	
wks prep/coord	1	Senior	2	hrs/wk	
	1	project eng	5	hrs/wk	
	1	Staff eng	12	hrs/wk	
	1	technician	10	hrs/wk	
	1	day			

1

Total Purge Volume Generated per event: 165 gal; 55 gal/drum

MNA wells 0

Waste Management

Total drums for disposal	3	drums	Haz percentage	0%	
Total haz drums for disposal	0		Non-haz percentage	100%	
Haz T&D loads	0				
Total non-haz drums for disposal	3				
Non-haz T&D loads	1				
Characterization samples	3				

Task Repetitions Calculator:

Year 1	0.00
Year 2	
Year 3	
Year 4	
Year 5	
Year 6	
Year 7	
Year 8	
Year 9	
Year 10	
Year 11	
Year 12	
Year 13	
Year 14	
Year 15	
Year 16	
Year 17	
Year 18	
Year 19	
Year 20	
Total Reps:	0.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Sci/Eng/Arch/Designer	hour	$151.42	2		$303		$0
Project Sci/Eng/Arch/Designer	hour	$120.80	5		$604		$0
Staff Sci/Eng/Arch/Designer	hour	$104.69	12		$1,256		$0
Technician III	hour	$94.15	50		$4,708		$0
Program Manager	hour	$333.54	0.2		$67		$0
Senior Project Manager	hour	$192.96	1.1		$212		$0
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	2.7		$409		$0
	hour						
				Subtotal:	$7,559		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Drum Disposal							
Drum rate (soil or liquid, 55-gallon incl. drum purchase)	each	$195.00	3		$585		$0
Transportation (200 miles up to 14 drums) , non-haz	each load	$450.00	1		$450		$0
55-gallon drum (soil or liquid, 55-gallon), haz	each	$0.00	0		$0		
Transportation (200 miles up to 14 drums), haz	each load	$0.00	0		$0		
Laboratory							
VOCs (8260B)	each	$46.00	14		$644		$0
BTEX/MtBE (8021)	each	$45.00	0		$0		
Metals - Al, Ar, Br, Cr, Fe, Pb, Mn	each	$57.19	12		$686		$0
Permanent Gases (CO2, N2, O2)	each	$0.00	0		$0		
Chloride by IC	each	$0.00	0		$0		
Cations	each	$45.96	0		$0		
Light hydrocarbons (methane, ethane, ethene)	each	$48.00	0		$0		
Nitrate+Nitrite	each	$0.00	0		$0		
Sulfide, total	each	$33.00	0		$0		
Total Organic Carbon (TOC)-single analysis	each	$21.00	0		$0		
Divalent manganese	each	$0.00	0		$0		
Dissolved Hydrogen	each	$142.98	0		$0		
Dehalococcoides	each	$326.80	0		$0		
Dinoseb	ea	$125.00	0		$0		
			0				
			0				
				Subtotal:	$2,365		

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
PID per day	day	$0.00	0		$0	Own	
Interface probe IP-150' Solinist per day	day	$0.00	0		$0	Own	
Truck/car rental per day	day	$50.00	5		$250		$0
Level D PPE	day/person	$15.00	6		$90		$0
Miscellaneous (photographs, gas, tolls, supplies, etc.)	day	$20.00	0		$0		
Meals (day work)	day/person	$25.00	0		$0		
Shipping (Coolers)	each	$100.00	2		$200		$0
GPS Unit Garmine e Trex Vista	each	$0.00	0		$0		
Decon area setup/supplies	day	$25.00	1		$25	Own	$0
Submersible pump w/ control box per day	day	$0.00	5		$0	Own	$0
Horiba U-52 with flow-through cell per day	day	$0.00	5		$0	Own	$0
Generator per day	day	$0.00	5		$0	Own	$0
Bailer (24 per box)	each	$3.47	0		$0		
				Subtotal:	$565		

		Incremental Cost	Extended Cost
Permit Compliance		**$65,907**	**$1,647,676**
Site Maintenance	Module Total:	$65,907	$1,647,676

Assume costs for landfill monitoring, stormwater maintenance and vegetative maintenance
Monthly inspection of landfill cap
Weekly storm water inspections and management of stromwater
Weekly maintenance, mowing and clearing

Technician Hours per day	8
Days per week (PC)	1
Weeks per year	52

Assume actions conducted by full time site operator in conjunction with CATS operation with assistance from additional personnel for 2 people tasks

Days	52	days
Hours per day	8	hrs
Number of technicians	2	
Man-hrs	832	hrs

52 days

0 wk prep/coord

PREP TIME

1	Project Manager	2	hrs/mo
1	Senior Engineer/Geologist	2	hrs/mo
1	Project Engineer/Geologist	4	hrs/mo
1	Engineer/Geologist I	8	hrs/mo
1	Field Technician	4	hrs/mo
1	Project Assistant	0	hrs/mo

Project Management 10% Labor

Program Manager	1.6	hrs/wk
Senior Project Manager	8.5	hrs/wk
Project Manager	0	hrs/wk
Task Manager	21.8	hrs/wk

11 wk

Field Oversight

1	Project Manager	0	hrs/wk
1	Senior Engineer/Geologist	0.5	hrs/wk
1	Project Engineer/Geologist	2	hrs/wk
1	Engineer/Geologist I	4	hrs/wk
1	Field Technician	0	hrs/wk
1	Project Assistant	0.27	hrs/wk

Task Repetitions Calculator:	
Year 1	1.00
Year 2	1.00
Year 3	1.00
Year 4	1.00
Year 5	1.00
Year 6	1.00
Year 7	1.00
Year 8	1.00
Year 9	1.00
Year 10	1.00
Year 11	1.00
Year 12	1.00
Year 13	1.00
Year 14	1.00
Year 15	1.00
Year 16	1.00
Year 17	1.00
Year 18	1.00
Year 19	1.00
Year 20	6.00
Total Reps:	25.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	Extended
Senior Project Manager	hour	$192.96	0		$0		
Senior Sci/Eng/Arch/Designer	hour	$151.42	6		$833		$20,820
Project Sci/Eng/Arch/Designer	hour	$120.80	22		$2,658		$66,439
Sci/Eng/Arch/Designer 2	hour	$93.47	44		$4,113		$102,819
Technician I	hour	$56.96	832		$47,388		$1,184,700
Project Assistant	hour	$79.65	3		$239		$5,974
Program Manager	hour	$333.54	2		$534		$13,342
Senior Project Manager	hour	$192.96	9		$1,640		$41,005
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	22		$3,303		$82,578
				Subtotal:	$60,707		

's

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes
				Subtotal:	$0	

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	Extended
PID per day	day	$0.00	0		$0	Own	
Truck/car rental per day	day	$50.00	52		$2,600		$65,000
Level D PPE	day/person	$15.00	104		$1,560		$39,000
Interface probe IP-150' Solinist per day	day	$0.00	0		$0	Own	
Meals (day work)	day/person	$25.00	0		$0		
Miscellaneous (photographs, gas, tolls, supplies, etc.)	day	$20.00	52		$1,040		$26,000
Shipping (Coolers)	each	$100.00	0		$0		
Communications	day	$2.00	0		$0		
				Subtotal:	$5,200		

		Incremental Cost	Extended Cost
Annual Corrective Action Report		**$29,991**	**$749,764**
Negotiation, Drafting and Agency Coordination	Module Total:	$29,991	$749,764

Task Repetitions Calculator:	
Year 1	
Year 2	
Year 3	
Year 4	
Year 5	
Year 6	1.00
Year 7	1.00
Year 8	1.00
Year 9	1.00
Year 10	1.00
Year 11	1.00
Year 12	1.00
Year 13	1.00
Year 14	1.00
Year 15	1.00
Year 16	1.00
Year 17	1.00
Year 18	1.00
Year 19	1.00
Year 20	1.00
Year 21	1.00
Year 22	1.00
Year 23	1.00
Year 24	1.00
Year 25	1.00
Year 26	1.00
Year 27	1.00
Year 28	1.00
Year 29	1.00
Year 30	1.00
Total Reps:	25.00

DO NOT INSERT ROWS INTO THE TASK REPS CALCULATOR

Compilation and Analysis				**Project Management**	10% Labor		
	Senior Expert	4	hrs	**Program Manager**	0.8	hrs	#
	Project Advisor	2	hrs	**Senior Project Manager**	4.2	hrs	#
	Principal	4	hrs	**Project Manager**	0	hrs	
	Senior	8	hrs	**Task Manager**	10.7	hrs	#
	Project	12	hrs				#
	Staff	30	hrs				
	Drafting	10	hrs				
	PA	2	hrs				
Draft Report				**Subcontracting**			
	Senior Expert	5	hrs				
	Project Advisor	5	hrs				
	Principal	8	hrs				
	Senior	10	hrs				
	Project	15	hrs				
	Staff	30	hrs				
	Drafting	10	hrs				
	PA	3	hrs				
Final Report				**Expenses**			
	Senior Expert	2	hrs				
	Project Advisor	1	hrs				
	Principal	8	hrs				
	Senior	4	hrs				
	Project	12	hrs				
	Staff	7	hrs				
	Drafting	7	hrs				
	PA	3	hrs				

Subtotal: **202**

9 Number of Paper Copies 25 Pages per Copy

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
Senior Expert	hour	$326.64	11		$3,593		$89,825
Project Advisor	hour	$238.42	8		$1,907		$47,685
Principal Sci/Eng/Arch/Designer	hour	$194.30	20		$3,886		$97,152
Senior Sci/Eng/Arch/Designer	hour	$151.42	22		$3,331		$83,282
Project Sci/Eng/Arch/Designer	hour	$120.80	39		$4,711		$117,779
Staff Sci/Eng/Arch/Designer	hour	$104.69	67		$7,026		$175,648
CADD/Drafter II	hour	$72.58	27		$1,968		$49,195
Project Assistant	hour	$79.65	8		$611		$15,266
	hour						
Program Manager	hour	$333.54	1		$267		$6,671
Senior Project Manager	hour	$192.96	4		$810		$20,261
Project Manager	hour	$167.99	0		$0		
Task Manager	hour	$151.52	11		$1,621		$40,531
	hour						
	hour						
				Subtotal:	$29,732		

Description **Unit** **Unit Rate** **Quantity** **Surcharge** **Revenue** **Notes**

			Subtotal:	$0	

Description	Unit	Unit Rate	Quantity	Surcharge	Revenue	Notes	
ADEM RCRA Permit Fees	ea	1.00	$ -		$0		
ADEM UIC Permit Fees	ea	1.00	$ -		$0		
Copies	each	$0.15	225		$34		$844
Shipping (Reports)	each	$25.00	9		$225		$5,625
				Subtotal:	$259		

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APPENDIX B

APPENDIX B-1

Contingency Plan

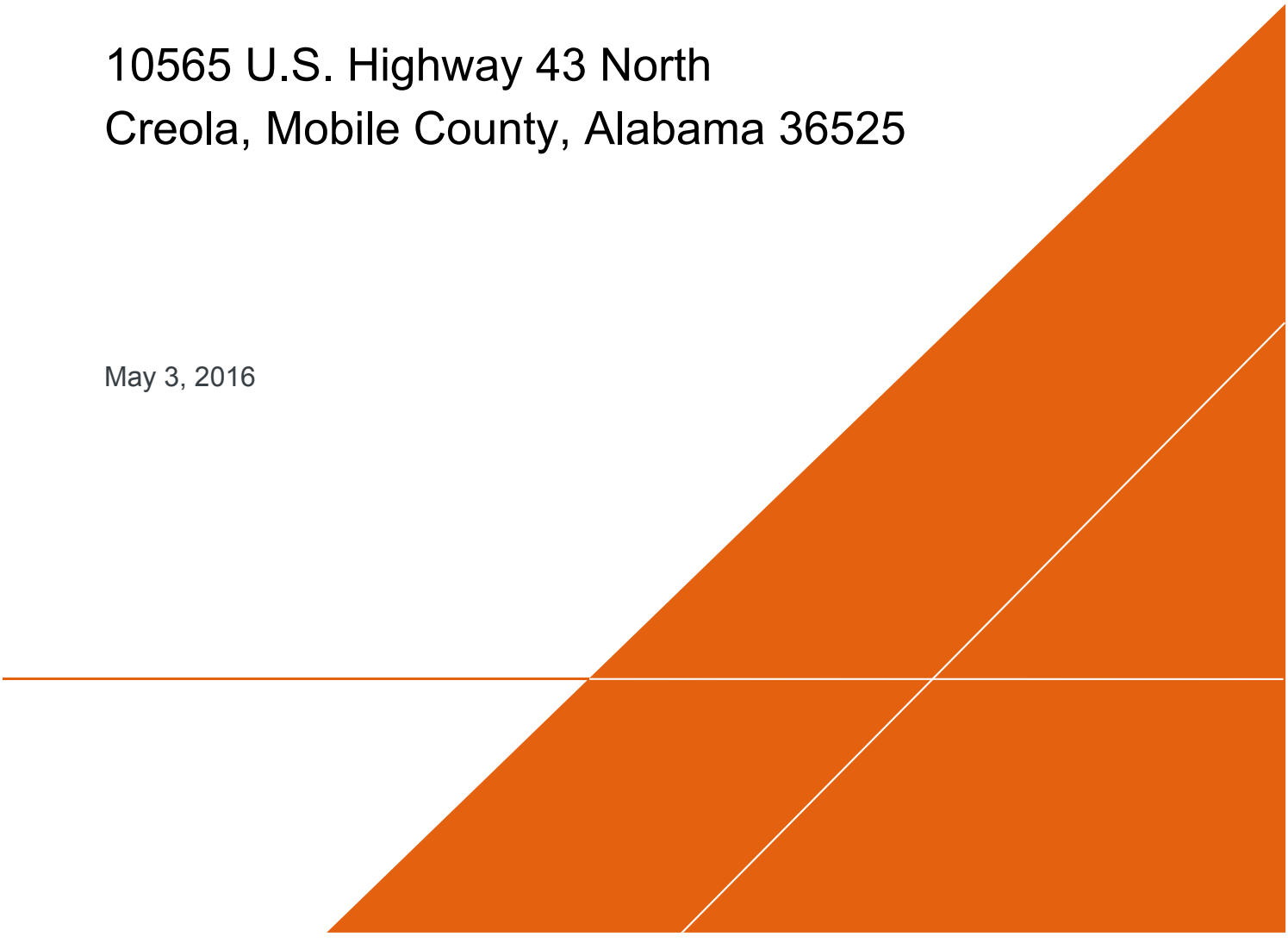
ARCADIS Design & Consultancy for natural and built assets

Rentokil Initial

CONTINGENCY PLAN

10565 U.S. Highway 43 North
Creola, Mobile County, Alabama 36525

May 3, 2016



CONTINGENCY PLAN

10565 U.S. Highway 43 North
Creola, Mobile County, Alabama

Pamela S. McIlwain
Principal Environmental Scientist

Andrew Eversull
Project Manager

Prepared for:

Rentokil Initial Environmental Services, LLC

Prepared by:
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Our Ref.:

03648005.0000.00200

Date:

May 3, 2016

RECORD OF REVISIONS

Revision No	Date Issued	Page No	Description

CONTENTS

TABLES

FIGURES

APPENDICES

1 FACILITY INFORMATION

40 CFR 270.14(B)(7), PART 264, SUBPART D AND ADEM Admin. CODE r. 335-14-5-.02

The Contingency Plan is a document that sets out an organized, planned, and coordinated course of action to be followed in case of an incident involving fire, explosions, or any unpermitted sudden or non-sudden release of hazardous waste or hazardous waste constituents to air, soil, or surface water that could threaten human health and/or the environment at Rentokil Initial Environmental Services, LLC (RIES). The facility is located at 10565 U.S. Highway 43 North, Creola, Mobile County, Alabama.

RIES is a former truck wash facility that began operations in the early 1970s and ceased operation in 1986. The facility has a closed permitted landfill regulated by the Alabama Department of Environmental Management (ADEM). Surface impoundments used during facility operations were closed by excavating contaminated sediment in the impoundments and placing the sediments in the on-site landfill. The landfill has a leachate collection system that accumulates leachate from the bottom of the landfill into a sump. Periodically, leachate in the sump is pumped to an aboveground storage tank (AST). The AST is a 10,000-gallon tank located within concrete secondary containment. The leachate AST is a 90-day storage unit permitted under the Resource Conservation and Recovery Act (RCRA).

The 82-acre REIS facility has a locked gate and fence at the entrance to the site with a fence surrounding the closed RCRA landfill, treatment system, and office. In addition to the closed RCRA landfill, the site has been actively treating contaminants of concern in groundwater using groundwater recovery wells, aboveground treatment, and underground injection of treated water for approximately 24 years.

Structures at the facility include the following: the current site office, metal building containing the former wash rack and office, small diesel tank, equipment shed, groundwater treatment system, and closed RCRA landfill. The groundwater treatment system includes settling basins, air stripper, multiple water filters, carbon vessel, 5,000-gallon development water storage tank, and a 20,000-gallon holding tank. Figure 1 is a site location map, and Figure 2 shows the layout of the facility with property boundaries and facility structures.

The site has a full-time Site Manager who also serves as the Emergency Coordinator. The Site Manager performs daily inspections, routine operational maintenance of the groundwater treatment system, and subcontractor oversight on an as-needed basis. The Emergency Coordinator will immediately notify the fire department, law enforcement, hospital, and ADEM Field Operations Division (Table 1) in the event of a spill or leak and provide information regarding cause, location, flow, and type. The Emergency Coordinator will take appropriate measures to ensure his safety and that of occasional subcontractors or visitors at the site as well as initiate appropriate measures to mitigate the spill/leak or fire, if possible.

2 EMERGENCY CONTACT LIST AND COORDINATION AGREEMENTS

40 CFR 264.37, 264.52(c) and (d) and ADEM Admin. Code r. 335-14-5-.04(3)-(4)

This Contingency Plan will be maintained at the site, in a location that can be readily accessed, for the Emergency Coordinator's use. Should an emergency arise, the Emergency Coordinator will notify the fire

department, law enforcement, hospital, and ADEM Field Operations Division. Table 1 is a list of emergency contact information for the Emergency Coordinator and outside emergency contacts and agencies.

The Emergency Coordinator will notify the fire department, law enforcement, hospital, and ADEM Field Operations Division in the event activation of the Contingency Plan necessitates additional services. A copy of the Contingency Plan has been submitted to these agencies (with a return receipt requested) so that they are familiar with the layout of the facility, properties of the hazardous wastes handled at the facility and associated hazards, entrances to and roads inside the facility, and other aspects of the facility. These agencies were asked to sign a Coordination Agreement Form to acknowledge that they reviewed this Plan, understood their role under the Plan, and would ensure all members of the agency are informed of its content and their individual responsibilities. Signed agreements will be maintained on file in the office at the site. Copies of the request sent to the agencies are provided in Appendices A through D.

The Creola Fire Department has been asked to provide the following assistance during an emergency:

- Primary emergency authority;
- Immediate response;
- Primary firefighting services;
- Rescue and emergency transport services; and
- Communications support.

3 IMPLEMENTATION OF CONTINGENCY PLAN AND EMERGENCY PROCEDURES

40 CFR 264.52(a), 264.56(d) and ADEM Admin. Code r. 335-14-5-.04

The site is no longer an operational facility; therefore, it does not accept, transport, or dispose of wastes on site. No waste is treated at the facility except groundwater. Leachate from the closed landfill is collected and sent off site for disposal. The site is in a post-closure status that includes inspection of the closed landfill cover, groundwater recovery, treatment and reinjection, and routine groundwater sampling from on-site wells to evaluate groundwater conditions as part of the RCRA permit. Two waste streams exist at the site and include spent carbon media from the groundwater treatment process and leachate from the closed RCRA landfill.

The provisions of this Contingency Plan must be carried out immediately whenever there is an imminent or actual incident, such as a fire or release of hazardous waste or hazardous waste constituents that could adversely threaten human health and/or the environment. Incidents may result from tank overflow or rupture, pipeline leaks, pump failure, leaking containers, etc. The site is not an active facility but operates a groundwater treatment system. Therefore, the hazardous wastes contained on site are minimal and releases that could adversely threaten human health and/or the environment are not likely. This section of the Contingency Plan provides guidelines to the Emergency Coordinator in order to evaluate the need to implement the Plan. The Contingency Plan will be implemented in the following situations.

3.1 Spill or Material Release

40 CFR 264.52, 264.51 and ADEM Admin. Code r. 335-14-5-.04

Hazardous waste or material spills may result from tank overflow or rupture, pipeline leaks, pump failure, leaking containers, and other accidents. A secondary containment structure encompasses the 90-day leachate AST to contain spilled contaminants. In the event of failure of the secondary containment structure, RIES will respond to spills/leaks as outlined below.

3.1.1 Discovery

The first response phase is the discovery of a spill/leak. Upon discovery of a spill or leak, immediately shut down the pump and treat system.

3.1.2 Notification

The second response phase is the prompt reporting of a spill/leak in accordance with procedures. Emergency call lists will be posted in the equipment shed and site office. Notification should include as much information as possible, including type, quantity, cause, and location of the incident as well as any possible environmental and safety assessments.

3.1.3 Containment

The third response phase is to initiate any appropriate measures to prevent additional loss using methods and procedures (may include pumping and valving) to stop further discharge or spread of a material from the facility and/or to extinguish incipient-stage fires.

3.1.4 Cleanup

The fourth and final phase of spill response is the removal of pollutants, utilizing all necessary adsorbents and mechanical devices, and disposal or recycling of the recovered material at approved permitted facilities in accordance with applicable federal and state regulations.

3.2 Emergency Response Procedures

40 CFR 264.52, 264.56 and ADEM Admin. Code r. 335-14-5-.04

Emergency procedures are the responsibility of the Emergency Coordinator, the primary employee at the site. The most important factor is to protect responding personnel and others from dangers due to the release. In the event of an emergency, the specific procedures outlined below will be followed.

1. If it is an imminent or actual emergency, involving a release, fire, or other situation that threatens human health and/or the environment, the Emergency Coordinator will immediately contact the fire department, law enforcement, hospital, and ADEM Field Operations Division;
2. Determine the origin, location, nature, and extent of the problem;

3. Establish a command post from which to coordinate and direct the overall emergency response effort (the command post would likely be the site office, which is where a telephone, list of emergency phone numbers, and copy of this Contingency Plan are available); and

If it is a localized situation, not involving a sudden or non-sudden incident that could cause a threat to human health and/or the environment, the matter should be handled according to routine procedures.

3.2.1 Notification

40 CFR 264.52, 264.56(a), (d), and (i) and ADEM Admin. Code r. 335-14-5-.04(7)

If an incident occurs that could threaten human health and/or the environment, the Emergency Coordinator shall immediately:

1. Ensure his/her safety at the site before proceeding;
2. Notify the fire department, law enforcement, hospital, and ADEM Field Operations Division (refer to Table 1 for emergency contact telephone listing); and
3. Furnish the following information when notifying the response teams:
   a. Name, address, and telephone number of reporter;
   b. Name, address, and EPA Identification Number of the facility;
   c. Time, location, and type of incident (e.g., spill, fire, release);
   d. Name and quantity of material(s) involved, to the extent known;
   e. The extent of injuries, if any; and
   f. The possible hazards to human health or the environment outside the facility.

In addition, the following agencies must be notified:

1. Alabama Emergency Management Agency (AEMA; 1-800-843-0699, 24 hours a day);
2. National Response Center (NRC) (1-800-424-8802 or 202-267-2675, 24 hours a day); and
3. ADEM (334-271-7700 between 8 a.m. and 5 p.m., Monday through Friday).

The Creola Fire Department must be informed that the facility has taken the necessary steps to prevent and prepare for future incidents before operations are resumed in the affected area(s) of the facility.

3.2.2 Identification/Assessment/Reporting

40 CFR 264.56(b), (c), and (d) and ADEM Admin. Code r. 335-14-5-.04(7)

In the event of a release, fire, or explosion, the Emergency Coordinator must immediately identify the character, exact source, amount, and areal extent of any released materials. The Emergency Coordinator must assess possible hazards to human health and/or the environment that may result from the release, fire, or explosion, considering both direct and indirect effects of the release, fire, or explosion (e.g., the effects of any toxic, irritating, or asphyxiating gases that are generated or the effects of any hazardous surface water run-off from water or chemical agents used to control fire and heat-induced explosions. The facility is not an active industrial facility but operates a groundwater treatment system. Therefore, events endangering human health and/or the environment are not likely. If the Emergency

Coordinator determines that the release could threaten human health and/or the environment, he will report such findings and notify the fire department, law enforcement, hospital, and ADEM Field Operations Division immediately (contact numbers provided in Table 1), AEMA (1-800-843-0699), NRC (1-800-424-8802), and ADEM 1-334-271-7700).

3.2.3 Control Procedures

40 CFR 264.52 (b)-(e) and 264.56(c) and ADEM Admin. Code r. 335-14-5-.04(7)

The purpose of the Contingency Plan is to prevent and properly respond to sudden and non-sudden incidents at the facility. The Plan satisfies RCRA requirements for responses to emergencies involving hazardous wastes. The site is no longer an operational facility; therefore, it does not accept, transport, or dispose of wastes on site. No waste is treated at the facility except groundwater. The site is in a post-closure status, collecting and disposing landfill leachate, recovering and treating groundwater in the on-site treatment system, injecting treated water below the ground surface, and monitoring groundwater wells as part of the permit. Two waste streams exist at the site and include spent carbon media from the groundwater treatment process and leachate from the closed RCRA landfill. Leachate from the landfill is collected and sent off site for disposal. The waste carbon from the groundwater treatment system is sent off site for regeneration annually.

3.2.3.1 General Response Procedures – Spills

In the event of a spill or a leak that has been determined to be of a smaller magnitude and which can safely be handled by the Emergency Coordinator, he shall utilize appropriate personal protective equipment (PPE), mitigate the spill/leak at the source, and dispose of all contaminated or used PPE and spill-containing equipment as necessary. The Emergency Coordinator shall then replace the used equipment and PPE for future responses.

A secondary containment structure encompasses the 90-day leachate AST. In the event of a spill or release, leachate will be contained within the secondary containment structure, and the Emergency Coordinator will determine if assistance from the fire department is necessary or if small-scale response procedures should be followed.

3.2.3.2 General Response Procedures – Fires

If a small-scale/incipient-stage fire occurs, the Emergency Coordinator will suppress the smoldering or flaming material using the appropriate extinguisher, eliminate the source of ignition, and notify the fire department if deemed necessary. Appropriate PPE should be worn and used during the emergency. In the event of a large-scale fire, the Emergency Coordinator will notify the fire department. A small first-aid kit is maintained on site and available for minor and non-threatening injuries. In case of a medical emergency, call 911 for the fire department and relevant emergency unit to be dispatched to the site.

After the emergency is resolved, the Emergency Coordinator will dispose of all used PPE and replace the used equipment and PPE for future responses.

3.2.4 Prevention of Recurrence or Spread of Fires, Explosions, or Releases

40 CFR 264.56(e) and ADEM Admin. Code r. 335-14-5-.04(7)(e)

During an emergency, the Emergency Coordinator must take all reasonable measures necessary to ensure that releases do not occur, reoccur, or spread to other hazardous waste at the facility. Actions to prevent the reoccurrence or spread of releases may include:

1. Collecting and containing released wastes;
2. Prohibiting smoking in all areas except designated smoking areas;
3. Using non-sparking tools;
4. Protecting the area from open flame or heat-generating activities; and
5. Monitoring all valves, pipes, or equipment for leaks or ruptures.

All reasonable safety procedures will be followed prior to resuming monitoring and closure activities.

3.2.5 Storage of Released Material and Wastes and Post-Emergency Equipment Maintenance

40 CFR 264.56(g) & (h) and ADEM Admin. Code r. 335-14-5-.04(7)(g)

Immediately after an incident involving hazardous waste, the Emergency Coordinator will make arrangements for proper storage and/or disposal of all water and contaminated materials resulting from the release. All resulting wastes generated will be considered a RCRA hazardous waste and managed as a RCRA waste unless it can be demonstrated to be non-regulated. The Emergency Coordinator will ensure that, in the affected area(s) of the facility, wastes which may be incompatible with the released material are stored, treated, or disposed until cleanup procedures are completed.

After an emergency event, or as required during the emergency response, all emergency equipment utilized in the affected area will be cleaned or replaced so that they are suitable for future use. Prior to resuming operations, an inspection of all utilized safety equipment will be conducted. All proper authorities will be notified that the post-emergency equipment maintenance has been performed and operations will resume.

4 PREPAREDNESS AND PREVENTION

40 CFR 264.52 – 264.56 and ADEM Admin. Code r. 335-14-5-.03

The 90-day leachate AST tank is inspected daily when the AST tank contains leachate. In the event of a fire, the Creola Fire Department will provide a water truck with adequate pressure equipment. Whenever there is an imminent or actual emergency situation, the Emergency Coordinator will notify the fire department for assistance.

4.1 Required Equipment

40 CFR 264.56 and ADEM Admin. Code r. 335-14-5-.03(1)-(5)

The following equipment is required:

1. An accessible telephone on site that can be used during an emergency to contact police, fire, local emergency response teams, and the ADEM Field Operations Division. The Emergency Coordinator has a cellular telephone to make emergency calls, if needed; and
2. Portable fire extinguishers at each building near the storage of flammable materials, the 90-day leachate AST tank, and mechanical and electrical systems associated with the groundwater treatment system.

Facility communications, fire protection equipment, spill control equipment, and decontamination equipment, where required, are inspected, maintained, and tested as necessary to ensure its proper operation in the event of an emergency. The Emergency Coordinator is responsible for the documentation of equipment testing and maintenance.

4.2 Emergency Equipment

40 CFR 264.52(e) and ADEM Admin. Code r. 335-14-5-.04(3)(e)

Table 2 lists the type and physical location of the site's emergency equipment, including firefighting equipment systems, spill control equipment, and decontamination equipment. The location of each piece of equipment and an understanding of its capabilities has been posted in the site office. The inspection form for monthly inspections of fire extinguishers and spill response material is provided in Appendix E.

4.3 Emergency Coordinator's Responsibilities

40 CFR 264.52(d), 264.55, 264.56(a) and ADEM Admin. Code r. 335-14-5-.04(6)

If an imminent or actual emergency is discovered at the site, the Emergency Coordinator will act according to the aforementioned procedures and notify the fire department, law enforcement, hospital, and ADEM Field Operations Division if the spill/release is unable to be contained with site measures. The groundwater recovery and aboveground treatment system will be shut down in the case of an imminent or actual emergency. Any subcontractor on site will be given an orientation by the Emergency Coordinator of potential hazards at the site and the subcontractor's responsibility to notify the Emergency Coordinator immediately upon the discovery of an incident.

The Emergency Coordinator will take measures (e.g., isolate leaks or discharges) to ensure that releases do not occur, reoccur, or spread. Such measures will be directed at preventing intermixing of incompatible wastes.

In the event that the fire department responds to an emergency at the facility, the fire department supervisor assumes the duties and authorities of the Emergency Coordinator.

In the event of a reported actual or imminent emergency, the Emergency Coordinator must immediately:

1. Identify the character, exact source, amount, and extent of released material;

2. Notify the fire department, law enforcement, hospital, and ADEM Field Operations Division, if necessary;
3. Notify and contact an outside remediation contractor, if necessary; and
4. Monitor for leaks, pressure buildup, gas generation, or ruptures in valves, pipes, or other equipment, if applicable and where appropriate.

4.4 Post-Emergency Responsibilities

40 CFR 264.56(j) and ADEM Admin. Code r. 335-14-5-.04(7)(e)&(f)

After an emergency, the Emergency Coordinator will perform the following:

1. Maintain in the operating record all reports of any incident that requires implementation of the Contingency Plan;
2. Immediately supervise cleanup efforts and ensure that the recovered waste or contaminated material is properly treated, stored, or disposed;
3. Ensure that no waste that may be incompatible with the released material is stored or treated until cleanup procedures are completed; and
4. Ensure emergency equipment is in operational order, restocked, or replaced in the event of a future incident.

4.5 Amendments to the Contingency Plan

40 CFR 264.53, 264.54 and ADEM Admin. Code r. 335-14-5-.04(5)

The Contingency Plan will be reviewed and immediately amended, if necessary, whenever:

1. The facility permit is revised;
2. The plan fails in an emergency;
3. The facility changes – in its design, construction, operation, maintenance, or other circumstances – in a way that materially increases the potential for fires, explosions, or releases of hazardous waste or hazardous waste constituents, or changes the response necessary in an emergency;
4. The list of emergency coordinators changes; or
5. The list of emergency equipment changes.

A copy of this Contingency Plan shall be maintained at all times at the RIES facility Emergency Coordinator's office. In addition, this Plan has been provided to the Creola Fire Department, Creola Police Department, Springfield Medical Center, and ADEM Mobile Central Field Office. All changes in this Plan will be updated at the site and fire department within 30 days of the effective date of the change.

TABLES

Table 1
Emergency Contact Information
Contingency Plan
Rentokil Initial Environmental Services, LLC
Creola, Mobile County, Alabama

ARCADIS Design & Consultancy for natural and built assets

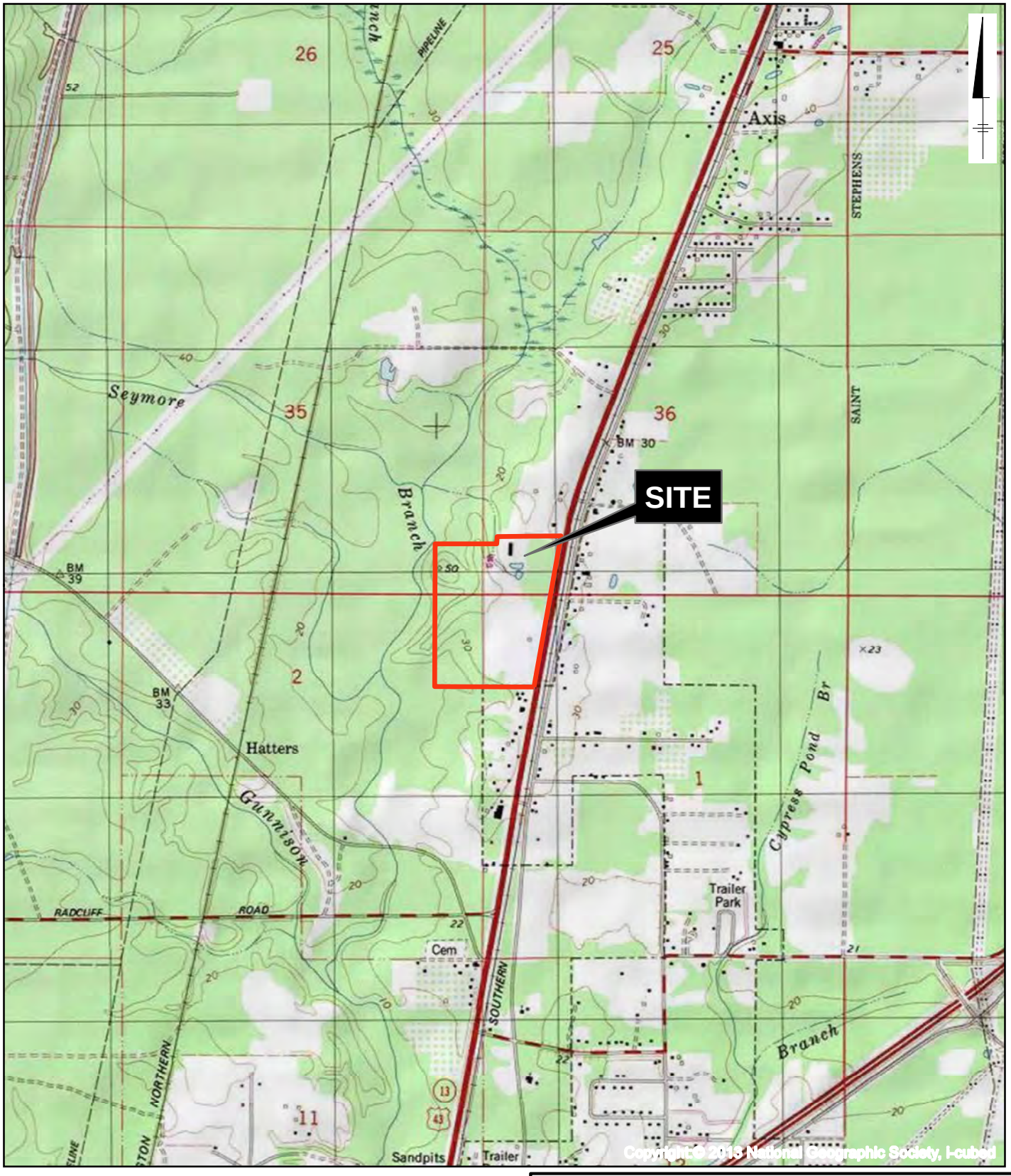
EMERGENCY COORDINATOR	
Larry Noble *Site Manager*	Office: 251-675-7073 Cell: 251-583-3887
Facility Address 10565 U.S. Highway 43 North Creola, Mobile County, AL 36525	
Home Address 168 South Broad Street Mobile, AL 36602	
EMERGENCY CONTACTS	
Creola Fire Department	911* or 251-675-8543
Creola Police Department	911* or 251-675-8145
Springhill Memorial Hospital – 3719 Dauphin Street, Mobile, AL	251-344-9630
Mobile Local Emergency Planning Committee (LEPC)	251-460-8000
GOVERNMENT AGENCIES	
Alabama Emergency Management Agency 24 hours a day	1-800-843-0699
National Response Center 24 hours a day	1-800-424-8802 or 202-267-2675
Alabama Department of Environmental Management 8 a.m. to 5 p.m., Monday through Friday	334-271-7700
Alabama Department of Environmental Management Mobile Central Field Office	251-450-3400
EMERGENCY RESPONSE CONTRACTOR	
Ranger Environmental	251-679-8611

Table 2
Emergency Equipment List
Contingency Plan
Rentokil Initial Environmental Services, LLC
Creola, Mobile County, Alabama

ARCADIS Design & Consultancy for natural and built assets

Emergency Equipment	General Location
Fire Extinguishers	8 on site • 1 located in site office • 1 located in workshop (in site office) • 1 located at diesel tank • 1 located at 90-day leachate AST • 2 located in equipment shed • 1 located in former office • 1 located in former washrack
Telephone	• 1 "landline" telephone located in site office • 1 cell phone with Emergency Coordinator
Spill Response Kit (absorbent materials)	2 kits (spill pads, booms, bag of absorbent material, gloves, safety glasses) • 1 located at diesel tank • 1 located at 90-day leachate AST
Eye Wash / Shower	• 2 eye wash bottles - located in workshop (in site office) • fully functional shower (in site office)
Other Protective Equipment	Located in site office: • safety glasses; full-face shield • 2 pair rubber boots w/steel toe • 12 pair gloves (nitrile, elbow length) • 12 pair leather gloves

FIGURES



0 2,000 4,000

Feet

Legend

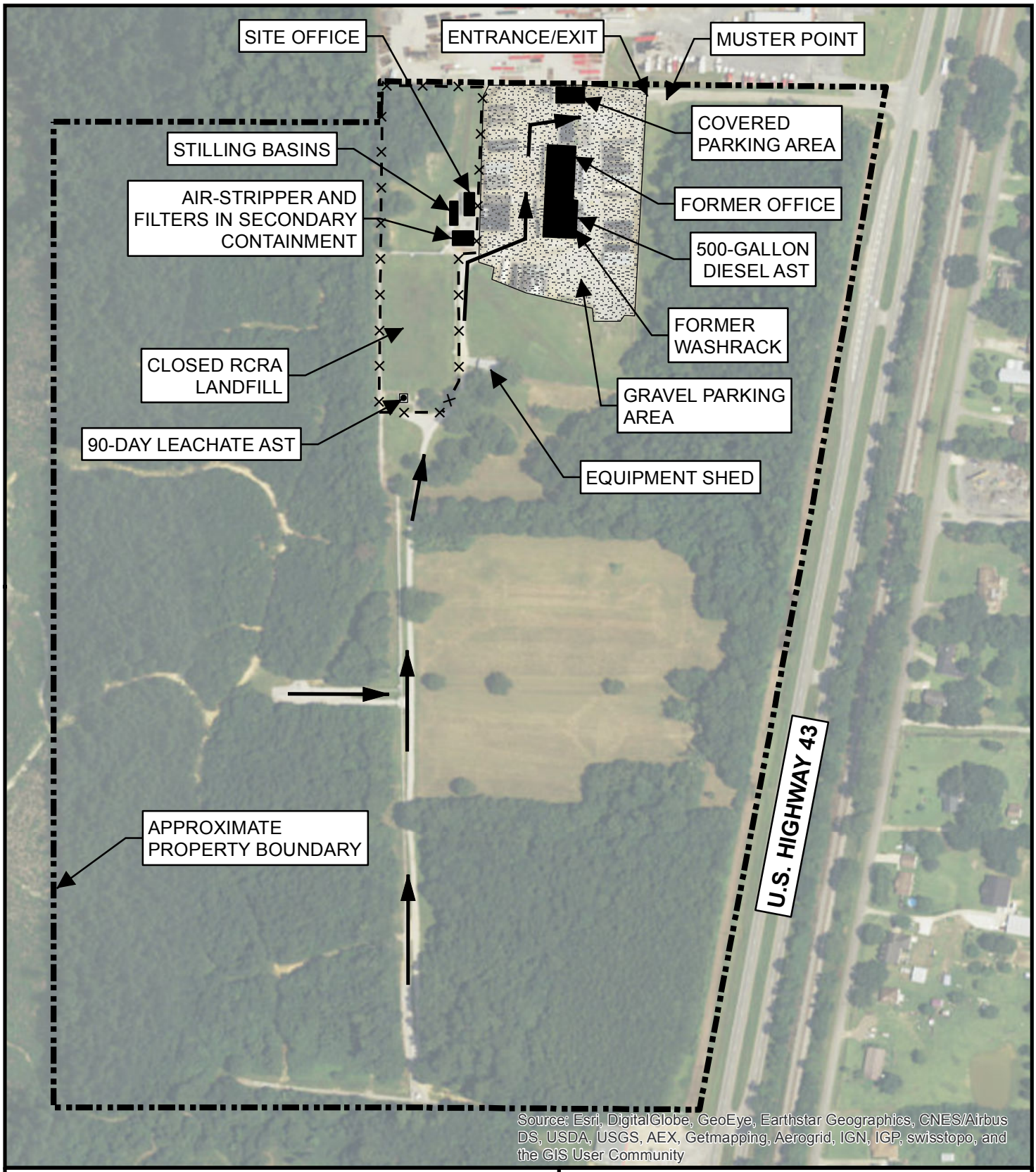
Property Boundary

RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC
CREOLA, AL

SITE LOCATION

ARCADIS Design & Consultancy for natural and built assets

FIGURE
1



LEGEND

EVACUATION ROUTE

FENCE

300 150 0 300 Feet

N

RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC
CREOLA, AL

SITE LAYOUT MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURE
2

APPENDIX A

Fire Department Request

VIA CERTIFIED MAIL NO. 7013 1710 0000 4575 9741
RETURN RECEIPT REQUESTED

Mr. Gary D. Huff – Fire Chief
Creola Fire Department
190 Dead Lake Road
Creola, Alabama 36525

Arcadis U.S., Inc.
10352 Plaza Americana Drive
Baton Rouge
Louisiana 70816
Tel 225 292 1004
Fax 225 218 9677
www.arcadis.com

ENVIRONMENT

Subject:
Contingency Plan
Rentokil Initial Environmental Services, LLC
10565 U.S. Highway 43 North
Creola, Mobile County, Alabama

Date:
May 3, 2016

Contact:
Pamela McIlwain

Extension
249

Email:
pam.mcllwain@arcadis.com

Our ref:
03648005.0000.00200

Dear Mr. Huff:

On behalf of our client, Rentokil Initial Environmental Services, LLC (RIES), and in accordance with Alabama and federal regulations, Arcadis U.S., Inc. (Arcadis) is providing your department with a copy of our Contingency Plan, which describes the following:

- The actions our Emergency Coordinator will take in response to emergencies (e.g., fires or spills of hazardous waste);
- Arrangements we would like your department to agree to in the event of an emergency;
- A layout of the site; and
- A description of the properties and associated hazards of the hazardous wastes handled at our facility.

We request that your agency agree to provide the following services in the event of an emergency regarding waste storage at our facility:

- Primary emergency authority;
- Immediate response;
- Rescue and transport services;
- Communications support; and
- Primary firefighting services.

The RIES facility is not an active industrial facility but operates a groundwater treatment system under a Resource Conservation and Recovery Act (RCRA) permit. The site has a full-time Site Manager who also serves as the Emergency Coordinator. The Site Manager performs daily inspections, routine operational maintenance of the groundwater treatment system, and subcontractor oversight on an as-needed basis. A minimal amount of hazardous and nonhazardous wastes are generated or transported to and from the site. Two waste streams exist at the site and include spent carbon media from the groundwater treatment process and leachate from the closed RCRA landfill.

Please review the attached Contingency Plan and, if acceptable, complete and return to Arcadis (10352 Plaza Americana Drive, Baton Rouge, LA 70816) the attached Certification Sheet. If you have any questions, please contact Ms. Pam McIlwain of Arcadis at (225) 292-1004.

Sincerely,

Arcadis U.S., Inc.

Pamela S. McIlwain

Principal Environmental Scientist

Andrew Eversull

Project Manager

Copies:

Mr. Larry Noble (electronic)

Attachments

A Certification Sheet for Designated Outside Agencies – Emergency Response Roles

B REIS Emergency Response Plan

CERTIFICATION SHEET FOR
DESIGNATED OUTSIDE AGENCIES – EMERGENCY RESPONSE ROLES
AT

Rentokil Initial Environmental Services, LLC
10565 U.S. Highway 43 North
Creola, Mobile County, Alabama

As required under Title 40, Part 265, Subpart C of the Code of Federal Regulations, a representative of Rentokil Initial Environmental Services, LLC (RIES) has contacted the Creola Fire Department in order to familiarize the department with the Contingency Plan, including anticipated emergency response role, the layout of the facility, properties of hazardous waste handled at the facility and associated hazards, places where facility personnel would normally be working, entrances to roads inside the facility, and possible evacuation routes.

_____ _____

Creola Fire Department Date

_____

Arcadis or RIES Representative

APPENDIX B

Police Department Request

VIA CERTIFIED MAIL NO. 7013 1710 0000 4575 9796
RETURN RECEIPT REQUESTED

Creola Police Department
190 Dead Lake Road, #A
Creola, Alabama 36525

Arcadis U.S., Inc.
10352 Plaza Americana Drive
Baton Rouge
Louisiana 70816
Tel 225 292 1004
Fax 225 218 9677
www.arcadis.com

Subject:
Contingency Plan
Rentokil Initial Environmental Services, LLC
10565 U.S. Highway 43 North
Creola, Mobile County, Alabama

ENVIRONMENT

Date:
May 3, 2016

Contact:
Pamela McIlwain

Extension
249

Email:
pam.mcllwain@arcadis.com

Our ref:
03648005.0000.00200

To Whom it May Concern:

On behalf of our client, Rentokil Initial Environmental Services, LLC (RIES), and in accordance with Alabama and federal regulations, Arcadis U.S., Inc. (Arcadis) is providing your department with a copy of our Contingency Plan, which describes the following:

- The actions our Emergency Coordinator will take in response to emergencies (e.g., fires or spills of hazardous waste);
- Arrangements we would like your department to agree to in the event of an emergency;
- A layout of the site; and
- A description of the properties and associated hazards of the hazardous wastes handled at our facility.

We request that your agency agree to provide the following services in the event of an emergency regarding waste storage at our facility:

- Immediate response;
- Rescue and transport services; and
- Communications support.

The RIES facility is not an active industrial facility but operates a groundwater treatment system under a Resource Conservation and Recovery Act (RCRA) permit. The site has a full-time Site Manager who also serves as the Emergency Coordinator. The Site Manager performs daily inspections, routine operational maintenance of the groundwater treatment system, and subcontractor oversight

on an as-needed basis. A minimal amount of hazardous and nonhazardous wastes are generated or transported to and from the site. Two waste streams exist at the site and include spent carbon media from the groundwater treatment process and leachate from the closed RCRA landfill.

Please review the attached Contingency Plan and, if acceptable, complete and return to Arcadis (10352 Plaza Americana Drive, Baton Rouge, LA 70816) the attached Certification Sheet. If you have any questions, please contact Ms. Pam McIlwain of Arcadis at (225) 292-1004.

Sincerely,

Arcadis U.S., Inc.

Pamela S. McIlwain

Principal Environmental Scientist

Andrew Eversull

Project Manager

Copies:

Mr. Larry Noble (electronic)

Attachments

A Certification Sheet for Designated Outside Agencies – Emergency Response Roles

B REIS Emergency Response Plan

CERTIFICATION SHEET FOR
DESIGNATED OUTSIDE AGENCIES – EMERGENCY RESPONSE ROLES
AT

Rentokil Initial Environmental Services, LLC
10565 U.S. Highway 43 North
Creola, Mobile County, Alabama

As required under Title 40, Part 265, Subpart C of the Code of Federal Regulations, a representative of Rentokil Initial Environmental Services, LLC (RIES) has contacted the Creola Police Department in order to familiarize the department with the Contingency Plan, including anticipated emergency response role, the layout of the facility, properties of hazardous waste handled at the facility and associated hazards, places where facility personnel would normally be working, entrances to roads inside the facility, and possible evacuation routes.

_____ _____

Creola Police Department Date

_____

Arcadis or RIES Representative

APPENDIX C

Hospital Request

VIA CERTIFIED MAIL NO. 7013 1710 0000 4575 9789
RETURN RECEIPT REQUESTED

Springhill Medical Center
210 Government Street
Mobile, Alabama 36602

Arcadis U.S., Inc.
10352 Plaza Americana Drive
Baton Rouge
Louisiana 70816
Tel 225 292 1004
Fax 225 218 9677
www.arcadis.com

Subject:
Contingency Plan
Rentokil Initial Environmental Services, LLC
10565 U.S. Highway 43 North
Creola, Mobile County, Alabama

ENVIRONMENT

Date:
May 3, 2016

Contact:
Pamela McIlwain

Extension
249

Email:
pam.mcllwain@arcadis.com

Our ref:
03648005.0000.00200

To Whom it May Concern:

On behalf of our client, Rentokil Initial Environmental Services, LLC (RIES), and in accordance with Alabama and federal regulations, Arcadis U.S., Inc. (Arcadis) is providing your department with a copy of our Contingency Plan, which describes the following:

- The actions our Emergency Coordinator will take in response to emergencies (e.g., fires or spills of hazardous waste);
- Arrangements we would like your department to agree to in the event of an emergency;
- A layout of the site; and
- A description of the properties and associated hazards of the hazardous wastes handled at our facility.

We request that your agency agree to provide the following services in the event of an emergency regarding waste storage at our facility:

- Immediate response;
- Rescue and transport services; and
- Communications support.

The RIES facility is not an active industrial facility but operates a groundwater treatment system under a Resource Conservation and Recovery Act (RCRA) permit. The site has a full-time Site Manager who also serves as the Emergency Coordinator. The Site Manager performs daily inspections, routine operational maintenance of the groundwater treatment system, and subcontractor oversight

on an as-needed basis. A minimal amount of hazardous and nonhazardous wastes are generated or transported to and from the site. Two waste streams exist at the site and include spent carbon media from the groundwater treatment process and leachate from the closed RCRA landfill.

Please review the attached Contingency Plan and, if acceptable, complete and return to Arcadis (10352 Plaza Americana Drive, Baton Rouge, LA 70816) the attached Certification Sheet. If you have any questions, please contact Ms. Pam McIlwain of Arcadis at (225) 292-1004.

Sincerely,

Arcadis U.S., Inc.

Pamela S. McIlwain

Principal Environmental Scientist

Andrew Eversull

Project Manager

Copies:

Mr. Larry Noble (electronic)

Attachments

A Certification Sheet for Designated Outside Agencies – Emergency Response Roles

B REIS Emergency Response Plan

CERTIFICATION SHEET FOR
DESIGNATED OUTSIDE AGENCIES – EMERGENCY RESPONSE ROLES
AT

Rentokil Initial Environmental Services, LLC
10565 U.S. Highway 43 North
Creola, Mobile County, Alabama

As required under Title 40, Part 265, Subpart C of the Code of Federal Regulations, a representative of Rentokil Initial Environmental Services, LLC (RIES) has contacted the Springhill Medical Center in order to familiarize the center with the Contingency Plan, including anticipated emergency response role, the layout of the facility, properties of hazardous waste handled at the facility and associated hazards, places where facility personnel would normally be working, entrances to roads inside the facility, and possible evacuation routes.

_____ _____

Springhill Medical Center Date

_____

Arcadis or RIES Representative

APPENDIX D

ADEM Field Office Request

VIA CERTIFIED MAIL NO. 7013 1710 0000 4575 9772
RETURN RECEIPT REQUESTED

Mobile Central Field Office
Alabama Department of Environmental Management
2204 Perimeter Road
Mobile, Alabama 36615

Arcadis U.S., Inc.
10352 Plaza Americana Drive
Baton Rouge
Louisiana 70816
Tel 225 292 1004
Fax 225 218 9677
www.arcadis.com

ENVIRONMENT

Subject:
Contingency Plan
Rentokil Initial Environmental Services, LLC
10565 U.S. Highway 43 North
Creola, Mobile County, Alabama

Date:
May 3, 2016

Contact:
Pamela McIlwain

Extension
249

Email:
pam.mcllwain@arcadis.com

Our ref:
03648005.0000.00200

To Whom it May Concern:

On behalf of our client, Rentokil Initial Environmental Services, LLC (RIES), and in accordance with Alabama and federal regulations, Arcadis U.S., Inc. (Arcadis) is providing your department with a copy of our Contingency Plan, which describes the following:

- The actions our Emergency Coordinator will take in response to emergencies (e.g., fires or spills of hazardous waste);
- Arrangements we would like your department to agree to in the event of an emergency;
- A layout of the site; and
- A description of the properties and associated hazards of the hazardous wastes handled at our facility.

We request that your agency agree to provide the following services in the event of an emergency regarding waste storage at our facility:

- Immediate response;
- Rescue and transport services; and
- Communications support.

The RIES facility is not an active industrial facility but operates a groundwater treatment system under a Resource Conservation and Recovery Act (RCRA) permit. The site has a full-time Site Manager who also serves as the Emergency

Coordinator. The Site Manager performs daily inspections, routine operational maintenance of the groundwater treatment system, and subcontractor oversight on an as-needed basis. A minimal amount of hazardous and nonhazardous wastes are generated or transported to and from the site. Two waste streams exist at the site and include spent carbon media from the groundwater treatment process and leachate from the closed RCRA landfill.

Please review the attached Contingency Plan and, if acceptable, complete and return to Arcadis (10352 Plaza Americana Drive, Baton Rouge, LA 70816) the attached Certification Sheet. If you have any questions, please contact Ms. Pam McIlwain of Arcadis at (225) 292-1004.

Sincerely,

Arcadis U.S., Inc.

Pamela S. McIlwain

Principal Environmental Scientist

Andrew Eversull

Project Manager

Copies:

Mr. Larry Noble (electronic)

Attachments

A Certification Sheet for Designated Outside Agencies – Emergency Response Roles

B REIS Emergency Response Plan

CERTIFICATION SHEET FOR
DESIGNATED OUTSIDE AGENCIES – EMERGENCY RESPONSE ROLES
AT

Rentokil Initial Environmental Services, LLC
10565 U.S. Highway 43 North
Creola, Mobile County, Alabama

As required under Title 40, Part 265, Subpart C of the Code of Federal Regulations, a representative of Rentokil Initial Environmental Services, LLC (RIES) has contacted the Alabama Department of Environmental Management (ADEM) Mobile Central Field Office in order to familiarize the office with the Contingency Plan, including anticipated emergency response role, the layout of the facility, properties of hazardous waste handled at the facility and associated hazards, places where facility personnel would normally be working, entrances to roads inside the facility, and possible evacuation routes.

_____ _____

ADEM Mobile Central Field Office Date

_____

Arcadis or RIES Representative

APPENDIX E

Monthly Inspection Form for Fire Extinguishers and Spill Response Materials

Monthly Inspection for
Fire Extinguishers and Spill Response Materials
Rentokil Initial Environmental Services, LLC
Creola, Alabama

Name: Date:

Fire Extinguishers

Fire extinguishers are located at the following locations: site office, workshop of the site office, by the diesel aboveground storage tank (AST), 90-day leachate AST, equipment shed, former office, and former washrack.

Please verify the following items for each fire extinguisher:

Yes	No	If No, Location of the Fire Extinguisher?	Description
			Located in the designated place?
			No obstruction to access or visibility?
			Operating instructions on the nameplate are legible and facing outward?
			Safety seals and tamper indicators are not broken or missing?
			Fullness of the extinguisher as determined by weighing or "hefting"?
			Examination for obvious physical damage including no corrosion, leakage, cracks, dents, or clogged nozzle?
			Pressure gauge reading or indicator in the operable range or position?

If "No" was answered on any of the above items, immediate actions must be taken to address the deficiency.
Corrective Action:

Spill Response Materials

Spill response materials are located in the 90-day leachate AST and by the diesel AST. The spill response materials consist of absorbent pads and cat litter to clean up liquid spills and leaks.

Yes	No	Description
		Is there adequate supply of spill response materials?
		Are they located in the locations listed above?

If "No" was answered on any of the above items, immediate actions must be taken to address the deficiency.
Corrective Action:

Arcadis U.S., Inc.

10352 Plaza Americana Drive

Baton Rouge, Louisiana 70816

Tel 225 292 1004

Fax 225 218 9677

www.arcadis.com

APPENDIX B-2

Emergency Response Plan

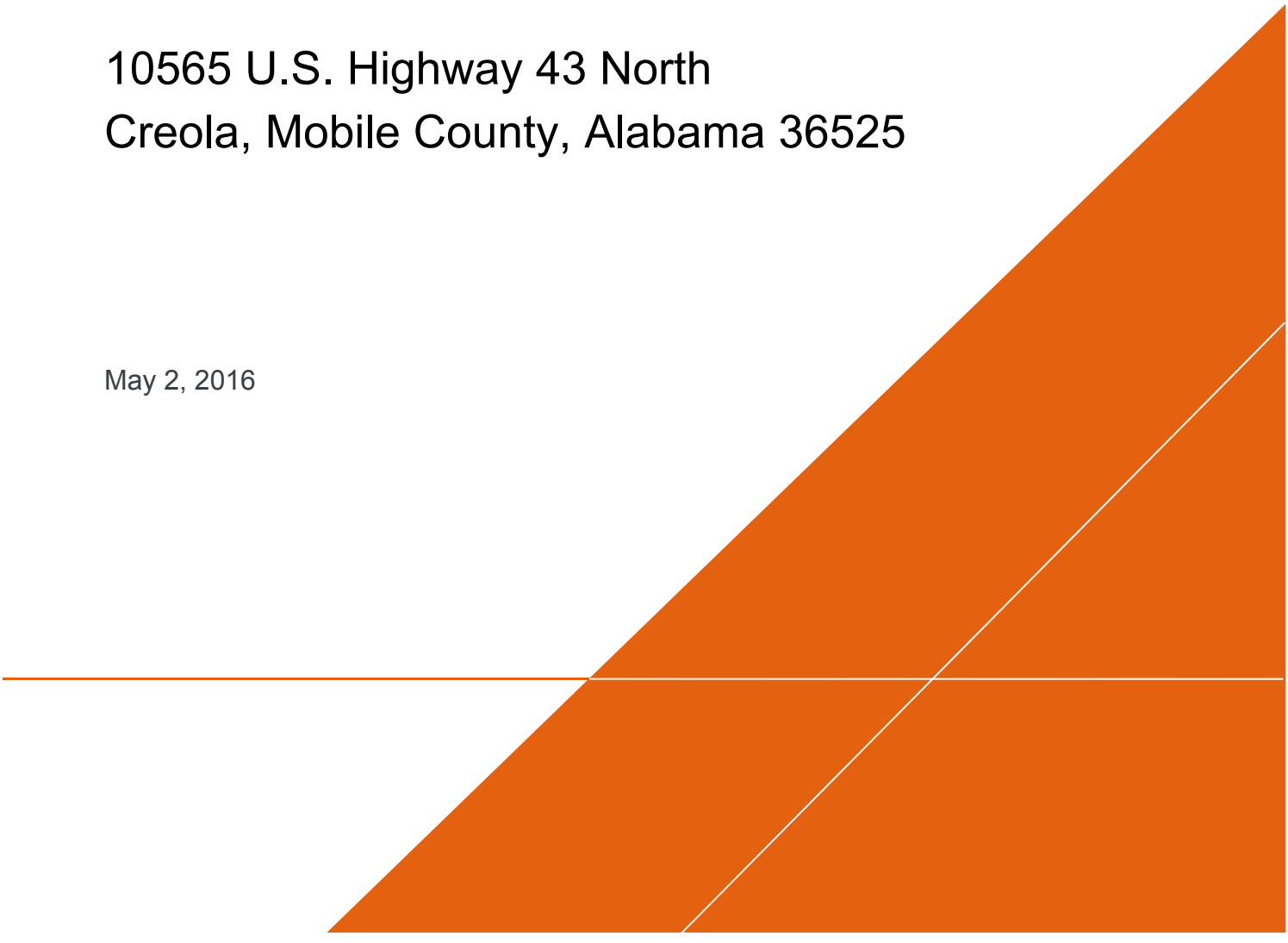
ARCADIS Design & Consultancy for natural and built assets

Rentokil Initial

EMERGENCY RESPONSE PLAN

10565 U.S. Highway 43 North
Creola, Mobile County, Alabama 36525

May 2, 2016



EMERGENCY RESPONSE PLAN

Rentokil Initial Environmental Services, LLC
10565 U.S. Highway 43 North
Creola, Mobile County, Alabama 36525

Joel Riley
Environmental Scientist

Pamela S. McIlwain
Principal Environmental Scientist

Andrew Eversull
Project Manager

Prepared for:

Rentokil Initial Environmental Services, LLC

Prepared by:

Arcadis U.S., Inc.
10352 Plaza Americana Drive
Baton Rouge
Louisiana 70816
Tel 225 292 1004
Fax 225 218 9677

Our Ref.:

03648005.0000.00100

Date:

May 2, 2016

RECORD OF REVISIONS

Revision No	Date Issued	Page No	Description

CONTENTS

FIGURES

APPENDIX

ACRONYMS AND ABBREVIATIONS

AAC	Alabama Administrative Code
ADEM	Alabama Department of Environmental Management
AEMA	Alabama Emergency Management Agency
AST	Aboveground Storage Tank
CFR	Code of Federal Regulations
EMT	Emergency Medical Technician
ERP	Emergency Response Plan
NOAA	National Oceanic and Atmospheric Administration
RCRA	Resource Conservation and Recovery Act
RIES	Rentokil Initial Environmental Services, LLS
SDS	Safety Data Sheets

FACILITY INFORMATION

Name of Facility and Location:

Rentokil Initial Environmental Services, LLC

10565 U.S. Highway 43 North

Creola, AL 36525

Latitude: N 30º 54.717'

Longitude: W 88º 2.2849'

Responsible Official:

Jason Hughes

Arcadis Project Manager

(205) 930-5965 (Office)

Pam McIlwain

Arcadis Associate Project Manager

(225) 292-1004 (Office)

Larry Noble

Arcadis Site Manager

(251) 675-7073 (Office)

Type of Manufacturer:

Former car washes (Standard Industrial Classification 7542)

REVISED 10/1/2017

1 INTRODUCTION

1.1 Purpose and Scope

This document is the Emergency Response Plan (ERP) for the Rentokil Initial Environmental Services, LLC (RIES) facility (site). The site is located in Creola, Mobile County, Alabama. The site property covers 82 acres, with a locked gate and fence in place at the entrance to the site with a fence surrounding the closed Resource Conservation and Recovery Act (RCRA) landfill, treatment system, and office. The facility is located at 10565 U.S. Highway 43 North, Creola, Mobile County, Alabama.

The purpose of the ERP is to guide and aid employees in the efficient and safe performance of their work operations. The safety program will operate on the assumption that safety belongs as an integral part of effective, smooth-flowing production. It has to be thought of, and acted on, as part of the plan or system for getting the job effectively completed. This ERP describes the actions facility personnel must take in response to accident, severe weather, fire, explosion, or other emergencies.

This ERP was prepared in accordance with Alabama Administrative Code (AAC); Code of Alabama 1975 §§31-9-1 Chapter 320-0-1. According to AAC 320-4-1-.03, Local Operational Plans must be consistent with federal and state plans and be based on an analysis of potential hazards facing the jurisdiction. A local emergency operation plan is considered current if it has been published, revised, or reviewed on an annual basis.

1.2 Compatibility with Other Plans

This ERP will be compatible with other plans and activities on site, the Arcadis U.S., Inc. (Arcadis) Health and Safety Plan, and the Contingency Plan so as to prevent any conflicting statements, procedures, and/or practices during implementation of this and other plans.

2 FACILITY ASSESSMENT

The RIES facility is located in the northern portion of Creola, Alabama, at 10565 U.S. Highway 43 North, in Mobile County, Alabama, approximately 0.25 mile northwest of the intersection of US Old Highway 43 and Lister Lane. The site is owned by Rentokil and operated by Arcadis. The general location of the property and the physiographic features of the surrounding area are shown on Figure 1, developed from the topographic map for Creola, Alabama.

RIES is a former truck wash facility that began operations in the early 1970s and ceased operation in 1986. The facility has a closed permitted landfill regulated by the Alabama Department of Environmental Management (ADEM). Surface impoundments used during facility operations were closed by excavating contaminated sediment in the impoundments and placing the sediments in the on-site landfill. The landfill has a leachate collection system that accumulates leachate from the bottom of the landfill into a sump. Periodically, leachate in the sump is pumped to an aboveground storage tank (AST). The AST is a 10,000-gallon tank located within concrete secondary containment. The leachate AST is a 90-day storage unit permitted under the Resource Conservation and Recovery Act (RCRA). The leachate AST is located

near the east side of the closed RCRA landfill, and leachate is pumped into this AST on an as-needed basis.

The 82-acre REIS facility has a locked gate and fence at the entrance to the site with a fence surrounding the closed RCRA landfill, treatment system, and office. In addition to the closed RCRA landfill, the site has been actively treating contaminants of concern in groundwater using groundwater recover wells, aboveground treatment, and underground injection of treated water for approximately 24 years.

Structures at the facility include the following: the current site office, metal building containing the former washrack and former office, small diesel tank, equipment shed, groundwater treatment system, and closed RCRA landfill. The groundwater treatment system includes settling basins, air stripper, multiple water filters, carbon vessel, 5,000-gallon development water storage tank, and 20,000-gallon holding tank. Figure 2 shows the layout of the facility with property boundaries and facility structures.

3 RESPONSIBILITIES

- It is the responsibility of the Project Manager and Site Manager to enforce and implement, respectively, this program.
- It is the responsibility of employees to follow this program and safe work practices at all times. Employees with questions or in need of clarification of this program should contact their Project Manager.

4 GENERAL SAFETY RULES

4.1 Communication

- Immediately report all injuries and/or incidents, no matter how slight, to the Site Manager. The Site Manager will advise on appropriate action.
- Immediately report all fires, leaks, and spills, no matter how small, to the Site Manager. The Site Manager will advise on appropriate action.
- Immediately report any unsafe condition or practice to the Project Manager and Site Manager. Unsafe equipment must be tagged to prevent use.
- All visitors must report to the Site Manager (in the site office) immediately upon arrival at the site.
- No work may be started in any area or on any equipment without the knowledge and consent of the person in charge (Project Manager).
- Call 911 in the event of an emergency.

4.2 Personnel Accountabilities

- Do not operate equipment for which you are not trained.
- Horseplay or fighting on the facility premises is prohibited.

- Seat belts must be worn by the driver and all passengers while conducting business at the facility. The driver is responsible for ensuring that ALL passengers are wearing seat belts prior to putting the vehicle in motion. All-terrain vehicles/four-wheelers are exempted.
- The use, possession, transportation, or sale of illegal drugs, alcoholic beverages, firearms, deadly weapons, or explosives while on the premises or in vehicles is prohibited.
- Smoking is not permitted on site.
- Be aware of people and objects around your equipment before operating. Check all sides before entering your vehicle.
- When lifting loads, use proper techniques, such as bending of knees, obtaining assistance, and using mechanical lifting aids.

4.3 Personal Protective Equipment/Apparel

- Approved hard hats are required to be worn by site personnel during construction and/or maintenance activities performed at the facility from time to time.
- Footwear in good condition, suitable for the working conditions on the job, with steel-toe protection must be worn. Tennis shoes are prohibited in operations or other designated areas. All visitors must comply with this rule unless otherwise approved by the Project Manager.
- Hearing protection must be worn in high noise areas (85 A-weighted decibels or higher, or where posted).
- Approved safety glasses with side shields or goggles are mandatory for site personnel working on the groundwater remediation system or the closed RCRA landfill.
- Proper eye protection, such as goggles and/or face shields, must be worn during any work activities or operation where foreign objects may enter the eye, such as sampling, drum management, system operations and maintenance, grinding, welding, drilling, chipping, or scraping. Persons assisting in or observing the above operations must also wear proper eye protection.
- Any person whose clothing becomes saturated with flammable liquids or chemicals should immediately withdraw to an area safe from fire hazards, change clothes, and take appropriate steps to wash contacted skin area.

4.4 Drug Policy

The facility has a strict drug policy that must be followed by all employees. The drug policy is designed to deter the possibility of drug-related hazards and ensure on-the-job safety for all employees.

The mandatory company policy on drugs is as follows:

- Nonprescription drugs or narcotics considered dangerous or illegal by the U. S. Department of Justice are prohibited on facility property;

- Employees who possess, use, or sell such material on facility property or who arrive on facility property under the influence of such material will be subject to disciplinary action up to and including discharge; and
- The company reserves the right to ask federal and/or state authorities to search facility premises and property, including living quarters, for nonprescription drugs or narcotics considered dangerous or illegal.

4.5 Machinery

In the event of a foreseeable natural disaster, if possible:

- Secure all equipment;
- Fuel the generators and tractors;
- Secure all ASTs;
- Deactivate the groundwater remediation system; and
- Ensure all general site materials are secure.

Use only proper tools and equipment maintained in good working condition. Under normal operations, all operating machinery and electrical switchgear must have all required safety guards, switches, and alarms in place and functional.

4.6 Location of Emergency Equipment

All emergency equipment must be in good condition, inspected annually, and kept clear of any obstructions. This list must be kept up to date by the Site Manager.

First aid kits to treat minor injuries or minor illnesses are stored at the following locations:

- Site office; and
- Site Manager's vehicle.

Fire extinguishers capable of extinguishing Level A, B, and C fires are stored at the following locations:

- Site office;
- Workshop (in site office);
- Diesel AST;
- 90-Day leachate AST;
- Equipment shed (2);
- Former office; and
- Former washrack.

Spill kits containing absorbent pads and socks are located near the diesel AST and 90-day leachate AST. The site has adequately trained personnel and equipment to contain and clean up minor to moderate volumes of spilled materials. On-site equipment and materials include, but are not limited to, spill kits, shovels, dirt, visqueen, some absorbent materials (towels, mops, etc.), and various equipment. The site also keeps an empty drum on hand for collecting spill cleanup materials. If necessary, temporary structures such as booms or earthen berms can be rapidly deployed or constructed to contain larger spills/releases.

In the event of an emergency, personnel will be notified of the emergency using cellular telephones. Decontamination equipment is not stored on site. The fire department will provide decontamination services, if necessary. If needed, Springhill Memorial Hospital can provide additional decontamination services. Contact information is provided in Section 6, Medical Emergencies.

4.7 Storage of Materials

The facility has a 90-day leachate AST for liquid recovered from the closed RCRA landfill. A carbon vessel and 20,000-gallon water tank is located adjacent to the facility groundwater treatment system. A 5,000-gallon development water storage tank is located adjacent to the injection point. Figure 2 depicts the site layout.

4.8 Severe Weather

4.8.1 Hurricanes

Hurricanes are not just a coastal problem. Their impacts can be felt hundreds of miles inland and damage can be severe. First, the Site Manager and Project Manager will work together to determine if the site is located within the storm surge hurricane evacuation zone. If the site is within the surge zone, the hurricane's current and projected path must be monitored. The Project Manager is responsible for making the decision to shut down the site, which should be made between 18 and 36 hours before anticipated landfall. If evacuation is determined to be necessary, secure all site ASTs, tanks, buildings, and miscellaneous equipment. Deactivate the groundwater treatment system and turn off all fuel pumps. Once the site is secure, safely evacuate the site following established evacuation routes out of the storm surge zone. Be sure to remove all pertinent hard copies of files from the site.

After the hurricane has passed, do not return to the site until local travel bans are lifted and approval has been received from the Project Manager. Avoid any floodwater while driving and watch out for downed power lines. Avoid walking under any trees that may have been stressed during high winds. Biological hazards may be relocated to areas they normally do not reside. Be aware of surroundings and potential hazards at all times. Thoroughly inspect the property and photograph any damages. When given approval from the Project Manager, reactivate the groundwater treatment system only if there was no storm damage.

4.8.2 Tornados

Tornados are nature's most violent storms. Tornados are spawned from powerful thunderstorms or possibly hurricanes. A tornado appears as a rotating, funnel-shaped cloud that extends from a

thunderstorm to the ground with whirling winds that can reach 300 miles per hour. Damage paths can be in excess of 1 mile wide and 50 miles long. Before a tornado strikes, the wind may die down and the air may become very still. A cloud of debris can mark the location of a tornado even if a funnel is not visible. Tornados generally occur near the trailing edge of a thunderstorm. It is not uncommon to see clear, sunlit skies behind a tornado.

Be familiar with tornado terms:

- ***Tornado Watch*** – Tornados are possible. Remain alert for approaching storms. Watch the sky and stay tuned to National Oceanic and Atmospheric Administration (NOAA) Weather Radio, commercial radio, or television for information.
- ***Tornado Warning*** – A tornado has been sighted or indicated by weather radar. Take shelter immediately.

Look for the following danger signs:

- Dark, often greenish sky;
- Large hail;
- A large, dark, low-lying cloud (particularly if rotating); and
- Loud roar, similar to a freight train.

If you see approaching storms or any of the danger signs, be prepared to take shelter immediately. If a tornado watch or warning has been listed, listen to NOAA Weather Radio, commercial radio, or television newscasts for the latest information. In any emergency, always listen to the instructions given by local emergency management officials. Be alert to changing weather conditions.

If you are under a tornado warning, seek shelter immediately! Most injuries associated with high winds are from flying debris, so remember to protect your head. Go to a pre-designated area in the site office. If there is no basement, go to the center of a small interior room on the lowest level (closet, interior hallway) away from corners, windows, doors, and outside walls. Put as many walls as possible between you and the outside. Get under a sturdy table and use your arms to protect your head and neck.

4.8.3 Flooding

Flash flooding is possible in areas that have rivers and creeks that are experiencing heavy rainfall. Avoid walking or driving through floodwaters because they may be deeper or moving faster than it appears. Just 6 inches of moving water can knock you down, and 2 feet of water can sweep your vehicle away. If there is a chance of flash flooding, move immediately to higher ground. Listen to NOAA Weather Radio, commercial radio, or television newscasts for the latest information.

Be familiar with flooding terms:

Flood Watch = "Be Aware." Conditions are right for flooding to occur in your area.

- Turn on your television/radio. You will receive the latest weather updates and emergency instructions.
- Know where to go. You may need to reach higher ground quickly and on foot.

- Build or restock your emergency preparedness kit. Include a flashlight, batteries, cash, and first-aid supplies.

Flood Warning = "Take Action!" Flooding is either happening or will happen shortly.

- Move immediately to higher ground or stay on high ground.
- Evacuate if directed.
- Avoid walking or driving through floodwaters. Turn Around, Don't Drown! Just 6 inches of moving water can knock you down, and 2 feet of water can sweep your vehicle away.

5 EMERGENCY PROCEDURES

5.1 Emergency Reporting

- Personnel encountering an emergency should immediately report it to the Site Manager. The Site Manager will then determine the appropriate response personnel to contact. In most instances, this will be 911 emergency services.
- All emergency situations must be reported. If an employee discovers a fire or other emergency, the employee must report it to the supervisor immediately. The Site Manager must then contact appropriate emergency services.
- For emergencies involving injuries, the Site Manager must quickly assess the severity of the incident, determine the number of injured persons, and arrange for appropriate emergency services. Should the Site Manager not be immediately available, the employee should call 911 as well as notify the Project Manager.

5.2 Emergency Services Protocol

Use the following procedures when contacting the fire department, police department, Emergency Medical Technician (EMT), or other emergency response party. If contact is needed directly with the fire department, police department, EMT, or other appropriate party, be calm and accurate and ensure instructions are understood before hanging up. Provide the following information:

- Your name;
- Company name;
- Location and GPS coordinates (if applicable);
- Type of incident (fire, medical emergency, spill, cave-in, or other); and
- Call back number or cell phone number.

In the event of a fire, an employee may first attempt to extinguish the fire with the extinguishers that are provided throughout the site. If a fire cannot be put out with the appropriate fire extinguisher, evacuate the building immediately. As a reminder, employees should never place themselves or other employees

in danger to extinguish a fire or respond to an emergency. Properly trained employees may administer first aid/CPR until emergency personnel arrive on site.

In the event of a spill, an employee should attempt to stop the ongoing release by closing valves, turning off pumps, etc., only if it is safe to do so. Employees should have access to Safety Data Sheets (SDS) to review and identify potential hazards, protective equipment, and cleanup procedures.

In the event of a tornado, employees first need to be notified of impending inclement weather. Employees should then shut off all power to machinery and equipment, gas lines, etc., as long as time permits. The site does not have a designated shelter area. Seek shelter away from doors and windows and toward the center of a building, near inside walls, corridors, or support columns. Employees who are outdoors should seek shelter in a low-lying ditch or near a solid structure. After a tornado alarm, or an actual tornado, all employees should gather at the assembly area, which is outside the front gate, in order to be accounted for.

In the event of an earthquake, due to its sudden onset, employees must take into account that as a result of the initial earthquake, other emergencies may develop. Employees must monitor gas lines, power, and process piping as well as follow the reporting procedures.

5.3 Emergency Escape Routes

All employees are instructed to evacuate the building through the nearest possible exit. Emergency escape routes must be kept clear at all times. Employees, visitors, contractors that are not located in a building will need to evacuate following the designated path as well.

5.4 Evacuation Procedures

When an announcement is made, evacuate immediately through the closest, safe exit. One possible exit is via the front entrance to the site off U.S Highway 43. All evacuees should proceed to the assembly area, which is outside the front gate.

5.5 Responsibilities of Employees

- Listen to the instructions of the Site Manager and emergency response agency personnel.
- Keep talking to a minimum. Listen for instructions from authorized personnel and comply with the instructions.
- Keep calm. Walk; **do not run.**
- **Do not leave** the evacuation area until emergency response agency personnel have given the authorization.

5.6 Responsibilities of Site Manager

- If visitors are on site, the Site Manager or their escort is to assume responsibility for the evacuation of visitors. Visitors are to report to the assembly area, which is outside the front gate.

- Keep track of employees/visitors in the surrounding area as they evacuate.
- Account for employees/visitors at the assembly area and report to emergency response agency staff any persons that are not accounted for.

5.7 Individuals Requiring Evacuation Assistance

Individuals requiring assistance in an emergency evacuation, whether temporary or permanent, should notify the Project Manager and Site Manager.

6 MEDICAL EMERGENCIES

Medical emergencies should be immediately reported to the Project Manager and Site Manager. In the event of a medical emergency, call 911. The Springhill Memorial Hospital will be contacted. It has been verified that they can respond to emergencies at the site.

Springhill Memorial Hospital
3719 Dauphin Street
Mobile, AL 36608
Telephone Number: (251) 344-9630

Information pertaining to the emergency will be provided to the emergency operator. Unless absolutely necessary, do not attempt to move the injured or ill person. Try to make them comfortable. Someone should stay with the injured or ill person until arrival of emergency personnel. Arrange to have someone meet the emergency unit at the entrance to the facility in order to direct them to the location of the injured or ill person.

If it is deemed that the injury cannot be treated on site, the emergency medical personnel should be instructed to transport the patient to Springhill Memorial Hospital.

7 MEDICAL NON-EMERGENCIES

All injuries and/or incidents, no matter how slight, must be reported to the Site Manager and Project Manager. If possible, the injury may be treated with first aid. If a minor injury cannot be treated with first aid, transport the injured person to:

Greater Mobile Urgent Care
1114 Shelton Beach Road
Saraland, AL 36571
Telephone Number: (251) 663-0123

8 FIRE SAFETY

8.1 Classification of Fires

Class A – Fires involving ordinary combustible materials such as wood, coal, paper, or fabric where wetting and cooling is the method of extinguishment used. Water or solutions containing a large percentage of water are of first importance.

Class B – Fires involving flammable petroleum products and other flammable liquids or greases where it is essential to exclude oxygen as a method of extinguishment.

Class C – Fires in or near energized electrical equipment for which the use of water as an extinguishing agent would be hazardous, necessitating the use of a "non-conducting" extinguishing agent.

Other Fires – Certain combustible materials or reactive chemicals require, in some cases, special extinguishing agents or techniques. Smothering or coating is the basic approach of extinguishment.

8.2 Location of Fire Extinguishers

Fire extinguishers capable of extinguishing Level A, B, and C fires are stored at the following locations:

- Site office;
- Workshop (in site office);
- Diesel AST;
- 90-Day leachate AST;
- Equipment shed (2);
- Former office; and
- Former washrack.

8.3 Responsibilities of the Site Manager

The Site Manager shall be responsible for preventing and controlling fires associated with work operations. The Site Manager shall see that, where practicable and possible, combustible materials (solids, liquids, and gases) are kept away from any activities where heat and fire are generated. If the combustible materials cannot be feasibly moved away from the work operation, consider moving the work operation away from the combustible materials. When fire-producing work operations must be performed in the immediate or near vicinity to known or suspected combustible materials, it shall be the Site Manager's responsibility to take any or all of the following steps, where practicable, to prevent and control a fire:

- Study work operations and survey the work site to determine type and extent of fire exposures associated with the work; and
- Determine what can be done to remove the work from exposure or exposure from the work.

If exposure cannot be eliminated, how can it be reduced? Ask yourself the following questions:

- Can combustible materials be covered, wet down, or shielded from work operations?
- Can ignition sources be kept up-wind from combustible materials?
- Do I have sufficient and the proper type of extinguishing equipment to control a possible fire?
- Should I post a fire watch?
- Do I know all the combustible materials and ignition sources associated with this work operation?
- Are other workers, crews, customer personnel, etc., aware of my work operations and do they know the extent and duration of these?
- What is the least number of personnel needed to safely perform this work and not have unnecessary workers exposed?
- In an emergency, can I safely evacuate my workers?

8.4 Method of Use

- Training on proper use of the fire extinguisher shall be conducted at least annually during safety meetings.
- Fire extinguishers shall be recharged immediately after use or annually if not used.
- Carbon dioxide extinguishers shall be recharged when the weight loss is more than 10 percent.
- All extinguishers shall be visually inspected on a monthly basis and recertified annually.

8.5 Fire Emergency

If a fire cannot be safely contained, the Site Manager should enforce the evacuation procedures. From a safe distance, call 911. It has been verified that the Creola Fire Department is certified to respond to emergencies at the site.

If a fire in the site office cannot be contained, personnel in the building are to:

- Check for heat/smoke before opening any door;
- Close the door to the area as you leave. DO NOT go back to close the doors. Do not return for coats, purses, etc.;
- Follow evacuation procedures; and
- Immediately notify the Project Manager.

9 UNAUTHORIZED DISCHARGES

9.1 Unauthorized Discharges That Cause Emergency Conditions

An emergency condition is any condition which could reasonably be expected to endanger the health and safety of the public, cause significant adverse impact to the land, water, or air environment, or cause severe damage to property.

9.1.1 Telephone Notification Procedures

In the event of an unauthorized discharge that does result in an emergency condition, the Site Manager shall immediately (a reasonable period of time after taking prompt measures to determine the nature, quantity, and potential off-site impact of a release, considering the exigency of the circumstances), but in no case later than 1 hour after learning of the discharge, notify federal, state, and local agencies as appropriate.

If this site released a listed hazardous substance to the environment in excess or equal to reportable quantities, the following actions are required:

- The permittee must notify the National Response Center (NRC) at (800) 424-8802, in accordance with the requirements of 40 Code of Federal Regulations (CFR) 110, 40 CFR 117, and 40 CFR 302, as soon as they acquire knowledge of the release. Releases are defined to include any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment; and
- If the release is an emergency, the permittee must notify the nearest ADEM office or the Alabama Emergency Management Agency (AEMA) State Warning Point at (800) 843-0699 within 1 hour, in accordance with the requirements, as soon as they acquire knowledge of the release.

One notification to the appropriate hotline(s) for any unauthorized discharge will suffice for unauthorized discharges that continue for more than 1 day if the initial notification clearly states that the discharge is expected to continue for more than 1 day.

The appropriate hotline(s) must be immediately notified of any adverse change in the nature or rate of the discharge. Additional notifications must be made for discharges of multiple constituents when they originate from different causes or sources or they are substantially different in nature from the discharges in the initial notification.

Compliance with this section does not relieve dischargers of the necessity of following any applicable written notification procedure or any terms and conditions of any applicable permit or license issued under Alabama Environmental Regulations.

9.1.2 Written Notification Procedures

If a spill of a reportable quantity occurs, a written report for the discharge shall be submitted to the Mobile Branch of ADEM as soon as possible using the Release Information Form, which is provided in Appendix A. Written notification reports shall be submitted to ADEM by fax (251) 479-2593, or by mail addressed to

the Alabama Department of Environmental Management, 2204 Perimeter Road, Mobile, AL 36615. The transmittal envelope and report or fax cover page and report should be clearly marked RELEASE INFORMATION FORM. If mailed, the submittal date will be the date of the postmark on the envelope accompanying the written notification report. If faxed, the submittal date of the written notification will be the date of receipt by the department.

Oil spills reports, which are generated if oil is spilled above the reportable limit, shall be submitted to the Regional Administrator, U.S. Environmental Protection Agency, Region 4, Atlanta Federal Center, 61 Forsyth Street, SW, Atlanta, GA 30303.

Written notification reports shall include, but not be limited to, the following information:

- Name; address; telephone number and any other applicable identification numbers of the person, company, or other party who is filing the written report; and specific identification that the report is the written follow-up report required by this section;
- Time and date of prompt notification; the state official contacted when reporting; the name of the person making that notification; and identification of the site or facility, vessel, transport vehicle, or storage area from which the unauthorized discharge occurred;
- Date(s), time(s), and duration of the unauthorized discharge and, if not corrected, the anticipated time it is expected to continue;
- Details of the circumstances (unauthorized discharge description and root cause) and events leading to any unauthorized discharge and if the release point is subject to a permit:
  - Current permitted limit for the pollutant(s) released; and
  - Permitted release point/outfall identification.
- Common or scientific chemical name of each specific pollutant that was released as the result of an unauthorized discharge, including the Chemical Abstract Service number and U.S. Department of Transportation hazard classification, and the best estimate of amounts of any or all released pollutants (total amount of each compound expressed in pounds, including calculations);
- A statement of the actual or probable fate or disposition of the pollutant or source of radiation and what off-site impact resulted;
- Remedial actions taken, or to be taken, to stop unauthorized discharges or to recover pollutants or sources of radiation;
- Procedures or measures which have been or will be adopted to prevent recurrence of the incident or similar incidents, including incidents of loss of sources of radiation;
- If an unpermitted or unlicensed site or facility is involved in the unauthorized discharge, a schedule for submitting a permit or license application to the department or rationale for not requiring a permit or license;
- The reporting party's status (former or present owner, operator, disposer, etc.);
- For discharges to the ground or groundwater, the following information shall also be included: all information of which the reporting party is aware that indicates pollutants are migrating, including, but

not limited to, monitoring well data; possible routes of migrations; and all information of which the reporting party is aware regarding any public or private wells in the area of the migration used for drinking, stock watering, or irrigation;

- Which other agencies were notified;
- Names of all other responsible parties of which the reporting party is aware;
- A determination by the discharger of whether or not the discharge was preventable, or if not, an explanation of why the discharge was not preventable;
- The extent of injuries, if any; and
- The estimated quantity, identification, and disposition of recovered materials, if any.

9.2 Unauthorized Discharges That Do Not Cause Emergency Conditions

The Site Manager is responsible for determining if a spill must be reported to federal, state, or local regulatory agencies. The individual contacting the regulatory agency should ask if other agencies should be notified and if written confirmation of the spill is required.

In the event of a non-emergency, ADEM will be notified in accordance with applicable regulations. Reporting can be accomplished verbally by calling the ADEM local office at (251) 450-3400 during normal working business hours Monday through Friday, 8 a.m. to 4:30 p.m.; after hours call the AEMA State Warning Point (800) 843-0699.

The site has adequately trained personnel and equipment to contain and clean up minor to moderate volumes of spilled materials. In case of a large spill, specific response procedures have been developed. As part of these procedures, external resources (contractors) have been identified to assist landfill personnel.

10 HAZARDOUS MATERIALS

The site currently generates landfill leachate and spent activated carbon that are considered hazardous wastes. The landfill leachate is stored in a 90-day AST, with a capacity of approximately 6,800 pounds, prior to disposal. The site will regularly inspect the leachate storage tank and will keep the tank secure in case of emergency situations such as fire or a natural disaster. Additionally, the site periodically changes out spent carbon from the groundwater treatment system. Approximately 10,000 pounds of activated carbon is utilized at the site. All wastes are managed and disposed according to state and federal regulations.

11 TRAINING

According to 29 CFR 1910.38, Emergency Action Plans, training sessions concerning the procedures outlined in this ERP shall be conducted for all employees working at the facility. An employer must designate and train employees to assist in safe and orderly evacuation of other employees. A copy of the

training program shall be maintained on site and will contain signed documents of who attended the training, what was covered, and the date the training occurred.

12 PLAN REVISIONS

The ERP shall be reviewed by the permit holder annually and updated if necessary, or when implementation demonstrates that a revision is needed. The ERP will reviewed and/or updated whenever there is new equipment, facility construction, personnel changes, or major changes that might affect the ERP.

13 REFERENCES/OTHER PLANS

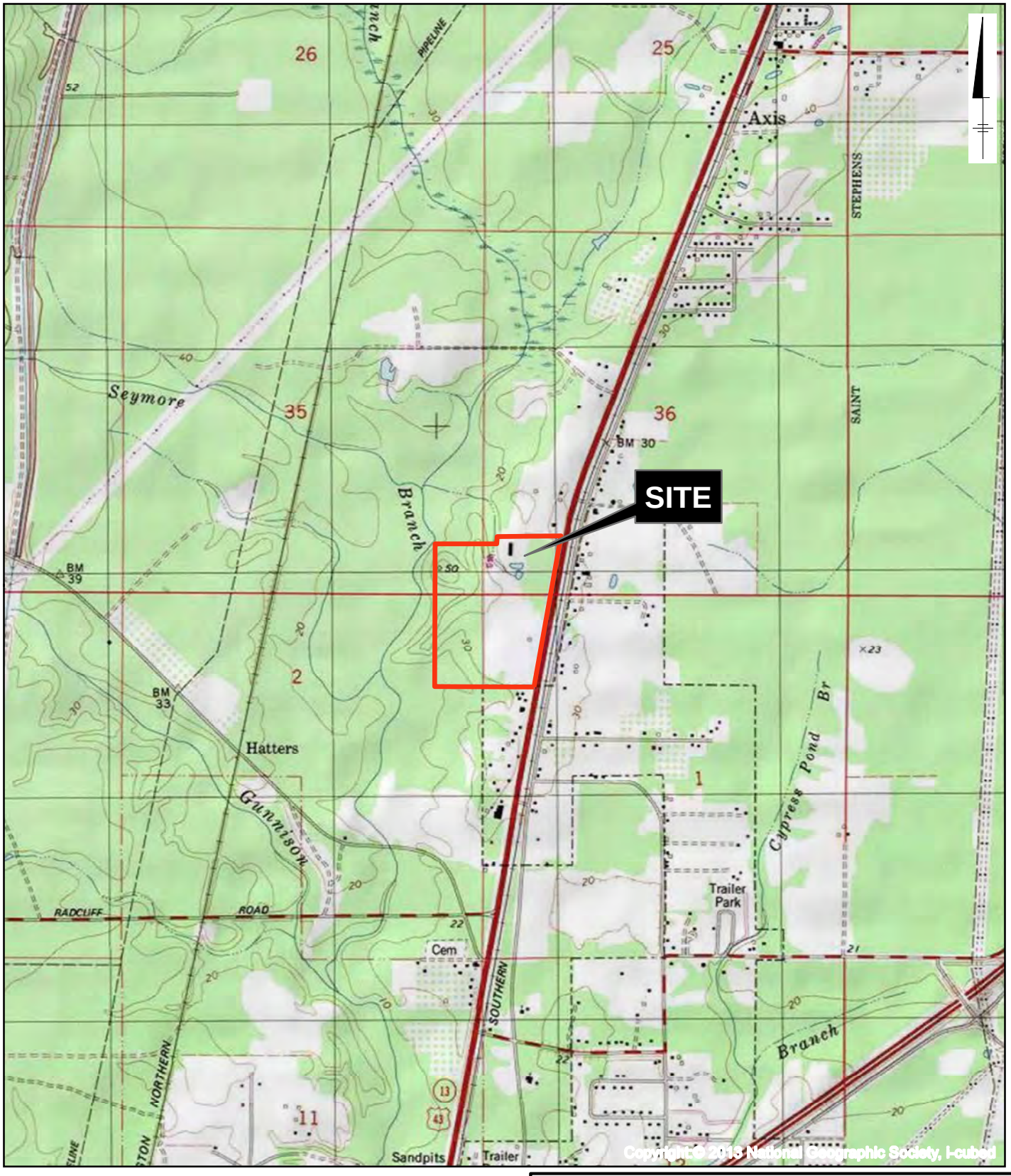
Alabama Emergency Management Agency Administrative Code Chapter 320-4-1: Operational Plans

Emergency Action Plans (29 CFR 1910.38)

Oil Pollution Prevention Regulations (40 CFR 112)

REIS. 2016. Site-Specific Health and Safety Manual. Creola, Alabama. 16 March.

FIGURES



0 2,000 4,000

Feet

Legend

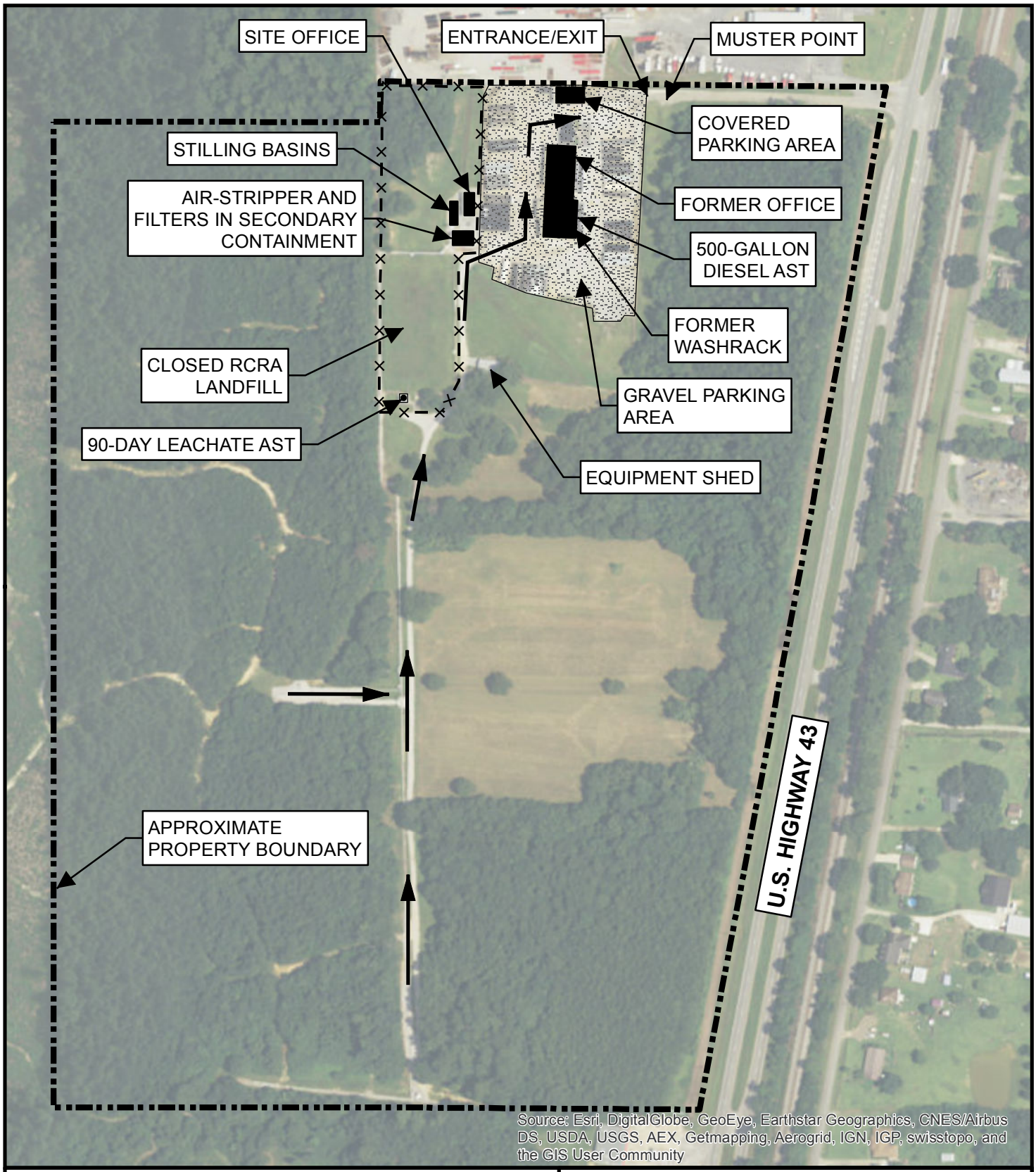
Property Boundary

RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC
CREOLA, AL

SITE LOCATION

ARCADIS Design & Consultancy for natural and built assets

FIGURE
1



LEGEND

EVACUATION ROUTE

FENCE

300 150 0 300 Feet

N

RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC
CREOLA, AL

SITE LAYOUT MAP

ARCADIS Design & Consultancy for natural and built assets

FIGURE
2

APPENDIX A

Alabama Department of Environmental Management
Release Information Form

ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

FIELD OPERATIONS DIVISION

RELEASE INFORMATION FORM

The Mobile Branch of the Alabama Department of Environmental Management has been contacted by you or your company regarding a release. Because we have been notified, critical information is needed to complete our response file concerning this release. Please take a few moments to complete this form and fax it to 251-479-2593 or mail it to ADEM, 2204 Perimeter Road, Mobile Alabama 36615, Attn.: , as soon as possible. If you should have any questions please contact me at 251-450-3400.

COMPANY NAME:

_____

MAILING ADDRESS:

_____

CITY/STATE/ZIP CODE:

_____

CONTACT: _____ TELEPHONE #: _____

LIST ADEM PERMITS W/ NUMBERS: _____

INCIDENT LOCATION: _____
(CITY/COUNTY/STATE)

INCIDENT DATE/TIME: _____

LATITUDE: _____ LONGITUDE:_____

MATERIAL INVOLVED IN INCIDENT: _____

CAS/ID#: _____

SPILLED AMOUNT:_____ UNITS: _____ ACTUAL: _____ ESTIMATED: _____

RELEASE IMPACTED: WATER: _____ AIR: _____ LAND: _____

IF RELEASE IMPACTED WATER: WATER BODY AFFECTED:_____

HUC CODE OF WATER BODY AFFECTED: _____ FISH KILL: YES: _____ NO: _____

CLEAN-UP ATTEMPTED: YES: _____ NO: _____

RECOVERED AMOUNT:_____UNITS: _____ ACTUAL: _____ ESTIMATED: _____

CLEAN-UP PERFORMED BY: SELF: _____ CONTRACTOR: _____

IF CONTRACTOR: NAME/ADDRESS OF CONTRACTOR: _____

CONTACT: _____ TELEPHONE #: _____

PLEASE INCLUDE WITH THIS FORM A BRIEF DESCRIPTION OF THE RELEASE TO INCLUDE INFORMATION REGARDING CAUSE OF THE RELEASE.

WILL THERE BE AN FORMAL REPORT CONCERNING THIS RELEASE? : YES: _____ NO: _____

IF YES, PLEASE MAIL A COPY OF THE REPORT TO:

ADEM
2204 PERIMETER ROAD
MOBILE, AL 36615
ATTN.:

OR FAX A COPY TO: ADEM, 251-479-2593 ATTN.:

Arcadis U.S., Inc.

10352 Plaza Americana Drive

Baton Rouge, Louisiana 70816

Tel 225 292 1004

Fax 225 218 9677

www.arcadis.com

APPENDIX C

Groundwater Monitoring, Sampling, and Analysis Plan

ARCADIS Design & Consultancy for natural and built assets

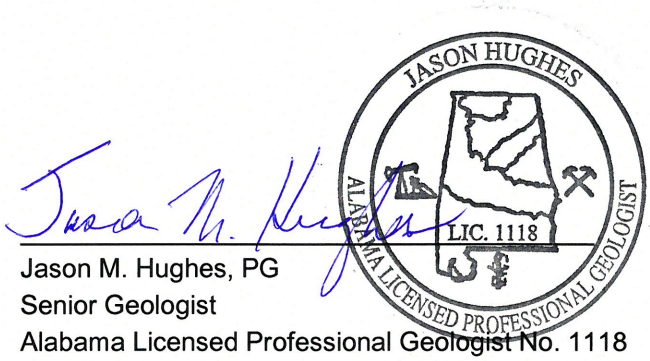
Rentokil Initial

GROUNDWATER MONITORING, SAMPLING, AND ANALYSIS PLAN

Creola, Alabama

USEPA ID No. ALD 021 257 951

February 2018



Jason M. Hughes, PG
Senior Geologist
Alabama Licensed Professional Geologist No. 1118

GROUNDWATER MONITORING, SAMPLING, AND ANALYSIS PLAN

Creola, Alabama
USEPA ID No. ALD 021 257 951

Prepared for:

Rentokil Initial Environmental Services, LLC

Prepared by:

Arcadis U.S., Inc.
1728 3rd Avenue North
Suite 300
Birmingham, Alabama 35203
Tel 205 930 5700
Fax 205 930 5707

Our Ref.:

03648005.2017.00001

Date:

February 2018

CONTENTS

TABLES

FIGURE

APPENDIX

ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
ADEM	Alabama Department of Environmental Management
AS/SVE	Air Sparge and Soil Vapor Extraction
BDY	Boundary (well)
BKG	Background (well)
CF	chloroform
COC	constituent of concern
CT	carbon tetrachloride
EFF	Effectiveness (well)
HRSC	High Resolution Site Characterization
L/min	liter per minute
MNA	monitored natural attenuation
POC	Point of Compliance (well)
PRG	Program (well)
QA/QC	Quality Assurance/Quality Control
RCRA	Recourse Conservation and Recovery Act
RIES	Rentokil Initial Environmental Services, LLC
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound

1 INTRODUCTION

Rentokil Initial Environmental Services, LLC (RIES) owns the property located at 10565 Highway 43 North, Creola, Alabama (the Site) that includes a closed Resource Conservation and Recovery Act (RCRA) landfill and a corrective action program that controls and treats groundwater pursuant to an Alabama Hazardous Wastes Management and Minimization Act Post Closure Permit (the RCRA Permit). RIES performs monitoring and reporting for both the landfill and corrective action in accordance with the RCRA Permit (Final Permit Determination, April 19, 2017). The Site is listed under U.S. Environmental Protection Agency (USEPA) identification number ALD 021 257 951.

The groundwater monitoring program is an integral part of the Corrective Action Program. The monitoring program is described in this Groundwater Monitoring, Sampling, and Analysis Plan. Additional groundwater monitoring may be undertaken in order to collect data to evaluate enhancements to the ongoing groundwater corrective action. For instance, additional groundwater monitoring will be completed to collect data for performance monitoring and compliance with the Site Underground Injection Control Permit and Air Sparge and Soil Vapor Extraction activities as described in the Corrective Action Plan (Appendix A of the RCRA Permit Application).

To ensure that quality data are obtained during the groundwater monitoring portion of post-closure care, the procedures described in this document will be followed. Sampling procedures were developed from the *RCRA Ground-Water Monitoring Technical Enforcement Guidance Document* (USEPA 1992). Low-flow purging and sampling procedures were developed from the document *Low Flow (Minimal Drawdown) Ground-Water Sampling Procedures* (USEPA Groundwater Issue dated April 1996).

2 GROUNDWATER MONITORING SYSTEM

With the completion of the High Resolution Site Characterization (HRSC) investigations in January 2015, and ultimately the Phase II corrective actions described in the Corrective Action Plan for a targeted approach to reduce constituent of concern (COC) mass in groundwater, the groundwater monitoring well system will evaluate Site conditions and improvements with time. The groundwater monitoring system is generally described in Section 2.1.

2.1 Groundwater Monitoring System

The groundwater monitoring system was modified in 2016 based on the HRSC results, review of the existing monitoring well system, discussions with the Alabama Department of Environmental Management (ADEM), and the selection of the Phase II corrective action. The groundwater monitoring system was approved in the Final Permit Determination issued by ADEM on April 19, 2017.

2.2 Boundary Wells

Wells BDY-32U, BDY-32M, BDY-32L, BDY- 28RU, BDY-28RM, BDY-29RU, and BDY-29RM are Boundary (BDY) wells for the entire facility **(Figure C-1)**. The BDY wells target the upper (U) and middle (M) portions of the semi-confined aquifer. Sampling of the BDY wells will continue to be conducted annually with analysis for volatile organic compounds (VOCs), metals, and Dinoseb (**Table C-1**).

2.3 Point of Compliance and Background Wells

Well BKG-16SRU is maintained as the Background (BKG) groundwater monitoring well for the entire facility as specified in **Table C-1** and **Figure C-1**. Wells POC-1RU, POC-5RU, POC-10RU, and POC-13RU are maintained as Point of Compliance (POC) wells as specified in **Table C-1** and **Figure C-1**. Sampling of the POC and BKG wells will continue to be conducted annually for VOCs, metals, and Dinoseb (**Table C-1**).

2.4 Effectiveness Wells

Wells EFF-31RU, EFF-31RM, EFF-101U, EFF-101M, EFF-102U, EFF-103U, EFF-103M, EFF-2RU, EFF-33U, EFF-33M, EFF-34U, EFF-34M, EFF-35U, EFF-35M, EFF-36U, EFF-36M, EFF-37U, EFF-37M, EFF-1, EFF-3, EFF-21UR, EFF-21M, EFF-21L, EFF-22U, EFF-22M, EFF-22L, EFF-23U, EFF-23M, EFF-23L, EFF-24U, EFF-24M, EFF-24LR, EFF-25U, EFF-25M, and EFF-25L are maintained as Effectiveness (EFF) wells as specified in **Table C-1** and **Figure C-1**. Sampling of EFF wells will continue to be conducted semiannually for VOCs and metals, with Dinoseb analyzed on an annual basis (**Table C-1**). More frequent monitoring or analysis of additional parameters will be conducted as needed to evaluate performance of the Phase II corrective actions.

3 GROUNDWATER SAMPLING PROCEDURES

The following sections describe the procedures that will be used to collect routine groundwater samples, transfer samples under chain of custody, and ensure data quality is maintained throughout the groundwater monitoring program.

3.1 Water Level and Well Depth Measurements

Prior to each sampling event, the static depth-to-water will be measured in each well in the groundwater monitoring system and the total depth of the well will be sounded using an electronic water level indicator. The water level is measured as the distance from the water surface to the marked edge at the top of the well casing. Measurements will be made to the nearest 0.01 foot and recorded. After each use, the electronic water level device will be carefully rinsed with distilled water to prevent cross- contamination. Monitoring wells to be measured semiannually are included in **Table C-1**.

3.2 Quality Assurance (QA)/Quality Control (QC) Procedures and Equipment Decontamination During Sampling

The procedures described in this section will be followed during groundwater sampling to maintain QA/QC of the samples and reduce the possibility of cross-contamination:

- Monitoring wells will be purged and sampled in the order from least to most contaminated.
- If a stainless-steel submersible purge pump is used during well evacuation, the pump will be triple rinsed with distilled water between uses.

- If disposable bailers or decontaminated re-usable bailers are used to collect groundwater samples, the cord used to lower the bailer will be discarded after each well.
- Sample bottle sets at each monitoring well will be filled in the order of decreasing volatilization as described below in Section 3.4.
- QC samples collected during each sampling event will include a trip blank, a field blank, and duplicate samples at a rate of 10 percent. Additionally, an equipment blank will be collected, if needed. One equipment blank will be collected for each piece of decontaminated sampling or purging equipment used during each sampling mobilization. The equipment blank will be collected by pouring laboratory certified (organic-free) water supplied by the contract laboratory into or over the equipment and decanting the water into a sample container.

3.3 Monitoring Well Purging

Low-flow/low-volume purging techniques are procedures used to minimize purged water volumes. Flow rates do not exceed the recharge rate of the aquifer (no decrease in the water level in the monitoring well). The pump intake is placed within the screened interval at the zone of sampling, preferably the zone with the highest flow rate. The water level is monitored with a water level recorder or similar device while pumping. Low-flow purging techniques are acceptable for use in aquifers that exhibit relatively high to moderate transmissivities. The sediments in the semi-confined aquifer and upper Miocene aquifer at the Creola facility range from fine to coarse sands, indicating at least moderate transmissivities. Analysis of data from a 24-hour pump test at the facility indicated that the transmissivity of the semi-confined unit ranges from 260 to 450 feet per day). This range of hydraulic conductivities indicates that low-flow purging and sampling techniques are technically feasible at the facility. The following low-flow purging procedures will be followed:

- Low-flow purging will be limited to monitoring wells that, with sustained pumping, exhibit no continuous drawdown. Water levels are measured and recorded before pumping. Purging will be initiated, and the flow adjusted to a rate that results in minimal (< 0.1 meter) well drawdown. Water levels and flow rates will be recorded every 5 to 10 minutes during purging and upon completion of sampling. The optimum pumping rate for each well will be determined from this information and recorded for future reference.
- The pump intake will be located near the middle of the screened interval to avoid mixing formation water with sediments in the well bottom or the overlying stagnant water within the well casing. A properly decontaminated variable speed submersible pump, such as the Rediflo2®, will be carefully lowered into the well to minimize disturbance of the water column and suspended solids in the well.
- Purge rates for low-flow sampling will typically be 0.1 – 0.5 liter per minute (L/min). A higher purge rate may be acceptable, based on the Site hydrology and will be determined at each well location. If purge rates greater than 0.25 L/min are used, pump lines will be cleared using a flow rate less than 0.25 L/min prior to sample collection for analysis of VOCs.
- The minimum purge volume will be the equivalent of at least twice the combined volumes of the sample pump and tubing.

- An in-line flow-through-cell will be used for field-parameter measurements of temperature, specific conductance, and pH. Turbidity measured in nephelometric turbidity units, using a turbidity meter, may also be included as a stabilization parameter. The well will be purged until water quality parameters (temperature, specific conductance, pH) have stabilized for three consecutive measurements taken at 3- to 5-minute intervals. The stabilization of groundwater chemistry parameters will be assessed in accordance with the criteria included in the Alabama Environmental Investigation and Remediation Guidance (most recent revision).
- All purge data, including purge volumes, elapsed times, pump-flow rates, water level, and values for geochemical parameters will be recorded on field data sheets. The pumping rate used for sampling will be the same or less than the purging rate and will be sufficiently low to minimize sample aeration. When collecting samples for VOC analysis, pumps will be operated at rates less than 0.25 L/min and the discharge from the pump will be a thin, continuous stream of water when filling the sample vial. Field parameter measurements will be submitted with sampling results.

3.4 Sample Collection

Once the well has been properly purged, sample collection can proceed. If low-volume purging and sampling is used, the pumping rate for sampling will be the same or less than the purging rate and will be sufficiently low to minimize sample aeration. When collecting samples for VOC analysis, pumps will be operated at rates less than 0.25 L/min and the discharge from the pump will be a thin, continuous stream of water when filling the sample vial.

Groundwater samples will be collected with a disposable polyethylene bailer from wells purged by removing multiple well volumes. The bailer will be lowered and retrieved with nylon cord. A new nylon cord will be used each time a sample is collected. Groundwater samples will be poured from the bailer directly into the laboratory-supplied containers. Containers will be filled in order of decreasing volatilization, as follows:

1) Volatiles;
2) Chlorinated Herbicides and Pesticides; and
3) Total Metals.

Containers will be filled to the neck of the bottle. If necessary for sample preservation, a measured volume of appropriate preservative may be added (**Table C-2**). Vials for VOC analyses will be filled to form a meniscus at the top of the vial. The cap will be carefully placed on the vial to ensure that no air bubbles are entrapped.

Each sample container will be carefully labeled as to its contents, sample location, time, date, and name of sampler. The labeled information will be transferred to the Sampling Field Data Form for each well sampled. Sample seals will be used when sample collection is performed by personnel not employed by the contract analytical laboratory. The full sample containers with tightened caps will be placed in ice chests and maintained at 4 degrees Celsius (°C) throughout the sampling and transportation period.

3.5 Sample Preparation, Preservation, and Shipping, Handling, and Analysis

Table C-2 presents the analytical method, container type, preservation, and holding time for the parameters that will be analyzed. The laboratory selected for water testing will provide the sample bottles needed for analysis, as shown in **Table C-2**. Bottles will be properly cleaned and sterilized prior to delivery to the well site. In addition to preservation provided by chilling in an ice chest at 4°C, samples may be preserved as shown in **Table C-2**. Sample handling and analysis are performed according to the applicable standard methodology. A copy of the applicable standard operating procedures for sample handling and analysis used by the contract laboratory is included in Appendix A.

3.6 Chain-of-Custody Control

Water samples will be handled in a manner that minimizes potential for accidental sample contamination. To ensure proper handling, a minimum number of personnel will be responsible for sample procurement, storage, and transport. Each sample container will be carefully labeled as to its contents, sampling location, time, date, and name of sampler. Sample analysis request forms will accompany each sampling event. Sampling Field Data Forms will be used to record field measurements and sampling analysis. Chain-of-custody forms will accompany the samples to the laboratory facility. Samples will be included in the Master Log-In Book upon arrival at the laboratory facility. An example of an appropriate chain-of-custody form and the typical information recorded are included in Appendix A.

3.7 Laboratory Quality Assurance and Quality Control Procedures

QA/QC procedures for the contract laboratory are provided in Appendix A.

4 GROUNDWATER MONITORING PROGRAM

This section describes the analytical parameters and methods for groundwater monitoring. Section 4.1 describes the Corrective Action Groundwater Monitoring Program, and Section 4.2 describes the Corrective Action Reporting format. Miocene groundwater sampling and QA/QC are described in Sections 4.3 and 4.4, respectively.

4.1 Corrective Action Groundwater Monitoring Program

The objective of the Corrective Action Groundwater Monitoring is to evaluate the effectiveness of the Site Remediation Program. The following establishes a Corrective Action Monitoring Program meeting the requirements of ADEM Rule 335-14-5-.06(11).

Groundwater monitoring of the well network will be conducted as identified in **Table C-3**. All BDY, BKG, and POC wells will be sampled on an annual basis and monitored for the presence of VOCs, metals, and Dinoseb. All EFF wells will be sampled on a semiannual basis and monitored for the presence of VOCs and metals, with Dinoseb analyzed annually. Monitored natural attenuation (MNA) sampling will be performed in EFF wells as shown **Table C-1**. MNA monitoring includes the collection of samples for analysis of VOCs, metals, nitrate, sulfide, carbon dioxide (gas), hydrogen (gas) chloride, and petroleum-

related compounds (benzene, toluene, ethylbenzene, and xylene). Once initial sampling is conducted, the appropriateness and sampling frequency of the analytes based on Site conditions may be evaluated and modifications will be recommended as part of the ongoing corrective action reporting process.

The monitoring will be completed in support of a groundwater corrective action effectiveness evaluation that will be conducted once four rounds of samples are collected from the newly installed wells. The groundwater corrective action effectiveness evaluation will be conducted using the following criteria.

4.1.1 Trend Analyses

Time-series plots and intrawell Shewhart-Cumulative Sum control charts will be used annually to evaluate trends of carbon tetrachloride (CT) and chloroform (CF) concentrations for EFF wells. CT and CF are referenced in this section because they represent the primary COCs; however, all VOCs and associated daughter products will be evaluated, if detected. Time-series plots will also be provided as visual interpretations of trends. Trends will be evaluated only for wells where CT or CF were detected for a sufficient number of sampling events (four consecutive events above the laboratory method detection limit) to develop valid trends.

4.1.2 Spatial Analysis

Spatial analyses of the distribution of CT and CF throughout the Site and correlation of concentrations between monitoring wells may be performed to re-evaluate/identify the optimum number and location of BDY and EFF wells in the network. Spatial analyses may include “spatial tolerance” metrics to estimate the efficacy of the network when selected wells are removed sequentially from the network and/or groundwater modeling shows additional monitoring wells are needed where data gaps are predicted to exist. Monitoring wells may be removed from routine sample collection (not water level measurements) where analysis shows CT and CF concentrations are predicted as highly unlikely to increase.

4.1.3 Temporal Analysis

Temporal analyses of the distribution of CT and CF in monitoring wells at the Site may be performed to re-evaluate/identify the optimum frequency of sampling events at BDY and EFF wells in the network. Techniques developed by the USEPA and the Air Force Center for Environmental Excellence (AFCEE 2005) will be used for temporal analyses.

4.2 Reporting

Semiannual groundwater monitoring and corrective action reporting will continue. Details of the monitoring well abandonments and installation of additional wells will be included in the routine monitoring report following completion. The reports will include data from groundwater monitoring, analysis of data, remedial actions, and conclusions regarding the effectiveness of the monitoring program. If the analysis of the data warrants any change to the remedial action program, recommendations for revisions will be included in the semiannual report.

The semiannual reports will include:

- Site history or reference to previously submitted Site history.
- Descriptions of remedial measures activities over the preceding 6 months.
- Groundwater monitoring activities, including:
  - Sample locations and dates.
  - Analytical methods.
  - Method reporting limits for each constituent reported.
- A map of the groundwater monitoring system.
- Potentiometric surface maps.
- Isoconcentration maps.
- Tables of well concentrations with comparison to the current remedial goal.

4.3 Miocene Groundwater Monitoring Program

At this time, the upper Miocene PRG wells (MCN-4D, MCN-6D, MCN-8, MCN-16D, MCN-27D, MCN-28D, MCN-30D, and MCN-31D) will not be sampled routinely. These wells will only be sampled as needed should a corresponding EFF well near an MCN well indicate concentrations above the Groundwater Protection Standard. Should it be determined that the upper Miocene PRG wells require routine sampling, an application for a permit modification to make changes to the program will be submitted to ADEM within 90 days following such determination.

4.4 Quality Assurance/Quality Control Samples

Three types of QA/QC samples will be collected during each semiannual monitoring event. These will include a trip blank(s), a field blank(s), and a duplicate sample(s). These QA/QC samples will be analyzed for the volatile compounds listed in **Table C-2**. Additionally, an equipment blank may be collected during each monitoring event, if needed. One equipment blank will be collected for each piece of decontaminated sampling or purging equipment.

TABLES

Table C-1
Monitoring Well Network
Groundwater Monitoring, Sampling, and Analysis Plan
Rentokil Initial Environmental Services, LLC
Creola, Alabama

ARCADIS Design & Consultancy for natural and built assets

Well ID	Well Status	Well Type	Longitude	Latitude	Well Depth (ft)	Screen Interval	Ground Elevation (ft MSL)	Top of the Riser (ft MSL)	Monitoring
BKG-16SRU	New	BKG Well	88.038296	30.912394	35.00	15.00	37.70	37.70	Annual Monitoring for VOCs, Metals & Dinoseb
POC-1RU	New	POC Well	88.039054	30.910551	35.00	15.00	41.20	44.44	
POC-5RU	New	POC Well	88.039422	30.911156	35.00	15.00	42.80	46.49	
POC-10RU	New	POC Well	88.039203	30.909915	35.00	15.00	41.78	45.08	
POC-13RU	New	POC Well	88.039772	30.910392	35.00	15.00	37.30	41.07	
BDY-32U	TW-32U	BDY Well	88.041566	30.910161	40.00	15.00	22.71	25.71	
BDY-32M	TW-32M	BDY Well	88.041571	30.910131	85.00	15.00	22.94	25.94	
BDY-32L	TW-32L	BDY Well	88.041562	30.910203	132.00	15.00	26.52	26.52	
BDY-28RU	New	BDY Well	88.036726	30.909286	45.00	15.00	35.30	39.09	
BDY-28RM	New	BDY Well	88.036625	30.909304	60.00	15.00	33.60	37.51	
BDY-29RU	New	BDY Well	88.038890	30.906274	45.00	15.00	29.10	32.61	
BDY-29RM	New	BDY Well	88.038945	30.906279	60.00	15.00	28.80	32.45	
MCN-6D	TW-6D	Upper Miocene PRG Well	88.039325	30.910327	160.00	30.00	41.74	42.63	
MCN-8	TW-8	Upper Miocene PRG Well	88.038569	30.911298	155.00	30.00	35.30	36.34	
EFF-101U	New	New Injection Test EFF Well	88.039221	30.911880	35.00	10.00	36.50	39.93	Semiannual Monitoring for VOCs and Metals and Annual Monitoring for Dinoseb
EFF-101M	New	New Injection Test EFF Well	88.039175	30.911828	50.00	10.00	36.30	39.76	
EFF-102U	New	New Injection Test EFF Well	88.038236	30.910338	35.00	10.00	38.20	41.83	
EFF-103U	New	New Injection Test EFF Well	88.038246	30.910281	50.00	10.00	38.80	42.48	
EFF-103M	New	New AS/SVE EFF Well	88.038279	30.910290	35.00	10.00	38.80	42.74	
EFF-2RU	New	Replacement Well	88.038840	30.911007	50.00	10.00	37.20	40.90	
EFF-33U	New	EFF Well Based on VAP	88.037979	30.910255	35.00	10.00	37.00	41.13	Semiannual Monitoring for VOCs and Metals and Annual Monitoring for Dinoseb Semiannual Monitoring for Corrective Action Effectiveness MNA Parameters (nitrate, sulfide, chloride, carbon dioxide[gas], hydrogen [gas], and BTEX,) per USEPA Region 4 *Suggested Practices for Evaluation of a Site for Natural Attenuation of Chlorinated Solvents.*
EFF-33M	New	EFF Well Based on VAP	88.037938	30.910277	50.00	10.00	36.50	40.30	
EFF-34U	New	EFF Well Based on VAP	88.038537	30.909499	35.00	10.00	39.80	43.82	
EFF-34M	New	EFF Well Based on VAP	88.038590	30.909527	50.00	10.00	40.10	44.15	
EFF-35U	New	EFF Well Based on VAP	88.040185	30.910160	35.00	10.00	39.50	43.23	
EFF-35M	New	EFF Well Based on VAP	88.040249	30.910137	50.00	10.00	39.70	42.72	
EFF-36U	New	EFF Well Based on VAP	88.039049	30.908686	35.00	10.00	39.40	42.89	
EFF-36M	New	EFF Well Based on VAP	88.039042	30.908780	45.00	10.00	39.30	43.09	
EFF-37U	New	EFF Well Based on VAP	88.040950	30.908893	45.00	10.00	47.90	51.75	
EFF-37M	New	EFF Well Based on VAP	88.040997	30.908902	55.00	10.00	50.20	53.36	
EFF-1	FIW-1	EFF Well Retained	88.038099	30.912306	35.00	10.00	UNK	39.19	
EFF-3	FIW-3	EFF Well Retained	88.038471	30.912000	37.00	10.00	UNK	37.54	

Table C-1
Monitoring Well Network
Groundwater Monitoring, Sampling, and Analysis Plan
Rentokil Initial Environmental Services, LLC
Creola, Alabama

ARCADIS Design & Consultancy for natural and built assets

Well ID	Well Status	Well Type	Longitude	Latitude	Well Depth (ft)	Screen Interval	Ground Elevation (ft MSL)	Top of the Riser (ft MSL)	Monitoring
EFF-21UR	TW-21UR	EFF Well Retained	88.037604	30.910997	16.00	5.00	37.80	42.66	Semiannual Monitoring for VOCs and Metals and Annual Monitoring for Dinoseb Semiannual Monitoring for Corrective Action Effectiveness MNA Parameters (nitrate, sulfide, chloride, carbon dioxide[gas], hydrogen [gas], and BTEX,) per USEPA Region 4 *Suggested Practices for Evaluation of a Site for Natural Attenuation of Chlorinated Solvents.*
EFF-21M	TW-21M	EFF Well Retained	88.037617	30.910994	54.00	10.00	37.80	40.65	
EFF-21L	TW-21L	EFF Well Retained	88.037617	30.910983	93.00	10.00	37.80	40.72	
EFF-22U	TW-22U	EFF Well Retained	88.040598	30.910938	36.0	10.00	43.42	47.61	
EFF-22M	TW-22M	EFF Well Retained	88.040623	30.910921	67.00	10.00	44.44	47.75	
EFF-22L	TW-22L	EFF Well Retained	88.040642	30.910902	48.38	10.00	44.70	48.38	
EFF-23U	TW-23U	EFF Well Retained	88.040641	30.909032	33.00	10.00	41.65	44.21	
EFF-23M	TW-23M	EFF Well Retained	88.040626	30.909065	58.00	10.00	41.37	45.05	
EFF-23L	TW-23L	EFF Well Retained	88.040635	30.909101	86.00	10.00	41.95	45.77	
EFF-24U	TW-24U	EFF Well Retained	88.039252	30.907993	27.50	10.00	38.65	42.18	
EFF-24M	TW-24M	EFF Well Retained	88.039220	30.907993	62.00	10.00	38.62	42.42	
EFF24LR	TW-24LR	EFF Well Retained	88.039265	30.908024	92.00	15.00	38.95	42.08	
EFF-25U	TW-25U	EFF Well Retained	88.037388	30.908760	27.00	10.00	38.12	41.34	
EFF-25M	TW-25M	EFF Well Retained	88.037362	30.908760	68.00	10.00	38.17	41.19	
EFF-25L	TW-25L	EFF Well Retained	88.037337	30.908757	82.00	10.00	38.17	41.46	
EFF-31RM	TW-31M	Replacement Well	88.041612	30.908559	55.00	10.00	46.00	49.65	
EFF-31 RU	TW-31S	Replacement Well	88.041572	30.908552	45.00	10.00	45.80	49.70	
MCN-4D	TW-4D	Upper Miocene PRG Well	88.039117	30.911791	140.00	25.00	35.69	36.20	Annual sampling for Metals and VOCs is required if the “M” or “L” well (as designated in the “Well ID” column) in the nearest EFF well cluster indicates VOC and/or metal concentration in groundwater at or above the GWPS
MCN-16D	TW-16D	Upper Miocene PRG Well	88.038266	30.912410	120.00	20.00	38.59	42.06	
MCN-27D	TW-27D	Upper Miocene PRG Well	88.036033	30.912285	150.50	40.00	41.70	44.55	
MCN-28D	TW-28D	Upper Miocene PRG Well	88.036696	30.909318	130.00	30.00	34.70	37.81	
MCN-30D	TW-30D	Upper Miocene PRG Well	88.037308	30.911114	150.00	30.00	38.23	40.48	
MCN-31D	TW-31D	Upper Miocene PRG Well	88.041615	30.908624	169.00	30.00	46.61	49.61	
R4	RCY	Recovery well Retained	88.040037	30.908741	81.00	70.00	34.70	36.70	Constituents listed in Table III.3
R5	RCY	Recovery well Retained	88.039920	30.908802	85.00	70.00	36.50	37.72	

Acronyms:

POC - Point of Compliance Wells
EFF - Effectiveness Monitoring Wells
BKG - Background Wells
PRG - Program Monitoring Wells
BDY - Boundary Monitoring Wells
MCN - Miocene Wells
RCY – Recovery Wells
VOC - Volatile Organic Compounds
U – Indicates that the well is screened in the upper section of the semi-confined aquifer
M – Indicates that the well is screened in the middle section of the semi-confined aquifer
L - Indicates that the well is screened in the lower section of the semi-confined aquifer

Table C-2
Container, Preservative, Holding Time, and Analytical Method
Groundwater Monitoring, Sampling, and Analysis Plan
Rentokil Initial Environmental Services, LLC
Creola, Alabama

ARCADIS Design & Consultancy for natural and built assets

Parameters	Method	Container	Preservative	Holding Time
Volatile Organics	8260C	2-3 40 mL VOA vials	HCL to pH<2 Cool to 4°C, +/- 2°C	14 Days
Semivolatile Organics	8270	2 1,000 mL Amber Glass with Teflon-Lined Cap	Cool to 4°C, +/- 2°C	Extraction - 14 Days Analysis - 40 Days
Metals	6000/7000 Series	500 mL Plastic Bottle	HNO_3 to pH<2, Cool to 4°C, +/- 2°C	6 months
Chlorinated Herbicides	Dinoseb	1,000 mL Amber Glass with Teflon-Lined Cap	Cool to 4°C, +/- 2°C	Extraction - 14 Days Analysis - 40 Days
pH	150.1	100 mL Plastic Bottle	Not Applicable	In Field
Specific Conductivity	120.1	100 mL Plastic Bottle	Not Applicable	In Field
Temperature	170.1	100 mL Plastic Bottle	Not Applicable	In Field

Table C-3
Constituents and Analytical Methods for Compliance Monitoring and Corrective Action Monitoring
Groundwater Monitoring, Sampling, and Analysis Plan
Rentokil Initial Environmental Services, LLC
Creola, Alabama

Constituent	Method	First Semiannual[1]	Second Semiannual (Annual)[2]
Volatile Organic Compounds			
2-Butanone (MEK)	8260	X	X
Carbon Disulfide	8260	X	X
Carbon Tetrachloride	8260	X	X
Chloroform	8260	X	X
1, 1-Dichloroethane	8260	X	X
1, 2-Dichloroethane	8260	X	X
Tetrachloroethene	8260	X	X
Metals			
Cadmium	6020	X	X
Chromium	6020	X	X
Lead	6020	X	X
Mercury	7470	X	X
Herbicides			
Dinoseb	8151		X
Field Parameters			
pH	150.1	X	X
Conductivity	120.1	X	X
Temperature		X	X

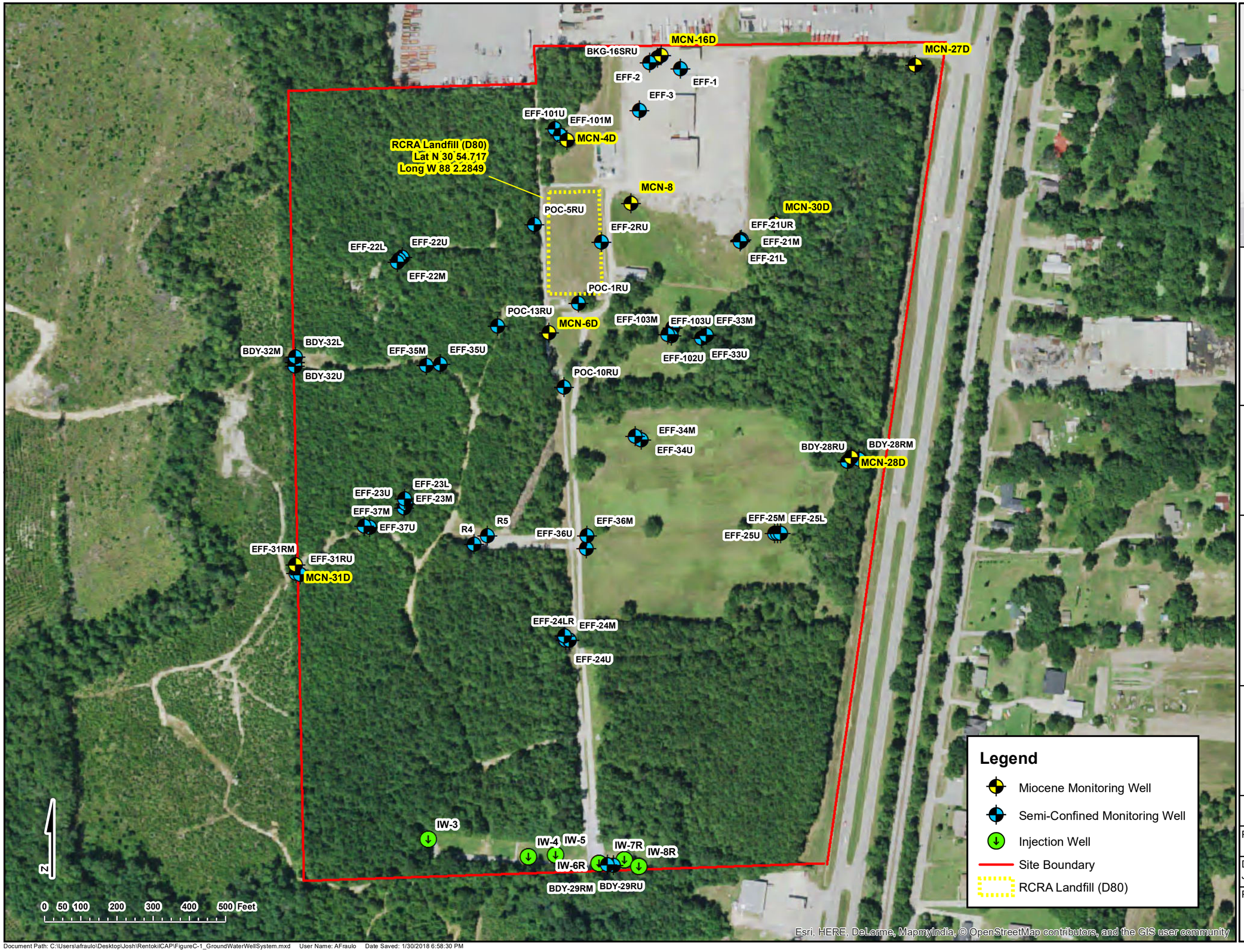
Notes:

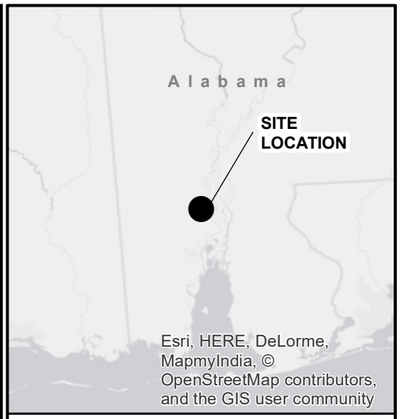
[1]First semiannual sample collection will be performed in March and the report will be issued to ADEM by May 30th.

[2]Second semiannual sample collection will be performed in October and the report will be issued to ADEM by December 30th.

Miocene wells MCN-4D, MCN-6D, MCN-8, MCN-16D, MCN-27D, MCN-28D, MCN-30D, and MCN-31D are not sampled routinely. Background Well, Boundary Wells, and Point of Compliance Wells are sampled annually.

FIGURES





Groundwater Well System

Rentokil Initial Environmental Services, LLC
10565 Highway 43 North
Creola, AL 36525

ARCADIS
10352 PLAZA AMERICANA DRIVE
BATON ROUGE, LA 70816
TEL: 225-292-1004
FAX: 225-218-9677
WWW.ARCADIS-US.COM

PROJECT MANAGER:	CHECKED BY: PM
DRAWING BY: JWC	DATE: January 2018
PROJECT NUMBER: 03648005.2017	FIGURE NUMBER: 2-2

Document Path: C:\Users\afraulo\Desktop\Josh\RentokilCAP\FigureC-1_GroundWaterWellSystem.mxd User Name: AFraulo Date Saved: 1/30/2018 6:58:30 PM

APPENDIX A

Laboratory Quality Assurance Manual

Quality Assurance Manual

TestAmerica Pensacola
3355 McLemore Dr.
Pensacola, Fl 32514
850-474-1001
850-478-2671

www.testamericainc.com

Facility Distribution No. PS-QAM-001 **Distributed To: CONTROLLED SOP's\QAM**

Only the Electronic Version of this Manual at Pensacola is Controlled

Title Page:

Quality Assurance Manual
Approval Signatures & Laboratory Approved Signatories

Laboratory Director – Charles Newton	Date 12/22/14
Quality Assurance Manager – Maria Bundy	Date 12/22/14
Operations Manager/Technical Manager – Lance Larson	Date 12/22/14
EH&S Coordinator – Stephanie Wilson	Date 12-22-14
Technical Manager (Customer Service/Sample Control) Director – Marty Edwards	Date 12/22/14
Technical Manager (Administration) – Kathy Avery	Date 12/22/14
Supervisor (Extractions) – Vando Chea	Date 12/22/14
Technical Manager (Semivolatiles) – Daniel Waite	Date 12/22/2014
Technical Manager, (Volatiles) – Shelley Kearley	Date 12/22/14
Technical Manager (Inorganics) – John Harris	Date 12/22/14

SECTION 2

TABLE OF CONTENTS

SECTION 2. TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

REFERENCED CORPORATE SOPS AND POLICIES

SOP/Policy Reference	Title
CA-C-S-001	Work Sharing Process
CA-I-P-002	Electronic Signature and Reporting Policy
CA-L-P-001	Ethics Policy
CA-L-P-002	Contract Compliance Policy
CA-L-S-001	Internal Investigation of Potential Data Discrepancies and Determination for Data Recall
CA-L-S-002	Subcontracting Procedures
CA-Q-S-001	Solvent and Acid Lot Testing and Approval
CA-Q-S-002	Acceptable Manual Integration Practices
CA-Q-S-004	Method Compliance & Data Authenticity Audits
CA-Q-S-006	Detection Limits
CA-Q-S-008	Management Systems Review
CA-Q-WI-020	Corporate Work Instruction
CA-T-P-001	Qualified Products List
CW-E-M-001	Corporate Environmental Health and Safety Manual
CW-F-P-002	Authorization Matrix
CW-F-P-004	Procurement and Contracts Policy
CW-F-S-007	Capital Expenditure Request and Controlled Purchases
CW-F-S-018	Vendor Selection
CW-Q-S-001	Corporate Document Control and Archiving
CW-Q-S-002	Writing a Standard Operating Procedure (SOPs)

REFERENCED LABORATORY SOPs

SOP/Policy Reference	Title
PS-CSD-004	Client Services Departmental Policies
PS-CSD-007	Log In Review and Final Job Approval
PS-QAD-003	Calculation of Control Limits
PS-QAD-014	Thermometers and Temperature Control
PS-QAD-016	Calibration and Use of Laboratory Balances and Laboratory Weights
PS-QAD-017	Non-conforming Events
PS-QAD-021	Demonstrations of Capability
PS-LAB-001	Document Control
PS-LAB-007	Records Management
PS-LAB-010	Backup and Security of Personal Computers in the Laboratory
PS-LAB-011	Pipette, Syringe, Dispenser, and Digital Burette Calibration and Verification
PS-LAB-014	Training Program and Documentation
PS-LAB-015	Waste Handling and Disposal Practices
PS-SCD-005	Procedure for Splitting and/or Compositing Samples
PS-SCD-007	Receiving Samples and Logging Samples into LIMS
PS-WCD-001	pH [EPA 150.1 / SM 4500H+ B / SW-846 9040B / SW-846 9040C / SW-846 9045C / SW-846 9045D]
PS-WCD-006	Odor [EPA 140.1]
PS-WCD-010	Total Volatile Solids and Fixed Solids [EPA Method 160.4 / SM 2540E AND 2540G]
PS-WCD-019	Total Coliform Analysis by Membrane Filtration (MF) [SM9222B]
PS-SCD-020	Total Coliform Analysis by Membrane Filtration (MF) [SM9222B]

SOP/Policy Reference	Title
PS-SCD-027	Presence-Absence (P-A) Coliform Test for Total and Fecal Coliform in Drinking Water [SM 9223]
PS-SCD-030	Receiving Samples and Logging Samples into LIMS

SECTION 3. INTRODUCTION, SCOPE AND APPLICABILITY

3.1 Introduction and Compliance References

TestAmerica Pensacola's Quality Assurance Manual (QAM) is a document prepared to define the overall policies, organization objectives and functional responsibilities for achieving TestAmerica's data quality goals. The laboratory maintains a local perspective in its scope of services and client relations and maintains a national perspective in terms of quality.

The QAM has been prepared to assure compliance with The NELAC Institute (TNI) Standard, dated 2009, Volume 1 Modules 2 and 4, and ISO/IEC Guide 17025:2005(E). In addition, the policies and procedures outlined in this manual are compliant with TestAmerica's Corporate Quality Management Plan (CQMP) and the various accreditation and certification programs listed in Appendix 3. The CQMP provides a summary of TestAmerica's quality and data integrity system. It contains requirements and general guidelines under which all TestAmerica facilities shall conduct their operations. ***[Please note that the 2009 TNI Standard is based on the 2005 version of 17025.]***

The QAM has been prepared to be consistent with the requirements of the following documents:

- EPA 600/4-88/039, *Methods for the Determination of Organic Compounds in Drinking Water,* EPA, Revised July 1991.
- EPA 600/R-95/131, *Methods for the Determination of Organic Compounds in Drinking Water,* Supplement III, EPA, August 1995.
- EPA 600/4-79-019, *Handbook for Analytical Quality Control in Water and Wastewater Laboratories,* EPA, March 1979.
- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996; Final Update IV, January 2008.*
- Federal Register, 40 CFR Parts 136, 141, 172, 173, 178, 179 and 261.
- *Statement of Work for Inorganics & Organics Analysis, SOM and ISM, current versions, USEPA Contract Laboratory Program Multi-media, Multi-concentration.*
- APHA, *Standard Methods for the Examination of Water and Wastewater,* 18th Edition, 19th, 20th 21st and On-Line Editions.
- *Manual for the Certification of Laboratories Analyzing Drinking Water (EPA 815-R-05-004, January 2005*

3.2 Terms and Definitions

A Quality Assurance Program is a company-wide system designed to ensure that data produced by the laboratory conforms to the standards set by state and/or federal regulations. The program functions at the management level through company goals and management policies, and at the analytical level through Standard Operating Procedures (SOPs) and quality control. The TestAmerica program is designed to minimize systematic error, encourage constructive, documented problem solving, and provide a framework for continuous improvement within the organization.

Refer to Appendix 4 for the Glossary/Acronyms.

3.3 Scope / Fields of Testing

The laboratory analyzes a broad range of environmental and industrial samples every month. Sample matrices vary among air, drinking water, effluent water, groundwater, hazardous waste, sludge and soils. The Quality Assurance Program contains specific procedures and methods to test samples of differing matrices for chemical, physical and biological parameters. The Program also contains guidelines on maintaining documentation of analytical processes, reviewing results, servicing clients and tracking samples through the laboratory. The technical and service requirements of all analytical requests are thoroughly evaluated before commitments are made to accept the work. Measurements are made using published reference methods or methods developed and validated by the laboratory.

The methods covered by this manual include the most frequently requested methodologies needed to provide analytical services in the United States and its territories. The specific list of test methods used by the laboratory can be found in Appendix 5 of the QAM. The approach of this manual is to define the minimum level of quality assurance and quality control necessary to meet these requirements. All methods performed by the laboratory shall meet these criteria as appropriate. In some instances, quality assurance project plans (QAPPs), project specific data quality objectives (DQOs) or local regulations may require criteria other than those contained in this manual. In these cases, the laboratory will abide by the requested criteria following review and acceptance of the requirements by the Laboratory Director and the Quality Assurance (QA) Manager. In some cases, QAPPs and DQOs may specify less stringent requirements. The Laboratory Director and the QA Manager must determine if it is in the lab's best interest to follow the less stringent requirements.

3.4 Management of the Manual

3.4.1 Review Process

The template on which this manual is based is reviewed annually by Corporate Quality Management Personnel to assure that it remains in compliance with Section 3.1. This manual itself is reviewed every two years by senior laboratory management to assure that it reflects current practices and meets the requirements of the laboratory's clients and regulators, as well as, the CQMP. Occasionally, the manual may need changes in order to meet new or changing regulations and operations. The QA Manager will review the changes in the normal course of business and incorporate changes into revised sections of the document. All updates will be reviewed by the senior laboratory management staff. The laboratory updates and approves such changes according to our Document Control & Updating procedures (Pensacola SOP PS-LAB-001 – Document Control).

SECTION 4. MANAGEMENT REQUIREMENTS

4.1 Overview

TestAmerica Pensacola is a local operating unit of TestAmerica Laboratories, Inc.. The organizational structure, responsibilities and authorities of the corporate staff of TestAmerica Laboratories, Inc. are presented in the CQMP. The laboratory has day-to-day independent operational authority overseen by corporate officers (e.g., Chief Executive Officer, Executive VP Operations, Corporate Quality, etc.). The laboratory operational and support staff work under the direction of the Laboratory Director. The organizational structure for both Corporate & TestAmerica Pensacola is presented in Figure 4-1.

4.2 Roles and Responsibilities

In order for the Quality Assurance Program to function properly, all members of the staff must clearly understand and meet their individual responsibilities as they relate to the quality program. The following descriptions briefly define each role in its relationship to the Quality Assurance Program.

4.2.1 Additional Requirements for Laboratories

The responsibility for quality resides with every employee of the laboratory. All employees have access to the QAM, are trained to this manual, and are responsible for upholding the standards therein. Each person carries out his/her daily tasks in a manner consistent with the goals and in accordance with the procedures in this manual and the laboratory's SOPs. Role descriptions for Corporate personnel are defined in the CQMP. This manual is specific to the operations of TestAmerica's Pensacola laboratory.

4.2.2 Laboratory Director

TestAmerica Pensacola's Laboratory Director is responsible for the overall quality, safety, financial, technical, human resource and service performance of the whole laboratory and reports to their respective GM. The Laboratory Director provides the resources necessary to implement and maintain an effective and comprehensive Quality Assurance and Data Integrity Program. Specific responsibilities include, but are not limited to:

- Provides one or more Department Managers for the appropriate fields of testing. The name(s) of the Department Manager will be included in the national database. If the Operations Manager is absent for a period of time exceeding 15 consecutive calendar days, the Operations Manager must designate another full time staff member meeting the qualifications of the Operations Manager to temporarily perform this function. If the absence exceeds 65 consecutive calendar days, the primary accrediting authority must be notified in writing.
- Ensures that all analysts and Department Managers have the appropriate education and training to properly carry out the duties assigned to them and ensures that this training has been documented.
- Ensures that personnel are free from any commercial, financial and other undue pressures which might adversely affect the quality of their work.
- Ensures TestAmerica's human resource policies are adhered to and maintained.

- Ensures that sufficient numbers of qualified personnel are employed to supervise and perform the work of the laboratory.
- Ensures that appropriate corrective actions are taken to address analyses identified as requiring such actions by internal and external performance or procedural audits. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs may be temporarily suspended by the Laboratory Director.
- Reviews and approves all SOPs prior to their implementation and ensures all approved SOPs are implemented and adhered to.
- Pursues and maintains appropriate laboratory certification and contract approvals
- Ensures client specific reporting and quality control requirements are met.
- Captains the management team, consisting of the QA Manager, the Department Manager(s), and the Operations Manager as direct reports.

4.2.3 Quality Assurance (QA) Manager or Designee

The QA Manager has responsibility and authority to ensure the continuous implementation of the quality system.

The QA Manager reports directly to the Laboratory Director and has access to Corporate QA for advice and resources. This position is able to evaluate data objectively and perform assessments without outside (e.g., managerial) influence. Corporate QA may be used as a resource in dealing with regulatory requirements, certifications and other quality assurance related items. The QA Manager directs the activities of the QA officers to accomplish specific responsibilities, which include, but are not limited to:

- Serves as the focal point for QA/QC in the laboratory.
- Having functions independent from laboratory operations for which he/she has quality assurance oversight.
- Ensures compliance with NELAC/TNI Standards.
- Maintaining and updating the QAM.
- Monitoring and evaluating laboratory certifications; scheduling proficiency testing samples.
- Monitoring and communicating regulatory changes that may affect the laboratory to management.
- Training and advising the laboratory staff on quality assurance/quality control procedures that are pertinent to their daily activities.
- Have documented training and/or experience in QA/QC procedures and the laboratory's Quality System.
- Having a general knowledge of the analytical test methods for which data audit/review is performed (and/or having the means of getting this information when needed).
- Arranging for or conducting internal audits on quality systems and the technical operation.
- The laboratory QA Manager will maintain records of all ethics-related training, including the type and proof of attendance.

- Maintain, improve, and evaluate the corrective action database and the corrective and preventive action systems.
- Notifying laboratory management of deficiencies in the quality system and ensuring corrective action is taken. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs shall be investigated following procedures outlined in Section 12 and if deemed necessary may be temporarily suspended during the investigation.
- Objectively monitoring standards of performance in quality control and quality assurance without outside (e.g., managerial) influence.
- Coordinating of document control of SOPs, MDLs, control limits, and miscellaneous forms and information.
- Review a percentage of all final data reports for internal consistency. Review of Chain of Custody (COC), correspondence with the analytical request, batch QC status, completeness of any corrective action statements, 5% of calculations, format, holding time, sensibility and completeness of the project file contents.
- Review of external audit reports and data validation requests.
- Follow-up with audits to ensure client QAPP requirements are met.
- Establishment of reporting schedule and preparation of various quality reports for the Laboratory Director, clients and/or Corporate QA.
- Development of suggestions and recommendations to improve quality systems.
- Research of current state and federal requirements and guidelines.
- Captains the QA team to enable communication and to distribute duties and responsibilities.
- Ensuring Communication & monitoring standards of performance to ensure that systems are in place to produce the level of quality as defined in this document.
- Notifying laboratory management of deficiencies in the quality system and ensuring corrective action is taken. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs are temporarily suspended following the procedures outlined in Section 12.
- Evaluation of the thoroughness and effectiveness of training.

4.2.4 Operations Manager

The Operations Manager manages and directs the analytical production sections of the laboratory and reports to the Laboratory Director. The scope of responsibility ranges from the new-hire process and existing technology through the ongoing training and development programs for existing analysts and second- and third-generation instrumentation. Specific responsibilities include, but are not limited to:
:

- Evaluates the level of internal/external non-conformances for all departments.
- Ensures compliance with NELAC/TNI Standards.
- Continuously evaluates production capacity and improves capacity utilization.
- Continuously evaluates turnaround time and addresses any problems that may hinder meeting the required and committed turnaround time from the various departments.

- Develops and improves the training of all analysts in cooperation with the QA Manager and in compliance with regulatory requirements.
- Works with the Department Managers to ensure that scheduled instrument maintenance is completed.
- Is responsible for efficient utilization of supplies.
- Constantly monitors and modifies the processing of samples through the departments.
- Fully supports the quality system and, if called upon in the absence of the QA Manager, serves as his substitute in the interim.
- Coordinating, writing, and reviewing preparation of all test methods, i. e., SOPs, with regard to quality, integrity, regulatory and optimum and efficient production techniques, and subsequent analyst training and interpretation of the SOPs for implementation and unusual project samples. He/she insures that the SOPs are properly managed and adhered to at the bench. He/she develops standard costing of SOPs to include supplies, labor, overhead, and capacity (design vs. demonstrated versus first-run yield) utilization.
- Enhancing efficiency and improving quality through technical advances and improved LIMS utilization. Capital forecasting and instrument life cycle planning for second generation methods and instruments as well as asset inventory management.
- Coordinating sample management from “cradle to grave,” insuring that no time is lost in locating samples.
- Scheduling all QA/QC-related requirements for compliance, e.g., MDLs, etc.
- Captains Department Managers to communicate quality, technical, personnel, and instrumental issues for a consistent team approach.
- Coordinates audit responses with supervisors and QA Manager.

4.2.5 Environmental Health and Safety Officer

The Environmental Health and Safety Officer reports directly to the Laboratory Director. The duties consist of:

- Staying current with the hazardous waste regulations.
- Continuing training on hazardous waste issues.
- Reviewing and updating annually the Hazardous Waste Contingency Plan in the Environmental Health & Safety Manual.
- Auditing the staff with regard to compliance with the Hazardous Waste Contingency Plan.
- Contacting the hazardous waste subcontractors for review of procedures and opportunities for minimization of waste.
- Conduct ongoing, necessary safety training and conduct new employee safety orientation.
- Administer dispersal of all Material Safety Data Sheet (MSDS) information.
- Give instruction on proper labeling and practice.
- Serve as chairman of the laboratory safety committee.
- Provide and train personnel on protective equipment.

- Oversee the inspection and maintenance of general safety equipment – fire extinguishers, safety showers, eyewash fountains, etc. and ensure prompt repairs as needed.
- Supervise and schedule fire drills and emergency evacuation drills.
- Determine what initial and subsequent exposure monitoring, if necessary to determine potential employee exposure to chemicals used in the laboratory.
- When determined necessary, conduct exposure monitoring assessments.
- Determine when a complaint of possible over-exposure is "reasonable" and should be referred for medical consultation.
- Assist in the internal and external coordination of the medical consultation/monitoring program conducted by TestAmerica's medical consultants.

4.2.6 Technical Manager or Designee (Also Known as Department Manager in Laboratory Documentation)

The Technical Manager(s) report(s) directly to the Laboratory Director. He/she is accountable for all analyses and analysts under their experienced supervision. The scope of responsibility ranges from the new-hire process and existing technology through the ongoing training and development programs for existing analysts and new instrumentation. Specific responsibilities include, but are not limited to:

- Ensures compliance with NELAC/TNI Standards.
- Exercises day-to-day supervision of laboratory operations for the appropriate field of accreditation and reporting of results. Coordinating, writing, and reviewing preparation of all test methods, i. e., SOPs, with regard to quality, integrity, regulatory and optimum and efficient production techniques, and subsequent analyst training and interpretation of the SOPs for implementation and unusual project samples. He/she insures that the SOPs are properly managed and adhered to at the bench. He/she develops standard costing of SOPs to include supplies, labor, overhead, and capacity (design vs. demonstrated versus first-run yield) utilization.
- Reviewing and approving, with input from the QA Manager, proposals from marketing, in accordance with an established procedure for the review of requests and contracts. This procedure addresses the adequate definition of methods to be used for analysis and any limitations, the laboratory's capability and resources, the client's expectations. Differences are resolved before the contract is signed and work begins. A system documenting any significant changes is maintained, as well as pertinent discussions with the client regarding their requirements or the results of the analyses during the performance of the contract. All work subcontracted by the laboratory must be approved by the client. Any deviations from the contract must be disclosed to the client. Once the work has begun, any amendments to the contract must be discussed with the client and so documented.
- Monitoring the validity of the analyses performed and data generated in the laboratory. This activity begins with reviewing and supporting all new business contracts, insuring data quality, analyzing internal and external non-conformances to identify root cause issues and implementing the resulting corrective and preventive actions, facilitating the data review process (training, development, and accountability at the bench), and providing technical and troubleshooting expertise on routine and unusual or complex problems.

- Providing training and development programs to applicable laboratory staff as new hires and, subsequently, on a scheduled basis. Training includes instruction on calculations, instrumentation management to include troubleshooting and preventive maintenance.
- Enhancing efficiency and improving quality through technical advances and improved LIMS utilization. Capital forecasting and instrument life cycle planning for second generation methods and instruments as well as asset inventory management.
- Coordinating sample management from “cradle to grave,” insuring that no time is lost in locating samples.
- Scheduling all QA/QC-related requirements for compliance, e.g., MDLs, etc..
- Captains department personnel to communicate quality, technical, personnel, and instrumental issues for a consistent team approach.
- Coordinates audit responses with the QA Manager.

4.2.7 Laboratory Analysts

Laboratory analysts are responsible for conducting analysis and performing all tasks assigned to them by the group leader or supervisor. The responsibilities of the analysts are listed below:

- Perform analyses by adhering to analytical and quality control protocols prescribed by current SOPs, this QA Manual, and project-specific plans honestly, accurately, timely, safely, and in the most cost-effective manner.
- Document standard and sample preparation, instrument calibration and maintenance, data calculations, sample matrix effects, and any observed non-conformance on worklists, benchsheets, lab notebooks and/or the Non-Conformance Database.
- Report all non-conformance situations, instrument problems, matrix problems and QC failures, which might affect the reliability of the data, to their supervisor, the Department Manager, and/or the QA Manager or member of QA staff.
- Perform 100% review of the data generated prior to entering and submitting for secondary level review.
- Suggest method improvements to their supervisor, the Department Manager, and the QA Manager. These improvements, if approved, will be incorporated. Ideas for the optimum performance of their assigned area, for example, through the proper cleaning and maintenance of the assigned instruments and equipment, are encouraged.
- Work cohesively as a team in their department to achieve the goals of accurate results, optimum turnaround time, cost effectiveness, cleanliness, complete documentation, and personal knowledge of environmental analysis.

4.2.8 Customer Service Manager

The Customer Service Manger reports to the Laboratory Director and serves as the interface between the laboratory’s technical departments and the laboratory’s clients. The staff consists of the Project Management team, the Sample Control team and the Bottle Prep team. With the overall goal of total client satisfaction, the functions of this position are outlined below:

- Technical training and growth of the Project Management team.

- Technical liaison for the Project Management team.
- Human resource management of the Project Management team.
- Responsible to ensure that clients receive the proper sampling supplies.
- Accountable for response to client inquiries concerning sample status.
- Responsible for assistance to clients regarding the resolution of problems concerning COC.
- Ensuring that client specifications, when known, are met by communicating project and quality assurance requirements to the laboratory.
- Notifying the Department Managers of incoming projects and sample delivery schedules.
- Responsible for discussing with client any project-related problems, resolving service issues, and coordinating technical details with the laboratory staff.
- Responsible for staff familiarization with specific quotes, sample log-in review, and final report completeness.
- Monitor the status of all data package projects in-house to ensure timely and accurate delivery of reports.
- Inform clients of data package-related problems and resolve service issues.
- Coordinate requests for sample containers and other services (data packages).
- Ensures the timely and correct shipment of sample containers, including proper preservatives and instructions to clients.
- Maintains accurate records of sample container shipments.
- Supervises the organized storage and appropriate climate control of samples.
- Supervises the disposal of samples in accordance with the Waste Disposal SOP, the Hazardous Waste Contingency Plan in the Chemical Hygiene/Safety Manual, and the U. S. Department of Agriculture requirements.
- Direct the logging in of incoming samples into the LIMS.
- Ensure the verification of data entry from login.

4.2.9 Project Manager

The Project Managers report to the Customer Service Manager and serve as the interface between the laboratory's technical departments and the laboratory's clients. With the overall goal of total client satisfaction, the functions of this position are outlined below:

- Responsible to ensure that clients receive the proper sampling supplies.
- Accountable for response to client inquiries concerning sample status.
- Responsible for assistance to clients regarding the resolution of problems concerning COC.
- Ensuring that client specifications, when known, are met by communicating project and quality assurance requirements to the laboratory.
- Notifying the Department Managers of incoming projects and sample delivery schedules.
- Responsible for discussing with client any project-related problems, resolving service issues, and coordinating technical details with the laboratory staff.

- Responsible for staff familiarization with specific quotes, sample log-in review, and final report completeness.
- Monitor the status of all data package projects in-house to ensure timely and accurate delivery of reports.
- Inform clients of data package-related problems and resolve service issues.
- Coordinate requests for sample containers and other services (data packages).

4.2.10 Project Manager Assistant

The Project Manager Assistants report to the Customer Service Manger and serve as the interface between the laboratory's technical departments and the Project Managers. With the overall goal of total client satisfaction, the functions of this position are outlined below:

- Responsible to ensure that clients receive the proper sampling supplies.
- Ensuring that client specifications, when known, are met by communicating project and quality assurance requirements to the laboratory.
- Notifying the Department Managers of incoming projects and sample delivery schedules.
- Monitor the status of all data package projects in-house to ensure timely and accurate delivery of reports.
- Coordinate requests for sample containers and other services (data packages).

4.2.11 Human Resource/Office Manager

The Human Resources/Office Manager provides administrative support to the Laboratory Director and other laboratory personnel as needed. Manages the activities of all administrative and clerical support staff. Responsible for the smooth administration of all office functions which includes, but is not limited to, reception, human resources, payroll, administrative support, facilities management, accounting, A/P, A/R, and invoicing activities, and EH&S.

- Supervises all clerical and administrative staff members to ensure duties are performed according to standard operating procedures.
- Audits timesheets and prepares payroll spreadsheet for biweekly submittal.
- Manages and supports human resources policies and activities.
- Provides recommendations to Laboratory Director on staffing needs within the administrative department.
- Assists with employee relations issues, as needed.
- Schedules facility maintenance and repair to ensure laboratory is operating within operational, security and safety requirements.
- Provides assistance with accounting, accounts payable, accounts receivable, and invoicing activities to ensure appropriate financial reporting.
- Coordinates purchasing activities for administrative items and for laboratory areas to provide departments with the proper supplies in a timely manner.

- Maintains petty cash fund and distributes funds as needed for the purchase of items for the laboratory.
- Assists in management of EH&S policies and procedures to ensure a safe and secure workplace for employees.
- Assists with receptionist/front desk and other clerical duties, as needed, in support of the administrative staff.
- Provides training for administrative personnel.
- Ensures human resources policies and programs are communicated in a timely manner to laboratory staff, providing training when needed.
- Oversees facility preparation for on-site meetings with clients to present a good image for TestAmerica.

4.2.12 EDD Coordinator

The Electronics Disc Deliverables Technician is responsible for producing accurate client electronic disc deliverables (EDD's) once specification and programming is completed. Coordinates with laboratory personnel to ensure data is entered in LIMS and is correct in format and content. Verifies that EDD's comply with client requirements.

- Scans and stores all incoming hardcopy data for completed package.
- Updates package due date list daily to stay informed of project deadlines.
- Creates and verifies electronic disc deliverables according to client specifications.
- Writes data to CD-ROM for client packages for paperless delivery.
- Performs IQ maintenance on project data so information is available for client use.
- Compiles and edits scanned Adobe files for delivery to client.
- Scans and posts all hardcopy materials on the network as needed.

4.2.13 QA Specialist

The QA Specialist is responsible for QA documentation and involvement in the following activities:

- Assist the QA Manager in performing the annual internal laboratory audits, compiling the evaluation, and coordinating the development of an action plan to address any deficiency identified.
- Facilitate external audits, coordinating with the QA Manager and Laboratory Staff to address any deficiencies noted at the time of the audit and subsequently presented in the final audit report.
- Assist the QA Manager in the preparation of new SOP's and in the maintenance of existing SOPs, coordinating annual reviews and updates.
- Manages the performance testing (PT) studies, coordinates follow up studies for failed analytes and works with QA Manager and Laboratory Staff to complete needed corrective action reports.

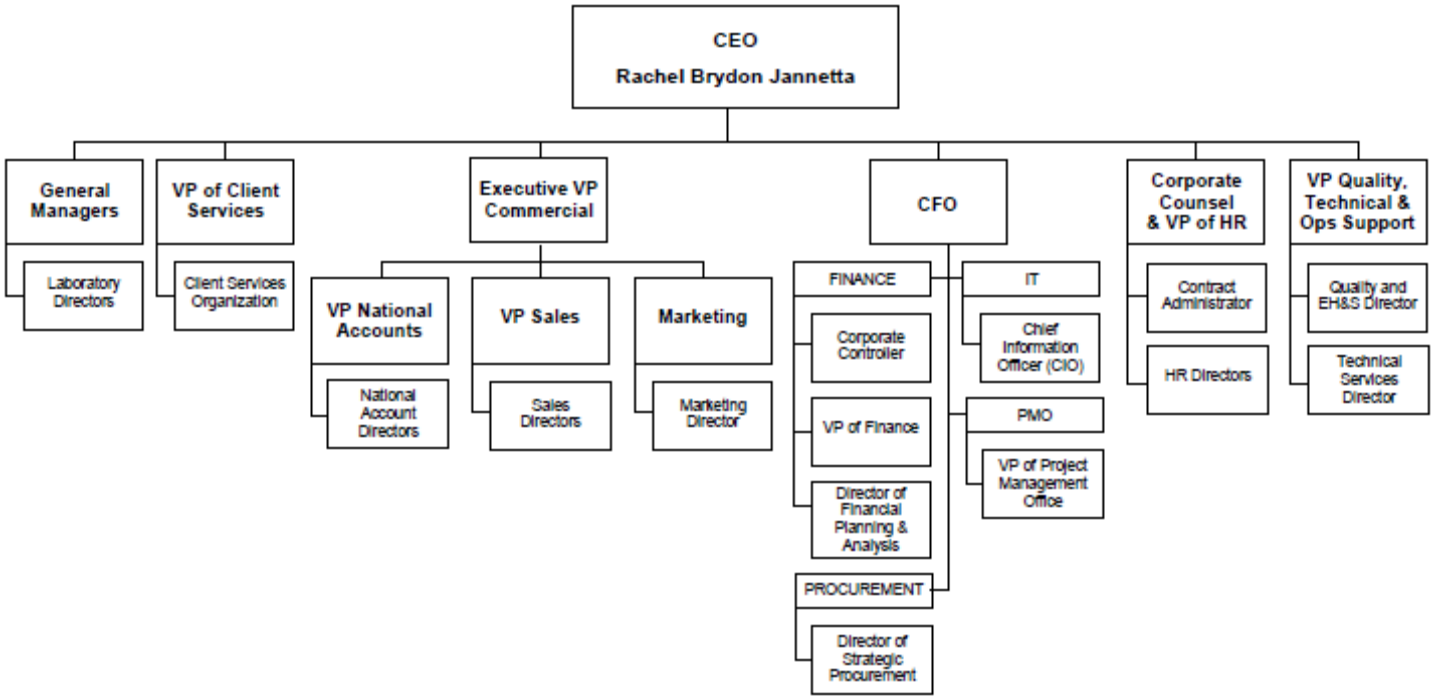
- Personnel training records review and maintenance.
- Document control maintenance.
- Manages certifications and accreditations.

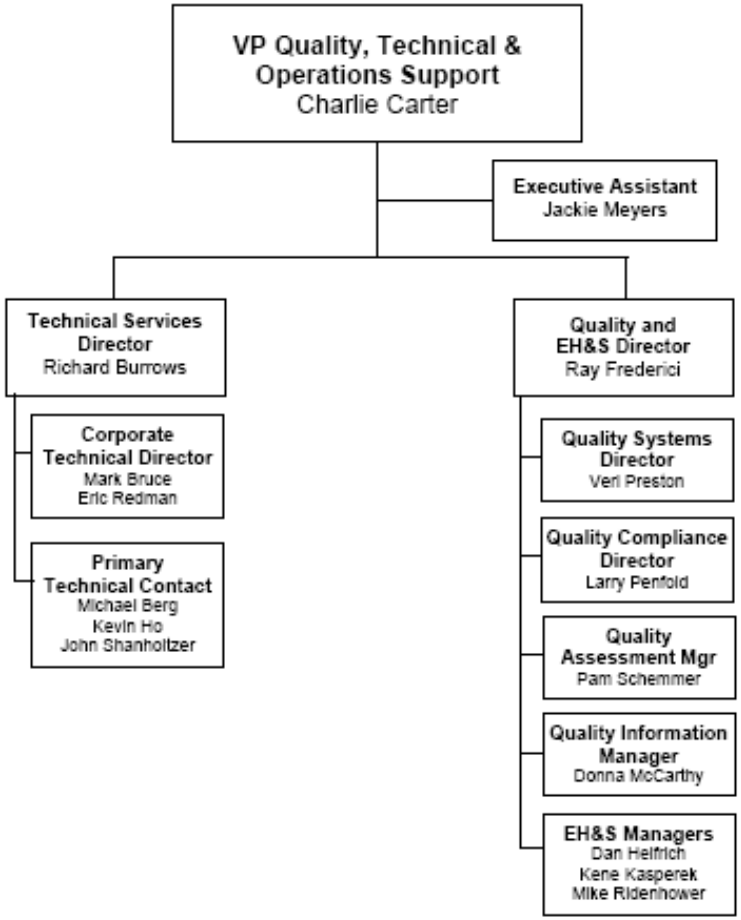
4.3 Deputies

The following table defines who assumes the responsibilities of key personnel in their absence:

Key Personnel	Deputy	Comment
Laboratory Director	Marty Edwards	
Quality Assurance Manager	Darlene Nelson	
Customer Service Manager	Stephanie Akers	
Operations Manager	Charles Newton	
Environmental Health & Safety Director	Maria Bundy	
Extractions Department Manager	Becky Tremmel	
GC Semivolatiles Department Manager	Kim Ayers	
GC Volatiles Department Manager	Lance Larson	
Metals Department Manager	Gary St. Pere	
Wet Chemistry Department Manager	Sharon Taber	

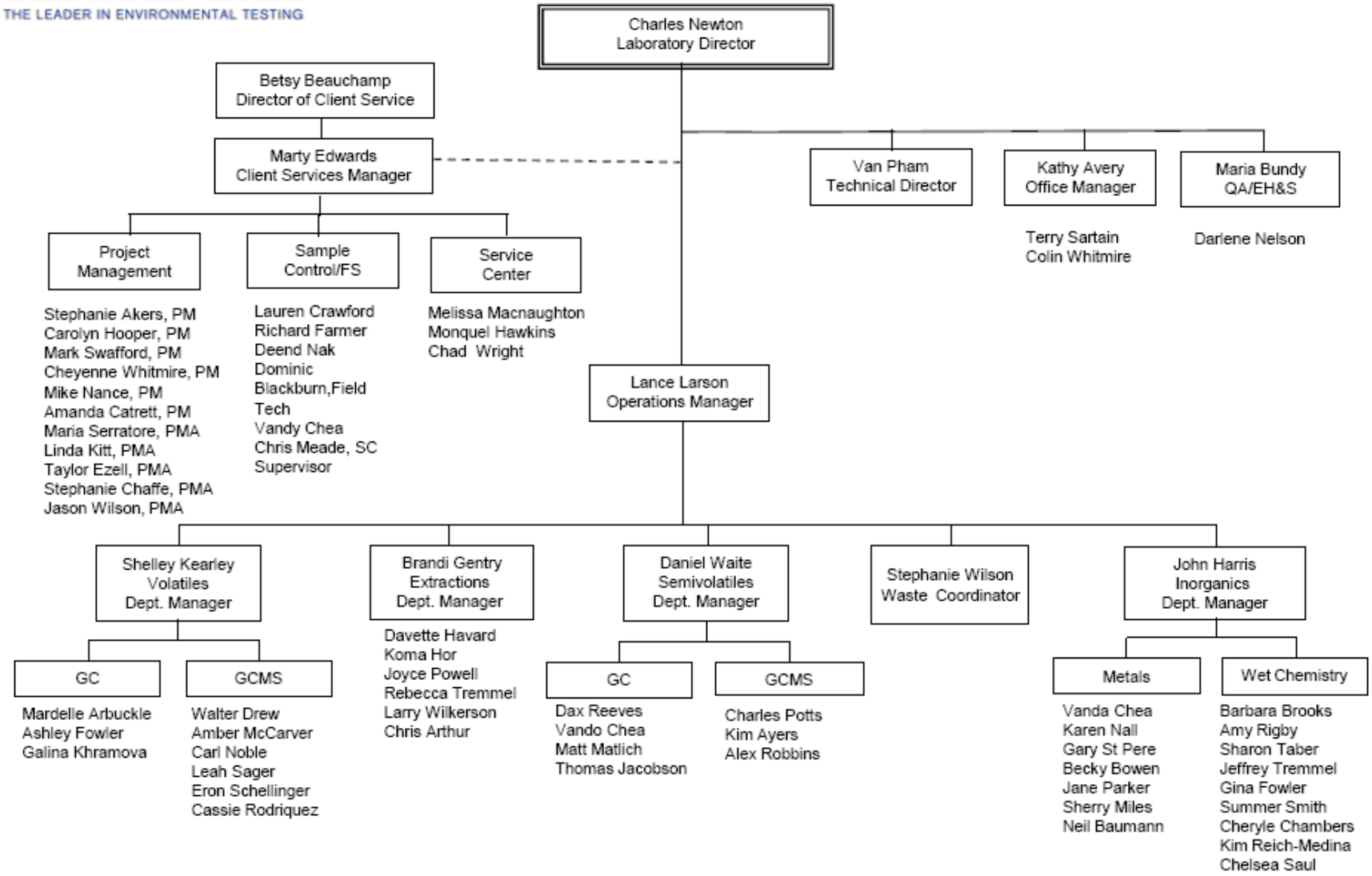
Figure 4-1. Corporate and Laboratory Organization Charts




VP Quality, Technical & Operations Support
Charlie Carter
Executive Assistant
Jackie Meyers
Technical Services Director
Richard Burrows
Corporate Technical Director
Mark Bruce
Eric Redman
Primary Technical Contact
Michael Berg
Kevin Ho
John Shanholtzer
Quality and EH&S Director
Ray Frederici
Quality Systems Director
Veri Preston
Quality Compliance Director
Larry Penfold
Quality Assessment Mgr
Pam Schemmer
Quality Information Manager
Donna McCarthy
EH&S Managers
Dan Helfrich
Kene Kasperek
Mike Ridenhower

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Pensacola Laboratory Organization



SECTION 5. QUALITY SYSTEM

5.1 Quality Policy Statement

It is TestAmerica's Policy to:

- Provide data of known quality to its clients by adhering to approved methodologies, regulatory requirements and the QA/QC protocols.
- Effectively manage all aspects of the laboratory and business operations by the highest ethical standards.
- Continually improve systems and provide support to quality improvement efforts in laboratory, administrative and managerial activities. TestAmerica recognizes that the implementation of a quality assurance program requires management's commitment and support as well as the involvement of the entire staff.
- Provide clients with the highest level of professionalism and the best service practices in the industry.
- To comply with the ISO/IEC 17025:2005(E) International Standard, the 2009 TNI Standard and to continually improve the effectiveness of the management system.

Every staff member at the laboratory plays an integral part in quality assurance and is held responsible and accountable for the quality of their work. It is, therefore, required that all laboratory personnel are trained and agree to comply with applicable procedures and requirements established by this document.

5.2 Ethics and Data Integrity

TestAmerica is committed to ensuring the integrity of its data and meeting the quality needs of its clients. The elements of TestAmerica's Ethics and Data Integrity Program include:

- An Ethics Policy (Corporate Policy No. CW-L-P-004) and Employee Ethics Statements.
- Ethics and Compliance Officers (ECOs).
- A Training Program.
- Self-governance through disciplinary action for violations.
- A Confidential mechanism for anonymously reporting alleged misconduct and a means for conducting internal investigations of all alleged misconduct. (Corporate SOP No. CW-L-S-002)
- Procedures and guidance for recalling data if necessary (Corporate SOP No. CW-L-S-002).
- Effective external and internal monitoring system that includes procedures for internal audits (Section 15).

- Produce results, which are accurate and include QA/QC information that meets client pre-defined Data Quality Objectives (DQOs).
- Present services in a confidential, honest and forthright manner.
- Provide employees with guidelines and an understanding of the Ethical and Quality Standards of our Industry.
- Operate our facilities in a manner that protects the environment and the health and safety of employees and the public.
- Obey all pertinent federal, state and local laws and regulations and encourage other members of our industry to do the same.
- Educate clients as to the extent and kinds of services available.
- Assert competency only for work for which adequate personnel and equipment are available and for which adequate preparation has been made.
- Promote the status of environmental laboratories, their employees, and the value of services rendered by them.

5.3 Quality System Documentation

The laboratory's Quality System is communicated through a variety of documents.

- Quality Assurance Manual – Each laboratory has a lab specific quality assurance manual.
- Corporate SOPs and Policies - Corporate SOPs and Policies are developed for use by all relevant laboratories. They are incorporated into the laboratory's normal SOP distribution, training and tracking system. Corporate SOPs may be general or technical.
- Work Instructions - A subset of procedural steps, tasks or forms associated with an operation of a management system (e.g., checklists, preformatted bench sheets, forms).
- Laboratory SOPs – General and Technical
- Laboratory QA/QC Policy Memorandums

5.3.1 Order of Precedence

In the event of a conflict or discrepancy between policies, the order of precedence is as follows:

- Corporate Quality Management Plan (CQMP)
- Corporate SOPs and Policies
- Laboratory QA/QC Policy Memorandum
- Laboratory Quality Assurance Manual (QAM)
- Laboratory SOPs and Policies
- Other (Work Instructions (WI), memos, flow charts, etc.)

Note: The laboratory has the responsibility and authority to operate in compliance with regulatory requirements of the jurisdiction in which the work is performed. Where the CQMP conflicts with those regulatory requirements, the regulatory requirements of the jurisdiction shall hold primacy. The laboratory's QAM shall take precedence over the CQMP in those cases.

5.4 QA/QC Objectives for the Measurement of Data

Quality Assurance (QA) and Quality Control (QC) are activities undertaken to achieve the goal of producing data that accurately characterize the sites or materials that have been sampled. Quality Assurance is generally understood to be more comprehensive than Quality Control. Quality Assurance can be defined as the integrated system of activities that ensures that a product or service meets defined standards.

Quality Control is generally understood to be limited to the analyses of samples and to be synonymous with the term *"analytical quality control"*. QC refers to the routine application of statistically based procedures to evaluate and control the accuracy of results from analytical measurements. The QC program includes procedures for estimating and controlling precision and bias and for determining reporting limits.

Request for Proposals (RFPs) and Quality Assurance Project Plans (QAPP) provide a mechanism for the client and the laboratory to discuss the data quality objectives in order to ensure that analytical services closely correspond to client needs. The client is responsible for developing the QAPP. In order to ensure the ability of the laboratory to meet the Data Quality Objectives (DQOs) specified in the QAPP, clients are advised to allow time for the laboratory to review the QAPP before being finalized. Additionally, the laboratory will provide support to the client for developing the sections of the QAPP that concern laboratory activities.

Historically, laboratories have described their QC objectives in terms of precision, accuracy, representativeness, comparability, completeness, selectivity and sensitivity (PARCCSS).

5.4.1 Precision

The laboratory objective for precision is to meet the performance for precision demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Precision is defined as the degree of reproducibility of measurements under a given set of analytical conditions (exclusive of field sampling variability). Precision is documented on the basis of replicate analysis, usually duplicate or matrix spike (MS) duplicate samples.

5.4.2 Accuracy

The laboratory objective for accuracy is to meet the performance for accuracy demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Accuracy is defined as the degree of bias in a measurement system. Accuracy may be documented through the use of laboratory control samples (LCS) and/or MS. A statement of accuracy is expressed as an interval of acceptance recovery about the mean recovery.

5.4.3 Representativeness

The laboratory objective for representativeness is to provide data which is representative of the sampled medium. Representativeness is defined as the degree to which data represent a characteristic of a population or set of samples and is a measurement of both analytical and

field sampling precision. The representativeness of the analytical data is a function of the procedures used in procuring and processing the samples. The representativeness can be documented by the relative percent difference between separately procured, but otherwise identical samples or sample aliquots.

The representativeness of the data from the sampling sites depends on both the sampling procedures and the analytical procedures. The laboratory may provide guidance to the client regarding proper sampling and handling methods in order to assure the integrity of the samples.

5.4.4 Comparability

The comparability objective is to provide analytical data for which the accuracy, precision, representativeness and reporting limit statistics are similar to these quality indicators generated by other laboratories for similar samples, and data generated by the laboratory over time.

The comparability objective is documented by inter-laboratory studies carried out by regulatory agencies or carried out for specific projects or contracts, by comparison of periodically generated statements of accuracy, precision and reporting limits with those of other laboratories.

5.4.5 Completeness

The completeness objective for data is 90% (or as specified by a particular project), expressed as the ratio of the valid data to the total data over the course of the project. Data will be considered valid if they are adequate for their intended use. Data usability will be defined in a QAPP, project scope or regulatory requirement. Data validation is the process for reviewing data to determine its usability and completeness. If the completeness objective is not met, actions will be taken internally and with the data user to improve performance. This may take the form of an audit to evaluate the methodology and procedures as possible sources for the difficulty or may result in a recommendation to use a different method.

5.4.6 Selectivity

Selectivity is defined as: The capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. Target analytes are separated from non-target constituents and subsequently identified/detected through one or more of the following, depending on the analytical method: extractions (separation), digestions (separation), interelement corrections (separation), use of matrix modifiers (separation), specific retention times (separation and identification), confirmations with different columns or detectors (separation and identification), specific wavelengths (identification), specific mass spectra (identification), specific electrodes (separation and identification), etc..

5.4.7 Sensitivity

Sensitivity refers to the amount of analyte necessary to produce a detector response that can be reliably detected (Method Detection Limit) or quantified (Reporting Limit).

5.5 Criteria for Quality Indicators

The laboratory maintains a Quality Control Limit Summary that contains tables that summarize the precision and accuracy acceptability limits for performed analyses. This summary includes an effective date, is updated each time new limits are generated and are managed by the laboratory's QA department. Unless otherwise noted, limits within these tables are laboratory generated. Some acceptability limits are derived from US EPA methods when they are required. Where US EPA method limits are not required, the laboratory has developed limits from evaluation of data from similar matrices. Criteria for development of control limits is contained in laboratory SOP PS-QAD-003, Calculation of Control Limits, and Section 24 of this document.

5.6 Statistical Quality Control

Statistically-derived precision and accuracy limits are required by selected methods (such as SW-846) and programs [such as the Ohio Voluntary Action Plan (VAP)]. The laboratory routinely utilizes statistically-derived limits to evaluate method performance and determine when corrective action is appropriate. The analysts are instructed to use the current limits in the laboratory (dated and approved by the Technical Manager and QA Manager) and derived from the Laboratory Information Management System (LIMS). The Quality Assurance department maintains an archive of all limits used within the laboratory in both the LIMS and QAM. If a method defines the QC limits, these method limits are used.

If a method requires the generation of historical limits, the lab develops such limits from recent data in the QC database of the LIMS following the guidelines described in Section 24. All calculations and limits are documented and dated when approved and effective. On occasion, a client requests contract-specified limits for a specific project.

Current QC limits are entered and maintained in the LIMS analyte database. As sample results and the related QC are entered into LIMS, the sample QC values are compared with the limits in LIMS to determine if they are within the acceptable range. The analyst then evaluates if the sample needs to be rerun or re-extracted/rerun or if a comment should be added to the report explaining the reason for the QC outlier.

5.6.1 QC Charts

As the QC limits are calculated, QC charts are generated by the LIMS showing warning and control limits for the purpose of evaluating trends. The charts are saved by the LIMS system as directed by the QA Manager. The QA Manager evaluates these to determine if adjustments need to be made or for corrective actions to methods. All findings are documented and kept on file.

5.7 Quality System Metrics

In addition to the QC parameters discussed above, the entire Quality System is evaluated on a monthly basis through the use of specific metrics (refer to Section 16). These metrics are used to drive continuous improvement in the laboratory's Quality System.

SECTION 6. DOCUMENT CONTROL

6.1 Overview

The QA Department is responsible for the control of documents used in the laboratory to ensure that approved, up-to-date documents are in circulation and out-of-date (obsolete) documents are archived or destroyed. The following documents, at a minimum, must be controlled:

- Laboratory Quality Assurance Manual
- Laboratory Standard Operating Procedures (SOP)
- Laboratory Policies
- Work Instructions and Forms
- Corporate Policies and Procedures distributed outside the intranet

Corporate Quality posts Corporate Manuals, SOPs, Policies, Work Instructions, White Papers and Training Materials on the company intranet site. These Corporate documents are only considered controlled when they are read on the intranet site. Printed copies are considered uncontrolled unless the laboratory physically distributes them as controlled documents. A detailed description of the procedure for issuing, authorizing, controlling, distributing, and archiving Corporate documents is found in Corporate SOP No. CW-Q-S-001, Corporate Document Control and Archiving. The laboratory's internal document control procedure is defined in SOP PS-LAB-001 (Document Control).

The laboratory QA Department also maintains access to various references and document sources integral to the operation of the laboratory. This includes reference methods and regulations. Instrument manuals (hard or electronic copies) are also maintained by the laboratory.

The laboratory maintains control of records for raw analytical data and supporting records such as audit reports and responses, logbooks, standard logs, training files, MDL studies, Proficiency Testing (PT) studies, certifications and related correspondence, and non conformance memos (NCMs), Out of Control Event forms and Corrective Action Reports. Raw analytical data consists of bound logbooks, instrument printouts, any other notes, magnetic media, electronic data and final reports.

6.2 Document Approval and Issue

The pertinent elements of a document control system for each document include a unique document title and number, pagination, the total number of pages of the item or an 'end of document' page, the effective date, revision number and the laboratory's name. The QA personnel are responsible for the maintenance of this system.

Controlled documents are authorized by the QA Department and other management. In order to develop a new document, a technical manager should submit an electronic draft to the QA Department for suggestions and approval before use. Upon approval, QA personnel add the identifying version information to the document and retain that document as the official document on file. That document is then provided to all applicable operational units (may include electronic access). Controlled documents are identified as such and records of their

distribution are kept by the QA Department. Document control may be achieved by either electronic or hardcopy distribution.

The QA Department maintains a list of the official versions of controlled documents. Laboratory SOPs will be reviewed at least once every two years. SOPs related to drinking water analysis will be reviewed annually.

Quality System Policies and Procedures will be reviewed at a minimum of every year and revised as appropriate. Changes to documents occur when a procedural change warrants a revision of the document.

6.3 Procedures for Document Control Policy

For changes to the QA Manual, an electronic version of the section being revised must be submitted to the QA Manager for update and approval. When the revision has been completed and a new revision number is issued to the section, it will be controlled and distributed for training. Uncontrolled copies must not be used within the laboratory. Previous revisions and back-up data are stored by the QA department. Electronic copies are stored on the server (corp-fs-02\analytical\Public) in the CONTROLLED SOP's folder.

For changes to SOPs, the person initiating the revision must submit an electronic or hand corrected hard copy to the QA Manager for approval. The SOP will then be controlled and a new revision number and effective date will be given to the document. The revisions made to the document will be tracked in the last section of the SOP. The document will then be issued for management signatures. A training copy will be issued with a training form to the appropriate departments. The controlled copy will be saved to the CONTROLLED DOCUMENTS on the server.

Forms, worksheets, work instructions and information are organized by department in the appropriate SOP. Electronic versions are kept on the QA Directory department and on the server in the DMQC directory as .pdf.

6.4 Obsolete Documents

All invalid or obsolete documents are removed, or otherwise prevented from unintended use. The laboratory has specific procedures as described above to accomplish this. In general, obsolete documents are collected from employees according to distribution lists and are marked obsolete on the cover or destroyed. At least one copy of the obsolete document is archived as described in Section 14.

SECTION 7. SERVICE TO THE CLIENT

7.1 Overview

The laboratory has established procedures for the review of work requests and contracts, oral or written. The procedures include evaluation of the laboratory's capability and resources to meet the contract's requirements within the requested time period. All requirements, including the methods to be used, must be adequately defined, documented and understood. For many environmental sampling and analysis programs, testing design is site or program specific and does not necessarily "fit" into a standard laboratory service or product. It is the laboratory's intent to provide both standard and customized environmental laboratory services to our clients.

A thorough review of technical and QC requirements contained in contracts is performed to ensure project success. The appropriateness of requested methods, and the lab's capability to perform them must be established. Projects, proposals and contracts are reviewed for adequately defined requirements and TestAmerica's capability to meet those requirements. Alternate test methods that are capable of meeting the clients' requirements may be proposed by the lab. A review of the lab's capability to analyze non-routine analytes is also part of this review process.

All projects, proposals and contracts are reviewed for the client's requirements in terms of compound lists, test methodology requested, sensitivity (detection and reporting levels), accuracy, and precision requirements (% Recovery and RPD). The reviewer ensures that the laboratory's test methods are suitable to achieve the requirements and that the laboratory holds the appropriate certifications and approvals to perform the work. The laboratory and any potential subcontract laboratories must be certified, as required, for all proposed tests.

The laboratory must determine if it has the necessary physical, personnel and information resources to meet the contract, and if the personnel have the expertise needed to perform the testing requested. Each proposal is checked for its impact on the capacity of the laboratory's equipment and personnel. As part of the review, the proposed turnaround time will be checked for feasibility.

Electronic or hard copy deliverable requirements are evaluated against the laboratory's capacity for production of the documentation.

If the laboratory cannot provide all services but intends to subcontract such services, whether to another TestAmerica facility or to an outside firm, this will be documented and discussed with the client prior to contract approval. (Refer to Section 8 for Subcontracting Procedures.)

The laboratory 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 complete the work satisfactorily. Any discrepancy between the client's requirements and the laboratory's capability to meet those requirements is resolved in writing before acceptance of the contract. It is necessary that the contract be acceptable to both the laboratory and the client. Amendments initiated by the client and/or TestAmerica, are documented in writing.

All contracts, QAPPs, Sampling and Analysis Plans (SAPs), contract amendments, and documented communications become part of the project record.

The same contract review process used for the initial review is repeated when there are amendments to the original contract by the client, and the participating personnel are informed of the changes.

7.2 Review Sequence and Key Personnel

Appropriate personnel will review the work request at each stage of evaluation.

For routine projects and other simple tasks, a review by the Project Manager (PM) is considered adequate. The PM confirms that the laboratory has any required certifications, that it can meet the clients' data quality and reporting requirements and that the lab has the capacity to meet the clients turn around needs. It is recommended that, where there is a sales person assigned to the account, an attempt should be made to contact that sales person to inform them of the incoming samples.

For new, complex or large projects, the proposed contract is given to the National Account Director, who will decide which lab will receive the work based on the scope of work and other requirements, including certification, testing methodology, and available capacity to perform the work. The contract review process is outlined in TestAmerica's Corporate SOP No. CA-L-P-002**,** Contract Compliance Policy.

This review encompasses all facets of the operation. The scope of work is distributed to the appropriate personnel, as needed based on scope of contract, to evaluate all of the requirements shown above (not necessarily in the order below):

- Contract Administrator
- VP of Operations
- The Laboratory Director
- The Laboratory Client Service Manager
- The Laboratory Project Manager
- The Laboratory Operations Manager
- Laboratory Department Managers
- Corporate Information Technology Managers
- Regional and/or National Account representatives
- Laboratory and/or Corporate Quality
- Laboratory and/or Corporate Environmental Health and Safety Managers/Directors
- The Laboratory Director reviews the formal laboratory quote and makes final acceptance for their facility.

The National Account Director, Contract Administrator, or local account representative then submits the final proposal to the client.

In the event that one of the above personnel is not available to review the contract, his or her back-up will fulfill the review requirements.

The Contracts Department maintains copies of all signed contracts. All contracts are maintained by the laboratory Office Manager.

7.3 Documentation

Appropriate records are maintained for every contract or work request. All stages of the contract review process are documented and include records of any significant changes. Copies of these records are maintained by the Office Manager.

The contract will be distributed to and maintained by the appropriate sales/marketing personnel and the Regional Account Manager. A copy of the contract and formal quote will be filed with the laboratory Office Manager, PM and the Lab Director.

Records are maintained of 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. The PM keeps a phone log of conversations with the client. Each PM tracks their phone log by date.

7.3.1 Project-Specific Quality Planning

Communication of contract specific technical and QC criteria is an essential activity in ensuring the success of site specific testing programs. To achieve this goal, the laboratory assigns a PM to each client. The PM is the first point of contact for the client. It is the PM's responsibility to ensure that project specific technical and QC requirements are effectively evaluated and communicated to the laboratory personnel before and during the project. QA department involvement may be needed to assist in the evaluation of custom QC requirements.

PM's are the primary client contact and they ensure resources are available to meet project requirements. Although PM's do not have direct reports or staff in production, they coordinate opportunities and work with laboratory management and supervisory staff to ensure available resources are sufficient to perform work for the client's project. Project management is positioned between the client and laboratory resources.

Prior to work on a new project, the dissemination of project information and/or project opening meetings may occur to discuss schedules and unique aspects of the project. Items to be discussed may include the project technical profile, turnaround times, holding times, methods, analyte lists, reporting limits, deliverables, sample hazards, or other special requirements. The PM introduces new projects to the supervisory staff during production meetings. These meetings provide direction to the laboratory staff in order to maximize production and client satisfaction, while maintaining quality. In addition, project notes may be associated with each sample batch as a reminder upon sample receipt and analytical processing.

During the project, any change that may occur within an active project is agreed upon between the client/regulatory agency and the PM/laboratory. These changes (e.g., use of a non-standard method or modification of a method) and approvals must be documented prior to implementation. Documentation pertains to any document, e.g., letter, e-mail, variance, contract addendum, which has been signed by both parties. (It should be noted that South Carolina does not allow modifications to approved methods or standard operating procedures unless the criteria is stricter than the written method.)

Such changes are also communicated to the laboratory supervisory staff by e-mail or production meeting. Such changes are updated to the project notes and are introduced to the managers at these meetings. The laboratory staff is then introduced to the modified requirements via the Technical Manager. After the modification is implemented into the laboratory process, documentation of the modification is made in the case narrative of the data report(s).

The laboratory strongly encourages client visits to the laboratory and for formal/informal information sharing session with employees in order to effectively communicate ongoing client needs as well as project specific details for customized testing programs.

7.4 Special Services

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. It is the laboratory's goal to meet all client requirements in addition to statutory and regulatory requirements discussed in Section 5. The laboratory has procedures to ensure confidentiality to clients (Section 17 and 25).

Note: ISO 17025 states that a laboratory "shall afford clients or their representatives cooperation to clarify the client's request". This topic is discussed in Section 7.

The laboratory's standard procedures for reporting data are described in Section 25. Special services are also available and provided upon request. These services include:

- Reasonable access for our clients or their representatives to the relevant areas of the laboratory for the witnessing of tests performed for the client.
- Assist client-specified third party data validators as specified in the client's contract.
- Supplemental information pertaining to the analysis of their samples. Note: An additional charge may apply for additional data/information that was not requested prior to the time of sample analysis or previously agreed upon.

7.5 Client Communication

Project managers are the primary-communication link to the clients. They shall inform their clients of any delays in project completion as well as any non-conformances in either sample receipt or sample analysis. Project management will maintain ongoing client communication throughout the entire client project.

Technical Managers or the Operations Manager are available to discuss any technical questions or concerns that the client may have.

7.6 Reporting

The laboratory works with our clients to produce any special communication reports required by the contract.

7.7 Client Surveys

The laboratory assesses both positive and negative client feedback. The results are used to improve overall laboratory quality and client service. TestAmerica's Sales and Marketing teams periodically develops lab and client specific surveys to assess client satisfaction.

SECTION 8. SUBCONTRACTING OF TESTS

8.1 Overview

For the purpose of this quality manual, the phrase subcontract laboratory refers to a laboratory external to the TestAmerica laboratories. The phrase "work sharing" refers to internal transfers of samples between the TestAmerica laboratories. The term outsourcing refers to the act of subcontracting tests.

When contracting with our clients, the laboratory makes commitments regarding the services to be performed and the data quality for the results to be generated. When the need arises to outsource testing for our clients because project scope, changes in laboratory capabilities, capacity or unforeseen circumstances, we must be assured that the subcontractors or work sharing laboratories understand the requirements and will meet the same commitments we have made to the client. Refer to TestAmerica's Corporate SOP's on Subcontracting Procedures (CA-L-S-002).

When outsourcing analytical services, the laboratory will assure, to the extent necessary, that the subcontract or work sharing laboratory maintains a program consistent with the requirements of this document, the requirements specified in TNI/ISO 17025 and/or the client's Quality Assurance Project Plan (QAPP). All QC guidelines specific to the client's analytical program are transmitted to the subcontractor and agreed upon before sending the samples to the subcontract facility. Additionally, work requiring accreditation will be placed with an appropriately accredited laboratory. The laboratory performing the subcontracted work will be identified in the final report, as will non-TNI accredited work where required.

Project Managers (PMs), Client Service Managers (CSM), or Account Executives (AE) for the Export Lab (TestAmerica laboratory that transfers samples to another laboratory) are responsible for obtaining client approval prior to subcontracting any samples. The laboratory will advise the client of a subcontract arrangement in writing and when possible approval from the client shall be retained in the project folder. Standard TestAmerica Terms & Conditions include the flexibility to subcontract samples within the TestAmerica laboratories. Therefore, additional advance notification to clients for intra-laboratory subcontracting is not necessary unless specifically required by a client contract.

Note: In addition to the client, some regulating agencies (e.g, USDA) or contracts (e.g, certain USACE projects) may require notification prior to placing such work**.**

8.2 Qualifying and Monitoring Subcontractors

Whenever a PM or Account Executive (AE) or Client Service Manager (CSM) becomes aware of a client requirement or laboratory need where samples must be outsourced to another laboratory, the other laboratory(s) shall be selected based on the following:

- The first priority is to attempt to place the work in a qualified TestAmerica laboratory;
- Firms specified by the client for the task (Documentation that a subcontractor was designated by the client must be maintained with the project file. This documentation can be as simple as placing a copy of an e-mail from the client in the project folder);
- Firms listed as pre-qualified and currently under a subcontract with TestAmerica: A listing of all approved subcontracting laboratories is available on the TestAmerica intranet site.

Supporting documentation is maintained by corporate offices and by the TestAmerica laboratory originally requesting approval of the subcontract lab. Verify necessary accreditation, where applicable, (e.g., on the subcontractors TNI, A2LA accreditation or State Certification).

- Firms identified in accordance with the company's Small Business Subcontracting program as small, women-owned, veteran-owned and/or minority-owned businesses;
- TNI or A2LA accredited laboratories.
- In addition, the firm must hold the appropriate certification to perform the work required.

All TestAmerica laboratories are pre-qualified for work sharing provided they hold the appropriate accreditations, can adhere to the project/program requirements, and the client approved sending samples to that laboratory. The client must provide acknowledgement that the samples can be sent to that facility (an e-mail is sufficient documentation or if acknowledgement is verbal, the date, time, and name of person providing acknowledgement must be documented). The originating laboratory is responsible for communicating all technical, quality, and deliverable requirements as well as other contract needs.

When the potential sub-contract laboratory has not been previously approved, Account Executives or PMs may nominate a laboratory as a subcontractor based on need. The decision to nominate a laboratory must be approved by the Laboratory Director/Manager. The Laboratory Director requests that the QA Manager begin the process of approving the subcontract laboratory as outlined in Corporate SOP No. CA-L-S-002, Subcontracting Procedures. The client must provide acknowledgement that the samples can be sent to that facility (an e-mail is sufficient documentation or if acknowledgement is verbal, the date, time, and name of person providing acknowledgement must be documented).

8.2.1 Once the appropriate accreditation and legal information is received by the laboratory, it is evaluated for acceptability (where applicable) and forwarded to the Corporate Quality Information Manager (QIM) for review. Once all documents are reviewed for completeness, the Corporate QIM will forward the documents to the Purchasing Manager for formal signature and contracting with the laboratory. The approved vendor will be added to the approved subcontractor list on the intranet site and the finance group is concurrently notified for JD Edwards.

8.2.2 The client will assume responsibility for the quality of the data generated from the use of a subcontractor they have requested the lab to use. The qualified subcontractors on the intranet site are known to meet minimal standards. TestAmerica does not certify laboratories. The subcontractor is on our approved list and can only be recommended to the extent that we would use them.

8.2.3 The status and performance of qualified subcontractors will be monitored periodically by the Corporate Contracts and/or Quality Departments. Any problems identified will be brought to the attention of TestAmerica's Corporate Finance or Corporate Quality personnel.

- Complaints shall be investigated. Documentation of the complaint, investigation and corrective action will be maintained in the subcontractor's file on the intranet site. Complaints are posted using the Vendor Performance Report.
- Information shall be updated on the intranet when new information is received from the subcontracted laboratories.

- Subcontractors in good standing will be retained on the intranet listing. The QA Manager will notify all TestAmerica laboratories, Corporate Quality and Corporate Contracts if any laboratory requires removal from the intranet site. This notification will be posted on the intranet site and e-mailed to all Laboratory Directors/Managers, QA Managers and Sales Personnel.

8.3 Oversight and Reporting

The PM must request that the selected subcontractor be presented with a subcontract, if one is not already executed between the laboratory and the subcontractor. The subcontract must include terms which flow down the requirements of our clients, either in the subcontract itself or through the mechanism of work orders relating to individual projects. A standard subcontract and the Lab Subcontractor Vendor Package (posted on the intranet) can be used to accomplish this, and Corporate Counsel can tailor the document or assist with negotiations, if needed. The PM (or EDS, AEs or CSM, etc.) responsible for the project must advise and obtain client consent to the subcontract as appropriate, and provide the scope of work to ensure that the proper requirements are made a part of the subcontract and are made known to the subcontractor.

Prior to sending samples to the subcontracted laboratory, the PM confirms their certification status to determine if it's current and scope-inclusive. The information is documented on a Subcontracted Sample Form (Figure 8-1) and the form is retained in the project folder. For TestAmerica laboratories, certifications can be viewed on the company's TotalAccess Database.

The Sample Control department is responsible for ensuring compliance with QA requirements and applicable shipping regulations when shipping samples to a subcontracted laboratory.

All subcontracted samples must be accompanied by a TestAmerica Chain of Custody (COC). A copy of the original COC sent by the client must also be included with all samples workshared within TestAmerica. Client CoCs are only forwarded to external subcontractors when samples are shipped directly from the project site to the subcontractor lab. Under routine circumstances, client CoCs are not provided to external subcontractors.

Through communication with the subcontracted laboratory, the PM monitors the status of the subcontracted analyses, facilitates successful execution of the work, and ensures the timeliness and completeness of the analytical report.

Non-TNI accredited work must be identified in the subcontractor's report as appropriate. If TNI accreditation is not required, the report does not need to include this information.

Reports submitted from subcontractor laboratories are not altered and are included in their original form in the final project report. This clearly identifies the data as being produced by a subcontractor facility. If subcontract laboratory data is incorporated into the laboratories EDD (i.e., imported), the report must explicitly indicate which lab produced the data for which methods and samples.

Note: The results submitted by a TestAmerica work sharing laboratory may be transferred electronically and the results reported by the TestAmerica work sharing lab are identified on the

final report. The report must explicitly indicate which lab produced the data for which methods and samples. The final report must include a copy of the completed COC for all work sharing reports.

8.4 Contingency Planning

The Laboratory Director may waive the full qualification of a subcontractor process temporarily to meet emergency needs; however, this decision & justification must be documented in the project files, and the 'Purchase Order Terms And Conditions For Subcontracted Laboratory Services' must be sent with the samples and Chain-of-Custody. In the event this provision is utilized, the laboratory (e.g., PM) will be required to verify and document the applicable accreditations of the subcontractor. All other quality and accreditation requirements will still be applicable, but the subcontractor need not have signed a subcontract with TestAmerica at this time. The comprehensive approval process must then be initiated within 30 calendar days of subcontracting.

Figure 8-1.

Subcontracted Sample Form

Date/Time: _____

Subcontracted Laboratory Information:

- Subcontractor's Name: _____
- Subcontractor Point of Contact: _____
- Subcontractor's Address: _____
- Subcontractor's Phone: _____
- Analyte/Method: _____
- Certified for State of Origin: _____
- TNI Certified: Yes_____No_____
- USDA Permit (__Domestic __ Foreign) Yes_____No_____
- A2LA (or ISO 17025) Certified: Yes_____No_____
- CLP-like Required: Yes_____No_____
  (Full doc required)
- Requested Sample Due Date: _____
  (Must be put on COC)
- Client POC Approval on-file to Subcontract Samples to Sub Laboratory: Yes_____No_____

Project Manager: _____

Laboratory Sample # Range: _____
(Only of Subcontracted Samples)

Laboratory Project Number (Billing Control #): _____

All subcontracted samples are to be sent via bonded carrier and Priority Overnight. Please attach tracking number below and maintain these records in the project files.

PM Signature_____**Date**_____

SECTION 9. PURCHASING SERVICES AND SUPPLIES

9.1 Overview

Evaluation and selection of suppliers and vendors is performed, in part, on the basis of the quality of their products, their ability to meet the demand for their products on a continuous and short term basis, the overall quality of their services, their past history, and competitive pricing. This is achieved through evaluation of objective evidence of quality furnished by the supplier, which can include certificates of analysis, recommendations, and proof of historical compliance with similar programs for other clients. To ensure that quality critical consumables and equipment conform to specified requirements, which may affect quality, all purchases from specific vendors are approved by a member of the supervisory or management staff. Capital expenditures are made in accordance with TestAmerica's Corporate Controlled Purchases Procedure, SOP No. CW-F-S-007.

Contracts will be signed in accordance with TestAmerica's Company-wide Authorization Matrix Policy, Policy No. CW-F-P-002. Request for Proposals (RFP's) will be issued where more information is required from the potential vendors than just price. Process details are available in TestAmerica's Corporate Procurement and Contracts Policy (Policy No. CW-F-P-004). RFP's allow TestAmerica to determine if a vendor is capable of meeting requirements such as supplying all of the TestAmerica facilities, meeting required quality standards and adhering to necessary ethical and environmental standards. The RFP process also allows potential vendors to outline any additional capabilities they may offer.

9.2 Glassware

Glassware used for volumetric measurements must be Class A or verified for accuracy according to laboratory procedure. Pyrex (or equivalent) glass should be used where possible. For safety purposes, thick-wall glassware should be used where available.

9.3 Reagents, Standards & Supplies

Chemical reagents, solvents, glassware, and general supplies are ordered as needed to maintain sufficient quantities on hand. Purchasing guidelines for equipment and reagents must meet with the requirements of the specific method and testing procedures for which they are being purchased. Solvents and acids are pre-tested in accordance with Corporate SOP on Solvent & Acid Lot Testing & Approval, SOP No. CA-Q-S-001.

9.3.1 Purchasing

Chemical reagents, solvents, glassware, and general supplies are ordered as needed to maintain sufficient quantities on hand. Materials used in the analytical process must be of a known quality. The wide variety of materials and reagents available makes it advisable to specify recommendations for the name, brand, and grade of materials to be used in any determination. This information is contained in the method SOP. The analyst completes the Requisition Order Sheet (Figure 9-1) when requesting reagents, standards, or supplies. The analyst may check the item out of the on-site consignment system that contains items approved for laboratory use.

The analyst must provide the item number, item description, package size, catalogue page number, price and the quantity needed. If an item being ordered is not the exact item requested, approval must be obtained from the department manager prior to placing the order. The Office Manager places the order.

9.3.2 Receiving

It is the responsibility of the Office Manager to receive the shipment. It is the responsibility of the employee who ordered the materials to date the material when received. Once the ordered reagents or materials are received, the employee compares the information on the label or packaging to the original order to ensure that the purchase meets the quality level specified. Safety Data Sheets (SDSs) are available online through the Company's intranet website. MSDSs that are received with shipments should be turned into the Office Manager. Anyone may review these for relevant information on the safe handling and emergency precautions of on-site chemicals.

9.3.3 Specifications

Generally the methods used by the laboratory specify the grade of solvents, reagents, and chemical standards that must be used, and the laboratory's analytical procedures shall specify an equivalent or higher grade. If the quality of those materials is not specified in the methods, analytical reagent grade will be used whenever commercially available. For some materials (e.g., chemical standards containing mixtures of organic compounds), reagent grade may not be commercially available, and the laboratory shall procure materials prepared from raw materials with a purity of 95% or greater. It is the responsibility of the analyst to check the procedure carefully for the suitability of grade of reagent.

Chemicals must not be used past the manufacturer's expiration date and must not be used past the expiration time noted in a method SOP. If expiration dates are not provided, the laboratory may contact the manufacturer to determine an expiration date.

The laboratory assumes a five year expiration date on inorganic dry chemicals and solvents unless noted otherwise by the manufacturer or by the reference source method. Chemicals/solvents should not be used past the manufacturer's or SOPs expiration date unless 'verified' (refer to item 3 listed below).

- An expiration date can not be extended if the dry chemical/solvent is discolored or appears otherwise physically degraded, the dry chemical must be discarded.

- Expiration dates can be extended if the dry chemical/solvent is found to be satisfactory based on acceptable performance of quality control samples (Continuing Calibration Verification (CCV), Blanks, Laboratory Control Sample (LCS), etc.).

- If the dry chemical/solvent is used for the preparation of standards, the expiration dates can be extended 6 months if the dry chemical is compared to an unexpired independent source in performing the method and the performance of the dry chemical/solvent is found to be satisfactory. The comparison must show that the dry chemical/solvent meets CCV limits. The comparison studies are maintained in the department.

Wherever possible, standards must be traceable to national or international standards of measurement or to national or international reference materials. Records to that effect are available to the user.

Compressed gases in use are checked for pressure and secure positioning daily. To prevent a tank from going to dryness or introducing potential impurities, the pressure should be closely watched as it decreases to approximately 15% of the original reading, at which point it should be replaced. For example, a standard sized laboratory gas cylinder containing 3,000 psig of gas should be replaced when it drops to approximately 500 psig. The quality of the gases must meet method or manufacturer specification or be of a grade that does not cause any analytical interference.

Water used in the preparation of standards or reagents must have a specific conductivity of less than 1- µmho/cm (or specific resistivity of greater than 1.0 megohm-cm) at 25^{o}C. The specific conductivity is checked and recorded daily. If the water's specific conductivity is greater than the specified limit, the Facility Manager and appropriate Technical Managers must be notified immediately in order to notify all departments, decide on cessation (based on intended use) of activities, and make arrangements for correction.

The laboratory may purchase reagent grade (or other similar quality) water for use in the laboratory. This water must be certified "clean" by the supplier for all target analytes or otherwise verified by the laboratory prior to use. This verification is documented.

Standard lots are verified before first time use if the laboratory switches manufacturers or has historically had a problem with the type of standard.

Purchased bottleware used for sampling must be certified clean and the certificates must be maintained. If uncertified sampling bottleware is purchased, all lots must be verified clean prior to use. This verification must be maintained.

Records of manufacturer's certification and traceability statements are maintained in files or binders in each laboratory section. These records include date of receipt, lot number (when applicable), and expiration date (when applicable). Incorporation of the item into the record indicates that the analyst has compared the new certificate with the previous one for the same purpose and that no difference is noted, unless approved and so documented by the Operation's Manager or QA Manager.

9.3.4 Storage

Reagent and chemical storage is important from the aspects of both integrity and safety. Light-sensitive reagents may be stored in brown-glass containers. Storage conditions are per the Corporate Environmental Health & Safety Manual (Corp. Doc. No. CW-E-M-001) and method SOPs or manufacturer instructions. Section 22 discusses conditions for standard storage.

9.4 Purchase of Equipment/Instruments/Software

When a new piece of equipment is needed, either for additional capacity or for replacing inoperable equipment, the analyst or Technical Manager makes a supply request to the Operations Manager and/or the Laboratory Director. If they agree with the request the

procedures outlined in TestAmerica's Corporate Policy No. CA-T-P-001, Qualified Products List, are followed. A decision is made as to which piece of equipment can best satisfy the requirements. The appropriate written requests are completed and purchasing places the order.

Upon receipt of a new or used piece of equipment, an identification name is assigned and added to the equipment list. IT must also be notified so that they can synchronize the instrument for back-ups. Its capability is assessed to determine if it is adequate or not for the specific application. For instruments, a calibration curve is generated, followed by MDLs, Demonstration of Capabilities (DOCs), and other relevant criteria (refer to Section 20). For software, its operation must be deemed reliable and evidence of instrument verification must be retained by the QA Department. Software certificates supplied by the vendors are filed with the Office Manager. The manufacturer's operation manual is retained at the bench.

9.5 Services

Service to analytical instruments (except analytical balances) is performed on an as needed basis. Routine preventative maintenance is discussed in Section 21. The need for service is determined by analysts and/or Technical Manager. The service providers that perform the services are approved by the Laboratory Director.

9.6 Suppliers

TestAmerica selects vendors through a competitive proposal / bid process, strategic business alliances or negotiated vendor partnerships (contracts). This process is defined in the Procurement & Contracts Policy (Policy No. CW-F-P-004). The level of control used in the selection process is dependent on the anticipated spending amount and the potential impact on TestAmerica business. Vendors that provide test and measuring equipment, solvents, standards, certified containers, instrument related service contracts or subcontract laboratory services shall be subject to more rigorous controls than vendors that provide off-the-shelf items of defined quality that meet the end use requirements. The JD Edwards purchasing system includes all suppliers /vendors that have been approved for use.

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

Any issues of vendor performance are to be reported immediately by the laboratory staff to the Corporate Purchasing Group by completing a Vendor Performance Report.

The Corporate Purchasing Group will work through the appropriate channels to gather the information required to clearly identify the problem and will contact the vendor to report the problem and to make any necessary arrangements for exchange, return authorization, credit, etc.

As deemed appropriate, the Vendor Performance Reports will be summarized and reviewed to determine corrective action necessary, or service improvements required by vendors

The laboratory has access to a listing of all approved suppliers of critical consumables, supplies and services. This information is provided through the JD Edwards purchasing system.

9.6.1 New Vendor Procedure

TestAmerica employees who wish to request the addition of a new vendor must complete a J.D. Edwards Vendor Add Request Form (available on the intranet site).

New vendors are evaluated based upon criteria appropriate to the products or services provided as well as their ability to provide those products and services at a competitive cost. Vendors are also evaluated to determine if there are ethical reasons or potential conflicts of interest with TestAmerica employees that would make it prohibitive to do business with them as well as their financial stability. The QA Department and/or the Operations Manager are consulted with vendor and product selection that have an impact on quality.

Figure 9-1. Requisition Order Form

Requisition Order Form

VENDOR:

PHONE:

FAX: **OP #**

REQ. DATE	REQUISITIONER	DEPT. CODE	DATE ENTERED	OR#

NOTE: FIELDS HIGHLIGHTED ARE TO BE FILLED IN REF. #

LINE #	QTY	UNIT OF MEASURE	CATALOG/ITEM #	DESCRIPTION	BO	ESTIMATED UNIT PRICE	TOTAL
					TOTAL		

DEPARTMENT CODES

010 – ORGANIC PREP	050 – GC/MS VOA	060 – GC/MS Semi VOA
070 – GC VOA	080 – GC Semi VOA	085 – WET CHEM
090 – METALS	095 – FIELD SERVICE	260 – LAB ADMIN/QA/MIS
320 – SAMPLE CNTRL	320 – PROJ MGMT/DATA CNTRL	435 - SALES

Approved By Supervisor Date

Approved By Lab Manager Date

SECTION 10. COMPLAINTS

10.1 Overview

The laboratory considers an effective client complaint handling processes to be of significant business and strategic value. Listening to and documenting client concerns captures 'client knowledge' that enables our operations to continually improve processes and client satisfaction. An effective client complaint handling process also provides assurance to the data user that the laboratory will stand behind its data, service obligations and products.

A client complaint is any expression of dissatisfaction with any aspect of our business services, (e.g., communications, responsiveness, data, reports, invoicing and other functions) expressed by any party, whether received verbally or in written form. Client inquiries, complaints or noted discrepancies are documented, communicated to management, and addressed promptly and thoroughly.

The laboratory has procedures for addressing both external and internal complaints with the goal of providing satisfactory resolution to complaints in a timely and professional manner.

The nature of the complaint is identified, documented and investigated, and an appropriate action is determined and taken. In cases where a client complaint indicates that an established policy or procedure was not followed, the QA Department must evaluate whether a special audit must be conducted to assist in resolving the issue. A written confirmation or letter to the client, outlining the issue and response taken is recommended as part of the overall action taken.

The process of complaint resolution and documentation utilizes the procedures outlined in Section 12 (Corrective Actions) and is documented by the CSM, following SOP PS-CSD-004 (Client Services Departmental Policies).

10.2 External Complaints

An employee that receives a complaint initiates the complaint resolution process and the documenting the complaint according to SOP PS-CSD-004 (Client Services Departmental Policies).

Complaints fall into two categories: correctable and non-correctable. An example of a correctable complaint would be one where a report re-issue would resolve the complaint. An example of a non-correctable complaint would be one where a client complains that their data was repeatedly late. Non-correctable complaints should be reviewed for preventive action measures to reduce the likelihood of future occurrence and mitigation of client impact.

The general steps in the complaint handling process are:

- Receiving and Documenting Complaints
- Complaint Investigation and Service Recovery
- Process Improvement

The laboratory shall inform the initiator of the complaint of the results of the investigation and the corrective action taken, if any.

10.3 Internal Complaints

Internal complaints include, but are not limited to: errors and non-conformances, training issues, internal audit findings, and deviations from methods. Corrective actions may be initiated by any staff member who observes a nonconformance and shall follow the procedures outlined in Section 11. In addition, Corporate Management and Sales and Marketing may initiate a complaint by contacting the laboratory or through the corrective action system described in Section 11.

10.4 Management Review

The number and nature of client complaints is reported by the QA Manager to the laboratory and QA Director in the QA Monthly report. Monitoring and addressing the overall level and nature of client complaints and the effectiveness of the solutions is part of the Annual Management Review (Section 16).

SECTION 11. CONTROL OF NON-CONFORMING WORK

11.1 Overview

When data discrepancies are discovered or deviations and departures from laboratory SOPs, policies and/or client requests have occurred, corrective action is taken immediately. First, the laboratory evaluates the significance of the nonconforming work. Then, a corrective action plan is initiated based on the outcome of the evaluation. If it is determined that the nonconforming work is an isolated incident, the plan could be as simple as adding a qualifier to the final results and/or making a notation in the case narrative. If it is determined that the nonconforming work is a systematic or improper practices issue, the corrective action plan could include a more in depth investigation and a possible suspension of an analytical method. In all cases, the actions taken are documented using the laboratory's corrective action system (refer to Section 12).

Due to the frequently unique nature of environmental samples, sometimes departures from documented policies and procedures are needed. When an analyst encounters such a situation, the problem is presented to the Department Manager for advice. The Department Manager may elect to discuss it with the Operations Manager or have a PM contact the client to decide on a logical course of action. Once an approach is agreed upon, the analyst documents it using the laboratories corrective action system described in Section 12. This information can then be supplied to the client in the form of a footnote or a case narrative with the report.

Project Management may encounter situations where a client may request that a special procedure be applied to a sample that is not standard lab practice. Based on a technical evaluation, the lab may accept or opt to reject the request based on technical or ethical merit. An example might be the need to report a compound that the lab does not normally report. The lab would not have validated the method for this compound following the procedures in Section 19. The client may request that the compound be reported based only on the calibration. Such a request would need to be approved by the Operations Manager and QA Manager, documented and included in the project folder. Deviations **must** also be noted on the final report with a statement that the compound is not reported in compliance with NELAC (or the analytical method) requirements and the reason. Data being reported to a non-NELAC state would need to note the change made to how the method is normally run.

11.2 Responsibilities and Authorities

TestAmerica Corporate entitled *Internal Investigation of Potential Data Discrepancies and Determination for Data Recall* (SOP No. CW-L-S-002), outlines the general procedures for the reporting and investigation of data discrepancies and alleged incidents of misconduct or violations of TestAmerica's data integrity policies as well as the policies and procedures related to the determination of the potential need to recall data.

Under certain circumstances the Laboratory Director, Operations Manager, Technical Manager or a member of the QA team may exceptionally authorize departures from documented procedures or policies. The departures may be a result of procedural changes due to the nature of the sample; a one-time procedure for a client; QC failures with insufficient sample to reanalyze, etc. In most cases, the client will be informed of the departure prior to the reporting of the data. Any departures must be well documented using the laboratory's corrective action procedures described in Section 12. This information may also need to be documented in

logbooks, as appropriate. Any impacted data must be referenced in a case narrative and/or flagged with an appropriate data qualifier.

Any misrepresentation or possible misrepresentation of analytical data discovered by any laboratory staff member must be reported to facility senior laboratory management within 24-hours. The Senior Management staff is comprised of the Laboratory Director, the QA Manager, the Operations Manager and the Customer Services Manager. The reporting of issues involving alleged violations of the company's Data Integrity or Manual Integration procedures must be conveyed to the Director of Quality & Client Advocacy and the laboratory's Quality Director within 24 hours of discovery.

Whether an inaccurate result was reported due to calculation or quantitation errors, data entry errors, improper practices, or failure to follow SOPs, the data must be evaluated to determine the possible effect.

The Laboratory Director, QA Manager, ECOs, Corporate Quality, Executive VP of Operations, and the Quality Directors have the authority and responsibility to halt work, withhold final reports, or suspend an analysis for due cause as well as authorize the resumption of work.

11.3 Evaluation of Significance and Actions Taken

For each nonconforming issue reported, an evaluation of its significance and the level of management involvement needed is made. This includes reviewing its impact on the final data, whether or not it is an isolated or systematic issue, and how it relates to any special client requirements.

TestAmerica's Corporate Data Investigation & Recall Procedure (SOP No. CW-L-S-002) distinguishes between situations when it would be appropriate for the laboratory management to make the decision on the need for client notification (written or verbal) and data recall (report revision) and when the decision must be made with the assistance of the ECO's and Corporate Management. Laboratory level decisions are documented and approved using the laboratory's standard nonconformance/corrective action reporting (Section 13) in lieu of the data recall determination form contained in TestAmerica Corporate SOP No. CW-L-S-002.

11.4 Prevention of Nonconforming Work

If it is determined that the nonconforming work could recur, further corrective actions must be made following the laboratory's corrective action system. Periodically as defined by the laboratory's preventive action schedule, the QA Department evaluates non-conformances to determine if any nonconforming work has been repeated multiple times. If so, the laboratory's corrective action process may be followed.

11.5 Method Suspensions/Restriction (Stop Work Procedures)

In some cases it may be necessary to suspend/restrict the use of a method or target compound which constitutes significant risk and/or liability to the laboratory. Suspension/restriction procedures can be initiated by any of the persons noted in Section 11.2, Paragraph 5.

Prior to suspension/restriction, confidentiality will be respected, and the problem with the required corrective and preventive action will be stated in writing and presented to the Laboratory Director.

The Laboratory Director shall arrange for the appropriate personnel to meet with the QA Manager as needed. This meeting shall be held to confirm that there is a problem, that suspension/restriction of the method is required and will be concluded with a discussion of the steps necessary to bring the method/target or test fully back on line. In some cases that may not be necessary if all appropriate personnel have already agreed there is a problem and there is agreement on the steps needed to bring the method, target or test fully back on line.

The QA Manager will also initiate a corrective action report as described in Section 13 if one has not already been started. A copy of any meeting notes and agreed upon steps should be faxed or e-mailed by the laboratory to the appropriate General Manager and member of Corporate QA. This fax/e-mail acts as notification of the incident.

After suspension/restriction, the lab will hold all reports to clients pending review. No faxing, mailing or distributing through electronic means may occur. The report must not be posted for viewing on the internet. It is the responsibility of the Laboratory Director to hold all reporting and to notify all relevant laboratory personnel regarding the suspension/restriction (i.e., Project Management, Log-in, etc…). Clients will NOT generally be notified at this time. Analysis may proceed in some instances depending on the non-conformance issue.

Within 72 hours, the QA Manager will determine if compliance is now met and reports can be released, OR determine the plan of action to bring work into compliance, and release work. A team, with all principals involved (Laboratory Director, Operations Manager, Technical Manager, QA Manager) can devise a start-up plan to cover all steps from client notification through compliance and release of reports. Project Management and the Directors of Client Services and Sales and Marketing must be notified if clients must be notified or if the suspension/restriction affects the laboratory's ability to accept work. The QA Manager must approve start-up or elimination of any restrictions after all corrective action is complete. This approval is given by final signature on the completed corrective action report.

SECTION 12. CORRECTIVE ACTION

12.1 Overview

A major component of TestAmerica's Quality Assurance (QA) Program is the problem investigation and feedback mechanism designed to keep the laboratory staff informed on quality related issues and to provide insight to problem resolution. When nonconforming work or departures from policies and procedures in the quality system or technical operations are identified, the corrective action procedure provides a systematic approach to assess the issues, restore the laboratory's system integrity, and prevent reoccurrence. Corrective actions are documented using Non-Conformance Memo (NCM) (refer to Figure 12-1) and Corrective Action Reports.

12.2 General

Problems within the quality system or within analytical operations may be discovered in a variety of ways, such as QC sample failures, internal or external audits, proficiency testing (PT) performance, client complaints, staff observation, etc.

The purpose of a corrective action system is to:

- Identify non-conformance events and assign responsibility for investigation.
- Resolve non-conformance events and assign responsibility for any required corrective action.
- Identify systematic problems before they become serious.
- Identify and track Client complaints and provide resolution (see more on client complaints in Section 10).

12.2.1 Non-Conformance Memo (NCM)/Corrective Action Form (CAF) - is used to document the following types of corrective actions: (A copy of the CAF is kept on a shared drive that all employees have access to.)

- Deviations from an established procedure or SOP
- QC outside of limits (non matrix related)
- Isolated Reporting / Calculation Errors
- Client Complaints
- Questionable trends that are found in the monthly review of NCMs.
- Issues found while reviewing NCMs that warrant further investigation.
- Corrective actions that cross multiple departments in the laboratory.
- Systematic Reporting / Calculation Errors

12.1.1 Out of Control Event (OOCE) - is used to document the following types of corrective actions:

- Questionable trends that are found in the review of NCRs.
- Issues found while reviewing NCRs that warrant further investigation.

- Corrective actions that cross multiple departments in the laboratory.
- Systematic reporting / calculation errors
- Client complaints
- Data recall investigations
- Identified poor process or method performance trends
- Excessive revised reports

This will provide background documentation to enable root cause analysis and preventive action.

12.3 Closed Loop Corrective Action Process

Any employee in the company can initiate a corrective action. There are four main components to a closed-loop corrective action process once an issue has been identified: Cause Analysis, Selection and Implementation of Corrective Actions (both short and long term), Monitoring of the Corrective Actions, and Follow-up.

12.3.1 Cause Analysis

- Upon discovery of a non-conformance event, the event must be defined and documented. An OOCE must be initiated, the Technical Manager, Operations Manager or QA Manager is assigned to investigate the issue and the event is investigated for cause. Table 12-1 provides some general guidelines on determining responsibility for assessment.
- The cause analysis step is the key to the process as a long term corrective action cannot be determined until the cause is determined.
- If the cause is not readily obvious, the Technical Manager, Lab Director, or QA Manager (or QA designee) is consulted.

12.3.2 Selection and Implementation of Corrective Actions

- Where corrective action is needed, the laboratory shall identify potential corrective actions. The action(s) most likely to eliminate the problem and prevent recurrence are selected and implemented. Responsibility for implementation is assigned.
- Corrective actions shall be to a degree appropriate to the magnitude of the problem identified through the cause analysis.
- Whatever corrective action is determined to be appropriate, the laboratory shall document and implement the changes. The OOCE or CAF is used for this documentation.

12.3.3 Root Cause Analysis

Root Cause Analysis is a class of problem solving (investigative) methods aimed at identifying the basic or causal factor(s) that underlie variation in performance or the occurrence of a significant failure. The root cause may be buried under seemingly innocuous events, many steps preceding the perceived failure. At first glance, the immediate response is typically directed at a symptom and not the cause. Typically, root cause analysis would be best with three or more incidents to triangulate a weakness.

Systematically analyze and document the Root Causes of the more significant problems that are reported. Identify, track, and implement the corrective actions required to reduce the likelihood of recurrence of significant incidents. Trend the Root Cause data from these incidents to identify Root Causes that, when corrected, can lead to dramatic improvements in performance by eliminating entire classes of problems.

Identify the one event associated with problem and ask why this event occurred. Brainstorm the root causes of failures; for example, by asking why events occurred or conditions existed; and then why the cause occurred 5 consecutive times until you get to the root cause. For each of these sub events or causes, ask why it occurred. Repeat the process for the other events associated with the incident.

Root cause analysis does not mean the investigation is over. Look at technique, or other systems outside the normal indicators. Often creative thinking will find root causes that ordinarily would be missed, and continue to plague the laboratory or operation.

12.3.4 Monitoring of the Corrective Actions

- The Technical Manager and QA Manager are responsible to ensure that the corrective action taken was effective.
- Ineffective actions are documented and re-evaluated until acceptable resolution is achieved. Technical Managers are accountable to the Laboratory Director to ensure final acceptable resolution is achieved and documented appropriately.
- Each CAR is entered into a spreadsheet for tracking purposes and a monthly summary of all corrective actions is retained for review by department to aid in ensuring that the corrective actions have taken effect.
- The QA Manager reviews monthly CARs for trends. Highlights are included in the QA monthly report (refer to Section 16). If a significant trend develops that adversely affects quality, an audit of the area is performed and corrective action implemented.
- Any out-of-control situations that are not addressed acceptably at the laboratory level may be reported to the Corporate Quality Director by the QA Manager, indicating the nature of the out-of-control situation and problems encountered in solving the situation.

12.3.5 Follow-up Audits

- Follow-up audits may be initiated by the QA Manager and shall be performed as soon as possible when the identification of a nonconformance casts doubt on the laboratory's compliance with its own policies and procedures, or on its compliance with state or federal requirements.
- These audits often follow the implementation of the corrective actions to verify effectiveness. An additional audit would only be necessary when a critical issue or risk to business is discovered.

(Also refer to Section 15.1.4, Special Audits.)

12.4 Technical Corrective Actions

In addition to providing acceptance criteria and specific protocols for technical corrective actions in SOPs PS-QAD-003 (Calculation of Control Limits), PS-LAB-006 (Out of Control Events and Corrective Actions) and PS-LAB-008 (Non-Conforming Events), the laboratory has general procedures to be followed to determine when departures from the documented policies and procedures and quality control have occurred (refer to Section 11 for information regarding the control of non-conforming work). The documentation of these procedures is through the use of an NCM or CAF.

Table 12-1 includes examples of general technical corrective actions. For specific criteria and corrective actions refer to SOP PS-LAB-006 (Out of Control Events and Corrective Actions).

Table 12-1 provides some general guidelines for identifying the individual(s) responsible for assessing each QC type and initiating corrective action. The table also provides general guidance on how a data set should be treated if associated QC measurements are unacceptable. Specific procedures are included in SOP PS-LAB-006 (Out of Control Events and Corrective Actions) and QAM Sections 19 and 20. All corrective actions are reviewed at monthly, at a minimum, by the QA Manager and highlights are included in the QA monthly report.

To the extent possible, samples shall be reported only if all quality control measures are acceptable. If the deficiency does not impair the usability of the results, data will be reported with an appropriate data qualifier and/or the deficiency will be noted in the case narrative. Where sample results may be impaired, the Project Manager is notified by a written NCM and appropriate corrective action (e.g., reanalysis) is taken and documented**.**

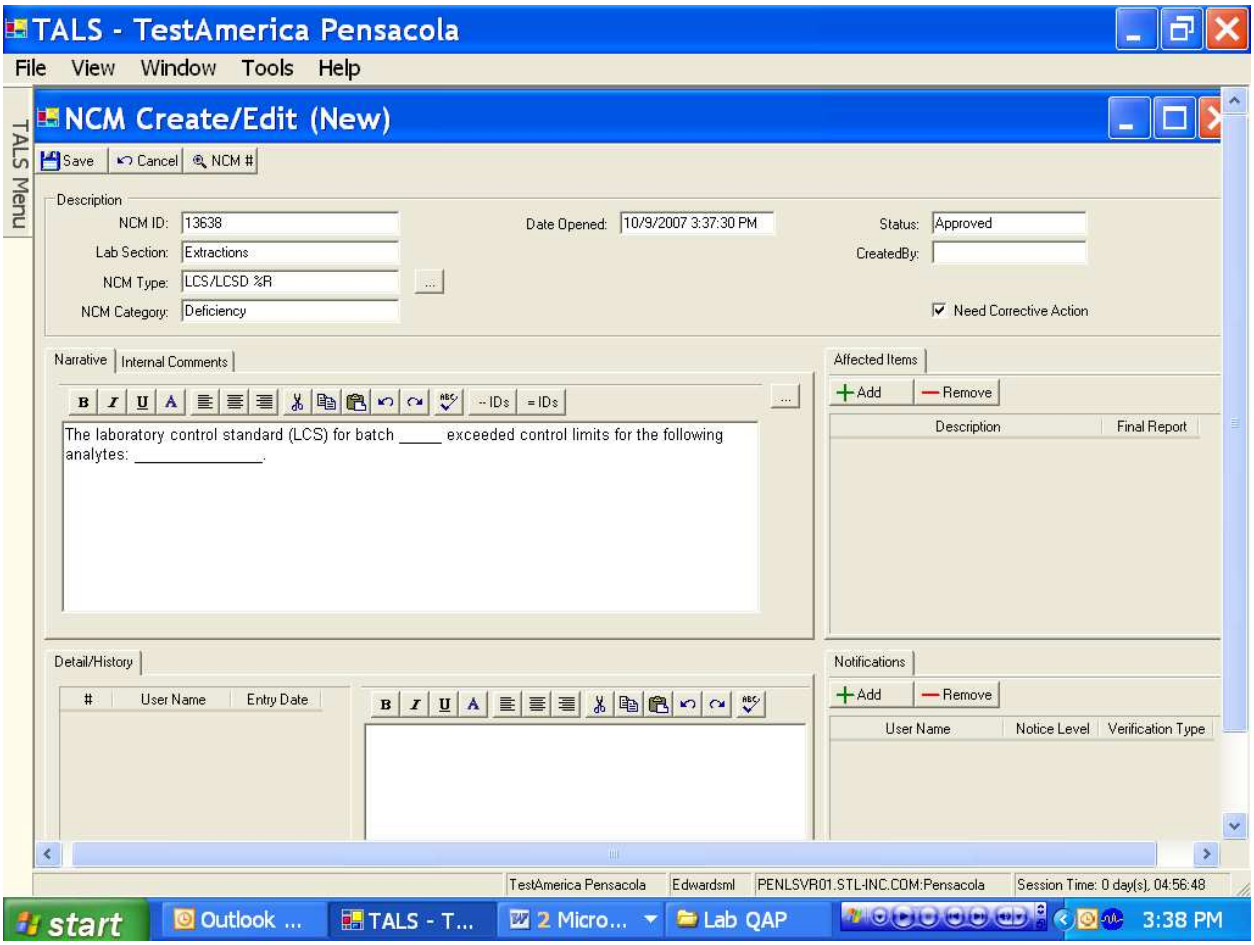
12.5 Basic Corrections

When mistakes occur in records, each mistake shall be crossed-out, [not obliterated (e.g. no white-out)], and the correct value entered alongside. All such corrections shall be initialed (or signed) and dated by the person making the correction. In the case of records stored electronically, the original “uncorrected” file must be maintained intact and a second “corrected” file is created.

This same process applies to adding additional information to a record. All additions made later than the initial must also be initialed (or signed) and dated.

When corrections are due to reasons other than obvious transcription errors, the reason for the corrections (or additions) shall also be documented.

Figure 12-1.
Examples – Non-Compliance Memo/Corrective Action Form



TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Pensacola
PS-QAF-001, Rev. 0
Effective Date: 01/31/2011
Page No.: 1 of 2

Out of Control Event/Corrective Action Report (OOCE/CAR)

1.	GENERAL INFORMATION		
Date event/issue occurred:		Individual identifying the event/issue:	
Individuals involved in the event/issue:			
Category:	Specify the category where the requirement was not met or the event/issue occurred: ☐ Samples ☐ QC ☐ Instrument(s) ☐ Analyst/Tech ☐ Final Report ☐ Client ☐ Shipping ☐ Holding time ☐ Temperature ☐ Other (if 'Other' is checked, please provide detailed information. If information provided is incomplete, form will be returned with request for more detail.)		

2.	EVENT/ISSUE DETAILS
Event/Issue Description:	
Requirement or policy not met:	
How the event/ issue was identified:	

3.	APPROACH TO COMPLIANCE		
Cause Analysis:			
List cause(s) found from an assessment of the issue or event.			
Corrective Action:	Task	Person(s) Responsible	Completion Date
List detailed tasks, the personnel responsible for completing the task, and expected completion dates for each task.			
Interim Activities (until compliance is reached):			
QA approval (initials):		Date approach approved:	

4.	REVIEW OF COMPLIANCE		
First Reviewer (initials and date):		First Review Results (tasks completed):	
Final Reviewer (initials and date):		Final Review Results (all tasked completed):	

5.	CONCLUSION				
Final results of corrective action:					
Re-assessment required:	☐ Yes ☐ No	Re-assessment date (if needed):		Individual assigned:	

Table 12-1. -- General Corrective Action Procedures

QC Activity *(Individual Responsible for Initiation/Assessment)*	Acceptance Criteria	Recommended Corrective Action
Initial Instrument Blank *(Analyst)*	- Instrument response < MDL.	- Prepare another blank. - If same response, determine cause of contamination: reagents, environment, instrument equipment failure, etc..
Initial Calibration Standards *(Analyst, Technical Manager(s))*	- Correlation coefficient > 0.99 or standard concentration value. - % Recovery within acceptance range. - See details in Method SOP.	- Reanalyze standards. - If still unacceptable, remake standards and recalibrate instrument.
Independent Calibration Verification (Second Source) *(Analyst, Technical Manager(s)*	- % Recovery within control limits.	- Remake and reanalyze standard. - If still unacceptable, then remake calibration standards or use new primary standards and recalibrate instrument.
Continuing Calibration Standards *(Analyst, Data Reviewer)*	% Recovery within control limits.	- Reanalyze standard. - If still unacceptable, then recalibrate and rerun affected samples.
Matrix Spike / Matrix Spike Duplicate (MS/MSD) *(Analyst, Data Reviewer)*	- % Recovery within limits documented in ***TALs method limit group module.***.	- If the acceptance criteria for duplicates or matrix spikes are not met because of matrix interferences, the acceptance of the analytical batch is determined by the validity of the LCS. - If the LCS is within acceptable limits the batch is acceptable. - The results of the duplicates, matrix spikes and the LCS are reported with the data set. - For matrix spike or duplicate results outside criteria the data for that sample shall be reported with qualifiers.

QC Activity *(Individual Responsible for Initiation/Assessment)*	Acceptance Criteria	Recommended Corrective Action
Laboratory Control Sample (LCS) *(Analyst, Data Reviewer)*	- % Recovery within limits specified in ***TALs method limit group module.***.	- Batch must be re-prepared and re-analyzed. This includes any allowable marginal exceedance. When not using marginal exceedances, the following exceptions apply: 1) when the acceptance criteria for the positive control are exceeded high (i.e., high bias) and there are associated samples that are non-detects, then those non-detects may be reported with data qualifying codes; 2) when the acceptance criteria for the positive control are exceeded low (i.e., low bias), those sample results may be reported if they exceed a maximum regulatory limit/decision level with data qualifying codes. **Note:** If there is insufficient sample or the holding time cannot be met, contact client and report with flags.
Surrogates *(Analyst, Data Reviewer)*	- % Recovery within limits of method or within three standard deviations of the historical mean.	- Individual sample must be repeated. Place comment in LIMS. - Surrogate results outside criteria shall be reported with qualifiers.
Method Blank (MB) *(Analyst, Data Reviewer)*	< Reporting Limit [1]	- Reanalyze blank. - If still positive, determine source of contamination. If necessary, reprocess (i.e. digest or extract) entire sample batch. Report blank results. - Qualify the result(s) if the concentration of a targeted analyte in the MB is at or above the reporting limit AND is > 1/10 of the amount measured in the sample.
Proficiency Testing (PT) Samples *(QA Manager, Technical Manager(s))*	- Criteria supplied by PT Supplier.	- Any failures or warnings must be investigated for cause. Failures may result in the need to repeat a PT sample to show the problem is corrected.
Internal / External Audits *(QA Manager, Technical Manager(s), Laboratory Director)*	- Defined in Quality System documentation such as SOPs, QAM, etc..	- Non-conformances must be investigated through CAR system and necessary corrections must be made.

QC Activity *(Individual Responsible for Initiation/Assessment)*	Acceptance Criteria	Recommended Corrective Action
Reporting / Calculation Errors (Depends on issue – possible individuals include: Analysts, Data Reviewers, Project Managers, Technical Managers, QA Manager, Corporate QA, Corporate Management)	- SOP CW-L-S-002, Internal Investigation of Potential Data Discrepancies and Determination for Data Recall.	- Corrective action is determined by type of error. Follow the procedures in SOP CW-L-S-002or your lab's CA SOP.
Client Complaints *(Project Managers, Lab Director/Manager, Sales and Marketing)*	-	- Corrective action is determined by the type of complaint. For example, a complaint regarding an incorrect address on a report will result in the report being corrected and then follow-up must be performed on the reasons the address was incorrect (e.g., database needs to be updated).
QA Monthly Report (Refer to Section 16 for an example) (QA Manager, Lab Director/Manager, *Technical Manager(s)*)	- QAM, SOPs.	- Corrective action is determined by the type of issue. For example, CARs for the month are reviewed and possible trends are investigated.
Health and Safety Violation (Safety Officer, Lab Director/Manager, *Technical Manager(s)*)	- Environmental Health and Safety (EHS) Manual.	- Non-conformance is investigated and corrected through CAR system.

Note: 1. Except as noted below for certain compounds, the method blank should be below the detection limit or client action levels. Concentrations up to five times the reporting limit will be allowed for the ubiquitous laboratory and reagent contaminants: methylene chloride, toluene, acetone, 2-butanone and phthalates **provided** they appear in similar levels in the reagent blank and samples. This allowance presumes that the detection limit is significantly below any regulatory limit to which the data are to be compared and that blank subtraction will not occur. For benzene and ethylene dibromide (EDB) and other analytes for which regulatory limits are extremely close to the detection limit, the method blank must be below the method detection limit.

SECTION 13. PREVENTIVE ACTION

13.1 Overview

The laboratory's preventive action programs improve~~,~~ or eliminate potential causes of nonconforming product and/or nonconformance to the quality system. This preventive action process is a proactive and continuous process of improvement activities that can be initiated through feedback from clients, employees, business providers, and affiliates. The QA Department has the overall responsibility to ensure that the preventive action process is in place, and that relevant information on actions is submitted for management review.

Dedicating resources to an effective preventive action system emphasizes the laboratory's commitment to its Quality Program. It is beneficial to identify and address negative trends before they develop into complaints, problems and corrective actions. Additionally, customer service and client satisfaction can be improved through continuous improvements to laboratory systems.

Opportunities for improvement may be discovered during management reviews, the monthly QA Metrics Report, evaluation of internal or external audits, results & evaluation of proficiency testing (PT) performance, data analysis & review processing operations, client complaints, staff observation, etc..

The monthly Management Systems Metrics Report shows performance indicators in all areas of the laboratory and quality system. These areas include revised reports, corrective actions, audit findings, internal auditing and data authenticity audits, client complaints, PT samples, holding time violations, SOPs, ethics training, etc.. These metrics are used in evaluating the management and quality system performance on an ongoing basis and provide a tool for identifying areas for improvement.

The laboratory's corrective action process is integral to implementation of preventive actions. A critical piece of the corrective action process is the implementation of actions to prevent further occurrence of a non-compliance event. Historical review of corrective action provides a valuable mechanism for identifying preventive action opportunities.

13.1.1 The following elements are part of a preventive action system:

- Identification of an opportunity for preventive action.
- Process for the preventive action.
- Define the measurements of the effectiveness of the process once undertaken.
- Execution of the preventive action.
- Evaluation of the plan using the defined measurements.
- Verification of the effectiveness of the preventive action.
- Close-Out by documenting any permanent changes to the Quality System as a result of the Preventive Action. Documentation of Preventive Action is incorporated into the monthly QA reports, corrective action process, management review.

13.1.1 Any Preventive Actions undertaken or attempted shall be taken into account during the annual Management Systems Review (Section 16). A highly detailed report is not required; however, a summary of successes and failures within the preventive action program is sufficient to provide management with a measurement for evaluation.

SECTION 14. CONTROL OF RECORDS

The laboratory maintains a records management system appropriate to its needs and that complies with applicable standards or regulations as required. The system produces unequivocal, accurate records that document all laboratory activities. The laboratory retains all original observations, calculations and derived data, calibration records and a copy of the analytical report for a minimum of five years after it has been issued.

14.1 Overview

The laboratory has established procedures for identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records. A record index is listed in Table 15-1. Quality records are maintained by the QA Department in a database, which is backed up as part of the regular laboratory backup. Records are of two types; either electronic or hard copy paper formats depending on whether the record is computer or hand generated (some records may be in both formats). Technical records are maintained by the Administrative Assistant after the departments have relinquished the data.

Table 14-1. Record Index[1]

	Record Types [1]:	Retention Time:
Technical Records	- Raw Data - Logbooks[2] - Standards - Certificates - Analytical Records - MDLs/IDLs/DOCs - Lab Reports	10 Years from analytical report issue*
Official Documents	- Quality Assurance Manual (QAM) - Work Instructions - Policies - SOPs - Policy Memorandums - Manuals	10 Years from document retirement date*
QA Records	- Internal & External Audits/Responses - Certifications - Corrective/Preventive Actions - Management Reviews - Method & Software Validation / Verification Data - Data Investigation	10 Years from archival* **Data Investigation:** 10 years or the life of the affected raw data storage whichever is greater (beyond 10 years if ongoing project or pending investigation)
Project Records	- Sample Receipt & COC Documentation - Contracts and Amendments - Correspondence - QAPP - SAP - Telephone Logbooks - Lab Reports	5 Years from analytical report issue*
Administrative Records	Finance and Accounting	10 years

	Record Types [1]:	Retention Time:
	EH&S Manual, Permits	7 years
	Disposal Records	Indefinitely
	Employee Handbook	Indefinitely
	Personnel files, Employee Signature & Initials, Administrative Training Records (e.g., Ethics)	10 Years (HR Personnel Files must be maintained indefinitely)
	Administrative Policies Technical Training Records	10 years

[1] Record Types encompass hardcopy and electronic records.
[2] Examples of Logbook types: Maintenance, Instrument Run, Preparation (standard and samples), Standard and Reagent Receipt, Archiving, Balance Calibration, Temperature (hardcopy or electronic records).
* Exceptions listed in Table 14-2.

14.1.1 All records are stored and retained in such a way that they are secure and readily retrievable at the laboratory facility or the off-site storage facility (Lock-n-Store) that provides a suitable environment to prevent damage or deterioration and to prevent loss**.** All records shall be protected against fire, theft, loss, environmental deterioration, and vermin. In the case of electronic records, electronic or magnetic sources, storage media are protected from deterioration caused by magnetic fields and/or electronic deterioration.

Access to the data is limited to laboratory and company employees and shall be documented with an access log**.** Records archived off-site are stored in a secure location where a record is maintained of any entry into the storage facility. Whether on-site or off-site storage is used, logs are maintained in each storage box to note removal and return of records. Retention of records is maintained on-site at the laboratory for at least 6 months after their generation and moved off-site for the remainder of the required storage time. Records are maintained for a minimum of five years unless otherwise specified by a client or regulatory requirement.

For raw data and project records, record retention shall be calculated from the date the project report is issued. For other records, such as Controlled Documents, QA, or Administrative Records, the retention time is calculated from the date the record is formally retired. Records related to the programs listed in Table 14-2 have lengthier retention requirements and are subject to the requirements in Section 14.1.2.

14.1.2 Programs with Longer Retention Requirements

Some regulatory programs have longer record retention requirements than the standard record retention time. These are detailed in Table 14-2 with their retention requirements. In these cases, the longer retention requirement is implemented and noted in the archive. If special instructions exist such that client data cannot be destroyed prior to notification of the client, the container or box containing that data is marked as to who to contact for authorization prior to destroying the data.

Table 14-2. Special Record Retention Requirements

Program	[1]Retention Requirement

Program	[1]Retention Requirement
Drinking Water – All States	5 years (project records)
Commonwealth of MA – All environmental data 310 CMR 42.14	10 years
Louisiana – All	10 years
Michigan Department of Environmental Quality	10 years
TSCA - 40 CFR Part 792	10 years after publication of final test rule or negotiated test agreement

[1]Note: Extended retention requirements must be noted with the archive documents or addressed in facility-specific records retention procedures.

14.1.3 The laboratory has procedures to protect and back-up records stored electronically and to prevent unauthorized access to or amendment of these records. All analytical data is maintained as hard copy or in a secure readable electronic format. For analytical reports that are maintained as copies in PDF format, refer to section 19.14.1 (Computer and Electronic Data Related Requirements) for more information.

14.1.4 The record keeping system allows for historical reconstruction of all laboratory activities that produced the analytical data, as well as rapid recovery of historical data (Records stored off site should be accessible within 7 days of a request for such records). The history of the sample from when the laboratory took possession of the samples must be readily understood through the documentation. This shall include inter-laboratory transfers of samples and/or extracts.

- The records include the identity of personnel involved in sampling, sample receipt, preparation, or testing. All analytical work contains the initials (at least) of the personnel involved. The laboratory's copy of the COC is scanned and stored in the LIMS. The chain of custody would indicate the name of the sampler. If any sampling notes are provided with a work order, they are kept with this package.

- All information relating to the laboratory facilities equipment, analytical test methods, and related laboratory activities, such as sample receipt, sample preparation, or data verification are documented.

- The record keeping system facilitates the retrieval of all working files and archived records for inspection and verification purposes (e.g., set format for naming electronic files, set format for what is included with a given analytical data set see SOP PS-LAB-007 (Records Management). Instrument data is stored sequentially by instrument. A given day's analyses are maintained in the order of the analysis. Run logs are maintained for each instrument or method. Where an analysis is performed without an instrument, bound logbooks or bench sheets are used to record data. These records are then scanned and attached to the data batches in TALs. Standard and reagent information is entered into the reagent module of TALs for each method as required.

- Changes to hardcopy records shall follow the procedures outlined in Section 13 and 20.

Changes to electronic records in LIMS or instrument data are recorded in audit trails.

- The reason for a signature or initials on a document is clearly indicated in the records such as “sampled by,” “prepared by,” “reviewed by”, or “analyzed by”.
- All generated data except those that are generated by automated data collection systems, are recorded directly, promptly and legibly in permanent dark ink.
- Also refer to Section 19.14.1 “Computer and Electronic Data Related Requirements”**.**

14.2 Technical and Analytical Records

14.2.1 The laboratory retains records of original observations, derived data and sufficient information to establish an audit trail, calibration records, staff records and a copy of each analytical report issued, for a minimum of ten years unless otherwise specified by a client or regulatory requirement (refer to Section 15.1). The records for each analysis shall contain sufficient information to enable the analysis to be repeated under conditions as close as possible to the original. The records shall include the identity of laboratory personnel responsible for the sampling, performance of each analysis and reviewing results.

14.2.2 Observations, data and calculations are recorded real time as they are made and are identifiable to the specific task.

14.2.3 Changes to hardcopy records shall follow the procedures outlined in Section 13 and 20. Changes to electronic records in LIMS or instrument data are recorded in audit trails. The essential information to be associated with analysis, such as strip charts, tabular printouts, computer data files, analytical notebooks, and run logs, include (previous discussions relate where most of this information is maintained – specifics may be added below):

- laboratory sample ID code**;**
- Date of analysis; Time of Analysis is also required if the holding time is seventy-two (72) hours or less, or when time critical steps are included in the analysis (e.g., drying times, incubations, etc.); instrumental analyses have the date and time of analysis recorded as part of their general operations. Where a time critical step exists in an analysis, location for such a time is included as part of the LIMS generated backlog.
- Instrumentation identification and instrument operating conditions/parameters. Operating conditions/parameters are typically recorded in instrument maintenance logs where available.
- analysis type**;**
- all manual calculations and manual integrations**;**
- analyst's or operator's initials/signature**;**
- sample preparation including cleanup, separation protocols, incubation periods or subculture, ID codes, volumes, weights, instrument printouts, meter readings, calculations, reagents**;**

- test results**;**
- standard and reagent origin, receipt, preparation, and use**;**
- calibration criteria, frequency and acceptance criteria**;**
- data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions**;**
- quality control protocols and assessment**;**
- electronic data security, software documentation and verification, software and hardware audits, backups, and records of any changes to automated data entries; and
- Method performance criteria including expected quality control requirements. These are indicated both in the LIMS and on specific analytical report formats**.**

14.2.4 All logbooks used during receipt, preparation, storage, analysis, and reporting of samples or monitoring of support equipment shall undergo a documented supervisory or peer review on a monthly basis.

14.3 Laboratory Support Activities

In addition to documenting all the above-mentioned activities, the following are retained QA records and project records (previous discussions in this section relate where and how these data are stored):

- all original raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analysts' work sheets and data output records (chromatograms, strip charts, and other instrument response readout records)**;**
- a written description or reference to the specific test method used which includes a description of the specific computational steps used to translate parametric observations into a reportable analytical value**;**
- copies of final reports**;**
- archived SOPs**;**
- correspondence relating to laboratory activities for a specific project**;**
- all corrective action reports, audits and audit responses**;**
- proficiency test results and raw data; and
- results of data review, verification, and crosschecking procedures

14.3.1 Sample Handling Records

Records of all procedures to which a sample is subjected while in the possession of the laboratory are maintained. These include but are not limited to records pertaining to:

- sample preservation including appropriateness of sample container and compliance with holding time requirement;

- sample identification, receipt, acceptance or rejection and login;
- sample storage and tracking including shipping receipts, sample transmittal / COC forms; and
- procedures for the receipt and retention of samples, including all provisions necessary to protect the integrity of samples.

14.4 Administrative Records

The laboratory also maintains the administrative records in either electronic or hard copy form. See Table 15-1.

14.5 Records Management, Storage and Disposal

All records (including those pertaining to test equipment), certificates and reports are safely stored, held secure and in confidence to the client. Certification related records are available upon request.

All information necessary for the historical reconstruction of data is maintained by the laboratory. Records that are stored only on electronic media must be supported by the hardware and software necessary for their retrieval.

Records that are stored or generated by computers or personal computers have hard copy, write-protected backup copies, or an electronic audit trail controlling access**.**

The laboratory has a record management system (a.k.a., document control) for control of laboratory notebooks, instrument logbooks, standards logbooks, and records for data reduction, validation, storage and reporting. Laboratory notebooks are issued on a per analysis basis, and are numbered sequentially. All data are recorded sequentially within a series of sequential notebooks. Bench sheets are filed sequentially. Standards are maintained in the LIMS – no logbooks are used to record that data**.** Records are considered archived when noted as such in the records management system (a.k.a., document control.)

14.5.1 Transfer of Ownership

In the event that the laboratory transfers ownership or goes out of business, the laboratory shall ensure that the records are maintained or transferred according to client's instructions. Upon ownership transfer, record retention requirements shall be addressed in the ownership transfer agreement and the responsibility for maintaining archives is clearly established. In addition, in cases of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records must be followed. In the event of the closure of the laboratory, all records will revert to the control of the corporate headquarters. Should the entire company cease to exist, as much notice as possible will be given to clients and the accrediting bodies who have worked with the laboratory during the previous 10 years of such action.

14.5.2 Records Disposal

Records are removed from the archive and destroyed after 10 years unless otherwise specified by a client or regulatory requirement. On a project specific or program basis, clients may need

to be notified prior to record destruction. Records are destroyed in a manner that ensures their confidentiality such as shredding, mutilation or incineration. (Refer to Tables 15-1 and 15-2). Electronic copies of records must be destroyed by erasure or physically damaging off-line storage media so no records can be read.

If a third party records management company is hired to dispose of records, a “Certificate of Destruction” is required.

SECTION 15. AUDITS

15.1 Internal Audits

Internal audits are performed to verify that laboratory operations comply with the requirements of the lab's quality system and with the external quality programs under which the laboratory operates. Audits are planned and organized by the QA staff. Personnel conducting the audits should be independent of the area being evaluated. Auditors will have sufficient authority, access to work areas, and organizational freedom necessary to observe all activities affecting quality and to report the assessments to laboratory management and when requested to corporate management.

Audits are conducted and documented as described in the TestAmerica Corporate SOP on performing Internal Auditing, SOP No. CW-Q-S-003. The types and frequency of routine internal audits are described in Table 15-1. Special or ad hoc assessments may be conducted as needed under the direction of the QA staff.

Table 15-1. Types of Internal Audits and Frequency

Description	Performed by	Frequency
Quality Systems Audits	QA Department, QA approved designee, or Corporate QA	All areas of the laboratory annually
QA Technical Audits	Joint responsibility: a) QA Manager or designee b) Technical Manager or Designee (Refer to CW-Q-S-003)	Technical Audits Frequency: 50% of methods annually
SOP Method Compliance	Joint responsibility: a) QA Manager or designee b) Technical Manager or Designee (Refer to CW-Q-S-003)	SOP Compliance Review Frequency: • Every 2 years
Special	QA Department or Designee	Surveillance or spot checks performed as needed, e.g., to confirm corrective actions from other audits.
Performance Testing	Analysts with QA oversight	Two successful per year for each TNI field of testing or as dictated by regulatory requirements

15.1.1 Annual Quality Systems Audit

An annual quality systems audit is required to ensure compliance to analytical methods and SOPs, TestAmerica's Data Integrity and Ethics Policies, TNI quality systems, client and state requirements, and the effectiveness of the internal controls of the analytical process, including but not limited to data review, quality controls, preventive action and corrective action. The

completeness of earlier corrective actions is assessed for effectiveness & sustainability. The audit is divided into sections for each operating or support area of the lab, and each section is comprehensive for a given area. The area audits may be performed on a rotating schedule throughout the year to ensure adequate coverage of all areas. This schedule may change as situations in the laboratory warrant.

15.1.2 QA Technical Audits

QA technical audits are based on client projects, associated sample delivery groups, and the methods performed. Reported results are compared to raw data to verify the authenticity of results. The validity of calibrations and QC results are compared to data qualifiers, footnotes, and case narratives. Documentation is assessed by examining run logs and records of manual integrations. Manual calculations are checked. Where possible, electronic audit miner programs (e.g., MintMiner and Chrom AuditMiner) are used to identify unusual manipulations of the data deserving closer scrutiny. QA technical audits will include all methods within a two-year period.

15.1.3 SOP Method Compliance

Compliance of all SOPs with the source methods and compliance of the operational groups with the SOPs will be assessed by the Technical Manager or qualified designee at least every two years. It is also recommended that the work of each newly hired analyst is assessed within 3 months of working independently, (e.g., completion of method IDOC). In addition, as analysts add methods to their capabilities, (new IDOC) reviews of the analyst work products will be performed within 3 months of completing the documented training.

15.1.4 Special Audits

Special audits are conducted on an as needed basis, generally as a follow up to specific issues such as client complaints, corrective actions, PT results, data audits, system audits, validation comments, regulatory audits or suspected ethical improprieties. Special audits are focused on a specific issue, and report format, distribution, and timeframes are designed to address the nature of the issue.

15.1.5 Performance Testing

The laboratory participates semi-annually in performance audits conducted through the analysis of PT samples provided by a third party. The laboratory generally participates in the following types of PT studies: Water Pollution (WP), Hazardous Waste (HW), Water Supply (WS), Underground Storage Tank (UST), and Discharge Monitoring Report – Quality Assurance (DMRQA).

It is TestAmerica's policy that PT samples be treated as typical samples in the production process. Furthermore, where PT samples present special or unique problems, in the regular production process they may need to be treated differently, as would any special or unique request submitted by any client. The QA Manager must be consulted and in agreement with any decisions made to treat a PT sample differently due to some special circumstance.

Written responses to unacceptable PT results are required. In some cases it may be necessary for blind QC samples to be submitted to the laboratory to show a return to control.

15.2 External Audits

External audits are performed when certifying agencies or clients conduct on-site inspections or submit performance testing samples for analysis. It is TestAmerica's policy to cooperate fully with regulatory authorities and clients. The laboratory makes every effort to provide the auditors with access to personnel, documentation, and assistance. Laboratory supervisors are responsible for providing corrective actions to the QA Manager who coordinates the response for any deficiencies discovered during an external audit. Audit responses are due in the time allotted by the client or agency performing the audit. When requested a copy of the audit report and the labs corrective action plan will be forwarded to Corporate Quality.

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. The client may only view data and systems related directly to the client's work. All efforts are made to keep other client information confidential.

15.2.1 Confidential Business Information (CBI) Considerations

During on-site audits, auditors may come into possession of information claimed as business confidential. A business confidentiality claim is defined as "a claim or allegation that business information is entitled to confidential treatment for reasons of business confidentiality or a request for a determination that such information is entitled to such treatment." When information is claimed as business confidential, the laboratory must place on (or attach to) the information at the time it is submitted to the auditor, a cover sheet, stamped or typed legend or other suitable form of notice, employing language such as "trade secret", "proprietary" or "company confidential". Confidential portions of documents otherwise non-confidential must be clearly identified. CBI may be purged of references to client identity by the responsible laboratory official at the time of removal from the laboratory. However, sample identifiers may not be obscured from the information. Additional information regarding CBI can be found in within the 2009 TNI standards.

15.3 Audit Findings

Audit findings are documented using the Corrective Action Report spreadsheet. The laboratory's corrective action responses for both types of audits may include action plans that could not be completed within a predefined timeframe. In these instances, a completion date must set and agreed to by operations management and the QA Manager.

Developing and implementing corrective actions to findings is the responsibility of the Technical Manager where the finding originated. Findings that are not corrected by specified due dates are reported monthly to management in the QA monthly report. . When requested, a copy of the audit report and the labs corrective action plan will be forwarded to Corporate Quality.

If any audit finding casts doubt on the effectiveness of the operations or on the correctness or validity of the laboratory's test results, the laboratory shall take timely corrective action, and shall notify clients in writing if the investigations show that the laboratory results have been affected. Once corrective action is implemented, a follow-up audit is scheduled to ensure that the problem has been corrected.

Clients must be notified promptly in writing, of any event such as the identification of defective measuring or test equipment that casts doubt on the validity of results given in any test report or amendment to a test report. The investigation must begin within 24-hours of discovery of the problem and all efforts are made to notify the client within two weeks after the completion of the investigation.

SECTION 16. MANAGEMENT REVIEWS

16.1 Quality Assurance Report

A comprehensive QA Report shall be prepared each month by the laboratory's QA Department and forwarded to the Laboratory Director, Technical Managers, and their Quality Director as well as the VP of Operations. All aspects of the QA system are reviewed to evaluate the suitability of policies and procedures. During the course of the year, the Laboratory Director, VP of Operations or Corporate QA may request that additional information be added to the report.

On a monthly basis, Corporate QA compiles information from all the monthly laboratory reports. The Corporate Quality Directors prepare a report that includes a compilation of all metrics and notable information and concerns regarding the QA programs within the laboratories. The report also includes a listing of new regulations that may potentially impact the laboratories. This report is presented to the Senior Management Team and General Managers.

16.2 Annual Management Review

The senior lab management team (Laboratory Director, Technical Managers, QA Manager) conducts a review annually of its quality systems and LIMS to ensure its continuing suitability and effectiveness in meeting client and regulatory requirements and to introduce any necessary changes or improvements. It will also provide a platform for defining goals, & objectives and action items that feed into the laboratory planning system. Corporate Operations and Corporate QA personnel is be included in this meeting at the discretion of the Laboratory Director. The LIMS review consists of examining any audits, complaints or concerns that have been raised through the year that are related to the LIMS. The laboratory will summarize any critical findings that can not be solved by the lab and report them to Corporate IT.

This management systems review (Corporate SOP No. CW-Q-S-004 & Work Instruction No. CW-Q-WI-003) uses information generated during the preceding year to assess the "big picture" by ensuring that routine actions taken and reviewed on a monthly basis are not components of larger systematic concerns. The monthly review should keep the quality systems current and effective, therefore, the annual review is a formal senior management process to review specific existing documentation. Significant issues from the following documentation are compiled or summarized by the QA Manager prior to the review meeting:

- Matters arising from the previous annual review.
- Prior Monthly QA Reports issues.
- Laboratory QA Metrics.
- Review of report reissue requests.

- Review of client feedback and complaints.
- Issues arising from any prior management or staff meetings.
- Minutes from prior senior management meetings. Issues that may be raised from these meetings include:
  - Adequacy of staff, equipment and facility resources.
  - Adequacy of policies and procedures.
  - Future plans for resources and testing capability and capacity.

- The annual internal double blind PT program sample performance (if performed),
- Compliance to the Ethics Policy and Data Integrity Plan. Including any evidence/incidents of inappropriate actions or vulnerabilities related to data Integrity.

A report is generated by the QA Manager and management. The report is distributed to the appropriate General Manager and the Quality Director. The report includes, but is not limited to:

- The date of the review and the names and titles of participants.
- A reference to the existing data quality related documents and topics that were reviewed.
- Quality system or operational changes or improvements that will be made as a result of the review [e.g., an implementation schedule including assigned responsibilities for the changes (Action Table)].

Changes to the quality systems requiring update to the laboratory QA Manual shall be included in the next revision of the QA Manual.

16.3 Potential Integrity Related Managerial Reviews

Potential integrity issues (data or business related) must be handled and reviewed in a confidential manner until such time as a follow-up evaluation, full investigation, or other appropriate actions have been completed and issues clarified. TestAmerica's Corporate Data Investigation/ Recall SOP shall be followed (SOP No. CW-L-S-002). All investigations that result in finding of inappropriate activity are documented and include any disciplinary actions involved, corrective actions taken, and all appropriate notifications of clients.

TestAmerica's CEO, Executive VP of Operations, VP of Client & Technical Services, VPs of Operations, and Quality Directors receive a monthly report from the **Corporate Quality and EHS Director** Director summarizing any current data integrity or data recall investigations. The VPs of Operations are also made aware of progress on these issues for their specific labs.

SECTION 17. PERSONNEL

17.1 Overview

The laboratory's management believes that its highly qualified and professional staff is the single most important aspect in assuring a high level of data quality and service. The staff consists of professionals and support personnel as outlined in the organization chart in Figure 4-1.

All personnel must demonstrate competence in the areas where they have responsibility. Any staff that is undergoing training shall have appropriate supervision until they have demonstrated their ability to perform their job function on their own. Staff shall be qualified for their tasks based on appropriate education, training, experience and/or demonstrated skills as required.

The laboratory employs sufficient personnel with the necessary education, training, technical knowledge and experience for their assigned responsibilities.

All personnel are responsible for complying with all QA/QC requirements that pertain to the laboratory and their area of responsibility. Each staff member must have a combination of experience and education to adequately demonstrate a specific knowledge of their particular area of responsibility. Technical staff must also have a general knowledge of lab operations, test methods, QA/QC procedures and records management.

Laboratory management is responsible for formulating goals for lab staff with respect to education, training and skills and ensuring that the laboratory has a policy and procedures for identifying training needs and providing training of personnel. The training shall be relevant to the present and anticipated responsibilities of the lab staff.

The laboratory only uses personnel that are employed by or under contract to, the laboratory. Contracted personnel, when used, must meet competency standards of the laboratory and work in accordance to the laboratory's quality system.

17.2 Education and Experience Requirements for Technical Personnel

The laboratory makes every effort to hire analytical staffs that possess a college degree (AA, BA, BS) in an applied science with some chemistry in the curriculum. Exceptions can be made based upon the individual's experience and ability to learn. Selection of qualified candidates for laboratory employment begins with documentation of minimum education, training, and experience prerequisites needed to perform the prescribed task. Minimum education and training requirements for TestAmerica employees are outlined in job descriptions and are generally summarized for analytical staff in the table below.

The laboratory maintains job descriptions for all personnel who manage, perform or verify work affecting the quality of the environmental testing the laboratory performs. Job Descriptions are located on the TestAmerica intranet site's Human Resources web-page (Also see Section 4 for position descriptions/responsibilities).

Experience and specialized training are occasionally accepted in lieu of a college degree (basic lab skills such as using a balance, colony counting, aseptic or quantitation techniques, etc., are also considered).

As a general rule for analytical staff:

Specialty	Education	Experience
Extractions, Digestions, some electrode methods (pH, DO, Redox, etc.), or Titrimetric and Gravimetric Analyses	H.S. Diploma	On the job training (OJT)
GFAA, CVAA, FLAA, Single component or short list Chromatography (e.g., Fuels, BTEX-GC, IC	A college degree in an applied science or 2 years of college and at least 1 year of college chemistry	Or 2 years prior analytical experience is required
ICP, ICPMS, Long List or complex chromatography (e.g., Pesticides, PCB, Herbicides, HPLC, etc.), GCMS	A college degree in an applied science or 2 years of college chemistry	or 5 years of prior analytical experience
Spectra Interpretation	A college degree in an applied science or 2 years of college chemistry	And 2 years relevant experience Or 5 years of prior analytical experience
Technical Managers – **General**	Bachelors Degree in an applied science or engineering with 24 semester hours in chemistry or 2 years of college with 16 semester hours in chemistry An advanced (MS, PhD.) degree may substitute for one year of experience	And 2 years experience in environmental analysis of representative analytes for which they will oversee
Technical Managers – **Wet Chem** only (no advanced instrumentation)	Associates degree in an applied science or engineering or 2 years of college with 16 semester hours in chemistry	And 2 years relevant experience

Specialty	Education	Experience
Technical Managers - Microbiology	Bachelors degree in applied science with at least 16 semester hours in general microbiology and biology An advanced (MS, PhD.) degree may substitute for one year of experience	And 2 years of relevant experience

When an analyst does not meet these requirements, they can perform a task under the direct supervision of a qualified analyst, peer reviewer or Technical Manager, and are considered an analyst in training. The person supervising an analyst in training is accountable for the quality of the analytical data and must review and approve data and associated corrective actions.

17.3 Training

The laboratory is committed to furthering the professional and technical development of employees at all levels.

Orientation to the laboratory's policies and procedures, in-house method training, and employee attendance at outside training courses and conferences all contribute toward employee proficiency. Below are examples of various areas of required employee training:

Required Training	Time Frame	Employee Type
Environmental Health & Safety	Prior to lab work	All
Ethics – New Hires	1 week of hire	All
Ethics – Comprehensive	90 days of hire	All
Data Integrity	30 days of hire	Technical and PMs
Quality Assurance	90 days of hire	All
Ethics – Comprehensive Refresher	Annually	All
Initial Demonstration of Capability (DOC)	Prior to unsupervised method performance	Technical

The laboratory maintains records of relevant authorization/competence, education, professional qualifications, training, skills and experience of technical personnel (including contracted personnel) as well as the date that approval/authorization was given. These records are kept on file at the laboratory. Also refer to "Demonstration of Capability" in Section 19.

The training of technical staff is kept up to date by:

- Each employee must have documentation in their training file that they have read, understood and agreed to follow the most recent version of the laboratory QA Manual and SOPs in their area of responsibility. This documentation is updated as SOPs are updated.

- Documentation from any training courses or workshops on specific equipment, analytical techniques or other relevant topics are maintained in their training file.
- Documentation of proficiency (refer to Section 19).
- An Ethics Agreement signed by each staff member (renewed each year) and evidence of annual ethics training.
- A Confidentiality Agreement signed by each staff member signed at the time of employment.
- Human Resources maintains documentation and attestation forms on employment status & records; benefit programs; timekeeping/payroll; and employee conduct (e.g., ethics). This information is maintained in the employee's secured personnel file.

Further details of the laboratory's training program are described in the SOP PS-LAB-014.

17.4 Data Integrity and Ethics Training Program

Establishing and maintaining a high ethical standard is an important element of a Quality System. Ethics and data integrity training is integral to the success of TestAmerica and is provided for each employee at TestAmerica. It is a formal part of the initial employee orientation within 1 week of hire followed by technical data integrity training within 30 days, comprehensive training within 90 days, and an annual refresher for all employees. Senior management at each facility performs the ethics training for their staff.

In order to ensure that all personnel understand the importance TestAmerica places on maintaining high ethical standards at all times; TestAmerica has established a Corporate Ethics Policy No. CW-L-P-002 and an Ethics Statement. All initial and annual training is documented by signature on the signed Ethics Statement demonstrating that the employee has participated in the training and understands their obligations related to ethical behavior and data integrity.

Violations of this Ethics Policy will not be tolerated. Employees who violate this policy will be subject to disciplinary actions up to and including termination. Criminal violations may also be referred to the Government for prosecution. In addition, such actions could jeopardize TestAmerica's ability to do work on Government contracts, and for that reason, TestAmerica has a Zero Tolerance approach to such violations.

Employees are trained as to the legal and environmental repercussions that result from data misrepresentation. Key topics covered in the presentation include:

- Organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting.
- Ethics Policy
- How and when to report ethical/data integrity issues. Confidential reporting.
- Record keeping.
- Discussion regarding data integrity procedures.
- Specific examples of breaches of ethical behavior (e.g. peak shaving, altering data or computer clocks, improper macros, etc., accepting/offering kickbacks, illegal accounting practices, unfair competition/collusion)

- Internal monitoring. Investigations and data recalls.
- Consequences for infractions including potential for immediate termination, debarment, or criminal prosecution.
- Importance of proper written narration / data qualification by the analyst and project manager with respect to those cases where the data may still be usable but are in one sense or another partially deficient.

Additionally, a data integrity hotline (1-800-736-9407) is maintained by TestAmerica and administered by the Corporate Quality Department.

SECTION 18. ACCOMMODATIONS AND ENVIRONMENTAL CONDITIONS

18.1 Overview

The laboratory is a 22,000 ft^2 secure laboratory facility with controlled access and designed to accommodate an efficient workflow and to provide a safe and comfortable work environment for employees. All visitors sign in and are escorted by laboratory personnel. Access is controlled by various measures.

The laboratory is equipped with structural safety features. Each employee is familiar with the location, use, and capabilities of general and specialized safety features associated with their workplace. The laboratory provides and requires the use of protective equipment including safety glasses, protective clothing, gloves, etc. OSHA and other regulatory agency guidelines regarding required amounts of bench and fume hood space, lighting, ventilation (temperature and humidity controlled), access, and safety equipment are met or exceeded.

Traffic flow through sample preparation and analysis areas is minimized to reduce the likelihood of contamination. Adequate floor space and bench top area is provided to allow unencumbered sample preparation and analysis space. Sufficient space is also provided for storage of reagents and media, glassware, and portable equipment. Ample space is also provided for refrigerated sample storage before analysis and archival storage of samples after analysis. Laboratory HVAC and deionized water systems are designed to minimize potential trace contaminants.

The laboratory is separated into specific areas for sample receiving, sample preparation, volatile organic sample analysis, non-volatile organic sample analysis, inorganic sample analysis, microbiological sample analysis, and administrative functions.

18.2 Environment

Laboratory accommodation, test areas, energy sources, lighting are adequate to facilitate proper performance of tests. The facility is equipped with heating, ventilation, and air conditioning (HVAC) systems appropriate to the needs of environmental testing performed at this laboratory.

The environment in which these activities are undertaken does not invalidate the results or adversely affect the required accuracy of any measurements.

The laboratory provides for the effective monitoring, control and recording of environmental conditions that may affect the results of environmental tests as required by the relevant specifications, methods, and procedures. Such environmental conditions include humidity, voltage, temperature, and vibration levels in the laboratory.

When any of the method or regulatory required environmental conditions change to a point where they may adversely affect test results, analytical testing will be discontinued until the environmental conditions are returned to the required levels (refer to Section 12).

Environmental conditions of the facility housing the computer network and LIMS are regulated to protect against raw data loss.

18.3 Work Areas

There is effective separation between neighboring areas when the activities therein are incompatible with each other. Examples include:

- Volatile organic chemical handling areas, including non volatile sample preparation and waste disposal, and volatile organic chemical analysis areas.

Access to and use of all areas affecting the quality of analytical testing is defined and controlled by secure access to the laboratory building as described below in the Building Security section.

Adequate measures are taken to ensure good housekeeping in the laboratory and to ensure that any contamination does not adversely affect data quality. These measures include regular cleaning to control dirt and dust within the laboratory.

Work areas are available to ensure an unencumbered work area. Work areas include:

- Access and entryways to the laboratory.
- Sample receipt areas.
- Sample storage areas.
- Chemical and waste storage areas.
- Data handling and storage areas.
- Sample processing areas.
- Sample analysis areas.

Refer to the following documents and procedures for specific requirements for microbiological laboratory facility requirements.

o Standard Methods, 20th Ed., 9020B, Sec. 2
o TNI V1M5, 1.7.3.7.a

18.4 Floor Plan

A floor plan can be found in Appendix 1.

18.5 Building Security

Building keys and alarm codes are distributed to employees as necessary.

Visitors to the laboratory sign in and out in a visitor's logbook. A visitor is defined as any person who visits the laboratory who is not an employee of the laboratory. In addition to signing into the laboratory, the Environmental, Health and Safety Manual contains requirements for visitors and vendors. There are specific safety forms that must be reviewed and signed. Visitors (with the exception of company employees) are escorted by laboratory personnel at all times, or the location of the visitor is noted in the visitor's logbook.

SECTION 19. TEST METHODS AND METHOD VALIDATION

19.1 Overview

The laboratory uses methods that are appropriate to meet our clients' requirements and that are within the scope of the laboratory's capabilities. These include sampling, handling, transport, storage and preparation of samples, and, where appropriate, an estimation of the measurement of uncertainty as well as statistical techniques for analysis of environmental data.

Instructions are available in the laboratory for the operation of equipment as well as for the handling and preparation of samples. All instructions, Standard Operating Procedures (SOPs), reference methods and manuals relevant to the working of the laboratory are readily available to all staff. Deviations from published methods are documented (with justification) in the laboratory's approved SOPs. SOPs are submitted to clients for review at their request. Significant deviations from published methods require client approval and regulatory approval where applicable.

19.2 Standard Operating Procedures (SOPs)

The laboratory maintains SOPs that accurately reflect all phases of the laboratory such as assessing data integrity, corrective actions, handling customer complaints as well as all analytical methods and sampling procedures. The method SOPs are derived from the most recently promulgated/approved, published methods and are specifically adapted to the laboratory facility. Modifications or clarifications to published methods are clearly noted in the SOPs. All SOPs are controlled in the laboratory:

Note: In some cases (non-acceptance of a newer method revision by a state agency, permit requirement, etc…) the laboratory is required to offer testing by a method version that is not the most recent revision of a method. In this case, the SOP will be derived from the required method.

- All SOPs contain a revision number, effective date, and appropriate approval signatures. Controlled copies are available to all staff electronically through the shared DMQC drive.
- Procedures for writing an SOP are incorporated by reference to TestAmerica's Corporate SOP entitled 'Writing a Standard Operating Procedure', No. CW-Q-S-002
- SOPs are reviewed at a minimum of every two years. SOPs related to drinking water analysis are reviewed annually (annual review is required for Drinking Water and DoD SOPs). Where necessary, SOPs are revised to ensure continuing suitability and compliance with applicable requirements.

19.3 Laboratory Methods Manual

For each test method, the laboratory shall have available the published referenced method as well as the laboratory developed SOP. The reference methods are found on the DMQC drive at the location DMQC\Technical Documents, Methods, Forms, Standards\Reference Methods\(particular department)\(test).

Note: If more stringent standards or requirements are included in a mandated test method or regulation than those specified in this manual, the laboratory shall demonstrate that such

requirements are met. If it is not clear which requirements are more stringent, the standard from the method or regulation is to be followed. Any exceptions or deviations from the referenced methods or regulations are noted in the specific analytical SOP.

The laboratory maintains an SOP Index for both technical and non-technical SOPs. Technical SOPs are maintained to describe a specific test method. Non-technical SOPs are maintained to describe functions and processes not related to a specific test method.

19.4 Selection of Methods

Since numerous methods and analytical techniques are available, continued communication between the client and laboratory is imperative to assure the correct methods are utilized. Once client methodology requirements are established, this and other pertinent information is summarized by the Project Manager. These mechanisms ensure that the proper analytical methods are applied when the samples arrive for log-in. For non-routine analytical services (e.g., special matrices, non-routine compound lists), the method of choice is selected based on client needs and available technology. The methods selected should be capable of measuring the specific parameter of interest, in the concentration range of interest, and with the required precision and accuracy.

19.4.1 Sources of Methods

Routine analytical services are performed using standard EPA-approved methodology. In some cases, modification of standard approved methods may be necessary to provide accurate analyses of particularly complex matrices. When the use of specific methods for sample analysis is mandated through project or regulatory requirements, only those methods shall be used.

When clients do not specify the method to be used or methods are not required, the methods used will be clearly validated and documented in an SOP and available to clients and/or the end user of the data.

The analytical methods used by the laboratory are those currently accepted and approved by the U. S. EPA and the state or territory from which the samples were collected. Reference methods include:

- *Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act, and Appendix A-C; 40 CFR Part 136, USEPA Office of Water. Revised as of July 1, 1995, Appendix A to Part 136 - Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater (EPA 600 Series)*
- *Methods for Chemical Analysis of Water and Wastes, EPA 600 (4-79-020), 1983.*
- *Methods for the Determination of Inorganic Substances in Environmental Samples, EPA-600/R-93/100, August 1993.*
- *Methods for the Determination of Metals in Environmental Samples, EPA/600/4-91/010, June 1991. Supplement I: EPA-600/R-94/111, May 1994.*
- *Technical Notes on Drinking Water Methods, EPA-600/R94-173, October 1994*
- *NIOSH Manual of Analytical Methods, 4th ed., August 1994.*

- *Statement of Work for Inorganics & Organics Analysis, SOM and ISM, current versions, USEPA Contract Laboratory Program Multi-media, Multi-concentration.*
- *Standard Methods for the Examination of Water and Wastewater, 18th/19th /20th/ on-line edition; Eaton, A.D. Clesceri, L.S. Greenberg, A.E. Eds; American Water Works Association, Water Pollution Control Federation, American Public Health Association: Washington, D.C.*
- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996; Final Update IV, January 2008.*
- *Manual for the Certification of Laboratories Analyzing Drinking Water (EPA 815-R-05-004, January 2005)*
- *Code of Federal Regulations (CFR) 40, Parts 136, 141, 172, 173, 178, 179 and 261*
- *Method for Determination of Volatile Petroleum Hydrocarbons (Gasoline), IDNR Method OA-1, revision 7/27/93.*
- *Method for Determination of Extractable Petroleum Products (And Related Low Volatility Organic Compounds), IDNR Method OA-2, revision 7/27/93.*
- *Method for Determination of Extractable Petroleum Hydrocarbons by GC/FID, TN Extractable Petroleum Hydrocarbons (EPH) Method.*
- *Total Petroleum Hydrocarbons TNRCC Method 1005, Revision 03; Texas Natural Resource Conservation Commission, June 1, 2001.*
- *Methods 8020/8015 (Modified), Gasoline Range Organics (GRO), Revision 4.0, Oklahoma Department of Environmental Quality, 02/24/1996.*
- *Methods 8000/8100 (Modified), Diesel Range Organics (DRO); Revision 4.1; Oklahoma Department of Environmental Quality, 10/22/1997.*
- *Florida Residual Petroleum Organic Method (FL-PRO), Florida DOH, April 10, 1996.*
- *Missouri Risk-Based Corrective Action (MRBCA) Process for Petroleum Storage Tanks, Final Draft, January 2004.*

The laboratory reviews updated versions to all the aforementioned references for adaptation based upon capabilities, instrumentation, etc., and implements them as appropriate. As such, the laboratory strives to perform only the latest versions of each approved method as regulations allow or require.

Other reference procedures for non-routine analyses may include methods established by specific states (e.g., Underground Storage Tank methods), ASTM or equipment manufacturers. Sample type, source, and the governing regulatory agency requiring the analysis will determine the method utilized.

The laboratory shall inform the client when a method proposed by the client may be inappropriate or out of date. After the client has been informed, and they wish to proceed contrary to the laboratory's recommendation, it will be documented.

19.4.2 Demonstration of Capability

Before the laboratory may institute a new method and begin reporting results, the laboratory shall confirm that it can properly operate the method. In general, this demonstration does not test the performance of the method in real world samples, but in an applicable and available clean matrix sample. If the method is for the testing of analytes that are not conducive to spiking, demonstration of capability may be performed on quality control samples.

A demonstration of capability (DOC, Lab SOP PS-QAD-021, Demonstrations of Capability) is performed whenever there is a change in instrument type (e.g., new instrumentation), matrix, method or personnel (e.g., analyst hasn't performed the test within the last 12 months).

Note: The laboratory shall have a DOC for all analytes included in the methods that the laboratory performs, and proficiency DOCs for each analyst shall include all analytes that the laboratory routinely performs. Addition of non-routine analytes does not require new DOCs for all analysts if those analysts are already qualified for routine analytes tested using identical chemistry and instrument conditions.

The initial demonstration of capability must be thoroughly documented and approved by the Technical Manager and QA Manager prior to independently analyzing client samples. All associated documentation must be retained in accordance with the laboratories archiving procedures (refer to Section 14, Control of Records).

The laboratory must have an approved SOP, demonstrate satisfactory performance, and conduct a method detection limit study (when applicable). There may be other requirements as stated within the published method or regulations (i.e., retention time window study).

Note: In some instances, a situation may arise where a client requests that an unusual analyte be reported using a method where this analyte is not normally reported. If the analyte is being reported for regulatory purposes, the method must meet all procedures outlined within this QA Manual (SOP, MDL, and Demonstration of Capability). If the client states that the information is not for regulatory purposes, the result may be reported as long as the following criteria are met:

- The instrument is calibrated for the analyte to be reported using the criteria for the method and ICV/CCV criteria are met (unless an ICV/CCV is not required by the method or criteria are per project DQOs).
- The laboratory's nominal or default reporting limit (RL) is equal to the quantitation limit (QL), must be at or above the lowest non-zero standard in the calibration curve and must be reliably determined. Project RLs are client specified reporting levels which may be higher than the QL. Results reported below the QL must be qualified as estimated values. Also see Section 19.6.1.3, Relationship of Limit of Detection (LOD) to Quantitation Limit (QL).
- The client request is documented and the lab informs the client of its procedure for working with unusual compounds.

19.4.3 Initial Demonstration of Capability (IDOC) Procedures

19.4.3.1 The spiking standard used must be prepared independently from those used in instrument calibration.

19.4.3.2 The analyte(s) shall be diluted in a volume of clean matrix sufficient to prepare four aliquots at the concentration specified by a method or the laboratory SOP.

19.4.3.3 At least four aliquots shall be prepared (including any applicable clean-up procedures) and analyzed according to the test method (either concurrently or over a period of days).

19.4.3.4 Using all of the results, calculate the mean recovery in the appropriate reporting units and the standard deviations for each parameter of interest.

19.4.3.5 When it is not possible to determine the mean and standard deviations, such as for presence, absence and logarithmic values, the laboratory will assess performance against criteria described in the Method SOP.

19.4.3.6 Compare the information obtained above to the corresponding acceptance criteria for precision and accuracy in the test method (if applicable) or in laboratory generated acceptance criteria (LCS or interim criteria) if there is no mandatory criteria established. If any one of the parameters do not meet the acceptance criteria, the performance is unacceptable for that parameter.

19.4.3.7 When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst must proceed according to either option listed below:

- Locate and correct the source of the problem and repeat the test for all parameters of interest beginning with 19.4.3.3 above.
- Beginning with 19.4.3.3 above, repeat the test for all parameters that failed to meet criteria. Repeated failure, however, will confirm a general problem with the measurement system. If this occurs, locate and correct the source of the problem and repeat the test for all compounds of interest beginning with 19.4.3.1 above.

Note: Results of successive LCS analyses can be used to fulfill the DOC requirement.

A certification statement (refer to Figure 19-1 as an example) shall be used to document the completion of each initial demonstration of capability. A copy of the certification is archived in the analyst's training folder.

Methods on line prior to the effective date of this Section shall be updated to the procedures outlined above as new analysts perform their demonstration of capability. A copy of the new record will replace that which was used for documentation in the past. At a minimum, the precision and accuracy of four mid-level laboratory control samples must have been compared to the laboratory's quality control acceptance limits.

19.4.3.8 For analytes/methods where no LCS is performed the department manager observes the analyst perform the test and evaluates the performance based on the lab SOP for the test. The acceptability criteria for this type of DOC are therefore subjective. The statement "*The test referenced by this DOC does not provide for LCS spikes which generally compose TestAmerica Pensacola DOC's. In order to demonstrate capability the referenced analyst performed the test under the scrutiny of the*

department manager who by signing this form verifies that the analyst's performance meets any and all requirements" is added to the NELAC DOC certification statement. TestAmerica Pensacola tests falling into this DOC category are:

Volatile Solids	PS-WCD-010		
Coliforms	PS-WCD-019	PS-WCD-020	PS-WCD-027
Amenable Cyanide	PS-WCD-036		
Odor	PS-WCD-006		
pH	PS-WCD-001		
Paint Filter	PS-WCD-033		

19.5 Laboratory Developed Methods and Non-Standard Methods

Any new method developed by the laboratory must be fully defined in an SOP and validated by qualified personnel with adequate resources to perform the method. Method specifications and the relation to client requirements must be clearly conveyed to the client if the method is a non-standard method (not a published or routinely accepted method). The client must also be in agreement to the use of the non-standard method.

19.6 Validation of Methods

Validation is the confirmation by examination and the provision of objective evidence that the particular requirements for a specific intended use are fulfilled.

All non-standard methods, laboratory designed/developed methods, standard methods used outside of their scope, and major modifications to published methods must be validated to confirm they are fit for their intended use. The validation will be as extensive as necessary to meet the needs of the given application. The results are documented with the validation procedure used and contain a statement as to the fitness for use.

19.6.1 Method Validation and Verification Activities for All New Methods

While method validation can take various courses, the following activities can be required as part of method validation. Method validation records are designated QC records and are archived accordingly.

19.6.1.1 Determination of Method Selectivity

Method selectivity is the demonstrated ability to discriminate the analyte(s) of interest from other compounds in the specific matrix or matrices from other analytes or interference. In some cases to achieve the required selectivity for an analyte, a confirmation analysis is required as part of the method.

19.6.1.2 Determination of Method Sensitivity

Sensitivity can be both estimated and demonstrated. Whether a study is required to estimate sensitivity depends on the level of method development required when applying a particular

measurement system to a specific set of samples. Where estimations and/or demonstrations of sensitivity are required by regulation or client agreement, such as the procedure in 40 CFR Part 136 Appendix B, under the Clean Water Act, these shall be followed.

19.6.1.3 Relationship of Limit of Detection (LOD) to the Quantitation Limit (QL)

An important characteristic of expression of sensitivity is the difference in the LOD and the QL. The LOD is the minimum level at which the presence of an analyte can be reliably concluded. The QL is the minimum concentration of analyte that can be quantitatively determined with acceptable precision and bias. For most instrumental measurement systems, there is a region where semi-quantitative data is generated around the LOD (both above and below the estimated MDL or LOD) and below the QL. In this region, detection of an analyte may be confirmed but quantification of the analyte is unreliable within the accuracy and precision guidelines of the measurement system. When an analyte is detected below the QL, and the presence of the analyte is confirmed by meeting the qualitative identification criteria for the analyte, the analyte can be reliably reported, but the amount of the analyte can only be estimated. If data is to be reported in this region, it must be done so with a qualification that denotes the semi-quantitative nature of the result.

19.6.1.4 Determination of Interferences

A determination that the method is free from interferences in a blank matrix is performed.

19.6.1.5 Determination of Range

Where appropriate to the method, the quantitation range is determined by comparison of the response of an analyte in a curve to established or targeted criteria. Generally the upper quantitation limit is defined by highest acceptable calibration concentration. The lower quantitation limit or QL cannot be lower than the lowest non-zero calibration level, and can be constrained by required levels of bias and precision.

19.6.1.6 Determination of Accuracy and Precision

Accuracy and precision studies are generally performed using replicate analyses, with a resulting percent recovery and measure of reproducibility (standard deviation, relative standard deviation) calculated and measured against a set of target criteria.

19.6.1.7 Documentation of Method

The method is formally documented in an SOP. If the method is a minor modification of a standard laboratory method that is already documented in an SOP, an SOP Attachment describing the specific differences in the new method is acceptable in place of a separate SOP.

19.6.1.8 Continued Demonstration of Method Performance

Continued demonstration of Method Performance is addressed in the SOP. Continued demonstration of method performance is generally accomplished by batch specific QC samples such as LCS, method blanks or PT samples.

19.7 Method Detection Limits (MDL)/ Limits of Detection (LOD)

Method detection limits (MDL) are initially determined in accordance with 40 CFR Part 136, Appendix B or alternatively by other technically acceptable practices that have been accepted by regulators. MDL is also sometimes referred to as Limit of Detection (LOD). The MDL theoretically represents the concentration level for each analyte within a method at which the Analyst is 99% confident that the true value is not zero. The MDL is determined for each analyte initially during the method validation process and updated as required in the analytical methods, whenever there is a significant change in the procedure or equipment, or based on project specific requirements. Generally, the analyst prepares at least seven replicates of solution spiked at one to five times the estimated method detection limit (most often at the lowest standard in the calibration curve) into the applicable matrix with all the analytes of interest. Each of these aliquots is extracted (including any applicable clean-up procedures) and analyzed in the same manner as the samples. Where possible, the seven replicates should be analyzed over 2-4 days to provide a more realistic MDL. [To allow for some flexibility, this low level standard may be analyzed every batch or every week or some other frequency rather than doing the study all at once. In addition, a larger number of data points may be used if the appropriate t-value multiplier is used]

Refer to the Corporate SOP No. CA-Q-S-006.

19.8 Instrument Detection Limits (IDL)

The IDL is sometimes used to assess the reasonableness of the MDLs or in some cases required by the analytical method or program requirements. IDLs are most used in metals analyses but may be useful in demonstration of instrument performance in other areas.

IDLs are calculated to determine an instrument's sensitivity independent of any preparation method. IDLs are calculated either using 7 replicate spike analyses, like MDL but without sample preparation, or by the analysis of 10 instrument blanks and calculating 3 x the absolute value of the standard deviation.

If IDL is > than the MDL, it may be used as the reported MDL.

19.9 Verification of Detection and Reporting Limits

Once an MDL is established, it must be verified, on each instrument, by analyzing a quality control sample (prepared as a sample) at no more than 3 times the calculated MDL for single analyte analyses (e.g. most wet chemistry methods, Atomic Absorption, etc.) and at no more than 4 times the calculated MDL for multiple analyte methods (e.g. GC, GCMS, ICP, etc.). The analytes must be qualitatively identified. This verification does not apply to methods that are not readily spiked (e.g. pH, turbidity, etc.) or where the lab does not report to the MDL. If the MDL does not verify, then the lab will not report to the MDL, or redevelop their MDL or use the level where qualitative identification is established. MDLs must be verified at least annually.

When the laboratory establishes a quantitation limit, it must be initially verified by the analysis of a low level standard or QC sample at 1-2 the reporting limit and annually thereafter. The annual requirement is waved for methods that have an annually verified MDL. The laboratory will comply with any regulatory requirements.

19.10 Retention Time Windows

Most organic analyses and some inorganic analyses use chromatography techniques for qualitative and quantitative determinations. For every chromatography analysis or as specific in the reference method, each analyte will have a specific time of elution from the column to the detector. This is known as the analyte's retention time. The variance in the expected time of elution is defined as the retention time window. As the key to analyte identification in chromatography, retention time windows must be established on every column for every analyte used for that method. These records are kept with the files associated with an instrument for later quantitation of the analytes. Complete details are available in the laboratory SOPs.

19.11 Evaluation of Selectivity

The laboratory evaluates selectivity by following the checks within the applicable analytical methods, which include mass spectral tuning, second column confirmation, ICP interelement interference checks, chromatography retention time windows, sample blanks, spectrochemical, atomic absorption or fluorescence profiles, co-precipitation evaluations and specific electrode response factors.

19.12 Estimation of Uncertainty of Measurement

19.12.1 Uncertainty is "a parameter associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand" (as defined by the International Vocabulary of Basic and General Terms in Metrology, ISO Geneva, 1993, ISBN 92-67-10175-1). Knowledge of the uncertainty of a measurement provides additional confidence in a result's validity. Its value accounts for all the factors which could possibly affect the result, such as adequacy of analyte definition, sampling, matrix effects and interferences, climatic conditions, variances in weights, volumes, and standards, analytical procedure, and random variation. Some national accreditation organizations require the use of an "expanded uncertainty": the range within which the value of the measurand is believed to lie within at least a 95% confidence level with the coverage factor k=2.

19.12.2 Uncertainty is not error. Error is a single value, the difference between the true result and the measured result. On environmental samples, the true result is never known. The measurement is the sum of the unknown true value and the unknown error. Unknown error is a combination of systematic error, or bias, and random error. Bias varies predictably, constantly, and independently from the number of measurements. Random error is unpredictable, assumed to be Gaussian in distribution, and reducible by increasing the number of measurements.

19.12.3 The minimum uncertainty associated with results generated by the laboratory can be determined by using the Laboratory Control Sample (LCS) accuracy range for a given analyte. The LCS limits are used to assess the performance of the measurement system since they take into consideration all of the laboratory variables associated with a given test over time (except for variability associated with the sampling and the variability due to matrix effects). The percent recovery of the LCS is compared either to the method-required LCS accuracy limits or to the statistical, historical, in-house LCS accuracy limits.

19.12.4 To calculate the uncertainty for the specific result reported, multiply the result by the decimal of the lower end of the LCS range percent value for the lower end of the uncertainty

range, and multiply the result by the decimal of the upper end of the LCS range percent value for the upper end of the uncertainty range. These calculated values represent a 99%-certain range for the reported result. As an example, suppose that the result reported is 1.0 mg/l, and the LCS percent recovery range is 50 to 150%. The uncertainty range would be 0.5 to 1.5 mg/l, which could also be written as 1.0 +/- 0.5 mg/l.

19.12.5 In the case where a well recognized test method specifies limits to the values of major sources of uncertainty of measurement (e.g. 524.2, 525, etc) and specifies the form of presentation of calculated results, no further discussion of uncertainty is required.

19.13 Sample Reanalysis Guidelines

Because there is a certain level of uncertainty with any analytical measurement, a sample re-preparation (where appropriate) and subsequent analysis (hereafter referred to as 'reanalysis') may result in either a higher or lower value from an initial sample analysis. There are also variables that may be present (e.g., sample homogeneity, analyte precipitation over time, etc.) that may affect the results of a reanalysis. Based on the above comments, the laboratory will reanalyze samples at a client's request with the following caveats. **Client specific Contractual Terms & Conditions for reanalysis protocols may supersede the following items.**

- Homogenous samples: If a reanalysis agrees with the original result to within the RPD limits for MS/MSD or Duplicate analyses, or within $\pm$ 1 reporting limit for samples $\leq$ 5x the reporting limit, the original analysis will be reported. At the client's request, both results may be reported on the same report but not on two separate reports.

- If the reanalysis does not agree (as defined above) with the original result, then the laboratory will investigate the discrepancy and reanalyze the sample a third time for confirmation if sufficient sample is available.

- Any potential charges related to reanalysis are discussed in the contract terms and conditions or discussed at the time of the request. The client will typically be charged for reanalysis unless it is determined that the lab was in error.

- Due to the potential for increased variability, reanalysis may not be applicable to Non-homogenous, Encore, and Sodium Bisulfate preserved samples. See the Department Manager or Operations Manager if unsure.

19.14 Control of Data

The laboratory has policies and procedures in place to ensure the authenticity, integrity, and accuracy of the analytical data generated by the laboratory.

19.14.1 Computer and Electronic Data Related Requirements

The three basic objectives of our computer security procedures and policies are shown below. More detail is outlined in SOP PS-LAB-010. The laboratory is currently running the TALS which is an in-house LIMS system that has been highly customized to meet the needs of it's clients. It is referred to as LIMS for the remainder of this section. The LIMS utilizes Microsoft SQL which

is an industry standard relational database platform. It is referred to as Database for the remainder of this section.

19.1.1.1 **Maintain the Database Integrity:** Assurance that data is reliable and accurate through data verification (review) procedures, password-protecting access, anti-virus protection, data change requirements, as well as an internal LIMS permissions procedure.

- LIMS Database Integrity is achieved through data input validation, internal user controls, and data change requirements.
- The LIMS database is further protected by being redundantly located on servers in both Denver, Colorado and Houston, Texas. The LIMs system operates using a centralized database in which all information is directly captured in both locations as soon as the information is created in the LIMs. All changes to the LIMs are electronically tracked.
- Spreadsheets and other software developed in-house must be verified with documentation through hand calculations prior to use. Cells containing calculations must be lock-protected and controlled.
- Instrument hardware and software adjustments are safeguarded through maintenance logs, audit trails and controlled access.

19.14.1.1 **Ensure Information Availability:** Protection against loss of information or service is ensured through scheduled back-ups of electronic instrument data, stable file server network architecture, secure storage of media, line filter, Uninterruptible Power Supply (UPS), and maintaining older versions of software as revisions are implemented.

19.14.1.2 **Maintain Confidentiality:** Ensure data confidentiality through physical access controls such as password protection or website access approval when electronically transmitting data.

19.14.2 Data Reduction

The complexity of the data reduction depends on the analytical method and the number of discrete operations involved (e.g., extractions, dilutions, instrument readings and concentrations). The analyst calculates the final results from the raw data or uses appropriate computer programs to assist in the calculation of final reportable values.

For manual data entry, e.g., Wet Chemistry, the data is reduced by the analyst and manually entered into the LIMs system. The data including transcription is then verified by the Department Manager or alternate analyst. The spreadsheets, or any other type of applicable documents, are signed by the analyst to confirm the accuracy of the manual entry(s) and then scanned and attached to the data batch in the LIMs system for archival.

Manual integration of peaks will be documented and reviewed and the raw data will be flagged in accordance with the TestAmerica Corporate SOP CA-Q-S-002, *Acceptable Manual Integration Practices*.

Analytical results are reduced to appropriate concentration units specified by the analytical method, taking into account factors such as dilution, sample weight or volume, etc. Blank correction will be applied only when required by the method or per manufacturer's indication; otherwise, it should not be performed. Calculations are independently verified by appropriate laboratory staff. Calculations and data reduction steps for various methods are summarized in the respective analytical SOPs or program requirements.

19.14.2.1 All raw data must be retained and scanned and attached to the data batch in the LIMs for archival. All criteria pertinent to the method must be recorded. The documentation is recorded at the time observations or calculations are made and must be signed or initialed/dated (month/day/year). It must be easily identifiable who performed which tasks if multiple people were involved.

19.14.2.2 In general, concentration results are reported in milligrams per liter (mg/l) or micrograms per liter (µg/l) for liquids and milligrams per kilogram (mg/kg) or micrograms per kilogram (µg/kg) for solids. The units "mg/l" and "mg/kg" are the same as "parts per million (ppm)". The units "µg/l" and "µg/kg" are the same as "parts per billion (ppb)." For values greater than 10,000 mg/l, results can be reported in percent, i.e., 10,000 mg/l = 1%.

- Several environmental methods, such as color, turbidity, conductivity, use very specific, non-concentration units to report results (e.g., NTU, umhos/cm etc).
- Occasionally, the client requests that results be reported in units which take into account the measured flow of water or air during the collection of the sample. When they provide this information, the calculations can be performed and reported.

19.14.2.3 In reporting, the analyst or the instrument output records the raw data result using values of known certainty plus one uncertain digit. If final calculations are performed external to LIMS, the results should be entered in LIMS with at least three significant figures. In general, results are reported to 2 significant figures on the final report.

19.14.2.4 For those methods that do not have an instrument printout or an instrumental output compatible with the LIMS System, the raw results and dilution factors are entered directly into LIMS by the analyst, and the software calculates the final result for the analytical report. LIMS has a defined significant figure criterion for each analyte.

19.14.2.5 The laboratory strives to import data directly from instruments or calculation spreadsheets to ensure that the reported data are free from transcription and calculation errors. For those analyses with an instrumental output compatible with the LIMS, the raw results and dilution factors are transferred into LIMS electronically after reviewing the quantitation report, and removing unrequested or poor spectrally-matched compounds. Chrom raw data reports, calibration information, , concentrations, retention times, chromatograms, and mass spectra, if applicable, are electronically captured and stored/archived in TALs. Raw data reports, calibration information etc.. for non-chrom instruments is retained with the data file. The data file is stored in a monthly folder on the instrument computer; periodically, this file is transferred to the server and automatically backed-up to the data centers in Denver and Houston..

19.14.3 Logbook / Worksheet Use Guidelines

Logbooks and worksheets are filled out 'real time' and have enough information on them to trace the events of the applicable analysis/task. (e.g. calibrations, standards, analyst, sample ID, date, time on short holding time tests, temperatures when applicable, calculations are traceable, etc.)

- Corrections are made following the procedures outlined in Section 12.
- Logbooks are controlled by the QA department. A record is maintained of all logbooks in the lab.
- Unused portions of pages must be "Z"'d out, signed and dated.
- Worksheets are created with the approval of the Technical Director/QA Manager at the facility. The QA Manager controls all worksheets following the procedures in Section 6.

19.14.4 Review / Verification Procedures

Review procedures are outlined in SOP PS-CSD-007 to ensure that reported data are free from calculation and transcription errors, that QC parameters have been reviewed and evaluated before data is reported. The general review concepts are discussed below, more specific information can be found in the SOPs.

19.14.4.1 The data review process at TestAmerica Pensacola starts at the Sample Control level. Sample Control personnel review chain-of-custody forms and input the sample information and required analyses into a computer LIMS. The Project Managers perform final review of the chain-of-custody forms and inputted information.

19.14.4.2 The next level of data review occurs with the Analysts. As results are generated, analysts review their work to ensure that the results generated meet QC requirements and relevant EPA methodologies. The Analysts transfer the data into the LIMS and add data qualifiers if applicable. To ensure data compliance, a different analyst performs a second level of review. Second level review is accomplished by checking reported results against raw data and evaluating the results for accuracy. During the second level review, blank runs, QA/QC check results, initial and continuing calibration results, laboratory control samples, sample data, qualifiers and spike information are evaluated. Where calibration is not required on a daily basis, secondary review of the initial calibration results may be conducted at the time of calibration. All sample data from manual methods and from automated methods, all GC/MS spectra, all manual integrations, and all manual data entry transcription are reviewed. Manual integrations are also electronically reviewed utilizing auditing software to help ensure compliance to ethics and manual integration policies. Issues that deem further review include the following:

- QC data are outside the specified control limits for accuracy and precision
- Reviewed sample data does not match with reported results
- Unusual detection limit changes are observed
- Samples having unusually high results

- Samples exceeding a known regulatory limit
- Raw data indicating some type of contamination or poor technique
- Inconsistent peak integration
- Transcription errors
- Results outside of calibration range

19.14.4.3 Unacceptable analytical results may require reanalysis of the samples. Any problems are brought to the attention of the Laboratory Director, Project Manager, Quality Assurance Manager, Operations Manager or Department Manager for further investigation. Corrective action is initiated whenever necessary.

19.14.4.4 The results are then entered or directly transferred into the LIMS and a hard copy (or .pdf) is printed for the client.

19.14.4.5 As a final review prior to the release of the report, the Project Manager reviews the results for appropriateness and completeness. This review and approval ensures that client requirements have been met and that the final report has been properly completed. The process includes, but is not limited to, verifying that chemical relationships are evaluated, COC is followed, cover letters/ narratives are present, flags are appropriate, and project specific requirements are met.

19.14.4.6 Any project that requires a data package is subject to a tertiary data review for completeness and acceptable quality control requirements. The Project Manager then signs the final report. The accounting personnel also check the report for any clerical or invoicing errors. When complete, the report is sent out to the client.

19.14.4.7 A visual summary of the flow of samples and information through the laboratory, as well as data review and validation, is presented in Figure 19-2.

19.14.5 Manual Integrations

Computerized data systems provide the analyst with the ability to re-integrate raw instrument data in order to optimize the interpretation of the data. Though manual integration of data is an invaluable tool for resolving variations in instrument performance and some sample matrix problems, when used improperly, this technique would make unacceptable data appear to meet quality control acceptance limits. Improper re-integrations lead to legally indefensible data, a poor reputation, or possible laboratory decertification. Because guidelines for re-integration of data are not provided in the methods and most methods were written prior to widespread implementation of computerized data systems, the laboratory trains all analytical staff on proper manual integration techniques using TestAmerica's Corporate SOP CA-Q-S-002 as the guidelines**.**

19.14.5.1 The analyst must adjust baseline or the area of a peak in some situations, for example when two compounds are not adequately resolved or when a peak shoulder needs to be separated from the peak of interest. The analyst must use professional judgment and common sense to determine when manual integrating is required.

Analysts are encouraged to ask for assistance from a senior analyst or manager when in doubt.

19.14.5.2 Analysts shall not increase or decrease peak areas for the sole purpose of achieving acceptable QC recoveries that would have otherwise been unacceptable. The intentional recording or reporting of incorrect information (or the intentional omission of correct information) is against company principals and policy and is grounds for immediate termination.

19.14.5.3 Client samples, performance evaluation samples, and quality control samples are all treated equally when determining whether or not a peak area or baseline should be manually adjusted.

19.14.5.4 All manual integrations receive a second level review. Manual integrations must be indicated on an expanded scale “after” chromatograms such that the integration performed can be easily evaluated during data review. Expanded scale “before” chromatograms are also required for all manual integrations on QC parameters (calibrations, calibration verifications, laboratory control samples, internal standards, surrogates, etc.) unless the laboratory has another documented corporate approved procedure in place that can demonstrate an active process for detection and deterrence of improper integration practices.

Figure 19-1.
Demonstration of Capability Documentation

Initial/Continuing Demonstration of Capability Certification Statement

Date:		Matrix:	
Laboratory Name:	TestAmerica Pensacola	Method:	
Laboratory Address:	3355 McLemore Dr, Pensacola, FL 32514	Parameters:	
Analyst:		Prep Tech:	
Analytical SOP:		Prep. SOP:	

We the undersigned CERTIFY that:

1. The analyst identified above, using the cited test method(s), which is in use at this facility for the analyses of samples under the National Environmental Laboratory Accreditation Program, have met the Initial/Continuing Demonstration of Capability.
2. The test method(s) was performed by the analyst(s) identified on this certification.
3. A copy of the test method(s) and the laboratory-specific SOPs are available for all personnel on-site.
4. The data associated with the demonstration capability are true, accurate, complete and self-explanatory[1].
5. All raw data (including a copy of this certification form) necessary to reconstruct and validate these analyses have been retained at the facility, and that the associated information is well organized and available for review by authorized assessors.
6. Analytes for which spiking is not an option and for which quality control samples are not readily available, the supervisor/manager of the department may observe the chemist who performed the method and document acceptability by signing this document.
7. For analytes that are "calculated", the IDOC may consist of 4 LCS samples from the analytes that are used to calculate the method.
8. The analyst/prep tech has read and understands the methods and the corresponding SOPs listed above, and agrees to perform the methods accordingly; or request a revision of the SOP where appropriate.

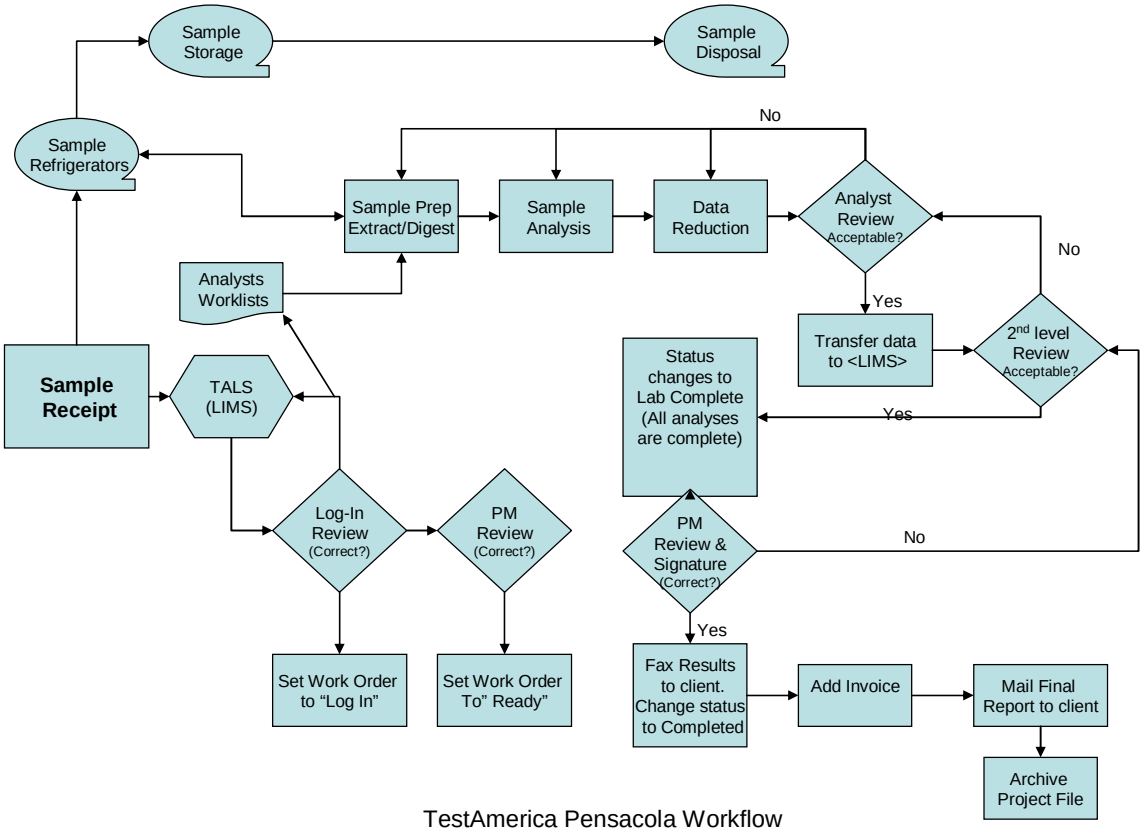
[1] True: Consistent with supporting data.
Accurate: Based on good laboratory practices consistent with sound scientific principles/practices.
Complete: Includes the results of all supporting performance testing.
Self-Explanatory: Data properly labeled and stored so that the results are clear and require no additional explanation.

Analyst/Prep Tech (print)	Signature	Date
Supervisor/Senior Tech Name (print)	Signature	Date
QA Review Name (Print)	Signature	Date

3355 McLemore Drive Pensacola, FL 32514 tel 850.474.1001 fax 850.478.2671 www.testamericainc.com

Figure 19-2.

Work Flow



TestAmerica Pensacola Workflow

SECTION 20. EQUIPMENT AND CALIBRATIONS

20.1 Overview

The laboratory purchases the most technically advanced analytical instrumentation for sample analyses. Instrumentation is purchased on the basis of accuracy, dependability, efficiency and sensitivity. Each laboratory is furnished with all items of sampling, preparation, analytical testing and measurement equipment necessary to correctly perform the tests for which the laboratory has capabilities. Each piece of equipment is capable of achieving the required accuracy and complies with specifications relevant to the method being performed. Before being placed into use, the equipment (including sampling equipment) is calibrated and checked to establish that it meets its intended specification. The calibration routines for analytical instruments establish the range of quantitation. Calibration procedures are specified in laboratory SOPs by department and method.

Equipment is only operated by authorized and trained personnel. Manufacturer's instructions for equipment use are readily accessible to all appropriate laboratory personnel.

20.2 Preventive Maintenance

The laboratory follows a well-defined maintenance program to ensure proper equipment operation and to prevent the failure of laboratory equipment or instrumentation during use. This program of preventive maintenance helps to avoid delays due to instrument failure.

Routine preventive maintenance procedures and frequency, such as lubrication, cleaning, and replacements, should be performed according to the procedures outlined in the manufacturer's manual. Qualified personnel must also perform maintenance when there is evidence of degradation of peak resolution, a shift in the calibration curve, loss of sensitivity, or failure to continually meet one of the quality control criteria.

Table 20-2 lists examples of scheduled routine maintenance. It is the responsibility of each Technical Manager to ensure that instrument maintenance logs are kept for all equipment in his/her department. Preventative maintenance procedures may be/ are also outlined in analytical SOPs or instrument manuals. (Note: for some equipment, the log used to monitor performance is also the maintenance log.)

Instrument maintenance logs are controlled and are used to document instrument problems, instrument repair and maintenance activities. Maintenance logs shall be kept for all major pieces of equipment. Instrument maintenance logs may also be used to specify instrument parameters.

- Documentation must include all major maintenance activities such as contracted preventive maintenance and service and in-house activities such as the replacement of electrical components, lamps, tubing, valves, columns, detectors, cleaning and adjustments.

- Each entry in the instrument log includes the Analyst's initials, the date, a detailed description of the problem (or maintenance needed/scheduled), a detailed explanation of the solution or maintenance performed, and a verification that the equipment is functioning properly (state

what was used to determine a return to control. e.g. CCV run on *'date'* was acceptable, or instrument recalibrated on 'date' with acceptable verification, etc.).

- When maintenance or repair is performed by an outside agency, service receipts detailing the service performed can be affixed into the logbooks adjacent to pages describing the maintenance performed. This taped in page must be signed across the page entered and the logbook so that it is clear that a page is missing if only half a signature is found in the logbook. The documents may also be filed separately as long as they can be easily traced back to the logbook entry.

If an instrument requires repair (subjected to overloading or mishandling, gives suspect results, or otherwise has shown to be defective or outside of specified limits) it shall be taken out of operation and tagged as out of service or otherwise isolated until such a time as the repairs have been made and the instrument can be demonstrated as operational by calibration and/or verification or other test to demonstrate acceptable performance. The laboratory shall examine the effect of this defect on previous analyses.

In the event of equipment malfunction that cannot be resolved, service shall be obtained from the instrument vendor manufacturer, or qualified service technician, if such a service can be tendered. If on-site service is unavailable, arrangements shall be made to have the instrument shipped back to the manufacturer for repair. Back up instruments, which have been approved, for the analysis shall perform the analysis normally carried out by the malfunctioning instrument. If the back up is not available and the analysis cannot be carried out within the needed timeframe, the samples shall be subcontracted.

At a minimum,, if an instrument is sent out for service or transferred to another facility, it must be recalibrated and the laboratory MDL verified (using an MDLV) prior to return to lab operations.

20.3 Support Equipment

This section applies to all devices that may not be the actual test instrument, but are necessary to support laboratory operations. These include but are not limited to: balances, ovens, refrigerators, freezers, incubators, water baths, field sampling devices, temperature measuring devices, thermal/pressure sample preparation devices and volumetric dispensing devices if quantitative results are dependent on their accuracy, as in standard preparation and dispensing or dilution into a specified volume. All raw data records associated with the support equipment are retained to document instrument performance.

20.3.1 Weights and Balances

The accuracy of the balances used in the laboratory is checked every working day, before use. All balances are placed on stable counter tops.

Each balance is checked prior to initial serviceable use with at least two certified ASTM type 1 weights spanning its range of use (weights that have been calibrated to ASTM type 1 weights may also be used for daily verification). ASTM type 1 weights used only for calibration of other weights (and no other purpose) are inspected for corrosion, damage or nicks at least annually and if no damage is observed, they are calibrated at least every 5 years by an outside calibration laboratory. Any weights (including ASTM Type 1) used for daily balance checks or

other purposes are recalibrated/recertified annually to NIST standards (this may be done internally if laboratory maintains “calibration only” ASTM type 1 weights).

All balances are serviced annually by a qualified service representative, who supplies the laboratory with a certificate that identifies traceability of the calibration to the NIST standards.

All of this information is recorded in logs, and the recalibration/recertification certificates are kept on file. Refer to SOP PS-QAD-016 for further information.

20.3.2 pH, Conductivity, and Turbidity Meters

The pH meters used in the laboratory are accurate to ± 0.1 pH units, and have a scale readability of at least 0.05 pH units. The meters automatically compensate for the temperature, and are calibrated with at least two working range buffer solutions before each use.

Conductivity meters are also calibrated before each use with a known standard to demonstrate the meters do not exceed an error of 1% or one umhos/cm.

Turbidity meters are also calibrated before each use. All of this information is documented in logs.

Consult pH and Conductivity, and Turbidity SOPs for further information.

20.3.3 Thermometers

All thermometers are calibrated on an annual basis with a NIST-traceable thermometer. IR thermometers, digital probes and thermocouples are calibrated quarterly

The NIST thermometer is recalibrated every three years (unless thermometer has been exposed to temperature extremes or apparent separation of internal liquid) by an approved outside service and the provided certificate of traceability is kept on file. The NIST thermometer(s) have increments of 0.5 degree and 1 degree (0.5 degree or less increments are required for drinking water microbiological laboratories), and have ranges applicable to method and certification requirements. The NIST traceable thermometer is used for no other purpose than to calibrate other thermometers.

All of this information is documented in logbooks. Monitoring method-specific temperatures, including incubators, heating blocks, water baths, and ovens, is documented in method-specific logbooks. More information on this subject can be found in SOP PS-QAD-014 (Temperature).

20.3.4 Refrigerators/Freezer Units, Waterbaths, Ovens and Incubators

The temperatures of all refrigerator units and freezers used for sample and standard storage are monitored each working day.

Ovens, waterbaths and incubators are monitored on days of use.

All of this equipment has a unique identification number, and is assigned a unique thermometer for monitoring.

Sample storage refrigerator temperatures are kept between > 0ºC and ≤ 6 ºC.

Specific temperature settings/ranges for other refrigerators, ovens waterbaths, and incubators can be found in method specific SOPs.

All of this information is documented in Daily Temperature Logsheets posted on the equipment and method-specific logbooks.

20.3.5 Autopipettors, Dilutors, and Syringes

Mechanical volumetric dispensing devices including burettes (except Class A Glassware) are given unique identification numbers and the delivery volumes are verified gravimetrically, at a minimum, on a quarterly basis. and have ranges applicable to method and certification requirements. Glass micro-syringes are considered the same as Class A glassware, however are verified semiannually. If glass micro-syringes are ordered without certificates of acceptance, they are verified by a one point calibration verification prior to use.

For those dispensers that are not used for analytical measurements, a label is applied to the device stating that it is not calibrated. Any device not regularly verified can not be used for any quantitative measurements. Refer to laboratory SOP PS-LAB-011(Pipette, Syringe, Dispenser, and Digital Burette Calibration and Verification).

Micro-syringes are purchased from Hamilton Company. Each syringe is uniquely identified and an initial calibration check is performed prior to use. Calibrations or replacements are performed semiannually thereafter.

20.3.6 Autoclaves

Autoclaves are checked quarterly for length of sterilization cycle and pressure maintained. This information is recorded in the Wet Chem QC logbook. The instrument is cleaned on a monthly basis. Each day of use the temperature and pressure are recorded.

20.3.7 Field Sampling Devices (Isco Auto Samplers)

Each Auto Sampler (ISCO) is assigned a unique identification number in order to keep track of the calibration. This number is also recorded on the sampling documentation.

Cleaning and calibration of the auto sampler is recorded in a logbook assigned to field services.

20.4 Instrument Calibration

Calibration of analytical instrumentation is essential to the production of quality data. Strict calibration procedures are followed for each method. These procedures are designed to determine and document the method detection limits, the working range of the analytical instrumentation and any fluctuations that may occur from day to day.

Sufficient raw data records are retained to allow an outside party to reconstruct all facets of the initial calibration. Records contain, but are not limited to, the following: calibration date, method,

instrument, analyst(s) initials or signatures, analysis date, analytes, concentration, response, type of calibration (Avg RF, curve, or other calculations that may be used to reduce instrument responses to concentration.)

Sample results must be quantitated from the initial calibration and may not be quantitated from any continuing instrument calibration verification unless otherwise required by regulation, method or program.

If the initial calibration results are outside of the acceptance criteria, corrective action is performed and any affected samples are reanalyzed if possible. If the reanalysis is not possible, any data associated with an unacceptable initial calibration will be reported with appropriate data qualifiers (refer to Section 12) or a Case Narrative.

Note: Instruments are calibrated initially and as needed after that and at least annually *(the annual requirement does not apply to Isotope dilution).*

20.4.1 Calibration Standards

Calibration standards are prepared using the procedures indicated in the Reagents and Standards section of the determinative method SOP. If a reference method does not specify the number of calibration standards, a minimum of 3 calibration points (exception being ICP methods) will be used.

Standards for instrument calibration are obtained from a variety of sources. All standards are traceable to national or international standards of measurement, or to national or international standard reference materials.

The lowest concentration calibration standard that is analyzed during an initial calibration must be at or below the stated reporting limit for the method based on the final volume of extract (or sample).

The other concentrations define the working range of the instrument/method or correspond to the expected range of concentrations found in actual samples that are also within the working range of the instrument/method. Results of samples not bracketed by initial instrument calibration standards (within calibration range to at least the same number of significant figures used to report the data) must be reported as having less certainty, e.g., defined qualifiers or flags (additional information may be included in the case narrative). The exception to these rules is ICP methods or other methods where the referenced method does not specify two or more standards.

All initial calibrations are verified with a standard obtained from a second source and traceable to a national standard, when available (or vendor certified different lot if a second source is not available). For unique situations, such as air analysis where no other source or lot is available, a standard made by a different analyst at a different time or a different preparation would be considered a second source. This verification occurs immediately after the calibration curve has been analyzed, and before the analysis of any samples.

20.4.1.1 Calibration Verification

The calibration relationship established during the initial calibration must be verified initially and at least daily as specified in the laboratory method SOPs in accordance with the referenced analytical methods and in the 2009 TNI Standard. The process of calibration verification applies to both external standard and internal standard calibration techniques, as well as to linear and non-linear calibration models. Initial calibration is with a standard source secondary (second source standard) to the calibration standards, but continuing calibration verifications may use the same source standards as the calibration curve.

Note: The process of calibration verification referred to here is fundamentally different from the approach called "calibration" in some methods. As described in those methods, the calibration factors or response factors calculated during calibration are used to update the calibration factors or response factors used for sample quantitation. This approach, while employed in other EPA programs, amounts to a daily single-point calibration

All target analytes and surrogates, including those reported as non-detects, must be included in periodic calibration verifications for purposes of retention time confirmation and to demonstrate that calibration verification criteria are being met, i.e., RPD, per 2009 TNI Std. EL-V1M4 Sec. 1.7.2.

All samples must be bracketed by periodic analyses of standards that meet the QC acceptance criteria (e.g., calibration and retention time). The frequency is found in the determinative methods or SOPs.

Note: If an internal standard calibration is being used (basically GCMS) then bracketing standards are not required, only daily verifications are needed. The results from these verification standards must meet the calibration verification criteria and the retention time criteria (if applicable).

If the results of a CCV are outside the established acceptance criteria and analysis of a second consecutive (and immediate) CCV fails to produce results within acceptance criteria, corrective action shall be performed. Once corrective actions have been completed & documented, the laboratory shall demonstrate acceptable instrument / method performance by analyzing two consecutive CCVs, or a new initial instrument calibration shall be performed.

Sample analyses and reporting of data may not occur or continue until the analytical system is calibrated or calibration verified. However, data associated with an unacceptable calibration verification may be fully useable under the following special conditions and reported based upon discussion and approval of the client:

a). when the acceptance criteria for the CCV are exceeded high (i.e., high bias) and the associated samples within the batch are non-detects, then those non-detects may be reported with a footnote or case narrative explaining the high bias. Otherwise the samples affected by the unacceptable CCV shall be re-analyzed after a new calibration curve has been established, evaluated and accepted; or

b). when the acceptance criteria for the CCV are exceeded low (i.e., low bias), those sample results may be reported if they exceed a maximum regulatory limit/decision level.

Otherwise the samples affected by the unacceptable CCV shall be re-analyzed after a new calibration curve has been established, evaluated and accepted.

Samples reported by the 2 conditions identified above will be appropriately flagged.

20.4.1.2 Verification of Linear and Non-Linear Calibrations

Calibration verification for calibrations involves the calculation of the percent drift or the percent difference of the instrument response between the initial calibration and each subsequent analysis of the verification standard. (These calculations are available in the laboratory method SOPs. Verification standards are evaluated based on the % Difference from the average CF or RF of the initial calibration or based on % Drift or % Recovery if a linear or quadratic curve is used.

Regardless of whether a linear or non-linear calibration model is used, if initial verification criterion is not met, then no sample analyses may take place until the calibration has been verified or a new initial calibration is performed that meets the specifications listed in the method SOPs. If the calibration cannot be verified after the analysis of a single verification standard, then adjust the instrument operating conditions and/or perform instrument maintenance, and analyze another aliquot of the verification standard. If the calibration cannot be verified with the second standard, then a new initial calibration is performed.

- When the acceptance criteria for the calibration verification are exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise, the samples affected by the unacceptable calibration verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted.

- When the acceptance criteria for the calibration verification are exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise, the samples affected by the unacceptable verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted. Alternatively, a reporting limit standard may be analyzed to demonstrate that the laboratory can still support non-detects at their reporting limit.

20.5 Tentatively Identified Compounds (TICs) – GC/MS Analysis

For samples containing components not associated with the calibration standards, a library search may be made for the purpose of tentative identification. The necessity to perform this type of identification will be determined by the purpose of the analyses being conducted. Data system library search routines should not use normalization routines that would misrepresent the library or unknown spectra when compared to each other.

Note: If the TIC compound is not part of the client target analyte list but is calibrated by the laboratory and is both qualitatively and/or quantitatively identifiable, it should not be reported as a TIC. If the compound is reported on the same form as true TICs, it should be qualified and/or narrated that the reported compound is qualitatively and quantitatively (if verification in control) reported compared to a known standard that is in control (where applicable).

For example, the RCRA permit or waste delisting requirements may require the reporting of non-target analytes. Only after visual comparison of sample spectra with the nearest library searches may the analyst assign a tentative identification.

20.6 GC/MS Tuning

Prior to any GCMS analytical sequence, including calibration, the instrument parameters for the tune and subsequent sample analyses within that sequence must be set.

Prior to tuning/auto-tuning the mass spec, the parameters may be adjusted within the specifications set by the manufacturer or the analytical method. These generally don't need any adjustment but it may be required based on the current instrument performance. If the tune verification does not pass it may be necessary to clean the source or perform additional maintenance. Any maintenance is documented in the maintenance log.

Table 20-2. Schedule of Routine Maintenance

Instrument	Procedure	Frequency
Leeman Mercury Analyzer	Check tubing for wear	Daily
	Fill rinse tank with 10% HCl	Daily
	Insert clean drying tube filled with Magnesium Perchlorate	Daily
	Fill reductant bottle with 10% Stannous Chloride	Daily
ICP	Check pump tubing	Daily
	Check liquid argon supply	Daily
	Check fluid level in waste container	Daily
	Check filters	Weekly
	Clean or replace filters	As required
	Check torch	Daily
	Check sample spray chamber for debris	Monthly
	Clean and align nebulizer	Monthly
	Check entrance slit for debris	Monthly
	Change printer ribbon	As required
	Replace pump tubing	As required
UV-Vis Spectrophotometer	Clean ambient flow cell	As required
	Precision check/alignment of flow cell	As required
	Wavelength verification check	Semi-annually
Auto Analyzers	Clean sampler	Daily
	Check all tubing	Daily
	Clean inside of colorimeter	Daily
	Clean pump well and pump rollers	Quarterly
	Clean wash fluid receptacle	Weekly
	Oil rollers/chains/side rails	Weekly
	Clean optics and cells	Quarterly
Hewlett Packard GC/MS	Ion gauge tube degassing	As required
	Pump oil-level check	Monthly
	Pump oil changing	Annually
	Analyzer bake-out	As required
	Analyzer cleaning	As required
	Resolution adjustment	As required
	COMPUTER SYSTEM AND PRINTER:	
	Air filter cleaning	As required
	Change data system air filter	As required
	Printer head carriage lubrication	As required
	Paper sprocket cleaning	As required
	Drive belt lubrication	As required
Gas Chromatograph	Compare standard response to previous day or since last initial calibration	Daily
	Check carrier gas flow rate in column	Daily via use of known compound retention
	Check temp. of detector, inlet, column oven	Daily
	Septum replacement	As required
	Check system for gas leaks with SNOOP	W/cylinder change as required
		Monthly
	Check for loose/frayed wires and insulation	As Required
	½"Bake injector/column	As Required
	Change/remove sections of guard column	As Required
	Replace connectors/liners	As Required

Instrument	Procedure	Frequency
	Change/replace column(s)	
Electron Capture Detector (ECD)	Detector wipe test (Ni-63) Detector cleaning	Semi-annually As required
Flame Ionization Detector (FID)	Detector cleaning	As required
Photoionization Detector (PID)	Change O-rings Clean lamp window	As required As required
HPLC	Change guard columns Change lamps Change pump seals Replace tubing Change fuses in power supply Filter all samples Change autosampler rotor/stator	As required As required Semi-annually or as required As required As required Daily As required
Balances	Class “S” traceable weight check Clean pan and check if level Field service	Daily, when used Daily At least Annually
Conductivity Meter	0.01M KCl calibration Conductivity cell cleaning	Daily As required
Total Organic Carbon Analyzer	Check gas flow Check fluid level (IC reservoirs) Replace “O” rings Check needle Replace scrubbers (halogen and CO2) Replace catalyst Vendor repair	As required Daily Daily Each use Yearly As required As required
Turbidimeter	Check light bulb	Daily, when used
Deionized/Distilled Water	Conductivity Point Sources Daily conductivity check Check deionizer light Monitor for VOA’s System cleaning Replace cartridge & large mixed bed resins	Water Quality Daily Daily As required As required
Drying Ovens	Temperature monitoring Temperature adjustments	Daily As required
Refrigerators/ Freezers	Temperature monitoring Temperature adjustment Defrosting/cleaning	Daily As required As required
Vacuum Pumps/ Air Compressor	Drained Belts checked Lubricated	Weekly Monthly Semi-annually
pH/Specific Ion Meter	Calibration/check slope Clean electrode	Daily As required
BOD Incubator	Temperature monitoring Coil and incubator cleaning	Daily Monthly
Centrifuge	Check brushes and bearings	Every 6 months or as needed
Water baths	Temperature monitoring Water replaced	Daily Monthly or as needed

Table 20-3. Preventive Maintenance Procedures for Laboratory Equipment

Instrument/ Equipment Type	Maintenance	Frequency
Gas Chromatograph	Replace Gas line dryers and filters	As needed*
	Replace Gas cylinders	As needed*
	Check or adjust column gas flow and/or detector make-up flow	As needed*
	Replace Injection port Septa	Daily*
	Replace Injection port liners/re-silonize liners	GC, As needed; GC/MS, Daily*
	Replace injection port liner o-ring	GC, As needed; GC/MS, Daily*
	Replace inlet seal and ring	GC, As needed, GC/MS, Daily*
	Replace column ferrules	GC, As needed; *
	Clip column (injector and detector end)	GC, As needed; GC/MS, Daily*
	Replace syringes on autosamplers	As needed*
	Replace heated-zones heaters and sensors	As needed*
	Replace inlet assembly	As needed*
	Empty solvent rinse and solvent rinse-waste vials (on autosampler tower)	Daily or as needed
	Replace column	As needed*
Flame Ionization Detector (FID)	Clean/replace jet	As needed*
	Clean collector	As needed*
	Check and/or adjust gas flows	As needed*
	Replace graphite ferrule	After each cleaning (OI detectors only)
Photoionization Detector (PID)	Clean window	As needed*
	Replace o-ring seat	As needed*
	Replace Lamp	As needed*
	Check and/or adjust gas flows	As needed*
	Adjust Lamp power supply intensity	As needed*
Mass Spectrometer (MS)	Clean source, replace source parts, replace filaments	As needed*
	Clean analyzer	As needed*
	Replace electron multiplier	As needed*
	Clean or replace glass jet separator, replace transfer line from jet separator to MS	As needed*
	Change rough pump oil	After each source cleaning
	Refill calibration compound (PFTBA) vial	As needed
Purge and Trap Equipment	Refill rinse water supply/Empty rinse water waste	Weekly or as needed
	Refill spiking solutions vials	As needed
	Rinse sparge tubes	Daily
	Clean or replace 6-port valve	As needed*
	Replace Transfer lines (from Autosampler to LSC and from LSC to GC)	As needed*
	Adjust gas flows and pressures	As needed
	Perform leak check	As needed

Instrument/ Equipment Type	Maintenance	Frequency
Inductively Coupled Plasma, Atomic Emission Spectrometer (ICP-AES)	Replace Peristaltic pump tubing	As needed*
	Clean autosampler, change tubing	As needed*
	Clean nebulizer and torch assembly	As needed*
	Replace nitrogen and argon tanks	As needed*
	Refill rinse water receptacle	Daily
	Empty waste receptacle	Daily
	Check for internal standard and sample flow through peristaltic pump tubing	As often as possible
	Replace internal standard solution receptacle	As needed
	Operate and check vents	Daily
	Perform Hg alignment	Daily*
	Check water level and water filter on recirculating-cooling unit, refill and replace filter	Check daily, refill and replace as needed
	Check purge windows	Daily, replace as needed
	Replace nebulizer and o-rings	As needed*
	Replace torch	As needed*
	Replace mixing chambers	As needed*
	Clean or replace air filters	As needed
	Check pneumatic filters	As needed
	Perform wave calibration (UV and Vis)	Quarterly*
	Calibrate Detector	Quarterly*
High Pressure Liquid Chromatography (HPLC)	Replace pre-column filter	As needed*
	Refill Solvent reservoirs	Daily or as needed
	Reverse column and rinse with solvents	Daily or as needed*
	Replace column	As needed*
	Clean solvent reservoir filters	As needed*
	Replace ball-valve cartridges on high pressure pump	As needed*
	Replace DAD flow cell windows	As needed*
	Check system solvent pressure	Daily
pH Meters	Clean or replace electrode	As needed
	Refill electrode electrolyte	As needed
Balance	Clean pan and platform	After each use
	Check Level bubble	Daily
	Check calibration	Daily
	Check sensitivity	Weekly
	Cleaning and calibration by authorized service	Annually
Conductivity Meter	Clean probe	As needed
Dissolved Oxygen Meter	Replace membrane	As needed
	Clean probe	As needed
ZHE vessels	Replace o-rings and screens	As needed
ZHE and TCLP Tumblers	Check Rotation Rate	Weekly
Spectrophotometers	Clean and check tubing	As needed
Burettes and Pipets	Clean and check calibration	Quarterly*
Thermometers	Check calibration	Annually, Quarterly for Digitals and IR Thermometer*

Instrument/ Equipment Type	Maintenance	Frequency
Ovens	Check and/or adjust temperature, record temperature on log sheet	Daily
Refrigerators and Freezers	Check and/or adjust temperature, record temperature on log sheet	Daily
	Defrost freezers	As needed
Lachat, Flow Injection Analyzer	Replace tubes on autodilutor	As needed*
	Clean autosample surfaces	As needed
	Spray silicone on cloth and rub on pump rollers	As needed
	Clean or replace o-rings and ports on valves	As needed*
	Clean union and T's on manifold and replace o-rings on manifold	As needed
	Dry and clean detector surfaces	As needed
	Replace flow cell o-rings and flares	As needed*
	Replace manifold tubing	As needed*
	Adjust pump timing	As needed

*Date and maintenance performed are recorded in Maintenance Log of the instrument/equipment

SECTION 21. MEASUREMENT TRACEABILITY

21.1 Overview

Traceability of measurements shall be assured using a system of documentation, calibration, and analysis of reference standards. Laboratory equipment that are peripheral to analysis and whose calibration is not necessarily documented in a test method analysis or by analysis of a reference standard shall be subject to ongoing certifications of accuracy. At a minimum, these must include procedures for checking specifications of ancillary equipment: balances, thermometers, temperature, Deionized (DI) and Reverse Osmosis (RO) water systems, automatic pipettes and other volumetric measuring devices. (Refer to Section 20.3). With the exception of Class A Glassware and Glass microliter syringes, quarterly accuracy checks are performed for all mechanical volumetric devices. Microsyringes are verified at least semi-annually or disposed of after 6 months of use. Wherever possible, subsidiary or peripheral equipment is checked against standard equipment or standards that are traceable to national or international standards. Class A Glassware and Glass microliter syringes should be routinely inspected for chips, acid etching or deformity (e.g., bent needle). If the Class A glassware or syringe is suspect, the accuracy of the glassware will be assessed prior to use.

21.2 NIST-Traceable Weights and Thermometers

Reference standards of measurement shall be used for calibration only and for no other purpose, unless it can be shown that their performance as reference standards would not be invalidated.

For NIST-traceable weights and thermometers, the laboratory requires that all calibrations be conducted by a calibration laboratory accredited by A2LA, NVLAP (National Voluntary Laboratory Accreditation Program), APLAC (Asia-Pacific Laboratory Accreditation Cooperation), or EA (European Cooperation for Accreditation). A certificate and scope of accreditation is kept on file at the laboratory.

Calibration laboratory's policy for achieving measurement traceability is defined and includes the subsequent elements of uncertainty.

The uncertainty calculations of the calibration laboratory are supported by uncertainty budgets and are represented by expanded uncertainties typically using a coverage factor of k=2 to approximate the 95% confidence level. This explanation accompanies the measurement result and the associated uncertainty.

The tolerance uncertainty ratio (TUR) is calculated using the expanded uncertainty of the measurement, not the collective uncertainty of the measurement standards. A statement to this effect accompanies the TUR along with the coverage factor and confidence level.

The calibration report or certificate submitted to the Pensacola laboratory contains, in a well designed format, a traceability statement, the conditions under which the calibrations were made in the context of any potential influence, a compliance statement with an identified metrological specification and the pertinent clauses, a clearly identified record of the quantities and functional test results before and after re-calibration, and no recommendation on the calibration interval. Opinions and interpretations of results are presented along with the basis

upon which they were made and identified as such. The report may be submitted by facsimile or other electronic means as long as the requirements of the International Standard are achieved. If significant amendments are made to a calibration certificate, a supplemental certificate for the serial-number-specified piece of equipment is so identified. When a new certificate is offered, it uniquely identifies and references the one it replaces. All calibration reports are filed in the QA Office.

The calibration laboratory supports in-house calibration systems: documented procedures for in-house calibrations, evidence by a report, certificate, or sticker, for an appropriate amount of time; training records of calibration personnel; certificates from accreditation services demonstrating traceability to national or international standards of measurement; procedures for evaluating measurement uncertainty; timely and documented recalibration of reference standards. When subcontracting to a calibration laboratory, the Pensacola laboratory does not use a firm who subcontracts the work.

An external certified service engineer services laboratory balances on an annual basis. This service is documented on each balance with a signed and dated certification sticker. Balance calibrations are checked each day of use. All mercury thermometers are calibrated annually against a traceable reference thermometer. Temperature readings of ovens, refrigerators, and incubators are checked on each day of use.

21.3 Reference Standards / Materials

Reference standards/materials, where commercially available, are traceable to certified reference materials. Commercially prepared reference standards, to the extent available, are purchased from vendors that are accredited to ISO Guide 34 and ISO/IEC Guide 17025. All reference standards from commercial vendors shall be accompanied with a certificate that includes at least the following information:

- Manufacturer
- Analytes or parameters calibrated
- Identification or lot number
- Calibration method
- Concentration with associated uncertainties
- Purity

If a standard cannot be purchased from a vendor that supplies a Certificate of Analysis, the purity of the standard is documented by analysis. (Refer to Section 9 for additional information on purchasing). The receipt of all reference standards must be documented. Reference standards are labeled with a unique Standard Identification Number and expiration date. All documentation received with the reference standard is retained as a QC record and references the Standard Identification Number.

All reference, primary and working standards/materials, whether commercially purchased or laboratory prepared, must be checked regularly to ensure that the variability of the standard or material from the ‘true’ value does not exceed method requirements. The accuracy of calibration standards is checked by comparison with a standard from a second source. In cases where a second standard manufacturer is not available, a vendor certified different lot is acceptable for use as a second source. For unique situations, such as air analysis where no other source or lot is available, a standard made by a different analyst would be considered a second source.

The appropriate Quality Control (QC) criteria for specific standards are defined in laboratory SOPs. In most cases, the analysis of an Initial Calibration Verification (ICV) or LCS (where there is no sample preparation) is used as the second source confirmation. These checks are generally performed as an integral part of the analysis method (e.g. calibration checks, laboratory control samples).

All standards and materials must be stored and handled according to method or manufacturer's requirements in order to prevent contamination or deterioration. Refer to the Corporate Environmental Health & Safety Manual or laboratory SOPs. For safety requirements, please refer to method SOPs and the laboratory Environmental Health and Safety Manual.

Standards and reference materials shall not be used after their expiration dates unless their reliability is verified by the laboratory and their use is approved by the Quality Assurance Manager. The laboratory must have documented contingency procedures for re-verifying expired standards.

21.4 Documentation and Labeling of Standards, Reagents, and Reference Materials

Reagents must be at a minimum the purity required in the test method. The date of reagent receipt and the expiration date are documented. The lots for most of the common solvents and acids are tested for acceptability prior to company wide purchase. (Refer to TestAmerica's Corporate SOP (CA-Q-S-001), Solvent and Acid Lot Testing and Approval.)

All manufacturer or vendor supplied Certificate of Analysis or Purity must be retained, stored appropriately, and readily available for use and inspection. These records are maintained by the analytical departments in LIMS for standards and in the DMQC shared directory for reagents and solvents. Records must be kept of the date of receipt and date of expiration of standards, reagents and reference materials. In addition, records of preparation of laboratory standards, reagents, and reference materials must be retained, stored appropriately, and be readily available for use and inspection. For detailed information on documentation and labeling, please refer to the individual method SOPs.

Commercial materials purchased for preparation of calibration solutions, spike solutions, etc.., are usually accompanied with an assay certificate or the purity is noted on the label. If the assay purity is 96% or better, the weight provided by the vendor may be used without correction. If the assay purity is less than 96% a correction will be made to concentrations applied to solutions prepared from the stock commercial material. Blended gas standard cylinders use a nominal concentration if the certified value is within +/-15%, otherwise the certified values is used for the canister concentration.

21.4.1 All standards, reagents, and reference materials must be labeled in an unambiguous manner. Standards are logged into the laboratory's LIMS system, and are assigned a unique identification number. The following information is typically recorded in the electronic database within the LIMS.

- Standard ID
- Description of Standard
- Department

- Preparer's name
- Final volume and number of vials prepared
- Solvent type and lot number
- Preparation Date
- Expiration Date
- Standard source type (stock or daughter)
- Standard type (spike, surrogate, other)
- Parent standard ID (if applicable)
- Parent Standard Analyte Concentration (if applicable)
- Parent Standard Amount used (if applicable)
- Component Analytes
- Final concentration of each analyte
- Comment box (text field)

Records are maintained electronically for standard and reference material preparation. These records show the traceability to purchased stocks or neat compounds. These records also include method of preparation, date of preparation, expiration date and preparer's name or initials. Preparation procedures are provided in the Method SOPs.

21.4.2 All standards, reagents, and reference materials must be clearly labeled with a minimum of the following information:

- Expiration Date
- Standard ID (Created by TALS)
- Special Health/Safety warnings if applicable

Records must also be maintained of the date of receipt for commercially purchased items or date of preparation for laboratory prepared items. Special Health/Safety warnings must also be available to the analyst. This information is maintained as follows:

- Date received is written on the chemical container and also documented on the receipt
- Date of preparation is documented in LIMS and on the container label
- Health and Safety warnings are contained in the method SOPs

21.1.1 In addition, the following information may be helpful:

- Date opened (for multi-use containers, if applicable)
- Description of standard (if different from manufacturer's label or if standard was prepared in the laboratory)
- Recommended Storage Conditions
- Concentration (if applicable)
- Initials of analyst preparing standard or opening container

All containers of prepared reagents must include an expiration date and an ID number to trace back to preparation.

Procedures for preparation of reagents can be found in the Method SOPs.

Standard ID numbers must be traceable through associated logbooks, worksheets and preparation/analytical batch records.

All reagents and standards must be stored in accordance to the following priority: 1) with the manufacturer's recommendations; 2) with requirements in the specific analytical methods as specified in the laboratory SOP.

SECTION 22. SAMPLING

22.1 Overview

The laboratory provides sampling services. Sampling procedures are described in the following SOPs:

- PS-FSD-001, Sampling Procedures for Documentation and Identification
- PS-FSD-002, Wipe Sampling for the Detection of PCBs
- PS-FSD-003, Calibration of Dissolved Oxygen Meters
- PS-FSD-004, Calibration of YSI 556 MPS Meter

22.2 Sampling Containers

The laboratory offers clean sampling containers for use by clients. These containers are obtained from reputable container manufacturers and meet EPA specifications as required. Certificates of cleanliness provided by the supplier are maintained at the laboratory. Alternatively, the certificates may be maintained by the supplier and available to the laboratory on-line.

22.2.1 Preservatives

Upon request, preservatives are provided to the client in pre-cleaned sampling containers. In some cases containers may be purchased pre-preserved from the container supplier. Whether prepared by the laboratory or bought pre-preserved, the grades of the preservatives are at a minimum:

- Hydrochloric Acid – Reagent ACS (Certified VOA Free) or equivalent
- Methanol – Purge and Trap grade
- Nitric Acid – Instra-Analyzed or equivalent
- Sodium Bisulfate – ACS Grade or equivalent
- Sodium Hydroxide – Instra-Analyzed or equivalent
- Sulfuric Acid – Instra-Analyzed or equivalent
- Sodium Thiosulfate – ACS Grade or equivalent

22.3 Definition of Holding Time

The date and time of sampling documented on the COC form establishes the day and time zero. As a general rule, when the maximum allowable holding time is expressed in “days” (e.g., 14 days, 28 days), the holding time is based on calendar day measured. Holding times expressed in “hours” (e.g., 6 hours, 24 hours, etc.) are measured from date and time zero. The first day of holding time ends twenty-four hours after sampling. Holding times for analysis include any necessary reanalysis. However, there are some programs that determine holding time compliance based on the date and specific time of analysis compared to the time of sampling regardless of how long the holding time is.

22.4 Sampling Containers, Preservation Requirements, Holding Times

The preservation and holding time criteria are derived from the source documents for the methods. If method required holding times or preservation requirements are not met, the reports will be qualified using a flag, footnote or case narrative. As soon as possible or “ASAP” is an EPA designation for tests for which rapid analysis is advised, but for which neither EPA nor the laboratory have a basis for a holding time. This criteria can be found in the individual method SOPs and on the TestAmerica Intranet.

22.5 Sample Aliquots / Subsampling

Taking a representative sub-sample from a container is necessary to ensure that the analytical results are representative of the sample collected in the field. The size of the sample container, the quantity of sample fitted within the container, and the homogeneity of the sample need consideration when sub-sampling for sample preparation. It is the laboratory’s responsibility to take a representative subsample or aliquot of the sample provided for analysis.

Analysts should handle each sample as if it is potentially dangerous. At a minimum, safety glasses, gloves, and lab coats must be worn when preparing aliquots for analysis.

Guidelines on taking sample aliquots & subsampling are located SOP PS-SCD-005 (Procedure for Splitting and/or Compositing Samples).

SECTION 23. HANDLING OF SAMPLES

Sample management procedures at the laboratory ensure that sample integrity and custody are maintained and documented from sampling/receipt through disposal.

23.1 Chain of Custody (COC)

The COC form is the written documented history of any sample and is initiated when bottles are sent to the field, or at the time of sampling. This form is completed by the sampling personnel and accompanies the samples to the laboratory where it is received and stored under the laboratory's custody. The purpose of the COC form is to provide a legal written record of the handling of samples from the time of collection until they are received at the laboratory. It also serves as the primary written request for analyses from the client to the laboratory. The COC form acts as a purchase order for analytical services when no other contractual agreement is in effect. An example of a COC form may be found in Figure 23-1.

23.1.1 Field Documentation

The information the sampler needs to provide at the time of sampling on the container label is:

- Sample identification
- Date and time
- Preservative

During the sampling process, the COC form is completed and must be legible (see Figure 23-1). This form includes information such as:

- Client name, address, phone number and fax number (if available)
- Project name and/or number
- The sample identification
- Date, time and location of sampling
- Sample collectors name
- The matrix description
- The container description
- The total number of each type of container
- Preservatives used
- Analysis requested
- Requested turnaround time (TAT)
- Any special instructions
- Purchase Order number or billing information (e.g. quote number) if available
- The date and time that each person received or relinquished the sample(s), including their signed name.

When the sampling personnel deliver the samples directly to TestAmerica personnel, the samples are stored in a cooler with ice, as applicable, and remain solely in the possession of the client's field technician until the samples are delivered to the laboratory personnel. The

sample collector must assure that each container is in his/her physical possession or in his/her view at all times, or stored in such a place and manner to preclude tampering. The field technician relinquishes the samples in writing on the COC form to the sample control personnel at the laboratory or to a TestAmerica courier. When sampling personnel deliver the samples through a common carrier (Fed-Ex, UPS), the CoC relinquished date/time is completed by the field personnel and samples are released to the carrier. Samples are only considered to be received by lab when personnel at the fixed laboratory facility have physical contact with the samples.

Note: Independent couriers are not required to sign the COC form. The COC is usually kept in the sealed sample cooler. The receipt from the courier is stored in Job folder with the COC.

23.2 Sample Receipt

Samples are received at the laboratory by designated sample receiving personnel and a unique laboratory project identification number is assigned. Each sample container shall be assigned a unique sample identification number that is cross-referenced to the client identification number such that traceability of test samples is unambiguous and documented. Each sample container is affixed with a durable sample identification label. Sample acceptance, receipt, tracking and storage procedures are summarized in the following sections.

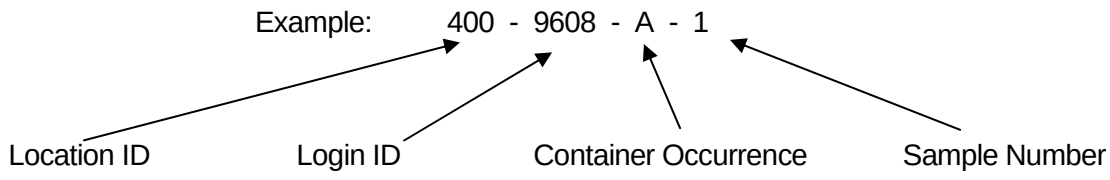
23.2.1 Laboratory Receipt

When samples arrive at the laboratory, sample receiving personnel inspect the coolers and samples. The integrity of each sample must be determined by comparing sample labels or tags with the COC and by visual checks of the container for possible damage. Any non-conformance, irregularity, or compromised sample receipt must be documented on the TALs sample receipt checklist, in the NCM module of TALs, and brought to the immediate attention of the client. The COC, shipping documents, documentation of any non-conformance, irregularity, or compromised sample receipt, record of client contact, and resulting instructions become part of the project record. (See SOP PS-SCD-007)

23.2.1.1 Unique Sample Identification

All samples that are processed through the laboratory receive a unique sample identification to ensure that there can be no confusion regarding the identity of such samples at anytime. This system includes identification for all samples, subsamples and subsequent extracts and/or digestates.

The laboratory assigns a unique identification (e.g., Sample ID) code to each sample container received at the laboratory. This Primary ID is made up of the following information (consisting of 4 components):



The above example states that TestAmerica Pensacola Laboratory (Location 400). Login ID is 9608 (unique to a particular client/job occurrence). The container code indicates it is the first container ("A") of Sample #1.

If the primary container goes through a prep step that creates a "new" container, then the new container is considered secondary and gets another ID. An example of this being a client sample in a 1-Liter amber bottle is sent through a Liquid/Liquid Extraction and an extraction vial is created from this step. The vial would be a SECONDARY container. The secondary ID has 5 components.

Example: 400 - 9608 - A - 1 - **A** ←——**Secondary Container Occurrence**

Example: 400-9608-A-1-A, would indicate the PRIMARY container listed above that went through a step that created the 1st occurrence of a Secondary container.

With this system, a client sample can literally be tracked throughout the laboratory in every step from receipt to disposal.

23.3 Sample Acceptance Policy

Per State and/or Federal Regulation, the client is responsible to ensure that samples are shipped in accordance with DOT/IATA requirements, and that radioactive materials may only be delivered to licensed facilities. Any samples containing (or suspected to contain) Source, Byproduct, or Special Nuclear Material as defined by 10 CFR should be delivered directly to facilities licensed to handle such radioactive material. Natural material or ores containing naturally occurring radionuclides may be delivered to any TestAmerica facility or courier as long as the activity concentration of the material does not exceed 270 pCi/g alpha or 2700 pCi/g beta (49 CFR Part 173).

23.3.1 The laboratory sample acceptance policy clearly outlines the circumstances under which samples shall be accepted or rejected. These include:

- a COC filled out completely; to include sample identification, location, date and time of collection, collector's name, preservation type, sample type and any additional comments concerning the samples.
- the COC must be legible
- samples must be properly labeled and include unique identification in indelible ink.
- proper sample containers with adequate volume for the analysis and necessary QC

Note: Samples submitted with insufficient volume to perform a method required matrix spike/matrix spike duplicate (MS/MSD) will be accepted for analysis. However, final reports submitted to clients for which insufficient sample was available for a preparation/analytical batch to have an MS/MSD will be narrated as lacking sufficient sample to perform the MS/MSD.

- samples must be preserved according to the requirements of the requested analytical method;

- samples must be received at the temperature requirements of the requested analytical method;
- sample holding times must be adhered to;
- samples should not show damage or signs of contamination to sample container. Volatile vials are also inspected for headspace. The project manager will be notified if any sample is received in comprised or damaged condition.

When “compromised” samples are received, it must be documented in the project records and the client must be contacted for instructions. If the client decides to proceed with analysis, the project report shall clearly indicate any of the above conditions and the resolution. Data from samples which do not meet these criteria are flagged and the nature of the variation from policy is defined.

- Check and record the temperature of the samples, temperature blanks, with the IR gun, that require thermal preservation.
  - Samples shall be deemed acceptable if arrival temperature is just above freezing and less than or equal to 6.0° C. Samples that are hand-delivered immediately after collection may not be at the required temperatures; however, if there is evidence that the chilling process has begun, such as the arrival on ice, the samples shall be considered acceptable. This will be documented on the COC.
  - If the samples were shipped in ice and solid ice is still present and in direct contact with samples, report the samples as "received on ice." Direct contact means samples must be surrounded by ice cubes or crushed ice. Ice present in a plastic bottle or other container does not constitute direct contact. Samples shipped with only “blue ice” may not be reported as “received on ice”.
- Verify sample preservation as specified in the test method. pH is verified in the sample receiving areas and recorded on the sample container pH preservation form. This form is maintained with the job folder. Any deviations in pH are brought to the attention of the analytical staff and the project manager. pH for volatile samples is checked after sample analysis . The pH for volatiles is recorded on the sample run log. Chlorine is checked on samples requiring extractable organics, BOD, TOX, cyanide, fluoride, ammonia, TKN, CBOD and Nitrate; presence or absence is recorded. The chlorine check for extractable organics is performed in the organic extractions department and is documented in the preparation batch at the time the sample is checked. Chlorine checks for all other samples are performed at the time of preparation or analysis and recorded on the appropriate bench sheet.
- After inspecting the samples, the sample receiving personnel sign and date the COC form, make any necessary notes of the samples' conditions and store them in appropriate refrigerators or storage locations.
- If samples are received without a COC, TestAmerica will provide a generic COC form to be completed by the client when the samples are brought to the laboratory. The client is always provided with a copy of the completed COC form for their records.

- If analyses with short holding times are requested, the dates and times are inspected to ensure that holding times have not already expired.

- Samples received after normal working hours are left in their coolers and placed in a walk-in refrigerator in Sample Control. The person receiving the samples must record the date and time received, the presence or absence of custody seals, the temperature of samples, and initials.

- Any deviations from the checks described in Section 23.2.1 that question the suitability of the sample for analysis, or incomplete documentation as to the tests required will be resolved by consultation with the client. If the sample acceptance criteria (Section 23.3) are not met, the laboratory shall either:

    - Retain all correspondence and/or records of communications with the client regarding the disposition of rejected samples [The project manager may be able to make decisions on samples with prior knowledge from the client, but documentation of acceptable scenarios must be provided and acknowledge by the client, and records of these decisions must be documented] , or

    - Fully document any decision to proceed with sample analysis that does not meet sample acceptance criteria.

        Note: North Carolina requires that they be notified when samples are processed that do not meet sample acceptance criteria.

Once sample acceptance is verified, the samples are logged into the LIMS according SOP PS-SCD-008 (Procedure for Receiving Samples and Logging Samples into the LIMS).

23.3.2 Sample Log-in

All samples that are received by the laboratory are logged into the LIMS to allow the laboratory to track and evaluate sample progress. Each group of samples that are logged in together (typically one project from a given client/sampling event) is assigned a unique job number. Within each job, each sampling point (or sample) receives a unique number. Sample numbers are generated sequentially over time, and are not re-assigned. A sample may be composed of more than one bottle since different preservatives may be required to perform all analyses requested. Even if multiple containers are received for a single sample, each container is uniquely identified with an alphabetic letter added to the sample number. The LIMS generates sample labels that are attached to each bottle for a given sample.

Each job/set of samples is logged into LIMS with a minimum of the following information:

- Client Name, Project Name, Address, Phone, Fax, Report to information, invoice to information (most of this information is “default information” that is stored in the LIMS).
- Date and time sampled;
- Date and time received;
- Job and/or project description, sample description;
- Sample matrix, special sample remarks;

- Reporting requirements (i.e., QC level, report format, invoicing format);
- Turn-around-time requirements;
- Parameters (methods and reporting limits or MDLs are default information for a given parameter)

After inspecting the samples, the sample receiving personnel sign and date the COC form, make any necessary notes of the samples' conditions and store them in appropriate refrigerators or storage locations.

Any deviations from these checks that question the suitability of the sample for analysis, or incomplete documentation as to the tests required will be resolved by consultation with the client. If the sample acceptance policy criteria are not met, the laboratory shall either:

- Retain all correspondence and/or records of communications with the client regarding the disposition of rejected samples. The project manager may be able to make decisions on samples with prior knowledge from the client, but documentation of acceptable scenarios must be provided and acknowledge by the client, and records of these decisions must be documented; or

- Fully document any decision to proceed with sample analysis that does not meet sample acceptance criteria.

> Note: North Carolina requires that they be notified when samples are processed that do not meet sample acceptance criteria.

23.4 Sample Storage

In order to avoid deterioration, contamination or damage to a sample during storage and handling, from the time of receipt until all analyses are complete, samples are stored in refrigerators suitable for the sample matrix. Samples submitted for metals analysis are stored in refrigerators until the initial preparation is started. The samples are then transferred to un-refrigerated shelving units. In addition, samples to be analyzed for volatile organic parameters are stored in separate refrigerators designated for volatile organic parameters only. Samples are never to be stored with reagents, standards or materials that may create contamination.

To ensure the integrity of the samples during storage, refrigerator blanks are maintained in the volatile sample refrigerators and analyzed every two weeks.

Analysts and technicians retrieve the sample container allocated to their analysis from the designated refrigerator and place them on carts, analyze the sample, and return the remaining sample to the refrigerator from which it originally came. All unused portions of samples are returned to the secure sample control area. Empty containers are disposed of per SOP PS-LAB-015 (Waste Handling and Disposal Practices) All samples are kept in the refrigerators for four weeks after the final report is complete, which meets or exceeds most sample holding times. Unless stipulated differently by client contract, after four weeks the samples are moved to the sample disposal shed where they are stored before they are disposed of. This holding period allows samples to be checked if a discrepancy or question arises. Special arrangements may be made to store samples for longer periods of time. This extended holding period allows

additional metal analyses to be performed on the archived sample and assists clients in dealing with legal matters or regulatory issues.

Access to the laboratory is controlled such that sample storage need not be locked at all times unless a project specifically demands it. Samples are accessible to laboratory personnel only. Visitors to the laboratory are prohibited from entering the refrigerator and laboratory areas unless accompanied by an employee of TestAmerica.

23.5 Hazardous Samples and Foreign Soils

To minimize exposure to personnel and to avoid potential accidents, hazardous and foreign soil samples are stored in an isolated area designated for hazardous waste only. The hazard status of each sample is determined in one of three ways. First, the sample may be known to be hazardous upon receipt. This information is usually obtained from MSDS provided with the sample by the client. Second, the matrix of the sample may automatically result in the sample being designated as hazardous- this is primarily reserved for oil and solvent samples. Finally, testing performed on the sample may require the sample to be designated as hazardous. The internal chain of custody module (ICOC) of the LIMs system allows sample testing results to be compared to preset limits derived from regulatory limits in order to determine if a sample is hazardous. The ICOC module is used prior to sample disposal to segregate all hazardous samples. Once a sample has been deemed hazardous, “HAZ” is written on the sample container in red sharpie marker and the sample is taken to the hazardous sample designated area for disposal by the EHSC assisted by staff trained in waste disposal. All hazardous samples are either returned to the client or drummed and disposed of appropriately through a hazardous waste disposal firm that removes them from the laboratory.

Foreign soils are labeled with a blue dot upon receipt. All foreign soils are taken to the area designated for foreign soils upon completion of testing. Foreign soil samples are sent out for incineration by a USDA-approved waste disposal facility.

See SOP PS-LAB-015 Waste Disposal for an complete description of waste disposal practices at TestAmerica Pensacola.

23.6 Sample Shipping

In the event that the laboratory needs to ship samples, the samples are placed in a cooler with enough ice to ensure the samples remain just above freezing and at or below 6.0°C during transit. The samples are carefully surrounded by packing material to avoid breakage (yet maintain appropriate temperature). A trip blank is enclosed for those samples requiring water/solid volatile organic analyses (see Note). The chain-of-custody form is signed by the sample control technician and attached to the shipping paperwork. Samples are generally shipped overnight express or hand-delivered by a TestAmerica courier to maintain sample integrity. All personnel involved with shipping and receiving samples must be trained to maintain the proper chain-of-custody documentation and to keep the samples intact and on ice. The Environmental, Health and Safety Manual contains additional shipping requirements.

Note: If a client does not request trip blank analysis on the COC or other paperwork, the laboratory will not analyze the trip blanks that were supplied. However, in the interest of good client service, the laboratory will advise the client at the time of sample receipt that it was noted

that they did not request analysis of the trip blank; and that the laboratory is providing the notification to verify that they are not inadvertently omitting a key part of regulatory compliance testing.

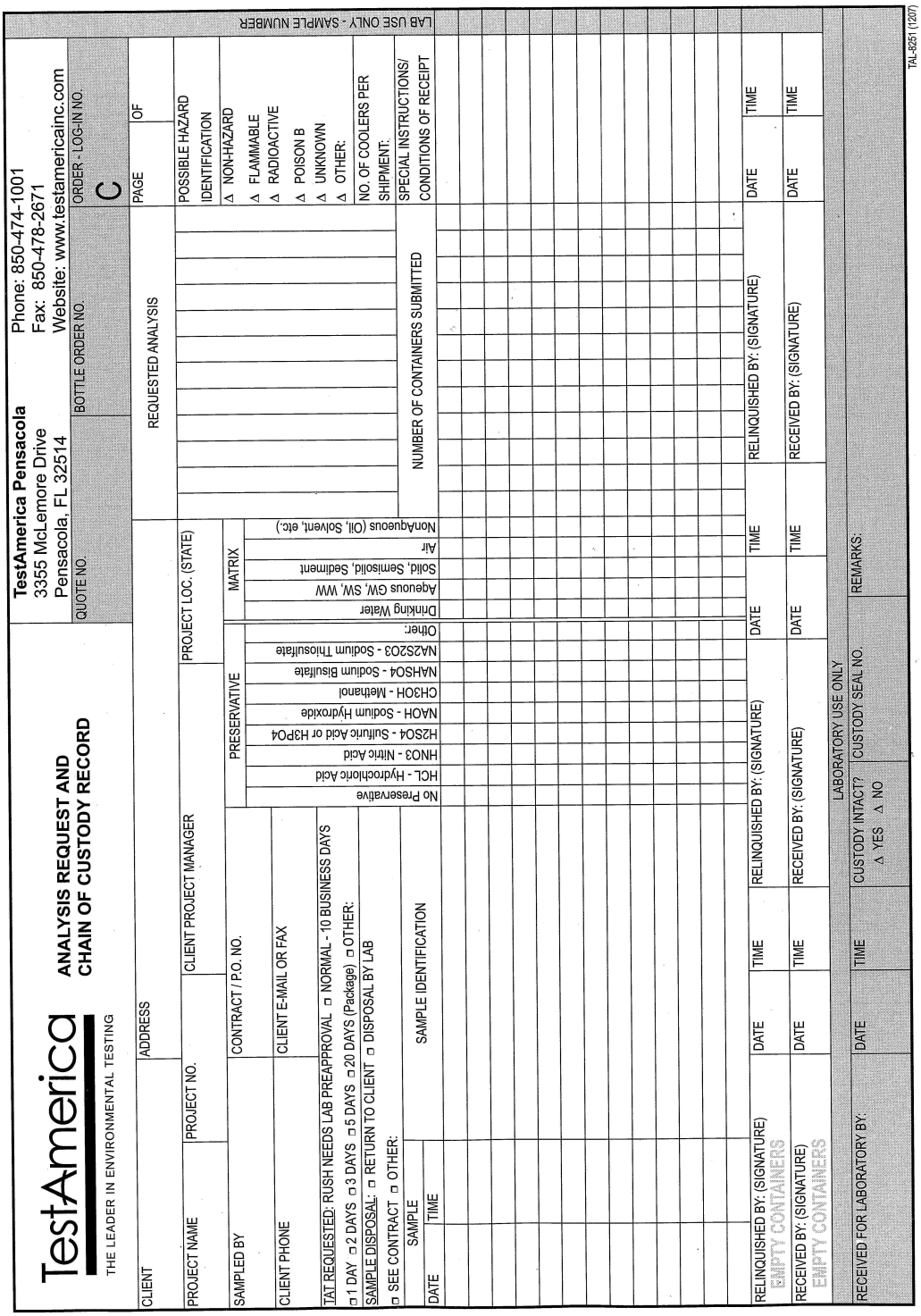
23.7 Sample Disposal

Samples should be retained for a minimum of 30 days after sample receipt; however, provisions may be made for earlier disposal of samples once the holding time is exceeded. Some samples are required to be held for longer periods based on regulatory or client requirements (e.g., 60 days after project report is sent). The laboratory must follow the longer sample retention requirements where required by regulation or client agreement. Several possibilities for sample disposal exist: the sample may be consumed completely during analysis, the sample may be returned to the customer or location of sampling for disposal, or the sample may be disposed of in accordance with the laboratory's waste disposal procedures laboratory SOP PS-LAB-015. All procedures in the laboratory Environmental, Health and Safety Manual are followed during disposal. Samples are normally maintained in the laboratory no longer than 60 days from receipt unless otherwise requested. Unused portions of samples found or suspected to be hazardous according to state or federal guidelines may be returned to the client upon completion of the analytical work.

If a sample is part of a known litigation, the affected legal authority, sample data user, and/or submitter of the sample must participate in the decision about the sample's disposal. All documentation and correspondence concerning the disposal decision process must be kept on file. Pertinent information includes the date of disposal, nature of disposal (such as sample depletion, hazardous waste facility disposal, return to client), names of individuals who conducted the arrangements and physically completed the task. The laboratory will remove or deface sample labels prior to disposal unless this is accomplished through the disposal method (e.g., samples are incinerated). A Waste Disposal Record should be completed.

Figure 23-1.

Chain of Custody (COC)



SECTION 24. ASSURING THE QUALITY OF TEST RESULTS

24.1 Overview

In order to assure our clients of the validity of their data, the laboratory continuously evaluates the quality of the analytical process. The analytical process is controlled not only by instrument calibration as discussed in Section 21, but also by routine process quality control measurements (e.g. Blanks, Laboratory Control Samples (LCS), Matrix Spikes (MS), duplicates (DUP), surrogates, Internal Standards (IS)). These quality control checks are performed as required by the method or regulations to assess precision and accuracy. In addition to the routine process quality control samples, Proficiency Testing (PT) Samples (concentrations unknown to laboratory) are analyzed to help ensure laboratory performance.

24.2 Controls

Sample preparation or pre-treatment is commonly required before analysis. Typical preparation steps include homogenization, grinding, solvent extraction, sonication, acid digestion, distillation, reflux, evaporation, drying and ashing. During these pre-treatment steps, samples are arranged into discreet manageable groups referred to as preparation (prep) batches. Prep batches provide a means to control variability in sample treatment. Control samples are added to each prep batch to monitor method performance and are processed through the entire analytical procedure with investigative/field samples.

24.3 Negative Controls

Table 24-1. Negative Controls

Control Type	Details
Method Blank (MB)	are used to assess preparation and analysis for possible contamination during the preparation and processing steps.
	The specific frequency of use for method blanks during the analytical sequence is defined in the specific standard operating procedure for each analysis. Generally it is 1 for each batch of samples; not to exceed 20 environmental samples.
	The method blank is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (e.g., Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The method blank goes through all of the steps of the process (including as necessary: filtration, clean-ups, etc.).
	Reanalyze or qualify associated sample results when the concentration of a targeted analyte in the blank is at or above the reporting limit as established by the method or by regulation, AND is greater than 1/10 of the amount measured in the sample.
Calibration Blanks	are prepared and analyzed along with calibration standards where applicable. They are prepared using the same reagents that are used to prepare the standards. In some analyses the calibration blank may be included in the calibration curve.
Instrument Blanks	are blank reagents or reagent water that may be processed during an analytical sequence in order to assess contamination in the analytical system. In general, instrument blanks are used to differentiate between contamination caused by the analytical system and that caused by the sample handling or sample prep process. Instrument blanks may also be inserted throughout the analytical sequence to minimize the effect of carryover from samples with high analyte content.

Table 24-1. Negative Controls

Control Type	Details
Trip Blank [1]	are required to be submitted by the client with each shipment of samples requiring aqueous and solid volatiles analyses (or as specified in the client's project plan). Additionally, trip blanks may be prepared and analyzed for volatile analysis of air samples, when required by the client. A trip blank may be purchased (certified clean) or is prepared by the laboratory by filling a clean container with pure deionized water that has been purged to remove any volatile compounds. Appropriate preservatives are also added to the container. The trip blank is sent with the bottle order and is intended to reflect the environment that the containers are subjected to throughout shipping and handling and help identify possible sources if contamination is found. The field sampler returns the trip blank in the cooler with the field samples.
Field Blanks [1]	are sometimes used for specific projects by the field samplers. A field blank prepared in the field by filling a clean container with pure reagent water and appropriate preservative, if any, for the specific sampling activity being undertaken. (EPA OSWER)
Equipment Blanks [1]	are also sometimes created in the field for specific projects. An equipment blank is a sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (TNI)
Holding Blanks	also referred to as refrigerator or freezer blanks, are used to monitor the sample storage units for volatile organic compounds during the storage of VOA samples in the laboratory

[1] When known, these field QC samples should not be selected for matrix QC as it does not provide information on the behavior of the target compounds in the field samples. Usually, the client sample ID will provide information to identify the field blanks with labels such as "FB", "EB", or "TB."

Evaluation criteria and corrective action for these controls are defined in the specific standard operating procedure for each analysis.

24.3.1 Negative Controls for Microbiological Methods

Microbiological Methods utilize a variety of negative controls throughout the process to ensure that false positive results are not obtained. These controls are critical to the validity of the microbiological analyses. Some of these negative controls are*:*

Table 24-2. Negative Controls for Microbiology

Control Type	Details
Sterility Checks (Media)	are analyzed for each lot of pre-prepared media, ready-to-use media and for each batch of medium prepared by the laboratory.
Filtration Blanks	blanks are run at the beginning and end for each sterilized filtration unit used in a filtration series. For pre-sterilized single use funnels a sterility check is performed on at least one funnel per lot.
Sterility checks (Sample Containers)	are performed on at least one container per lot of purchased, pre-sterilized containers. If containers are prepared and sterilized by the laboratory, one container per sterilization batch is checked. Container sterility checks are performed using non-selective growth media.
Sterility Checks (Dilution Water)	are performed on each batch of dilution water prepared by the laboratory and on each batch of pre-prepared dilution water. All checks are performed using non-selective growth media.
Sterility Checks (Filters)	are also performed on at least one filter from each new lot of membrane filters using non-selective growth media.

Negative culture controls demonstrate that a media does not support the growth of non-target organisms and ensures that there is not an atypical positive reaction from the target organisms. Prior to the first use of the media, each lot of pre-prepared selective media or batch of laboratory prepared selective media is analyzed with at least one known negative culture control as appropriate to the method.

24.4 Positive Controls

Control samples (e.g., QC indicators) are analyzed with each batch of samples to evaluate data based upon (1) Method Performance (Laboratory Control Sample (LCS) or Blank Spike (BS)), which entails both the preparation and measurement steps; and (2) Matrix Effects (Matrix Spike (MS) (Matrix spikes are not applicable to air) or Sample Duplicate (MD, DUP), which evaluates field sampling accuracy, precision, representativeness, interferences, and the effect of the matrix on the method performed. Each regulatory program and each method within those programs specify the control samples that are prepared and/or analyzed with a specific batch

Note that frequency of control samples vary with specific regulatory, methodology and project specific criteria. Complete details on method control samples are as listed in each analytical SOP.

24.4.1 Method Performance Control - Laboratory Control Sample (LCS)

The LCS measures the accuracy of the method in a blank matrix and assesses method performance independent of potential field sample matrix affects in a laboratory batch.

The LCS is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (for example: Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The LCS is spiked with verified known amounts of analytes or is made of a material containing known and verified amounts of analytes, taken through all preparation and analysis steps along with the field samples. Where there is no preparation taken for an analysis (such as in aqueous volatiles), or when all samples and standards undergo the same preparation and analysis process (such as Phosphorus), a calibration verification standard is reported as the LCS. In some instances where there is no practical clean solid matrix available, aqueous LCS's may be processed for solid matrices; final results may be calculated as mg/kg or ug/kg, assuming 100% solids and a weight equivalent to the aliquot used for the corresponding field samples, to facilitate comparison with the field samples.

Certified pre-made reference material purchased from a NIST/A2LA accredited vendor may also be used for the LCS when the material represents the sample matrix or the analyte is not easily spiked (e.g. solid matrix LCS for metals, TDS, etc.).

The specific frequency of use for LCS during the analytical sequence is defined in the specific standard operating procedure for each analysis. It is generally 1 for each batch of samples; not to exceed 20 environmental samples.

If the mandated or requested test method, or project requirements, do not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample (and Matrix Spike) where applicable (e.g. no spike of pH). However, in cases where the components interfere with accurate assessment (such as simultaneously

spiking chlordane, toxaphene and PCBs in Method 608), the test method has an extremely long list of components or components are incompatible, at a minimum, a representative number of the listed components (see below) shall be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses, permit specified analytes and other client requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.

- For methods that have 1-10 target analytes, spike all components.
- For methods that include 11-20 target analytes, spike at least 10 or 80%, whichever is greater
- For methods with more than 20 target analytes, spike at least 16 components.
- Exception: Due to analyte incompatibility in pesticides, Toxaphene and Chlordane are only spiked at client request based on specific project needs.
- Exception: Due to analyte incompatibility between the various PCB aroclors, aroclors 1016 and 1260 are used for spiking as they cover the range of all of the aroclors. Specific aroclors may be used by request on a project specific basis.

Accuracy Calculation: Percent Recovery (%R) Calculation (applies to LCS, CCV, Surrogates, and Matrix Spikes.

$$\%R = \frac{AV}{TV} \times 100$$

Where: AV = Analyzed Value
TV = True Value

24.4.2 Positive Controls for Microbiological Methods

- Each lot of pre-prepared media (including chromofluorogenic reagent) and each batch of laboratory prepared media is tested with a pure culture of known positive reaction.
- In addition, every analytical batch also contains a pure culture of known positive reaction.
- A pure culture of known negative reaction is also tested with each analytical batch to ensure specificity of the procedure.

24.5 Sample Matrix Controls

Table 24-3. Sample Matrix Control

Control Type	Details	
Matrix Spikes (MS)	Use	used to assess the effect sample matrix of the spiked sample has on the precision and accuracy of the results generated by the method used;

Table 24-3. Sample Matrix Control

Control Type	Details	
	Typical Frequency [1]	At a minimum, with each matrix-specific batch of samples processed, an MS is carried through the complete analytical procedure. Unless specified by the client, samples used for spiking are randomly selected and rotated between different client projects.If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. Refer to the method SOP for complete details
	Description	essentially a sample fortified with a known amount of the test analyte(s).
Surrogate	Use	Measures method performance to sample matrix (organics only).
	Typical Frequency [1]	are added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. The recovery of the surrogates is compared to the acceptance limits for the specific method. Poor surrogate recovery may indicate a problem with sample composition and shall be reported, with data qualifiers, to the client whose sample produced poor recovery.
	Description	are similar to matrix spikes except the analytes are compounds with properties that mimic the analyte of interest and are unlikely to be found in environment samples.
Duplicates[2]	Use	For a measure of analytical precision, with each matrix-specific batch of samples processed, a matrix duplicate (MD or DUP) sample, matrix spike duplicate (MSD), or LCS duplicate (LCSD) is carried through the complete analytical procedure.
	Typical Frequency [1]	Duplicate samples are usually analyzed with methods that do not require matrix spike analysis.
	Description	Performed by analyzing two aliquots of the same field sample independently or an additional LCS.
Internal Standards	Use	are spiked into all environmental and quality control samples (including the initial calibration standards) to monitor the qualitative aspect of organic and some inorganic analytical measurements.
	Typical Frequency [1]	All organic and ICP methods as required by the analytical method.
	Description	Used to correct for matrix effects and to help troubleshoot variability in analytical response and are assessed after data acquisition. Possible sources of poor internal standard response are sample matrix, poor analytical technique or instrument performance.

[1] See the specific analytical SOP for type and frequency of sample matrix control samples.

[2] LCSD's are normally not performed except when regulatory agencies or client specifications require them. The recoveries for the spiked duplicate samples must meet the same laboratory established recovery limits as the accuracy QC samples. If an LCSD is analyzed both the LCS and LCSD must meet the same recovery criteria and be included in the final report. The precision measurement is reported as "Relative Percent Difference" (RPD). Poor precision between duplicates (except LCS/LCSD) may indicate non-homogeneous matrix or sampling.

The percent recovery calculation for matrix spikes is essentially the same as the calculation shown in 25.4.1.6 except that:

$$AV = Sp - Sa$$

Where: Sp = Spike result
Sa = Sample result

Precision Calculation (Relative Percent Difference - RPD)

$$RPD = \frac{|S - D|}{\frac{(S + D)}{2}} \times 100$$

Where: S=Sample Concentration
D=Duplicate Concentration

24.6 Acceptance Criteria (Control Limits)

As mandated by the test method and regulation, each individual analyte in the LCS, MS, or Surrogate Spike is evaluated against the control limits published in the test method. Where there are no established acceptance criteria, the laboratory calculates in-house control limits with the use of control charts or, in some cases, utilizes client project specific control limits.

Note: For methods, analytes and matrices with very limited data (e.g., unusual matrices not analyzed often), interim limits are established using available data or by analogy to similar methods or matrices.

Once control limits have been established, they are verified, reviewed, and updated if necessary on an annual basis unless the method requires more frequent updating Control limits are updated every six months for Arizona methods. Control limits are established per method (as opposed to per instrument) regardless of the number of instruments utilized.

Laboratory generated % Recovery acceptance (control) limits are generally established by taking $\pm$ 3 Standard Deviations (99% confidence level) from the average recovery of a minimum of 20-30 data points (more points are preferred).

- Regardless of the calculated limit, the limit should be no tighter than the Calibration Verification (ICV/CCV). (Unless the analytical method specifies a tighter limit).

- In-house limits cannot be any wider than those mandated in a regulated analytical method. Client or contract required control limits are evaluated against the laboratory's statistically derived control limits to determine if the data quality objectives (DQOs) can be achieved. If laboratory control limits are not consistent with DQOs, then alternatives must be considered, such as method improvements or use of an alternate analytical method.

- The lowest acceptable recovery limit will be 10% (the analyte must be detectable and identifiable). Exception: The lowest acceptable recovery limit for Benzidine will be 5% and the analyte must be detectable and identifiable.

- The maximum acceptable recovery limit will be 150%.

- The maximum acceptable RPD limit will be 35% for waters and 40% for soils. The minimum RPD limit is 10%.

- If either the high or low end of the control limit changes by $\leq$ 5% from previous, the control chart is visually inspected and, using professional judgment, they may be left unchanged if there is no affect on laboratory ability to meet the existing limits.

24.6.1 The lab must be able to generate a current listing of their control limits and track when the updates are performed. In addition, the laboratory must be able to recreate historical control limits.

The QA department generates Control Chart and Data Summary that contains tables that summarize the precision and accuracy acceptability limits for analyses performed at the Pensacola laboratory. This summary includes an effective date, is updated each time new limits are generated and is located. Unless otherwise noted, limits within these tables are laboratory generated. The analysts are instructed to use the current limits in the laboratory (dated and approved by the Department Manager and QA Manager) and entered into the Laboratory Information Management System (LIMS). The Quality Assurance department maintains an archive of all limits used within the laboratory.

24.6.2 A LCS that is within the acceptance criteria establishes that the analytical system is in control and is used to validate the process. Samples that are analyzed with an LCS with recoveries outside of the acceptance limits may be determined as out of control and should be reanalyzed if possible. If reanalysis is not possible, then the results for all affected analytes for samples within the same batch must be qualified when reported. The internal corrective action process (see Section 13) is also initiated if an LCS exceeds the acceptance limits. Sample results may be qualified and reported without reanalysis if:

- The analyte results are below the reporting limit and the LCS is above the upper control limit.

- If the analytical results are above the relevant regulatory limit and the LCS is below the lower control limit.

Or, for TNI and Department Of Defense (DOD) work, there are an allowable number of Marginal Exceedances (ME):

<11 analytes	0 marginal exceedances are allowed.
11 – 30 Analytes	1 marginal exceedance is allowed
31-50 Analytes	2 marginal exceedances are allowed
51-70 Analytes	3 marginal exceedances are allowed
71-90 Analytes	4 marginal exceedances are allowed
> 90 Analytes	5 marginal exceedances are allowed

- Marginal exceedances are recovery exceedances between 3 SD and 4 SD from the mean recovery limit (TNI).

- Marginal exceedances must be random. If the same analyte exceeds the LCS control limit repeatedly, it is an indication of a systematic problem. The source of the error must be located and corrective action taken. To determine if a marginal exceedance is random, the analyst reviews the 2 most recent batches containing an LCS result for the method analyte combination in question. If the analyte did not exceed the control limits in either of the 2 preceding batches, then the exceedance is considered to be random. If the analyte failed in either of the 2 preceding batched the failure is not random and random marginal exceedance does not apply.

Though marginal exceedances may be allowed, the data must still be qualified to indicate it is outside of the normal limits.

24.6.3 If the MS/MSDs do not meet acceptance limits, the MS/MSD and the associated spiked sample is reported with a qualifier for those analytes that do not meet limits. If obvious preparation errors are suspected, or if requested by the client, unacceptable MS/MSDs are reprocessed and reanalyzed to prove matrix interference. A more detailed discussion of acceptance criteria and corrective action can be found in the laboratory SOP PS-QAD-017 and in Section 12.

24.6.4 If a surrogate standard falls outside the acceptance limits, if there is not obvious chromatographic matrix interference, reanalyze the sample to confirm a possible matrix effect. If the recoveries confirm or there was obvious chromatographic interference, results are reported from the original analysis and a qualifier is added. If the reanalysis meets surrogate recovery criteria, the second run is reported (or both are reported if requested by the client). Under certain circumstances, where all of the samples are from the same location and share similar chromatography, the reanalysis may be performed on a single sample rather than all of the samples and if the surrogate meets the recovery criteria in the reanalysis, all of the affected samples would require reanalysis.

24.7 Additional Procedures to Assure Quality Control

The laboratory has written and approved method SOPs to assure the accuracy of the test method including calibration (see Section 20), use of certified reference materials (see Section 21) and use of PT samples (see Section 15).

A discussion regarding MDLs, Limit of Detection (LOD) and Limit of Quantitation (LOQ) can be found in Section 20.

- Use of formulae to reduce data is discussed in the method SOPs.
- Selection of appropriate reagents and standards is included in Section 9 and 21.
- A discussion on selectivity of the test is included in Section 5.
- Constant and consistent test conditions are discussed in Section 18.
- The laboratories sample acceptance policy is included in Section 23.

SECTION 25.0 REPORTING RESULTS

25.1 Overview

The results of each test are reported accurately, clearly, unambiguously, and objectively in accordance with State and Federal regulations as well as client requirements. Analytical results are issued in a format that is intended to satisfy customer and laboratory accreditation requirements as well as provide the end user with the information needed to properly evaluate the results. Where there is conflict between client requests and laboratory ethics or regulatory requirements, the laboratory's ethical and legal requirements are paramount, and the laboratory will work with the client during project set up to develop an acceptable solution. Refer to Section 7.

In cases where a client asks for simplified reports, there must be a written request from the client. There still must be enough information that would show any analyses that were out of conformance (QC out of limits) and there should be a reference to a full report that is made available to the client.

Review of reported data is included in Section 19.

25.2 Test Reports

Analytical results are reported in a format that is satisfactory to the client and meets all requirements of applicable accrediting authorities and agencies. A variety of report formats are available to meet specific needs. The report is printed on laboratory letterhead, reviewed, and signed by the appropriate project manager. At a minimum, the standard laboratory report shall contain the following information:

25.2.1 A report title (e.g. Analytical Report) with a "sample results" section header.

25.2.2 Each report cover page printed on company letterhead, the report cover page contains the laboratory name, address and telephone number.

25.2.3 A unique identification of the report (e.g. job number) and on each page an identification in order to ensure the page is recognized as part of the report and a clear identification of the end.

Note: Page numbers of report are represented as page # of ##. Where the first number is the page number and the second is the total number of pages.

25.2.4 A copy of the chain of custody (COC).

- Any COCs involved with Subcontracting are included.
- In most cases, the applicable COC is not paginated but is an integral part of the report. If the COC is not a paginated portion of the report then there will be a statement on the front of the report to effect of "The Chain of Custody, X page(s), is included and is an integral part of this report.".

- Any additional addenda to the report must be treated in a similar fashion so it is a recognizable part of the report and cannot accidentally get separated from the report (e.g., Sampling information).

25.2.5 The name and address of client and a project name/number, if applicable.

25.2.6 Client project manager or other contact

25.2.7 Description and unambiguous identification of the tested sample(s) including the client identification code.

25.2.8 Date of receipt of sample, date and time of collection, and date(s) of test preparation and performance, and time of preparation or analysis if the required holding time for either activity is less than or equal to 72 hours.

25.2.9 Date reported or date of revision, if applicable.

25.2.10 Method of analysis including method code (EPA, Standard Methods, etc).

25.2.11 Practical quantitation limits or reporting limit.

25.2.12 Method detection limits (if requested)

25.2.13 Definition of Data qualifiers and reporting acronyms (e.g. ND).

25.2.14 Sample results.

25.2.15 QC data consisting of method blank, surrogate, LCS, and MS/MSD recoveries and control limits.

25.2.16 Condition of samples at receipt including temperature. Condition is reported on the Sample Receipt Checklist, the temperature is recorded on the original COC.

25.2.17 A statement expressing the validity of the results, that the source methodology was followed and all results were reviewed for error.

25.2.18 A statement to the effect that the results relate only to the items tested and the sample as received by the laboratory.

25.2.19 A statement that the report shall not be reproduced except in full, without prior express written approval by the laboratory coordinator.

25.2.20 A signature and title of the person(s) accepting responsibility for the content of the report and date of issue. Signatories are appointed by the Lab Director.

25.2.21 When TNI accreditation is required, the lab shall certify that the test results meet all requirements of TNI or provide reasons and/or justification if they do not.

25.2.22 Where applicable, a narrative to the report that explains the issue(s) and corrective action(s) taken in the event that a specific accreditation or certification requirement was not met.

25.2.23 When Soil samples are analyzed, a specific identification as to whether soils are reported on a “wet weight” or “dry weight” basis.

25.2.24 Appropriate laboratory certification number for the state of origin of the sample, if applicable.

25.2.25 If only part of the report is provided to the client (client requests some results before all of it is complete), it must be clearly indicated on the report (Preliminary). A complete report must be sent once all of the work has been completed.

25.2.26 Any non-TestAmerica subcontracted analysis results are provided as a separate report on the official letterhead of the subcontractor. All TestAmerica subcontracting is clearly identified on the report as to which laboratory performed a specific analysis.

25.2.27 Certification Summary report, where required, will document that unless otherwise noted, all analytes tested and reported by the laboratory were covered by the noted certifications.

Note: Refer to the Corporate SOP on Electronic Reporting and Signature Policy (No. CA-I-P-002) for details on internally applying electronic signatures of approval.

25.3 Reporting Level or Report Type

TestAmerica Pensacola offers four levels of quality control reporting. Each level, in addition to its own specific requirements, contains all the information provided in the preceding level. The packages provide the following information in addition to the information described above:

- Level I is a report with the features described in Section 25.2 above.
- Level II is a Level I report plus summary information, including results for the method blank, percent recovery for laboratory control samples and matrix spike samples, and the RPD values for all MSD and sample duplicate analyses.
- Level III contains all the information supplied in Level II, but presented on the CLP-like summary forms, and relevant calibration information. No raw data is provided.
- Level IV is the same as Level III with the addition of all raw supporting data.

In addition to the various levels of QC packaging, the laboratory also provides reports in diskette deliverable form. Initial reports may be provided to clients by e-mail or facsimile. All e-mailed or faxed reports are followed by hardcopy unless specified otherwise. Procedures used to ensure client confidentiality are outlined in Section 25.6.

25.3.1 Electronic Data Deliverables (EDDs)

EDDs are routinely offered as part of TestAmerica's services. TestAmerica Pensacola offers a variety of EDD formats including Environmental Restoration Information Management System (ERPIMS), Excel, GISKEY, Ch2MHILL 4.0, CSX Stand, Dw1, EIM, Element, Equis, Fdep_ Validator, GES KEY, Nj_Hazsite, Terrabase, and Text Files.

EDD specifications are submitted to the IT department by the EDD Coordinator for review and undergo the contract review process. Once the facility has committed to providing data in a specific electronic format, the coding of the format may need to be performed. This coding is documented and validated. The validation of the code is retained by the IT staff coding the EDD.

EDDs shall be subject to a review to ensure their accuracy and completeness. If EDD generation is automated, review may be reduced to periodic screening if the laboratory can demonstrate that it can routinely generate that EDD without errors. Any revisions to the EDD format must be reviewed until it is demonstrated that it can routinely be generated without errors. If the EDD can be reproduced accurately and if all subsequent EDDs can be produced error-free, each EDD does not necessarily require a review.

25.4 Supplemental Information for Test

The lab identifies any unacceptable QC analyses or any other unusual circumstances or observations such as environmental conditions and any non-standard conditions that may have affected the quality of a result. This is typically in the form of a footnote or a qualifier and/or a narrative explaining the discrepancy in the front of the report.

25.4.1 Numeric results with values outside of the calibration range, either high or low are qualified as 'estimated'.

25.4.2 Where quality system requirements are not met, a statement of compliance/non-compliance with requirements and/or specifications is required, including identification of test results derived from any sample that did not meet TNI sample acceptance requirements such as improper container, holding time, or temperature.

25.4.3 Where applicable, a statement on the estimated uncertainty of measurements; information on uncertainty is needed when a client's instructions so require.

25.4.4 Opinions and Interpretations - The test report contains objective information, and generally does not contain subjective information such as opinions and interpretations. If such information is required by the client, the Laboratory Director will determine if a response can be prepared. If so, the Laboratory Director will designate the appropriate member of the management team to prepare a response. The response will be fully documented, and reviewed by the Laboratory Director, before release to the client. There may be additional fees charged to the client at this time, as this is a non-routine function of the laboratory.

Note: Review of data deliverable packages for submittal to regulatory authorities requires responses to non-conforming data concerning potential impact on data quality. This necessitates a limited scope of interpretation, and this work is performed by the Operations

Manager or the QA Department. This is the only form of “interpretation” of data that is routinely performed by the laboratory.

When opinions or interpretations are included in the report, the laboratory provides an explanation as to the basis upon which the opinions and interpretations have been made. Opinions and interpretations are clearly noted as such and where applicable, a comment should be added suggesting that the client verify the opinion or interpretation with their regulator.

25.5 Environmental Testing Obtained from Subcontractors

If the laboratory is not able to provide the client the requested analysis, the samples would be subcontracted following the procedures outlined in Section 8.

Data reported from analyses performed by a subcontractor laboratory are clearly identified as such on the analytical report provided to the client. Results from a subcontract laboratory outside of the TestAmerica network are reported to the client on the subcontract laboratory’s original report stationary and the report includes any accompanying documentation.

25.6 Client Confidentiality

In situations involving the transmission of environmental test results by telephone, facsimile or other electronic means, client confidentiality must be maintained.

TestAmerica will not intentionally divulge to any person (other than the Client or any other person designated by the Client in writing) any information regarding the services provided by TestAmerica or any information disclosed to TestAmerica by the Client. Furthermore, information known to be potentially endangering to national security or an entity’s proprietary rights will not be released.

Note: This shall not apply to the extent that the information is required to be disclosed by TestAmerica under the compulsion of legal process. TestAmerica will, to the extent feasible, provide reasonable notice to the client before disclosing the information.

Note: Authorized representatives of an accrediting authority are permitted to make copies of any analyses or records relevant to the accreditation process, and copies may be removed from the laboratory for purposes of assessment.

25.6.1 Report deliverable formats are discussed with each new client. If a client requests that reports be faxed or e-mailed, the reports are faxed with a cover sheet or e-mailed with the following note that includes a confidentiality statement similar to the following:

This material is intended only for the use of the individual(s) or entity to whom it is addressed, and may contain information that is privileged and confidential. If you are not the intended recipient, or the employee or agent responsible for delivering this material to the intended recipient, you are hereby notified that any dissemination, distribution or copying of this communication is strictly prohibited. If you have received this communication in error, please notify us immediately by telephone at the 1-800-765-0980 (or for e-mails: please notify us immediately by e-mail or by phone (1-800-765-0980) and delete this material from any computer).

25.7 Format of Reports

The format of reports is designed to accommodate each type of environmental test carried out and to minimize the possibility of misunderstanding or misuse.

25.8 Amendment of Test Reports

Corrections, additions, or deletions to reports are only made when justification arises through supplemental documentation. Justification is documented using the laboratory's corrective action system (refer to Section 13).

The revised report is retained on the Archive data server, as is the original report. The revised report is stored in the Archive data server under the sample number followed by "Rev. #". The revised report will have the "Revision #".

When the report is re-issued, a notation of "Revision #" is placed on the cover/signature page of the report with a brief explanation of reason for the re-issue and a reference back to the last final report generated.

25.9 Policies on Client Requests for Amendments

25.9.1 Policy on Data Omissions or Reporting Limit Increases

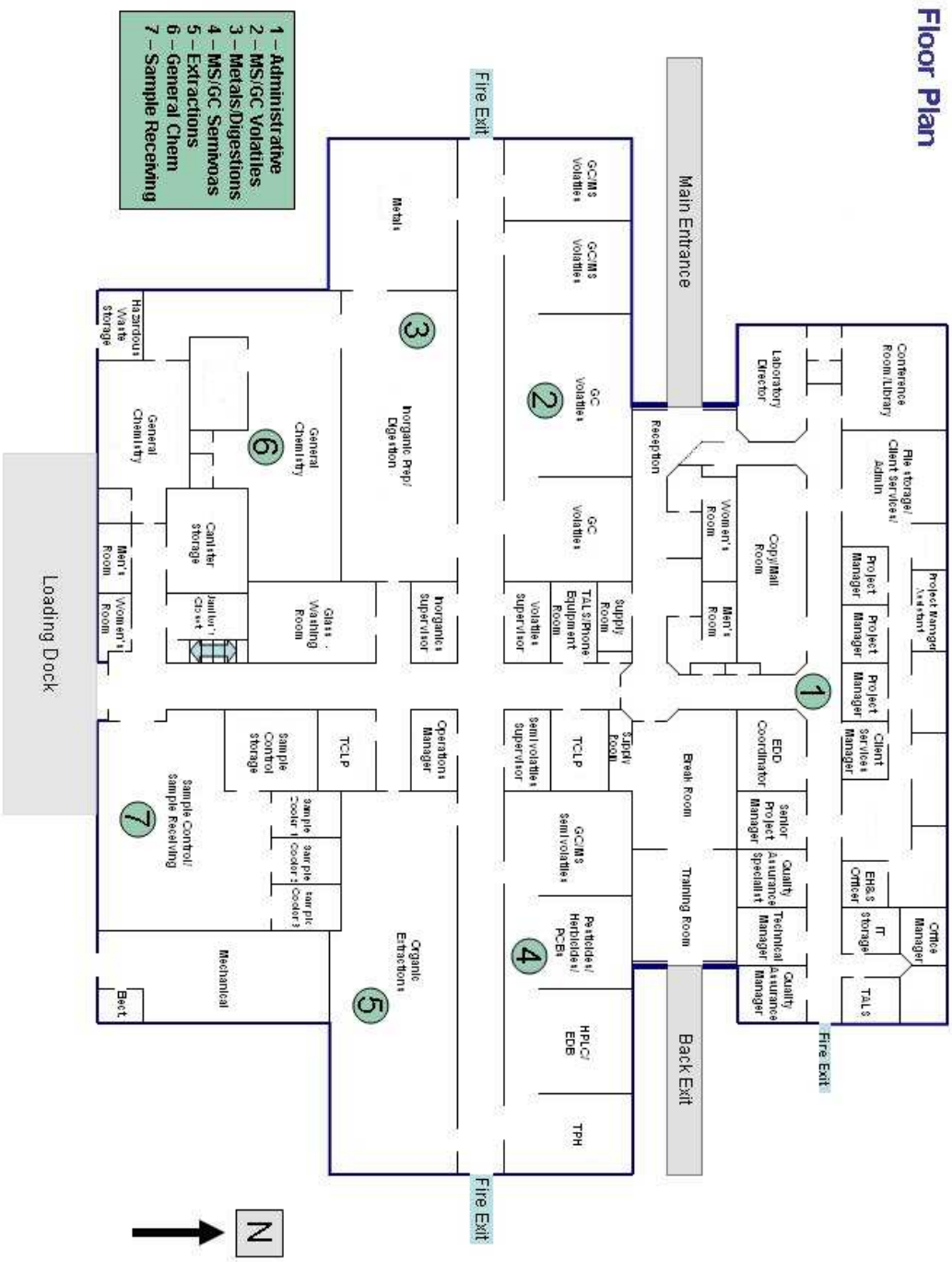
Fundamentally, our policy is simply to not omit previously reported results (including data qualifiers) or to not raise reporting limits and report sample results as ND. This policy has few exceptions. Exceptions are:

- Laboratory error.
- Sample identification is indeterminate (confusion between COC and sample labels).
- An incorrect analysis (not analyte) was requested (e.g., COC lists 8315 but client wanted 8310). A written request for the change is required.
- Incorrect limits reported based on regulatory requirements.
- The requested change has absolutely *no possible* impact on the interpretation of the analytical results and there is *no possibility* of the change being interpreted as misrepresentation by anyone inside or outside of our company.

25.9.2 Multiple Reports

TestAmerica does not issue multiple reports for the same workorder where there is different information on each report (this does not refer to copies of the same report) unless required to meet regulatory needs and approved by QA.

Appendix 1. Laboratory Floor Plan



Appendix 2. Laboratory Certifications, Accreditations, and Validations

Alabama *Department of Environmental Management, Laboratory ID No. 40150 (Drinking Water by Reciprocity with FL)*

Arizona *Department of Health Services, Lab ID No. AZ0710 (EPA 1631E)*

Arkansas *Department of Pollution Control and Ecology, (88-0689) (Environmental)*

Florida *DOH,* ***Primary NELAP*** *Laboratory ID No. E81010 (Drinking Water, Solid/Hazardous Waste and Wastewater)*
Laboratory ID No.E87089 ((Drinking Water, Solid/Hazardous Waste, Wastewater, and Biological Tissue)

Illinois *Environmental Laboratory Accreditation Program (ELAP),* ***Secondary NELAP*** *Laboratory ID No. 200041 (Wastewater and Solid/Hazardous Waste)*

Iowa *Department of Natural Resources, Laboratory ID No. 367 (Wastewater, UST, Solid Waste, & Contaminated Sites)*

Kansas *Department of Health & Environment,* ***Secondary NELAP*** *Laboratory ID No. E-10253 (Wastewater and Solid/Hazardous Waste)*

Kentucky *Petroleum Storage Tank Env Assurance Fund, Laboratory ID No. 0053 (UST)*

Louisiana DEQ, LELAP, **Secondary NELAP** Certificate No. 02075, Agency Interest ID 30748. (Wastewater and Solid/Hazardous Waste)
Certificate No. 01992, Agency Interest ID 30673 (Wastewater, Solid/Hazardous Waste, Biological Tissue)

Maryland *DH&MH Laboratory ID No. 233 (Drinking Water by Reciprocity with Florida)*

Massachusetts *DEP, Laboratory ID No. M-FL094 (Wastewater)*

Michigan *Bureau of E&OccH, Laboratory ID No.9912 (Drinking Water by Reciprocity with Florida)*

New Jersey *DEP&E,* ***Secondary NELAP*** *Laboratory ID No. FL006 (Wastewater and Solid/Hazardous Waste)*

North Carolina *DENR, Laboratory ID No. 314 (Solid/Hazardous Waste and Wastewater)*

Oklahoma *Department of Environmental Quality, Laboratory ID No. 9810 (Solid/Hazardous Waste and Wastewater)*

Pennsylvania *Department of Environmental Resources,* ***Secondary NELAP*** *Laboratory ID No. 68-00467 (Wastewater & Solid/Hazardous Waste)*

South Carolina *DH&EC, Laboratory ID No. 96026 (Wastewater & Solid/Hazardous Waste by Reciprocity with FL)*

Tennessee *Department of Health & Environment, Laboratory ID No. 02907 (Drinking Water)*

Texas *Commission on Environmental Quality,* ***Secondary NELAP*** *Laboratory ID No. T104704286-08-1 (Wastewater & Solid/Hazardous Waste)*
Laboratory ID No. T104704460-13-4 (Biological Tissue)

USDA *Permit to Receive Soil, Permit no. P330-13-00193 (Foreign Soil Permit)*

Virginia *Department of General Services,* ***Secondary NELAP*** *Laboratory ID No. 460166 (Wastewater & Solid/Hazardous Waste)*

West Virginia *DOE, Office of Water Resources, Laboratory ID No. 136 (Haz Waste and Wastewater)*

EPA ICR *(Information Collection Rule) Approved Laboratory, Laboratory ID No. ICRFL031*

The certificates and accredited parameter lists are available for each State/Program at www.testamericainc.com under Analytical Services Search – Certifications.

Appendix 3. Standard Operating Procedures

SOP Number	SOP Name
PS-LAB-002	Dilution of Samples
PS-LAB-003	Sample Homogenization and Subsampling
PS-LAB-004	Logbook Format, Review and Control
PS-LAB-005	Proper Use of Pipets for Liquid Measurement
PS-LAB-006	Out of Control Events and Corrective Actions
PS-LAB-007	Records Management
PS-LAB-008	Nonconforming Events
PS-LAB-009	Confidential and Proprietary Information
PS-LAB-011	Pipette, Syringe, Dispenser, and Digital Burette Calibration and Verification
PS-LAB-012	Addition of New Analytes or Methods
PS-LAB-013	Laboratory Security and Contingency Plan for Backup Equipment
PS-LAB-014	Training Program and Documentation
PS-LAB-015	Waste Handling and Disposal Practices
PS-LAB-016	Process for Review, Revision and Control of Laboratory Documents
PS-LAB-017	Correction of Errors and Use of Indelible Ink
PS-LAB-018	Tagging Out of Out of Service Equipment and Non-conforming Materials
PS-LAB-019	Procedure for Handling a Data Inquiry by a Client
PS-LAB-021	Reagent Traceability
PS-ADM-004	Safety Rules
PS-ADM-007	Chemical Storage Inventory
PS-ADM-008	Receptionist Responsibilities
PS-CSD-003	Documenting Project Information & Project Set-up
PS-CSD-004	Client Service Departmental Policies
PS-CSD-005	Documentation of Sample Loss
PS-CSD-006	Providing Matrix Spike and Matrix Spike Duplicate Bottles for Extractable Parameters
PS-CSD-007	Log In Review and Final Job Approval
PS-CSD-010	LIMS Project Work Notes
PS-IC-001	Ion Chromatography
PS-EXT-001	Continuous Liquid-Liquid Extraction [EPA 600 Series/SW-846 3520C]
PS-EXT-002	Separatory Funnel Liquid-Liquid Extraction [EPA 600 Series/SW-846 3510C]
PS-EXT-003	Preparation of Soil/Sediment by Automated Soxhlet for the Analysis of Semivolatile Organic Compounds [SW-846 Method 3541]
PS-EXT-004	Extraction and Esterification of Chlorinated Acid Herbicides from Aqueous and Non-Aqueous Samples [SW-846 8151A]
PS-EXT-005	Preparation of Soil/Sediment by Pulsed Sonication for the Analysis of Semivolatile Organic Compounds [SW-846 Method 3550B & 3550C]
PS-EXT-007	Glassware Preparation

PS-EXT-008	Extraction of Soil/Sediment by Microwave for the Analysis of Semivolatile Organic Compounds [SW-846 Method 3546]
PS-EXT-011	Extraction followed by Gravimetric Determination of Oil & Grease in Soil and Water for n-hexane Extractable Material (HEM) and Silica Gel Treated n-Hexane Extractable Material (SGT-HEM) [{EPA 1664/SW-846 9070A/SW-846 9071B]
PS-EXT-012	Preparation of Semi-volatiles in Oil by the Waste Dilution [SW-846 3580A]
PS-EXT-017	Resistivity Verification
PS-EXT-018	Toxicity Compound Leaching Procedure (TCLP): Nonvolatiles, Method 1311
PS-EXT-020	SPLP Extractions: Semivolatile Organic Compounds, Metals, Cyanide & Halogens (SW-846 1312)
PS-EXT-019	TCLP Extraction method 1311 Volatiles
PS-EXT-021	SPLP Extraction method 1312 Volatiles
PS-FSD-001	Sampling Procedures for Documentation and Identification
PS-FSD-002	Wipe Sampling for the Detection of PCBs
PS-FSD-003	Calibration of Dissolved Oxygen Meter(s)
PS-FSD-004	Calibration of YSI 556 MPS (Multi-Probe System) Meter
PS-GCS-001	Analysis of Total Petroleum Hydrocarbons [TNRCC 1006]
PS-GCS-002	Analysis of Polynuclear Aromatic Hydrocarbons (PAHs) by HPLC [EPA 610/SW-846 8310]
PS-GCS-003	Extraction and Analysis of Water and Soil Samples for EDB and DBCP [EPA 504.1/SW-846 8011]
PS-GCS-004	Reviewing & Reporting Analytical Data
PS-GCS-005	Diesel Silica Gel Clean-up - HMS Silica Gel
PS-GCS-006	Data and Records Management for the GC Semivolatiles Department
PS-GCS-007	Analysis of Carbon Monoxide, Carbon Dioxide, Oxygen, Nitrogen and Methane in Air [ASTM D 1946-90 (Mod)]
PS-GCS-008	The Determination of Methane, Ethane, and Ethene in Waters by Dissolved Gas Analysis [RSK-175 (Mod)]
PS-GCS-009	Determination of C6 to C35 [TPH Working Group]
PS-GCS-010	Determination of Diesel Range Organics (DRO) and Petroleum Range Organics (PRO) [8015B, FL PRO, TN DRO, and Others]
PS-GCS-011	Determination of Extractable Petroleum Hydrocarbons [Massachusetts EPH (Mod)]
PS-GCS-013	Analysis of Total Petroleum Hydrocarbons [TNRCC 1005]
PS-GCS-014	Organochlorine Pesticide Analysis [8081A and 8081B and 608]
PS-GCS-015	Herbicides in Waters and Soils [SW-846 8151A]
PS-GCS-016	PCB Analysis [608/8082A/8082B]
PS-GCS-017	Nonhalogenated Volatile Organics by Direct-Injection [SW 8015B Mod]
PS-MSS-001	Determination of Semivolatile Organic Compounds by Mass Spectrometry [EPA 625 Mod/ SW846 8270C/8270D, Missouri-TPH DRO, OLM4.2]
PS-MSS-002	Organophosphorus Pesticides by GCMS [8141 Mod]
PS-GCV-001	Analysis of Aromatics and TPH by GC PID/FID [SW846 8021B, SW846 8015B, EPA 602]

PS-GCV-002	Analysis of Volatile Petroleum Hydrocarbons by Modified Massachusetts VPH Method
PS-MSV-001	Determination of Volatile Organic Compounds [SW846 8260B/C, EPA 624, SM 6200B, CLP OLM03.1, and MO GRO]
PS-MET-001	Sample Preparation for Total Metals Analysis in Aqueous Samples [EPA 200.7/SW-846 3010A]
PS-MET-004	Sample Preparation for Total Metals Analysis for Dust Wipe Media [SW846 3050B (Mod)]
PS-MET-005	Sample Preparation for Total Metals Analysis [SW-846 3050B]
PS-MET-007	Sample Preparation of Glass Fiber Filters (8" x 10") for Analysis [ICP/GFAA]
PS-MET-009	Sample Preparation for Acid-Extractable Metals Analysis [SM 3030C]
PS-MET-010	Metals by Inductively Coupled Plasma (ICP) Spectroscopy [EPA 200.7/ SW846 6010]
PS-MET-011	Preparation and Analysis of Aqueous Samples for Mercury [EPA 245.1/SW-846 7470A]
PS-MET-012	Preparation and Analysis of Aqueous Samples for Mercury [EPA 1631E]
PS-MET-013	Preparation and Analysis of Solid, Sludge, Oil and Wipe Samples for Mercury [SW846 7471A AND 7471B]
PS-MET-015	Sample Preparation for Total Recoverable ICAP/GFAA Metals Analysis [SW-846 3005A]
PS-MET-016	Elements by ICP-MS [200.8 and 6020]
PS-MET-017	Homogenization and Preparation of Tissue Samples
PS-MET-018	Calculation of Hardness
PS-QAD-003	Calculation of Control Limits
PS-QAD-004	Detection Limits
PS-QAD-005	Compliance with Radioactive Materials License
PS-QAD-007	Validation and Verification of Laboratory Generated Software
PS-QAD-010	Sample Preservation and Holding Times
PS-QAD-011	Log-in, Delivery and Reporting of Proficiency Testing (PT) Samples
PS-QAD-014	Thermometers and Temperature Control
PS-QAD-016	Calibration and Use of Laboratory Balances and Laboratory Weights
PS-QAD-020	Data Audits by the QA Department
PS-QAD-021	Demonstrations of Capability
PS-QAD-022	Audit Resolution, Tracking and Closure Protocol
PS-SCD-001	Preparation of Bottle Orders and Completing Shipping Orders
PS-SCD-002	Cleaning, Certification and Shipment of Air-Sampling SUMMA Canisters
PS-SCD-003	Work Instruction for Sample Tracking of BP MC252
PS-SCD-004	Procedure for Reagent Labeling and Recording
PS-SCD-005	Procedure for Splitting and/or Compositing Samples
PS-SCD-007	Procedure for Receiving Samples and Logging Samples into the LIMS
PS-SCD-008	Moisture Analyzer & Dry Weight Reporting
PS-SCD-009	Procedure for Project Prioritization

PS-SCD-010	Procedure for Sample Control Inventory and Ordering
PS-WCD-001	pH [EPA 150.1 / SM 4500H+ B / SW-846 9040B / SW-846 9040C / SW-846 9045C / SW-846 9045D]
PS-WCD-002	Total Kjeldahl Nitrogen (TKN) Digestion and Analysis [EPA 351.2]
PS-WCD-003	Analysis of Samples for Ferrous Iron (SM3500Fe D(19th ed.) B(20th ed.))
PS-WCD-005	Biochemical Oxygen Demand and Carbonaceous Biochemical Oxygen Demand [EPA 405.1 / SM 20 5210B]
PS-WCD-006	Odor [EPA 140.1]
PS-WCD-007	Flashpoint Analysis bySW-846 1010 (Liquids) and Chapter 7 (Solids)
PS-WCD-008	Analysis of Total Solids or Percent Moisture [160.3, SM2540B, SM2540G, ASTM D2216]
PS-WCD-009	Analysis of Total Dissolved Solids (TDS) / Filterable Residue [EPA 160.1/SM 2540C]
PS-WCD-010	Total Volatile Solids and Fixed Solids [EPA Method 160.4 / SM 2540E AND 2540G]
PS-WCD-011	Analysis of Settleable Solids [EPA 160.5, SM 2540 F]
PS-WCD-012	Analysis of Total Suspended Solids (TSS)/ Non-Filterable Residue [EPA 160.2, SM 2540 D]
PS-WCD-013	Analysis of Nitrate (NO3) and Nitrite (NO2) Nitrogen [EPA 353.2/SM 4500-NO3 F]
PS-WCD-014	Color [EPA 110.2, SM2120B]
PS-WCD-016	Chemical Oxygen Demand (COD) [EPA 410.4, SM 5220 D]
PS-WCD-017	Analysis of Phenols (Manual Spectrophotometric) [EPA 420.1]
PS-WCD-018	Analysis of Samples for Reactive Sulfide and Reactive Cyanide [SW846 7.3.3.2 / 9014 and SW 7.3.4.2 / 9034]
PS-WCD-019	Total Coliform Analysis by Membrane Filtration (MF) and Fecal Coliform Analysis by Membrane Filtration (MF) [SM9222B and SM9222D]
PS-WCD-021	Fluoride Analysis [340.2 / SM4500-F C]
PS-WCD-022	Specific Conductance at 25^{o}C [EPA 120.1/SM 2510B/SW-846 9050A]
PS-WCD-023	Analysis of Samples for Turbidity [EPA Method 180.1 / SM2130B]
PS-WCD-024	Analysis for Total Halides (TX) in Solid/Oil [SW-846 5050 / SW-846 9253]
PS-WCD-025	Analysis of Samples for Ammonia [350.1, 4500NH3 H]
PS-WCD-027	Presence-Absence (P-A) Coliform Test for Total and E. Coli in Drinking Water [SM 9223]
PS-WCD-033	Paint Filter Liquids Test [SW-846 9095B]
PS-WCD-034	Total Organic Carbon Analysis in Soil [Walkley-Black]
PS-WCD-036	Konelab Analyses
PS-WCD-037	Alkalinity and Carbon Dioxide by use of the PC-Titrate Autotitrator System
PS-WCD-038	Analysis of Total Organic Carbon by 415.1 / 9060 / 9060A / 5310B
PS-WCD-039	Methylene Blue Active Substances (MBAS) (Method 425.1/5540C)
PS-WCD-040	Heat of Combustion/Bomb Oxidation

CA-Q-S-001	Corporate SOP, Solvent and Acid Testing and Approval
CA-Q-S-005	Corporate SOP, Calibration Curves.
CA-T-P-002	Corporate SOP, Selection of Calibration Points
CA-Q-S-002	Corporate SOP, *Acceptable Manual Integration Practices.*
CW-E-M-001	Corporate Environmental Health and Safety Manual

Appendix 4. Glossary/Acronyms

Glossary:

Acceptance Criteria:
Specified limits placed on characteristics of an item, process, or service defined in requirement documents. (ASQC)

Accreditation:
The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory. In the context of the National Environmental Laboratory Accreditation Program (NELAP), this process is a voluntary one. (NELAC)

Accrediting Authority:
The Territorial, State, or Federal Agency having responsibility and accountability for environmental laboratory accreditation and which grants accreditation (NELAC) [1.5.2.3]

Accuracy:
The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (QAMS)

Aliquot:
a representative portion of the sample, standard, or reagent.

Analyst:
The designated individual who performs the “hands-on” analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality. (NELAC)

Analyte: The element, molecule, or compound that is being measured in a given procedure. Also referred to as a parameter.

Analytical Method: Defines the sample preparation and instrumentation procedures that must be performed to determine the quantity of analyte in a sample.

Analytical Sequence: the order in which calibration standards, verification standards, QC items, and samples are analyzed.

Analytical Spike or Post-Digestion Spike: addition of a known concentration of analyte to an aliquot of sample after the preparation steps have been performed

Analytical Uncertainty: A subset of Measurement uncertainty that includes all laboratory activities performed as part of the analysis.

Anion: A negatively charged ion.

Anomaly:
A situation with a non quantifiable exception to established procedures. An example: COC not filled out correctly, bottle labels do not match COC, elevated RL due to matrix. The anomaly is recorded using the NCM function in LIMS

Aromatic:
Relating to the six-carbon-ring configuration of benzene and its derivatives.

Assessment:
The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria.

Audit:
a systematic evaluation to determine the conformance to specifications of an operational function or activity. Common types of audits include: data audits, internal audits, and external audits.

Background Correction:
A technique to compensate for variable background contribution to the instrument signal and the determination of trace metals.

Batch:
Environmental samples which are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A preparation batch is composed of one to 20 environmental samples of the same 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 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) and /or those samples not requiring preparation, which are analyzed together as a group using the same calibration curve or factor. An analytical batch can include samples originating from various environmental matrices and can exceed 20 samples. (NELAC Quality Systems Committee)

Blank:
A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. (ASQC)

Blind Sample:
A sample for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process.

Calibration:
To determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter, instrument, or other device. The levels of the applied calibration standard should bracket the range of planned or expected sample measurements. (NELAC)

Calibration Check Compounds (CCC):
Term used in conjunction with SW-846, Method 8260 and 8270 to refer to the compounds in which the percent RSD is evaluated against method-prescribed criteria to decide the validity of a calibration.

Calibration Curve:
The graphical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (NELAC)

Calibration Method:
A defined technical procedure for performing a calibration. (NELAC)

Calibration Standard:
A substance or reference material used to calibrate an instrument (QAMS)

Cation:
A positively charged ion.
CERCLA/SARA –
The Comprehensive Environmental Response and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986. The acronym CERCLA is frequently used to refer to both acts, as in the term Superfund. CERCLA requires the administrator of the USEPA to promulgate regulations designating hazardous substances that, when released into the environment, may present substantial danger to public health, welfare, or the environment. The act established the Superfund and required the promulgation of regulations governing the funding and cleanup of waste sites and contaminated areas

Certified Reference Material (CRM):
A reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body. (ISO Guide 30–2.2)

Chain of Custody:
An unbroken trail of accountability that ensures the physical security of samples and includes the signatures of all who handle the samples. (NELAC) [5.12.4]

Chemical Analysis:
Any of a variety of laboratory methods used to evaluate the concentrations of compounds and elements present in an environmental sample.
Clean Air Act:
The enabling legislation in 42 U>S>C> 7401 et seq., Public Law 91-604, 84 Stat. 1676 Pub. L. 95-95, 91 Stat., 685 and Pub. L. 95-190, 91 Stat., 1399, as amended, empowering EPA to promulgate air quality standards, monitor and enforce them. (NELAC)

Clean Water Act (CWA):
A Federal law that controls the discharge of pollutants into surface water in a number of ways, including discharge permits. The Act that sets the basic structure for regulating discharges of pollutants to surface waters of the United States. CWA imposes contaminant limitations or guidelines for all discharges of wastewater into the nation's waterways
Client Complaint:
A complaint is a situation where dissatisfaction is expressed with the service provided by the laboratory.

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA/SUPERFUND):
The enabling legislation in 42 U.S.C. 9601-9675 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 U.S.C. 9601 et seq., to eliminate the health and environmental threats posed by hazardous waste sites. (NELAC)

Compromised Samples:
Those samples which are improperly sampled, insufficiently documented (chain of custody and other sample records and/or labels), improperly preserved, collected in improper containers, or exceeding holding times when delivered to a laboratory. Under normal conditions, compromised samples are not analyzed. If emergency situation require analysis, the results must be appropriately qualified. (NELAC)

Composite Sample:

Portions of material collected from more than one spatial location or at different times that are blended and submitted for chemical analyses. Composite samples can provide data representative of a large area with relatively few samples. However, the resulting data are less accurate with regard to the concentrations of contaminants detected in a specific location, because they represent average values.

Concentration:
the mass of analyte per unit mass or volume of sample. Common units of concentration for environmental analyses are microgram per liter or kilogram (ug/L or ug/kg) and milligrams per liter or kilogram (mg/L or mg/kg).

Confidence interval:
for normally distributed (random) data, the intervals where 68%, 95%, and 99% of the data fall. 68% of the data should fall within 1 standard deviation of the mean, 95% of the data should fall within 2 standard deviations of the mean, and 99% of the data should fall within 3 standard deviations of the mean.

Confidential Business Information (CBI):
Information that an organization designates as having the potential of providing a competitor with inappropriate insight into its management, operation or products. NELAC and its representatives agree to safeguarding identified CBI and to maintain all information identified as such in full confidentiality.

Confirmation:
Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to: (NELAC)

Second column confirmation
Alternate wavelength
Derivatization
Mass spectral interpretation
Alternative detectors or
Additional Cleanup procedures

Conformance:
An affirmative indication or judgment that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ASQC E4-1994)

Continuing Calibration Verification (CCV) Standard –
A mid-concentration analytical standard run periodically to verify the calibration of the analytical instrument. Also known as continuing calibration check (CCC).

Contract Laboratory Program (CLP) –
A nationwide laboratory network established by the USEPA, structured to provide legally defensible analytical results to support USEPA enforcement actions or other requirements of the use community. The CLP incorporates a level of quality assurance appropriately designed for the intended usage of the data.

Control Limits:
accuracy or precision ranges that determine whether the experimentally determined results are in control. If the results are within the acceptance ranges, the results are said to be in control; if the results are outside the limits, they are said to be out-of–control.

Corporate Quality Management Plan (CQMP):
the TestAmerica corporate document describing the management policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation to ensure the quality of its product and the utility of the product to its users.

Correction:

Actions necessary to correct or repair analysis specific non-conformances. The acceptance criteria for method specific QC and protocols as well as the associated corrective actions. The analyst will most frequently be the one to identify the need for this action as a result of calibration checks and QC sample analysis**.** No significant action is taken to change behavior, process or procedure.

Corrective Action:
The action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence. (ISO 8402)

Corrective Action Report (CAR):
The CAR form is used in situations where a recurring problem or breakdown in systems is observed and warrants a more thorough investigation than a single-event NCR. CARs may be initiated from: a specific nonconformance situation (NCR), an observed trend or frequency of events that warrant corrective action, an audit finding, etc.

Correlation Coefficient:
A number (r), which indicates the degree of dependence between two variables (concentration and response). The more dependent the variables are, the closer the value is to one. This value is used to evaluate the straightness of a line, (the linearity of the instrument).

Data Audit:
A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data re of acceptable quality (i.e., that they meet specified acceptance criteria). (NELAC)

Data Reduction:
The process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form. (EPA-QAD)

Data Validation:
An evaluation of laboratory data quality based on a review of the data deliverables. This process involves procedures verifying instrument calibration, calibration verification, and other method-specific performance criterion.

Deficiency:
An unauthorized deviation from acceptable procedures or practices, or a defect in an item. (ASQC)

Demonstration of Capability (DOC):
procedure to establish the ability to generate acceptable accuracy and precision.

Detection Limit:
The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value. See Method Detection Limit. (NELAC)

Direct Aqueous Injection (DAI):
A technique in which an aliquot of the aqueous sample or aqueous leachate is injected directly into the gas chromatograph with no prior sample preparation.

Disposal:
Final placement or destruction of wastes. Disposal may be accomplished through the use of landfills, treatment processes, etc.

Document Control:
The act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly, and controlled to ensure use of the correct version at the location where the prescribed activity if performed. (ASQC)

Duplicate Analyses:
The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory. (EPA-QAD)

Environmental Detection Limit (EDL):
The smallest level at which a radionuclide in an environmental medium can be unambiguously distinguished for a given confidence interval using a particular combination of sampling and measurement procedures, sample size, analytical detection limit, and processing procedure. The EDL shall be specified for the 0.95 or greater confidence interval. The EDL shall be established initially and verified annually for each test method and sample matrix. (NELAC Radioanalysis Subcommittee)

Equipment Blank:
Sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (NELAC)

External Standard Calibration:
Calibrations for methods that do not utilize internal standards to compensate for changes in instrument conditions.

Extractable Organics:
Semivolatiles (base/neutral and acid extractable compounds) and pesticide/polychlorinated biphenyl compounds that can be partitioned into an organic solvent from the sample matrix and are amenable to gas chromatography (GC).

Federal Water Pollution Control Act (Clean Water Act, CWA):
The enabling legislation under 33 U.S.C. 1251 et seq., Public Law 92-50086 Stat 816, that empowers EPA to set discharge limitations, write discharge permits, monitor, and bring enforcement action for non-compliance. (NELAC)

Field Blank:
Blank prepared in the field by filing a clean container with pure de-ionized water and appropriate preservative, if any, for the specific sampling activity being undertaken (EPA OSWER)

Field Control Samples:
General term assigned to field-generated replicates (duplicates/splits/spikes), blanks, background/upgradient samples, etc.

Field Duplicate Sample:
Independent sample collected at approximately the same time and place, using the same methods as another sample. The duplicate and original sample are containerized, handled, and analyzed in an identical manner.

Field of Testing:
NELAC's approach to accrediting laboratories by program, method and analyte. Laboratories requesting accreditation for a program-method-analyte combination or for an up-dated/improved

method are required to submit to only that portion of the accreditation process not previously addressed (see NELAC, section 1.9ff). (NELAC)

Filtrate:
A filtered liquid.

Filtration:
The physical removal of solid particles from a liquid wastestream by passing the liquid across a filter medium, which serves as a barrier to the solid material.

GRO:
Gasoline Range Organics

Gas Chromatography/Mass Spectroscopy (GC/MS):
Two distinct analytical techniques used to separate and identify organic compounds: the GC is used for the separating portion and the MS is used as the detection portion of an analysis. Both techniques are typically performed by a single instrument.

Good Laboratory Practices (GLP):
formal regulations for performing basic laboratory operations outlined in 40 CFR Part 160 and 40 CFR Part 729.

Heavy Metals:
In reference to environmental sampling, typically identified as the following trace inorganics: cadmium, lead, mercury, silver, etc. (all metals of health concern). Heavy metals can cause biological damage if consumed at low concentrations and tend to accumulate in the food chain.

Holding Times (Maximum Allowable Holding Times):
The maximum times that samples may be held prior to analyses and still be considered valid or not compromised. (40 CFR Part 136)

Homogeneous:
The quality of uniform composition.

Inorganic Chemicals:
Chemical substances of mineral origin, not of basically carbon structure.

Inquiry:
A question or request for information about the service provided by the laboratory.
Instrument Blank: a blank matrix that is the same as the processed sample matrix (i.e. extract, digestate, condensate) and introduced onto the instrument for analysis.

Instrument Detection Limit (IDL):
the minimum amount of a substance that can be measured on a specific instrument, with a specified degree of confidence that the amount is greater than zero. The IDL is associated with the instrumental portion of a specific method only, and sample preparation steps are not considered in its derivation. An IDL value, by definition, has an uncertainty of ±100%. The IDL thus represents a range where qualitative detection occurs on a specific instrument. Quantitative results are not produced in this range.

Internal Standard:
A known amount of standard added to a test portion of a sample and carried through the entire measurement process as a reference for evaluating and controlling the precision and bias of the applied analytical test method. (NELAC)

Internal Standard Calibration:
Calibrations for methods that utilize internal standards to compensate for changes in instrument conditions.

Instrument Blank:
A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (EPA-QAD)

Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample):

- A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes, taken through all preparation and analysis steps. Where there is no preparation taken for an analysis (such as in aqueous volatiles), or when all samples and standards undergo the same preparation and analysis process (such as Phosphorus), there is no LCS. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

- An LCS shall be prepared at a minimum of 1 per batch of 20 or less samples per matrix type per sample extraction or preparation method except for analytes for which spiking solutions are not available such as total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The results of these samples shall be used to determine batch acceptance.

Note: NELAC standards allow a matrix spike to be used in place of this control as long as the acceptance criteria are as stringent as for the LCS. (NELAC)

Laboratory Duplicate:
Aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently. (NELAC)

Least Squares Regression (1st Order Curve):
The least squares regression is a mathematical calculation of a straight line over two axes. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The regression calculation will generate a correlation coefficient (r) that is a measure of the "goodness of fit" of the regression line to the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r must be greater than or equal to 0.99 for organics and 0.995 for inorganics.

Limit of Detection (LOD):
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. (Analytical Chemistry, 55, p.2217, December 1983, modified) See also Method Detection Limit.

Limit(s) of Quantitation (LOQ):
The minimum levels, concentrations, or quantities or a target variable (e.g., target analyte) that can be reported with a specified degree of confidence.

Linear Dynamic Range (LDR):
The linear dynamic range is that concentration over which the detector output for an instrument is linear when related to the concentration. The graph of the response versus the concentration is a straight line.

Log number:

a sequential number that is assigned to each client's samples upon receipt into the laboratory. This log number provides the primary means of associating the samples to the client.

Mass spectrometry:
a detection instrument that differentiates compounds by their differences in mass, or mass fragments. The basic components of the MS are the ion source and lenses, the mass filter (quadrapoles), and the electron multiplier. The ion source and lenses create the ions and propel them on a consistent path to the quadrapoles. The quadrapoles filter the ions that are produced in the source, allowing them to continue to the electron multiplier, where the ions are collected and the signal sent to the data system.

Mass spectra:
a graphical representation of the abundance of the mass ions produced when a compound is detected by mass spectrometry. The mass spectra is essentially a fingerprint of the compound and along with the retention time of the compound provides excellent qualitative information about the presence of the compound.

Matrix:
The component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions shall be used:

- Aqueous: Any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts.
- Drinking Water: any aqueous sample that has been designated as a potable or potential potable water source.
- Saline/Estuarine: any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.
- Non-aqueous Liquid: any organic liquid with <15% settleable solids.
- Biological Tissue: any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.
- Solids: includes soils, sediments, sludges, and other matrices with >15% settleable solids.
- Chemical Waste: a product or by-product of an industrial process that results in a matrix not previously defined.
- Air: whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbant tube, impinger solution, filter, or other device. (NELAC)

Matrix Spike (spiked sample or fortified sample):
Prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Matrix spikes shall be performed at a frequency of one in 20 samples per matrix type per sample extraction or preparation method except for analytes for which spiking solutions are not available such as, total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The selected sample(s) shall be rotated among client samples so that various matrix problems may be noted and/or addressed. Poor performance in a matrix spike may

indicate a problem with the sample composition and shall be reported to the client whose sample was used for the spike. (QAMS)

Matrix Spike Duplicate (spiked sample or fortified sample duplicate):
A second replicate matrix spike is prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.

Matrix spike duplicates or laboratory duplicates shall be analyzed at a minimum of 1 in 20 samples per matrix type per sample extraction or preparation method. The laboratory shall document their procedure to select the use of an appropriate type of duplicate. The selected sample(s) shall be rotated among client samples so that various matrix problems may be noted and/or addressed. Poor performance in the duplicates may indicate a problem with the sample composition and shall be reported to the client whose sample was used for the duplicate. (QAMS)

Method Blank:
A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses. (NELAC)

Method Detection Limit:
The minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. (40 CFR Part 136, Appendix B)

Negative Control:
Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results. (NELAC)

Non-conformance:

any occurrence that prevents the lab from delivering data that is compliant with the control criteria published (or incorporated by reference) in an applicable QA plan. The Non-conformance Module (NCM) function in LIMS is used to document nonconformance conditions and to specify the necessary action(s) taken to correct the specific problem.

Observation:

A non-routine situation to which there are no established procedures, but may be out of the ordinary. Example: sample has strong odor; sample is dark in color. These are recorded using the NCM module in LIMS.

Organic:

Referring to or derived from living organisms; any compound containing carbon.

Parts per billion (ppb):
one part of analyte per billion parts of sample. For aqueous samples, a ppb is equivalent to ug/L; for soils, ug/kg.

Parts per million (ppm):
one part of analyte per million parts of sample. For aqueous samples, a ppm is equivalent to mg/L; for soils, mg/kg.

Percent Recovery:

percent recovery is used to assess accuracy and is calculated:
where
Cexperimental = experimentally determined concentration
Cknown = known or theoretical concentration

Percent Solids:
The proportion of solid in a soil sample determined by drying an aliquot of the sample.

Performance Audit:
The routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory. (NELAC)

Performance Based Measurement System (PBMS):
A set of processes wherein the data quality needs, mandates or limitations of a program or project are specified and serve as criteria for selecting appropriate test methods to meet those needs in a cost-effective manner. (NELAC)

$$\%REC = \frac{C\,\text{exp}\,erimental}{Cknown} \otimes 100$$

pH: A numerical designation of relative acidity or basicity (Alkalinity). A pH of 7 indicates neutrality; lower values indicate increasing acidity; high values indicate increasing alkalinity.

Positive Control:
Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects. (NELAC)

Precision:
The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms. (NELAC)

Preservation:
Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample. (NELAC)

Preventive Action: the pro-active process of noting and correcting a potential problem before it happens due to a weakness in a system, method, or procedure.

Proficiency Testing:
A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (NELAC) [2.1]

Proficiency Testing Program:
The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories. (NELAC)

Proficiency Test Sample (PT):
A sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria. (QAMS)

Quality Assurance:
An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence. (QAMS)

Quality Assurance Manual (QAM):
A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users. (NELAC)

Quality Assurance [Project] Plan (QAPP):
A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved. (EAP-QAD)

Quality Control:
The overall system of technical activities which purpose is to measure and control the quality of a product or service so that it meets the needs of users. (QAMS)

Quality Control Sample:
An uncontaminated sample matrix spiked with known amounts of analytes from a source independent from the calibration standards. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system. (EPA-QAD)

Quality System:
A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC (ANSI/ASQC-E-41994)

Quantitation Limits:
The maximum or minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be quantified with the confidence level required by the data user. (NELAC)

Range:
The difference between the minimum and the maximum of a set of values. (EPA-QAD)

Raw Data:
any original information from a measurement activity or study recorded in laboratory notebooks, worksheets, records, memoranda, notes, or exact copies thereof and that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfiche copies, computer printouts, magnetic/optical media, including dictated observations, and recorded data from automated instruments. Reports specifying inclusion of “raw data” do not need all of the above included, but sufficient information to create the reported data.

RCRA:
The **Resource Conservation and Recovery Act** (RCRA), enacted in 1976, is the principal federal law in the United States governing the disposal of solid waste and hazardous waste.

Reagent:
a material that is used in a process or analysis but is not directly related to the measured analyte concentration.

Reagent Blank (method reagent blank):
A sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps. (QAMS)

Record Retention: the systematic collection, indexing and storing of documented information under secure conditions.

Reference Material:
A material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (ISO Guide 30-2.1)

Reference Standard:
A standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived. (VIM-6.0-8)

Relative Percent Difference: the relative percent difference is calculated between the concentrations of two spikes or sample duplicates:
where

$$\%RPD = \left| \frac{(C1 - C2)}{\frac{C1 + C2}{2}} \right| \otimes 100$$

C_1 = concentration of the sample or spike
C_2 = concentration of the sample duplicate or spike duplicate

Replicate Analyses:
The measurements of the variable of interest performed identically on two or more sub-samples of the same sample within a short time interval. (NELAC)

Report Limit (RL):
The laboratory nominal Quantitation Limit (QL) or the level of sensitivity required by the client but not lower than the LOD.

Representativeness:
A qualitative measure of the extent to which a sample(s) acquired from a medium describes the chemical characteristics of that medium.

Resolution:
Also known as separation, or percent resolution. The separation between peaks on a chromatogram, calculated by dividing the depth of the valley between the peaks by the peak height of the smallest peak being resolved, and multiplied by 100.

Resource Conservation and Recovery Act (RCRA):
The enabling legislation under 42 USC 321 et seq. (1976), that gives EPA the authority to control hazardous waste from the “cradle-to-grave”, including its generation, transportation, treatment, storage, and disposal. (NELAC)

Safe Drinking Water Act (SDWA):
The enabling legislation, 42 USC 300f et seq. (1974), (Public Law 93-523), that requires the EPA to protect the quality of drinking water in the U.S. by setting maximum allowable contaminant levels, monitoring, and enforcing violations. (NELAC)

Sample:
A portion of material collected for chemical analyses. Note that a sample is identified by a unique sample number and that the term and the number may apply to multiple sample containers, if a single sample is submitted for a variety of chemical analyses.

Sampling and Analysis Plan (SAP):
a formal document describing the detailed sampling and analysis procedures for a specific project.

Sample Duplicate:
Two samples taken from and representative of the same population and carried through all steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variance of the total method including sampling and analysis. (EPA-QAD)

Scope of Work:
It is a general description of the work a party intends to do at a site. It includes the media to be sampled and the constituents analyzed for, but not necessarily location and sample number.

Second Order Polynomial Curve (Quadratic):
The 2^{nd} order curves are a mathematical calculation of a slightly curved line over two axis. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The 2^{nd} order regression will generate a coefficient of determination (COD or r^2) that is a measure of the "goodness of fit" of the quadratic curvature the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r^2 must be greater than or equal to 0.99.

Selectivity:
(Analytical chemistry) the capability of a test method or instrument to respond to a target substance of constituent in the presence of non-target substances. (EPA-QAD)

Semivolatile Organics:
Compounds that are amenable to analysis by extraction of the sample with an organic solvent. The term semivolatile organic is used synonymously with base/neutral/acid (BNA) compounds.

Sensitivity:
The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (NELAC)

Solvent:
the organic liquid used to extract the compounds of interest out of the sample matrix. The solvent is also used to dissolve (put into solution) standards. In general, the solvent used to prepare the standards is also used to extract the samples. A good rule of thumb is that “like dissolves like”, that is, a solvent must be similar in chemical structure to the compound that is being extracted or being dissolved. For most organic extractions, the solvent should also not be miscible (dissolves in all proportions) with water.

Spike:
A known mass of target analyte added to a blank, sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene and PCBs in Method 608), the test method has an extremely long list of components or components are incompatible, a representative number (at a minimum 10%) of the listed components may be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses permit specified analytes and other client requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.. (NELAC)
SPLP: Synthetic Precipitation Leaching Procedure (SPLP) is used to evaluate the potential for leaching metals into ground and surface waters. This method provides a more realistic assessment of metal mobility under actual field conditions, i.e. what happens when it rains (or snows). East of the Mississippi River the fluid is slightly more acidic at pH 4.20 reflecting the air pollution impacts of heavy industrialization and coal utilization. A pH of 5.00 is used west of the Mississippi reflecting less industrialization and smaller population densities.

Standard:
The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of NELAC and meets the approval requirements of NELAC procedures and policies. (ASQC)

Standard:
a material or solution of known purity or concentration that is used to calibrate an instrument or verify the calibration of an instrument or process.

Neat standard: a pure compound, element, or salt that contains the target analyte. The purity, usually expressed as a percent, of the neat standard must be known.

Stock standard: a solution made from one or more neat standards. The stock standard will usually have a high concentration, usually higher than 1000mg/L (1000ug/mL).

Secondary or intermediate stock standard: a solution made from two or more stock standards. A secondary standard may also be a certified solution purchased from a vendor as a mixture of several target analytes.

Calibration or working standard - the standard that is analyzed on the instrument or using the analytical procedure.

Standard Operating Procedures (SOPs):
A written document which details the method of an operation, analysis, or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks. (QAMS)

Standardized Reference Material (SRM):
A certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical method. (EPA-QAD)

Storage Blank:
a blank matrix stored with field samples of a similar matrix. This is required for the Volatiles Department only.

Surrogate:

A substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes.

Surrogate compounds must be added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. Poor surrogate recovery may indicate a problem with sample composition and shall be reported to the client whose sample produced poor recovery. (QAMS)

Suspended Metals:
The concentration of metals determined in the portion of a sample that is retained on a 0.45-µm filter. (The concentration of suspended metals may also be calculated from the difference between the total metals sample results minus the dissolved metals sample results.)

Systems Audit (also Technical Systems Audit):
A thorough, systematic, qualitative on-site assessment of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system. (EPA-QAD)

System Performance Check Compounds (SPCCs):
Term used in conjunction with SW-846, Method 8260 and 8270, to refer to the compounds in which the RF is evaluated against method-prescribed criteria to decide the validity of a calibration.

Target Analyte List (TAL):
refers to the Contract Lab Program list of inorganic analytes that includes metals and cyanide. May also refer to any general list of inorganic target analytes.

TALs:
TestAmerica Laboratory Information System is the sample and data management software system in use at TestAmerica Mobile.

Target Compound List (TCL):
refers to the Contract Lab Program list of organic compounds that includes volatiles (GC/MS), semivolatiles (GC/MS), and pesticides and PCBs (GC/EC), metals and cyanide. May also refer to any general list of organic target compounds.

TCLP –
toxicity compound leaching procedure

Test Method:
defined technical procedure for performing a test.

Theoretical (or Known) Concentration:
the mass of target analyte spiked into a sample or blank matrix divided by the volume or weight of sample processed through the procedure, calculated as follows:

$$C(theoretical) = \frac{Cspike \otimes Vspike}{Vsample} \quad or \quad C(theoretical) = \frac{Cspike \otimes Vspike}{Wsample}$$

Total Metals:
Concentration of metals determined in an unfiltered water sample which is preserved (acidified) in the field, transported to the laboratory, and then follows a rigorous digestion.

Total Recoverable Metals –

Concentration of metals in an unfiltered water sample which is preserved (acidified) in the field and transported to the lab, which then performs the digestion with hot dilute mineral acid. This preparation method is typically utilized for drinking water samples and EPTox or TCLP extracts.

Toxic Substances Control Act (TSCA):
The enabling legislation in 15 USC 2601 et seq., (1976) that provides for testing, regulating, and screening all chemicals produced or imported into the United States for possible toxic effects prior to commercial manufacture. (NELAC)

Traceability:
The property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons. (VIM-6.12)

Trip Blank:
Samples prepared by adding clean, analyte-free water to sample containers for analysis for volatile organics. Preservatives are added to the blank, and the containers are sealed prior to the sampling trip. Trip blanks are transported with empty sample containers to the site of work and remain sealed until analyzed with collected environmental samples. Trip blanks permit evaluation of contamination generated from sample containers or occurring during the shipping and laboratory storage process.

Tune:
to adjust the parameters of the mass spectrometer in order to meet the mass calibration criteria.

Uncertainty:
A parameter associated with the result of a measurement that characterizes the dispersion of the value that could reasonably be attributed to the measured value.

Verification:
confirmation by examination and provision of evidence that specified requirements have been met.

Volatile organic compound (VOC):
an organic compound that is amenable to purge and trap analysis. In general, VOC have low boiling pints (<200C), high vapor pressures (tend to evaporate easily as low temperatures), and have low molecular weight (generally less than 300 amu).

Working Range:
The difference between the Limit of Quantitation and the upper limit of measurement system calibration.

Acronyms:

BS – Blank Spike
BSD – Blank Spike Duplicate
CAR – Corrective Action Report
CCV – Continuing Calibration Verification
CF – Calibration Factor
CFR – Code of Federal Regulations
COC – Chain of Custody
CRS – Change Request Form
DOC – Demonstration of Capability
DQO – Data Quality Objectives
DU – Duplicate
DUP - Duplicate
EHS – Environment, Health and Safety

EPA – Environmental Protection Agency
GC - Gas Chromatography
GC/MS - Gas Chromatography/Mass Spectrometry
HPLC - High Performance Liquid Chromatography
ICP - Inductively Coupled Plasma Atomic Emission Spectroscopy
ICV – Initial Calibration Verification
IDL – Instrument Detection Limit
IH – Industrial Hygiene
IS – Internal Standard
LCS – Laboratory Control Sample
LCSD – Laboratory Control Sample Duplicate
LIMS – Laboratory Information Management System
MDL – Method Detection Limit
MS – Matrix Spike
MSD – Matrix Spike Duplicate
SDS - Safety Data Sheet
NELAC - National Environmental Laboratory Accreditation Conference
NELAP - National Environmental Laboratory Accreditation Program
PT – Performance Testing
QAM – Quality Assurance Manual
QA/QC – Quality Assurance / Quality Control
QAPP – Quality Assurance Project Plan
RF – Response Factor
RPD – Relative Percent Difference
RSD – Relative Standard Deviation
SD – Standard Deviation
SOP: Standard Operating Procedure
TAT – Turn-Around-Time
VOA – Volatiles
VOC – Volatile Organic Compound

ACRONYM	DEFINTION
AA	Atomic absorption
AL	Action Level
ASTM	American Society for Testing and Materials
BFB	Bromofluorbenzene
BNA	Base, neutral, acids (semivolatile organics)
BOD	Biochemical oxygen demand
BS	Blank Spike
BSD	Blank Spike Duplicate
BTEX	Benzene, toluene, ethylbenzene, xylenes
BTU	British thermal unit
CA	Corrective action
CAA	Clean Air Act
CAR	Corrective Action Report
CCC	Calibration Check Compounds
CCV	Continuing Calibration Verification
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CF	Calibration Factor
CFR	Code of Federal Regulation
CFU	Colony Forming Units
CLLE	Liquid-liquid extraction
CLP	Contract Laboratory Program
COC	Chain of custody

ACRONYM	DEFINTION
COD	Chemical oxygen demand
CQMP	Corporate Quality Management Plan
CRDL	Contract Required Detection Limit (CLP)
CRQL	Contract Required Quantitation Limit (CLP)
CRS	Change Request Form
CWA	Clean Water Act
DFTPP	Decafluorotriphenylphosphate
DMR	Discharge Monitoring Report
DO	Dissolved oxygen
DOC	Demonstration of Capability
DOT	Department of Transportation
DQOs	Data quality objectives
DRO	Diesel Range Organics
DU	Laboratory duplicate
DUP	Laboratory duplicate
ECD	Electron capture detector
EDD	Electronic data deliverable
EHS	Environmental, Health, and Safety
ELCD	Electrolytic conductivity detector
EP TOX	Extraction procedure toxicity
EPA	U.S. Environmental Protection Agency
EQL	Estimated quantitation limit
eV	Electron volt
FID	Flame ionization detector
GALP	Good automated laboratory practices
GC	Gas chromatograph or gas chromatography
GC/MS	Gas chromatograph/mass spectrometer
GFAA	Graphite furnace atomic absorption
GLP	Good laboratory practices
GPC	Gel permeation column (chromatography)
GRO	Gasoline range organics
HAPS	Hazardous Air Pollutants
HAZCAT	Hazardous characterization testing
HASMAT	Hazardous materials
HDPE	high density polyethylene
HPLC	High performance liquid chromatography
IC	Ion chromatography
ICAP	Inductively coupled argon plasma emission spectroscopy
ICP	Inductively coupled plasma
ICP/MS	Inductively coupled plasma/mass spectrometer
ICV	Initial Calibration Verification
IDL	Instrument detection limit
IH	Industrial Hygiene
IR	Infrared radiation
IS	Internal Standard
ISO	International Standards Organization
LC	Liquid chromatography
LCS	Laboratory control sample
LCSD	Laboratory control sample duplicate
LDR	Linear dynamic range
LIMS	Laboratory Information Management System

ACRONYM	DEFINTION
LOD	Limit of detection
LOQ	Limit of quantitation
LUFT	Leaking underground fuel tank
LUST	Leaking underground storage tank
MB	Method blank
MBAS	Methylene blue active substances
MCL	Maximum contaminant level
MDL	Method detection limit
MEK	Methyl Ethyl Ketone (2-butanone)
MIBK	Methyl-Isobutyl-Ketone
MPN	Most probable number
MS	Mass spectrometer
MS	Matrix spike
MSA	Method of standard additions
MSD	Matrix spike duplicate
MSDS	Material safety data sheet
NELAC	National Environmental Laboratory Accreditation Conference
NELAP	National Environmental Laboratory Accreditation Program
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology (formerly NBS)
NBS	National Bureau of Standards
NPD	Nitrogen – phosphorus detector
NPDES	National Pollution Discharge Elimination System
ORO	Oil Range Organics
OSHA	Occupational Safety and Health Administration
PAH	Polynuclear aromatic hydrocarbon
PARCC	Precision, accuracy, representativeness, comparability, and completeness
PCB	Polychlorinated biphenyl
PCDD	Polychlorinated dibenzodioxin
PCDF	Polychlorinated dibenzofurans
PCE	Perchloroethylene, a.k.a Tetrachloroethylene
PE	Performance evaluation
PID	Photoionization detector
PNA	Polynuclear aromatic
ppb	Parts per billion (µ/L or µ/Kg)
PPL	Priority pollutant list
ppm	Parts per million (e.g., mg/L or mg/Kg)
ppt	Parts per trillion
PQL	Practical quantitation limit
PT	Proficiency Test
PTFE	Polytetrafluoroethylene
PVC	Polyvinyl chloride
QA	Quality assurance
QAM	Quality Assurance Manual
QAPP	Quality assurance project plan
QAPP	Quality Assurance Project Specific Plan
QC	Quality Control
PEM	Performance Evaluation Mixture (Pesticides)
RCRA	Resource Conservation Recovery Act
RF	Response factor
RL	Reporting Limit

ACRONYM	DEFINTION
RPD	Relative percent difference
RT	Retention time
RRT	Relative Retention time
RSD	Relative standard deviations
SAP	Sampling and analysis plan
SARA	Superfund Amendments and Reauthorization Act
SD	Standard Deviation
SDG	Sample delivery group
SDWA	Safe Drinking Water Act
SOC	Synthetic organic compound
SOP	Standard operating procedures
SOW	Scope of Work or Statement of Work
SPCC	System performance check compound
SPE	Solid phase extraction
SRM	Standard reference material
SS	Suspended Solids
SW-846	Solid waste analytical protocols
TAL	Target Analyte List (CLP inorganics)
TALs	TestAmerica Laboratory Information System
TAT	Turn Around Time
TCDD	Tetrachlorodibenzodioxin
TCDF	Tetrachlorodifbenzofuran
TCE	Trichloroethylene
TCL	Target Compound List (CLP organics)
TCLP	Toxicity characteristic leachate procedure
TDS	Total dissolved solids
TRPH	Total recoverable petroleum hydrocarbons
THM	Trihalomethane
TIC	Tentatively identified compound
TNI	The NELAC Institute (formerly NELAC)
TOC	Total organic carbon
TOX	Total organic halides
TPH	Total petroleum hydrocarbons
TS	Total solids
TSS	Total suspended solids
TVS	Total volatile solids
US EPA	United States Environmental Protection Agency
UST	Underground storage tank
UV	Ultraviolet
VOA	Volatile organic analysis (Analyte)
VOC	Volatile organic compounds

Arcadis U.S., Inc.

1728 3rd Avenue North

Suite 300

Birmingham, Alabama 35203

Tel 205 930 5700

Fax 205 930 5707

www.arcadis.com

APPENDIX D

Copy of Recorded Deed

STATE OF ALABAMA §
§
MOBILE COUNTY §

A F F I D A V I T

IN RE: Redwing Carriers, Inc.
Creola, Alabama

The property described in "Exhibit A" and recorded in Real Property Book 1057 at Page 302 in the Office of the Judge of Probate in Mobile County, Alabama has been used to manage hazardous waste. Its use is restricted under Rule 14-6-07 of Alabama Department of Environmental Management's Administrative Code. There is currently 5,000 cubic yards of solid hazardous disposed of located NE of the SW corner of the property. This property is maintained under the Rules and Regulations of the Alabama Department of Environmental Management and the laws of the State of Alabama regarding the closure and monitoring of a hazardous waste facility. This information is on file with the Mobile County Commission.

D. Patrick Harris
Attorney for Redwing Carriers, Inc.

OF COUNSEL:

HARRIS & HARRIS, P.C.
200 South Lawrence Street
Montgomery, Alabama 36104
(205) 265-0251

"EXHIBIT A"

LEGAL DESCRIPTION

Beginning at the Southwest corner of Section 36, Township 1 South, Range 1 West; thence run North 00 degrees 12 minutes East and along the West line of said Section 36, 960.00 feet; thence South 88 degrees 35 minutes 38 seconds East, 1125.56 feet to a point on the West right of way line of U. S. Highway No. 43; said point also being on the arc of a curve having a radius of 5843.96 feet; thence run Southwestwardly and along the arc of said curve and also being along the West right of way line of said U. S. Highway No. 43, 73.04 feet to the point of tangency of said curve; thence South 10 degrees 47 minutes 30 seconds West and continuing along the West right of way line of said Highway, 886.96 feet to a point on the South line of said Section 36; thence North 89 degrees 21 minutes 30 seconds West and along the South line of said Section 36, 948.78 feet to the point of beginning.

EXCEPTING THEREFROM all oil, gas and other minerals in, on and/or under the above described property, which are hereby expressly reserved by the grantor, together with the right of ingress and egress for the purpose of exploring, mining and drilling said land for oil, gas and other minerals and removing the same therefrom; and

SUBJECT TO: Oil, gas and mineral lease from Bertha M. Link Ballinger and husband to Roy J. Anderson, dated September 8, 1966 and recorded in Real Property Book 782, page 213 of the records in the office of the Judge of the Probate Court of Mobile County, Alabama.

APPENDIX E

Financial Assurance

LANCE R. LEFLEUR
DIRECTOR

KAY IVEY
GOVERNOR

Alabama Department of Environmental Management
adem.alabama.gov

1400 Coliseum Blvd. 36110-2400 ▪ Post Office Box 301463
Montgomery, Alabama 36130-1463
(334) 271-7700 ▪ FAX (334) 271-7950

June 13, 2017

Mr. Andrew Eversull
Principal Environmental Engineer
ARCADIS U.S., Inc.
2170 Highland Avenue, Suite 250
Birmingham, AL 35216

Dear Mr. Eversull:

RE: Rentokil Initial Environmental Services, LLC
Creola, Alabama
Letter of Credit Number: 04110265
EPA ID NO: ALD 021 257 951

The Department has completed its review of your May 12, 2017, amendment to the Letter of Credit Number 04110265, submitted to demonstrate financial assurance for post-closure, at the referenced facility. The information submitted is satisfactory, and Rentokil Initial Environmental appears to be in compliance with the requirements of the ADEM Admin. Code R. 335-14-5-.08 and/or 335-14-6-.08. The Letter of Credit amount increased to the new balance of $9,400,300.00

If you have any further questions or comments regarding this matter, please contact Mr. Abe Oberkor at 334-271-7758.

Sincerely,

Brent A. Watson

Brent A. Watson, Chief
Compliance & Enforcement Section

BAW/AOO/nbf

cc Bob Stewart-EPA Region 4
Steven Phillips-ADEM

Birmingham Branch
110 Vulcan Road
Birmingham, AL 35209-4702
(205) 942-6168
(205) 941-1603 (FAX)

Decatur Branch
2715 Sandlin Road, S.W.
Decatur, AL 35603-1333
(256) 353-1713
(256) 340-9359 (FAX)

Mobile Branch
2204 Perimeter Road
Mobile, AL 36615-1131
(251) 450-3400
(251) 479-2593 (FAX)

Mobile-Coastal
3664 Dauphin Street, Suite B
Mobile, AL 36608
(251) 304-1176
(251) 304-1189 (FAX)

BNP PARIBAS
CORPORATE & INVESTMENT BANKING

BNP PARIBAS
TRADE SERVICES OPERATIONS
787 SEVENTH AVENUE
NEW YORK, NY 10019

DATE: MAY 12, 2017

IRREVOCABLE STANDBY LETTER OF CREDIT 04110265

BENEFICIARY:
DIRECTOR
ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
1400 COLISEUM BOULEVARD
MONTGOMERY, AL 36110-2059

APPLICANT:
RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC
4067 INDUSTRIAL PARK DRIVE, BUILDING 3A
NORCROSS, GA 30071

WE HEREBY AMEND THIS LETTER OF CREDIT AS FOLLOWS:

LETTER OF CREDIT AMOUNT INCREASED BY USD1,520,400.00 TO THE NEW BALANCE OF USD9,400,300.00

ALL OTHER TERMS AND CONDITIONS REMAIN UNCHANGED.

CERTAIN ADMINISTRATIVE SERVICES FOR BNP PARIBAS MAY BE PROVIDED BY BNP PARIBAS RCC, INC., BNP PARIBAS, THROUGH ITS CANADA BRANCH, OR ANY DIRECT OR INDIRECT MAJORITY OWNED SUBSIDIARY OF BNP PARIBAS.

BNP PARIBAS
BY: BNP PARIBAS RCC, INC., AS AUTHORIZED AGENT

AUTHORIZED SIGNATURE

AUTHORIZED SIGNATURE

Corporate Trust Services
5555 San Felipe Street
11th Floor
Houston, TX 77056

April 21, 2014

APR 25 2014

Alabama Department of Environmental Management
ADEM Montgomery Office
1400 Coliseum Boulevard
Montgomery, AL 36110-2400

Re: Rentokil Initial Environmental Services
Postclosure Environmental Trust
Facility Name: ALD 021 257 951
Facility Address: 10565 Highway 43, Creola, Alabama 36525

All:

Pursuant to a resignation notice, JPM Chase Bank, original Trustee under a trust agreement dated September 19, 2008 has resigned as trustee for an environmental trust with Rentokil for the property captioned above.

U.S. Bank National Association has agreed to serve as the successor to this account. For your files, I have enclosed an executed Successor Trustee Agreement indicating that U.S. Bank National Association has become the Trustee for the above captioned EPA property.

Please accept this letter and Successor Agreement as formal notice that U.S. Bank has agreed to become successor trustee under the original EPA agreement.

Should you have any questions, please do not hesitate to call me at 713-235-9206 or send me an email at mauri.cowen@usbank.com.

Regards,

Mauri J. Cowen

AGREEMENT OF RESIGNATION, APPOINTMENT AND ACCEPTANCE (the "Agreement"), dated as of February 12, 2014 (the "Effective Date") by and among Rentokil Initial environmental Services, Inc., a Georgia Corporation (the "Grantor"), U.S. BANK NATIONAL ASSOCIATION, a national banking association duly organized and existing under the laws of the United ("Successor Trustee") and JPMORGAN CHASE BANK, N.A., a national banking association duly organized and existing under the laws of the United States ("Resigning Trustee").

RECITALS:

WHEREAS, the Grantor appointed Resigning Trustee as the Trustee (the "Trustee"), under a Standby Trust Agreement with the Alabama Department of Environmental Management dated September 19, 2008 (the "Governing Instrument"). WHEREAS, the Resigning Trustee has agreed to resign as Trustee, and the Grantor wishes to appoint the Successor Trustee to succeed the Resigning Trustee; and the Successor Trustee wishes to accept appointment as Trustee under the Governing Instrument

NOW, THEREFORE, the Grantor, Resigning Trustee and Successor Trustee, for and in consideration of the premises and of other good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, hereby consent and agree as follows:

1

THE RESIGNING TRUSTEE

1.1 Resigning Trustee hereby represents and warrants to Successor Trustee that:

(a) The Governing Instrument, and each amendment and supplemental Governing Instrument thereto, if any, was validly and lawfully accepted executed and delivered by Resigning Trustee and is in full force and effect.

(b) No covenant or condition contained in the Governing Instrument has been waived, to the best knowledge of Resigning Trustee.

(c) There is no action, suit or proceeding pending or, to the best of Resigning Trustee's knowledge, threatened against Resigning Trustee before any court or any governmental authority arising out of any act or omission of Resigning Trustee as Trustee under the Governing Instrument.

(d) The Resigning Trustee has provided a copy of all documents in its possession to the Successor Trustee and holds no moneys, assets or property under the Governing Instrument.

(e) This Agreement has been duly authorized, executed and delivered on behalf of Resigning Trustee and constitutes its legal, valid and binding obligation, enforceable in accordance with its terms.

(f) Resigning Trustee has not received any notices, orders, requests or instructions from the Grantor or the EPA Regional Administrator, as outlined in the Governing Instrument, nor has Resigning Trustee given any notices as outlined in the Governing Instrument, and Resigning Trustee has no actual knowledge that a default or event of default has occurred and is continuing under the Governing Instrument.

1.2 Resigning Trustee hereby assigns, transfers, delivers and confirms to Successor Trustee all right, title and interest of Resigning Trustee in and to the trust under the Governing Instrument, all funds and other assets held in trust, if any, under the Governing Instrument and all the rights, powers, trusts and duties of the Trustee under the Governing Instrument, without limitation, all of its rights to, and all of its security interests in and liens upon, the Fund, if any, and all other rights of Resigning Trustee with respect to the Fund, if any, pursuant to the Governing Instrument. Resigning Trustee shall execute and deliver such further documents and shall do such other things as Successor Trustee may reasonably require so as to more fully and certainly vest and

confirm in Successor Trustee all the rights, powers, trusts and duties hereby assigned, transferred, delivered and confirmed to Successor Trustee as Trustee.

1.3 Resigning Trustee shall deliver to Successor Trustee, as of or promptly after the Effective Date, all of the items listed on Exhibit A hereto.

2

THE GRANTOR

2.1 The Grantor hereby accepts the resignation of Resigning Trustee as Trustee, under the Governing Instrument.

2.2 The Grantor hereby appoints Successor Trustee as Trustee, under the Governing Instrument to succeed to the Resigning Trustee, and hereby vests Successor Trustee with all the rights, powers, trusts and duties of Resigning Trustee under the Governing Instrument with like effect as if originally named as Trustee.

2.3 The Grantor hereby represents and warrants to Resigning Trustee and Successor Trustee that:

(a) No event has occurred and is continuing which is, or after notice or lapse of time would become, an event of default under the Governing Instrument.

(b) No notices, orders, requests or instructions, as outlined in the Governing Instrument have been received from the EPA Regional Administrator that have not been complied with.

(c) No covenant or condition contained in the Governing Instrument has been waived by the Grantor

(d) There is no action, suit or proceeding pending or, to the best of the Grantor's knowledge, threatened against the Grantor before any court or any governmental authority arising out of any act or omission of the Grantor under the Governing Instrument.

(e) The Letter of Credit described in Schedule A to this Agreement was never delivered to the Resigning Trustee. The original Letter of Credit is currently held by Citibank, located in London, England.

(f) This Agreement has been duly authorized, executed and delivered on behalf of the Grantor and constitutes its legal, valid and binding obligation, enforceable in accordance with its terms.

(g) All conditions precedent relating to the appointment of U.S. Bank National Association as successor Trustee under the Governing Instrument have been complied with by the Grantor.

(h) The Governing Instrument has not been amended or modified and is in full force and effect.

3

THE SUCCESSOR TRUSTEE

3.1 Successor Trustee hereby represents and warrants to Resigning Trustee and to the Grantor that:

(a) Successor Trustee is not disqualified under the provisions of the Governing Instrument and is eligible to act as Trustee under the Governing Instrument.

(b) This Agreement has been duly authorized, executed and delivered on behalf of Successor Trustee and constitutes its legal, valid and binding obligation, enforceable in accordance with its terms.

3.2 Successor Trustee hereby accepts its appointment as successor Trustee under the Governing Instrument and accepts the assets, rights, powers, trusts and duties of Resigning Trustee as Trustee under the Governing Instrument, upon the terms and conditions set forth therein, with like effect as if originally named as Trustee under the Governing Instrument.

4

MISCELLANEOUS

4.1 Except as otherwise expressly provided herein or unless the context otherwise requires, all terms used herein which are defined in the Governing Instrument shall have the meanings assigned to them in the Governing Instrument.

4.2 This Agreement and the resignation, appointment and acceptance effected hereby shall be effective as of the close of business on the date of execution and delivery of this Agreement and all assets thereof by each of the parties hereto.

4.3 This Agreement does not constitute an assumption by Successor Trustee of any liability of Resigning Trustee arising out of any action or inaction by Resigning Trustee in the performance of its duties under the Governing Instrument. Grantor and Resigning Trustee each hereby release the other from any obligations or liabilities in respect to the Governing Instrument and the trust account established thereby as of the date of this Agreement.

4.4 Resigning Trustee hereby acknowledges payment or provision for payment in full by the Grantor of compensation for all services rendered by Resigning Trustee in its capacity as Trustee, under the Governing Instrument and reimbursement in full by the Grantor of the expenses, disbursements and advances incurred or made by Resigning Trustee in its capacity as Trustee in accordance with the provisions of the Governing Instrument.

4.5 This Agreement shall be governed by and construed in accordance with the laws of the State of Texas, without regard to conflicts of laws principles thereof. Each party hereto irrevocably waives any objection on the grounds of venue, forum non-conveniens or any similar grounds and irrevocably consents to service of process by mail or in any other manner permitted by applicable law and consents to the jurisdiction of the courts located in the State of Texas. To the extent that in any jurisdiction any party hereto may now or hereafter be entitled to claim for itself or its assets, immunity from suit, execution, attachment (before or after judgment) or other legal process, such party shall not claim, and hereby irrevocably waives, such immunity. Each of the parties hereto

further hereby waive any right to a trial by jury with respect to any lawsuit or judicial proceeding arising or relating to this Agreement.

4.6 This Agreement may be executed in any number of counterparts each of which shall be an original, but such counterparts shall together constitute but one and the same instrument. The exchange of copies of this Agreement and of signature pages by facsimile or PDF transmission shall constitute effective execution and delivery of this Agreement as to the parties hereto and may be used in lieu of the original Agreement for all purposes. Signatures of the parties hereto transmitted by facsimile or PDF shall be deemed to be their original signatures for all purposes.

4.7 The Grantor acknowledges that, in accordance with Section 326 of the USA Patriot Act, Successor Trustee, like all financial institutions, and in order to help fight the funding of terrorism and money laundering, is required to obtain, verify and record information that identifies each person or legal entity that establishes a relationship or opens an account with Successor Trustee. The Grantor agrees that it will provide Successor Trustee with such information as it may request in order for Successor Trustee to satisfy the requirements of the USA Patriot Act.

4.8 This Agreement sets forth the entire agreement of the parties with respect to its subject matter, and supersedes and replaces any and all prior contemporaneous warranties, representations or agreements, whether oral or written, with respect to the subject matter of this Agreement other than those contained in this Agreement.

4.9 The Grantor, Resigning Trustee and Successor Trustee hereby acknowledge receipt of an executed counterpart of this Agreement and the effectiveness thereof.

4.10 Unless otherwise provided herein, all notices, requests and other communications to any party hereunder shall be in writing (including facsimile and electronic transmission in PDF format) and shall be given to such party, addressed to it, as set forth below:

If to the Grantor:

Rentokil Initial Environmental Services, Inc.
500 Spring Ridge Dr.
Reading, PA 19612
(610) 372-9750 ext 25113
linda.hall@rentokilna.com

If to Resigning Trustee:

JPMorgan Chase Bank, N.A.
Escrow Services
712 Main Street, 5th Floor
Houston, TX 77002

Attn: Lori Knight
Phone: (713) 216-5793
Facsimile: (713) 216-6927
Email: lori.knight@chase.com

If to Successor Trustee:

U.S. Bank National Association
5555 San Felipe, Suite 1150
Houston, Texas 77002
Attention: Corporate Trust Services
Phone: 713-235-9206
Facsimile: 713-235-9213
Email: mauri.cowen@usbank.com

[Signature pages to follow]

IN WITNESS WHEREOF, the parties hereto have caused this Agreement of Resignation, Appointment and Acceptance to be duly executed, all as of the day and year first above written.

As Grantor

By: _____
Name: S. J. Peace
Title: Manager

JPMORGAN CHASE BANK, N.A.,
as Resigning Trustee

By: _____
Name: Lori Knight
Title: Associate

U.S. BANK NATIONAL ASSOCIATION,
as Successor Trustee

By: _____
Name: Mauri J. Cowen
Title: Vice President

IN WITNESS WHEREOF, the parties hereto have caused this Agreement of Resignation, Appointment and Acceptance to be duly executed, all as of the day and year first above written.

As Grantor

By: _____
Name: S. J. Peace
Title: Manager

JPMORGAN CHASE BANK, N.A.,
as Resigning Trustee

By: _____
Name: Lori Knight
Title: ~~Associate~~ Vice President

LORI KNIGHT

U.S. BANK NATIONAL ASSOCIATION,
as Successor Trustee

By: _____
Name: Mauri J. Cowen
Title: Vice President

IN WITNESS WHEREOF, the parties hereto have caused this Agreement of Resignation, Appointment and Acceptance to be duly executed, all as of the day and year first above written.

As Grantor

By: _____
Name: S. J. PEACE
Title: MANAGER.

JPMORGAN CHASE BANK, N.A.,
as Resigning Trustee

By: _____
Name:
Title:

U.S. BANK NATIONAL ASSOCIATION,
as Successor Trustee

By: _____
Name: Mauri J. Cowen
Title: Vice President

Schedule A

Letter of Credit No. _____04110265_____

Letter of Credit Amount: _____$7,879,900.00_____

Issuing Bank Name : _____BNPP New York_____

Issuing Bank Address and Phone Number:

BNPP New York
Trade Services Operations
787 Seventh Avenue
New York, NY 10019____

_____
Contact name: Maria Albuquerque
Telephone No. 001 201 850 6761_____

12/624.

BNP PARIBAS
CORPORATE & INVESTMENT BANKING

BNP PARIBAS
TRADE SERVICES OPERATIONS
787 SEVENTH AVENUE
NEW YORK, NY 10019

DATE: JANUARY 19, 2012

IRREVOCABLE STANDBY LETTER OF CREDIT 04110265

BENEFICIARY:
DIRECTOR
ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
1400 COLISEUM BOULEVARD
MONTGOMERY, AL 36110-2059

APPLICANT:
RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC
4067 INDUSTRIAL PARK DRIVE, BUILDING 3A
NORCROSS, GA 30071

AMOUNT: USD 7,879,900.00

EXPIRY: JANUARY 19, 2013

RE: SITE EPA IDENTIFICATION NUMBER: ALD 021 257 951
SITE ADDRESS: 10565 U.S. HIGHWAY 43 NORTH, CREOLA, ALABAMA 36525-4550

DEAR SIR:

WE HEREBY ESTABLISH OUR IRREVOCABLE STANDBY LETTER OF CREDIT NO. 04110265 IN YOUR FAVOR, AT THE REQUEST AND FOR THE ACCOUNT OF RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC, 4067 INDUSTRIAL PARK DRIVE, BUILDING 3A, NORCROSS, GEORGIA, 30071, UP TO THE AGGREGATE AMOUNT OF SEVEN MILLION, EIGHT HUNDRED AND SEVENTY-NINE THOUSAND, NINE HUNDRED AND NO/100 UNITED STATES DOLLARS (USD 7,879,900.00), AVAILABLE UPON PRESENTATION OF:

(1) YOUR SIGHT DRAFT, BEARING REFERENCE TO THIS LETTER OF CREDIT NO. 04110265, AND,

(2) YOUR SIGNED STATEMENT READING AS FOLLOWS: "I CERTIFY THAT THE AMOUNT OF THE DRAFT IS PAYABLE PURSUANT TO REGULATIONS ISSUED UNDER AUTHORITY OF THE ALABAMA HAZARDOUS WASTES MANAGEMENT ACT OF 1978, AS AMENDED."

THIS LETTER OF CREDIT IS EFFECTIVE AS OF JANUARY 19, 2012 AND SHALL EXPIRE ON JANUARY 19, 2013, BUT SUCH EXPIRATION DATE SHALL

BE AUTOMATICALLY EXTENDED FOR A PERIOD OF 12 MONTHS ON JANUARY 19, 2013 AND ON EACH SUCCESSIVE EXPIRATION DATE, UNLESS, AT LEAST 120 DAYS BEFORE THE THEN CURRENT EXPIRATION DATE, WE NOTIFY BOTH YOU AND RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC, BY CERTIFIED MAIL THAT WE HAVE DECIDED NOT TO EXTEND THIS LETTER OF CREDIT BEYOND THE CURRENT EXPIRATION DATE. IN THE EVENT YOU ARE SO NOTIFIED, ANY UNUSED PORTION OF THE CREDIT SHALL BE AVAILABLE UPON PRESENTATION OF YOUR SIGHT DRAFT FOR 120 DAYS AFTER THE DATE OF RECEIPT BY BOTH YOU AND RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC, AS SHOWN ON THE SIGNED RETURN RECEIPT. WHENEVER THIS LETTER OF CREDIT IS DRAWN ON UNDER AND IN COMPLIANCE WITH THE TERMS OF THIS CREDIT, WE SHALL DULY HONOR SUCH DRAFT UPON PRESENTATION TO US, AND WE SHALL DEPOSIT THE AMOUNT ON THE DRAFT DIRECTLY INTO THE STANDBY TRUST FUND OF RENTOKIL INITIAL ENVIRONMENTAL SERVICES, LLC, IN ACCORDANCE WITH YOUR INSTRUCTIONS.

WE CERTIFY THAT THE WORDING OF THIS LETTER OF CREDIT IS IDENTICAL TO THE WORDING SPECIFIED IN ADEM ADMINISTRATIVE CODE SUBPARAGRAPH 335-14-5-.08(12)(D) AS SUCH RULES WERE CONSITUTED ON THE DATE SHOWN IMMEDIATELY BELOW.

THIS LETTER OF CREDIT IS SUBJECT TO THE 2007 REVISION OF THE UNIFORM CUSTOMS AND PRACTICE FOR DOCUMENTARY CREDITS OF THE INTERNATIONAL CHAMBER OF COMMERCE (PUBLICATION 600).

BNP PARIBAS
BY: BNP PARIBAS RCC, INC., AS AUTHORIZED AGENT

BNP PARIBAS

AUTHORIZED SIGNATURE
MARIA ALBUQUERQUE
ASSISTANT VICE PRESIDENT

AUTHORIZED SIGNATURE
ROBERT BRUCE
ANALYST

DOCUMENTS MUST BE PRESENTED TO BNP PARIBAS VIA COURIER TO: BNP PARIBAS, EQUITABLE TOWER, 787 SEVENTH AVENUE, NEW YORK, NY 10019 ATTN: TRADE FINANCE SERVICES OR TO BNP PARIBAS RCC, INC., NEWPORT TOWER-SUITE 188, 525 WASHINGTON BOULEVARD, JERSEY CITY, NJ 07310 ATTN: TRADE FINANCB SERVICES.

CERTAIN ADMINISTRATIVE SERVICES FOR BNP PARIBAS MAY BE PROVIDED BY BNP PARIBAS RCC, INC. A WHOLLY OWNED SUBSIDIARY OF BNP PARIBAS

APPENDIX F

Analytical Laboratory Data (provided on CD)

Arcadis U.S., Inc.

1728 3rd Avenue North

Suite 300

Birmingham

Alabama 35203

Tel 205 930 5700

www.arcadis.com