FINAL

Plan of Operations

Lime Treatment Pilot Study
Plum Brook Ordnance Works –Pentolite Road Red Water Ponds (PRRWP)
Sandusky, Ohio

Contract No. W91237-06-C-0006

Prepared for:

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DEFINITIONS AND ACRONYMS

BTEX	Benzene, Toluene, Ethylbenzene, Xylene
COC	Contaminant of Concern
COCs	Contaminants of Concern
DERP-FUDS	Defense Environmental Restoration Program for Formerly Used Defense Sites
DNT	Dinitrotoluene
DRO	Diesel Range Organics
EPA	Environmental Protection Agency
GSA	General Services Administration
HAZWOPER	Hazardous Waste Operations and Emergency Response
HI	Hazard Index
HTF	Hypersonic Tunnel Facility
HTRW	Hazardous, Toxic, and Radioactive Waste
HSWA	Hazardous and Solid Waste Amendments
IDW	Investigation Derived Waste
ILCR	Incremental Lifetime Cancer Risk
IQCT	Independent Quality Control Team
ISRA	Interim Soil Removal Action
IT	International Technology Corporation
MCL	Maximum Contaminant Level
MSDS	Material Safety Data Sheet
MSL	Mean Sea Level
NASA	National Aeronautics and Space Administration

DEFINITIONS AND ACRONYMS (continued)

NCP	National Contingency Plan or National Oil and Hazardous Substance Pollution Contingency Plan
NIOSH	National Institute for Occupational Safety and Health
NPDES	National Pollutant Discharge Elimination System
NTCRA	Non-Time Critical Removal Action
ORO	Oil Range Organics
OSHA	Occupational Safety & Health Administration
PAH	Polynuclear Aromatic Hydrocarbons
PBOSB	Plum Brook Operations Support Group
PBOW	Plum Brook Ordnance Works
PBS	Plum Brook Station
PCBs	Polychlorinated Biphenyls
POC	Point of Contact
PQL	Practical Quanitation Limit
PPE	Personal Protective Equipment
PRGs	Preliminary Remediation Goals
QA	Quality Assurance
QC	Quality Control
QAP	Quality Assurance Plan
QCP	Quality Control Plan
RAB	Restoration Advisory Board
RBCs	Risk Based Concentrations
RCRA	Resource Conservation and Recovery Act

DEFINITIONS AND ACRONYMS (continued)

RI/FS	Remedial Investigation/Feasibility Study
RPDs	Relative Percent Differences
SARA	Superfund Ammendments and Reauthorization Act
SMCL	Secondary Maximum Contaminant Level
SOW	Scope of Work
SSHO	Site Safety and Health Officer
SSHP	Site-Specific Safety and Health Plan
SVOCs	Semi-Volatile Organic Compounds
TAL	Target Analyte List
TCLP	Toxicity Characteristic Leaching Procedure
TDS	Total Dissolved Solids
TNB	Trinitrobenzene
TNT	Trinitrotoluene
TOC	Total Organic Carbon
TPH	Total Petroleum Hydrocarbons
TSDF	Treatment, Storage, and Disposal Facility
TSS	Total Suspended Solids
UCL	Upper Confidence Limit
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
VOCs	Volatile Organic Compounds
WTI	Waste Tron, Inc.

PLAN OF OPERATIONS

Lime Treatment Pilot Study
Plum Brook Ordnance Works –Pentolite Road Red Water Ponds (PRRWP)
Sandusky, Ohio

Contract No. W91237-06-C-0006

1.0 PROJECT DESCRIPTION

1.1 Background and Purpose

The purpose of this contract at Pentolite Road Red Water Ponds (PRRWP) is to study the application of lime for the treatment and reduction of nitroaromatic contamination in soil found in the PRRWP area of the National Aeronautics and Space Administration (NASA) Plum Brook Ordinance Works (PBOW) site, located in Sandusky, Ohio. The United States Corps of Engineers (USACE) is the responsible agency under the Defense Environmental Restoration Program for Formerly Used Defense Sites (DERP-FUDS) at PBOW. The results of the completed ISRA provide analysis and evaluation of the PRRWP area. Based on the data contained in this it appears PRRWP is a good candidate for field implementation of the lime treatment technology outlined in the USACE technical report, ERDC/EL TR-03-15, September 2003, *Lime Treatment of 2,4,6-Trinitrotoluene Contaminated Soils: Proof of Concept Study.*

The single Contaminant of Concern (COC), 2,4,6 Trinitrotoluene (TNT) is at concentrations that exceed the preliminary remediation goals (PRGs) as identified in the *Final Action Memorandum for the Pentolite Road Red Water Ponds Interim Removal Action* (USACE 2003). The PRGs are based upon Remedial Goal Objectives (RGOs), which are chemical and receptor specific, risk based remedial criteria that capture all the exposure assumptions and toxicological data used in risk assessment. This reduction in nitroaromatic contamination will be done to minimize the threats to, and provide adequate protection to, human health and the environment from exposure to soil at PRRWP. The study's approach will be to excavate soil from various levels to create eight test plots into which lime will be tilled. The pH of the plots will be measured and recorded. Samples will be collected weekly and analyzed to monitor the effectiveness of the treatment.

1.2 Site Location and History

The former PBOW is located approximately 4 miles south of Sandusky, Ohio and 59 miles west of Cleveland, Ohio. Although the PBOW site is primarily situated in Perkins and Oxford Townships, the eastern edge of the site extends into Huron and Milan Townships. The site is bounded on the north by Bogart Road, on the south by Mason Road, on the west by County Road 43, and on the east by U.S. Highway 250. The surrounding area is mostly agricultural and residential.

The 9,009 acre PBOW site was built by the United States Army in early 1941 as a manufacturing plant for 2,4,6-TNT, DNT, and Pentolite. Production of explosives at PBOW began in December 1941 and continued until 1945.

PBOW PRRWP consists of an area of approximately 9 acres located at the north-central portion of the former PBOW. PRRWP is located just south of Pentolite Road, southeast of the former Pentolite Area and approximately one mile north of TNT B. During the operation of the site by the Department of Defense (DOD), the wastewater produced by the purification of TNT within the TNT A and TNT B areas was discharged by means of wooden flumes and/or ceramic pipes into various settling ponds (West Area Red Water Ponds and PRRWP). This wastewater was then transported to a wastewater treatment and incineration area. PRRWP also received discharge from Wastewater Treatment Plant #1 that previously existed on site located approximately 700' east of the PRRWP area. Original PRRWP construction plans indicate pond dimensions of 200' wide (east-west) by 400' long (north-south) by 3' deep with a 1' high levee, which created a storage capacity of 182,000 cubic yards of wastewater. NASA had PRRWP filled in 1977 following a breach of the ponds.

NASA acquired the property on March 15, 1963 and currently utilizes the site. The General Services Administration (GSA) performed further decontamination efforts during the 1963 transfer. The decontamination process included removing contaminated surface soils above the drain tiles, flumes, etc., destruction of all buildings by fire, and the removal of all soil, debris, sumps, and concrete foundations. All materials, including the soil in those areas, were flashed. The area was then rough graded. The decontamination process also included the burning of excavated nitroaromatic filled flumes.

NASA currently operates the PBS of the John Glenn Research Center at Lewis Field. Most of the aerospace testing facilities built at the site in the 1960's are on standby or inactive status. On April 18, 1978, NASA declared approximately 2,152 acres of PBOW as excess. The Perkins Township Board of Education acquired 46 acres of the excess acreage and uses this area as a bus transportation area. The remaining excess acreage in the Southwest area was sold to various private concerns. NASA currently controls approximately 6,400 acres of land which includes approximately 5,400 acres within the fence line. Of the acreage inside the fence line, NASA has a use agreement with the Ohio National Guard for 604 acres and the remainder is utilized for aerospace research as a satellite operation of the Glenn Research Center. The acreage outside the fence remains part of the test facility exclusion zone and is leased to various farmers and the Erie County Conservation League. The details of land transactions are listed in the site management plan (ICI, 1995) and can be found at the NASA PBS.

1.3 Overview of Remedy and Proposed Action

To date, an ISRA has been conducted at the PRRWP area and a report prepared that addresses soil contamination limits that still remain in the area. The COC was identified as nitroaromatics, specifically, 2,4,6 TNT. TNT existed in surface soil, subsurface soil, and groundwater, however surface water and sediment were not found to be contaminated.

The objective of ISRA for PRRWP completed in 2003 and the current Lime Treatment Pilot Study at PRRWP is to minimize threats to, and provide adequate protection to, human health and

the environment from exposure to contaminants in soil. The remedial objectives identified for soils at PRRWP are to:

1.) Minimize the potential for human exposure via incidental ingestion, dermal contact, and inhalation of soil contaminated with nitroaromatics.

2.) Minimize the potential for nitroaromatics to migrate from soil at the site to the groundwater.

Due to funding limitations, only the 20' x 20' x 10' area identified in the *Final Action Memorandum for the Pentolite Road Red Water Ponds Interim Removal Action* (USACE 2003), has been excavated and backfilled with clean soil. The area was only excavated to a depth of 8' rather than the 10' specified because groundwater was encountered. Exploratory test pits were used in place of continued excavation to determine the horizontal limits of the contamination. Following the test pit activities, confirmation sampling and the calculation of the hazard index (HI) determined that the original extent of contamination was grossly underestimated. Further excavation or treatment is necessary to minimize threats to, and provide adequate protection to, human health and the environment from exposure to the nitroaromatic contamination in the soil. In addition to the original excavation of 118 cubic yards, approximately 7,600 cubic yards of additional excavation or treatment would be required to remediate PRRWP.

The Lime Treatment Pilot Study project has become available due to newly distributed funding and will investigate the possibility of reducing the TNT found in the area below the PRG level so that the soil can remain on site rather than being disposed of off site.

Project actions consist of (at minimum): excavation, tilling (in lifts between 12" and 18") of the soil with hydrated/slaked lime (potential for several treatments based on reduction levels achieved during 1st treatment), obtaining a pH that is conducive for treatment to occur, sampling periodically (field and lab confirmation analysis) to determine the decrease in the nitroaromatics, comparing the reduced levels to the identified preliminary remediation goal (PRG) of 13.8 mg/kg for TNT. Surveying will also be performed to determine the volumes of soils treated prior to placing the soil back into the ground, seeding area with common grasses occurring naturally in the PRRWP area, and preparing a report documenting the processes performed in this pilot study along with its findings. The results of this pilot study will also be presented to a Restoration Advisory Board (RAB) meeting.

In discussion with the Ohio EPA, it was agreed upon that the soil could be placed back in the ground at the PRRWP should the treatment not reduce the TNT levels below the RGO levels. This agreement was based on the facts that future funding will be available for a continuation of the Interim Soil Removal Action on the additional contaminated soil and because this soil was identified as non-hazardous

1.4 Overview of Tasks

McTech will provide all equipment, labor, materials, and supervision necessary for the Pilot Study as described in the Statement of Work (SOW). Activities generally consist of excavation, tilling, sampling, replacing soil back into the ground, and site restoration.

The following tasks are required to be performed under this SOW:

Task 1 Preparation and submission of a Site Specific Safety and Health Plan.

Task 2 Preparation and submission of a Quality Control Plan.

Task 3 Preparation and submission of a Plan of Operations

Task 4 Notification/ scheduling of field activities and coordination of utility marking with NASA officials prior to site mobilization.

Task 5 Site surveying as necessary for identifying limits of excavation.

Task 6 Excavation of contaminated material/ Tilling of hydrated or slaked lime.

Task 7 Field Screening/ Confirmation Analysis by Laboratory

Task 8 Site Restoration

Task 9 Preparation/ Submission of the Draft and Final Lime Treatment Pilot Study Report for PRRWP.

Task 10 Public meeting support to the USACE for the work defined by this contract.

The tasks outlined in Section 2.0 of the SOW are described in detail in the following sections of this Plan of Operations. This work will be conducted by McTech in an environmentally acceptable manner conforming to existing federal, state, and local regulations under USACE Huntington District (CELRH) supervision.

1.4.1 (Task 1) Preparation and Submission of a Site-Specific Safety and Health Plan (SSHP)

McTech Corp will prepare a SSHP that covers the planned field activities. As always, the plan will comply with the requirements of the U.S. Army Corps of Engineers, Safety and Health Requirements Manual, EM 385-1-1, latest version, and the Department of Labor, Occupational Safety and Health Administration (OSHA) as presented in Title 29 of the Code of Federal Regulations, Part 1910.120. At a minimum, McTech SSHP will address the following items:

- Cover sheet. Identify company name, contract number, project location, signed and dated by plan developer.
- Responsibilities and lines of authority.
- Employee qualifications. Physical fitness, job competence, special skills, equipment operation.
- Employee training. First aid, CPR, back injury prevention.
- Safety meetings. "Tool box" meetings.

- Job Hazard Analysis. Preparation and revision, discussion with employees.
- Emergency response plan. Emergency number, means of communication, route to nearest medical facility.
- Accident reporting and Project Manager responsibility. Report all accidents immediately to the Contracting Officer and submit ENG Form 3394 within two (2) working days.
- First aid kits.
- Personal protection equipment. As a minimum, employees must wear long-legged trousers, sleeved-shirt, and steel-toes shoes. Safety glasses with side shields and hard hats may also be appropriate, depending on activity.
- Hearing protection.
- Vehicles and equipment.
- Public safety.
- Fire safety.
- Environmental hazards.
- Housekeeping.
- Standard operating procedures.

McTech will read and conform to the SSHP when conducting this work. Documentation to this effect will be furnished to the Government Point of Contact (POC) prior to initiation of any work. The plan will also include the names, and qualifications of the Site Safety and Health Officer (SSHO), including education, training and work experience.

1.4.2 (Task 2) Preparation and Submission of a QCP

McTech Corp will prepare a QCP that covers all products and activities including planned field activities, contained in the SOW. The QCP will be prepared according to the applicable ISO 9000 processes as identified at www.lrh.usace.army.mil/ct/quality developed for this type of work.

The QCP will define the responsibilities and roles of each member on the Independent Quality Control Team (IQCT), along with those preparing or performing the tasks/activities in this SOW. The QCP will also detail the methods and procedures for inspection of work, identifying and correcting deficiencies, maintenance of records, list of authorized Quality Control Inspectors, list of authorized McTech Corp representatives, and security measures.

The draft and final versions of the various plans will include a separate QC appendix that includes an activity review checklist (appropriate checks on those activities that were performed/reviewed) for the specific product, along with a signed sheet which designates the name, date and official work title of those persons performing/conducting the QC activities. All comments and responses, from both McTech's QC review and USACE's QC review, as well as contract compliance review comments of the plans will be included in the QC appendix of the final plans.

1.4.3 (Task 3) Preparation and Submission of a Plan of Operations

McTech Corp will prepare a Plan of Operations that covers the planned office and field activities. McTech will also include in the Plan of Operations a Sampling and Analysis Plan that will outline the sampling and analysis required. This has been included in Section 5.0 of this Plan of Operations.

McTech Corp will also include in the Plan of Operations an Investigative Derived Waste Plan (IDWP) for this project. Requirements for this plan can be found in under Task 7, Section 3.7. Please reference this section for all IDW requirements.

1.4.4 (Task 4) Field Activities/Utilities

Field Activities The site is currently owned by NASA Plum Brook Station (PBS), however, rights of entry are not required for this pilot study. Coordination with PBS personnel will be conducted by USACE to ensure that McTech is allowed access to/from the site to perform all activities during this removal action. McTech will be required to enter/exit through the PBS security gate, therefore, McTech personnel will follow all rules set forth by PBS security. McTech will coordinate their field activities with all appropriate authorities and agencies as required. No field work will be started until the QCP and SSHP have been reviewed NASA and approved by USACE and the Notice to Proceed has been given by the USACE Contracting Officer. McTech will also be responsible for providing (with the notification) an up-to-date, detailed time schedule for the field work to be performed.

Utilities An excavation permit has already been acquired / coordinated with the Plum Brook Operations and Support Group for the PRRWP area. McTech will coordinate with PBOW NASA and PBOSG (NASA's contractor) to determine if the previously acquired excavation permit is still valid. Work will stop immediately if any underground utilities are detected and the NASA POC will be notified immediately.

1.4.5 (Task 5) Site Survey

The Final ISRA Report for TNT B, dated May 2006 identifies the surveyed limits for the proposed excavation. McTech will utilize this report in obtaining information to survey/stake the limits prior to tilling. These areas will also be surveyed once the excavation/tilling is completed.

1.4.6 (Task 6) Excavation of Contaminated Material/ Tilling of Hydrated or Slaked Lime.

McTech will excavate an area approximately 60 feet by 40 feet within the area of concern to a depth of approximately 8 feet. This material will be excavated in a safe manner and activities will adhere to all environmental and safety laws, regulations and ordinances. During excavation efforts, McTech will stop excavation when encountering bedrock or groundwater. Any water generated during the excavation will be considered existing groundwater or surface water and will be left in place.

McTech will carefully excavate the soils in 12 to 18 inch lifts staging each lift in a separate pile. Each pile will then be spread out to a depth of no greater than 18 inches. This will result in a total of 8 treatment piles. Piles 1 and 2 will be used as the control for this pilot study. Hydrated Lime will be tilled with the soils from the remaining piles. Refer to Section 4.0 of this Plan of Operations for more detail. Tilling will continue on a daily basis. Piles 3 and 4 will have lime added to the tilling operation every 7 days. Piles 5, 6, 7, and 8 will have lime added to the tilling as needed, based on pH measurements of the piles, in order to obtain a fairly constant, elevated pH that has been shown in laboratory studies to be more conducive for the alkaline hydrolysis to occur. This process of tilling with lime addition, and periodic sampling will continue for a 6 week period.

This pilot study will be able to compare the results achieved via alkaline hydrolysis on a periodic basis (once per week addition), a continuing basis (sustained elevated pH), and the control plot. Weather conditions such as temperature and precipitation may affect the rates of TNT reduction. However, by utilizing the "control plots" weather related variables should be effectively controlled. Weather conditions are recorded on the daily QCR.

McTech will decontaminate all equipment that comes in contact with the soil. Before excavation will begin McTech will submit a plan (within the Plan of Operations) showing the proposed limits of excavation and the locations of each treatment pile.

1.4.7 (Task 7) Field Screening/ Confirmation Analysis by Laboratory

Field pH measurements will be made daily on each pile. Composite samples will be collected every seven days from each of the 8 piles. These samples will be analyzed for the single Contaminant of Concern (COC), 2,4,6 Trinitrotoluene (TNT) and compared to the identified RGO of 13.8 mg/kg.

1.4.8 (Task 8) Site Restoration

At the completion of this pilot study and with the approval of the Ohio EPA all excavated soils will be returned to the original excavation. All disturbed areas will be seeded with common grasses found within the PRRWP area.

Due to the minimal IDW expected to be generated, an IDW Plan is not a separate Plan but rather is included as a distinct section, Section 6.0 within the Plan of Operations. For IDW, McTech will collect the waste, any used PPE, decontamination liquids, and all waste generated from the construction activities. This media will be containerized and placed in a secured area on the site until the results of the analyses are known. All containers will be labeled as to project name, contents, and date of collection, and secured to prevent tampering. If drums are used, they will be secured with tarps, ropes and pallets. Waste from different sites will not be mixed.

1.4.9 (Task 9) Preparation and Submission of Draft and Final Lime Treatment Pilot Study Report

McTech will prepare a draft and final Lime Treatment Pilot Study Report, which details the complete efforts during all activities in the SOW. Once the draft report has been generated, McTech will submit it to USACE for review. Any comments arising from this review will be incorporated by McTech into the final report. Refer to the QCP for all required reporting to be incorporated into the final report.

1.4.10 (Task 10) Meeting Support

McTech will support USACE project manager or Technical Coordinator during meetings necessary to discuss the work defined by this contract. It is assumed a maximum of 1 meeting outside of field activities time will be held to discuss the proposed work. This meeting will be held at a location in the Sandusky Ohio area. McTech will be responsible for preparing slides, handouts, and coordinating this meeting. McTech will place a notice in the local newspaper

announcing the meeting and inviting the public to attend. McTech will document the meeting minutes and supply these to the USACE project manager or technical coordinator. If necessary, McTech will plan to give a presentation highlighting the requirements of this work.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES

The collection of quality data and the completion of any given project are strongly affected by the project organization. A project that is properly organized with personnel responsibilities well-delineated results in a successful project conclusion. A listing of functional areas and qualified personnel are given for this project.

A. **Government Technical POC** — The technical POC representing the USACE who will serve as a liaison between the USACE and the contractor.

USACE POC		Phone Number
Lisa Humphreys		(304) 399-5953
	Cellular	(304) 617-1461

B. **NASA Technical POC**— These are the technical POC representing NASA.

NASA POC	Phone Number
Robert Lallier	(419) 621-3234

NASA PBOSG	Phone Number
Gary Ponikvar	(419) 621-3342

C. **Contractor's Project Manager** – McTech Corp's Project Manager provides technical insight and provides supervision for the project. The Project Manager has overall responsibility to see that the project is completed in accordance with the Scope of Work.

McTech Corp Project Manager		Phone Number
Kimberlie Chambers	Cellular	(304) 215-0099
	Alternate	(218) 330-6436

D. **On-site Project Manager**—The On-site Project Manager will be in charge of field activities in coordination with the Contractor's Project Manager.

McTech Corp On-site Project Manager		Phone Number
Dan Cashbaugh		(216) 391-7700
	Cellular	(216) 404-8109

E. **Site Safety and Health Officer (SSHO)** – The SSHO is responsible for safety on site. This person has the authority to stop work if unsafe conditions warrant.

McTech Corp SSHO	Phone Number
Dan Cashbaugh	(216) 391-7700
James B. Russell (alternate)	

F. **Quality Control Officer (QCO)**—This person is responsible for QC at the site. This person has the authority to stop the work if QC is not being met. The QCO is an employee of McTech Corp and is trained in QC.

McTech Corp QCO		Phone Number
Michael Malloy	Cellular	(216) 857-4517

G. **Field Personnel** – These personnel are responsible for assisting the Project Managers in completing the tasks required under this contract.

McTech Corp Field Personnel		Phone Number
James B. Russell		(216) 391-7700

C&K Industrial Services, Inc. Field Personnel		Phone Number
Gary Cooper		(216) 642-0055
	Cellular	(216) 956-9253

H. **McTech Corp Independent Quality Control Team**— An internal quality control team will independently review the work plans and reports to ensure that they meet requirements of the Scope of Work.

McTech Corp Independent Quality Control Team	Phone Number
Mark Perkins	(216) 391-7700
Rodney Bumgardner	(304) 201-2205

I. **REIC Laboratory**–Samples will be sent to the following USACE certified laboratory. REIC Laboratory is located in Beaver, West Virginia.

REIC Laboratory Contact	Phone Number
Grant Wilton	(800) 999-0105

J. **Erie County Landfill**— Non-hazardous materials removed from the site will be disposed of at the Erie County Landfill.

Erie County Landfill Contact	Phone Number
Fred Dobbert	(419) 433-3624

K. **Molnar Construction, Inc.**—This company will be used for the transportation of any non-hazardous materials removed from the site.

Molnar Construction Contact		Phone Number
Matt Molnar		(419) 732-2763
	Cellular	(419) 656-3423

L. **Mountain State**—Personnel from Mountain State will perform a survey of the treatment area and the area to be excavated.

Mountain State Contact	Phone Number

M. **C&K Industrial Services, Inc.**—Non-hazardous IDW containing liquids will be managed by C&K Industrial Services, Inc. located in Cleveland, Ohio.

C&K Industrial Services Inc.		Phone Number
Scott Dean		(216) 642-0055
	Cellular	(216) 952-1375

N. **Environmental Quality Company - Wayne County Landfill**— Hazardous soil removed from the site will be disposed of at the Wayne County Landfill.

Wayne County Landfill Contact	Phone Number
Melissa Rickabaugh	(800) 592-5489

O. **EnviroServe, Inc.**—This company will be used for the transportation of hazardous materials removed from the site.

EnviroServe Contact	Phone Number
George Karas	(216) 642

3.0 APPLICABLE or RELEVANT AND APPROPRIATE REQUIREMENTS

Characterization activities at the PBOW site, specifically PRRWP, have indicated soil contamination resulting from past processes at the site. The *Final Action Memorandum for the Pentolite Road Red Water Ponds Interim Removal Action* (USACE 2003). identified the soil remediation goal for TNT, the nitroaromatic COC identified at this site.

The *Final Action Memorandum for the Pentolite Road Red Water Ponds Interim Removal Action* (USACE 2003) addressed soil contamination only. The elements of the selected remedy(s) were presented in *Final Action Memorandum for the Pentolite Road Red Water Ponds Interim Removal Action* (USACE 2003). The overall objective of the Soil Removal Action for the PBOW site was to minimize threats to, and provide adequate protection to, human health and the environment from exposure to contaminants in soil. The remedial objectives identified for soils at the PBOW site were:

1) Minimize the potential for human exposure via incidental ingestion, dermal contact, and inhalation of soil contaminated with nitroaromatics. PRG values are used to insure that the potential for human exposure is minimized. The PRG values are calculated based on risk assessments conduced during the RI/FS.

2) Minimize the potential for nitroaromatics to migrate from soil at the site to the groundwater. This migration potential is measured using the toxicity characteristic leaching procedure (TCLP) developed under the RCRA guidelines, which simulates the contaminants leaching from soil to groundwater.

The soil objectives were designed to sufficiently address the principal threats at this site, which were nitroaromatics.

3.1 Preliminary Remedial Goals

Based upon the RI/FS Investigation the only COC for the site was TNT, therefore only one PRG was established for PRRWP. The PRG was based on residential usage of the site in the future. Refer to Table 1 for the COC PRG for this site.

Table 1 - Contaminant of Concern

Contaminant of Concern	PRG (mg/kg)[1]
Nitroaromatics	
TNT	13.8

[1] mg/kg=milligram per kilogram

3.2 Resource Conservation and Recovery Act

The PRG for PRRWP was established to minimize the potential for human exposure to the COC. However, the PRG does not correlate with the toxicity of the COC within excavated soil, and cannot be used to determine whether excavated soil is hazardous. Therefore the toxicity of the excavated soil must be determined in addition to the comparison with the established PRG for the site.

Subtitle C of the Federal Resource Conservation and Recovery Act (RCRA), as amended by the Hazardous and Solid Waste Amendments (HSWA) of 1984, authorizes the EPA to regulate the management of hazardous wastes. The designation of a waste as hazardous subjects all those charged with managing that waste to the stringent "cradle-to-grave" requirements of RCRA Subtitle C. It is crucial, therefore, for all those managing wastes to properly identify them and determine whether or not those wastes are in fact "hazardous". There are four kinds of hazardous wastes as defined by Subtitle C of RCRA:

- Solid wastes, which exhibit hazardous characteristics (i.e., ignitability, corrosivity, reactivity, or toxicity).
- Solid wastes specifically listed by the Agency as being hazardous.
- A waste that is considered a declared waste.
- A waste mixed with a known hazardous waste.

The toxicity characteristic identifies wastes that are most likely to leach hazardous concentrations of certain toxic contaminants into groundwater under improper storage conditions. The toxicity of a waste can be determined by applying the Toxicity Characteristic Leaching Procedure (TCLP), a test designed to simulate the leaching of toxic contaminants. Full TCLP analysis (volatiles, semi-volatiles, metals, herbicides, and pesticides) will be performed on all soil and investigation derived waste (IDW) that was removed from the project site. Analytical data from the TCLP analysis will be compared to the RCRA regulatory levels for TCLP contaminants. During the pilot study no contaminated soil is expected to leave the site.

4.0 FIELD ACTIVITIES

McTech will notify the USACE POC and receive approval of the planned project schedule prior to mobilizing to the site. McTech will set up an office trailer on site to be used by McTech and USACE project personnel throughout the duration of the project.

McTech will begin clearing/grubbing activities for the excavation and tilling areas. Material grubbed from theses areas will be placed in windrows for wildlife habitat if approved by NASA and USACE.

McTech applied for the digging and excavation permit on November 27, 2006. This permit was subsequently approved and issued on November 30, 2006. McTech will use an excavator to remove contaminated soils from the approximately 30 feet by 40 feet excavation area. As the contaminated soil is removed in approximately 12 to 18 inch lifts, it will be staged in 8 separate piles in the tilling area. Once completed, the excavation will be barricaded and marked. The soil piles will then be spread out to approximately 12 inch depth, but in no case will it exceed 18 inch depth, using a dozer. Each of the piles should consist of approximately 2400 cubic feet (0.055 ac-ft). The piles will be placed such that sufficient area exists to maneuver in and around each pile. One five point composite sample will be obtained from each of the piles and submitted for laboratory analysis as indicated in Section 5.0 of this Plan of Operation. Field pH measurement will be made from across each of the piles. All field pH measurements and composite samples will be obtained from as near as feasible to the mid depth and at various locations of each pile.

Based upon the available literature review and the SOW hydrated lime should be added and mixed with the impacted soils at a rate of 3 to 5 tons per acre-foot. It is anticipated that this will increase the pH to a level that is more conducive for the treatment through alkaline hydrolysis to occur.

In order to evaluate the lime application rate, applicable pH levels, and overall treatment effectiveness, the soil piles will be treated as follows:

Piles 1 and 2 will be used as the control on this pilot study. These piles will be tilled and managed in the same manner as each of the other piles. The only exception will be that no lime will be added and mixed during the study. It is expected that the pH level will remain constant throughout the study.

Piles 3 and 4 will receive lime addition at the rates noted above on a weekly basis, with the application being the same as the remaining piles. With the anticipated soil volume, the application rate will be 250 pounds per pile per application. These piles will be tilled and managed in the same manner as each of the other piles. The only exception will be the lime addition once per week. It is expected that the pH level will peak at each treatment and then taper off until subsequent application.

The four remaining piles 5, 6, 7, and 8 will have an initial application of lime at the rates identified above. With the anticipated soil volume, the application rate will be 500 pounds per pile. Each pile will be tilled daily with the use of an All Terrain Vehicle with a tiller attachment.

will be strictly dependant upon the measured pH value. It is expected that the pH level will remain fairly constant and significantly elevated over Piles 1 and 2, the control.

The stock piles will only be placed on the already contaminated soil, well within the limits of the contaminated area, thereby preventing the contamination of surrounding areas. At the conclusion of this pilot study the excavated and treated soils will be placed back into the original excavation using a dozer and excavator as appropriate.

5.0 ANALYTICAL REQUIREMENTS

McTech will use Research Environmental and Industrial Consultants Laboratory of Beaver, West Virginia to perform the analytical testing for the confirmation and waste characterization samples associated with this project. REIC is a USACE certified laboratory. REIC's detection and quanitation limits are based upon their minimum detection limit (MDL) studies and are specific for each media and the instrumentation that is being used. The laboratory will follow the most currently promulgated EPA methods.

McTech will collect representative samples from each of the 8 treatment piles. The first sample will be collected prior to the addition of the lime. Subsequent samples will be collected on a weekly basis for a six week period. These samples will be analyzed for the single Contaminant of Concern (COC), 2,4,6 Trinitrotoluene (TNT) using approved EPA Methods.

6.0 EQUIPMENT DECONTAMINATION/INVESTIGATION DERIVED WASTE

Stainless steel sampling spoons/trowels, a stainless steel mixing bowl, and a backhoe bucket will be used for sampling. Laboratory equipment (pipets, cuvettes, beakers, and so forth), as appropriate, associated with the field screening will be decontaminated. Also, the stainless steel sampling spoons/trowels, mixing bowl, and backhoe bucket will require decontamination.

All non-disposable sampling equipment will be thoroughly cleaned. Decontamination of all of the sampling equipment will be accomplished prior to and between sampling.

Refer to Table 5 for general decontamination procedures for sampling equipment that will be reused at the site.

Table 6--Decontamination Procedures

Parameter[1]	Detergent Wash	Tap Water Rinse	Inorganic Desorbing Agents	Tap Water Rinse	Organic Desorbing Agents	Deionized Water Rinse	Air Dry
Nitroaromatics	yes	yes	no	no	Hexane	yes	yes

1 No inorganic desorbing agents (hydrochloric acid or nitric acid) will be used for the Total/TCLP metals since we are not looking for trace levels and we will use stainless steel or disposable sampling equipment.

In cases of gross contamination on sampling equipment, a tap water wash may first be performed to remove clumps of dirt in order to make the detergent wash more effective. The detergent wash will be a non-phosphate detergent solution, which will be used with brushing or circulating techniques to remove gross contamination. Potable tap water will be used as a rinse for the equipment. A solvent rinse using hexane will be used as an organic desorbing agent. The analytical laboratory performing the analysis will be consulted prior to sampling to ensure that decontamination procedures do not affect the subsequent analysis. It is recommended that all solvent rinses be made from an appropriate grade of chemical, such as pesticide or purge-and-trap grade quality. A triple rinse with deionized organic-free water will follow all other decontamination reagents.

All rinsates will be collected and properly disposed. Collection will occur in the designated decontamination areas. A decontamination area will be transportable (kiddie swimming pool or equivelant) between office trailer site and the excavation/treatment area as necessary. Drums, buckets, water, detergent, and brushes will be located in the work area. Drums will be available for containerizing the decontamination waste. A pump will be available to transfer decontamination liquids to the drums.

Investigation Derived Waste (IDW) (PPE, decontamination liquids, waste from field test kits, and all waste/media generated from the investigation activities) from the site will be disposed in accordance with this Plan of Operations and in compliance with EPA's off-site disposal policy, RCRA regulations including the RCRA land disposal restrictions for on-site and off-site waste disposal, and the Department of Transportation's (DOT) regulations. McTech will arrange for all services necessary for transport and disposal of the waste at an appropriate disposal facility. Personnel will adhere to the safety procedures as outlined in the Site-Specific Safety and Health Plan. Personnel will wear, at a minimum, Level D PPE when performing waste sampling activities.

Flammable or other known hazardous waste will be segregated and stored separately. Waste will not be stored on site longer than 90 consecutive days. Waste from this site will not be combined with waste from another site. All waste will be transported in containers meeting DOT specifications. All drums/containers will be labeled with the project name, contents, and collection start date.

Non-hazardous liquid waste will be managed by C&K Industrial Services, Inc. and non-hazardous solid waste may be disposed at Erie County Landfill. All hazardous IDW will be transported to an appropriate disposal facility (EQ Environmental in Michigan) by Enviroserve, a licensed hazardous waste transporter.

All waste manifest will be reviewed and signed by NASA. McTech will provide the USACE and NASA with the following documentation concerning the disposal of all IDW from the site:

- Laboratory analysis
- Copies of waste profiles which include land disposal restriction notifications
- Signed manifests (hazardous and non-hazardous)
- Weigh slips for bulk transport

7. 0 FIELD DOCUMENTATION PROCEDURES

The following sections outline the standard practices and procedures for proper documentation of activities for this project. Standard documentation required on all USACE projects, including daily reports and field logs will be completed by the Project Manager.

7.1 Field Logbook/Field Activity Forms

A bound notebook will be maintained by the field crew to provide daily records of significant events, observations, and measurements during field investigations. In addition, field records will be maintained regarding the various aspects of the sampling. All pertinent information regarding the site and sampling procedures must be documented in indelible ink. Notations should be made in logbook fashion, noting the time and date of all entries. The field records should include the following information:

- Site Location
- Project Number or Work Order Authorization
- Name and title of author
- Names and responsibilities of field personnel on site
- Names and titles of site visitors
- Sampling location and number of samples taken
- Sample description (color, odor etc.)
- Sample collection method and sample preservation methods
- Sample ID numbers
- Dates and times
- Matrix of sample
- Photograph logs
- Sampling changes, modifications or change orders
- Weather conditions
- Other applicable comments

7.2 Photographs

Photographs will be taken of all site activities. A digital camera will be used and, if possible, the camera will be programmed to include the date and time on each photo. For each photograph taken, the following items should be noted in the field logbook:

- Date and time
- Photographer (signature)
- Name of site/Project number
- General direction faced and description of the subject taken

7.3 Sample Identification Labeling

All sampling will be done in accordance with USEPA protocol. Sample labels are required to properly identify the samples. All samples will be labeled in the field and care will be taken to

assure that each sample container is properly labeled. The samples will be placed in sealed plastic bags to prevent the labels from soaking off or becoming illegible from exposure to water during transport to the laboratory. Labels will contain the following information:

- Site location and project number
- Sample Identification number assigned sequentially as described below
- Description of the sample
- Time and date sample was taken
- Notation of whether preservatives were added to the sample and type of preservative
- Type of sample (such as a grab or composite)
- Type of analysis requested

All field documentation should be done in indelible ink. Errors in field sampling documents will be corrected by drawing a single line through the error, writing in the correction, and initialing and dating. Sample numbers should be assigned sequentially and include the project number and pile number from which the soil was sampled. For example: 200614M-P1-001, 200614M-P1-002, 200614M-P2-001, and so on.

7.4 Chain-of-Custody

Chain-of-custody procedures provide documentation of the handling of each sample from the time it is collected until analysis is completed. Chain-of-custody procedures are implemented so that a record of sample collection, transfer of samples between personnel, sample shipping, and receipt by laboratory that will analyze the sample is maintained. The chain-of-custody record serves as a legal record of possession of the sample. To simplify records and eliminate potential litigation problems, as few people as possible should handle the samples during the investigation. A sample is considered to be under custody if one or more of the following criteria are met:

- The sample is in the sampler's possession.
- The sample is in the sampler's view after being in possession.
- The sample was in the sampler's possession and then was locked up to prevent tampering.
- The sample is in a designated secure area.

A chain-of-custody should be filled out on-site and will include the following information:

- Project number
- Project manager
- Site location
- Client contact
- Description of the sample
- Time and date sample was taken
- Notation of whether preservatives were added to the sample
- Type of preservative
- Type of sample such as a grab or composite
- Matrix of sample
- Amount of sample being transported to the laboratory

- Sample number or ID assigned in the field
- The appropriate analytical parameters to be tested
- Seals will be placed on each sample container (except VOCs)
- Any other information that the sampler feels is pertinent to the analysis of the sample(s).

The sampler must sign the chain-of-custody and all sample containers will be transported with a chain-of-custody form. Shipping containers will be sealed for shipment to the laboratory. The original chain-of-custody form will accompany the shipment and McTech will retain copies. A sample chain-of-custody form is located in Appendix C.

7.5 Corrections to Documentation

All original data recorded in field logbooks, on sample labels, and chain-of-custody records are to be written in indelible ink. If an error is made on any document related to this project, corrections should be made by drawing a single line through the error and entering the correct information. The erroneous information will not be obliterated. Any error discovered on a document should be corrected by the person who made the entry. All corrections will be initialed and dated.

8.0 SAMPLE PACKING AND TRANSPORTATION

The following are procedures for packaging and shipping of samples for this project:

- All containers, except the VOC vials, will be taped shut.
- All samples will be chilled immediately after collection.
- Each sample container will be placed in a separate plastic bag and sealed. As much air, as possible will be squeezed from the bag prior to sealing. Sample containers and bags will be sealed with evidence tape or custody seals.
- A picnic cooler will be used as the shipping container. In preparation for shipping samples, the drain plug on the cooler will be taped shut from the inside and outside, and a large plastic bag will be used as a liner for the cooler. Inert packing material will be placed in the bottom of the liner.
- The sample containers will be placed upright in the lined picnic cooler in such a way that they do not touch and will not touch during shipping.
- All samples will be shipped to the laboratory on ice and chilled to 4 °C.
- Plastic ice packs or ice placed in double plastic bags will be placed around, among, and on top of the sample containers.
- The paperwork going to the laboratory will be placed inside a sealed plastic bag, which will be taped to the inside lid of the cooler.
- The cooler will be taped shut with strapping tape.
- At least two signed custody seals will be placed on the cooler lid (one in front, the other on the side).

9.0 MCTECH CORP CHEMICAL QUALITY CONTROL

9.1 Data Quality Objectives

The process of generating useful chemical data of acceptable quality begins with determining what the objectives of collecting the data are, and what decisions will be made based on the data that is generated. Next, the actual type of data that is required to meet these objectives is determined, along with the appropriate data collection methodologies and quality control procedures. The methodologies for collecting quality data must be consistent with accepted practices and standard operating procedures that have been developed for the specific type of data collection to insure quality chemical data. Generally, these steps have been predetermined by the USACE for this project and are delineated in the SOW.

Quality controls are incorporated into both the sample collection and analytical procedures. Quality controls utilized in sample collection include, but are not limited to, following the approved plans and procedures for sample collection, proper documentation of sample collection activities and site conditions, reporting and resolving any problems during sampling activities, and proper handling, preserving, packaging, and shipment of samples. In addition, quality control samples (duplicates and trip blanks) are collected to check the accuracy, completeness, precision, and comparability of the actual field samples. The contract analytical laboratory will follow its internal quality control procedures to insure analytical data quality. The laboratory will use the precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS) defined below to insure that their internal quality control objectives have been successfully met.

After the samples have been analyzed and the data reports have been generated, the resulting data will be reviewed, and compared. To assess the quality of the field activities, quality control samples (i.e. duplicates, trip blanks, matrix spikes) will be evaluated for completeness and duplicate relative percent differences (RPDs). The calculation of RPDs from field sample and field duplicate sample data indicates the precision of the sampling efforts as well as the sample media. RPDs are calculated by the following equation:

$$RPD = (C_f - C_d)/\{(C_f + C_d)/2\} X\ 100$$

Where C_f is the concentration of the compound found in the field sample and C_d is the concentration of the compound found in the field duplicate (QC) sample. The RPDs should equal 35% or lower for soils to indicate homogeneity of the sample and the reproducibility of the analytical data (a measure of precision). If the data does not meet the desired RPDs it may be necessary to re-analyze the samples in question, or re-sample if problems cannot be resolved. Decisions to re-analyze or to re-sample will be made with the joint input of the USACE, McTech, and the contract laboratory. In this process the PARCCS of the data will be evaluated and a joint determination of the data quality will be made accordingly.

Once all data has been received and analyzed in accordance with the above requirements, the results and recommendations will be forwarded onto USACE. The USACE will then use this information to make decisions regarding specific properties as they relate to project implementation.

The laboratory will use the following PARCCS to insure that their internal quality control objectives have been successfully met.

- Accuracy: This is the degree to which a measurement agrees with the actual value. The accuracy of an analytical procedure is determined by addition of a known amount of spike standard to a field sample matrix or a laboratory control matrix.

- Precision: This is a measure of the degree of reproducibility of an analytical value and it is used as a check of the quality of the sampling and analytical procedures. Precision is determined by analyzing replicate samples. Duplicate samples will be collected in the field for this project.

- Completeness: Completeness is a measure of the amount of the data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. The minimum level of completeness expected is 95% for each analytical method requested. This level is met in the laboratory by ensuring proper sample extraction procedures. This level is met in the field by collecting enough sample that the laboratory has an ample amount in case they need to reanalyze the sample.

- Representativeness: Representativeness expresses the degree to which sample data accurately and precisely represents actual conditions. Representativeness is a qualitative determination. The representativeness objective of the quality assurance program is to eliminate conditions that may result in non-representative data. Maintaining sample integrity is of the utmost importance.

- Comparability: Comparability is the confidence with which one data set can be compared with another. When traceable standards and standard methodology are used, the analytical results can be compared to other laboratories with similar operating procedures. Quality Assurance samples will not be collected for this project.

All field activities will be performed in accordance with the protocols outlined in this Plan of Operations. Samples will be kept in ice filled coolers until they are shipped via overnight express or hand delivered to the laboratory.

9.2 Lab Quality Assurance for Chemical Data Measurement

The overall Quality Assurance (QA) objective is to ensure that data of known and acceptable quality is generated from both field and laboratory activities. REIC will be responsible for ensuring that their personnel adhere to their laboratory Quality Assurance Plan (QAP). The number and types of internal QC checks for each analytical method are defined in the laboratory's QAP, which is contained in Appendix D. The laboratory must follow the quality

objectives for precision, accuracy, representativeness, comparability, completeness, and method detection limits as set forth in their laboratory QAP.

All data generated from the chemical analysis will be reported in accordance with the Scope of Work. Any sample failing the method or laboratory quality control limit may be re-analyzed. The analytical laboratory, McTech, and the USACE will jointly make the decision regarding re-analysis. Internal QC results should include information about agreement between replicate analyses, spike and surrogate recoveries.

The Remedial Action Summary Report will include analytical results and a Level 2 Quality Control data report from the laboratory. The Level 2 data package will include the following:

- Case Narrative-Information should include number and type of samples received, analysis of those samples, any problems that occurred, whether quality control was within acceptable limits, etc.
- Analytical Report-Summary of all sample analysis information including surrogates for organic methods. Detection limits/reporting limits will be included
- Chain-of-custody
- Summary of Quality Control-A summary will be included of all quality control specific to the project. This may include method reagent blanks, midlevel calibration checks, spike and spike duplicates. All QC will include acceptance criteria and relative percent data where applicable.

9.3 Field Quality Control for Chemical Data Measurement

Field quality control is as vital to a project as is quality control within the laboratory. Proper execution of each project task is needed in order to yield consistent reliable information that is representative of the media and conditions being measured. The overall quality assurance objective is to ensure that data of known quality is generated so that it will be useful in meeting the intended project objectives. The On-site Project Manager will be responsible for seeing that field personnel (McTech and subcontractors) adhere to McTech's QCP.

QC field oversight checklists to be used for field activities are provided in Appendix C as well as in the QCP. The field oversight checklists should be completed for each project site. The On-site Project Manager will provide an explanation on the QC field oversight sheets for any items that he marks were not completed. The On-site Project Manager will review the following items with the field crew prior to beginning on-site operations.

- Scope of Work
- Contents of this Plan of Operations
- Contents of Site-Specific Safety and Health Plan
- Contents of Quality Control Plan
- Field equipment to be used at project sites
- Sample collection equipment
- Labeling for sample containers
- Chain-of-custody forms
- Laboratory information

- Proper preservation methods for samples
- Proper packaging and shipping procedures for samples
- Proper equipment decontamination procedures
- Proper use of field screening and/or field monitoring equipment

10.0 DAILY QUALITY CONTROL REPORTS

During the field excavation and tilling activities, daily Quality Control Reports (QCR) will be prepared daily, dated, and signed by the On-site Project Manager or the QC Officer. McTech will utilize the USACE QCR Report Form (see Appendix C). The following information will be recorded on the QCR:

- Weather information
- Field instrument measurements
- Departures from the approved plans (any deviation that may affect data quality objectives must be conveyed to the USACE immediately)
- Personnel on-site and their job activities
- Any problems encountered
- Instructions from government personnel
- Field photo descriptions

11.0 CORRECTIVE ACTION

Corrective action measures may be required to be taken in the event a discrepancy is discovered in the field, during an audit, and/or the laboratory discovers a discrepancy or problem. Laboratory discrepancies, unrelated to field procedures, will be addressed by the laboratory's personnel and will be corrected in accordance with their QAP.

Any deviations from the approved plans will be fully documented. The USACE Contracting Officer's Representative (COR) will be notified if deviations from the approved plans are necessary. The USACE COR must approve the deviation prior to proceeding with the deviation. Deviations from the plans that compromise data quality or personnel safety will not be allowed.

12.0 SPILL PREVENTION, CONTROL, AND COUNTERMEASURE

Although a formal Spill Prevention, Control and Countermeasure (SPCC) Plan is not required for the work McTech is performing on this site, it is important to ensure that the area is secured and that the situation is assessed quickly. Ventilation, vapor suppression, and dust suppression may be required prior to cleaning up a site. Trained personnel will clean up spills quickly unless safety reasons prevent it. All of McTech's personnel on-site have been trained in emergency response and clean-up operations. The Project Manager will immediately inform the USACE and NASA POCs of any spills, regardless of the spill location. Additionally, it may be appropriate to contact the Ohio EPA, Northeast District Office (330-963-1200) and the National Response Center after contacting the USACE and NASA POCs.

12.1 Potential Spills

Potential sources for spills on this project are:

- Spills or leaks of decontamination liquids from equipment decontamination activities.
- Spills or leaks of decontamination liquids from personnel decontamination activities.
- Petroleum leaks from trucks or heavy equipment used at the site.
- Spills of chemicals (acetone, nitric acid, Tornado-50 cleaner, hexane) used on site. It should be noted that only small amounts (1-2 gallons each) of acetone, nitric acid, Tornado-50 cleaner, and hexane will be used on-site.

Material Data Safety Sheets (MSDS) for the products that may be brought onsite will be posted at the site. Chemicals/petroleum products will not be stored onsite without a current MSDS being provided and kept onsite. At this time, McTech does not intend to store diesel, motor oil, antifreeze, or any other petroleum product on-site. The following is a list of the materials anticipated to be stored on-site.

- Acetone
- Tornado-50 cleaner
- Hexane
- Hydrated LIme
- Dilute nitric acid
- PPE and small amounts of lab waste (less than 5 gallons of lab waste)

12.2 Spill Prevention

This plan represents a written commitment by McTech to supply the manpower, equipment, and materials required to expeditiously control and remove any potential harmful spills that may occur at the NASA PBS site due to project activities. The following are spill prevention procedures that will be implemented at the site:

- All drums used to store liquids that would be harmful to the environment if spilled will be checked on a weekly basis. The drums should be stored on a pallet for ease of transportation. The On-site Project Manager will perform the weekly inspections.
- Heavy equipment (trucks, excavators, etc.) will be inspected weekly prior to use to ensure that they are not leaking. A copy of the inspection form can be found in Appendix C of the SSHP.
- The hydrated lime required for this project will be place in a secured storage building until its application to the contaminated soil in the PRRWP.
- A secure area will be used for the storage of decontamination fluids.
- Personnel will be instructed as to their particular requirements as described in this Spill Control Plan

12.3 Spill Response

In the event of a spill or a leak, site personnel will:

- Inform the Project Manager, Kimberlie Chambers immediately. Ms. Chambers will then immediately inform the USACE of any spills, regardless of the spill location and/or amount. In the event that the Project Manager is not on-site the On-site Project Manager will be informed of any spills.
- All nonessential personnel will be cleared from the area. Personnel trained in emergency response and spill control measures will be utilized to contain any spillage of materials.
- Personnel will isolate the area.
- If spill occurs outside of the exclusion (hot) zone, then personnel must designate the spill area as an exclusion zone to limit potential exposure to onsite personnel.
- Trained personnel will attempt to locate the source of the spillage and stop the flow if it can be done safely.
- Trained personnel will begin containment and recovery of the spilled materials.
- PPE required during spill response for this project will at a minimum be Level D PPE. Level C or higher PPE may be used if spill conditions so warrant.
- Spill clean up will be performed only by personnel who are trained with spill response procedures.
- Material safety data sheets (MSDS) will be posted for any potential hazardous materials that are expected to be encountered or used.
- Spills will be reported to the USACE and NASA POCs. If the spilled material reaches any navigable body of water, the Ohio EPA, Northeast District Office (330) 963-1200 and the National Response Center (800) 424-8802 may be notified.
- Fire extinguishers will be available on-site and ready for use.
- Eye wash will be available on-site and ready for use.
- This Spill Control Plan will be posted at the site

12.4 Spill Containment

Spill containment equipment will be located on-site. Materials used for cleanup will be placed in drums for proper disposal according to appropriate state and federal regulations. Spill containment material that will be on-site is:

- Lime spilled in outside of the Pilot Study area shall be cleaned up with brooms, shovels and buckets and taken to the Pilot study area for future use..
- Absorbent pads, booms, or rolls (sufficient number to absorb a minimum of 200 gallons of spilled liquids).
- Drums containing IDW waste or other materials will be stored within in a lined dike area capable of containing any spills or leaks.
- Fluorescent marking tape and/or orange construction fence.

The following are requirements for handling drummed materials on-site:

- All drums and containers used will meet DOT, OSHA, and EPA regulations for the waste that they contain.
- Drums and containers will be inspected and their integrity assured prior to being moved. Drums or containers that cannot be inspected before being moved because of storage conditions, will be positioned in an accessible location and inspected prior to further handling.

- Operations for the site will be organized so as to minimize the amount of drum or container movement.
- Employees involved in the drum container operations will be warned of the hazards associated with the containers.
- Where spills, leaks or ruptures may occur, adequate quantities of spill containment equipment (absorbent, pillows, etc.) will be stationed in the immediate area.
- Drums or containers that cannot be moved without failure will be emptied into a structurally sound container.

12.5 Spill Reporting

McTech personnel are to immediately report any imminent or actual spills to the McTech Project Manager and/or On-site Project Manager. The Project Manager/On-site Project Manager will then report immediately to the USACE POC and NASA POC. The USACE POC will report the information to any regulatory agencies or authorize the Project Manager to do so if the spill amount is reportable. If appropriate, the Ohio EPA, Northeast District Office (330) 963-1200 and the National Response Center (800) 424-8802 may be notified. Reportable Quantities of spilled material will be posted in the office trailer. It is of great importance for personnel to gather the following information if they encounter an imminent or actual spill.

- The location of the release or imminent release.
- The name and quantity of the material involved, to the extent known.
- The possible source or cause of the release.
- The date and time of the release.
- A description of any emergency response actions taken or currently being taken by others.

After the cleanup of a spill, the Project Manager will investigate to determine the possible cause of the spill. The Project Manager will implement corrective actions to prevent a reoccurrence of the spill.

12.6 Contingency

In the event that on-site field personnel cannot handle the spill, NASA and McTech will dispatch their Emergency Response Teams. The Emergency Response Teams have been trained and have sufficient equipment to perform spill clean up for this project.

13.0 PROTECTION OF RIVERS, STREAMS, AND IMPOUNDMENTS

McTech will exercise every reasonable precaution throughout the life of the project to prevent silting of ditches and streams at the site. Erosion and silt control measures will include, but are not limited to, the following:

- Prior to suspension of excavation operations for any appreciable length of time, McTech will shape the top of earthwork in such a manner as to permit the runoff of rainwater and construct earth berms along the top edges of embankments to intercept runoff water. The berm

construction will not be permitted to decrease the stability of the embankment section. In addition, silt fence and straw bales may also be used to prevent erosion from runoff water.

- Preventive measures taken to adequately control any run-off or run-on of water to excavation areas or to the storage/staging areas. Should such preventive measures fail and an appreciable amount of material begins to erode into a waterway, McTech will act immediately to bring the silt under control.
- All excavated soil will be deposited in stockpile areas to prevent any contamination from migrating to waterways or washing away by high water or runoff.
- Diversion ditches will be constructed around areas where running or standing water is present.

14.0 AIR EMISSION CONTROLS

If necessary, water will be used for dust control in areas of excavation and on haul roads. A water truck will remain on site for the duration of the project. The Project Manager/On-site Project Manager and the QC Officer will make visual observations of dust levels to determine if water suppression is necessary and/or working.

15.0 PROJECT SCHEDULE

McTech will furnish originals and copies of the work plans and response to comments in the quantities below. A written response to all comments will also be prepared by McTech and included in the final submittal document. Submittals are as follows:

- Draft and Final QCP, SSHP and Plan of Operations – 7 draft and 7 final copies of each plan to USACE
- Draft and Final Lime Treatment Pilot Study Report – 7 draft and 7 final copies to USACE

15.1 Address for Submittals

U.S. Army Corps of Engineers
Huntington District
502 Eighth Street
Huntington, WV 25701-2070
ATTN: CELRH-EC-CE (Lisa A. Humphreys)

15.2 Due Dates, McTech Corp Submittals and Action Items

McTech Corp Submittals / Action Items	No. Days
Notice to Proceed	0
Submission of Draft QCP, SSHP and Plan of Operations	20 Days after NTP
Submission of Final QCP, SSHP and Plan of Operations	30 Days after NTP
Submission of Draft Lime Treatment Pilot Study Report	120 days after NTP
Submission of Final Lime Treatment Pilot Study Report	30 days following receipt of comments to Draft LTPS

16.0 REFERENCES

The following reference materials were used in compiling the information contained in this plan and/or were be used in other documents associated with this project.

40 CFR Part 261, *Identification and Listing of Hazardous Waste,* United States Environmental Protection Agency

CELRHR 5-2-7, *Quality Management Plan,* U.S. Army Corps of Engineers, May, 1999

EM 200-1-2, *Technical Project Planning Process*, U.S. Army Corps of Engineers, August 1998

EM 200-1-3, *Requirements for the Preparation of Sampling and Analysis Plans* , U.S. Army Corps of Engineers, February 2001

EM-200-1-6, *Chemical Quality Assurance for Hazardous, Toxic and Radioactive Waste Projects (HTRW)*, U.S. Army Corps of Engineers, October 1997

ER-1110-1-263, *Chemical Data Quality Management for Hazardous Waste Remedial Activities,* U.S. Army Corps of Engineers, April 1998

ER 1165-2-132, *HTRW Guidance for Civil Works Projects*, U.S. Army Corps of Engineers, June 1992

ERDC/EL TR-03-15, September 2003, *Lime Treatment of 2,4,6-Trinitrotoluene Contaminated Soils: Proof of Concept Study* U.S. Army Corps of Engineers, September 2003

ESTCP website:
http://www.estcp.org/projects/compliance/200216o.cfm

"Final Action Memorandum for Interim Removal Action for Pentolite Road Red Water Ponds", USACE , June 2003

Final Interim Soil Removal Action Report, WTI, 2006

"Final Plan of Operations for Stabilization, Excavation, and Disposal of Contaminated Soil for Pentolite Road Red Water Ponds", WTI, December 2002

"Final Quality Control Plan", WTI, December 2002

"Final Site-Specific Safety and Health Plan for Pentolite Road Red Water Ponds", WTI, December 2002

"General Quality Control Plan", WTI, August 2004

"General Safety and Health Plan", WTI, August 2004

Kinetics of the Alkaline Hydrolysis of Important Nitroaromatic Co-Contaminants of 2,4,6 Trinitrotoluene in Highly Contaminated Soils, Monika Emmrich, Environmental Science and Technology/Bol 35, No 5, pgs 874-877, 2001

United States Environmental Protection Agency, web site at http://www.epa.gov

Appendix A Scope of Work

Scope of Work for the
In Situ Lime Treatment Pilot Study
Plum Brook Ordnance Works – Pentolite Road Red Water Ponds (PRRWP)
Sandusky, Ohio
Performance Based Contract No. W91237-06-C-0006

1.0 Introduction / Authority.

This work shall be awarded as Performance Based and issued as a firm fixed-price contract. The purpose of this Scope of Work is for the application of lime in the treatment / reduction of nitroaromatics in soil for the Pentolite Road Red Water Ponds Area (PRRWP) of the Plum Brook Ordnance Works (PBOW) Project. The United States Army Corps of Engineers (USACE) is the responsible authority under the Defense Environmental Restoration Program (DERP) at the former PRRWP. Based on the results of the completed treatment of the soils, the USACE will continue a Non-Time Critical Removal Action (NTCRA) in Pentolite Road Red Water Ponds Area. The treatment / reduction will be conducted in hopes of reducing the nitroaromatics to prevent human exposure to site soil containing the one constituent of concern (COCs) at concentrations that exceed remediation goals. The remediation goals are chemical- and receptor-specific risk-based remedial criteria that capture all the exposure assumptions and toxicological data used in the risk assessment. The in situ treatment approach would employ tilling of lime directly into the soil for the half-acre (8' depth or to groundwater or bedrock, whichever comes first) of contaminated soil identified in the PRRWP area.

1.1 Site History and Location.

The site of the former Plum Brook Ordnance Works (PBOW) is located approximately 4 miles south of Sandusky, Ohio and 59 miles west of Cleveland, Ohio. Although primarily in Perkins and Oxford Townships, the eastern edge of the site extends into Huron and Milan Townships. PBOW is bounded on the north by Bogart Road, on the south by Mason Road, on the west by County Road 43, and on the east by U.S. Highway 250. The surrounding area is mostly agricultural and residential.

The 9,009-acre PBOW site was built in early 1941 as a manufacturing plant for 2,4,6-trinitrotoluene (TNT), dinitrotoluene (DNT), and pentolite. Production of explosives at PBOW began in December 1941 and continued until 1945. It is estimated that more than 1 billion pounds of nitroaromatic explosives were manufactured during the 4-year operating period. The three explosive manufacturing areas were designated TNT Area A (TNTA), TNT Area B (TNTB), and TNT Area C (TNTC).

PBOW Pentolite Road Red Water Ponds (PRRWP) consists of an area of approximately 9 acres located at the north-central portion of former PBOW. PRRWP is located just south of Pentolite Road, southeast of the former Pentolite Area and approximately one mile north of TNT B. Wastewater from TNT A and B were sent by wooden flumes and ceramic pipes to the Wastewater Treatment Plant #1 which were located about 700 feet east of the PRRWP. During the operation of the site by the Department of Defense (DOD), process wastewater resulting

from the purification of the TNT was discharged to various settling ponds (West Area Red Water Ponds and the PRRWP) at the site. This wastewater (referred to as "red water" because of its color) was transported to a wastewater treatment and incineration area and discharged via wooden flumes and elevated discharge pipes into the settling ponds. The wastewater was then discharged from Wastewater Treatment Plant #1 through pipes to the PRRWP. Original PRRWP construction plans indicate pond dimensions of 200' wide (east-west) by 400' long by 3' deep with a 1' high levee and had a capacity of 182,000 cubic yards of wastewater. NASA had PRRWP filled in 1977 following a breach of the ponds.

The National Aeronautics and Space Administration (NASA) acquired the property on March 15, 1963 and currently utilizes the site. GSA performed further decontamination efforts during 1963 to facilitate this transfer. The decontamination process included removing contaminated surface soils above the drain tiles, flumes, etc., destruction of all buildings by fire, then removal of all soil, debris, sumps, and concrete foundations. All materials, including the soil in those areas, were flashed; the area was then rough graded. The decontamination process also included the burning of excavated nitroaromatic-filled flumes.

NASA currently operates the Plum Brook Station (PBS) of the John Glenn Research Center at Lewis Field. Most of the aerospace testing facilities built in the 1960s at the site are in standby or inactive status. On April 18, 1978, NASA declared approximately 2,152 acres of PBOW as excess. The Perkins Township Board of Education acquired 46 acres of the excess acreage and uses this area as a bus transportation area. GSA retains ownership of the remaining excessed acreage and currently has a use agreement with the Ohio National Guard for 604 acres of this land. NASA presently controls approximately 6,400 acres and is using the site to conduct space research as a satellite operation of the John Glenn Research Center at Lewis Field in Cleveland, Ohio. The details of land transactions are listed in the site management plan (ICI, 1995) and can be found at the NASA PBS.

To date, an Interim Soil Removal Action (ISRA) has been conducted at the PRRWP area and a report prepared that addresses soil contamination limits that still remain in the area.
The COC was identified as a nitroaromatic, specifically, 2,4,6-Trinitrotoluene (TNT). TNT existed in surface soil, subsurface soil, and groundwater; however, surface water and sediment were not found to be contaminated.

The overall objective of the Interim Soil Removal Action for PRRWP was to minimize threats to, and provide adequate protection to, human health and the environment from exposure to contaminants in soil. The remedial objectives identified for soils at PRRWP were:

1) Minimize the potential for human exposure via incidental ingestion, dermal contact, and inhalation of soil contaminated with nitroaromatics.

2) Minimize the potential for nitroaromatics to migrate from soil at the site to the groundwater.

Due to funding limitations, only the 20' x 20' x 10' area identified in the *PRRWP Final Action Memorandum* (USACE, 2003) has been excavated and backfilled with clean soil. The area was only excavated to a depth of 8' rather than the 10' specified because ground water was encountered at that depth. Exploratory test pits were used in place of continued excavation to determine the horizontal limits of the contamination. Following the test pit activities, confirmation sampling and the calculation of the hazard index (HI) determined that the original extent of contamination was grossly underestimated. Further excavation or treatment is necessary to minimize threats to, and provide adequate protection to, human health and the environment from exposure to the nitroaromatic contamination in soil. In addition to the original excavation of 118 cubic yards, approximately 7,600 cubic yards of additional excavation or treatment would be required to remediate PRRWP.

Currently, funding has become available to investigate the possibility of reducing the TNT found in the area to below Remedial Goal Objective (RGOs) level so that the soil can remain on site rather than being disposed of off site at a landfill and this is what the Scope of Work will cover.

1.2 Proposed Action Description

This project involves the treatment / reduction of nitroaromatics in soil in the PRRWP area within the Plum Brook Ordnance Works Project. This area consists of contaminated soil which horizontally covers approximately a half-acre and vertically covers an 8' depth (could be shallower if groundwater or bedrock is encountered).

Anticipated project actions consist of (at a minimum): excavation, tilling (in lifts between 12" to 18") of the soil with hydrated / slaked lime (potential for several treatments based on reduction achieved during 1st treatment), obtaining a pH that is conducive for treatment to occur, sampling periodically (field and lab confirmation) to determine the decrease in the nitroaromatics, comparing the reduced levels against the identified RGO of 13.8 mg/kg for TNT, surveying volumes of soil tested, placing soil back in the ground, seeding area with common grasses found within the PRRWP area, preparing a report documenting the processes performed, findings and results of this field experiment and presenting the findings at a Restoration Advisory Board (RAB) meeting.

In discussions with Ohio EPA, it was agreed that the soil could be placed back in the ground at the PRRWP should the treatment not reduce the TNT levels below the RGO levels. This agreement was based on the facts that future funding will be available for a continuation of the Interim Soil Removal Action on the additional contaminated soil and because this soil was identified as non-hazardous.

2.0 Statutes, Regulations, and Guidance (Reference Documents)

2.1 PRRWP Final Action Memorandum, dated 2003, USACE
2.2 Final Interim Soil Removal Action Report dated 2006, WTI
2.3 ESTCP website describing the treatability and field demonstrations: http://www.estcp.org/projects/compliance/200216o.cfm

2.4 Final Report: Evaluation of Lime and Persulfate Treatment of Plum Brook Ordnance Works

2.5 Kinetics of the Alkaline Hydrolysis of Important Nitroaromatic Co-Contaminants of 2,4,6-Trinitrotoluene in Highly Contaminated Soils, Monika Emmrich, Environmental Science & Technology / Vol 35, No. 5, pgs 874 – 877, 2001

2.6 US Army Corps of Engineers, Technical Project Planning (TPP) Process, 31 August 1998, EM 200-1-2.

2.7 US Army Corps of Engineers, Engineering and Design – Requirements for the Preparation of Sampling and Analysis Plans, 1 February 2001, EM 200-1-3.

2.8 US Army Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1, latest version.

3.0 Objectives.

The Contractor shall provide all equipment, labor, materials and supervision necessary for the treatment / reduction of the contaminant of concern – TNT within the PRRWP area. Overall, this work shall consist of the following tasks:

Task 1	Preparation/Submission of a Site-Specific Safety and Health Plan (SSHP)
Task 2	Preparation/Submission of a Quality Control Plan (QCP)
Task 3	Preparation/Submission of a Plan of Operations
Task 4	Field Activities/Utilities
Task 5	Site / Volume Survey
Task 6	Excavation / Tilling Efforts
Task 7	Field Screening / Confirmation by Laboratory
Task 8	Site Restoration
Task 9	Preparation/Submission of Draft and Final In Situ Lime Treatment Pilot Study for PRRWP
Task 10	Meeting Support

4.0 Tasks. The tasks outlined in Section 3.0 are described in detail in the following sections of this Scope of Work (SOW). This work shall be conducted by the Contractor in an environmentally acceptable manner conforming to existing federal, state, and local regulations under US Army Corps of Engineers (USACE)/Huntington District (CELRH) supervision.

4.1 (Task 1) Preparation and Submission of a Safety and Health Plan (SSHP)

The SSHP shall be prepared to cover field activities planned for the PRRWP area. The plan shall comply with the requirements of the U.S. Army Corps of Engineers, Safety and Health Requirements Manual, EM 385-1-1, latest version, and the Department of Labor, Occupational Safety and Health Administration (OSHA) as presented in Title 29 of the Code of Federal Regulations, Part 1910.120. As a minimum, the contractor SSHP shall address the following items:

- Cover sheet. Identify company name, contract number, project location, signed and dated by plan developer.
- Responsibilities and lines of authority.
- Employee qualifications. Physical fitness, job competence, special skills, equipment operation.
- Employee training. First aid, CPR, back injury prevention.
- Safety meetings. "Tool box" meetings.
- Job Hazard Analysis. Preparation and revision, discussion with employees.
- Emergency response plan. Emergency number, means of communication, route to nearest medical facility.
- Accident reporting and supervisor responsibility. Report all accidents immediately to the Contracting Officer and submit ENG Form 3394 within two (2) working days.
- First aid kits.
- Personal protection equipment. As a minimum, employees must wear long-legged trousers, sleeved-shirt, and steel-toes shoes. Safety glasses with side shields and hard hats may also be appropriate, depending on activity.
- Hearing Protection
- Vehicles and equipment.
- Public safety.
- Fire safety.
- Environmental hazards.
- Housekeeping.
- Standard operating procedures.

The contractor shall read and conform to the SSHP when conducting this work. Documentation to this effect shall be furnished to the Government POC prior to initiation of any work. The plan shall also include the names, and qualifications of the Site Safety and Health Officer, including education, training and work experience.

4.2 (Task 2) Preparation and Submission of a Quality Control Plan (QCP)

The QCP shall be prepared according to the applicable ISO 9000 processes as identified at www.lrh.usace.army.mil/ct/quality developed for this type of work.

The QCP shall define the responsibilities and roles of each member on the Independent Quality Control Team (IQCT), along with those preparing or performing the tasks/activities in this SOW.

The QC Plan shall also detail the methods and procedures for inspection of work, identifying and correcting deficiencies, maintenance of records, list of authorized Quality Control Inspectors, list of authorized Contractor representatives, and security measures.

The draft and final versions of the various plans shall include a separate QC appendix that includes an activity review checklist (appropriate checks on those activities that were performed/reviewed) for the specific product, along with a signed sheet which designates the name, date and official work title of those persons performing/conducting the QC activities. All comments and responses, from both the Contractor's QC review and USACE's QA/QC review, as well as contract compliance review comments of the plans shall be included in the QC appendix of the final plans.

4.3 (Task 3) Preparation and Submission of a Plan of Operations

A Plan of Operations shall be prepared that covers the office / field activities planned for this work effort. This plan shall include a detailed scheme for the project's activities. This plan shall be submitted and approved by USACE prior to start-up of construction field activities.

The Contractor shall include in the Plan of Operations a Sampling and Analysis Plan, which will also Quality Assurance Project Plan (QAPP) and Field Sampling Plan (FSP) that will outline the sampling and analysis as well as the laboratory's quality assurance plan and any field sampling activities required for disposal of the contaminated soil as well as that required for confirmation/field screening efforts once excavation has been completed. The Contractor shall also address any IDW that may be generated during these efforts.

Sampling shall be for the one CoC - Nitroaromatics (method 8330) and pH to verify soil has reached the levels necessary to achieve treatment. The sampling and analysis shall be done in accordance with current USEPA SW-846 protocol.

4.4 (Task 4) Field Activities/Utilities

4.4.1 Field Activities. The site is currently owned by NASA Plum Brook Station (PBS), however, rights of entry are not required for this removal action. Coordination with PBS personnel will be conducted by USACE to ensure that the Contractor is allowed access to/from the site to perform all activities during this effort. The Contractor shall be required to enter/exit through the PBS security gate, therefore, he shall follow all rules set forth by PBS security. The USACE shall be notified in writing at least two (2) weeks prior to commencement of any field work. The Contractor shall coordinate his field activities with all appropriate authorities and agencies as required. No field work shall be started until the QCP, SSHP and Plan of Operations have been approved by USACE. The Contractor shall prepare and submit to USACE a written response to all comments. The Contractor shall also be responsible for providing (with the notification) an up-to-date, detailed time schedule for the field work to be performed.

4.4.2 Utilities. An excavation permit has already been acquired / coordinated with the Plum Brook Operations and Support Group (PBOSG) for the PRRWP area as well as any additional excavation areas discovered through the trenching / test pitting efforts. Therefore, the Contractor shall

coordinate with PBOW NASA and PBOSG (NASA's Contractor) to determine if the previously acquired excavation permit is still valid.

4.5 (Task 5) Site / Volume Survey

The Final ISRA for PRRWP, dated May 2006 (WTI) identifies the surveyed limits for the proposed excavation of the half-acre area. The Contractor shall utilize this report in obtaining information to survey/stake the limits prior to tilling. These areas shall also be surveyed once excavation/tilling is complete so as to get final quantities removed / treated as well as obtain coordinates for preparation of final mapping / as-built drawings for the draft and final reports.

4.6 (Task 6) Excavation / Tilling

The Contractor shall excavate / till the soil within the PRRWP contaminated limits with hydrated / slaked lime (3 – 5 tons / acre-ft) and maintain a pH level that is conducive to achieve treatment / reduction of the nitroaromatics in the soil. He shall do this in lifts no greater than 18 inches, excavate and stage the soil once treatment has been achieved (or when it reaches maximum reduction, even though it's not below the RGO level of 13.8 mg/kg). He shall continue this process until it is confirmed that the treatment is or isn't possible to reach a level below the RGO level which would make it possible to put the soil back in the ground.

4.7 (Task 7) Field Screening / Confirmation by Laboratory

The Contractor shall conduct field screening for TNT to see if the RGO level is being achieved prior to weekly confirmation sampling. Based on lab experiments for lime stabilization, and the half-life of 7 days, the Contractor shall assume a sampling effort once a week. He shall sample for the one CoC, TNT that's been identified for this site and document / tabulate the data for inclusion into the draft and final reports. Based on field conditions and volume of soil being tilled at a time, the Contractor shall coordinate with USACE POC to determine the number of samples per volume of soil that's required. The Contractor shall conduct all sampling in accordance with USEPA sampling protocol.

4.8 (Task 8) Site Restoration

At the completion of the project activities, the Contractor shall restore the site to initial or better conditions. The Contractor shall discuss in the Plan of Operations the details of the site restoration. Holes in the ground generated from removal shall be backfilled to the grade equivalent to surrounding areas. Once the site has been regraded, the Contractor shall reseed the area with vegetation indicative to what is currently in the PRRWP area. Site shall be restored back to natural contours / elevations and promote drainage so no ponding occurs.

4.9 (Task 9) Preparation/Submission of Draft and Final In Situ Lime Treatment Pilot Study for PRRWP

The Contractor shall prepare a draft and final In Situ Lime Treatment Pilot Study Report, which details the complete efforts during all activities in the SOW. Once the draft report has been

generated, the Contractor shall submit it to USACE for review. Any comments arising from this review shall be incorporated by the Contractor into the final report. See Section 4.2 for QC review and documentation requirements. See Section 5.3 for reporting requirements.

4.10 (Task 10) Meeting Support

The Contractor shall support USACE Project Manager or Technical Coordinator during meetings necessary to discuss the work defined by this work order. It is assumed a maximum of 1 meeting outside of field activities time will be held to discuss the proposed work. This meeting will be held at a location in the Sandusky Ohio area. The Contractor shall be responsible for preparing slides, handouts, and coordinating this meeting. The Contractor shall place a notice in the local newspaper announcing the meeting and inviting the public to attend. The Contractor shall document the meeting minutes and supply these to the USACE project manager or technical coordinator. If necessary the Contractor shall plan to give a presentation highlighting the requirements of this work.

5.0 Contractor Submittals / Schedule / Reporting / Other

5.1 Contractor Submittals

The Contractor shall furnish originals and copies of the work plans and response to comments in the quantities below. A written response to all comments shall also be prepared by the Contractor and included in the final submittal document. Submittals are as follows:

Draft and Final QCP, SSHP and Plan of Operations – 7 draft and 7 final copies of each plan to USACE

Draft and Final In Situ Lime Treatment Pilot Study Report – 7 draft and 7 final copies to USACE

Addresses for submittals:

U.S. Army Corps of Engineers
Huntington District
502 Eighth Street
Huntington, WV 25701-2070
ATTN: CELRH-EC-CE (Lisa A. Humphreys)

5.2 Due Dates, Contractor Submittals and Action Items

Contractor Submittals / Action Items	No. Days
Notice to Proceed	0
Submission of Draft QCP, SSHP and Plan of Operations	20 Days after NTP
Submission of Final QCP, SSHP and Plan of Operations	30 Days after NTP

Submission of Draft In Situ Lime Treatment Pilot Study Report	120 days after NTP
Submission of Final In Situ Lime Treatment Pilot Study Report	30 days following receipt of comments to Draft Report

5.3 Reports

All work plans presenting data, analyses, recommendations, and drawings shall be prepared in a standard format for reports, as described herein. The Contractor shall submit copies of the draft and final versions of the work plans using MS Word. A CD ROM containing the text and drawings will be submitted along with the final work plan. A decimal paragraphing system shall be used. All site drawings shall be done in English units and of engineering quality with sufficient detail to show interrelations of major features on the site map (i.e. north arrows, keys, scales, etc.). When drawings are required, data may be combined to reduce the number of drawings, however, the drawings are not to be congested to the point that sight of the detail is lost. All drawings included in the reports shall be done on Microstation V8, conform to the current USACE CADD Standards and shall be submitted to USACE along with the final work plan. The report shall consist of 8.5" by 11" pages with drawings folded, if necessary, to this size. If the Contractor must submit large drawings (42" by 29" size) folded to 8.5" by 11", use of top loading sheet protectors for the folded drawings will be required. The Draft and Final Work Plans shall be bound in three-ring binders and clearly labeled as "Draft" and "Final", respectively. Appendices in the work plans will be identified by tabs or other approved manner. A title page shall identify the title, the Contractor, the Corps of Engineer, Huntington District, and the date. Plastic photo holder sheets are to be used when including photos in report. All photos are to be at least 35mm or digital color photos and properly labeled and put on a CD for storage. Plastic loose-leaf media files are to be used when submitting CD ROMS. Photo documentation for each of the individual sites shall be taken before and after construction activities. Contractor Quality Control Reports, Manifests, Analytical Results and any other large volume appendix may be put on CD to reduce size of report. Should this occur, the Contractor may need to put a summary of the data in the body of the report or as a cover to the appendix. The Contractor shall also put the entire report on CD or DVD and include it in the final report submission. The entire report shall be provided in the working files as well as .pdf format, Optical Character Regognition – OCR'd (using Adobe 7 Professional) so that it can be easily incorporated into the electronic PBOW Administrative Record and Public Repository.

5.4 Other

The Contractor shall maintain a file documenting all correspondence, phone conversations, and meetings with the USACE and other elements. It shall be bound in an appropriate folder and filed in reverse chronological order. This correspondence file shall be available for inspection at any time by the USACE upon request and shall be submitted to the USACE upon the conclusion of this work order.

Additional responsibilities of the Contractor under this work order include, but are not limited to, the following items of work:

1) Depending on site conditions, the use of water may be required to control dust during construction activities. The amount of dust resulting from the construction activities shall be controlled to prevent the spread of dust to occupied areas near the construction site and to avoid creation of a nuisance in the surrounding area. Use of water shall not be allowed to result in, or create, hazardous or objectionable conditions such as flooding and pollution.
2) The Contractor is responsible for ensuring traffic safety in all work areas. Flagmen, temporary signage or other approved means shall be provided by the Contractor as needed to comply with the above requirement.
3) The use of burning at the project site for disposal of refuse and debris will not be permitted.
4) The Contractor shall be responsible for keeping the roads free from soil and other debris (i.e., swept periodically collect material (if dropped) and dispose of properly) as well as making sure the travel to/from the security gate by subcontractors (i.e., trucking requirements) as maintained to not destroy existing roads.
5) The Contractor shall have the following items on-site and available at any time: 1) SSHP, 2) QCP and 3) Plan of Operation 4) Final ISRA Report for PRRWP, dated May 2006 (WTI).
6) The Contractor shall obtain all permits, licenses, and maintain these documents at the project site where work is to be performed and have such documents readily available. The Contractor shall insure that he meets all Federal, State and Local requirements for the safe removal, containment, hauling and disposal of materials related to the project activities.
7) Compliance with the provisions of this SOW by subcontractors will be the responsibility of the Contractor.

6.0 Payment

Construction work shall be negotiated as firm fixed-price and billable periodically based on completion of activities and in accordance with the payments clause. This will include provision of backup documentation (including certified payrolls) prior to payment as well as inspection of site for verification of activities performed. Upon construction completion, if it is determined that certain activities have not been performed or constructed, then costs for those shall not be billed by the Contractor. A final modification will be issued / negotiated to reflect actual work items and the work order will be reduced / modified to reflect work not completed.

7.0 Public Affairs

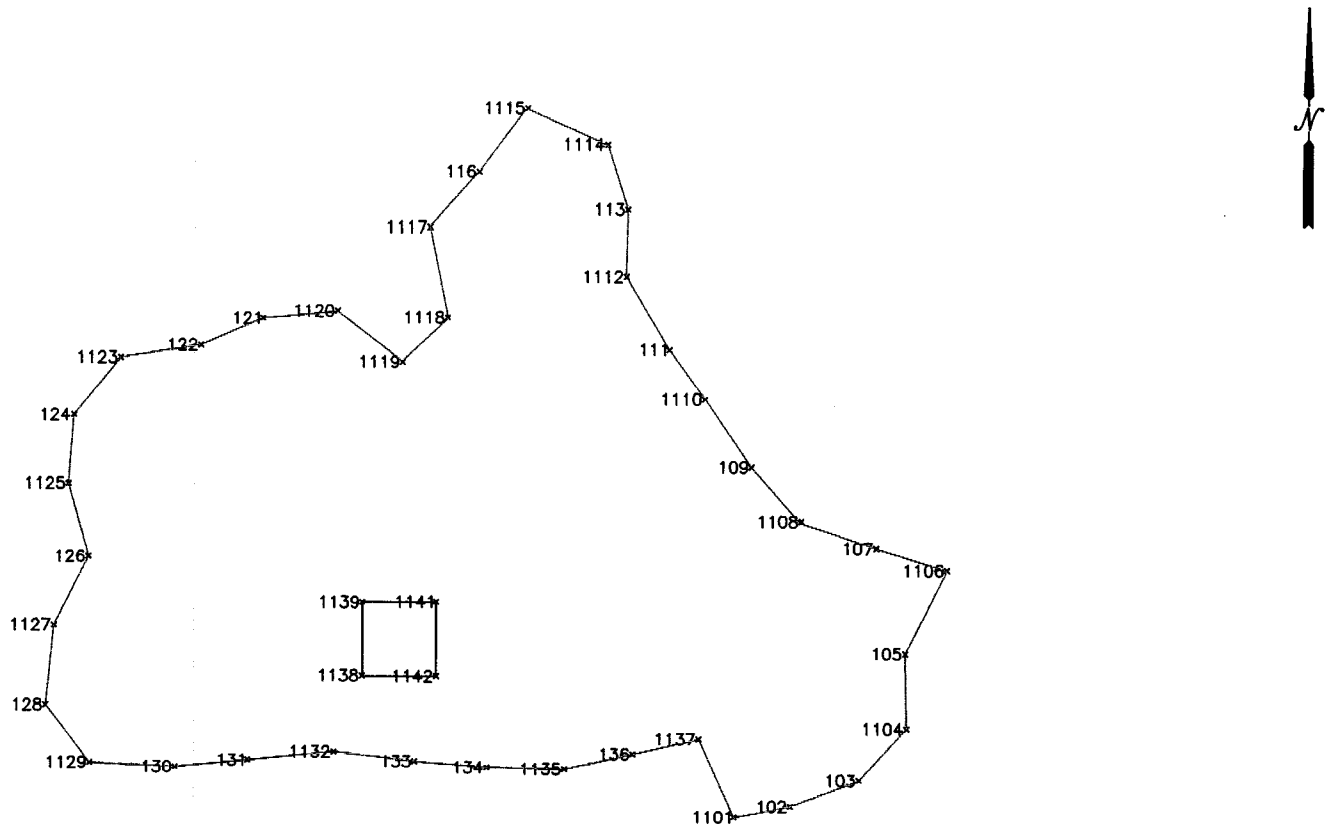
The Contractor shall not make available to the news media or publicly disclose any data generated or reviewed under this contract. When approached by the news media, the Contractor shall refer them to the USACE Contracting Officer (CO) for response. Reports and data generated under this contract shall become the property of the Government and distribution to any other source by the Contractor, unless authorized by the CO is prohibited.

8.0 Point of Contact

The Contractor shall supply USACE a point-of-contact to facilitate communications. USACE's point-of-contact for the work is:

USACE, Huntington District
502 8th Street
Huntington, WV 25701-2070
Attn: CELRH-EC-CE, Lisa Humphreys
(304) 399-5953
304-360-2558 (cell)
Lisa.a.humphreys@us.army.mil

Appendix B Site Map



US ARMY CORPS OF ENGINEERS
HUNTINGTON DISTRICT

PLUM BROOK ORDNANCE WORKS
NASA PLUM BROOK STATION

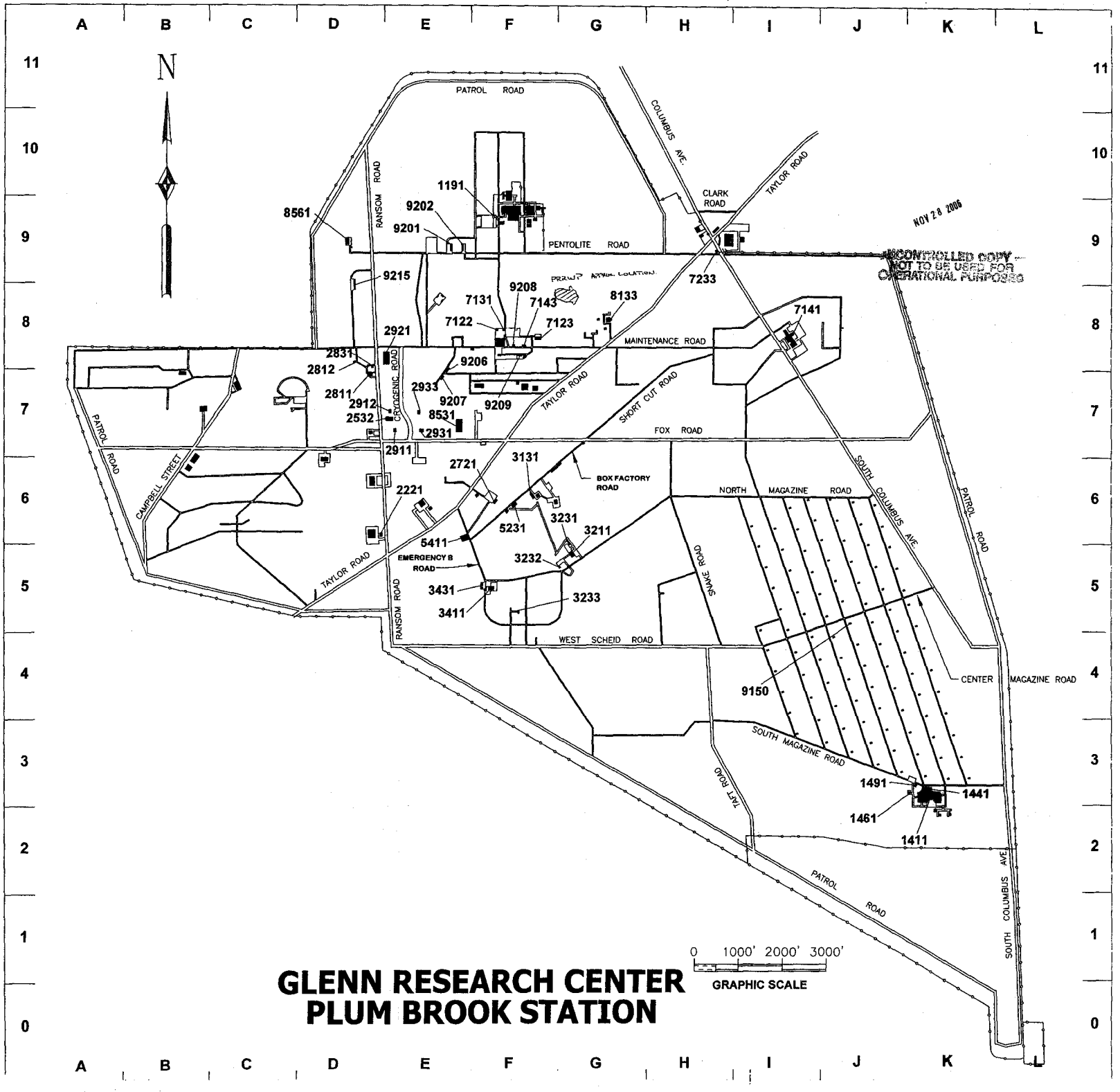
PENTOLITE ROAD RED WATER PONDS
LIME TREATMENT PILOT STUDY
CONTRACT NUMBER W91237-06-C0006

50 0 50
SCALE: 1"=50'

PREPARED BY:
Mountain State Company
P.O. BOX 10 • CEDAR GROVE, WV 25039
2318 E. DuPONT AVE. • BELLE, WEST VIRGINIA
PHONE (304) 949-4762 • FAX (304) 949-4764
jimi_msc@charter.net

DATE PREPARED: SEPTEMBER 2006

NOTE: THE 100 SERIES POINTS FOUND
THE 1000 SERIES POINTS RESET



GLENN RESEARCH CENTER
PLUM BROOK STATION

NOV 28 2006
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Appendix C Field Activity Forms

REI Consultants, Inc.
225 Industrial Park Rd.
P.O. Box 286, Beaver, WV 25813
Phone: 304-255-2500 or 800-999-0105
FAX: 304-255-2572
e-mail: rlabs@reiclabs.com

CLIENT: _____
ADDRESS: _____
CITY/STATE/ZIP: _____
BILL TO: _____
CITY/STATE/ZIP: _____
PURCHASE ORDER # _____
QUOTE # _____

CONTACT PERSON: _____
TELEPHONE #: _____
FAX #: _____
E-MAIL ADDRESS: _____
SITE ID & STATE: _____
PROJECT ID: _____
SAMPLER: _____

SAMPLE LOG AND ANALYSIS REQUEST

TURNAROUND TIME REQUIREMENTS

REGULAR: ___
*RUSH: ___ 5-Day
___ 3-Day
___ 2-Day
___ 1-Day

*Rush work needs prior Laboratory approval and will include surcharges

PRESERVATIVES

0 No Preservative
1 Hydrochloric Acid
2 Nitric Acid
3 Sulfuric Acid
4 Sodium Thiosulfate
5 Sodium Hydroxide
6 Zinc Acetate
7 EDTA

PRESERVATIVE CODES

NOTE PRESERVATIVES →

ANALYSIS REQUESTED & METHOD

SAMPLE ID	NO. & TYPE OF CONTAINERS	SAMPLING DATE / TIME	MATRIX	SAMPLE COMP / GRAB													COMMENTS

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Temperature Upon Arrival °C	☐ FAX Results	☐ Email Results	

SAFETY INSPECTION CHECKLIST FOR CRAWLER TRACTORS, DOZERS, SCRAPERS, MOTOR GRADERS, BACKHOES, HEAVY HAULAGE UNITS

U.S. Army Engineers, Huntington District

NSTRUCTIONS

ECTION 1 -- GENERAL INFORMATION:

a. *Date*: enter month, day and year of Safety Inspection.

b. *Owner/User*: Enter designated ownership of equipment (Corps, Corps leased or Contractor by name).

c. *Contract Number*: Contractors enter the respective contract number

d. *Type of Equipment* : Enter *Ford 515 Backhoe, ID 450 Bulldozer,* etc.

e. *Number*: Enter equipment number which Contractor has issued on large scale operations.

f. *Inspected By*: Enter signature and title of Corps or Contractor inspector (Corps inspector may be a maintenance leader, aintenance mechanic or operator and a Contractor inspector may be a mechanic, operator or service person).

g. *Reviewed By*: Enter signature and title of Corps or Contractor reviewer (Corps reviewer may be the mechanic, shift leader, oreman or superintendent). Before a signature and title of Corps or Contractor reviewer is entered, the checklist must be reviewed by ıe next level of direct supervision and the equipment spot checked unannounced to insure inspections are performed.

:CTION 2 -- SAFETY INSPECTION CHECKLIST: Check **YES, NO** *or* **N/A** *if question or statement does not apply.*

ECTION 3 -- RECEIPT OF ACKNOWLEDGMENT: Sign, provide title and date checklist. If Corps personnel was the inspector and iewer, a Corps manager, supervisor or responsible employee will sign the receipt of acknowledgment. If a Contractor personnel was .ɜ inspector and reviewer the checklist becomes a part of the official project file and a copy is furnished to the Contracting Officer epresentative (COR). The COR will then sign the receipt of acknowledgment. The COR may request a copy of the checklist at any ne. The COR or a representative may perform an unannounced spot check inspection to ensure compliance of safety inspection uirements. To determine if inspector and reviewer are Corps or Contractor personnel, see SECTION 1, Items f. and g.

ECTION 1	**GENERAL INFORMATION**	
Date	b. Owner/User	c. Contract Number
Type of Equipment		e. Number
Inspected by (*signature*) (*title*)	g. Reviewed by: (*signature*) (*title*)	

:CTION 2 **SAFETY INSPECTION CHECKLIST**

TE: Reference USACE Manual EM 385-1-1, April 1981, as revised. Equipment must be in full compliance with ecklist and contract requirements.

s protection (grills, screen, canopies) provided to shield the operator from falling or flying ,ɔcts?			
Are adequate rollover protection and seat belts provided?			
Is a safe means of 3 point contact access to cab or operator's compartment provided -- steps, bars, non-slip surfaces, etc.?			
Are required head and tail lights, flashing lights and slow moving vehicle signs provided and ɜrly positioned?			
ıs the parking and service brake system capable of holding the equipment fully loaded on the de of operation?			
oes the unit have an emergency brake system?			

CTION 2, Cont.	YES	NO	NA
. Does the emergency brake system work automatically when regular breaks fail?			
Can the emergency brake system be activated form the cab or operator's position?			
. Are fuel tanks located so that spills or overflows do not run on the engine or electrical stems?			
/. Is the reverse alarm signal operable?			
. Are cabs equipped with distortion free, shatterproof or safety glass?			
. Are exhausts located so that discharges do not endanger or obstruct the view of the operator?			
. Are moving parts, shafts, pulleys and belts adequately guarded?			
. Are any of the units structural members bent, cracked or otherwise showing signs of physical mage?			
. Are track rails, grousers, truck rollers, idlers and sprockets in good condition free from cessive wear, cracks, loose bolts or pins?			
. Are hydraulic lines and cylinders adequately guarded and free of physical damage?			
. Are tires on tire-mounted equipment free from excessive wear, breaks and of proper and equal ??			
. Is the manufacturer-recommended tire inflation pressure maintained?			
Are all towing devices properly mounted and in good condition?			
. Does the equipment have at least one dry chemical or CO2 fire extinguisher with minimal ing of 5 b:C available? (Corps owned or leased equipment must have extinguisher installed on equipment)			
. Is a 16 unit (minimum) first aid kit readily available in the equipment or on the job sit? Corps ned or leased equipment must have first aid kits installed.			
. Are all instruments, ammeters, pressure gauges, temperature gauges, tachometers or other tical systems operable and in good condition?			
Are all operating levers, pedals, etc., in good operating condition?			
. Do all modifications, replacement parts and/or repairs to the equipment maintain the same ty factor as originally designed and manufactured?			
. Is the equipment equipped with outriggers or leveling devices and are they in operable ndition?			
. Is the equipment operations manual available to the operator?			

Remarks:

TION 3 **RECEIPT OF ACKNOWLEDGMENT**

ipt Acknowledged by: *(Signature)* *(Title)* *(Date)*

VISITOR LOG

Everyone entering the exclusion zone and the contamination reduction zone shall meet the training and medical requirements of 29 CFR 1910.120. Visitors not meeting these requirements are only allowed in the support/clean zone. All visitors to the project site are required to adhere to the Site Specific Health and Safety Plan.

Compliance Agreement

I have read and understand this Site Specific Health and Safety Plan. I will comply with the provisions contained herein.

Project Site: _____

Name (Printed)	Signature	Date

Daily Safety Meeting

Project: _____ Date: _____

Discussion of work conditions and task expected to be completed today:

Topics to be discussed: (list below) **Task related to Safety Topic:** (list below)

Comments from Project Manager or SSHO concerning the meeting:

Notes concerning any safety related incidents that occurred:

Safety Meeting attendance:

I have attended the daily safety meeting. I have been briefed on today's job tasks and fully understand the safety issues associated with each task.

Name (printed)	**Signature**	**Date**

PPE CHECKLIST

All personnel shall perform an inspection of their PPE prior to performing activities on-site. The following items shall be checked.

____ Determine that the clothing material is that which has been designated for this project.

____ Visually inspect clothing for: imperfect seams, non-uniform coatings, tears, malfunctioning closures

____ Hold up to light and check for pinholes

____ Flex product and make observations for cracks or other signs of shelf deterioration

____ If the product has been used before, inspect inside and out for signs of chemical attack, discoloration, swelling, or stiffness.

____ Visually inspect gloves for imperfect seams, tears, and non-uniform coating

____ Pressurize gloves with air; listen for pinhole leaks

____ Check hardhat for cracks or other signs of stress

____ Check the suspension of your hardhat. Look for loose or torn cradle straps, loose rivets, broken sewing lines or other defects.

____ If using earmuffs, check the muffs for cracks, cuts or missing gaskets.

____ If using earplugs, check the plugs for cracks and or cuts.

____ Check safety glasses for scratches

____ If using a respirator, check for holes in filters

____ If using a respirator, check for cracks or scratches on the face piece

____ If using a respirator, check for loss of elasticity or tears in straps

____ If using a respirator, check for general cleanliness

____ If using an air purifying respirator, check for proper fit by performing the positive-pressure and negative pressure tests

SAFETY EQUIPMENT CHECKLIST

_____ Fire Extinguisher (in office trailer)

_____Fire Extinguisher (on heavy equipment)

_____16-unit first aid kit

_____Eye wash bottle

_____Cellular phone

CONTRACTOR'S QUALITY CONTROL REPORT (QCR) (ER 1180-1-6)

DATE:_____ REPORT NO._____

CONTRACT NUMBER AND NAME OF CONTRACTOR_____

_____

DESCRIPTION AND LOCATION OF THE WORK:_____

WEATHER CLASSIFICATION:_____

CLASS A No interruptions of any kind from weather conditions occurring on this or previous shifts.
CLASS B Weather occurred during this shift that caused a complete stoppage of all work.
CLASS C Weather occurred during this shift that caused a partial stoppage of work.
CLASS D Weather overhead excellent or suitable during shift. Work completely stopped due to results of previous adverse weather.
CLASS E Weather overhead excellent or suitable during shift but work partially stopped due to previous adverse manner.
OTHER Explain. CLASSIFICATION:

CLASS _____

TEMPERATURE:

MAX ___ MIN ___

PRECIPITATION:

INCHES _____

CONTRACTOR/SUBCONTRACTORS AND AREA OF RESPONSIBILITY FOR WORK PERFORMED TODAY: (Attach list of items of equipment either idle or working as appropriate.)

a._____

_____

b._____

_____

c._____

_____

d._____

_____

e._____

_____

f._____

_____

g._____

_____

1. WORK PERFORMED TODAY: (Indicate location and description of work performed. Refer to work performed by prime and /or subcontractors by letter in Table above.)

2. TYPE AND RESULTS OF INSPECTION: (Indicate whether: P-Preparatory, I-Initial, or F-Follow-up and include satisfactory work completed or deficiencies with action to be taken.)

3. TESTS REQUIRED BY PLANS AND/OR SPECIFICATIONS PERFORMED AND RESULTS OF TESTS:

4. VERBAL INSTRUCTIONS RECEIVED: (List any instructions given by Government personnel on construction deficiencies, retesting required, etc., with action to be taken.)

5. REMARKS: (Cover any conflicts in plans, specifications or instructions: acceptability of incoming materials; offsite surveillance activities; progress of work, delays, causes and extent thereof; days of no work with reasons for same.)

6. SAFETY: (Include any infractions of approved safety plan, safety manual or instructions from Government personnel. Specify corrective actions taken.)

_____

INSPECTOR

CONTRACTOR'S CERTIFICATION: I certify that the above report is complete and correct and that all material and equipment used, work performed and tests conducted during this reporting period were in strict compliance with the contract plans and specifications except as noted above.

_____

CONTRACTOR'S APPROVED AUTHORIZED REPRESENTATIVE

Quality Control Field Oversight Checklist
General Procedures

The following checklist is provided for use in the field to assure that general QC procedures are followed. The Project Manager or his designee should complete and sign a checklist for the project site.

Project Site _____

Date: _____
Personnel on-site:

_____

_____

_____

Signature: _____

		Yes	No	N/A
1.	Did the Field Supervisor or Project Manager discuss the following items with the field crew prior to beginning field activities?			
	Site Security issues	____	____	____
	Contents of the Plan of Operations	____	____	____
	Contents of Site-Specific Safety and Health Plan	____	____	____
	Contents of Quality Control Plan	____	____	____
2.	Was the USACE notified in writing 2 weeks prior to mobilizing to the site?	____	____	____
3.	Was the USACE provided a time schedule for field work?	____	____	____
4.	Were digging permits obtained from NASA prior to mobilizing to the site for excavation activities?	____	____	____
5.	Did Waste Ron personnel and subcontractors view the safety/orientation video prior to beginning work?	____	____	____

	Yes	No	N/A
6. Were digging permits limits strictly adhered to?	____	____	____
7. Were excavation limits survey by a qualified surveyor prior to performing excavation activities?	____	____	____
8. Were all drawings done in English units and of engineering quality with sufficient detail to show interrelations of major features on t he site map (i.e. north arrows, keys, scales, etc.)?	____	____	____
9. Were all drawings done in Microstation 95 (or the newest version) and in conformance with the current USACE CADD standards?	____	____	____
10. If drawings are larger than 8.5" by 11" were they folded to 8.5" x 11" size?	____	____	____
11. At a minimum, photos shall be taken of the following site activities.			
A. Surveying	____	____	____
B. Sites prior to excavation (including Borrow Area)	____	____	____
C. Excavation	____	____	____
D. Stabilization of soil	____	____	____
E. Loading of soil for transportation	____	____	____
F. Sampling activities	____	____	____
G. Decontamination activities	____	____	____
H. Storage/handling of IDW	____	____	____
I. Backfilling of the excavation pits	____	____	____
J. Seed and mulching of all disturbed areas	____	____	____
12. If water was generated during excavation, was it properly containerized, sampled, analyzed, and disposed in accordance with state and federal regulations?	____	____	____
13. Prior to disposal, were excavated and stabilized soils properly stored until analytical results were available?	____	____	____
14. Was clean fill material placed in the excavation pits? (Note: Borrow materials must be tested prior to use as fill)	____	____	____
15. Were excavation areas rough graded as necessary to achieve proper drainage and reseeded/mulched?	____	____	____
16. Was all IDW containerized and sampled?	____	____	____

Quality Control Field Oversight Checklist
HTRW Sampling Procedures

The following checklist is provided for use in the field to assure that general QC procedures are followed. The Project Manager should complete and sign a checklist for the project site.

Project Site _____

Date: _____

Personnel on-site: _____

_____

Signature: _____

What type and how many samples were collected? _____

_____

Describe the sampling procedure. _____

		Yes	No	N/A
1.	Were representative samples collected?	____	____	____
2.	Were samples properly placed into sample containers?	____	____	____
3.	Was the following information recorded on the sample labels?			
	Site location	____	____	____
	Project number	____	____	____
	Sample Identification number assigned in field	____	____	____
	Description of the sample	____	____	____
	Time and date sample was taken	____	____	____
	Notation of whether preservatives were added to the sample	____	____	____
	Type of preservative	____	____	____
	Type of analysis requested	____	____	____

Quality Control Field Oversight Checklist
HTRW Sampling Procedures
Continued

		Yes	No	N/A
4.	Were samples chilled with ice immediately after collection?	____	____	____
5.	Was a COC form filled out on-site?	____	____	____
6.	Was the following information recorded on the COC form?			
	Project number	____	____	____
	Project manager	____	____	____
	Site location	____	____	____
	Client contact	____	____	____
	Description of the sample	____	____	____
	Time and date sample was taken	____	____	____
	Notation of whether preservatives were added to the sample	____	____	____
	Type of preservative	____	____	____
	Type of sample such as a grab or composite	____	____	____
	Matrix of sample	____	____	____
	Amount of sample being transported to the laboratory	____	____	____
	Sample number or ID assigned in the field	____	____	____
	The appropriate analytical parameters to be tested	____	____	____
7.	Were COC seals placed on each sample container (except samples for volatiles analysis)?	____	____	____
8.	Was the COC from signed and dated?	____	____	____

Quality Control Field Oversight Checklist
HTRW Sampling Procedures
Continued

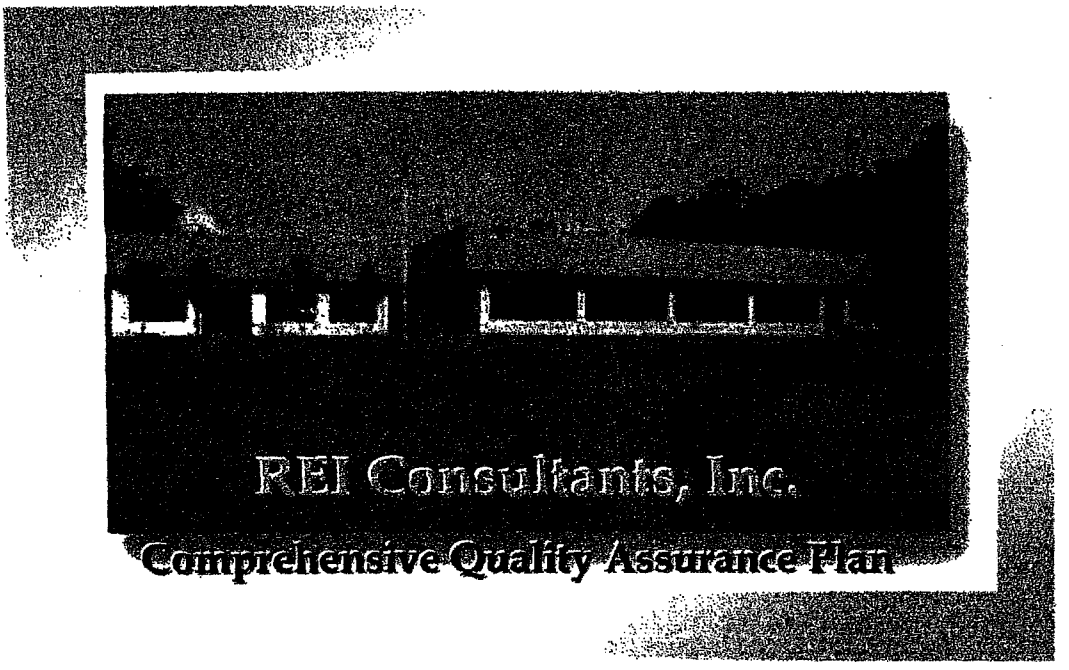
		Yes	No	N/A
9.	Were the following packing and shipping procedures performed?			
	All containers, except the volatile organic analysis (VOA) vials, are to be taped shut.	____	____	____
	Was the drain plug taped shut on the picnic cooler from the inside and outside, and a large plastic bag used as a liner for the cooler?	____	____	____
	Was inert packing material placed in the bottom of the liner?	____	____	____
	Were the sample containers placed upright in the lined picnic cooler in such a way that they do not touch and will not touch during shipping?	____	____	____
	Were plastic ice packs or ice placed in double plastic bags placed around, among, and on top of the sample bottles?	____	____	____
	Was the paperwork going to the laboratory placed inside a sealed plastic bag, which was taped to the inside lid of the cooler?	____	____	____
	Was the cooler taped shut with strapping tape?	____	____	____
	Was at least two signed custody seals placed on the cooler (one in front, the other on the side)?	____	____	____
10.	Was the proper sampling procedure followed as outlined in the Sampling and Analysis Section of the Plan of Operations?	____	____	____
11.	Was sampling equipment properly decontaminated between samples?	____	____	____
12.	Was a decontamination area located where the cleaning activities would not cross-contaminate clean and/or drying equipment?	____	____	____

Quality Control Field Oversight Checklist
HTRW Sampling Procedures
Continued

		Yes	No	N/A
13.	Was cleaned equipment properly stored?	____	____	____
14.	Were the cleaning and decontamination procedures conducted in accordance with the project plans?	____	____	____
15.	Were sampling locations properly selected?	____	____	____
16.	Were photographs taken of sampling/decon activities?	____	____	____
17.	Was sampling equipment constructed of Teflon, polyethylene, glass, or stainless steel?	____	____	____
18.	Were samples collected in proper order? (least suspected contamination to most contaminated?)	____	____	____
19.	Were clean disposable latex or vinyl gloves worn during sampling and field screening tests?	____	____	____
20.	Were gloves changed between sampling events and screening tests?	____	____	____
21..	Were equipment rinse blanks collected after field cleaning?	____	____	____
22.	Were proper sample containers used for samples?	____	____	____
23.	Were duplicate and split samples collected?	____	____	____
24.	Were samples properly field preserved?	____	____	____
25.	Were field and/or trip blanks utilized?	____	____	____
29.	Were field screening tests utilized for nitroaromatics and lead (where appropriate) prior to collection of the excavation pit confirmation samples?	____	____	____
30.	Were the procedures for the field test kits, as described in the Plan of Operations followed?	____	____	____
31.	Was all information generated during the field screening activities recorded in accordance with the Plan of Operations requirements?	____	____	____

Appendix D Laboratory QA Plan

REIC's QA Plan



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REI Consultants

Approved Signatories

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Ray Erickson Laboratory Operations Director	6-30-06 Date
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Ivan Leef Inorganic Laboratory Manager	6-30-06 Date
Angela Leef Quality Manager	6-30-06 Date
Erica Seay Roanoke Analytical Supervisor	7-7-06 Date
Grant Wilton Project Manager	6/30/06 Date
Joy Mullins Project Manager	6/30/06 Date
Kathy Lough Project Coordinator	6-30-06 Date
Rock Bortell Project Coordinator	6-30-06 Date
Beth Johnson Project Coordinator	6-30-06 Date

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1.0 Quality Assurance Policies

1.1 **Quality Assurance Policy Statement:** This is a comprehensive quality assurance plan (CompQAP) for Research, Environmental and Industrial Consultants, Inc. (REIC). This document describes REIC's quality assurance program as a consulting and analytical services laboratory. A well conceived QA program enables REIC to provide a sound framework for generation of field and laboratory data that is valid, comparable, representative and defensible. Specifically, these objectives are routinely achieved by:

- Assessing the quality of each analytical system, including precision, accuracy, and sensitivity sufficient for requirements of each project;
- Ensuring early identification of conditions which might affect quality of data of each project;
- Requiring sufficient documentation to verify the quality of data generated for each project; and
- Validating and evaluating field information and analytical results to ensure data usability.

REIC emphasizes the application of sound quality assurance (QA) and quality control (QC) principles starting from the project initiation, through all laboratory activities and finally, to the production of the final project analytical report. This document is designed to provide not only a uniform set of procedures, but also a means to measure the quality of data generated.

The validity and reliability of the information generated is assured and enhanced by the adherence to documented quality control procedures and quality assurance protocols.

1.2 **Code of Ethics:** Every effort must be made to ensure that all business decisions, products, and interactions are initiated and completed in a manner characteristic of honest, responsible and equitable actions. REIC's Code of Ethics is established to protect REIC, our clients, and our employees from actual or potential conflicts of interest and unlawful acts, and to ensure that only the highest of professional ethics are incorporated in all facets of work. A copy of REIC's Code of Ethics agreement is included as ***Appendix A*** of this CompQAP.

1.3 **Scope of the QA Program:** Understanding the scope of the QA program requires discerning the differences between QC and QA. Quality control refers to specific actions (procedures) designed to ensure that system performance is consistent with established acceptance criteria (limits). It is these specific actions that will ensure data accuracy, precision, and comparability. When the system performance is consistent with the established limits, we say that the data has been generated under in-control conditions. When not consistent, data is considered generated under out-of-control system conditions.

Quality assurance refers to the system whereby an organization, such as REIC, provides assurance to its clients that monitoring of quality-related activities has occurred (or is occurring). Implementation of the QA program, described in this CompQAP, is designed to ensure that data generated by REIC is collected under in-control conditions and sufficient documentation is available to support the data.

1.4 **Application:** This Comprehensive QA Plan describes REIC's QA program as it applies to field and laboratory activities, which generate analytical chemical data. This includes field activities, which may affect chemical integrity of samples, as well as chemical laboratory activities. Air sampling, biological sampling, toxicological studies, geotechnical parameter measurements, while not directly addressed in this plan, are sufficiently

supported by the general principles described herein. Specific procedures and requirements are provided for sampling and analysis of:

- Domestic and industrial solid waste and wastewater sampling
- Soil and sediment sampling
- Non-potable water
- Potable water
- Surface water sampling (ponds, streams, rivers)
- Monitoring wells sampling
- Air screening/monitoring
- Method development to support toxicological studies (acute and/or chronic effects).

Note: REIC is not responsible for field activities conducted by the client(s).

Analytical methodologies to which this CompQAP will support include:

- Gas chromatography
- Gas chromatography/Mass spectrometry
- Liquid chromatography
- Atomic absorption/emission
- Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP/AES)
- Inductively Coupled Plasma/Mass Spectroscopy (ICP/MS)
- Wet chemistry analysis
- Ion chromatography
- UV-VIS spectroscopy
- Combustion UV/Wet Oxidation analysis for TOC
- Material characterization
- Hydrocarbon characterization
- Infrared characterization
- Aquatic Biology evaluations
- TCLP extractions and evaluations

(Please note that a comprehensive listing of equipment and instrumentation is covered in **Appendix E** of this CompQAP.)

1.5 **Document Updates:** This CompQAP shall be reviewed and updated on a periodic basis as personnel and equipment are changed or added. Also, as new quality control procedures for field and laboratory work are developed and approved, they will be introduced to provide additional statistical information. Date and revision number will document all changes.

1.6 **Quality Assurance Project Plans:** A site specific Quality Assurance Project Plan may be prepared for a specific project based on this CompQAP. The site-specific requirements of a project as specified in the project scope of work (or work plan) are incorporated into the Quality Assurance Project Plan (QAPP). A typical project description will include the following information:

- Project background, site description, overall project objectives, intended use of acquired data and project schedule (this information will be presented in section 1.0 of the QAPP and will be adapted from Section 1.0 of this CompQAP).
- List of measurement parameters, including the acceptance criteria (precision/ accuracy) of control analytes and the detection limits for the full list of the project analytes (adapted from section 3.0 of this CompQAP).
- Tables for the number of samples to be collected and field QC samples, map of sampling locations, and types of samples to be collected i.e. surface water, groundwater, soil, sediment, and/or sludge will be included in Section 4.0.

Proficiency Test Program: REIC participates in at least three major USEPA supported Federal and State proficiency testing programs. These include the Water Supply Study

(WS Series), Water Pollution Study (WP Series), and the DMRQA Study for the NPDES Program. These programs are performed at a minimum of once per year utilizing NIST-approved PT providers for the analytes established by the EPA for drinking water and non-potable water. REIC also performs studies to comply with NELAP and the USACE HTRW accreditation programs. The specific analytes and matrices are based on the scope of laboratory services.

1.7 **Review of Requests for the Acceptance of New Work:** The General Manager is responsible for deciding whether or not to accept new work. The technical and service requirements of all requests to provide analyses are thoroughly evaluated before commitments are made to accept the work. This evaluation includes a review of facilities and instrumentation, staffing, and any special QC or reporting requirements to ensure that analyses can be performed to meet the goals of the client. Upon accepting the project, the General Manager, Laboratory Operations Directors, and/or the assigned Project Manager/Coordinator meet with the Laboratory Managers, Supervisors, and Quality Manager and distribute pertinent documentation with all project requirements and the projected time frame for completion of the analyses.

2.0 Organization and Responsibilities

-See Organizational Chart on Next Page-

2.1 **Project Director:** REIC's General Manager is the project director for all field and laboratory projects. The project director is responsible for all contractual obligations of the proposed work and direct corporate efforts as needed to achieve the project goals of schedule, cost, and technical performance. The Project Director's responsibilities include: Appointing the Project Manager/Coordinator for field project operations, the Laboratory Operations Directors and Laboratory Managers (Inorganic and Organic) for laboratory operations, supervising these individuals in performance of project duties, approving all field and laboratory QC procedures, allocating manpower, reviewing and approving new contracts and contract changes.

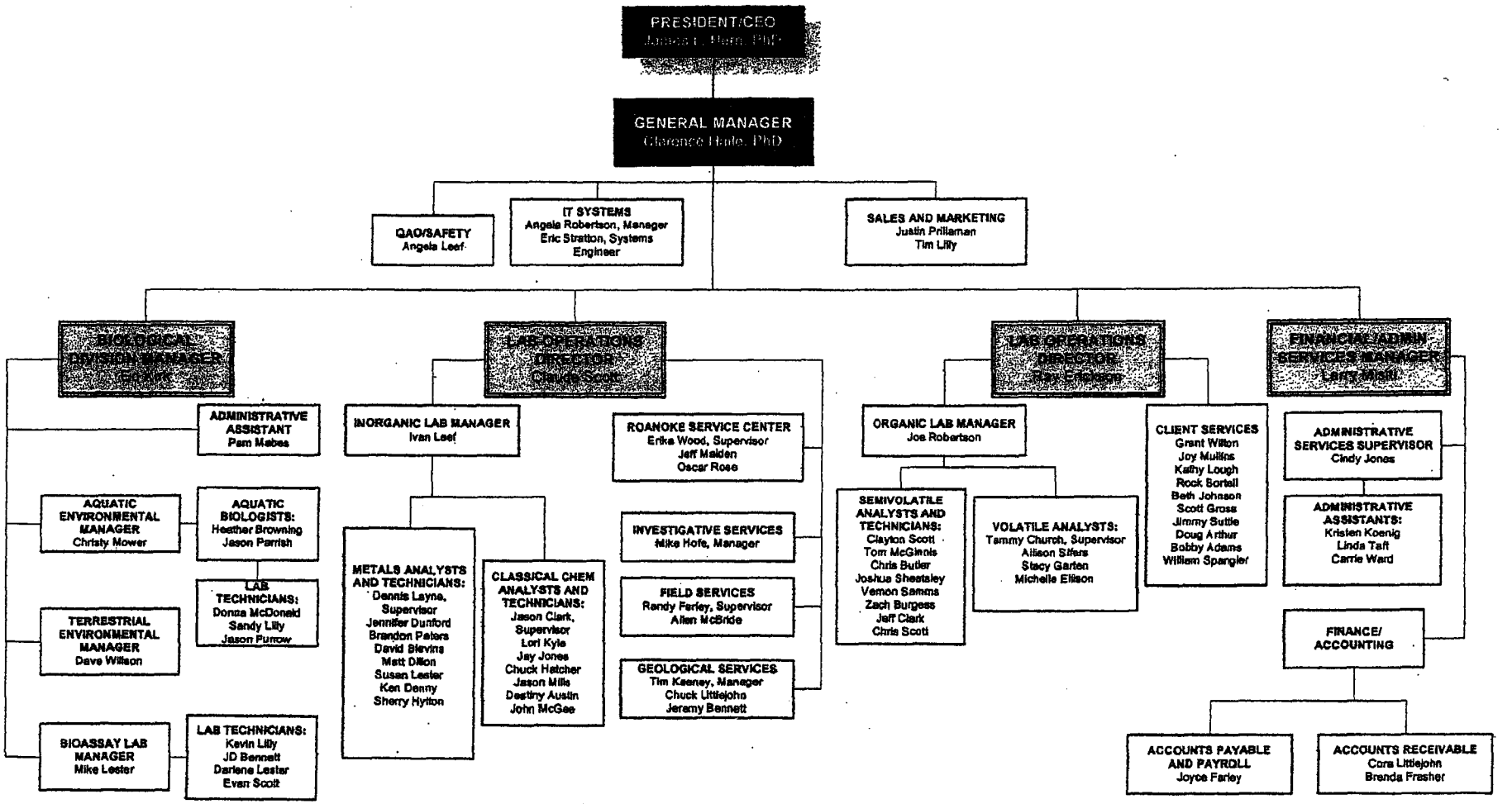
2.2 **Laboratory Operations:**

2.2.1 **General Manager** – The General Manager is responsible for management oversight and direction for all laboratory, field, financial, and administrative operations of REIC.

2.2.2 **Laboratory Operations Directors** – Laboratory Operations Directors are responsible for management oversight and direction of assigned laboratory and field operations. This includes ensuring that all personnel under their direction understand and conduct all work in compliance with this Quality Manual. Responsibilities also include ensuring that all results are properly validated prior to release to clients.

2.2.3 **Laboratory Manager** - Laboratory Managers are under the direct supervision of the Laboratory Operations Directors. The Laboratory Managers are responsible for providing consistent and accurate laboratory data produced by the analysts for compliance with precision, accuracy, and completeness objectives before final report generation. Other responsibilities include the review of any QC deficiencies reported by the analyst and/or project Quality Manager.

REI Consultants, Inc. Organizational Chart



Last Updated: April 26, 2006

2.2.4 **Laboratory Supervisor** – It is the responsibility of the Supervisors to assist the Laboratory Managers in providing consistent and accurate laboratory data produced by the analysts for compliance with precision, accuracy, and completeness objectives before final report generation. This includes assisting the Laboratory Managers in the review of any QC deficiencies reported by the analyst and/or project Quality Manager.

2.2.5 **Laboratory Analyst/Technician** - It is the responsibility of the Analysts to perform instrument calibrations, calibration verifications, and preliminary QC checks to ensure that each batch of data being generated is compliant with all method and quality program criteria. The Analyst is responsible for incorporating any data changes, resulting from the review by the Quality Manager and/or the Project Chemist, into the respective job file folder and LIMS.

2.2.6 **Project Manager/Coordinator** – Duties and responsibilities of which include serving as the point of contact for assigned clients, reviewing the *Statement of Work* for each project and verifying compatibility with laboratory capabilities, communicating project requirements to lab department managers and analysts, and reviewing project invoices and reports for completeness and compatibility with project requirements.

2.2.7 **Field Team Leader:** The Project Manager/Coordinator is responsible for effective day-to-day management of the project as well as direct communication and liaison with the client and the Laboratory Operations Directors and General Manager. The Project Manager/Coordinator has the ultimate responsibility of ensuring that all project quality control (QC) procedures are followed by the field team in the performance of the project. The Project Manager may appoint the field team leader (sampling team project leader). The field team leader is responsible to the Project Manager for ensuring that all QC and technical field procedures are followed, and that all field activities are documented properly. The field team leader and field team members must bring any unusual observations or problems to the immediate attention of the Project Manager/Coordinator and/or the Quality Manager.

2.2.8 **LIMS Administrator** - The LIMS Administrator reports to the General Manager and is responsible for managing the day-to-day operations of REIC's LIMS and computer network. These duties include all training of new personnel utilizing LIMS and any training required for new LIMS procedures. The LIMS Administrator maintains a current inventory of all hardware and software for damages/defects, troubleshooting problems and arranging for repair or replacement of all network and LIMS computers and associated equipment. The LIMS Administrator serves as the primary technical resource for LIMS and network users. The Administrator also develops, implements, and maintains policies, procedures, and SOPs for use of the network and LIMS. All security, privacy, and licensing issues are set and monitored by the Administrator. These duties also include any customization of the network and/or LIMS tests and any detailed programming as deemed necessary by the General Manager and/or Laboratory Operations Directors.

2.3 **Quality Assurance Program** - REIC's General Manager appoints the Quality Manager and is responsible for supervising the Quality Manager in the performance of his/her project duties. The Quality Manager maintains the overall company QA program and interacts with the Laboratory Operations Directors, Laboratory Managers, Project Managers/Coordinators, Laboratory Supervisors, and client QA/QC personnel to correct problem situations as necessary. The REIC Quality Manager has direct responsibility for assessing QC performance, determining if QA objectives are being met, recommending

corrective actions, and keeping the General Manager and Laboratory Operations Directors informed of all relevant QA/QC information. The Quality Manager is independent of the project team and answers directly to the General Manager. The Quality Manager is specifically responsible for the following:

- Assessing that approved QA/QC procedures are being applied to a project;
- Conducting both performance and systems audits of laboratory and field operations to ensure compliance with the requirements of the company QA program (stated in SOPs, CompQAP and/or QAPP);
- Identifying any QC deficiencies on project activities and notifying the General Manager and/or the Laboratory Operations Directors of any QC deficiencies discovered during audits;
- Providing an independent review of field information and analytical data packages to ensure the quality of all deliverables from the project team to the client;
- Interacting and communicating with client Quality Manager to resolve QA/QC problems specific to a project;
- Reporting to the General Manager as needed on the QA status of on-going projects and on the findings from formal audits;
- Monitoring the QA and QC activities of the laboratory to ensure conformance with approved company policies, procedures, sound practices, and recommend improvements as necessary;
- Ensure that sampling is conducted in a manner consistent with the CompQAP or QAPP;
- Periodically conduct field audits to inspect sampling activities; and
- Periodically audit sampling documentation and procedures to ensure that samples are labeled, preserved, stored, and transported according to approved chain-of-custody procedures.

2.4 **Training** – All personnel are trained in new methods utilizing a mentoring process. New staff members (or staff members learning new methodologies) are assigned to their immediate supervisor or an experienced staff member. Each employee must read, understand, and use the latest version of the laboratory's SOPs, which relates to the new methodology as well as the associated reference material. The development and training associated with new analytical methods is discussed in section 10.3 (Demonstration of Method Capability).

The mentoring process occurs as follows:

- The staff member is familiarized with the method by observation of an experienced staff member;
- Supervised practice of the method, with review by the trainer and supervisor;
- Unsupervised practice of the method, with review, this may include a blind spike sample or other blind unknown;
- Unsupervised performance of the method.

Completion of these steps is documented on a training checklist signed by the supervisor/laboratory manager of the department. For newly trained employees, work is reviewed daily by the supervisor until the supervisor is satisfied the employee is competent in the procedure. All analytical data produced by the new staff member is also reviewed and signed off by the laboratory supervisor.

Each employee demonstrates continued proficiency by acceptable performance on in-house laboratory control spikes, blind samples, and/or inter-laboratory comparison exercises. Training records (to include continuing education, participation in vendor or industry training classes) are kept in the personnel training records maintained by the laboratory managers and the personnel office.

2.5 **Laboratory Capabilities** – The professional staff of REIC consists of over sixty trained, undergraduate and graduate scientists whose knowledge and experience span the disciplines of analytical chemistry, environmental chemistry, biochemistry, chemical engineering, geology, and biology. All work is based on methodologies and approaches established by the US EPA, State agencies, industrial standards, and professional codes, and are enforced by a stringent QA/QC program. A more complete listing of REIC's qualifications can be found in REIC's "Statement of Qualifications" document. A complete listing of REIC's instrumentation can be found in **Appendix E**. A copy of REIC's "Data Integrity and Ethics Policy" is also included in **Appendix A**

2.6 **Laboratory Minimum Level of Qualifications** – Employment in the laboratory must meet the following criteria at a minimum:

1. **Technician** – High school graduate or GED.
2. **Analyst** – Above criteria plus experience or additional training in a laboratory.
3. **Biologist/Chemist/Engineer** – College degree.
4. **Laboratory Manager** – College courses and/or degree plus items (1) and (2) above.

2.7 **Laboratory Transfer of Ownership or Closure** – If the ownership of the laboratory is transferred or the laboratory is closed existing clients will be notified immediately. A letter will be provided to all clients detailing re-organization conditions and an explanation of any effects or changes in laboratory operations. In case of laboratory closure, clients may not be ready to terminate contact by the closing date. Sufficient time will be allowed for clients needing additional analyses to transfer samples to other laboratories. All existing clients will be provided referral options. New clients will be referred upon contact. The relocation of client records will be considered carefully. While some clients will have copies of their analytical records transferred to another laboratory, the original client records will either be returned upon request at their expense or destroyed. A signed release of information form will be obtained before transferring records.

3.0 Quality Assurance Objectives for Data Measurements

The overall quality assurance objective is to ensure that data of known and acceptable quality is generated. The quality of data is measured through qualitative and quantitative parameters. These parameters include accuracy, precision, completeness, representativeness, and comparability. Proper execution of each project task is needed in order to yield consistent information, results that are representative of the media and conditions being measured, and ultimately be useful for meeting the intended project objectives. REIC will calculate and report data in units consistent with those of other organizations and agencies to allow comparability of databases. REIC performs analyses for specified compounds using the standardized methods. In the process, baseline data is applied to establishing control limits for daily analyses. These control limits, which include precision, accuracy, and reporting limits, may therefore be considered for typical performance.

3.1 **Comparability** - Comparability is the confidence with which one data set can be compared with another. These data sets include data generated by different laboratories performed under the same work plan, data generated by laboratories in previous years, or data generated using differing techniques or analytical protocols. The comparability objectives of REIC are as follows:

- Demonstrate traceability of standards to the National Institute of Standards and Technology (NIST) or EPA approved sources,
- Use standard methodology,
- Report results from similar matrices in standard units,
- Apply appropriate levels of QC within the context of the laboratory QA program, and

- Participate in inter-laboratory studies to document laboratory performance.

When traceable standards and standard methodology are used, the analytical results can be compared to other similarly operating laboratories.

3.2 **Representativeness** - Representativeness expresses the degree to which sample data accurately and precisely represents actual conditions. Representativeness is a qualitative determination. The representativeness objective of REIC's quality assurance program is to eliminate conditions that may result in non-representative data. In the laboratory proper temperature, extraction, and sample holding times are closely observed to ensure that sample integrity is maintained. Also, blank samples are examined for cross contamination.

3.3 **Completeness** – Completeness is a measure of the amount of the data obtained from a measurement system compared to the amount that is expected to be obtained under correct normal conditions. The minimum level of completeness expected is 95 percent for each analytical method requested. This is expected to be achieved by ensuring proper sample extraction procedures. Also, for each sample received by the laboratory, especially those shipped in fragile containers, a backup sample is to be made available in case breakages occur, or when the analyses criteria are not initially met.

3.4 **Accuracy** - Accuracy is the degree to which a measurement agrees with the actual value, i.e. amount of measurement bias. Accuracy is expressed as a percent recovery of a concentration of reference material (or laboratory standard). The accuracy of an analytical procedure is determined by addition of a known amount of spike standard to a field sample matrix or a laboratory control matrix. A control matrix is made of distilled (or deionized) water or sterile, clean soil (with known physical and chemical properties). The field sample matrix is described as all components of the sample mixture except the analyte (compound being measured). A method for the determination of accuracy values, which is routinely used in the laboratory, is described in section 12.0 of this CompQAP. Examples of accuracy acceptance criteria for control analytes and associated method reporting limits can be provided to clients upon request.

3.5 **Precision** - Precision is a measure of the degree of reproducibility of an analytical value and it is used as a check of the quality of the sampling and analytical procedures. Precision is determined by analyzing replicate samples. The significance of a precision measurement depends on whether the sample is a field duplicate, laboratory control matrix duplicate, or a matrix spike duplicate. Laboratory determination of precision is discussed in section 12.0 of this CompQAP. Examples of current precision acceptance criteria for control analytes along with associated method reporting limits and method detection limits can be provided to clients upon request.

3.6 **Detection Limits** – REIC references two types of reporting limits: Method Detection Limits (MDLs) and Practical Quantitation Limits (PQLs).

MDLs are determined for all analytes as specified in 40CFR 136 Appendix B[1] and as described in the NELAC standards. The MDL is defined as the minimum concentration of an analyte that can be measured by the method 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. All MDLs are determined for each test and matrix according to US EPA requirements as part of an initial demonstration of capability. MDLs are determined on for each method and sample matrix unless stated otherwise by the determinative method.

[1] Appendix B to Part 136 – Definition and Procedure for the Determination of the Method Detection Limit. Revision 1.11 (40CFR Chapter 1-Part 136).

PQLs are defined as the lowest standard of the initial calibration curve for the inorganic and organic assays. This standard is typically between 5 to 10 times the MDL. The PQL is confirmed by analyzing a laboratory control sample spiked at this level with an expected recovery that is dependent upon the analytical method.

REIC references PQLs as the default reporting limits for all clients who do not specify reporting limit requirements. Data are flagged between the PQL and the MDL when clients request reporting to MDLs. The MDLs and PQLs are compiled by the Laboratory Supervisors and Quality Manager. See **Appendix C** for more detailed information.

4.0 Sampling Procedures and Sample Handling

4.1 Field Sampling Operations: Prior to any field operations, the Field Services Supervisor and field team personnel will review the project work plan and the associated QAPP. These documents should be referenced for specific information concerning equipment, supplies, and sampling procedures. The field sampling procedures included in these documents and REIC's field sampling standard operating procedures include: documentation requirements, sample collection, preservation, packaging, shipping, and equipment decontamination.

4.2 Sample Handling

4.2.1 Sample Containers/Preservation/Holding Times - Standard sampling kits are used. The kits are prepared according to the type of analysis requested ***(See Appendix D)***. All sample kits are prepared by the sample custodian and made ready for walk-in clients, delivery by REIC courier, or shipment by bonded courier. All kit supplies are stored in REIC's kit preparation room to avoid cross contamination. Unless specified, all sample containers used are pre-cleaned commercially. They are purchased from commercial vendors as pre-cleaned containers. Sample containers used at REIC laboratory are disposable; therefore, washing is not necessary before sample kits are prepared for clients or REIC field personnel. All sample kits are transported in coolers to the field. A Chain-of-Custody (COC) sheet is enclosed. The sample identification labels on the containers must always match those on the sample COCs. Sample kits can be delivered by a REIC courier, picked up by the client, or shipped by bonded carrier (i.e. UPS, Federal Express). Clients are encouraged to transport samples to the laboratory as soon as possible so that holding times ***(see Appendix D)*** will not be exceeded. ***Although REIC will give advice on sample shipping and packing, it is the sampler's ultimate responsibility to representatively sample, pack, and ship the samples to REIC Laboratory.*** The types of preservatives used are provided in ***Appendix D***. Clients or REIC field personnel may receive sample containers pre-preserved. The laboratory will supply additional preservatives in suitable containers for sample preservation in the field.

4.2.2 Sample Dispatch to the Laboratory: Field documentation will consist of (at a minimum): field notes, sample labels, and COC forms (or sample transmittal forms). Samples will be packed such that they are segregated by site, sampling location or sample analysis type. VOC samples from different locations may be placed in the same coolers with materials (i.e. bubble wrapped and sealed in a Ziploc-type bag) to avoid breakage. Shipping containers will be insulated (if cooling is required) and will be sealed with tape or locked to avoid tampering. Reusable refrigerant packs (not dry ice) or a water ice bath will be used in cooling samples to 4°C. Packed samples will be delivered to the laboratory by the sampling team or via a common carrier.

4.2.3 **Field Reagents and Waste Handling:** All chemicals transported to the field will be stored in appropriate containers, labeled, and will be packed to avoid breakage. Chemicals will be segregated from sample containers so as to avoid accidental contamination. All reagents must be reagent grade or higher.

4.2.4 **Field Waste Disposal:** All field-generated wastes will be segregated and contained for proper disposal by a commercial contractor. Associated cost may be negotiated with clients in advance of the project initiation. All non-chlorinated solvents (isopropanol, hexane, and acetone) will be collected and returned to the laboratory to be disposed of or recycled by a commercial contractor. Acids and bases will be diluted or neutralized and can be flushed into a sanitary sewer or will be disposed of commercially. Contaminated purge waters will be contained and disposed of commercially or will be allowed to evaporate on an impermeable surface. Calibration standards for field meters will be diluted and flushed into the community treatment sewer.

5.0 Test Methods and Standard Operating Procedures

REIC maintains Standard Operating Procedures (SOPs) for all laboratory methods, field activities, and general operations. The SOPs are based on the guidance as published by EPA (QA/G-6 Guidance for the preparation of Standard Operating Procedures and other pertinent industry references[2]. The SOPs describe the equipment and actual procedures used in the laboratory. Copies of the SOPs are readily available to all personnel. Each SOP indicates the effective date and the revision number. Any calculations that are performed external to an instrument or in its automation software are documented in the SOP.

SOPs are used to ensure consistency and to save time and effort. Any deviations from the established procedure during an analysis are documented. All SOPs are reviewed on a yearly basis and as changes become necessary (incorporating advances in instrumentation/technology and/or EPA approved methodology updates) under the direction of the laboratory managers and Quality Manager.

6.0 Sample Custody and Integrity

Sample custody is a vital aspect of an environmental measurement program. Some environmental study programs generate data that may be used as evidence in a court of law. The samples must be traceable from the time of sample collection until the data is introduced as evidence in enforcement proceedings. A sample is said to be in someone's custody if it meets the following criteria:

- It is in someone's physical possession,
- It is in one's view, after being in one's physical possession,
- It is in one's physical possession and then locked or sealed so that tampering will be evident, or
- It is kept in a secure area, restricted to authorized personnel only.

6.1 **Field Sampling Operations:** The chain-of-custody (COC) record is initiated at the time the sample containers are dispatched to the field sampling team. The field sampling team may be the client's or REIC's field sampling personnel. A formal sample custody record ***(See REIC's COC on the following page)*** accompanies each set of containers. The form ensures that a system is made available by which sample information is logged

[2] Other SOP references include Good Laboratory Practices (40 CFR Part 160) and the USACE's Shell for Analytical Chemistry Requirements.

from the point of sampling through each change of custody until the samples arrive at the laboratory. Although the laboratory can give advice to the client on sample packaging and shipping procedures, it is the client's ultimate responsibility to provide proper and adequate documentation until the samples are relinquished. A Chain-of-Custody (COC) is used by the field team to record sample identification and the following information: sample description, collection date and time, sampling location, preservation, analyses required, samplers' names, comments concerning the samples, client name, and the signature of the person relinquishing the samples to the bonded carrier or REIC personnel. Errors in all field sampling documents are deleted with one line through the error, initialed and dated.

6.2 Laboratory Operations:

6.2.1 Receiving Samples - Samples may be shipped to the laboratory or picked up by a REIC courier (when locality allows). In all cases, a REIC representative will sign, date, and record the time on appropriate custody forms as receiving the sample cooler. At the laboratory, the sample custodian will immediately initiate the following steps:

- Check samples for breakage or leakage,
- Check the temperature of the ice bath,
- Verify the number of samples received and confirm that all container designations agree with information provided on the Chain-of-Custody.
- Record any breakage of sample bottle seals, which may have occurred during transport to the laboratory.
- The sample custodian notes the condition of the samples and coolers on the accompanying Chain-of-Custody forms and
- Then proceeds to log the samples into a Laboratory Information Management System (LIMS).
- Upon finding any sample preservation or documentation discrepancies (broken sample containers, cooler damage) or any suspicious findings which might indicate that sample integrity has been compromised, the client is notified immediately and the matter is resolved before the samples are approved and actually accepted for analysis.
- A copy of the custody form is returned to the client with the sample analysis deliverable report and another copy is kept on project file at the laboratory.
- If the scope of the project should change after the samples have been received in the lab, this is documented on the Chain-of-Custody.

6.2.2 Bill of Lading - A bill of lading (bus bill or air bill) documents receipt of the samples by the carrier. It is not possible for the carrier's representative to sign the custody form since it is sealed in the sample cooler. Bills of lading are kept on project files at REIC.

6.2.3 Tracking of Samples - Proceeding with log-in, the sample custodian enters sample identifications (IDs) and other associated information such as: Lab sample IDs, sampling date, client IDs, etc., into a computerized sample tracking system -- ***Laboratory Information Management System (LIMS).*** The tracking system consists of a customized program having the ability to search and locate individual samples in the laboratory. All data within the computer system is copied (backed-up) on magnetic tape and secured at the end of each working day. Hard copies of sample tracking worksheets are maintained and copies placed in sample file folders along with Chain-of-Custody forms. These tracking documents, as well as the LIMS, help to coordinate the analyses required. Sample handling, preparation, and analysis are documented on tracking

worksheets throughout their analysis period in the laboratory. The tracking worksheets include such information as the Lab sample IDs, clients IDs, storage, preservation, actions, sample date, extraction date, analysis date, etc.

6.3 **Maintaining Sample Integrity** - Upon receiving samples from the field, improper conditions for each sample will be documented on the chain of custody and will be reported to the Project Manager/Coordinator and the client. The Project Manager/Coordinator will then make a decision after consulting with the General Manager, Laboratory Operations Directors, and/or client Project Officer on whether to reject the sample. REIC maintains walk-in environmental chambers, which are specific for various types of sample analyses. They are maintained in a manner such that internal contamination is minimized. The chambers are monitored and their environmental conditions are recorded continuously. Additionally, the chambers have both audible and electronic notification alarm systems to warn if ambient conditions drastically change due to chamber malfunctions. Upon conclusion of the appropriate analysis, any additional sample materials are stored for a period of two weeks after formal notification of results being submitted to the client. At that time, the samples are disposed of in an environmentally friendly manner or returned to the client. All sample disposal is carried out in accordance with Federal and State regulations.

7.0 Calibration Procedures and Frequency

The quality assurance objective of instrument calibration is to ensure that the instrument employed is capable of producing acceptable quantitative data. Initial calibration is designed to indicate that the instrument is capable of acceptable performance at the beginning of the sample analysis sequence. Continuing calibration verification is necessary in order to demonstrate satisfactory instrument performance (calibration accuracy) over the duration of sample analysis.

7.1 Field Instruments:

7.1.1 **pH Meter** - Standardize the pH meter immediately before taking any measurements. The calibrating solutions must bracket the sample analyses - either pH 7.0 and pH 4.0 or pH 7.0 and pH 10.0. Use the following procedure to standardize the meter:

- Place the probe in the pH 7.0 and adjust the knob to achieve a reading of 7.0.
- Place the probe in the second solution (whether 4.0 or 10.0) and adjust the knob to achieve the reading of 4.0 or 10.0, accordingly.
- Repeat those steps until adjustment is no longer needed. Clean the probe with distilled water and clean tissue. ***Note: Store the probe in distilled water when not in use.***

7.1.2 **Temperature** - No calibration is required in the field for the temperature probe. See laboratory thermometer comparison with the NIST certified thermometer ***(Section 7.3.8 "Temperature Monitoring").***

7.1.3 **Conductivity** - Use a KCl solution to check the (K) constant daily. Maintain a record (log book) of each check. Clean the probe with distilled water and tissues. Measure conductivity of the sample in a Teflon or plastic bottle.

7.1.4 **Dissolved Oxygen (DO)** - The oxygen meter to be used in the field will be calibrated in the laboratory. A record for calibration must be reviewed by the field technician before taking the instrument to the field.

REIC

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CHAIN OF CUSTODY RECORD NO. 148237

CLIENT: _____ CONTACT PERSON: _____
ADDRESS: _____ TELEPHONE #: _____
CITY/STATE/ZIP: _____ FAX #: _____
BILL TO: _____ E-MAIL ADDRESS: _____
CITY/STATE/ZIP: _____ SITE ID & STATE: _____
PURCHASE ORDER # _____ PROJECT ID: _____
QUOTE # _____ SAMPLER: _____

SAMPLE LOG AND ANALYSIS REQUEST

TURNAROUND TIME REQUIREMENTS
REGULAR: ___
*RUSH: ___ 5-Day ___ 3-Day ___ 2-Day ___ 1-Day
*Rush work needs prior Laboratory approval and will include surcharges

PRESERVATIVES
0 No Preservative
1 Hydrochloric Acid
2 Nitric Acid
3 Sulfuric Acid
4 Sodium Thiosulfate
5 Sodium Hydroxide
6 Zinc Acetate
7 EDTA

PRESERVATIVE CODES — NOTE PRESERVATIVES →

ANALYSIS REQUESTED & METHOD

SAMPLE ID	NO. & TYPE OF CONTAINERS	SAMPLING DATE / TIME	MATRIX	SAMPLE COMP / GRAB														COMMENTS

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time
Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Date/Time	Temperature Upon Arrival °C	☐ FAX Results	☐ Email Results	

7.2 **Standard Receipt and Traceability of Calibrations:** All calibrations and working standards are prepared from pure or commercially available materials. Upon receipt, standards are dated and all information concerning these standards including LOT#, supplier, concentration, and purity is filed. If the standard has an expiration date, the date is circled in ink to ensure the analyst does not use expired standard. As the standards expire, each is disposed of in an environmentally safe manner. All other information concerning these chemicals can be obtained through the information in the purchase order book/REIC's inventory system and/or the supplier of chemicals as necessary. Working standards are prepared either directly from the stock standard or an intermediate standard is prepared and the working standards are prepared from the intermediate standard. **A standards preparation log is maintained for analytical sections.** The daily working standards are entered as prepared in a standards logbook. All stock and intermediate standards are prepared either in Class A volumetric glassware or serially diluted from standards prepared in Class A volumetric glassware. Laboratory equipment such as balances, ovens, refrigerators, freezers, incubators, water baths, temperature measuring devices and volumetric dispensing devices are documented as follows:

- Records are kept of all activities such as maintenance and service calls.
- Calibrations are documented per method and/or manufacturers instructions, using NIST traceable references where available over the entire range of use.

7.3 **Laboratory Instruments:** The major instrumentation and calibration procedures are discussed below. This is only the general overview. Detailed calibration procedures and frequency are in each method and instrument manufacturer operation manual. All calibration materials are purchased (where possible) in a pure form and are diluted to working concentration levels using standard analytical techniques.

7.3.1 **Spectrophotometric, Potentiometric, Colorimetric, Turbidimetric, Infrared (IR), and Ultraviolet Absorption** - This section applies to those inorganic and organic analyses that require the use of a standard calibration curve for calibration. The working calibration is generated by plotting the standard response for each standard versus the concentration of each standard. Quality control acceptance criteria for calibration of this group of instruments includes:

- Constructing a 3-5 point calibration curve (3-5 standards and a blank) prior to any sample analysis, as needed. Refer to the calibration instructions of the manufacturer and the specific calibration section of each EPA method. The correlation coefficient of the line must be $\geq$0.995. Failure to meet these criteria will necessitate reanalysis of the standards.
- Monitoring of the instrument's consistency response is demonstrated through the analysis of a midlevel standard or Continuing Calibration Verification (CCV) after the analysis of ten (10) samples. The response of the CCV must generally be within $\pm$10 percent of the true value. Failure to meet these criteria will necessitate reanalysis of all samples analyzed since the last acceptable CCV.
- Demonstrating system cleanliness through the analysis of a method reagent blank prior to sample analysis.
- Maintaining sample response within the response limits of the standards.

7.3.2 **pH and Ion Specific Analyzers:** Quality control acceptance criteria for the calibration of this group of instruments includes:

- Constructing a three (3) point (2 points for pH) calibration curve prior to the analysis of any sample(s).
- Verifying instrument's consistency response through the periodic analysis (after the analysis of every 10 samples) of standards.
- Demonstrating system cleanliness through the analysis of a method reagent blank prior to sample analysis.
- Maintaining sample response within the limits of the standards' response. The pH meter is calibrated with known buffer via the pH closest to the expected sample pH. A second buffer (4, 7, or 10) is used to verify that the first measurement (buffer) was correct.

7.3.3 **Trace Metals and Cyanide Analysis Calibration:**

Atomic Absorption Analysis

Volumetric dilutions are made from stock solutions to obtain intermediate standards (100, 10 and 1.0 ppm) solutions. These intermediate standards may be used directly as working standard solutions or diluted as necessary for flame analysis. However, for more sensitive graphite furnace and hydride analyses, volumetric dilutions must be prepared from the 1.0 and 10 ppm standard solutions to generate working standards. The working standard solutions must be prepared daily. The acceptance criteria for calibration of the AA are as follows:

- The instrument must be calibrated daily and each time the instrument is set up. A blank and at least three standards must be used in establishing the calibration curve. One of the standards must be at the PQL.
- The correlation coefficient of the line must be $\geq$0.995. Failure to meet this criterion will necessitate reanalysis of the standards.
- Instrument consistency is monitored through the analysis of a midlevel standard (CCV) and the calibration blank after the analysis of ten (10) samples. The response of the CCV must be within $\pm$10 percent of the true value. Failure to meet this criterion will necessitate reanalysis of all samples analyzed since the last acceptable CCV.
- System cleanliness is demonstrated through the analysis of a reagent blank prior to sample analysis.
- The sample response must be maintained within the limits of the response of the standards.

Mercury Analysis

- The instrument must be calibrated daily and each time the instrument is set up. A blank and 5 standards must be used in establishing the calibration curve.
- The correlation coefficient should be $\geq$0.995.
- Continuing calibration verification (CCV) standards are analyzed at a minimum of every 10 samples to document consistent instrument response. The CCV result must be within $\pm$10% of the true value.

Cyanide Analysis

- The instrument must be calibrated daily and each time the instrument is set up. A blank and at least three standards must be used in establishing the calibration curve.
- The correlation coefficient for the photometric calibration should be $\geq$0.995.

- Initial calibration verification (ICV) and Continuing calibration verification (CCV) standards are analyzed at a minimum of every 10 samples to document consistent instrument response. The results of ICV and CCVs for each element in the solution must be within 10% of their respective true values.

Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP-AES)

Multi-element calibration standards are prepared as needed. The analyte concentrations in the standards are verified daily by observing changes in emission intensity and by analyzing known independent check standards.

- The instrument is calibrated daily and each time it is set up. A blank and at least three standards are used in establishing the analytical calibration curve.
- A Continuing calibration verification standard and a continuing calibration blank are analyzed at a minimum of every 10 samples to document consistent instrument response. The results of CCVs for each element in the CCV solution must be within 10% of their respective true values.
- A laboratory control sample (LCS) serves as a monitor of the overall performance of all steps in the analysis, including the sample preparation. All aqueous LCS results must fall within 15% or less of the true value.

Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)

Multi-element calibration standards are prepared as needed. Analyte concentrations in the standards are verified daily by analyzing known independent check standards.

- The instrument is calibrated daily and during each set up. A blank and at least two standards (generally 3) are used in establishing the analytical calibration curves.
- The continuing calibration verification (CCV) solution and a continuing calibration blank are analyzed after every 10 samples to document consistent instrument response. The results of the CCVs for each element must be within 10% of their respective true values.
- A laboratory control matrix spike (LCS) serves as a monitor of the overall performance of all steps in the analysis, including the sample preparation. All aqueous LCS results must fall within 15% or less of the true value.
- Mass and detector calibrations are performed on a weekly basis. Tuning of the instrument is performed daily.

7.3.4 Tuning and GC/MS Mass Calibration

- Refer to calibration instructions of the manufacturer and the specific calibration section of each EPA method for analysis of volatiles and semivolatiles.
- A tune must be performed during each analytical shift (every 12 hours for SW846 8260/8270 and EPA 524/525, and every 24 hours for EPA 624 and 625 Methods). For BNA analysis the instrument shall be tuned to DFTPP. For VOA analysis the instrument is tuned to BFB. Tuning is designed to assure that instrument response meets specifications. (See table on next page for examples of mass intensity specifications for DFTPP and BFB.)
- No data may be collected prior to the initial tune. For VOA analyses, the BFB tune and the initial or continuing calibration may be

performed simultaneously as long as the tune is performed before calibration. The same is true for BNA analysis.

- Generate a minimum five (5) point initial calibration for SW-846 8260/8270, a minimum six (6) point for EPA 525, and a minimum three (3) point initial calibration for EPA 624/625/524 to include all target analytes. The relative response factor (RRF) and percent relative deviation (%RSD) will be calculated for each compound.
- For all CCCs (VOA and BNA), the %RSD must be less than or equal to 30 percent according to SW-846 8260/8270, or the %RSD for all compounds must be less than or equal to 30% for EPA 524/525 (35 percent according to EPA 624/625). *Note: Other calibration approaches may be used but must follow guidelines established by the determinative method.*
- A midlevel standard from the initial calibration standards is used in daily analysis. The difference (or drift) between the average RRF of the CCCs in the daily calibration and initial calibration standards must be less than or equal to 20 percent for SW-846 8260/8270 or the difference or drift of all compounds must be less than or equal to 20 percent for EPA 625. (See EPA 624 for specific midlevel QC requirements.)

7.3.5 GC/HPLC Analysis:

- Generate a 5-point calibration curve (minimum of 3-point for drinking water and wastewater methods) for all analyzed compounds monthly or prior to any sample analysis, as needed. Refer to the calibration instructions of the manufacturer and the specific calibration section of each SW846/EPA method.
- Analyze the instruments consistency response through the analysis of a standard after every analytical shift or daily (12hours for SW846).
- Demonstrate system cleanliness through the analysis of a reagent blank prior to sample analysis.
- Maintain sample response within the limits of the response of the standards.

7.3.6 Gravimetric Methods Calibration: A set of Class 1 certified weights is used to check the calibration daily. The analytical balance is checked with at least one weight. The weight selected is to reflect the routine use of the balance. The check is performed by the first analyst to use the balance during the day. Results are recorded in the balance calibration logbook. The full set of Class 1 weights is used to check calibration on a monthly basis. All analytical balances are re-certified on an annual basis.

Tune Criteria for Volatile and Semivolatile GC/MS Analyses

BFB Key Ion Abundance Criteria [a]	
Mass	**Ion Abundance Criteria**
50	15 - 40% of mass 95
75	30 -60% of mass 95
95	base peak, 100% relative abundance
96	5 to 9% of mass 95
173	< 2% of mass 174
174	> 50% of mass 95
175	5 to 9% of mass 174
176	> 95% but < 101% of mass 174
177	5 - 9% of mass 176

DFTPP Key Ion Abundance Criteria [a]	
Mass	**Ion Abundance Criteria**
51	*30 - 60% of mass 198*
68	*< 2% of mass 69*
70	*< 2% of mass 69*
127	*40 - 60% of mass 198*
197	*< 1% of mass 198*
198	*base peak, 100% relative abundance*
199	*5 - 9% of mass 198*
275	*10 - 30% of mass 198*
365	*> 1% of mass 198*
441	*present but < mass 443*
442	*> 40% of mass 198*
443	*17 - 23% of mass 442*

[a] Test Methods for Evaluating Solid Waste, Final Updates III. Revision 4, December 1996.

7.3.7 **Titrimetric Methods Calibration:** Primary standard reference materials are purchased through a supplier. All purchased titrants and back titrants must be standardized and certified by the supplier. QC check standards of the parameter of interest will be prepared and analyzed to verify standardization and the analyst ability to discern the end point.

7.3.8 **Temperature Monitoring:** Temperatures for refrigerators, ovens and incubators are measured on a daily basis and recorded in appropriate temperature logbooks. Dedicated thermometers are checked annually against the NIST certified thermometer and documented. Walk in coolers and study chambers are fitted with wheel chart recording thermometers that monitor and record temperatures continuously on a 24 hour basis. These recording thermometers have both audible and electronic alarm systems. The temperature recordings are verified annually against the NIST certified thermometer. Equipment with out-of-control temperature findings will be adjusted to correct the temperature and it will be monitored more frequently until the temperature is in-control and steady.

7.3.9 **TOC Analysis** – An operating calibration curve is prepared daily prior to sample analysis by measuring a reagent blank and at least three organic carbon standards. A reagent blank and a standard is analyzed after every 10 sample measurements. Each check must be within 10% of the true value.

7.3.10 **Ion Chromatograph:**

- The ion chromatograph is calibrated daily, before sample analysis, using a calibration blank and 3-5 standards.
- The instrument's consistency response is demonstrated through the analysis of a standard after every ten (10) samples analyzed.
- System cleanliness is demonstrated through the analysis of a deionized water blank prior to sample analysis and after every 10 samples.
- Sample response is maintained within the limits of the response of the standards.

7.3.11 **Adiabatic Calorimeter:** A benzoic acid pellet is analyzed prior to any analysis to ensure correct operation of the calorimeter. The value of the pellet must fall within the acceptable range of 2400 cal/g ± 10 cal/g. Should the value fall out of the acceptable limits, another pellet is analyzed. If the value is still unacceptable, troubleshooting and servicing may be needed.

8.0 Analytical Procedures

8.1 **Field Analytical Procedures:** Conductivity, salinity, pH, dissolved oxygen, and temperature are the most common field parameters. These parameters are measured in the field according to EPA methods ***(see Section 3.0)*** and internal REIC SOPs.

8.2 **Laboratory Analytical Procedures:** The analytical procedures used are listed in Section 3.0. Analyses of samples will be performed in accordance with protocols and QA procedures established by the EPA.

8.2.1 **Sources for Drinking Water Methods –**

- Title 40 of the ***"Code of Federal Regulations"*** (40 CFR), Parts 141 and 143 National Primary and Secondary Drinking Water Regulations; Sampling, Monitoring, and Analytical Requirements;
- ***"Methods for the Determination of Organic Compounds in Drinking Water"***, EPA/600/4-88/039, Dec. 1988; Revised July 1991; appended with "Supplement I", EPA/600/4-90/020, July 1990; and "Supplement II", EPA/600/R-92/129, Aug. 1992; and "Supplement III", EPA/600/R-95/131, August 1995. U.S. EPA.
- ***"Manual for the Certification of Laboratories Analyzing Drinking Water,*** Fifth Edition", EPA 815-R-05-004. January 2005. U.S. EPA.
- ***"Methods for Chemical Analysis of Water and Wastes"***, EPA/600/4-79/020; March 1983, U.S. EPA.
- ***"Annual Book of ASTM Standards"***, Vols. 11.01 and 11.02; http://www.astm.org
- ***"18th Edition of Standard Methods for the Examination of Water and Wastewater"***, American Public Health Association, Washington, DC.

- ***"Methods for the Determination of Metals in Environmental Samples"***, EPA/600/4- 91/010, June 1991; appended with "Supplement I", EPA/600/R-94/111, May 1994; U.S. EPA.
- ***"Methods for the Determination of Inorganic Substances in Environmental Samples"***, EPA/600/R-93/100; Aug. 1993, U.S. EPA.
- ***"Technical Notes on Drinking Water Methods"***, EPA/600/R-94/173; Oct. 1994, U.S. EPA.
- ***"Microbiological Methods for Monitoring the Environment, Water and Waste"***, EPA/600/8-78/017, Dec. 1978; U.S. EPA.

8.2.2 Sources for Wastewater (NPDES) Effluent Methods –

- ***"Guidelines Establishing Test Procedures for the Analysis of Pollutants"; Title 40 "Code of Federal Regulations"*** (40 CFR), Part 136; Tables IA, IB, IC, ID, and IE; and Table II.
- ***"Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms***, Fifth Edition", EPA-821-R-02-012, October 2002; U.S. EPA.
- ***"Appendix C to Part 136 - Inductively Coupled Plasma / Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes, Method 200.7";*** Title 40 CFR 136.
- ***"Methods for Chemical Analysis of Water and Wastes"***, EPA/600/4-79/020; March 1983, U.S. EPA.
- ***"18th Edition of Standard Methods for the Examination of Water and Wastewater"***, American Public Health Association, Washington, DC.
- ***"Appendix A to Part 136 - Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater"***; Title 40 CFR 136, Revised as of July1, 1995.
- ***"Annual Book of ASTM Standards"***, Vols. 11.01 and 11.02; reprinted annually; American Society for Testing and Materials, Philadelphia, PA. http://www.astm.org
- ***"Microbiological Methods for Monitoring the Environment, Water and Waste"***, EPA/600/8-78/017, Dec. 1978; U.S. EPA.
- ***"Methods for the Determination of Metals in Environmental Samples"***, EPA/600/4- 91/010, June 1991; appended with "Supplement I", EPA/600/R-94/111, May 1994; U.S. EPA.
- ***"Methods for the Determination of Inorganic Substances in Environmental Samples"***, EPA/600/R-93/100; Aug. 1993, U.S. EPA.

8.2.3 Sources for Surface Water and Groundwater Methods –

- ***"Test Methods for Evaluating Solid Waste, Physical / Chemical Methods,*** Third Edition, SW-846", Nov. 1986; revised by "Revision I", Dec. 1987; amended by "Update I", July 1992; "Update IIA", Aug. 1993; and "Update IIB", Sept. 1994; "Update III", December 1996. U.S. EPA. http://www.epa.gov/epaoswer/hazwaste/test/main.htm
- ***"US EPA Contract Laboratory Program, Statement of Work for Inorganic Analysis"***; Document No. ILM 05.2, 2002. http://www.epa.gov/superfund/programs/clp
- ***"US EPA Contract Laboratory Program, Statement of Work for Organic Analysis"***; Document Nos. OLM 04.3. March 2003. http://www.epa.gov/superfund/programs/clp

- ***"Superfund Analytical Methods for Low Concentration in Water for Inorganics Analysis"***; Oct. 1991, U.S. EPA. http://www.epa.gov/superfund/programs/clp
- ***"Superfund Analytical Methods for Low Concentration in Water for Organics Analysis"***; Oct. 1992, U.S. EPA. http://www.epa.gov/superfund/programs/clp

8.2.4 Sources for Solids, Sediments, and Soil Methods –

- ***"Test Methods for Evaluating Solid Waste, Physical / Chemical Methods, Third Edition, SW-846"***, Nov. 1986; revised by "Revision I", Dec. 1987; Amended by "Update I", July 1992; "Update II", Aug. 1993; and "Update IIA", Sept. 1994; and Update IIB, Jan. 1995; "Update III", Revised December 1996. U.S. EPA. http://www.epa.gov/epaoswer/hazwaste/test/main.htm
- ***"US EPA Contract Laboratory Program, Statement of Work for Inorganic Analysis"***; Document No. ILM 05.2, 2002. http://www.epa.gov/superfund/programs/clp
- ***"US EPA Contract Laboratory Program, Statement of Work for Organic Analysis"***; Document Nos. OLM 04.3. March 2003. http://www.epa.gov/superfund/programs/clp
- ***ASTM Methods from "Annual Book of ASTM Standards", reprinted annually;*** American Society for Testing and Materials, Philadelphia, PA. http://www.astm.org
- ***"Official Methods of Analysis of the AOAC, 15th Edition"***, 1990; Association of Official Analytical Chemists, Arlington, VA.

8.2.5 Sewage Sludge (Residual) Tests for Land Use/Disposal –

- Title 40, Part 503 of the ***"Code of Federal Regulations"*** (40 CFR 503), for EPA Standards for the Use or Disposal of Sewage Sludge.
- ***"Publicly Owned Treatment Works (POTW) Sludge Sampling and Analysis Guidance Document"***, Office of Water Permits Division; 1989; U.S. EPA.
- ***"Test Methods for Evaluating Solid Waste, Physical / Chemical Methods, Third Edition, SW-846"***, Nov. 1986; revised by "Revision I", Dec. 1987; Amended by "Update I", July 1992; "Update II", Aug. 1993; and "Update IIA", Sept. 1994; and Update IIB, Jan. 1995; "Update III", Revised, December 1996. U.S. EPA. http://www.epa.gov/epaoswer/hazwaste/test/main.htm
- ***"18th Edition of Standard Methods for the Examination of Water and Wastewater"***, American Public Health Association, Washington, DC.
- ***"Methods for Chemical Analysis of Water and Wastes"***, EPA/600/4-79/020; March 1983, U.S. EPA.

8.2.6 Solid and Hazardous Waste Characterization Tests –

- ***"Test Methods for Evaluating Solid Waste, Physical / Chemical Methods, Third Edition, SW-846"***, Nov. 1986; revised by "Revision I", Dec. 1987; Amended by "Update I", July 1992; "Update II", Aug. 1993; and "Update IIA", Sept. 1994; and Update IIB, Jan. 1995; "Update III", June 1996, Revised December 1996. U.S. EPA. http://www.epa.gov/epaoswer/hazwaste/test/main.htm

- ***ASTM Methods from "Annual Book of ASTM Standards"***, reprinted annually; American Society for Testing and Materials, Philadelphia, PA. http://www.astm.org
- ***"US EPA Contract Laboratory Program, Statement of Work for Inorganic Analysis"***; Document No. ILM 05.2, 2002. http://www.epa.gov/superfund/programs/clp
- ***"US EPA Contract Laboratory Program, Statement of Work for Organic Analysis"***; Document Nos. OLM 04.3. March 2003. http://www.epa.gov/superfund/programs/clp

8.2.7 Biological Methods -

8.2.7.1 Microbiological:

- ***Title 40, Part 141, Subpart C of the "Code of Federal Regulations"*** (40 CFR 141.21), for Drinking Water Monitoring and Analytical Requirements; Coliform Sampling. USEPA, Washington, DC.
- ***Title 40, Part 136, Table IA, of the "Code of Federal Regulations"*** (40 CFR 136.3) for the List of Approved Biological Test Procedures; USEPA. Washington, DC.
- ***"Microbiological Methods for Monitoring the Environment, Water and Waste"***, EPA/600/8-78/017, Dec. 1978; U.S. EPA.
- ***"18th Edition of Standard Methods for the Examination of Water and Wastewater"***, American Public Health Association, Washington, DC.

8.2.7.2 Toxicity Characterization (Bioassay):

- ***"Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms***, Fifth Edition", EPA-821-R-02-012, October 2002; U.S. EPA.
- ***"Short-Term Methods for Estimating the Chronic Toxicity of Effluent and Receiving Waters to Freshwater Organisms, Fourth Edition"***, EPA/821-R-02-013, October 2002; U.S. EPA.

8.2.8 Modifications to Approved Methods - If a modified procedure is proposed, the client will be notified. A complete method description and associated quality control parameters (precision, accuracy, method detection limits/reporting limits) will be provided prior to or simultaneously with the sample analysis.

8.3 Laboratory Glassware Cleaning: Surface residues and soils in the glassware are removed and disposed of in the appropriate waste containers and dirty glassware is drained of solvents prior to submitting for cleaning. All laboratory glassware (volumetric flasks, separatory funnels, extraction tubes, beakers, graduated cylinders, and others) is cleaned according to the analysis/parameter group listed on the next page. Cleaned glassware is returned to the proper storage cabinets in each laboratory.

8.4 Laboratory Reagents:

- Spectroscopic Grade - stored in a cabinet designated for general storage.

- ACS Grade - stored in a secure cabinet with limited access.
- Laboratory Grade - stored in cabinets designated for storage of reactive chemicals. Each chemical is separated from any other chemical with which it can react dangerously.
- Industrial Grade - stored in the **flammables only** cabinets.
- Indicator - stored in a desiccators.
- Purity certified by supplier - stored in the non-flammable cabinets. Certified and tested to meet Standard Methods 20th Edition
- Standards - stored in vented cabinets for acid storage. Each acid stored separately.
- Purified - stored in the **flammable solvents only** cabinets.
- All chemicals are dated and initialed upon arrival at the laboratory. Chemicals are dated and initialed when opened.

Laboratory Glassware Cleaning Procedures	
Glassware Type	**Cleaning Procedure***
Bioassay	1-3, 5, 4, 16, 12
BOD	1-3, 15, 4, 16, 12
Extractable Organics (Pesticides & Herbicides)	1-4, 5 or 6, 12, 13
Microbiology	1-4, 14
Nutrients/Classics	1-4, 8, 4
Petroleum Hydrocarbons	1-4, 6, 13
Residues	1-4, 10
Trace Metals	1-4, 9, 4, 16, 12
Volatile Organics	1-4, 7, 10

Key to Cleaning Procedures	
1.	Remove all labeling from bottles and glassware.
2.	Wash with hot tap water and Alconox (Liquinox). Scrub insides of glassware and any fittings with a brush.
3.	Rinse thoroughly with hot tap water (3 times).
4.	Rinse thoroughly with deionized water.
5.	Rinse thoroughly with pesticide grade methylene chloride.
6.	Rinse thoroughly with pesticide grade hexane.
7.	Rinse with Methanol (as needed).
8.	Rinse with or soak in 1:1 HCl (as needed).
9.	Soak in 1:4 HNO3, 1:4 HCl (as needed).
10.	Bake at 180°C for 3-4 hours (as per method).
11.	After use, rinse with last solvent used.
12.	Store inverted or capped with suitable material or suitable container stopper.
13.	Rinse with solvent used in the analysis prior to use.
14.	Autoclave at 250°C for 30 minutes.
15.	Nochromix rinse.
16.	Air dry.

**Cleaning Procedures are followed in order specified.*

8.5 **Laboratory Waste Disposal:** Waste materials generated in the laboratory are disposed of promptly and properly. The following procedures are employed in the disposal of laboratory wastes:

8.5.1 Liquid Wastes - In general, no chemical wastes may be disposed of in the sink. Only certain dilute and neutralized acid wastes can be disposed of in the sink.

- **Disposal of Standards and Solutions** - as standards and solutions are made, the solvents, constituents, date, and initial must be placed on the container. This information must be on the containers before it is offered for disposal. Standards containing any amount of organic solvents must not be poured into the sink. Aqueous standards containing organic or inorganic (metals, etc.) compounds must be stored in the appropriate waste container/drum and disposed of by a qualified waste disposal company.

- **Disposal of Solvent Wastes** - All solvents must be disposed of into the appropriate container located in the extractions laboratory. The waste container will be emptied by designated waste disposal personnel only. Waste chloroform is segregated from other solvent wastes for recycling purposes. Each is disposed of in glass bottles then into 5-gallon containers with appropriate label on the outside. Waste from TCLP extractions is collected and stored in an acceptable manner. Solvent wastes are classified /collected in waste solvent drums and disposed of by a qualified waste disposal company.

8.5.2 Solid Wastes - Solvent saturated solids and soil samples are collected and stored in an acceptable manner for disposal by a qualified waste disposal company. Vials are disposed of in the incineration glass container. Unmarked containers or unknowns cannot be disposed of until they are identified.

8.5.3 Sample Waste Return Policy - In general, samples are disposed of or returned to the client two weeks after a final report has been submitted.

8.5.4 Sample Waste Disposal - The following procedures are used to dispose of excess samples that have completed all necessary testing: Samples will be disposed of in two weeks after the final report has been submitted to the client - unless longer time is authorized by the General Manager, Laboratory Operations Director, Laboratory Manager, or the Project Manager/Coordinator. Prior to disposal, a sample disposal list will be generated by the appropriate waste disposal personnel. This list will be maintained in a logbook. Non-hazardous soil samples will be bulked into a drum for offsite disposal. Non-hazardous water samples (waste water and drinking water matrices) will be disposed of by neutralization where necessary and then disposed of by the local sanitary board. All other samples are containerized and disposed of by

a qualified waste disposal company. Empty sample containers should be disposed of (after crushed) in a dumpster. Appropriate protective equipment must be worn (safety glasses, gloves, apron, etc.) when crushing empty sample containers.

9.0 Data Reduction, Validation, and Reporting

9.1 **Analytical Data Reduction:** Data transfer and reduction are essential functions in summarizing information from field and laboratory measurements. It is essential that data reduction processes are performed accurately, and that accepted statistical techniques are utilized. Analysts will be responsible for calculating final data and QC data from raw data recorded in the field logbooks, laboratory bench sheets, chart recordings, instrument printouts, and computer printouts.

9.1.1 **Field Data** - Data obtained from field instruments such as pH meters, salinity and conductivity meters, and dissolved oxygen meters, is read directly from the instrument in appropriate units. Such instruments are used after calibration has been performed according to the owner's operation manual or REIC's field standard operating procedures. Data is recorded by the field analyst into the field logbooks. Data validation in the field involves making several readings to evaluate reproducibility of a measurement. The field team leader or any other member of the field team will review the field notes daily. The initials of the reviewer and date of the review will be entered on each page of the field logbook. The field data is sent to the laboratory in the field logbooks and is reported to the client in the hard copy laboratory reports.

9.1.2 **Laboratory Data** - Data that is obtained directly from instruments such as conductivity meters, pH meters, and the total carbon analyzer is entered manually onto bench worksheets. Some procedures, however, require reading graduation marks on glassware, observing color changes, and performing tests in replicates. Many methods use instrumental methods of analysis, in which the instrument is connected to a microprocessor or have microprocessor data systems as integral parts of the instrument. In such cases the calculations are internally performed once the appropriate calibration standards are entered into the instrument. The instrument analyses are calibrated in appropriate units. During the analyses, instruments coupled to computer controlled systems, convert signals to raw digital data, capture raw data, integrate, generate calibration and response factors, calculate and produce results. Results are expressed in units such as: micrograms per liter (µg/L), milligrams per liter (mg/L), milligrams per kilogram (mg/kg), etc. All data generated from spectrophotometric methods of analysis is computed according to Beer's law to produce a calibration curve based on the level of concentration of standards run during the analysis. The analyst ensures that the standards bracket the sample response, and that all data is generated from the linear portions of the calibration curve. When the analysts record data onto loose bench worksheets, or into the LIMS, they verify that all data entries and date sequences are correct. Drawing a line through the incorrect entry, followed by initials, makes correction of any worksheet error. All loose sheets are kept in bound books. Periodically the sheets are removed and filed. Bound

notebooks are also used for chronological sequence of data insertion. The pages are numbered and a table of contents is entered for referencing. All bench sheets, ring-binder books, and bound notebooks (logbooks) never leave the laboratory. These are a source of information for data transfer to appropriate report forms. LIMS files are backed-up daily and stored in case hardware failure is experienced within the computer system.

9.2 Data Validation:

9.2.1 Responsibility of the Analyst – The analyst will check the entry of data imported into the LIMS and calculations against the raw data. The initials of the analyst and date are entered on all data batches reviewed. The analyst must also review extraction, digestion, and instrument logs for correctness and completeness. Analysts are responsible for analyzing the appropriate type and quantity of quality control samples required for all analytical batches. Results must also meet pre-established control limits. If control limits are not met, the analyst is responsible for documenting and justifying data that is considered reportable. The analyst must also understand and document appropriate flagging of the final analytical results or associated quality control data. Results that are not compliant with method requirements or additional requirements of REIC's quality program must not be reported, except as described below. The Laboratory Supervisor and/or Laboratory Manager must be notified and the data reviewed. If re-analysis using a separate aliquot along with all associated quality control is not possible, the General Manager and/or Laboratory Operations Directors must be notified and written notification must be provided to the client immediately by the assigned Project Manager/Coordinator. (Further discussions of corrective actions are described in Chapter 14 of this ComQAP.) The analyst is also responsible for assembling the data file for each batch of samples, including the raw data and summary batch report, and forwarding the batch file to the assigned supervisor or designated data validator.

9.2.2 Responsibility of the Supervisor - The Laboratory Supervisor or designee is responsible for the review and validation of project data before reporting. These responsibilities include making sure that reported final data is correct and has been reviewed against the raw data. The Laboratory Supervisor will compare final data against previous values for any obvious errors in reported values and to ensure that all the supporting data including QC results is present.

9.2.3 Responsibility of the Quality Manager - The Quality Manager will review at least 2 data batches generated per month. The requirements to be checked in data validation are provided in the tables below for inorganic and organic data review parameters.

INORGANIC DATA CHECKS
Sample Chain of Custody (COC)
Extraction and analysis sample holding times
Calibration:
Initial calibration

ORGANIC DATA CHECKS
Sample Chain of Custody (COC)
Extraction & analysis sample holding times
Initial calibration
Continuing calibration verification

INORGANIC DATA CHECKS
Initial calibration verification
Continuing calibration verification
Blanks
Laboratory control sample
Quality control sample
Duplicate sample
Matrix spike sample
Field duplicates
Equipment blanks
Other method specific QC
Overall Assessment

ORGANIC DATA CHECKS
Blanks
Surrogate recoveries
Duplicate sample
Matrix spike/Matrix spike duplicate
Internal standard performance
Compound identification
Compound quantitation & reporting limits
System performance
Field duplicates
Equipment blanks
Chromatogram retention times
Mass spectrometer tuning criteria compliance
Overall Assessment

9.3 **Data Reporting** - Raw data is not normally provided in the formal report, but can be included if the client desires. Reports are reviewed and approved by the Project Managers/Coordinators who prepare a cover letter and/or case narrative explaining any details needing additional comment. Upon completion and approval, the report is sent to the client and mailing date reported in the LIMS.

9.4 **Data Archiving** -Copies of Chain-of-Custody forms, sample tracking worksheets, raw data, QC/QA materials, formal reports, and laboratory performance reports are kept on file by the laboratory for a minimum of five years. These files are available to the client or their approved representative(s) for review at any reasonable time within this period. All records are archived on-site under lock and key. Due to large volumes of paper and records generated, older records are archived on-site in a different building that is accessible by authorized personnel only. Access is also documented by a records log book maintained within the building. It should also be noted that all bench logbooks, instrument maintenance logs, and supplies record books are dated in consecutive order, filed, and kept indefinitely.

9.5 **Document Control System** – A document control system is used to ensure that all laboratory personnel have access to current policies and procedures at all times. Documents that are managed by this system include the CompQAP, SOPs, logbooks, etc. The system consists of a document review, revision and approval system, and document control and distribution. The CompQAP and SOPs are reviewed on an annual basis and as needed. All logbooks are numbered and a log is maintained in the QC Department of all logbooks issued and returned. The CompQAP and all SOPs are reviewed and approved by the Quality Manager, the Technical Director (Laboratory Manager and/or Laboratory Supervisor), Laboratory Operations Directors and/or the General Manager. All quality documents are controlled by the Quality Manager. Controlled copies are provided to applicable individuals/departments in the laboratories. The Quality Manager maintains a distribution list for controlled copies and ensures that any revisions are distributed appropriately.

9.6 **Confidentiality** - All laboratory results and associated raw data are kept in confidence to the customer who requested the analyses. REIC maintains confidentiality for all information associated with client projects. Access to

laboratory records and LIMS data is limited to laboratory personnel except with the permission of the Quality Manager, Laboratory Operations Directors, or General Manager. REIC's LIMS and network security are also controlled by REIC's Systems Administrator who reports to the General Manager. Where clients require transmission of test results by telephone, facsimile, or other electronic means, staff will ensure confidentiality is preserved.

10.0 Internal Quality Control Checks

Internal quality control (QC) checks are those procedures used during all phases of the project that are designed to control the individual processes involved in data generating activities. The QA objectives of a given project and the anticipated uses of data determine the type of QC checks needed. The QC checks apply to both field and laboratory activities. The following discussion describes the various QC checks performed for field samples and laboratory activities.

10.1 **Field Quality Control Checks:** For clients who bring sufficient volumes of samples for analysis or for projects in which REIC is responsible for field sampling, typically the field QC checks consist of equipment blanks, trip blanks (for VOAs only), and field duplicates. These field QC samples are analyzed for parameters of interest and are collected at frequencies determined by the project or according to recommendations presented in the following table. *(Although REIC will give advice on sampling, it is the sampler's ultimate responsibility to representatively sample, pack, and ship the samples to REIC Laboratory.)*

10.1.1 Travel (Trip) Blanks - Trip blanks are used to determine if any onsite atmospheric contaminants are seeping into the sample vials, or if any cross contamination of samples is occurring during shipment or storage of sample containers. Trip blanks are only analyzed for volatile organics. The trip blanks consist of sample bottles filled in the laboratory with organic-free water and any applicable preservatives. Trip blanks are sealed and placed in the ice chest. Trip blanks are sent to the sampling location with sampling kits and are returned unopened from the sampling location with the samples.

Frequency of Field QC Check Samples		
QC Samples	Water/Liquids	Soil/Sediment
Trip Blank (for VOAs only)	2 per Cooler	NR
Equipment Blank (rinsate)*	2 per Day	1 per Day
Field Duplicates: 1-4 Samples	NR	NR
5-9 Samples	5 % per Event	5 % per Event
>10 Samples	10 % per Event	10 % per Event
Split Samples**	----	----

Note: All parameters must meet QC sample type and frequency requirements. Numbers calculated from percent specifications will be rounded up to nearest whole numbers.

Abbreviations and Special Notes:

NR = Not Required.

* *For long field activities in which samples are collected daily, only samples from every other day may be analyzed. Other samples are held and analyzed only if evidence of contamination exists.*

** *The requirement for split samples (reference duplicates) has not been defined. If split samples are needed, the frequency of collection will be provided in the site-specific quality assurance plan.*

Trip blanks should originate at the facility providing the blank water and sample containers. It is not necessary to take an aqueous trip blank when a non-aqueous medium is being sampled.

FREQUENCY: One trip blank (2 trip blanks for Drinking Water VOCs) should accompany each cooler containing VOCs samples, should be stored at the laboratory with the samples, and analyzed by the laboratory.

10.1.2 Equipment Blanks - Equipment blanks are the final analyte-free water rinse from equipment cleaning collected daily during a sampling event. An equipment blank is prepared by pouring target, analyte-free (deionized) water into or over the sampling equipment (bailers, tubing, soil samplers). The rinse water is collected in a sample container, preserved, and handled in the same manner as the samples.

FREQUENCY: One equipment blank should be collected each day samples are collected. For long drawn field sampling events, only samples from every other day may be analyzed. Other samples are held and analyzed only if evidence of contamination exists.

10.1.3 Field Duplicates - A field duplicate is a replicate sample collected and analyzed to demonstrate the reproducibility of sampling technique. A field duplicate is separate from the duplicate the laboratory must run and cannot be replaced by a laboratory-generated duplicate. Field duplicates are representative of field sampling precision, whereas laboratory duplicates are a measure of analytical precision. Both pieces of information are essential in determining the quality of data generated for a project. A field duplicate is prepared at the sampling location from equal portions of sample aliquots combined to make the sample. Both the field duplicate and the sample are collected at the same time, in the same container type, preserved in the same way, and analyzed by the same laboratory as a measure of sampling precision.

FREQUENCY: Field duplicates should make up 10% of the samples collected.

10.1.4 Sample Splitting - Sample splitting is performed when two or more parties want to have a portion of the same sample. A field split or referee duplicate is prepared at the sampling location from equal portions of sample aliquots combined to make the sample. Both the field split and the sample are collected at the same time, in the same container type, preserved in the same way. The split sample is submitted to a referee laboratory for analysis to assist in evaluating inter-laboratory precision and the validation of the results.

FREQUENCY: Field splits to be determined by a client.

10.2 Laboratory Quality Control Checks

Internal laboratory control checks used by REIC are discussed in detail in each method performed. REIC will demonstrate the ability to produce acceptable results using the methods requested. The minimum QC spike requirements for organic and inorganic analyses are presented below.

Laboratory Minimum Samples Required							
	Standard Matrix		Sample Matrix				
Analysis	Blank	Spike	Spike	Spike Duplicate	Sample Duplicate	Surrogate Spike	Filter Blank
ORGANICS							
All Analyses (except TCLP)	5%	5%	5%	5%	NA	100%	5%
TCLP	5%	5%	+	5%	NA	NA	5%
INORGANICS							
pH	10%	NA	NA	NA	10%	NA	NA
Residues	10%	NA	NA	NA	10%	NA	NA
Turbidity	10%	NA	NA	NA	10%	NA	NA
Specific conductivity	10%	NA	NA	NA	10%	NA	NA
Dissolved oxygen	10%	NA	NA	NA	10%	NA	NA
TCLP	10%	10%	+	NA	NA	NA	10%
All Other Analyses	10%	10%	10%	10%	NA	NA	10%

Source: REIC. List of Abbreviations: NA = Not Applicable; + = 5% or 1 per waste type, whichever is greater

10.2.1 Holding Time - The amount of analyte in a sample can change with time due to chemical instability, degradation, volatilization, etc. If the specified holding time is exceeded the data generated may not be valid. Those analytes detected in samples analyzed past holding time requirements must be flagged as estimates.

10.2.2 Optimum Batch Size - The laboratory will determine the optimum batch size. The optimum batch size is the number of samples of similar matrix, which can be processed concurrently through the entire preparation (i.e., extraction) and analysis. (Method requirements typically designate up to either 10 or 20 samples.) After the batch size is determined the QC criteria described in the following sections are followed.

10.2.3 Calibration - All methods are calibrated prior to sample analysis ***(see Section 7.0)***. The following requirements are observed.

- **Semi-volatiles, Volatile Organics, and Pesticides/PCBs analyses,** the current EPA methods (600 series) and SW-846 methods (8000 series) shall be used; including frequency requirements, requirements for calibration check compounds (CCCs), and system performance check compounds (SPCCs).

  a. Tuning and performance criteria are established to ensure adequate mass resolution, proper identification of compounds,

and to some extent - sufficient instrument sensitivity. These criteria are not sample specific. Instrument performance is determined using standard materials. Therefore, the mass tuning criteria must be met at all times. The tuning standard for volatile organics is bromofluorobenzene (BFB) and for semivolatiles is decafluorotriphenyl-phosphine (DFTPP). If the ion abundance criteria for a method are not met, all associated data must be classified as invalid (unusable).

b. The response factor measures the instrument's response to specific chemical compounds. The response factor for method specified compounds must be equal or greater than the limit in both the initial and continuing calibrations. A value less than the specified limit indicates a serious detection and quantitation problem (poor sensitivity) and analytes in the sample will be qualified as an estimate. ***–Refer to the specific method for other appropriate guidelines.***

c. Percent RSD is computed from the initial calibration and is used to indicate the stability of the specific compound response over increasing concentration. Also, the percent recovery D is used to compare the response factor of the continuing calibration check to the mean response factor (RRF) from the initial calibration. Percent D is a measure of the instrument's daily performance. A value outside of the method specified limits indicates potential detection and quantitation errors. For these reasons all positive results are qualified as estimated. ***–Refer to the specific method for other appropriate guidelines.***

d. For the Pesticides/PCB analysis, %RSD for aldrin, endrin, DDT, and dibutychlorendate must not exceed 10%. Percent D must be within 15% on the primary quantitation column and 20% on the confirmation column. ***See specific method for other appropriate guidelines.***

- **Other Methods of Analysis**

a. At least three levels of concentration standards for each analyte shall be analyzed for initial calibration.

b. The correlation coefficient of the standard linear curve will be $\geq$ 0.995 (inorganics) and $\geq$ 0.990 (organics).

c. The midlevel calibration standard will be repeated at a frequency of 5% (organics) and 10% (inorganics) and at the end of a run.

d. Response of the control analytes must be within $\pm$ 10% (inorganics) and $\pm$20% (organics) of initial response.

e. Detection limits for each parameter will be determined and checked annually to ensure they meet limits specified for the project.

f. The calibration shall include one standard at a concentration at the level of the PQL.

g. The calibration curve shall bracket all samples in the concentration range. GC/MS Calibration shall be checked every 12 hours (or 24 hours for 624/625) of operation.

h. The laboratory shall use the calibration check acceptance criteria specified in the method.

i. If samples are outside the calibration range, the laboratory shall appropriately perform dilution to bring the samples concentrations within the calibration range.

10.2.4 **Method Reagent Blanks** - Quality assurance (QA) blanks, i.e., trip blanks, equipment blanks, water blanks, and method (reagent) blanks, are designed to identify any contamination which may have been introduced into the samples during field activity or sample preparation. Trip blanks measure cross-contamination of samples during shipment. Equipment blanks measure cross-contamination from the sampling equipment. Method (reagent) blanks measure laboratory contamination. If the concentration of the analyte is less than the method-quantifying limit, the analytes are qualified as non-detects. A method blank is analyzed for all methods with each sample batch.

10.2.5 **Spikes and Laboratory Control Matrix Spikes (LCS)** - In methods not using surrogates (metals, anions, wet chemicals), in addition to the method blank, a blank spike or a LCS are analyzed. For pesticides/PCBs methods, surrogate compounds are employed. A method blank and Laboratory Control Matrix Spike are also analyzed with each batch as separate samples. A pesticide and/or PCB are used as spiking compounds. In methods using surrogates spiked into all samples, the blank serves as both the method blank and the blank surrogate spike.

10.2.6 **Second Column Confirmation** – For GC and HPLC methods, confirmation techniques include analysis by GC/MS, GC or HPLC data from two different detectors or dissimilar columns. Confirmation is necessary when samples are from a site of unknown historical activity or when doubt exists over the identification of a peak on the chromatogram.

10.2.7 **Surrogate Spikes** - Surrogate spiking compounds are target analyte compound substitutes. The surrogates are chemically similar to the analytes of interest, and emulate their respective instrumental response. The surrogates do not interfere with the target analytes and are not naturally occurring in the environmental samples. Surrogate spikes are performed for all methods for which surrogates are a customary procedure. Surrogate spikes monitor both the performance of the analytical system and the effectiveness of the method on the type of sample matrix. The surrogate compounds are spiked into each client sample, QC sample, standard, and method blank in a batch. Samples are spiked prior to sample preparation.

10.2.8 **Matrix Spike/Matrix Spike Duplicates (MS/MSD)** - Spiked samples are samples that have specific concentrations of analytes of interest added. Except for all Drinking Water analyses and metals, sample-specific MS/MSD are analyzed in all methods for every 20 samples of a similar matrix (either soil or water). For metals analysis only, a matrix spike is required for every 10-20 samples of similar matrix (depending on the method). However, a matrix spike duplicate may be performed at the laboratory's discretion in lieu of a laboratory duplicate.

10.2.9 **Internal Standard Performance** - Internal standard (IS) performance criteria are designed to ensure that GC-MS sensitivity and response are stable during every analysis. The internal standard area count must not vary by more than a factor of 2 (50 -200%) from the associated continuing calibration standard. The retention time of the IS must not vary by more than 30 seconds from the associated continuing

calibration standard. If data is generated outside these criteria, all positive results for compounds quantitated using that IS are qualified as estimates.

10.2.10 Compound Identification - For volatiles and semivolatile organics, the compounds are identified on the GC-MS by using the analyte's relative retention time window (RRT) and by comparison to mass fragmentation patterns obtained from known standards. For the results to be a positive hit, the sample peak must be within plus or minus 0.06 RRT units of the standard compound and have a mass fragmentation pattern which has a ratio of the primary and secondary m/e intensities within 20% of that in the standard compound. For pesticides, the retention times of reported compounds must fall within the calculated retention time window for the two chromatographic columns.

10.3 Demonstration of Method Capability

An initial demonstration of capability (IDC) is performed prior to acceptance and use of any methodology. This initial demonstration of method performance is performed each time there is a significant change in instrument type, personnel, or test method. The process is described in **Appendix C**. A "Demonstration of Capability Certification Statement" is completed for each analyst and maintained by the Laboratory Managers and/or the Quality Manager. A copy of the documentation used for each demonstration is also included in **Appendix C**. For any methods or procedures that the method does not mandate an IDC or no procedure is provided (such as Turbidity, TCLP, Flash Point, etc.), the IDC will be performed by demonstrating the procedure to the Laboratory Supervisor or designee and documented with the IDC form and recorded in the personnel training records.

11.0 System and Performance Audits

11.1 **Systems Audits:** A system audit is a qualitative evaluation of all components of a project (field and/or laboratory activities) to determine if each component is properly performed. The audits are designed to assure that systems and operational capabilities are maintained, and the study methodologies and quality control measures for the project are being followed as specified in the quality assurance project plan. The Quality Manager will conduct system audits as needed to ensure proper operational capabilities. Audits of critical functions by the QA staff will include:

- Verification that standards, procedures, records, charts, data disks, etc., are properly maintained.
- Verification that the actual practice agrees with written instructions.
- Selection of methods that must include all phases of a laboratory's effort is monitored, to include but not be limited to sample logging, chain of custody, sample preparation, standard preparation, extract storage and analysis, and data reduction.
- Verification that QC/QA records are adequately filed and maintained so as to assure protection and retrievability.
- Walk-through the laboratory for general observations.

11.2 **Performance Audits:** Performance audits are quantitative evaluations of the components of a project or routine operations. Performance audits are used to

evaluate the laboratory's ability to obtain accurate results in the analyses of known check samples by specific analytical methods.

11.2.1 **Internal Performance Audits** - Internal performance audits consists of analyses of commercially purchased QC check standards and/or in-house prepared QC check standards. Commercial suppliers give the options of confidential double blind evaluations or single blind with the certified results mailed along with standards. The stock solutions used to make in-house QC check standards are different from those used for calibration standards. The QC check samples are carried through the complete analytical preparation and analysis and the calculated values are compared to the true target values. During the analytical data review, the Quality Manager pays close attention to these recoveries and must recommend corrective action in cases of repeated poor recoveries. In addition to regular measurement of the QC check sample, the Quality Manager may introduce QC check samples for analyses with other project samples; blind to the analyst. The parameter groups are selected at random by the Quality Manager. The findings will be summarized and reported to management directly following completion of laboratory analyses.

11.2.2 **Managerial Review** – At least annually, the laboratory management (General Manager, Laboratory Operations Directors, and Laboratory Managers) will conduct a review of REIC's quality system to ensure continued acceptability and effectiveness. This will include introducing any necessary changes, corrective actions, or improvements in the quality control program and overall laboratory operations. The review will consider all reports from managerial and supervisory personnel, the outcome of internal audits, assessments performed by outside auditing bodies, the results of proficiency test, any changes in the volume and type of work undertaken, feedback from clients, corrective actions and any other relevant information collected during the year in review.

11.2.3 **External Performance Audits** - Laboratory performance audits are also performed in conjunction with the performance evaluation programs and performance testing (PT) samples administered by various agencies. Examples of programs that REIC participates in that include on-site audits are the State of West Virginia DEP (Lab Number: 060); State of West Virginia DHHR (Lab Number 00412CM); State of North Carolina DENR (Lab Number: 466); State of Virginia DEQ (Lab Number: 00281); and the Florida Department of Health (NELAP Number: E87958). REIC maintains certifications via reciprocity agreements with the following state programs: the Virginia Department of General Services (Lab Number: 00281); Tennessee Department of Health (Lab Number: 02926); and Kentucky DEP (Lab Number: 90039). REIC also maintains a registration for performing analyses with the state of Pennsylvania DEP (Lab Number: 68-839.

11.3 **Memberships, Licenses, and Certifications:** The following is a list of memberships, licenses, and certifications currently held by REIC:

- American Chemical Society
- Associations of Analytical Chemists
- West Virginia Petroleum Marketers Association
- Rural Water Association
- Mining & Reclamation Association

- American Water Works Association
- The Solid Waste Association of North America
- West Virginia Manufacturers Association
- Association of West Virginia Solid Waste Authorities
- West Virginia Oil Marketers & Grocers Association
- State of West Virginia Department of Health, Office of Environmental Health Services
- State of West Virginia Department of Commerce, Labor, and Environmental Resources, Department of Environmental Protection, Water Resources Section
- Commonwealth of Virginia Department of General Services, Division of Consolidated Laboratory Services
- Commonwealth of Kentucky Natural Resources and Environmental Protection Cabinet, Department of Environmental Protection
- State of Tennessee Department of Conservation, Division of Underground Storage Tanks
- State of Tennessee Department of Health and Laboratory Services
- North Carolina DEHNR Division of Solid Waste Management
- State of Florida Health Department (NELAP)
- Pennsylvania Department of Environmental Protection, Bureau of Office System and Services

A complete listing of methods and certified parameters for the above listed programs can be provided to clients upon request. REIC's complete listing of NELAC accredited methods/parameters is summarized in **Appendix F**. A copy of REIC's compliance statement with the NELAC standards is also included in **Appendix B**.

11.4 **Audit Reports:** The Quality Manager shall provide an audit report comprised of summary findings to the General Manager and/or Laboratory Operations Coordinators on a periodic basis or as needed. Deviations will be noted and discussed by management. The audit findings, both compliance and non-compliance, must be documented, filed in a secure place, maintained as part of the QA documentation. Minimally, these reports should include: Periodic assessment of measurement quality indicators, i.e., data accuracy, precision, and completeness; Results of internal and/or external audits; Results of system audits; Significant QA problems and recommended solutions. (The Quality Manager may also provide reports to the General Manager on a weekly basis during the status meetings conducted by the Project Managers/Coordinators and Laboratory Managers/Supervisors.)

12.0 Facilities, Equipment, and Preventative Maintenance

12.1 **Facilities and Equipment** – For over eighteen years, REIC has been performing environmental services and evaluations for a multitude of highly technical and demanding projects. From its inception, REIC has addressed the major environmental testing protocols and has steadily evolved incorporating the latest analytical procedures and state-of-the-art facilities and equipment. REIC's clients have learned to expect unparalleled service with uncompromising quality on a routine daily basis. All work is approached with the highest of professional ethics, personable interactions, and professional accountability.

REIC's headquarters is located ten miles south of Beckley, WV along Interstate 64, some fifty miles to the east of Charleston, WV and ninety miles west of

Roanoke, VA. The parent facility houses its 20,000 square foot Analytical Chemistry Division at the Raleigh County Airport Industrial Park **(See floor plan on next page)**. The Biological Division is operated from its 7500 square foot modern laboratory in Cool Ridge, WV. REIC also maintains a service center and laboratory in Roanoke Virginia, for microbiological analyses for Virginia clients.

12.2 **Computers and Electronic Data Security Requirements** – Electronic data security is achieved through a multi-faceted approach to data access and storage. All servers, personal computers, instrument workstations, and printers are connected via the REIC local area network (LAN). The network is a secure Microsoft Windows Server 2003 Active Directory domain. The domain controllers provide authentication services for users and supply additional authorization data, such as user group memberships. These services are used to control access to resources on the network.

Laboratory data is managed and stored in the Laboratory Information Management System (LIMS). This system is a Microsoft Access database stored on a network server and accessed by REIC personnel from client workstations. The LIMS has another level of security built in with different levels of access privileges for all REIC personnel.

Electronic data is protected from corruption via backups that are created nightly by server tape backup devices. Tapes are rotated through a two week cycle with one tape taken off-site weekly. Hard copies of raw analytical data and analytical reports are also kept on file for a period of five years.

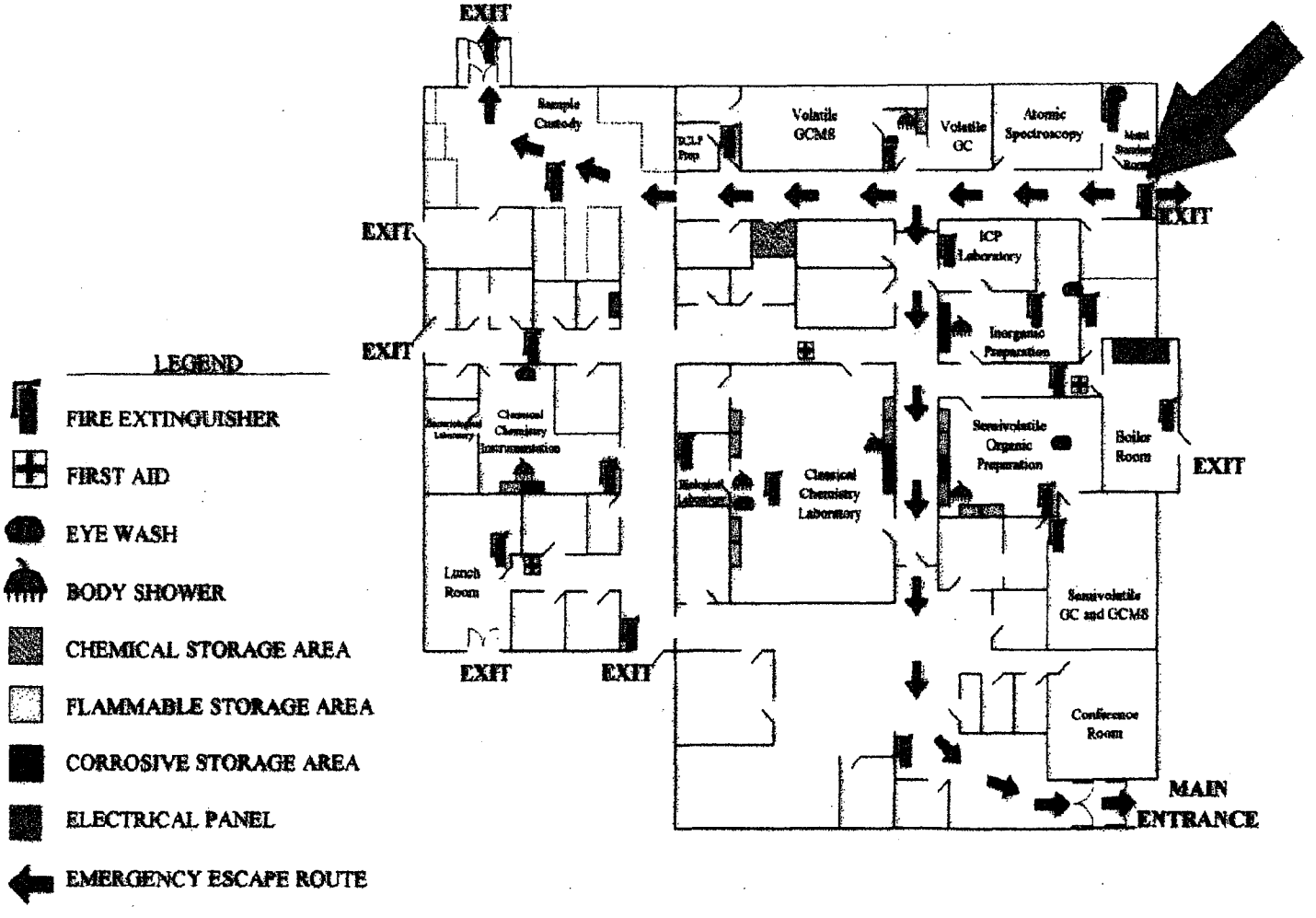
REIC remotely maintains a web site and email server outside the LAN to minimize the security threat from incoming internet traffic. Analytical data and status information are accessible to our clients through this secure client on-line access. REIC's web address is http://www.reiclabs.com.

12.3 **Preventative Maintenance** - To ensure that instruments are operating properly at all times, REIC follows a rigorous maintenance schedule and trouble-shooting procedures. All laboratory instruments undergo regular maintenance as required in the manufacturer's operation manual for each of the instruments. Trouble shooting protocols are also performed, if needed, for instruments according to instructions in the operation manual. Manufacturer service departments or local service repair companies provide repair. In the case of downtime of specialized instruments, service contracts with the manufacturer are maintained.

In the event of excessive downtime, REIC will either acquire instrumentation to complete project work or subcontract project work to fulfill project requirements.

REIC

Quality Environmental Services



12.3.1 **Maintenance Documentation:** Maintenance service contracts or internal maintenance logs are kept for each instrument. The maintenance log is kept at the instrument, so that preventive care or repair can be recorded immediately. All maintenance and repairs are documented in the instrument's logbook. The records include the date of maintenance or repair and description of work.

Other examples of the logbook entries are: name of the person providing the service, date, time, nature of service provided, notations, etc. Also, any applicable change in operation conditions, such as sensitivity, signal drift, temperature, corrections, alignments, etc, are recorded in the instrument's maintenance log book. For solvents, reagents, or gases, examples of log entries are: charting of the gas flow readings, gas pressure of cylinders, replacement dates of gas cylinders and water deionization cartridges, replacement of solvents, etc.

12.4 Instrument Maintenance Schedules:

12.4.1 Gas Chromatograph			
DAILY	**COLUMN CHANGE**	**SEMIANNUALLY**	**AS NEEDED**
Replace injector septum if necessary. Check and fill solvent rinse vials. Check cylinder and regulator output pressure. Inspect gas filter driers, check flow through flow controllers. Set and check injector, oven, and detector temperatures. Run a baseline for proper sensitivity and noise level to be used. Run solvent blank and standard solution, check for false peaks, bad retention times, baseline drift, poor peak shapes, and low sensitivity.	Check for leaks under pressure. Check carrier gas flow through column with bubble flow meter. Condition column overnight and run daily check. Clean injector glass liners or replace as necessary.	Wipe check ECD (performed by contracted service group). Reactivate or recharge flow controller filter dryers.	Bake out ECD. Leak test all gas fittings to cylinders. Optimize gas flows to the FID. Clean FID and align jet if necessary.

12.4.2 HPLC	
AS NEEDED	
Dismantle the detector flow cell and clean. Replace detector lamps according to manufacturer's recommendation. Guard column frets and packings replaced when system pressure increases.	Replace piston seals and check valves. Check and refill solvent containers.

12.4.3 Gas Chromatograph/Mass Spectrometer				
DAILY	**WEEKLY**	**COLUMN CHANGE**	**SEMI-ANNUALLY**	**AS NEEDED**
Check cylinder and regulator output pressure. Inspect gas filter driers, check flow through flow controllers, and adjust ionization gauge controllers. Set and check injector, oven, and detector temperatures. Check MS tuning, and run an auto/manual tune if necessary. Run solvent blank and standard solution, check for false peaks, bad retention times, baseline drift, poor peak shapes, and low sensitivity. Check and fill solvent rinse vials.	Replace injector septum if necessary. Change inlet liner as needed.	Check for leaks under pressure. Change the septum. Condition column overnight and run daily check.	Oil Turbo molecular pump wick. Renew rough pump oil.	Change the guard column. Auto manual tune the MS. Recalibrate. Clean the MSD source. Clean the injection port.

12.4.4 Atomic Absorption Spectrophotometer (AA)			
DAILY	**WEEKLY**	**MONTHLY**	**ANNUALLY**
Clean burner head/injection port. Check water pressure. Check gas pressures. Check & clean furnace optics if necessary. Inspect lamps for damage.	Clean aspirator and nebulizer for deposits. Dust instrument exterior Check absorbance for line/element selection. Clean furnace.	Examine O-rings in burner assembly and replace if necessary. Check cones in graphite furnace if necessary. Inspect furnace cooling lines. Refill spray chamber reservoir.	Schedule service visit by manufacturer to clean optics and for other maintenance.

12.4.5 Inductively Coupled Plasma-Atomic Emission Spectrometer (ICP-AES)				
DAILY	**MONTHLY**	**QUARTERLY**	**AS NEEDED**	**ANNUALLY**
Check nebulizer flow rate. Keep ICP exterior dust free. Clean/flush nebulizer. Check vacuum pressure gauge. Record instrument operating parameters. Record zero position and reference wavelength.	Refill argon humidification reservoir.	Clean filters. Change cooling water reservoir. Clean & inspect torch/spray chamber.	Install new power tube, when the tube wears out. Dust/clean instrument exterior and torch box. Dust off intake and exhaust.	Install new mirror. Manufacturer's preventive maintenance. Change vacuum pump oil

12.4.6 Inductively Coupled Plasma-Mass Spectroscopy (ICP-MS)				
DAILY	**WEEKLY**	**MONTHLY**	**SEMI-ANNUALLY**	**ANNUALLY**
Verify acceptable sensitivity & stability. Record all settings and operational parameters. Properly dispose of both waste reservoirs (spray chamber drain & probe rinse drain).	Perform mass calibration. Perform detector calibration Complete system tuning. Exchange/clean glassware. Check water filter & change if necessary. Check air filters & clean/exchange if necessary. Inspect pump tubing; replace if necessary. Inspect sample/skimmer cones & clean/ex change if necessary. Inspect all tubing/lines for degradation & leaks. Dust off the instrument & associated hardware.	Clean extraction lens. Check rotary pump oil levels. Check oil mist filters. Archive all analytical data on disks & then purge the data from the computer's hard drive.	Examine lens stack and clean if necessary. Examine penning gauge & clean if necessary Change rotary pump oil. Examine slide valve & check operation.	Replace detector (or as needed).

12.4.7 pH Meter, Conductivity Meters, Dissolve Oxygen, & Ion Specific Analyzer

12.4.7.1 pH Meter	
DAILY	**AS NEEDED**
Check the pH electrode tips for cracks. Analyze two calibration buffer standards & record results. (Aliquots of buffer standards shall be used only once.) Check the slope with a midrange standard buffer. Rinse electrode thoroughly between use and after use. Place the electrodes in storage buffer after use.	Solution refilled in the glass electrode. Replace the ceramic junction (Pentek pH meter).

12.4.7.2 Conductivity Meter & Conductance Bridge		
DAILY	**ANNUALLY**	**AS NEEDED**
Check and record the cell constant. Rinse the electrodes thoroughly between and after use. Place the electrode in the storage liquid after use.	Check the internal calibration with appropriate resistors (conductance bridge).	Make temperature correction. Clean according to the manufacturer's instructions (Bridge).

12.4.7.3 Dissolved Oxygen Meter	
DAILY	**AS NEEDED**
Call local National Weather Service for barometric pressure. Make corrections for barometric pressure and temperature. Record corrections and calibration results. Check that the stirring device is functioning properly. Protect the probes between and after use.	Refurbish O_2 sensor according to the manufacturer's instructions. Replace fill-solution and membrane.

12.4.7.4 Ion Specific Meter	
DAILY	**AS NEEDED**
Check the electrode tips for cracks or scratches. Calibrate with at least three standards and record results. Rinse electrode thoroughly between use and after use.	Make temperature corrections.

12.4.8 Analytical Balance and Electronic Balance	
DAILY	**AS NEEDED**
Clean weighing pan after each use. Return dust covering over the balance after use. Verify functional calibrations with Class 1 certified weights for analytical balances.	Bring in a qualified service and repair firm to service the balances. Balance certifications are performed annually by a qualified service firm.

12.4.9 Purge and Trap Auto-Sampler
Check for system leaks, accumulation of dirt in purge chamber and degradation of trap. Clean or replace as needed.

12.4.10 Low Temperature Incubator		
DAILY	**QUARTERLY**	**AS NEEDED**
Check and record the temperature from the digital meter. Prevent bacterial contamination of the incubator.	Compare the meter to the lab thermometer traceable to NIST, and record the results.	Clean the incubator according to the manufacturer's instructions.

12.4.11 Norwalk Walk-in Coolers and Study Chambers		
DAILY	**WEEKLY**	**ANNUALLY**
Inspect the digital temperature readout device. Make sure the proper temperature is maintained. Check that the wheel chart needle is recording properly.	Check and record that the audible alarm is functioning. Replace and file the (7day) wheel chart-papers. Reorganize and clean the interiors.	Compare the monitors to the lab thermometer traceable to NIST, and record the results.

12.4.12 Working Thermometers (Glass/Mercury)	
DAILY	**ANNUALLY**
Check for continuity of the liquid column.	Compare each dedicated thermometer to the lab thermometer traceable to NIST, and record the results.

12.4.13 Deionized Water Units			
DAILY	**QUARTERLY**	**ANNUALLY**	**AS NEEDED**
Note the cartridge indicator reading.	Analyze for pH, Conductivity, Chlorine, and Bacteria.	Analyze for heavy metals; Pb, Cd, Cu, Cr, Ni, and Zn.	Change the cartridges when exhausted. Record the analyses results and any system changes.

12.4.14 Drying Ovens	
DAILY	**ANNUALLY**
Check and record the temperature (thermometer bulb in sand). Check that the door fits properly. Check and prevent sample cross contamination.	Compare the thermometer to the lab thermometer traceable to NIST, and record the results.

12.4.15 Muffle Furnace	
DAILY	**ANNUALLY**
Check and record the temperature setting. Check that the door fits properly. Check sure the fumes are properly exhausted.	Compare the meter to the lab thermometer traceable to NIST, and record the results.

12.4.16 LECO Tube Sulfur Analyzer	
AS NEEDED	
Calibrate with standards from a commercial supplier. Set and check the operating temperature.	Check all tubing and the gas pressure. Clean the titration vessel after use.

12.4.17 Total Organic Carbon Analyzer
The injection septum is replaced every 100 (or less) injections. All pump tubes should be replaced at two-week intervals. Every two or three day's intervals check printer tape, infrared zero, and infrared span.

12.4.18 Spectrophotometer or Colorimeters	
DAILY	**BIANNUALLY**
Clean sample cells thoroughly or replace with new ones.	Verify the wavelength with a color standard or equivalent, and record results.

12.4.19 BOD Incubator		
DAILY	**QUARTERLY**	**AS NEEDED**
Check the digital meter and the inside thermometer. Make sure that thermometer bulb is immersed in liquid. Check that the door seals properly. Prevent bacterial contamination of the incubator.	Compare the meter to the Lab thermometer traceable to NIST.	Clean the incubator according to manufacturer's instructions.

13.0 Calculations of Data Quality Indicators

13.1 **Precision:** Precision is a measure of the degree of reproducibility of an analytical value and is used to check on the quality of the sampling and analytical procedures. Precision of the analytical method, at each stage, is determined by calculation of the relative percent difference (RPD) between duplicate analytical recoveries of sample component, relative to the average of those recoveries: Since an absolute value is used for the difference between R_1 and R_2, there is no lower control limit. These calculations are usually performed on sample matrix spikes and matrix spike duplicates and/or samples and respective sample duplicates.

$$RPD = \{ |(R_1 - R_2)| / [(R_1 + R2)/2] \} \times 100$$

Where: R_1 and R_2 = concentration of Duplicates 1 and 2, respectively.

13.2 **Accuracy:** Accuracy is a degree to which a measurement agrees with the actual value (i.e., amount of measurement bias). Accuracy is expressed as a percent recovery of a sample's target value (known concentration of reference material). The accuracy of the analytical procedure is determined by the addition of a known amount of material (matrix spike) to a field sample matrix or a Laboratory Control matrix. A Laboratory Control matrix is made up of deionized (distilled water) or clean soil (of known physical and chemical properties). Percent recovery is calculated as follows: If RPD or R-values do not meet acceptance criteria as specified in Section 3, results reported in all samples processed as part of the same set must be labeled as suspect, and the sample analysis may need to be repeated. The laboratory Quality Manager will be notified, and the necessary corrective action will be implemented.

$$R = [(x_s - x_u)/K] \times 100$$

Where: R = % Recovery
x_s = the measured value for the spiked sample
x_u = the measured value for the unspiked sample, and
K = the known value of spike in the sample.

13.3 **Completeness:** Completeness is a measure of the amount of data obtained from a measurement system compared to the amount that was expected to be obtained. Analytical completeness is assessed by comparing the total number of samples with valid analytical results to the number of samples collected and delivered to the laboratory. The result is calculated following data validation and reduction. Completeness (C) is determined by:

$$C = S_2/S_1$$

where: S_1 = total number of samples planned, and
S_2 = number of valid data points.

A value of 95% or higher is the goal. For values less than 95 percent, problems in the analytical procedures must be examined and possible solutions explored.

13.4 **Detection Limits:** When analytical measurements fall below the confidence level, the results are reported as "non-detects" (ND). This level can be: the Minimum quantifying level (MQL), practical quantitation limit (PQL), or method detection limit (MDL). The choice is based upon the needs of the client, objectives of the project, and requirements of the regulatory agency. The MQL is the concentration of an analyte that can be measured and reported based on the sample matrix. The MQL may be 2 to 10 times greater than the MDL. The PQL is the lowest concentration level that can be reliably achieved within the specified limits of precision and accuracy during routine laboratory operating conditions. The MDL is the minimum concentration of a substance that can be reliably recovered in a sample matrix, distinguished from the background noise level, and reported with a 99% confidence that the analyte concentration is greater than zero. For unknown or difficult matrices, REIC laboratory will either determine or use the MDL(s) provided in the EPA analytical methods being employed. When determining MDLs, the analyst uses the procedures given in 40 CFR Part 136, Appendix B. The detection limit is defined as follows for all measurements:

$$MDL = t_{(n-1,\ 1-\alpha=0.99)} \times S$$

where:	*MDL*	=	*method detection limit*
	S	=	*standard deviation of the replicate analyses*
	t (n-1, 1-α=0.99)	=	*Students' t-value appropriate to a 99 percent confidence level and a standard deviation estimate with n-1 degrees of freedom*

13.5 **Control Chart Procedures:** For selected parameters, as precision data is accrued, parameter and matrix specific control charts are generated. The average RPD (P') and the standard deviation (Sp) of the RPD will be recalculated. In a precision control chart, the assessment is expressed as a RPD interval from zero to:

$P' + [(3)\ S_p]$ = ***precision control level.***
$P' + [(2)\ S_p]$ = ***precision warning level.***

For the accuracy control charts, the average percent recovery (R') and the standard deviation (S_r) of the average percent recovery will be recalculated for selected parameters and matrices. The accuracy assessment is expressed as percent recovery interval from:

$R' + [(3)\ S_r]$ = ***upper control level.***

$R' + [(2)\ S_r]$ = ***upper warning level.***

down to:

$R' - [(2)\ S_{lr}]$ = ***lower warning level.***

$R' - [(3)\ S_r]$ = ***lower control level.***

The precision and accuracy control charts for selected parameters will be updated on a regular basis. After each five to ten new measurements are added, the average of the most current twenty to thirty data points and the standard deviation of the average will be updated.

14.0 Corrective Action

14.1 **Field Activities:** Field activities that are improper will be corrected as quickly as possible. The project field manager or designated field team leader will be responsible to see that corrective action is initiated and documented; whenever the error has the potential to compromise the quality of the data being generated or there is a chance that the error might be repeated. The Quality Manager can also make recommendations, during the field audits or field data reviews, to the field manager who can ensure

immediate implementation. The corrective action report must document in detail the nature of the problem, proposed corrective action, who is responsible for executing it, and who will verify that it was carried out. Examples for frequently measured parameters in the field and limits to which they should agree (as determined by replicate measurements or prior expectations) include:

- pH determination should agree within 0.02 pH units.
- Conductivity measurements should agree within 2 numbers of the last significant digit.
- Depth to water level determinations/readings should agree within 0.01 foot. If re-measurements are not successful, then instrument calibration and operation and the field analyst technique should be evaluated.

14.2 **Laboratory Activities:** When the performance of analytical systems is found to be unsatisfactory, corrective action will be initiated. The General Manager, Laboratory Operations Coordinators, Laboratory Managers, Project Personnel, Laboratory Supervisor, Analyst/Technician, and Quality Officer may be involved in the corrective action depending on the extent of the correction. For corrective actions that will impact the project budget or schedule, the general manager, laboratory operations coordinators, and/or the project manager/coordinator must be closely involved. There are two kinds of corrective action:

- **Immediate corrective actions** are taken to correct or repair nonconforming equipment and systems. The need for such action is likely to be identified by the analyst through calibration checks and spike analyses. Immediate corrective actions are initiated by notifying the Laboratory Supervisor and/or Laboratory Manager. If re-analysis using a separate aliquot of sample along with the associated quality control is not possible, the General Manager and/or Laboratory Operations Directors must be notified and written notification must be provided to the client within one working day.
- **Long-term corrective actions** are taken to eliminate causes of nonconformance. The need for such a corrective action may be identified through audits. Examples of this type of corrective action include:
    - Identifying vendors to supply reagents of sufficient purity;
    - Rescheduling of field activity or laboratory routine to ensure that samples are always analyzed within the correct holding time; and
    - Personnel training or replacement.

14.3 **Corrective Actions Procedures:** Corrective actions may be initiated as a result a problem identified through a system or performance audit, data review, or data end user's request. The process is generally initiated by the Quality Control Manager or Laboratory Manager and documented with a system performance log by the analyst or laboratory supervisor responsible for the data. The analyst has the ultimate responsibility of evaluating the effectiveness of the corrective actions. If the corrective action is ineffective, it is the analyst's responsibility to notify the Laboratory Supervisor and/or Laboratory Manager. Laboratory management must verify that corrective actions have been effective by performing a follow-up data review, submitting a proficiency sample or performing other internal audit activities. For either immediate or long-term corrective actions taken as a result of non-conformance in field and laboratory activities, the procedure is as follows:

- Define the problem;
- Assign the responsibility to appropriate personnel to investigate the problem;
- Find and describe the cause of the problem;
- Determine the appropriate corrective action to eliminate the problem;
- Assign and accept responsibility for implementing the corrective action;

- Establish the effectiveness of the suggested corrective action and implement the correction; and
- Verify that the corrective action has achieved its goal and the problem has been eliminated, i.e., in the preparation of new standard or calibration solutions, provided the results of the old together with the new calibration standards verify that the problem as been eliminated.

Occasionally data is reported when the accompanying quality control data are not within established quality control objectives, sample hold times have been exceeded, clients request data be reported below the laboratory's established reporting limits or some other reason the data is not to standard. These instances are documented in the final analysis results by using data qualifier codes (flags) to alert the data end user to the fact that the data may only be used within limitations. Final reports may also have a parameter comment that is added by the analyst to qualify a result when the data management codes do not suffice or additional qualification is needed.

Data Qualifiers	
Qualifier	**Description**
B	Analyte detected in the associated Method Blank
E	Value estimated due to calibration range exceedence
H	Sample extraction/analysis holding time exceeded
J	Analyte detected at less than the PQL
R	RPD exceeds accepted recovery limits
S	Spike/Surrogate Recovery exceeds accepted recovery limits

Specific corrective action procedures per method are further discussed in REIC's SOPs.

14.4. **Non-Conforming Work:** If at any time it is determined that any aspect of the analytical process has compromised the Laboratory's ability to generate defensible data the analyst must notify the Laboratory Supervisor/Manager immediately. The Laboratory Supervisor/Manager must review the data and notify the Laboratory Operations Coordinators and/or General Manager. Clients must then be notified in writing (e-mail is acceptable) of the irregularity by the Project Manager/Coordinator within the notified working day. This policy applies to situations in which the Laboratory Supervisor/Manager and Laboratory Operations Coordinators and/or General Manager have determined that the significance of the irregularity justifies recalling work that has already been released or when the Laboratory has decided that it will not report results that are considered invalid. This policy does not apply to those situations in which a data qualifier/flag or sample note can be used to qualify the data. Corrective actions described previously in this chapter must be taken immediately to remedy the situation.

15.0 QA Report to Management

The General Manager will be updated of the quality control procedures and results of field and laboratory operations. Oral reports will be on a weekly basis and formal detailed reports on a periodic basis (or as needed). The quality assurance report issued, as part of the report to the client, shall be retained as part of the project file and may not be available for review by any other external auditor other than the client.

Management shall also receive quality assurance reports as they are obtained from external systems or performance audits. The Quality Manager will provide a formal report to management on a periodic basis. The report may include:

- Overall over-view of the progress of the QA program.
- Changes in the project specific QA plans, training, and accomplishments.

- Summaries of field audits and laboratory quarterly audits Summaries of findings of monthly analytical data packages review.
- Significant QA/QC problems, recommended solutions, and results of corrective actions.
- Response to external audit findings and any corrective action implemented.

16.0 Subcontracting, Support Services, and Supplies

16.1 **Subcontracting Laboratory Services** – A listing is maintained of laboratories that provide subcontracted services for REIC along with copies of all associated certifications (such as NELAC, USACE, and state certifications). A Chain-of-Custody is generated by REIC prior to sending or initiating services from the subcontracted laboratory. All associated documentation provided by the subcontractor for a specific project is included as an appendix to REIC's final analysis report (Certificate of Analysis) that is submitted to the client.

16.2 **Outside Support Services and Supplies** – REIC only uses those outside support services and supplies that are of adequate quality to sustain confidence in the laboratory's tests. Records of all suppliers for support services or supplies required for tests are maintained by the purchasing department.

16.3 **Inspection/Acceptance Requirements for Supplies and Consumables** – Prior to acceptance of any supplies and consumables, the items are checked for breakage. Any discrepancies in the packing lists are noted. The packing slips are given to the purchasing department for filing.

16.4 **Customer Complaint Resolution** – In its commitment to quality improvement, REIC has implemented a "Client Concerns" program to address complaints and issues regarding data quality. The program is intended to address the following areas of concern:

- Sample turnaround time
- Data quality
- Invoicing
- Customer service

Client concerns are given a unique numerical identifier and can be initiated by any REIC staff member. All concerns are reviewed by the General Manager and Laboratory Operations Directors and copies are filed with REIC's Project Managers/Coordinators. These files are available to clients for review except in the case where client confidentiality may be compromised. REIC's Client Concerns SOP further addresses how complaints are registered, documented, and brought to closure (changes is procedure, corrective action taken, etc.).

17.0 References

1. **Code of Federal Regulations**; Part 136 (40 CFR 136); U.S. Government Printing Office: Washington, DC. Web Address: http://ecfr.gpoaccess.gov/cgi. (Updated daily.)
2. **Code of Federal Regulations**; Part 141 (40 CFR 141); U.S. Government Printing Office: Washington, DC. Web Address: http://ecfr.gpoaccess.gov/cgi. (Updated daily.)
3. **Method for the Determination of Organic Compounds in Drinking Water**; EPA/600/4-88/039, Dec. 1988; Revised July 1991; appended with "Supplement I", EPA/600/4-90/020, July 1990; "Supplement II", EPA/600/R-92/129, Aug. 1992; and "Supplement III", EPA/600/R-95/131, August 1995. U.S. EPA.
4. **Manual for the Certification of Laboratories Analyzing Drinking Water**, Fifth Edition, EPA/815-R-05-004. January 2005. U.S. EPA.
5. **Methods for Chemical Analysis of Water and Wastes**; EPA/600/4-79/020; March 1983, U.S. EPA.

6. **Annual Book of ASTM Standards**, Vol. 11.01 and Vol. 11.02; American Society for Testing and Materials, Philadelphia, PA. http://www.astm.org
7. **18th Edition of Standard Methods for the Examination of Water and Wastewater;** American Public Health Association, Washington, DC.
8. **Methods for the Determination of Metals in Environmental Samples;** EPA/600/4-91/010, June 1991; appended with Supplement I, EPA/600/R-94/111, May 1994; USEPA.
9. **Methods for the Determination of Inorganic Substances in Environmental Samples;** EPA/600/R-93/100; Aug. 1993, USEPA.
10. **Technical Notes on Drinking Water Methods**; EPA/600/R-94/173; Oct. 1994, U.S. EPA.
11. **Microbiological Methods for Monitoring the Environment, Water and Waste**; EPA/600/8-78/017, Dec. 1978; U.S. EPA.
12. **Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms**, Fifth Edition; EPA/-821-R-02-012, October 2002; U.S. EPA.
13. **Test Methods for Evaluating Solid Waste, Physical / Chemical Methods**, Third Edition, SW-846; Nov. 1986; revised by Revision I, Dec. 1987; amended by Update I, July 1992; Update IIA, Aug. 1993; and Update II, Sept. 1994; and Update IIB, Jan. 1995; Update III, June 1996, Revision 5, December 1996. U.S. EPA. http://www.epa.gov/epaoswer/hazwaste/test/main.htm.
14. **Contract Laboratory Program Statement of Work for Inorganic Analysis**, Multi-Media, Multi-Concentration; Document No(s). ILM 05.2, 2002; U.S. EPA.
15. **Contract Laboratory Program Statement of Work for Organic Analysis, Multi-Media, Multi-Concentration**; Document No. OLM04.3, 2003; U.S. EPA.
16. **Superfund Analytical Methods for Low Concentration in Water for Inorganics Analysis**; Oct. 1991, U.S. EPA.
17. **Superfund Analytical Methods for Low Concentration in Water for Organics Analysis**; Oct. 1992, U.S. EPA.
18. **Code of Federal Regulations**; Part 503 (40 CFR 503); for EPA Standards for the Use or Disposal of Sewage Sludge; U.S. EPA
19. **Publicly Owned Treatment Works (POTW) Sludge Sampling and Analysis Guidance Document**; Office of Water Permits Division; 1989; U.S. EPA.
20. **Drinking Water Monitoring and Analytical Requirements, Coliform Sampling**; Title 40, Part 141, Subpart C of the Code of Federal Regulations(40 CFR 141.21)
21. **Short-Term Methods for Estimating the Chronic Toxicity of Effluent and Receiving Waters to Freshwater Organisms**, 3rd Edition; EPA/600/4-91/002, July 1994; Environmental Monitoring Systems Laboratory, U.S. EPA, Cincinnati, OH.
22. **Short-Term Methods for Estimating the Chronic Toxicity of Effluent and Receiving Waters to Marine and Estuarine Organisms**, Third Edition; EPA/600/4-91/003, July 1994; Environmental Monitoring Systems Laboratory, U.S. EPA, Cincinnati, OH.
23. **RCRA Groundwater Monitoring Technical Enforcement Guidance Document (TEGD)**; OSWER-9950.1, Sept. 1996; updated by RCRA Ground-Water Monitoring: Draft Technical Guidance; EPA/530/R-93/001, Nov. 1992; Office of Solid Waste, U.S. EPA.
24. **Region II CERCLA Quality Assurance Manual**; Revision 1; U.S. EPA 1989.
25. **Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses**; EPA/540/R-94/013 February 1994, Hazardous Site Evaluation Division, U.S. EPA.
26. **Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses**; EPA/540/R-94/082, Dec. 1994, Hazardous Site Evaluation Division, U.S. EPA.

Appendix A: REIC's Corporate Code of Ethics

1. **GENERAL POLICY:** This Code is established to protect REI Consultants, Inc. (REIC) its clients and its employees from actual or potential conflicts of interest and unlawful acts, and to ensure that only the highest of professional ethics are incorporated in all facets of work. Every effort must be made to ensure that all business decisions, products, and interactions are initiated and completed in a manner characteristic of honest, responsible and equitable actions.
2. **CLIENT PRODUCTS AND INTERACTIONS:** All products, including data, reports, conclusions and communications will be carried out in a professional and responsible manner. All evaluations, data reduction, conclusions, reports and other activities relating to client projects will be performed in an objective, sound scientific manner and in accordance with Good Laboratory Practices (GLP) guidelines. Open and honest communications will be provided to approved client representatives and be available for the primary purpose of clarifications or resolving problems. All documents, information, data, reports, communications and other items of client interaction will be protected and held confidential within REIC and not be transferred or communicated to anyone outside REIC, other than to an approved client representative.
3. **CONFLICTS OF INTEREST:** Employees will report, through their immediate supervisor, any financial or employment interests in any business (1) which directly competes with REIC or (2) which supplies REIC with a substantial amount of goods or services or (3) which sells to REIC a substantial part of its output or (4) which is directly involved with any specific client. This does not apply to an interest as a security holder in companies whose securities are listed on any national securities exchange or traded over the counter by members of the National Association of Securities Dealers, unless it exceeds approximately 5% of voting control. This applies to the employee or any member of his/her immediate family.
4. **BRIBES, PAYOFFS, KICKBACKS AND RECEIPT OF GIFTS:**
   A. Employees or members of their immediate families should not enter into any agreement, arrangement or device by way of fee, rebate, loan advance, consultant agreement, legal representation or otherwise, designed or intended to reward directly or indirectly, any governmental agency or employee, official or representative thereof, or any officer, director, employer or shareholder of any customer or potential customer for decisions or actions favorable to REIC. In short, nothing in the nature of a bribe, payoff, or kick back should be paid or accepted to secure or maintain business.
   B. Employees or members of their immediate families shall not seek or accept favors, gifts, payments, loans, travel, lodging, entertainment or the equivalent from any vendor, potential vendor or other party with whom REIC does business. Promotional gifts of a nominal value motivated by commonly accepted business courtesies, such as hats, mugs and pens may be accepted, but not if acceptance of such gifts could infer prejudice toward or obligation to the donor. Providing and receiving normal business entertainment, such as lunches and dinners, is allowed provided such activities are not frequent or lavish. Other forms of entertainment, such as theater and sporting event tickets, golf dates or other outings may be accepted only if it is practical for the employee to reciprocate. If reciprocation is not possible, the employee should obtain supervisory approval. Approval of attendance of conventions and other meetings where entertainment is customary and provided on a group basis shall satisfy the requisite supervisory approval. Nothing in the nature of a bribe, payoff, or kickback will be accepted from any existing or potential vendor or other party with whom REIC does business.
5. **POLITICAL CONTRIBUTIONS:** No Company funds or services will be contributed, directly or indirectly, to any political campaign of any person seeking political office or expended in support of or opposition to such party or person except to the extent that REIC resources (including time of employees) may be utilized to maintain the operation of legally organized Political Action Committees as permitted by applicable law.
6. **DISCLOSURE AND USE OF PROPRIETARY INFORMATION**
   A. Company and client information not generally available to the public shall not be used by employees directly or indirectly, for their own personal gain, nor shall it be provided for the use of others (see Section 2). Specifically, such non-public information shall not be used in connection with the purchase, sale or trading of Company securities. Use or dissemination of such information for these purposes can result in both civil and criminal penalties.

B. An employee shall not copy data, reports, communications, licensed or copyrighted software, or instruction manuals for personal use.

7. **USE, DISPOSITION AND PROTECTION OF COMPANY ASSETS:**
   A. Employees shall not knowingly cause REIC to use any funds or other assets or provide any services, for any purpose that is unlawful under the laws of the United States, any state thereof, or any jurisdiction, foreign or domestic.
   B. Employees of REIC or any subsidiary shall not use Company funds to create any undisclosed or unrecorded Company assets for any purpose.
   C. No payment on behalf of REIC or any subsidiary shall directly or indirectly be approved or made with the intention or understanding that part of such payments is to be used for any purpose other than that described by the properly approved document supporting the payment.
8. **BOOKS AND RECORDS:**
   A. All supervisors are responsible for enforcement of compliance by employees who are subject to this Code of Ethics, as well as to ensure such employee's knowledge and compliance therewith.
   B. Any employee having information of any violation of this Code of Ethics must report such information or knowledge promptly to the appropriate level of management within that employee's company.
   C. Appropriate disciplinary action shall be taken with respect to any violation of the Code of Ethics.

9. **PROFESSIONALISM:** REIC functions and communicates to clients in a manner consistent with the highest of current professional standards. Client confidentiality and privacy is maintained at all times; and responses to inquiries are approved by the client prior to verbal or written correspondence.

   In cases where possible problems or errors are encountered, REIC openly discusses potential areas of concern and will readily communicate difficulties or mistakes to its clients. Open, frank and professional interactions are required for all staff and subcontractors within the REIC organization.

☐ **I have read and agree to conduct all of my activities and responsibilities in conjunction with REIC's Corporate Code of Ethics.**

_____

Name

_____

Signature **Date**

REI Consultants

ETHICS AND DATA INTEGRITY AGREEMENT

I. I, _____, state that I understand the high standards of integrity required of me with regard to the duties I perform and the data I report in connection with my employment at *REI Consultants*.

II. I agree that in the performance of my duties at *REI Consultants:*

a. I shall not intentionally report data values that are not the actual values obtained;
b. I shall not intentionally report the dates and times of data analyses that are not the actual dates and times of data analyses; and
c. I shall not intentionally represent another individual's work as my own.

III. I agree to inform *REI Consultants* of any accidental reporting of non-authentic data by myself in a timely manner.

IV. I agree to inform *REI Consultants* of any accidental or intentional reporting of non-authentic data by other employees.

_____
(Signature)

_____
(Date)

Appendix B: *Certification Statement*

REI Consultants NELAC Certification Statement

The applicant understands and acknowledges that REI Consultants, Inc. is required to be continually in compliance with the National Environmental Laboratory Accreditation Conference (NELAC) standards, and shall be subject to suspension, revocation, and denial of accreditation as specified therein.

I hereby certify that I am authorized to sign this application on behalf of the applicant/owner and that there are no misrepresentations in my answers to the questions on this application.

(Signature, QA Officer)	Angela M. Leef (Printed Name of QA Officer)	5-22-06 Date
(Signature, General Manager)	Clarence L. Haile (Printed Name, General Manager)	22 May 2006 Date

Appendix C: *Initial Demonstration of Capability (IDC)*

An initial demonstration of capability (IDC) is performed prior to using any analytical procedure, and at any time there is a significant change in instrument type, personnel, or test method. All demonstrations are documented through the use of the form in this appendix. A copy of the certification statement is retained in a file in the Laboratory Managers offices and/or the QC Department.

An IDC study will include a precision and accuracy study, MDL study, and performance evaluation (PE) study. For any methods or procedures that the method does not mandate an IDC or no procedure is provided (such as Turbidity, TCLP, Flash Point, etc.), the IDC will be performed by demonstrating the procedure to the Laboratory Supervisor or designee and documented with the IDC form and recorded in the personnel training records.

Precision and Accuracy Study (P/A Study)

1. Four duplicate samples are prepared by spiking the analytes at the mid-level concentration of the initial calibration range into a clean matrix.
2. The samples are analyzed according to the test method either concurrently or over a period of days.
3. Using all of the results, the mean recovery and the standard deviation are calculated for each parameter of interest.
4. The calculated mean and standard deviation are compared to the corresponding acceptance criteria for precision and accuracy on the test method (if applicable) or in the laboratory generated acceptance criteria (if there are not established mandatory criteria). If any one of the parameters do not meet the acceptance criteria, the performance is considered unacceptable for that parameter.

Method Detection Limit Study (MDL Study)

1. Seven duplicate samples are prepared by spiking the analytes at the level of 1 to 2 times the practical quantitation limit (PQL) into a clean matrix.
2. The samples are analyzed according to the test method, either concurrently or over a period of days.
3. Using all of the results, the mean recovery and the standard deviation are calculated for each parameter of interest.
4. The MDL is calculated by multiplying the standard deviation by 3.14. The recovery and calculated MDL are compared to the corresponding acceptance criteria in the test method (if applicable) or in laboratory generated acceptance criteria (if there are not established mandatory criteria). If any one of the parameters do not meet the acceptance criteria, the performance is unacceptable for that parameter.

Performance Evaluation

REIC will use the appropriate test method to analyze the proficiency test (PT) sample or a standard reference material provided by a certified vendor. If any one of the parameters do not meet the acceptance criteria, the performance is unacceptable for that parameter.

The analysis of actual samples may begin upon meeting the required criteria. When one or more of the tested parameters fail at least one of the acceptance criteria, the laboratory will repeat the test for all parameters that failed to meet the criteria.

Appendix C: Demonstration of Capability Certification Statement

REI Consultants

Demonstration of Capability Certification Statement

Date: _____

Analyst: _____

Method: _____

Parameter/Group: _____

SOP #: _____

Revision #: _____

Matrix: _____

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 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 of capability are true, accurate, complete and self-explanatory.*[3]
5. *All raw data (including a copy of this certification form) necessary to reconstruct and validate these analytes have been retained at the facility, and that the associated information is well organized and available for review by authorized assessors.*

_____ _____

Laboratory Manager (Joe Robertson/Ivan Leef) Date

_____ _____

Angela M. Leef Date
Quality Manager

[3] 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.

Appendix D

Sample Containers and Preservations

Appendix D: Required Containers, Preservation Techniques, and Holding Times			
Measurement	**Containers**	**Preservation**	**Max Holding Time to Analysis**
Bacterial Tests			
Coliform, Fecal & Total	*P,G*	Cool, 4°C 0.008% $Na_2S_2O_3$	*6 hours*
Fecal Streptococci	*P,G*	*Cool, 4°C 0.008% $Na_2S_2O_3$*	*6 hours*
Inorganic Tests			
Acidity	*P,G*	*Cool, 4°C*	*14 days***
Alkalinity	*P,G*	*Cool, 4°C*	*14 days***
Ammonia	*P,G*	*Cool, 4°C, H_2SO_4 to pH <2*	*28 days***
Bicarbonate	*P,G*	*Cool, 4°C*	*14 days***
BOD 5-Day	*P,G*	*Cool, 4°C*	*48 hours***
Bromide	*P,G*	*None Required*	*28 days***
Carbon, Organic (TOC)	*P,G*	*Cool, 4°C; H_2SO_4 to pH<2*	*28 days***
COD	*P,G*	*Cool, 4°C; H_2SO_4 to pH<2*	*28 days***
Chloride	*P,G*	*None Required*	*28 days***
Chlorine, Residual	*P,G*	*None Required*	*Analyze Immediately***
Conductance, Specific	*P,G*	*Cool, 4°C*	*28 days***
Color	*P,G*	*Cool, 4°C*	*48 hours***
Cyanide, Total & Amenable	*P,G*	*Cool, 4°C; NaOH to pH>12; 0.6 g ascorbic acid*	*14 days**, ++++*
Fluoride	*P*	*None Required*	*28 days***
Formaldehyde	*G*	*Cool, 4°C*	*30 days***
Hardness	*P,G*	*H_2SO_4 or HNO_3 to pH<2*	*6 months***
Hydrogen Sulfide, Total	*P*	*Cool, 4°C; Add Zinc Acetate*	*28 days***
Ignitability	*G*	*Cool, 4°C*	*7 days*
MBAS, (Surfactants)	*P,G*	*Cool, 4°C*	*48 hours***
Nitrate-Nitrite	*P,G*	*Cool, 4°C H_2SO_4 to pH<2*	*28 days***
Nitrite	*P,G*	Cool, 4°C	48 hours**
Odor	*G*	Cool, 4°C	Analyze Immediately**
Oil & Grease	*G*	Cool, 4°C; H_2SO_4 to pH<2	28 days**
Kjeldahl Organic Nitrogen	*P,G*	Cool, 4°C; H_2SO_4 to pH<2	28 days**
Orthophosphate	*P,G*	. Filter Immediately, Cool, 4°C	48 hours**
Oxygen, Dissolved	*G, Top& Bottle*	None Required	Analyze Immediately**
Oxygen, Winkler	*G, Top& Bottle*	Fix on site and store in dark	8 hours**
pH	*P,G*	None Required	Analyze Immediately**
Phenolic Materials	*G*	Cool, 4°C; H_2SO_4 to pH<2	28 days**
Phosphorus, Total	*P,G*	Cool, 4°C; H_2SO_4 to pH<2	28 days**
Phosphate, Total	*G*	Cool, 4°C; H_2SO_4 to pH<2 or Freeze	28 days**
Phosphorus, Total Dissolved	*P,G*	Filter, Cool, 4°C; H_2SO_4 to pH<2	24 hrs
Reactivity (CN&S)	*P,G*	Cool, 4°C	14 days**
Residue, Total	*P,G*	Cool, 4°C	7 days**
Residue, Filterable	*P,G*	Cool, 4°C	7 days**
Residue, Nonfilterable	*P,G*	Cool, 4°C	7 days**
Residue, Settleable	*P,G*	Cool, 4°C	48 hours**

Appendix D: Required Containers, Preservation Techniques, and Holding Times			
Measurement	**Containers**	**Preservation**	**Max Holding Time to Analysis**
Residue, Volatile	***P,G***	Cool, 4°C	**7 days****
Sulfate	***P,G***	Cool, 4°C	**28 days****
Specific Gravity	***P,G***	Cool, 4°C	**Analyze Immediately****
Sulfide	***P,G***	Cool, 4°C; add Zinc Acetate & NaOH to pH>9	**7 days****
Sulfite	***P,G***	EDTA	**Analyze Immediately**
Turbidity	***P,G***	Cool, 4°C	**48 hours****
Metals			
Chromium VI	***P,G***	*Cool, 4°C*	***24 hours*****
Mercury	***P,G***	*HNO_3 to pH<2*	***28 days*****
Metals, except Chromium VI and Mercury	***P,G***	*HNO_3 to pH<2*	***6 months***
Organic Tests (Semivolatiles)			
Chlorinated Hydrocarbons	***G, Teflon Lined Cap***	*Cool, 4°C; 0.008% $Na_2S_2O_3$+++++*	***7 days to extraction 40 days after extraction***
Extractable Organic Halides (EOX)	***G, Teflon Lined Cap***	*Cool, 4°C*	***28 days*****
Chlorinated Herbicides	***G, Teflon Lined Cap***	*Cool, 4°C; 0.008% $Na_2S_2O_3$+++++*	***7 days to extraction 40 days after extraction***
PCB's	***G, Teflon Lined Cap***	*Cool, 4°C; 0.008% $Na_2S_2O_3$+++++*	***7 days to extraction 40 days after extraction***
Pesticides	***G, Teflon Lined Cap***	*Cool, 4°C; 0.008% $Na_2S_2O_3$+++++*	***7 days to extraction 40 days after extraction***
Phthalate Esters	***G, Teflon Lined Cap***	*Cool, 4°C*	***7 days to extraction 40 days after extraction***
Phenols (Acid Extractables)	***G, Teflon Lined Cap***	*Cool, 4°C; 0.008% $Na_2S_2O_3$+++++*	***14 days to extraction 40 days after extraction***
Polynuclear Aromatic Hydrocarbons (PAH)	***G, Teflon Lined Cap***	*Cool, 4°C; 0.008% $Na_2S_2O_3$+++++ Store in dark*	***7 days to extraction 40 days after extraction***
Organic Tests (Volatiles)			
Acrylonitrile & Acrolein	***G Teflon Lined Cap***	*Cool, 4°C; 0.008% $Na_2S_2O_3$ +++++ Adjust pH to 4-5*	***14 days***
BTEX	***G, Teflon Lined Cap***	Cool, 4°C; Hcl; pH<2; 0.008% $Na_2S_2O_3$+++++	**14 days**
Purgeable Aromatic Hydrocarbons	***G, Teflon Lined Cap***	Cool, 4°C; HCl to pH<2; 0.008% $Na_2S_2O_3$+++++	**14 days**
Purgeable Halocarbons	***G, Teflon Lined Cap***	Cool, 4°C; HCl to pH<2; 0.008% $Na_2S_2O_3$+++++	**14 days**
Trihalomethanes	***G, Teflon Lined Cap***	Cool, 4°C; HCl to pH<2; 0.008% $Na_2S_2O_3$+++++	**14 days**
Toxicity Testing			
Acute tests	***Cubitainers***	Cool, 4°C	**36 hours**
Chronic tests	***Cubitainers***	Cool, 4°C	**36 hours**
Renewal	***Cubitainers***	Cool, 4°C	**36 hours**
Screening	***Cubitainers***	Cool, 4°C	**36 hours**

-Legend and footnotes on next page-

Definitions, Abbreviations, and Footnotes:

Measurement and Container Definitions		
BOD	-	Biochemical Oxygen Demand
COD	-	Chemical Oxygen Demand
PCB	-	Polychlorinated Biphenyl
G	-	Glass
P	-	Polyethylene

Preservations		
HCl	-	Hydrochloric Acid
HNO_3	-	Nitric Acid (metals grade)
NaOH	-	Sodium Hydroxide (ACS grade)
H_2SO_4	-	Sulfuric Acid (metals grade)
$Na_2S_2O_3$	-	Sodium Thiosulfate
°C	-	Degrees Celsius

* *For nonvolatile organics, containers for soil and sediment samples are glass with Teflon-lined caps and for volatiles, containers are glass with Teflon-lined septum. Soil sample containers for organics are glass bottles with Teflon-lined caps, polyethylene (P), or glass (G).*

\+ *Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still considered valid. Samples may be held for longer periods only if the laboratory has data on file to show that the specific types of samples under study are stable for the longer time.*

** *Holding times provided are for waters. EPA does not have holding times for these parameters in soil. These water holding times will be used as goals for those methods where a soil analysis is applicable.*

++ *7/40 = 7 days until extraction; 40 days from extraction until analysis.*
14/40 =14 days until extraction; 40 days from extraction until analysis.

*** *Mercury in soil has a 6-month holding time (EPA, Contract Laboratory Program).*

+++++ *Sample preservation should be performed immediately upon sample collection. The only preservation for soil samples is cooling at 4°C. For composite samples, each aliquot should be preserved at the time of collection. When use of an automatic sampler makes it impossible to preserve each aliquot, then samples may be preserved by maintaining at 4°C until compositing and sample splitting are completed. Only add sodium thiosulfate if the sample contains free or combined chlorine. A field test kit needs to be used for this determination. If free or combined chlorine is present, add sodium thiosulfate prior to the addition of HCl if HCl is required.*

**** *These parameters are best analyzed in the field. In consideration of shipping limitations, when these analyses are requested of our laboratory for confirmation purposes, REIC policy is to analyze these constituents within 24 hours of receipt.*

++++ *Maximum holding time is 24 hours when sulfide is present. Optionally, all samples may be tested with lead acetate paper before pH adjustments in order to determine if sulfide is present. If sulfide is present, it can be removed by the addition of cadmium nitrate powder until a negative spot test is obtained. The sample is filtered and then NaOH is added to pH 12. The ascorbic acid only needs to be added if an oxidizing agent such as chlorine is present.*

Appendix E: REI Consultants, Inc. Major Equipment Listing

High Pressure Liquid Chromatography Systems (HPLC)

Instrument ID	Make	Model	Detector Type*	Serial Number	Analysis	Service Date
SVHPLC1	Hewlett-Packard	1050	79853C UV 1046A Fluorescence 1046A Electrochemical	3140J02567/3118A01145 314A01167	8310/550/549.2/ 547/531.1	Oct. 1993
SVHPLC2	Hewlett-Packard	1050	79853C UV	3323J0342/3405A02856 3141A01167	8310/8330/ 8315/8332/550	Oct. 1993
SVHPLC3	Hewlett-Packard	1050	79853C UV	3114A00220/3522J04571	8330/550	May 2004

Gas Chromatograph/Mass Spectrometry Systems (GC/MS)

Instrument ID	Make	GC Model	Detector Model	Serial Number(s) (GC/MS/AutoSampler/Concentrator)	Analysis	Service Date
VOMS1	Hewlett-Packard	5890 Series II	5971A	———Out of Service———		
VOMS2	Agilent	6890	5973	US00038210/US03340487 11934-596A/951533009	524.2/8260B/624	July 2001
VOMS3	Hewlett-Packard	5890 Series II	5972	3336A55398/Not Listed/ 12292/93342001	524.2/8260B/624	Sept. 1994
VOMS4	Hewlett-Packard	5890 Series II	5971A	3133A37795/3188A02802/ 3425A30105/3424A00103	524.2/8260B/624	April 1996
VOMS5	Agilent	6890N	5973N	CN10403035/US35110132/ 14141/329020204EandP	524.2/8260B/624	Feb. 2004

Gas Chromatograph/Mass Spectrometry Systems (GC/MS)

Instrument ID	Make	GC Model	Detector Model	Serial Number(s) (Instrument/Towers)	Analysis	Service Date
SVMS1	Hewlett-Packard	6890+	5973	US00028664/US91922554	525.2/8270C/625	July 1999
SVMS2	Agilent	6890+	5973N	US00037590/US72010542	525.2/8270C/625	Sept. 2003
SVMS3	Hewlett-Packard	6890+	5973	US00020797/ILLEGIBLE	525.2/8270C/625	May 2001

* SVHPLC1 includes Pickering post-column carbamate system

Gas Chromatograph Systems (GC)

Instrument ID	Make	GC Model	Detector Type	Serial Number(s) (GC/AutoSampler/Concentrator)	Analysis	Service Date
VOGC1	Hewlett-Packard	5890 Series II	5320ELCD 4430 PID	3235A44098/91224005/ARCHON8100-13686/14-2000-60M	8021B/502.2	Feb. 1993
VOGC2	Hewlett-Packard	5890 Series II	TCD	GC: 3336A53082	3810	May 2000
VOGC3	Hewlett-Packard	5890 Series II	4430 PID 4410 FID	3033A33205/90080047/92261018	8021B/8015B/603	May 1991
VOGC4	Hewlett-Packard	5890 Series II	4430 PID 4410 FID	3203A41263/90135021/3203A41263	8021B/8015B	Oct. 1999
VOGC5	Hewlett-Packard	5890 Series II	4430 PID 4410 FID	———Out of Service———	8021B/8015B	May 2004
VOGC6	Hewlett-Packard	5890 Series II	4430 PID 4410 FID	3336A58707/12723/91224005	8021B/8015B	Feb. 1991
VOGC7	Agilent	6890 +	4430 PID 4410 FID	US00025299/11917-496A/89297002	8021B/8015B	May 2002

Instrument ID	Make	GC Model	Detector Model	Serial Number(s) (Instrument/Towers)	Analysis	Service Date
SVECD1	Hewlett-Packard	6890+	Dual Micro ECD	US00024533/US83901937/ US83502200/US90204383	8081A/8082	June 1998
SVECD2	Agilent	6890N	Dual ECD	CN10431060/CN431130210 CN42620095/CN42620100	8081A/8082/508/608 8151A/515.1/615	Aug. 2004
SVECD3	Hewlett-Packard	5890 Series II	NPD	3223A43710/3302A33624	507	Aug. 1990
SVECD4	Hewlett-Packard	5890 Series II+	Dual ECD	3310A47808/3013A21120 3237A32145	504/552/548/8032	Aug. 1992
SVECD5	Hewlett-Packard	5890 Series II	Dual ECD	3019A28629/3013A21569 3114A25953	8082	April 1990
SVFID1	Agilent	6890+	Dual FID	US00043338/US74804333	8015B (DRO/ORO)	Jan. 2003
SVFID2	Hewlett-Packard	5890 Series II	Dual FID	3133A37645/3013A22182	8100/8041	April 1996
SVFID3	Hewlett-Packard	5890 Series II	Dual FID	3308A46965/3013A22245 3237A32170	8015B (DRO/ORO)	Nov. 1992

Appendix E: REI Consultants, Inc. Major Equipment Listing

Metals

Instrument ID	Make	Model	Serial Number	Type	Analysis	Service Date
X7	Thermo Elemental	X7	X0303	ICPMS	200.8/6020	Nov. 2003
Iris	Thermo-Jarrell Ash	Iris Advantage	7996	Solid State, Axial/Radial ICP-AES	200.7/6010B	July 1998
Atomscan	Thermo-Jarrell Ash	Atom-Scan Advantage	10942	Sequential/PMT/ Radial ICP-AES	200.7/6010B	Nov. 2000
Spec20Plus	Varian	SpectrAA-20Plus	AA20-92121878	FAAS	200/7000 Series	Dec. 1992
220Z_1	Varian	SpectrAA-220 Zeeman	EL99073382	GFAAS	200/7000 Series	Sept. 1999
220Z_2	Varian	SpectrAA-220 Zeeman	EL99073383	GFAAS	200/7000 Series	Sept. 1999
M6000A	CETAC	M-6000A	09004MAS	Mercury Analyzer	245.1/7470A/ 7471A	Oct. 2000
Vista	Varian	Vista Pro	EL05093961	Solid State Axial ICP-AES	200.7/6010B	Oct. 2005

Classical Chemistry

Instrument ID	Make	Model	Serial Number	Type	Analysis	Service Date
DX300	Dionex	DX-300	921720/863819	IC	300.0/9056	1992
DX120	Dionex	DX-120	99070575/ 98093279	IC	300.0/9056	Aug. 1998
LECO	LECO	SC-444	3153/3255/3023	Carbon/Sulfur Analyzer	Carbon and Sulfur	1994
Auto Titrator Systems (2)	Schott	TWAIPHA	441895/441894	Titrator	pH/Alkalinity Forms/ Acidity Forms	Jan. 2002
Technicon	Bran Luebbe	Auto Analyzer 3	9521803 5449246 9523576 54503545 950100	Auto Analyzer	Cyanide/Ammonia	Nov. 2001
Oil and Grease	Horizon	SPE-DEX 3000 XL/SPE-DEX3000	05-2017 1004	Oil and Grease Extractor	Oil and Grease, 1664	March 2005 July 2000
%Water	Karl Fisher/ EM Science	Karl Fisher Titrator Aqua Star C3000 Titrator Aqua Star EV-6L Oil Evaporator	81365-10 84242-02	Titrator	%Water	March 2002
TOC	Tekman Dohrmann	Phoenix 8000	US01249002/ 190J1368	TOC Analyzer	TOC	Oct. 2001

Appendix F: NELAC Method List

Organic Analyses:

Parameter/ Group	Matrix	Method
BNAs	Soil and Liquid	SW8270C / EPA 625
Aromatic Hydrocarbons	Liquid	SW8260B/EPA 624 and SW8021B/EPA 602
BTEX and MTBE	Soil and Liquid	SW8021B / EPA 602
Herbicides	Soil and Liquid	SW8151A / EPA 615
PCBs	Soil, Oil and Liquid	SW8082 / EPA 608
Pesticides including Toxaphene and Chlordane	Soil and Liquid	SW8081A / EPA 608
TPH (DRO)	Soil and Liquid	SW8015B
TPH (GRO)	Soil and Liquid	SW8015B
Volatiles	Liquid	SW8260B / EPA 624 and SW8021B / EPA 601 and EPA 602
Volatiles High and Low Level	Soils	SW8260B / EPA 624 and SW8021B / EPA 601 and EPA 602
Flash Point	Soil and Liquid	SW1010
Explosives	Soil and Liquid	SW8330
PAHs	Soil and Liquid	SW8310/EPA 610

Metals Analyses:

Parameter	Matrix	Method
Antimony, Arsenic, Barium, Beryllium, Cadmium, Chromium, Cobalt, Copper, Lead, Manganese, Molybdenum, Nickel, Selenium, Silver, Strontium, Thallium, Tin Titanium, Vanadium, and Zinc	Liquid	EPA 200.8/SW6020
Aluminum, Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Molybdenum, Nickel, Potassium, Selenium, Silicon, Silver, Sodium, Strontium, Thallium, Tin, Titanium, Vanadium, and Zinc	Liquid	EPA 200.7/SW6010B
Aluminum, Antimony, Arsenic, Barium, Beryllium, Boron, Cadmium, Calcium, Chromium, Cobalt, Copper, Iron, Lead, Magnesium, Manganese, Molybdenum, Nickel, Potassium, Selenium, Silicon, Silver, Sodium, Strontium, Thallium, Tin, Titanium, Vanadium, and Zinc	Soil	SW6010B
Antimony	Liquid	EPA 204.2 /SW7041
Arsenic	Liquid	EPA 206.2 /SW7060A
Cadmium	Liquid	EPA 213.2/ SW 7131A
Chromium	Liquid	EPA 218.2/SW7191
Lead	Liquid	EPA 239.2/SW7421
Mercury	Liquid	EPA 245.1/SW7470A
Mercury	Soil	SW7471A
Selenium	Liquid	EPA 270.2/SW7740
Thallium	Liquid	EPA 279.2/SW7841
Hexavalent Chromium	Soil and Liquid	SW7196A and SM3500CrD
Total Hardness as $CaCO_3$	Liquid	SM2340B

Appendix F: NELAC Method List

Classical Chemistry Analyses:

Parameter	Matrix	Method
BOD	Liquid	SM5210B
COD	Liquid	EPA 410.4
TOC	Liquid	EPA 415.2
Fluoride	Liquid	EPA 300.0 and 340.2
Alkalinity as CaCO3	Liquid	SM2320B
Chloride	Liquid	EPA 300.0
Conductivity	Liquid	SM2510B
Sulfate	Liquid	EPA 300.0
Nitrite as Nitrogen	Liquid	EPA 300.0
Ammonia Nitrogen as Nitrogen	Liquid	EPA 350.1, 350.2, and 350.3
Nitrate Nitrogen as Nitrogen	Liquid	EPA 300.0
Orthophosphate as Phosphorus	Liquid	EPA 300.0
TKN	Liquid	EPA 351.3 and 351.4
Total Phosphorus as Phosphorus	Liquid	EPA 365.2
Oil and Grease	Liquid	EPA 1664
pH	Liquid	EPA 150.1
TDS	Liquid	SM2540C
TS	Liquid	SM2540B
TSS	Liquid	SM2540D
Total Cyanide	Liquid	EPA 335.4 and 335.2
Total Phenolics	Liquid	EPA 420.1
Corrosivity	Soil	SW9045C
Turbidity	Liquid	EPA 180.1

Appendix E QC Documentation

Quality Control Certification

Plan of Operations

Lime Treatment Pilot Study
Plum Brook Ordnance Works –Pentolite Road Red Water Ponds (PRRWP)
Sandusky, Ohio

Contract No. W91237-06-C-0006

This document is provided to certify that the Independent Quality Control Team (IQCT) has reviewed the Plan of Operations in accordance with the Quality Control Plan. All comments resulting from the various reviews have been resolved and/or incorporated.

Assignment	Name	Signature	Date
Senior Review	Mark Perkins		11/30/06
Peer Review	Rodney Bumgardner		11/28/06

Comments on Plan of Operations

Plan of Operations

Lime Treatment Pilot Study
Plum Brook Ordnance Works – Pentolite Road Red Water Ponds
Sandusky, Ohio

Contract No. W91237-06-C-0006

The following comments were provided by the USACE and Ohio EPA. All comments resulting from this review have been resolved and/or incorporated.

CELRH-EC-CE (1110)

8 November 2006
Albert/5760

MEMORANDUM FOR CELRH-EC-CE, ATTN: Lisa A. Humphreys

SUBJECT: Quality Assurance Review Comments for Draft Plan of Operations, Lime Treatment Pilot Study, Plum Brook Ordnance Works, Pentolite Road Redwater Ponds, Sandusky, Ohio – Contract No. W91237-06-C-0006, October 2006

RESPONSES HAVE BEEN PROVIDED BY MCTECH CORP 28 NOVEMBER 2006.
Kimberlie K. Chambers
Environmental Project Manager

1. The subject draft plan has been reviewed and the following comments are provided:

Definitions and Acronyms

- GSA. *Service* should be revised to *Services*.

Concur, added "s" to Service.

- The following acronyms should be added: ICI and WTI

Concur, added and Waste Tron, Inc.

Report Text

- Title on page 1. The title is incorrect; it references the ISRA at TNT Area B.
- Section 1.1
  - 1st paragraph, 1st sentence. "work order" should be revised to "contract". "nitro aromatic" should be revised to one word, at this and all other occurrences in the plan. "PRRWP" and "PBOW should be defined at their first occurrence.

    Concur, the above recommended changes were made to the first sentence and applicable throughout the document.

  - 1st paragraph, 2nd sentence. Recommend you add/revise to state that the USACE is the *agency* (rather than authority) responsible for environmental restoration of the PBOW site under the DERP-*FUDS (*defining the acronym FUDS) program.

    Concur, "authority" was change to agency. The acronym FUDS was not used in the SOW description; however, it was added to this sentence and defined as it is in the TOC.

- 1st paragraph, last sentence. I am not aware of how 'the results of the completed ISRA led USACE to the lime treatment investigation'; however, the results that are published in the USACE technical report, ERDC/EL TR-03-15, September 2003, *Lime Treatment of 2,4,6-Trinitrotoluene Contaminated Soils: Proof of Concept Study*, would appear to provide the justification that the lime treatment pilot study at the PRRWP could be successful. Recommend that this reference and the study's results be discussed as a means to provide additional background and justification for the pilot study at the PBOW PRRWP project site.

Concur, this sentence was changed to the following, 'the results of the completed ISRA provide analysis and evaluation of the PRRWP area. Based on the data contained in this it appears PRRWP is a good candidate for field implementation of the lime treatment technology outlined in the USACE technical report, ERDC/EL TR-03-15, September 2003, *Lime Treatment of 2,4,6-Trinitrotoluene Contaminated Soils: Proof of Concept Study*.' The reference to this report was also added to the reference section.

- 2nd paragraph, 1st sentence. It does not appear to be appropriate that the title of the action memorandum contain abbreviations (PRRWP), unless this is the correct title of the document.

Concur, the title was corrected.

- Section 1.2
  - 3rd paragraph, 1st sentence. It is noted that *PRRWP* will not need to be defined here since it should be defined in the 1st sentence in Section 1.1.

Concur, definition removed.

  - 3rd paragraph, 3rd – 5th sentences. These sentences need to be reviewed for consistency, brevity and accuracy. The 4th sentence states that the wastewater was transported to the wastewater treatment plant via flumes/pipes into different settling ponds at PRRWP. The 5th sentence states the wastewater went to WWTP #1, then the PRRWP, but 3rd sentence states the wastewater went to the PRRWP.

Concur, fourth sentence was clarified by removing the second half of the sentence which now reads, "This wastewater was then transported to a wastewater treatment and incineration area." In addition, clarification was added to the fifth sentence by adding the word, "also" as the second word in this sentence.

  - 4th paragraph, 2nd sentence. "GSA" should be defined.

Concur, GSA was defined.

- Section 1.2, cont'd
  - 5th paragraph, next-to-last sentence. The "s" on "Conservations" should be deleted.

  Concur, "s" was deleted.

- Section 1.3
  - 3rd paragraph, 1st sentence. The action memorandum's title is not consistent with what is provided in Section 1.1, 2nd paragraph. Please revise one or the other to the correct title.

  Concur, the title was revised in this paragraph as the first instance is correct.

  - 5th paragraph, 2nd sentence. The word "soils", for "…volume of *soils* tested…" should be revised to "soil"; also recommend you revise the statement to "…volume of soil *treated* (or excavated)…" rather than *tested.*

  Concur, removed the "s" from soils and replaced "tested" with "treated".

- Section 1.4
  - 1st paragraph, 1st sentence. The statement "…*by in* the SOW" needs to be revised; likely delete the word "by"; also, "SOW" has not been defined.

  Concur, "by" was deleted and SOW defined.

  - Task 5. The phrasing "Site surveying is necessary…" does not match the phrasing of other tasks. Recommend revising the word "is" to "as", or you could state the task as "Site surveying to identify excavation limits", or similar phrasing.

  Concur, changed "is" to "as".

  - Task 9. The word "Report" should be added after "Study".

  Concur, "Report" added.

  - Task 10. The phrase "will be provided" should be deleted and "delivery order" should be revised to "contract".

  Concur, made changes as suggested.

  - 2nd paragraph, 1st sentence. This should be revised to "The tasks outlined in Section 2.0 ***of the SOW*** are described in detail in the following sections of this ***Plan***"

  Concur, changes made to this sentence as suggested.

- Section 1.4.1, last paragraph. The terms "POC" and "SSHO" have not been defined.

Concur, terms were defined.

- Section 1.4.2,
  - 1st paragraph, 1st sentence. It is noted that the QCP applies to ALL products and activities under the SOW, not just the field activities.

    Concur, added, "all products and activities including" directly following the word, "covers".
  - 1st paragraph, 2nd sentence. "…*this* SOW" should be revised to "…*the* SOW".

    Concur, changed as suggested.

  - General. It is noted that the 1st and 2nd sentences could be revised to one sentence since they state similar things.

    Concur, combined sentences to read as follows, "McTech Corp will prepare a QCP that covers all products and activities including planned field activities, contained in the SOW."

- Section 1.4.3, 2nd paragraph, next-to-last sentence. The word "Under" should not be capitalized. Also, recommend that the phrase "of the SOW" be added after "3.7".

Concur, made changes as suggested.

- Section 1.4.4
  - Field Activities
    - 2nd sentence. "…during this *removal action*" should be revised to "…for this pilot study", or similar phrasing.

      Concur, changed as suggested.

    - 3rd sentence. "…, *he* will follow…"; likely should revise "he" to "personnel" or "McTech personnel", similar phrasing.

      Concur, changed as suggested.

    - 4th sentence. "…*his* field activities" should be revised to "…*their* field..."

      Concur, changed as suggested.

    - Next-to-last sentence. Is this sentence regarding response to comments applicable in this section? Likely should be in Section 1.4.2.

      Concur, clarification is needed. This is already covered in section 1.4.2 and is not needed in this section and therefore, deleted.

- Section 1.4.6
  - Title. The title should be revised to a "title format", with all words, other than minor words like "the", etc., capitalized.

  Concur, change as suggested.

- Section 1.4.6, cont'd
  - 1st paragraph, 1st sentence. "…excavate *approximately* an area approximately…"; the first "approximately" should be deleted.

  Concur, deleted.

  - 4th – 7th sentences. You may consider stating the amount of lime to be applied and the pH level to be achieved; or reference the section in the Plan where this information may be found.

  Concur, referred reader to Section 4.0 Field Activities of this Plan of Operations.

  - General. You may consider brief statements regarding rain water, runoff water, etc., although these are discussed later in the Plan. Regarding rain water, are there any concerns that the lime-treated piles could become too saturated if there are periods of prolonged rain or snow at the site? Any concerns due to cold weather?

  Concur, the following has been added to Section 1.4.6, "Weather conditions such as temperature and precipitation may affect the rates of TNT reduction. However, by utilizing the "control plots" weather related variables should be effectively controlled. Weather conditions are recorded on the daily QCR."

- Section 1.4.8, 1st paragraph, 1st sentence. You should state how the backfilled soil will be compacted (tracked in, roller-compacted, etc.) If the excavation pit becomes filled with either groundwater or surface water, the pit will require dewatering and disposal (possible analysis) of the water prior to backfilling operations.

Do not concur, per section 1.4.6, "Any water generated during excavation will be considered existing groundwater or surface water and be left in place". Because this is a Pilot Study and not a remediation no contaminated soil or water will be removed from the site. (with the exception of IDW) Ohio EPA has agreed to this process.

- Section 1.4.9, last two sentences. The referenced sections of the SOW are not correct. These requirements should have been provided in the QCP and/or this Plan.

Concur, delete the last two sentences and change to, "Refer to the QCP for all required reporting to be incorporated into the final report".

- Section 1.4.10, 1st sentence. "…work order" should be revised to "…contract"

Concur, changed as suggested.

- H. This section may require revision per comments that were provided for the QCP regarding Ms. Chambers (the PM) also serving as IQCT peer reviewer.

Concur, Mr. Rodney Bumgardner is the IQCT peer reviewer.

- Section 3.0, 1st paragraph, 2nd sentence. The document/project title *PRRWP ISRA* does not appear to be correct terminology.

Concur, the Memorandum was the document that set the soil remediation goal.

- Section 3.2, last paragraph.
  - General. This paragraph should be indented to align with previous paragraphs.

Concur, formatting changed.

  - 2nd sentence. TCLP should be defined.

Concur, defined as suggested.

  - Last two sentences. The sentences are written in past tense; is that correct? The testing requirement should be a future item to be performed for waste characterization and disposal for this project.

Concur, this should not be past tense futher is should be noted that "During the Pilot Study, no contaminated soil is expected to leave the site".

- Section 4.0
  - General. It is recommended that rain and runoff/run on water be discussed.

Concur, the following sentences were added, "The piles will only be placed on the already contaminated soil, well within the limits of the contaminated area, thereby preventing the contamination of surrounding areas."

  - 3rd paragraph, 2nd sentence. It is noted that the *approved* date for the digging permit will need to be added in the final Plan of Operations.

Concur, This date was added.

  - 4th paragraph. The word "draft" should be deleted.

Concur, deleted.

- Section 6.1, 3rd paragraph. It is recommended that the Enviroserve POC be added to Section 2.0.

Concur, the Enviroserve POC was added.

- Section 7.2. Recommend stating that the pictures will be digital format; you may want to add that camera will be formatted to show on the photograph the date it was taken.

Concur, the following sentence was added, "A digital camera will be used and, if possible, the camera will be programmed to include the date and time on each photo."

- Section 12.1, 2nd paragraph. An MSDS for the hydrated lime should be provided.

Concur, Hydrated Lime was added to the bulleted list for MSDS.

- Section 12.2. It is noted that there are special storage requirements for the hydrated lime and it is recommended that these be provided in this Plan.

Concur, the following bullet was added, "The hydrated lime required for this project will be place in a secured storage building until its application to the contaminated soil in the PRRWP."

- Section 12.3. I did not review the SSHP for this project, but there should be reference to the particular section(s) of the SSHP that discuss emergency response and medical treatment for exposure to the lime. You may want to repeat those requirements in this Plan so that spill response and other onsite personnel are aware of the hazards.

Concur, a reference to Section 3.2.9 of the SSHP was added to this section. All personnel on site are required to review the SSHP and sign off.

- Section 12.4. There is likely cleanup equipment particular to the cleanup of any spilled lime, which would differ from typical liquid spill cleanup equipment. It is recommended that this equipment be listed.

Concur, the following bullet was added, "Any lime spilled in outside of the Pilot Study area shall be cleaned up with brooms, shovels and buckets and taken to the Pilot study area for future use."

- Section 13.1. There appears to be an errant "bullet" below "13.1". Also, since there are no Sections 13.2, 13.3, etc., it is recommended that the subsection title 13.1 be deleted.

Concur, bullet deleted and 13.1 was deleted.

- Section 15.0.
  - General. A blank line is needed before the 1st bulleted item.

    Concur, line added.

  - Addresses for submittals. The word "Addresses" should be revised to "Address".

    Concur, changed as suggested.

- Addresses for submittals and Due Dates, McTech Corp. Submittals and Action Items. It is recommended that these two items/titles be shown as subsections 15.1 and 15.2 or revise into statements/paragraphs.

  Concur, change to subsections and added to the table of contents.

- Section 16.0
  - 1st sentence. The word "report" should be revised to "Plan".

    Concur, changed.

  - General, format. The first four WTI references are not in alphabetical order.

    Concur, alphabetized.

  - Final Action Memorandum reference. It is noted that the name for this reference is not as shown in Section 1.1, 2nd paragraph. Also, the reference should be USACE 2003.

    Concur, this reference was changed.

  - Composting references. The four composting references (Cornell, Irishearthworm, UFGS, and University of Missouri) should be deleted as the are not applicable to this project.

    Concur, these references were deleted.

  - Lime treatment reference. The following reference which pertains to the lime treatment of 2,4,6-TNT should be added: **USACE Environmental Quality Technology Program, Engineer Research and Development Center Engineering Letter (ERDC/EL TR-03-15, September 2003, *Lime Treatment of 2,4,6-Trinitrotoluene Contaminated Soils: Proof of Concept Study*.** Also, there are several references provided in Section 2.0 of the project Scope of Work which should added.

    Concur, all of these references were added.

- Appendix B. Vicinity and site location maps should be provided that show the PBOW site location and then the PRRWP project location to give some sense of location/direction/orientation. The map that is provided has no references to locate it on the PBOW site. The map title also references Red Water Area and stabilization, excavation and disposal of contaminated soil, which is not this project; please revise.

  Concur, these changes have been made to this drawing.

2. Please contact me at ext. 5760 if you have any questions.

FRANK R. ALBERT, Jr., P.E.
Environmental Engineer

Comments on Plan of Operations

Plan of Operations

Lime Treatment Pilot Study
Plum Brook Ordnance Works – Pentolite Road Red Water Ponds
Sandusky, Ohio

Contract No. W91237-06-C-0006

The following comments were provided by the TAPP Contractor Bennett & Williams. All comments resulting from this review have been resolved and/or incorporated.

BENNETT & WILLIAMS
ENVIRONMENTAL CONSULTANTS, INC.
2700 EAST DUBLIN-GRANVILLE ROAD • SUITE 400 • COLUMBUS, OHIO 43231-4054
TELEPHONE: (614) 882-9122 • FAX: (614) 882-4260 • 1-800-635-3810

MEMORANDUM

TO: LISA Humphreys, USACE PBOW Coordinator, and others

FROM: Julie Weatherington-Rice, Ph.D., RAB TAPP Coordinator and Mike Robison, P.E. Sr. Engineer, B&W

RE: Draft Plan of Operations Lime Treatment Pilot Study Plum Brook Ordnance Works Pentolite Road Redwater Ponds Sandusky, Ohio, McTech Corp.

DATE: November 22, 2006

Per our current contractual arrangement with US ACE which require both a technical memorandum for each report and an educational explanation to the RAB, this memorandum constitutes the technical review of the McTech October 2006 Draft Plan of Operations Lime Treatment Pilot Study Plum Brook Ordnance Works Pentolite Road Redwater Ponds Sandusky, Ohio document. Please forward these comments to those who should receive them.

Both Dr. Julie Weatherington-Rice and Michael Robison, P.E. of our staff reviewed this document. It was reviewed for both scientific and engineering concerns. This report consists of a general comments section, and then a specific comments section that addresses specific sections of the report.

General Comments

Because of the similarities in this clean-up process and that proposed by Jacobs Engineering in their June 2006 Draft document on the No. 2 Burning Grounds clean-up, we have identified similar concerns. There are two issues in this report that B&W has addressed previously in two earlier report reviews and we wish to repeat them here. The first one is the issue of the resulting surficial high pH of the materials returned to the remediation site and the limitation of high pH materials on seed germination and vegetation growth. The section below is copied from our July 26, 2006 memo on the Reservoir No. 2 Burning Grounds remediation project.

FOR THE BEST ADVICE ON EARTH®

"Vegetation Limiting Phosphorus and pH Issues Researched"

"Since this draft report does not specify which "grass" is to be planted at the re-graded Reservoir No. 2 Burning Grounds after treatment and restoration is completed, we are assuming that the grass seeding of choice will be a typical fescue(s) and/or a fescue/bluegrass/rye mixture. While we recognize that the phosphate augmentation to stabilize the lead in the soil is planned for "disposed of" materials, we are adding the phosphorous information as well for basic information.

"As a general rule of thumb, available phosphorous values should not exceed 400 pounds per acre. Levels higher than that can result in impacts to seed germination and the stunting of vegetative growth. There is also the potential for release of bound phosphates to surface water if the field capacity is above that reading. This would be especially problematical at Plum Brook since Lake Erie has just recently experienced a renewed upswing it its phosphorus loading levels after many years of declining levels. Plum Brook drains directly to Lake Erie, thereby potentially increasing the loading levels to the lake at a time when other researchers are trying to quantify the source(s) for the upswing and reduce the loading rates again.

Recent additional research identified by B&W staff subsequently to our original July 26, 2006 memo indicates that excess phosphorus applications in agricultural settings appears to be one of the major sources of excess dissolved phosphorus in Lake Erie. Therefore, we strongly recommend that the final soils level for phosphorus loading whether applied for remediation and/or fertilization remain well below 400 pounds per acre when this area is regraded. Additional levels of phosphorus will not only be in excess of levels that are needed for grass growth, they will be above the levels that can be maintained on site and will become a contribution to the additional dissolved phosphorus loadings in Lake Erie.

"The final grass seed selection will dictate the final pH limitations of the re-graded site. In addition, since fescues can have root masses that extend three feet (or more) in depth below the surface of the ground while Kentucky bluegrasses have roots only about six inches in depth, the specific seeding choices also impact how deep the final pH readings must be monitored for successful revegetation. Most of the available on-line extension bulletins addressing pH limitations for seed germination and/or plant growth from the various land-grant universities seem to be addressing low pH limitations and/or optimum pH conditions. The condition at Plum Brook will be a high pH limitation. We did find a useful reference on tall fescue management from West Virginia University Extension Service that recommended a pH in the range of 5.8 to 6.5 for highest productivity. Since the lime stabilization process calls for raising the pH to 11 *(no final pH level has been identified in this report)*, these

optimum values are significantly below the resulting materials that will be used for fill and/or left in place after treatment. Additional publications from other universities indicated the same general range of ideal growing conditions.

"There is, however, another way to address this issue. We were able to locate an excellent reference from Ernst Conservation Seeds. Their catalogue lists each grass and forbs by individual pH requirements and allows the customer to purchase either straight seed or a blended seed. A quick review of their information indicates that tall fescue *(festuca arundinacea) (F. elatior)* can be grown in settings that include *"Low fertility, acid, clay, loamy and sandy soils, pH 5.0 to 9.0. Partial shade tolerant. Drought tolerant."* Most of the other fescues, ryes and bluegrasses have lower upper pH thresholds. For instance, Perennial Ryegrass *(Lolium perenne)* has an upper pH limitation of 7.5 and Kentucky Bluegrass *(Poa pratensis)* has an upper pH limitation of 8.4. Therefore, if it is possible to mix the ex-situ or in-situ lime slurry treated materials with other materials on the site to insure a pH reading of no higher than 7.5 or so to a depth of three feet, revegetation of the site should be much less of a problem.

"It should be noted that this issue in no way reflects on the technical processes being considered for site remediation in this Draft report. This issue is only important in terms of trying to revegetate the site after the remediation and regarding has been completed."

Since the original comments were written, we have identified additional ways to resolve the remaining high pH limitation to seed germination and plant growth. Another possibility is to create an upper capping of clean on-site soil materials with background pH balances. It may only be necessary to place a cap of approximately one foot in depth of local clean soils materials to insure the ability of seed germination and plant growth. The depth of the untreated clean soils layer will function as the base of root growth; however, for some number of years until precipitation leaches the higher remaining pH levels out of the replaced remediated materials. Therefore, the selection of grass seed should be based, at least in part, on this limiting factor. Of course, planting time, fertilization, seedbed mulching, and watering will also be critical for successful vegetative growth. We recommend that those specifics also be included in the final document. For localized Erie County weather and seasonal limitations for on-site seed germination and plant growth either before or after killing frost dates, it is best to check with the Erie Soil & Water Conservation District. They can be reached at 419-626-5211.

An additional alternative would be to place a thinner cover of clean, on-site soils materials and then sod the site. This option will probably be more expensive than the option above.

Dust Control

There is limited discussion in this Draft report about the need for dust control at the site during excavation, treatment, and replacement of treated materials. The discussion is not well referenced. Therefore, we are including the comments we made concerning dust control at the PBOW site in our July 7, 2006 review of the TNT- Area B soils project. The comments and the reference included in the list of citations of that report are applicable here as well. The recommendations in the Ohio EPA (2006) Guidance Document can be used to achieve a suitable measure of dust control at the site during this effort. Maintaining levels of dust in accordance with the Ohio EPA (2006) Guidance Document should also result in Ohio EPA approval of this dust control issue.

> "This section discusses the potential need for dust control on haul roads but it gives no measurable criteria that would be used as a benchmark to determine when dust control should be implemented. Also, there are no criteria listed in an appendix or an outside reference where this information can be found."

Specific Comments

1.4.6 (Task 6) Excavation of contaminated material/Tilling of hydrated or slaked lime

Soil is to be excavated until groundwater is reached. In this test area, excavation was terminated at 8 feet, instead of the planned 10 feet because ground water was encountered. This means that 20% of the contaminated soil was left in place. This inability to reach the base of the contaminated area raises a number of questions. Will the Ohio EPA grant clean closure to any area where contaminated soil is left in place? What if groundwater is encountered at even shallower depths when the project goes forward? There should be some discussion as to the ramifications of leaving contaminated soil in place. In addition, because the seasonal levels of shallow ground water vary significantly based on the season and on the antecedent soil moisture conditions before remediation begins, it is critical to time this activity during the driest part of the year to insure the greatest depth to the perched ground water level at the site. Perhaps a sampling program at the base of the excavations is needed to check if the PRG is still being exceeded in the remaining materials.

Information regarding the periods of deepest perched ground water levels can be developed from historical climate information and from the ground water elevations in the shallow unconsolidated materials monitoring wells finished at the top of the Plum Brook shale on site at PBOW, such as the ones found at the Acid Areas 2 & 3. This is yet another excellent opportunity for information transfer from one PBOW project to another on site.

1.4.8 (Task 8) Site Restoration

This section might be a suitable location to address the issue of final pH values of these materials when used for site restoration. A discussion of how the site will be restored to assure a suitable soil base for seed germination could be included here as well. Further, the plan should state that follow up inspections are going to be made to ensure that the cover is maintained.

This concludes our technical comments on this Draft Report.

References Cited in this Report Relating to Seed Germination

Ernest Conservation Seeds, 2006, Home Page, Catalog, Company Info, Naturalized Reclamation & Conservation Species, Price List & Ordering. Meadville, PA. http://www.ernstseed.com/, searched 6/22/2006.

Rayburn, Edward B., October 1993, Tall Fescue Management, West Virginia University Extension Service Forage Management. Morgantown WV. http://www.caf.wvu.edu/~forage/tallfesc.htm, searched 6/22/06.

References Cited in the Report Relating to Dust Control

Ohio EPA, 2006, Ohio Administrative Code 3745-17, Particulate Matter Standards, http://onlinedocs.andersonpublishing.com/oh/lpExt.dll?f=templates&fn=main-h.htm&cp=OAC.

Additional Useful References not Cited in this Report Relating to Seed Germination

Broome, Malcolm L. and David J. Lang, no date, Forage: Tall Fescue in Mississippi. Mississippi State University Extension Service Information Sheet 830, 2 pages.

Chachalis, Demosthenis and Krishna N. Reddy, 2000, Factors affecting *Campsis radicans* seed germination and seedling emergence. *Weed Science:* Vol. 48, No. 2, pp. 212-216. Abstract on line at .../?request=get-abstract&issn=0043-1745&volume=048&issue=02&page=021. searched 6/22/06.

Cherney, Jerry H. and Keith D. Johnson, No date, Tall Fescue for Forage Production. Purdue Forage Information. http://www.agry.purdue.edu/ext/forages/publications/ay98.htm. searched 6/22/06.

Gibeault, Victor A. and Richard Autio, 1987, Turf-Type Tall Fescue Performance in California. *California Turfgrass Culture* Vol. 37 Nos 1&2, 1987, U of California Cooperative Extension. 3 pages.

Hanson, Jonathan and Holly Johnson, 6/21/06, Integrated Forage, Crop, and Livestock Systems for Northern Great Plains, USDA ARS Research Project. Mandan, ND.

http://www.ars.usda.gov/research/.../publications.htm?SEQ_NO_115=16554, searched 6/22/06.

Pinkerton, Bruce, 1999, Establishment of Tall Fescue. Clemson University Cooperative Extension Service Web Based Electronic Forage Fact Sheet 17, 1999. http://www.clemson.edu/agronomy/grasslands/forage/tallfescue/establish.html. searched 6/22/06.

Pitman, W. D., 2000, 'Georgia-5' Tall Fescue Establishment Responses to Amendment of Louisiana Coastal Plain Soils in *Agronomy Journal* 92:479-484 (2000), abstract located http://agron.scijournals.org/cgi/contant/full/92/3/479. searched 6/22/06

Streich, Anne, Janssen, Don and Steven Rodie, No date, Landscapes for Shade (Shade and Turfgrass). NebGuide, U. of Nebraska – Lincoln Extension. http://elkhorn.unl.edu/epublic/pages/publicationsD.jsp?publicationId=201. searched 6/22/06.

Washington County Cooperative Extension Service, No date, Pasture Management; Tall Fescue. Oklahoma Cooperative Extension Service. http://www.onenet.net/~wcokstateu/pasture.htm. searched 6/22/06.

Response to Bennett & Williams technical review of the McTech October 2006 Draft Plan of Operation Lime Treatment Pilot Study.

General Comments & Specific Comment 1.4.8 (Task 8)

This pilot study will utilize control plot, in order to evaluate the applicability of the alkaline hydrolysis. These control plots will not undergo lime addition. At the conclusion of this study the soils will be returned to the excavation. The control plots will be used to make up the upper two feet of the fill. Therefore, elevated soil pH should not be an issue with reseeding. Specific grass mixture will be selected at the conclusion of the pilot study and will consist of common grasses found within the PRRWP area. For this small pilot study dust control and/or suppression is not expected to be an issue. The field activities will be carried out in December and January when hot and dry weather conditions will be avoided.

Specific Comment 1.4.6 (Task 6)

As presented in Section 1.3 "Overview of Remedy and Proposed Action", the Ohio EPA has agreed that the soil involved in this pilot study could be returned to the excavation even if the TNT reduction does not reach the RGO levels. This agreement was based on the future availability to fund the continuance of the Interim Soil Removal Action. Further, the intent of this pilot study is to evaluate the TNT reduction through alkaline hydrolysis. The results will be used to further analyze the available options for the continuation of remedial activities. The anticipated depth to groundwater used in this pilot study is based on previous excavations in the area.

Comments on Plan of Operations
DRAFT
Plan of Operations

Lime Treatment Pilot Study
Plum Brook Ordnance Works –Pentolite Road Red Water Ponds
Sandusky, Ohio

Contract No. W91237-06-C-0006

The following comments were provided by the McTech Corp Independent Quality Control Team (IQCT). All comments resulting from this review have been resolved and/or incorporated.

General:

Check spacing and reconcile the Table of Contents once all changes have been made. Currently, the page numbering is off.

Response: Spacing checked and Table of Contents page references changed as needed.

Specific:

1) Cover and throughout document: Please insert the correct contract number: W91237-06-C-0006. Also, remove the word, "in-situ" from the title and throughout the document as this will not be in place treatment, rather we will be excavating the soil prior to treatment.*Response:*

Response: Correct contract number inserted and "in-situ" term removed from document

2) Table of Contents still list Section 4.2 and 4.2 although they do not exist in the document, please delete.

Response: Removed these from table of contents.

3) Section 3.0, second sentence, delete as it is not applicable to this project.

Response: Deleted second sentence.

4) Section 4.0, third paragraph, first sentence. The digging permit date is not correct, please change to 10/27/06. Next sentence, Also there is only one permit, therefore delete the "s".

Response: Permit date changed and "s" deleted.

5) Appendix B, site map should be updated to show area of excavation and suggested test plot locations.

Response: An updated, more detailed, map has been requested from Mountain State Company.

6) Appendix E still refers to the review of the SSHP. Please change to Plan of Operations

Response: Changed to Plan of Operations.

Kim Chambers

From: Humphreys, Lisa A LRH [Lisa.A.Humphreys@lrh01.usace.army.mil] **Sent:** Tue 11/28/2006 1:12 PM
To: Kim Chambers
Cc:
Subject: FW: Status of PBOW PRRWP Lime Treatment Pilot Study Plan ofOperations Revew
Attachments:

Here's Ohio EPA's email stating they have no comments on the PRRWP Lime Study treatment pilot study. You'll be getting these formally from Pam on Friday. I'll be forwarding the TAPP contractor's comments when I find the email ...

Thanks!

From: Paul Jayko [mailto:Paul.Jayko@epa.state.oh.us]
Sent: Tue 11/28/2006 9:59 AM
To: Humphreys, Lisa A LRH
Subject: Re: Status of PBOW PRRWP Lime Treatment Pilot Study Plan ofOperations Revew

Lisa,

Ohio EPA has concluded it's review to the Plan of Operations for the Lime Treatment Pilot Study and has no substantive comments. Thank you.

Paul Jayko

>>> "Humphreys, Lisa A LRH" <Lisa.A.Humphreys@lrh01.usace.army.mil> 11/21/2006 10:59 am >>>
Paul, Bob,

Just checking to see where you all stand on the Lime Treatment Pilot Study review. We're having the pre-con meeting on Monday and was hoping to address

any issues you all had on the Plan of Operations before then if possible (hopefully there's no show stoppers) ...I'm on leave the rest of the week but will be checking email and taking cell phone calls if you need me ...I can pass the electronic comments on to Kim and she can put them in the final Plan of Ops and make sure we're good to go ....take care and call if you need anything ...

Lisa :-)

304-617-1461

304-360-2558

You replied on 11/21/2006 3:36 PM.
This message was sent with high importance.

Kim Chambers

From: Humphreys, Lisa A LRH [Lisa.A.Humphreys@lrh01.usace.army.mil] **Sent:** Tue 11/21/2006 1:01 PM
To: Kim Chambers
Cc:
Subject: FW: Status of PBOW PRRWP Lime Treatment Pilot Study Plan of Operations Revew
Attachments:

Here's Bob's comments on the Plan of Ops for the lime treatment ..thanks!

From: Lallier, Robert F. (GRC-QSE0) [mailto:Robert.F.Lallier@nasa.gov]
Sent: Tuesday, November 21, 2006 12:59 PM
To: Humphreys, Lisa A LRH
Subject: RE: Status of PBOW PRRWP Lime Treatment Pilot Study Plan of Operations Revew
Importance: High

Lisa,

Here are my somewhat minor comments:

Page 6, section 1.4.4, line 7: ...the QCP and SSHP have been reviewed by NASA and approved by USACE..

Page 14, 4th paragraph: ...The USACE and NASA..., also add the following to the end of the paragraph: "All waste manifests will be reviewed and signed by NASA."

That's it.

See you next week and have a wonderful Thanksgiving. Don't get too burned on the beach!

Bob

Robert F. Lallier Jr.

Environmental Manager

NASA Plum Brook Station

6100 Columbus Avenue

Sandusky, OH 44870

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From: Humphreys, Lisa A LRH [mailto:Lisa.A.Humphreys@lrh01.usace.army.mil]
Sent: Tuesday, November 21, 2006 10:59 AM
To: Paul Jayko; Lallier, Robert F. (GRC-QSE0)
Subject: Status of PBOW PRRWP Lime Treatment Pilot Study Plan of Operations Revew

Paul, Bob,

Just checking to see where you all stand on the Lime Treatment Pilot Study review. We're having the pre-con meeting on Monday and was hoping to address any issues you all had on the Plan of Operations before then if possible (hopefully there's no show stoppers) ...I'm on leave the rest of the week but will be checking email and taking cell phone calls if you need me ...I can pass the electronic comments on to Kim and she can put them in the final Plan of Ops and make sure we're good to go ....take care and call if you need anything ...

Lisa ☺

304-617-1461

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SUBJECT: Quality Assurance Review Comments for Draft Plan of Operations, Lime Treatment Pilot Study, Plum Brook Ordnance Works, Pentolite Road Redwater Ponds, Sandusky, Ohio – Contract No. W91237-06-C-0006, October 2006

RESPONSES HAVE BEEN PROVIDED TO NASA BY MCTECH CORP 28 NOVEMBER TO NASA EMAIL OF 11 NOVEMBER
Kimberlie K. Chambers
Environmental Project Manager

1) Concur, change made.

2) Concur, added sentence.