ACF INDUSTRIES LLC

INCORPORATED

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Weatherford.Jeffrey@epamail.epa.gov

December 2, 2005

Jeffrey Weatherford
U.S. Environmental Protection Agency
97 N. Outer Road
Eureka, Missouri 63025

Re: Carter Carburetor Superfund Site St. Louis, Missouri, Administrative Settlement Agreement and Order on Consent for Removal Action, Docket No. CERCLA-07-2005-0372

Dear Mr. Weatherford:

As required under the Administrative Settlement Agreement and Order on Consent for Removal Action, Section VII, Paragraphs 43 and 44, please find enclosed an original copy of MACTEC Engineering and Consulting, Inc.'s Health and Safety Plan (HASP), Quality Assurance Project Plan (QAPP) and Site Characterization Work Plan (SCWP).

Sincerely,

Richard A. Hyink

Richard Hyink
Director-Safety & Environment

Copies to:
Gene Watson – MACTEC

Michael Parris
Hazardous Waste Program Manager
Missouri Department of Natural Resources
P.O. Box 176
Jefferson City, Missouri 65102-0176

Health and Safety Plan (HASP) for Carter Carburetor Site Characterization Work Plan

Prepared for:

ACF Industries, LLC
Carter Carburetor SITE
2800 Block North Grand
St. Louis, Missouri

December 2005

MACTEC Engineering and Consulting, Inc.
3199 Riverport Tech Center Drive
St. Louis, Missouri 63043

MACTEC Engineering and Consulting Project No. 3250055164

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1.0 Project, Site, and Task Information

Project Name: Carter Carburetor	**Project Number: 3250055164**
Site Location: 2800 Block North Grand, St. Louis, MO	
Start Date of Site Activities: 2/1/2006	**End Date of Site Activities: 12/1/2006**
Project Manager: Eugene M. Watson	

Site Information

Site description (e.g., landfill, UST, industrial site, significant geographic features):
The Site is located in an urban setting. The surrounding area is a mix of residential and commercial neighborhoods composed of medium to low income dwellings, as well as small and large businesses. The population of the City of St. Louis is approximately 350,000. Surface water from the Site drains to storm sewers that discharge into the Metropolitan St. Louis Sewer District (MSD). The former Carter Carburetor facility manufactured carburetors and other components for gasoline and diesel powered equipment. The Site being investigated includes the former North and South Die Cast Buildings and the former North Parking lot. Former manufacturing processes within these buildings utilized various hydraulic/lubricating oils and dielectric fluid as part of their ongoing operations. Underground storage tanks (USTs) have been typically used to store hydraulic fluids (Pydraul). The Site is partially surrounded by a chain-link fence.

If a designated Hazardous Waste Site (NPL, state), describe:
N/A

Site history (describe previous use(s)):
The former Carter Carburetor facility manufactured carburetors and other components for gasoline and diesel powered equipment. Former manufacturing processes within these buildings utilized various hydraulic/lubricating oils and dielectric fluid as part of their ongoing operations. Underground storage tanks (USTs) have been typically used to store hydraulic fluids (Pydraul).

Additional significant features or information (e.g., limited access, traffic):
Written access agreement to site by LRA.

Are site contaminants known or expected in (note concentrations and physical form)?:
Liquid PCBs (in oil) Solid PCBs (in/on Building surfaces) Gaseous

Are site contaminants expected in:

Soil: Yes	Air: Yes
Groundwater: Yes	Other (drums, tanks, etc.):
Surface Water: Yes	Additional Comments:

Task Information

Task Name:	**Task Description :** **(include anticipated LOP, tools & equipment to be used)**
Mobilization/De-mobilization	Company vehicle and equipment, Level D
Soil-Concrete Borings/Drilling/Excavations	Install borings with Geoprobe /Drill Rigs/Backhoe, Mod Level D
Collect Soil/Concrete Core Samples	Place soil/concrete into appropriate containers, Mod Level D
Survey Locations	Survey equipment, Level D
Structural Analysis	Sampling equipment, Level D
Subsurface Utility Locating	Locating equipment, Level D

2.0 HASP Approval

Scheduled Start-up Date: 2/1/2006 **Scheduled Start-up Time:** 07:00

Project: ACF Industries **Site:** Carter Carburetor Site

Project Number: 3250055164 **Location:** St. Louis, MO

We have reviewed the attached HASP, including the HASP Request Worksheet, for the above referenced site. We recognize that when this form is completed, the attached HASP is approved for the field activities on the above referenced site. Changes to this HASP shall be documented in writing and approved.

Chris L. Tedder _____ _____

Name and Signature of HASP Author Date

Lana M. Smith _____ _____

Name and Signature of HASP Reviewer Date

Eugene M. Watson _____ _____

Project Manager Signature Date

_____ _____

Field Team Leader Signature Date

_____ _____

Site Health & Safety Officer Signature Date

3.0 HASP Acknowledgement

Project: ACF Industries **Site: Carter Carburetor**

Project Number: 3250055164 **Site Location: St. Louis, MO**

I acknowledge that I understand the requirements of this HASP, and agree to abide by the procedures and limitations specified. I also acknowledge that I have been given an opportunity to have my questions regarding the HASP and its requirements answered prior to performing field activities. Health and safety training and medical surveillance requirements applicable to my field activities at this site are current and will not expire during on-site activities.

Signature	Employee Number	Date

I acknowledge that I have verified that the employees listed above have fulfilled the health and safety training requirements for this site. I have also verified that the above employees have fulfilled the medical surveillance requirements and any client requirements to participate in a drug surveillance program for this site and do not have any medical restrictions that would prohibit them from working at this site.

Project Managers Signature: _____ Date: _____

4.0 Contractor Coordination

Project: ACF Industries **Site: Carter Carburetor**

Project Number: 3250055164 **Site Location: St. Louis, MO**

I acknowledge that:

I have provided subcontractors who will be performing field activities on this site with a copy of this HASP, and I have informed the subcontractors that OSHA 29 CFR 1910.120 applies to their field activities.

I have verified that all subcontractors working on this project have been approved for use by the office/division under MACTEC E and C's Contractor Pre-Evaluation Program for the types of tasks they will be performing on site.

I have verified that all subcontractors have a method to comply with the client's drug surveillance procedure.

____ Applicable __X__ Not Applicable

I have informed all subcontractors that copies of their written HASP and any applicable Material Safety Data Sheets must be on site at all times.

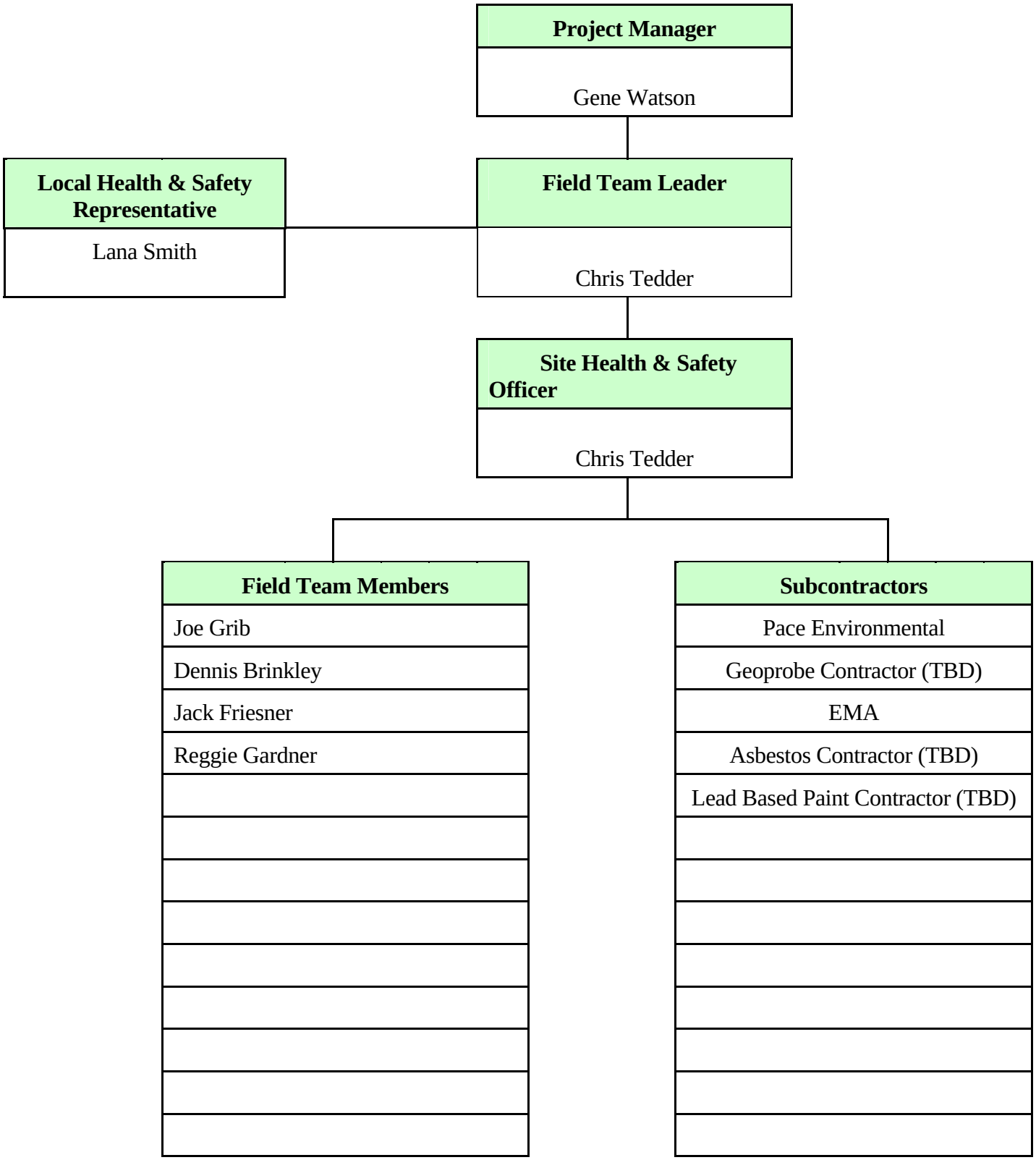
For lockout/tagout operations: I have obtained information on the subcontractor's lockout/tagout program (from the subcontractor or LHSM) and have provided that information to the FTL/SHSO for use in field health and safety training.

__ Applicable __X__ Not Applicable

I have verified that all subcontractors have Workers' Compensation Insurance

Project Manager Signature Date

5.0 HASP Organization Chart



EMA – Environmental Management Alternatives

TBD – To Be Determined

6.0 Identified/Suspected Site Contaminants

Contaminant Name (Synonyms)	Appearance & Physical Form (Pure substance)	OSHA PEL/ ACGIH TLV	STEL	IDLH	Routes of Entry	Potential Health Effects (Acute & Chronic)	PID Ionization Potential
Benzene (Benzol)	Colorless to light yellow liquid with aromatic odor	0.5 ppm (TLV)	2.5 ppm	500 ppm	Inhalation Absorption Ingestion Contact	Irrit eyes, skin, nose, resp sys; gidd; head; naus; staggered gait, ftg, anor, lass; derm; bone marrow depress	9.24
1,2-Dichloroethene (1,2-Dichloroethylene)	Colorless liquid with a slightly acrid chloroform-like odor	200 ppm (PEL)	NE	1000 ppm	Inhalation Ingestion Contact	Irrit eyes, resp sys, CNS depres	9.65
Ethyl Benzene	Colorless liquid with an aromatic odor	100 ppm (PEL)	125 ppm	800 ppm	Inhalation Ingestion Contact	Irrit eyes, skin, muc memb; head, derm, narco, coma	8.76
Petroleum Distillates	Colorless liquid with a gasoline or kerosene-like odor	100 ppm (PEL)	NE	1100 ppm	Inhalation Ingestion Contact	Irrit eyes, nose, throat; dizz, drow, head, nau; dry cracked skin; chemical pneu (aspir liq)	
Polychlorinated Biphenyls (PCB, chlorodiphenyl)	Colorless to pale yellow, viscous liquid or solid with mild hydrocarbon odor	0.5 mg/m3 (PEL)	NE	5 mg/m3	Inhalation Absorption Ingestion Contact	Irrit eyes; chloracne; liver damage; reproductive effects	2.53 (avg.)
Toluene (Toluol, methyl benzene, phenyl methane	Colorless liquid with a sweet pungent benzene-like odor	50 ppm (TLV)	150 ppm	500 ppm	Inhalation Absorption Ingestion Contact	Irrit eyes, nose; ftg, weak, conf, euph, dizz, head; dilated pupils; lac; ner, musc ftg, insom; pares; derm; liver, kidney damage	8.82
Trichloroethene (Trichloroethylene, TCE)	Colorless liquid (sometimes dyed blue) with a chloroform-like odor	50 ppm (PEL)	200 ppm Ceiling	1000 ppm	Inhalation Absorption Ingestion Contact	Irrit eyes, skin; head, vert; vis dist, ftg, gidd, tremor, som, nau, vomit; derm; card arhy, pares; liver inj; [carc]	9.45
Vinyl Chloride (Chlorethene, Chloroethylene)	Colorless gas or liquid (below 75EF) with a pleasant odor at high concentrations	1 ppm (PEL)	5 ppm Ceiling	ND	Inhalation Ingestion Contact	Weak abdom pain, GI bleeding; enlarged liver; pallor or cyan of extremities, liq. frostbite; [carc]	9.99

Contaminant Name (Synonyms)	Appearance & Physical Form (Pure substance)	OSHA PEL/ ACGIH TLV	STEL	IDLH	Routes of Entry	Potential Health Effects (Acute & Chronic)	PID Ionization Potential
Xylenes (o-,m-,p-isomers)	Colorless liquid with an aromatic odor	100 ppm (PEL)	150 ppm	900 ppm	Inhalation Absorption Ingestion Contact	Irrit eyes, skin, nose, throat; dizz, excitement, drow, inco, staggering gait, corn vacuolization, anor, nau, vomit, abdom pain, derm	8.44-8.56

Note:
ACGIH = American Conference of Governmental Industrial Hygienists
STEL = Short Term Exposure Limit (STEL)
IDLH = Immediately Dangerous to Life or Health
OSHA = Occupational Safety and Health Administration
PEL = Permissible Exposure Limit (OSHA)
TLV = Threshold Limit Value (ACGIH)
REL = Recommended Exposure Limit (NIOSH)
ppm = parts per million
NIOSH = National Institute for Occupational Safety and Health
ND = Not Determined
NA = Not Applicable
NE - Not Established
mg/m3 = milligrams per cubic meter
Ca/carc = Carcinogen

Abbreviations in table taken from the NIOSH *Pocket Guide to Chemical Hazards*

7.0 Task Hazard Evaluation

Hazards	Tasks					
	Mobilization/ De-mobilization	**Drilling/Coring/ Boring**	**Excavating**	**Soil/Core Sampling**	**Surveying/ Structural Analysis**	**Subsurface Utility Locating**
Biological	☒	☒	☒	☒	☒	☒
Boating/Water	☐	☐	☐	☐	☐	☐
Chemical	☐	☒	☒	☒	☐	☐
Confined Space	☐	☐	☒	☐	☐	☒
Drilling/Boring	☐	☒	☐	☐	☐	☐
Electrical	☒	☒	☒	☐	☐	☒
Excavation	☐	☐	☒	☐	☐	☐
Fall	☐	☐	☐	☐	☐	☐
Fire/Explosion	☒	☒	☒	☐	☐	☒
Heavy Equipment	☐	☒	☒	☐	☐	☐
Noise	☐	☒	☒	☐	☐	☐
Temperature-Cold	☒	☒	☒	☒	☒	☒
Temperature-Hot	☒	☒	☒	☒	☒	☒
UST	☐	☐	☐	☐	☐	☐
Vehicular	☒	☒	☒	☐	☒	☒

8.0 Levels of Protection

Task (Describe)	Anticipated LOP		Upgrade LOP			
	LOP	**Airborne Levels**	**LOP**	**Airborne Levels**	**LOP**	**Airborne Levels**
Mobilization and De-mobilization	D	Background	N/A	N/A	N/A	N/A
Soil/Concrete Core Boring/ Drilling/Excavation	Mod D	< 0.5 ppm (Benzene Dräger Tube); < 1.0 ppm (Vinyl chloride Dräger Tube); and < 25 ppm PID above background and /or No Visible dust	C	> 0.5 ppm (Benzene Dräger Tube); > 1.0 ppm (Vinyl chloride Dräger Tube); and > 25 ppm PID above background and /or No Visible dust	Shut Down	**> 2.5 ppm** (Benzene Dräger Tube): **> 5 ppm** (Vinyl chloride Dräger Tube); and/or > 100 ppm PID above background
Soil/Concrete Core Sampling	Mod D	< 0.5 ppm (Benzene Dräger Tube); < 1.0 ppm (Vinyl chloride Dräger Tube); and < 25 ppm PID above background and /or No Visible dust	C	> 0.5 ppm (Benzene Dräger Tube); > 1.0 ppm (Vinyl chloride Dräger Tube); and > 25 ppm PID above background and /or No Visible dust	Shut Down	> 2.5 ppm (Benzene Dräger Tube): **> 5 ppm** (Vinyl chloride Dräger Tube); and/or > 100 ppm PID above background
Surveying/Structural Analysis	D	Background	N/A	N/A	N/A	N/A
Subsurface Utility Locating	D	Background	N/A	N/A	N/A	N/A

9.0 Hazard Mitigation

9.1 General Safety Rules

- Eating, drinking, chewing gum or tobacco, smoking, and applying lip balm or make-up is prohibited in any area designated to be contaminated.
- Contact with contaminated surfaces should be avoided. Whenever possible, Field Team Members should not walk through puddles, mud, or discolored surfaces; kneel on the ground; or lean, sit or place equipment on drums, vehicles, or the ground.
- Smoking and other sources of ignition are prohibited in the vicinity of heavy equipment and flammable or contaminated material, including flammable vapors.
- Personnel must wash hands and face prior to eating and drinking. Field personnel must shower as soon as possible after leaving the site.
- Horseplay is prohibited in all work areas.
- Working while under the influence of intoxicants, narcotics, or controlled substances is prohibited.
- Good housekeeping procedures shall be followed to reduce slips, trips, and falls.
- Operations shall be restricted to daylight hours unless adequate lighting is provided or if lighting is required within the building per Attachment F of MACTEC's UCEP Program.
- All electrical equipment will be shut off during fueling operations.
- Gasoline or diesel powered generators used to provide electricity at the work site will be placed in open, well ventilated areas to avoid issues related to exposure and increased levels of carbon monoxide.
- Field equipment will be operated in a manner to minimize dust generation.

9.2 Electrical Hazards

- Locate and mark buried electric lines before all subsurface work.
- For voltages 50 kV or less, maintain at least 10 feet of clearance from overhead power lines. For voltages exceeding 50 kV, the clearance shall be increased by 4 inches for every 10 kV over 50 kV.
- Electrical equipment, including pumps, sampling equipment, and power tools will be inspected prior to use to ensure that they are in good repair and have no frayed or loose connections.

- All electrical equipment used on site will be properly grounded or bonded.
- Ground Fault Circuit Interrupters (GFCI) will be used with electrical equipment on site.
- If electrical equipment must be connected by splicing wires, use properly insulated connectors and wrap with electrical tape.
- Do not perform work on electrical hook-ups and/or equipment when they are located in standing water. When water is present, either drain/dry the area or move the equipment to a dry location.

9.3 Temperature Hazards

9.3.1 For Heat

- When work is being performed under high temperatures and humidity, implement a heat stress monitoring program according to SOP. Monitoring should include heart rate and body temperature measurements.
- Work/rest periods should be modified as necessary based on the results of the monitoring program.
- Preventative measures should be taken to avert employee illness, including rest periods, work slowdowns, job rotation, and/or performing work during cooler hours of the day. Shade or air-conditioned shelter should be provided for employees during rest periods.
- Potable, cool water will be provided for employees. Workers should be encouraged to drink 16 ounces of water prior to their shift, and drink at every rest break (or every 15 to 20 minutes).
- The SHSO or FTL will discuss the signs and symptoms of heat related illnesses with workers and document on the Daily Safety Meeting Checklist.

9.3.2 For Cold

- In cold extremes, if feet or other body parts become wet they should be dried at the earliest possible time.
- After going through the decontamination procedures, employees should proceed directly to a protected area.
- At temperatures of 32 F, the effects of wind speed become pronounced. A tarp or other barrier should be used to reduce the effects of wind speed if possible. A protected area will be provided for employees for rest breaks.
- Protective clothing shall be used, especially on the head, neck, and hands, to the extent possible to reduce chances of hypothermia and frostbite.
- Avoid skin contact with metal objects. Tools and equipment with nonmetallic handles should be used when possible.

- The SHSO or FTL will discuss the signs and symptoms of cold weather injuries with workers and document on the Daily Safety Meeting Checklist.

9.4 Drilling/Boring Hazards

- A *warning device or signal person* shall be provided to protect employees from moving drilling/boring equipment. *For signal person:* Where hand signals are used, only one person shall be the designated signal person, and shall be located to see the load and be clearly visible to the operator.

- Employees are not allowed under or in a derrick being raised or lowered.

- Employees shall be informed of where to locate themselves to prevent accidents from hoists, augers, etc.

- MACTEC's Lockout/Tagout Program shall be followed during maintenance or repair activities.

- **All** personnel shall be informed of the location of the "kill switch" for each piece of equipment on site.

- Loose fitting clothing and long hair that is not tied up/back are not allowed when working in the vicinity of the drilling/boring equipment.

9.5 Heavy Equipment Hazards

- A *warning device or signal person* shall be provided to protect employees from moving drilling/boring equipment. *For signal person:* Where hand signals are used, only one person shall be the designated signal person, and shall be located to see the load and be clearly visible to the operator.

- Employees are not permitted underneath loads handled by lifting or digging equipment. Employees shall also stay clear of any vehicle being loaded or unloaded.

- Seatbelts shall be worn if available, except for equipment designed for stand-up operation.

- Equipment shall be shut down during refueling.

- Loose fitting clothing and long hair that is not tied up/back are not allowed when working in the vicinity of heavy equipment.

9.6 Vehicular Hazards

- The local traffic control authority shall be contacted prior to interrupting the flow of public travel.

- Employees exposed to public vehicular traffic shall wear warning vests marked with or made of reflective or high-visibility material.

- Public traffic shall be protected from site hazards by placing traffic cones, barricades, construction fencing, etc. at a safe distance around the work site.

9.7 Excavation Hazards

- The Competent Person for this excavation activity will be determined and coordinated between MACTEC and the contactor providing the excavation services.
- Prior to commencing excavation activities, locate all underground utilities, including electrical, sewer, telephone, natural gas, as well as any other underground installations.
- For excavations 4 feet or more in depth, a stairway, ramp or ladder will be provided for egress. For trenches, the means of egress will be no more than 25 feet apart.
- Work in excavations where water is accumulating is not permitted unless control measures, such as pumping, are implemented.
- Excavations shall be inspected at least daily and in accordance with SOP.
- All entries into excavations shall be done in accordance with SOP and MACTEC's Confined Space Entry Program.
- Fall protection must be provided if employees will be crossing over excavations and for excavations which cannot be readily seen.
- All excavations shall be sloped, shored, or benched according to SOP and 29 CFR 1926 Subpart P.

9.8 Fall Hazards

Protection from falling objects shall be provided when work is being performed at 6 ft or more above the next lowest level. A system of toeboards and screens or guardrails, a canopy structure, or barricades may be used to provide protection. Employees shall also wear hard hats in the affected areas.

Guardrails, safety nets, or personal fall arrest systems shall be provided for employees on walking/working surfaces 6 ft or more above the next lowest level:

9.8.1 For Guardrails

Guardrails shall consist of a 3 rail system. The top rail shall be 42" above the walking/working surface; the mid rail shall be installed at mid height between the walking/working surface and the top rail; and a toe board shall be installed at the surface level.

9.8.2 For Safety Nets

Safety nets shall be installed as close as practicable to the walking/working surface, but no more than 30 ft below. Minimum horizontal distances shall comply with 29 CFR 1926.502(c)(2).

A drop test shall be performed prior to beginning work. The safety net shall be inspected at least weekly for wear and damage.

9.8.3 For Personal Fall Arrest Systems

- All materials must meet the specifications of 1926.502(d).
- Body belts, harnesses, and all components shall be designated for personal fall protection only, and shall not be used as hoists for work materials.
- Any component subjected to an impact loading shall be immediately removed from service.
- Prior to use, all components shall be inspected for wear and damage.

9.9 Chemical Hazards

9.9.1 Air Monitoring

Equipment Required

All monitoring equipment to be used on site includes:

PID (Will need to specify lamp - 10.2 or 11.7 eV)
Dräger Pump with Benzene 0.5/c tubes (or equivalent)
Dräger Pump with Vinyl Chloride 0.5/c tubes (or equivalent)
LEL Meter/Explosimeter – for Confined Space work

Frequency

- **For UCEP** – Upon initial site entry, air monitoring shall be performed in accordance with the UCEP Program in order to properly characterize the site and obtain adequate information on hazardous air conditions.

  Additional monitoring shall be conducted whenever work begins on a different portion of the site; when different contaminants are handled or encountered; when a different operation is initiated; if the event of a spill or leak; and whenever the SHSO or FTL determines that additional monitoring is warranted.

- **For Confined Space Entry (including entry into excavations)** – The conditions of the confined space (or excavation) shall be tested prior to entry to determine if entry conditions are acceptable. The results of the air monitoring shall be noted on the entry permit or certificate. Oxygen shall be tested first, then the LEL, and lastly all potential contaminants (see SOP). Continuous monitoring shall be conducted unless otherwise permitted by MACTEC's Confined Space Entry Program.

- **For Lead** – Initial monitoring for each job classification in each work area associated with lead exposure shall be conducted. Until the results of the initial assessment are known and analyzed, employees shall wear the interim level of protection as stated in 29 CFR 1926.62. All samples shall be personal samples and shall be taken to represent the shift with the highest exposure.

  The frequency of lead monitoring will be based upon the results of the initial determination in accordance with 29 CFR 1926.62. These monitoring requirements shall be included as an addendum to this HASP after analysis of the initial results.

Additional lead monitoring shall be conducted whenever there is a change in equipment, process, control methods, personnel, or whenever a new task is added.

Air Monitoring Techniques

Air monitoring shall be conducted on the employee(s) who have the potential for the highest exposure to the contaminant(s). Monitoring shall be performed in such as way that personal exposures to the contaminants may be calculated. Airborne levels of contaminants shall be noted periodically in the field log book and every reading shall be recorded on the appropriate Personal Monitoring Form. If only representative employees will be monitored, the names of other employees represented by the monitoring shall be noted in the field log book and on the Personal Monitoring Forms. Integrated, full-shift monitoring requiring laboratory analysis shall not be relied on as the sole means of exposure assessment for any work area or task where conditions may change rapidly.

Real time monitoring shall be conducted using a 10.0 – 10.6 eV PID and Dräger Pump with Benzene and vinyl chloride 0.5/c tubes. If PID readings are above background in the breathing zone, monitor breathing zone with Benzene and Vinyl chloride 0.5/c Dräger tubes (or equivalent). If benzene levels are below 0.5 ppm and vinyl chloride is below 1.0 ppm, continue working at level D/modified D until breathing zone levels on the PID reach or exceed 25 ppm. If benzene levels are greater than or equal to 0.5 ppm or vinyl chloride levels are greater than or equal to 1.0 ppm, or PID readings are greater than or equal to 25 ppm, upgrade to Level C PPE. Stop work if Benzene levels reach or exceed 2.5 ppm or Vinyl chloride levels reach or exceed 5.0 ppm or PID readings reach or exceed 100 ppm as Level B PPE will be required.

Calibration

All air monitoring instruments shall be calibrated according to manufacturer's instructions and standard industrial hygiene practice (see SOP). Direct reading instruments shall be calibrated prior to (each day's) use. Air sampling pumps shall be calibrated prior to and after each use. The average of the two sampling flow rates shall be used. Each calibration shall be recorded in the individual instrument log book, as well as on the appropriate Personal Monitoring Forms.

9.9.2 Levels of Protection

For Level C:

- Full-face air purifying respirator (cartridge type: combination organic vapor – MSC GMC or equivalent – change cartridges twice daily);
- Chemical resistant clothing (type: polycoated tyvec);
- Outer chemical resistant gloves (type: pvc/nitrile);
- Inner chemical resistant gloves (type:pvc/nitrile);
- Chemical resistant outer boots and steel toe inner boots, or Chemical resistant, steel toe boots; and
- Hard hat.

For Modified Level D:

- Chemical resistant clothing (tyvec coveralls)
- Gloves – (pvc/nitrile);
- Chemically resistant steel toed boots or chemically resistant over boots with steel toed boots;
- Safety glasses with side shields;
- Splash goggles will be worn when handling concentrated acids or caustics; and

- Hard hat.

For Level D:

- Coveralls or appropriate work clothing;
- Gloves (pvc, leather or work);
- Steel toe boots;
- Safety glasses with side shields;
- Splash goggles will be worn when handling concentrated acids or caustics; and
- Hard hat.

Certification of PPE Hazard Assessment

I certify that the hazard assessment regarding personal protective equipment for MACTEC E and C's work at ACF Carter Carburetor was completed on November 7, 2005 by Gene Watson in accordance with 29 CFR 1910.132. The results of the hazard assessment are incorporated in the PPE requirements noted above.

_____

Signature of Project Manager

9.9.3 Engineering Control

For Dust Control

Measures shall be taken on site to reduce airborne dust levels when visible airborne dust becomes present. Water shall be applied to work and traffic areas as appropriate to reduce the amount of dust generated.

9.10 Biological Hazards

9.10.1 For Plants/Animals

- Review the identification and habitat characteristics of rodents, snakes, spiders, ticks and bees/hornets to avoid bites or stings. Identify site personnel with a known reaction to any such bites or stings. Avoid nesting areas and habitats when possible and wear protective clothing and/or insect repellent. Always wear protective gloves when reaching into enclosed spaces where animals and/or insects are likely to hide.
- Keep all piping off the ground unless the ends are sealed against animals and insects.
- Review the identification characteristics of poison ivy and poison oak. Avoid contact with these plants and any unknown plants, and wear protective clothing.
- Avoid animal and bird droppings. These materials often contain mold, fungus, or bacteria which can cause respiratory problems such as lung disease and allergies. When entering nesting areas, wear protective clothing and use a dust mask or respirator with HEPA cartridges.

9.10.2 For Mold/Fungus

- Avoid contact with mold and fungus. Wear protective gloves and protective clothing if appropriate and use a dust mask or respirator with HEPA cartridges.

9.10.3 For Bloodborne Pathogens

- Always observe universal precautions.
- Avoid contact with any needles and sharp objects, or any materials contaminated with blood or body fluids. If contact cannot be avoided wear appropriate protective equipment.
- When administering first aid wear protective gloves and clothing. Wash hands immediately after help is rendered with soap and water. If hand washing facilities are not available, clean with antiseptic wipes, and then wash hands as soon as possible.

9.11 Noise Hazard

Noise monitoring should be conducted on a periodic basis to determine the need for hearing protection. Alternatively, the use of hearing protection can be based on historical data for a similar project. Hearing protection, with the appropriate attenuation factor, will be worn by all employees in the area when noise levels meet or exceed 85 dB(A). The Field Team Leader shall strictly enforce the use of appropriate hearing protection when noise levels exceed 90 dB(A).

9.12 Site specific/Additional Hazards

9.12.1 Confined Space Entry

For any entry into a confined space, MACTEC's Confined Space Entry Program must be followed, including use of an entry permit or certification. Entries into permit-required confined spaces will be in accordance with SOP and entries into non-permit spaces will be in accordance with SOP. Only those individuals who have successfully completed the training outlined in SOP are allowed to enter confined spaces. Provisions for rescue, including non-entry rescues must be initiated and must be in accordance with the Confined Space Entry Program. All confined spaced entries will be coordinated with the client and any applicable subcontractors.

9.12.2 Lockout/Tagout

All hazardous sources of energy, including electrical, mechanical, pressure, thermal, stored energy, and hazardous chemical or agents must be locked out in accordance with MACTEC's Lockout/Tagout Program. Lockouts may only be performed by Authorized Employees who have successfully completed the training outlined in SOP.

Locks and tags shall be used whenever the equipment is capable of handling a lock. Tags alone are only permitted where the equipment was designed without the capability of being locked. Every energy source associated with the equipment must be locked/tagged out. Every individual working on the equipment shall apply his/her own lock. All lockout/tagout equipment must be approved by MACTEC for use. The lockout/tagout procedures outlined in SOP shall be followed.

Equipment Specific Lockout/Tagout Procedures are as follows: Determined per the equipment used on site. (control of source). Contractors/drilling contractor should inform all site personnel of drill rig and other equipment specific lockout/tagout procedures that institute on the equipment they bring on site.

9.13 Decontamination Procedures

9.13.1 For Level C

Station 1: Outer boot and glove wash (tap water with Alconox)
Station 2: Outer boot and glove rinse (tap water)
Station 3: Outer boot and glove removal
Station 4: Tyvek removal
Station 5: Respirator removal and wipe down
Station 6: Inner glove removal and hand wash/rinse

All disposable items will be bagged for appropriate disposal.

9.13.2 For Modified Level D

Station 1: Outer boot and glove wash (tap water with Alconox)
Station 2: Outer boot and glove rinse (tap water)
Station 3: Outer boot and glove removal
Station 4: Tyvek removal
Station 5: Respirator removal and wipe down
Station 6: Inner glove removal and hand wash/rinse

All disposable items will be bagged for appropriate disposal.

9.13.3 For Level D

Station 1: Outer boot and glove wash (tap water with Alconox)
Station 2: Outer boot and glove rinse (tap water)
Station 3: Outer boot and glove removal
Station 4: Inner glove removal and hand wash/rinse

All disposable items will be bagged for appropriate disposal.

9.14 Medical Surveillance Requirements

All site personnel shall be actively participating in MACTEC's Medical Surveillance Program, including baseline and annual examinations at an Health Resources clinic and in accordance with 29 CFR 1910.120 and 29 CFR 1910.134. A copy of each employee's Medical Summary form will be retained on site. At least one field team member will be trained and certified in CPR and First Aid.

For any exposure incidents while rendering first aid or CPR, the exposed individuals shall receive a medical evaluation and Hepatitis B vaccination in accordance with MACTEC's Bloodborne Pathogen Program. The LHSM and Continuum be notified **immediately** of any exposure incidents.

MACTEC's OSHA 300 Log is kept on file at The St. Louis Office at 3199 Riverport Tech Center Drive, St. Louis, Missouri.

To go with Bloodborne Pathogens – All personnel on site shall have completed the series for Hepatitis B vaccine, or have been tested and found to be immune. For those individuals who declined the vaccine, a copy of their signed declination statement (see Attachment C of the Bloodborne Pathogen Program) shall be kept on site.

To go with Lead – All personnel exposed to lead at or above 30 ug/m^3 on any day shall receive baseline biological monitoring, including blood testing and analysis for lead and zinc protoporphyrin levels (BLL

and ZPP). Personnel who are exposed to lead at or above 30 ug/m^3 for 30 days in any consecutive 12 month period shall receive additional medical surveillance in accordance with 29 CFR 1926.62. The additional medical surveillance shall include the required periodic BLL and ZPP testing and the appropriate medical examinations and consultations.

To go with Arsenic – All personnel exposed to arsenic above 5 ug/m^3 for 30 days per year, shall receive, in addition to their Health Resources examination, a nasal/skin examination and a sputum cytology examination. These employees shall also receive an annual chest x-ray.

To go with Cadmium – All personnel exposed to cadmium at or above 2.5 ug/m^3 for 30 days in 12 consecutive months shall receive biological monitoring for cadmium in blood, cadmium in urine, and beta-2 microglobulin in urine in addition to their Health Resources exam (both initially and annually). Additional medical examination requirements prior to working on site will be in accordance with 29 CFR 1910.1027.

9.15 Training Requirements

All workers will complete 40-hour training in accordance with SOP with the appropriate and current 8-hour refresher training in accordance with SOP.

SHSOs and FTLs shall also have successfully completed 8 hours of supervisor training in accordance with SOP.

At least one field team member shall be trained and certified in first aid and CPR. Personnel who have received this training must also receive bloodborne pathogen training in accordance with MACTEC's Bloodborne Pathogen Program and SOP.

All workers shall have successfully completed respirator training in accordance with SOP and MACTEC's Respirator Program for the appropriate type(s) of respirator.

Prior to commencement of site activities and daily thereafter, site specific training will be provided in accordance with SOP and will include an overview of HASP requirements. The Daily Safety Meeting Checklist included as part of this HASP will be used to document this training.

To go with Lead – Employees shall have successfully completed training in accordance with 29 CFR 1926.62. Training shall include as a minimum: the content of the lead standard; the specific nature of operations which may result in lead exposure, lead medical surveillance; engineering controls and work practices; instructions regarding chelating agents; and employees' rights to access medical records.

To go with Confined Space Entry – Any employees on site participating in a confined space entry, including entrants, attendants, entry supervisors, and MACTEC rescue personnel shall have successfully completed confined space entry training in accordance with SOP and MACTEC's Confined Space Program. Other site personnel shall be given awareness training including the location(s) of confined space(s) on site.

To go with Lockout/Tagout – Employees involved in any lockout and/or tagout procedure on site shall have successfully completed training for Authorized Employees in accordance with SOP. Employees working nearby or otherwise affected by the lockout/tagout activities shall receive training for Affected Employees in accordance with SOP.

To go with Fall Protection – All workers on site who may be exposed to fall hazards shall have successfully completed training in accordance with 29 CFR 1926.503. At a minimum training shall include recognizing fall hazards and the procedures to be followed to minimize these hazards. Training must be provided by a competent person as described in 29 CFR 1926.503(2).

To go with Bloodborne Pathogens – All workers on site who may be exposed to bloodborne pathogens shall have successfully completed training in accordance with SOP and MACTEC's Bloodborne Pathogen Program.

9.16 Site Control

Site Work Zones

Three work zones shall be established on site as appropriate and feasible by the FTL: Exclusion Zone, Contamination Reduction Zone, and Support Zone. Site work zone delineation will be based on the site activities and on the size and configuration of the site. Support zones shall be established upwind of the Exclusion Zone and field activities. Wind direction may be determined by visual observation or field instrumentation. Work zones shall be delineated using barrier tape or other effective means.

The Exclusion Zone will be the immediate area around field activities where contamination does or could occur. The Contamination Reduction Zone is the transition between the contaminated area and the clean area. The Contamination Reduction Zone should be designed to limit, as much as possible, the probability of the Support Zone becoming contaminated. The Support Zone is considered to be a "clean" area; all administrative and other support services should be performed in the Support Zone.

Buddy System

All site personnel must practice the buddy system of at least 2 people who maintain visual or verbal contact. Contact should be either constant or at some frequent interval during field work (frequency should depend on nature of hazards present). The buddy may be an MACTEC employee, subcontractor, or client representative as appropriate.

Site Communications

On site communication will be verbal. When verbal communication is not possible, cell phones, two way radios or predetermined hand signals will be used.

10.0 Emergency Information

LOCAL RESOURCES	
Address & Phone Numbers	
Police: 911	Fire: 911
Ambulance: 911	
Medical Facility Name: BJC Healthcare, 4444 Forest Park Ave.	
Directions to Medical Facility : Turn Right (south) on N. Grand Blvd., Turn Rt. Onto Forest Park, turn left onto Kingshighway, then left into Emergency Room entrance	
FTM Who Drove Route:	Date:
Poison Control Center: 800-366-8888 or 314-772-5200	Waste Clean-up Contacts: Chemtrec 800-424-9300
National Response Center: (800) 424-8802	USCG: (216) 522-3919

SITE RESOURCES		
	Equipment	**Location on Site**
First Aid	Approved first aid kit and eyewash	Company Vehicle
Fire Control	ABC 10 lb. Fire extinguisher	Company Vehicle
Transportation	Company Vehicle	Work Site (in Support Zone)
Communication	Cell Phone	Company Personnel/Vehicle
Spill Control		
Rescue		

MACTEC ENGINEERING AND CONSULTING RESOURCES	
CHS: Howard Gordon	Phone: 303-273-5041
LHSM: Lana Smith	Phone: (314) 209-5925 or (314) 541-9962
CHM: Cindy Sundquist	Phone: (207) 828-3309 or (207) 650-7593
Health Resources: MACTEC	Phone: 800-219-8043
Office Manager: Paul Lorton	Phone: 314-209-5947 or 636-940-9229
Other:	Phone:

11.0 Contingency Plan

11.1 Emergency Communication Procedures

Standardized hand signals will be utilized for commnication between filed staff/ field team members in emergency situations. The standardized signals and their interpretation are presented below:

- Hand gripping throat -- Can't breathe, out of air
- Grip partners wrist or both hands on waist -- Leave immediately
- Hands on top of head -- Need assistance
- Thumbs up -- Yes, okay, I'm alright, I understand
- Thumbs down -- No, negative
- Hand up with palms extend/facing out -- Stop, don't come any closer
- Hand drawn across throat -- Shut off (kill) running equipment

Cellular phones will be available for off-site communication

11.2 Evacuation Procedures

Stop work immediately, turn off equipment, and proceed quickly to the predetermined rendezvous point (usually at the vehicle for transportation off site). When all field team members have arrived at the rendezvous point, leave the site in a calm and orderly manner. If the predetermined rendezvous point is off site then verify that all field team members are present after the evacuation.

11.3 Fire or Explosion

In the event of a fire or explosion, the area will be immediately evacuated and the Fire Department will be summoned as soon as possible. Workers in the exclusion zone will exit through the contamination reduction zone and will, at a minimum, remove or scrub their outer boots and remove their outer layer of protective clothing prior to proceeding to the assembly location. Site personnel will gather at a designated location upwind of the fire/explosion (use predominant wind direction). The location shall be established during the daily safety meeting, and a head count will be taken at the location. Upon their arrival, notify the fire department of the location and nature of the fire/explosion. Also provide information on the location and identification of hazardous and flammable materials on site.

If it can be done safely, site personnel who have had the appropriate training may perform the following:

- Use available on-site fire extinguisher to control or extinguish the fire if it is small and localized;
- Remove or isolate flammable or other hazardous materials that may contribute to the fire;
- Begin containment and recovery of any spilled materials (see below).

11.4 Spill Response

In the event of a spill, the SHSO shall be notified immediately. Procedures for exposure monitoring and control as outlined in this HASP shall be followed, including upgrading the LOP for spill containment/clean-up if necessary. FTMs should stop the spill source and contain and cleanup the spill as necessary and appropriate. After the cleanup is completed, air monitoring will be conducted by the SHSO to ensure that airborne levels of the contaminant(s) are at a safe or appropriate level.

Any spill will be reported to the Field Team Leader, the Project Manager, and applicable/appropriate local, state and federal agencies.

11.5 For a Medical Emergency

If trained and willing, initiate first aid and get medical attention for the injured person immediately. Have the injured person transported to the nearest medical facility (see above) or call ambulance as necessary. As soon as possible, notify the injured person's supervisor or the project manager. Supervisors/PM's notify your LHSM and Health Resources immediately.

11.6 Emergency Decontamination Procedures

The level of decontamination (decon) in a medical emergency will be determined by the extent of the injury. For minor injuries, personnel must go through the proper decontamination sequence as stated in this HASP.

In life-threatening emergencies or when decontamination may aggravate the condition, decontamination procedures may be omitted. If decon cannot be performed, a FTM should accompany the injured worker to the medical facility, if possible, to provide information to medical response personnel regarding the contaminants and decon procedures. In lieu of decontamination, actions such as removal of the outer layer of protective clothing or wrapping the victim in plastic (during treatment) can be taken if they will not delay or interfere with the treatment of the injury. In the event the victim has been splashed with a corrosive material, the effected area should always be flushed with water (see below).

11.7 For a Chemical Exposure Emergency

- EYE CONTACT: Flush eyes with copious amounts of water for 15 minutes.
- SKIN CONTACT: Remove contaminated clothing. Flush skin with copious amounts of water for 15 minutes.
- INHALATION: Remove to fresh air.
- INGESTION: Consult Poison Control Center, MSDS or other appropriate medical resource (see above).

12.0 Daily Safety Meeting Checklist

Project: ACF – Carter Carburetor Site: N. Grand and Dodier, St. Louis, MO
Project Number: 3250055164 Date: _____

To be reviewed on the first day of site activities and when new workers arrive on site:
Site Health & Safety Officer: Chris Tedder
Alternate for Health & Safety: Gene Watson
Location of on-site HASP: within project vehicle
Site training requirements: 40 Hour Training, Supervisor Training, First Aid & CPR
Specific medical surveillance requirements: Current Annual Physical, Respirator approval and fit test

**** During the project, one or more of the agenda items could be selected for the required daily site training.***

Date: _____ _____ _____ _____ _____

Agenda:	**Check-off:**				
1. Planned work for this day (discuss)	☐	☐	☐	☐	☐
2. Physical hazards and controls (discuss/review)	☐	☐	☐	☐	☐
3. Chemical hazards and controls (discuss/review)	☐	☐	☐	☐	☐
4. Biological hazards and controls (discuss/review)	☐	☐	☐	☐	☐
5. Level of protection required (specify A, B, C, D) ____	☐	☐	☐	☐	☐
6. Personal protective equipment required	☐	☐	☐	☐	☐

	SPECIFY TYPE
Respirator	Scott or MSA
Protective coveralls	Tyveks
Safety glasses/goggles	
Hard hat	ANSI approved
Foot protection	Safety boots
Inner gloves	
Outer gloves	
Hearing protection	Ear plugs or ear muffs
Other	

7. Review inspection, decontamination & maintenance procedures and limitations of the above stated PPE.	☐	☐	☐	☐	☐
8. Decontamination procedure (discuss/review)	☐	☐	☐	☐	☐
9. Exclusion zone established. Radius _____ft (specify)	☐	☐	☐	☐	☐
10. Site emergency response plan (discuss/review)	☐	☐	☐	☐	☐
11. Signs & symptoms of overexposure to chemicals anticipated on site	☐	☐	☐	☐	☐
12. General health & safety rules	☐	☐	☐	☐	☐
13. Specific health & safety requirements relating to site activities including: (discuss/review)					
Drilling/boring	☐	☐	☐	☐	☐
UST	☐	☐	☐	☐	☐
Excavations	☐	☐	☐	☐	☐
Heavy equipment	☐	☐	☐	☐	☐
Confined space entry	☐	☐	☐	☐	☐
Lockout/tagout	☐	☐	☐	☐	☐
Working in temperature extremes	☐	☐	☐	☐	☐
14. Other health & safety issues (discuss/note)	☐	☐	☐	☐	☐

Daily Safety Meeting Checklist (continued)

Sign-Off Sheet

I have participated in the daily safety meeting discussing the topics indicated on the reverse and fully understand my responsibility for complying with all health and safety requirements. I have had the opportunity to have my questions on site health and safety issues and procedures answered.

Employee	Employee Number	Date

Signature of person conducting training

Date

13.0 Site Chemical Inventory

Project: ACF – Carter Carburetor Project Number: 3250055164

Chemical Name (Match to MSDS)	Estimated Quantity on Site at Any Given Time	Location on Site
Liquinox/Alconox	1 gallon	Company vehicle

A current MSDS must be present on site for each chemical listed above. All chemical containers must be labeled in accordance with SOPs. Subcontractors must maintain their own chemical

14.0 Project Monitoring/Exposure Form

Page __ of __

Project: ACF – Carter Carburetor Project No. 3250055164

Site H&S Officer _____ Site Location: _____

Date: _____ Temp: _____ Weather: Wind:

MACTEC Employee (performing the monitoring): _____

Instrument(s): _____ Serial No.: _____ MACTEC No.: _____

Calibrated: Before: ☐Yes ☐No During: ☐Yes ☐No After: ☐Yes ☐No

Calibration Standard: _____ Results: _____

Chemical Constituents: _____

MACTEC Employee(s) Onsite: _____

Daily Site Health & Safety Meeting: ☐Yes ☐No Time:

Subcontractor(s) Onsite During Activities: _____

Comments:

Activity (i.e., soil borings, tank decon)	**LOP** (A, B, C, D)	**Time** (Military)	**Breathing Zone Reading***	**Background Reading**	**Actions/ Comments**

* Note: Refer to Project HASP for upgrade specifications.

Signature: Date:

Page __

Activity (i.e., soil borings, tank decon)	**LOP** (A, B, C, D)	**Time** (Military)	**Breathing Zone Reading***	**Background Reading**	**Actions/ Comments**

* Note: Refer to Project HASP for upgrade specifications.

15.0 Incident - Accident Forms

15.1 Incident Accident Reporting

In the event of an incident or accident at the work site report incident and fill out the “Incident Analysis Report” as required within the appropriate company designated time frame. Follow the “Instructions for Completing Incident Report Form” and “Guide to Reporting Incidents” in filling out the form.

15.2 Vehicle Accident Reporting

In the event of a vehicle incident or accident fill out the “Vehicle Incident Report” as required within the appropriate company deignated time frame in addition to the “Incident Analysis Report”.

Check one
Initial Report: ☐
Update: ☐
Final Report: ☐

Category C: ☐
Category B: ☐
Category A: ☐

INCIDENT ANALYSIS REPORT

Revision 0

Attorney-Client Work Product Prepared in Anticipation of Litigation

(Review instructions on page 9 prior to completing this form)

Local Office ID Number: _____ Division ES&H Manager Tracking Number: _____

Report Date: _____

Section 1 – General Information

Incident Date: _____

Employee Name: _____ Sex: ☐ M ☐ F Time of incident: _____

Job Title: _____ Hire Date: _____ Time employee began work: _____

Department: _____ Project Manager: _____ Client: _____

Office where employee works from: __ Immediate Supervisor: _____ Hours employee worked during last 7 days: _____ hr

Location where incident occurred: _____ Is this a Company controlled work site: ☐ Yes ☐ No

Section 2 – Incident Type (mark all that apply)

A. Type of incident being reported required ☐ Near Miss ☐ First-aid case ☐ Medical treatment ☐ Hospitalization

☐ Fatality ☐ Day Away Case ☐ Restricted/Transfer Case

☐ Environmental Release ☐ Regulatory Inspection

☐ Notice of Violation ☐ Other (please describe):

B. If an **injury or illness**: describe the part of the body that was affected and how it was affected:

C. If an **environmental release**: describe the quantity and name and CAS# of material released into the environment:

D. If an **inspection by a regulatory agency**, what agency, who were the inspectors, inspector contact information:

Section 3 – Incident Description (Attach and number additional pages, as needed, to ensure all details related to the incident are captured.)

A. List the names of all persons involved in the incident, and employer information:

B. List the names of any witnesses, their employer, and a local/company telephone number or address:

C. What was the employee(s) doing just prior to the incident?

D. What happened?

E. What object or substance directly harmed the employee:

F. List any damaged equipment or property (other than motor vehicles) model and serial number **and** estimated costs to repair/replace damaged equipment or property, if applicable:

Section 4 - Incident Analysis

A. Was a Job Hazard Analysis (JHA) completed for the work being performed? YES ☐ NO ☐ Who prepared the JHA?

B. When and who was the last safety officer (i.e. LHSR, supervisor, Division ES&H Manager, etc.) at your work site?

C. When and what safety training **directly related** to the incident has the person(s) involved had?

Section 5 - Incident Investigation Results

#	**Causal Factors** (Attach and number any additional pages as needed to completely address this section)
1	
2	
3	
4	
5	

Root Cause(s) Analysis (The below items represent major root cause categories which have been determined to be Less Than Adequate (LTA). A more detailed determination of the root cause will be facilitated, if needed, by your Division's ES&H Manager)

1. Equipment Reliability Program Implementation 2. Administrative / Management Systems 3. Immediate Supervision 4. Training	1. Human Factors Engineering 2. Communications 3. Personal Performance

Root Cause #	**Corrective Actions to be taken** (Attach additional pages as needed to completely address this section)	**Responsible Person**	**Proposed Completion Date**	**Closed on Date**	**Verified by and Date Verified**

Section 6 – Approvals

Incident investigated by:

Employee(s):	Date:	Employee's Supervisor:	Date:
LHSR/Project/Office Manager:	Date:	Division ES&H Manager:	Date:

Instructions for Completing Incident Report Form

All required information must be completed as requested.

Attachment 3 provides additional guidance for completing this report.

The purpose of the Incident Analysis Report (IAR) form is to identify the facts associated with an incident investigation, to learn from its causal factors, and to make improvements to MACTEC's ES&H Management System so similar incidents can be prevented in the future. It is imperative that all applicable fields be completed in detail and that additional pages are used, as needed, to ensure that all appropriate information is provided in detail. **Attachment 3** provides a quick overview of the reporting requirements. Upon completing **Attachment 1**, all applicable signatures need to be completed via electronic signature or as an original prior to forwarding to the applicable Division ES&H Manager for review and approval. Upon approval, it will be forwarded to the Corporate Director of ES&H.

The following left to right, line by line instructions are provided to help facilitate the completion of each section of **Attachment 1**.

1. Mark in the box on the top left if this is the **Initial Report** containing all the information available at the issuance of the report, if it is an **Update** with more current information, or if it is the **Final Report**.

2. Mark if it is a **Category C, B** or **A** incident.

3. Indicate if there is a **Local Office ID Number** being used to track this report, indicate **N/A** if none is being used.

4. The Division ES&H Manager will place a unique number in the **Tracking Number** line corresponding to their Corrective Action Tracking Database.

5. Complete **Section 1, General Information**, in its entirety.

6. Complete **Section 2, Incident Type**, by **marking all appropriate boxes** and **address questions** in **Subsections B, C, and D,** as appropriate, using additional pages as needed.

7. **Section 3, Incident Description**, requires the documentation of who was involved in the incident and witnesses who saw what happened. **Subsections C through F** requires as much objective information as possible to help document what happened. Use additional pages to properly document the detail of the incident to help incident reconstruction and determine causal factors.

8. **Section 4, Incident Analysis: Subsection A** addresses information regarding the job hazard analysis (JHA). **Mark the appropriate box** if one was or was not available prior to work beginning. Identify who prepared the JHA. **Subsection B** looks to define who the site safety representative was and when they last were present at the site prior to the incident occurring. **Subsection C** requires the listing of specific training information, type and date, directly related to the incident. For example, if the incident occurred while an employee was working on a telecommunication tower, training such as Fall Protection and Tower Climbing would be relevant while, training in Hazard Communication or Confined Space would not be relevant.

9. **Section 5**, **Incident Investigation Results**, list here and on additional paper, if needed, the causal factors associated with the incident. As indicated in the Definition Section 4 of the Procedure, causal factors are events or conditions in the incident sequence that contributed to the unwanted result. There are three types of causal factors: **direct cause**, which is the immediate event or condition that caused the accident; the **contributing causes**, which are the events or situations that collectively, with the other causes, increase the likelihood of an accident but that did not cause the incident, and the **root cause**, which, if corrected, would have prevent the recurrence of the incident. There are various methodologies in determining the root cause of an incident, two common approaches are 1) Events and Causal Factor Analysis and 2) Barrier Analysis. Both of these methods provide useful results in determining why an incident occurred and illuminates areas which if improved, can prevent reoccurrence.

a. **Events and Causal Factor Analysis** includes charting, which depicts the logical sequence of events and conditions (causal factors) that allowed the event to occur, and the use of deductive reasoning to determine events or conditions that contributed to the accident. As an aid in conducting this type of analysis, seven (7) major root cause categories are provided below. An incident usually results from one or a multiple number of the below categories. The investigation of these major root causes can lead to specific root causes that will need correction to prevent reoccurrence. They are:

1. **Equipment Reliability Program Implementation** – Incidents associated with the design and implementation of the maintenance program.
2. **Administrative / Management Systems** – Incidents attributed to inadequate or inadequately implemented policies, programs, procedures, instructions, job hazard analyses (JHAs), etc.
3. **Immediate Supervision** – Incident attributed to immediate supervision failing to provide adequate instructions, preparation, job scope definition, job oversight, conducting workarounds, etc.
4. **Training** – The lack, adequacy or timing, of training attributed to the incident.
5. **Human Factors Engineering** – Limitations and capabilities of an individual's interface with the design, development, production and control of systems, layout of the work environment and condition of the work environment (i.e. noise, thermal stress, physical or mental workload, etc.).
6. **Communications** – Failure to properly exchange information (e.g. face-to-face discussions, telephone, short written messages, log entries, etc.) attributed to the incident occurring.
7. **Personal Performance** – The incident can be attributed to employee's physical or mental well-being, attitude, mental capacity, attention span, lack of rest, substance abuse, etc.

b. **Barrier Analysis** reviews hazards (sometimes referred to as energy. It is this energy that impacts people or property) and the targets (people or objects) of the hazards, and the controls or barriers that management systems put in place to separate the hazards from the targets. Barriers may be physical, such as equipment design or protective clothing, or elements of management, such as training, procedures, job hazard analyses, and supervision. Providing answers to the following initial questions while conducting the investigation helps to establish the root cause(s).

1. What were the implemented barriers to prevent the incident from occurring on this job?
2. How did each barrier perform in preventing the incident from occurring?
3. Why did a barrier fail?
4. How did a barrier affect the incident?

Example (Effects and Causal Factor Analysis): A carpenter using a table saw cuts his hand on the rotating saw blade: Direct cause – hand is cut in table saw when blade makes contact with unprotected hand. Contributing factor – saw blade guard was removed from table saw prior to use. Root Causes – **Equipment reliability program implementation** was less than adequate (LTA) as the blade guard was very easy to remove, **Administrative / Management Systems** were LTA as the procedure that controlled the use of the table saw did not address use or removal of the saw blade guard, **Training** was LTA as no training program had been established so the carpenter was untrained in the proper use of the table saw, **Immediate Supervision** was LTA as the carpenter's supervisor was not on the job site providing the required oversight.

Example (Barrier Analysis): Same scenario as above**.** Target is the carpenter's hand. Energy is the rotating table saw blade. A physical barrier existed in the table saw's blade guard. By removing the guard, the only barriers would be training, supervision, and procedures. Training was not a barrier as none was provided. The supervisor could have been a barrier preventing the carpenter from removing the guard or instructing him on how to use the table saw correctly but he was not around. Finally, the existing potential barrier, the table saw procedure, did not address the use of or removal of the saw blade guard.

The table is to be completed by indicating the number of the Major Root Cause, the specific corrective actions that will be undertaken to prevent the reoccurrence of the incident, who will implement the corrective actions, when the corrective actions are expected to be implemented, the actual date the actions were completed and who and when these actions have been verified as being completed.

10. **Section 6, Approvals**. Prior to emailing an **initial, updated** or **final** IAR to your Division ES&H Manager for approval, obtain the required dated signatures. Signatures may be electronic or in ink. If the original signed copy of the IAR is retained in the office, send a PDF copy of the IAR documenting the appropriate signatures.

Guide to Reporting Incidents

Incident Category	**Category C:** A near miss, first-aid was rendered, minor equipment and/or property damage, or liability to the Company has occurred resulting in an estimated real or potential loss of less than $1,000. Release of a non-reportable quantity of chemicals.	**Category B:** An incident where an injury/illness has the potential of being classified as recordable or is classified as a recordable event, or has the potential to or has caused financial liability to the Company of greater than $1,000 but less than $10,000.	**Category A:** Serious incident resulting in a fatality, multiple injuries, serious injury /illness to an employee resulting in lost work. An event that has the potential to or has caused material financial liability to the Company of greater than $10,000.
Examples of Incidents	▪ Near miss ▪ First-aid injury – cut finger requiring an adhesive bandage. ▪ Minor damage to equipment or property (less than $1,000) ▪ Non-reportable quantity spill ▪ Unsafe condition or action ▪ Site visit from regulatory agency without any findings or Notice of Violations. Note: If there is a question as to Category C or B, follow Category B notification actions.	▪ Personal injury or illness other than first-aid to an employee, subcontractor or member of the public. ▪ *Any hazardous or toxic material exposure via inhalation, ingestion, puncture or dermal exposure greater than:* - OSHA Short Term Exposure Limit (STEL), or - OSHA Ceiling Value (CV). - OSHA Permissible Exposure Limit (PEL), or - Other industry-defined Best Practices {such as the American Conference of Governmental Industrial Hygiene (ACGIH) Threshold Limit Values (TLVs)}. ▪ *Any ergonomic injury or illness (i.e. musculoskeletal injuries, repetitive motion injuries, etc.)* ▪ Any contamination event leading to a release, suspected release or spread of hazardous or toxic material, on or off site, which requires special action by MACTEC. ▪ Any incident or series of incidents for which a formal investigation is deemed appropriate by MACTEC's management. ▪ Vehicle incident involving injury. ▪ Damage to property greater than $1,000 but less than $10,000. ▪ Any near miss incident that could have been very serious if a barrier separating the employee from the hazard had not been in place. ▪ Required non-emergency notification to a regulatory agency. ▪ Fire	▪ Hospitalization of any employee due to an occupational incident. ▪ Multiple injuries associated with a single occupational incident. ▪ Fatality ▪ Bloodborne pathogens exposure. ▪ *Release of a hazardous substance on or offsite in an amount exceeding the reportable quantity specified in 40 CFR Part 302.* ▪ *The discharge from a site of any substance which require any special action (e.g. reassurance monitoring of the environment).* ▪ Explosion. ▪ Multiple injuries of subcontractors or members of the public. ▪ Damage to equipment/property greater than $10,000. ▪ Work stoppage due to an unsafe condition or act. ▪ Regulatory agency response to an incident with the public or media involvement. ▪ Required emergency notification to regulatory agency due to an incident.
Reporting Requirements	Employee or witness reports incident to supervisor. Seek immediate medical attention if the injury is other than first-aid. Supervisor and all employees involved document incident on appropriate form(s) and submit within the required time frame.	Employee or witness reports incident. If injuries have occurred, seek immediate medical attention as needed by dialing 911, or site specific emergency response number. Supervisor and employees involved document incident on appropriate form(s). The Division ES&H Manager will provide assistance, as needed, to determine all applicable causal factors and appropriate corrective actions to prevent reoccurrence. Submit initial, updated or final report(s) within the required time frame.	Employee or witness reports incident. If injuries have occurred, seek immediate medical attention as needed by dialing 911, or site specific emergency response number. Supervisor notifies their Division's ES&H Manager by telephone or cellular telephone and then follows up by email. The Division ES&H Manager will notify the Corporate Director of ES&H. The Corporate Director of ES&H will chair or support an incident investigation team to determine all applicable causal factors and establish appropriate corrective actions to prevent reoccurrence.

VEHICLE INCIDENT REPORT

Revision 0

Attorney-Client Work Product Prepared in Anticipation of Litigation

(Review instructions on page 12 prior to completing this form)

Section 1 - General Information

Time incident occurred: _ ☐ AM ☐ PM / ☐ Dark ☐ Light / Road Condition: ☐ Dry ☐ Wet

Were police summoned to scene? ☐ Yes ☐ No Police Department and Location: _____

Report #: _____ Officer's Name and Badge Number: _____

Section 2 - Company Driver and Vehicle

Driver's name: _____ D/L # _____ State: _____

Driver's home office address: _____ Driver's Phone # _____

Company Vehicle # _____ Year _____ Model _____ License # _____ State _____

Company car? _ Owned by employee? _____

Leased/rented from _____

Passenger/Witness Name(s) _____ Address: _____ Phone: _____

Passenger/Witness Name(s) _____ Address: _____ Phone: _____

Passenger/Witness Name(s) _____ Address: _____ Phone: _____

Damage to vehicle: _____

Injuries to employee(s): _____

Injuries to others: _____

Vehicle was being used for: Company business ☐ Yes ☐ No Personal business ☐ Yes ☐ No

Towed: ☐ Yes ☐ No By Whom: _____ To Where: _____

Section 3 - Other Driver and Vehicle Information

Driver's Name: _____ D/L # _____ State _____

Current address _____ City _____ State _____

Telephone Home: _____ Work: _____ Cell: _____

Reg. Owner's Name: _____ Address: _____ City: _____ State: _____
(verify registration document)

The Other Vehicle: Make _____ Model _____ Year _____ License # _____ State _____

Insurance company name: _____ Address: _____ Phone # _____

Policy No. _____ Contact Person _____ Phone # _____

Passenger/Witness Name(s) _____ Address: _____ Phone: _____

Passenger/Witness Name(s) _____ Address: _____ Phone: _____

Damage: (*Make note of pre-existing damage and take pictures if possible.* ***Attach additional pages as needed****)* _____

_____

_____

_____

_____

Injuries to other driver/passengers: _____

_____

_____

Section 4 – Approvals (signatures required)

Form completed by: _____ Signature: _____ Date: _____
Please Print/Type

Things to Do First In The Event Of a Motor Vehicle Incident

1. Most important: **STOP**.
2. **Call 911 if there are injuries.**
3. Call for an officer if the incident occurred on public property (streets, highways or roads). Disputes often arise between the parties involved as to who was at fault; therefore, a police report is important. If an officer is unable to attend the scene of the accident, a counter police report may be filed at most stations. Insurance companies rely on police reports to determine liability.
4. Complete the Incident Investigation Report and the Vehicle Incident Report forms. It is important that both these forms are completed in detail. Include a diagram of the incident on the back of the report. Incomplete information may lead to delays in processing associated claims and in helping to prevent this type of incident from occurring again.
5. Express no opinion as to who was at fault. This is for the insurance companies to determine.
6. Give only information that is required by the authorities or as directed by MACTEC contractual requirements.
7. Sign only those statements required by the authorities or as directed by MACTEC contractual requirements. Do not sign away your rights or the company's rights.
8. If you are injured or think you were injured, tell your supervisor and see a physician. Your supervisor will notify MACTEC's Worker's Compensation insurance carrier, your Division's ES&H Manager and the Corporate Director of ES&H by phone, email or fax. For additional instructions on what to do, go to MACTEC's ES&H website on the intranet at:
9. http://intranet.mactec.com/EnvSafetyHealth/HealthSafety_Claims_Reporting.htm
10. Your supervisor will forward both completed incident reports immediately to your Division's ES&H Manager.

Instructions for Completing Vehicle Incident Report Form

All required information must be completed as requested.
Attachment 3 provides additional guidance for completing this report.

1. **Section 1, General Information**, **provides a foundation** for when, where, conditions at the time of the incident and what law enforcement representative responded to the incident scene.

2. **Section 2, Company Driver and Vehicle**, documents **who was driving** the MACTEC owned, rental or personal vehicle used for company business. Mark "See IAR" if any requested information has been previously provided on the IAR.

3. **Section 3, Other Driver and Vehicle Information**, provides contact information on the other party involved in the incident. Complete each question making sure that the registration information of the other driver's vehicle is reviewed and indicate any unusual relationship between the registered owner and the driver. If you have a digital camera, camera phone, etc. with you document the extent of the damage and any other issues that should be captured.

4. **Section 4, Approvals**, requires the electronic or ink signature of each of the four individuals required to complete the form. The form should then be **immediately sent** either as a PDF or WORD file to the applicable Division ES&H Manager and the Corporate Director of ES&H upon completion.

5. The **signed original must reside at the office** where the employee involved in the incident is based.

NOTE: Please provide area codes for all telephone numbers provided on form.

ATTACHMENT 3
Guide to Reporting Incidents

Incident Category	**Category C:** A near miss, first-aid was rendered, minor equipment and/or property damage, or liability to the Company has occurred resulting in an estimated real or potential loss of less than $1,000. Release of a non-reportable quantity of chemicals.	**Category B:** An incident where an injury/illness has the potential of being classified as recordable or is classified as a recordable event, or has the potential to or has caused financial liability to the Company of greater than $1,000 but less than $10,000.	**Category A:** Serious incident resulting in a fatality, multiple injuries, serious injury /illness to an employee resulting in lost work. An event that has the potential to or has caused material financial liability to the Company of greater than $10,000.
Examples of Incidents	Near miss First-aid injury – cut finger requiring an adhesive bandage. ▪ Minor damage to equipment or property (less than $1,000) Non-reportable quantity spill ▪ Unsafe condition or action ▪ Site visit from regulatory agency without any findings or Notice of Violations. Note: If there is a question as to Category C or B, follow Category B notification actions.	▪ Personal injury or illness other than first-aid to an employee, subcontractor or member of the public. ▪ *Any hazardous or toxic material exposure via inhalation, ingestion, puncture or dermal exposure greater than:* OSHA Short Term Exposure Limit (STEL), or OSHA Ceiling Value (CV). OSHA Permissible Exposure Limit (PEL), or - Other industry-defined Best Practices {such as the American Conference of Governmental Industrial Hygiene (ACGIH) Threshold Limit Values (TLVs)}. ▪ *Any ergonomic injury or illness (i.e. musculoskeletal injuries, repetitive motion injuries, etc.)* ▪ Any contamination event leading to a release, suspected release or spread of hazardous or toxic material, on or off site, which requires special action by MACTEC. ▪ Any incident or series of incidents for which a formal investigation is deemed appropriate by MACTEC's management. ▪ Vehicle incident involving injury. ▪ Damage to property greater than $1,000 but less than $10,000. ▪ Any near miss incident that could have <u>been very serious if a barrier separating the employee from the hazard had not been in place.</u> ▪ Required non-emergency notification to a regulatory agency. ▪ Fire	▪ Hospitalization of any employee due to an occupational incident. ▪ Multiple injuries associated with a single occupational incident. Fatality Bloodborne pathogens exposure. ▪ *Release of a hazardous substance on or offsite in an amount exceeding the reportable quantity specified in 40 CFR Part 302.* ▪ *The discharge from a site of any substance which require any special action (e.g. reassurance monitoring of the environment).* ▪ Explosion. ▪ Multiple injuries of subcontractors or members of the public. ▪ Damage to equipment/property greater than $10,000. ▪ Work stoppage due to an unsafe condition or act. ▪ Regulatory agency response to an incident with the public or media involvement. Required emergency notification to regulatory agency due to an incident.
Reporting Requirements	▪ Employee or witness reports incident to supervisor. Seek immediate medical attention if the injury is other than first-aid. Supervisor and all employees involved document incident on appropriate form(s) and submit within the required time frame.	▪ Employee or witness reports incident. If injuries have occurred, seek immediate medical attention as needed by dialing 911, or site specific emergency response number. Supervisor and employees involved document incident on appropriate form(s). The Division ES&H Manager will provide assistance, as needed, to determine all applicable causal factors and appropriate corrective actions to prevent reoccurrence. Submit initial, updated or final report(s) within the required time frame.	Employee or witness reports incident. If injuries have occurred, seek immediate medical attention as needed by dialing 911, or site specific emergency response number. Supervisor notifies their Division's ES&H Manager by telephone or cellular telephone and then follows up by email. The Division ES&H Manager will notify the Corporate Director of ES&H. The Corporate Director of ES&H will chair or support an incident investigation team to determine all applicable causal factors and establish appropriate corrective actions to prevent reoccurrence.

Quality Assurance Project Plan (QAPP) for Carter Carburetor Site Characterization Work Plan

Prepared for:

ACF Industries, LLC
Carter Carburetor SITE
2800 Block North Grand
St. Louis, Missouri

December 2005

Prepared by:

MACTEC Engineering and Consulting, INC.
3199 Riverport Tech Center Drive
St. Louis, MO 63043

MACTEC Engineering and Consulting Project Number 3250055164

TABLES

FIGURES

APPENDICES

1.0 Introduction

The purpose of the quality assurance project plan (QAPP) is to establish the policies, organization, objectives, functional activities, and specific quality assurance (QA) activities for environmental measurements and information collected during the Site Characterization to be performed at the former Carter Carburetor facility owned by ACF Industries, LLC (ACF). The Carter Carburetor facility (Site) is located in St. Louis, -Missouri.

The scope of the QAPP was developed from United States (US) Environmental Protection Agency (EPA) guidelines outlined in EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations, Draft Final, EPA QA/R-5, November 1997.

1.1 Project Background - General

The Site is located in an urban setting within the City of St. Louis. The surrounding area is a mix of residential and commercial neighborhoods composed of medium to low income dwellings, small and large businesses. The population of the City of St. Louis is approximately 350,000. Surface water from the Site drains to a combined storm and sanitary sewer system that discharge into the St. Louis Metropolitan Sewer District (STL-MSD) system. The former Carter Carburetor facility manufactured carburetors and other equipment for gasoline and diesel powered equipment. Former manufacturing processes within these buildings utilized various hydraulic/lubricating oils and dielectric fluid as part of their ongoing operations. Underground storage tanks (USTs) have been typically used to store hydraulic fluids (Pydraul). The Site is partially surrounded by a chain-link fence.

1.2 Project Background - Specific

Detailed information regarding the scope and background of this project is included in Sections 2 and 3 of the Work Plan.

1.3 Project Objectives

Detailed information regarding the work to be performed for this project is included in Sections 4 and 5 of the Work Plan. The project schedule is shown in Section 6 of the Work Plan.

2.0 Organization and Responsibilities

The individuals directly involved in this project and their responsibilities are:

2.1 United States (US) Environmental Protection Agency (EPA) Region 7 Project Coordinator

Mr. **Jeffrey Weatherford** has been identified as EPA's Project Coordinator for this project. Mr. Weatherford will have the authority granted an On-Scene Coordinator by the NCP. In addition, Mr. Weatherford shall have the authority consistent with the NCP to halt any work conducted under the Work Plan and to take any necessary response action which he determines to be necessary to protect public health or welfare or the environment.

2.2 ACF Industries, LLC, (ACF) Project Coordinator

Mr. **Richard Hyink** has been identified as the ACF Project Coordinator for this project. Mr. Hyink shall be the recipient of all approvals, disapprovals, notifications and other correspondence from EPA. In this role, he will be the primary point of contact for the Project.

ACF has selected MACTEC as its primary contractor to perform the Work as required under the Administrative Settlement Agreement and Order on Consent for Removal Action Docket No. Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) -07-2005-0372.

2.3 MACTEC Project Manager

Mr. **Eugene Watson** has been identified as the Project Manager (PM) for this project. Mr. Watson will have managerial authority on behalf of MACTEC for the project. In this role, he will be the primary point of contact for MACTEC. He has overall responsibility for completing the project on time and within the budget. Mr. Watson has served in the same role on numerous environmental projects over his 20-year career.

2.4 MACTEC Project Principal

Mr. **Jeffrey Brandow, P.E.,** will be the Project Principal/Senior Technical Reviewer on this project. Mr. Brandow will participate in strategic planning sessions, provide guidance to the project team on regulatory and technical issues, assist in regulatory meetings, and provide technical review of project deliverables. Mr. Brandow has over 23-years of combined experience in the public and private sector,

and has worked on numerous polychlorinated biphenyl (PCB) remediation projects at industrial facilities and electric utility companies throughout the country. He is currently leading a PCB remediation project at an active manufacturing facility in South Bend, Indiana, and is also providing guidance on PCB remediation and disposal issues for the Connecticut Yankee nuclear power plant decommissioning project. Throughout his career, Mr. Brandow's role as Project Manager, Engineer and Technical Reviewer on a wide range of CERCLA, Resource Conservation and Recovery Act (RCRA) Corrective Action, Brownfields, and Voluntary Remedial Action projects provides him with a strong and varied background to serve as technical advisor on this project.

2.5 MACTEC Project Team

Mr. **Dennis Brinkley, P.E., R.G.**, will act as the Project Principal Engineer on this project. As Project Principal Engineer, Mr. Brinkley will provide technical evaluation, review and expertise. Mr. Brinkley has served as Project Manager, Geologist, Engineer and Principal on similar site investigation and remediation projects over his 17-year career including a recent Removal Site Evaluation and Engineering Evaluation and Cost Estimate (EE/CA) project located in Region 7.

Mr. **Chris Tedder, R.G.,** will act as the Field Team Leader (FTL) on this project. As FTL, Mr. Tedder will provide technical evaluation, review, and expertise. Mr. Tedder has served as FTL and Task Manager on similar project investigations over his 15-year career.

Mr. **Jack Friesner** will be a member of the field team serving as Staff Geologist. Mr. Friesner has seven years of experience conducting subsurface investigations including the direction of monitoring well installation as well as soil and groundwater sampling.

Mr. **Joseph Grib** will be a member of the field team serving as Staff Scientist. Mr. Grib has three years of experience conducting subsurface investigations including the direction of monitoring well installation as well as soil and groundwater sampling.

2.6 MACTEC QA Manager

Ms. **Lana Smith** will be the MACTEC QA Manager. The MACTEC QA Manager reports directly to the MACTEC PM and also has a line of communication to ACF. The MACTEC QA Manager will be

responsible for ensuring that all the stated procedures for this project are being followed. Additional specific functions and duties include:

- Reviewing and approving QA plans and procedures;
- Providing QA technical assistance to project staff;
- Reporting on the adequacy, status, and effectiveness of the QA program on a regular basis to the MACTEC PM; and
- Reviewing field procedures as well as field and analytical data generated by the field team to ensure it meets the project requirements.

2.7 Analytical Laboratory

Pace Analytical Laboratory (Pace), Lenexa, Kansas has been identified as the Project Laboratory for the analytical analysis of samples for this project.. Specfic qualifications and certifications can be found in Appendix A, PACE QA/QC Manual.

2.7.1 Pace Project Manager

Ms. Mary Jane Walls will be the Pace Project Manager. Ms. Walls will have the managerial authority on behalf of Pace for the project. In this role, she will be the primary point of contact for MACTEC. As Pace PM she has the overall laboratory responsibility for completing the project on time, within cost, assuring proper handling, analysis, Quality control (QC), QA, and reporting of results for the samples

2.7.2 Pace QA Manager

Mr. Charlie Girgin will be the Pace QA Manager. Mr. Girgin reports directly to the Pace PM and also has a line of communication to MACTEC. The Pace QA Manager will be responsible for ensuring that all the stated laboratory analytical procedures for this project are being followed.

Figure l depicts the project organization chart indicating key individuals associated with the project and lines of communication.

3.0 Quality Assurance Objectives for Data

The overall QA objective for this field effort is to develop and implement procedures for field sampling, chain of custody, laboratory analysis by Pace of St. Louis, and reporting that will provide results that are legally defensible in a court of law. Specific procedures for sampling, chain of custody, laboratory analysis, reporting limits, and reporting of data are described in other sections of this QAPP.

The overall objective of the QAPP is to establish quality assurance criteria for all project activities so that the data generated is scientifically valid, usable for characterizing chemical distribution and potential risks at the Site, and supportive of the investigation report conclusions. The following sections establish data quality and management objectives for the investigation.

3.1 Precision

Precision is a measure of the degree to which two or more measurements are in agreement. Field precision is assessed through the collection and measurement of field duplicates at a rate of 1 duplicate per 20 analytical samples per media.

Analysis Precision Objectives: Precision is the level of agreement among individual measurements of the same chemical or physical property. During the data validation process, precision is expressed in terms of relative percent difference. Chemical concentration data obtained from the analysis of field duplicate and matrix spike duplicate samples will be compared to evaluate analytical precision. The relative percent difference (RPD) equals the difference in duplicate sample chemical concentrations multiplied by 100 percent and divided by the mean average duplicate sample chemical concentration.

3.2 Accuracy

Accuracy measures the bias of a measurement system and may be defined as the degree of agreement between a measurement and its accepted or true value. Accuracy in the field is assessed through the adherence to all protocols and requirements for sample handling, preservation and holding times.

Analysis Accuracy Objectives: The accuracy of chemical results is assessed by examining the results of spike recovery and blank samples. Accuracy of spike samples is expressed as the percent recovery (REC). The REC is the difference between the spiked and unspiked sample results for a chemical divided by the amount of chemical added to the sample and multiplied by 100 percent. Perfect accuracy is defined as 100 percent recovery. An elevated REC indicates high sensitivity in detecting a compound; therefore, non-detect results would not be qualified under this condition. A low REC indicates a low sensitivity in detecting a compound which could require qualification of non-detect results. Results of the Laboratory Control Spike (LCS), in conjunction with the Matrix Spike/Matrix Spike Duplicate (MS/MSD), can be used to provide evidence the laboratory performed the method correctly and, if applicable, the extent of matrix interference.

3.3 Completeness

Completeness defines the percentage of measurements judged to be valid measurements. Field and laboratory completeness is the number of valid measurements obtained from those measurements planned to be collected in the field or laboratory, respectively. Field completeness is a measure of the amount of valid measurements obtained from measurements planned to be collected in the field. Field completeness will be at least 95%.

Analysis Completeness Objectives: The laboratory completeness goal is 95 percent. Laboratory completeness will be calculated by dividing the number of samples for which valid laboratory data was obtained by the number of samples submitted for laboratory analysis and multiplying the quotient by 100 percent. At this project stage, no critical samples have been identified for this project. However, critical samples may be identified during the investigation based on field observations or an assessment of the collected data. Provisions for obtaining critical samples as they are identified will be developed with the concurrence of the EPA project manager. Similarly, a minimum number of samples needed to characterize the Site has not been developed for this project.

3.4 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents a characteristic of a population, parameter, and variations at a sampling point, a process condition, or an environmental condition. Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the sampling procedures presented in the Site Characterization Work Plan are followed and that proper sampling techniques are used. The representativeness of the data will be determined by:

- Qualitative comparison of actual sampling procedures to those presented in the Workplan.
- Quantitative comparison of analytical results for field duplicates (air, water and wipe samples) and field splits (soil and concrete samples) to determine parameter variation at a sampling point.
- Invalidating nonrepresentative data or identifying data to be classified as questionable through qualitative or quantitative data validation procedures.

Only representative data will be used in subsequent data reduction, validation, and site characterization. Nonrepresentative or questionable data is data which does not accurately reflect Site conditions observed at other sampling points and is not believed to reflect Site impact. A determination of whether data is representative will be completed both qualitatively and through the use of accepted numerical data validation procedures.

Measures to Ensure Representativeness of Laboratory Data: Representativeness in the laboratory is ensured by using proper analytical procedures for the appropriate target analyte, sample matrix, detection limit and method. The sampling network was designed to provide data necessary to characterize potential releases to soil and groundwater. During development of this network, consideration was given to the operational history of the facility, past waste disposal practices, existing analytical data, and the environmental setting.

3.5 Comparability

Comparability is a qualitative parameter used to express the confidence with which one data set may be compared to another. To produce comparable data, the units specified for analytical results obtained during the field investigations will be consistent throughout this project. Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the procedures in the Sampling/Work Plan are followed and that proper sampling techniques are used.

Measures to Ensure Comparability of Laboratory Data: Planned analytical data will be comparable when similar sampling and analytical methods are used as documented in this QAPP. Standardized analytical methods will be utilized for each parameter. Comparability is also dependent on similar QA objectives.

4.0 Sampling Procedures

4.1 Field Data Collection

Field data collection activities will be recorded using field logbooks. Field logbooks will be bound field survey books or notebooks. Logbooks will be assigned to field personnel, but will be stored in the project file when not in use. Each logbook will be identified by the project-specific document number. Logbook entries will contain a variety of information. At the beginning of each entry, the date, start time, weather, names of field team members present, level of personal protection being used will be entered.

Descriptions of any measurements or collected samples will be recorded. Entries will be made in ink, signed or initialed, and dated. No erasures will be made. If an incorrect entry is made, the information will be crossed out with a single strike mark that is signed or initialed and dated by the sampler. Whenever a sample is collected, or a measurement is made, a detailed description of the location of the sample or measurement will be recorded. Equipment used to collect samples and measurements will be identified, along with the date of calibration.

Notes will also be recorded to document other sampling specifics including equipment used, time of sampling, sample description, depth of sample collection, number of sample containers, and container volume. Sample identification numbers will be assigned prior to sample collection. Field duplicate samples will be noted under sample description. Digital photographs will be taken during field activities. These photographs will be paired with a photograph of a identification log that includes the photo subject, date, direction the photo is being taken, and initials of the photographer.

4.2 Laboratory Data Collection

The requested laboratory turnaround time is 10 working days. Samples are received by Pace Sample Management Group who records and files all shipping documentation. The Pace Sample Management Group has full responsibility for ensuring that proper custody procedures are followed at the laboratory and that project specific files are maintained. Upon receipt by Pace, samples proceed through an orderly processing sequence designed to measure continuous integrity of both the sample and its documentation. Upon receipt of a sample shipment, the Pace Sample Management Group initiates a sample log-in checklist which is the Sample Condition Upon Receipt Form (SCUR) for each sample shipment. Custody seals on coolers remain intact until the Pace Sample Management Group is ready to log-in the specific set of samples contained in the cooler. Coolers are inspected for proper seals and to ensure the seals are intact.

The temperature of a representative sample is measured using a calibrated electronic thermometer. The samples are then unpacked, inspected, and checked against the accompanying chain-of-custody record. Any discrepancies involving sample integrity, sample breakage, cooler temperature, appropriate container use, preservatives, and missing or incorrect documentation are immediately noted on the SCUR Form. If inconsistencies, discrepancies or inadequacies with respect to the received samples are identified, the Pace PM will notify the Pace Operations Manager and the MACTEC PM who are responsible for resolving the problem. Resolution typically will involve contacting the field sampling team with follow-up documentation of conversations and resolution. Samples will not be logged until the problems are resolved. Completed SCUR Forms are forwarded to the Pace PM for review.

Once all sample shipment problems have been resolved (if any), the Pace Sample Management Group will log the samples into Pace's tracking log and transfer the sample information to the laboratory's electronic database – Laboratory Information Management System (LIMS).

A unique laboratory identification (ID) number will be assigned to each sample at the time of logging. Sample numbers will be assigned sequentially. Sample numbers will be used on any paperwork associated with the sample so that documentation throughout the laboratory can be matched to the appropriate sample.

The samples are logged into the LIMS database. The information recorded in the database includes the client name; the field identification number; the laboratory identification number; date and time of receipt in the laboratory; date and time of sample collection; sample matrix; sample preservation and analysis; and the number of containers for each analysis. Additional pertinent comments may also be recorded. The initials of personnel who handled the samples are also manually written on the hard copy of the log-in paperwork. Upon completion of the log-in process a summary report is generated from the database and reviewed by the Pace PM.

Samples are assigned a storage location during the log-in procedure. Assignment is made based on the storage requirements for each sample and test method. Samples are stored in a walk-in refrigerator. Each sample will remain in its storage location until the time of analysis. The samples are removed by the designated personnel/analysts and returned to the storage area, if necessary, immediately after the required sample quantity has been taken.

Samples and sample extracts will be retained after analysis is complete. Unused portions of samples and sample extracts will be disposed of 30 days after the delivery of final report delivery unless otherwise specified.

A case file will be created. Project information including the final report, invoice, client contact notes, chain of custody, and relevant paperwork contained in the case files. After project completion, an inventory of the case files will be created and transferred along with the contents of the case files to a storage box.

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5.0 Sample Handling and Custody

5.1 Field Sample Handling

All samples collected in the field will be placed in proper sample containers, labeled, and stored in an iced cooler from the time of collection through sample shipment or field screening. A chain-of-custody record will accompany all samples during collection and shipment.

The final project files include original field documentation records, laboratory reports, and completed chain-of-custody forms. The final project files will be maintained at the MACTEC St. Louis office. A sample or a final evidence file will be considered in the custody of MACTEC if:

- It is in the view of a MACTEC employee after being in the possession of MACTEC;
- It was in the possession of MACTEC and has been placed in a secure area by a MACTEC employee, and/or;
- It is maintained in a MACTEC-designated secure area.

The chain-of-custody will provide for the tracking of sample possession and handling from the time of collection through laboratory analyses.

Sample Labels and Sample Numbering System

Sample labels will be affixed to the sample containers at the time of sampling. The sample labels will remain on the containers throughout the time they are retained. They will contain the following information:

- Sample group;
- Sample quadrant;
- Sample designator;
- Sample depth;
- Sample collector(s);
- Date and Time of collection;
- Preservatives used, if any (including preservatives added by the laboratory); and
- Analysis to be conducted.

The sample group, sample quadrant, sample designator, sample depth will be used to uniquely identify each sample collected. The sample group, consisting of three digits, will identify which floor the sample was collected from and the type of sample collected. The sample quadrant, consisting of four digits, a dash, and four digits, will identify the sample location in a specific quadrant/area. Quadrants will be designated using the building column identification labels present on each column. The sample designator consisting of two digits

representing the sample identification number within the quadrant for individual grab samples or the letters "CP" for a composite sample The sample depth will list the interval for concrete core samples or the midpoint depth (in feet below ground surface) for the subsurface soil samples. Concrete core samples will be collected from the designated intervals:

- 01 = surface to 1-inch depth;
- 02 = between 1 to 3-inches; and
- 03 = below 3-inches.

Specific sample location numbers designated in the project Workplan sampling maps will be used as provided in the Workplan. If during field activities, additional samples are added or sampling locations are changed, sampling numbers will be assigned consecutively in the field starting from the last specific sample number assigned. The following list summarizes the sample numbering system to be utilized during the Site investigation.

Sample Group:

[Floor 0 – Pump Room, 1 – first floor, 2- second floor, or 3 - third floor] + [SS (subsurface soil) or CR (concrete core)] +

Sample Quadrant:

[the quadrant label (the column identification labels that defines a designated sampling area starting with the northwest column followed by the southeast column, separated by a dash)] +

Sample Designator:

[01 (sequential sample number in quadrant)] and [Composite samples taken from the combined separate samples in a quadrant will be labeled using the designation "C1" (sequential composite sample number in the quadrant)] +

Sample Depth:

[depth (indicating the depth interval from which the sample was collected)]

Following are examples of how each type of sample will be labeled.

Fifth subsurface soil sample collected from quadrant AA06-DD12 on the first floor at a depth of 6 feet

i.e. 1SS-AA06-DD12-05-06

Third concrete core sample collected from quadrant A10-E15 from the second floor at a depth between 1 to 3 inches

i.e. 2CR-A10-E15-03-02

Second subsurface soil composite sample collected from quadrant AA06-DD12 on the first floor at a depth of 8 feet

i.e. 1SS-AA06-DD12-C2-08

Samples collected for QA/QC purposes such as duplicates, rinsates, and matrix spike/matrix spike duplicates will be indicated by adding the letter "D", "R", or "MS" / "MSD", respectively to the end of the sample identification.

5.2 Field Custody Procedures

The chain-of-custody record will trace sample possession from the time of collection and will serve as physical evidence of sample custody. It will include the following information written in permanent ink:

- Sample identification;
- Signature of field site manager or designated individual(s) responsible for sample custody;
- Date and time of collection;
- Sample type;
- Number of sample containers;
- Laboratory analysis to be performed;
- Signature of laboratory person(s) receiving samples;
- Inclusive dates and times of possession.

Each chain-of-custody record will be filled out and signed in permanent ink by a MACTEC field team member. Prior to sealing the container, a carbon copy or photocopy will be made of the chain-of-custody record. Copies of the chain-of-custody forms will be maintained to keep a record of shipments to the laboratory.

Chain-of-custody protocol will be adhered to during all phases of the sample collection, storage, shipment, and analysis procedures. Original laboratory analytical reports and chain-of-custody forms will be maintained with the project files. Maintaining the chain-of-custody in the field will be the responsibility of the MACTEC Field Team Leader. The Field Team Leader will perform and/or direct the collection, handling, field analysis, and/or shipment of all samples collected from the Site. The sampling team will retain custody of all field samples until shipment to the analytical laboratory.

Sample Packaging

The sample packaging and shipment procedures will ensure that the samples will arrive at the laboratory with the chain-of-custody intact.

a. The field sampler will be personally responsible for the care and custody of the samples until they are transferred or properly dispatched.
b. Sample containers will be identified by use of sample labels with sample numbers, sampling locations, the sample date/time of collection and the collectors.
c. Sample labels will be completed using waterproof ink unless prohibited by weather conditions.
d. Samples will be accompanied by a properly completed chain-of-custody form that contains the associated sample numbers and locations. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the form. This chain-of-custody form documents the custody transfer of samples from the sampler to another person, to the permanent laboratory, or to/from a secure storage area.
e. Sample containers will be wrapped individually and placed on ice at 4°C in a sample box or cooler. Insulation material such as styrofoam peanuts or additional bubble pack will be used to fill any remaining void space in each sample box or cooler. Samples will be shipped to Pace with a signed chain-of-custody record secured to the inside top of each shipping container.

Sample Seal

When the samples leave the custody of the sample collector, the shipping cooler will be sealed to help determine whether samples have been tampered with during transportation. The seal will include the sampler's signature, time, and date.

5.3 Laboratory Custody Procedures

Pace Laboratory facility is operated under controlled access to ensure sample and data integrity. Visitors must register at the front desk and be properly escorted.

Samples are removed from their storage area by designated personnel/analysts and returned to the storage area, if necessary, immediately after the required sample quantity has been taken. The LIMS contains the sample extraction and analysis dates and times for tracking purposes within the laboratory.

Samples and sample extracts are retained after analysis is complete. Unused portions of samples and sample extracts are disposed of 30 days after the delivery of final report delivery unless otherwise specified.

6.0 Calibration Procedures and Frequency

6.1 Field Instruments

Field instruments will be calibrated immediately prior to use in the field. The calibration procedures will follow standard manufacturers' instructions to ensure equipment is functioning with in tolerances established by the manufacturers. A copy of the instrument user manuals will be placed in a binder and brought to the field. A record of the instrument calibration will be maintained in the field notebook by the Field Team Member calibrating the equipment.

6.2 Laboratory Instruments

Laboratory instrumentation calibration and maintenance information will be outlined in the Pace laboratory's QA/QC program manual.

7.0 Data Validation and Usability

7.1 Data Review, Validation and Verification Requirements

Analytical data reduction, review, reporting and storage requirements will be outlined in the contract laboratory's QA/QC program manual. This information is submitted as Appendix A. The quality of the laboratory test results will be assessed through evaluation of the results of the submitted QA/QC samples and laboratory internal QA/QC results. The laboratory data assessment procedures will follow the National Functional Guidelines for Organic analysis (NFGO) (USEPA,1999), and will consider the following items:

- Analytical Precision - Laboratory precision will be evaluated by calculating the RPD for field duplicates and the REC for matrix spike and matrix spike samples. The NFGO guidance does not establish RPD and REC standards for field duplicate and matrix spike duplicate data; however, this data will be reviewed to assess the overall accuracy of the analytical process. Data qualifications for samples not achieving MACTEC control criteria may be assigned.
- Analytical Accuracy - Surrogate spikes, laboratory blank, and field blank data will be reviewed to assess analytical precision. The data validation review will assign data qualifiers to analytical results for samples with surrogate recoveries below established surrogate recovery standards. Depending on the level of recovery data may be qualified as estimated (J*/UJ) or unusable (R) based on low or high surrogate recoveries.
- Positive detections in laboratory blank samples may indicate chemicals introduced into the samples during handling. Site sample chemical detections less than five times (ten times for common laboratory chemicals) the blank sample chemical concentration will be qualified as undetected (U*).
- Positive chemical detections in field blank samples will be indicated by qualifying associated chemical data with a BCD internally adopted (F) qualifier to document the field blank detection.
- Representativeness - The representativeness review will consider sample preservation and storage procedures followed during the Site Characterization, results of the precision and accuracy evaluation,

  and sample holding times. Failure of field personal to properly handle Site samples may result in the qualification data as estimated or unusable. The representativeness review will also consider qualitatively whether precision or accuracy are sufficient to characterize Site conditions. Analytical data for samples which were not analyzed or extracted within established holding times may be qualified. Samples having PCB and volatile analysis with parameter sample values above Instrument Detection Limit (IDL) may be flagged as estimated (J) based on the review of all data. Values less than the IDL can be qualified as estimated (UJ) or rejected (R) based on review of all data.
- Completeness - The completeness review will assess the percentage of sample measurements judged to be valid.

7.2 Validation and Verification Methods

The contracted laboratory will be responsible for accurately performing the prescribed methods. This includes all procedures, QC checks, corrective actions and data storage. MACTEC will review the analytical data and ensure that the laboratory correctly followed the method protocol.

Data validation will be completed on 10% of the data. Data validation will include a review of the following items: chain-of-custody, analysis completeness, holding times, method blank results, field blank results, duplicate sample results, control spike or matrix spike results, field duplicates, and detection limits. The validation will be completed in accordance with the NFGO. Results of the data validation review will be presented in the investigation report provided by MACTEC.

7.3 Reconciliation with User Requirements

After data has been validated, the Project Manager will evaluate the results by considering the quality control parameters of precision, accuracy, representativeness, comparability, and completeness as outlined in Section 3. If data quality indicators do not meet the requirements as outlined, the data may be discarded and re-sampling may occur. The Project Manager will make this decision after consultation with the other key project personnel. The data will then be analyzed in order to identify the appropriate removal action for the site.

8.0 Data Management, Reduction, and Reporting

Data generated through field sampling activities or by the laboratory operation will be reduced and validated prior to reporting. No datum will be disseminated until it has been subjected to the procedures that are summarized in subsections below.

8.1 Data Management

Sampling activities, laboratory activities and data tracking and receipt will be the responsibility of the project manager. In addition to the procedures outlined in Sections 7.1, 7.2, and 7.3 of this document, the following procedures will be used to ensure that all samples are collected for the required parameters outlined in the Work Plan:

- Daily coordination/communication with the field site manager to ensure sampling is being conducted as planned.
- Chain-of- custody forms checked daily for accuracy.
- Cooler receipt forms checked daily for accuracy.

Data management and evaluation shall include the following activities:

- All analytical data shall be sent to the Consultant by the subcontracted laboratories in an electronic format appropriate for input into a Microsoft Access database program;
- After data is input into the database, a review of data shall be performed to identify possible anomalies. The review will assure that the quantities of locator and episodic data are reasonable and assure locator names and parameter names are correct;
- All analytical data shall undergo 10 percent data validation;
- Validation results shall be incorporated into the project database, and all validated data shall be flagged as such;
- Review of project database to identify potential data anomalies;
- Review of project database to assure data quality objective (DQOs) have been met; and
- Review of field data (i.e. boring logs, daily sampling logs, Chain of Custodies (COC), etc.) to assure completeness.

8.2 Field Data Reduction

Field data reduction procedures will be minimal in scope compared to those implemented in the laboratory setting. Only direct-read instrumentation will be employed in the field. The field instruments

will generate measurements directly read from the meters following calibration per manufacturer's recommendations. Such data will be written into field log books immediately after measurements are taken. If errors are made, results will be legibly crossed out, signed or initialed and dated by the field member, and corrected in a space adjacent to the original (erroneous) entry. Later, when the results tables and figures required for this study are being completed, the MACTEC will proof the tables and figures to determine whether any transcription errors have been made by the technical field staff.

8.3 Laboratory Data Reduction

This section presents Pace's laboratory Data Reduction Procedures. MACTEC will perform data reduction and internal validation under the direction of the MACTEC QA Manager. The MACTEC QA Manager is responsible for assessing data quality and advising of any data which were rated "preliminary" or "unacceptable" or other notations which would caution the data user of possible unreliability.

Analytical data generated will be extensively checked for accuracy and completeness. The data validation process consists of data generation, data reduction, and three levels of review, as described below.

After acquisition, the raw data is reduced into reportable values by the analyst using computer software. Additional sample information is added to the sample results during data reduction by the analyst. Identification of target analytes is first performed by the computer software and then checked by the analyst. Each chromatographic integration is also checked. Missed target analytes and misidentified analytes are corrected by the analyst. The finished results are then converted electronically for use in the data reporting software. The analyst is responsible for reviewing the sample and QC results for compliance to this QAPP. QC exceptions are immediately brought to the attention of the Pace PM or the Pace QA Manager. Corrective action for problems is made where necessary.

The analyst then assembles hard copies of the computer software output into a final laboratory data package. Additional relevant supporting documentation, including sample and standard preparation record are also added to the final laboratory data package. The completed package is submitted to the facility supervisor for review.

The audit process is coordinated by the Pace QA Manager. The first review process includes a review of all hand calculated values and a review of computer generated results. The process checks the traceability of a final result through the instrument calibration and to the sample preparation steps. Upon completion

of the review, the supervisor will release the results to the Pace PM for review and reporting. The final data package and the review checks are maintained in the laboratory files. The Pace PM is responsible for completing the project narrative letter and assembling the package for final reporting.

Data reporting procedures will be carried out for field and laboratory operations as indicated below.

8.4 Field Data Reporting

Field data reporting will be conducted principally through the transmission of tables and/or figures containing tabulated results of measurements made in the field, and documentation of field calibration activities.

8.5 Laboratory Data Reporting

The Pace PM is responsible for the generation of the final laboratory reports. The Pace PM will review the report to determine whether the report meets project requirements. The Pace PM will sign all reports prior to their release.

Analyses will be thoroughly documented. This documentation will be sufficient to recreate the analysis on paper. The report will consist of the tabulated results and a summary of quality control samples.

9.0 Quality Control

9.1 Field Quality Control

Field Duplicates

Collection and analysis of field duplicate samples provide an overall estimate of precision associated with sample collection and analysis. The field duplicate samples will be identified as "DUP," without further information as to the source of the replicate. The source information will be recorded in the field notes and the chain of custody at the time of collection. Field duplicates will be collected at a frequency of 1 per 20 samples (5 percent) as shown on Table 1.

Decontamination

Drilling and sampling equipment will be decontaminated prior to initial use at the Facility.

To prevent possible cross-contamination between samples, down-hole drilling tools and sampling equipment will be decontaminated between sampling locations. Decontamination of soil samplers (MacroCore® samplers), concrete coring bits, and other pieces of field equipment will be performed at the sampling locations. Decontamination procedures for sampling equipment consists of a wash of an Alconox® or Liquinox® solution, a potable/tap water rinse, followed by a distilled water rinse. Wash and rinse waters will be collected into a bucket or drum.

Waste materials derived from the field investigation, such as drill cuttings, decontamination rinse waters, and personal protective equipment, will be accumulated in drums or portable roll-off containers for subsequent transfer into larger roll-off units on-site for management and until proper disposal arrangements by MACTEC on behalf of ACF.

9.2 Laboratory Quality Control

The following quality control measures and checks will be employed by the Laboratory:

- Method and procedural blanks to assess the level of contamination associated with the processing and analysis of samples;
- Blank Spike (BS) samples consisting of representative target analytes spiked into a blank matrix to assess method performance independent of sample matrix;
- MS/MSD samples to assess method performance in the subject matrix;

- Analysis of samples within generally accepted method holding times

Control limits are created for each QC parameter. These limits may be based on historical results or set considering the accuracy and precision requirements of the resultant analyses.

9.2.1 Holding Times

Holding Times Sample analysis will be scheduled to meet method holding times. A best effort will be made to complete extraction and analysis before the holding time for preparation has expired so that samples can be re-extracted within holding time should problems arise. Nonconformance situations will be fully documented in the report narrative.

9.2.2 Duplicates

A duplicate sample is obtained from a single or composite sample split into two similar portions to produce two samples. The project goal is to collect about 5 percent duplicate samples during the Site investigation. Split soil and concrete samples will be collected by placing soil or concrete from a single sampling location in a mixing bowl and, after mixing, transferring the sample into separate sample containers. Soil and concrete duplicate sample results will indicate the precision and reproducibility of the analytical results.

The duplicate and split QA/QC samples will be collected in the same manner and analyzed for the same parameters as field samples from the same location and matrix.

9.2.3 Equipment Rinsates

Equipment blanks (rinsate blanks) are a means of proving that sampling equipment is thoroughly decontaminated. This demonstrates that no cross contamination is occurring. Rinsate samples are processed by rinsing decontaminated sampling equipment (soil samplers, bailers, etc.) with distilled or deionized water obtained from the laboratory. The rinse water is collected in sample containers, preserved, and handled in the same manner as the samples. Rinse blanks are required at a rate of 1 per 20 samples per equipment type decontaminated. New, manufacturer cleaned disposable liners will be used in each soil sampler, eliminating the need for equipment blanks for soil sampling.

9.2.4 Method Blanks

Method blank samples are generated within the laboratory and used to assess contamination resulting from laboratory procedures.

9.2.5 Matrix Spike (MS)/Matrix Spike Duplicate (MSD)

Matrix spikes provide information about the effect of the sample matrix on extraction/digestion and measurement methodology. Matrix spikes are performed in duplicate and are referred to as MS/MSD samples for inorganic analyses. MS/MSDs will be run at a frequency of 5 percent (see Table 1). Matrix spike and matrix spike duplicate samples will be collected in the field for analysis by the analytical laboratory. MACTEC field members will collect duplicate samples and designate the samples as matrix spike and matrix spike duplicate samples. The samples will be spiked with a known amount of chemical by the laboratory prior to analysis. About five percent matrix spike and matrix spike duplicate samples will be collected during the investigation. Adequate samples will be provided to the laboratory for the analysis of the required matrix spike and matrix spike duplicate samples.

Matrix spike and matrix spike duplicate analytical results will be utilized to assess the precision of the laboratory analytical results.

MS/MSD Samples: One set of MS/MSD samples will be prepared and analyzed with each batch of 20 or fewer investigative samples. Recovery and relative percent difference for the spiked compounds will be calculated and compared to acceptance limits. The laboratory will use the following to evaluate the QC results:

1. For samples with results within "Acceptance Limits," data will be accepted and reported.
2. For samples with results outside "Acceptance Limits" but within "Warning Limits," results of the associated laboratory QC results (blank, blank spike, surrogate recoveries) will be evaluated. If laboratory QC results are within limits, the sample results will be accepted and reported.
3. Samples with results outside "Warning Limits" will be re-extracted and re-analyzed. If the reanalysis supports the initial analysis, the initial analysis will be reported with a discussion of the corrective action in the project narrative. If the reanalysis yields results within limits, the reanalysis will be reported.

Although not expected, there may be other situations where re-extraction and re-analysis may not be required:

- MS/MSD samples require significant dilution due to the concentrations of target compounds present beyond the linear range of the instrument. In this case, the matrix spike compounds may be so dilute as to be unmeasurable. An attempt to compensate for this will be made at the time of sample preparation.
- Target analytes in the MS/MSD sample are at levels significantly higher than that spiked. Again, an attempt will be made to compensate for this at the time of sample preparation.
- The sample is characterized by significant chromatographic interference. This is minimized by the use of sample cleanups and selected ion monitoring. Additional cleanups will be considered if this occurs.

10.0 Audits

10.1 Field Audits

There will be one field QC audit during the project field work. The field audit will be conducted towards the start up of field activities. An audit report will be submitted to the MACTEC PM to provide verification on completion of any corrective action items.

10.2 Laboratory Audits

At this time it is not proposed to submit blind performance evaluation (PE) samples to the analytical laboratory for analysis. The laboratory does conduct PE sample analysis as part of its program certification requirements. As a result, an independent PE effort is not necessary.

11.0 Instrument/Equipment Testing, Inspections, and Maintenance

11.1 Field Instruments

A calibration and operation program will be implemented for carrying out routine calibration and maintenance on all field instruments. The program will be administered by the PM, Field Team Leader, and the field team members. Trained staff members will perform field calibrations, equipment checks, and instrument maintenance prior to using equipment. They will maintain proficiency in equipment operation, perform the prescribed field operating and calibration procedures outlined in the equipment manuals accompanying the respective instruments. Each piece of equipment will have a unique serial number for tracking during field use, calibration, and for maintaining maintenance records. All field calibrations will be documented in the field logbook and/or on the field equipment calibration record. If on-site monitoring equipment should fail, the field site manager will be contacted immediately. The field site manager will either provide replacement equipment or have the malfunction repaired immediately.

Preventative maintenance of field equipment, which is performed by field personnel, routinely precedes each sampling event; more extensive maintenance is performed by manufacturers on the basis of hours in use. Sampling crews report performance of the equipment after each sampling event. Critical spare parts are kept in stock. At times, it is necessary to perform routine maintenance in the field; therefore, each field instrument is provided with an operating manual and tool kit.

11.2 Laboratory Instruments

The analytical subcontractor shall perform equipment calibration and preventive maintenance as outlined in their Quality Assurance Plan. Pace will utilize Contract Laboratory Program (CLP) protocols consistent with EPA requirements for Superfund Projects.

Laboratory preventative maintenance of equipment and instruments will be performed by trained laboratory personnel routinely with extensive maintenance performed by manufacturers on the basis of hours in use. Laboratory performance of the equipment after maintenance and/or repairs will be noted and evaluated. Critical spare parts shall be kept in stock at the laboratory. Laboratory instrument shall be provided with an operating manual and tool kit located in the laboratory to perform any maintenance required.

12.0 Corrective Actions

Corrective or preventive action is required when potential or existing conditions are identified that may adversely impact data quantity or quality. Corrective action (CA) could be immediate or long term. In general, any member of the project staff who identifies a condition adversely affecting quality can initiate corrective action by notifying their supervisor or the Project QA Manager in writing. The written communication will identify the conditions and explain how it may affect the data quality or quantity.

12.1 Immediate Corrective Action

Immediate CA is usually applied to spontaneous, nonrecurring problems (e.g., instrument malfunction). The individual who detects or suspects nonconformance to previously established criteria or protocol in equipment, instruments, data, or methods, will immediately notify their supervisor. The supervisor and the appropriate FTL will investigate the extent of the problem and take the necessary corrective steps.

Corrective action on a day-to-day basis for field sampling will be handled by consultation between the field team members (FTMs) and the FTL. The field site manager will make immediate decisions with the team members on new protocols to be followed. If appropriate, the FTL will develop the revised protocol in checklist format. A copy of all revised protocol checklists will be stored in the project files. In addition, all changes in field sampling procedures will be documented in the field logbooks and reported in the final report.

If a large quantity of data is affected, the FTL must prepare a memorandum to the PM and Project QA Manager. These individuals will collectively decide how to proceed to correct the problem(s). Corrective measures will be coordinated with Cater Carburetor and any actions taken will be reported in a QC progress report. If the problem is limited in scope, the FTL will decide on the corrective action measure and document the solution in the memorandum in addition to the corrective action request/routing form.

12.2 Long-Term Corrective Action

Long-term corrective action procedures are devised and implemented to prevent the recurrence of the potentially serious problem. The Project QA Manager will be notified of the problem and will conduct an investigation to determine the severity and extent of the problem. They will then file a corrective action request with the FTL and PM. If the corrective action will impact project budget or schedule, the action requires involvement of Carter Carburetor.

Corrective actions may also be initiated as a result of other activities including:

- Performance audits
- System audits
- Laboratory/field comparison studies, and
- QA project audits.

Examples of long-term corrective actions include:

Staff training in technical skills or in implementation of QA Program,

Rescheduling of work routines to ensure project schedule is maintained and is on budget, and

Revision of QA Program or replacement of project personnel.

For either immediate or long-term corrective actions, steps comprising a closed loop corrective action system are as follows:

1. Define the problem,
2. Assign responsibility for investigating the problem,
3. Investigate and determine the cause of the problem,
4. Determine a corrective action to eliminate the problem,
5. Assign and accept responsibility for implementing the corrective action,
6. Establish effectiveness of the corrective action and implement the corrective action, and
7. Verify that the corrective action has eliminated the problem.

Depending on the nature of the problem, corrective action employed may be formal or informal. In either case the occurrence of the problem, corrective action employed, verification that the problem has been eliminated must be documented. Final resolution of the problem will be documented by the signature of the Project QA Manager who shall sign the corrective action form to indicate that the project problems have been resolved.

Corrective actions for laboratory analyses will be handled either internally by the contract laboratory or by consultation between the laboratory QA/QC officer and MACTEC's QA/QC manager. Based on the review of the laboratory results and QA data submitted, the PM, after consultation with the QA/QC manager, will identify results which do not meet the QA objectives. MACTEC will then make immediate decisions with the laboratory QA/QC officer on corrective actions to be taken, including new protocols to be followed. If corrective actions are needed, revised protocols will be developed in a checklist format. A copy of all revised protocol checklists will be stored in the project files and reported in the final report.

13.0 Reports to Management

The following reports will be prepared and submitted to provide information on the status of the project:

13.1 QC Reports

Monthly Progress Report

Monthly progress reports will be submitted to all parties on the distribution list on the 10th of each month. This monthly report will summarize progress made during the reporting period; anticipated problem areas and recommended solutions; problems resolved; upcoming events/activities planned; key staffing changes; and project percentage complete. A data summary report will be included in each monthly report.

13.2 Project Reports

Site Characterization Work Plan Report

This report will present and evaluate information gathered during the field work to characterize the site contamination. It will be submitted to all parties on the distribution list. Distribution list is included in Appendix B.

14.0 References

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USEPA, Region 7. *Engineering Evaluation/Cost Analysis for the Carter Carburetor Site, St. Louis, Missouri*, November 1998.

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TABLES

Table 1 Quality Assurance/Quality Control (QA/QC) Sample Summary, Carter Carburetor Site, St. Louis, Missouri

Matrix	Number of Samples	Analytical Parameter	Field Duplicates[a]	Equipment Blanks[b]	MS/MSD/D[b]
Concrete					
Site	133	PCBs	7	7	7
Brick Chips					
Site	20	PCBs	1	1	1
Subsurface Soil					
Site	38	PCBs VOC PAHs RCRA Metals	2		2

Notes:
MS/MSD/D matrix spike/matrix spike duplicates/duplicates
[a] Number of duplicates figured on 5 percent of total number of samples for each medium and analyte.
[b] Number of equipment blank and matrix spike/matrix spike duplicate samples figured on 5 percent of total number of samples for each medium and analyte list.
PCBs – Polychlorinated biphenyls
VOCs – Volatile Organic Compounds
PAHs – Polynuclear Aeromatic Hydrocarbons
RCRA – Resource Conservation and Recovery Act

Table 2 Analytical Sample Summary, Carter Carburetor Facility, St. Louis, Missouri

Field Parameters	Analytical Methodology	Number of Samples
Concrete		
Polychlorinated biphenyls (PCBs)	SW-846 8082	154
Brick Chips		
Polychlorinated biphenyls (PCBs)	SW-846 8082	23
Subsurface Soil		
Polychlorinated biphenyls (PCBs) Volatile Organic Compounds (VOCs) Polynuclear aeromatic hydrocarbons (PAHs) RCRA Metals	SW-846 8082 SW-846 8260B SW-846 8270C SW-846 6010 or 6020	42

Notes:
RCRA – Resource Conservation and Recovery Act

Table 3 Sample Containers, Preservatives, and Holding Times for Laboratory Samples, Carter Carburetor Facility, St. Louis, Missouri

Sample Matrix	Sample Container(s)	Preservatives	Holding Times
Concrete – Solid			
Polychlorinated biphenyls (PCBs)	Wide-mouth bottle	Store at 4°C At laboratory store at < -10°C	1 year
Subsurface Soil – Soil			
Polychlorinated biphenyls (PCBs)	4 oz. glass jar	Store at 4°C	14/40 Days
Volatile Organic Compounds (VOCs)	4 oz. glass jar	Store at 4°C	14 Days
Polynuclear aeromatic hydrocarbons (PAHs)	4 oz. glass jar	Store at 4°C	14/40 Days
RCRA Metals	4 oz. glass jar	Store at 4°C	6 Months

Notes: °C – degrees Celsius < - less than oz – ounce # / # - Extraction /Analysis
RCRA – Resource Conservation and Recovery Act

FIGURES

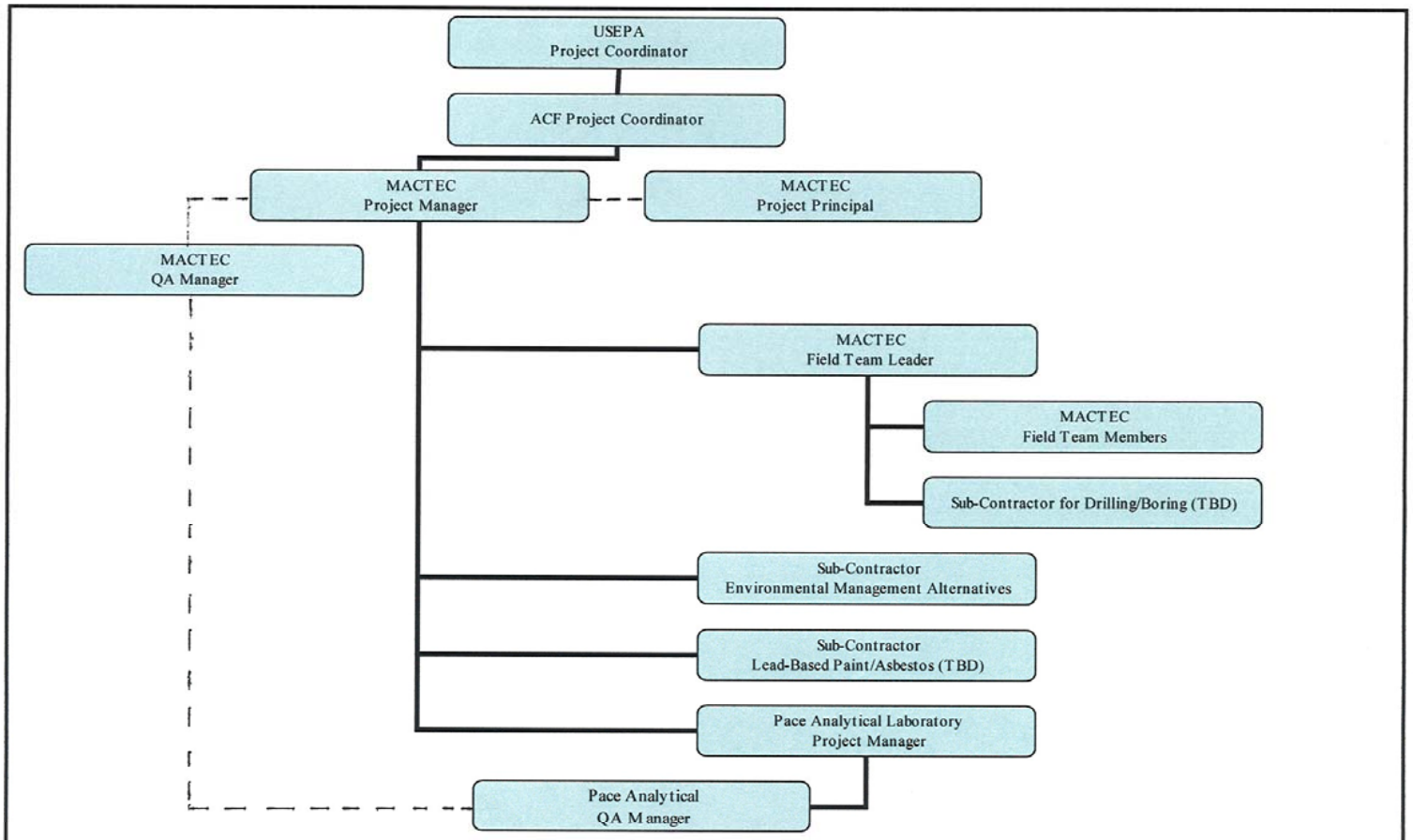

Figure 1
Project Quality Assurance Project Plan (QAPP) Organizational Chart
QAPP for Carter Carburetor Site Characterization Work Plan
St. Louis, MO

MACTEC

APPENDICES

Appendix A
Pace Analytical QA Manual

QUALITY MANUAL

Quality Assurance/Quality Control
Policies and Procedures

Prepared by Pace Analytical Services, Inc.
1700 Elm Street S.E., Suite 200
Minneapolis, Minnesota 55414
(612) 607-1700

for:

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Indianapolis Laboratory 7726 Moller Road Indianapolis, IN 46268 317-875-5894	Kansas Laboratory 9608 Loiret Blvd Lenexa, KS 66219 913-599-5665	Minnesota Laboratory 1700 Elm Street S.E. Minneapolis, MN 55414 612-607-1700
New Orleans Laboratory 1000 Riverbend Blvd., Suite F St. Rose, LA 70087 504-469-0333	Pittsburgh Laboratory 5203 Triangle Lane Export, PA 15632 724-733-1161	Waltz Mill Radiochemistry Laboratory I-70 Madison Exit Madison, PA 15663 724-722-5214
Pace Analytical del Caribe El Retiro Industrial Zone P.O. Box 325 Calle B&C San German, PR 00683 787-720-0329	Green Bay Laboratory 1241 Bellevue Street Green Bay, WI 54302 920-469-2436	Kimberly Laboratory 1090 Kennedy Avenue Kimberly, WI 54136 920-469-2436

Approval

Steve A. Vanderboom
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9-30-05
Date

Clarence L. Haile, Ph.D.
Director of Quality, Safety & Training
(612) 607-6439

30 Sept 2005
Date

Signature Page

This document, with the necessary addenda, has been accepted as the Quality Manual.

	11-14-05	Lenexa, Kansas
Laboratory General Manager	Date	Laboratory
Charles E Jurgen	10-31-05	
Quality Manager	Date	
Hang M Bay	11-15-05	
Technical Director	Date	
[illegible]	11/15/05	
Technical Director	Date	
[illegible]	11/15/05	
Technical Director	Date	
Jim Harrell	11/16/05	
Technical Director	Date	
Technical Director	Date	

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1.0 INTRODUCTION & ORGANIZATIONAL STRUCTURE

"To meet the business needs of our customers for high-quality, cost-effective analytical measurements and services"

Pace Analytical Statement of Purpose

1.1 Introduction to Pace

Pace Analytical Services, Inc. is a privately held, full-service analytical testing firm operating a nationwide system of laboratories. Pace offers extensive services beyond standard analytical testing, including: bioassay for aquatic toxicity, air toxics, industrial hygiene testing, explosives, high resolution mass spectroscopy (including dioxins, furans and coplanar PCB's), radiochemical analyses, product testing, pharmaceutical testing, field services and mobile laboratory capabilities. Pace has implemented a consistent Quality System in each of its laboratories and service centers. In addition, the company utilizes an advanced data management system that is highly efficient and allows for flexible data reporting. Together, these systems ensure data reliability and superior on-time performance. This document defines the Quality System and QA/QC protocols.

Pace Analytical's goal is to continue to combine its expertise in laboratory operations with customized solutions to meet the specific needs of its clients.

1.2 Statement of Purpose

To meet the business needs of our customers for high quality, cost-effective analytical measurements and services.

1.3 Quality Policy Statement and Goals of the Quality System

Pace Analytical is committed to providing the highest quality product to our clients, while maintaining good professional practices.

The management of Pace Analytical is responsible for maintaining the highest possible standard of service for our clients by following a documented quality system. The overall objective of this quality system is to provide reliable data by adhering to rigorous quality assurance policies and quality control procedures as documented in this Quality Manual.

All personnel within the Pace network are required to be familiar with all facets of the quality system and implement these policies and procedures in their daily work. This daily focus on quality is applied with the initial project planning, and is continued through all field and laboratory activities and ultimately, to the final report generation.

The management of Pace demonstrates its commitment to quality by providing the resources, including facilities, equipment and personnel to ensure the adherence to these documented policies and procedures. All Pace personnel comply with all current applicable state, federal, and industry standards (such as the NELAC and ISO 17025 standards).

1.4 Pace Analytical Core Values

- **INTEGRITY**
- **VALUE EMPLOYEES**
- **KNOW OUR CUSTOMERS**
- **HONOR COMMITMENTS**
- **FLEXIBLE RESPONSE TO DEMAND**
- **PURSUE OPPORTUNITIES**
- **CONTINUOUSLY IMPROVE**

1.5 Code of Ethics

Pace Analytical's fundamental ethical principles are as follows:

- Each Pace Analytical employee is responsible for the propriety and consequences of his or her actions.
- Each Pace Analytical employee must conduct all aspects of Company business in an ethical and strictly legal manner, and must obey the laws of the United States and of all localities, states and nations where Pace Analytical does business or seeks to do business.
- Each Pace Analytical employee must reflect the highest standards of honesty, integrity and fairness on behalf of the Company with clients, suppliers, the public, and one another.

Strict adherence by each Pace Analytical employee to this Code of Ethics and to the Standards of Conduct is essential to the continued vitality of Pace Analytical.

Failure to comply with the Code of Ethics and Standards of Conduct will result in disciplinary action up to and including termination and referral for civil or criminal prosecution where appropriate. An employee will be notified of an infraction and given an opportunity to explain, as prescribed under current disciplinary procedures.

1.6 Standards of Conduct

1.6.1 Data Integrity

The accuracy and integrity of the analytical results produced at Pace Analytical are the cornerstones of the company. Lack of data integrity is an assault on our most basic values and puts Pace Analytical and its employees at grave financial and legal risk. Therefore, employees are to accurately prepare and maintain all technical records, scientific notebooks, calculations and databases. Employees are prohibited from making false entries or misrepresentations of data (e.g., dates, calculations, results or conclusions).

Managerial staff must make every effort to ensure that personnel are free from any undue pressures that may affect the quality or integrity of their work; including commercial, financial, over-scheduling and working condition pressures.

1.6.2 Confidentiality

Pace Analytical employees must not (directly or indirectly) use or disclose confidential or proprietary information except when in connection with their duties at Pace Analytical. This is effective over the course of employment and for a period of two years thereafter.

Confidential or proprietary information, belonging to either Pace Analytical and/or its clients, includes but is not limited to test results, trade secrets, research and development matters, procedures, methods, processes and standards, company-specific techniques and equipment, marketing and client information, inventions, materials composition, etc.

1.6.3 Financial Responsibility

Pace Analytical employees must accurately keep all books, records and accounts for which they are responsible. Employees are responsible for maintaining and safeguarding all company funds and/or assets in their possession or control. Additionally, all employees are responsible for submission of accurate reporting documents pertaining to payroll (timesheets, etc.) and reimbursement requests (expense reports, tuition reimbursement, etc.).

1.6.4 Drug-free Workplace

Pace Analytical recognizes that alcoholism and other drug dependencies are a significant social problem with a potential for causing severe detriment to the workforce. Employees have the right to work in an alcohol and drug-free environment. Employees are not to report to work under the influence of alcohol or controlled substances as prescribed in the Drug-free Workplace Program. The possession, use and sale of alcohol and controlled substances as well as detailed information regarding drug testing is described in the Drug-Free Workplace Program Policy handout provided to all new employees. Additional copies are available from Human Resources. Employees are obligated to conform to the strict Drug-Free Workplace Program Policy.

1.6.5 Conflict of Interest

Pace Analytical employees must avoid situations that might involve a conflict of interest or appear questionable to others. The employee must be careful in two general areas:

- Participation in activities that conflict or appear to conflict with Pace Analytical responsibilities.
- Offering or accepting anything that might influence the recipient or cause another person to believe that the recipient may be influenced. This includes bribes, kickbacks or illegal payments.

Employees are not to engage in outside business or economic activity relating to a sale or purchase by the Company. Other questionable activities include service on the Board of Directors of a competing or supplier company, significant ownership in a competing or supplier company, employment for a competing or supplier company or participation in any outside business during the employee's work hours.

1.6.6 Non-Harassment

Pace Analytical endeavors to provide a workplace free of both harassment and discrimination. Harassment of an employee or job applicant on the basis of race, color, creed, religion, national origin, sex, disability, age, marital status, sexual orientation, or any characteristic protected by applicable municipal, state, and federal laws is both illegal and a violation of company policy. Pace Analytical maintains a Sexual Harassment Prevention policy that clearly defines the company's stance against sexual harassment and provides a mechanism for reporting infractions. The Sexual Harassment Prevention Policy is addressed in employee orientation, and employees are provided the Policy handbook. Additional copies are available from Human Resources.

1.6.7 Proper and Professional Conduct

Employees are bound to use fairness, honesty and regard for the law in their business relationships with Pace Analytical investors, clients, suppliers, employees, and applicants as well as all local, national and international communities and governments.

1.6.8 Protection of Property

Pace Analytical employees have an obligation to protect all company and client property against loss, theft and misuse. Employees are responsible for maintaining an orderly, clean workplace. Employees are also liable for using company and client property for intended purposes only. Employees are prohibited from using company property for their personal use without the expressed permission of their supervisor or General Manager. No such use of property may be made after termination of employment with Pace Analytical. Employees must also make every effort to prevent the misuse of company and client property by other persons. Misuse includes selling, loaning or giving away company or client property.

1.6.9 Communication

Each employee is responsible for obtaining the information necessary to follow directives in the Code of Ethics and the Standards of Conduct, and for reporting to their management or Human Resources representative any observed deviations from these policies. The identity of the employee reporting the infraction will not be disclosed without his/her permission unless disclosure is unavoidable during an investigation. No adverse action will be taken against a Pace Analytical employee because he/she has reported a suspected impropriety. These reports will be treated in confidence to the maximum extent consistent with the fair and rigorous enforcement of the Code of Ethics and Standards of Conduct.

1.6.10 Compliance

All employees are required to read, understand and comply with the various components of the standards listed in this document. As confirmation that they understand this responsibility, each employee is required to sign an acknowledgment form annually that becomes part of the employee's permanent record.

1.7 Laboratory Organization

The Pace Corporate Office centralizes company-wide accounting, business development, financial management, human resources development, information systems, marketing, quality, safety and training activities. Pace Analytical's Director of Quality, Safety & Training is responsible for assisting the development, implementation and monitoring of quality programs for the company. See Figure 1.1 for the Corporate Organizational structure.

Each laboratory within the system operates with local management, but all share common systems and receives support from the Corporate Office.

A General Manager supervises each regional laboratory. Quality Managers at each lab report directly to their General Manager but receive guidance and direction from the Director of Quality, Safety & Training.

Under the direction of the General Manager, the technical staff of the laboratory is generally organized into the following functional groups:

- Organic Sample Preparation
- Wet Chemistry Analysis
- Metals Analysis
- Volatiles Analysis
- Semi-volatiles Analysis
- Radiochemical Analysis
- Product Testing
- Equipment Maintenance
- Microbiology

Appropriate support groups are present in each laboratory. Figure 1.2 represents a typical organizational structure for a laboratory operation. The organizational structure for a specific laboratory is part of each laboratory's addendum to this Quality Manual.

1.8 Laboratory Job Descriptions

1.8.1 General Manager

1. Oversees all functions of the operations.
2 Authorizes personnel development including staffing, recruiting, training, workload scheduling, employee retention and motivation.
3 Prepares budgets and staffing plans.
4 Monitors the Quality Systems of the laboratory and advises the Quality Manager accordingly.
5 Ensures compliance with all applicable state, federal and industry standards.

1.8.2 Quality Manager

1. Oversees the laboratory Quality Systems while functioning independently from laboratory operations. Reports directly to the General Manager.
2. Monitors Quality Assurance policies and Quality Control procedures to ensure that the laboratory achieves established standards of quality.
3. Maintains records of quality control data and evaluates data quality.
4. Conducts periodic internal audits and coordinates external audits performed by regulatory agencies or client representatives.
5. Reviews and maintains records of proficiency testing results.
6. Maintains the document control system
7. Assists in development and implementation of appropriate training programs.
8. Provides technical support to laboratory operations regarding methodology and project QA/QC requirements.
9. Maintains certifications from federal and state programs.
10. Ensures compliance with all applicable state, federal and industry standards.

1.8.3 Project Manager

1. Coordinates all aspects of specific projects.
2 Focal point for client contact pertaining to project requirements and project status.
3 Arranges bottle orders and shipment of sample kits to clients.
4 Verifies login information relative to project requirements and field sample Chains-of-Custody.
5 Communicates with operations staff to update and set project priorities.
6 Provides results to clients in the requested format (verbal, hardcopy, electronic, etc.).

7 Works with clients, laboratory staff, and other appropriate Pace Analytical staff to develop project statements of work or resolve problems of data quality.

1.8.4 Operations Manager or Department Manager/Supervisor

1. Oversees the day-to-day production and quality activities of the laboratory.
2. Ensures that quality assurance and quality control criteria of analytical methods and projects are satisfied.
3. Assesses data quality and takes corrective action when necessary.
4. Approves and releases technical and data management reports.
5. Ensures compliance with all applicable state, federal and industry standards.

1.8.5 Group Supervisor/Leader

1. Trains analysts in laboratory operations and analytical procedures.
2. Organizes and schedules analyses with consideration for sample holding times.
3. Implements data verification procedures by assigning data verification duties to appropriate personnel.
4. Evaluates instrument performance and supervises instrument calibration and preventive maintenance programs.
5. Reports non-compliance situations to laboratory management including the Quality Manager.

1.8.6 Analyst

1. Analyzes samples according to published methods and laboratory procedures.
2. Monitors quality control data. This includes examination of raw data such as chromatograms as well as an inspection of reduced data, calibration curves, and laboratory notebooks.

1.8.7 Sample Management Personnel

1. Signs for incoming samples and verifies the data entered on the Chain-of-Custody forms.
2. Enters the sample information into the Laboratory Information Management System (LIMS) for tracking and reporting.
3. Stages samples according to EPA requirements.
4. Assists Project Managers in filling bottle orders and sample shipments.

1.8.8. Systems Administrator or Systems Manager

1. Assists with the creation and maintenance of electronic data deliverables (EDDs)
2. Coordinates the installation and use of all hardware, software and operating systems
3. Performs troubleshooting on all aforementioned systems
4. Trains new and existing users on systems and system upgrades
5. Maintains all system security passwords
6. Maintains the electronic backups of all computer systems

1.8.9. Safety/Chemical Hygiene Officer

1. Maintains the laboratory Chemical Hygiene Plan
2. Plans and implements safety policies and procedures
3. Maintains safety records

4. Organizes and/or performs safety training
5. Performs safety inspections and provides corrective/preventative actions
6. Assists personnel with safety issues (e.g. personal protective equipment)

1.9 Training and Orientation

Additional information can be found in SOP ALL-Q-020 ***Training Procedures***.

Each new employee receives a five part orientation: human resources, data integrity ethics, safety, Quality Systems, and departmental.

The human resources orientation includes benefits, salary, and company policies. All records are stored with Human Resources.

The data integrity system of each lab contains four elements:

- Data integrity training
- Signed data integrity documentation for all employees
- In-depth, periodic monitoring of data integrity –including but not limited to:
  - logbook checks
  - raw data review
  - final report review
  - manual integration checks
- Documentation of review and investigations regarding data integrity issues.

The safety orientation includes an in-depth review of the Pace Analytical Chemical Hygiene Plan/Safety Plan, which are consistent with the requirements of OSHA's Hazard Communication Program (29 CFR 1910.1200) and other pertinent regulations.

The Quality Systems orientation provides the new employee with information through an introduction to the Quality Manual and SOPs, acceptable record keeping practices, and the individual's responsibility to data quality.

The new employee's Department Supervisor provides the employee with a basic understanding of the role of the laboratory within the structure of Pace Analytical and the basic elements of that individual's position.

Supervised training uses the following techniques:

- Hands-on training
- Lectures and training sessions
- Method-specific training
- Conferences and seminars
- Short courses
- Specialized training by instrument manufacturers
- Proficiency testing programs.

Group Supervisors/Leaders are responsible for providing documentation of training and proficiency for each employee under their supervision. The employee's training file indicates what procedures an analyst or a technician is capable of performing, either independently or with supervision. The files also include documentation of continuing capability (see Section 3.4 for details on Demonstration of Capability requirements). Training documentation files for each person are kept in a central location in each laboratory. The Quality Manager is responsible for maintaining the training files.

All procedures and training records are maintained and available for review during laboratory audits. These procedures are reviewed/updated annually by lab management.

1.10 Laboratory Safety

It is the policy of Pace Analytical to make safety and health an integral part of daily operations and to ensure that all employees are provided with safe working conditions, personal protective equipment, and requisite training to do their work without injury. Each employee is responsible for his/her own safety by complying with established company rules and procedures.

Sample receiving areas and laboratories are equipped with suitable hoods, protective clothing and eye wear, gloves, barrier creams and any other appropriate measures to prevent or minimize staff contact with hazardous substances. Other appropriate safety equipment such as eyewash stations, drench showers, spill absorbents and neutralizers, fire extinguishers, and first aid materials are available.

Each laboratory has a designated Safety/Chemical Hygiene Officer and Safety Committee that meets regularly and discusses agenda topics and addresses action items. The Safety/Chemical Hygiene Officer facilitates the preparation and maintains the Chemical Hygiene Plan/Safety Manual, provides safety and occupational health orientation to new employees, conducts safety training and review sessions as required, and maintains up-to-date familiarity with safety and occupational health issues pertinent to the laboratory.

1.11 Security and Confidentiality

Security is maintained by controlled access to laboratory buildings. Exterior doors to laboratory buildings remain either locked or continuously monitored by Pace Analytical staff. Keyless door-lock combinations (and computer access codes/logins) are changed on a regular basis. Posted signs direct visitors to the reception office and mark all other areas as off limits to unauthorized personnel. All visitors to the facilities must sign the Visitor's Logbook maintained by the receptionist and/or a staff member will accompany them during the duration of their stay on the premises. In this instance, the staff member will escort the visitor back to the reception area at the end of his/her visit where he/she signs out. Prior to departure of the last staff member at the close of each day, the facility is checked for security.

Additional security is provided where necessary, e.g., specific secure areas for sample, data and client report storage, as requested by clients or in cases of national security. These areas are lockable within the facilities, or are in secure offsite storage. Access is limited to specific individuals or their designees. Security of sample storage areas is the responsibility of the Sample Custodian. Security of samples and data during analysis and data reduction is the responsibility of Group Supervisors. Security of client report archives is the responsibility of the Client Services Manager. These secure areas are locked whenever these individuals or their designees are not present in the facility.

Access to designated laboratory sample storage locations is limited to authorized personnel only. Provisions for lock and key access are provided. No samples are to be removed without proper authorization. If requested by client or contract, samples are not to be removed from secure storage areas without filling out the associated internal Chain-of-Custody records.

Standard business practices of confidentiality are applied to all documents and information regarding client analyses. Specific protocols for handling confidential documents are described in Pace Analytical SOPs. Additional protocols for internal identification of samples and data by number only are implemented as required under contract-specific Quality Assurance Project Plans (QAPPs).

All information pertaining to a particular client, including national security concerns will remain confidential. Data will not be released to outside agencies without written authorization from the client.

Figure 1.1

Corporate/Management Structure

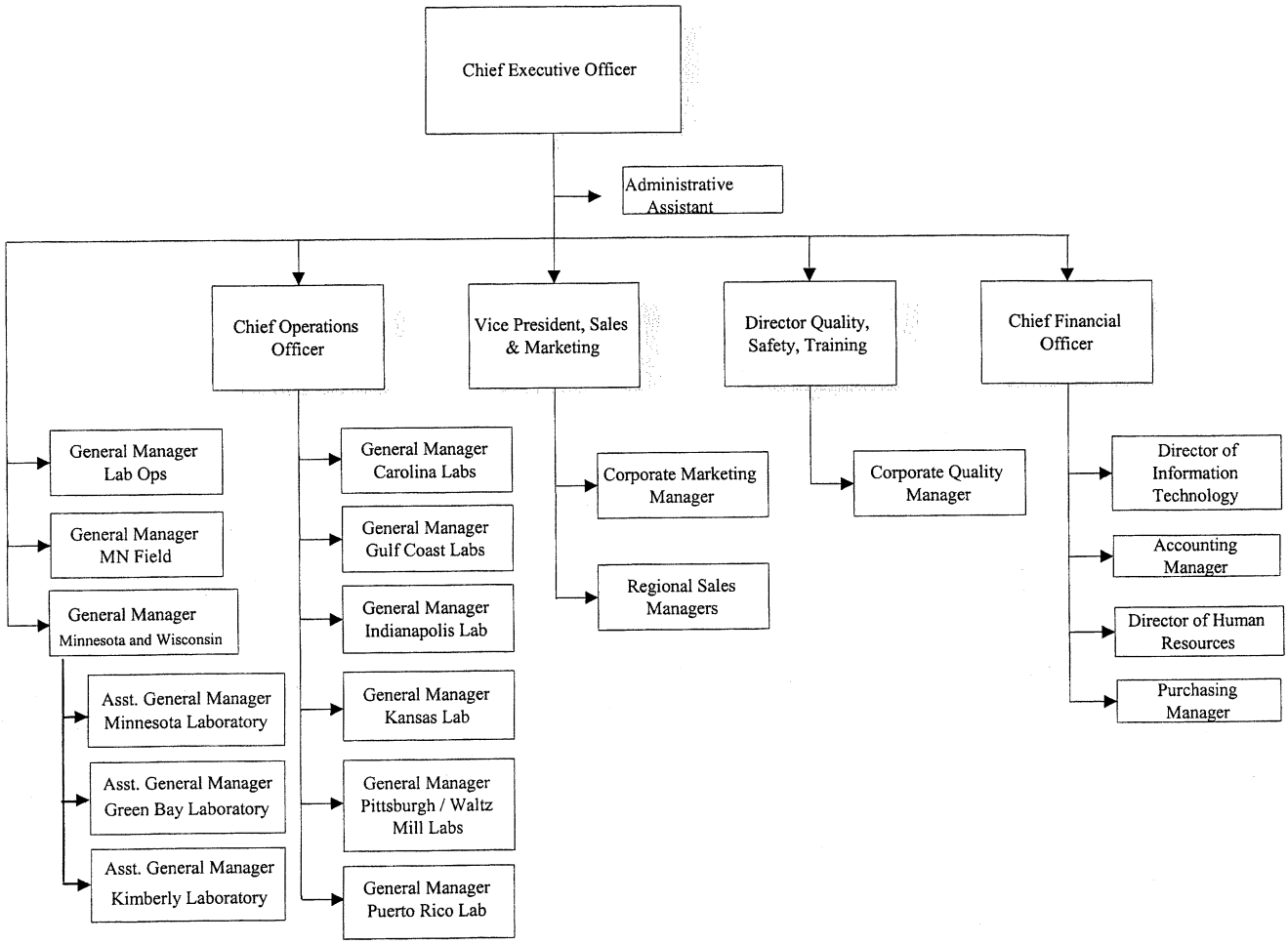
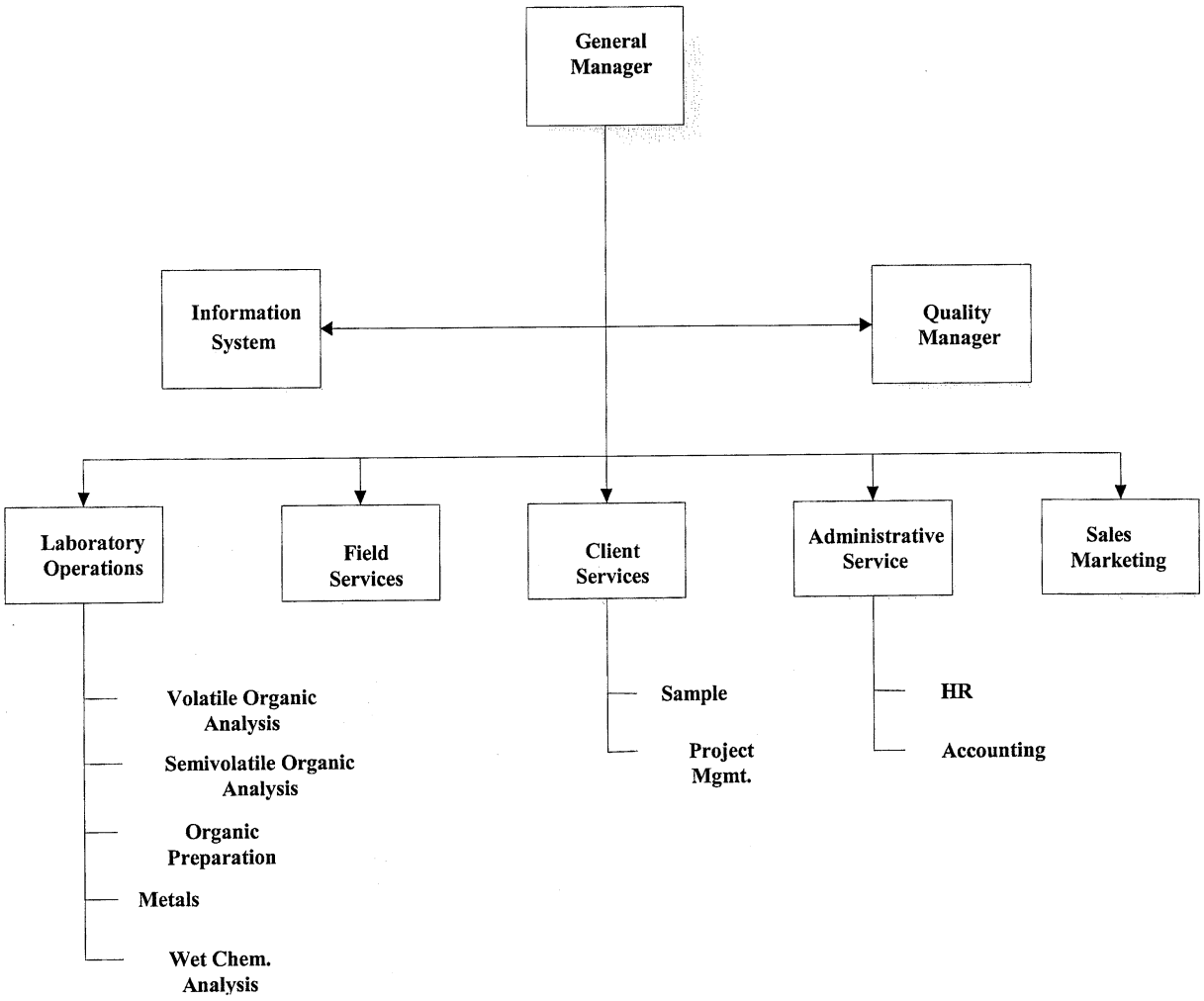


Figure 1.2

Typical Laboratory Organizational Chart



2.0 SAMPLE CUSTODY

Additional information can be found in SOP ALL-C-001 ***Sample Management.***

2.1 Sampling Support

Each individual Pace Analytical laboratory provides shipping containers, sample containers (including applicable chemical preservatives), custody documents, and field quality control samples (e.g., trip blanks) to support field-sampling events. Tables 2.1, 2.2, 2.3 and 2.4 list general guidelines for sample container types, preservatives and holding times for a variety of methods. Note that all analyses listed are not necessarily performed at all Pace Analytical locations and there may be additional laboratory analyses performed that are not included in these tables. Pace laboratories may provide pick-up and delivery services to their clients when needed.

2.2 Project Initiation

Prior to accepting new work, the lab reviews its capability to perform this work. The purpose of this review is to establish that the lab has sufficient resources (personnel, equipment capacity, analytical method capability, etc.) to complete the required work. Once client needs and data quality objectives are defined, client services personnel or sales representatives contact the laboratory management. Members of the management staff review current instrument capacity, personnel availability and training, analytical procedures capability, laboratory certifications and projected sample load. Management will then inform the sales and client services personnel whether the lab can accept the new projects. This communication is preferably via written correspondence or email, although it may occur during daily operations meetings.

The laboratory maintains records of all such reviews, including discussions with clients. The lab also maintains records of sub-contracted work and keeps a file of all sub-contractor information including current certifications.

2.3 Sample Acceptance Policy

In accordance with regulatory guidelines, Pace Analytical Services has compiled the following sample acceptance policy for all samples received at our laboratories.

If the samples do not meet the sample receipt acceptance criteria outlined below, the laboratory shall document all non-compliances and contact the client and either reject the samples or fully document any decision to proceed with the analyses of samples which do not meet these criteria. Any results reported from samples not meeting these criteria will be appropriately qualified on the final report.

All samples must:

- Have unique client identification that are clearly marked with durable waterproof labels on the sample containers and that match the chain of custody.
- Have clear documentation on the chain of custody related to the location of the sampling site with the time and date of sample collection.
- Have the sampler's name and signature
- Have the requested analyses clearly marked
- Have clear documentation of any special analysis requirements (data deliverables, etc.);
- Be in appropriate sample containers with clear documentation of the preservatives used.
- Be correctly preserved unless method allows for laboratory preservation.

- Be received within holding time. Any samples with hold times that are exceeded will not be processed without prior client permission.
- Have sufficient sample volume to proceed with the analytical testing. If insufficient sample volume is received, analysis will not proceed without client approval.
- Be received within appropriate temperature ranges, (for samples requiring cooling to 4 °C, the acceptable range is just above freezing to 6°C, as defined by NELAC). The cooler temperature is recorded directly on the COC. Samples that are delivered to the lab immediately after collection are considered acceptable if there is evidence that the chilling process has been started, for example by the arrival of the samples on ice. If samples arrive that are not compliant with these temperature requirements, the client will be notified. The analysis will NOT proceed unless otherwise directed by the client. If less than 72 hours remain in the hold time for the analysis, the analysis may be started while the client is contacted to avoid missing the hold time. Data will be appropriately qualified on the final report.

Samples for drinking water analysis will be rejected at the time of receipt if improperly preserved, or if received past holding time, with the exception of VOA samples that are tested at the time of analysis.

2.4 Chain-Of-Custody

A chain-of-custody (COC) (see figure 2.1) document provides the legal documentation of samples from time of collection to completion of analysis. It is important that these documents be as complete as possible. Pace Analytical has implemented standard operating procedures to ensure that sample custody objectives of traceability and responsibility are achieved for every project.

Field personnel or client representatives complete a chain-of-custody form for all samples. Samples are received by the laboratory accompanied by these forms.

If sample shipments are not accompanied by the correct documentation, the Sample Receiving department will notify the Project Manager. The Project Manager is then responsible for obtaining the correct documentation/information from the client so that analysis of samples can proceed.

The sampler is responsible for providing the following information on the chain-of-custody:

- Client project name
- Project location or number
- Field sample number/identification
- Date and time sampled
- Sample type (matrix)
- Preservative
- Requested analyses
- Sampler signature
- Relinquishing signature
- Date and time relinquished
- Sampler remarks (if applicable)
- Custody Seal Number (if applicable)
- Regulatory Program Designation
- The state where the samples were collected to ensure all applicable state requirements are met
- Turnaround time requested
- Purchase order number

The record is filled out completely and legibly with indelible ink. Errors are corrected by drawing a single line through the initial entry and initialing and dating the change. All transfers of samples must be recorded on the chain-of-custody in the "relinquished" and "received by" sections. All information except signatures should be printed.

2.5 Sample Receipt

Sample receiving personnel inspect each sample shipment upon arrival. The following items are checked:

- Presence of custody seals or tapes on the shipping containers
- Presence of Chain-of-Custody or similar documentation
- Presence of sample tags or labels
- Agreement between the sample tags or labels, Chain-of-Custody, and any client documentation.
- Condition of the samples when received, including:
  - Sample temperature: samples are acceptable if the arrival temperature is within 2°C of the required temperature, except as specified in the applicable test method or other state or federal regulation. Samples that are hand-delivered directly from the field on the same day that they are collected are acceptable if there is evidence that the chilling process has begun (arrival on ice).
  - Sample condition: Intact, broken/leaking
  - Headspace in VOA vials
  - Sample holding time
  - Sample pH when required
  - Adequate sample volume
  - Appropriate containers/preservatives

If discrepancies are found, the Pace Analytical Project Manager is contacted immediately. If the Project Manager is not available, the Quality Manager is contacted for further directions. Discrepancies are documented and reported with analytical results.

2.6 Sample Log-in

After the sample inspection, all sample information on the chain-of-custody is entered into the Laboratory Information Management System (LIMS).

Sample data must include, at a minimum:

- Client name and contact
- Client number
- Pace Analytical project number
- Pace Analytical Project Manager
- Sample descriptions
- Due dates
- List of analyses requested

All samples received are logged into the LIMS system within one working day of receipt. Sample login may be delayed due to client clarification of analysis needed, corrective actions for sample receipt non-conformance, or other unusual circumstances.

All sample containers are assigned a unique laboratory identification code that is unequivocally linked to the field identification code. This code is placed on the sample container as a durable label.

Sample labels are printed from the LIMS system and affixed to each sample container.

Samples with hold times that are near their expiration date/time may be sent directly to the laboratory for analysis at the discretion of the Project Manager and/or General Manager.

2.7 Sample Storage

2.7.1 Storage Conditions

Samples are stored away from all standards, reagents, food or other potential sources of contamination. Samples are stored in a manner that prevents cross-contamination (e.g. volatile samples are stored separate from other samples). All sample fractions, extracts, leachates and other sample preparation products are stored in the same manner as actual samples or as specified by the analytical method

2.7.2 Temperature Monitoring

Samples are taken to the appropriate storage location (ambient, refrigerator, freezer) immediately after the sample receipt and check-in procedures are completed . All sample storage areas are located in limited access areas and are monitored to ensure sample integrity.

The temperature of each refrigerated storage area is maintained at $4^{\circ}C \pm 2^{\circ}C$ unless state or program requirements differ. The temperature of each freezer storage area is maintained at $<0^{\circ}C$ unless state or program requirements differ. The temperature of each storage area is monitored and recorded each workday. If the temperature falls outside the acceptable limits, the following corrective actions are taken and appropriately documented:

- The temperature is rechecked after two hours to verify temperature exceedance. Initiate corrective action if necessary.
- The Quality Manager and/or laboratory management are notified if the problem persists.
- The samples are relocated to a proper environment if the temperature cannot be maintained after corrective actions are implemented.
- The affected clients are notified.
- Documentation is provided on analytical report.

2.7.3 Hazardous Materials

Pure product or potentially heavily contaminated samples are tagged as "hazardous" or "lab pack" and are stored separately from other samples.

2.7.4 Foreign Soils

Depending on the soil disposal practices of the laboratory, foreign soils and soils from USDA regulated areas are segregated. The USDA requires these samples to be incinerated or sterilized by an approved treatment procedure.

2.8 Sample Protection

Pace laboratory facilities are operated under controlled access to ensure sample and data integrity. Visitors must register at the front desk and be properly escorted.

Samples are removed from their storage areas by designated personnel and returned to the storage areas, if necessary, immediately after the required sample quantity has been taken.

Upon client request, additional and more rigorous chain-of-custody protocols for samples and data can be implemented. For example, some projects may require complete documentation of sample custody within the secure laboratory.

2.9 Subcontracting Analytical Services

Additional information can be found in SOP ALL-Q-017 ***Subcontracting Samples***.

Every effort is made to perform chemical analyses for Pace Analytical clients within the laboratory that receives the samples. When subcontracting to a laboratory other than the receiving laboratory (inside or outside the Pace network) becomes necessary, a preliminary verbal communication with an appropriate laboratory is undertaken. Clients are notified in writing of the lab's intention to subcontract any portion of the testing to another laboratory. Work performed under specific protocols may involve special considerations.

Prior to subcontracting samples to a laboratory outside Pace Analytical, the potential sub-contract laboratory will be pre-qualified by verifying that the subcontractor meets the following criteria:

- All certifications required for the proposed subcontract are in effect,
- Sufficient professional liability and other required insurance coverage is in effect, and
- Is not under investigation by any federal, state, or local government agency for data integrity issues and has not been under such investigation at any time during the past 5 years.

The contact and preliminary arrangements are made between the Pace Analytical Project Manager and the appropriate subcontract laboratory personnel. The specific terms of the subcontract laboratory agreement include :

- Method of analysis
- Number and type of samples expected
- Project specific QA/QC requirements
- Deliverables required
- Laboratory certification requirement
- Price per analysis
- Turn around time requirements

Chain-of-custody forms are generated for samples requiring subcontracting to other laboratories. The sample receiving personnel re-package the samples for shipment, create a transfer chain-of-custody form and record the following information:

- Pace Analytical Laboratory Number
- Matrix
- Requested analysis
- Special instructions (quick turn-around, required detection or reporting limits, unusual information known about the samples or analytical procedure).
- Signature in "Relinquished By"

All subcontracted sample data reports are sent to the Pace Analytical Project Manager.

Any Pace Analytical work sent to other labs within the Pace network is handled as subcontracted work (also known as inter-regional) and all final reports are labeled clearly with the name of the laboratory performing the work.

2.10 Sample Retention and Disposal

Additional information can be found in SOP ALL-S-002 ***Waste Handling***.

Samples (and sample by-products) must be retained by the laboratory for a period of time necessary to protect the integrity of the sample or sample by-product (e.g. method holding time) and to protect the interests of the laboratory and the client.

Unused portions of samples are retained by each laboratory based on program or client requirements for sample retention and storage. The typical sample retention time is a minimum of 30 days past the submission of the report. Any Pace laboratory not following this retention/disposal time must have a specific policy for retention and disposal of samples in their Quality Manual addendum.

After this period expires, non-hazardous samples are properly disposed of as non-hazardous waste.

The preferred method for disposition of hazardous samples is to return the excess sample to the client. It may not be feasible to return samples, or the client may require Pace Analytical to dispose of excess samples. In that case, Pace Analytical will arrange for proper disposal by an approved contractor.

Table 2.1 Inorganic Parameters in Aqueous Samples

Parameter	Method			Container	Volume Needed (mL)	Preservative	Max Hold Time
	EPA Water	Standard Methods	EPA Waste SW-846				
Acidity	305.1	2310B		P, G	100	4°C	14 Days
Alkalinity	310.1/310.2	2320B		P, G	250	4°C	14 Days
Anions by IC, including Br, Cl, F, NO_2, NO_3, PO_4, SO_4, SO_3	300.0		9056	P, G	100	4°C	By anion
Bacteria, Total Plate Count		9221D		WK/P	100	4°C, $Na_2S_2O_3$	24 Hours
BOD/cBOD	405.1	5210B		P, G	500	4°C	48 hours
COD	410.1/410.2/ 410.4	5220C		P, G	250	pH<2 H_2SO_4, 4°C	28 Days
Chloride	325.2/325.3	4500-Cl	9250/9251/9252	P, G	100	none required	28 Days
Chorine, Residual	330.1/330.5/ 330.2	4500-Cl		P, G	500	none required	Immediate
Color	110.3/110.2	2120B,C,E		P, G	250	4°C	48 Hours
Cyanide, Reactive			Chapter 7	P, G	100	none required	28 Days
Cyanide, Total and Amenable	335.2/335.3/ 335.4	4500-CN	9010/9012	P, G	500	4°C; pH>12 NaOH, ascorbic acid if chlorine present	14 Days (24 hrs if sulfide present)
Flashpoint/Ignitability			1010/1030	P, G	50	none required	28 Days
Fluoride	340.1/340.2	4500-Fl C,D		P	500	none required	28 Days
Hardness, Total ($CaCO_3$)	130.2/130.1	2340B or C		P, G	250	pH<2 HNO_3, 4°C	6 Months
Nitrogen, Ammonia	350.1/350.2/ 350.3	4500-NH_3		P, G	500	pH<2 H_2SO_4, 4°C	28 Days
Nitrogen, Kjeldahl	351.2/351.3	4500-N_{org}		P, G	1000	pH<2 H_2SO_4, 4°C	28 Days
Nitrogen, Nitrate	352.1/353.2/ 353.3	4500-$N0_3$		P, G	100	4°C	48 Hours
Nitrogen, Nitrite	354.1	4500-$N0_2$		P, G	100	4°C	48 Hours
Nitrogen, Nitrate & Nitrite	353.2	4500-$N0_3$		P, G	100	pH<2 H_2SO_4, 4°C	28 Days
Nitrogen, Organic	351.3	4500-N_{org}		P, G	100	pH<2 H_2SO_4, 4°C	28 Days
Odor	140.1	2150B		G	1000	4°C	24 Hours
Oil and Grease/HEM	1664A	5520B,D	9070	G	1000	pH<2 H_2SO_4, 4°C	28 Days
Oxygen, Dissolved	360.1	4500-D		G	500	none required	Immediate
pH	150.1/150.2	4500-H	9040/9041	P, G	100	none required	Immediate
Phenol, Total	420.1/420.2		9065/9066	G	1000	pH<2 H_2SO_4, 4°C	28 Days
Phosphorus, Orthophosphate	365.1/365.2/ 365.3	4500-P		P	100	Filter, 4°C	48 Hours
Phosphorus, Total	365.1/365.2/ 365.4	4500-P		P, G	100	pH<2 H_2SO_4, 4°C	28 Days
Silica, Dissolved	370.1	4500-Si D		P	100	4°C	28 Days
Solids, Total	160.3	2540B		P, G	100	4°C	7 Days
Solids, Total Volatile	160.4	2540E		P, G	100	4°C	7 Days
Solids, Total Dissolved	160.1	2540C		P, G	100	4°C	7 Days
Solids, Total Suspended	160.2	2540D		P, G	100	4°C	7 Days
Solids, Settleable	160.5	2540F		G	1000	4°C	48 Hours
Specific Conductance	120.1	2510B	9050	P, G	100	4°C	28 Days
Sulfate	375.4/375.2	4500-$S0_4$	9036/9038	P, G	100	4°C	28 Days
Sulfide, Reactive			Chapter 7	P, G	100	none required	28 Days
Sulfide, Total	376.1, 376.2	4500-S	9030	P, G	500	pH>9 NaOH and ZnOAc	7 Days
Sulfite	377.1	4500-$S0_3$		P, G	500	none required	Immediate
Surfactants	425.1	5540C		P, G	250	4°C	48 Hours
Total Organic Carbon (TOC)	415.1/415.2	5310B,C,D	9060	G	100	pH<2 H_2SO_4 or HCl,4°C	28 Days
Total Organic Halogen (TOX)	450.1	5320	9020/9021	G, no headspace	500	4°C	14 Days
Turbidity	180.1	2130B		P, G	100	4°C	48 Hours
Metals (and other ICP elements)	200.7/200.8		6010/6020	P, G	500	pH<2 HNO_3	6 Months
Mercury	245.1		7470	P, G	250	pH<2 HNO_3	28 Days
Low Level Mercury	1631			G		BrCl, 4°C	90 days (if preserved and oxidized)
Hexavalent Chromium	218.4	3500-Cr	7196	P, G	500	4°C	24 Hours
Paint Filter Liquid Test.			9095	P, G	100	none required	N/A
Ferrous Iron		3500-Fe-D		G	100	none required	Immediate

Table 2.2 Organic Parameters in Aqueous Samples

Parameter	Method			Container	Volume Needed (mL)	Preservative	Max Hold Time
	EPA Drinking Water	EPA Water	EPA Waste SW-846				
Aromatic and Halogenated Volatiles		601/602	8021	40-mL vial	3 vials	pH<2 HCl, 4°C, $Na_2S_2O_3$ if Cl_2 present	14 Days
Volatiles	524.1/524.2			40-mL vial	3 vials	pH<2 HCl, 4°C, $Na_2S_2O_3$ if Cl_2 present	14 Days
Volatiles		624		40-mL vial	3 vials	pH<2 HCl, 4°C, $Na_2S_2O_3$ if Cl_2 present	14 Days (7 unpreserved)
Volatiles			8260	40-mL vial	3 vials	pH<2 HCl, 4°C, $Na_2S_2O_3$ if Cl_2 present	14 Days
Gas Range Organics			8015M	40-mL vial	3 vials	pH<2 HCl	14 Days
EDB & DBCP	504.1		8011	40-mL vial	3 vials	4°C, $Na_2S_2O_3$ if Cl_2 present	14 Days
Base/Neutrals and Acids		625	8270	G	1000	4°C, $Na_2S_2O_3$ if Cl_2 present	7/40 Days
Base/Neutrals, Acids & Pesticides	525.1/525.2			G	1000	4°C, $Na_2S_2O_3$ if Cl_2 present	7/30 Days
Organochlorine Pesticides and PCB's		608	8081/8082	G	1000	4°C, $Na_2S_2O_3$ if Cl_2 present	7/40 Days
Organophosphorous Pesticides			8141	G, amber	1000	4°C, $Na_2S_2O_3$ if Cl_2 present	7/40 Days
Polynuclear Aromatic Hydrocarbons		610	8310	G	1000	4°C, $Na_2S_2O_3$ if Cl_2 present	7/40 Days
Chlorinated Herbicides	515.1		8151	G, amber	1000	4°C, $Na_2S_2O_3$ if Cl_2 present	14/28 Days**
Haloacetic Acids	552.1/552.2			40-mL vial, amber	3 vials	NH_4Cl, 4°C	14/7 Days
Diesel Range Organics			8015M	G	1000	4°C	7/40 Days
Explosives			8330	G	1000	4°C	7/40 Days
2, 3, 7, 8-TCDD	1613B			G	1000	none required	90/40 Days
Methane, Ethane, & Ethene			3810M	20-mL vial	3 vials	pH<2 HCl, 4°C	14 Days

Table 2.3 Inorganic and Organic Parameters in Solid Samples

Parameter	EPA Method	Container	Weight Needed (g)	Preservative	Max Hold Time
Metals	6010 or 6020	G	100	4°C	6 months
Mercury	7471	G	100	4°C	28 days
Aromatic and Halogenated Volatiles	5035/8021	5035 vial kit	1 kit	See Note	14 days
Volatiles	5035/8260	5035 vial kit	1 kit	See Note	14 days
Gasoline Range Organics	5035/8015M	5035 vial kit	1 kit	See Note	14 days
Base/Neutrals and Acids	8270	G	100	4°C	14/40 Days
Organochlorine Pesticides and PCBs	8081/8082	G	100	4°C	14/40 Days
Organophosphorous Pesticides	8141	G	100	4°C	14/40 Days
Polynuclear Aromatic Hydrocarbons	8310	G	100	4°C	14/40 Days
Chlorinated Herbicides	8151	G, amber	100	4°C	14/40 Days
Diesel Range Organics	8015M	G	100	4°C	14/40 Days
Explosives	8330	G	100	4°C	14/40 Days
2, 3, 7, 8-TCDD	1613B	G	100	none required	90/40 Days

Note: 5035 vial kit contains

2 vials water, preserved by freezing **or**
2 vials aqueous $NaHSO_4$, preserved at 4°C **and**
1 vial methanol preserved at 4°C **and**
1 vial unpreserved stored at 4°C

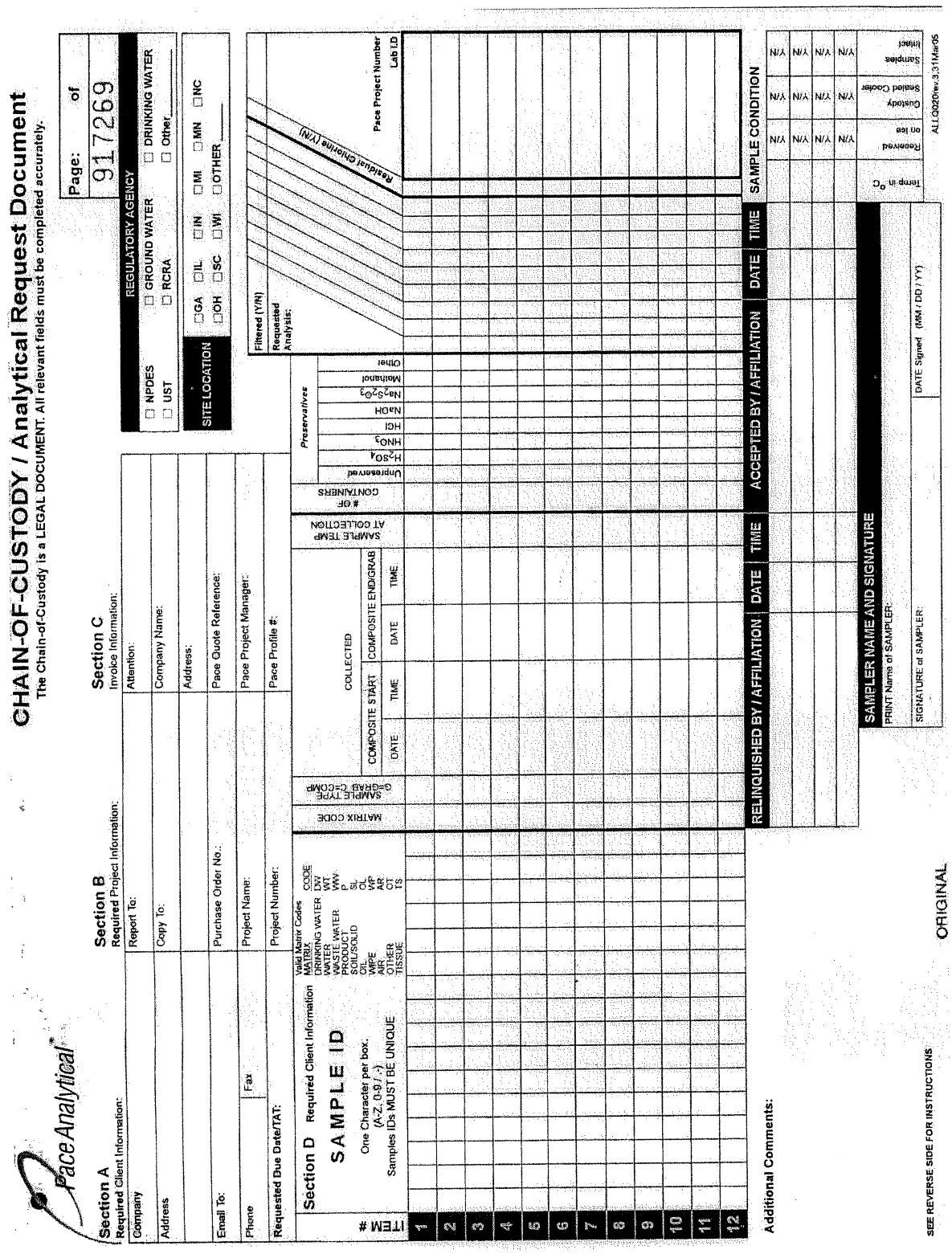
Table 2.3 Inorganic and Organic Parameters in Air Samples

Parameter	EPA Method	Container	Recommended Max Hold Time
Permanent Gases	3C	Summa Canister	14 Days
Permanent Gases	3C	Tedlar Bag	48 Hours
Methane, Ethane, Ethene	3C-M	Summa Canister	14 Days
Methane, Ethane, Ethene	3C-M	Tedlar Bag	48 Hours
Non-Methane Organics	25C	Summa Canister	14 Days
Non-Methane Organics	25C	Tedlar Bag	48 Hours
BTEX/Total Hydrocarbons	TO-3	Summa Canister	14 Days
BTEX/Total Hydrocarbons	TO-3	Tedlar Bag	48 Hours
Organochlorine Pesticides & PCBs	TO-4	PUF	7/40 Days
Dioxins & Furans	TO-9	PUF	30/45 Days
Polynuclear Aromatic Hydrocarbons	TO-13	PUF	7/40 Days
Volatiles	TO-14	Summa Canister	14 Days
Volatiles	TO-14	Tedlar Bag	48 Hours
Volatiles	TO-15	Summa Canister	14 Days
Ozone Precursors	TO-15	Summa Canister	14 Days
Particulates	PM10	Filters	6 Months
Metals	IO-3.5	Filters	6 Months
Stationary SourceParticulates	5	Filter/Solutions	6 Months
Lead Emissions	12	Filter/Solutions	6 Months
Stationary Source Dioxins & Furans	23	XAD Trap	30/45 Days
Stationary Source Metals	29	Filters	6 Months, 28 Days for Hg
Stationary Source Mercury	101	Filters	6 Months, 28 Days for Hg
Stationary Source PM10	201A	Filters	6 Months
Condensable Particulate Emissions	202	Solutions	6 Months
Hydrogen Halide & Halogen Emissions	26	Solutions	6 Months

Table 2.4 Rad Chem Parameters

Parameter	Method			Container	Volume Needed (mL)	Preservative	Max Hold Time
	EPA Water	Standard Methods	EPA SW-846				
Gross Alpha and Gross Beta	900.0		9310	P, G	1000	pH<2 HNO_3	180 days
Gross Alpha (NJ 48Hr Method)	NJAC 7:18-6			P, G	1000	pH<2 HNO_3	48 Hrs
Gamma Emitting Radionuclides	901.1			P, G	1000	pH<2 HNO_3	180 days
Alpha Emitting Radium Isotopes	903.0		9315	P, G	1000	pH<2 HNO_3	180 days
Radium-226 Radon Emanation Technique	903.1			P, G	1000	pH<2 HNO_3	180 days
Radium-228	904.0		9320	P, G	1000	pH<2 HNO_3	180 days
Radioactive Strontium	905.0			P, G	1000	pH<2 HNO_3	180 days
Tritium	906.0			G	1000	pH<2 HNO_3	180 days
Uranium Radiochemical Method	908.0	D5174-97		P, G	1000	pH<2 HNO_3	180 days

Figure 2.1 CHAIN-OF-CUSTODY FORM (Example)



3.0 ANALYTICAL CAPABILITIES

3.1 Analytical Method Sources

Pace Analytical laboratories are capable of analyzing a full range of environmental samples from a variety of matrices, including air, surface water, wastewater, groundwater, soil, sediment, biota, and other waste products. Methodologies are applied from regulatory and professional sources including EPA, ASTM, USGS, NIOSH and, State agencies. Section 11 is a representative listing of general analytical protocol references. In some situations, Pace Analytical develops and validates methodologies that may be more applicable to a specific problem or objective. Pace Analytical discloses in writing to its clients and regulatory agencies any instances in which modified methods are being used in the analysis of samples.

3.2 Analytical Method Documentation

The primary form of documentation of analytical methods is the Standard Operating Procedure (SOP). SOPs contain pertinent information as to what steps are required by an analyst to successfully perform a procedure. The required contents for the SOPs are specified in the company-wide SOP for Preparation of SOPs (ALL-Q-001). The SOPs are consistent company-wide documents with addenda as needed for individual laboratories.

The SOPs may be supplemented by Work Processing and Training Documents that further detail how methods are specifically performed with detailed training information.

3.3 Analytical Method Validation

When non-standard methods (e.g. methods other than EPA, NIOSH, ASTM, AOAC, etc.) are required for specific projects or analytes of interest, or when the laboratory develops a method, or modifies a standard method, the laboratory validates the method prior to applying it to client samples. Method validity is established by meeting criteria for precision and accuracy as established by the data quality objectives specified by the end user of the data. The laboratory records the validation procedure, the results obtained and a statement as to the usability of the method. The minimum requirements for method validation include determination of the limit of detection and limit of quantitation of each analyte of interest.

3.4 Demonstration of Capability (DOC)

Analysts complete an initial demonstration of capability (IDOC) study prior to starting a method or when there is a change in instrument type, personnel or test method (when a defined 'work cell' is in operation, the entire work cell must meet the criteria). The mean recovery and standard deviation of each analyte, taken from 4 replicates of a quality control standard (analyzed at 1-4 times the Limit of Quantitation), is calculated and compared to method criteria (if available) or established lab criteria for evaluation of acceptance. Each laboratory maintains copies of all demonstrations of capability, and corresponding raw data, for future reference and must document the acceptance criteria prior to the analysis of the DOC. Demonstrations of capability are renewed on an annual basis.

Additional information can be found in SOP ALL-Q-020 ***Training Procedures***.

3.5 Regulatory and Method Compliance

Pace Analytical understands that the expectations of our clients commonly include the assumption that laboratory data will satisfy specific regulatory requirements. Therefore Pace Analytical will attempt to ascertain, prior to beginning a project, what applicable regulatory jurisdiction, agency, or protocols apply to that project. This information is also required on the Chain-of-Custody submitted with samples.

Pace Analytical will make every effort to detect regulatory or project plan inconsistencies as they arise and communicate them to the clients to aid in the decision-making process.

It is Pace Analytical policy to disclose in a forthright manner any detected noncompliance that may affect the usability of data produced by our laboratories.

4.0 QUALITY CONTROL PROCEDURES

4.1 Data Integrity System

The data integrity system at Pace Analytical provides assurances to management that a highly ethical approach is being applied to all planning, training and implementation of methods. Data integrity is crucial to the success of our company and Pace is committed to providing a culture of quality throughout the organization. To accomplish this goal, Pace has implemented a data integrity system that encompasses the following four requirements:

- A data integrity training program: standardized training is given to each new employee and a yearly refresher is presented to all employees. Key topics within this training include:
  - Need for honesty in analytical reporting
  - Process for reporting data integrity issues
  - Specific examples of unethical behavior and improper practices
  - Documentation of non-conforming data that is still useful to the data user
  - Consequences and punishments for unethical behavior
  - Examples of monitoring devices used by management to review data and systems
- Signed data integrity documentation for all employees: this includes a written quiz following the Ethics training session and written agreement to abide by the Code of Ethics and Standards of Conduct explained in the employee manual
- In-depth, periodic monitoring of data integrity: including peer data review and validation, internal data audits, proficiency testing studies, etc.
- Documentation of any review or investigation into possible data integrity infractions. This documentation must be available for review for lab assessors.

Pace management makes every effort to ensure that personnel are free from any undue pressures that may affect their quality of work including commercial, financial, over-scheduling, and working condition pressures.

The management also provides a mechanism for confidential reporting of data integrity issues that includes confidentiality and a receptive environment in which all employees are comfortable discussing items of ethical concern.

4.2 Method Blank

A method blank is used to evaluate contamination in the preparation/analysis system. The method blank is processed through all preparation and analytical steps with its associated samples. Any affected sample associated with a contaminated method blank will be re-analyzed if possible or reported with an appropriate data qualifier.

A method blank is processed at a minimum frequency of 1 per preparation batch. In the case of a method that has no separate preparation step (e.g. volatiles), a method blank is processed with no more than 20 samples of a specific matrix performed by the same analyst, in the same method, using the same standards or reagents.

The method blank consists of a matrix similar to the associated samples that is known to be free of the analytes of interest.

Each method blank is evaluated for contamination. The source of any contamination is investigated and documented corrective action is taken when the concentration of any target analyte is detected above the reporting limit and is greater then 1/10 of the amount of that analyte found in any associated sample. Corrective actions may include re-analyzing the samples with a clean blank or reporting the data with the appropriate data qualifiers.

4.3 Laboratory Control Sample/Laboratory Control Sample Duplicate (LCS/LCSD)

The Laboratory Control Sample (LCS) is used to evaluate the performance of the entire analytical system including preparation and analysis. The LCS results are compared to established acceptance criteria and if the results are outside of the criteria, then the system is out-of-control. Any affected sample associated with a failing LCS will be re-analyzed if possible or reported with an appropriate data qualifier.

An LCS is processed at a minimum frequency of 1 per preparation batch. In the case of a method that has no separate preparation step (e.g. volatiles), an LCS will be processed with no more than 20 samples of a specific matrix performed by the same analyst, in the same method, using the same standards or reagents.

The LCS consists of a matrix similar to the associated samples that is known to be free of the analytes of interest that is then spiked with known concentrations of target analytes.

The LCS contains all analytes specified by a specific method or by the client or regulatory agency. In the absence of specified components, the lab will spike with the following compounds:

- For multi-peak analytes (e.g. PCBs), a representative standard will be processed.
- For methods with long lists of analytes, a representative number of target analytes may be chosen. The following criteria is used to determine the number of LCS compounds used:
  - For methods with 1-10 target compounds, the lab will spike with all compounds
  - For methods with 11-20 target compounds, the lab will spike with at least 10 compounds or 80%, whichever is greater
  - For methods with greater than 20 compounds, the lab will spike with at least 16 compounds.

The LCS is evaluated against the method or laboratory-derived acceptance criteria. Any compound that is outside of these limits is considered to be 'out of control' and must be qualified appropriately. Any associated sample containing an 'out-of-control' compound must either be re-analyzed with a successful LCS or reported with the appropriate data qualifier.

For LCSs containing a large number of analytes, it is statistically likely that a few recoveries will be outside of control limits. This does not necessarily mean that the system is out of control, and therefore no corrective action would be necessary (except for proper documentation). NELAC has allowed for a minimum number of marginal exceedances, defined as a recoveries that are beyond the LCS control limits (3X the standard deviation) but less than the marginal exceedance limits (4X the standard deviation. The number of allowable exceedances depends on the number of compounds in the LCS. If more analyte recoveries exceed the LCS control limits than is allowed (see below) of if any one analyte exceeds the marginal exceedance limits, then the LCS is considered non-compliant and corrective actions are necessary. The number of allowable exceedances is as follows:

- >90 analytes in the LCS- 5 analytes
- 71-90 analytes in the LCS- 4 analytes
- 51-70 analytes in the LCS- 3 analytes
- 31-50 analytes in the LCS- 2 analytes
- 11-30 analytes in the LCS- 1 analyte
- <11 analytes in the LCS- no analytes allowed out)

A matrix spike can be used in place of a non-compliant LCS in a batch as long as the MS passes the LCS acceptance criteria (this is a NELAC allowance). When this happens, full documentation must be made available to the data user.

4.4 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

A matrix spike (MS) is used to determine the effect of the sample matrix on compound recovery for a particular method. The information from these spikes is sample or matrix specific and is not used to determine the acceptance of an entire batch (see LCS).

A **Matrix Spike/Matrix Spike Duplicate** (MS/MSD) set is processed at a frequency specified in a particular method or as determined by a specific client. In the absence of such requirements, an MS/MSD set is routinely analyzed once per every 20 client samples per matrix per method.

The MS and MSD consist of the sample matrix that is then spiked with known concentrations of target analytes. Lab personnel spike client samples that are specifically designated as MS/MSD samples or, when no designated samples are present in a batch, randomly select samples to spike that have adequate sample volume or weight. Spiked samples should be prepared and analyzed in the same manner as the original samples and should be selected from different clients if possible.

The MS and MSD contain all analytes specified by a specific method or by the client or regulatory agency. In the absence of specified components, the lab will spike with the same number of compounds as previously discussed in the LCS section.

The MS/MSD are evaluated against the method or laboratory-derived criteria. Any compound that is outside of these limits is considered to be 'out of control' and must be qualified appropriately. Batch acceptance, however, is based on method blank and LCS performance, not on MS/MSD recoveries. The spike recoveries give the data user a better understanding of the final results based on their site-specific information.

A matrix spike and sample duplicate may be performed instead of a matrix spike and matrix spike duplicate when specified by the client or method.

4.5 Surrogates

Surrogates are compounds that reflect the chemistry of target analytes and are typically added to samples for organic analyses to monitor the effect of the sample matrix on compound recovery.

Surrogates are added to each client sample (for organics), method blank, LCS and MS prior to extraction or analysis. The surrogates are evaluated against the method or laboratory-derived acceptance criteria. Any surrogate compound that is outside of these limits is considered to be 'out of control' and must be qualified appropriately. Samples with surrogate failures are typically re-extracted and/or re-analyzed to confirm that the out-of-control value was caused by the matrix of the sample and not by some other systematic error. An exception to this would be samples that have high surrogate values but no reportable hits for target compounds. These samples would be reported, with a qualifier, because the implied high bias would not affect the final results.

4.6 Sample Duplicate

A sample duplicate is a second portion of sample that is prepared and analyzed in the laboratory along with the first portion. It measures the precision associated with preparation and analysis. A sample duplicate is processed at a frequency specified by the particular method or as determined by a specific client.

The sample and duplicate are evaluated against the method or laboratory-derived criteria for relative percent difference (RPD). Any duplicate that is outside of these limits is considered to be 'out of control' and must be qualified appropriately.

4.7 Internal Standards

Internal Standards are analytes added to every standard, method blank, laboratory control sample, matrix spike, matrix spike duplicate, and sample at a known concentration, prior to analysis for the purpose of adjusting the response factor used in quantifying target analytes.

4.8 Field Blanks

Field blanks are blanks prepared at the sampling site in order to monitor for contamination that may be present in the environment where samples are collected. These field quality control samples may be referenced as field blanks, rinseate blanks, or equipment blanks. The lab analyzes these field blanks as normal samples and informs the client if there are any target compounds detected above the reporting limits.

4.9 Trip Blanks

Trip blanks are blanks that are prepared in the laboratory before the sampling event and are used to monitor for contamination of samples during transport. These blanks accompany the empty sample containers to the field and then accompany the collected samples back to the lab. These blanks are routinely analyzed for volatile sample methods.

4.10 Limit of Detection (LOD)

Additional information can be found in SOP ALL-Q-004 ***Method Detection Limit Studies***.

Pace laboratories are required to use a documented procedure to determine a limit of detection (LOD) for each analyte of concern in each matrix reported. All sample-processing steps of the preparation and analytical methods are included in this determination. For any test that does not have a valid LOD, sample results below the lowest calibration standard cannot be reported.

The LOD is initially established for the compounds of interest for each method in a clean matrix with no target analytes present and no interferences at a concentration that would impact the results. The LOD is then determined every time there is a change in the test method that affects how the test is performed or when there has been a change in the instrument that affects the sensitivity. The LOD is verified on an annual basis.

Unless otherwise noted, the method used by Pace laboratories to determine LODs is based on the Method Detection Limit (MDL) procedure outlined in 40 CFR Part 136, Appendix B. Where required by regulatory program or client, the above referenced procedure will be followed.

4.11 Limit of Quantitation (LOQ)

Additional information can be found in SOP ALL-Q-004 ***Method Detection Limit Studies***.

A limit of quantitation (LOQ) for every analyte of concern must be determined. For Pace laboratories, this LOQ is referred to as the PRL, or Pace Reporting Limit. This PRL is based on the lowest calibration standard concentration that is used in each initial calibration. Results below this level are not allowed to be reported without qualification since the results would not be substantiated by a calibration standard. For methods with a determined LOD, results can be reported out below the LOQ but above the LOD if they are properly qualified (e.g. J flag).

There must be a sufficient buffer between the LOD and the limit of quantitation (LOQ). The PRL must be higher than the LOD.

4.12 Proficiency Testing (PT) Studies

Pace Analytical laboratories participate in the NELAC-defined proficiency testing program. PT samples are obtained from NIST-approved providers and analyzed and reported at a minimum of two times per year for the relevant fields of testing per matrix.

The lab initiates an investigation whenever PT results are deemed 'unacceptable' by the PT provider. All findings and corrective actions taken are reported to the Quality Manager. A corrective action plan (including re-analysis of similar samples) is initiated and this report is sent to the appropriate state accreditation agencies for their review.

PT samples are treated as typical client samples, utilizing the same staff, methods, equipment, facilities, and frequency of analysis. PT samples are included in the laboratory's normal analytical processes and do not receive extraordinary attention due to their nature.

Comparison of analytical results with anyone participating in the same PT study is prohibited prior to the close of the study.

Additional information can be found in SOP ALL-Q-010 ***PE/PT Program***.

5.0 DOCUMENT MANAGEMENT AND CHANGE CONTROL

5.1. Document Management

Additional information can be found in SOP ALL-Q-002 ***Document Management.***

Pace Analytical Services has established a procedure for managing documents that are part of the quality system. The list of managed documents includes, but is not limited to, Standard Operating Procedures, Quality Manuals, quality policy statements, training documents, work-processing documents, charts, posters, memoranda, notices, forms, software, and any other procedures, tables, plans, etc. that have a direct bearing on the quality system.

A master list of all documents is maintained at each facility identifying the current revision status and distribution of the documents. This establishes that there are no invalid or obsolete documents in use in the lab. All documents are reviewed periodically and revised if necessary and obsolete documents are systematically discarded or archived for legal or knowledge preservation purposes.

Each document related to the quality system is uniquely identified to include the date of issue, the revision identification, page numbering, the total number of pages and the issuing authorities. For complete information on document numbering, refer to the company-wide Standard Operating Procedure Document Numbering (ALL-Q-003).

As an alternative to the hard copy system of control, secured electronic copies of controlled documents may be maintained on the local or wide-area network (LAN or WAN). These document files must be read-only for all personnel except the Quality Department and system administrator. Other requirements for this system include:

- Ready accessibility to all laboratory staff
- A complete description of the computerized aspects, including security
- A provision to explicitly indicate that all printed copies are uncontrolled and expire on the date printed.

5.1.1 Quality Manual

The Quality Manual is the company-wide document that describes all aspects of the quality system for Pace Analytical laboratories. It is document-controlled by the corporate quality office and signed copies are distributed to each of the regional Quality Managers. The regional management personnel sign the Quality Manual and the local Quality Manager is then in charge of distribution to employees and external clients or regulatory agencies and maintaining a controlled list of distributed copies. Each laboratory may attach a lab-specific addendum to the Quality Manual as needed. The Quality Manual is reviewed on an annual basis by all of the Pace Quality Managers and revised accordingly.

5.1.2 Standard Operating Procedures (SOPs)

SOPs fall into two categories: company-wide documents (starting with the prefix ALL-) or individual lab documents (starting with the individual lab abbreviation). Company-wide SOPs (ALL SOPs) are document-controlled by the corporate quality office and signed copies are distributed to each of the laboratory Quality Managers. Laboratory management personnel sign the company-wide (ALL) SOPs and the local Quality Manager distributes to employees and external clients or regulatory agencies and maintains a controlled list of distributed copies. Each laboratory may attach a lab-specific addendum to any of the company-wide (ALL) SOPs as

needed. Individual lab specific SOPs are controlled by the local Quality Manager in the same manner.

SOPs are reviewed every two years at a minimum (a more frequent review may be required by state or federal agencies or clients). Documentation of this review and any applicable revisions are made in the last section of each SOP. This provides a historical record of all revisions.

All copies of superseded SOPs are removed from general use and at least one copy of each SOP is archived for audit or knowledge preservation purposes. This not only ensures that all Pace employees use the most current version of each SOP but also supplies the Quality Manager with a historical record of each SOP.

Additional information can be found in SOP ALL-Q-001 ***Preparation of SOPs***.

5.1.3 Training documents

The training documents are more detailed documents that describe lab-specific details such as computer and equipment set-up, sample preparation and analysis steps, data validation steps, documentation requirements, and data packet preparation. Documentation that an analyst has completed their training via these training documents is maintained in their training file.

5.2 Document Change Control

Changes to documents are reviewed and approved in the same manner as the original document control. Any revision to a document requires the approval of the applicable signatories. After revisions are approved, a revision number is assigned and the previous version of the document is officially retired. Copies may be kept for audit or knowledge preservation purposes.

All controlled copies of the previous document are replaced with controlled copies of the revised document and the old copies are destroyed or archived. All affected personnel are advised that there has been a revision and any necessary training can be scheduled.

6.0 EQUIPMENT AND MEASUREMENT TRACEABILITY

Additional information can be found in SOP ALL-Q-013 ***Support Equipment***.

Each Pace lab is equipped with instrumentation and support equipment to perform the required analyses. Support equipment includes chemical standards, thermometers, balances, pipettes, etc. This section will detail some of this equipment and instrumentation and the procedures necessary for its proper calibration.

6.1 Standards and Traceability

Laboratories must retain all pertinent information for all standards, reagents and chemicals to assure traceability to a national standard. This includes documentation of purchase, receipt, preparation and use.

Upon receipt, all purchased standard reference materials are recorded into a standard logbook or database. The entries include the Pace laboratory's unique identification number, the chemical name, manufacturer name, manufacturers identification numbers, receipt date and expiration date. Vendor's certificates of analysis for all standards, reagents, or chemicals are retained by the lab for future reference.

Subsequent preparations of intermediate or working solutions are also documented in a standard logbook or database. These entries include the stock standard name and lot number, the manufacturer name, the solvents used for preparation, the solvent lot number and manufacturer, the preparation steps, preparation date, expiration dates, preparer's initials, and a unique Pace Analytical lab number. This number is used in any applicable sample preparation or analysis logbook so the standard can be traced back to the standard preparation record.

All prepared standard or reagent containers include the Pace identification number, the standard or chemical name, the date of preparation, the date of expiration, the concentration and units, and the preparer's initials. This ensures traceability back to the standard preparation logbook.

If a second source standard is required to verify an existing calibration or spiking standard, this standard is purchased from a different supplier. If no second source is available, a second standard may be purchased from the same supplier but the lab is required to receive a certificate of warranty or similar documentation noting that both standards were prepared from different raw materials. Obtaining two standards from the same parent material is not acceptable for satisfying this requirement.

6.2 General Calibration Procedures

All types of support equipment and instrumentation are calibrated before use to ensure that they function properly. All calibrations are performed by, or under the supervision of, an experienced analyst at scheduled intervals against either certified standards traceable to recognized national standards, or reference standards whose values have been statistically validated. Instrumentation or support equipment that cannot be calibrated to specifications, or is otherwise defective, is taken out of service. They are clearly labeled as out-of-service until they have been repaired and tested to meet specifications. In the event that recalibration of a piece of test equipment casts doubt on the validity of test results already transmitted to the client, the client is notified in writing by the laboratory within 3 business days from the time of discovery. This allows for sufficient investigation and review of documentation to determine the impact on the analytical results. Instrumentation found to be consistently out of calibration is either repaired and positively verified or replaced.

Calibration standards for each parameter are chosen to establish the linear range of the instrument and must bracket the concentrations of those parameters measured in the samples. The lowest calibration standard is the lowest concentration for which quantitative data may be reported. Data reported below this level is considered to have less certainty and must be reported using appropriate data qualifiers (e.g. J flag) or explained in a narrative. The highest calibration standard is the highest concentration for which quantitative data may be

reported. Data reported above this level is considered to have less certainty and must be reported using appropriate data qualifiers (e.g. E flag) or explained in the narrative.

Calibration standards are prepared at a minimum of three concentration levels for inorganic analyses and a minimum of five concentrations for organic analyses. A calibration blank is also included for some inorganic analyses. Any specific method requirement for number and type of calibration standards supersedes the general requirement.

Initial calibration curves are evaluated against appropriate statistical models as required by the analytical methods. Curves that do not meet the appropriate criteria require corrective action that may include re-running the initial curve.
During the course of analysis, the calibration curve is verified by the analysis of a calibration verification standard. This verification standard must also pass acceptance criteria for sample analysis to proceed. Concentrations of calibration verification standards must be varied periodically to evaluate the entire range of the initial calibration curve.

6.3 Calibration Procedures for GC/MS (Gas Chromatograph/ Mass Spectrometer)

More detailed calibration information can be obtained from Pace Standard Operating Procedures or other similar documentation (e.g. SOP ALL-O-001 ***GC/MS Semi-volatiles***).

6.3.1 GC/MS Tuning

The first step in preparing a GC/MS instrument for sample analysis is to tune the instrument. This is accomplished through the analysis of 4-bromofluorobenzene (BFB) for volatile analysis or decafluorotriphenylphosphine (DFTPP) for semi-volatile analysis. The tune standard must pass the method acceptance criteria for mass spectral abundance for these compounds before calibration standards are evaluated.

6.3.2 Initial Calibration

The GC/MS system is initially calibrated with standards at multiple concentrations to establish the linearity of the instrument's response. The number of calibration standards used depends on the specific method criteria or client project requirements, although normally a minimum of five standards is used.

The response factor (RF) for each compound at each concentration is calculated and an average RF is obtained for each compound in the initial calibration curve. The percent relative standard deviation (%RSD) is calculated for each compound. This RSD value should be $\leq$ 15% for each reported compound and must be $\leq$ 30% for those compounds in the method identified as calibration check compounds (CCCs). For compounds with an RSD >15%, a least squares regression can be applied (the best fit value must be >0.99 to confirm linearity) or data for these compounds must be reported with the appropriate data qualifiers. A non-linear calibration curve (quadratic) may be constructed if at least 6 standards are included in the initial calibration.

The mean RF from the initial calibration curve is used to calculate the sample concentration of the compound of interest when the %RSD demonstrates linearity. Otherwise, the sample concentration is determined using the calibration curve equation generated from the initial calibration standards.

6.3.3 Calibration Verification

A calibration verification standard is analyzed with each analytical batch to verify that the initial calibration is still valid. This standard must contain all target analytes and is typically analyzed at a

concentration around the midpoint of the initial calibration curve. For linear calibration using the average response factor, the RF data from this standard is compared to the average RF from the initial calibration. Other calibration models compare the calculated concentration of the calibration verification standard to the expected concentration of the calibration verification standard. If the % Difference is greater than 20% then either the calibration verification standard must be re-analyzed with acceptable results or any data reported for those compounds that exceeded the acceptance criteria are reported with the appropriate data qualifiers.

6.4 Calibration Procedures for GC and HPLC (Gas Chromatograph and High Performance Liquid Chromatograph)

More detailed calibration information can be obtained from Pace Standard Operating Procedures or other similar documentation (e.g. SOP ALL-O-006 ***Organochlorine Pesticides*** and SOP ALL-O-007 ***Polychlorinated Biphenyls***).

6.4.1 Initial Calibration

The GC or HPLC system is initially calibrated with standards at multiple concentrations to establish the linearity of the instrument's response. The number of calibration standards used depends on the specific method criteria or client project requirements, although normally a minimum of five standards is used.

The response factor (RF) for each compound at each concentration is calculated and an average RF is obtained for each compound in the initial calibration curve. The percent relative standard deviation (%RSD) is calculated for each compound. This RSD value should be $\leq$ 20% for each reported compound. For compounds with an RSD >20%, a least squares regression can be applied (the best fit value must be >0.99 to confirm linearity) or data for these compounds must be reported with the appropriate data qualifiers.

The mean RF from the initial calibration curve is used to calculate the sample concentration of the compound of interest.

6.4.2 Calibration Verification

A calibration verification standard is analyzed within each analytical batch at method/program specific intervals to verify that the initial calibration is still valid (this standard is also run at the end of each batch). This standard must contain all target compounds except for multi-component analytes where a representative substance or mixture may be used. The calibration verification standard is typically analyzed at a concentration around the midpoint of the initial calibration curve. The RF data from this standard is compared to the average RF from the initial calibration. If the RF from any compound differs from the average RF from the initial calibration by more than ±15%, then either the calibration verification standard must be re-analyzed or any data reported for those compounds that exceeded the acceptance criteria are reported with the appropriate data qualifiers. Reported sample results must be bracketed by acceptable calibration verification standards.

6.5 Calibration Procedures for ICP, ICP/MS and AAS (Inductively Coupled Plasma, Inductively Coupled Plasma/Mass Spectrometer and Atomic Absorption Spectrometer)

More detailed calibration information can be obtained from Pace Standard Operating Procedures or other similar documentation (e.g. SOP ALL-M-002 ***ICP Metals***)

6.5.1 Initial Calibration

The ICP, ICP/MS or AAS system is initially calibrated with standards at multiple concentrations to establish the linearity of the instrument's response. The number of calibration standards used depends on the specific method criteria or client project requirements, although normally a minimum of three standards is used (ICP and ICP/MS calibration can be performed with a single standard and a calibration blank if annual linear range studies are conducted).

6.5.2 Calibration Verification

A calibration verification standard is analyzed within each analytical batch at method/program specific intervals to verify that the initial calibration is still valid (this standard is also run at the end of each batch). If the response from this standard differs from the initial calibration standard by more than 10% for ICP and ICP/MS or by more than 20% for AAS, then the instrument must be re-calibrated before proceeding with sample analysis. A calibration blank is also run with each calibration verification standard to verify the cleanliness of the system.

Interference check standards are also run per method requirements at the beginning and end of each batch and must pass method acceptance criteria.

6.6 General Equipment Calibration Procedures

6.6.1 Analytical Balances

Each analytical balance is checked and (if necessary) calibrated annually by a qualified service technician. The calibration of each balance is checked each day of use with weights traceable to NIST. Calibration weights are ASTM Class 1 (replaces Class S designation) and are re-certified annually against a NIST traceable reference. Some accrediting agencies may require more frequent checks. If balances are calibrated by an external agency, verification of their weights must be provided. All information pertaining to balance maintenance and calibration is recorded in the individual balance logbook and/or is maintained on file in the Quality department.

6.6.2 Thermometers

Certified, or reference, thermometers are maintained for checking calibration of working thermometers. Reference thermometers are provided with NIST traceability for initial calibration and are re-certified, at a minimum, yearly with equipment directly traceable to NIST.

Working thermometers are compared with the reference thermometers annually according to corporate metrology procedures. Each thermometer is individually numbered. In addition, working thermometers are visually inspected by laboratory personnel prior to use and temperatures are documented.

Laboratory thermometer inventory and calibration data are maintained in the Quality department.

6.6.3 pH/Electrometers

The meter is calibrated before use each day, and once after each four hours of continuous use using fresh buffer solutions.

6.6.4 Spectrophotometers

During use, spectrophotometer performance is checked at established frequencies in analysis sequences against initial calibration verification (ICV) with continuing calibration verification (CCV) standards.

6.6.5 Pipettes

Mechanical hand pipettes are calibrated on a quarterly basis.

6.7 Instrument/Equipment Maintenance

The objectives of the Pace Analytical maintenance program are twofold: to establish a system of instrument care that maintains instrumentation and equipment at required levels of calibration and sensitivity, and to minimize loss of productivity due to repairs.

The Laboratory Operations Manager and department manager/supervisors are responsible for providing technical leadership to evaluate new equipment, solve equipment problems and coordinate instrument repair and maintenance. The analysts have a primary responsibility to perform routine maintenance.

To minimize downtime and interruption of analytical work, preventive maintenance is routinely performed on each analytical instrument.

Department manager/supervisors are responsible for maintaining an adequate inventory of spare parts required to minimize equipment downtime. This inventory includes parts and supplies that are subject to frequent failure, have limited lifetimes, or cannot be obtained in a timely manner should a failure occur.

All major equipment and instrumentation items are uniquely identified to allow for traceability. Equipment/instrumentation are, unless otherwise stated, identified as a system and not as individual pieces. The laboratory maintains equipment records that include the following:

- The name of the equipment and its software
- The manufacturer's name, type, and serial number
- Approximate date received and date placed into service
- Current location in the laboratory
- Condition when received (new, used, etc.)
- Copy of any manufacturer's manuals or instructions
- Dates and results of calibrations and next scheduled calibration (if known)
- Details of past maintenance activities, both routine and non-routine
- Details of any damage, modification or major repairs

All instrument maintenance is documented in maintenance logbooks that are assigned to each particular instrument or system.

When maintenance is performed to repair an instrument problem, depending on the initial problem, demonstration of return to control may be satisfied by the successful analysis of a reagent blank or continuing calibration standard. The entry must include a summary of the results of that analysis and verification by the analyst that the instrument has been returned to an in-control status. In addition, each entry must include the initials of the analyst making the entry, the dates the maintenance actions were performed, and the date the entry was made in the maintenance logbook, if different from the date(s) of the maintenance.

Any equipment that has been subjected to overloading or mishandling, or that gives suspect results, or has been shown to be defective, is taken out of service and clearly identified. The equipment shall not be used to analyze client samples until it has been repaired and shown to perform satisfactorily.

6.8 Spare Parts

Department manager/supervisors are responsible for maintaining an adequate inventory of spare parts required to minimize equipment downtime. This inventory includes parts and supplies that:

- Are subject to frequent failure,
- Have limited useful lifetimes, or
- Cannot be obtained in a timely manner should failure occur.

7.0 CONTROL OF DATA

Analytical results processing, verification and reporting are the processes that result in the delivery of defensible analytical data to the data user. These processes include calculation of raw data into final concentration units, reviewing results for accuracy and assembly of the technical report for delivery to the data user.

All analytical data undergo a well-defined, well-documented multi-tier review process before being reported to the client. The following information describes procedures employed at Pace Analytical for translating raw analytical data into accurate, finished sample reports and describes data storage policies.

7.1 Analytical Results Processing

When "raw data" is manually generated by an analyst, it is recorded in either a bound notebook (run logbook), or copies of the computer printouts are appropriately labeled and filed. Logbooks and other bench records are kept in accordance with each laboratory's Standard Operating Procedure on documentation practices (this may also include the use of electronic logbooks). The primary analyst is responsible for the initial reduction and review of the data. This includes confirming compliance with required methodology; checking the calculations used; checking quality control data against known criteria; noting any discrepancies that occurred both in the necessary logbooks and as a footnote or narrative in LIMS; and entering analytical data into the LIMS system. The primary analyst then compiles the initial data package for data verification. This compilation must include sufficient documentation to review the data. It may include chromatograms or strip-chart recordings, before and after printouts of manual integrations, other computer printouts, chain-of-custody copies if available, and logbook copies. Some agencies or clients require different levels of data reporting. For these special levels, the primary analyst may also need to compile additional project information such as initial calibration data or extensive spectral data before the data package goes to the verification step.

7.2 Data Verification

Data verification is the process of examining data and accepting or rejecting it based on pre-defined criteria. This review step is designed to ensure that the reported data are free from calculation and transcription errors, that quality control parameters are evaluated, and that any discrepancies are properly documented.

Analysts performing the analysis and subsequent data reduction have the primary responsibility for the quality of the data produced. The primary analyst initiates the data verification process by reviewing and accepting the data provided QC criteria have been met for the samples being reported. Data review checklists are used to document the data review process.

The completed data package is then sent to a designated qualified reviewer (this cannot be the primary analyst). This reviewer provides an independent technical assessment of the data package and technical review for accuracy according to methods employed and laboratory protocols. All data that are manually entered into the LIMS is reviewed at a rate of 100%. This involves a quality control review for use of the proper methodology and detection limits, compliance to quality control protocol and criteria, presence and completeness of required deliverables, and accuracy of calculations and data quantitation. The reviewer also reviews analyst-generated calculations.

For results that are processed via computer, calculations are checked by the analyst (or designee) assigned to this task at a frequency designed to assure that the data reductions are valid. The results are either manually transferred to a standard reporting form or reported via computer generation of forms.

Once the data have been technically reviewed and approved, authorization for release of the data from the analytical section is indicated by initialing and dating the data review checklist or otherwise initialing and dating the data.

The Operations or Project Manager examines the report for method appropriateness, detection limits and QC acceptability. Any deviations from the referenced methods are checked for documentation and validity, and QC corrective actions are reviewed for successful resolution.

Use of checklists ensures that all data are systematically handled and no steps are omitted. Checklists are reviewed, retained, and made accessible should they need to be referenced at a later date.

7.3 Data Reporting

All data segments pertaining to a particular Pace Analytical project number are delivered to the Client Services Department (Project Manager) for assembly into the final report. All points mentioned during technical and QC reviews are included in a case narrative, if the data quality is or may be impacted.

Final reports are prepared according to the level of reporting required by the client. A standard Pace Analytical final report consists of the following components:

1. A title which designates the report as "Final Report", "Laboratory Results", "Certificate of Results", etc.
2. Name and address of laboratory (or subcontracted laboratories, if used).
3. Phone number and name of laboratory contact where questions can be referred.
4. A unique number for the report (project number). The pages of the report shall be numbered and a total number of pages shall be indicated (usually in the cover letter).
5. Name and address of client and name of project (if applicable).
6. Unique identification of samples analyzed (including client sample numbers).
7. Identification of any sample that did not meet acceptable sampling requirements (from NELAC or other governing agency), such as improper sample containers, holding times missed, sample temperature, etc.
8. Date and time of collection of samples, date of sample receipt by the laboratory, dates of sample preparation and analysis, and times of sample preparation and analysis when the holding time for either is 72 hours or less.
9. Identification of the test methods used.
10. Identification of sampling procedures if sampling was conducted by the laboratory.
11. Deviations from, additions to, or exclusions from the test methods. These can include failed quality control parameters, deviations caused by the matrix of the sample, etc., and can be shown as a case narrative or as defined footnotes to the analytical data.
12. Identification of whether calculations were performed on a dry or wet-weight basis.
13. Reporting limits used.
14. Final results or measurements, supported by appropriate chromatograms, charts, tables, spectra, etc.
15. If required, a statement of the estimated uncertainty of the test results.
16. A signature and title of person accepting responsibility for the content of the report (can be an equivalent electronic identification) and date report was issued.
17. A statement clarifying that the results of the report relate only to the samples tested or to the samples as they were received by the laboratory.
18. If necessary, a statement indicating that the report must not be reproduced except in full, without the written approval of the laboratory.
19. Identification of all test results provided by a subcontracted laboratory or other outside source.
20. Identification of results obtained outside of quantitation levels.

Any changes made to a final report shall be designated as "Revised" or equivalent wording. The laboratory must keep sufficient archived records of all lab reports and revisions. For higher levels of data deliverables, a

copy of all applicable raw data is sent to the client along with a final report of results. When possible, the Pace Analytical laboratory will provide electronic data deliverables (EDD) as required by contracts or upon client request.

Client data that requires transmission by telephone, telex, facsimile or other electronic means undergoes appropriate steps to preserve confidentiality.

7.4 Data Archiving

All records compiled by Pace Analytical labs are maintained, stored and secured by the Quality Manager or by a designated Data Archivist for a minimum of five years unless superseded by federal, contractual, and/or accreditation requirements. These records can include client data reports, certificates pertaining to calibration and maintenance of equipment, raw data from instrumentation, quality control documents and logbooks. These records are retained in order to provide for possible historical reconstruction of data. Access to archived data is kept to a minimum, with the Data Archivist maintaining the archive documentation in a secure, fireproof (if possible) location. Some laboratories archive their data in an off-site facility and the Data Archivist will keep a record of this archival as well. Records that are computer-generated have either a hard copy or electronic backup copy.

In the event of a change in ownership, accountability or liability, reports of analyses performed pertaining to accreditation will be maintained by the acquiring entity for a minimum of five years. In the event of bankruptcy, laboratory reports and/or records will be transferred to the client and/or the appropriate regulatory entity.

7.5 Resolution of Client Complaints or Questions

Pace Analytical is committed to providing superior service to our customers including cooperation to clarify and resolve questions or complaints pertaining to completed analytical work. Each Pace Analytical laboratory maintains written or electronic documentation of questions and complaints received from clients or the client's authorized representative regarding work performed. The resolution or answers to the questions and complaints are also included in the documentation. In the event that an error is found when investigating the question or complaint, a revised or supplemental report is issued as necessary.

8.0 QUALITY SYSTEM AUDITS AND REVIEWS

In an effort to assess the effectiveness of the Quality Systems, all Pace Analytical laboratories are subject to internal and external audits and reviews.

8.1 Internal Audits

8.1.1 Responsibilities

The Quality Manager is responsible for designing and/or conducting internal audits. Since internal audits represent an independent assessment of laboratory functions, the auditor must be functionally independent from laboratory operations to ensure objectivity. The auditor must be familiar enough with the objectives, principles, and procedures of laboratory operations to be able to perform a thorough and effective evaluation. The Quality Manger evaluates audit observations and verifies the completion of corrective actions. In addition, an annual corporate audit is conducted by the Director of Quality, Safety & Training and/or designee.

8.1.2 Scope and Frequency of Internal Audits

Internal systems audits are conducted yearly at a minimum. The scope of these audits includes evaluation of specific analytical departments or a specific quality-related system as applied throughout the laboratory.

Examples of system-wide elements that can be audited include:

- Quality Systems documents, such as Standard Operating Procedures, training documents, Quality Manual and all applicable addenda
- Personnel and training files.
- General laboratory safety protocols.
- Chemical handling practices, such as labeling of reagents, solutions, standards, and associated documentation.
- Documentation concerning equipment and instrumentation, calibration/maintenance records, operating manuals.
- Sample receipt and management practices.
- Analytical documentation, including any discrepancies and corrective actions.
- General procedures for data security, review, documentation, reporting and archiving.
- Data integrity issues such as proper manual integrations.

When the operations of a specific department are evaluated, a number of additional functions are reviewed including:

- Detection limit studies
- Internal chain-of-custody documentation
- Documentation of standard preparations
- Quality Control limits and Control charts

Certain projects may require an internal audit to ensure laboratory conformance to site work plans, sampling and analysis plans, QAPPs, etc.

A representative number of data audits are completed annually. The report format of any discrepancy is similar to that of other internal audits.

8.1.3 Internal Audit Reports and Corrective Action Plans

Additional information can be found in SOP ALL-Q-011 ***Audits and Inspections***.

A full description of the audit, including the identification of the operation audited, the date(s) on which the audit was conducted, the specific systems examined, and the observations noted are summarized in an internal audit report. Although other personnel may assist with the performance of the audit, the Quality Manager writes and issues the internal audit report identifying which audit observations are deficiencies that require corrective action.

Once completed, the internal audit report is issued jointly to the Laboratory General Manager and the manager(s)/supervisor(s) of the audited operation at a minimum. The responsible manager(s)/supervisor(s) responds with a plan to correct all of the deficiencies cited by the due date specified in the audit report. Each response must include timetables for completion of all proposed corrective actions.

The Quality Manager reviews the audit responses. If the response is accepted, the Quality Manager uses the action plan and timetable as a guideline for verifying completion of the corrective action(s). If the Quality Manager determines that the audit response does not adequately address the correction of cited deficiencies, the response will be returned for modification.

To complete the audit process, the Quality Manager performs a re-examination of the areas where deficiencies were found to verify that all proposed corrective actions have been implemented. An audit deficiency is considered closed once implementation of the necessary corrective action has been verified. If corrective action cannot be verified, the associated deficiency remains open until that action is completed.

8.2 External Audits

Pace Analytical laboratories are audited regularly by regulatory agencies, to maintain laboratory certifications, and by clients to maintain appropriate specific protocols.

Audit teams external to the company review the laboratory to assess the existence of systems and degree of technical expertise. The Quality Manager and other QA staff host the audit team and assist in facilitation of the audit process. Generally, the auditors will prepare a formalized audit report listing deficiencies observed and follow-up requirements for the laboratory. In some cases, items of concern are discussed during a debriefing convened at the end of the on-site review process.

The laboratory staff and supervisors develop corrective action plans to address any deficiencies with the guidance of the Quality Manager. The Laboratory General Manager provides the necessary resources for staff to develop and implement the corrective action plans. The Quality Manager collates this information and provides a written report to the audit team. The report contains the corrective action plan and expected completion dates for each element of the plan. The Quality Manager follows-up with the laboratory staff to ensure corrective actions are implemented.

8.3 Quarterly Quality Reports

Additional information can be found in SOP ALL-Q-014 ***Quality System Review***.

The Quality Manager is responsible for preparing a quarterly report to management summarizing the effectiveness of the laboratory Quality Systems. This status report will include:

- Results of internal systems or performance audits
- Corrective action activities

- Discussion of QA issues raised by clients
- Results of third party or external audits
- Status of laboratory certifications
- Proficiency Testing Study Results
- Results of internal laboratory review activities
- Summary of holding time violations
- Method detection limit study status
- Training activity summary
- SOP revision summary
- 3P Implementation summary (internal program)
- Other significant Quality System items

The Corporate Director of Quality, Safety & Training utilizes the information from each laboratory to make decisions impacting the Quality Systems of the company as a whole. Each General Manager utilizes the quarterly report information to make decisions impacting Quality Systems and operational systems at a local level.

8.4 Annual Managerial Review

A managerial review of Quality Systems is performed on an annual basis at a minimum. This allows for assessing program effectiveness and introducing changes and/or improvements.

The managerial review must include the following topics of discussion:

- Policy and procedure suitability
- Manager/Supervisor reports
- Internal audit results
- Corrective and preventative actions
- External assessment results
- Proficiency testing studies
- Sample capacity and scope of work changes
- Client feedback, including complaints

This managerial review must be documented for future reference by the Quality Manager and copies of the report are distributed to laboratory staff.

9.0 CORRECTIVE ACTION

Additional information can be found in SOP ALL-Q-012 ***Corrective Action/Preventative Action Process.***

During the process of sample handling, preparation and analysis, certain occurrences may warrant the necessity of corrective actions. These occurrences may take the form of analyst errors, deficiencies in quality control, method deviations, or other unusual circumstances. The Quality System of Pace Analytical provides systematic procedures for documentation and completion of corrective actions. This can be done using a Corrective Action Tracking Log that lists the deficiency by ID, along with the deficiency source, responsible party, root cause, resolution, due date, and date resolved.

9.1 Corrective Action Documentation

The following items are examples of occurrences that warrant some form of documented corrective action:

- Quality Control data outside of acceptance criteria
- Sample Acceptance Policy deviations
- Missed holding times
- Instrument failures (including calibration failure)
- Sample preparation or analysis errors
- Sample contamination
- Errors in client reports
- Audit findings (internal and external)
- Proficiency Testing (PT) sample failures
- Client complaints or inquiries

Documentation of corrective actions may be in the form of a comment or footnote on the final report that explains the deficiency (e.g. matrix spike recoveries outside of acceptance criteria) or it may be a more formal documentation (either paper system or computerized spreadsheet). This will depend on the extent of the deficiency, the impact on the data, and the method or client requirements for documentation.

The person who discovers the deficiency or non-conformance initiates the corrective action documentation. The documentation must also include the affected projects and sample numbers, the name of the applicable Project Manager, the client name and the sample matrix involved.

The person initiating the corrective action documentation must also list suspected or known causes of the deficiency or non-conformance as well as any corrective actions that they have taken. They would then sign and date the form and pass it to their immediate supervisor or the Project Manager. The supervisors and PMs add in their observations and further corrective actions, sign and date the form and pass to any other applicable lab employee. The Quality Manager is responsible for final review and signoff of all formal corrective action forms. A copy of the form is archived with each project and a copy is kept in the quality office.

9.2 Corrective Action Completion (Specific Examples)

9.2.1. Quality Control outside of acceptance criteria: the analyst that is generating or validating Analytical data is responsible for checking the results against established acceptance criteria (quality control limits). The analyst must immediately address any deficiencies discovered. Method blank, LCS or matrix spike failures are evaluated against method, program, and client requirements and appropriate footnotes are entered into the LIMS system. Some deficiencies may be caused by matrix interferences. Where possible, matrix interferences are confirmed by re-analysis. Quality control

deficiencies must be made known to the client on the final report for their review of the data for usability. If appropriate, the supervisor is alerted to the QC failure and if necessary a formal corrective action can be initiated. This may involve the input of the Quality Manager or the General Manager. The department supervisor and/or Operations Manager are responsible for evaluating the source of the deficiency and for returning the analytical system to control. This may involve instrument maintenance, analytical standard or reagent evaluation, or an internal audit of the analytical procedure.

9.2.2. **Sample Acceptance Policy deviations:** any deviation from the Sample Acceptance Policy listed in this Manual must be documented on the Chain-of-Custody or other applicable form by the sample receiving personnel or by the Project Manager. The client must be notified of these deviations as soon as possible so they can make decisions on whether to continue with the sample analysis or re-sample. Copies of this documentation must be included in the project file. Analysts or supervisors that discover such deviations must contact the sample receiving personnel or appropriate Project Manager so they can initiate the proper documentation and client contact. If a more formalized corrective action must be documented, the Quality Manager should be made aware of the situation.

9.2.3. **Missed holding times**: in the event that a holding time requirement has been missed, the analyst or supervisor must complete a formal corrective action form. The Project Manager and the Quality Manager must be made aware of these hold time exceedances.

The Project Manager must contact the client for appropriate decisions to be made with the resolution documented and included in the client project file. The Quality Manager includes a list of all missed holding times in their Quarterly Report to the corporate office.

9.2.4. **Instrument Failures**: in the event of an instrument failure that either causes the necessity for re-analysis or questions the validity of generated results, a formal corrective action must be initiated. The analyst and supervisor must evaluate any completed data for validity and usability. They are also responsible for returning the instrument to valid operating condition and for documenting that the system is in control (e.g. acceptable calibration verification).

9.2.5. **Sample Preparation or Analysis errors**: whenever there is an error in the preparation or analysis of samples, the analyst evaluates the impact on the usability of the analytical data with the assistance of their supervisor or manager. The affected samples will be re-processed or re-analyzed under acceptable conditions. In the event that no additional sample is available for re-analysis, the client must be contacted for their decision on how to proceed. Documentation may take the form of footnotes or a formal corrective action form.

9.2.6. **Errors in client reports:** when an error on the client report is discovered, the Project Manager is responsible for initiating a formal corrective action form that describes the failure (e.g. incorrect analysis reported, reporting units are incorrect, reporting limits do not meet objectives). The Project Manager is also responsible for revising the final report if necessary and submitting it to the client.

9.2.7. **Audit findings:** the Quality Manager is responsible for documenting all audit findings and their corrective actions. This documentation must include the initial finding, the persons responsible for the corrective action, the due date for reporting back to the auditing body, the root cause of the issue, and the corrective action taken to resolve the findings. The Quality Manager is also responsible for providing any back-up documentation used to prove that a corrective action has been completed.

9.2.8. **Proficiency Testing failures**: Any PT result returned to the Quality Manager as "not acceptable" requires an investigation and applicable corrective actions. The operational staff is made aware of the PT failures and they are responsible for reviewing the applicable raw data and calibrations and list possible causes for error. The Quality Manager will review their findings and initiate another external PT sample or an internal PT sample to try and correct the previous failure. Replacement PT

results must be monitored by the Quality Manager and reported to the applicable regulatory authorities.

9.2.9. **Client Complaints**: Project Managers are responsible for issuing corrective action forms for client complaints. As with other corrective actions, the possible causes of the problem are listed and the form is passed to the appropriate analyst or supervisor. After their corrective actions have been listed, the Project Manager reviews the corrective action to determine if the client needs or concerns are being addressed.

10.0 GLOSSARY

3P Program	The Pace Analytical continuous improvement program that focuses on Process, Productivity and Performance. Best Practices are identified that can be used by all Pace labs.
Accuracy	The agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components that are due to sampling and analytical operations; a data quality indicator.
Aliquot	A portion of a sample taken for analysis.
Analyte	The specific chemical species or parameter an analysis seeks to determine.
Batch	Environmental samples that are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A preparation batch is composed of one to 20 environmental samples of the same NELAC-defined matrix, meeting the above-mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) that are analyzed together as a group. An analytical batch can include prepared samples originating from various environmental matrices and can exceed 20 samples.
Blank	A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results.
Blind Sample	A sample for submitted for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test analyst or laboratory proficiency in the execution of the measurement process.
Contract Required Detection Limit (CRDL)	Detection limit that is required for EPA Contract Laboratory Program (CLP) contracts.
Contract Required Quantitation Limit (CRQL)	Quantitation limit (reporting limit) that is required for EPA Contract Laboratory Program (CLP) contracts.
Calibration	To determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter, instrument, or other device. The levels of the applied calibration standard should bracket the range of planned or expected sample measurements.
Calibration Curve	The graphic representation of known values, such as concentrations for a series of calibration standards and their instrument response.
Chain-of-Custody (COC)	A record that documents the possession of samples from the time of collection to receipt in the laboratory. This record generally includes the number and type of containers, mode of collection, collector, time of collection, preservation, and requested analyses.
Confirmation	Verification of the identity of a component through the use of an alternate scientific approach from the original method. These may include, but are not limited to: • second-column confirmation • alternate wavelength • derivatization derivative • mass spectral interpretation • additional cleanup procedures

Comparability	An assessment of the confidence with which one data set can be compared to another. Comparable data are produced through the use of standardized procedures and techniques.
Completeness	The percent of valid data obtained from a measurement system compared to the amount of valid data expected under normal conditions. The equation for completeness is: % Completeness = (Valid Data Points/Expected Data Points)*100
Calibration Verification	The process of verifying a calibration by analysis of standards and comparing the results with the known amount.
Control Chart	A graphic representation of a series of test results, together with limits within which results are expected when the system is in a state of statistical control (see definition for Control Limit)
Control Limit	A range within which specified measurement results must fall to verify that the analytical system is in control. Control limit exceedances may require corrective action or require investigation and flagging of nonconforming data.
Corrective Action	The action taken to eliminate the causes of a nonconformity, defect, or other undesirable situation in order to prevent recurrence.
Data Quality Objective (DOQ)	Systematic strategic planning tool based on the scientific method that identifies and defines the type, quality, and quantity of data needed to satisfy a specified use or end user.
Data Reduction	The process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more usable form.
Demonstration of Capability	A procedure to establish the ability of the analyst to generate acceptable accuracy.
Detection Limit (DL)	General term for the lowest concentration or amount of the target analyte that can be identified, measured and reported with confidence that the analyte concentration is not a false positive value. See definitions for Method Detection Limit and Limit of Detection.
Document Control (Management)	Procedures to ensure that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly and controlled (managed) to ensure use of the correct version at the location where the prescribed activity is performed.
Dry Weight	The weight after drying in an oven at a specified temperature.
Duplicate or Replicate Analysis	The identically performed measurement on two or more sub-samples of the same sample within a short interval of time
Environmental Sample	A representative sample of any material (aqueous, non-aqueous, or multimedia) collected from any source for which determination of composition or contamination is requested or required. Environmental samples can generally be classified as follows: • Surface Water and Ground Water • Drinking Water - Delivered (treated or untreated) water designated as potable water • Water/Wastewater - Raw source waters for public drinking water supplies, ground waters, municipal influents/effluents, and industrial influents/effluents • Sludge - Municipal sludges and industrial sludges. • Soil - Predominately inorganic matter ranging in classification from sands to clays. • Waste - Aqueous and non-aqueous liquid wastes, chemical solids, and industrial liquid and solid wastes
Equipment Blank	A sample of analyte-free media used to rinse common sampling equipment to check effectiveness of decontamination procedures.

Field Blank	A blank sample prepared in the field by filling a clean container with reagent water and appropriate preservative, if any, for the specific sampling activity being undertaken.
Field Measurement	Determination of physical, biological, or radiological properties, or chemical constituents that are measured on-site, close in time and space to the matrices being sampled/measured, following accepted test methods. This testing is performed in the field outside of a fixed-laboratory or outside of an enclosed structure that meets the requirements of a mobile laboratory.
Holding Time	The maximum time that samples may be held prior to preparation and/or analysis as defined by the method.
Homogeneity	The degree to which a property or substance is uniformly distributed throughout a sample.
Initial Calibration (ICAL)	The process of analyzing standards, prepared at specified concentrations, to define the quantitative response relationship of the instrument to the analytes of interest. Initial calibration is performed whenever the results of a calibration verification standard do not conform to the requirements of the method in use or at a frequency specified in the method.
Internal Standards	A known amount of standard added to a test portion of a sample as a reference for evaluating and controlling the precision and bias of the applied analytical method.
Laboratory Control Sample (LCS)	A blank sample matrix, free from the analytes of interest, spiked with known amounts of analytes or a material containing known amounts of analytes. It is generally used to establish intra-laboratory or analyst-specific precision and bias or to assess the performance of all or a portion of the measurement system. Sometimes referred to as Laboratory Fortified Blank, Spiked Blank or QC Check Sample.
Limit of Detection (LOD)	An estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte and matrix specific and may be laboratory-dependent.
Limit of Quantitation (LOQ) .	The minimum levels, concentrations or quantities of a target variable (e.g. target analyte) that can be reported with a specified degree of confidence
Laboratory Information Management System (LIMS)	A computer system that is used to maintain all sample information from sample receipt, through preparation and analysis and including sample report generation.
Lot	A quantity of bulk material of similar composition processed or manufactured at the same time.

Matrix	The component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions are used: • **Aqueous**: any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts. • **Drinking Water**: any aqueous sample that has been designated a potable or potentially potable water source. • **Saline/Estuarine**: any aqueous sample from an ocean or estuary, or other saltwater source. • **Non-aqueous liquid**: any organic liquid with <15% settleable solids. • **Biological Tissue**: any sample of a biological origin such as fish tissue, shellfish or plant material. Such sample can be grouped according to origin. • **Solids**: includes soils, sediments, sludges, and other matrices with >15% settleable solids. • **Chemical Waste**: a product or by-product or an industrial process that results in a matrix not previously defined • **Air**: whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas vapor that are collected with a sorbent tube, impinger solution, filter, or other device.
Matrix Spike (MS)	A sample prepared by adding a known quantity of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used to determine the effect of the matrix on a method's recovery efficiency. (sometimes referred to as Spiked Sample or Fortified Sample)
Matrix Spike Duplicate (MSD)	A second replicate matrix spike prepared in the laboratory and analyzed to obtain a measure of precision of the recovery of each analyte. (sometimes referred to as Spiked Sample Duplicate or Fortified Sample Duplicate)
Method Blank	A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures: and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses.
Method Detection Limit (MDL)	One way to establish a Limit of Detection (LOD); defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.
Performance Based Measurement System (PBMS)	An analytical system wherein the data quality needs, mandates or limitations of a program or project are specified and serve as criteria for selecting appropriate test methods to meet those needs in a cost-effective manner.
Precision	The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms.
Preservation	Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample.
Proficiency Testing	A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source.
Protocol	A detailed written procedure for field and/or laboratory operation that must be strictly followed.

Quality Assurance Project Plan (QAPP)	A formal document describing the detailed quality control procedures required by a specific project.
Quality Assurance (QA)	An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence.
Quality Control (QC)	The overall system of technical activities whose purpose is to measure and control the quality of a product or service so that it meets the needs of users.
Quality Manual	A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users.
Quality System	A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC.
Random Error	The EPA has established that there is a 5% probability that the results obtained for any one analyte will exceed the control limits established for the test due to random error. As the number of compounds measured increases in a given sample, the probability for statistical error also increases.
Raw Data	Any original factual information from a measurement activity or study recorded in a laboratory notebook, worksheets, records, memoranda, notes, or exact copies thereof that are necessary for the reconstruction and evaluation of the report of the activity or study. Raw data may include photography, microfilm or microfiche copies, computer printouts, magnetic media, including dictated observations, and recorded data from automated instruments. If exact copies of raw data have been prepared (e.g. tapes which have been transcribed verbatim, dated and verified accurate by signature), the exact copy or exact transcript may be submitted.
Reagent Grade	Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents that conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.
Reference Standard	A standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived.
Reporting Limit (RL)	The level at which method, permit, regulatory and client specific objectives are met. The reporting limit may never be lower than the Limit of Detection (i.e. statistically determined MDL). Reporting limits are corrected for sample amounts, including the dry weight of solids, unless otherwise specified. There must be a sufficient buffer between the Reporting Limit and the MDL.
Representativeness	A quality element related to the ability to collect a sample reflecting the characteristics of the part of the environment to be assessed. Sample representativeness is dependent on the sampling techniques specified in the project work plan.
Sample Delivery Group (SDG)	A unit within a single project that is used to identify a group of samples for delivery. An SDG is a group of 20 or fewer field samples within a project, received over a period of up to 14 calendar days. Data from all samples in an SDG are reported concurrently.
Sample Tracking	Procedures employed to record the possession of the samples from the time of sampling until analysis, reporting and archiving. These procedures include the use of a Chain-of-Custody Form that documents the collection, transport, and receipt of compliance samples to the laboratory. In addition, access to the laboratory is limited and controlled to protect the integrity of the samples.

Sensitivity	The capability of a method or instrument to discriminate between measurement responses representing different levels (concentrations) of a variable of interest.
Standard	A substance or material with properties known with sufficient accuracy to permit its use to evaluate the same property in a sample.
Standard Blank	A calibration standard consisting of the same solvent/reagent matrix used to prepare the calibration standards without the analytes. It is used to construct the calibration curve by establishing instrument background.
Standard Operating Procedure (SOP)	A written document which details the method of an operation, analysis, or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks
Surrogates	A substance with properties that mimic the analyte of interest. It is unlikely to be found in environmental samples and is added to them for quality control purposes.
Systems Audit	An on-site inspection or assessment of a laboratory's quality system.
Traceability	The property of a material or measurement result defining its relationship to recognized international or national standards through an unbroken chain of comparisons.
Training Document	A training resource that provides detailed instructions to execute a specific method or job function.
Trip Blank	This blank sample is used to detect sample contamination from the container and preservative during transport and storage of the sample. A cleaned sample container is filled with laboratory pure water; any preservative used in the sample is added and then the blank is stored, shipped, and analyzed with its group of samples.
Validation	The confirmation by examination and provision of objective evidence that the particular requirements for a specific intended use are fulfilled.
Verification	Confirmation by examination and provision of evidence that specified requirements for instruments have been met. The result of verification leads to a decision either to restore in service, to perform adjustment, to repair, to downgrade, or to declare obsolete. In all cases, it is required that a written trace of the verification performed shall be kept on the measuring instrument's individual record.
Warning Limits	The limits (typically 2 standard deviations either side of the mean) shown on a control chart within which most results are expected to lie (within a 95% probability) while the system remains in a state of statistical control.
Work Cell	A defined group of analysts that together perform the method analysis. The members of the group and their specific functions within the work cell must be fully documented.
Working Range	The range of results between the Limit of Quantitation and the upper limit of measurement system calibration.

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Appendix B
Distribution List

Site Characterization Work Plan Project Distribution List

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Site Characterization Work Plan for Carter Carburetor

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December 2005

MACTEC Engineering and Consulting Project No. 3250055164

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ACF	American Car and Foundry, Industries
AOC	Administrative Order on Consent
ASTM	American Society for Testing and Materials
bgs	Below ground surface
CFR	Code of Federal Regulations
CGI	Combustible Gas Indicator
CIH	Certified Industrial Hygienist
COC	Chain of Custody
CPR	Cardiopulmonary Resuscitation
DOT	Department of Transportation
EE/CA	Engineering Evaluation/Cost Analysis
EPA	United States Environmental Protection Agency
FSM	Field Site Manager
FSP	Field Sampling Plan
HSM	Health and Safety Manager
HSP	Health and Safety Plan
LEL	Lower Explosive Limit
MACTEC	MACTEC Engineering and Consulting, Inc.
MS/MSD	Matrix Spike/Matrix Spike Duplicates
NIOSH	National Institute for Occupational Safety and Health
NFGO	National Functional Guidelines for Organic Review
PCBs	Polychlorinated biphenyls
PID	Photoionization detector
PPE	Personal Protective Equipment
ppm	Parts per million
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
REC	Percent Recovery
RPD	Relative Percent Difference
SC	Site Characterization
SCE	Site Characterization Evaluation
SHSS	Site Health and Safety Supervisor
Site	2800 Block North Grand, St. Louis, Missouri
SOPs	Standard Operating Procedures
SVOCs	Semi-Volatile Organic Compounds
TPH	Total Petroleum Hydrocarbons
TSCA	Toxic Substances Control Act
WBGT	Wet Bulb Globe Temperature

1.0 Introduction

This Site Characterization (SC) Work Plan for the Carter Carburetor site located in the 2800 block of North Grand Avenue in St. Louis, Missouri ("Site") was prepared to fulfill the obligations of the Administrative Settlement Agreement (ASA) and Order on Consent for Removal Action: CERCLA-07-2005-0372 (AOC) between ACF Industries, LLC (ACF) and the United States Environmental Protection Agency (EPA). The SC objective is to characterize the Site and to evaluate whether removal actions are necessary to protect human health and the environment.

1.1 Work Plan Purpose and Approach

The purpose of the SC Work Plan is to outline investigation activities needed to characterize the Site. The results of the investigation activities will be used to determine whether removal actions are necessary and, if so, what removal actions are appropriate.

MACTEC reviewed data from past Toxic Substances Control Act (TSCA) investigations at the Site. These TSCA investigations were conducted by EPA Region VII and their contractors dating back to 1987. Previous investigation results were used to identify areas where further and more detailed investigation was necessary.

Once EPA approves the SC Work Plan and the work is complete, a Site Characterization Evaluation (SCE) Report will be prepared. The SCE Report will present and evaluate information gathered during the SC field work to characterize the Site. Based on this information, an Engineering Evaluation/Cost Analysis (EE/CA) will be performed to identify the most appropriate removal action for the Site. If throughout this process the most appropriate removal action is determined and agreed upon prior to completion of the entire project process, the remaining sampling work may be terminated with EPA approval.

1.2 Work Plan Organization

The remainder of this SC Work Plan is organized into six main sections which describe the Site background, sampling rationale, and planned activities as listed below.

- Section 2.0 - Site Description: Provides information about the Site's characteristics and location;
- Section 3.0 - Site History: Describes the history of the Site, and known activities occurring at the Site;
- Section 4.0 - Initial Evaluation: Outlines the chemicals of concern, exposure routes of these chemicals, and the previously conducted risk calculations;
- Section 5.0 - Data Collection: Explains the rationale and proposed data collection activities to be performed during the SC implementation;
- Section 6.0 - Schedule: Outlines the schedule for performance of all project tasks and related activities and the expected duration of each; and
- Section 7.0 - References: Includes references for source materials used to prepare the SC Work Plan.

2.0 Site Description

This section of the SC Work Plan presents background information pertaining to the environmental setting for the Site.

2.1 Site Location

The Carter Carburetor Site is located at 2800-2840 North Spring Street in the north-central portion of the City of St. Louis, in a mixed residential and commercial neighborhood. The surrounding area is composed primarily of medium to low income residential dwellings, with commercial development along arterial roads. The site is located on the west side of Grand Boulevard bounded by St. Louis Avenue to the southwest, Dodier Street to the northeast and Spring Avenue to the northwest. The Herbert Hoover Boys and Girls Club is located to the north across Dodier Street. Two high schools and three elementary schools are located within a half-mile radius of the Site. Residences are located west of Spring Street, and east of Grand Boulevard from the Site. The Site is 80 feet in elevation above the Mississippi River and is not within the river's 100-year floodplain zone (Figure 2-1).

2.2 Site Operations

The former Carter Carburetor facility manufactured carburetors and other components for gasoline and diesel powered equipment. The Site includes a 4 story manufacturing building (CBI Building), a former automotive garage, a former warehouse, and the former north/south die cast buildings.

Former manufacturing processes within these buildings utilized various hydraulic/lubricating oils, fuels, paints, cleaning solvents, and dielectric fluid as part of their ongoing operations. Underground storage tanks (USTs), aboveground storage tanks (ASTs), and drums were typically used to store chemical products/residues inside and outside of the buildings. Access to the CBI Building on the Site is strictly controlled. The Site is partially surrounded by a chain-link fence.

2.3 Environmental Setting

A preliminary evaluation of the environmental setting at the Site was prepared during the development of the Draft Engineering Evaluation/Cost Analysis in November 1998 to better understand the framework for migration of any potential constituent releases and the potential effects on human health and the environment. This information is presented below.

2.3.1 General Setting

The Site is located in an urban setting. The surrounding area is a mix of residential and commercial neighborhoods composed of medium to low income dwellings, small and large businesses. The population of the City of St. Louis is approximately 350,000. Surface water from the Site drains to storm sewers that discharge into the Metropolitan St. Louis Sewer District (MSD). Geological and hydrogeological information was acquired through an evaluation of the soil boring logs and groundwater elevation measurements that were conducted at the Site. Results are summarized below.

2.3.2 Geologic Setting

Subsurface geologic units in the area of the Site include a silt-rich loess layer, a clay-rich loess layer, and one layer of residual soil overlying St. Louis Limestone or the Cherokee Group (Lutzen and Rockaway, 1971).

The bedrock geology in the city of St. Louis consists of essentially flat-lying sedimentary formations, mostly limestone and dolomite (Lutzen and Rockaway, 1971). Geologic formations exposed in St. Louis County, which lies adjacent to and west of the city, range in age from Ordovician to middle Pennsylvanian.

The uppermost bedrock encountered in the area of the Site is the undifferentiated Pleasanton, Marmaton, and Cherokee Groups of Pennsylvanian age. Shales, siltstones, sandstones, coal beds, and thin limestone beds are the dominant lithology of these three groups. Regionally, the Pennsylvanian-age groups have a total thickness ranging from 10 to 300 feet. During the April 2003 investigation, bedrock was encountered at 24 feet bgs.

Underlying the Pennsylvanian strata is Mississippian-age limestone. The Ste. Genevieve Formation (0 to 160 feet thick), St. Louis Limestone (0 to 180 feet thick), Salem Formation (0 to 180 feet thick), and Warsaw Formation (0 to 110 feet thick) are all limestone and compose the upper portion of the Mississippian-age bedrock.

2.3.2.1 Site Specific Geological Characterization for former North and South Die Cast Buildings

Site soil borings were completed as part of the Supplemental Environmental Field Investigation to provide site-specific stratigraphic and hydrogeologic data. Soil boring data indicate the presence of four general soil stratigraphic units overlying the bedrock surface at the Site. These four general units are defined in descending order as (1) Limestone Gravel/Concrete Unit, (2) Fill Unit, (3) Silty Clay Unit, (4) Clay Unit.

Limestone Gravel/Concrete Unit

Upon demolition of the former North and South Diecast Buildings in 1998, the concrete floor of the buildings was sealed with an epoxy resin in order to eliminate/retard the movement of water through the concrete and to prevent the movement of PCBs from the concrete. In order to prevent contact with the portions of the

concrete floor which had been impacted by PCBs, the floor was then covered with up to three feet of crushed limestone in order to prevent contact with sealed concrete. Soil boring data indicate that the limestone fill material ranges from 1½ feet thick on the west side of the Diecast Buildings to 3½-feet thick along the southeast and east portions of the buildings. The limestone gravel is underlain by the concrete floor, which is from 4 to 6 inches thick.

Fill Unit

Soil boring data indicate that a heterogeneous Fill Unit overlies the native materials under most portions of the former Diecast buildings. Fill generally consists of a clay/silty clay matrix, with intermixed sand, gravel, and cinders along with some brick and wood debris. Unit thickness varied across the Site, but was typically 3 to 6 feet in thickness with a maximum thickness of 15 feet. Brick fragments were found in borings G-04-02 and G-04-03, with the brick fragments found within Boring G-04-03 at a depth of 18 feet bgs. These brick fragments found at depth could represent the location of a former cistern or sewer.

Silty Clay Unit

Soil boring data indicate the presence of a Silty Clay Unit beneath the surface or the previously defined Fill Unit. These native materials generally consisted of olive-gray to reddish-brown, soft to stiff, silty clay often containing iron oxidation discoloration. Unit thickness generally ranged from 6 to 19 feet. Soils from the Silty Clay Unit were characterized as having low to moderate moisture content; groundwater was not present in the soil borings upon completion.

Clay Unit

Soil boring data from the deeper soil borings indicate the presence of a Clay Unit underlying the Silty Clay Unit. These native materials generally consisted of reddish-orange tan to brown, stiff to very stiff, plastic clay. This unit was generally encountered at depths greater than 20 feet bgs and extended to the top of bedrock, which was encountered at a depth of between 19 and 29½ feet bgs. The typical depth to bedrock was between 23 and 26 feet bgs. The Clay Unit generally included some coarse gravels intermixed with the clay at the bedrock interface.

Based on interpretations from the Site boring results, previous investigations, and regional geological information, the Silt Unit and the Clay Unit are expected to be relatively uniform and continuous beneath the Site and immediate surrounding area. As such, these units serve as an aquitard beneath the Site, limiting vertical migration of groundwater.

2.3.3 Hydrogeology

Water supplies in the St. Louis area are obtained from the Mississippi, Missouri, and Meramec Rivers. Approximately 82 percent of the water supply is pumped from the Mississippi River, whereas approximately 12 percent is pumped from the Missouri River and Meramec River combined (Miller et al., 1974). Aquifers exist in both the bedrock and unconsolidated deposits along the Mississippi and Missouri Rivers. These aquifers account for approximately 3 percent of the water supply (Miller et al., 1974).

Groundwater on the Carter Carburetor site was encountered at approximately 24 feet below ground surface (bgs) at the soil bedrock interface during the 1995 Preliminary Assessment/Site Inspection (E&E, 1995c). Groundwater was not encountered during the April 2003 site investigation.

The shallow groundwater table may be modified locally at the Site due to the presence of buildings or parking lots. Overall the shallow groundwater is expected to flow in the general direction of the topography, northeast towards the Mississippi River approximately 1.75 miles to the northeast. Given the low permeability and thickness of the unconsolidated deposits underlying the Site, direct connection to deeper, bedrock aquifers is not expected.

2.3.4 Surface Water Hydrology

General surface water drainage at the Site is by overland flow to storm sewer intakes located across the Site or to open drainage ditches that drain to storm sewers. The storm sewers discharge into the MSD sewer system at several locations.

Presently, approximately 65 -70 percent of the surface area at the Site is covered with buildings and paved parking lots. Several of the aboveground structures associated with discontinued processes have been demolished, although concrete at or below grade remains. An extensive network of utilities including potable and service water lines, storm sewers, sanitary sewers, and other utilities (typical of an industrial facility) is located underground.

3.0 Site History

Site information presented in this section was taken from EPA's Administrative Settlement Agreement and Order on Consent for Removal Action (CERCLA-07-2005-0372), MACTEC Reports, EPA documents prepared for the former Carter Carburetor site and historical data. This information will be updated if additional information is obtained during the EE/CA process or if information contained herein is deemed to be inaccurate.

3.1 Site History

The Site includes one and one half square city blocks in the city of St. Louis, Missouri. The Site is bounded on the north by Dodier Street, on the east by Grand Blvd, on the south by St. Louis Avenue and on the west by North Spring Avenue and Hyams Street. At one time, the Site consisted of several multistory, connected, manufacturing and warehouse buildings, approximately 480,000 square feet in size, and adjacent lots located in a mixed, urban commercial/residential area. The Site property covers approximately 10 acres. The Site is 80 feet in elevation above the Mississippi River and is not within its 100 year flood plain zone.

ACF Industries, Incorporated owned the property from the 1930's until April 26, 1985, when the Site property and buildings (also referred to herein as the "Facility") were deeded to the Land Reutilization Authority of the City of St. Louis, Missouri ("LRA"). During ACF's ownership, the Facility was operated by Carter Carburetor Corporation and Carter Automotive Products, both subsidiaries of ACF, who manufactured carburetors for use in gasoline and diesel powered equipment. When ACF closed the Facility in 1984, the manufacturing lines were dismantled and most of the equipment was shipped to new locations or sold. At the time the Site property was deeded to LRA, approximately twenty (20) transformers and an undisclosed number of capacitors and switch gears, all of which contained PCB fluids, remained on-site. ACF believes the transformers, capacitors and switch gears were operational and intact at the time of the conveyance to LRA. ACF Industries, Inc. became ACF Industries LLC on May 1, 2003.

On April 26, 1985, LRA deeded the Facility to Hubert and Sharon Thompson (the "Thompsons"). On January 9, 1986, the Thompsons sold the northern portion of the Facility to Edward Pivirotto and his wife (the "Pivirottos"). The Pivirottos subsequently failed to pay the real estate taxes on the portion of the Facility they owned, resulting in a Sheriff's sale on August 20-22, 1991. Because no substantive bids were received at the sale, the property reverted to LRA by operation of law. Thus on February 2, 1992, LRA became the owner of the northeastern portion of the Facility previously owned by the Pivirottos. The LRA currently owns the property upon which the Die Cast buildings were located, the south warehouse facility and an adjacent north

parking lot.

On June 20, 1989, Carter Building, Inc. ("CBI"), a Delaware Corporation, (no relationship to ACF Industries, LLC, Carter Carburetor Corporation, or Carter Automotive Products) entered into a lease and option to purchase agreement with Hubert and Sharon Thompson. On June 28, 1990, CBI provided notice to the Thompsons that CBI was exercising its right to purchase the portion of the Facility owned by the Thompsons. Following the filing of a suit for breach of contract and for specific performance and a subsequent foreclosure proceeding, CBI received a Trustee's deed (Under Foreclosure) for a portion of the Facility from the Missouri Title Company, John E. O'Brien, Successor Trustee, in October 1991.

3.2 Site Enforcement History

In the early 1980's, ACF was required by the Industrial Pollution Control Section of the Metropolitan St. Louis Sewer District to monitor and control waste water discharges containing PCBs. ACF instituted physical and procedural controls to reduce PCBs in their waste water discharges. A source of the PCB contamination was PCB-contaminated hydraulic fluid in machinery and equipment used in the Carter Carburetor manufacturing processes at the Facility.

In August 1987, EPA conducted a Toxic Substances Control Act ("TSCA") inspection of the Facility which led to the issuance of a Complaint and Notice of Hearing to Hubert Thompson. In April 1988, Mr. Thompson contracted with U.S. Pollution Control Inc. to clean up and remove the PCB containing transformers.

In June 1988, a Consent Order issued by EPA required Mr. Thompson to remove and dispose of the PCB transformers. Following the response actions by the Thompsons, a cleanup verification study was performed by Environmental Operations, Inc. in November 1989. This study indicated that PCBs were still present in the pump room (electrical substation #1).

In February 1989, the Missouri Department of Natural Resources ("MDNR") conducted an inspection at the Site. The inspection revealed that transformers, transformer oil, switches, and contaminated concrete had been shipped offsite for disposal. Samples collected during the MDNR inspection revealed PCB contamination in soils under an old transformer area. In April 1989, EPA collected samples at the Site and found PCB concentrations in the soils ranging from 17.2 parts per million ("ppm") to 18.5 ppm.

In March 1990, EPA conducted another TSCA inspection to determine if further cleanup action was

necessary. Analysis of samples collected during this inspection indicated that surface wipe samples still exceeded regulatory cleanup standards and that a PCB transformer and two drums of PCB containing material remained on-site.

Another PCB study was conducted by Environmental Science and Engineering, Inc. (ESE) in September 1990 on behalf of Mr. Thompson. This study focused solely on the first floor pump room (electrical substation #1) which had originally contained six transformers. As a result of this study, EPA requested Mr. Thompson to provide a description of completed and/or planned cleanup activities at the Site. In February 1991, Mr. Thompson responded, indicating that he did not have the assets to continue the cleanup activities at the Site.

The EPA Emergency Planning and Response Branch (EP&R) conducted Site investigations in November 1993 and January 1994. The primary reason for the investigations was to collect environmental samples and conduct an assessment of the Site to determine if anyone had access to and could be exposed to the areas previously determined to contain PCBs. Samples were collected from areas at the facility known or suspected to have significant concentrations of PCBs. These areas included: (A) a vaulted pump room near the center of the CBI portion of the Facility that contained pumps, old boilers and other equipment, and once housed electrical substation #1; (B) locations near and below electrical substation #3 which was on the roof of the LRA portion of the Facility; and (C) locations near electrical substation #4 which was in the northeast corner of the LRA portion of the Facility. Analysis of a sediment sample taken from the floor drain in the pump room indicated the presence of PCB contamination; however, it could not be determined if PCB contamination had or was capable of being released to the city sewer system through this floor drain. Analytical results from samples taken during the November 1993 and January 1994 investigations confirmed the presence of high levels of PCBs at and near two large PCB transformers at electrical substations #3 and #4, indicating that releases of PCBs had occurred from each transformer. Two drums of oil containing PCBs were also found near the PCB transformer at electrical substation #4. A large PCB stained area, approximately 15 feet by 40 feet in size, was discovered immediately west of the drums of PCB oil. Analytical results from samples collected also indicated that PCBs were on certain areas of the floors in the main part of the manufacturing building. As a result of the discoveries, EPA requested the LRA to immediately over pack and secure the two drums of PCB oil, restrict access to the Site and post PCB warning stickers.

The EPA conducted another Site investigation in March of 1994. The purpose of this investigation was to collect additional air, wipe and dust samples to further characterize the Site and determine the potential threat

to those individuals who were in the building on a daily basis. Analytical results from the air sampling and from fifty (50) wipe samples of the floors, walls and equipment at the facility confirmed the existence of PCBs.

In December 1995 and January 1996, EPA and its contractors conducted an Integrated Assessment Investigation in order to complete a Preliminary Assessment (PA) and Site Inspection (SI) to determine if off-site migration had occurred and to provide recommendations for further action based on the results of the PA/SI. This investigation of PCBs was based on the operational history and past investigations. The potential sources of PCBs within the facility were:

A. Transformers. One of the two 100-gallon PCB transformers was located on the roof on the western portion of the South Die Cast building (electrical substation #3). The second transformer was located on the northeast corner of the North Die Cast building (electrical substation #4). Seventeen (17) 1-gallon PCB and/or PCB containing transformers/capacitors were located inside both the North and South Die Cast buildings and the south warehouse facility.

B. Drums. Two (2) drums were staged in a room south of the South Die Cast building with PCB placarding on the drums.

C. Metal shavings. An unknown volume of metal shavings was spread throughout the Facility in both the North and South Die Cast buildings. Analytical results indicated the shavings were contaminated with PCBs, cyanide and heavy metals.

D. Smokestack/exhaust ventilation. Analysis of wipe samples collected from the smokestack/exhaust ventilation system in the North and South Die Cast buildings revealed the presence of PCBs.

E. Sumps and trenches. Five (5) sumps and/or trenches were located in the North and South Die Cast buildings. Most of the sumps contained liquids and sediments. One sump sample indicated the presence of PCBs.

F. Building material and dust. Analytical results of wipe samples and building material samples indicated areas, primarily in the die casting rooms that contained PCBs.

Based upon analytical results from samples taken during EPA's November 16, 1993 and January 6, 1994 investigations, significant PCB contamination existed outside of the Facility structures in the north parking lot area. This PCB contamination was at least partially the result of releases from a PCB transformer (electrical substation #4) located on the northeast corner of the North Die Cast building. PCB contamination in this outside area was as high as 180,000 mg/kg.

Analysis of wipe samples collected around the smokestack/exhaust ventilation areas during the Integrated Assessment Investigation indicated the presence of PCB contamination. PCBs were used during the carburetor manufacturing process as a fire retardant to keep die casting machines from overheating. The Thompsons and Pivirottos did not operate die casting machinery after they became owners of portions of the Facility property.

Based upon the November 1993, January and March 1994 investigations, and the December 1995 and January 1996 Integrated Assessment Investigation, EPA determined that concentrations of PCBs existed on all four floors of the Facility. PCBs had contaminated areas outside the building near electrical substation #4 and on the roof of the building near electrical substation #3, as well as surfaces inside the Die Cast building. Sample analytical results exceeded cleanup levels as outlined in OSWER Directive No. 9355.4-01, "Guidance on Remedial Actions for Superfund Sites with PCB Contamination" and the PCB Spill Cleanup Policy set forth in Subpart G of 40 C.F.R. Part 761.

On March 18, 1996, EPA determined that a time-critical removal action should be performed at the Site in order to reduce the immediate threat to human health and the environment posed by conditions at the Site. The basis for EPA's determination that such action was necessary and a description of the actions that needed to be taken were detailed in the Removal Action Memorandum, signed by the Regional Administrator of the EPA, Region VII on March 18, 1996.

In July 1996, EPA issued an Unilateral Administrative Order for Removal Response Activities ("UAO"), Docket Number VII-96-F-0026, pursuant to Section 106(a) of CERCLA, 42 U.S.C. § 9606(a), to Respondent, ACF. The UAO required ACF to undertake the actions identified in the March 1996 Removal Action Memorandum, which included: (A) the removal and disposal of a PCB transformer; (B) characterization, removal and disposal of all contaminated building material and debris located on the north side of the North Die Cast building; (C) characterization and disposal of the contents of the two Die Cast buildings and south warehouse, followed by the demolition of the three structures and off-site disposal of the demolition debris; and (D) the installation of an interim cover over the Die Cast buildings foundation floors following the demolition of the two Die Cast buildings and south warehouse.

In May of 1997, ACF began on-site removal actions pursuant to the 1996 UAO. The time-critical removal action required by the UAO primarily focused on the demolition and disposal of PCB and asbestos in buildings on the eastern portion of the Site. These buildings included two Die Cast buildings and the south

warehouse. The south warehouse was completely demolished, including the foundations and floor. The Die Cast buildings were partly demolished, leaving the PCB contaminated foundation walls and floors of the Die Cast buildings in place but coated with epoxy and covered with limestone aggregate. ACF has complied with the requirements of the UAO.

Since the conclusion of the UAO removal action, a portion of the walls of the Die Cast building have become exposed as the limestone aggregate has eroded away. The epoxy coating has also weathered and flaked off of the exposed concrete foundation walls that are not currently covered by the limestone aggregate.

In July 1998, EPA conducted an investigation at the Site and collected chip, wipe and water samples from the Carter Carburetor Manufacturing Building (also referred to as the CBI building), the largest remaining Site building, which was then owned by Carter Building, Inc. Results of analyses of the wipe samples collected on the first floor indicated the presence of PCBs at levels as high as 247.5 µg/100 cm² for one sample with an average wipe sample concentration inside the CBI building on the first floor of 61.5 µg/100 cm². The concrete chip sample analytical results from the first floor indicated PCB concentration as high as 858 mg/kg (parts per million) for one sample with an average chip sample concentration of 176 mg/kg. Results of analyses of two water samples collected from a pit on the first floor indicated PCB contamination at 841 and 490 µg/l. On the second floor, only one wipe sample analytical result exceeded 10 µg/100 cm² with a concentration of PCBs at 11.2 µg/100 cm². The third floor sample analytical results indicated PCB concentrations as high as 38.3 µg/100 cm² for one sample with an average concentration of 11.1 µg/100 cm².

3.3 Voluntary Site Investigations

In April 2003, ACF contracted with MACTEC Engineering and Consulting, Inc. (MACTEC) to conduct additional environmental sampling at the Site. Several soil boring samples were collected at the Site, the majority of which were collected from beneath the concrete foundation floor of the two former Die Cast buildings. The analytical results from these soil samples indicated PCB concentrations as high as 11,470 parts per million ("ppm") in the sampled subsurface area, primarily beneath the Die Cast building's concrete foundation floors. This limited investigation led to two subsequent investigations performed by MACTEC in 2005, the *"Supplemental Environmental Field Investigation for the Former Carter Carburetor Site – Former North and South Die Cast Buildings"* and *"Limited Groundwater Investigation for the Former Carter Carburetor Site"*.

3.3.1 Summary of 2005 Supplemental Field Investigation

The Supplemental Environmental Field Investigation for the Former Carter Carburetor Site was performed for ACF by MACTEC in 2005. Based on a review of previous investigation results and an evaluation of site-wide conditions, the Supplemental Environmental Field Investigation was performed for collection of the data needed to achieve the following investigation objectives at the Site:

- Describe the nature and extent of PCB impact to soil at the Site; and
- Gather necessary data to support risk assessment, and/or remediation requirements.

Between March 21 and 29, 2005, soil boring activities were completed using a track-mounted (GeoProbe®) hydraulic DPT rig. All soil borings were installed using standard direct push soil probe methodology. Direct push soil borings completed with the Geoprobe® rig were advanced using a 2.0-inch outside diameter (OD) macro-core sampler with disposable polyvinyl acetate liner and 1.25-inch OD steel probing rods

Sixty-eight (68) soil borings were installed. Sixty-one (61) of the borings were completed through the concrete floor of the former North and South Die Cast buildings (designated by boring IDs G-##-##); thirty-one (31) within the North Die Cast building footprint and thirty (30) within the South Die Cast building footprint. Three (3) soil borings (designated by boring IDs SS#-##) were collected adjacent to the northeast corner of the former North Die Cast building where the transformer for former electrical substation #4 was located. Four (4) soil borings were collected north of the former North Die Cast building (designated by TK-##) adjacent to underground storage tanks #14 and 15. Continuous soil samples were collected from each boring for field screening, lithographic description, and subsequent chemical analysis. Up to four (4) soil samples were submitted from each boring for laboratory analysis for PCBs

Twenty-five (25) concrete cores were collected from the floor of the former North and South Die Cast Buildings footprints. The concrete cores from the former North Die Cast building were designated by NCD-##; whereas the cores from the former South Die Cast building were designated by SCD-##. Soil and concrete core samples were analyzed by Pace Analytical Laboratory of Lenexa, Kansas. Each soil and concrete sample was submitted for analysis of PCB content by EPA Method 8082, which reports seven different PCB aroclors (PCB-1016, PCB-1221, PCB-1232, PCB-1242, PCB-1248, PCB-1254, and PCB-1260).

To collect the core samples, a drill rig equipped with 4.25-inch inside diameter hollow stem augers was used to loosen the compacted limestone gravel fill which overlies the former floor. The gravel was then removed

with a shovel to expose the concrete. A 4-inch diameter polyvinyl chloride (PVC) pipe was placed atop the desired sample location, backfill was placed around the outside of the pipe, and the core drill was then advanced through the pipe. The concrete core was removed from the pipe, placed into a sealable plastic bag, labeled, and forwarded to the laboratory for analysis.

The analytical results from the investigation indicated that there were significant concentrations of PCBs detected in the area of the former North and South Die Cast Buildings. For a complete review of the investigation, please refer to MACTEC's document:

MACTEC Engineering and Consulting, Inc. *Supplemental Environmental Field Investigation Report for the Former Carter Carburetor Site – PCB Delineation of the North and South Diecast Buildings, St. Louis, Missouri*, October 2005.

3.3.2 Summary of 2005 Groundwater Investigation

The Limited Groundwater Investigation for the Former Carter Carburetor Site presents the results of groundwater sampling at the Former Carter Carburetor Die Cast Buildings and Warehouse site located at 2800-2840 North Spring Avenue, St. Louis, Missouri.

The purpose of the Limited Groundwater Investigation was to characterize potential impact to groundwater at the Site; and to gather necessary data to define the groundwater flow direction and gradient.

Field Investigation Activities conducted toward this purpose included the following:

- The installation of four shallow, small diameter wells using a direct push hydraulic boring machine;
- The collection of groundwater samples from each well into sample containers which were pre-cleaned and assembled to USEPA's Protocol "B"; and
- Analysis of the samples by two outside laboratories.

Groundwater is present at the Site at depth between approximately 12 and 19 feet below ground surface which is below a typical construction worker exposure of 10 feet bgs. The groundwater gradient was calculated approximately 0.0155 feet per foot to the southeast, away from the Herbert Hoover Boys and Girls Club.

Based on the results of the laboratory analyses and a review of previous investigations conducted at the site, MACTEC concluded that groundwater should be excluded in future exposure modeling and sampling.

PCBs were not detected in the groundwater samples collected from the four wells installed for this Limited Groundwater Investigation. Low concentrations of VOCs were detected in samples collected from all four monitoring wells. The presence of cis-DCE and vinyl chloride in addition to TCE indicates that natural biodegradation of chlorinated hydrocarbon compounds is occurring.

The Limited Groundwater Investigation report noted that VOCs were not detected in previous groundwater sampling by EPA at a location just north of the Site (50 feet), or in the background sample collected in Fairground Park (approximately 5 blocks north of the Site). No PCBs or other contaminants attributable to the Site were detected by EPA in five water samples collected from four private water faucets at different locations in proximity to the Site

The Site is located in a commercial/ industrial urban area, with development in the area dating to at least the late 1800's. The groundwater pathway was scored as a zero by Ecology and Environment, Inc. (E & E) for the US EPA during the Preliminary Assessment/Site Inspection (Memorandum from E &E to Paul Doherty of EPA dated April 6, 1996). No groundwater targets were identified within a 4-mile radius of the Site and there are not any receiving streams within a one-mile radius of the Site. A review of aerial photos, USGS topographic maps, and the USDA NRCS (SCS) soil survey indicate that the nearest receiving stream is the Mississippi River, located approximately two miles northeast of the facility. Surface stormwater runoff within the area is directed to the MSD sewer system, with treatment and discharge at the Bissel Point Plant. Potable water supplies within St. Louis City and County are obtained from the Mississippi and Missouri Rivers, with intakes upgradient and greater than two miles from the Site. Wells identified by a well search of the Missouri Department of Natural Resources database within a 2-mile radius of the site were all industrial use, installed between 1904 and 1936. The nearest well to the Site (approximately 1,100 feet to the east) was installed in 1915 and plugged and abandoned with a note of saline groundwater. Literature indicates that the water quality of the uppermost bedrock aquifer is likely poor and not suitable as potable water.

Based on these results and the planned future use of the former Die Cast Buildings portion of the Site, MACTEC concluded that groundwater should be excluded from future exposure modeling and sampling.

The completed groundwater investigation report can be found in MACTEC's document:

MACTEC Engineering and Consulting, Inc. *Limited Groundwater Investigation Report for the Former Carter Carburetor Site St. Louis, Missouri, October 2005.*

4.0 Initial Evaluation

4.1 Potential On-Site Chemicals

4.1.1 Chemicals of Concern

The AOC and Site historical records indicate that the following chemicals are present onsite in concentrations sufficient to be of anticipated concern to EPA**;**

- PCBs,
- Total Petroleum Hydrocarbons (TPH),
- Trichloroethylene (TCE),
- BTEX
  - Benzene,
  - Toluene,
  - Ethyl Benzene, and
  - Xylene

PCBs originated from the PCB –containing oils which were used as dielectric fluids in the manufacturing process on site (See Section 3.0). TCE was an industrial cleaning solvent reportedly used on site. TPH and BTEX resulted from fuels (diesel fuel and gasoline) and waste oils associated with the application of dielectric fluid and other industrial oils in the manufacturing process onsite.

PCBs are a group of man-made organic chemicals which chlorinate the biphenyl molecule to varying degrees. PCBs are suspected carcinogens. They are typically mixed with oily liquids and are found with mixtures of different compounds rather than as a single compound. In the United States, PCBs were known by a variety of industrial trade names such as Aroclor. The Aroclor name was followed by an identifying four digit number which serves to identify the degree of chlorination of the compound. PCBs are very stable compounds. They do not easily degrade due to temperature, aging, or microbial activity. PCBs have a high viscosity which is a function of the extent of chlorination. PCBs are not considered volatile at ambient temperature. They also have no odor in their pure form; however, an odor is typically present because PCBs are usually encountered as a mixture with other chemicals.

4.1.2 Location of PCBs

PCB residuals from past operations are expected to be found within the building on floors and/or walls where PCB oil spills or releases may have occurred. As previously noted, manufacturing operations were located in the former North and South Die Cast Buildings and the first floor of the CBI building. Based on information contained in previous reports, possible PCB residual may also be found on concrete walls on the first floor due to drum storage. Possible PCB residual may be present on the second and third floors of the CBI building due to transfer by foot traffic during post operational periods after the sale of CBI Building by Carter Carburetor. The extent of contamination at the CBI Building Site has been evaluated by previous EPA inspections. PCBs have been detected on the first, second and third floors. Soil located in front of the building's two loading docks and the entrance was also sampled previously. PCBs were detected in these soil samples. Air samples have previously been taken; however, PCBs were not detected. Previous TSCA Inspection Reports noted that PCB-containing oil was stored in a fuel oil tank located in the basement and that this tank is reported to have been emptied and cleaned. PCB may be found in this tank or elsewhere in the basement.

Numerous cleanup methods have been attempted on portions of the Site building. According to available records, PCBs have been detected after the latest clean-up attempt. Data had previously been collected at the Site during EPA inspection and enforcement activities. Not all previously collected data will be used to characterize and evaluate the current Site condition. The available data was evaluated based on three factors to determine whether it was appropriate to characterize the current Site. Data was only used to evaluate the current Site condition when meeting the following three criteria:

The data was collected after all cleanup activities had been completed.

Information exists indicating the data went through a Quality Assurance and/or Quality Control (QA/QC) process.

The location where the sample was collected is known.

Data which meets all three criteria is considered appropriate to characterize the current site condition is shown in Table 4-1.

Data which did not meet the three criteria is still used to help understand PCB impact throughout the Site. This data, however, will not be used as a basis for current or future Site characterization purposes.

4.0 Initial Evaluation

4.1 Potential On-Site Chemicals

4.1.1 Chemicals of Concern

The AOC and Site historical records indicate that the following chemicals are present onsite in concentrations sufficient to be of anticipated concern to EPA**;**

- PCBs,
- Total Petroleum Hydrocarbons (TPH),
- Trichloroethylene (TCE),
- BTEX
  - Benzene,
  - Toluene,
  - Ethyl Benzene, and
  - Xylene

PCBs originated from the PCB –containing oils which were used as dielectric fluids in the manufacturing process on site (See Section 3.0). TCE was an industrial cleaning solvent reportedly used on site. TPH and BTEX resulted from fuels (diesel fuel and gasoline) and waste oils associated with the application of dielectric fluid and other industrial oils in the manufacturing process onsite.

PCBs are a group of man-made organic chemicals which chlorinate the biphenyl molecule to varying degrees. PCBs are suspected carcinogens. They are typically mixed with oily liquids and are found with mixtures of different compounds rather than as a single compound. In the United States, PCBs were known by a variety of industrial trade names such as Aroclor. The Aroclor name was followed by an identifying four digit number which serves to identify the degree of chlorination of the compound. PCBs are very stable compounds. They do not easily degrade due to temperature, aging, or microbial activity. PCBs have a high viscosity which is a function of the extent of chlorination. PCBs are not considered volatile at ambient temperature. They also have no odor in their pure form; however, an odor is typically present because PCBs are usually encountered as a mixture with other chemicals.

4.1.2 Location of PCBs

PCB residuals from past operations are expected to be found within the building on floors and/or walls where PCB oil spills or releases may have occurred. As previously noted, manufacturing operations were located in the former North and South Die Cast Buildings and the first floor of the CBI building. Based on information contained in previous reports, possible PCB residual may also be found on concrete walls on the first floor due to drum storage. Possible PCB residual may be present on the second and third floors of the CBI building due to transfer by foot traffic during post operational periods after the sale of CBI Building by Carter Carburetor. The extent of contamination at the CBI Building Site has been evaluated by previous EPA inspections. PCBs have been detected on the first, second and third floors. Soils under the former North and South Die Cast Buildings were also sampled previously by MACTEC. PCBs were detected in these soil samples.

None of the data previously collected by the EPA will be used to characterize and evaluate the current Site condition. The only data to be used will be the data collected by MACTEC in 2003 and 2005 that meet the requirements of 40CFR761 (PCB Mega Rule). Data which do not meet the PCB Mega Rule criteria will still be used to help understand PCB impact throughout the Site. These data, however, will not be used as a basis for current or future Site characterization purposes.

4.2 Potential Exposure Media

4.2.1 Interior Surface

Interior surfaces of the building such as floors and walls are the most likely exposure media. Previous sampling events have indicated PCB exposure potential on floors based on concrete drill chip samples and wipe samples. The floors are on average four inches thick on the top three floors and six inches thick on the bottom floor (concrete on grade). The concrete drill dust samples characterized the top one half of an inch. The wipe samples measured surface concentrations only.

4.2.2 Surface Water

For the following reasons, surface water is not an expected exposure medium. Current releases to surface water at the Site have not been documented. Surface water releases, if occurring, would be limited to periods of rainfall. Only surface soil erosion may cause PCBs to be transported in sediment downgradient of the Site, but would not be expected to affect the water quality of surface

waters within the watershed or the Mississippi River. The building occupies most of the Site and a parking lot and limestone cap covers the remaining area of the Site. Exposure concerns downgradient of the Site would most likely be limited to direct contact to contaminated sediments which are generally not present since runoff surfaces are generally sloped, covered in semi-permeable materials, and flow to storm sewer inlets.

4.2.3 Groundwater

Groundwater is not an anticipated exposure medium at the Site due to the low mobility and solubility of PCB compounds. In addition, most surfaces at or around the Site are paved, limiting the ability of PCBs to reach the soil where it could impact the groundwater.

4.2.4 Air

Dust may be a potential exposure medium within the building. Some potential for dust releases will exist as long as dust generating activities occur on the Site. Vapor releases from the Site are expected to be limited by the low volatility of PCBs and the number of years since any releases may have occurred.

4.2.4 Soil

Only small areas around the Site are unpaved. The potential for direct contact to the soil is currently restricted by the limited soil surface.

4.3 Risk Assessment

Risk assessment calculations for the former North and South Die Cast buildings were performed to determine the appropriate cleanup level for PCBs. These data were submitted to the EPA for review. Once the risk assessment has been approved by the EPA for the soil cleanup value for the former North and South Die Cast Buildings, a remedy for the contaminated soil will be evaluated. With regard to the CBI Building, a commercial/industrial future use scenario will be assumed in order to calculate the PCB cleanup levels. The method and calculations will be approved by the EPA. As future sampling activities are completed, the newly collected data and the previously collected useable data will be used to determine appropriate future removal actions, if any, that should be taken.

5.0 Data Collection

5.1 Introduction

The purpose of collecting additional data at the Site is to determine the appropriate removal action for the Site. Previous risk assessment calculations have shown that current PCB concentrations in the vicinity of the former North and South Die Cast Buildings exceed the calculated and approved cleanup levels. Data will be collected for three purposes: l) to more accurately identify the location of PCBs within the Site; 2) to evaluate potential treatment technologies; and 3) to provide information for disposal of contaminated material removed as a part of any removal action.

This section describes the following: the different types of samples to be collected at the Site; and sampling activities planned for subsurface soil and each interior floor. The anticipated total number and types of samples planned to be collected during the investigation are summarized in Table 5-2. Using a biased and random sample selection method on the floors, a random selection on the walls, preliminary conceptual estimates are that 133 concrete core samples, 40 brick chip samples and 42 subsurface soil samples will be collected at the Site for laboratory analysis. The number of samples collected for laboratory analysis may be modified during field activities based on observed Site conditions. This number does not include samples collected for quality control/quality assurance purposes or structural assessment samples.

All samples collected during the SC Work Plan will be analyzed for PCBs. All soil samples submitted for laboratory analysis from the Site will also be analyzed for Volatile Organic Compounds (VOCs) Polyaromatic Hydrocarbons (PAHs), and RCRA Metals. Analysis will be conducted using a Contract Laboratory Program laboratory. If additional samples are obtained for laboratory analysis, the parameters selected for analysis will be consistent with requirements of the AOC.

The proposed sample locations are shown in Figures 5-2 through 5-7. Field modifications to the proposed locations or the selection of additional sampling locations may be necessary based on field observations. Any such modifications will be documented in the SCE Report.

5.2 Types of Samples

Three different media will be sampled during the field investigation in order to characterize any impact: concrete, brick, air, and soil/sediment. In addition to structural assessment samples, the following eight types of samples may be collected to characterize contamination at the Site:

Composite Brick Chips
Concrete Cores
Subsurface Soil

5.2.1 Composite Brick Chip Samples

The purpose of composite brick chip samples is to characterize PCB impact in the top one inch of the walls. Table 5-1 gives a summary of the numbers and types of proposed samples.

The purpose of wall composite brick chip samples is to characterize any impact resulting from drum storage along the walls. The collection of wall composite brick chip is also on a grid system. The sampling area will be randomly determined by utilizing DOE's Visual Sample Plan (VSP) software model, Version 4.0 or later. Twenty samples will be collected on the first floor, ten each on the second and third floors.

The most likely location of PCB impact on the walls would be where regular storage of drums would have occurred, primarily the first floor. The most probable location for drum storage would be along exterior walls. In addition to sampling the exterior walls within the CBI building, four wall samples (included in the 20 first floor samples) will be collected along the internal loading dock area on the first floor. These samples will be collected to assess any PCB impact that might have occurred while transferring drums onto the interior loading dock. All composite brick chip samples will be analyzed for PCBs.

5.2.2 Concrete Core Samples

The purpose of concrete core samples collected from the floor is to characterize PCB impact throughout the entire depth of the concrete. The probability of locating PCB impact at depth increases with the identification of increased surface impact. A biased and random investigation approach will be used to determine the location of the concrete core samples. Previous concrete wipe and chip data (Ecology and Environment, Inc.,*"Sampling Results for the Carter Carburetor Site, St. Louis, Missouri"* January 27, 1999) was reviewed to determine the potential for PCB contamination in the first, second and third floors of the CBI building. In May and June, 2005, MACTEC personnel surveyed the interior of the existing CBI building to establish the building lines and column locations. The building lines and columns locations were surveyed conventionally on a random

coordinate system. The data was used to establish a GIS drawing of the CBI building in order to develop a sample composite scheme. Three classifications of PCB concentration potential were generated based on the review of historical data: high, medium and low. Each area of probability is denoted by color on the sample scheme maps (Figures 5-2 thru 5-4). Areas of high probability for PCBs are denoted in red, medium in yellow and low in green. For the areas within the CBI building that were determined to have a high or medium probability of PCB contamination greater than 50 mg/Kg, a biased sampling approach was taken. Composite grids for areas of high probability (red areas) will have two discrete concrete cores samples taken from a biased sampling approach. Composite grids for areas of medium probability (yellow areas) will also have two discrete concrete cores samples taken from a biased sampling approach. The difference in between the two is the amount of floor area each composite sample covers. For areas determined to have a low probability (green areas) of PCB contamination (<50 mg/Kg), a random sampling approach based on VSP was taken. One concrete core sample will be taken in each composite area.

On the first floor, concrete cores will be collected within each composite area (Figure 5-2). The concrete cores will be two inches in diameter and should penetrate the full thickness of the concrete floor, which is estimated to be six inches. For each core, the top one inch will be collected and composited according to the sample composite scheme. Then the remainder of the core will be spilt in half (middle and bottom) and composited according to the sample composite scheme. For example, a collected core sample that is six inches thick would result in three different aliquots which would be composited. Each concentration would be correlated to a certain depth interval in the concrete. All concrete core samples will be analyzed for PCBs.

Based on historical analytical data, high concentrations of PCBs are not anticipated to be detected. Therefore, on the second and third floors, it is anticipated that only the first inch of concrete will be cored and sampled. If it is not possible to sample only the first inch of concrete, a concrete core sample of the full thickness of the floor (anticipated four inches) will be collected. Samples will be composited according to the composite scheme as denoted in Figure 5-3 and 5-4.

5.2.3 Subsurface Soil Samples

The purpose of subsurface soil samples is to evaluate any impact that PCBs may have had on the subsurface soils beneath the CBI building. All subsurface soil samples will be discrete samples collected using a direct push method such as a Geoprobe from above the water table. Soil materials will be classified using USCS soil classification system. Subsurface soil samples will be collected at four feet intervals. All subsurface soil samples will be analyzed for VOCs, PAHs, PCBs and RCRA Metals.

5.2.6 Structural Assessment Samples

The purpose of collecting structural assessment samples is to obtain information regarding the structural makeup of the building that would be needed if the final selected removal action required demolition or partial removal of the building. Sample and test locations will be submitted to EPA for review prior to sampling or testing. All sampling and testing will be performed by a structural engineer registered in Missouri.

5.2.7 Air Samples

The purpose of air sampling is to evaluate the current Site condition. Air samples will be collected before sampling activities are conducted. Air samples from the breathing zone will be sampled on the first three floors of the building using portable pumps and filters. The exact locations of the air samples will be determined by risk assessment personnel in the field. Using the same procedures, three types of air samples will be collected. These are: Total suspended particulate; PCB concentration in suspended particulate; and Vapor phase PCBs. Two separate, but identical personal air sampling pumps will be required; one for the total suspended particulate analysis and the other for the latter two analyses. All samples will be collected using National Institute for Occupational Safety and Health (NIOSH) methodology. Air samples will be analyzed for total suspended particulate, PCB concentration in suspended particulate, and vapor phase PCBs.

5.3 Exterior Samples

During the previous investigations in 2003 and 2005, ACF evaluated the subsurface conditions surrounding the CBI building in detail, specifically the soils underneath the former North and South Die Cast Buildings, the underground storage tanks (USTs) and underground piping that was identified. Additionally, the former Pydraul UST and waste PCB oil USTs located in the North Parking Lot were investigated. Please refer to MACTEC reports for a complete summary of the investigations:

MACTEC Engineering and Consulting, Inc. *Final Environmental Field Investigation Report for Former Carter Carburetor Site St. Louis, Missouri Facility,* August 2003.

MACTEC Engineering and Consulting, Inc. *Supplemental Environmental Field Investigation Report for the Former Carter Carburetor Site – PCB Delineation of the North and South Diecast Buildings, St. Louis, Missouri*, October 2005.

MACTEC Engineering and Consulting, Inc. *Limited Groundwater Investigation Report for the Former Carter Carburetor Site St. Louis, Missouri, October 2005.*

5.3.1 Subsurface Soil Samples

Exterior subsurface impacts will be evaluated through collection of subsurface soil samples. The most

probable location for potential impact is where spills allegedly occurred. Subsurface soil samples will be collected at possible previous spill locations, close to or at the same location as the surface soil samples. The subsurface soil sampling will allow classification of soil types, screening of the vertical soil profile for physical evidence of chemicals and collection of a subsurface soil sample for analysis from each sampling location.

Soil samples will be collected in the immediate vicinity of the former trichloroethene (TCE) tank located on the west side of Spring Street. At this location, four (4) subsurface soil samples will be collected and analyzed for trichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, and vinyl chloride. The approximate location of the TCE UST is depicted in Figure 5-5. The sample locations will be identified in the field once the actual location of the TCE UST is determined.

5.4 Interior Samples

5.4.1 CBI Building

5.4.1.1 First Floor

The main area of the first floor was used primarily for manufacturing during Carter Carburetor operations within the CBI Building. Additionally, this area it may have been used as a staging area for receipt of incoming materials. It also has been reported that this area may have been used for drum storage as well following cessation of Carter Carburetor operations onsite. Concrete chip and wipe samples have been collected previously by EPA from the first floor of the CBI Building. Concrete chip samples yielded PCB concentrations ranging from 3.5 to 858 mg/Kg (ppm); and wipe samples ranged from 0.84 to 5560 µg/100 cm^2.

For the SC sampling program, concrete core samples will be collected from the floors and the stairwells to characterize the extent of PCBs in the concrete (see Figure 5-2). One hundred twenty-eight (128) concrete core samples will be collected. All core samples will have the first 1-inch analyzed which will result in collection of sixty-eight (68) concrete composite samples (see discussion in Section 5.2.2). Based on the results of the top 1-inch composite samples, up to an additional one hundred thirty-six (136) composite samples could be analyzed. Twenty (20) brick chip samples will be collected randomly as determined by VSP along the walls and receiving area on the first floor. All stairwell locations, which will be determined in the field, will be composite sampling locations. All sampling will be based on the random VSP model. Sampling will be on stairwell landings between floors. Where landings are not present between floors, the samples will be collected outside the door on the subject floor. New walls will not be sampled.

5.4.1.2 Second Floor

Previous sampling results for the second floor yielded PCB concentrations ranging from 0.43 to 51.5 µg/100cm^2. Proposed sample locations are shown in Figure 5-3. It is anticipated that only the top 1-inch of concrete will be cored and sampled. Thirty-three concrete core samples will be collected and submitted for analysis. Since the second floor is considered to have a low probability of PCB contamination, all of the composite grids only dictate one (1) sample for analysis. All samples collected will be analyzed for PCBs.

5.4.1.3 Third Floor

Previous sampling results for the third floor yielded PCB concentrations ranging from 1.68 to 141 µg/100cm^2. Proposed sample locations are shown in Figure 5-4. It is anticipated that only the top 1-inch of concrete will be cored and sampled. Forty-five concrete core samples will be collected and twenty-seven (27) composite samples will be submitted for analysis. The majority of the third floor is considered to have a low probability of PCB contamination. The west side of the third floor has a medium probability of PCB contamination. Two concrete core samples will be collected from each composite grid area and composited into one sample to be submitted for analysis. All samples collected will be analyzed for PCBs.

5.5 Surrounding Area Surveys

In addition to the collection of media samples for characterization of chemical constituents, additional information will be gathered from the neighborhoods surrounding the Site. These surveys will provide demographic information, locations of potentially sensitive human receptor groups, possible well locations, and surface water drainage characteristics.

Population surveys will be performed by a visual survey of residences, schools, and businesses within a 1-mile radius of the Site. Residence information will be compared to census data to estimate the total population within the vicinity of the Site. Human population data within a 1-mile radius of the Site will be obtained from the EPA. Population numbers will be calculated using 1990 census data. Census block's within the 1-mile radius of the Site will be summarized by the EPA's Geographical Information System. Some blocks may intersect the 1-mile radius and will be either counted or discounted using the block centroid (geometrical center). Whole blocks with centroid within the 1-mile radius boundary will be counted and whole blocks with centroid outside the range will be excluded from the population estimate.

Sensitive population concerns will be assessed by noting the locations of schools, hospitals, and recreational areas within the 1-mile survey area. Sensitive receptor sites such as schools, day care centers, food processing plants, restaurants, etc., will be surveyed from a vehicle. The geographical relationship of all sensitive receptor sites will be displayed.

The groundwater use survey will be based on water connection records obtained from the City of St. Louis, Missouri and from the state. City records will be reviewed in an effort to identify residences not connected to the public water supply system. City cross-connection requirements will also be evaluated to determine whether residences may be connected to the private and municipal water systems. Residences potentially utilizing private water sources, such as wells, will be identified in the SCE Report.

5.6 INVESTIGATING RESPONSE TECHNOLOGIES

Potential response technologies applicable to the Site will be investigated. Currently four general response technologies have been identified — in-situ treatment, solvent wash, scarification and demolition.

6.0 Schedule

Subsequent tasks to those described within the RSE Work Plan are projected for the remainder of the activities listed in the AOC. These activities have been estimated as to the duration and approximate relative location to other tasks. The projected schedule is indicated in Figure 6-1.

7.0 REFERENCES

United States Environmental Protection Agency, Region VII. *Administrative Settlement Agreement and Order on Consent for Removal Action*, in the matter of: Carter Carburetor Site, St. Louis, Missouri, September 29, 2005

Shannon & Wilson, Inc. F*inal Report. Carter Carburetor Site 2837 to 2853 North Grand Avenue St. Louis, Missouri CERCLA Docket #VII-96-F-0026*, October 1998.

United States Environmental Protection Agency, Region 7. *Engineering Evaluation/Cost Analysis for the Carter Carburetor Site, St. Louis, Missouri*, November 1998.

Ecology and Environment, Inc. *Sampling Results for the Carter Carburetor Site, St. Louis, Missouri*, January 1999.

Ecology and Environment, Inc. *Revised Draft Engineering Evaluation/Cost Analysis for the Carter Carburetor Site St. Louis, Missouri*, July 2000.

MACTEC Engineering and Consulting, Inc. *Final Environmental Field Investigation Report for Former Carter Carburetor Site St. Louis, Missouri Facility,* August 2003.

MACTEC Engineering and Consulting, Inc. *Supplemental Environmental Field Investigation Report for the Former Carter Carburetor Site – PCB Delineation of the North and South Diecast Buildings, St. Louis, Missouri*, October 2005.

MACTEC Engineering and Consulting, Inc. *Limited Groundwater Investigation Report for the Former Carter Carburetor Site St. Louis, Missouri, October 2005.*

Lutzen, E. and J. Rockaway. 1971. *Engineering Geology of St. Louis County, Missouri.* Engineering Geology Series No. 4.

Miller, D., et al. 1974. *Water Resources of the St. Louis Area, Missouri*. USGS and Missouri Geological Survey and Water Resources.

Tables

Table 5-1

Quality Assurance/Quality Control (QA/QC) Sample Summary
Carter Carburetor Site, St. Louis, Missouri

Matrix	Number of Samples	Analytical Parameter	Field Duplicates[a]	Equipment Blanks[b]	MS/MSD/D[b]
Concrete					
Site	133	PCBs	7	7	7
Brick Chips					
Site	20	PCBs	1	1	1
Subsurface Soil					
Site	38	PCBs VOC PAHs RCRA Metals	2		2

Notes:
MS/MSD/D matrix spike/matrix spike duplicates/duplicates
[a] Number of duplicates figured on 5 percent of total number of samples for each medium and analyte.
[b] Number of equipment blank and matrix spike/matrix spike duplicate samples figured on 5 percent of total number of samples for each medium and analyte list.
PCBs – Polychlorinated biphenyls
VOCs – Volatile Organic Compounds
PAHs – Polynuclear Aeromatic Hydrocarbons
RCRA – Resource Conservation and Recovery Act

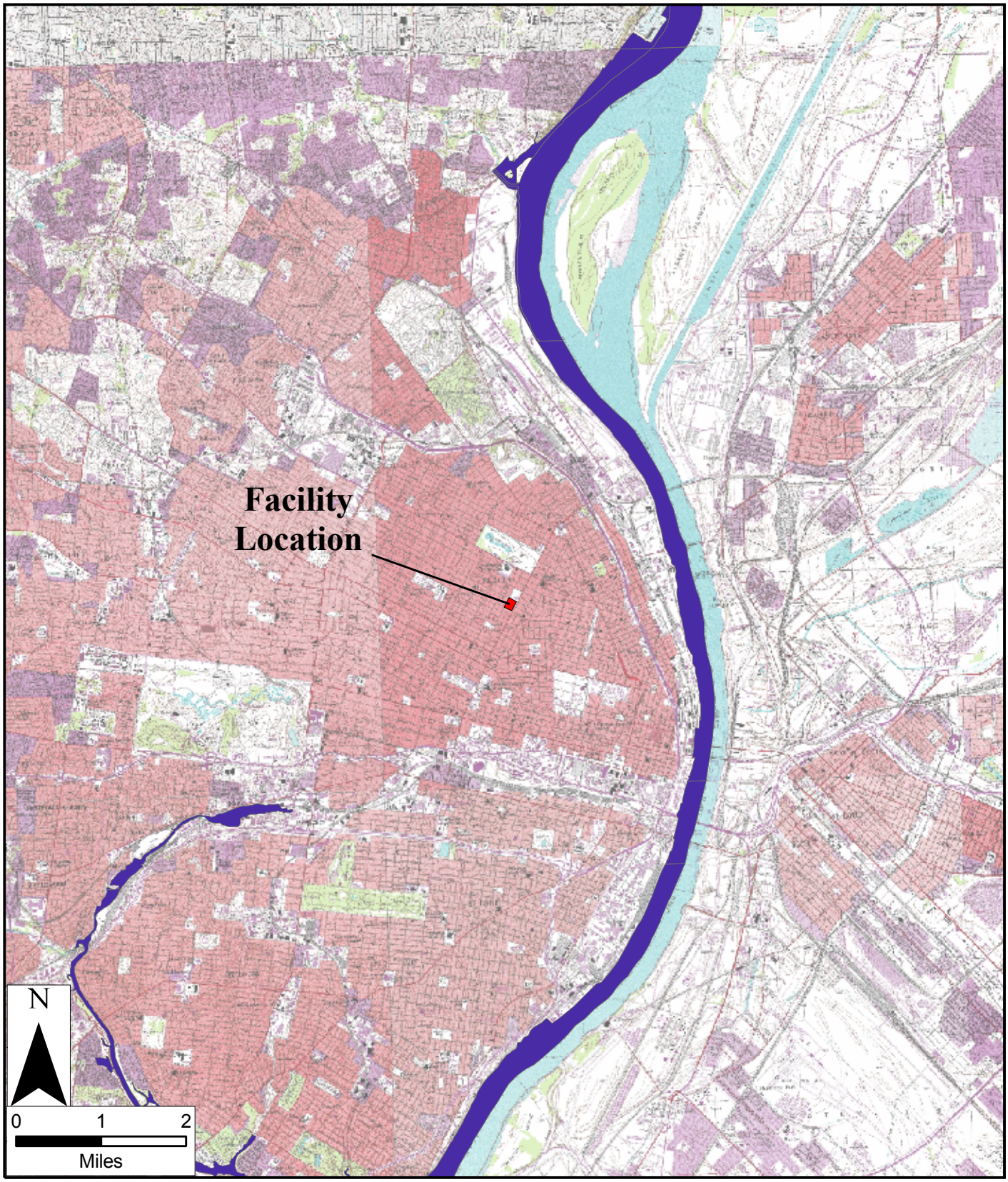
Table 5-2

Analytical Sample Summary
Carter Carburetor Facility, St. Louis, Missouri

Field Parameters	Analytical Methodology	Number of Samples
Concrete		
Polychlorinated biphenyls (PCBs)	SW-846 8082	154
Brick Chips		
Polychlorinated biphenyls (PCBs)	SW-846 8082	23
Subsurface Soil		
Polychlorinated biphenyls (PCBs) Volatile Organic Compounds (VOCs) Polynuclear aeromatic hydrocarbons (PAHs) RCRA Metals	SW-846 8082 SW-846 8260B SW-846 8270C SW-846 6010 or 6020	42

Notes:
RCRA – Resource Conservation and Recovery Act

Figures



Legend

- Facility Location
- 100 Year Floodplain

Drawn By: BSM Approved by: EMW

Checked By: DLB Date: December 2, 2005

MACTEC

Figure 2-1
Former Carter Carburetor Site
100-year Floodplain Map
St. Louis, Missouri

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Legend

Facility Location

Drawn By: BSM Approved by: EMW

Checked By: DLB Date: December 2, 2005

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Figure 2-2
Former Carter Carburetor Site
Facility Location Map
St. Louis, Missouri

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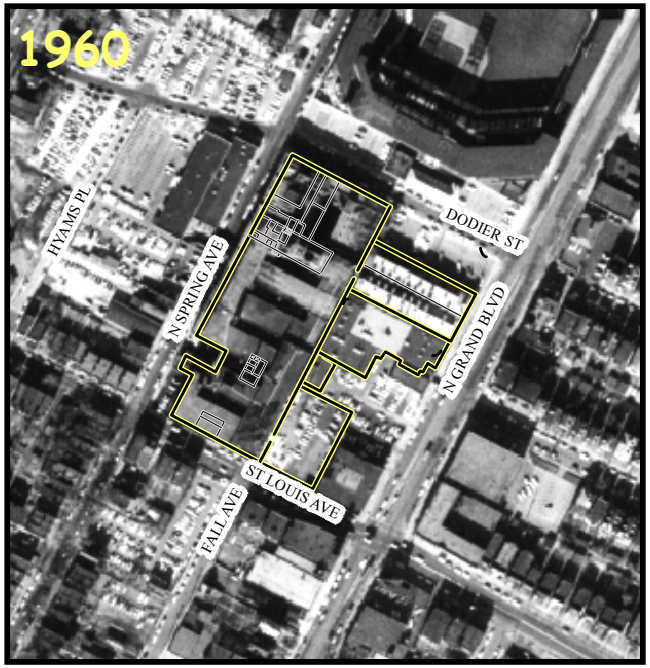

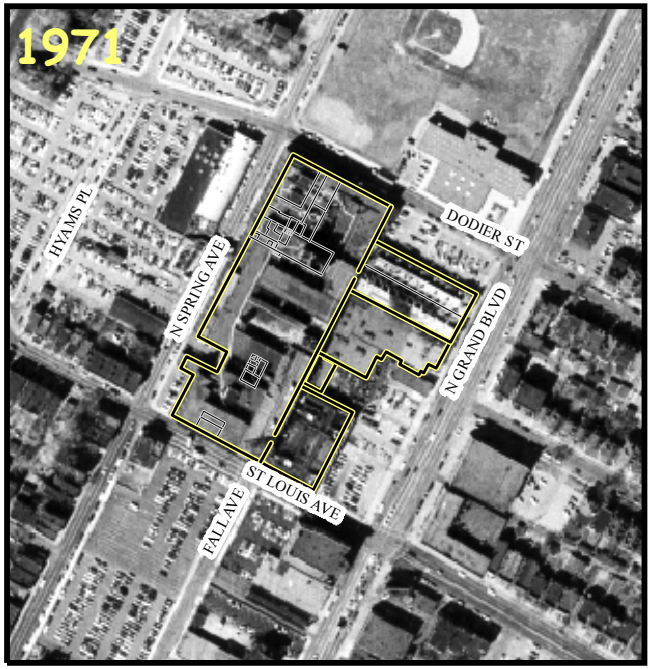

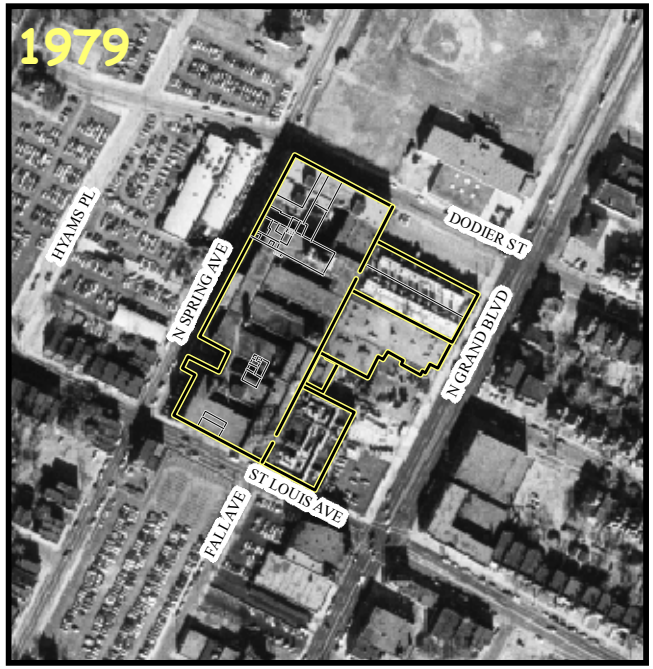

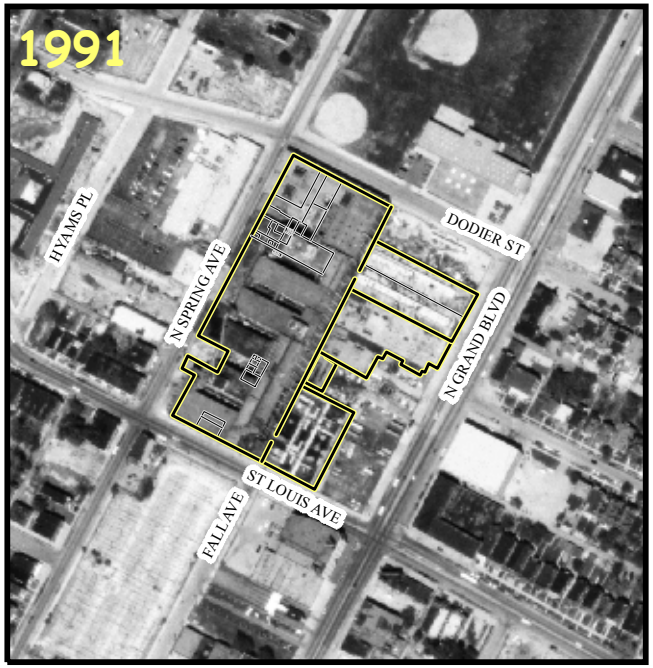

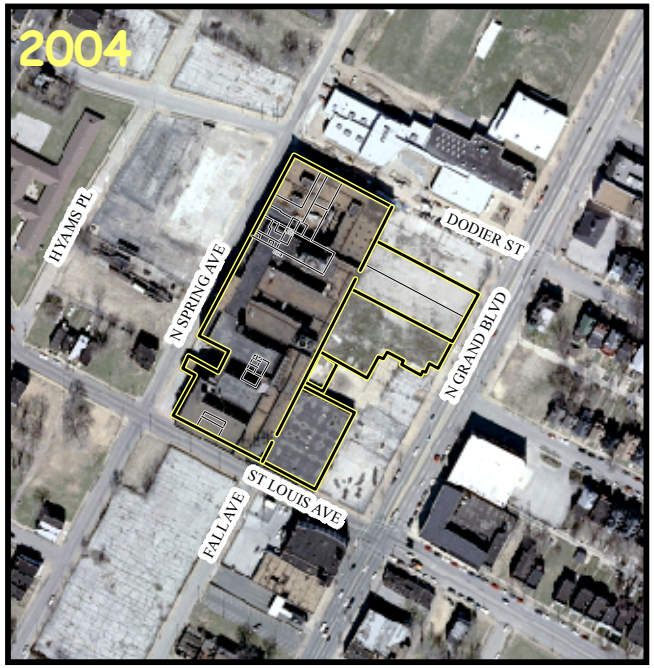

Figure 2-3
Former Carter Carburetor Site
Historical Reference
(1960, 1971, 1979, 1991, & 2004)

Legend

Exterior Building Wall

N
W E
S

0 125 250 500 Feet

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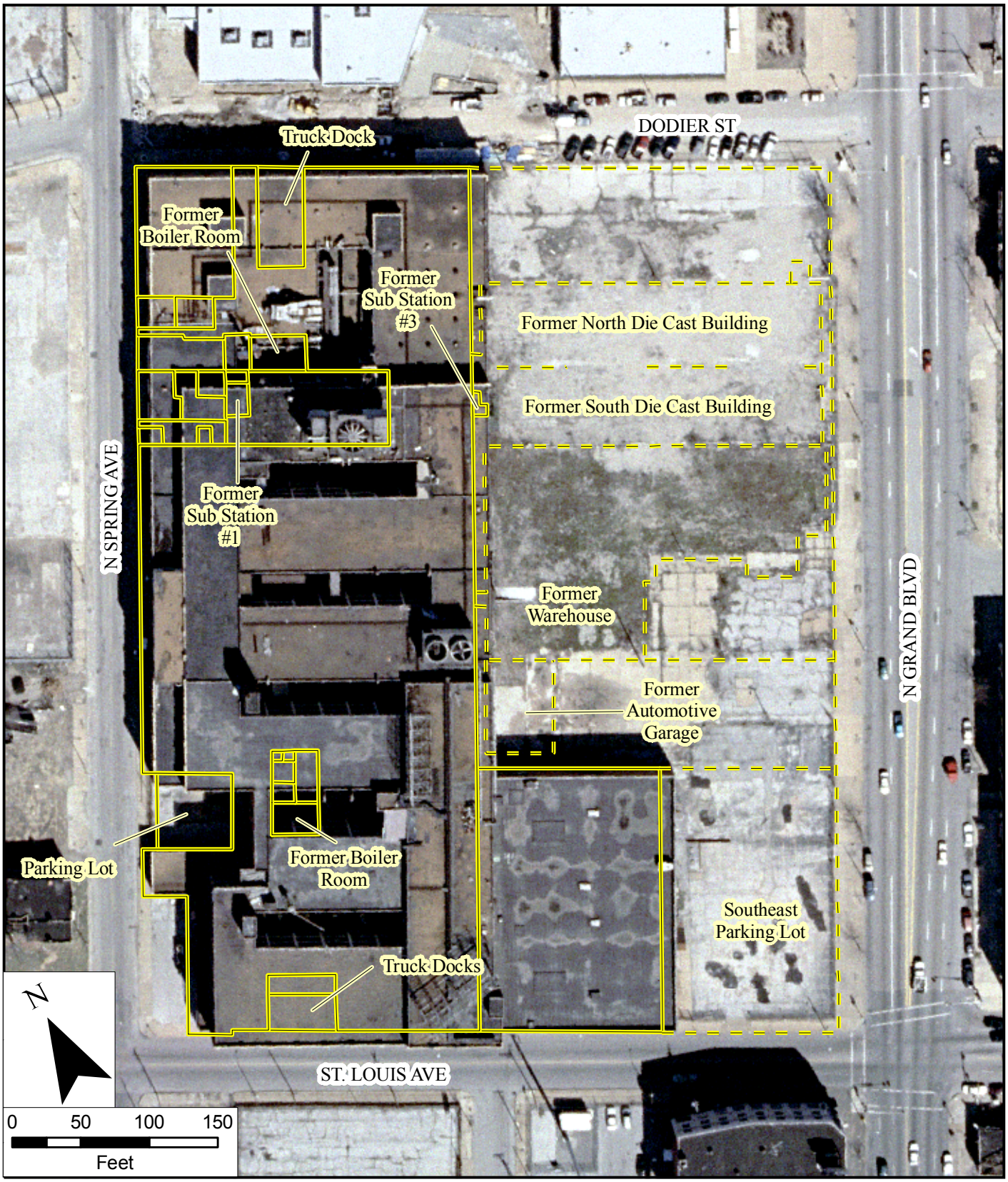

Legend

Current Building Extent

Former Building Extent

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Figure 5-1
Former Carter Carburetor Site
Site Layout
St. Louis, Missouri

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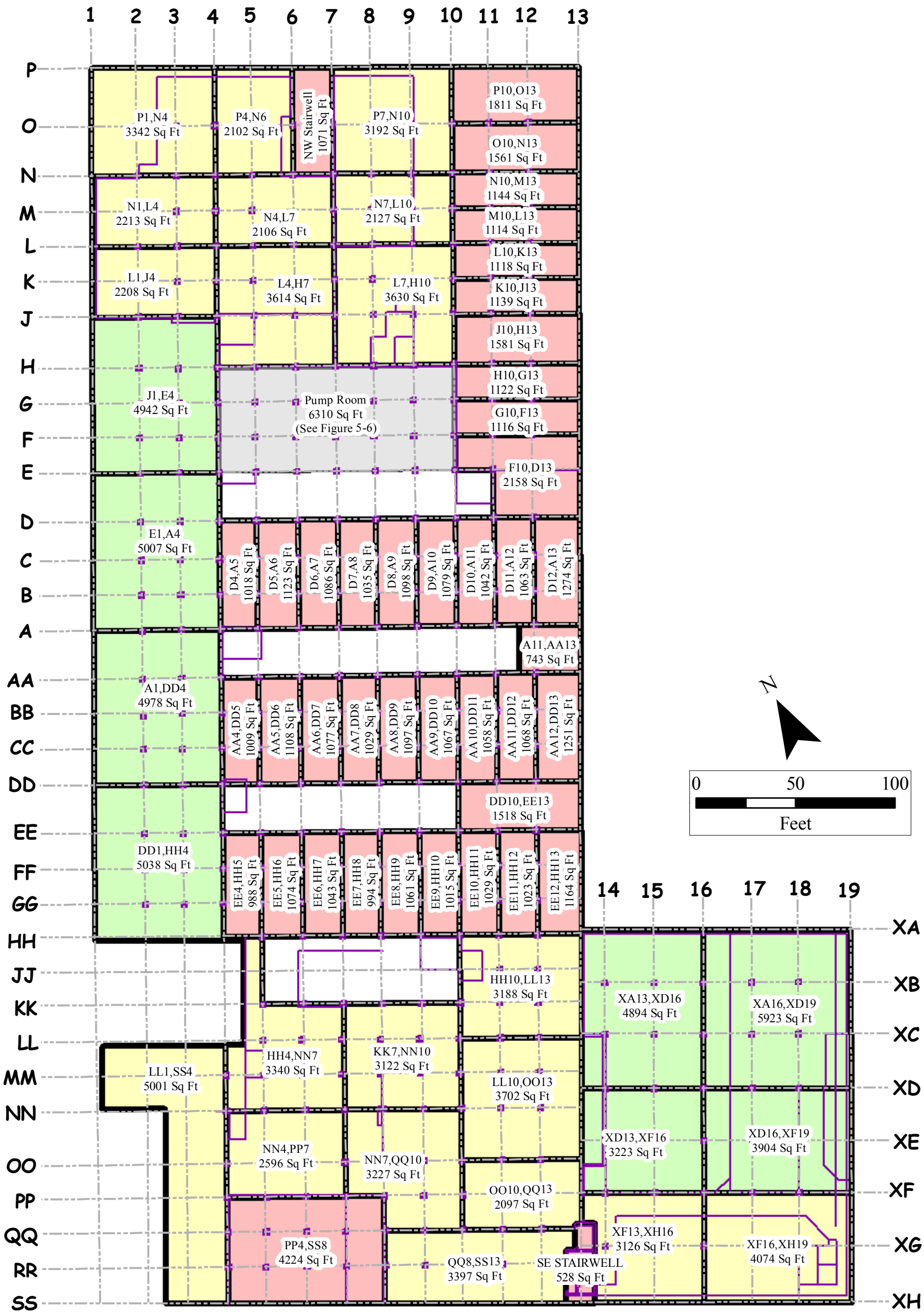

Legend

- Building Column

PCB Potential / Sample Area

- HIGH
- MEDIUM
- LOW

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Checked By: DLB Date: December 1, 2005

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Figure 5-2
Former Carter Carburetor Site
Composite Grid
Proposed 1st Floor
Concrete Core Samples
St. Louis, Missouri

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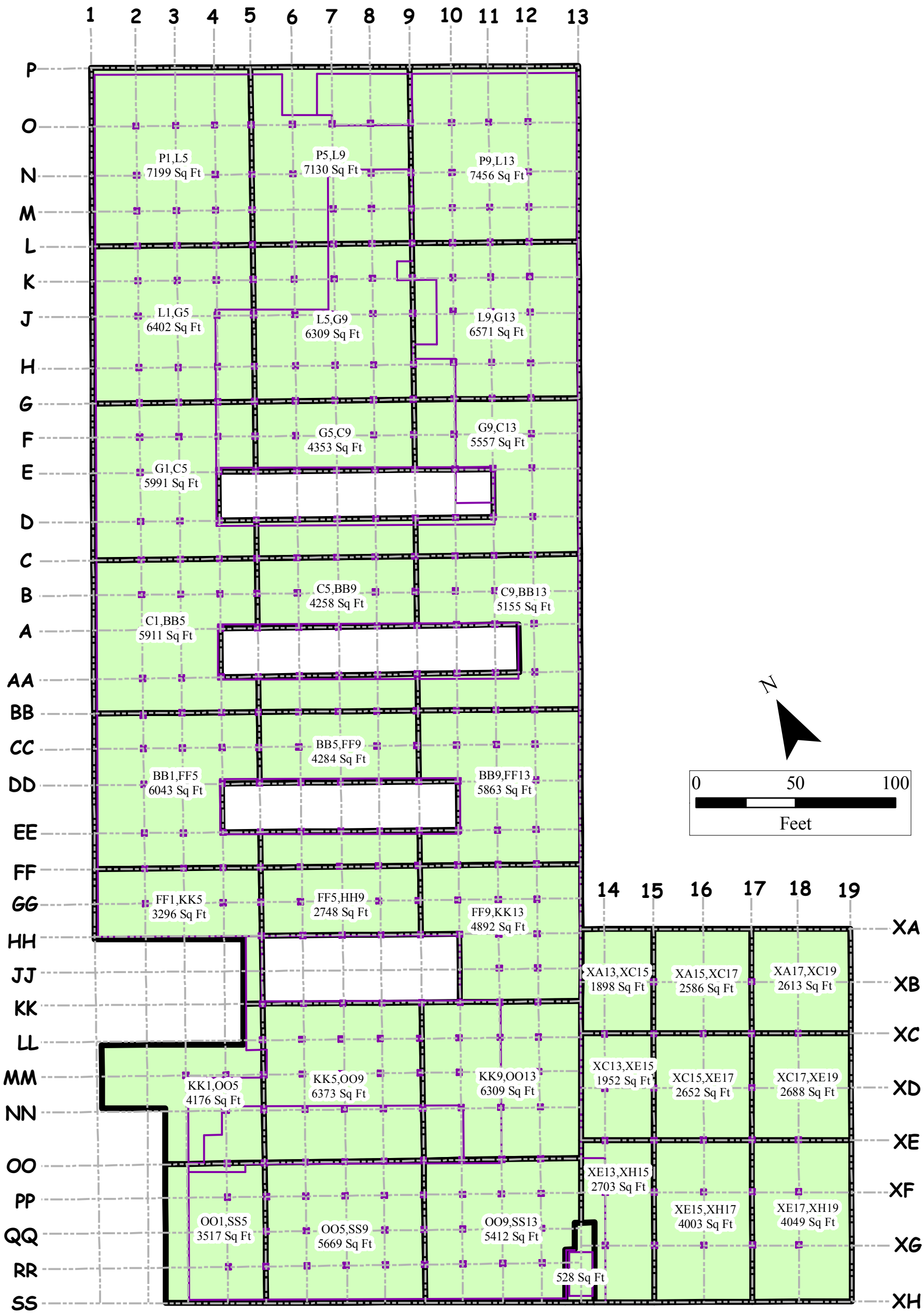

Legend

- Building Column

PCB Potential / Sample Area

- HIGH
- MEDIUM
- LOW

Drawn By: BSM Approved by: EMW

Checked By: DLB Date: December 1, 2005

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Figure 5-3
Former Carter Carburetor Site
Composite Grid
Proposed 2nd Floor
Concrete Core Samples
St. Louis, Missouri

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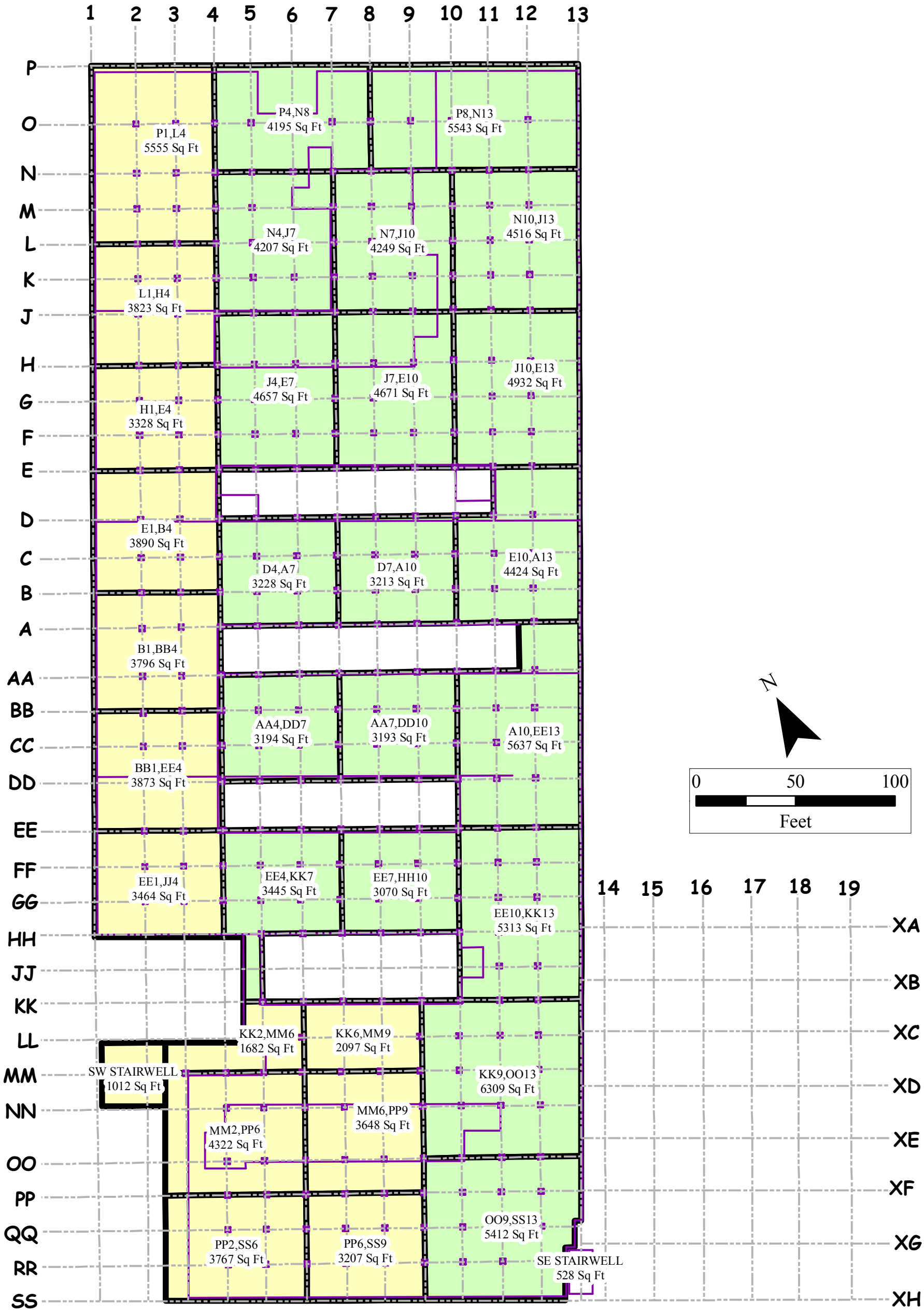

Legend

- Building Column

PCB Potential / Sample Area

- HIGH
- MEDIUM
- LOW

Drawn By: BSM Approved by: EMW

Checked By: DLB Date: December 1, 2005

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Figure 5-4
Former Carter Carburetor Site
Composite Grid
Proposed 3rd Floor
Concrete Core Samples
St. Louis, Missouri

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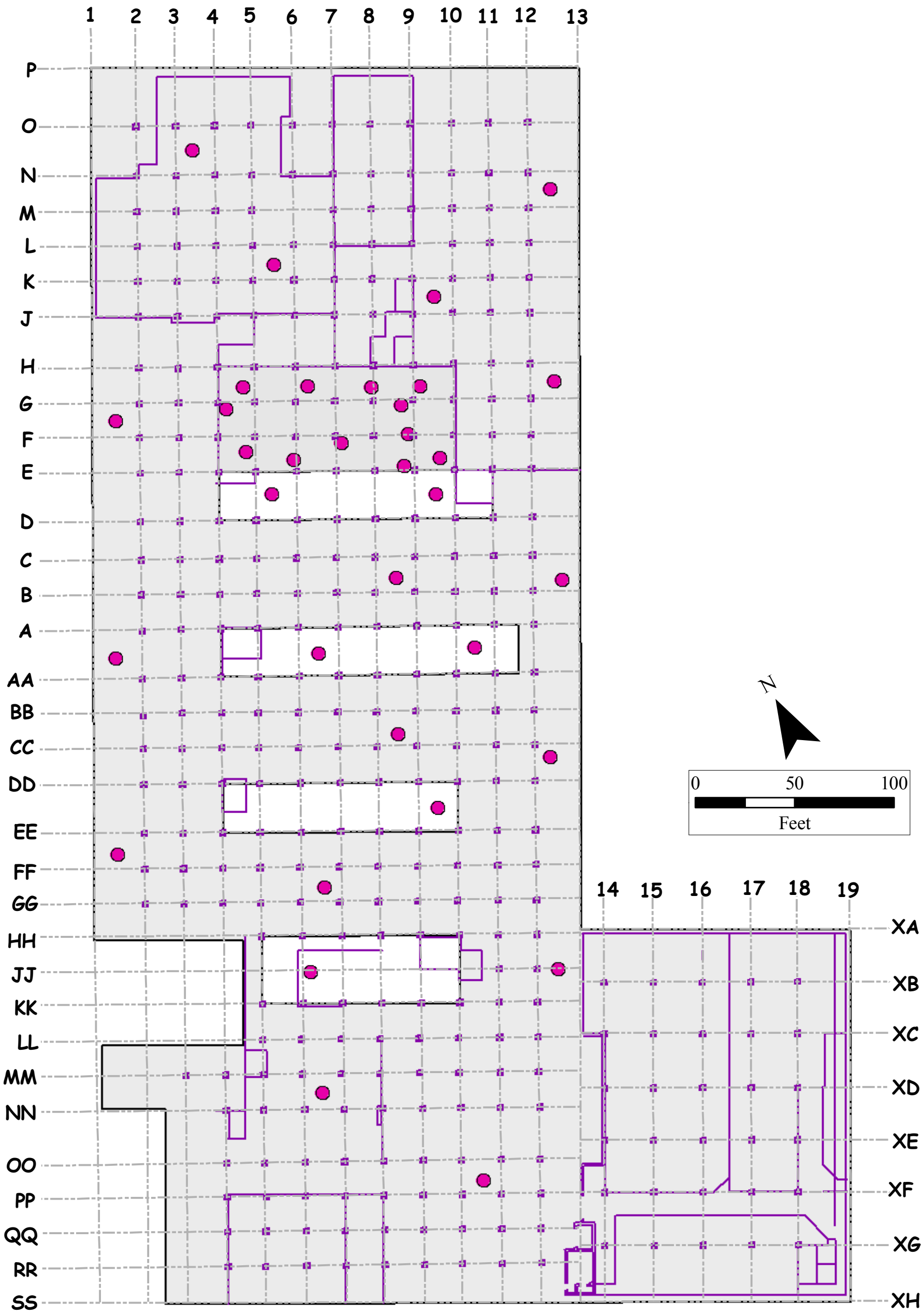

Legend

- Building Column
- Proposed Soil Sample Location

Drawn By: BSM Approved by: EMW

Checked By: DLB Date: December 1, 2005

MACTEC

Figure 5-5
Former Carter Carburetor Site
Proposed 1st Floor
Soil Samples
St. Louis, Missouri

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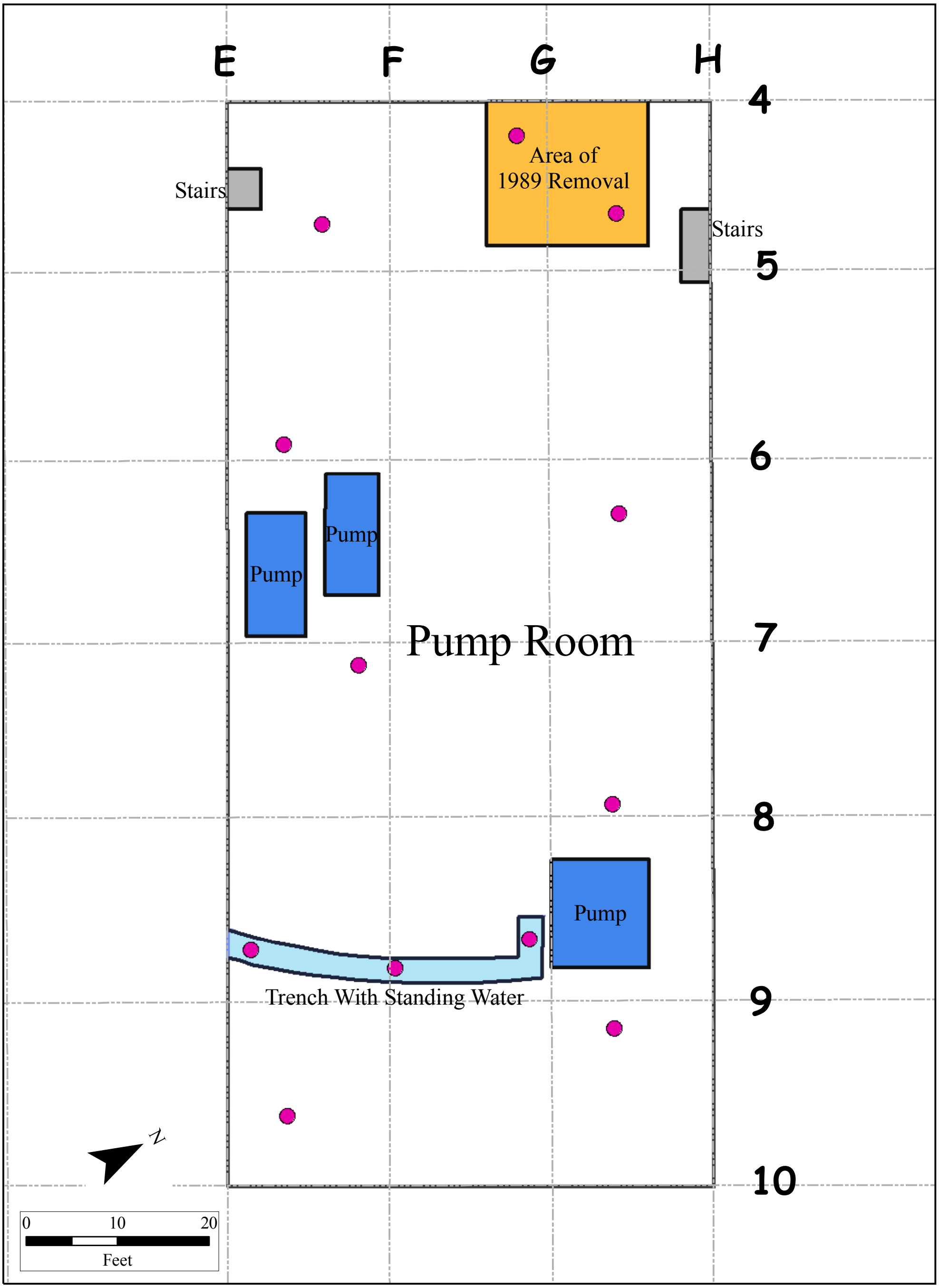

Legend

- Proposed Soil Sample Location
- Area of 1989 Removal
- Pump
- Stairs
- Trench With Standing Water

Drawn By: BSM Approved by:

Checked By: EMW Date: December 1, 2005

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Figure 5-6
Former Carter Carburetor Site
Proposed Pump Room
Soil Samples
St. Louis, Missouri

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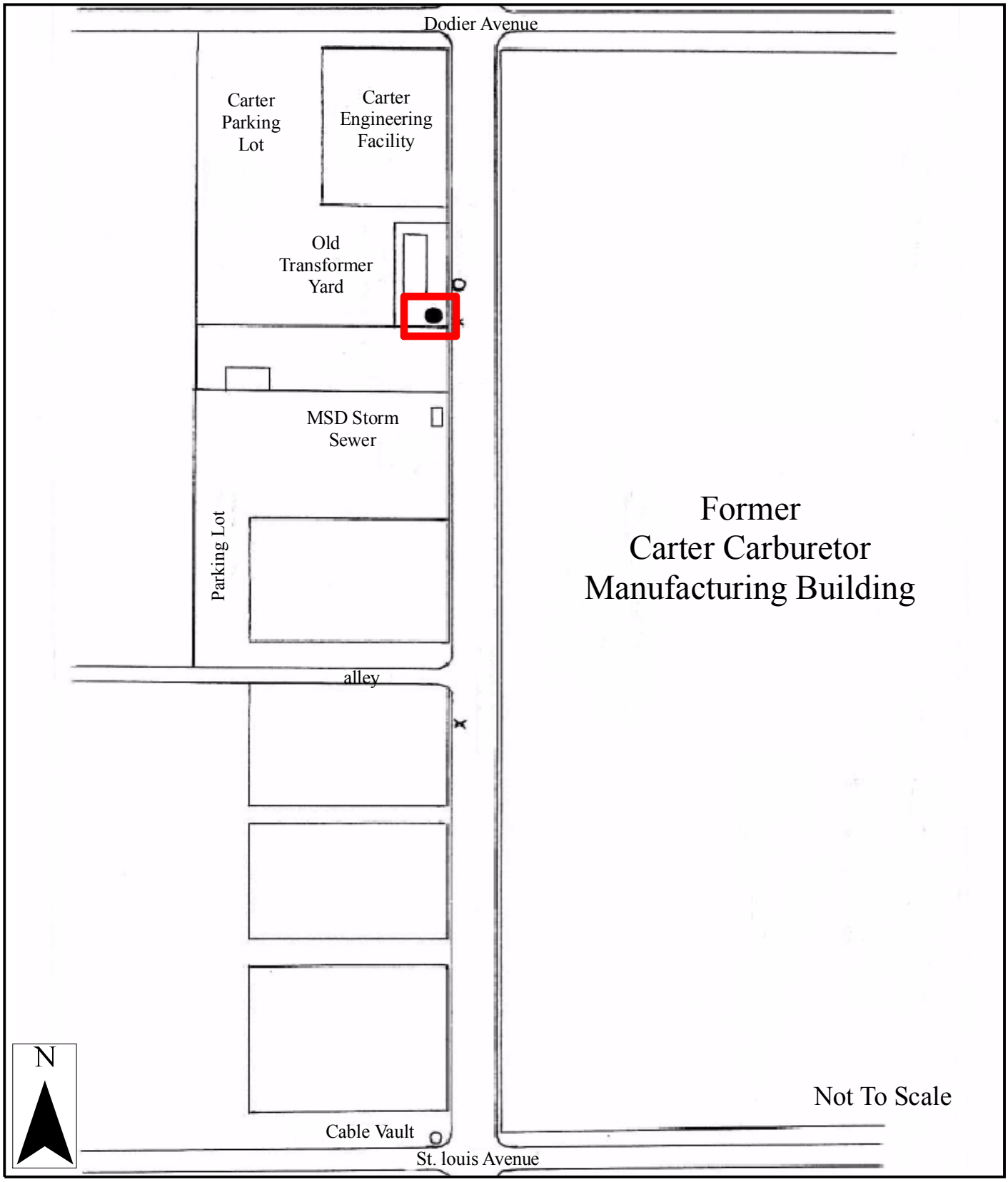

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X Soil Sample at Curb

● Above Ground Storage Tank (out of service)

▭ Area for Subsurface TCE Investigation

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Checked By: DLB Date: December 2, 2005

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Figure 5-7
Former Carter Carburetor Site
TCE UST West Spring Street
St. Louis, Missouri

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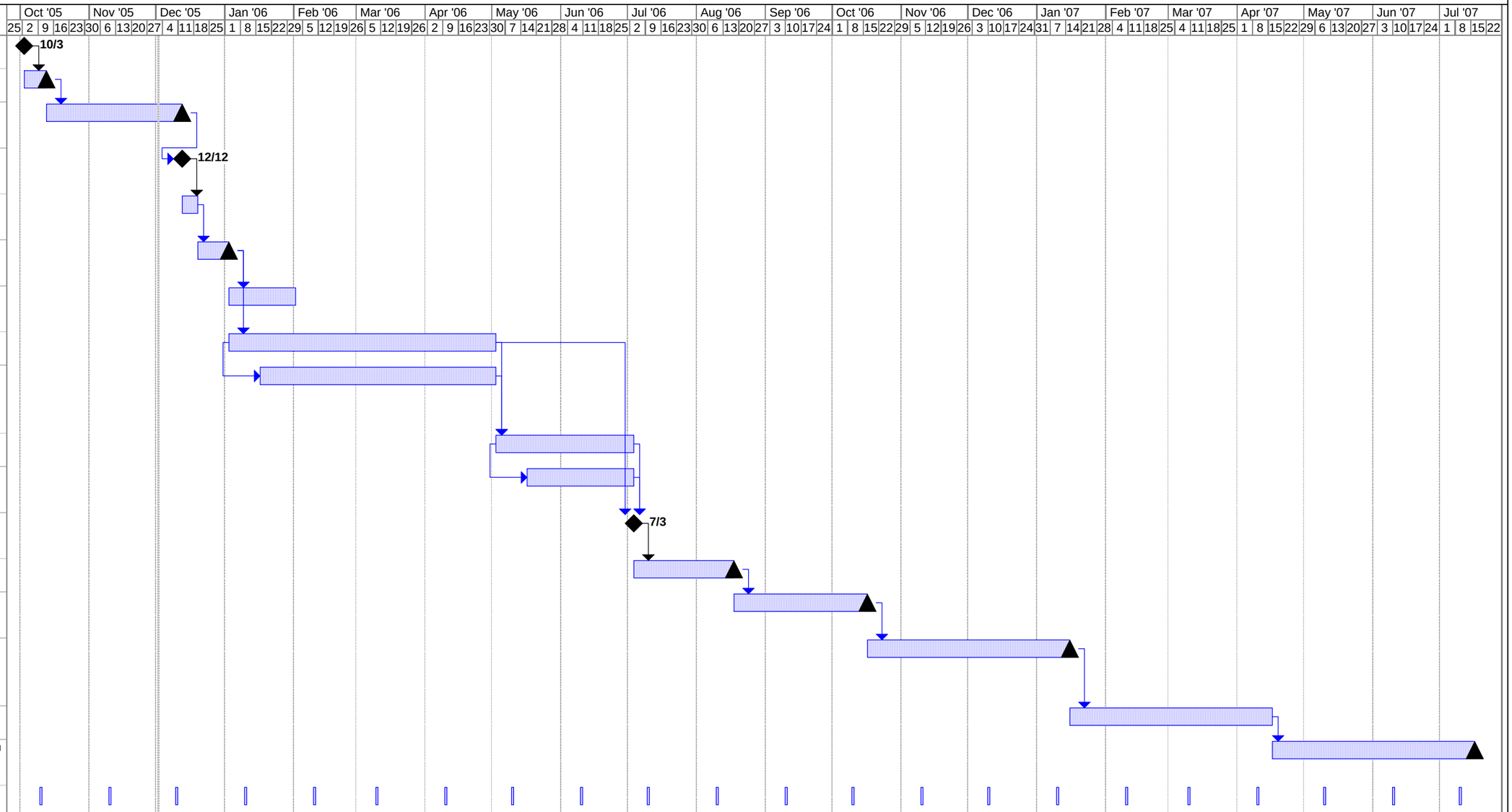
Figure 6-1
Conceptual
ASA AOC Carter Carburetor
Schedule

ID	Task Name
1	ASA AOC Executed
2	Submissison of Qualifications
3	Submission of QARP, HASP, WP
4	USEPA Review/Approval of HASO,QARParp,WP
5	Incorporate comments from USEPA
6	Approval of QARP, HASP, WP by USEPA
7	Mobilization for Field Sampling & EPA Notice
8	ASA AOC Field Sampling Event
9	Review of Analytical Data & Data Validation
10	Conformation Sampling Event
11	Review of Analytical Data & Data Validation
12	Completion of Field Activities
13	Interim Data Submission
14	USEPA Review Data Submission
15	Streamlined Risk Assessment Review & Submission
16	EPA Review
17	EE/CA Development & Submission
18	**Monthly Progress Report**



Project: Conceptual Schedule figure 6
Date: Fri 12/2/05

Task | Progress | Summary | External Tasks | Deadline
Split | Milestone | Project Summary | External Milestone