APPENDIX C

STANDARD OPERATING PROCEDURES (SOPs)

APPENDIX C
STANDARD OPERATING PROCEDURES (SOPs)

TABLE OF CONTENTS

TABLE OF CONTENTS

C.1 DECONTAMINATION

DECONTAMINATION
STANDARD OPERATING PROCEDURE C-1

1.0 Scope and Application

1.1 This SOP is applicable to the development and application of a decontamination program to reduce the potential for uncontrolled distribution of potential field contaminants and the potential exposure of sample media to secondary contaminant sources.

2.0 Summary of Method

2.1 This document has been prepared to serve as default procedures to assist personnel with the performance of specific tasks and procedures related to the collection of surface soil samples. These procedures have been developed to address quality control requirements specific to the evaluation of PFOA as outlined below. The procedures addressed in this SOP include the following:

- Personnel Decontamination Procedures
- Decontamination of Drilling Equipment
- Decontamination of Sampling Equipment
- Decontamination of Support Equipment
- Management of Investigation Derived Waste

3.0 Health And Safety Issues

3.1 As with any activities associated with potential contaminants, work tasks should be conducted in strict accordance with EPA, OSHA, 3M, and WESTON safety policy and procedures. This will include at a minimum, preparation of a site Health and Safety Plan to ensure that all aspects of potential risk are evaluated. In addition to the potential chemical hazards associated with this activity, the following potential hazards should also be considered:

- Pressurized Hoses
- Slips, Trips, and Falls

4.0 Personnel Qualifications

4.1 All field personnel with potential for exposure to contaminated media on site are required to take the 40-hour Health and Safety Training and

regular refresher courses prior to engaging in any field effort. At a minimum, all personnel are required to be trained to recognize hazards associated with the field work and fully familiar with provisions of the HASP.

5.0 Equipment and Supplies

5.1 The equipment necessary for decontamination in the field will vary depending on the activities being conducted. A general list of equipment that may be utilized is as follows:

- Pressurized steam cleaner
- Polyethylene containers
- Low phosphate soap solution
- Potable water source
- Distilled Water
- De-ionized Water
- Methanol (Scientific Grade)
- Plastic Sheeting
- Paper Towels
- Garbage Bags
- Permanent Markers
- Brushes
- Spray Bottles
- Hazard Labels
- Nitrile gloves

6.0 Decontamination Activities

6.1 The following are the steps to be taken for proper decontamination of equipment and personnel during field investigation activities. The effectiveness of the decontamination process will be evaluated as part of the Quality Assurance (QA) program through the collection of equipment rinsate blanks for analytical testing.

7.0 Personnel Decontamination

7.1 Personnel decontamination during investigation activities is critical for reducing exposure of site personnel to potential field contaminant and to reduce the potential for cross-contamination between sampling locations. Based on anticipated hazards expected in the field, personnel will conduct field activities in Modified Level D Protection to include safety boots,

safety glasses, hard hat, and nitrile gloves. Should conditions warrant, disposable boot covers and Tyvek cover-alls may also be used. The following steps should be followed for personnel decontamination:

- Remove any gross debris from gloves and place it in the designated waste accumulation point.
- If boot covers or Tyvek suits are worn, remove them taking care to avoid the outside of the material. Place the items into the designated waste accumulation point.
- Remove nitrile gloves, taking care not to contact the outside of the gloves, and place the gloves in the designated waste accumulation point.
- Thoroughly wash hands with a non-phosphate soap solution (Alconox or Liquinox)
- Thoroughly wash hands with a potable water rinse
- Dry hands

8.0 Decontamination of Drilling Equipment

8.1 Decontamination of drilling equipment will be conducted at a designated site designed to contain all fluids and cuttings. This may include a wash pad with a drain directing the fluids to the onsite treatment facility, or a temporary decontamination pad specifically constructed for this purpose. The pad should be provided with an adequate potable water source. The following steps should be followed during the decontamination process:

- Position the equipment on the pad to avoid release of debris or overspray to adjacent areas.
- Don nitrile gloves and a face shield over safety glasses.
- Remove gross debris from equipment and contain at a designated waste accumulation point.
- Start the steam pressure washer and thoroughly wash the equipment.
- Rinse the equipment with potable water and allow it to air dry.

Additional Steps For Sampling Equipment

- Rinse the equipment with methanol
- Rinse the equipment with potable or distilled water.
- Allow the equipment to air dry
- Dispose of expendables and debris at the designated waste accumulation point.

9.0 Decontamination of Field Monitoring Equipment

- Don nitrile gloves
- Remove any gross debris and place it into the designated waste accumulation point.
- Wipe the outside of the equipment with a moist towel
- Allow the equipment to air dry
- Dispose of expendables and debris at the designated waste accumulation point.

10.0 Decontamination of Field Sampling Equipment

- Don nitrile gloves
- Remove any gross debris and place it into the designated waste accumulation point.
- Wash the equipment in a low-phosphate soap solution (Alconox or Liquinox)
- Thoroughly rinse the equipment in potable water
- Thoroughly rinse the equipment with de-ionized water
- Rinse the equipment with Methanol
- Allow the equipment to air dry
- Place the equipment in clean plastic sheeting or bags until next use
- Dispose of expendables and debris at the designated waste accumulation point.

11.0 Decontamination of Pumps and Electrical Equipment

11.1 Equipment involving internal components sensitive to decontamination fluids or electrical equipment, such as well pumps and water level indicators, that may be damaged by standard decontamination procedures will be decontaminated as follows:

- Place the pump into a low-phosphate soap solution and operate the pump for approximately one minute to ensure adequate rinsing of the internal pump assembly. For water level measurement devices, unreel the tape into the soap solution and agitate aggressively.
- Place the equipment into a potable water rinse. Operate pumps as described above to remove any residual soap solution. When done, lift feed line while operating to purge the pump. Thoroughly rinse measurement tapes by agitating aggressively in potable water.
- Rinse outside of pump or measuring tape with de-ionized water, shake excess water off, and allow equipment to air dry.

- Dispose of expendables and debris at the designated waste accumulation point.

12.0 Investigation Derived Waste Management

Investigation Derived Wastes (IDW) generated during the investigation activities should be properly managed to ensure safety to site personnel and to reduce the potential of impact to other areas of the site by the wastes. Wastes may include expendable sampling items such as gloves, booties, plastic sheeting, paper towels, pump tubing, or bailers; media solids including soil cuttings, decontamination debris, or sediment residuals; or liquids such as well purge fluids or decontamination fluids. Should media be encountered that potentially meets the classification as a hazardous waste, these materials should be properly contained, labeled and stored until a formal waste characterization may be achieved. Final disposition will be based on the classification of the waste. It is not anticipated that hazardous wastes will be encountered as part of the proposed field tasks. Personnel should segregate all IDW according to the classifications identified above for final disposition. The following procedures should be followed to ensure proper management of IDW:

12.1 Expendable Materials

Expendable items are commercially acquired materials used in support of field activities. These materials may include but are not limited to:

- Gloves
- Boot covers
- Pump tubing
- Well sampling bailers
- Plastic sheeting
- Well material packaging
- Rope

These materials should placed into plastic garbage bags placed within the areas of activity or carried on the vehicle. Upon completion of the activity or when the bag has filled, the wastes should be placed into a designated dumpster onsite for disposal as solid waste.

12.2 Solid Media Waste

Sampling-derived waste included in this category would include the following:

- soil cuttings

- drilling mud
- sediment residuals
- solids accumulated during decontamination.

Soil cuttings and drilling muds may be spread at the location of drilling provided there is not obvious features such as photo-ionizing detector screening data, sheen, or odors to suggest significant impact. If it is deemed necessary by the site geologist to contain the cuttings, the materials should be placed into lined steel 55-gallon drums, sealed, labeled with the date, contents, and location; and subsequently transferred to the soil staging pad in the north part of the facility until the waste can be adequately characterized.

Soil or sediment cuttings generated during surface soil and sediment sampling will be used to backfill the constructed sampling borehole.

Solids accumulated during decontamination will be placed into lined steel 55-gallon drums. Once filled, each drum will be sealed, identified with the contents and date, and transferred to the onsite staging area for subsequent testing.

Disposal methods applied to each media should be recorded in the field logbook including the location of disposal and estimated quantity.

12.3 Liquid Media Waste

Liquid wastes potentially generated during investigation activities may include the following:

- Drilling fluids
- Purged well water
- Decontamination fluids

All liquid wastes generated during the investigation will be contained for transfer to the onsite wastewater treatment plant. This may be by way of pails, 55-gallon drums, or polyethylene tanks. Quantities discharged to the treatment plant will be documented in the field logbook. If the fluid exhibits significant impact from potential contaminants of concern, the water may be contained in 55-gallon steel drums, labeled with the date, contents and location, and transferred to the soil staging pad for subsequent testing prior to disposal.

13.0 Data and Records Management

13.1 All data and information (e.g., location of decontamination pad, water source, site conditions) should be documented within site logbooks with permanent ink.

14.0 References

Quality Assurance Project Plan for the Phase 2 Characterization Program. (QAPP). WESTON, July 2004.

Phase 2 Work Plan for Sampling Environmental Media for PFOA at the 3M Decatur, AL Plant (Phase 2 Work Plan). WESTON. August 2004.

Health and Safety Plan. (HASP). Appendix A of the *Phase 2 Work Plan for Sampling Environmental Media for PFOA at the 3M Decatur, AL Plant*. WESTON. August 2004.

C.2 CLAM/MUSSEL SAMPLING

CLAM/MUSSEL SAMPLING AND PROCESSING
STANDARD OPERATING PROCEDURE C-2

1.0 Scope and Application

This Standard Operating Procedure is applicable to the collection and processing of freshwater clams and mussels from the Tennessee River and Bakers Creek and includes procedures for tissue processing for PFOA analysis.

2.0 Summary of Method

2.1 This SOP presents the methods by which the freshwater Asiatic clam (*Corbicula fluminea*) or various species of freshwater mussels inhabiting the Tennessee River in the vicinity of the Decatur facility. Collection methods may include:

- Freshwater benthic sledge
- Petite Ponar

The type of equipment that will be used to collect *Corbicula* clams or mussels will depend on the nature of the habitat in which collection will occur as well as the availability of suitable numbers of clams or mussels. The use of the benthic sledge will be the preferred method with which to harvest clams or mussels from the river at the proposed sampling locations. The petite Ponar will be used if sample collection by sledge is unsuccessful. Should the use of the ponar prove ineffective, the alternatives of snorkeling/diving will be considered.

3.0 Health and Safety Issues

Health and safety issues associated with the collection of clams and mussels including the use of all sampling gear as well as processing are addresses in Section 3 of the Health and Safety Plan (HASP).

4.0 Interferences

4.1 The primary problem with clam or mussel sampling includes the availability of sufficient numbers of clams/mussels for collection.

- The availability of adequate numbers of clams at the proposed sampling locations may be a potential problem that will be addressed by the use of alternative sampling gear and/or the relocation of sampling locations.

4.2 It is important to note that sampling for PFOA requires special procedures including the type of equipment used and handling procedures. The precautions to be applied are as follows:

- The handling of prepackaged foods or fast foods prior to sampling should be avoided. Prior to sampling and sample preparation, personnel should thoroughly wash per the decontamination procedures outlined in the Decontamination SOP (Appendix C-1).

- Nitrile or latex gloves should be worn at all times when handling equipment or sampling.

- Teflon treated equipment should not be used for sampling activities. Sample containers should also be free of Teflon liners or seals.

4.3 Where feasible, all sampling materials and sample preparation equipment should be disposable to avoid potential cross-contamination between sampling locations.

5.0 Personnel Qualifications

All clam/mussel sampling will be performed by Weston personnel. All field sampling personnel are required to take the 40-hr health and safety training and regular refresher courses prior to engaging in any field effort. All scuba diving will be performed by a certified diver with a certified backup diver. At a minimum, all personnel are required to be trained to recognize the hazards associated with the fieldwork, and fully familiar with the provisions of the HASP.

6.0 Equipment and Supplies

Equipment for Collecting Clams

- Approved Work Plan
- Approved QAPP
- Approved HASP
- Clam collection field notebook
- Waterproof ink pens
- Camera and film
- Detailed maps of each sample location
- Hand-held GPS unit (Garmin GPS Map 76S or similar)
- Hand-held compass
- Cellular phone
- Petit Ponar dredge w/ 30’ rope or pole mount and pole
- Freshwater benthic sledge w/ tether and 100 ft’ trawling line
- Boat trailer with working lights
- Holding tank or live well (aerator or water circulator)
- Personnel flotation devices (all crew members) and safety toss
- Thermometer

- First aid kit
- Fire extinguisher (if needed)
- Tool box
- Depth sounder

Additional Equipment for Processing Fish Samples

- Clam collection field notebook
- Waterproof ink pens
- Tables & Stools
- Meter measuring board with 1 mm divisions (2) (for measuring fish, one per fish health crew)
- Portable electronic balance and 500 g calibration standard (±20 g accuracy) (2) (for fish wet weight, one balance per crew)
- Portable electronic balance and 10 g calibration standard (±0.01 g accuracy) (2) (for tissue weights, one balance per crew)
- 1 quart heavy duty Ziploc™ freezer bags
- Pesticide grade methanol (for decontamination of tools)
- ASTM Type II reagent water or distilled water (for decontamination of tools)
- Wash bottles, non- Teflon, prelabeled for methanol and distilled water (for decontamination)
- Wash basin (1/team, for nondisposable used dissection tools)
- Disposable nitrile gloves (several sizes, 2 pairs per fish)
- Chem-wipe^{tm} or equivalent (many boxes)
- Sharps container
- Garbage cans (30 gal with 30-gal heavy duty trash bags)
- Prelabeled self adhesive sample labels (for each sample, including QA/QC)
- Clear packing tape (for securing sample labels and sealing shipping containers)
- Small coolers (6) (for bacterial cultures, viral cultures, and scales and spine samples)
- Large hazardous materials coolers (9) (for residue, parasite, histopathology samples)
- Dry ice (for residue samples)
- Hazardous materials shipping labels (fixatives, dry ice, flammable materials)
- Chain of custody forms
- Plastic bags (for protecting chain of custody forms)
- Fed Ex airbills, prepared
- Custody seals (for sealing containers for chain of custody)
- 9 V and D batteries
- Paper towels
- Flashlight/lanterns/headlamp

* The appropriate sampling device must be of proper composition. Sampling equipment must not contain Teflon coatings or subassemblies. Samplers constructed of glass, stainless steel or PVC should be used based upon the analyses to be performed.

7.0 Sample Collection – Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, minimum sample volume requirements, and which equipment and supplies are needed.

2. Scientific collection permits will be acquired prior to the collection of all clam/mussel sampling,

3. Obtain necessary sampling and monitoring equipment.

4. Prior to clam/mussel sampling, all equipment will be thoroughly checked by the team leader to ensure that the boat, boat motor, dredge, GPS etc. are in good working order.

5. Decontaminate or pre-clean equipment, and ensure that it is in working order.

6. Prepare schedule and coordinate with staff and clients, if appropriate.

7. Perform a general site survey prior to site entry in accordance with the HASP and facility requirements.

8. Locate appropriate clam/mussel beds within each of the general sampling locations.

9. Use stakes, flags, or buoys to identify and mark all sampling locations until positional data has been obtained. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions.

8.0 Sample Collection Procedures – Secondary Parameters

1. Water quality measurements of conventional parameters will be collected from any co-located surface water sampling points (Surface Water SOP; Appendix C-7).

2. Sediment physical characteristics will be obtained at any co-located sediment sampling locations (Sediment Sampling SOPs; Appendix C-6).

3. When sufficient numbers of preferred Asiatic clams are collected, sampling will be ceased at that sampling location/area.

9.0 Sample Collection – Method Options

9.1 Benthic dredge

1. At each sampling location, the benthic dredge will be lowered and the towline paid out to a length that ensures that the bottom of the dredge is in the correct sampling position.

2. After lowering, the dredge will be towed over some known distance (using GPS to mark the starting and ending waypoints of the transect.

3. Upon retrieval of the dredge, Asiatic clams and mussels will be placed in separate aerated containers containing location-specific water until the initiation of sample processing.

4. When sufficient numbers of preferred Asiatic clams are collected, sampling will be ceased at that sampling location/area.

9.2 Petit Ponar

1. Attach the necessary length of sample line to a decontaminated Ponar. Solid braided 5-mm (3/16-in.) nylon line is usually of sufficient strength; however, 20-mm (3/4 -in.) or greater nylon line allows for easier hand hoisting. Note if the pole-mounted option to the Ponar is used, attach the sampling pole to the sampler.

2. Open sampler jaws until latched. From this point, support the sampler by its lift line, or the sampler will be tripped and the jaws will close.

3. Lower the sampler rapidly through last foot until contact is felt.

4. Allow sample line to slack several centimeters. In strong currents, more slack may be necessary to release mechanism.

5. Slowly raise Ponar to clear surface.

6. Upon retrieval of the Ponar, Asiatic clams and mussels will be placed in separate aerated containers containing location-specific water until the initiation of sample processing

7. When sufficient numbers of preferred Asiatic clams are collected, sampling will be ceased at that sampling location/area.

10.0 Sample Processing and Preservation

1. Clams/mussels will be collected in accordance with methods above, identified by sample location, and retained in live wells until sample processing is initiated.

2. Clams/ mussels will be rinsed of debris with location-specific water.

3. The following metrics will be collected for each individual clam or mussel included in any composite sample:

    - Species
    - Total height (length)
    - Total weight (w/ shell)

4. Upon completion of recording of sample metrics, one (1) clam/mussel sample will be composited (whole) for each location and will be submitted for whole tissue analysis. Minimum tissue volume needed 15 g (Exygen Research, 2004).

All clam samples will be placed in Ziploc® freezer bags. The sample ID label will be placed on the outside of the Ziploc® bags and secured with clear tape. The samples will be placed in double Ziploc® freezer bags (recommended to minimize breakage) with a second ID label, and stored on ice at 0-4°C. Samples for analyses will be shipped by overnight delivery service (next morning delivery) to the Exygen Research laboratory.

11.0 Documentation

All sample documentation will follow the project specific SOPs for field sample ID, data sheet, chain-of-custody, and custody seal procedures. All data and information will be documented in field data logbooks with permanent ink.

12.0 Quality Control and Quality Assurance

1. Representative samples are required. In order to collect a representative sample, the substrate conditions should be determined prior to sampling. This will aid in determining sediment particle size characteristics the appropriate means of sample equipment placement, and appropriate sample locations.

2. All field QC samples required in the QAPP must be followed; these may involve field blanks and collection of replicate samples.

13.0 References

Quality Assurance Project Plan for the Phase 2 Characterization Program. (QAPP). WESTON, July 2004.

Phase 2 Work Plan for Sampling Environmental Media for PFOA at the 3M Decatur, AL Plant (Phase 2 Work Plan). WESTON. August 2004.

Health and Safety Plan. (HASP). Appendix A of the *Phase 2 Work Plan for Sampling Environmental Media for PFOA at the 3M Decatur, AL Plant*. WESTON. August 2004.

Method of Analysis for the Determination of Perfluorooctanoic Acid (PFOA) in Fish and Clams by LC/MS/MS. Exygen Research, 2004

C.3 FISH COLLECTION

FISH COLLECTION AND PROCESSING
STANDARD OPERATING PROCEDURE C-3

1. Scope and Application

This Standard Operating Procedure (SOP) is applicable to the collection and processing of fish for chemical analysis from the Tennessee River and Bakers Creek and includes procedures for fish tissue processing for PFOA analysis.

2.0 Summary of Method

This SOP presents the method by which fish will be collected. Collection methods may include:

- boat-mounted electrofishing,
- backpack electrofishing,
- trap-fishing.
- bait and hook

The type of equipment that will be used to collect fish will depend on the nature of the habitat being fished as well as the type of fish to be collected. Boat-mounted electrofishing will be used for sections of the river that are greater than 3 ft deep and where access is only possible by boat. Backpack shocking will be performed in stream segments less than 3 ft deep. Depending on the success of electrofishing, trap-fishing may be used as alternative approach. In addition, bait and hook methods may be used to collect species where this approach has been shown to be successful, e.g. catfish.

3.0 Health and Safety Issues

Health and safety issues associated with fish collection effort including the use of all equipment as well as fish processing are addressed in Section 3 of the Health and Safety Plan (HASP).

3.1 When working with potentially hazardous materials, follow EPA, OSHA, and specific health and safety procedures as documented in the HASP.

3.2 When conducting sampling from a boat in an impoundment or flowing waters, follow appropriate boating safety procedures contained in the HASP.

4.0 Interferences

4.1 Primary potential interferences with fish sampling include the availability of

sufficient numbers of target species fish for collection and cross-contamination of samples during sample processing.

- The availability of adequate numbers of target fish may be a potential issue that will be addressed by the selection of surrogate fish species where necessary.

- Cross-contamination issues will be eliminated or minimized by the implementation of decontamination procedures associated with fish processing. These procedures are presented in the Decontamination Procedures SOP (Appendix C-1).

4.2 It is important to note that sampling for PFOA requires special procedures including the type of equipment used and handling procedures. The precautions to be applied are as follows:

- The handling of prepackaged foods or fast foods prior to sampling should be avoided. Prior to sampling and sample preparation, personnel should thoroughly wash per the decontamination procedures outlined in the Decontamination Procedures SOP (Appendix C-1).

- Nitrile or latex gloves should be worn at all times when handling equipment or sampling.

- Teflon treated equipment should not be used for sampling activities. Sample containers should also be free of Teflon liners or seals.

- All sampling materials and equipment should be disposable to avoid potential cross-contamination between sampling locations.

4.3 Following proper decontamination procedures and minimizing disturbance of the sample site will eliminate these problems.

5.0 Personnel Qualifications

All fish collection and processing will be performed by Weston personnel. All field samplers are required to take the 40-hr health and safety training and regular refresher courses prior to engaging in field effort. At a minimum all personnel are required to be trained to recognize the hazards associated with the fieldwork, and be familiar with the provisions of the HASP.

6.0 Equipment and Supplies

Equipment for Collecting Fish

- Approved Work Plan
- Approved QAPP
- Approved HASP
- Fish capture field notebook
- Waterproof ink pens
- Detailed maps of each sample location
- Hand-held GPS unit (Garmin GPS Map 76S or similar)
- Hand-held compass
- Cellular phone
- 60-ft trap nets
- Meter measuring board
- Calipers
- Electrofishing boat and motor (gas and oil), oars (2), boat hook, anchor, rope
- Boat trailer with working lights
- Generator (check gas, oil, and connections)
- Electroshocking voltage converter
- Electrodes (anode and cathode)
- Foot pedal, deadman switches (one for each person netting)
- Insulated, long-handled dip nets (3)
- Insulated, short-handled dip nets (2)
- Holding tank or live well (aerator or water circulator)
- Electrically insulated footwear (all crew members)
- Electrically insulated gloves (5,000 V minimum)
- Personnel flotation devices (all crew members) and safety toss
- Thermometer
- First aid kit
- Fire extinguisher (if needed)
- Tool box
- Depth sounder

Additional Equipment for Processing Fish Samples

- Fish health assessment field notebook
- Waterproof ink pens
- Tables & Stools
- Short-handled dip net (2) (for handling of all live fish, one per crew)

- 60 to 80 L cooler (2) (fish processing station live well)
- 20 to 40 L cooler (2) (ice water tank, one for each fish health sampling crew)
- Aerator (2)
- Airstones & tubing
- Water bucket (with liter marks on the inside)
- Meter measuring board with 1 mm divisions (2) (for measuring fish, one per fish health crew)
- Portable electronic balance and 500 g calibration standard (±20 g accuracy) (2) (for fish wet weight, one balance per fish health crew)
- Portable electronic balance and 10 g calibration standard (±0.01 g accuracy) (2) (for tissue weights, one balance per fish health crew)
- Wire side cutters (2) (for removing dorsal fin spines, one per fish health crew)
- Polycarbonate cutting boards
- Dissecting scissors (1/fish, may be cleaned; for opening body cavity, cutting intestine and gill)
- Probe (1/fish, may be cleaned; for internal necropsy)
- Medium curved-tip forceps (1/fish, may be cleaned; for handling and manipulating tissues)
- Sterile scalpel blade (1-#11, 1-#22 per fish, for tissue removal)
- Scalpel handles (2/fish, may be cleaned; one for each blade)
- Surgical steel razor blades (4/fish, for cutting tissues)
- 1 quart heavy duty Ziploc™ freezer bags (1/fish for clean dissection tools)
- Pesticide grade methanol (for decontamination of tools)
- ASTM Type II reagent water or distilled water (for decontamination of tools)
- Wash bottles, non- Teflon, prelabeled for methanol and distilled water (for decontamination)
- Wash basin (1/team, for nondisposable used dissection tools)
- Disposable nitrile gloves (several sizes, 2 pairs per fish)
- Kimwipes (many boxes)
- Sharps container
- Garbage cans (30 gal with 30-gal heavy duty trash bags)
- 125, 250 & 500 ml jars, certified clean (at least 1/fish for fillet contaminant samples)
- Prelabeled self adhesive sample labels (for each sample, including QA/QC)
- Clear packing tape (for securing sample labels and sealing shipping containers)
- Small coolers (6) (for bacterial cultures, viral cultures, and scales and spine samples)
- Large hazardous materials coolers (9) (for residue, parasite, histopathology samples)
- Wet ice (for viral samples)
- Dry ice (for residue samples)
- Hazardous materials shipping labels (fixatives, dry ice, flammable materials)

- Chain of custody forms
- Plastic bags (for protecting chain of custody forms)
- Fed Ex airbills, prepared
- Custody seals (for sealing containers for chain of custody)
- 9 V and D batteries
- Paper towels
- Parafilm
- Flashlight/lanterns/headlamps.

* The appropriate sampling device must be of proper composition. Sampling equipment must not contain Teflon coatings or subassemblies. Samplers constructed of glass, stainless steel or PVC should be used based upon the analyses to be performed.

7.0 Sample Collection – Preparation

1. Prior to electrofishing all equipment will be thoroughly checked by the team leader (the individual with the most senior experience) to ensure that generators, drop rods, shocking wands, cables, backpack batteries, etc. are in good working condition.

2. Scientific collection permits will be acquired prior to collecting fish.

3. Locate appropriate fish habitat within each general sampling location.

8.0 Sample Collection Procedures

1. The electroshocking must be conducted in accordance with the health and safety requirements described in the *Health and Safety Plan* and in accordance with applicable collection permits of the State of Alabama. All members of the electroshocking crew must carefully review the Health and Safety Plan and must be given the opportunity to ask any questions regarding the health and safety requirements before electroshocking begins.

2. Begin shocking the selected area using a pulse DC setting and voltage appropriate for the conditions (to be determined by the fish collection supervisor).

3. Net any fish that may be longer than 20 cm (approximately 8 in.) in total length. Do not net smaller fish.

4. Identify any target species and potential surrogate species descriptions in species key. If the species is one of the target species for that location, retain and measure the total length of the fish accordingly.

   Target Species
   - Largemouth Bass (*Micropterus salmoides*)
   - Channel catfish (*Ictalurus punctatus*)

5. If the fish falls within the target length for that species and the target sample number for that species has not yet been collected from that sampling location, place the fish in a live-well for processing.

9.0 Fish Processing and Preparation for Tissue Analysis

9.1 Initial Processing

1. Fish will be collected in accordance with the methods identified by location and retained in live wells containing location-specific water until sample processing is initiated.

2. Fish containers (e.g., live wells) will be labeled with capture location information and aerated to minimize fish mortality before fish processing. All fish retained for potential sample analysis will be enumerated and separated by species and size class.

3. The following metrics will be recorded for each individual fish included in any sample:

   - Total length
   - Total weight
   - Fillet weight
   - Physical exam

4. Upon completion of collection of metrics, fish samples will be either submitted for whole body and fillet analysis.

9.2 Whole Body Sample Processing

Fish samples for whole body analysis will be rinsed of all debris with deionized water and placed in decontaminated polypropylene containers The sample ID labels will be placed on the outside of the container and secured with clear tape. If more than one fish is used for a sample (composite), all fish used for the sample will be placed on one piece of polypropylene material, wrapped and labeled with the appropriate sample ID. To preserve sample

integrity, samples will be placed in double re-sealable plastic bags with a second ID label and placed in either a cooler with dry ice or a suitable freezer until analyzed.

9.3 Fillet Sample Processing

Procedures for filleting fish are described below. An initial cut should be made from the dorsal fin to the pelvic fin, just behind the opercular flap. Run the tip of the knife along the dorsal side of the fish, from the initial cut to the caudal fin. Continue making successively deeper cuts, running the knife blade as close to the neural spines and ribs as possible. After the fillet is obtained, remove the skin. Place the skin side of the fillet down on the dissecting tray, hold on to the tail portion of the fillet, and run the knife between the skin and the muscle tissue. Remove any debris from the skinless fillet by rinsing with deionized water.

After a fillet is cleaned, place the sample in a pre-weighed decontaminated tray and record the weight to the nearest gram. For composite samples, obtain all the fillets for the composite and weigh to the nearest gram. Minimum sample size is 15.0 g of tissue (Exygen Research, 2004). Fillet samples will be placed in decontaminated polypropylene containers.

9.4 Tissue Analysis

Whole body and fillet tissue samples will be analyzed for PFOAs in accordance with the QAPP. In addition, moisture and lipid content will also be analyzed.

10.0 Data and Records Management

All sample documentation will follow project specific SOPs for field sample ID, data sheet, chain-of-custody, and custody seal procedures. All data and information will be documented in field data logbooks with permanent ink.

11.0 Decontamination

All dissection equipment will be decontaminated following the project-specific Decontamination SOP (Appendix C-1).

12.0 Field Quality Assurance/Quality Control Samples

All field QA/QC procedures will be followed in accordance with those outlined in the approved QAPP. One duplicate sample (left side fillet) will be collected every 20 samples for samples large enough to produce the minimum required sample mass (approximately 30 g) per fillet. One MS/MSD sample will be collected for every 20 samples large enough to provide triple the required sample mass (45 g).

13.0 References

Quality Assurance Project Plan for the Phase 2 Characterization Program. (QAPP). WESTON, July 2004.

Phase 2 Work Plan for Sampling Environmental Media for PFOA at the 3M Decatur, AL Plant (Phase 2 Work Plan). WESTON. August 2004.

Health and Safety Plan. (HASP). Appendix A of the *Phase 2 Work Plan for Sampling Environmental Media for PFOA at the 3M Decatur, AL Plant*. WESTON. August 2004.

Method of Analysis for the Determination of Perfluorooctanoic Acid (PFOA) in Fish and Clams by LC/MS/MS. Exygen Research, 2004.

C.4 GROUNDWATER SAMPLING

GROUNDWATER SAMPLING
STANDARD OPERATING PROCEDURE C-4

1.0 Scope and Application

1.1 This Standard Operating Procedure SOP is applicable to the collection of representative groundwater samples from temporary and permanent groundwater monitoring well systems for laboratory testing of general analytical parameters and PFOA. The procedures set forth herein have been prepared in accordance with the following American Society for Testing and Materials (ASTM) Standard Practices:

- D4448-85a (2001) Guide for Sampling Groundwater Monitoring Wells
- 5903-96 (2001). Guide for Planning and Preparing for a Groundwater Sampling Event
- D6001-96 (2002) Guide for Direct Push Water Sampling for Geoenvironmental Investigations

2.0 Summary of Method

2.1 Ground water samples are usually obtained from either temporary or permanently installed ground water monitoring wells. They can also be obtained, however, anywhere ground water is present, such as in a pit or a dug or drilled hole. The equipment and methods applied to each situation vary significantly. The procedures presented herein specifically address the collection of groundwater from monitoring well systems and include the following purging and sampling techniques:

- Bailer Method
- Grundfos Pump

3.0 Health And Safety Issues

3.1 As with any activities associated with potential contaminants, work tasks should be conducted in strict accordance with EPA, OSHA, 3M, and WESTON safety policy and procedure. This will include at a minimum, preparation of a site Health and Safety Plan to ensure that all aspects of potential risk are evaluated. In addition to the potential chemical hazards

associated with this activity, the following potential hazards should also be considered:

- Traffic and pedestrian access
- Biological Hazards
- Electrical Equipment
- Remote work areas
- Slips, Trips, and Falls
- Lifting heavy loads

The site Health and Safety Plan should be thoroughly reviewed by all personnel involved.

4.0 Personnel Qualifications

4.1 All field personnel with potential for exposure to contaminated media on site are required to take the 40-hour OSHA Safety Training Course. Certificates for each person will be incorporated into the site Health and Safety Plan.

5.0 Equipment and Supplies

5.1 Equipment needed for collection of groundwater samples include:

- Electronic Water Level Indicator
- Logbook and waterproof pen
- Calculator
- Field purge forms and well location maps
- Safety Equpment
- Decontamination equipment and reagents
- Groundwater Quality Monitoring Equipment (pH, temperature, and specific conductivity)
- Wastewater holding tank
- Tygon tubing, clamps, couplings
- Grundfos 2-inch Rediflo Pump
- Grundfos 4-inch Pump
- Appropriate sample bottles and preservatives
- Chain of Custody forms
- Coolers
- Ice
- Plastic (polyethylene) sheeting
- Commercial plastic zip-sealed bags

- Sample bottle labels
- Approved Work Plan
- Approved QAPP
- Approved HASP
- Polyethylene disposable bailers
- Nitrile surgical gloves
- Polypropylene gloves
- Electrical cord
- Tool box with general tools (pliars, screwdrivers)
- 6,000-Watt gas-fired generator
- Commercial duty open-bed truck

6.0 Well Sampling Procedures

The general procedures to be applied for the sampling of monitoring wells will include the following general tasks:

- Well Preparation
- Well Purging
- Well Sampling
- Sample Custody

The following presents the specific procedures associated with each identified task.

6.1 Well Preparation

The following task should be conducted in preparation for well purging and sampling.

- Locate and confirm the identification of the well to be sampled.
- Locate the appropriate field Purge form for the well.
- Organize equipment and lay plastic sheeting in the immediate area of the well.
- Inspect the condition of the well casing, lock, and pad and record the observations on the field purge form and/or the field logbook.
- Don nitrile gloves
- Unlock the well casing and remove the riser plug to ensure that well conditions are stable.
- Using the electronic water level indicator, record the depth to groundwater from an established reference point on the top-of-casing. If a reference point is not indicated, establish one. Record the information on the field purge form.

- If the total depth of the well has not been established, use the water level indicator to measure the total depth of the well with reference to top-of-casing. Record the information on the field purge form.
- Decontaminate the water level indicator following the procedures outlined in the Decontamination SOP (Appendix C-1).
- Use the field data to calculate the well volume and anticipated purge volume.

6.2 Calculation of Well Volume

Purging is the process of removing stagnant water from a monitoring well, causing its replacement with ground water from the adjacent formation that is representative of local aquifer conditions. The volume of water removed to achieve this is dependent on the diameter of the well annulus and the length of the water column. This information is used to calculate the volume of potentially stagnant water that occurs within the well. The equation used to calculate the volume of a well is as follows:

$$\mathbf{V = h \times c}$$

Where:

V represents one volume of water calculated for the well (gallons)
h is the length of the water column within the well (feet)
c represents a purge factor calculated as gallons per foot based on the specific diameter of the well purged

As mentioned, the Purge Factor "c" represents a conversion factor based on the diameter of the well to be sampled which when multiplied with the water column length provides a volume in gallons for the well. The factors used for common well diameters are provided in Table 1 below:

Table 1 Well Purge Factors

WELL DIAMETER (inches)	PURGE FACTOR
1	0.041
2	0.163
3	0.367
4	0.653
5	1.02
6	1.469
7	1.999

WELL DIAMETER (inches)	PURGE FACTOR
8	2.611
9	3.305
10	4.08
11	4.934
12	5.875

Once the volume is calculated, preparation may be made to purge the well.

6.3 Well Purging Activities

As a rule, a minimum of three (3) well volumes should be removed as part of the purge process. However, this is dependent on the stabilization of groundwater parameters during the purging process to ensure that groundwater from the adjacent aquifer system is being sampled. The parameters monitored during the purging process include: pH, specific conductivity, and temperature. Visual turbidity and dissolved oxygen may also be monitored. The purging is considered complete when:

- A minimum of three (3) well volumes have been removed and
- Monitored parameters have stabilized to within ten percent (10%).

If, after three well volumes have been removed, the chemical parameters have not stabilized according to the above criteria, additional well volumes should be removed. If the parameters do not stabilize within five well volumes, the well will be considered adequately purged and sampling may be conducted. The conditions of purging should be noted in the field purge log. For wells that purge dry before the required volumes are removed, purging will be considered complete once the well has purged completely. The well will be allowed to recharge and subsequently sampled.

Depending on the anticipated volume of water to be removed and the well diameter, the following equipment may be used for purging:

- Polyethylene Bailer
- Grundfos 2-inch Rediflo Pump
- Grundfos 4-inch Pump

The following procedure should be applied to begin purging activities:

- Position the truck and storage tank proximal to the well.
- Don nitrile gloves
- Select the equipment to be used for purging. If pumps are used, select an adequate length of tubing to reach the base of the monitoring well.
- Attach the tubing (via stainless steel clamps) to the pump and carefully lower the pump and tubing into the well. The tubing should not contain Teflon. It is recommended that no more than five feet of hose be lowered into the water column. If the recovery rate of the well is faster than the pump rate and no observable draw down occurs, the pump should be raised until the intake is within one foot of the top of the water column for the duration of purging. If the pump rate exceeds the recovery rate of the well, the pump should be lowered, as needed, to accommodate the draw down.
- For pumps, assemble the flow-through chamber for the groundwater quality monitoring equipment. For bailers, set up a monitoring station where the probe may be inserted into a container with a sample of the groundwater.
- Insert the probe into the chamber and turn on the monitor.
- Place the tubing into the top of the tank to collect the purged fluids.
- Place the generator in a safe location and connect the pump or pump regulator.
- Turn on the pump and begin purging the well.
- Record the start time on the field purge log and collect initial screening data for the parameters being monitored. Record the data on the field purge form
- Continue purging recording parameter screening data a minimum of once per well volume, until three well volumes have been removed. If documented screening data have stabilized within 10%, terminate the purging process and record the stop time and final well purge volume on the field purge form.
- Disconnect the equipment and remove the pump from the well.
- Discard the expendable materials, i.e. tubing or bailers, and decontaminate the pump and associated equipment via the procedures outlined in the Decontamination SOP (Appendix C-1).
- Store the equipment on clean polyethylene sheeting to dry.
- Secure the well and inspect the grounds for trash or loose equipment.
- Proceed to the next well for purging.

6.4 Well Sampling Activities

Sampling is the process of obtaining, containerizing, and preserving the ground water sample after the purging process is complete. All sampling

will be conducted using disposable polyethylene bailers. It is important to note that the sampling for PFOA requires special procedures including equipment used and handling procedures. The precautions to be applied are as follows:

- The handling of prepackaged foods or fast foods prior to sampling should be avoided.
- Prior to purging and sampling wells, personnel should thoroughly wash per the decontamination procedures outlined in the Decontamination SOP (Appendix C-1).
- Nitrile or latex gloves should be worn at all times when handling equipment or sampling.
- Teflon treated equipment should not be used for sampling activities. This would include bailers and lines. Sample containers should also be free of Teflon liners or seals.
- All sampling materials and equipment should be disposable to avoid potential cross-contamination between wells.
- For wells requiring testing for PFOA and volatile organic compounds (VOCs), samples for PFOA should be collected first using a polyethylene bailer. Following the PFOA sampling, a Teflon bailer should be used to collect the additional media for other parameters including VOCs, Metals, and SVOCs.

Following completion of well purging, the well should be allowed to recharge adequately to complete the sampling activities. Wells that exhibit a fast recharge may be sampled immediately. Wells exhibiting slow recharge rates, may be sampled when an adequate volume of groundwater has accumulated. Sampling must be accomplished within 24-hours of purging. If this time has elapsed, the well should be repurged to ensure the integrity of the sampling media.

The sample procedures are as follows:

- Open the well and gather the necessary equipment.
- Don nitrile gloves.
- Place plastic sheeting on the ground around the well to provide a clean working area.
- Prepare the sample containers and complete the labels.
- Don fresh gloves.
- Remove a polyethylene bailer from its packaging and attach it to the polypropylene rope.
- Carefully lower the bailer into the well monitoring its contact with the water surface. Lower the bailer approximately 2/3rds of the bailer

length and carefully retrieve the bailer taking care not to let the bailer or rope contact the ground or adjacent structures.
- Fill the appropriate sample containers for PFOA analysis.
- Seal the containers, inspect the labels and place the containers into an ice chest.
- Don fresh gloves
- Complete the field purge forms and Chain-of-Custody forms.
- Dispose of the expendable items, secure the well and proceed to the next sampling location.

6.5 Sampling with Peristaltic Pump

Peristaltic pumps may be considered for samples requiring specific sampling depths or for samples collected from temporary piezometers or Geoprobe borings. The peristaltic pump utilizes a revolving cam to extract the media through a sampling tube, and thereby eliminating potential impact to the media by contact with pump. The steps in using the peristaltic pump are as follows:

- Setup the pump in an area free of obstruction to allow the tubing to fall freely to the point of media extraction. If a desired depth is required, the tubing may be premeasured to ensure proper sample depth.
- Place plastic sheeting in the area of sample acquisition to act as a clean work area.
- Lock the tubing into the pump cam assembly.
- Turn on the pump using a low flow setting so as not to disturb the sampling zone.
- Once water is received at the discharge point, continue pumping to purge the tubing of at least one sample tube volume.
- Collect the sample in laboratory-prepared containers. Seal, label, and place the containers into an ice chest cooled to approximately 4^{o} C.
- Remove the tubing from the pump cam assembly and place it within the wastes accumulation point, along with the plastic sheeting and any expendable items.
- Complete the sample log data and Chain-of-Custody forms.
- Proceed to the next sample location

7.0 Sample Handling and Preservation

7.1 Once the samples have been collected:

- Transfer the sample(s) into suitable labeled sample containers.

- Preserve the samples or use pre-preserved sample bottles, when appropriate.
- Cap container, tape the cap securely to the container and then place container into plastic zip-locked plastic bag. If the latter is unavailable, use plastic bags and secure closure with tape.
- Load all sample containers into cooler(s) ensuring that bottles are not totally immersed in ice.
- Record all pertinent data in the site logbook and on a field data sheet.
- Complete the chain-of-custody form.
- Attach custody seals to the cooler prior to shipment.
- Decontaminate all reusable sampling equipment prior to the collection of additional samples.

8.0 Data and Records Management

All data and information (e.g., sample collection method used) must be documented on field data sheets or within site logbooks with permanent ink.

9.0 Quality Control and Quality Assurance

9.1 Representative samples are required. In order to collect a representative sample, the hydrology and morphometrics, (e.g., measurements of volume, depth, etc.) of a stream or impoundment should be determined prior to sampling. This will aid in determining flow patterns in streams and appropriate sample locations, depths, and sampling methods.

9.2 All field QC samples required in the QAPP must be followed; these may involve field blanks, rinsate (equipment) blanks, and collection of replicate samples.

10.0 References

Quality Assurance Project Plan for the Phase 2 Characterization Program. (QAPP). WESTON, July 2004.

Phase 2 Work Plan for Sampling Environmental Media for PFOA at the 3M Decatur, AL Plant (Phase 2 Work Plan). WESTON. August 2004.

Health and Safety Plan. (HASP). Appendix A of the *Phase 2 Work Plan for Sampling Environmental Media for PFOA at the 3M Decatur, AL Plant*. WESTON. August 2004.

C.5 PORE WATER SAMPLING

PORE WATER SAMPLING
STANDARD OPERATING PROCEDURE C-5

1.0 Scope and Application

1.1 This Standard Operating Procedure (SOP) is applicable to the collection of representative pore water samples from sediments for PFOA analyses. Pore water, or "interstitial water," is defined as the water contained within the interstitial spaces between sediment particles.

2.0 Summary of Method

2.1 To obtain a representative sample of pore water, the water collected should have minimal mixing with the overlying surface water. A dialysis method will be used to minimize mixing with surface water and to enable use in coarse sediments. Pore water samples will be collected in situ via placement of "peepers" or similar containers in the sediment that allow pore water to diffuse into the sampling container over time (approximately 6-10 days). Peepers will be retrieved for PFOA analysis after allowing sufficient time to equilibrate.

2.2 Sampling will be performed in the 0.5 to 1 ft bgs depth interval.

3.0 Health And Safety Issues

3.1 When working with potentially hazardous materials, follow EPA, OSHA, and specific health and safety procedures as documented in the HASP.

3.2 When conducting sampling from a boat in an impoundment or flowing waters, follow appropriate boating safety procedures contained in the HASP.

4.0 Interferences

4.1 There are 2 primary potential interferences with pore water sampling. These include cross-contamination of samples and improper sample collection.

- Cross-contamination problems can be eliminated or minimized through the use of disposable and/or dedicated sampling equipment. Single use sampling equipment will minimize the potential for cross contamination.

- Improper sample collection can involve improper placement in the sediment and/or allowing insufficient time for equilibration prior to sample retrieval.

4.2 It is important to note that sampling for PFOA requires special procedures including the type of equipment used and handling procedures. The precautions to be applied are as follows:

- The handling of prepackaged foods or fast foods prior to sampling should be avoided.
- Prior to sampling, personnel should thoroughly wash per the decontamination procedures outlined in the Decontamination SOP (Appendix C-1).
- Nitrile or latex gloves should be worn at all times when handling equipment or sampling.
- Teflon treated equipment should not be used for sampling activities. Sample containers should also be free of Teflon liners or seals.
- All sampling materials and equipment should be disposable to avoid potential cross-contamination between sampling locations.

4.3 Following proper decontamination procedures, sampling with disposable/ single use equipment will minimize or eliminate these problems.

5.0 Personnel Qualifications

5.1 All field samples are required to take the 40-hour health and safety training course and regular refresher courses prior to engaging in any field collection activities.

5.2 When conducting sampling from a boat in an impoundment or flowing waters, follow appropriate boating safety procedures contained in the HASP.

6.0 Equipment and Supplies

6.1 Equipment needed for collection of pore water samples include:

- Peepers, chemical polyethylene snap vials with 1-µm filter caps
- Deionized water

- Probe, pry bar, pipe, or other equipment for peeper deployment
- Plastic zip-sealed bags
- Ice
- Cooler(s)
- Chain-of-custody forms, field data sheets
- Decontamination equipment and reagents
- Maps/plot plans
- Safety equipment
- Compass
- Tape Measure
- Global Positioning System (GPS)
- Stakes, flags, or buoys and anchors
- Logbook and waterproof pen
- Sample bottle labels
- Approved Work Plan
- Approved QAPP
- Approved HASP

* The appropriate sampling device and sampler placement equipment must be of proper composition. Sampling equipment and sample containers must not contain Teflon coatings or subassemblies.

7.0 Sample Collection – Preparation

1. Determine the extent of the sampling effort, minimum sample volume requirements, and which equipment and supplies are needed.

2. Obtain necessary sampling and monitoring equipment.

3. Decontaminate or pre-clean equipment, and ensure that it is in working order.

4. Perform a general site survey prior to site entry in accordance with the HASP and facility requirements.

5. Use stakes, flags, or buoys to identify and mark all sampling locations until sampling equipment has been retrieved and positional data has been obtained. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions.

8.0 Sample Collection – Secondary Parameters

1. The dialysis method is expected to provide sufficient volumes only for analysis of the primary parameter PFOA.

2. Water quality measurements of conventional parameters will be collected from any co-located surface water sampling points (Surface Water SOP C-7).

3. Sediment physical characteristics will be obtained at any co-located sediment sampling locations (Sediment Sampling SOP C-6).

9.0 Sample Collection

9.1 Dialysis

Sampling procedures for the dialysis method are as follows:

1. Construct “peepers” from a polyethylene snap vial of suitable volume by boring out the center of the cap. Note the minimum volume for water analysis of PFOA is at least 40 ml (Exygen, 2004).

2. Fill each vial with deionized water, then place a 1-µm filter screen over the opening and tighten the cap. The screen acts as a membrane across which the pore water diffuses over time and enters the bottle.

3. Once in the field, mark the sampling location with a stake, flagging, or other means.

4. Submerge the vial in the sediment and leave it for 6 to 10 days to allow it to equilibrate with the pore water. In gravel or coarse sand environments it will equilibrate faster than in fine-grained silts.

5. Retrieve the sample and label it according to sample location.

6. Place the samples in a cooler at 4 °C and ship to the laboratory.

7. In the laboratory extract the sample by inserting a pipette or syringe through the membrane.

8. Analyze the sample.

10.0 Sample Handling and Preservation

10.1 Once samples have been collected:

1. Place container into plastic zip-locked plastic bag.

2. Load all sample containers into cooler(s) ensuring that bottles are not totally immersed in ice.

3. Record all pertinent data in the site logbook and on a field data sheet.

4. Complete the chain-of-custody form.

5. Attach custody seals to the cooler prior to shipment.

6. Decontaminate all reusable sampling equipment prior to the collection of additional samples.

11.0 Data and Records Management

All data and information (e.g., sample collection method used) must be documented on field data sheets or within site logbooks with permanent ink. Bound field logbooks should be used for the maintenance of field records. All aspects of sample collection and handling as well as visual observations shall be documented in the field logbooks.

All entries in field logbooks should be legibly recorded, and contain accurate and inclusive documentation of an individual's project activities.

12.0 Quality Control and Quality Assurance

12.1 Representative samples are required. In order to collect a representative sample, the substrate conditions should be determined prior to sampling. This will aid in determining sediment particle size characteristics the appropriate means of sample equipment placement, and appropriate sample locations.

12.2 Field quality control samples are collected by the sampling team to determine whether data are of suitable quality. They include blanks, duplicates, and/or background samples.

13.0 References

Quality Assurance Project Plan for the Phase 2 Characterization Program. (QAPP). WESTON, July 2004.

Phase 2 Work Plan for Sampling Environmental Media for PFOA at the 3M Decatur, AL Plant (Phase 2 Work Plan). WESTON. August 2004.

Health and Safety Plan. (HASP). Appendix A of the *Phase 2 Work Plan for Sampling Environmental Media for PFOA at the 3M Decatur, AL Plant*. WESTON. August 2004.

Method of Analysis for the Determination of Perfluorooctanoic Acid (PFOA) in Water by LC/MS/MS. Exygen Research, 2004.

C.6 SEDIMENT SAMPLING

SEDIMENT SAMPLING
STANDARD OPERATING PROCEDURE C-6

1.0 Scope and Application

This Standard Operating Procedure (SOP) is applicable to the collection of sediment samples for PFOA analysis from locations on the Tennessee River, Bakers Creek, and select on-site drainages.

2.0 Summary of Method

Sediment sampling procedures are described in detail in the Phase 2 Quality Assurance Project Plan (QAPP). Sampling devices that will be used in this investigation will depend on a variety of factors including sediment depth, water depth, substrate type, and others. Based on these factors, the samplers to be used for sediment collection may include the following:

- Lexan tube sampler for surface sediments in shallow waters (e.g. less than 1.5 ft deep)
- Rope or pole-mounted Petite Ponar dredge for surface sediments from deeper waters, or
- Wildco Core Sampler with 15 ft handle extension.

The choice of samplers is dictated by sampling objectives and site constraints based on water depth. Each sampling technique presents various advantages and disadvantages for its application. For example, sample disturbance, sample volume, chemical/physical reactivity between potential contaminants and sampling tool materials, and ease of decontamination vary from technique to technique and will be part of the gear selection decision.

3.0 Health and Safety Issues

3.1 When working with potentially hazardous materials, follow EPA, OSHA, and specific health and safety procedures as documented in the HASP.

3.2 When conducting sampling from a boat in an impoundment or flowing waters, follow appropriate boating safety procedures contained in the HASP.

4.0 Interferences

4.1 Primary potential interferences with sediment sampling are associated with the cross contamination of samples during the collection of sediment.

- Cross-contamination will be avoided by the implementation of equipment decontamination procedures associated with sediment collection. Where feasible, disposable equipment sampling and/or sample preparation. These procedures are described in the Decontamination SOP C-1.

4.2 It is important to note that sampling for PFOA requires special procedures including t the type of equipment used and handling procedures. The precautions to be applied are as follows:

- The handling of prepackaged foods or fast foods prior to sampling should be avoided. Prior to sampling and sample preparation, personnel should thoroughly wash per the decontamination procedures outlined in the Decontamination Procedures SOP (Appendix C-1).

- Nitrile or latex gloves should be worn at all times when handling equipment or sampling.

- Teflon-treated equipment should not be used for sampling activities. Sample containers should also be free of Teflon liners or seals.

- All sampling materials and equipment should be disposable to avoid potential cross-contamination between sampling locations.

5.0 Personnel Qualifications

5.1 All sediment sample collection will be performed by Weston personnel. All field sampling personnel are required to take the 40-hr health and safety training and regular refresher courses prior to engaging in any field effort. At a minimum, all personnel are required to be trained to recognize the hazards associated with field work, and specifically working from a boat, as well as be fully knowledgeable of the provisions of the Health and Safety Plan (HASP).

6.0 Equipment and Supplies

- Personal Protective Equipment (see HASP)
- Decontamination items
- Polyethylene sheeting
- Rinse bottles
- Trash bags
- Paper towels
- Funnel
- Field logbook and black ball point pens

- Sediment Attribute Forms
- GPS (hand-held)
- Folding ruler marked in tenths of an inch
- Tape measure
- Stainless steel trowels
- Stainless steel bowls
- Shipping supplies
- Ziploc® bags (1 quart and 1 gallon size)
- Sharpies or other permanent marker
- Stakes
- Flagging
- Caution tape
- Identification tags for staked locations
- Mean Streak or other paint markers
- Scoops and scoopulas
- Wildco KB Corer w/liners and shells w/ 30' cable and messengers
- Petit Ponar dredge w/ 30' rope or pole mount and pole
- Polycarbonate sampling tubes
- Jon boats or similar
- Hip boots/chest waders
- Approved Work Plan
- Approved QAPP
- Approved HASP

* The appropriate sampling device must be of proper composition. Sampling equipment must not contain Teflon coatings or subassemblies. Samplers constructed of glass, stainless steel or PVC should be used based upon the analyses to be performed.

7.0 Sample Collection – Preparation

The following preparation steps will be performed prior to sediment sample collection:

1. Determine the extent of the sampling effort, the sampling methods to be employed, minimum sample volume requirements, and which equipment and supplies are needed.

2. Obtain necessary sampling and monitoring equipment.

3. Decontaminate or pre-clean equipment, and ensure that it is in working order.

4. Perform a general site survey prior to site entry in accordance with the HASP and facility requirements.

5. Use stakes, flags, or buoys to identify and mark all sampling locations until positional data has been obtained. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions.

6. Prior to sediment sampling, all equipment will be thoroughly checked by the team leader to ensure the boat, its motor, the sampling equipment, the GPS unit, etc are all good working condition,

7. Ensure that there are sediment sampling locations that coincide with fish and clam/mussel collection locations.

8. All sampling locations have been clearly identified and are free of any obstructions that may preclude their sampling,

9. No unusual conditions have occurred or are expected to occur that may affect the ability to obtain representative samples (e.g., dredging).

8.0 Sample Collection – Secondary Parameters

Water quality measurements of conventional parameters will be collected from any co-located surface water sampling points (Surface Water SOP Appendix C-7).

Sediment characteristics such as color, odor, and presence of organic material will be described on the field data sheets or in the sample log book. Sediment samples will subsequently be analyzed for grain size w/ hydrometer and total organic carbon (TOC).

9.0 Sample Collection – Method Options

9.2 Petite Ponar

1. Attach the necessary length of sample line to a decontaminated Ponar. Solid braided 5-mm (3/16-in.) nylon line is usually of sufficient strength; however, 20-mm (3/4 - in.) or greater nylon line allows for easier hand hoisting. Note if the pole-mounted option to the Ponar is used, attach the sampling pole to the sampler.

2. Open sampler jaws until latched. From this point, support the sampler by its lift line, or the sampler will be tripped and the jaws will close.

3. Lower the sampler rapidly through last foot until contact is felt.

4. Allow sample line to slack several centimeters. In strong currents, more slack may be necessary to release mechanism.

5. Slowly raise dredge to clear surface.

6. Place Ponar sampler into a stainless steel mixing bowl or suitable tray/tub and slowly open disturbing the collected sediment as little as possible.

9.2 Wildco Corer and other coring devices

The KB Wildco Corer is a metal tube with a replaceable tapered nosepiece on the bottom and a check valve on top. The check valve allows water to pass through the corer on its descent but prevents washout during its recovery. The corer can be used both with and without a polycarbonate (Lexan) core liner.

Sampling Procedure:

- Identify and record location of sediment sample using the GPS meter in the field notebook.
- Attach corer to the required length of sample line or cable.
- Secure the free end of the line to a fixed support on the boat.
- Measure the depth to the top of the sediment with a weighted object or pole.
- Mark the distance to the top of the sediment on the sample line with a proximity mark 3 ft above the sediment. Record depth to top of sediment and depth of sediment penetration.
- Begin lowering the sampler until the proximity mark is reached.
- Lower the sampler rapidly through last foot until contact is felt.
- Allow sample line to slack several centimeters.
- Retrieve corer with a smooth, continuous lifting motion, avoid jerking or bumping sampler as this may result on the loss of sample.
- Remove nose cone and slide liner out
- Extrude sediment until top 10 cm are remaining in coring tube.

- Collect the top 10 centimeters of the sediment plug with a stainless steel laboratory spoon or equivalent, and place sample into appropriate pre-labeled sample bottle.
- Secure the cap tightly.
- Label the sample bottle with the appropriate sample designation. Be sure to complete the label carefully and clearly, addressing all the categories or parameters.
- Place filled sample containers on ice immediately.
- Complete all chain-of-custody documents and field sheets, and record information in the field logbook.
- Decontaminate sampler.

10. Sample Processing

All sediment samples for PFOA analysis will be collected in 4-oz acid-rinsed, clear wide mouth glass jars with non-Teflon-lined lids. Sediment samples will also be analyzed for percent solids, moisture, and total organic carbon (TOC). Upon collection, all sediment samples will be placed in coolers containing sufficient ice to cover the samples. Samples will be maintained at 0-4 °C until samples are shipped. Once samples have been collected:

1. Homogenize sample thoroughly with a disposable or decontaminated stainless steel trowel.
2. Transfer the sample(s) into suitable labeled sample containers.
3. Preserve the samples or use pre-preserved sample bottles, when appropriate.
4. Cap container, tape the cap securely to the container and then place container into plastic zip-locked plastic bag. If the latter is unavailable, use plastic bags and secure closure with tape.
5. Load all sample containers into cooler(s) ensuring that bottles are not totally immersed in ice.
6. Record all pertinent data in the site logbook and on a field data sheet.
7. Complete the chain-of-custody form.
8. Attach custody seals to the cooler prior to shipment.

9. Decontaminate all reusable sampling equipment prior to the collection of additional samples.

11. Data and Records Management

All sample documentation will follow project specific SOPs for field sample ID, data recording, chain of custody, custody seal procedures. All data and information will be documented in field data logbooks with permanent ink. All entries in field logbooks should be legibly recorded, and contain accurate and inclusive documentation of an individual's project activities.

12. Decontamination

All sampling equipment will be decontaminated as specified in the project-specific Decontamination SOP C-1.

13. Field Quality Assurance/Quality Control Samples

All field QA/QC procedures will be followed as described in the Work Plan and the QAPP. Further detail on the data quality objectives, data validation, and data quality indicators can be found in the QAPP (*Weston, 2004*).

14. References

Quality Assurance Project Plan for the Phase 2 Characterization Program. (QAPP). WESTON, July 2004.

Phase 2 Work Plan for Sampling Environmental Media for PFOA at the 3M Decatur, AL Plant (Phase 2 Work Plan). WESTON. August 2004.

Health and Safety Plan. (HASP). Appendix A of the *Phase 2 Work Plan for Sampling Environmental Media for PFOA at the 3M Decatur, AL Plant*. WESTON. August 2004.

C.7 SURFACE WATER SAMPLING

SURFACE WATER SAMPLING
STANDARD OPERATING PROCEDURE C-7

1.0 Scope and Application

1.1 This Standard Operating Procedure (SOP) is applicable to the collection of representative aqueous samples from streams, rivers, lakes, ponds, and surface impoundments. It includes samples collected from depth, as well as samples collected from the surface.

2.0 Summary of Method

2.1 Sampling situations vary widely and, therefore, no universal sampling procedure will be applicable for all possible conditions. However, sampling of liquids from the above mentioned sources is generally accomplished through the use of one of the following samplers or techniques:

- Kemmerer bottle
- Peristaltic pump
- Direct method

2.2 These sampling techniques will allow for the collection of representative samples from the majority of surface waters and impoundments encountered.

2.3 Sampling depth will be determined on the basis of total water depth. For sampling locations less than 10 feet deep, samples will be collected at the 0.6 depth (six-tenths of the total depth of water). If the depth is too shallow to prevent disturbing substrate during sample collection, direct collection at the surface will be performed. For sampling locations greater than or equal to 10 feet deep, samples will be collected from the 0.2z and 0.8 depths (two-tenths and eight-tenths of the total depth of water) and composited in equal volumes.

3.0 Health And Safety Warnings

3.1 When working with potentially hazardous materials, follow EPA, OSHA, and specific health and safety procedures as documented in the HASP.

3.2 When conducting sampling from a boat in an impoundment or flowing waters, follow appropriate boating safety procedures contained in the HASP.

4.0 Interferences

4.1 There are two primary potential interferences with surface water sampling. These include cross-contamination of samples and improper sample collection.

- Cross-contamination problems can be eliminated or minimized through the use of disposable and/or dedicated sampling equipment. If this is not possible or practical, then decontamination of sampling equipment is necessary. Refer to the Decontamination SOP (Appendix C-1).

- Improper sample collection can involve using contaminated equipment, disturbance of the stream or impoundment substrate, and sampling in an obviously disturbed area.

4.2 It is important to note that sampling for PFOA requires special procedures including the type of equipment used and handling procedures. The precautions to be applied are as follows:

- The handling of prepackaged foods or fast foods prior to sampling should be avoided.

- Prior to sample collection, personnel should thoroughly wash per the decontamination procedures outlined in the Decontamination SOP Appendix (C-1).

- Nitrile or latex gloves should be worn at all times when handling equipment or sampling.

- Teflon treated equipment should not be used for sampling activities. Sample containers should also be free of Teflon liners or seals.

- When possible all sampling materials and equipment should be disposable to avoid potential cross-contamination between sampling locations.

4.3 Following proper decontamination procedures and minimizing disturbance of the sample site will eliminate these problems.

5.0 Personnel Qualifications

5.1 All surface water sample collection will be performed by Weston personnel. All field sampling personnel are required to take the 40-hr

health and safety training and regular refresher courses prior to engaging in any field effort. At a minimum, all personnel are required to be trained to recognize the hazards associated with field work, and specifically working from a boat, as well as be fully understanding of the provisions of the Health and Safety Plan (HASP).

6.0 Equipment and Supplies

6.1 Equipment needed for collection of surface water samples include:

- Kemmerer bottles*
- Line and messengers
- Sample bottle preservatives as specified by the analyses to be performed.
- Plastic zip-sealed bags
- Ice
- Cooler(s)
- Chain-of-custody forms, field data sheets
- Decontamination equipment and reagents specified in the Decontamination SOP (Appendix C-1).
- Maps/plot plans
- Safety equipment
- Compass
- Tape Measure
- Global Positioning System (GPS)
- Survey stakes, flags, or buoys and anchors
- Logbook and waterproof pen
- Sample bottle labels
- Approved Work Plan

- Approved QAPP
- Approved HASP

* The appropriate sampling device must be of proper composition. Sampling equipment must not contain Teflon coatings or subassemblies. Samplers constructed of glass, stainless steel or PVC should be used based upon the analyses to be performed.

7.0 Sample Collection – Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, minimum sample volume requirements, and which equipment and supplies are needed.

2. Obtain necessary sampling and monitoring equipment.

3. Decontaminate or pre-clean equipment, and ensure that it is in working order.

4. Perform a general site survey prior to site entry in accordance with the HASP and facility requirements.

5. Use stakes, flags, or buoys to identify and mark all sampling locations until positional data has been obtained. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions.

8.0 Sample Collection – Secondary Parameters

1. Water quality data should be collected in impoundments to determine if stratification is present. Measurements of dissolved oxygen, pH, and temperature can indicate if strata exist which would affect analytical results. Measurements should be collected at 1-meter intervals from the substrate to the surface using an appropriate instrument calibrated in accordance with the instrument manufacturer's instructions.

2. Water quality measurements such as dissolved oxygen, pH, temperature, and conductivity can assist in the interpretation of analytical data and the selection of sampling sites.

3. Generally, the deciding factors in the selection of a sampling device for sampling liquids in streams, rivers, lakes, ponds, lagoons, and surface impoundments are:

Will the sample be collected from the shore or from a boat?

What is the desired depth at which the sample is to be collected?

What is the overall depth and flow direction of the river or stream?

9.0 Sample Collection – Method Options

9.1 Kemmerer Bottle

A Kemmerer bottle may be used in most situations where site access is from a boat or structure such as a bridge or pier, and where samples at depth are required. Sampling procedures are as follows:

1. Using a properly decontaminated Kemmerer bottle, set the sampling device so that the sampling end pieces are pulled away from the sampling tube, allowing water to be sampled to pass through this tube.

2. Lower the pre-set sampling device to the pre-determined depth. Avoid bottom disturbance.

3. When the Kemmerer bottle is at the required depth, send down the messenger closing the sampling device.

4. Retrieve the sampler and discharge the first 10 to 20 ml to clear any potential contamination on the valve. Transfer the sample to the appropriate sample container.

9.2 Peristaltic Pump

Peristaltic pumps may be considered for samples requiring specific sampling depths or for samples requiring high volume of media. The peristaltic pump utilizes a revolving cam to extract the media through a sampling tube, and thereby eliminating potential impact to the media by contact with pump. The steps in using the peristaltic pump are as follows:

1. Setup the pump in an area free of obstruction to allow the tubing to fall freely to the point of media extraction. If a desired depth is required, the tubing may be premeasured to ensure proper sample depth.

2. Place plastic sheeting in the area of sample acquisition to act as a clean work area.

3. Lock the tubing into the pump cam assembly.

4. Turn on the pump using a low flow setting so as not to disturb the sampling zone.

5. Once water is received at the discharge point, continue pumping to purge the tubing of at least one sample tube volume.

6. Collect the sample in laboratory-prepared containers. Seal, label, and place the containers into an ice chest cooled to approximately 4^{o} C.

7. Remove the tubing from the pump cam assembly and place it within the wastes accumulation point, along with the plastic sheeting and any expendable items.

8. Complete the sample log data and Chain-of-Custody forms.

9. Proceed to the next sample location.

9.3 Direct Method

For shallow waters where Kemmerer or other techniques are unsuitable, the direct method may be utilized to collect water samples from the surface.

Using adequate protective clothing, obtain access to the sampling station by appropriate means. For shallow stream stations, collect the sample under the water surface pointing the sample container upstream. The container must be upstream of the collector. Avoid disturbing the substrate. For lakes and other impoundments, collect the sample under the water surface avoiding surface debris and the boat wake. The following procedure should be used to prepare the sampling container:

1. Moisten a Chem-wipe^{tm} or equivalent with methanol and wipe the exterior of the sampling bottle with the cap in place.

2. Submerge the sample bottle below the surface and remove the cap.

3. Fill the sample bottle below the water surface and recap under water.

4. Wipe the bottle with methanol-moistened Chem-wipe^{tm} or equivalent and apply sample label.

When using the direct method, do not use pre-preserved sample bottles as the collection method may dilute the concentration of preservative necessary for proper sample preservation.

10.0 Sample Handling and Preservation

10.1 Once samples have been collected:

1. Transfer the sample(s) into suitable labeled sample containers.
2. Preserve the samples or use pre-preserved sample bottles, when appropriate.
3. Cap container, tape the cap securely to the container and then place container into plastic zip-locked plastic bag. If the latter is unavailable, use plastic bags and secure closure with tape.
4. Load all sample containers into cooler(s) ensuring that bottles are not totally immersed in ice.
5. Record all pertinent data in the site logbook and on a field data sheet.
6. Complete the chain-of-custody form.
7. Attach custody seals to the cooler prior to shipment.
8. Decontaminate all reusable sampling equipment prior to the collection of additional samples.

11.0 Data and Records Management

All data and information (e.g., sample collection method used) must be documented on field data sheets or within site logbooks with permanent ink.

12.0 Quality Control and Quality Assurance

12.1 Representative samples are required. In order to collect a representative sample, the hydrology and morphometrics, (e.g., measurements of volume, depth, etc.) of a stream or impoundment should be determined prior to sampling. This will aid in determining flow patterns in streams and appropriate sample locations, depths, and sampling methods.

12.2 Field quality control samples will be collected by the sampling team to determine whether data are of suitable quality. They include blanks, duplicates and/or background samples.

13.0 References

Quality Assurance Project Plan for the Phase 2 Characterization Program. (QAPP). WESTON, July 2004.

Phase 2 Work Plan for Sampling Environmental Media for PFOA at the 3M Decatur, AL Plant (Phase 2 Work Plan). WESTON. August 2004.

Health and Safety Plan. (HASP). Appendix A of the *Phase 2 Work Plan for Sampling Environmental Media for PFOA at the 3M Decatur, AL Plant*. WESTON. August 2004.

C.8 SOIL SAMPLING

SOIL SAMPLING
STANDARD OPERATING PROCEDURE C-8

1.0 Scope and Application

1.1 This SOP is applicable to the development and application of a soil sampling program including discussion of methodology and equipment. Sampling systems vary depending on the objectives of the soil sampling program and soil conditions. The procedures discussed herein focus on the collection of surface soil samples (within approximately five feet from ground surface) utilizing manual hand-operated equipment and the collection of subsurface soil samples utilizing mechanical drilling techniques.

2.0 Summary of Method

2.1 This document has been prepared to served as default procedures to assist personnel with the performance of specific tasks and procedures related to the collection of surface soil samples. The procedures set forth herein are supported by the following American Society for Testing and Materials (ASTM) Standard Practices:

- D5911-96. *Practice for a Minimum Set of Data Elements to Describe a Soil Sampling Site*.
- D2487-93 *Classification of Soils for Engineering Purposes (Unified Soil Classification System.*
- D2488-93. *Practice for Description and Identification of Soils (Visual-Manual Procedures).*

2.2 These standards are amended to address quality control requirements specific to the evaluation of PFOA as outlined below.

The procedures addressed in this SOP include the following:

- Sampling with a scoop or trowel
- Sampling with a hand-operated bucket auger

3.0 Health And Safety Issues

3.1 As with any activities associated with potential contaminants, work tasks should be conducted in strict accordance with EPA, OSHA, 3M, and WESTON safety policy and procedures. This will include at a minimum,

preparation of a site Health and Safety Plan to ensure that all aspects of potential risk are evaluated. In addition to the potential chemical hazards associated with this activity, the following potential hazards should also be considered:

- Chemical Contaminants
- Foreign Debris in Soil
- Remote Work Areas
- Biological Hazards
- Unstable Terrain

4.0 Interferences

4.1 Primary potential interferences with soil sampling include cross-contamination of samples and improper sample collection.

- Cross-contamination problems can be eliminated or minimized through the use of disposable and/or dedicated sampling equipment. If this is not possible or practical, then decontamination of sampling equipment is necessary. Refer to the Decontamination SOP (Appendix C-1).

- Improper sample collection can involve using contaminated equipment, disturbance of the soils in the horizon or interval being sampled, and sampling in an obviously disturbed area.

4.2 It is important to note that sampling for PFOA requires special procedures including the type of equipment used and handling procedures. The precautions to be applied are as follows:

- The handling of prepackaged foods or fast foods prior to sampling should be avoided. Prior to sample collection, personnel should thoroughly wash per the decontamination procedures outlined in the Decontamination SOP (Appendix C-1).

- Nitrile or latex gloves should be worn at all times when handling equipment or sampling.

- Teflon treated equipment should not be used for sampling activities. Sample containers should also be free of Teflon liners or seals.

- When possible all sampling materials and equipment should be disposable to avoid potential cross-contamination between sampling locations.

4.3 Following proper decontamination procedures and minimizing disturbance of the sample site will eliminate these problems.

5.0 Personnel Qualifications

5.1 All field personnel with potential for exposure to contaminated media on site are required to take the 40-hour Health and Safety Training and regular refresher courses prior to engaging in any field effort. At a minimum, all personnel are required to be trained to recognize hazards associated with the field work and fully familiar with provisions of the HASP.

6.0 Equipment and Supplies

6.1 Soil sampling equipment used for sampling trace contaminants should be constructed of inert materials such as stainless steel. Ancillary equipment such as auger flights, post hole diggers, etc. may be constructed of other materials since this equipment does not come in contact with the samples.

6.2 Selection of equipment is usually based on the depth of the samples to be collected, but it is also controlled to a certain extent by the characteristics of the material. Manual techniques and equipment such as hand augers, are usually used for collecting surface or shallow, subsurface soil samples. Equipment and supplies that may be required as part of this SOP include the following:

- Stainless steel hand-operated bucket auger
- Stainless steel scoops
- Stainless steel bowls
- Stainless steel split-barrel sampler
- Plastic Sheeting
- Plastic zip-sealed bags
- Survey stakes or survey flags
- Permanent markers
- Field logbook
- Area maps, ruler, waterproof pens
- Measuring tape (100 foot)
- Munsell Soil Color Reference Guide
- Nitrile gloves
- Leather gloves
- Shovel or post-hole diggers

- Safety equipment (safety shoes, safety glasses, hard hat, first aid kit)
- Sample bottles, preservatives, labels
- Chain-of-Custody forms
- Coolers
- Ice
- Approved QAPP
- Approved HASP
- Radio or cell phone
- Truck or suitable off-road vehicle

7.0 Sample Collection – Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, minimum sample volume requirements, and which equipment and supplies are needed.

2. Obtain necessary sampling and monitoring equipment.

3. Decontaminate or pre-clean equipment, and ensure that it is in working order.

4. Perform a general site survey prior to site entry in accordance with the HASP and facility requirements.

5. Use stakes or flags to identify and mark all sampling locations until positional data has been obtained. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions.

8.0 Sample Collection – Secondary Parameters

1. Soil characterization data should be collected during soil sampling. Visual observations of soil color and texture, descriptions of soil horizons, moisture, the presence of any sludge or discolored layers and any disturbed areas should be recorded on field data sheets or in the field logbook.

9.0 Sampling Methodology

9.1 Surface Sampling Procedures

1. This discussion of soil sampling methodology is applicable to the collection of surface soil samples using scoops or hand augers. Additional reference is made to specific methods applicable to the work plan related to the collection

of samples to be tested for PFOA compounds associated with former sludge application fields

2. Sampling locations may be tentatively located prior to mobilization to the site based on historic records, aerial photographs, and site drawings. Upon entering the field, the proposed area should be evaluated to confirm that samples collected from the area meet the objectives of the investigation. Final sample locations should be designated by the field geologist. The following procedures may be applied to the site for sampling:

    - Using mapped locations, locate the sample location.
    - Conduct reconnaissance of the area to select an appropriate sample location deemed representative of the area investigated. Since the intent is to sample from areas where sludge has been applied, test borings may be necessary to identify impacted areas before the sample location is selected.
    - Clear an area around to sample site to reduce potential for vegetative debris in the sample.
    - Designate the location with a unique sample identifier and place a stake or survey flag at the location with the sample site identification.
    - Place plastic sheeting adjacent to the sample site to provide a clean work place.
    - Don nitrile gloves and prepare equipment. If hand augers are to be used, leather gloves are permitted provided there is no contact with the sampling media.
    - Begin construction of the sample boring by removing the A soil horizon (upper soil horizon containing the vegetative root mat generally high in organic debris).
    - Continue the boring until the desired depth is achieved.
    - Don nitrile gloves.
    - Collect soil from the sampling interval using decontaminated stainless steel equipment (scoop or auger).
    - Place soil into a decontaminated stainless steel bowl.
    - When adequate volume is achieved, don fresh nitrile gloves and blend the soil in the bowl until the soil is adequately homogenized.
    - Using a stainless steel scoop, place the soil media into appropriately prepared laboratory containers.
    - Seal, label, and place the containers into plastic zip-sealed bags and into a cooled ice chest.
    - Adequately describe the sample site including site setting, vegetation, drainage conditions, depth to sampling location, and a soil description.
    - Complete the Chain-of-Custody.

- Decontaminate the sampling equipment (according to the procedures outlined in to the Decontamination SOP (Appendix C-1).
- Dispose of expendable items in the waste allocation area and backfill sampling site.
- Conduct personal decontamination per the Decontamination SOP (Appendix C-1) and proceed to the next sample location.

9.2 Subsurface Soil Sampling

1. This discussion of soil sampling methodology is applicable to the collection of subsurface soil samples using hollow-stem drilling techniques and stainless steel split-barrel samplers. Additional reference is made to specific methods applicable to the work plan related to the collection of samples to be tested for PFOA compounds associated with former sludge application fields.

2. Soil samples may be retrieved at designated depths within soil borings using split-barrel samplers. The following procedures may be applied to the site for sampling:

    - Upon advancing the soil boring to the desired sampling depth, attach a decontaminated split-barrel sampler to the sampling rods and lower the sampler into augers within the borehole. For decontamination procedures, see the Decontamination SOP (Appendix C-1).
    - When the sampler is positioned at the bottom of the boring, place the hammer above and attach the anvil to the top of the sampling rods.
    - Mark the sampling rods from the top of the augers with three successive six-inch intervals and begin hammering the rods with the hammer. Once the third six-inch mark is equal to the top of augers, cease hammering and retrieve the sampler.
    - Prepare an area for the sampler by spreading plastic sheeting in an area that will not be affected by the drilling activities.
    - Don nitrile gloves and open the sampler by removing the shoe. Pull the split barrels apart exposing the soil sample.
    - Determine the extent of sluff (loose soil) in the barrel and discard.
    - Don fresh nitrile gloves.
    - If sample interval is below the water table and the sample is coated with mud, carefully remove the outer portion of the sample core using decontaminated stainless steel scoops. Place the cleaned soil core into a decontaminated stainless steel bowl.
    - Place soil into a decontaminated stainless steel bowl.
    - When adequate volume is achieved, don fresh nitrile gloves and blend the soil in the bowl until the soil is adequately homogenized.

- Using a stainless steel scoop, place the soil media into appropriately prepared laboratory containers.
- Seal, label, and place the containers into plastic zip-sealed bags and into a cooled ice chest.
- Adequately describe the sample site including sample depth, soil color and texture, moisture content, and a soil description.
- Complete the Chain-of-Custody.
- Decontaminate the sampling equipment (according to the procedures outlined in to the Decontamination SOP (Appendix C-1).
- Continue drilling to the next sampling interval.
- Upon completion of the soil boring, conduct personal decontamination per the Decontamination SOP (Appendix C-1) and proceed to the next boring location.

9.3 Special Techniques and Considerations

Sampling for PFOA requires special handling requirements to reduce the potential for cross-contamination between sample locations or contamination of the samples by secondary sources. The following steps should be followed when sampling for PFOA:

- Avoid fluoropolymers. Do not use aluminum foil during the sampling activities**.**
- Avoid blue ice
- Avoid pre-wrapped food items and “fast foods”.
- Wear clothing that has been washed at least six times.
- Do not use any items containing Teflon
- If PFOA is part of a larger sampling suite, the samples should be maintained in a cooler separate from other samples that may have Teflon-lined lids.

10.0 Sample Handling and Preservation

10.1 Once samples have been collected:

1. Transfer the sample(s) into suitable labeled sample containers.

2. Preserve the samples or use pre-preserved sample bottles, when appropriate.

3. Cap container, tape the cap securely to the container and then place container into plastic zip-locked plastic bag. If the latter is unavailable, use plastic bags and secure closure with tape.

4. Load all sample containers into cooler(s) ensuring that bottles are not totally immersed in ice.

5. Record all pertinent data in the site logbook and on a field data sheet.

6. Complete the chain-of-custody form.

7. Attach custody seals to the cooler prior to shipment.

8. Decontaminate all reusable sampling equipment prior to the collection of additional samples.

11.0 Data and Records Management

All data and information (e.g., sample collection method used) must be documented on field data sheets or within site logbooks with permanent ink.

12.0 Quality Control and Quality Assurance

12.1 All field QC samples required in the QAPP must be followed; these may involve field blanks, rinsate (equipment) blanks, and collection of replicate samples.

13.0 References

Quality Assurance Project Plan for the Phase 2 Characterization Program. (QAPP). WESTON, July 2004.

Phase 2 Work Plan for Sampling Environmental Media for PFOA at the 3M Decatur, AL Plant (Phase 2 Work Plan). WESTON. August 2004.

Health and Safety Plan. (HASP). Appendix A of the *Phase 2 Work Plan for Sampling Environmental Media for PFOA at the 3M Decatur, AL Plant*. WESTON. August 2004.

C.9 VEGETATION SAMPLING

VEGETATION SAMPLING
STANDARD OPERATING PROCEDURE C-9

1.0 Scope and Application

1.1 This Standard Operating Procedure (SOP) is applicable to the collection of representative vegetation samples for laboratory analyses. The most prevalent vegetation species common to the areas being studied and suitable for foraging by small mammals will be sampled.

2.0 Summary of Method

2.1 Sampling of aboveground vegetation will be performed with stainless steel shears or other cutting device. Clippings of the foliar material and stems will be collected.

2.2 This sampling technique will allow for the collection of samples of vegetation that are representative of potential forage for small mammals.

2.3 Aboveground vegetation will be clipped to within 1/2 inch of the soil surface to represent typical grazing behavior by small mammals.

3.0 Health And Safety Warnings

3.1 When working with potentially hazardous materials, follow EPA, OSHA, and specific health and safety procedures as documented in the HASP.

4.0 Interferences

4.1 The primary potential interferences with vegetation sampling include cross-contamination of samples and improper sample collection.

- Cross-contamination problems can be eliminated or minimized through the use of disposable and/or dedicated sampling equipment. Decontamination of shears or other cutting devices is necessary. Refer to the Decontamination SOP (Appendix C-1).

- Improper sample collection can involve using contaminated equipment, cutting vegetation samples too close to the soil, and misidentification of vegetation species to be sampled.

4.2 It is important to note that sampling for PFOA requires special procedures including the type of equipment used and handling procedures. The precautions to be applied are as follows:

- The handling of prepackaged foods or fast foods prior to sampling should be avoided.
- Prior to sampling and sample preparation, personnel should thoroughly wash per the decontamination procedures outlined in the Decontamination SOP (Appendix C-1).
- Nitrile or latex gloves should be worn at all times when handling equipment or sampling.
- Teflon treated equipment should not be used for sampling activities. Sample containers should also be free of Teflon liners or seals.
- All sampling materials and equipment should be disposable to avoid potential cross-contamination between sampling locations.

4.3 Following proper decontamination procedures and minimizing disturbance of the sample site will eliminate these problems.

5.0 Personnel Qualifications

5.1 All field personnel are required to take the 40-hour health and safety training course and regular refresher courses prior to engaging in any field collection activities. All personnel are required to be trained to recognize the hazards associated with field work as well as a full understanding of the HASP.

6.0 Equipment and Supplies

6.1 Equipment needed for collection of vegetation samples include:

- Stainless steel shears or other cutting devices
- Polyethylene film
- Plastic zip-sealed bags
- Ice
- Cooler(s)
- Chain-of-custody forms, field data sheets
- Decontamination equipment and reagents
- Maps/plot plans
- Safety equipment

- Compass
- Tape Measure
- Global Positioning System (GPS)
- Survey stakes, flags, or buoys and anchors
- Logbook and waterproof pen
- Sample bottle labels
- Approved Work Plan
- Approved QAPP
- Approved HASP

* The appropriate sampling device must be of proper composition. Sampling equipment must not contain Teflon coatings or subassemblies.

7.0 Sample Collection – Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, minimum sample volume requirements, and which equipment and supplies are needed.

2. Obtain necessary sampling and monitoring equipment.

3. Decontaminate or pre-clean equipment, and ensure that it is in working order.

4. Perform a general site survey prior to site entry in accordance with the HASP and facility requirements.

5. Use stakes or flags to identify and mark all sampling locations until positional data has been obtained. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions.

8.0 Sample Collection – Secondary Parameters

The following data on the vegetation sampling areas will be collected:

1. The presence, distribution, and dominance of target and nontarget vegetation species in the vicinity of the sampling locations will be characterized.

2. The assessment of vegetation community characteristics can assist in the selection of sampling locations and subsequent interpretation of analytical data.

3. Measurements of conventional soil characteristics and sieve and grain size analyses will be collected from any soil sampling points (Soil Sampling SOP C-8).

9.0 Sample Collection

1. The vegetation will be clipped within 1/2 inch of the ground in order to simulate grazing patterns. Vegetation samples will be collected from the current growing season. During sample collection, inspect the sample for dead material and remove any foliar or stem material that is not current (green) growth.

2. Use polyethylene sheeting to collect grass clippings and transfer clippings into a one-liter amber glass sample jar.

3. The total weight of each sample should range between 80 grams to 100 grams. Verify the weight of the sample is within the proper range by using the balance to weigh the sample bottle before and after collecting the sample.

4. Seal the jar and complete a sample label according to the field sample numbering convention.

5. Place samples in cooler with ice.

6. Decontaminate sampling equipment between locations according to the procedures contained in the Decontamination SOP (Appendix C-1).

10.0 Sample Handling and Preservation

10.1 Once samples have been collected:

1. Load all sample containers into cooler(s) ensuring that bottles are not totally immersed in ice.

2. Record all pertinent data in the site logbook and on a field data sheet.

3. Complete the chain-of-custody form.

4. Attach custody seals to the cooler prior to shipment.

5. Decontaminate all reusable sampling equipment prior to the collection of additional samples.

11.0 Data and Records Management

All data and information (e.g., sample collection method used) must be documented on field data sheets or within site logbooks with permanent ink.

12.0 Quality Control and Quality Assurance

12.1 Representative samples are required. In order to collect a representative sample, the vegetation should be positively identified prior to sampling. The use of common taxa will maximize the ability to compare results with samples from other locations.

12.2 All field QC samples required in the QAPP must be followed; these may involve field blanks and collection of replicate samples.

13.0 References

Quality Assurance Project Plan for the Phase 2 Characterization Program. (QAPP). WESTON, July 2004.

Phase 2 Work Plan for Sampling Environmental Media for PFOA at the 3M Decatur, AL Plant (Phase 2 Work Plan). WESTON. August 2004.

Health and Safety Plan. (HASP). Appendix A of the *Phase 2 Work Plan for Sampling Environmental Media for PFOA at the 3M Decatur, AL Plant*. WESTON. August 2004.

C.10 CONSTRUCTION OF MONITORING WELLS

CONSTRUCTION OF MONITORING WELLS
STANDARD OPERATING PROCEDURE C-10

Introduction

This document has been prepared to served as default procedures to assist Weston Solutions, Inc.(WESTON) personnel with the performance of specific tasks and procedures related to the installation of temporary or permanent groundwater monitoring systems. The procedures set forth herein are in accordance with the EPA Region IV *Environmental Investigations Standard Operating Procedures and Quality Assurance Manual* dated November 2001, and the following American Society for Testing and Materials (ASTM) Standard Practices:

- D5092-02. *Standard Practice for Design and Installation of Groundwater Monitoring Wells in Aquifers*
- D6724-01. *Standard Guide for Installation of Direct-Push Groundwater Monitoring Wells*
- D5781-2000. *Standard Guide for use of Dual-Wall Reverse Circulation Drilling for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices*
- D5782-2000. *Standard Guide for use of Direct Air-Rotary Drilling for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices*
- D5781-2000. *Standard Guide for use of Direct Rotary Drilling with Water-Based Drilling Fluid for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Devices*

WESTON amends these standards to include the use of applicable field forms or field log books per the requirements of the specific field task to record pertinent lithologic, well construction, drilling activities, water levels, well purging, and well development information. Examples of these forms are presented in this document.

These standards are also amended to address quality control requirements specific to the evaluation of fluorochemicals as outlined below.

Boring Construction

The design and installation of soil borings for construction of temporary or permanent monitoring wells will be in accordance with the ASTM procedures referenced above. Designing and installing monitoring wells in various geologic environments may require several different drilling methods and installation procedures. The selection of drilling methods and installation procedures should be based on the conditions anticipated or determined for the site of investigation.

The field procedures outlined below specifically reference the use of hollow-stem auger drilling

procedures, as this method is the preferred method for monitoring well construction in unconsolidated media. However, the procedures may also be applied to other drilling technologies.

Hollow-Stem Auger Drilling procedures are commonly applied for construction of wells in unconsolidated soil where the potential for collapse within the borehole exists. The monitoring well may be constructed within the augers to prevent collapse of the borehole during construction of the annulus. The augers are gradually removed during placement of the annulus materials.

In general, the following considerations should be made with respect to the borehole construction:

- All drilling equipment should be adequately decontaminated between boring locations to prevent cross-communication of potential contaminants. The decontamination procedures for drilling equipment are discussed in Decontamination SOP C-1.
- Borehole diameters should be such to provide a minimum of two inches of open borehole around the selected well material to provide adequate space for annulus construction.
- Placement and construction of the monitoring wells should be done within a short period of time after placement of the augers to prevent blockage within the augers due to mud infiltration.

Well Construction

Once the borehole is constructed to the desired depth, the well material should be inserted as soon as possible to prevent potential blockage within the borehole due to collapse or mud infiltration. The following procedures should be applied to well installation:

- Well materials should be compatible with site conditions and anticipated site contaminants to prevent degradation of the well materials and to prevent the potential introduction of contaminants of concern by the materials used. Consideration should also be made as to the materials used for o-rings and seals between well sections.
- Well materials should be new and sealed in the factory packaging until used to prevent potential contamination from outside sources prior to installation. Personnel handling the materials should wear adequate personal protective equipment (i.e. gloves and/or coveralls) to prevent contact with the material and the potential introduction of contaminants.
- Well materials should be constructed with flush-threaded joints to prevent internal well obstruction and to adequately seal well joints. If o-rings or other gaskets or seals are utilized at the joint, the material used for the riser seal should be considered for final well construction.
- Screens should be selected with appropriate length and slot diameter to allow adequate recharge and to prevent sediment infiltration into the well. (See ASTM 5092-02 for guidance on selection of screen slot size).

For the monitoring of potential fluochemical constituents, the following additional considerations should be made:

- Personnel handling the well materials should wash (decontaminate) their hands before handling well materials, especially if there has been recent contact with environmental lubricants, such as vegetable-based oils or pre-wrapped food items. The decontamination will be in accordance with the procedures outlined in Decontamination SOP C-1.
- Only latex or nitrile gloves should be worn during the handling and installation of well materials. Leather gloves or items containing Teflon should not be used.
- Well materials should be constructed of stainless steel (304 or 316)
- Well joint seals or o-rings should not contain Teflon.
- Equipment, such as tremie pipes, or funnels used to install sand packs should be adequately decontaminated following the procedures presented in Decontamination SOP C-1 to prevent potential introduction of contaminants of concern or cross-communication of contaminants between locations.

Filter Pack Placement

Once the well is in place, a sand pack will be constructed across to screen interval to serve as a communication interval between the screen and adjacent soil. The filter material will consist of prepackaged filter sand with a grain size suitable for site conditions. The filter material should be selected with a grain diameter adequate to prevent significant siltation of the sand pack or well screen (See ASTM 5092-02 for guidance on selection of sand pack materials).

When placing the filter pack into the borehole, a minimum of 6-inches of the filter pack material should be placed under the bottom of the well screen to provide a firm footing and an unrestricted flow under the screened area. Also, the filter pack should extend a minimum of 2-feet above the top of the well screen.

For borings exceeding a depth of 20 feet, the filter pack should be placed by the tremie or positive displacement method. This is done by placing the sand, either dry or as a slurry, into the annulus using a one-inch diameter pipe. The pipe is generally constructed with one-inch flush threaded PVC well riser. In some cases, it is necessary to install the sand as a slurry to prevent bridging within the annulus water zone. In this case, potable water will be added in a sufficient quantity to allow the sand to flow freely to the screen interval. Water should not be continually pumped into the borehole or used to wash materials down the borehole during placement. The source of the water used should be document as a permanent record of the well construction. Material depths will be monitored continually during construction of the sand pack to ensure there is no bridging of materials and to document final construction depths. This may be accomplished using the tremie pipe (of known length) or a water level indicator. The tremie pipe and measuring equipment must be decontaminated between boring locations to prevent cross-communication of potential contaminants.

In most instances, wells will be constructed within the augers to prevent collapse of the annulus. Depths to the annular material will be continually monitored to ensure that the material does not seize around the well within the augers. The augers will be gradually removed as construction of the annulus continues until a depth of approximately 20 feet below grade. At that point, depending on the competency of the soil, the augers may be completely removed for final annulus construction.

For borings of less than 20 feet (depending on soil conditions) well construction may be conducted without use of the augers or tremie pipe. The well material will be placed into the open borehole, followed by placement of the filter sand. The sand will be placed directly into the top of the borehole and allowed to settle by gravity. The depth to sand will be constantly measured to ensure that bridging does not occur and to

document final material depth.

Bentonite Pellet Seal (Plug)

A low-permeability seal should be placed on top of the filter pack. As a rule, the seal will consist of a minimum of two feet of commercially packated bentonite pellets. As with the sand pack, the pellets should be placed by way of the tremie pipe method to minimize the risk of bridging during construction. An exception to this may be for shallow borings (less than 20 feet) where the pellets may be introduced by slowly pouring the pellets into the top of the borehole. Though either method, the pellets should be introduced at a slow rate to prevent blockage within the tremie or bridging within the annulus. The depth to the seal should be continually measured to ensure proper placement of the seal and the seal thickness. If the seal occurs below water table, the pellets will hydrate naturally. If the seal is constructed above the water table, it will be necessary to hydrate the pellets with potable (or higher quality) water should be used. Pellets should be allowed to hydrate a minimum of 30 minutes prior to the introduction of the final grout seal.

Completion of the Annular Space

The remaining annular space between the bentonite seal and ground surface should be filled with an appropriate media dependant on the intended use of the well. For temporary wells, the space may be filled with soil cuttings, bentonite pellets or grout, or a cement/bentonite grout to the surface to prevent surface water infiltration. This completion may be augmented by the construction of a second bentonite pellet seal at ground surface to adequately seal the top of boring and mounded to direct surface water flow away from the well.

For wells intended to serve as permanent monitoring stations, the annular space should be filled with a a neat cement grout or a cement/bentonite grout. Cement grouts should be mixed using 6.5 to 7 gallons of water per 94-lb bag of Type 1 Portland cement. The addition of bentonite (5 to 10 percent) to the cement grout is generally used to delay the "setting" time and may not be needed in all applications. The specific mixtures and other types of cement and\or grout proposed should be evaluated on a case by case basis by a senior field geologist. The grout should be introduced as a slurry using a tremie pipe and pressure pumping, introducing the grout at the base of the annular space. Care should be given not to damage the bentonite seal due to excessive pumping pressure. The annulus should be filled to approximately two-feet below grade.

Above Ground Riser Pipe and Outer Protective Casing

The well casing, when installed and grouted, should be completed in such a way so as to protect and maintain the integrity of the well. Wells may be completed below grade (for traffic areas) or above ground.

Flush-mounted wells will be constructed with the well riser at or slightly below ground level. An outer protective casing consisting of a bolt-down cover should be installed to a height slightly above grade to allow surface water deflection. The outer casing will be sealed within a concrete pad. The pad will consist of a two-foot by two-foot concrete pad. The top of the concrete will meet the top of the casing with a gradual slope away from the well to allow surface water drainage. The cover will be fitted with an o-ring or gasket to ensure an adequate seal of the cover when in place. The well riser will be fitted with a lockable expandable plug and lock to restrict access to the well.

Above-ground wells should be completed with approximately 2.5 feet of riser extending above grade. The riser will be fitted with a lockable expendable plug. A lockable outer steel protective casing will be installed over the well riser to protect the integrity of the well. As a rule, the outer casing should be constructed within

a four-foot by four-foot concrete pad with a minimum thickness of six inches. The top of the concrete will gradually slope away from the well to direct surface water away from the well. The well plug and the outer protective casing should be constructed with a weep hole to allow for pressure equalization within the well. The weep hole constructed within the outer protective casing should be constructed at the top of the concrete (within the casing) to serve as a drain for accumulated water. The area between the well riser and outer casing will be filled with a clean filter sand to further stabilize the well riser. Prior to curing, a survey pin (constructed of brass or other suitable material) should be inserted into the top of the pad approximately six inches from the outer casing to serve as a permanent survey reference for ground elevation at the site.

In areas of high vehicle traffic or areas of limited view, such as areas with dense vegetation, steel posts or bollards may be installed around the well pad to prevent damage to the well. The bollards should be of an adequate diameter to prevent damage by the types of vehicles anticipated for the area. Posts should be constructed with a minimum of three feet of post above grade and at least two-feet of post below grade. The placement of the posts, such as distance from the pad and number of posts, should be designed based on site conditions to prevent the potential access to the well location by the vehicle. Cement should be used to hold the posts in place. Additional cement should be placed within the posts to provide additional strength. The posts may also be augmented by steel guardrails in areas of excessive traffic. The posts should be painted with a paint of distinct color to ensure visual identification. In most cases, safety yellow is appropriate. For areas with high brush that may interfere with the location of the wells, posts may be constructed of a sufficient height to serve as a visual locator. These will not be intended to serve as a structural protection device.

Double Cased Wells

Double cased wells should be constructed when there is reason to believe that interconnection of two distinct groundwater zones by well construction may cause cross contamination, and/or when flowing sands make it impossible to install a monitoring well using conventional methods. In this case, a pilot borehole should be bored through the overburden and/or the contaminated zone into the underlying confining layer or bedrock. For solitary wells, the pilot boring should be constructed in such a way to provide adequate description of the soil horizon. Typically, this is accomplished using hollow-stem auger drilling techniques. At locations requiring installation into the bedrock, rotary drilling techniques may be required to construct the bedrock socket. For clustered wells, the pilot boring may be constructed using rotary drilling techniques since a description of the soil horizon would be available from the residuum well construction.

Once the socket is constructed, an outer casing (constructed of carbon steel) will be placed into the borehole and sealed with grout. The borehole and outer casing should extend into the underlying confining unit approximately two feet, or into competent bedrock a minimum of one foot. For limestone terrain where monitoring wells are to be constructed below the epikarst zone, the casing should be extended a minimum of ten feet into first competent rock. In this case, the final depths should be determined by a senior field geologist. The size of the outer casing should be of sufficient inside diameter (ID) to contain the inner casing, and the 2-inch minimum annular space.

The outer casing should be grouted by the tremie method from the bottom to within 2 feet of the ground surface. The grout should be pumped into the annular space between the outer casing and the borehole wall. This can be accomplished by either placing the tremie tube in the annular space and pumping the grout from the bottom of the borehole to the surface, or placing a grout shoe or plug inside the casing at the bottom of the borehole and pumping the grout through the bottom grout plug and up the annular space on the outside of the casing. The grout should be allowed to cure a minimum of 24 hours before drilling is continued.

Advancement of the borehole within the outer casing may be accomplished by wet rotary or air rotary drilling techniques. If detailed lithologic information is required, rock coring is preferred to collect a continuous sample of the rock interval (See ASTM Method D 2113-93; *Practice for Diamond Core Drilling for Site Investigation*). Rotary drilling utilizes a roller cone bits and circulating air or fluid to remove the cuttings. If these technologies are to be applied, consideration should be made as to potential damage to adjacent wells or the ourter casing seal by high pressure air or water circulation. For limestone bedrock with a well developed epikarst, wet rotary drilling is preferred to reduce the potential for "blow-out" of adjacent wells. Water levels in adjacent wells may be monitored during initial drilling activities to avoid potential damage of the well. In most situations, drilling mud may consist of potable water. In some cases, bentonite additives may be required to ensure continued circulation of fluids.

The diameter of the tri-cone bit should be selected to achieve the desired well diameter for the final well (completed as an open borehole). When rock coring is utilized, it is generally necessary to ream the borehole with a tri-cone bit to achieve the final boring size.

Upon completion of the boring, the borehole should be adequately flushed of drill cuttings that may have accumulated within potential water-bearing fractures. For wet rotary drilling, this may be accomplished by the continued circulation of drilling fluids, continually moving the rotary bit within the borehole. Drilling fluids should be replaced as needed until the returned fluids are relatively free of drilling debris. Similar techniques may be applied in air-rotary drilling whereby debris and accumulated groundwater is forced out of the borehole by air pressure until the fluids removed are relatively free of debris.

Final well completion should be in accordance with the procedures as discussed above.

C.11 SMALL MAMMAL SAMPLING

SMALL MAMMAL SAMPLING
STANDARD OPERATING PROCEDURE C-11

1.0 Scope and Application

1.1 This Standard Operating Procedure (SOP) is applicable to the collection of small mammals for chemical analysis from a variety of terrestrial habitats and includes procedures for liver and plasma sampling for PFOA analyses

2.0 Summary of Method

2.1 This SOP presents the potential methods by which small mammals will be collected. As the target species may vary because of habitat differences, collection methods may vary accordingly. These methods include:

- Sherman Live Traps
- Pitfall traps

2.2 Sampling locations will be determined on the basis of suitability of terrestrial habitat characteristics for target small mammal species, results of a preliminary small mammal community survey, and co-location with soil and vegetation sampling locations as described in the Phase 2 Work Plan.

2.3 As the intent of this effort is to provide for analysis blood samples collected from small mammals, Sherman Live Traps and/or Pitfall traps will be the preferred equipment.

3.0 Health and Safety Issues

3.1 Health and safety issues associated with small mammal collection including the use of all equipment as well as potential issues associated with potential exposure to biological agents, e.g., Hanta virus, are addressed in Section 3 of the Health and Safety Plan (HASP Appendix A).

3.2 When working with potentially hazardous materials, follow EPA, OSHA, and specific health and safety procedures as documented in the HASP.

4.0 Interferences

4.1 Primary potential interferences with small mammal sampling include the potential

for cross-contamination of samples during plasma extraction and liver dissection. In addition, problems may arise resulting from insufficient numbers of target species available for collection.

- Cross-contamination issues will be eliminated or minimized by the implementation of decontamination procedures associated with small mammal sampling. These procedures are presented in the Decontamination SOP (Appendix C-1).

- The availability of adequate numbers of small mammal target species will be addresses by the conduct of a preliminary small mammal survey to determine the composition of the small community in the sludge application area. Based on these data, target species and numbers will be determined accordingly.

4.2 It is important to note that sampling for PFOA requires special procedures including the type of equipment used and handling procedures. The precautions to be applied are as follows:

- The handling of prepackaged foods or fast foods prior to sampling should be avoided.

- Prior to sampling and sample preparation, personnel should thoroughly wash per the decontamination procedures outlined in the Decontamination SOP (Appendix C-1).

- Nitrile or latex gloves should be worn at all times when handling equipment or sampling.

- Teflon treated equipment should not be used for sampling activities. Sample containers should also be free of Teflon liners or seals.

- All sampling materials and equipment should be disposable to avoid potential cross-contamination between sampling locations.

5.0 Personnel Qualifications

All small mammal sample collection will be performed by Weston personnel. All field sampling personnel are required to take the 40-hr health and safety training and regular refresher courses prior to engaging in any field effort. At a minimum, all personnel are required to be trained to recognize the hazards associated with field work, as well as be fully familiar with the provisions of the HASP.

6.0 Equipment and Supplies

A significant amount of specialized equipment is required to conduct surveys of small mammals. This equipment includes:

- Approved Work
- Health and Safety Plan
- Approved QAPP
- Sherman Live Traps
- Pitfall Traps
- Victor snap traps
- Bait for traps
- Bedding for traps
- Field Log Books
- Field Data Forms
- Blood collection gear
    - Including 21 gauge needles, green top vacutainers, syringes, cotton balls and alcohol
- Animal handling container
- Gloves
- Species Identification key
- Hand-held GPS unit (Garmin GPS Map 76S or similar)
- Waterproof ink pens
- Detailed maps of each sample location
- Portable electronic balance and 500 g calibration standard (±20 g accuracy) (for small mammal weight, one balance per crew)
- Portable electronic balance and 10 g calibration standard (±0.01 g accuracy)
- (for tissue weights)
- Calipers
- Wire side cutters (2)
- Polycarbonate cutting boards
- Dissecting scissors for opening body cavity
- Medium curved-tip forceps (for handling and manipulating tissues)
- Sterile scalpel blade (1-#11, 1-#22 for tissue removal)
- Scalpel handles
- Surgical steel razor blades (for cutting tissues)
- 1 quart heavy duty Ziploc™ freezer bags (for clean dissection tools)
- Pesticide grade methanol (for decontamination of tools)
- ASTM Type II reagent water or distilled water (for decontamination of tools)
- Wash bottles, non- Teflon, prelabeled for methanol and distilled water (for decontamination)
- Wash basin (1/team, for nondisposable used dissection tools)

- Disposable nitrile gloves (several sizes)
- Kimwipes (many boxes)
- Sharps container
- Garbage cans (30 gal with 30-gal heavy duty trash bags)
- 125, 250 & 500 ml jars, certified clean
- Prelabeled self adhesive sample labels (for each sample, including QA/QC)
- Clear packing tape (for securing sample labels and sealing shipping containers)
- Small coolers
- Large hazardous materials coolers
- Wet ice
- Dry ice (for residue samples)
- Hazardous materials shipping labels (fixatives, dry ice, flammable materials)
- Chain of custody forms
- Plastic bags (for protecting chain of custody forms)
- Fed Ex airbills, prepared
- Custody seals (for sealing containers for chain of custody)

- The appropriate sampling device must be of proper composition. Sampling equipment must not contain Teflon coatings or subassemblies. Samplers constructed of glass, stainless steel or PVC should be used based upon the analyses to be performed.

7.0 Sample Collection – Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, minimum sample volume requirements, and which equipment and supplies are needed.
2. Obtain necessary sampling and monitoring equipment.
3. Decontaminate or pre-clean equipment, and ensure that it is in working order.
4. Perform a general site survey prior to site entry in accordance with the HASP and facility requirements.
5. Use stakes or flags to identify and mark all sampling locations until positional data has been obtained. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions.

8.0 Sample Collection – Secondary Parameters

The small mammal collection locations will be co-located with vegetation and soil sampling locations. Consequently, the presence, distribution, and dominance of target and nontarget vegetation species in the vicinity of the sampling locations will be characterized (Vegetation Sampling SOP; Appendix C-9).

9.0 Sample Collection – Methods

9.1 Live Trapping

- A preliminary small mammal survey will be performed by trapping using Sherman live box traps to qualitatively evaluate mammalian community. Areas to be trapped will be based on available habitat and the similarity of the vegetative community to that present in other prospective sampling locations.

- One trap line with 10 traps will be set at each of the two prospective soil sampling locations within each of the fields.

- Traps will be set for two to three nights with the objective of trapping ten adult animals of the same species from each of the four fields. Once the traps are set, they will be checked twice daily in the field, during early morning and early evening hours.

- Trapping will be curtailed as soon as the trapping objectives are reached.

10.0 Sample Handling and Preservation

10.1 Initial Processing

Captured small mammals will be removed from traps and placed in clean, unused, individually labeled, re-sealable bags for transport to the processing area. Bags will be labeled with date, trap site, and individual sampling location. Prior to transport to the processing area, bagged small mammals will be placed in a cooler containing bagged wet ice.

Two person teams will prepare a processing table with clean plastic sheeting. All processing equipment and supplies will be decontaminated as specified in Decontamination SOP (Appendix C-1). On the data sheet for each small mammal, the sample location, collection date and time, collector's initials and individual small mammal identification number, species, sex, weight (g), total length (mm), ear length (mm) will be recorded.

10.2 Tissue Processing

Immediately prior to serum sampling and liver removal, the animal will be killed by cervical separation.

Blood (serum) Sampling

- Blood will be drawn from the mammal by means of a cardiac stick, Prior to extraction of blood from the heart, a slit will be made though the skin to the chest cavity to preclude contamination of the syringe with residual PFOA on

fur or skin. Using a 21-gauge needle and a green top-heparinized vacutainer, approximately 2-3 cc of whole blood will be drawn from the heart. A minimum of 1 cc of serum is required for analysis (Exygen, 2004a). All blood sampling equipment will be disposable and will be obtained new from Fisher Scientific**.**

- Upon retrieval, blood serum will be placed in a refrigerator where samples will be maintained at 4°C until shipment to the laboratory.

Liver Extraction

- Immediately following the sampling of blood from the mammal, the animal will be dissected and the liver of the animal removed. Care will be taken to avoid contamination of the liver with residual PFOA that may be on the skin or fur.

- Following removal, the liver will be weighed and examined for abnormalities. Note a minimum of 5 g of liver tissue is required for analysis (Exygen, 2004b). Liver samples for PFOA analysis will be rinsed of all surface debris with deionized water and placed in decontaminated polypropylene containers. The sample ID labels will be placed on the outside of the container and secured with clear tape. To preserve sample integrity, samples will be placed in double re-sealable plastic bags with a second ID label and placed in a refrigerator where they will be maintained at 4°C until shipment to the laboratory.

10.0 Data Records and Management

All sample documentation will follow project specific SOPs for field sample ID, data recording, chain of custody, custody seal procedures. All data and information will be documented in field data logbooks with permanent ink. All entries in field logbooks should be legibly recorded, and contain accurate and inclusive documentation of an individual's project activities.

11. Quality Control and Quality Assurance

Sampling devices must be of proper composition. Sampling equipment must not contain Teflon coatings or subassemblies. Samplers constructed of glass, stainless steel or PVC should be used based upon the analyses to be performed.

13.0 References

Quality Assurance Project Plan for the Phase 2 Characterization Program. (QAPP). WESTON, July 2004.

Phase 2 Work Plan for Sampling Environmental Media for PFOA at the 3M Decatur, AL Plant (Phase 2 Work Plan). WESTON. August 2004.

Health and Safety Plan. (HASP). Appendix A of the *Phase 2 Work Plan for Sampling Environmental Media for PFOA at the 3M Decatur, AL Plant*. WESTON. August 2004.

Method of Analysis for the Determination of Perfluorooctanoic Acid (PFOA) in Small Mammal Serum by LC/MS/MS. Exygen Research, Method No. V0001786. Exygen Research, 2004a.

Method of Analysis for the Determination of Perfluorooctanoic Acid (PFOA) in Small Mammal Liver by LC/MS/MS. Exygen Research, Method No. V0001785. Exygen Research, 2004b.