ODOT GENERIC
HEALTH AND SAFETY PLAN

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Appendices

1.0 Introduction

A Health and Safety Plan is required at all Sites where it is possible to come into contact with hazardous wastes or substances and where ODOT staff will:

- Perform cleanup or investigation activities at a government-listed Site (such as LUST, ECSI, CERCLA, etc.),
- Perform cleanup or investigation activities at a Site regulated under RCRA,
- Perform Site activities related to a voluntary cleanup,
- Conduct operations at a RCRA treatment, storage or disposal (TSD) facility, or
- Conduct post-emergency response operations at a spill scene.

The Site Specific HASP with this Generic HASP, combined, fulfill the requirements of 29 CFR 1910.120(b)(4) and ODOT's Hazardous Waste Cleanup Operations Standard STD 20021 and must both be present on Site during all hazardous waste site operations.

A Comprehensive Work Plan (a document that describes the proposed Site work and locations) must also be present on Site and should include:

- Project objectives and tasks proposed to achieve those goals
- Standard operating procedures (see Appendix A);
- Personnel requirements to implement the work plan;
- Specialized equipment or services to be used.

2.0 Hazard Assessment

Job hazard assessments (JHAs) that identified hazards for typical ODOT HazMat Site work are available form the ODOT Employee Safety or ODOT Geo-Environmental Headquarters. If a JHA is not available for a specific proposed activity, then a new JHA must be created and approved by ODOT Safety. Available Job Hazard Assessments include:

- Initial site assessment site visit
- Surface soil sampling
- Subsurface soil sampling with a hand auger
- Subsurface soil sampling via test pits (using a back-hoe)
- Subsurface soil sampling with a split spoon sampler (drilling)
- GeoProbe soil and groundwater sampling
- Groundwater well sampling
- Water level measurements (in wells)
- Sediment sampling (various methods)
- Surface water sampling (various methods)
- Field screening (field tests for soil samples)
- Sampling equipment decontamination
- Sample preparation and transportation
- Investigation derived waste handling (purge water, drill cuttings, excavated soil, etc.)
- Contaminated soil excavation
- UST removal and closure
- Lead paint sampling
- Asbestos containing material sampling
- Treated timber sampling

- Construction site inspections

ODOT has developed task specific standard operating procedures (SOPs), based on each JHA (see Appendix A). Typical hazards are identified below.

2.1 Physical Hazards

The Site Specific HASP specifies the proposed activities at the Site. The table below describes the physical hazards and mitigation measures associated with those tasks.

Physical Hazard	Prevention/Mitigation
Overhead hazards from heavy equipment	Wear hard hat when overhead equipment operating
Crushing hazards from heavy equipment	Wear steel-toed boots when working near heavy equipment. Avoid moving parts.
Entrapment in moving equipment parts	Do not wear lose clothing near moving equipment. All site workers should know how to operate equipment emergency shut offs.
Noise from heavy equipment or power tools	Wear ear plugs or ear muffs while heavy equipment or power tools are operating
Cold (possible hypothermia)	Wear appropriate clothing and stay dry
Heat (possible heat exhaustion or heat stroke)	Wear appropriate clothing, drink plenty of water and follow First Aid training
Biological hazards associated with sewer lines	Locate all utilities prior to disturbing the subsurface (see notifications below) and confirm locates on site. Do not handle sewage contaminated media without appropriate PPE.
Electrical (overhead/underground lines)	Locate all utilities prior to disturbing the subsurface (see notifications below) and confirm locates on site. De-energize any power lines that pose a threat
Fire/Explosion (pressurized drums or tanks)	Do not disturb containers with unknown contents. Inert all gasoline containers with dry ice prior to cutting. Locate all product lines. Use an LEL meter to monitor for explosive atmospheres as needed.
Burns from hot engine parts or steam cleaners	Keep body parts away from hot equipment
Cave in associated with excavations	Do not enter excavations over 3 feet deep unless they are benched and shored according to ODOT's Excavation and Trenching Policy
Drowning if working near water	Wear a personal flotation device when working in or near water greater than 6 inches deep. Take care on steep banks.
Suffocation (oxygen deficiency in tanks or excavations)	Do not enter excavations over 3 feet deep, tanks, or other confined spaces.
Slip, trip, fall hazards (uneven ground/obstacles)	Keep work site neat and tidy. Barricade excavations when not active.

2.2 Chemical Hazards

The Site Specific HASP describes contamination detected or suspected at the Site. The Table below provides information on the constituents of concern, depending on the type of contamination identified. The Generic Air Monitoring Plans in Appendix B contain health hazard information for these contaminants. **Note:** if the identified contaminants for a Site are not included below, the Site Specific HASP must include information for those contaminants.

Contaminant of Concern & Ionization Potential (eV)	Source Contamination	8-hr Time Weighted Average (ppm)			NIOSH IDLH (ppm)
		OSHA PEL	ACGIH TLV	NIOSH REL	
Gasoline (<10.6)	Gx, AR	NA	300	NA	NA
Diesel (varies)	Dx. AR	5 mg/m^3 (Oil Mist)	100 mg/m^3	5 mg/m^3 (Oil Mist)	5 mg/m^3 (Oil Mist)
Motor/Lube oil (varies)	HO, AR	5 mg/m^3 (Oil Mist)	5 mg/m^3	5 mg/m^3 (Oil Mist)	2500 mg/m^3 (Oil Mist)
Kerosene (JP-5) (varies)	K	NA	300	100 mg/m^3	NA
Benzene (9.4)	Gx, Dx, AR	1	0.5	0.1	500
Toluene(8.82)	Gx, Dx, AR	200	50	100	500
Ethylbenzene (8.76)	Gx, Dx, AR	100	100	100	800
Xylenes (8.44 - 8.56)	Gx, Dx, AR	100	100	100	900
Methyl tert-butyl ether (9.24)	Gx, AR	NA	50	NA	NA
Butylbenzene (8.69)	Gx, AR	NA	NA	NA	NA
Isopropylbenzene (8.69)	Gx, AR	50	50	50	900
Isopropyltoluene (?)	Gx, AR	NA	NA	NA	NA
Propylbenzene (8.72)	Gx, AR	NA	NA	NA	NA
Trimethylbenzene (8.27 - 8.39)	Gx, AR	NA	25	25	NA
Carbon Disulfide (10.08)	HO, AR	20	10	1	500
Naphthalene (8.12)	Gx, Dx, HO, K, AR	10	10	10	250
Other Polynuclear aromatic hydrocarbons – pyrene, phenanthrene, chrysene, anthracene, benzo(a)pyrene, etc.	Dx, HO, K, AR	0.2 mg/m^3	0.2 mg/m^3	0.1 mg/m^3	80 mg/m^3
Polychlorinated Biphenyls/PCBs (NA)	HO, AR	0.5 mg/m^3	0.5 mg/m^3	0.001 mg/m^3	5 mg/m^3
Lead (NA)	Gx, HO, LBP, AR	0.05 mg/m^3	0.05 mg/m^3	0.05 mg/m^3	100 mg/m^3
Cadmium (NA)	HO, AR	0.005 mg/m^3	0.01 mg/m^3	NA	9 mg/m^3
Chromium (NA)	HO, AR	1 mg/m^3	0.5 mg/m^3	0.5 mg/m^3	250 mg/m^3
Tetrachloroethene (9.32)	DC, HO, AR	100	25	minimize exposure	150
Trichloroethene (9.45)	DC, HO, AR	100	50	NA	1000
1,2-dichloroethene (9.65)	DC, HO, AR	200	200	200	1000
1,1-dichloroethene (10.0)	DC, HO, AR	NA	5	NA	NA
Vinyl Chloride (9.99)	DC, HO, AR	1	1	NA	NA
1,4-dioxane (9.13)	DC	100	20	1	500

Contaminant of Concern & Ionization Potential (eV)	Source Contamination	8-hr Time Weighted Average (ppm)			NIOSH IDLH (ppm)
		OSHA PEL	ACGIH TLV	NIOSH REL	
Stoddard Solvent/Mineral Spirits (<10.6)	DC, AR	500	100	350 mg/m^3	20,000 mg/m^3
Asbestos	ACM	0.1 $fiber/cm^3$	0.1 fibers $>5\mu m/cm^3$	0.1 $fiber/cm^3$	NA

Gx	Gasoline
Dx	Diesel
HO	Oil
K	Kerosene
SS	Service Station
DC	Dry Cleaner
AR	General industry and Auto Repair (fuels, solvents and metals)
LBP	Lead-based paint
ACM	Asbestos-containing material
NA	Not Available
OSHA	Occupational Safety and Health Administration
NIOSH	National Institute for Occupational Safety and Health
ACGIH	American Conference of Governmental Industrial Hygienists
PEL	Permissible Exposure Limit for an 8-hour workday in a 40-hour workweek
REL	Recommended Exposure Limit for a 10-hour workday in a 40-hour workweek
TLV	Threshold Limit Value – a time weighted average
IDLH	Immediately Dangerous to Life and Health

3.0 Personnel Duties and Qualifications

All personnel entering the exclusion zone (EZ) must have the following qualifications:

- 40-hour HazWoper certification (with current annual refresher),
- 24-hours of documented field experience (unless the person is being trained by a qualified supervisor),
- Current respirator fit testing and training (if applicable), and
- Current medical approval.

Proof of these qualifications must be available on Site or on file with ODOT Employee Safety or ODOT Geo-Environmental Headquarters. In addition, Site specific training, in the form of a pre-entry tail gate briefing, shall be conducted as described in Section 12.0.

The Duties and additional training requirements for personnel with specific Site responsibilities are described in ODOT's "Hazardous Waste Cleanup Operations" Standard STD20021 and are summarized below:

Project Manager (PM):

- Directs Site activities
- Plans and manages the project
- Designates and leads the project team
- Ensures HASP development and review
- Prepares and implements the work plan
- Demonstrates commitment to safety and reviews lessons learned
- Maintains project records
- Coordinates with ODOT, regulatory agencies and the public.

Inspector (may be same as PM):

- Is present on Site and leads and conducts on Site activities

- Implements the work plan and maintains schedules
- Coordinates with the SSO (see below)
- Oversees implementation of the HASP
- Controls access to the worksite
- provides Site briefings and hazard communications
- Works with SSO and PM to ensure planning was adequate and work is being conducted safely
- With SSO, verifies personnel are fully qualified
- Inspects contractor practices using STD 20021 Attachment G

Site Safety Officer (SSO):

- Has completed Supervisor level HazWoper training
- Implements the HASP and is located in the EZ
- Verifies effectiveness and compliance with the HASP
- Verifies project planning focuses on safety
- Conducts work control and hazard analysis
- Supports implementation of hazard controls in the HASP
- Verifies effectiveness and maintenance of PPE
- Establishes Site control boundaries
- Ensures worksite access is monitored
- With Inspector, verifies personnel are fully qualified
- Advises Safety Manager of hazards and exposures
- Monitors exposures and stressors
- Conducts field training
- Supports emergency response
- Verifies "Buddy" system is properly implemented
- Conducts daily Site inspections using the Checklist in STD 20021 Attachment F

ODOT Field Personnel:

- Express concerns regarding health and safety issues
- Can refuse unsafe work without reprisal (see STD 20021)
- Know and comply with STD 20021 and the HASP
- Use and maintain assigned PPE
- Remove damaged PPE from service
- Report serious workplace hazards to Supervisor/Manager

Contractor(s) – All contractors must provide their own Site Specific Health and Safety Plan, PPE and air monitoring. Contractors are also responsible for providing a "buddy partner" for ODOT employees as described in Section 3.1 and aid in emergency response procedures as described in Section 9.0 and the Site Specific HASP.

Visitors – Visitors must notify the SSO of their presence, wear required personal protective equipment (PPE) and seek SSO approval prior to entering the EZ.

3.1 Buddy System

ODOT employees shall employ a "buddy" system when working inside the EZ or contaminant reduction zone (CRZ). A buddy may be an ODOT employee or a contractor who meets the qualifications for all site workers described above.

- A "buddy" assists their partner; observes them for signs of exposure; periodically checks the integrity of their PPE; and notifies the SSHO if help is needed.
- The "buddy" must be within sight or hearing of the employee.
- The "buddy" must be certified to work in the PPE used by the employee.

A "limited trained buddy" can be used in the support zone (cold zone) instead of a fully qualified "buddy" provided only Level D PPE is required and EZ activities are limited to:

- Collecting ground water samples on a site that has been fully characterized;
- Collecting soil samples on a low risk site during the assessment phase;
- Installing fence on a hazardous waste site;
- Performing surface measurements on a potential hazardous waste site;
- Staking utilities on a potential hazardous waste site.

On those sites where a "limited trained buddy" is used, that person must:

- Stay outside the EZ and CRZ, no matter what;
- Be instructed on how to call for help should the hazardous waste site worker become injured or incapacitated (See Section 7 of the Site Specific HASP);
- Review the potential health hazards for the contaminants of concern paying particular attention to the signs of overexposure (see Section 2 and Appendix B);
- Be briefed on how to activate the emergency response plan and where to evacuate to should an incident occur on site (see Section 9 and the Site Specific HASP);
- Be briefed on where to remain (outside EZ and CRZ, within Site of the Site worker);
- Be briefed on any potential hazards located outside the EZ and CRZ;
- Be offered a medical evaluation if he or she feels they have been exposed to hazardous materials on site and have signs & symptoms of overexposure;
- Sign the acceptance sheet in the Site Specific HASP.

4.0 Personal Protective Equipment

Personal protective equipment to be used shall be level D, as set forth below, unless otherwise specified in the Site Specific HASP. If conditions arise which require a higher level of PPE, all Site personnel shall evacuate in accordance with Section 9, re-evaluate physical controls and PPE provisions and modify the Site Specific HASP.

Level D PPE for petroleum- and solvent-contaminated sites:

- Long pants and long sleeves
- Safety shoes or boots
- Safety glasses
- Hard Hat (if overhead hazards are present)
- Orange traffic vest (if working in or adjacent to highway)
- Nitrile, Neoprene or Viton gloves or other glove rated to resist the contaminants of concern
- Ear plugs (if working around heavy equipment or other loud noises)

Level C PPE - If work conditions require upgrading to Level C at a petroleum- or solvent-contaminated Site, PPE shall include:

- Hooded chemical protective suit such as Saranek or polyethylene-coated Tyvek
- Nitrile, Neoprene or Viton gloves or other glove rated to resist the contaminants of concern
- Neoprene, Nitrile or Latex over-booties

- Full-face respirator with organic vapor/acid gas cartridges and P100 filters – change cartridges every 5 hours or sooner if breakthrough is detected.

Respirators must be fully inspected and properly fitted prior to use and cartridges must be designed to work with the respirators being worn and must not have expired.

ODOT employees shall not work at Sites requiring Level B PPE or above.

5.0 Medical Surveillance

All Site workers must have a current medical clearance to work at a hazardous waste site and wear a respirator (unless their work is limited to Level D). Minimum medical requirements for ODOT employees are specified in STD 20021 and include:

- Baseline hazardous waste site worker physical;
- Periodic hazardous waste site worker physical (every one to two years at the physician's discretion); and
- Medical approval for respirator use.

Proof of medical approval must be available on Site or on file with ODOT Employee Safety or at ODOT Geo-Environmental Headquarters.

In addition, ODOT will provide emergency treatment or medical evaluation when:

- Employees exposed to chemicals during an incident on site; or
- Employees are injured or show signs of exposure to Site contaminants.

6.0 Air Monitoring

The generic air monitoring plans in Appendix B can be used, if the Site falls into one of the following categories and has no Site specific constituent analytical data, or if ODOT's Industrial Hygienist determines they are appropriate, based on Site specific analytical data:

- Gasoline/Diesel/Oil Contamination (Gx/Dx/HO)
- Dry Cleaning Establishment (DC)
- Fuels, solvents and metals contamination from general industry and auto repair (AR)

Air monitoring equipment needed includes:

- photo-ionization detector (PID) with 10.6 eV lamp (Gx/Dx/HO, DC, AR)
- photo-ionization detector (PID) with 11.7 eV lamp (DC*)
- Draeger pump or Draeger CMS system (Gx/Dx/HO, DC, AR)
- Benzene Draeger tubes (0.5 - 10 ppm) or Draeger Chips (0.5 – 10 ppm) (Gx/Dx/HO, AR)
- Vinyl Chloride Draeger tubes (0.5 - 30 ppm) or Draeger Chips (0.3 – 10 ppm) (DC, AR)
- Other air monitoring equipment specified by the Site Specific HASP

* a PID with an 11.7 eV lamp can detect solvents not detected by the 10.6 lamp. Therefore, employees may choose to use this stronger lamp based on the generic air monitoring plans.

Air monitoring equipment must be calibrated in accordance with the manufacturer's instructions:

- Prior to disturbing the ground,

- After the equipment has been turned off for more than an hour
- If there is a change in weather (especially humidity)

Perform air monitoring on the worker with the highest likelihood of exposure when:

- A new procedure is performed,
- A new location is disturbed, or
- A new pocket of contamination is encountered (as indicated by color or odor)

If other sources or contaminants from those described have impacted the Site, then a Site specific air monitoring plan must be attached to the Site Specific HASP.

7.0 Site Control

Prior to any work which may disturb contaminated areas, the SSO shall establish an EZ of a sufficient size to encompass the work area and project-related hazards. Mark the EZ using flagging tape or other physical/visual barriers and modify the EZ based on air monitoring results and field conditions.

8.0 Decontamination

The SSO shall establish a CRZ for decontamination just outside the EZ such that all field workers pass through that area upon exiting the EZ. Decontaminate all personnel and equipment prior to leaving the Site. Decontaminate sampling before use and between sampling locations. Decontamination shall include:

- Scrub & rinse re-useable PPE with non-phosphate detergent and potable water
- Place all washable PPE in a heavy duty plastic bag for triple washing in a laundry machine.
- Dispose of disposable PPE as solid waste (trash) in a heavy-duty plastic bag
- Wash and rinse sampling equipment with non-phosphate detergent and potable water, then rinse with de-ionized water OR transport in heavy duty plastic bags to a wash rack with an oil-water separator for pressure washing or steam cleaning - *petroleum sites only*.
- Wash all heavy equipment on site using a pressure washer or steam cleaner.
- Dispose of decontamination fluids with other investigation derived waste.

9.0 Emergency Response

In the event of an emergency that requires Site **evacuation**, the SSO or other Site worker shall blast a vehicle horn or similar device three (3) times. All Site workers shall immediately evacuate and assemble at the main entrance to the Site, unless the Site Specific HASP specifies an alternate location.

A **first aid** kit must be available on Site during all Site operations. If a Site worker becomes ill, injured or unconscious, administer first aid and/or CPR as soon as possible, if trained and willing to provide such services. If the illness or injury are too severe to be immediately remedied with the available first aid kit, immediately call 911 for an ambulance and then administer first aid until help arrives. In all cases, ODOT employees involved must report the incident to their manager and complete the required accident report forms available on ODOT's intranet Site at http://intranet.odot.state.or.us/employeesafety/newebsite/personalpackets/packetmainpagenew.htm

An appropriately rated fire extinguisher must be located on each piece of heavy equipment. In the event of **fire**, apply the fire extinguisher only if it is safe to do so. If the fire extinguisher can not completely extinguish the fine, call the Fire Department.

For **spill response** procedures, see Section 11.0.

An accessible telephone must be available on the Site at all times. The Site Specific HASP includes local emergency contact numbers and directions to the nearest hospital. Statewide emergency telephone numbers are listed below:

Service/Agency	Telephone Number
Police/Fire/Ambulance	911
Oregon Emergency Response System (OERS) – includes OSP and DEQ	1-800-452-0311
National Response Center (EPA/USCG)	1-800-424-8802
Poison Control Center	1-800-222-1222

10.0 Confined Space Entry

Site work shall not include any confined space entry, unless otherwise specified in the Site Specific HASP. All confined space entry procedures shall comply with ODOT's Confined Space Entry Safety Standard (PRO 96003).

11.0 Spill Containment

If a hazardous substance is spilled during field work the SSO should contain the spill if that can be accomplished using available materials and within their training. The spill should be cleaned up as soon as possible using either on-Site resources or an outside contactor. Note that ODOT employees are only trained to cleanup vehicle operating fluids. Call OERS for all petroleum or hazardous materials spills over the reportable quantities (RQs). Call the National Response center, only if the spill impacts surface water or is a hazardous material over it's RQ. If the RQ is not known, notify the appropriate agencies and determine whether a retraction is required later.

12.0 Pre-Entry Briefing

Site specific training, in the form of a pre-entry tail gate briefing, shall include:

- Names of personnel responsible for safety on site;
- A discussion of the HASP;
- Site specific safety and health hazards;
- Exposure monitoring and personal exposure guidelines;
- Use of fire extinguishers and emergency fire response procedures;
- Designated work zones;
- The nature of the hazards present and SOP's used to control the risks;
- PPE required and its proper use;
- Decontamination facilities and proper use;
- Work practices that will minimize risk on site;
- Site rules and regulations including vehicle use;
- Medical surveillance requirements, training requirements;
- Confined space and trenching procedures;
- Location of HASP on site;
- Location of telephone or other communication device;

- Emergency signals and procedures; and
- Procedures for reporting hazards on the site.

13.0 HASP Effectiveness

The SSO shall document the effectiveness of the HASP, using the ODOT Site Inspection Form provided in STD 20021, Appendix F. Carry copies of this form with the HASP to be completed on Site. Maintain copies of the Site Specific HASP with worker signatures and ODOT Safety approval, completed Site inspection forms and the Site work plan in the project file for at least 5 years.

APPENDIX A

ODOT Standard Operating Procedures

Surface Soil Sampling SOP

I. Equipment

- Site-specific sampling plan including map(s)/site plan(s)
- Site-specific Health and Safety Plan
- Safety equipment, as specified in the site-specific Health and Safety Plan
- Tape measure
- Survey stakes or flags
- Camera and film
- Cooler(s)
- Ice
- Decontamination supplies/equipment
- Plastic sheet
- Stainless steel scoop
- Spade or shovel
- Appropriate size sample containers
- Logbook
- Chain of Custody records and custody seals
- Field data sheets and sample labels
- Stainless steel bowl
- Aluminum foil
- Zip-lock type plastic bags

II. Field Preparation

1. Obtain utility locates using the "One-Call" service or private locator contractor, as appropriate. Utility locates should always be confirmed by property owner or On-Scene-Coordinator (OSC) before beginning work.
2. Read and understand the Site-specific Health and Safety Plan and follow the prescribed safety protocols.
3. Read and understand the site-specific sampling plan and obtain and organize necessary sampling and monitoring equipment.
4. Decontaminate or pre-clean equipment, and ensure that it is in working order.
5. Perform a general site survey prior to site entry in accordance with the site specific Health and Safety Plan.
6. Use stakes or flags to identify and mark all sampling locations. Locations may be adjusted based on site access, property boundaries, utilities, or surface obstructions. Record locations on site plan.

III. Sampling Procedures

NOTE: Tools plated with chrome or other materials should not be used (commonly found in garden implements such as potting trowels).

1. Carefully remove the top layer of soil or debris to the desired sample depth with a pre-cleaned spade.
2. Using a pre-cleaned, stainless steel scoop, plastic spoon, or trowel, remove and discard a thin layer of soil from the area, which came in contact with the spade.
3. If analyses for volatile constituents are to be performed, transfer the sample directly into an appropriate, labeled sample container with a stainless steel lab spoon or equivalent and secure the cap tightly.
4. Place a small amount of sample in a container and set aside for field screening and sample description.
5. Place the remainder of the sample into a stainless steel bowl that is thoroughly decontaminated and/or lined with clean aluminum foil. Mix thoroughly to obtain a homogenous sample representative of the entire sampling interval.
6. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, add additional samples from other sampling intervals to the composite material already in the homogenization bowl and mix thoroughly. Place the composite sample(s) into appropriate, labeled containers and secure caps tightly.
7. Place sample jars in plastic zip-lock type bags and store in iced cooler.
8. Once analytical samples have been packaged, perform the appropriate field test(s) to determine the relative concentrations of petroleum hydrocarbons and/or volatile organic compounds following the procedures in the appropriate SOPs.

9. Describe the soil characteristics, following the ODOT Soil and Rock Classification Manual. Record this information along with the results of field screening tests or other indications of contamination, measured recovery, sampled depth or interval, and depth of any geologic contacts, in the logbook and/or on field data (log) sheets.
10. Decontaminate sampling equipment before proceeding to next sample location.
11. Abandon all borings or excavations and dispose of all excess soil according to applicable regulations. If soil appears contaminated, containerize excess soil in DOT approved drums, dumpsters or wrap in plastic sheeting and label the waste with the location and generation date. Store in a secure location until analytical results are obtained to determine appropriate disposal options.

Subsurface Soil Sampling – Hand Auger SOP

I. Equipment

- Site-specific sampling plan including map(s)/site plan(s)
- Site-specific Health and Safety Plan
- Safety equipment, as specified in the site-specific Health and Safety Plan
- Tape measure
- Survey stakes or flags
- Camera and film
- Logbook
- Cooler(s)
- Ice
- Decontamination supplies/equipment
- Plastic sheet(s)
- Stainless steel scoop
- Spade or shovel
- Appropriate size/type sample containers
- Zip-lock type plastic bags
- Chain of Custody records and custody seals
- Field data sheets and sample labels
- Stainless steel homogenization bowl
- Bucket auger, T-handle, Extension rods
- Aluminum foil
- Bentonite chips

II. Field Preparation

1. Obtain utility locates using the "One-Call" service or private locator contractor, as appropriate. Utility locates should always be confirmed by property owner or On-Scene-Coordinator (OSC) before beginning work.
2. Read and understand the Site-specific Health and Safety Plan and follow the prescribed safety protocols.
3. Read and understand the site-specific sampling plan and obtain and organize necessary drilling, sampling and monitoring equipment.
4. Decontaminate or pre-clean equipment, and ensure that it is in working order.
5. Perform a general site survey prior to site entry in accordance with the site specific Health and Safety Plan.
6. Use stakes or flags to identify and mark all sampling locations. Locations may be adjusted based on site access, property boundaries, utilities, or surface obstructions. Record locations on site plan.

III. Sampling Procedures

1. Assemble the hand auger.
2. Clear the area to be sampled of any surface debris (e.g., twigs, rocks, and litter). It may be advisable to remove the first three to six inches of surface soil for an area approximately six inches in radius around the drilling location.
3. Begin augering, periodically removing and depositing accumulated soils onto a plastic sheet spread several feet from the hole. This prevents accidental brushing of loose material back down the borehole, facilitates refilling the hole later, and avoids possible contamination of the surrounding area.
4. After reaching the desired depth, decontaminate the auger according to the sampling plan
5. Collect a sample from the desired depth and slowly and carefully remove the auger from the hole.

6. If volatile organic analysis is to be performed, transfer the sample directly into an appropriate, labeled sample container with a stainless steel lab scoop or equivalent and secure the cap tightly.
7. Place a small amount of sample in a container and set aside for field screening and sample description.
8. Place the remainder of the sample into a decontaminated and/or aluminum foil lined stainless steel homogenization bowl, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval and place the sample into appropriate, labeled containers and secure the caps tightly.
9. If composite samples are to be collected, add additional samples from other sampling intervals to the composite material already in the homogenization bowl and mix thoroughly. Place the composite sample(s) into appropriate, labeled containers and secure caps tightly.
10. If additional samples are to be collected in the same hole, but at greater depths, repeat steps three (3) through eight (8). Make sure to decontaminate the auger between samples.
11. Place sample jars in plastic zip-lock type bags and store in iced cooler.
12. Once analytical samples have been packaged, perform the appropriate field test(s) to determine the relative concentrations of petroleum hydrocarbons and/or volatile organic compounds following the procedures in the appropriate SOPs.
13. Describe the soil characteristics, following the ODOT Soil and Rock Classification Manual. Record this information along with the results of field screening tests or other indications of contamination, measured recovery, sampled depth or interval and depth of any geologic contacts, in the logbook and/or on field data (log) sheets.
14. Abandon the hole according to applicable state regulations. If soil appears contaminated, containerize excess soil in DOT approved drums, dumpsters or wrap in plastic sheeting and label the waste with the location and generation date. Store in a secure location until analytical results are obtained to determine appropriate disposal options.

Subsurface Soil Sampling – Test Pit SOP

I. Equipment

- Site-specific sampling plan including map(s)/site plan(s)
- Site-specific Health and Safety Plan
- Safety equipment, as specified in the site-specific Health and Safety Plan
- Tape measure
- Survey stakes or flags
- Camera and film
- Logbook
- Cooler(s)
- Ice
- Decontamination supplies/equipment
- Plastic sheet(s)
- Stainless steel scoop
- Spade or shovel
- Appropriate size/type sample containers
- Zip-lock type plastic bags
- Aluminum foil
- Chain of Custody records and custody seals
- Field data sheets and sample labels
- Stainless steel, plastic, or other appropriate homogenization bucket, bowl or pan
- Back-hoe or Excavator

II. Field Preparation

1. Obtain utility locates using the "One-Call" service or private locator contractor, as appropriate. Utility locates should always be confirmed by property owner or On-Scene-Coordinator (OSC) before beginning work.
2. Read and understand the Site-specific Health and Safety Plan and follow the prescribed safety protocols.
3. Read and understand the site-specific sampling plan and obtain and organize necessary drilling, sampling and monitoring equipment.
4. Decontaminate or pre-clean equipment, and ensure that it is in working order.
5. Perform a general site survey prior to site entry in accordance with the site specific Health and Safety Plan.

6. Use stakes or flags to identify and mark all sampling locations. Locations may be adjusted based on site access, property boundaries, utilities, or surface obstructions. Record locations on site plan.

III. Sampling Procedures

A backhoe can be used to remove sections of soil, when detailed examinations of soil characteristics are required. Excavations greater than four (4) feet (1.22m) deep have special construction, inspection and work requirements (see "Excavation and Trenching", ODOT Safety Standard STD96006).

1. Prior to any excavation with a backhoe, it is important to ensure that all sampling locations are clear of overhead and buried utilities.
2. Review the site-specific Health & Safety plan and ensure that all safety precautions including appropriate monitoring equipment are installed as required.
3. Using the backhoe, excavate a trench approximately three feet wide and approximately one foot deep below the cleared sampling location. Place excavated soils on plastic sheets at least ten feet away from the edge of the excavation. Trenches greater than four feet deep must comply with ODOT Safety Standard STD096006, "Excavation and Trenching."
4. Clean off the vertical face of the sampling location and collect a soil sample using the excavator bucket, ensuring that material sampled is not contaminated by material from above. Collect the soil sample directly from the backhoe bucket. Samples from the backhoe bucket should be obtained from the center of the load, away from the sides of the bucket.
5. If volatile organic analyses are required, immediately transfer the sample into an appropriate, labeled sample container with a stainless steel lab scoop or equivalent and secure the cap tightly.
6. Place the remainder of the sample into a stainless steel homogenization container, decontaminated and/or lined with clean aluminum foil, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Place the sample into appropriate, labeled containers and secure the caps tightly.
7. Place a small amount of sample in a container and set aside for field screening and sample description.
8. If composite samples are to be collected, add additional samples from other sampling intervals to the composite material already in the homogenization bowl and mix thoroughly. Place the composite sample(s) into appropriate, labeled containers and secure caps tightly.
9. Once analytical samples have been packaged, perform the appropriate field test(s) to determine the relative concentrations of petroleum hydrocarbons and/or volatile organic compounds following the procedures in the appropriate SOPs.
10. Describe the soil characteristics, following the ODOT Soil and Rock Classification Manual. Record this information along with the results of field screening tests or other indications of contamination, measured recovery, sampled depth or interval, and depth of any geologic contacts, in the logbook and/or on field data (log) sheets.
11. Abandon the pit or excavation according to applicable regulations. This may require using "clean" backfill material.
12. Dispose of excavated material according to applicable regulations. If soil appears contaminated, containerize excess soil in DOT approved drums, dumpsters or wrap in plastic sheeting and label the waste with the location and generation date. Store in a secure location until analytical results are obtained to determine appropriate disposal options.

Subsurface Soil Sampling – Split Spoon/Hollow Stem Auger Drilling SOP

I. Equipment

- Site-specific sampling plan including map(s)/site plan(s)
- Site-specific Health and Safety Plan
- Safety equipment, as specified in the site-specific Health and Safety Plan
- Tape measure
- Survey stakes or flags
- Camera and film
- Logbook
- Cooler(s)
- Ice
- Decontamination supplies/equipment
- Plastic sheet(s)
- Stainless steel scoop
- Spade or shovel
- Appropriate size/type sample containers
- Zip-lock type plastic bags
- Bentonite chips
- Aluminum foil
- Chain of Custody records and custody seals
- Field data sheets and sample labels
- Stainless steel, plastic, or other appropriate homogenization bucket, bowl or pan
- Hollow-Stem Auger Drill Rig
- Split-spoon samplers

II. Field Preparation

1. Obtain utility locates using the "One-Call" service or private locator contractor, as appropriate. Utility locates should always be confirmed by property owner or On-Scene-Coordinator (OSC) before beginning work.
2. Read and understand the Site-specific Health and Safety Plan and follow the prescribed safety protocols.
3. Read and understand the site-specific sampling plan and obtain and organize necessary drilling, sampling and monitoring equipment.
4. Decontaminate or pre-clean equipment, and ensure that it is in working order.
5. Perform a general site survey prior to site entry in accordance with the site specific Health and Safety Plan.
6. Use stakes or flags to identify and mark all sampling locations. Locations may be adjusted based on site access, property boundaries, utilities, or surface obstructions. Record locations on site plan.

III. Sampling Procedures

All work should be performed in accordance with ASTM D1586-98, "Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils". Personnel experienced in the operation of the drilling equipment and licensed as monitoring well constructors (Oregon) will perform all drilling.

1. Advance boring to appropriate depth with hollow stemmed augers.
2. Decontaminate and assemble the split spoon sampler.
3. Attach the split spoon sampler to the drill rods and lower the sampling assembly until the tip of the sampler is at the desired sampling depth.
4. Drive the split spoon sampler its full length, but no more, using a 145-pound hammer. Do not drive past the bottom of the headpiece or compression of the sample will result.
5. Record in the site logbook or on field data sheets the length of the tube used to penetrate the material being sampled, and the number of blows per each six (6) inches required to obtain this depth.
6. Withdraw the sampler, and open by unscrewing the drive shoe and the head and splitting the barrel.
7. If a volatile analysis is required, immediately place a portion of the soil into the appropriate sampling container.
8. Measure the length of material recovered. If a split sample is desired, a cleaned, stainless steel knife should be used to divide the tube contents in half, longitudinally.
9. Place a small amount of sample in a container and set aside for field screening and sample description.
10. Place the sample in an appropriate labeled sample container and seal tightly.
11. If composite samples are required, place the soil from the desired sampling intervals into a decontaminated and/or aluminum foil lined stainless steel homogenization bowl, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval.

Place the composite sample into appropriate, labeled container(s) and secure the cap(s) tightly.
12. Place sample container(s) in a plastic zip-lock type bag(s) and store in an iced cooler.
13. Once analytical samples have been packaged, perform the appropriate field test(s) to determine the relative concentrations of petroleum hydrocarbons and/or volatile organic compounds following the procedures in the appropriate SOPs.
14. Describe the soil characteristics, following the ODOT Soil and Rock Classification Manual. Record this information along with the results of field screening tests or other indications of contamination, measured recovery, sampled depth or interval and depth of any geologic contacts, in the logbook and/or on field data/boring log sheets.
15. If additional samples are to be collected at greater depths, repeat steps one (1) through 14, making sure to decontaminate the sampler between uses.
16. Abandon all borings or excavations and dispose of all cuttings according to applicable regulations.
17. If soil appears contaminated, containerize excess soil in DOT approved drums, dumpsters or wrap in plastic sheeting and label the waste with the location and generation date. Store in a secure location until analytical results are obtained to determine appropriate disposal options.

Geo Probe – Soil and Groundwater Sampling SOP

I. Equipment

- Site-specific sampling plan including map(s)/site plan(s)
- Site-specific Health and Safety Plan
- Safety equipment, as specified in the site-specific Health and Safety Plan
- Tape measure
- Survey stakes or flags
- Camera and film
- Logbook
- Cooler(s)
- Ice
- Decontamination supplies/equipment
- Plastic sheet(s)
- Stainless steel scoop
- Spade or shovel
- Appropriate size/type sample containers
- Zip-lock type plastic bags
- Bentonite chips
- Plastic or stainless steel spoons
- Chain of Custody records and custody seals
- Field data sheets and sample labels
- Stainless steel, plastic, or other appropriate homogenization bucket, bowl or pan
- GeoProbe ™ and drilling/sampling equipment

II. Procedures

Personnel experienced in the operation of the GeoProbe ™ drilling equipment will perform all drilling.

Preparation

1. Obtain utility locates using the "One-Call" service or private locator contractor, as appropriate. Utility locates should always be confirmed by property owner or On-Scene-Coordinator (OSC) before beginning work.
2. Read and understand the Site-specific Health and Safety Plan and follow the prescribed safety protocols.
3. Read and understand the site-specific sampling plan and obtain and organize necessary drilling, sampling and monitoring equipment.
4. Decontaminate or pre-clean equipment, and ensure that it is in working order.
5. Perform a general site survey prior to site entry in accordance with the site-specific Health and Safety Plan.
6. Use stakes or flagging to identify and mark all sampling locations. Record the sampling locations on a site plan. All sample locations should be cleared for utilities prior to sampling.

Setup of Geoprobe

1. Back carrier vehicle to probing location.
2. Shift the vehicle to park and shut off ignition.
3. Set parking brake and place chocks under rear tires.
4. Laterally extend the Geoprobe from the vehicle over the desired sampling location.
5. Raise the probe hammer until the probe axis is vertical.
6. When the probe axis is vertical and the weight of the vehicle is on the probe unit, the equipment is ready to begin probing.

Drilling (Probing)

1. Select and assemble the appropriate drilling (probing) tools. This selection will vary depending on the material being drilled and the type of sample to be obtained.
2. Advance to the prescribed depth or for the prescribed interval using either "down-pressure or the percussion hammer.

Soil Sampling

1. Assemble soil-sampling device with acetate or similar material liner.
2. Attach assembled sampler onto leading probe rod.
3. Drive probe rods and sampler the designated distance. Be careful not to overdrive the sampler, which could compact the soil sample in the tube, causing the liner to crack.
4. Retract probe rods from the hole and recover the sample tube. Inspect the sample tube confirm that a sample was recovered.
5. Disassemble sampler and remove sample tube liner.
6. Measure the recovery and inspect liner for cracks. If no cracks are noted, cut the liner into 1-foot (0.3-meter) sections.
7. Collect a small amount of soil from an end of each section and place in a container for field screening and soil classification.
8. Place vinyl caps on the ends of sections and seal with electrical tape.
9. Label the outside of each section with the following information (minimum required information):
    - Boring ID
    - Date
    - Depth and top of interval
10. Place the sealed liner sections on ice, in a cooler.
11. If cracks are noted in the sample tube liner, extract the soil and place in a sample jar.
12. Label the jar with the following information (minimum required information):
    - Boring Number
    - Date
    - Sampled Interval
13. Place the jar in a zip-lock type plastic bag and store, on ice, in a cooler.
14. Once analytical samples have been packaged, perform the appropriate field test(s) to determine the relative concentrations of petroleum hydrocarbons and/or volatile organic compounds following the procedures in the appropriate SOPs.
15. Describe the soil characteristics, following the ODOT Soil and Rock Classification Manual. Record this information along with the results of field screening tests or other indications of contamination, measured recovery, sampled depth or interval and depth of any geologic contacts, in the logbook and/or on field data/boring log sheets.
16. Decontaminate and reassemble sampler.
17. Repeat steps 1 through 16 for each sampled interval and boring location, as appropriate.

Groundwater Sampling

1. Using the screen-point, advance to the desired depth.
2. Open the screen-point to expose the screened interval.
3. Use a decontaminated water level indicator to determine if water is entering the screen-point.

4. Wait until the water level stabilizes. Then purge one to three volumes from the casing using a peristaltic pump or Mini-bailer (one volume if purging is faster than recovery, three volumes if recovery is faster than purging)
5. Wait until sufficient water has entered the screen-point to provide an adequate sample volume. This may require removing water from the screen-point several times to accumulate sufficient sample volume.
6. Groundwater samples may be collected with the 20-mL well Mini-Bailer or peristaltic pump. If samples are being collected for volatile organic compound analysis (VOC), the 20-mL Well Mini-Bailer should be used. If samples are being collected for a variety of analyses, VOC samples should be collected first using the bailer. Remaining samples can be collected by pumping water to the surface. Withdrawing water with the pump is more efficient than collecting water with the 20-mL well Mini-Bailer.
7. Label sample containers with the following (minimum) information:
    - Boring Number
    - Date
    - Sampled Interval
8. Place sample containers in zip-lock type plastic bags and store, on ice, in a cooler.

Decontamination

1. Decontaminate all downhole equipment before moving to the next sampling site.
2. Follow decontamination requirements presented in the site-specific sampling plan.

Hole Abandonment

1. Abandon all borings or excavations and dispose of all cuttings according to applicable regulations.
2. If soil appears contaminated, containerize excess soil in DOT approved drums, dumpsters or wrap in plastic sheeting and label the waste with the location and generation date. Store in a secure location until analytical results are obtained to determine appropriate disposal options.

Groundwater Well Sampling SOP

I. Equipment

- Site-specific sampling plan including map(s)/site plan(s)
- Site-specific Health and Safety Plan
- Safety equipment, as specified in the site-specific Health and Safety Plan
- Water level indicator
- PID
- pH meter, conductivity meter, thermometer or multi-meter
- Field data sheets and sample labels
- Appropriate size sample containers
- Chain of custody records and seals
- 5-gallon plastic pails
- Flexible tubing for peristaltic pump
- PVC or Polyethylene tubing for all pumps.
- Nylon line
- Pump(s)
- bailer(s)
- Cooler(s)
- Ice
- Decontamination supplies/equipment
- Logbook
- Plastic sheet
- Zip-lock type plastic bags
- Hose clamps
- Control box (if necessary)
- Low flow valves
- Nitrile gloves
- Calculator
- Tool box (to include at least: screwdrivers, pliers, hammer, flashlight, adjustable wrench, hex wrench, well wrench, bolt cutters, razor knife, treble hook and "fishing" line)

II. Field Preparation

1. Obtain permission for site access.
2. Read and understand the Site-specific Health and Safety Plan and follow the prescribed safety protocols.

3. Read and understand the site-specific sampling plan and obtain and organize necessary drilling, sampling and monitoring equipment.
4. Decontaminate or pre-clean equipment, and ensure that it is in working order.
5. Perform a general site survey prior to site entry in accordance with the site specific Health and Safety Plan.
6. Locate and identify all wells.

III. Procedures

1. Unlock all well caps.
2. Measure depth to water & total depth of all monitoring wells-to reference point on well casing. Decontaminate the water level indicator after measuring each well. See Water Level Measurement SOP
3. Start sampling at the least contaminated well, if known.
4. Lay plastic sheeting around the well to minimize equipment contamination.
5. Remove locking well and casing caps, note location, time of day, and date in field notebook.
6. Screen headspace of well with PID as required in the sampling or health & safety plans.
7. Calculate the volume of water in the well and the volume to be purged using this formula:
   Well volume (v) = (height of water column) $\times \pi \times r^2$
8. Purge according to site-specific sampling plan or, generally, purge 3 well volumes from each well or until the following well parameters have stabilized: pH, temperature, & conductivity, whichever is less. Well parameters should be measured with a decontaminated and calibrated pH/temperature/conductivity meter. Record pH, conductivity, and temperature data in logbook. Purge wells using a bailer, decontaminated submersible pump with decontaminated and/or dedicated tubing or a peristaltic pump with decontaminated and/or dedicated tubing.
9. Purging with Bailers
   a) Attach the line to the bailer and slowly lower until the bailer is half submerged, being careful not to drop the bailer to the water, causing turbulence and the possible loss of volatile organic contaminants.
   b) Pull bailer out ensuring that the line either falls onto a clean area of plastic sheeting or never touches the ground.
   c) Examine the contents of the bailer. Look for floating product or sheen on the water surface.
   d) Empty the bailer into a pail until full to determine the number of bails necessary to achieve the required purge volume.
   e) Pour the water into a container and dispose of purge waters (site-specific sampling plan).
10. Purging with Pumps
    If free product is expected, lower a bailer into the well until it is half submerged, being careful not to drop the bailer to the water. Examine the contents of the bailer. Look for floating product or sheen on the water surface.

a) Assemble pump, hoses and safety cable, if using a submersible pump lower the pump into the well. If using a peristaltic pump lower the intake hose into the well. Make sure the pump/hose is deep enough so all the water is not evacuated (running the pump without water may cause damage). It may be necessary to adjust the depth of the pump/hose during pumping. In the case of the peristaltic pump, use a short piece of flexible hose in the pump and attach to PVC on polyethylene tubing to pump the well. Measure the volume of water pumped using a 5-gallon pail and time the rate of pumping.
b) If low-flow purging is required, attach value to outflow hose to restrict flow to 1/2 gpm.
c) Attach power supply, and purge the well until the specified volume of water has been evacuated (or until field parameters, such as temperature, pH, conductivity, etc. have stabilized). Do not allow the pump to run dry. If the pumping rate exceeds the well recharge rate, lower the pump further into the well, and continue pumping.
d) Collect and dispose of purge waters as specified in the site-specific sampling plan.

11. Assemble the appropriate bottles.
12. Once purging is complete collect all non-volatile samples using the (bailer or pump).
13. All samples for volatile analysis must be collected using bailers or positive displacement bladder pumps to minimize agitation.

a) Fill the vial to form a convex meniscus. Do not rinse the vial or overflow it. Cap securely.
b) Invert the vial and tap gently. Observe vial for at least 10 seconds. If an air bubble appears, discard the sample and begin again.
c) It is imperative that no entrapped air is in the sample vial.
14. Samples for dissolved metals analysis must be filtered in the field with a 0.45-μm filter or be delivered to the analytical laboratory within 24 hours.
15. Place samples in labeled laboratory prepared bottles.
16. Place bottles in zip-lock type bags and store on ice in a cooler.
17. Complete chain of custody.
18. Replace the well cap.
19. Log all samples in the site logbook and on the field data sheets and label all samples.
20. Transport sample to decontamination zone for preparation for transport to the analytical laboratory under chain of custody.
21. Upon completion, remove pump and assembly and fully decontaminate prior to purging/sampling the next monitoring well. Discard or dedicate the tubing to the well for future use during purging.
22. Repeat steps four (4) through 21 for each monitoring well to be sampled.
23. Prepare and transport ground water samples to the laboratory. Check sample documentation and make sure samples are properly packed for shipment.

IV. Calculations

If it is necessary to calculate the volume of the well, utilize the following equation:

Well volume (v)

$v = h \times \pi \times r^2$ *(CF) [Equation 1]*

π = *pi* approximately 3.14

r = radius of monitoring well (feet)

CF = conversion factor = 7.48 gal/cubic-feet

Volume (gallons per linear foot)

$v(gal/ft) = \pi \times r^2 \times CF$ *[Equation 2]*

h = height of the water column (feet)

[(total depth of the well) - (depth to water)]

* volume to be purged = $3 \times v$

Water Level Measurement SOP

I. Equipment

There are a number of devices, which can be used to measure water levels. The device must be capable of attaining an accuracy of 0.01 feet (3mm).

- Site-specific sampling plan including map(s)/site plan(s)
- Site-specific Health and Safety Plan
- Safety equipment, as specified in the site-specific Health and Safety Plan
- Decontamination supplies/equipment as detailed in the site-specific sampling plan
- Electronic water level indicator
- Oil/water interface sensor
- Metal tape measure
- Logbook
- Groundwater water level data forms

II. Field Preparation

1. Read and understand the Site-specific Health and Safety Plan and follow the prescribed safety protocols.
2. Read and understand the site-specific sampling plan and obtain and organize necessary sampling and monitoring equipment.
3. Decontaminate equipment, and ensure that it is in working order.
4. Perform a general site survey prior to site entry in accordance with the site specific Health and Safety Plan.
5. Locate and identify all wells and piezometers.

III. Sampling Procedures

Procedures for determining water levels are as follows:

1. If possible and when applicable, start at those wells that are least contaminated and proceed to those wells that are most contaminated.
2. Decontaminate all equipment entering well by following the procedures called for in the site-specific sampling plan.
3. Remove locking well cap, note well ID, time of day, elevation (top of casing) and date in site logbook or an appropriate groundwater level data form.
4. Remove well casing cap.
5. If required by site-specific condition, monitor headspace of well with a photoionization detector (PID) to determine presence of volatile organic compounds, and record in site logbook.
6. Measurement in wells without free product
   (a) Lower electric water level measuring device into the well until water surface is encountered.
   (b) Measure the distance from the water surface to the reference measuring point on the well casing or protective outer casing and record in the site logbook. The reference point is usually the highest point on the inner casing and is usually indicated with a small notch or mark. In addition, note that the water level measurement was from the top of the steel casing, the top of the PVC riser pipe, the ground surface, or some other position on the well head.
7. Measurement in wells with free product
   (a) Assemble the oil/water interface sensor following the manufacturer's instructions.
   (b) Lower sensor into the well until product surface is encountered. This is indicated by a pulsating tone.
   (c) Measure the distance from the product surface to the reference measuring point on the well casing or protective outer casing and record in the site logbook. The reference point is usually the highest point on the inner casing and is usually indicated with a small notch or mark. In addition, note that the water level measurement was from the top of the steel casing, the top of the PVC riser pipe, the ground surface, or some other position on the well head.
   (d) Continue to lower the device until the product/water interface is reached, indicated by a continuous tone. Measure and record the depth.
8. The groundwater level data forms should include the following information:
   - Site Name
   - Logger Name
   - Monitor well or piezometer number
   - Measuring Point
   - Total depth of well
   - Date
   - Time of reading
   - Depth to Water (depth to product surface and depth to product/water interface)
   - Comments

(e) Measure total depth of well (at least twice to confirm measurement) and record in site logbook or on groundwater level data form.
(f) Note any physical changes, such as erosion or cracks in protective concrete pad or variation in total depth of well, in field logbook and on groundwater level data form.
(g) Remove all downhole equipment, replace well casing cap and locking steel caps.
(h) Decontaminate all equipment as outlined in Step 3 above. Proceed to next well and repeat steps three (3) through 11.

Sediment Sampling SOP

I. Equipment

- Site-specific sampling plan including map(s)/site plan(s)
- Site-specific Health and Safety Plan
- Safety equipment, as specified in the site-specific Health and Safety Plan
- Tape measure
- Survey stakes or flags
- Camera and film
- Logbook
- Cooler(s)
- Ice
- Decontamination supplies/equipment
- Plastic sheet(s)
- Stainless steel scoop
- Spade or shovel
- Appropriate size sample containers
- Chain of Custody records and custody seals
- Field data sheets and sample labels
- Stainless steel bowl
- Aluminum foil
- Zip-lock type plastic bags
- Bucket auger, tube auger, extension rods, "T" handle
- Sediment coring device

II. Field Procedures

1. Obtain utility locates using the "One-Call" service or private locator contractor, as appropriate. Utility locates should always be confirmed by property owner or On-Scene-Coordinator (OSC) before beginning work.
2. Consult with the ODOT Region Environmental Coordinator or Biologist to assure compliance with applicable state and federal regulations pertaining to clean water and endangered species. Obtain necessary permits and/or letters of agreement.
3. Read and understand the Site-specific Health and Safety Plan and follow the prescribed safety protocols.
4. Read and understand the site-specific sampling plan and obtain and organize necessary drilling, sampling and monitoring equipment.
5. Decontaminate or pre-clean equipment, and ensure that it is in working order.
6. Perform a general site survey prior to site entry in accordance with the site specific Health and Safety Plan.
7. Use stakes, flagging, or buoys to identify and mark sampling locations (considering the flow regime, basin morphometry, sediment characteristics, overlying aqueous layer depth, contaminant source, and extent and nature of contamination), because of site access, property boundaries, and surface obstructions adjustments may be needed. Mark the locations on the site plan/map.

III. Sampling Surface Sediment with a Trowel or Scoop from Shallow Water

1. Surface sediment depth is considered to be the upper 6 inches of sediment. Shallow water is up to 12 inches in depth. Collection of surface sediment from shallow water can be accomplished with tools such as spades, shovels, trowels, and scoops (method best used in shallow sluggish water). A stainless steel or plastic sampling implement will suffice in most applications (avoid chrome plating or other materials, common with garden trowels).
2. Using a decontaminated sampling implement, remove the desired thickness and volume of sediment from the sampling area.
3. If volatile organic analysis is to be performed, transfer the sample directly into an appropriate, labeled sample container with a stainless steel lab scoop or equivalent and secure the cap tightly.
4. Place a small amount of sample in a container and set aside for field screening and sample description.
5. Place the remainder of the sample into a decontaminated and/or aluminum foil lined stainless steel homogenization bowl, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval and place the sample into appropriate, labeled containers and secure the caps tightly.

6. If composite samples are to be collected, add additional samples from other sampling intervals to the composite material already in the homogenization bowl and mix thoroughly. Place the composite sample(s) into appropriate, labeled containers and secure caps tightly.
7. Surface water should be decanted from the sample or homogenization container prior to sealing or transfer, while careful to retain the fine sediment fraction.
8. Place sample jars in plastic zip-lock type bags and store in iced cooler.
9. Once analytical samples have been packaged, perform the appropriate field test(s) to determine the relative concentrations of petroleum hydrocarbons and/or volatile organic compounds following the procedures in the appropriate SOPs.
10. Describe the soil characteristics, following the ODOT Soil and Rock Classification Manual. Record this information along with the results of field screening tests or other indications of contamination, measured recovery, sampled depth or interval and depth of any geologic contacts, in the logbook and/or on field data (log) sheets.

IV. Sampling Surface Sediment with a Bucket Auger or Tube Auger

Surface sediment depth is considered to be the upper 6 inches of sediment. Collection of surface sediment can be accomplished with a system consisting of bucket auger or tube auger, a series of extensions, and a "T" handle. The use of additional extensions in conjunction with a bucket auger can increase the depth of water from which sediment can be collected from 24 inches to 10 feet or more. However, sample handling and manipulation increases in difficulty with increasing depth of water. The bucket auger or tube auger is driven into the sediment and used to extract a core. The various materials represented by the core are homogenized or a sub-sample of the core is taken from the appropriate depth.

1. An acetate core sleeve may be inserted into the tube auger prior to sampling if characteristics of the sediments or water-body warrant. By using this technique, an intact core can be extracted.
2. Assemble the auger.
3. Clear the area to be sampled of any debris.
4. Insert the bucket auger or tube auger into sediment at a 0° to 20° angle from vertical. This orientation minimizes spillage of the sample from the sampler upon extraction from the sediment and water.
5. Rotate the auger to cut a core of sediment.
6. Slowly withdraw the auger; if using a tube auger, make sure that the slot is facing upward.
7. If volatile organic analysis is to be performed, transfer the sample directly into an appropriate, labeled sample container with a stainless steel lab scoop or equivalent and secure the cap tightly.
8. Place a small amount of sample in a container and set aside for field screening and sample description.
9. Place the remainder of the sample into a decontaminated and/or aluminum foil lined stainless steel homogenization bowl, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval and place the sample into appropriate, labeled containers and secure the caps tightly.
10. If composite samples are to be collected, add additional samples from other sampling intervals to the composite material already in the homogenization bowl and mix thoroughly. Place the composite sample(s) into appropriate, labeled containers and secure caps tightly.
11. Surface water should be decanted from the sample or homogenization container prior to sealing or transfer, while careful to retain the fine sediment fraction.
12. Place sample jars in plastic zip-lock type bags and store in iced cooler.
13. Once analytical samples have been packaged, perform the appropriate field test(s) to determine the relative concentrations of petroleum hydrocarbons and/or volatile organic compounds following the procedures in the appropriate SOPs.
14. Describe the soil characteristics, following the ODOT Soil and Rock Classification Manual. Record this information along with the results of field screening tests or other indications of contamination, measured recovery, sampled depth or interval and depth of any geologic contacts, in the logbook and/or on field data (log) sheets.

V. Sampling Subsurface Sediment with a Bucket Auger or Tube Auger

Subsurface sediment is considered to be from a depth of greater than six (6) inches. Collection of subsurface sediment can be accomplished with a system consisting of a bucket auger, a tube auger, a series of extensions and a "T" handle. The use of additional extensions can increase the depth of water from which sediment can be collected from 24 inches to 10 feet or more. However, water clarity must be high enough to permit the sampler to directly observe the sampling operation. In addition, sample handling and manipulation increases in difficulty with increasing depth of water. The bucket auger is used to bore a hole to the upper range of the desired sampling depth and then withdrawn. The tube auger is then lowered down the borehole, and driven into the sediment to the sampling lower range of the desired sampling depth. The tube is then withdrawn and the sample recovered from the tube. This method can be used to collect firmly consolidated sediments, but is somewhat limited by the depth of the water, and the integrity of the initial borehole.

1. Assemble the auger.
2. Clear the area to be sampled of any surface debris.
3. Begin augering, periodically removing any accumulated sediment (i.e., cuttings) from the auger bucket. Cuttings should be disposed of far enough from the sampling area to minimize cross contamination of various depths.
4. After reaching the upper range of the desired depth, slowly and carefully remove bucket auger from the boring.
5. Attach the tube auger bit to the required lengths of extensions, and then attach the "T" handle to the upper extension.
6. Carefully lower tube auger down borehole using care to avoid making contact with the borehole sides and, thus, cross contaminating the sample. Gradually force tube auger into sediment to the lower range of the desired sampling depth. Hammering of the tube auger to facilitate coring should be avoided as the vibrations may cause the boring walls to collapse.
7. Remove tube auger from the borehole, again taking care to avoid making contact with the borehole sides and, thus, cross contaminating the sample.
8. Discard the top of core (approximately 1 inch), as this represents material collected by the tube auger before penetration to the layer of concern.
9. If volatile organic analysis is to be performed, transfer the sample directly into an appropriate, labeled sample container with a stainless steel lab scoop or equivalent and secure the cap tightly.
10. Place a small amount of sample in a container and set aside for field screening and sample description.
11. Place the remainder of the sample into a decontaminated and/or aluminum foil lined stainless steel homogenization bowl, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval and place the sample into appropriate, labeled containers and secure the caps tightly.
12. If composite samples are to be collected, add additional samples from other sampling intervals to the composite material already in the homogenization bowl and mix thoroughly. Place the composite sample(s) into appropriate, labeled containers and secure caps tightly.
13. Surface water should be decanted from the sample or homogenization container prior to sealing or transfer, while careful to retain the fine sediment fraction.
14. Place sample jars in plastic zip-lock type bags and store in iced cooler.
15. Once analytical samples have been packaged, perform the appropriate field test(s) to determine the relative concentrations of petroleum hydrocarbons and/or volatile organic compounds following the procedures in the appropriate SOPs.
16. Describe the soil characteristics, following the ODOT Soil and Rock Classification Manual. Record this information along with the results of field screening tests or other indications of contamination, measured recovery, sampled depth or interval and depth of any geologic contacts, in the logbook and/or on field data (log) sheets.

VI. Sampling Subsurface Sediment with a Coring Device

Subsurface sediment is considered to be from a depth of greater than six (6) inches. Collection of subsurface sediment can be accomplished with a system consisting of a tube sampler, acetate tube, eggshell check valve, nosecone, extensions, and "T" handle, or drive-head. The use of

additional extensions can increase the depth of water from which sediment can be collected from 24 inches to 10 feet or more. This sampler may be used with either a drive hammer for firm sediment, or a "T" handle for soft sediment. However, sample handling and manipulation increases in difficulty with increasing depth of water.

1. Assemble the coring device by inserting the acetate core into the sampling tube.
2. Insert the "egg shell" check valve into the lower end of the sampling tube with the convex surface positioned inside the acetate core.
3. Screw the nosecone onto the lower end of the sampling tube, securing the acetate tube and eggshell check valve.
4. Screw the handle onto the upper end of the sampling tube and add extension rods as needed.
5. Place the sampler in a perpendicular position on the sediment to be sampled.
6. If the "T" handle is used, place downward pressure on the device until the desired depth is reached. After the desired depth is reached, rotate the sampler to shear off the core at the bottom. Slowly withdraw the sampler from the sediment and proceed to Step 15.
7. If the drive hammer is selected, insert the tapered handle (drive head) of the drive hammer through the drive head.
8. Drive the sampler into the sediment to the desired depth.
9. Record the length of the tube that penetrated the sample material and the number of blows required to obtain this depth.
10. Remove the drive hammer and fit the keyhole-like opening on the flat side of the hammer onto the drive head, the hammer serves as a handle for the sampler.
11. Rotate the sampler to shear off the core at the bottom.
12. Lower the sampler handle (hammer) until it just clears the two ear-like protrusions on the drive head, and rotate about 90°.
13. Slowly withdraw the sampler from the sediment. If the drive-head was used, pull the hammer upwards and dislodge the sampler from the sediment.
14. Carefully remove the coring device from the water.
15. Unscrew the nosecone and remove the eggshell check valve.
16. Slide the acetate core out of the sampler tube. Decant surface water, using care to retain the fine sediment fraction. If headspace is present in the upper end, a hacksaw may be used to shear the acetate tube off at the sediment surface. The acetate core may then be capped at both ends. Indicate on the acetate tube the appropriate orientation of the sediment core using a waterproof marker. The sample may be used in this fashion, or the contents transferred to a sample or homogenization container.
17. If volatile organic analysis is to be performed, transfer the sample directly into an appropriate, labeled sample container with a stainless steel lab scoop or equivalent and secure the cap tightly.
18. Place a small amount of sample in a container and set aside for field screening and sample description.
19. Place the remainder of the sample into a decontaminated and/or aluminum foil lined stainless steel homogenization bowl, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval and place the sample into appropriate, labeled containers and secure the caps tightly.
20. If composite samples are to be collected, add additional samples from other sampling intervals to the composite material already in the homogenization bowl and mix thoroughly. Place the composite sample(s) into appropriate, labeled containers and secure caps tightly.
21. Surface water should be decanted from the sample or homogenization container prior to sealing or transfer, while careful to retain the fine sediment fraction.
22. Place sample jars in plastic zip-lock type bags and store in iced cooler.
23. Once analytical samples have been packaged, perform the appropriate field test(s) to determine the relative concentrations of petroleum hydrocarbons and/or volatile organic compounds following the procedures in the appropriate SOPs.
24. Describe the soil characteristics, following the ODOT Soil and Rock Classification Manual. Record this information along with the results of field screening tests or other indications of contamination, measured recovery, sampled depth or interval and depth of any geologic contacts, in the logbook and/or on field data (log) sheets.

Surface Water Sampling SOP

I. Equipment

- Site-specific sampling plan including map(s)/site plan(s)
- Site-specific Health and Safety Plan
- Safety equipment, as specified in the site-specific Health and Safety Plan
- Camera and film
- pH meter, conductivity meter, thermometer or multi-meter
- Cooler(s)
- Ice
- Decontamination supplies/equipment
- Plastic sheet
- Glass beaker or measuring cup
- Appropriate size sample containers
- Logbook
- Chain of Custody records and custody seals
- Field data sheets and sample labels
- Zip-lock type plastic bags

II. Field Preparation

1. Read and understand the Site-specific Health and Safety Plan and follow the prescribed safety protocols.
2. Read and understand the site-specific sampling plan and obtain and organize 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 site specific Health and Safety Plan.
5. Record sampling locations on site plan. Locations may be adjusted based on site access, property boundaries, utilities, or surface obstructions.

III. Sampling Procedures

1. Assemble the appropriate bottles.
2. Collect samples using a glass beaker or measuring cup. Measure and record temperature, pH, and conductivity, as required.
3. All samples for volatile analysis must be collected carefully, minimizing agitation.

d) Fill the vial to form a convex meniscus. Do not rinse the vial or overflow it. Cap securely.

e) Invert the vial and tap gently. Observe vial for at least 10 seconds. If an air bubble appears, discard the sample and begin again.

f) It is imperative that no entrapped air is in the sample vial.

4. Samples for dissolved metals analysis must be filtered in the field with a 0.45-μm filter or be delivered to the analytical laboratory within 24 hours.
5. Place samples in labeled laboratory prepared bottles.
6. Place bottles in zip-lock type bags and store on ice in a cooler.
7. Complete chain of custody.
8. Log all samples in the site logbook and on the field data sheets and label all samples.
9. Transport sample to decontamination zone for preparation for transport to the analytical laboratory under chain of custody.
10. Decontaminate all equipment according to site-specific sampling plan.

Move to next sample location and repeat.

Field Screening Procedures SOP

I. Equipment

- Site-specific sampling plan including map(s)/site plan(s)
- Site-specific Health and Safety Plan
- Safety equipment, as specified in the site-specific Health and Safety Plan
- Decontamination supplies/equipment
- Stainless steel scoop
- Sample jars
- Logbook
- Photoionization Detector (PID)
- Field data (Boring Log) sheets
- Stainless steel bowl
- Aluminum foil
- De-ionized or distilled water
- Zip-lock type plastic bags
- "Petro-Flag" kit(s)

II. Field Preparation

1. Read and understand the Site-specific Health and Safety Plan and follow the prescribed safety protocols.
2. Read and understand the site-specific sampling plan and obtain and organize necessary sampling and monitoring equipment.
3. Decontaminate or pre-clean equipment, and ensure that it is in working order.

III. Field Screening Procedures

Field screening procedures are qualitative or semi-quantitative methods for determining the presence of hydrocarbons and other volatile organic compounds. Three methods are in general use within ODOT, headspace testing, "sheening" and the use of "Petro-Flag" kits.

Headspace Test

1. Calibrate the PID according to the manufacturer's instructions.
2. Fill a sample jar about half full of the soil to be tested, cover the top of the jar with foil, tightly cap the jar and shake vigorously. A zip-lock type bag can be used instead of a jar, but a PID reading must be taken on an empty bag to establish a baseline reading.
3. Place the jar or bag in a warm place for about five minutes.
4. Shake the sample again, open the lid, poke the PID nozzle through the foil and immediately sample the headspace above the soil. If a zip-lock type bag is used, the PID nozzle can be pushed directly into the bag above the level of the soil.
5. Record the results in the logbook and/or on field data (log) sheets.
6. Discard the soil. The sample jar can be decontaminated and used again. The empty bags and jars can be disposed of as solid waste/trash.

Sheening

1. Decontaminate a stainless steel bowl or line a bowl with aluminum foil.
2. Place about 250 ml of de-ionized water in the bowl and swirl the water around. Check for a sheen on the water. If there is a sheen, repeat the decontamination procedure and check again.
3. Place a spoonful of soil into the water and stir/swirl the soil into the water for about a minute.
4. Check for a sheen on the water and record the results in the logbook and/or on field data (log) sheets.
5. Decontaminate sampling equipment before proceeding to next sample.

"Petro-Flag" Kit

A number of these kits are available depending on the type of contaminant to be detected. Follow the manufacturer's instructions when using these kits for field screening. Record the results in the logbook and/or on field data (log) sheets.

Be aware that many of these kits contain reagents that are hazardous. This information and appropriate safety measures must be included in the Site Specific Health and Safety Plan.

SAMPLING EQUIPMENT DECONTAMINATION SOP

The scale of the decontamination effort is related to the type of operation (simple hand sampling vs. full-scale drilling and sampling, major excavating, etc.), the types of equipment involved and the types of contaminants encountered. This general SOP should be modified to fit the project conditions.

I. EQUIPMENT/APPARATUS

Decontamination equipment, materials, and supplies are generally selected based on availability. Other considerations include the ease of decontaminating or disposing of the equipment. Most equipment and supplies can be easily procured. For example, soft-bristle scrub brushes or long-handled bottlebrushes can be used to remove contaminants. Large galvanized wash tubs, stock tanks, or buckets can hold wash and rinse solutions. Children's wading pools can also be used. Large plastic garbage cans or other similar containers lined with plastic bags can help segregate contaminated equipment. Contaminated liquid can be stored temporarily in metal or plastic cans or drums.

The following standard materials and equipment are recommended for decontamination activities:

- Scrubbing and bottle brushes
- Plastic sheeting
- Paper towels
- Plastic or galvanized tubs or buckets
- 55-gallon drums
- Spray bottles
- Aluminum foil
- Safety equipment, as specified in the site-specific Health and Safety Plan
- Trash bags/containers
- Pressurized sprayers (H_2O) or Steam cleaner or Pressure washer
- Non-phosphate detergent
- Tap water
- De-ionized water

II. FIELD PREPARATION

1. Read and understand the Site-specific Health and Safety Plan and follow the prescribed safety protocols.
2. Read and understand the site-specific sampling plan and obtain and organize necessary decontamination, sampling and monitoring equipment.
3. At the Site, set up a decontamination area for each type of decontamination to be performed in the CRZ.

III. SMALL SAMPLING EQUIPMENT

1. Set up a decontamination area with a bucket of non-phosphate detergent and tap water, a bucket of clean tap water, a spray bottle of de-ionized water with an empty bucket, and several scrub brushes.
2. Scrape all loose dirt off and add to the investigation derived waste.
3. Scrub the sampling equipment with non-phosphate detergent and tap water until all visible dirt is removed.
4. Thoroughly rinse the equipment with tap water and inspect to ensure it is free of dirt.
5. Rinse with de-ionized water from the spray bottle, ensuring all fluids are caught in another bucket.

6. Re-assemble the sampling equipment and allow to dry.
7. If the equipment will not be re-used immediately, wrap it in aluminum foil to prevent contamination.

IV. LARGE EQUIPMENT

All samples and equipment leaving the contaminated area of a site must be decontaminated to remove any contamination that may have adhered to equipment.
Decontamination techniques used by ODOT Geo/Hydro include:

Mechanical
Mechanical methods of decontamination include using metal or nylon brushes. The amount and type of contaminants removed will vary with the hardness of bristles, length of time brushed, degree of brush contact, degree of contamination, nature of the surface being cleaned, and degree of contaminant adherence to the surface.

Low-pressure Water
This method consists of a container that is filled with water. The user pumps air out of the container to create a vacuum. A slender nozzle and hose allow the user to spray in hard-to-reach places.

High-pressure Water
This method consists of a high-pressure pump, an operator controlled directional nozzle, and a high- pressure hose. Operating pressure usually ranges from 340 to 680 atmospheres (atm) and flow usually range from 20 to 140 liters per minute.

In all cases the decontamination area should be set up to contain wash fluids (unless not required based on scope of work). Plastic sheeting can be used to create a bermed decontamination pad. All fluids and debris generated should be collected in a drum or similar container for proper disposal. All equipment should be thoroughly inspected after decontamination to ensure all visible dirt has been removed.

V. *PERSONNEL*

Decontamination Setup

As part of the health and safety and site specific sampling plans, a decontamination plan should be developed and reviewed. The decontamination line should be set up in the CRZ before any personnel or equipment enters the areas of potential exposure. Any personnel stationed in the CRZ to help with decontamination should be in the same level of PPE as the workers in the Hot Zone and should decontaminate themselves last using the same procedures. The personnel decontamination should include the following:

1. Wash outer PPE using tap water and non-phosphate detergent
2. Remove outer PPE being careful NOT to touch the exposed surfaces (turn PPE inside out as it is removed)
3. Place used disposable PPE in two heavy duty trash bags for disposal as solid waste
4. If a second layer of PPE clothing is use, repeat steps 1, 2, and 3.
5. Remove respirator (when worn)
6. Wipe respirator clean with a disinfectant wipe approved by the manufacturer
7. Place all non-disposable PPE in sealed bags for future use.

Sample Preparation and Transportation SOP

I. Equipment

- Site-specific sampling plan including map(s)/site plan(s)
- Site-specific Health and Safety Plan
- Safety equipment, as specified in the site-specific Health and Safety Plan
- Cooler(s)
- Ice
- Zip-lock type plastic bags
- Chain of Custody records and custody seals
- Indelible markers
- Trash bags
- Field data sheets and sample labels
- Box tape
- Shipping labels
- Packing materials ("foam peanuts", newspaper, bubble wrap, sawdust, vermiculite)

II. Field Preparation

1. Read and understand the Site-specific Health and Safety Plan and follow the prescribed safety protocols.
2. Read and understand the site-specific sampling plan and obtain and organize necessary sampling and monitoring equipment.
3. Clean out the cooler(s) and place one or more bags of ice into trash bags and then into the cooler. If dry ice is used, it should be wrapped in several layers of newspaper to help prevent freezing of water samples.

III. Sample Preparation

1. Each sample container must have a label.
2. The label must include the following information:
   "ODOT"
   Site or Project name
   Sample identifier
   Date/time sampled
   Name of person taking sample
   Analyses desired
3. Check the container lid – make sure it is properly sealed.
4. Apply a custody seal to the sample container, as appropriate.
5. Place the sample container in a zip-lock bag
6. Record the sample information on the Chain-of-Custody (COC) form and field data sheet and place the sample in the prepared cooler.

IV. Sample Transportation

1. Pack the samples carefully in a cooler to prevent breakage during transport. This may require the use of packing materials such as "peanuts", crumpled newspaper, or bubble wrap.
2. Make sure the cooler contains enough ice to last during transport.
3. Place the Chain-of-Custody in the cooler inside a zip-lock type plastic bag to keep it dry.
4. Secure the cooler(s) in the vehicle to prevent sliding.
5. Transport samples to the laboratory or overnight shipping office
6. Obtain appropriate signatures on the COC form and retain a copy.
7. If samples are to be shipped, place an address label inside the cooler(s) along with a copy of the COC form. Place custody seals on the cooler(s), seal with box tape and apply a shipping label. For shipping, the cooler(s) should be marked "Fragile" and "This Side Up".
8. Deliver the cooler(s) to the shipper and obtain appropriate signatures on the COC form and retain a copy.
9. Call the laboratory and give them an ETA for the shipment.

Investigation Derived Waste (IDW) Handling SOP

I. Equipment

- Site-specific sampling plan including map(s)/site plan(s)
- Site-specific Health and Safety Plan
- Safety equipment, as specified in the site-specific Health and Safety Plan
- DOT 17-H Drums or similar approved containers
- "Dumpster"-type containers
- Decontamination supplies/equipment
- Plastic sheeting
- Logbook
- Duct tape
- Appropriate labels for drums and containers
- Large trash bags

II. General

Investigation derived waste is soil or water that can reasonably be expected to be contaminated. Examples are auger cuttings, GeoProbe samples, test-pit spoils, monitoring well development or purge water, and decontamination fluids. Soil and water can be expected to be contaminated if it is derived from a known contaminated site or field-screening tests are positive

Investigation derived waste can be stored on-site if the area can be secured or it can be stored in a secured area of a central location. **Investigation derived waste shall NOT be stored for longer than 90 days.**

All containers, drums and soil piles shall be labeled. The label will include the following information (minimum required information): Project or site name and address
Contact name and phone number
Boring, test-pit, or well ID.
Interval represented
Container number (if multiple containers are generated)
Generation date or accumulation-start date
Type of waste (soil/water/both)
Type of contaminant (if known)

Petroleum contaminated soil can be stored on and covered by plastic sheeting. All other potentially contaminated IDW should be stored in sealed containers.

III. Field Preparation

1. Read and understand the Site-specific Health and Safety Plan and follow the prescribed safety protocols.
2. Read and understand the site-specific sampling plan and obtain and organize necessary equipment and supplies.
3. Perform a general site survey prior to site entry in accordance with the site specific Health and Safety Plan.
4. Determine the waste storage location(s) and record on a plan or sketch of the site and in the field logbook and field data sheets.

IV. Waste Soil Handling and Storage

1. Place soil in DOT 17-H drums or other appropriate containers. Segregate potentially contaminated from uncontaminated soil.
2. Take samples as necessary for waste characterization following appropriate sampling and sample preparation and transport SOPs.
3. Seal and label each IDW container.
4. Move containers to a secure area for storage.
5. When analytical results are received, re-label containers appropriately and arrange for disposal within 90 days of generation.
6. GeoProbe sample tubes should be placed in a trash bag, one bag per boring or project (as appropriate), and stored in a drum. Label the drum with the accumulation start date, type of

material, and contact name and phone number. Additional bags can be added to the drum if a log of the drum contents is kept. When analytical results are received, re-label the bag(s) appropriately and arrange for disposal within 90 days of generation.

7. Large volumes of soil from test-pits can be placed on plastic sheeting. Leave enough plastic exposed to thoroughly wrap the soil pile. Weight the edges with sandbags or seal with duct tape. Attach a label including the generation date, contact name and phone number, test-pit ID. Be certain that the site is secure. When analytical results are received arrange for appropriate disposal within 90 days of generation.

V. Waste Water Handling and Storage

1. Place water in DOT 17-H drums or other appropriate containers. Segregate potentially contaminated from uncontaminated water.
2. Take samples as necessary for waste characterization following appropriate sampling and sample preparation and transport SOPs.
3. Seal and label each IDW container.
4. Move containers to a secure area for storage.
5. When analytical results are received, re-label containers appropriately and arrange for disposal within 90 days of generation.

Contaminated Soil Excavation SOP

I. Equipment

- Site-specific remediation plan including map(s)/site plan(s)
- Site-specific Health and Safety Plan
- Safety equipment, as specified in the site-specific Health and Safety Plan
- Tape measure
- Survey stakes or flags
- Camera and film
- Logbook
- Sampling equipment and supplies (see other SOPs)
- Field screening equipment as described in the remediation plan
- Decontamination supplies/equipment
- Plastic sheet(s)
- Back-hoe or Excavator
- "Clean" backfill material
- water tank, tanker truck or drums
- Containers or "dumpsters"
- Dump truck(s)
- Fencing or barricades

II. Field Preparation

1. Obtain utility locates using the "One-Call" service or private locator contractor, as appropriate. Utility locates should always be confirmed by property owner or On-Scene-Coordinator (OSC) before beginning work.
2. Read and understand the Site-specific Health and Safety Plan and follow the prescribed safety protocols.
3. Read and understand the site-specific remediation plan and obtain and organize necessary excavation, sampling and monitoring equipment.
4. Decontaminate or pre-clean equipment as required, and ensure that it is in working order.
5. Perform a general site survey prior to site entry in accordance with the site specific Health and Safety Plan.
6. Use stakes or flags to identify and mark excavation limits, waste and stockpile areas. Locations may be adjusted based on site access, property boundaries, utilities, or surface obstructions. Record locations on site plan.
7. Use fencing or barricades to limit site access.

III. Excavation

A backhoe or excavator can be used to remove contaminated soil. Excavations greater than four (4) feet (1.22m) deep have special construction, inspection and work requirements (see "Excavation and Trenching", ODOT Safety Standard STD96006).

1. Prior to any excavation with a backhoe or excavator, it is important to ensure that the location is clear of overhead and buried utilities.
2. Excavate soil to the prescribed limits of excavation. Place excavated soil on plastic sheets or in containers or trucks. Excavations greater than four feet deep must comply with ODOT Safety Standard STD096006, "Excavation and Trenching."
3. If possible, segregate soil based on relative level of contamination.
4. Collect soil samples from the limits of the excavation using the excavator, being careful to collect soil from the center of the bucket.
5. Field screen the soil samples in accordance with the remediation plan, to determine whether additional excavation is required.
6. Once the final extent of excavation has been achieved, collect confirmatory samples from the bottom and side walls of the excavation using the excavator, being careful to collect soil from the center of the bucket. Place the composite sample into appropriate, labeled container(s) and secure the cap(s) tightly. Place sample container(s) in a plastic zip-lock type bag(s) and store in an iced cooler.
7. If groundwater enters the excavation, do not enter the excavation.
8. If a groundwater sample is desired, pump the groundwater into a tank, drum or tanker truck, until the excavation is dry or at least one volume of water has been removed and allow the excavation to recharge. Collect groundwater samples from the surface using a bailer attached to a nylon line.

IV. Decontamination

Decontaminate all equipment leaving the site, following the procedures in the appropriate SOP and/or the health & safety plan. Containerize all decontamination wastes and sample as appropriate. Dispose of decontamination waste according to applicable regulations.

V. Excavation Closure

Regulatory agencies may require the excavation to remain open pending the results of confirmatory sampling and such excavations should be secured with temporary fencing or other barricades. In residential areas, or areas where the public would have access to the excavation, the excavation should be lined with plastic sheets to delineate the edges of the excavation and back filled with clean fill. Once clearance is obtained, abandon the excavation according to applicable regulations. This may require using "clean" backfill material.

Dispose of excavated material and other waste according to applicable regulations. Waste may be stored on site until analytical results are obtained to determine appropriate disposal options (see site-specific remediation plan).

UST Removal/Closure SOP

I. Equipment

- Site-specific remediation plan including map(s)/site plan(s)
- Site-specific Health and Safety Plan
- Safety equipment, as specified in the site-specific Health and Safety Plan
- ODEQ UST Removal Checklist
- Tape measure
- Survey stakes or flags
- Camera and film
- Logbook
- Sampling equipment and supplies
- Decontamination supplies/equipment
- Plastic sheet(s)
- Back-hoe or Excavator
- "Clean" backfill material
- 55-gallon drums
- Containers or "dumpsters"
- Dump truck(s)
- Fencing or barricades
- Fork lift
- Straw bales
- Pavement saw or Jackhammer

II. Field Preparation

1. Obtain necessary permits. Make necessary regulatory agency notifications. Tank removal and closure must be performed by or under the supervision of a person licensed by the State of Oregon. All work must conform to Oregon DEQ standards/requirements.
2. Obtain utility locates using the "One-Call" service or private locator contractor, as appropriate. Utility locates should always be confirmed by property owner or On-Scene-Coordinator (OSC) before beginning work.
3. Read and understand the Site-specific Health and Safety Plan and follow the prescribed safety protocols.
4. Read and understand the site-specific remediation plan and obtain and organize necessary excavation, sampling and monitoring equipment.
5. Conduct a "pre-construction" meeting with all personnel expected to be on site. Cover health & safety requirements and procedures, construction practices and other project details.
6. Decontaminate or pre-clean equipment as required, and ensure that it is in working order.
7. Perform a general site survey prior to site entry in accordance with the site specific Health and Safety Plan.
8. Use stakes or flags to identify and mark excavation limits, waste and stockpile areas. Locations may be adjusted based on site access, property boundaries, utilities, or surface obstructions. Record locations on site plan.
9. Use fencing or barricades to limit site access.
10. Delineate EZ(s), CRZ(s) and support zone(s) as required by the site-specific health & safety and remediation plans.

III. Excavation

A backhoe or excavator can be used to remove soil.

1. Prior to any excavation with a backhoe or excavator, it is important to ensure that the location is clear of overhead and buried utilities.
2. Review the site-specific Health & Safety plan and ensure that all safety precautions including appropriate monitoring equipment are installed as required.
3. Set up soil containment with plastic sheets and straw bales.
4. Remove tank contents (done by contractor).
5. Cut and remove pavement.
6. Excavate soil to expose top of tank (see ODOT Contaminated Soil Excavation SOP). Based on observation or field tests, separate "clean" from contaminated soil.
7. Triple rinse tank and "inert" as called for in the site-specific Health & Safety and Remediation Plan.
8. Continue excavation to fully expose tank.
9. Monitor tank atmosphere and re-"inert" as necessary.

Tank Removal

1. Set up timbers to form a sloped "cradle" for tank.
2. Attach "non-sparking" lifting sling, hoist tank from excavation and place in prepared cradle.
3. Triple rinse tank and re-"inert", as called for in the site-specific Health & Safety and Remediation Plan.
4. Cut open ends of tank. Make one opening large enough to admit a person. Make the other opening large enough to admit a sprayer nozzle.
5. Scrape, wash down and remove waste from tank interior (performed by a contractor).
6. Mark tank with former contents and date of removal.
7. Load tank on transport and take to recycler.

IV. Decontamination

Decontaminate all equipment leaving the site, following the procedures in the appropriate SOP and/or the health & safety plan. Containerize all decontamination wastes and sample as appropriate. Dispose of decontamination waste according to applicable regulations.

V. Excavation Closure

Obtain confirmatory samples of soil and groundwater following appropriate ODOT soil and groundwater sampling SOPs and ODEQ requirements.

Regulatory agencies may require the excavation remain open pending the results of confirmatory sampling. Once clearance is obtained, abandon the excavation according to applicable regulations. This may require using "clean" backfill material.

Dispose of excavated material and other waste according to applicable regulations. Waste may be stored on site until analytical results are obtained to determine appropriate disposal options (see site-specific remediation plan).

APPENDIX B

Generic Air Monitoring Plans

EXPOSURE MONITORING PLAN
Generic Exposure Monitoring Plan – Gas/Diesel/Oil Contamination

Exposure Monitoring Plan Prepared by: Brenda Pittman, CIH CP6251

Suspected Contaminants Present: Potential for soils contaminated by: diesel, gasoline, oils and oil and fuel additives. Site assessment has not been performed or site assessment has been performed but analytical data is only available for total petroleum hydrocarbons; no constituent analysis have been performed. A list of chemicals and their exposure limit values employees could potentially be exposed to are listed in Attachment A.

Hazard Evaluation:
Soil in limited areas on site may be contaminated with various oils, oil additives, fuel and fuel additives including gasoline and diesel fuel. Water in limited areas may be contaminated with various fuel and fuel additives.

Oil is composed of an indefinite petroleum distillate content typically including polynuclear aromatic hydrocarbons (PAHs). The concentration of these products will vary widely depending on the source of oil, weathering and aging. The oils, fuels and fuel additives have a very low vapor pressure and are not expected to evaporate and contaminate the work air. The oils, fuels and fuel additives have bound to the soil and can become airborne when loose dirt or dust contaminated with these chemicals is generated and distributed in the air. If contaminated soil becomes airborne workers can inhale or ingest a minor amount of chemical contaminates on site.

Fuels can consist of diesel and gasoline. Diesel fuel like most oils is composed of an indefinite petroleum distillate content including PAH. Gasoline however, is composed of an indefinite petroleum distillate mixture that can include benzene; toluene; xylenes; naphthalenes; and polyaromatic hydrocarbons PAH. The concentrations of chemicals found in gasoline will vary widely depending upon the source of the fuel, weathering and aging.

Hazard Description:

- Potential health effects (exposure to soil): contact with soil may cause eye irritation, may cause skin irritation. If soil is ingested it may cause an elevation in blood lead levels which can lead to blood and reproductive effects. Inhalation of dust contaminated with the chemicals on site can cause respiratory tract irritation.
- Potential health effects (exposure to vapor from the soil): contact with vapor may cause nausea by inhalation and eye irritation. If benzene is present (a component of gasoline), it may be a hematologic toxin (affects the blood and blood forming organs), and is a carcinogen.
- Some people who have breathed or touched mixtures of PAHs and other chemicals for long periods of time have developed cancer. Some PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer), or had them on their skin (skin cancer).

Basic Precautions: Wear chemical resistant clothing as necessary to protect against skin or eye contact; periodically change protective clothing that has oil on it; immediately change clothing that is showing evidence of oil penetrating to your skin; and wash skin with soap and water when changing into street clothing, before eating/drinking or when exiting to a contamination reduction zone. Flush eyes with water if oil or dirt gets in them. If ingested do not induce vomiting – contact a physician.

Stay away from, or upwind of any freshly uncovered contaminated soil or stained soil. Use air-monitoring equipment to document exposure to hazardous vapors. Follow the air monitoring decision tree and evacuate the immediate area when indicated to prevent exposure to harmful vapors.

Air Monitoring Equipment Needed:
PID with 10.6 eV lamp
Drager pump
Drager tubes for benzene (0.5 – 10 ppm) Drager PN 67-28561 or 81-01841 at least one box of 10 available from Fisher Scientific (State Price Agreement in Effect) 1-800-766-7000.

Air Monitoring:
Before soil is disturbed:
Calibrate the PID to isobutylene – instrument will be operated in the work area for at lest several minutes to determine background level readings. Record background readings.

During operations where soil is disturbed. Operate the PID continually – even when sampling for benzene or petroleum hydrocarbons on site. Make sure you subtract the ambient background reading from the reading provided on the PID while you are performing aggressive operations and potentially releasing hazardous chemicals to the air. Make sure you retest per the Air Monitoring Decision Tree - See Attachment B, when:

- A new procedure is performed,
- A new location is disturbed, or
- When a new pocket of contaminated soil (as indicated by staining or color change) is encountered

RECORD ALL MEASURMENTS TAKEN IN FIELD NOTES FOR THE PROJECT FILE, MAKE SURE YOU INCLUDE THE TIME & OPERATION AS WELL AS RESULTS AND EQUIPMENT USED.

LEVELS OF PROTECTION

LEVEL D:

- Work clothing as dictated by the weather
- Safety shoes or boots with boot covers or rubber boots
- Safety glasses

- Hard hat
- Nitrile, neoprene or natural rubber gloves (use when handling or contact may occur with contaminated soils or similar incidents)
- Earplugs as needed
- Safety vest as needed

LEVEL C:

- Work clothing as directed by the weather
- Safety shoes or boots with boot covers or rubber boots
- Hard hat
- Saranex or polyethylene coated tyvek (or equivalent), coveralls with hood (used when handling or contact may occur with contaminated soils or material, tank contents, tank interior, performing decontamination or similar incidents.
- Neoprene, nitrile or natural rubber overboots (use when handling or contact may occur with contaminated soils or similar incidents)
- Nitrile, neoprene or natural rubber gloves
- Full face air purifying respirator with organic vapor, acid gas and P100 filters

ATTACHMENT A
POTENTIAL CONTAMINANTS ON SITE
GASOLINE/DIESEL/FUEL/LUBRICATING OIL CONTAMINATED SITE

Contaminant & Ionization Potential (eV)	Maximum Concentration (ppm)		OSHA PEL[1] (ppm)	ACGIH TLV[2] (ppm)
	Soil	Water		
Benzene (9.4)	Unknown	Unknown	1 ppm	0.5 ppm
butyl benzene (?)	unknown	unknown	none	none
ethyl benzene (8.76)	unknown	unknown	100 ppm	100 ppm
isopropybenzene (cumene) (8.75)	unknown	unknown	50 ppm	50 ppm
isopropyltoluene (?)	unknown	unknown	none	none
kerosene (JP-5) (?)	unknown	unknown	300 ppm	300 ppm
methyl tert-butyl ether (MTBE) (9.24)	unknown	unknown	none	50 ppm
propylbenzene (?)	unknown	unknown	none	none
toluene (8.82)	unknown	unknown	100 ppm	50 ppm
trimethyl benzene (?)	unknown	unknown	25 ppm	25 ppm
xylenes (8.44)	unknown	unknown	100 ppm	100 ppm
gasoline (?)	unknown	unknown	none	300 ppm
diesel (?)	unknown	unknown	5 mg/m3 (oil mist)	100 mg/m3 (total hydrocarbons)
motor oil/lube oil (?)	unknown	unknown	5 mg/m3 (oil mist)	5 mg/m3 (oil mist)
poly aromatic hydrocarbons (?) • naphthalene • pyrene • phenathrene • anthracene • benzoapyrene • etc.	unknown	unknown	 0.2 mg/m3 " " " "	 keep exposures as low as possible
Metals (none) • lead • cadmium	unknown	unknown	 50 ug/m3 0.01 mg/m2	 50 ug/m3 0.01 mg/m3

(1) Oregon OSHA Air Contaminant Standard
Concentration that must not be exceeded during any 8-hour workshift of a 40 hour workweek.

(2) American Conference of Governmental Industrial Hygienists (ACGIH) TWA

ATTACHMENT B
AIR MONITORING DECISION TREE
GASOLINE/DIESEL/FUEL/LUBRICATING OIL CONTAMINATED SITE

Total Organic Vapor Readings from PID	**TOTAL ORGANIC VAPOR GUIDANCE** *Further air monitoring needed?*	*Action on Site*	*PPE to be used*
Background to 1 ppm above background	NO	Work may continue	**Level D**
1 ppm above background	Yes – at 1 ppm - sample air with benzene detector tube or CMS chip, follow guidance listed below under "Benzene Level Guidance"	Work may continue	**Level D**
1-9.9 ppm	No – if no benzene was found.	Work may continue	**Level D**
10 – 24 ppm (no benzene detected)	Continue continuous monitoring with PID. Any readings above background should result in a reevaluation of the site to determine if the initial site characterization is accurate and previously unidentified solvents are now present	Work may continue in Level C with respirator	**Level C**
25 ppm or above (no benzene detected)	Leave area allow contaminates to dissapate. If airborne levels do not dissipate new site characterization needs to be performed.	Stop work – move away	**Stop work**
Readings from Detector Tube or Drager CMS	*BENZENE LEVEL GUIDANCE*	*Action on Site*	***PPE to be used***
0 – none detected	Refer back to section above – Total Organic Vapor Readings from PID		
0.5 - 1 ppm	Monitor for benzene every 30 minutes for change. Document readings.	Work may continue	**Level D**
1 – 10 ppm	Monitor every 30 minutes for change, do not reduce the level of protection until two sample results at least 30 minutes apart indicate levels below 0.5 ppm.	Utilize respiratory protection	**Level C**
Above 10 ppm	Leave area, allow contaminate to dissipate. If contaminates do not dissipate a new site characterization needs to be performed	Stop work – move away	**Stop work**

EXPOSURE MONITORING PLAN
Generic Exposure Monitoring Plan – Fuels, Solvents and Metal Contamination from General Industry and Automotive Repair

Exposure Monitoring Plan Prepared by: Brenda Pittman, CIH CP6251

Suspected Contaminants Present: Potential for soils contaminated by: diesel, gasoline, oils and oil and fuel additives. In addition, soil may be contaminated with various solvents that were used for industrial purposes. Site assessment has not been performed or site assessment has been performed but analytical data is only available for total petroleum hydrocarbons; no constituent analysis have been performed. A list of chemicals and their exposure limit values employees could potentially be exposed to are listed in Attachment A.

Hazard Evaluation:
Soil in limited areas on site may be contaminated with various solvents, oils, oil additives, fuel and fuel additives including gasoline and diesel fuel. Water in limited areas may be contaminated with various fuel and fuel additives as well as solvents and heavy metals. The amount of solvent found in soil will be dependent upon the soil type and weathering. As solvent and fuel contaminated soil and water is disturbed and exposed to the air, solvent vapor will evaporate from the soil and water.

Oil is composed of an indefinite petroleum distillate content typically including polynuclear aromatic hydrocarbons (PAHs). The concentration of these products will vary widely depending on the source of oil, weathering and aging. The oils, fuels and fuel additives have a very low vapor pressure and are not expected to evaporate and contaminate the work air. The oils, fuels and fuel additives have bound to the soil and can become airborne when loose dirt or dust contaminated with these chemicals is generated and distributed in the air. If contaminated soil becomes airborne workers can inhale or ingest a minor amount of chemical contaminates on site.

Fuels can consist of diesel and gasoline. Diesel fuel like most oils is composed of an indefinite petroleum distillate content including PAH. Gasoline however, is composed of an indefinite petroleum distillate mixture that can include benzene; toluene; xylenes; naphthalenes; and PAH. The concentrations of chemicals found in gasoline will vary widely depending upon the source of the fuel, weathering and aging.

Hazard Description:

- Potential health effects (exposure to soil): contact with soil may cause eye irritation, may cause skin irritation. If soil is ingested it may cause an elevation in blood lead levels which can lead to blood and reproductive effects. Inhalation of dust contaminated with the chemicals on site can cause respiratory tract irritation.
- Potential health effects (exposure to vapor from the soil): contact with vapor may cause nausea by inhalation and eye irritation. If benzene is present (a component of gasoline), it may be a hematologic toxin (affects the blood and blood forming organs), and is a carcinogen.

- Some people who have breathed or touched mixtures of PAHs and other chemicals for long periods of time have developed cancer. Some PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer), or had them on their skin (skin cancer).
- Solvents can enter the body through contact with skin and through inhalation. Solvents are generally colorless liquid with odors varying from sweet, fruity, to chloroform-like. Odor should not be used as an indicator of the airborne hazard present. Inhalation of solvent vapors can cause central nervous system depression, headache, dizziness, irritation to eyes, nose, throat. Inhaling large amounts can cause euphoria, uncoordination, slowed response time, slurred speech, drowsiness, visual disturbance, stupor and coma. Skin contact can cause irritation, and allergic sensitization and drying and cracking of skin. Excessive skin contact over a period of years for some solvents can cause liver, kidney, heart damage and changes to the blood. Some solvents like perchlorethylene, vinyl chloride and benzene have been suspected of causing cancer in humans. Some solvents may cause birth defects.

Basic Precautions: Wear chemical resistant clothing as necessary to protect against skin or eye contact; periodically change protective clothing that is soiled; immediately change clothing that is showing evidence of oil or solvent penetrating to your skin; and wash skin with soap and water when changing into street clothing, before eating/drinking or when exiting to a contamination reduction zone. Flush eyes with water if oil or dirt gets in them. If ingested do not induce vomiting – contact a physician.

Stay away from, or upwind of any freshly uncovered contaminated soil or stained soil. Use air-monitoring equipment to document exposure to hazardous vapors. Follow the air monitoring decision tree and evacuate the immediate area when indicated to prevent exposure to harmful vapors.

Air Monitoring Equipment Needed:
PID with a 10.6 eV lamp
Drager pump , Drager tubes for benzene and vinyl chloride. State contract with Fisher Scientific 1-800-766-7000. Fisher Part number 6728561 (benzene 0.5 – 10 ppm), Number 8101721 (vinyl chloride 0.5 – 30 ppm). OR Drager CMS and chips can be used: 6406170 (vinyl chloride 0.3-10 ppm) and 6406030 (benzene 0.2-10 ppm.

Air Monitoring:
Before soil is disturbed:
Calibrate the PID to isobutylene – instrument will be operated in the work area for at lest several minutes to determine background level readings. Record background readings.

During operations where soil is disturbed. Operate the PID continually – even when sampling for benzene or petroleum hydrocarbons on site. Make sure you subtract the ambient background reading from the reading provided on the PID while you are performing aggressive operations and potentially releasing hazardous chemicals to the

air. Make sure you retest per the Air Monitoring Decision Tree - See Attachment B, when:

- A new procedure is performed,
- A new location is disturbed, or
- When a new pocket of contaminated soil (as indicated by staining or color change) is encountered

RECORD ALL MEASURMENTS TAKEN IN FIELD NOTES FOR THE PROJECT FILE, MAKE SURE YOU INCLUDE THE TIME & OPERATION AS WELL AS RESULTS AND EQUIPMENT USED.

LEVELS OF PROTECTION

LEVEL D:

- Work clothing as dictated by the weather
- Safety shoes or boots with boot covers or rubber boots
- Safety glasses
- Hard hat
- Nitrile, neoprene or natural rubber gloves (use when handling or contact may occur with contaminated soils or similar incidents)
- Earplugs as needed
- Safety vest as needed

LEVEL C:

- Work clothing as directed by the weather
- Safety shoes or boots with boot covers, or rubber boots
- Hard hat
- Saranex or polyethylene coated tyvek (or equivalent), coveralls with hood (used when handling or contact may occur with contaminated soils or material, tank contents, tank interior, performing decontamination or similar incidents.
- Neoprene, nitrile or natural rubber overboots (use when handling or contact may occur with contaminated soils or similar incidents)
- Nitrile, neoprene or natural rubber gloves
- Full face air purifying respirator with organic vapor, acid gas and P100 filters

ATTACHMENT A
POTENTIAL CONTAMINANTS ON SITE
SITE WITH FUELS AND INDUSTRIAL SOLVENTS & CHEMICALS

Contaminant & Ionization Potential (eV)	Maximum Concentration (ppm)		OSHA PEL[1] (ppm)	ACGIH TLV[2] (ppm)
	Soil	Water		
Benzene (9.4)	Unknown	Unknown	1 ppm	0.5 ppm
butyl benzene (?)	unknown	unknown	none	none
ethyl benzene (8.76)	unknown	unknown	100 ppm	100 ppm
isopropybenzene (cumene) (8.75)	unknown	unknown	50 ppm	50 ppm
isopropyltoluene (?)	unknown	unknown	none	none
kerosene (JP-5) (?)	unknown	unknown	300 ppm	300 ppm
propylbenzene (?)	unknown	unknown	none	none
toluene (8.82)	unknown	unknown	100 ppm	50 ppm
trimethyl benzene (?)	unknown	unknown	25 ppm	25 ppm
xylene (8.44)	unknown	unknown	100 ppm	100 ppm
gasoline (?)	unknown	unknown	none	300 ppm
diesel (?)	unknown	unknown	5 mg/m3 (oil mist)	100 mg/m3 (total hydrocarbons)
motor oil/lube oil (?)	unknown	unknown	5 mg/m3 (oil mist)	5 mg/m3 (oil mist)
carbon disulfide (10.1)	unknown	unknown	20 ppm	10 ppm
dichloroethylene (?)	unknown	unknown	none	200 ppm
mineral spirits (?) (stoddard solvent)	unknown	unknown	200 ppm	100 ppm
naphthalene (8.13)	unknown	unknown	10 ppm	10 ppm
tetrachloroethene (PCE or perchloroethylene) (9.32)	unknown	unknown	100 ppm	25 ppm
methyl tert-butyl ether (MTBE) (9.24)	unknown	unknown	none	50 ppm
trichloropropane (?)	unknown	unknown	50 ppm	10 ppm
trichloroethene (TCE) (9.42)	unknown	unknown	100 ppm	50 ppm
1,2-dichloroethene (1,2-DCE) (9.65)	unknown	unknown	200 ppm	200 ppm
vinyl chloride (9.99)	unknown	unknown	1 ppm	1 ppm
poly aromatic hydrocarbons (?) • naphthalene • pyrene • phenathrene • anthracene • etc.	unknown	unknown	non volatile	non volatile
PCB'S (?)	unknown	unknown	0.5 mg/m3	non volatile
Metals (none) • lead • cadmium • chromium	unknown	unknown	 50 ug/m3 0.01 mg/m3 0.05 mg/m3	 50 ug/m3 0.01 mg/m3 0.05 mg/m3

(3) Oregon OSHA Air Contaminant Standard
Concentration that must not be exceeded during any 8-hour workshift of a 40 hour workweek.

(4) American Conference of Governmental Industrial Hygienists (ACGIH) TWA

ATTACHMENT B
AIR MONITORING DECISION TREE – SITES WITH UNKNOWN CONTAMINANTS – FUELS/OILS/SOLVENTS

Total Organic Vapor Readings from PID	*TOTAL ORGANIC VAPOR GUIDANCE Further air monitoring needed?*	*Action on Site*	*PPE to be used*
Background to 1 ppm above background	NO	Work may continue	**Level D**
1 ppm above background	Yes – sample air with vinyl chloride detector tube or CMS chip, follow guidance listed below under "Vinyl Chloride Level Guidance" • If no vinyl chloride is found, test the air for benzene • If no vinyl chloride or benzene is found continue work on site and follow guidance listed below	Work may continue	**Level D**
1 – 10 ppm (no vinyl chloride or benzene detected)	Continue continuous monitoring with PID. Any readings above background should result in a reevaluation of the site to determine if the initial site characterization is accurate and previously unidentified solvents are now present	Work may continue but evaluate work area for potential cause of the increased reading.	**Level D**
10 ppm – 25 ppm above background (no benzene or vinyl chloride detected)	Continue monitoring with PID. Document the source of the readings. Don a full face air purifying respirator with organic vapor / acid gas cartridges with HEPA filter. Change filters with every 5 hours of use	Work may continue in Level C	**Level C**
25 ppm or more above background	Leave area, allow contminates to dissipate. New site characterization needs to be performed.	Stop work	**Stop Work**
Readings from Detector Tube or Draager CMS	***VINYL CHLORIDE LEVEL GUIDANCE Further air monitoring needed?***	***Action on Site***	***PPE to be used***
0 – none detected	Refer back to section above – MONITOR FOR BENZENE		**Level D**
0.5 ppm	If vinyl chloride is found, monitor every 10 minutes for change.	Work may continue	**Level C**
1 ppm or higher	Stop Work, move away allow contaminates to dissipate – reevaluate the site. Work may not continue without an air supplied respirator (Level B)	Stop Work	**Stop Work**
Readings from Detector Tube or Draager CMS	***BENZENE LEVEL GUIDANCE Further air monitoring needed?***	***Action on Site***	***PPE to be used***
0 – NONE DETECTED	Refer back to section above – Total Organic Vapor Readings – PID		**Level D**
0.5 ppm – 1 ppm	Monitor for benzene every 30 minutes for change. Document readings.	Work may continue	**Level D**
1 - 10 ppm	Monitor every 30 minutes for change, do not reduce the level of protection until two samples results at least 30 minutes apart are below 0.5 ppm	Utilize respirator Work may continue	**Level C**
10+ ppm	Leave area, allow contaminates to dissipate. If contaminates do not dissipate a new site characterization needs to be performed.	Stop work	**Stop work**

EXPOSURE MONITORING PLAN
Generic Exposure Monitoring Plan – Dry Cleaning Establishments

Exposure Monitoring Plan Prepared by: Brenda Pittman, CIH CP6251

Suspected Contaminants Present: Potential for soils contaminated by: dry cleaning solvents. Site assessment has not been performed. A list of chemicals and their exposure limit values employees could potentially be exposed to are listed in Attachment A.

Hazard Evaluation:
Soil in limited areas on site may be contaminated with various solvents that were used for dry cleaning purposes. Water in limited areas may be contaminated with various dry cleaning solvents. The amount of solvent found in soil will be dependent upon the soil type and weathering. As solvent contaminated soil and water is disturbed and exposed to the air solvent vapor will evaporate from the soil or water. The higher the ambient temperature the greater the amount of vapor that will evaporate from soil and water.

Dry cleaning solvents may enter the body through contact with skin and through inhalation of vapors from volatized solvent. Dry cleaning solvents are generally colorless liquid with odors varying from sweet, fruity, to chloroform-like. Odor should not be used as an indicator of the airborne hazard present as the nose can become deadened to the smell and in some cases the solvent odor is not perceptible until airborne levels are hazardous.

Hazard Description:
Inhalation of solvent vapors causes central nervous system depression, headache, dizziness, and irritation to eyes, nose, and throat. Inhaling large amounts can cause euphoria, incoordination, slowed response time, slurred speech, drowsiness, visual disturbance, stupor and coma. Skin contact can cause irritation, and allergic sensitization and drying and cracking of skin. Excessive skin contact over a period of years for some solvents can cause liver, kidney, heart damage and changes to the blood.

Some dry cleaning solvents, like perchlorethylene, dichloroethyl ether, 1,2-dichloropropane, carbon tetrachloride, benzene, vinyl chloride, have been suspected of causing cancer in humans. Some dry cleaning solvents may cause birth defects.

Basic Precautions:
Wear chemical resistant clothing as necessary to protect against skin or eye contact; periodically change protective clothing that is soiled; immediately change clothing that is showing evidence of solvent penetrating to your skin; and wash skin with soap and water when changing into street clothing, before eating/drinking or when exiting to a contamination reduction zone. Flush eyes with water if soil or water gets in them. If ingested do not induce vomiting – contact a physician.

Stay away from, or upwind of any freshly uncovered contaminated soil or stained soil. Use air-monitoring equipment to document exposure to hazardous vapors. Follow the air monitoring decision tree and evacuate the immediate area when indicated to prevent exposure to harmful vapors.

Air Monitoring Equipment Needed:
PID with a **11.7 eV lamp** is preferred – higher lamp strength is needed to detect numerous solvents with IP above 10.6 eV

NOTICE: A number of chemicals could be present on site that would not be detected utilizing a PID with a 10.6 eV lamp alone – including: 1,1-dichloroethene (DCE, vinylidene chloride); 1,2-dichloropropane; trichloroethane (TCA); methylene chloride; methyl chloride; dichlorofluoromethane; chloroform.

DEQ studies have indicated there is a limited risk of encountering the above listed chemicals during remediation of former dry cleaning plants. Further, modeling of potential exposures to the above listed chemicals indicates massive soil or water contamination would need to be present to expose employees above the PEL. As such, employees have the discretion of using a PID with a 10.6 or 11.7 eV lamp. Employees wishing to use a PID with a 11.7 eV lamp will be provided with one.

Drager pump, Drager tubes for vinyl chloride: Number 8101721 (vinyl chloride 0.5 – 30 ppm).

Drager CMS and Chips: Fisher Scientific (1-800-766-7000 state contract) Part Number 6406170 (vinyl chloride 0.3 – 10 ppm)

Air Monitoring:
Before soil is disturbed:
Calibrate the PID to isobutylene – instrument will be operated in the work area for at lest several minutes to determine background level readings. Record background readings.

During operations where soil is disturbed. Operate the PID continually. Make sure you subtract the ambient background reading from the reading provided on the PID while you are performing aggressive operations and potentially releasing hazardous chemicals to the air. Make sure you retest per the Air Monitoring Decision Tree - See Attachment B, when:

- A new procedure is performed,
- A new location is disturbed, or
- When a new pocket of contaminated soil (as indicated by staining or color change) is encountered

RECORD ALL MEASURMENTS TAKEN IN FIELD NOTES FOR THE PROJECT FILE, MAKE SURE YOU INCLUDE THE TIME & OPERATION AS WELL AS RESULTS AND EQUIPMENT USED.

LEVELS OF PROTECTION

LEVEL D:
- Work clothing as dictated by the weather

- Safety shoes or boots with boot covers or rubber boots
- Safety glasses
- Hard hat
- Nitrile, neoprene or natural rubber (use when handling or contact may occur with contaminated soils or similar incidents)
- Earplugs as needed
- Safety vest as needed

LEVEL C:

- Work clothing as directed by the weather
- Safety shoes or boots
- Hard hat
- Saranex or polyethylene coated tyvek (or equivalent), coveralls with hood (used when handling or contact may occur with contaminated soils or material, tank contents, tank interior, performing decontamination or similar incidents.
- Neoprene, nitrile or natural rubber overboots (use when handling or contact may occur with contaminated soils or similar incidents)
- Nitrile, neoprene, natural rubber gloves or viton.
- Full face air purifying respirator with organic vapor, acid gas and P100 filters – cartridges must be changed with every 5 hours of use, or earlier if a contaminant can be detected by smell or taste when the respirator is worn in a contaminated environment

ATTACHMENT A
POTENTIAL CONTAMINANTS ON SITE – DRY CLEANING ESTABLISHMENT

Contaminant & Ionization Potential (ev)	Maximum Concentration (ppm) on site		OSHA PEL[1] (ppm)	ACGIH TLV[2] (ppm)
	Soil	Water		
amyl acetate (9.9)	Unknown	Unknown	100 ppm	10 ppm
chloroform (11.4)	Unknown	Unknown	50 ppm	100 ppm
dichloroethyl ether (<10.6)	Unknown	Unknown	5 ppm	5 ppm
1, 2 – dichloroethene (1,2-DCE) (9.65)	Unknown	Unknown	200 ppm	200 ppm
1,1 – dichloroethene (1,1-DCE) (vinylidene chloride) (<11.0)	Unknown	Unknown	none	5 ppm
dichlorofluoromethane (12.39)	Unknown	Unknown	1000 ppm	10 ppm
1,2-dichloropropane (10.87)	Unknown	Unknown	75 ppm	75 ppm
1,4-dioxane (9.13)	Unknown	Unknown	100 ppm	25 ppm
ethylene glycol ether (<10.6)	Unknown	Unknown	50 ppm	20 ppm
methylene chloride (11.35)	Unknown	Unknown	25 ppm	50 ppm
methyl chloride (11.28)	Unknown	Unknown	100 ppm	50 ppm
tetrachloroethene (PCE or Perchloroethylene) (9.32)	Unknown	Unknown	100 ppm	25 ppm
stoddard solvent (TPH) (<10.6)	Unknown	Unknown	200 ppm	100 ppm
trichloroethene (TCE) (9.42)	Unknown	Unknown	100 ppm	50 ppm
trichloroethane (TCA) (11.0)	Unknown	Unknown	10 ppm	10 ppm
turpentine (<9.0)	Unknown	Unknown	100 ppm	100 ppm
vinyl chloride (9.99)	Unknown	Unknown	1 ppm	1 ppm

Contaminants in Bold are more likely to occur on sites that had dry cleaners than other solvents listed

(5) Oregon OSHA Air Contaminant Standard
Concentration that must not be exceeded during any 8-hour workshift of a 40 hour workweek.

(6) American Conference of Governmental Industrial Hygienists (ACGIH) TWA

ATTACHMENT B
AIR MONITORING DECISION TREE – GENERAL DRY CLEANING

Total Organic Vapor Readings from PID	*TOTAL ORGANIC VAPOR GUIDANCE Further air monitoring needed?*	*Action on Site*	*PPE to be used*
Background to 1 ppm above background	NO	Work may continue	**Level D**
1 ppm above background	Yes – sample air with vinyl chloride detector tube or CMS chip, follow guidance listed below under "Vinyl Chloride Level Guidance" • If no vinyl chloride is found continue work on site and follow guidance listed below	Work may continue	**Level D**
1 - 5 ppm (no vinyl chloride detected)	Continue continuous monitoring with PID. Any readings above background should result in a reevaluation of the site to determine if the initial site characterization is accurate and previously unidentified solvents are now present	Work may continue but evaluate work area for potential cause of the increased reading.	**Level D**
5 ppm – 15 ppm above background (no vinyl chloride detected)	Continue monitoring with PID. Document the source of the readings. Don a full face air purifying respirator with organic vapor / acid gas cartridges with HEPA filter. Change filters with every 5 hours of use	Work may continue in Level C	**Level C**
15 ppm or more above background	Leave area, allow contaminates to dissipate. New site characterization needs to be performed.	Stop work	**Stop Work**
Readings from Detector Tube or Drager CMS	***VINYL CHLORIDE LEVEL GUIDANCE Further air monitoring needed?***	***Action on Site***	***PPE to be used***
0 – none detected	Refer back to section above		**Level D**
0.5 ppm	If vinyl chloride is found, monitor every 10 minutes for change.	Work may continue	**Level C**
1 ppm or higher	Stop Work, move away allow contaminates to dissipate – reevaluate the site. Work may not continue without an air supplied respirator (Level B)	Stop Work	**Stop Work**