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| JOB HAZARD ANALYSIS  |

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| **Hazard Types (HT)** | **Job Task:**  | **Geoprobe® Operations** |
| 1. Toxic Chemic2. Flammable Chemicals3. Corrosive Chemicals4. Environmental5. Explosion (Chemical Reaction)6. Explosion (Over pressurization)7. Mechanical/Vibration8. Electrical (Shock, Short Circuit)9. Electrical (Fire)10.Electrical (Static, ESD)11.Electrical (Loss of Power)12.Ergonomic (Overexertion)13. Ergonomic (Human Error)14. Vibration | 15. Fall (Slips/Trips)16 Fall (To a Different Level)17. Excavation (Collapse)18. Fire, Heat, Thermal, Cold19. Noise20. Radiation (Ionizing/Non-Ionizing)21. Visibility22. Weather23. Caught (In, On, Between)24. Struck (By, Against)25. Driving26. Confined Space27. Other | **Job Frequency/Duration:** 10 – 12 weeks per year**Tools Used**:Geoprobe® Equipment**PPE Used**Leather GlovesHard HatSteel-toed BootsHi-vis Clothing/and or reflective vestsSafety GlassesHearing ProtectionTyvak or latex boot covers as needed | **CRITICAL TO SAFETY (CTS)****Risk Estimation Matrix**

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| **Probability of****Occurrence of Harm** | **SEVERITY OF HARM** |
| **Catastrophic** | **Serious** | **Moderate** | **Minor** |
| Very Likely | Extreme | High | High | Medium |
| Likely | High | High | Medium | Low |
| Unlikely | Medium | Medium | Low | Negligible |
| Remote | Low | Low | Negligible | Negligible |

\* High = CTS tasks should receive engineering controls prior to assigning administrative or PPE controls. |
| **Job Description:** Personnel utilize Geoprobe® to conduct sampling operations to substantiate releases to the environment.  |
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| **Step****#** | **Procedures (LOP Procedure Step)** | **Potential Hazards** | **HT** | **Check****CTS** | **Recommended Safe Practice** | **PPE** |
| 1 | Mobilization/Demobilization - Equipment loading | -Equipment & supplies loading/unloading; struck by equipment, potential pinch points & obstructions; - Heavy lifting; dropped objects. | 12, 23, 24  | Low | - Use remote for operation of Geoprobe® during loading / unloading on trailer; awareness of personnel / equipment movement. -Use mechanical equipment for lifting whenever possible. - Use the buddy system when lifting heavy tools and supplies. - Use proper lifting techniques, i.e., bending at knees, keeping your back straight, keeping the load close to your body, and using your legs. - Stretch / warm-up before heavy lifting.  | Leather Gloves & Steel Toed Boots |
| 2 | Mobilization/Demobilization  | Slip, Trips, Falls | 15, 16 | Low | Awareness of surroundings/work area; keep staging/loading/unloading area organized with clear paths to vehicle(s)/trailer(s) | Leather Gloves and Steel Toed Boots |
| 3 | Driving to and from the field site | Motor Vehicle Accident | 21, 22 | Low | Stay alert, be aware of traffic around you. Obey all traffic laws, reduce speed for inclement weather conditions; not texting while driving; hands-free cellular set-up, or preferably, stop at appropriate location to make phone calls and check messages. | None |
| 4 |  Towing and Trailering  | Unsecured or improperly secured load. | 13, 21, 22, 24, 25 | Low | Increase stopping distance if you have a heavy trailer load. Be aware of restricted vision with a tall trailer. Suitable training and/or experience for towing trailer; pre-trip check of trailer/hitch for road-worthiness; spare tire & jack present and functional; all equipment & materials stowed & secured. Ensure all items are secured and will not become untied or bounce of trailer. | None |
| 5 | Hitching/unhitching |  | 23, 24 | Low | Complete trailer pre- check of lights, tire pressure, | None |
| 6 | Site Set Up/Prep | Brush & Site Clearing, work on/near roadway; potential injury from equipment/ter-rain/traffic | 12, 8 | Low | Proper use of power equipment, e.g., chain saw, requires appropriate experience and/or training; implement traffic control measures if/as needed. | Safety Glasses & steel toed boots. Hearing PPE & hard hat may be required.Hi-vis clothing and/or reflective vests if on/near roadway/traffic area |
| 7 | Site Set Up/Prep | Underground Utilities | 8 | Low | Call before you dig! Before proceeding with any subsurface investigation call 811 or visit [www.call811.com](http://www.call811.com) to get connected with local one call center for the state where project activities will occur. Underground utilities, if present, will be marked by the service. ALSO, contact city utilities, sometimes street lights/ water line is not identified by one call. | As above |
| 8. | Site Set Up/Prep | Ground Obstructions, if present | 12 | Low | Use suitable equipment and/or proper lifting techniques to remove obstructions(s) prior to positioning Geoprobe®. | As above |
| 9. | Site Set Up/Prep | Overhead obstructions/utilities | 8 | Low | Evaluate clearance to overhead obstruction(s); maintain adequate clearance from electrical wires. | As above |
| 10. | Geoprobe® Operation – General Precautions | Injury during Geoprobe® Operation | 1, 4, 7, 12, 13, 14, 19, 22, 23,24 | Medium | - Entry to work zone only by authorized personnel- Stay alert, observant, and maintain effective communications between all team members on-site.- No work will occur during electrical storms.- Read all safety tips in the Geoprobe® Owner’s Manual.-Operator should have copy of owner’s manual and site safety plan near Geoprobe®.- Air monitoring may be required on site dependent on contaminants present. This should be covered in Site Health and Safety Plan. -Untrained personnel should be assisted / trained by a qualified operator. -ALWAYS know the location of buried or underground utilities and services BEFORE pushing tools at any job site.-Heed all CAUTION, WARNING, and DANGER decals posted on the machine.-In the event of a problem, the operator should release all control levers and hit the kill switch. The spring-loaded levers will automatically return to the neutral position and machine operation will cease.-Do not wear loose clothing while operating this machine. Severe injury can result if clothing becomes entangled in moving parts.- Operating controls and gauges should be kept free of debris, grease, oil, etc.- Familiarize site personnel with location of Geoprobe® Emergency Kill switch button, in case of emergency.- Do not make modifications or add attachments to this machine which are not approved by Geoprobe® Systems.- Avoid hydraulic fluid leaks. Pressurized fluid may be injected into the skin resulting in serious bodily injury. | During Geoprobe® operation, the following eye, ear, foot and head protection are required:Safety glasses, hearing protection, safety-toed boots, and hard hat must be worn during Geoprobe® operation. Leather gloves should be worn when handling metal tooling. For the safety boots, a sturdy, over-the-ankle pair is recommended. Tyvek® or latex boot covers may be needed / desirable if site is contaminated and/or muddyHi-vis clothing and/or reflective vests if on/near roadway / traffic area |
| 11. | Geoprobe® Operation – Driving | Injury during Geoprobe®driving | 16, 24 | Medium | - The unit should only be driven when both outriggers are fully raised.- Do not drive with winch mast/probe cylinder extended; be sure of overhead clearance before raising Geoprobe® winch mast/probe cylinder.-Use special caution when moving the Geoprobe® on/off trailer/truck using ramps when wet or icy as it is significantly easier for the tracks to slip under such conditions.-Lower engine speed to provide more precise control of the track assemblies when maneuvering the unit in close quarters. USE caution as Geoprobe® tends to die if RPMs are too low which allows unit to “free wheel” and roll.- Do not attempt to drive the unit on slopes of more than 30 degrees. Always drive straight up or down steep grades. Avoid sideslopes whenever possible. Continuous operation should be limited to slopes of less than 20 degrees to avoid engine damage. | As above |
| 12. | Geoprobe® Operation/Tool Handling – Pushing tools and/or auguring at the borehole location. | Injury during Geoprobe® operation/tool handling | 7, 14, 23, 24 | Medium | - Designate one person to operate the machine while probing or auguring. This will avoid injuries from having someone unexpectedly engage the machine controls while another person is working near the machine / tools.-Operator must stand to the control side of the machine, clear of the probe foot and derrick, while operating the controls. Never reach across the probe assembly to manipulate the machine controls.- When using an assistant to assemble tool string, ensure hands are clear when engaging tower on either the pull cup or drive head.- Ensure all personnel clear of all moving parts before starting the Geoprobe®.- Keep feet clear when lowering probe foot.- Never place your hands on top of the tool string while raising or lowering the GH60 hammer.- Limit the rate at which the GH60 hammer is lowered while advancing the tool string to avoid raising the probe foot more than approximately 6 inches off of the ground surface.- Never move the probe assembly (swing, extend, fold, etc.) or operate the tracks while anyone is in physical contact with the tool string.- When operating the unit on sloped surfaces, always position the unit parallel with the slope. This provides the greatest degree of stability and will limit shifting during probing or auguring operations. Position the track-mounted machine with the control panel upslope whenever possible so the machine will roll away from the operator if it becomes unstable and moves unexpectedly.- Do not extend the outriggers such that the tracks are raised off of the ground more than one or two inches. Raising the tracks several inches off of the ground surface decreases the stability of the machine and provides no operational advantage.- Never raise the machine foot more than a few inches from the ground surface with the probe cylinder and/or winch mast fully extended. If the foot must be raised significantly, first lower the hammer and winch.-Use caution when probing on loose or soft surfaces. Reduced weight on the tracks may allow the unit to shift or slide under such conditions.Always place the machine foot firmly on the ground when pulling tools from the subsurface.- When operating inside buildings consider diesel exhaust and vent accordingly. | As Above |
| 13. | Geoprobe® Operation/Tool Handling – On-going Operational Support | Injury during Geoprobe® operation/tool and supply handling | 12, 24 | Low | - Use mechanical equipment for lifting whenever possible. - Use the buddy system when lifting heavy tools and supplies. - Use proper lifting techniques, i.e., bending at knees, keeping your back straight, keeping the load close to your body, and using your legs. - Stretch / warm-up before heavy lifting- Rotating parts can cause serious injuries. - Shut off the engine before attempting to clean or service the unit. |  |
| 14. | Sampling & Geoprobe®/Equipment Decon | Exposure to contaminants during sample/equipment handling and/or decon operations; exposure to reagents during sample analysis/preservation; spray or splash into eyes | 1, 4 | Low | - Wear PPE appropriate for the contaminant(s) of concern (COC) and/or reagents that are present/used at the site.- Decon activities should only be conducted in designated area with spill containment and/or proper drainage. | As described in Site Health and Safety Plan. |

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|  **Hazards –note all potential hazards associated with the job (check all that apply)** |
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| **Physical** |
| General  | [x]  | thermal stress | [x]  | cold | [x]  | noise |
| [ ]  | explosion | [ ]  | fire | [x]  | weather |
| [x]  | fatigue | [ ]  | violence | [x]  | illness/injury |
| Radiation | [x]  | ionizing | [ ]  | microwave | [ ]  | light |
| Vehicles | [x]  | traffic | [ ]  | heavy equip | [ ]  | forklift |
| [ ]  | helicopter | [ ]  | small aircraft | [x]  | Boat  |
| Boat Ops | [ ]  | sediment sampling  | [ ]  | rapid water | [ ]  | open water |
| [ ]  | diving | [ ]  | electrofish |
| Industrial | [ ]  | comp gas | [ ]  | electricity  | [ ]  | confined space |
| [ ]  | equip | [ ]  | moving parts  |
| Overhead | [x]  | obstruction | [ ]  | falling objects |
| Elevation | [ ]  | roof | [ ]  | scaffold | [ ]  | ladder |
| [ ]  | stairs | [ ]  | catwalk |
| Slips/trips | [x]  | terrain | [x]  | debris | [x]  | slippery |
| [ ]  | trench | [x]  | pits/holes |
| Other physical hazards:  | [ ]  | UXO |

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| **Biological**  |
| Agriculture | [ ]  | CAFO | [ ]  | fish | [ ]  | farm animals |
| Animals | [x]  | dogs | [x]  | feral animals | [x]  | snakes |
| Insects | [x]  | spiders | [x]  | mosquitoes | [x]  | wasp/hornet |
| [x]  | bees |
| Pathogens | [ ]  | bloodborne | [ ]  | sewage | [ ]  | med/lab  |
| Other Biological:  | [x]  | poisonous plants, domestic animals, scorpions |
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| **Chemical** |
| Containers | [ ]  | ammonia | [ ]  | chlorine | [ ]  | other |
| VOCs | [ ]  | solvents | [x]  | fuel | [ ]  | oils |
| Wastes | [ ]  | sewer | [ ]  | landfill | [ ]  | smoke/dust/fume |
| [ ]  | metals | [ ]  | PCBs | [ ]  | paints/surfacing |
| Particulates | [ ]  | fibers | [ ]  | diesel | [ ]  | asbestos  |
| Sampling | [ ]  | acids | [ ]  | bases |
| Other Chemicals: | [ ]  | VOCs, SVOCs, pesticides, herbicides, radionuclide, explosives, perchlorate; chemistry laboratories with abandoned chemicals |

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| **Personal Protective Equipment (PPE) Required (check all that apply)** | **Other Required Safety Equipment/Training** |
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| Feet: | [ ]  | safety boots | [x]  | steel-toe boots | [ ]  | shank |
| [ ]  | rubber boots | [ ]  | waders | [ ]  | Other:  |
| Gloves: | [x]  | leather | [ ]  | cotton | [x]  | cut-resistant |
| [ ]  | chemical resist | [x]  | disposable  |
| Body: | [x]  | safety vest | [ ]  | pfd | [ ]  | harness |
| [x]  | tyvek | [x]  | sarnex-tyvek | [ ]  | coveralls |
| Eyes: | [x]  | safety glasses  | [x]  | sunglasses | [ ]  | goggles |
| Head: | [x]  | hard hat | [x]  | hearing protection | [ ]  | respirator |

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| [x]  | dosimetry | [x]  | communication | [ ]  | decon |
| [x]  | first aid kit | [ ]  | fire extinguish | [ ]  | flares |
| [ ]  | chains/studs | [ ]  | eye wash/shower |

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| [ ]  | 24 hr HAZWOPER | [x]  | 40 hr HAZWOPER | [x]  | HAZWOPER Annual Refresher |
| [ ]  | TLD Program  | [x]  | RPP Program | [x]  | Medical Surveillance |
| [x]  | 1st Aid/CPR | [x]  | Other: 1) Defensive Driving; 2)Radiation Safety; 3)Boat Operations Training |

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| **Comments:** |
| Personnel may be potentially exposed to a wide variety of contaminants during Geoprobe® sampling activities. Personnel are exposed to hazardous noise when operating or being in the vicinity of this type of sampling; however, exact sound levels are not known at this time. Personnel are required to wear ear plugs and/or muffs while working around hazardous noise sources. Employees engage in field activities during all types of weather conditions, to include extreme heat and cold. Thermal stress is a viable hazard; therefore personnel must ensure adequate hydration and appropriate field gear is worn while engaging in field activities. In addition, field acitivies are conducted on various terrain and in remote locations where pits, holes, and trenches are encountered. Personnel need to be cognizant of their surroundings and take evasive actions to avoid contact with such hazards. Driving, trailer towing, ergonmics, lifting, slips, trips and falls are all identified hazards of this work. REFERENCE PPE HAZARD ASSESSMENT FORM FOR SPECIFIC EXPLANATION OF HAZARDS ASSOCIATED WITH THIS JOB HAZARD ANALYSIS. |
| **Certification of Hazard Assessment** |
| **Supervisor:** **date:**  | **Safety/Health Representative:** **date:**  |

 (To add additional table rows, click in the last field of the last row, and hit the “**TAB**” key)

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# Personal Protective Equipment Recommendations

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| Where engineering and administrative controls are not feasible or sufficient for controlling hazards, PPE must be used to protect workers. The following PPE are recommended for the noted tasks above: |
| **Eye and Face Protection** TAB & Place “x” into appropriate boxes |
| **X** | Safety glasses with side shields |   | Reflective goggles/face shield |
|  | Chemical splash goggles |   | Cutting/brazing/welding eye protection |
|   | Face shield | **X** | Other: Sunglasses  |  |
| **Head Protection** |
| **X** | Hard hat  |   | Helmet, cowl, hood |
|   | Welding helmet/mask |  | Other:  |   |
| **Foot Protection**  |
| **X** | Steel-toed safety shoes/boots |  | Other:  |   |
|  | Chemical-resistant boots |  |  |
| **Body Protection** |
|   | Apron (splash, work) |   | Head-reflective garments |
|  | Lab coat |  | Sleeves (cut-resistant) |
| **X** | Coveralls (work, chemical-resistant)Type chemical: VariousType coverall: Tyvek/Sarnex  | **X** | Other: Appropriate field gear for the weather, to include rain gear (thermal/cold stress); USCG Personal Flotation Device (Type I, II, or III) |  |
| **Respiratory Protection**  |
|  | Respirator |  | Type of respirator: Full-face  |
| **Hand Protection** |
|   | Rubber insulating gloves |   | Rubber insulating sleeves |
|   | Rubber insulating hoods | **X** | Other: Chemical Resistant Gloves (i.e. Nitrile or Neoprene); Cut Resistant Gloves (contact with plants); Leather gloves |  |
| **Other:** Reflective Safety VestEar plugs and/or muffsSunscreenInsect repellent If needed, chemical resistant gloves must be selected based upon adequate breakthrough times for specific chemicals of concern.  |

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| **PPE Hazard Assessment Form**  |
| **HEALTH AND SAFETY HAZARDS** |
| **Chemical Hazards**  **Description/Mitigation**TAB & Place X into appropriate boxes |
| **X** | Vapors/gases | Personnel may be potentially exposed to a wide variety of hazardous materials during sampling activities  |
| **X** | Dusts/mists/fumes | Personnel may be potentially exposed to a wide variety of hazardous materials during sampling activities  |
|  | Liquid splash | Personnel may be potentially exposed to a wide variety of hazardous materials during sampling activities  |
| **Comments:** | Contaminants on site may include but are not limited to, VOCs, SVOCs, pesticides, herbicides, solvents, fuel, radionuclide, metals, and acids/bases. Personal air sampling data is not available to document potential inhalation exposures. Personnel are required to wear, at a minimum, Level D (tyvek or sarnex coveralls). If a higher level of protection is warranted, this will be addressed in the Site Health and Safety Plan  |
| **Physical Hazards Description/Mitigation** |
| X | Ergonomics | Personnel may experience repetitive motions, frequent or heavy lifting, pushing, pulling, or carrying of heavy objects; and prolonged awkward postures. Vibration and cold may add risk to these work conditions. The level of risk depends on the intensity, frequency, and duration of the exposure to these conditions. Careful lifting techniques along with secure grips and packing at desk level or higher will reduce potential exposures.  |
| X | Heat —high temperatures | Employees engage in field activities during all types of weather conditions, to include extreme heats. Thermal stress is a viable hazard; therefore personnel must ensure adequate hydration and appropriate field gear is worn while engaging in field activities. |
| X | Cold —Cold temperatures | Employees engage in field activities during all types of weather conditions, to include cold weather. Although field activities are performed in termperate climates, cold weather may be a potential hazard. Appropriate field gear must be worn. |
| X | Electricity | Although rare, employees may be exposed to a variety of electrical components while on-site. Personnel need to be cognizant of their surroundings and take evasive actions to avoid contact with such electrical hazards. |
| X | Noise | Personnel are occasionally exposed to various sources of hazardous noise, to include various industrial equipment. Personnel are required to wear ear plugs and/or muffs while working around hazardous noise sources.  |
| X | Slips/Trips/Falls | Slips/trips/falls are always probable conducting field visits, outside where pits, holes, and various terrains are encountered. Personnel need to be cognizant of their surroundings and take evasive actions to avoid contact with such hazards.  |
| X | Elevation - Falls | Personnel may climb units, greater than 4 feet above ground surface, to observe potential deficiencies. Personnel climb stairways with approriate handrails and/or ladders affixed to various units. Personnel must inspect stairways/walkways to ensure structural integrity and/or question site personnel regarding structural stability prior to climbing. Personnel will not climb ladders.  |
| X | Other | Vehicular accidents and traffic are potential hazards encountered while driving to and from municipal plants. In addition, personnel may ride as passengers in small boats. Personnel are required to take Defensive Driving Training and Boat Operations Training. Personnel should also receive a safety brief from the boat operator prior to riding onboard.  |
| **Biological Hazards Description/Mitigation** |
| X | Animals/Insects  | Employees may encounter a variety of insects and snakes while in the field. These include snakes, mosquitos, bees, wasps, spiders, feral animals, scorpions, etc. Personnel need to be cognizant of their surroundings and take evasive actions to avoid contact with such animals/insects. |
| X | Other | Employees are often in remote locations, in which poison ivy and other infectious plants are present. Personnel must be trained to ensure they are aware of the surroundings and avoid plants to prevent injury/iillness. Cut-resistant gloves should also be utilized to reduce potential exposures.  |

**Completed by: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**SHEMP Review\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

References:

Job Hazard Analysis – Geoprobe, Patrick Mills, USGS, 7 Mar 2005, <<http://il.water.usgs.gov/proj/geoprobe/jhageoprobe1.htm>>, Accessed 23 Jun 2010.

Geoprobe Systems®, Geoprobe® Safety Information, <<http://www.geoprobe.com/service/safety.htm>>, Accessed 23 Jun 2010.

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| **Why is it important to check underground utilities?** |
| melted-2melted-1This meltdown could have been a serious tragedy for the probe machine operator. A main power line was missed during the underground utility investigations, but wasn’t missed by this Macro-Core® sampler! The cable was encountered about 5 feet below the surface, and luckily, no one was injured. The actual size of the power line was unknown, but the line was being fed from one plant building to another, and was fed from a distribution panel to a 2000 amp, 3-phase, sub-panel. The arcing did not trip a breaker ... it just arced/melted the sampler. |

**Be safe at your job. Accidents are preventable; don’t overlook details that put you or your personnel in danger. Replacement copies of your Geoprobe® owner’s manual can be ordered through Geoprobe® Customer Service at 1-800-436-7762.**