

Technology Safety Data Sheet

Innovative Sampling System to Support Monitored Natural Attenuation of TCE
TMS #3177

Section 1: Technology Identity

Technology Name(s):		Emergency Contact:	
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Section 2: Technology Pictures



Figure 1: View of the wellbore top, showing the sampling lines to the FLUTe® multilevel sampling system.



Figure 2: Engineer collecting data on ground-water samples using the FLUTe® sampling system.



Figure 3: Technician dumping collected underground water into collection container for subsequent disposal.

Section 3: Technology Description

The sampling system to support the monitoring of the natural attenuation of Trichloroethene (TCE) is a Flexible Liner Underground Technologies, LLC (FLUTe®) multilevel water sampling system. It is a method for collecting samples of groundwater at pre-determined depths. The sampling system can be deployed via the open borehole method. When the open borehole method is used, the liner is emplaced directly from the shipping reel. The top of the liner is attached to the borehole surface casing, and water is added to the interior of the liner. This drives the liner deeper into the hole, pulling the inside out liner from the reel. The interior water pressure on the everting end of the liner is the driving force for the installation, fully extending it to the bottom of the hole. The pressurized liner seals the hole by overfilling with water.

Spacers attached to the exterior of the liner define the location of ground water to be sampled down hole. Water from the formation flows into the interstitial space to the port and through the liner. The port is connected to a tube that carries the water to the bottom of the hole and then to the pumping system. The water flows through a series of check valves and U tubes. Displacement of the water is accomplished by pressure applied from a compressed nitrogen cylinder, forcing the water through a slender tube to the surface, where it is collected. Ground water samples are collected for volatile organic compounds (VOCs), tritium, indicator parameters (cations and anions), and water quality parameters (Dissolved Oxygen, Oxygen Reduction Potential, Specific Conductivity, pH, Temperature). The collected samples are analyzed in the laboratory.

Section 4: Safety Hazards

Hazard Category:

(Adapted from Appendix A to MIL-STD-882D, February 10, 2000, Department of Defense Standard Practice for System Safety.)

- 4 - Could result in death or permanent total disability
- 3 - Could result in permanent partial disability or injuries or occupational illness that may result in hospitalization of at least three persons
- 2 - Could result in injury or occupational illness resulting in one or more lost work days
- 1 - Could result in injury or illness not resulting in a lost work day
- N/A - Is not applicable to this technology and poses no appreciable risk

A. Buried Utilities, Drums, and Tanks

Hazard Rating: 1

Not an issue during operation of the FLUTe® but during drilling of the sampling well, it is critical to investigate all buried items near the proposed borehole.

B. Chemical (Reactive, Corrosive, Pyrophoric, etc)

Hazard Rating: 1

Only Nitrogen gas is used as a carrier gas. The water being sampled will be contaminated which will require wearing appropriate personal protective equipment.

C. Confined Space

Hazard Rating: N/A

Confined space is not part of this technology

D. Electrical

Hazard Rating: 1

There is a generator that is used to power electrical equipment, particularly the hand-held heater used to thaw frozen lines. All electrical lines should be free of damage and the outlets should be kept free of snow. The crew uses a ground fault circuit interrupter with the generator.

E. Explosives

Hazard Rating: N/A

Explosives are not part of this technology

F. Fire Protection

Hazard Rating: 1

There is a gasoline generator included on the trailer for this technology. A fire extinguisher should be kept at the site.

G. Gas Cylinders	Hazard Rating: 1
Compressed nitrogen is used to drive water out of the well for sampling. This system can use another manifold to handle up to 15 samples at one time. Nitrogen cylinders should be checked for hydrostatic test dates. Those that have expired should not be used. Follow all Compressed Gas Association recommendations when using bottles.	
H. Ladders/Platforms	Hazard Rating: 2
Dumping of wastewater required stepping up onto the trailer, which was approximately 18 inches above the ground. During the winter, this could pose slipping hazards.	
I. Lockout/Tagout	Hazard Rating: N/A
This system has nothing to lockout or tagout.	
J. Mechanical Hazards	Hazard Rating: N/A
There are no moving parts with this technology.	
K. Moving Vehicles	Hazard Rating: 2
There is a need to haul a trailer with waste bottles and the sampling control panel to the site. Vehicles are needed to bring technicians to the remote locations. Drivers need to be aware of workers on site. Sampling during the winter poses particular risks. The concrete base and metal casing protruding from the ground should be brightly marked to alert drivers of their presence.	
L. Overhead Hazards	Hazard Rating: N/A
Overhead hazards are not part of this technology.	
M. Pressure Hazards	Hazard Rating: 2
The nitrogen bottles are under 2200-psi pressure but the process uses only 180 psi and there is an inline relief valve that is set at 250 psi.	
N. Slips/Trips/Falls	Hazard Rating: 2
The work environment will always be outdoors and therefore susceptible to winds, snow, ice, and mud. Consequently, the risks of slips, trips, and falls are increased.	
O. Suspended Loads	Hazard Rating: N/A
Suspended loads are not part of this technology.	

P. Trenching/Excavation	Hazard Rating: N/A
Trenching and excavation are not part of this technology	
Section 5: Health Hazards	
A. Inhalation	Hazard Rating: 1
This technology captures volatile organics in water but the concentrations are generally quite low and there is little chance of fugitive emissions because the wastewater is quickly contained and disposed of in a closed container. It is advised that air sampling be conducted during the use of this system to determine whether airborne contaminants are present.	
B. Skin Absorption	Hazard Rating: 1
The only exposures would be contact with the water contaminated with chemicals but the concentrations are low. Technicians should still protect their hands from exposure using gloves that are compatible to the chemicals. Nitrile gloves offer the most protection generally.	
C. Noise	Hazard Rating: 1
This technology does not produce noise; however, a generator is needed infrequently for auxiliary tasks such as thawing frozen lines during the winter. Noise exposures for workers near the generator can approach the OSHA Permissible Exposure Limit. Consequently, the exposures should be measured and, if high, the compressor should be moved or workers given hearing protection.	
D. Heat Stress/Cold Stress	Hazard Rating: 2
Heat and cold stress programs are in place to control exposures during extreme temperatures. A canopy protecting workers from direct sunlight in summer is advisable.	
E. Ergonomics	Hazard Rating: 2
The operation requires much bending, sitting, stooping, and hyperextension when dumping the wastewater into the tanks. Some of the equipment, such as the sampling control panel, could be relocated to reduce the amount of stooping and bending. Proper location of the computer would relieve ergonomic stress as well. This should be considered from a monthly performance standpoint.	
F. Ionizing Radiation	Hazard Rating: 1
This technology is designed to sample contaminated water. Some sites may have contamination including radionuclides.	
G. Non-ionizing Radiation	Hazard Rating: N/A
Non-ionizing radiation is not part of this technology.	

H. Biological Hazards	Hazard Rating: N/A
Biological hazards are not part of this technology.	
I. Other	Hazard Rating: N/A
None	
Section 6: Phase Analysis	
A. Construction/Start-up	
<ul style="list-style-type: none"> • This technology can take advantage of existing open borehole wells drilled for the purpose of sampling ground water. • Compressed nitrogen gas must be hauled to the site, capped, and strapped upright. • The wastewater containers should be taken to the site on a trailer. • The sampling control panel must be installed near the wastewater trailer. • Vehicular traffic must be controlled at the site during start-up. • A pre-job analysis of the integrity of the system should be performed. 	
B. Operation	
<ul style="list-style-type: none"> • Technical Procedure, TPR-6371 details the water sampling procedure and should be followed to ensure quality control of the sampling process. • When using the generator, ground fault circuit interrupters should be used. 	
C. Maintenance (Emergency and Routine)	
Maintenance would be primarily parts replacement and should not pose any increased hazards.	
D. Shutdown (Emergency and Routine)	
Emergency shutdown of the nitrogen flow would be required if there is an ice blockage in the sampling system.	
E. Decontamination/Decommissioning	
All wastes need to be contained and properly disposed of but no formal decontamination procedures are warranted, given the extremely low concentrations of contaminants in the water.	
Section 7: Worker Protection Measures	
A. Exposure Monitoring	
<ul style="list-style-type: none"> • Noise from the generator should be evaluated to determine the level of hearing protection required. • Given the organic chemicals being sampled, organic vapor sampling is probably warranted. 	

B. Worker Training

- HAZWOPER
- Proper lifting
- Operating procedures
- Handling of compressed gases
- Heat and cold stress
- Personal Protective Equipment

C. Medical Surveillance

No additional surveillance is required resulting from the use of this technology.

D. Engineering Controls

No recommendation of additional controls beyond those incorporated into the current operating procedures.

E. Administrative Controls

Operating procedures should be followed.

F. Personal Protective Equipment

- Sturdy leather boots above the ankle
- Leather gloves
- Safety glasses
- Hardhats
- Nitrile gloves
- Eye wash bottle
- Fire extinguisher
- Sufficient clothing for cold weather

Section 8: Emergency Preparedness

Be aware of the emergency procedures at the site.

Section 9: Comments, Lessons Learned, & Special Considerations

Noise monitoring performed by INEEL personnel for this technology indicated the generator was the only area of concern. INEEL requires hearing protection when personnel are within 5 feet of the generator for extended times.

Compressed gas training is required of workers, by INEEL, when handling compressed gases.

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Copies of this Technology Safety Data Sheet and others developed by the Operating Engineers National Hazmat Program can be found on the internet at: www.iuoeiettc.org.