TABS ON CONTAMINATED SITES

Contaminated Sites Program - Federal Sites

This is one in a series of Technical Assistance Bulletins (TABs) prepared by Environment Canada-Ontario Region for Federal Facilities operating in Ontario.

TAB #1B

Understanding Organic Vapour Survey Findings

DESCRIPTION:
Organic vapours surveys (also known as organic vapour analyses) are a management tool for the location of contamination "hot spots". They are used as an aid to determine the extent of contamination and to protect public health and safety. These surveys do not provide accurate determinations of hydrocarbon contamination levels. Organic vapour surveys can confirm the presence of vapours and serve as a guide during a sub-surface investigation program.

Caution must be exercised when interpreting values recorded from an organic vapour survey (such as jar headspace analysis, or soil vapour survey), since vapour concentration measurements from these devices are often quite different from results obtained from laboratory methods. **The findings of an organic vapour survey do not correspond to any other test levels or laboratory results, and will give different results than a Total Petroleum Hydrocarbon (TPH) analysis.**

An organic vapour survey of either soil or water, will yield a value that represents the amount of organic vapours present, and is measured in parts per million (ppm). Since different organic chemicals have different vapour pressures, the types of organic vapours that this survey will detect varies with the type of instrument and probe used. Different instruments and probes will measure different organic vapours and give different vapour readings. Also, the presence of methane can interfere with vapour readings. Some instruments, such as the HNU system, do not measure methane; others such as the Gastech System do, and still others have methane elimination as an option.

Consultation with experts in the field is recommended when purchasing an organic vapour analyzer.

At all sites, background levels of organic vapours should be identified before the actual vapour survey is conducted. Once background levels are established, a plan of action should be developed that takes into account odour, staining (visual), and instrument readings to identify potentially contaminated areas.

Note: *There are no established guidelines that outline what criteria should be applied to organic vapour readings, nor do organic vapour readings correspond to any one specific analytical parameter. Organic vapour readings should* ***NOT*** *be compared to any criteria found in the CCME Canadian Environmental Quality Criteria for Contaminated Sites or similar guidelines.*

In general, when organic vapour analysis readings from Detectors (PIDs) and Flame Ionization Detectors (FIDs) meet or exceed the levels for the fuel types identified in **TABLE 1**, it may be an indication of high contamination levels. A more detailed investigation (e.g. sub-surface sampling and laboratory analysis) should be done.

TABLE 1: ORGANIC VAPOUR ANALYSIS GUIDE FOR SOILS

Fuel Type in Soil	Action Level *
Gasoline & Aviation Fuel	PID 10ppm FID 30ppm
Diesel Fuel, Fuel Oil, Waste Oils, Jet Fuel, Kerosene.	Any visual evidence of contamination, petroleum odour, or soil vapour headspace analysis values above background levels.
* Findings that meet or exceed these levels indicates that a more detailed investigation is necessary PID=Photoionization Detector FID=Flame Ionization Detector	

LOWER EXPLOSIVE LIMITS (LEL)

Combustible Gas Indicators (or explosimeters) are used to determine the Lower Explosive Limit (LEL) of the vapours present in an atmosphere. The LEL is usually determined for confined spaces, and in buildings, and depends on the mixture of product vapour and oxygen necessary to produce fire or explosion in the presence of an ignition source. The LEL is expressed as the percent of product vapour by volume in air. Most petroleum products are flammable between 1% and 10% of the LEL. Below 1%, the air/fuel mixture is too lean to ignite. Above 10%, the air/fuel mixture is too rich to ignite. **Even though the air/fuel mixture may be too rich to ignite, there still exists an extremely dangerous health and safety hazard.**

For example, gasoline's flammable range is 1.4% to 7.6% by volume in air. This means that the air must be composed of between 1.4% and 7.6% of gasoline vapour for it to be flammable; 1.4% is the minimum amount of gasoline vapour that must be present in air for it to ignite. Therefore, **1.4% is the LEL for gasoline**. Below 1.4%, not enough fuel vapours are available to burn. If there is more than 7.6% of gasoline vapour in the air, then there is too much gasoline vapour for ignition to occur.

Occasionally it may be cited that "organic vapour concentrations exceeded 100% of the LEL". In the example of gasoline, the LEL is 1.4%. Thus, when organic vapour concentrations exceed 100% of the LEL, this means that there was more than 1.4% gasoline vapour in the air.

TABLE 2 indicates the preventive action that should be taken when certain LELs are discovered.

TABLE 2: PREVENTIVE ACTION FOR LEL RANGES

% of LEL	Preventive Action
< 10	Continue monitoring with caution.
10 - 25	Continue monitoring, but with extreme caution, especially as higher levels are encountered.
≥ 25 **	Explosion hazard, withdraw from area immediately.
** Before resuming any on-site activities, project personnel should consult with experts in fire or explosion prevention to develop procedures for continuing operations.	

SOURCES

Minnesota Pollution Control Agency (1991). *Excavation of Petroleum Contaminated Soil.*

New England Interstate Water Pollution Control Commission (1989). *Tank Closure Without Tears: An Inspector's Safety Guide.*

United States Environmental Protection Agency (1988). *Standard Operating Safety Guides.*

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