

SUBSURFACE VAPOR SAMPLING FOR HUMAN HEALTH RISK EVALUATION

Subsurface vapor sampling is one of the most dynamic disciplines in the environmental field. Therefore, developing a guidance document for all site conditions is not practical. In addition, some consultants have simply cited certain regulatory agency guidance documents in their vapor sampling work plan rather than detailing and justifying the proposed work and the use of the resulting data. Therefore, GPP staff will not approve a vapor sampling work plan unless the consultant justifies the proposed work; details and justifies the proposed sample collection, transport, and analytical process; and indicates how the data will be evaluated and used. The following represents some of the concepts which should be considered in preparing a subsurface vapor sampling work plan:

- Precipitation increases the moisture content of subsurface soil which reduces subsurface vapor flow. Therefore, the work plan should either justify an appropriate time lag between the termination of precipitation and the commencement of subsurface vapor sampling or justify a precipitation amount or field procedure to demonstrate a vapor sample collected during or immediately after a precipitation event is valid for its purpose;
- A schematic identifying all components of the subsurface vapor purging, sampling, and monitoring system should be included in the work plan. Swagelok® fittings or equivalent should be specified for all connections to achieve a tight seal;
- Previous or proposed continuous logging of soil texture can identify permeable (target) strata that may provide acceptable subsurface vapor flow rates at a useful sampling depth. It may be difficult to justify using the same boring for both soil and subsurface vapor sampling unless the installation of a vapor sampling well is proposed;
- Collecting subsurface vapor samples from borings drilled <5 feet below grade may increase the risk of obtaining invalid data for the intended purpose. Therefore, the work plan must justify the proposed collection depth of the vapor sample and the construction of any wells;
- Field work should minimize exposing the subsurface sampling point to ambient air prior to sample collection. Therefore, the work plan should justify a minimum time to restore subsurface equilibrium once the vapor sampling depth has been exposed to ambient air;
- An equipment vacuum test will reduce the connections requiring a tracer gas atmosphere during sampling. A tracer gas atmosphere must be maintained around all sampling connections not tested by the equipment vacuum test. The tracer gas atmosphere must be monitored by an appropriate device (e.g. PID) and sampled. A shroud with pliable weatherstripping along its base and a port for inserting a monitoring and sampling device is commonly used to maintain an appropriate tracer gas atmosphere. Tracer gas generation, maintenance, monitoring, and sampling activities must be specified in the work plan;

- High vapor purge rates increase the chance of short-circuiting or driving hydrocarbon-affected soil into the vapor phase, whereas low purge rates increase labor costs and the potential percent of the sample due to leakage. Therefore, the work plan must justify an appropriate vapor flow rate (150 to 200 ml/minute is typically used) and indicate how this rate will be controlled;
- The work plan should justify an adequate purge volume prior to sampling. Termination of purging must be based on a decrease in monitored vacuum, not time;
- The purging and sampling apparatus should be vacuum checked prior to mobilizing to the field. GPP staff may ask the consultant to reschedule the work if the equipment fails the in-field vacuum test and the problem cannot be rectified in a timely manner;
- The sampler should consider wearing a new pair of gloves prior to assembling each sampling apparatus to limit potential cross-contamination. The work plan should detail and justify any decontamination procedures for re-usable parts of the sampling train; and
- The vapor samples must be analyzed for the contaminants of concern, tracer compound, and fixed gases by appropriate analytical methods, within an acceptable holding time, and at suitable reporting limits. The fixed gases (oxygen, carbon dioxide, and methane) serve as an indicator of biologic activity and as a cross-check for system leakage.

No permit is necessary for the installation and removal of sub-slab vapor sampling probes or unsaturated zone borings drilled to <10 feet below grade. However, a permit is necessary if a vapor sampling well is installed. Regardless of permit requirements, all field work must be scheduled with GPP staff at least three business days in advance of the work or we may not accept the results.