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Sampling Assessment of Vapor Intrusion

A vapor intrusion assessment determines if vapors are moving from soil or groundwater contamination into nearby buildings. Typically, the Alaska Department of Environmental Conservation (DEC) is concerned about exposure to low-levels of chemicals over many years, as this may raise a person's lifetime risk for developing cancer or other harmful effects. In very rare cases we find high concentrations of contaminants indoors that may pose short-term safety hazards, immediate health effects, or aesthetic problems, such as odor. For more information, see our vapor intrusion web page at www.dec.state.ak.us/spar/csp/vi.htm.

An assessment can be completed through a variety of methods, but the method DEC believes typically provides the best information is a "multiple lines of evidence" sampling approach. This involves sampling the indoor and outdoor air at the same time as the soil gas (the air in the soil pores) beneath the building.

Initial Step - Building Survey

The initial step in a vapor intrusion assessment is often a building survey, conducted by a DEC project manager, the site owner, a consultant, or others working on the cleanup. The survey gathers needed information about the building, including the:

- Use of the building (commercial or residential),
- Number of people (adults and children) using the building,
- Number of floors,
- Age of the structure,
- Presence of a basement or crawl space,
- Specifics of the heating and venting system,
- Presence of any sumps or utilities in the foundation that may increase the vapor movement into the building or prevent the use of certain sampling techniques.



The construction and use of a residential versus commercial building can affect the health risks vapor intrusion presents, the sampling approach, and the relevant cleanup levels. These pictures show a typical residential structure and a commercial facility, both located over contaminated groundwater.

If indoor air will be tested, sampling personnel will also take an inventory of chemicals stored inside the building and recent work on the building that may have involved paints, cleaning supplies, bug sprays, carpeting, etc. If possible, they will try to eliminate sources of chemicals inside the building at least 24 hours before sampling in order to avoid any interference with the vapor intrusion measurements.

Choosing Sample Types and Locations

The sample type and locations are chosen based on what is known about the building and the contamination. The “multiple lines of evidence” approach includes three types of samples:

- indoor air,
- outdoor air, and
- sub-slab or soil gas.

These samples are collected simultaneously in order to evaluate the true source of chemicals in the building and the health risk, if any, to the building occupants.

Indoor air samples directly measure the amount of

chemicals a person may inhale. They are collected over a period of time that matches the number of hours in a day that people are usually in the building. The collection time in residences is 24 hours, while in businesses the time is typically between 8 and 12 hours.



Indoor air samples are generally collected at between 4 and 6 feet above the ground to represent the breathing space of the average adult. The sampling location may change depending on the use of the building.

Outdoor air samples measure the chemicals in the air from outside sources (e.g. cars idling outside the building, the neighbor’s wood stove). The outdoor air sample is usually collected over a 24-hour period. In a vapor intrusion assessment, the chemical concentration in the outdoor air is subtracted from the indoor air concentration. This removes the unrelated outdoor sources from the vapor intrusion evaluation.



Outdoor air samples are typically placed on the upwind side of the building, several feet off the ground.

Sub-slab samples are the most useful samples in the vapor intrusion evaluation. They are used to measure the amount of chemical in the soil gas directly beneath the foundation. The foundation includes either the primary floor or the basement, if one exists.

This measurement gives the best estimate of the amount of chemical vapors available to intrude into the building.

If there are no chemicals detected in the sub-slab samples, it is not likely that vapor intrusion will occur into the building. Typically, we recommend a minimum of three sub-slab samples in order to understand the vapor concentration under different areas of the building. These concentrations can vary significantly from one side of a building to the next.

The sub-slab sampling process can seem intrusive to the building owner or occupant because it does involve drilling through the foundation. The procedure, however, is fairly simple, it leaves a small “footprint,” and the hole is sealed shut.



The first step is to drill a 1-inch diameter hole three inches into the foundation, followed by a 3/8-inch diameter hole the rest of the way through the slab.



Then the sampling probe is inserted into the foundation and cemented into place.



Once time is given for the cement to set, the sample can be collected. At left, a stainless steel canister collects sub-slab soil gas samples. Sub-slab samples are typically collected over a 20- to 30-minute timeframe.



Finally, the probe is capped, the drilling dust is vacuumed and the carpet folded back over to leave as small a disturbance as possible until the investigation is completely finished and the port can be removed. Once it is removed, the foundation is resealed with cement and the surface covering repaired.

Sub-slab samples are inappropriate in some buildings. Sub-slab samples are not collected in buildings with earthen-floor foundations or where radiant floor heating or other utilities are present that cannot be avoided. In these cases, a crawl space sample can be collected or a pipe can be drilled into the ground on the outside of the building to collect soil gas. These sampling techniques can also yield useful information, although they are not a direct measurement of the vapors beneath the building.

Regardless of the sample type, a stainless steel canister, sometimes called a “summa” canister, is used to collect the air. The canister is shipped to a special laboratory for a type of analysis that can detect chemicals at very low levels. This special analysis allows a comparison with the human health-based action levels mentioned earlier.



Crawl space samples are collected in a similar manner to indoor air. The canister is simply placed in the space and opened.



Stainless steel canisters.



Soil gas samples outside of the building are installed with a small drill rig, using steel rods that are driven to collect the sample and then removed.

The Contaminated Sites Program protects human health and the environment by managing the cleanup of contaminated soil and groundwater in Alaska.

For more information, please contact our staff
at the Contaminated Site program closest to you:

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