Research & Development Highlights

Soil Gases and Housing: A Guide for Municipalities

93-202 Technical Series

Introduction

The indoor air quality of residential buildings is of great concern because of its effect on occupant health and safety. This is especially important given the large amount of time Canadians spend indoors.

While air contaminants originate from a number of sources, this guide focuses specifically on soil gas infiltration into residential buildings from hazardous lands, i.e., landfill, commercial and industrial sites. This type of air contamination is becoming increasingly important as urban growth causes residential areas to encroach on hazardous lands, a situation that can fall under municipal responsibility and liability.

This publication is designed to create an awareness of the issues surrounding soil gases and housing so that municipalities can take appropriate steps to minimize potential problems.

Description of Publication

The guide examines the question of soil gas from a number of aspects:

- types of soil gases - their characteristics and sources
- pathways - through the soil and into the house
- monitoring aspects
- remediation techniques
- potential legal implications

The book gives a summary of the most problematic soil gases (with the exception of radon), describing their chemical composition and potential hazards. These gases include:

- petroleum product hydrocarbons,
- landfill gases, and
- other volatile organic compounds (VOCs).

Soil gases can originate from a number of sources, many of which may not be obvious to municipal officials and householders. While these are described in the guide, they are briefly touched on here.

Petroleum product hydrocarbons in the soil typically come from leaking underground storage tanks and spills, or from lands formerly associated with refineries. Estimates indicate that 7,500 to 20,000 underground storage tanks are currently leaking in Canada.

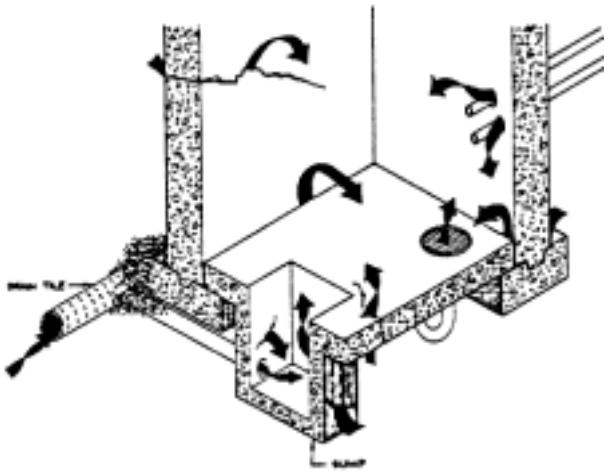
Landfill gas is produced from the decomposition of organic materials in a landfill. Gas production is affected by waste characteristics and environmental factors such as temperature, soil type, and rainfall. Gas cart be produced whether the landfill is open, has recently closed, or has been closed for many years.

Other VOCs (e.g., solvents, thinners and dry cleaning fluids) are the result of wastes from industrial sites, spills and indiscriminate dumping. This is especially important since the combination of a number of chemical contaminants may actually increase the overall toxicity of the resultant soil gas to levels higher than that of the individual contaminants.

Soil gases in the home pose both safety and health risks. Often these gases are highly volatile and when mixed with air can become flammable or explosive. Chemical contaminants found in soil gases can cause a variety of health risks ranging from the minor to life-threatening. The toxicity of each soil gas (and thus the potential health risk) is determined by chemical composition, concentration and duration of exposure. Information on specific contaminants and the related risks are fully examined in the guide.

Figure 1 provides an example of various methods of soil gas entry into buildings (i.e., subsurface and house entry pathways). The factors influencing this entry are further explained and illustrated.

Fig. I
Example of Soil Gas Entryways Into the House



This information can be used to determine the applicability of various gas monitoring devices and remediation techniques.

The guide examines the importance of long-term and short-term monitoring as well as factors affecting this assessment. A number of equipment types are described, and their applicability to certain soil gases and related advantages or drawbacks are given.

Remediation strategies are effectively summarized based on house-based controls (see table 1) and source controls. The guide is rounded out with an overview of legislative, planning and liability issues associated with soil gas migration problems.

While officials involved in soil gas issues should obtain qualified professional assistance, this guide will help them recognize potential soil gas issues and minimize the risks associated with this problem.

Table 1. Example of House-based Remediation Strategies

Approach	Strategy	Soil Gas Type	Limitations
House-based control	sub-slab venting	• petroleum hydrocarbons methane	requires maintenance; may cause subsurface landfill fires due to overpumping
	active venting (soil vacuum extraction)	• petroleum hydrocarbons • methane	requires maintenance; may not be well connected to sub-slab floor space; may cause subsurface landfill fires due to overpumping
	passive venting	• petroleum hydrocarbons • methane	not sufficient for high subsurface production rates
	pressurized air curtain	• methane	limited long-term data
	crawl space venting	• methane	limited performance data; requires maintenance
	liners	• methane	limited long-term data
	sealing, caulking	• petroleum hydrocarbons • methane	limited success has been documented
	plumbing corrections	• petroleum hydrocarbons • methane • other VOCs	will likely remedy the problem only partially
	evacuation or property demolition	• petroleum hydrocarbons • methane	expensive, usually unnecessary

Project Manager: *Don Fugler*
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Research Consultant: *Marbek Resource Consultants Ltd.*

A full report on this research project is available from the Canadian Housing Information Centre at the address below.

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The Canadian Housing Information Centre
Canada Mortgage and Housing Corporation
700 Montreal Road
Ottawa Ontario
K1A 0P7

Telephone: 1 613 748-2367
FAX: 1 613 748-2098

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