Position Paper on the Management of Vapour Intrusion in South Africa

By the NICOLA Vapour Intrusion Working Group

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Soil and groundwater contamination from industrial and other activities in South Africa presents a potential risk to human health, water resources or ecosystems. The scope of this position paper is focused on the assessment and management of impacts related to vapour inhalation exposure from soil or groundwater contamination sources.

Certain chemicals, such as volatile organic compounds (VOCs), that are released into the sub-surface, may cause vapours that migrate through the vadose zone. These vapours can enter buildings through cracks or other openings in the foundation slabs, through utility conduits, or by diffusing through concrete floor slabs and could lead to hazardous situations. Vapour intrusion (VI) is the term given to the migration of vapours from sub-surface sources into buildings, including those with basements. VI assessment is broadly divided into chlorinated VI (CVI) and petroleum VI (PVI), the fundamental difference being the rapid rate of attenuation of petroleum hydrocarbons in PVI assessments, due to aerobic biodegradation in the unsaturated (vadose) zone in the presence of atmospheric oxygen. Chlorinated hydrocarbons, by contrast, typically undergo anaerobic biodegradation and therefore do not attenuate to any significant degree in the vadose zone.

Within South Africa, the management of VI should be in line with the sustainable risk-based approach as stipulated in the legislative requirements pertaining to contaminated land, i.e., National Environmental Management Act (NEMA) and National Environmental Management: Waste Act (NEM:WA).

NICOLA's position on the management of PVI in South Africa is to capture the latest science on PVI risk assessment, including empirical studies of vapour attenuation across building foundations and methods for improved site assessment, and to apply this in the context of a sustainable risk-based approach. This encompasses the following steps:

1. Development of a sound conceptual site model (CSM) related to PVI-risks, including potential sources of contamination, fate and transport mechanisms, exclusion distances,
2. Evaluation of the associated risks using a tiered approach, starting with field measurements evaluated using Tier 1 Risk Based Screening Levels (RBSLs), moving towards Tier 2 Site Specific Screening Levels (SSTLs) and more complex modelling, where necessary; and

3. In the case that unacceptable risks are identified, appropriate sustainable risk-mitigating measures should be developed and implemented.

Unacceptable risks exist when there is a proven source-pathway-receptor linkage between a subsurface source of VOCs present near or beneath a building, causing VOC concentrations in the indoor air to exceed acceptable risk-based levels in relation to the exposure of occupants of the affected building. The indoor air quality in many buildings will contain detectable levels of VOCs caused by a number of unrelated sources, regardless of whether a sub-surface source of vapours exists. These is referred to as background concentrations and should be considered in the context of the VI risk assessment.

The following references are aligned with NICOLA's current understanding of the best applicable science and best practices to be applied for management of VI in South Africa:

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US EPA (2014). *Vapor Intrusion Screening Level (VISL) Calculator User's Guide.* United States Environmental Protection Agency, Office of Solid Waste and Emergency Response, Office of Superfund Remediation and Technology Innovation, Washington, D.C. May 2014.

US EPA (2015a). *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air.* United States Environmental Protection Agency, Office of Solid Waste and Emergency Response. Publication 9200.2-154. June 2015.

US EPA (2015b). *Technical Guide For Addressing Petroleum Vapor Intrusion at Leaking Underground Storage Tank Sites.* United States Environmental Protection Agency, Office of Underground Storage Tanks, Washington, D.C. Ref: EPA 510-R-15-001. June 2015.

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