

VAPOR INTRUSION - INTRODUCTION, BACKGROUND, AND OVERVIEW

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Introduction or Background

The U.S. Air Force (USAF) is currently developing a Guidance Document for Environmental Assessment of Soil Vapor Intrusion into Buildings. The purpose of this manual is to assist Air Force remedial project managers in evaluating the risks and hazards associated with the migration of organic vapors from contaminated groundwater and soils, to the occupants breathing indoor air. The vapor intrusion pathway is a potentially significant exposure mechanism in areas where residential, commercial, industrial, or public buildings are present over contaminated soils and/or groundwater. Historically, the remediation programs have not included vapor migration from groundwater and/or contaminated soils into the indoor environment. Recent events, involving both military and non-military sites, have raised the cognizance and concern for this pathway. The U.S. Environmental Protection Agency (USEPA) and the State agencies with jurisdictional control are requiring site owners to demonstrate that the risks and hazards associated with this pathway are and will be acceptable for all reasonable future use scenarios.

The USAF is required to conduct cleanups at active and closing installations under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, as amended. Additionally, the Air Force has approximately 80 installations that are regulated by the Resource Conservation and Recovery Act (RCRA) and are subject to the statutory requirements for corrective actions under the Hazardous and Solid Waste Act (HSWA). Neither CERCLA nor RCRA and their implementing regulations contain cleanup levels or performance standards that are to be used for evaluating and selecting remedial actions. CERCLA remedial actions must meet cleanup levels and performance standards provided in Applicable Relevant and Appropriate Requirements (ARAR) of other Federal and State environmental laws. RCRA cleanup levels and performance standards are negotiated on a case-by-case basis. The USAF is in the process of converting approximately 32 bases throughout the United States from a military to a civilian function under the Base Realignment and Closure (BRAC) Program. The Air Force is also responsible for hundreds of sites throughout the United States and abroad that are potentially contaminated with petroleum and other toxic chemicals.

Any Installation Restoration Program (IRP) site where the soils or groundwater contain volatile or semi-volatile Chemicals of Potential Concern (COPC) has the potential for chemical vapors to migrate from the subsurface into indoor air spaces. Assessment of this potential indoor inhalation exposure pathway requires an understanding of the processes influencing vapor transport in the vadose zone and into buildings. Volatilization of contaminants in subsurface soils or in groundwater and the subsequent mass transport of these vapors into indoor spaces constitute a potential inhalation exposure pathway that may need to be evaluated when risk assessments are prepared and when remedial objectives are established. Assessment of this potential indoor inhalation exposure pathway requires an understanding of the processes influencing vapor transport in the vadose zone and into buildings.

The goal of this effort is to provide technical and administrative support in the application of USEPA/State-of-the-Science Methods to characterize the air impacts of vaporous contaminant sources at USAF bases nationwide. This effort will allow USAF Program Managers to determine whether a threat to human health or the environment may exist and, if so, the magnitude and immediacy of the threat. Deciding whether actions are warranted to mitigate a potential threat and selecting appropriate remedial goals and remedial alternatives are considered to be risk management activities, and are distinct from risk assessment activities. Risk management is ultimately the responsibility of the regulatory and Air Force Remedial Project Managers (RPMs), who depend on risk assessors to provide credible and defensible risk assessments on which to base their decisions.

This draft guidance specifically addresses the evaluation of a single exposure pathway - the "vapor intrusion pathway." The intent of this draft guidance is to provide a tool to help the user conduct a screening evaluation as to whether or not the vapor intrusion exposure pathway is complete and, if so, whether it poses an unacceptable risk to human health. A complete pathway means that humans are exposed to vapors originating from site contamination. The guidance begins with simple and reasonably conservative screening approaches and gradually progresses toward a more complex assessment involving increasingly greater use of site-specific data. For those sites determined to have an incomplete vapor intrusion pathway, further consideration of the current site situation should not be needed. For those sites determined to have a complete pathway, guidance is provided on how to evaluate whether the pathway does or does not pose a potential significant risk to human health. This draft guidance is intended to address the incremental increases in exposures and risks from subsurface contaminants that may be intruding into indoor air. The guidance is primarily designed to ensure protection of the public in residential settings, but may be adjusted for other land uses (e.g., commercial/industrial, recreational) so that human exposures in non-residential settings may also be considered under this guidance. The investigator is reminded that one should continually evaluate what communication activities are needed to optimize public participation and community involvement. From a stakeholder perspective, being identified as the owner of a most-likely-to-be-impacted building often leads to high levels of anxiety and in some case anger. A carefully planned community relation's plan is recommended.

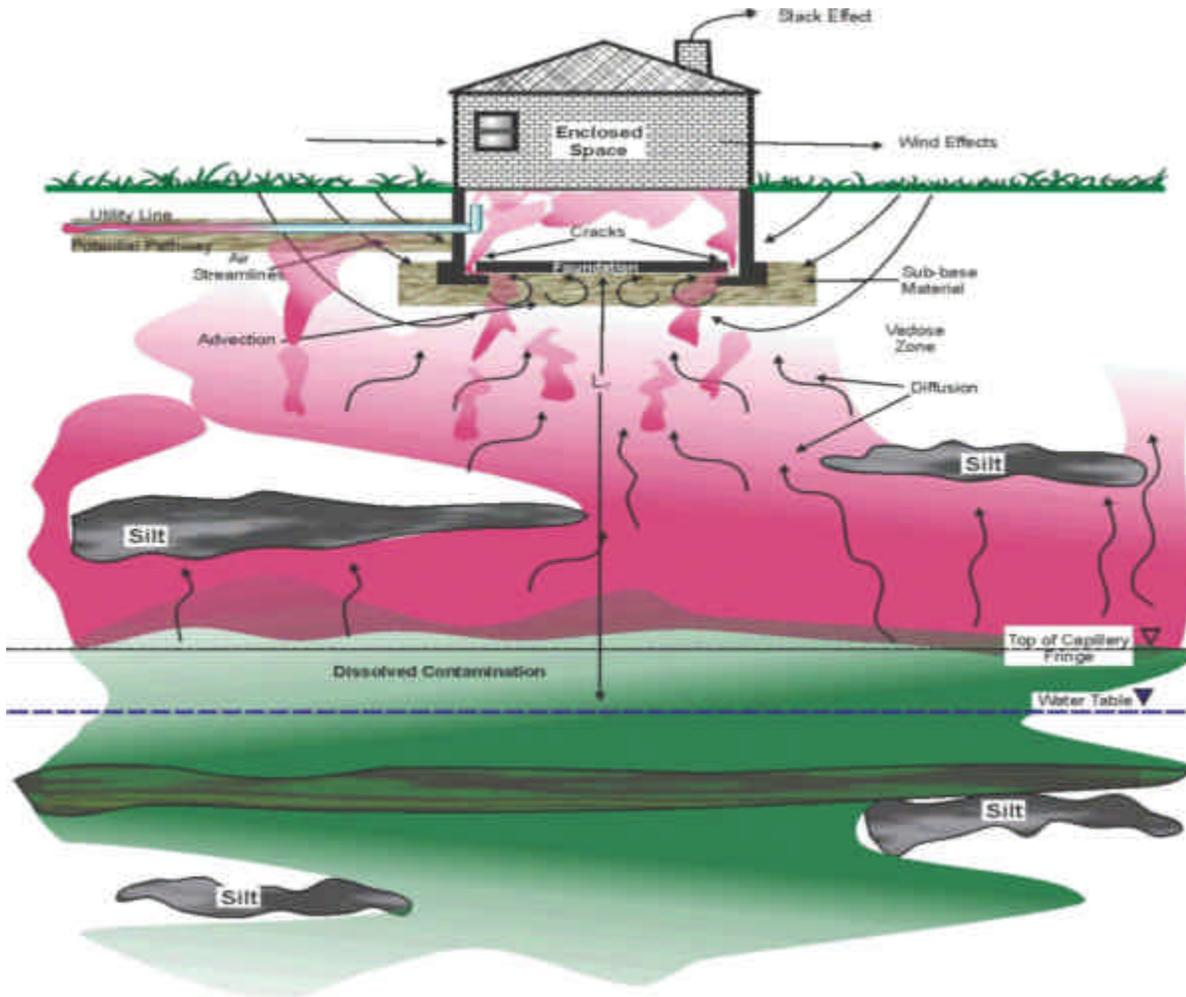


Figure 1 presents a schematic of the pathway for subsurface vapor intrusion into indoor air.

Conceptual Site Model and Vapor Intrusion Theory

Volatilization of contaminants located in subsurface soils or in groundwater and the subsequent mass transport of these vapors into indoor spaces constitutes a potential inhalation exposure pathway that may need to be evaluated when risk assessments are prepared. Likewise, this potential indoor inhalation exposure pathway may need evaluation when estimating a risk-based soil or groundwater concentration below which associated adverse health effects are unlikely.

Vapor intrusion is the migration of volatile chemicals from the subsurface into overlying buildings. Volatile chemicals in buried wastes and/or contaminated groundwater can emit vapors that may migrate through subsurface soils and into indoor air spaces of overlying buildings.

This draft guidance employs a tiered approach to assist the user in determining whether the exposure pathway is complete (i.e., subsurface vapors intrude into indoor air spaces) and, if so, whether the vapors are present at levels that may pose an unacceptable exposure risk. Although vapors may be present in soils beneath a building, the vapors may or may not pose a risk to human health. It may also be predicted that a plume would reach a

development or future construction may occur over a plume that would result in a potential for exposure via this pathway. Estimating human health risk from indoor air exposure depends on human exposure to the vapors. If contaminant vapors do not enter the building, the exposure pathway from the source of contamination to a person (receptor) is not “complete,” and in such circumstances the person cannot be considered to be at risk from indoor air exposure due to vapor intrusion. In other situations, vapors may enter the building, but be present at such low levels that the risk is considered to be acceptable. In some cases, however, vapors may seep into a building and accumulate at levels that may pose an unacceptable risk to human health and in certain other situations create a fire and/or explosion hazard.

Conclusions

The draft guidance provides technical and policy recommendations on determining if the vapor intrusion pathway poses an unacceptable risk to human health at cleanup sites. Vapor intrusion is a rapidly developing field of science and policy. If a site that you manage has completed the remediation process within the last 5 years, you should anticipate that vapor intrusion issues will be a part of the periodic review for adequacy. If a site that you manage is currently conducting a site investigation to determine the extent and nature of contamination, you should anticipate that questions concerning vapor intrusion must be answered before you can proceed to the next step. If you are the manager of a site that is conducting a feasibility study or is designing a remedial action, you should anticipate that questions concerning vapor intrusion must be answered before you can proceed to the next step.

References

Draft Guidance Document for Environmental Assessment of Soil Vapor Intrusion into Buildings
Prepared for: The Air Force Institute for Environment, Safety, and Occupational Health Risk Analysis (AFIERA)
2513 Kennedy Circle, Building 180 Brooks AFB, Texas 78235-5123
Contract No. F41624-01-D-9012 Task Order No. 0003 Security Classification: Unclassified