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Emerging Trend: Vapor Intrusion and its Impact on Real Estate Transactions and Liability

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Dallas Bar Association Real Property Law Section
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TABLE OF CONTENTS

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By Jill A. Kotvis

INTRODUCTION

Vapor intrusion "regulation" is coming. Slow to coalesce at the federal level, its success now appears to be assured by numerous states' actions, actions of two key standard setting organizations, and perhaps most importantly actions of various environmental professionals, environmental information vendors, and lenders. What we have with vapor intrusion is a perfect storm.

- Federal agencies began focusing on vapor intrusion in 2001 and have increasingly done so in greater depth and breadth since then.

- Numerous states are increasingly developing vapor intrusion guidance and in some cases regulations and statutes.

- Federal and state environmental agencies are reviewing the potential for vapor intrusion at "closed" contaminated sites and are re-opening closed sites for further investigation and response action.

- The American Society for Testing and Materials has developed a vapor encroachment screening standard.

- Environmental consulting professionals are concerned about their own liability after several lawsuits and are pressing for an expanded Phase I scope of work to include vapor intrusion screening.

- Environmental information vendors, environmental professionals, and personal injury lawyers are looking for an opportunity to add to their scope of their services and are driving the issue forward.

- Lenders are jumping on board and providing the final push becoming a leading edge on this issue similar to the role they played in the implementation of the Phase I environmental due diligence process in the 1980's.

Before we review how we got here, what it means, and some of the practical implications of vapor intrusion this White Paper will first address the basics. What is vapor intrusion, what properties or buildings are most susceptible, how do you determine if you have a potential vapor intrusion, how do you measure it, and how do you mitigate it? The Paper will then discuss the

current status of regulatory guidance and standards on vapor intrusion. Finally it will address the practicalities of vapor intrusion, how it might impact the scope, cost and risks of remedial action, environmental due diligence, real estate purchase, sale, lease and loan transactions and agreements, and the potential for increased liability and litigation risks.

WHAT IS VAPOR INTRUSION? [1]

Vapor intrusion is the process by which volatile chemicals (those that readily evaporate) migrate from the subsurface into overlying or adjacent or nearby buildings, thereby providing an exposure pathway by which people may come into contact with these volatile chemicals. Vapor intrusion may expose building occupants to potential toxic levels of vapors when volatile chemicals present in contaminated soil or groundwater emit vapors that migrate into buildings or adjacent or nearby buildings.

Both volatile and semi-volatile (those that evaporate more slowly) chemicals can present vapor intrusion issues (both will be collectively identified as "VOCs" in this White Paper for ease of reference). Examples of VOCs include degreasers, dry-cleaning solvents, gasoline and petroleum (including benzene), naphthalene, polychlorinated biphenys (PCBs), and certain pesticides. Volatile chemicals are primarily organic, but may also include inorganic analytes such as elemental mercury, radon and hyrodrogen sulfide.

VOCs in contaminated soil and groundwater can emit vapors that rise through the pore space of the unsaturated zone above the water table, called the "Vadose Zone". Fluctuations in the water table level due to seasonal precipitation changes, drought, or pumping may increase soil gas concentrations where contamination exists. Where bedrock underlies a property, the vapors move through fractures and openings in the rock. These vapors, also known as "soil gas", can move from the source of contamination laterally as well as vertically. Lateral movement can increase as groundwater plumes migrate away from the source of the contamination or if the ground surface is paved or frozen preventing the upward movement of vapors. The movement of soil gas is controlled by the processes of diffusion and advection. Diffusion causes vapors to spread from the higher concentrations closest to the source of contamination toward low concentrations in uncontaminated areas. Advection is the movement of soil gas from areas of higher to lower pressure.

WHY IS VAPOR INTRUSION A CONCERN TO ENVIRONMENTAL PROTECTION AGENCY (EPA) AND THE STATES?

1. General[2]

As diffusion causes vapors to rise through soil or bedrock they tend to accumulate under building foundations and other barriers such as pavement. These barriers create a capping effect

[1] U.S. Environmental Protection Agency (EPA), Office of Solid Waste and Emergency Response (OSWER), OSWER EPA (5203P); EPA R-08-01, *Brownfields Technology Primer: Vapor Intrusion Considerations for Redevelopment* (2008). Much of the information in this section is culled liberally from this document in order to provide the reader with an accurate sense of the EPA position on these issues.

[2] Id.

which inhibits upward movement of vapors. Because of cracks and other openings in the building foundations these barriers are not impenetrable. Vapor intrusion generally occurs when advection (movement due to pressure differences) draws vapor indoors via these openings due to a phenomenon called "building depressurization". The pressure beneath the building is typically higher than the pressure indoors.

Depressurization causes buildings to draw the soil gas indoors. Depressurization is caused by "leaky" heating and ventilation systems, exhaust fans, and stack and wind effects that reduce the pressure indoors. Stack effects cause building depressurization as a result of differences in indoor and outdoor temperatures. As warmer indoor air rises and exits the top of the building the resulting pressure differences induce vapor flow from the soils into the bottom of a building. Stack effects can also transport vapors to upper floors of a building via stairwells, elevator shafts, ductwork, etc. Wind currents passing over a building can also cause pressure differences that affect the flow of vapors into a building.

Vapors that pass within the zone of influence of a building will be drawn in through cracks in the foundation or through openings with utility lines, sump pumps, etc. Once in the building, vapor intrusion can pose a potential risk to the health of residents, workers, and other occupants who breathe the vapors. Soil gas that does not pass within the zone of influence of the building will continue to migrate within the subsurface or escape to the atmosphere.

In the past, cleanup of Brownfields and other contaminated sites focused primarily on protecting human health by preventing exposure to contaminants through direct contact (e.g., children playing in contaminated soil) or ingestion (e.g., drinking contaminated groundwater from wells). As EPA and state agencies have gathered more data and learned more about vapor intrusion over the last decade they have determined that the potential of inhaling chemical vapors due to vapor intrusion may need to be addressed because of the perceived hazards summarized below.

2. Safety Hazards, Fire and Explosion

In rare incidences and extreme cases the significant build-up of vapors from a nearby higher contaminated source (e.g., gasoline from leaking underground storage tanks or methane from landfills) may pose an immediate threat of fire or explosion. Vapors from leaking buried fuel tanks and fuel pipelines may enter nearby occupied buildings creating the potential for fire and explosion if they accumulate to sufficient concentrations in a confined space such as a basement room or utility room. If carried by shallow groundwater the fuels tend to stay on top of the saturated zone in relatively high concentrations thereby increasing the potential for entry into any building basement or a buried utility system (e.g. storm sewers) that might intercept a high water table.[3] For this reason regulatory actions involving leaking petroleum underground storage tanks will frequently require vapor testing in sumps and sewer outfalls.

[3], U.S. Department of Health and Human Services, Agency for Toxic Substances and Disease Registry, *Evaluating Vapor Intrusion Pathways at Hazardous Waste Sites* (2008).

3. Health Hazards[4]

General. "It is important to note that exposure to VOCs due to vapor intrusion does not necessarily mean that adverse health effects will occur".[5] The vapor intrusion health risk to building occupants depends on many variables including the toxicity of the chemical, concentrations of the chemical vapor in the indoor air, an individual's sensitivity to a chemical, the age and health of the building occupants, and the length and frequency of exposure (the amount of time the building occupants spend in the building).

Acute Health Effects. At concentrations often associated with a detectable odor short-term exposures may cause acute health effects such as headaches, nausea and eye and respiratory irritation. According to the U.S. Department of Health and Human Services (DHHS), Centers for Disease Control (CDC) such health effects are sometimes associated with petroleum-based products such as diesel fuel and heating oils. Benzene is a chemical particularly associated with fuel vapors that can be acutely irritating at low levels. People with pre-existing respiratory problems such as asthma, chronic obstructive pulmonary disease and children may be effected more than adults.

Intermediate Health Effects. Health effects from intermediate duration exposures of fourteen (14) to three hundred sixty-four (364) days to VOCs can include liver, neurological and reproductive effects.

Chronic Health Effects. The more common potential risks to building occupants are from inhaling over-time lesser amounts of chemical vapors that have accumulated indoors. On average people spend ninety percent (90%) of their time indoors. Because the VOC vapor contamination may not be visually apparent or have a detectable odor or taste, building occupants can be exposed over-time involuntarily and without awareness. According to the Agency for Toxic Substances Disease Registry (ATSDR) and the CDC long-term exposure to even low levels of certain chemical vapors may increase the risk of chronic health effects such as cancer. The non-cancer health effects most frequently associated with inhalation of relatively high levels of chlorinated VOCs are damage to the liver, kidneys and the nervous system.

WHICH SITES OR BUILDINGS ARE MOST SUSCEPTIBLE TO VAPOR INTRUSION?

Today most properties that require remediation are contaminated with chlorinated solvents such as the dry cleaning fluid Tetrachloroethylene also know as Perchloroethylene (PCE), the degreasing solvent Trichloroethylene (TCE), or with petroleum hydrocarbon compounds such as benzene that generally originate from petroleum underground storage tanks. Prior remediation does not preclude the possibility of a vapor intrusion issue nor does the fact that no remediation was previously required or accomplished. The soil or groundwater contamination remaining may still present a potential risk of vapor intrusion. Properties that are at higher risk are those that are current or former industrial sites, dry cleaners, gas stations,

[4] Id.

[5] Pennsylvania Department of Health (DOH) and U.S. Department of Health and Human Services, Agency of Toxic Substances and Disease Registry, Division of Health Assessment Consultation, *Health Consultation*, J Foster Wheeler Energy Corporation Church Road TCE Site, Mountain Top, Luzerne County, Pennsylvania, (2010).

automotive sites such as repair shops or auto dealerships, or properties that are adjacent to or near these types of properties.

Factors that increase the potential for a vapor intrusion include:

- high VOC concentrations in soil or groundwater
- contaminated soils or groundwater within a short lateral or vertical distance from a current or planned basement foundation or building slab
- sandy/permeable soils permitting rapid soil gas diffusion to the surface
- limited biodegradation during transport
- building openings to the subsurface such as sumps, dirt floors, unlined crawlspaces or cracked building slabs
- low building air exchange characteristic of weathered buildings (inside air flow affects migration of contaminants into a building)

HOW DO YOU DETERMINE IF YOU HAVE A POTENTIAL VAPOR INTRUSION ISSUE?

1. <u>EPA Draft 2002 Vapor Intrusion Guidance</u>[6]

Vapor intrusion is a potential issue at any existing or planned buildings located near soil or groundwater contaminated with VOCs. EPA's draft 2002 vapor intrusion guidance defines "near" as contamination within 100 feet (latterly or vertically) of buildings. The distance is greater if there is a conduit that intersects the soil gas migration route that would allow soil gas to migrate further than 100 feet. A conduit can be any passageway that can facilitate the flow of soil gas such as a sand or gravel soil layer, a utility line or an animal burrow.

The guidance states that:

> The recommended distance is designed to allow for the assessment to focus on buildings (or areas with the potential to be developed for human habitation) most likely to have a complete vapor intrusion pathway. Vapor concentrations generally decrease with increasing distance from a subsurface vapor source, and eventually at some distance the concentrations become negligible. The distance at which concentrations are negligible is a function of the mobility, toxicity and persistence of the chemical, as well as the geometry of the source, subsurface materials, and characteristics of

[6] EPA OSWER, EPA 530-D-02-004, *OSWER Draft Guidance for Evaluating the Vapor Intrusion Air Pathway From Groundwater and Soils (Subsurface Vapor Intrusion Guidance* (2002).

> the buildings of concern. Available information suggests that 100 feet laterally and vertically is a reasonable criterion when considering vapor migration fundamentals, typical sampling density, and uncertainty if defining the actual contaminant spatial distribution. Considering the nature of diffusive vapor transport and the typical anisotropy in soil permeability, in our judgment a similar criterion of 100 feet for vertical transport is generally conservative. These recommended distances will be re-evaluated and, if necessary, adjusted by EPA as additional empirical data are compiled.

2. American Society for Testing and Materials (ASTM), E2600-10 Guide for Vapor Encroachment Screening on Property Involved in Real Estate Transactions

ASTM E2600-10 provides guidelines for screening for potential vapor encroachment as a "best practice". The ASTM standard screens for vapor encroachment conditions using a two (2) tiered approach. During Tier 1 if the environmental professional identifies a known or suspected contaminated site/s within the area of concern (AOC), they determine whether the site/s could result in a vapor encroachment condition (VEC) to the target property. The AOC is measured from the target property boundary to the known or suspected contaminated property. The AOC is defined as 1/3 mile for known or suspected contaminated sites involving volatile or semi-volatile hazardous substances and 1/10 of a mile for known or suspected contaminated sites involving petroleum hydrocarbons. Knowledge of the groundwater gradient may reduce the defined AOC.

If a VEC exists the environmental professional separately will determine whether the VEC constitutes a Recognized Environmental Condition (REC) as defined in the ASTM 1527-05 standard for Phase I environmental site assessments. More often than not a potential VEC will not constitute an REC due to the distance of the soil or groundwater contamination from the target property or the buildings on the target property, the involved chemical or chemicals of concern, the site geology, etc. Although a few vocal attorneys and environmental consultants are shouting the "sky is falling", the more anticipated scenario to flow from the new VEC encroachment standard is identification of a VEC as a de minimus condition under ASTM 1527-05 definitions when the source of the contamination is off-site. A de minimus condition is not an REC under ASTM 1527-05. On-site sources of potential vapor intrusion from historic operations are anticipated to frequently be labeled as historic recognized environmental conditions (HRECs) under ASTM 1527-05.

If a VEC is identified the property owner or other party may decide to proceed to Tier 2 of the VEC standard but need not do so. The Tier 2 methodology investigates more specifically the contaminated soil or groundwater plumes from the sites identified in the Tier 1 review. Information for this phase of work can be obtained by reviewing regulatory agency files, previously prepared environmental reports or by soil gas sampling at the property boundary or other appropriate locations on the target property.

3. The Interstate Technology and Regulatory Council (IRTC) Technical Regulatory Guidance

Vapor Intrusion Pathway: A Practical Guide (January 2007). The guideline is a "multiple lines of evidence" approach to investigating the potential vapor intrusion pathway. The purpose of this guideline is to provide a generalized framework for evaluating the pathway and a description of the various tools available for investigation, data evaluation, and mitigation. The guideline is intended to be used in conjunction with any applicable federal or state vapor intrusion policy or guidance.

Intrusion Pathway: Investigative Approaches for Typical Scenarios (a supplement to Vapor Intrusion Pathway VI-1)(2007*).* This guideline describes applicable approaches for evaluating the vapor intrusion pathway under the following scenarios:

- An active service station in a residential neighborhood
- A dry cleaner in a strip mall adjacent to a neighbor
- A large industrial facility with a groundwater plume under several hundred receptors
- A vacant lot with proposed Brownfield development over a groundwater plume
- A vacant large commercial building with warehouse space and office space
- An apartment building with a parking garage over contamination

The scenarios follow the step-by-step approach described in the guidance document focus on the decision process and alternatives chosen, identify key issues about each scenario, highlight lessons learned during process, and describe the next steps to be followed.

HOW DO YOU DETERMINE IF YOU HAVE ACTUAL VAPOR INTRUSION?

"*Indoor air is an important but difficult exposure pathway to evaluate*"[7]

1. Methods Available

General. Assessment of the vapor intrusion pathway can be more complicated than environmental assessment of other environmental issues. Subsurface vapor movement can be unpredictable, especially where preferential pathways allow for vapor to migrate well beyond the original source of the contamination. The science of identification, mitigation and health effects is also developing rapidly and the various guidance for and policies on investigation and mitigation continue to evolve rapidly. Numerous methods are currently available for measuring

[7] EPA Region 6 and Texas Commission on Environmental Quality presentation, *Vapor Intrusion; An Overview*, (February 3, 2010), also presented by EPA Region 6 to Dallas Chapter, Society of Environmental Professionals (March 8, 2011). At the March 2011 presentation Region 6 recommended the use of the EPA Interim 2002 draft Sub-Surface Vapor Intrusion Guidance to assist in determining whether indoor air quality is a medium of concern.

vapor intrusion. Vapor intrusion can be evaluated using chemical transport and fate modeling, air monitoring/sampling, groundwater or soil sampling, gas sampling or epidemiological and toxicological analysis. Each method has pros and cons.

Soil Gas Sampling. Soil gas subsurface can be measured by soil gas sampling, sub-slab sampling or direct push temporary or permanent soil gas probe installation. "In-field" leak detection can also be accomplished with potable monitoring devices used to analyze for trace concentrations prior to and after sampling for the compounds of concern (e.g., with a Photo Ionization Detector). Vertical profiling is achieved by collecting soil gas samples at varying depths in a single location, or by using closely spaced vapor monitoring wells installed at varying depths. Soil porosity can affect data quality and sub-slab sampling. Soil gas sampling results can be variable temporally and spatially leading many states and the EPA to avoid using soil gas sampling as the sole measure of possible vapor intrusion. It can also be expensive to obtain representative results through soil gas sampling.

Indoor Air Sampling. Indoor air sampling provides the most direct estimate of potential inhalation exposures to building occupants. However indoor air sampling data is subject to variations due to seasonal changes, changes in the HVAC system, contaminant biodegradation processes, contaminant migration and the presence of VOCs in indoor air from numerous home and office products. The EPA 2002 draft vapor intrusion guidance recognizes that although indoor air sampling is a direct measurement, non-subsurface sources are present from many VOCs, background concentrations may exceed human health targets, and that there is temporal and spatial variability. Indoor ambient background sources of vapor include carpets, dry cleaned goods, air fresheners, cleaning supplies, glues, paints, solvents, smoke, heating oil and other vapors from consumer activities, household products, office equipment and supplies (e.g. copiers, printers and correction fluids), and building materials and furnishings. Because of these technical issues indoor air sampling is not required in all programs. Legal liability potential also argues against sampling indoor air in order to avoid development of evidence that may support exposure personal injury claims by occupants. For these reasons it is advisable to discuss the decision to collect indoor air sampling with environmental counsel before proceeding.

Numeric Models. There is significant controversy regarding the ability of numeric models (e.g., the Johnson & Ettinger 1991 Model) to accurately and precisely predict indoor air concentrations based on groundwater or soil vapor concentrations.

2. Multiple Lines of Evidence (MLE)

Variability Factors. Variability factors with vapor intrusion data include preferential pathways, soil moisture content, geologic heterogeneity, the water table, vapor transport, concentrations, pressure and temperature gradience, heating and air conditioning systems, and barometric pressure changes, building age and design, and ambient indoor and outdoor background sources of vapor.

Because a large number of variables affect vapor intrusion and because concentrations are highly variable in space and time within sub-surface conditions, building structures, and weather conditions, no single media data set can be used reliably and fully to evaluate vapor

intrusion risks. EPA's current position that is anticipated to be included in the revised EPA Vapor Intrusion Guidance expected in November 2012 is that the MLE approach should be pursued to evaluate vapor intrusion.[8]

Indoor Air Sampling Comparison to Sub-slab Sampling Favored by EPA. EPA has also noted that one of the increasingly common and apparently most efficient and successful applications of MLE is to compare the individual building's indoor and sub-slab concentrations after consideration of the extent of the vapor source area and other available evidence. EPA provided its "thoughts" that it is often more useful to collect sufficient data to evaluate in parallel two or more of the MLEs including interior-structure (e.g., indoor air and/or sub-slab samples), that it may be more expeditious and cost-effective to sample indoor air directly where there is data indicating a potential vapor intrusion problem, and that collecting sub-slab samples along with indoor samples often can provide a more complete evaluation and allow a more definitive conclusion to be drawn regarding the vapor intrusion pathway at a particular site (and can minimize occupant disruption for re-sampling).

According to EPA Region 6 in their recent vapor intrusion *Frequently Asked Questions* document:

> Paired data sets appearing in the U.S. EPA's Vapor Intrusion Database suggest that there is little correlation between exterior soil gas readings and indoor air values. It is now generally accepted that groundwater data and, to a greater degree, sub-slab soil gas data are better predictors of indoor air concentrations. Different approaches and protocols employed for soil gas sampling have made data comparisons difficult. If a site manager determines the need to proceed with a vapor intrusion investigation based on groundwater data, in many circumstances, it is best to go directly to sub-slab soil gas collection along with indoor air measurements.[9]

However, in a recent program presented by EPA Region 6, EPA also stated that only indoor air samples integrate the three major sources of vapor intrusion variables, subsurface source and migration factors, building factors, and above-ground environmental factors. "If you want to know what is in in-door air then you are going to have to sample it. The longer the sample the better it represents the actual long-term average due to temporal variability".[10]

In the end, the best sampling methods may be those which will provide the most defensible position to potential claims from building occupants or neighboring property owners and to regulatory agencies.

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[8] Pennsylvania DOH, *supra* note 5.

[9] EPA Region 6, Resource Conservation and Recovery Act (RCRA), Corrective Action Program, *Interim EPA Region 6 Corrective Action-Vapor Intrusion Frequently Asked Questions (FAQs*; Resource Conservation and Recovery Act, as amended, 42 U.S.C. § 1601 *et. al.* (1976).

[10] EPA Region 6, *Vapor Intrusion Assessment and Mitigation Strategies*, RCRA Training on Vapor Intrusion (2010).

HOW IS VAPOR INTRUSION MITIGATED?

1. Mitigation Methods Summary

Minimization of vapor intrusion exposure and risks in new buildings can be accomplished by designing or re-engineering building structures to accommodate or account for potential vapor intrusion. Vapor intrusion exposure and risks in new or existing buildings can be mitigated by excavation or remediation of the soil or groundwater source, sub-slab or sub-membrane depressurization systems, sub-slab pressurization, installation of a sub-slab passive barrier, engineered vapor controls, vertical positive pressure, and increased air exchange rates.

Soil gas values historically have not been good predictors of sub-slab concentrations. Sub-slab depressurization, the system most commonly used for controlling radon and VOC vapors intercepts vapor prior to building entry. This method is highly effective in most settings. Sub-membrane depressurization is also highly effective but requires good foundation seals and the membrane is susceptible to damage. Sub-slab pressurization provides passive pressure below the slab to deflect soil vapors. This method is less effective and not commonly applied. The in-door positive pressure method is also less effective and not commonly used due to the potential high energy cost from air and heat loss. Indoor treatment typically with carbon is less effective and not commonly applied due to higher costs and required on-going maintenance.

Passive sub-slab synthetic barriers can also be placed below slabs in new construction and existing buildings can be retrofitted for their use. The liners vary from thin plastic sheets to thick high-density polyethylene liners and spray on elastomers.[11] Liners intended to prevent water vapor are not adequate to mitigate VOC vapor intrusion. Eliminating the source of the contamination can be more protective of human health then mitigation only but will be more costly and take more time, and may not be technically feasible in many cases. Institutional controls can also prevent exposure to vapors by preventing construction of buildings, requiring controls in new buildings or restricting land or occupancy use.

2. Mitigation Costs

Estimated Costs. Costs to mitigate or avoid vapor intrusion can be estimated just as soil or groundwater remedial response costs are estimated currently. Buyers or lenders can address these costs in negotiations on the purchase price or in the terms of their purchase and sale or loan agreements in a similar manner as is currently accomplished with other environmental risks and costs. Price reductions, covenants and guarantees and other terms in the agreements, and separate escrow, remediation and indemnity agreements can be used to manage, minimize and transfer the potential environmental risks associated with the potential for vapor intrusion.

Direct Costs. The direct costs of mitigating VOC vapor indoor air impacts are generally not overly expensive. In most cases retrofitting existing buildings with standard radon-type venting systems will reduce indoor air concentrations below typical action levels and an

[11] EPA Region 6, *supra* note 7.

impervious liner such as a "liquid boot" can be installed to prevent migration of vapors when a vapor intrusion risk is identified pre-construction.

Indirect Costs. Although direct costs may be limited, indirect costs are hard to quantify and can be more significant. Indirect costs can include requirements for on-going performance monitoring, electricity, aiding in employee and community relations, property value diminution, stigma associated with the potential for vapor intrusion, and litigation and claims risks.

To minimize costs EPA Region 6 recommends preemptive mitigation in its 2010 vapor intrusion policy document:

> In cases where the vapor intrusion pathway is found to be complete, resulting in some indoor air exposure, risk-based decisions should be made to determine if exposures need to be mitigated. The level of effort needed to quantify and document the exact contribution of risk due to vapor intrusion over a chronic exposure period in order to conclusively determine that vapor intrusion mitigation is needed can be significant. In these cases for existing buildings, and even more so for new construction, it can be more expedient and cost-effective to presumptively mitigate residential homes than to undertake the further investigation or monitoring necessary to make a conclusive determination that will remain valid for a long (chronic) exposure period (EPA 2008).[12]

WHY IS VAPOR INTRUSION BECOMING SUCH AN IMPORTANT ISSUE?

1. EPA Vapor Intrusion Guidance

EPA Initial Guidance. EPA first began addressing vapor intrusion in 2001 when it issued the *RCRA Draft Supplemental Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway*.[13] This Guidance was superseded in November 2002 by the EPA Office of Solid Waste and Emergency Response (OSWER), *OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Pathway from Groundwater and Soils (Sub-surface Vapor Intrusion Guidance)*.[14]

EPA Re-evaluation of Vapor Intrusion Risks. In March 2008 EPA issued the *Brownfields Technology Primer; Vapor Intrusion Considerations for Redevelopment*[15] and upgraded its Vapor Intrusion Database. Later that year they released their *Draft Toxicological Review of Tetrachloroethylene (Perchloroethylene/PCE)*[16] and in October 2009 EPA released the *Draft Toxicological Review of Trichloroethylene (TCE)*.[17]

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[12] EPA Region 6, RCRA Corrective Action Program, *Vapor Intrusion Policy* (2010).
[13] EPA, RCRA Draft supplemental Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway (Vapor Intrusion Guidance), (2001).
[14] EPA, *supra* note 6.
[15] EPA, *supra* note 1.
[16] EPA, EPA/635/R-08/011A, IRIS Toxicological Review of Tetrachloroethylene (External Review Draft) (2008).
[17] EPA, EPA/635/R-09/011C, IRIS Toxicological Review of Trichloroethylene (Interagency Science Consultation Draft) (2009).

In December 2009 the EPA Office of Inspector General ("OIG") issued an evaluation report on EPA's failure to finalize its 2002 draft vapor intrusion guidance.[18] The report stated that EPA should issue a final vapor intrusion guidance that includes updated toxicity values for assessing human health risks from chemical vapors in indoor air and include toxicity values for TCE and PCE, includes a multiple lines of evidence approach, addresses vapor intrusion risks associated with petroleum releases at underground storage tank sites, reviews whether pre-empted mitigation is appropriate, and reviews the applicability of institutional controls and deed restrictions.

Based on new and more detailed information available on the vapor intrusion risks and the EPA OIG Report criticizing EPA for its slow progress, EPA is revising the 2002 draft vapor intrusion guidance and expects to issue the final guidance relating to non-petroleum sites in the fall of 2012. Anticipated modifications to the draft guidance include generic residential and non-residential levels for vapor intrusion sources and an MLE evaluation of potential exposure pathways in a pathway assessment. "Response options" for vapor intrusion risks are also being reviewed and have been suggested to be threefold: a "No Further Action" option based on clear evidence of no vapor intrusion, a "mitigate" option when vapor intrusion has been confirmed as unacceptable, and a "monitor only" option for unclear or unconfirmed vapor intrusion risks.

EPA Guidance on Petroleum Vapor Intrusion. In September 2010, EPA proposed guidance goals relating to vapor intrusion at leaking petroleum storage tank sites and in June 2011 EPA issued for comment a Draft Petroleum Vapor Intrusion Paper describing how the differential behavior of petroleum and chlorinated hydrocarbons in the subsurface can influence the potential for vapor intrusion to occur.[19] Issuance of a draft guidance on petroleum vapor intrusion is expected by November 2011 with a final guidance anticipated by November 2012.

EPA Addition of Vapor Intrusion Component to Hazard Ranking System Under CERCLA/Superfund.[20] Also in 2010 EPA began considering the addition of vapor intrusion as a new screening method and criteria for hazard ranking for qualifying sites for the Superfund National Priority List (NPL) through guidance or amendment of its Hazard Ranking System (HRS) regulation. When the hazard ranking system was developed under Superfund in the 1980's, groundwater migration, surface water, soil exposure and air emissions were considered the only pathways for human exposure that could result in a site being listed on the NPL. Adding exposures from vapor intrusion/encroachment from underground contamination sources would represent another pathway and might add sites to the Superfund NPL based solely on the basis of vapor intrusion pathway.

For additional information on the documents referenced above please refer to the separate *Progression Timeline – Vapor Intrusion Standards and Regulations* compilation prepared by Jill A. Kotvis.

[18] EPA, Office of Inspector General, Report No. 10-P-0042, Lack of Final Guidance on Vapor Intrusion Efforts to Address Indoor Air Risks (2009).
[19] EPA, Office of Underground Storage Tanks, Draft Petroleum Vapor Intrusion Paper (2011).
[20] EPA, [EPA-HQ-SFUND-210-1086; FRL-9260-1]. Potential Addition of Vapor Intrusion Component to the Hazard Ranking System (2011).

EPA Region 6 RCRA Corrective Action Vapor Intrusion Policy.[21] EPA Region 6 whose oversight area includes the state of Texas issued a vapor intrusion policy in October, 2010 to:

> (1) confirm that, under existing regulations and guidance, the consideration of the vapor intrusion pathway is an integral part of corrective action under the Resource Conservation and Recovery Act (RCRA), including the investigation and selection/implementation of final remedies, and (2) identify various factors that should be considered in conducting assessments and implementing remedies.

The policy further states that:

> …[b]ased on the information in the 2002 guidance, information advanced since that time, and issues that have been raised to the Region, the following recommendations are made regarding the evaluation of the vapor intrusion pathway:
>
> 1) The USEPA draft 2002 guidance recommends further consideration where inhabited buildings (or future developments) are located 100-feet vertically or laterally to subsurface contamination of sufficient volatility and toxicity that potentially could result in unacceptable indoor air inhalation risks. Even small concentrations of volatile contaminants in soils or groundwater with values in the range of the Maximum Concentration Limits (MCLs) or other risk-based concentration values can cause unacceptable exposures. (Note: Preferential pathways can increase the 100 foot distances.) Therefore, sampling should be the next step.
>
> 2) Indoor air samples coupled with either sub-slab or crawl space samples should be taken employing acceptable methods.
>
> 3) Acceptable methods typically are the use of canisters for 24-hour samples analyzed by USEPA methods (such as TO-15) which apply to the particular contaminants of concern.
>
> 4) Protocols should be followed before sampling to inform the occupants of the sampling process, and their role, as well as the probability of their indoor air results showing some contaminants from indoor and/or outdoor background sources despite their best efforts to remove potential indoor sources of chemicals that can interfere with the determination of contaminate concentrations from vapor intrusion.
>
> 5) Models should not be used as a single line of evidence, (i.e., alone) to screen out potential exposures where conditions as stated above exist. Data has shown that there is great variability in the migration of vapors

[21] EPA Region 6. *supra* note 12.

from the subsurface to indoor air suggesting numerical modeling results without confirmatory sampling may be an unreliable predictor when human health is at potential risk.

6) Soil gas data should not be used alone to make decisions regarding potential exposures as it has not yet been shown to correlate well with (or predict) indoor air concentrations.

7) Appropriate steps should be taken to investigate vapor intrusion exposures and to reduce risk to acceptable levels in non-residential settings where workplace-related vapors are not expected (because hazardous-vapor forming chemicals are not being used as a part of the routine operations). In industrial non-residential settings where similarly hazardous vapor-forming chemicals are being used as part of routine operations, review of vapor intrusion is generally not a priority while these conditions remain in place, unless conditions change, as in closure.

Although EPA Region 6 has couched their policy in terms of a recommendation, the actual "recommendations" are provided in directive and prescriptive language. Based on this Region 6 policy we may anticipate potential EPA involvement in the Texas RCRA corrective action matters being addressed by the Texas Commission on Environmental Quality (TCEQ) if the TCEQ does not begin independently to implement these vapor intrusion recommendations in its RCRA corrective action cases.

2. EPA Pending Efforts to Update Risk Estimates for Two of the Main Chemicals Behind Vapor Intrusion, TCE and PERC

EPA is conducting Integrated Risk Information System (IRIS) Toxicological Reviews of PCE and TCE addressing scientific support and rationale for hazard and dose response assessment pertaining to the chronic exposure to these chemicals through inhalation. IRIS is a human health assessment program that evaluates quantitative and qualitative risk information that may result from exposure to environmental contaminants. These efforts may result in lower default closure levels for groundwater and soil remediation, especially in residential settings and state regulatory guidance, and in the revised final EPA vapor intrusion guidance anticipated in the fall of 2012. For additional information on the documents referenced above please refer to the separate *Progression Timeline – Vapor Intrusion Standards and Regulations* compilation prepared by Jill A. Kotvis.

3. Additional Federal Agency Guidance

Because of EPA's failure to finalize its draft vapor intrusion guidance issued in 2002, several federal agencies including the Department of Defense, U.S. Postal Service and the Department of Housing and Urban Development initiated their own guidance and requirements for vapor intrusion screening, investigation, remediation and mitigation on properties which are subject to their oversight. The agencies, the dates and details of their "guidance" are detailed on

the separate *Progression Timeline – Vapor Intrusion Standards and Regulations* compilation prepared by Jill A. Kotvis.

4. Increased State Level Interest and Proliferation of State Guidance and Regulations and Programs

State Overview. According to the EPA approximately thirty (30) states have published guidance or regulations related to vapor intrusion. A partial compilation of state vapor intrusion policies, guidance, and regulations is provided on the separate *Compilation of State Vapor Intrusion Guidance and Regulations* compilation prepared by Jill A. Kotvis.

New York Tenant Notification Law[22]. In 2008 New York was the first state to require commercial and residential landlords to provide tenants with complete disclosure of data regarding vapor intrusion conditions pursuant to the "Tenant Notification of Indoor Air Contamination Law", Environmental Conservation Law § 27-2405 (the "Tenant Notification Law"), effective December 3, 2008. Under the Tenant Notification Law if the landlord receives test results from an "issuer" that indicates indoor contamination above threshold levels established by the New York State Department of Health or OSHA, the landlord must notify tenants and occupants of the property and, if requested, provide them with copies of the test results. The tenant notification can be triggered other than by evidence of actual indoor air contamination; contamination of sub-slab vapors, or soil or groundwater above established thresholds that indicate a vapor intrusion risk to indoor air quality can also trigger the notification. Only test results received from an "issuer" trigger the notice requirement. An issuer is defined as a person subject to a New York state order, a participant under New York's Brownfield Cleanup Program, or a municipality performing environmental restoration under an agreement with New York State or New York State itself.

Texas Standards. Although Texas does have a groundwater to air inhalation exposure pathway as one exposure pathway that should be reviewed when appropriate under the Texas Risk Reduction Program (TRRP) rules primarily applicable to outdoor air, the potential for vapor intrusion in indoor air is not generally considered in closures by the TCEQ at most soil and groundwater contaminated properties. To a limited extent vapor intrusion is addressed in Texas within the Petroleum Storage Tank Program when addressing leaking petroleum storage tanks and the potential explosivity of vapors, and occasionally within the Dry Cleaner Remediation Program. It was TCEQ's position in a state superfund action in 2007 that [t]here are no Texas Risk Reduction Rules (TRRP) comparison values that are appropriate for evaluating sub-slab vapor, and there is a great deal of uncertainty in attempting to evaluate the migration of sub-slab vapor to indoor air"[23]. A listing of certain Texas regulations and guidance is included in the separate *Compilation of State Vapor Intrusion Guidance and Regulations* compilation prepared by Jill A. Kotvis.

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[22] Adam M. Meek and Robert Koen, *Parsing the New Vapor Intrusion Tenant Notification Law*, New York Law Journal, March 16, 2009. This section on the New York law is quoted significantly from the article written by New York lawyers about New York law in order to present the most accurate representation to the reader of the law.

[23] TCEQ, *Memorandum Regarding Health Effects Review of Soil and Air Samples, Vista Chemical Site – Leander ISD Elementary School No. 19, Travis County* (2007)

Case Study: Bandera Road Groundwater Plume Superfund Site, City of Leon Valley, Bexar County, Texas (2010).[24] The Site which encompasses an area of approximately 1 mile long by ½ mile wide was identified as a result of assessment activities conducted pursuant to the TCEQ Voluntary Clean-up Program. The investigation identified the presence of PCE and TCE in concentrations above the Maximum Contaminant Level within the Edwards Aquifer, the sole-source drinking water aquifer for central Texas. The purpose of EPA's remedial investigation is to identify the nature and extent of groundwater contamination and potential vapor intrusion exposure pathways. On July 6, 2011, EPA Region 6 issued a proposed plan identifying the Preferred Alternative for cleaning up contaminated vapor, soil, and groundwater.

Case Study: Midessa Groundwater Plume, Midland, Texas (2010). The site consists of three contaminated groundwater plumes originating from an unidentified source(s). The groundwater contaminants consist of PCE, TCE, 1, 1-dichloroethene, 1, 1-dichloroethane, carbon tetrachloride, and 1, 4-dioxane. The Remedial Investigation began on September 23, 2010. The Phase I field event was completed the week of November 15, 2010, and included a site-wide sampling of the private water supply wells, geophysical logging of selected private supply wells, collection of indoor air samples from potentially effected commercial and residential buildings above the groundwater contamination, collection of surface soil samples and installation of passive soil gas samplers at a former chemical supply facility. The Trinity and Ogallala aquifer is the only groundwater source for drinking water in the site area. There is no other potable water supply for the residents. Human exposure is currently prevented through groundwater sampling and the use of filtration systems on individual private wells.

Case Study: Grand Prairie Vapor Intrusion; Delfasco Forge Site and S.E. 14th Street Groundwater Plume Site (2009).[25] TCE groundwater plumes were identified in Grand Prairie at Delfasco Forge, N. W. 15th Street area and S. E. 14th Street area. The Texas Environmental Health Institute, jointly established by Texas Department of State Health Services (TDSHS) and the Texas Commission on Environmental Quality (TCEQ) worked with the DHHS, ATSDR, the University of Texas and the DHHS, CDC to determine whether people living in homes above the plumes were being exposed to TCE through vapor intrusion. Soil gas, ambient air, indoor air and tap water samples were collected in and around the homes. Blood and urine samples were also obtained from people living in the homes. TCEQ first stated that "[t]here are some homes in the Delfasco area where TCE was found in the indoor air levels above long-term residential health-based screening levels for TCE. Based upon health effects observed in people exposed to TCE in occupational settings, we would not expect to see health effects in people exposed to the maximum level of TCE detected in the indoor air".

They also stated that "although we could not expect these levels to result in adverse health effects, the measured levels only represent the levels in the homes at the time the samples were collected. Indoor air levels can vary with changes in the weather or ventilation inside and outside the home. Additionally, there is a lack of available

[24] EPA Region 6, *Fact Sheet, Bandera Road Groundwater Plume, Bexar County, Leon Valley, Texas* (2011).
[25] Texas Department of State Health Services, *Grand Prairie Vapor Intrusion Fact Sheet* (2009).

scientific information about health effects in people exposed to low levels of TCE over an extended period of time. Therefore, we cannot state with absolute certainty that the levels of TCE in indoor air will always be safe". The TDSHS added that other indoor air consumer products could have contributed to the TCE impact in the indoor air quality samples. EPA stated in its September 2009 Fact Sheet that "[b]ased upon the data collected from the Delfasco Forge Site, some homes will require some abatement to reduce trichloroethylene concentration in the indoor air. To limit potential exposure and to reduce trichloroethylene concentrations in the indoor air, EPA is offering to install exhaust fans in homes that had, or are expected to have, elevated trichloroethylene levels".[26]

A 2009 study by the TDSHS concluded that the residents living above the groundwater plumes had significantly higher levels of TCE in their blood, and a higher percentage of people with detectable levels of TCE in their blood, suggesting "that vapor intrusion and human exposure was occurring".[27]

Case Study: Vista Chemical Site – Leander ISD Elementary School No. 19, Travis County, Texas (2007).[28] Several polycyclic aromatic hydrocarbons (PAHs) were detected above residential health-based screening values in surface soil. Initially the TCEQ stated that areas where constituents were detected in surface soil above health-based screening values should be addressed prior to re-use of a site for the school. Additional sampling of sub-slab soil and the indoor air indicated no "health concerns" in the sub-slab soil samples collected or in the indoor samples which were analyzed for VOCs, SVOCs or metals. The TCEQ thus concluded that "[b]ased on the available information further evaluation of a vapor intrusion pathway for human health is not necessary. Although some constituents were detected, none of them were detected in the indoor air at levels of concern. There are no TRRP comparison values that are appropriate for evaluating sub-slab vapor, and there is a great deal of uncertainty in attempting to evaluate the migration of sub-slab vapor to indoor air".

5. American Society for Testing and Materials (ASTM)

ASTM first issued a vapor intrusion standard involving assessment and mitigation guidelines in 2008 (ASTM E2600-08-Standard Practice for Assessment of Vapor Intrusion into Structures on Property Involved in Real Estate Transactions). This was later modified and superseded in 2010. The 2010 ASTM standard addresses only vapor encroachment screening guidelines as a "Best Practice" (ASTM E2600-10 Standard Guide for Vapor Encroachment Screening on Property Involved in Real Estate Transactions). ASTM E2600-10 is being marketed as a standardized methodology to evaluate the potential for vapors to encroach onto a property or into a dwelling overlying contaminated soil or groundwater. Additional detail on the ASTM standard is provided later in this Paper, and on the separate *Progression Timeline – Vapor Intrusion Standards and Regulations* compilation prepared by Jill A. Kotvis.

[26] EPA, *Fact Sheet – Grand Prairie, Texas, Southeast 14th and Northeast 15th Streets – Delfasco Forge Site* (2009).
[27] TDSHS, *supra* note 25.
[28] TCEQ, *supra* note 23.

6. Environmental Information Vendors

Subsequent to issuance of the EPA 2002 draft guidance on vapor intrusion, Environmental Data Resources (EDR) has been actively writing and speaking on the vapor intrusion topic at many venues including the annual EDR Due Diligence at Dawn Program, and programs of the Environmental Bankers Association and the Air & Waste Management Association (an association of environmental engineers, geologists and consultants). The Chairman of EDR Anthony Buonicore[29] was Chairman of the ASTM Task Group that developed the ASTM 1527-05 standard for environmental due diligence and the ASTM Task Group that developed the ASTM Vapor Intrusion standard in 2008 and the revised standard in 2010. Listed as CEO (or sometimes as President) of the Buonicore Group (not as Chairman of EDR), Mr. Buonicore has spoken and written and been extensively and frequently quoted in EDR advisories and publications on the topic vapor intrusion "and its risks", and has been an aggressive advocate of the use of both the ASTM Phase I and ASTM vapor encroachment guidance standards.

In addition to a significant number of services and products sold by EDR in support of the ASTM Phase I process, EDR has developed and in March 2011 launched the EDR VEC App.™ which it promotes as a tool to enable environmental consultants to screen properties for vapor encroachment under ASTM E2600-10, a service for which it charges $55.00 per property. EDR at the same time launched an E-newsletter, the *VEC Alert*, to "highlight the latest developments related to vapor intrusion risk in real estate transactions".[30] The initial newsletter included an attorney's recommendation to consultants that they paper their files with notes of their recommendations to clients regarding vapor intrusion, particularly in cases where a client decides not to assess the risk of vapor intrusion which the consultant has raised. EDR has also created a "flyer to help environmental due diligence professionals "explain" vapor intrusion risk to their clients" (quotes are included as emphasizes around the word explain).

And recently, an article authored by Anthony Buonicore appearing in the February 2011 Air & Waste Management Association publication, Buonicore states in his conclusion that "[e]nvironmental professionals conducting a Phase I today must consider vapor intrusion in their investigation, analogous to groundwater migration. The only choice that exists is the methodology used to evaluate vapor migration….From a liability viewpoint, it is expected that most environmental professionals will rely on ASTM E2600-10".[31] (Emphasis added)

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[29] Anthony Buonicore is listed on the DMG website as Consultant and Chairman of EDR. DMGI is a division of Daily Mail and General Trust plc, a United Kingdom media company. DMGI invests in business to business information companies. EDR is one of the operation companies of DMGI. http://dmginfo.com/consultants.html; see also speakers biographies for EDR 2011 *Due Diligence at Dawn*, http://www.edrnet.com/ddd/speakers.aspx.

[30] Diane P. Crocker, (EDR Market Research Group), *Vapor Intrusion and ASTM's Revised Vapor Encroachment Standard, The Experts Answer Why the Topic is So Hot Now and The Best Way You Can Protect Your Clients and Yourself From Liability*, December 6, 2010 The article quotes "Anthony Buonicore, P.C., CEO of the Buonicore Group" as an expert; Mr. Buonicore is the Chairman of EDR.

[31] Anthony Buonicore, *Vapor Encroachment Screening Under the Newly-Revised ASTM E2600-10 Standard*, Air & Waste Management Association, February, 2011.

7. Environmental Professionals

Vapor Intrusion as a Lucrative New Service. Environmental professionals are driving the vapor intrusion issue for two reasons. They are afraid of possible liability if they fail to address and investigate the vapor intrusion issue and they see the addition of the vapor intrusion to due diligence and the remedial process as a lucrative expansion of their services. For the latter reason almost every large environmental consulting or contracting firm has in the last six to eight months added vapor intrusion services to their websites and presented webinars on the topic.

Environmental Professionals' Fears. Environmental consultants are fearful that a failure to screen for address or opine on the potential for vapor intrusion during their performance of a Phase I Site Assessment will subject them to claims and lawsuits alleging their breach of a standard of care generally or specifically as presented by the ASTM E2600-10 vapor encroachment standard. They also argue that they are concerned that such a failure might also subject them to claims of non-compliance with the "All Appropriates Inquiries" requirements for qualifying for liability limitations under Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)[32] and the ASTM 1527-05 Standard Practice for Environmental Site Assessments. These fears have come from a limited number of lawsuits being brought against consultants, and primarily from marketing efforts and publications of environmental information vendors and attorneys.

> Case Study: Litigation Against Environmental Professionals. One example is an action in New York in which residents' claim that Exxon/Mobil failed to properly remediate an underground petroleum contaminant plume causing the residents adverse health effects. The action also involved a claim against the environmental consultant alleging that they failed to act in a reasonably diligent manner to investigate and remediate the contamination and that they designed the sampling plans in a manner that avoided revealing contamination and improperly or ineffectively remediated the plume.
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> Case Study: Environmental Information Vendor Publications. The following are quotes from articles written by the Market Research Group of EDR, the largest environmental vendor in the United States.
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> > For their part, environmental professionals should know that the best practices are changing, which means that they, too, could be found negligent if they fail to address vapor mitigation impacts during the Phase I investigation. Consultants usually specify a scope of services in their contracts and may be very specific about limiting an investigation to, e.g., performing an ASTM Phase I standard assessment and excluding business risks and other considerations. But an EP who did not identify vapor mitigation/intrusion as a potential concern to its client and then drafted around an obligation to mention it could certainly be sued by its client if a VI issue were later discovered.

[32] Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, 42 U.S.C. §§ 9601 *et. seq.* (1980).

> VI is such a hot topic in environmental law today with state agencies and with EPA and is now considered by so many consultants that to ignore it would be very risky, particularly since this is an area that gives rise to personal injury and property damage claims in addition to remediation costs. VI can lead to significant exposure for a client, and the client is then all the more likely to seek relief from an environmental professional who "missed it". To avoid further litigation, the sooner EPs incorporate that into their own scope, the better.[33]
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> Because of the substantial body of knowledge developed regarding vapor intrusion by EPA and state governments, ASTM, and other professional organizations, an environmental professional could easily be subject to a malpractice or negligence claim if they fail to identify a vapor encroachment condition.[34]

Case Study: Advice below provided in articles intended for environmental professionals by environmental information vendor EDR in marketing efforts relative to its new service called the "EDR Vapor Encroachment Condition (VEC) Application.

> Consultants who have not yet approached clients about adding a vapor encroachment screen to their Environmental Site Assessments should consider doing so, not only because of the potential for regulatory non-compliance, losses, and lawsuits but because they could be held to a new standard of care.
>
> If you were uncertain how to talk to your clients about vapor mitigation/intrusion risk and are concerned that they might get the impression they were just trying to up-sell them on yet another due diligence service, try to focus on educating them on the potentially costly impacts of ignoring a VI issue.[35]

8. Expanding Environmental Due Diligence and Phase I Scope of Work

Awareness of vapor intrusion as a potential pathway for human exposure is raising a new level of concern during property transactions involving existing or prior contamination on the transaction or nearby properties. Environmental professionals and lenders are more aggressively adding this exposure pathway to the scope of their Phase I or otherwise evaluating the vapor risk in the scope of their pre-acquisition or pre-foreclosure due diligence. Some consultants are advising their clients that it is mandatory but lenders and buyers are under no obligation to evaluate vapor intrusion generally and the "requirement" to do so to meet the "All Appropriate Inquiries" standard of due diligence for establishing liability limitations under CERCLA has not

[33] Dianne P. Crocker, (EDR Market Research Group), *Vapor Intrusion and ASTMs Revised Vapor Encroachment Standard*, December 6, 2010.
[34] Dianne P. Crocker (EDR Market Research Group), *Are you Prepared?,* Air & Waste Management Association, Inside the Industry, February, 2011.
[35] www.edrnet.com/vecapp

been fully resolved. The Phase I assessment does not typically include vapor intrusion assessment because vapor intrusion as an indoor air quality issue is outside of the scope of the EPA All Appropriate Inquiries requirements in 40 CFR 312 or ASTM E1527-05, as are mold, lead-based paint and asbestos. However, purchasers and lenders can choose to evaluate the potential for vapor intrusion by separately screening for vapor encroachment or separately performing an vapor intrusion assessment.[36]

> Case Study: Environmental Consultant Redefines Phase I Scope Without Client Consultation or Advance Agreement. Environmental consulting firm Life Space Corporation has on its own included vapor intrusion assessment into their standard Phase I environmental site assessment protocol even though this may not be in the best interest of their clients generally or even on a case-by-case basis. They state on their website that:
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> > In the best interests of our clients and their lenders, *Due Diligence Inspection and Assessment* has intergraded Vapor Intrusion Assessment into our standard Phase 1 Environmental Assessment Protocol. At *Due Diligence Inspection and Assessment* there is no additional fee; all *Due Diligence Inspection and Assessment* quotes and proposals include Tier 1 Vapor Encroachment Survey.[37]

9. Information Dissemination/Public Awareness

Public awareness of the health hazards potentially associated with vapor intrusion and other indoor air quality issues has increased through heightened media attention, internet websites, blogs, lawsuits and environmental consultants.

> Case Study: Public Awareness and Dissemination: Residents of the community near the Behr Dayton Thermal Products Plant, the source of significant groundwater contamination of TCE, organized as a group called the Behr VOC Area Leaders and released a documentary on YouTube called *This is our Neighborhood*.

HOW IS VAPOR INTRUSION IMPACTING REAL ESTATE TRANSACTIONS AND DEVELOPMENT?

1. Increased Remediation Obligations and Costs

Increased Remediation Obligations and Costs. EPA and state governments are increasingly raising vapor intrusion as an exposure pathway that must be reviewed during remediation involving VOCs and many states have or are developing guidance and/or specific requirements. This will increase site investigation costs. Identified vapor intrusion impacts may also increase the cost of groundwater remediation. While source containment and natural attenuation of off-site groundwater plumes may be sufficient to protect groundwater resources,

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[36] See a further discussion of the interplay of ASTM E2600-10 and ASTM E1527-05 in additional sections of this Paper.

[37] Life Space Corporation, http://www.usaduediligence.com/via.php

under newly developed guidelines and regulations, EPA and some state agencies may begin to require more active groundwater remedial action particularly off-site when the potential for vapor intrusion is involved.

The State of Texas. EPA's Region 6 office stated at a presentation co-presented with the TCEQ in 2010 that "as Agencies understanding and knowledge of the Vapor Intrusion pathway has grown, it is fairly evident that at many sites, a significant effort and resources may be needed to properly characterize the high degree of variability that may be present at a site. Therefore, the Agency also believes (and recommends) that a preventative or a removal system strategy also be considered as a **cost-effective** first/interim step to minimize potential and actual exposures to risks from Vapor Intrusion" (*emphasis by EPA*).[38]

Although Texas has no vapor intrusion guidance or specific vapor intrusion regulation, it does have certain existing regulations and guidance that would allow it to require that vapor intrusion be addressed at sites involving dry cleaners and gas stations and other sites with VOC contamination. Emphasizes on the vapor intrusion pathway may also impact the TCEQ's issuance of Voluntary Cleanup Program (VCP) Certificates of Completion and Municipal Setting Designation (MSD) Certificates. Because of the release of liability afforded by the VCP COC Texas may follow other states that are requiring full investigation of vapor intrusion and mitigation if necessary prior to providing the liability release assurances such as that provided final VCP COC. This may also result in the issuance of more conditional COC's which may never be closed with issuance of a final COC. Issuance of MSD Certificates by municipalities, and the MSD general avoidance of investigation and remediation of soil and groundwater contamination (ingestion pathway) may also be impacted.

> Case Study: TCEQ Disallows Use of MSD at Dry Cleaner Release Site in State-Lead Dry Cleaner Remediation Program (2010). The TCEQ has already informally implemented the policy that it will not allow or consider an MSD in closure of dry cleaner releases (VOCs) participating in the state-lead Dry Cleaner Remediation Program. The risk of vapor intrusion from dry cleaner solvent VOCs is suspected as a partial basis for this new policy.[39]
>
> Case Study: TCEQ Denial of MSD for RCRA Permitted Property with High Concentrations of TCE in the Shallow Groundwater (2007). Detrex Corporation, a solvent recycler in Arlington, Texas applied for an MSD with the City of Arlington and the TCEQ in 2007. The Detrex Arlington facility, a RCRA permitted treatment, storage and disposal facility applied for the MSD in relation to corrective action activities it was pursuing under its RCRA permit. The EPA Region 6 Director for RCRA in a letter dated September 5, 2007 to the TCEQ Remediation Division stated that they did not believe that the Detrex MSD application could satisfy the RCRA corrective action requirements in the permit and in the federal RCRA regulations for investigation, cleanup and monitoring of contaminated groundwater for the protection of human health and the environment and that it would be inappropriate for TCEQ to approve the MSD

[38] EPA Region 6 and TCEQ, *supra* note 7.

[39] Dry Cleaner Remediation Program Site No. 36, TCEQ letter, July 2, 2009; Municipal Setting Application MSD AP No. 136, TCEQ letter, August 3, 2010.

application. In a subsequent letter to the TCEQ Remediation Division on October 24, 2007, the Associate Director for RCRA at EPA Region 6 advised the TCEQ that the Region 6 support of the MSD legislation and modifications agreed to in the legislation protecting the priority of federal programs further dictated that an MSD should not be issued in relation to facilities subject to "Texas federally authorized/approved programs particularly RCRA and UST". The TCEQ denied the Detrex MSD application on the basis that "Detrex is ineligible for MSD certification because it is a RCRA-permitted facility."[40]

2. Increased Liability Risks

Increased Risk of Re-opening of Closed Sites. Most closures of contaminated sites result in the issuance of No Further Actions (NFA) letter by a state agency. These NFA letters contain re-opener language that allows state and federal agencies to open for further consideration sites that were previously closed when new information such as vapor intrusion is identified. Several states are investigating standards that would require the re-opening of closed remedial actions in which the vapor intrusion inhalation exposure was not addressed where it has significant potential to migrate from shallow soil or groundwater into buildings, thereby creating environmental liability for current or prior property owners. Various states including California, New York and Massachusetts are reviewing and in some cases re-opening formerly closed sites that had previously received No Further Action letters to examine whether exposure to vapor intrusion is a health concern.

The re-opening of closed contaminated sites presents significant potential liability risk to sellers who have retained liability for environmental issues under purchase and sale agreements that did not exempt vapor intrusion as a responsibility of seller. The potential liability risk is also increased for purchasers who have based their purchase of property and assumption of environmental liability on the closed status of a prior environmental issue on the property or who have agreed to limited indemnity or remedial obligations of the seller in the purchase and sale agreement and associated remediation, escrow or indemnity agreements based on a prior closure.

Human Health Claims-Indoor Air Quality. Federal and state human health regulatory agencies, consultants and lenders have placed increased emphasis on vapor intrusion as an exposure pathway for occupants of effected buildings and for construction workers. Vapor intrusion assessments may lead to greater liability for property owners whose property is identified as the source of the contamination causing the vapor intrusion. Real estate attorneys and their clients can expect vapor intrusion health and personal injury related claims to mimic mold, radon and asbestos claims.

Property Value Diminution. Allegations of soil vapor intrusion can lead to property value diminution claims.

Case Study: Potential Property Value Impact Due to Significant Groundwater VOC Impact and Potential Vapor Intrusion (2001-2011). This case involves a heavily VOC

[40] Detrex Corporation MSD Application No. 044, TCEQ Docket No. 2007-1617-MIS (2007), Executive Directors Response to Motion to Overturn.

contaminated property in the Dallas area which is being addressed and for closure in the Texas Voluntary Cleanup Program by the seller. Non-aqueous phase liquid (NAPL) solvents remain in the groundwater and the purchaser is concerned regarding the significant potential for vapor intrusion into the indoor air of the current buildings or buildings to be constructed on the property in the future. The seller has not addressed and is attempting to avoid addressing the NAPL and vapor intrusion issues and has requested that the purchaser agree to an MSD designation on the property. The settlement agreement between the purchaser and the seller was not negotiated by an environmental lawyer and provides insufficient detail or direction on these issues. The property is in an area of high potential for transit-oriented development in the future; however the property may be stigmatized and the value diminished if the NAPL and vapor intrusion issues are not addressed sufficiently. Single family residences adjacent to the property also present a risk of future personal injury and property damage claim.

3. Increased Litigation Risks

Rescission of Property Sale. Desperate times and the perfect storm have also reportedly resulted in purchasers' using vapor intrusion in attempts to undo or rescind their real property purchases. These purchasers sue the sellers for failure to disclosure vapor intrusion conditions, sue their environmental consultants for failing to identify vapor intrusion conditions or sue their lenders trying to undo their loan obligations based on mutual mistake of fact that both assumed the property was not contaminated at the time of purchase. Attorneys anticipate further purchaser lawsuits based on a failure of sellers, environmental consultants or lenders to implement the new ASTM standard.[41]

Personal Injury and Property Damage Claims. The plaintiffs' personal injury bar is jumping on vapor intrusion as the new asbestos. The new EPA Guidance, Toxicology Reviews on TCE and PCE, the ASTM standard, and the further information we now know about how radon and VOCs enter building structures will provide fodder for the argument that a risk-based approach to environmental remediation implemented during the last ten to twenty years primarily through state law was negligent in general or grossly negligent for not including the soil to indoor air exposure pathway.

In addition to increased potential remedial costs on and off-site, owners of certain source properties may face individual or class action lawsuits from nearby residents or building occupants claiming damages for property devaluation, personal injury and other losses. As we saw with mold, the perception of the health risk by the occupants of buildings and owners of property is in the eyes of the claimant and can substantially increase the risk of litigation.

Case Study: Greenpoint Oil Spill Litigation (2005). Discharges and releases from various refineries in New Town Creek, New York beginning in 1866 resulted in what is estimated to be at least 17 million gallons of petroleum product. In 2005 four hundred Greenpoint residents within the area of the oil recovery operation filed a lawsuit against Exxon/Mobil and additional defendants alleging that they suffered adverse health effects as a result of the petroleum release. The lawsuit led to studies including one conducted

[41] http://www.elabs7.com

by the EPA. In 2007 the State Attorney General of New York brought a lawsuit against Exxon/Mobil, BP and Amoco. An earlier RCRA lawsuit was also filed by an environmental organization Riverkeeper, Inc.

Case Study: Personal Injury and Property Damage Claim Involving Release from Retail Fuel Gas Station (1998). Residents living near a retail fuel station alleged property damage and personal injuries in relation to a petroleum release at a nearby gas station. After the 1998 gasoline release, vapor samples were collected from two homes which were evacuated after high levels of benzene were detected. In 1999, the Plaintiffs filed a lawsuit alleging property damage and a variety of personal injuries including blood cancers and neurological problems. Although groundwater sampling had been performed following the 1998 spill, indoor air sampling was not accomplished in the majority of the Plaintiffs' homes. They therefore could not document the level of contaminants to which they were exposed during the specific period. The Plaintiffs retained a consultant to conduct retrospective vapor intrusion analysis using the groundwater data and modeling to predict what the likely indoor air concentrations were in the Plaintiffs' homes in 1998. The consultant's report concluded that the "likely lower-bound estimate" or minimum vapor levels of benzene in indoor air were well above state and federal standards. The court ruled that the consultants' methodology was scientifically sound and that Plaintiffs could introduce the expert testimony that retrospectively established the indoor air concentrations that existed in their homes in 1998.

Case Study: Elmira Heights/Facet Enterprises Class Action (2010). The claim of the plaintiffs in this action related to industrial hazardous waste and a federal Superfund site that resulted in TCE contamination to an aquifer which was used as a potable water source by the towns in which the plaintiffs resided. EPA determined that the site posed a public health hazard because future exposures to contaminants in the groundwater could occur at levels that would be of public health concern. EPA tested over one-hundred homes and installed mitigation systems in at least thirty effected homes.

Case Study: Dupont Pompton Lakes. More than 150 vapor intrusion lawsuits were expected to be filed against DuPont in New Jersey in relation to vapor intrusion from groundwater contamination resulting from releases of degreasers from the former Dupont Explosives Manufacturing Plant over a 92 year period. The Plaintiffs allege that vapor intrusion from an underground contaminant plume endangered their health and lowered their property values. Dupont provided indoor air sampling at residences, installed a vapor mitigation system in relation to the contaminant plume and offered no-cost installation of mitigation systems to effected homeowners. The New Jersey Department of Health and Senior Services through a cooperative agreement with the ATSDR prepared a health consultation for the Pompton Lakes site. They concluded that current and future exposures to plume-related contaminants in indoor air at residences where properly functioning mitigation systems have been installed will not occur and therefore will not harm peoples' health.

Case Study: Behr Dayton Thermo Products (2008). The Behr Dayton Thermo Plant was proposed for the National Priority List of the U.S. EPA Superfund Program.

Groundwater contamination in the vicinity of the Behr Dayton Thermo Products Plant led to the closure of an elementary school and the installation of air evacuation systems in 100 homes affected by indoor air vapors from the groundwater contaminated by TCE and other organic chemicals. Residents in the area around the plant filed a lawsuit in 2009. They also placed a documentary detailing the history of the TCE contamination from the Behr Dayton Thermo Products Plant YouTube.

4. Environmental Due Diligence

General: Vapor Intrusion Impact on Scope of Phase I ESA. Awareness of vapor intrusion as a potential pathway for human exposure to soil and groundwater contamination has raised concerns about public health risks, remedial costs, and liability during property transactions. The potential for vapor intrusion can be considered during a Phase I Environmental Site Assessment (ESA) or a subsequent Phase II Environmental Site Investigation; however an evaluation of vapor intrusion in indoor air is not required under the ASTM E1527-05 Phase I standard. Either way the costs and timing of pre-acquisition environmental due diligence may increase. Information on an existing plume can only be determined by obtaining and reviewing files at the TCEQ or other relevant agency or by performing a Phase II investigation, and soil gas or indoor air sampling can add costs.

The proliferation of guidance documents and information on vapor intrusion and the number of federal agencies and financial institutions requiring vapor intrusion screening, including U.S. Department of Housing and Urban Development, are leading many to include ASTM E2600-10 Tier 1 Vapor Encroachment Screening as part of the Phase I ESA. If the push continues from environmental information vendors and environmental professionals (consultants, engineering, geologists, etc.), the ASTM vapor screening practice (the ASTM E2600-10 *Standard Guide for Vapor Encroachment Screening on Property Involved in Real Estate Transactions*) may become a routine component of a Phase I ESA (even though the ASTM E2600-10 standard specifically states the contrary).

Impact of ASTM E2600-10 Vapor Intrusion Encroachment Standard. The ASTM E2600-10 vapor encroachment standard guide focuses on assessing the potential for VOC vapors to encroach upon or migrate to the target property, timely screening for the potential rather than assessing the actual specific vapor intrusion pathways. The ASTM standard follows a tiered approach. Tier 1 uses general historic and database information (already a component of a Phase I) to determine if a vapor encroachment condition (VEC) exists by identifying known or suspected contaminated properties within the area of concern (1/3 mile for volatile compounds and 1/10 mile for petroleum hydrocarbons). If VEC exists or is likely to exist or cannot be ruled out the "user" (e.g. the party purchasing the property, the lender or otherwise) can decide what other action if any is desirable based on the facts of the transaction, the property and the identified VEC. It is interesting to note that certain environmental professionals and environmental information vendors use the alternative language "the environmental professional and the "user" will decide what further investigation, if any is warranted". The second Tier evaluates certain characteristics of an identified known plume of contamination and the proximity of the contaminated plume to the subject or target property. Tier 2 can involve sampling if no or insufficient plume information is available.

Is a Vapor Encroachment Condition a Recognized Environmental Condition? Further investigation beyond the ASTM vapor encroachment scope is necessary to determine if vapor intrusion is actually occurring in any building and whether the VEC could constitute an REC under the ASTM standard 1527-05 for Phase I environmental site assessments. Initially environmental professionals agreed that a finding of a VEC under ASTM E2600-10 was not an REC. More recently, however, operated by fear and serious marketing from environmental information vendors (and very prolific writings from one legal professional frequently associated with most EDR publications and presentations, programs and blogs) many environmental consultants are now taking the position that a finding of a VEC under ASTM E2600-10 or otherwise constitutes an REC, or an historic REC.

Vapor Intrusion Into Indoor Air – Not Within Scope of ASTM E1527-05. Technical legal discussions also abound as to whether vapor intrusion constitutes a "release" under CERCLA and whether it falls within the scope of the "All Appropriate Inquiries" requirements and ASTM E1527-05 necessary to qualify for the CERCLA liability limitations as a bona-fide perspective purchaser, contiguous land owner or innocent purchaser. However, although a VEC finding may be covered under the definition of a REC under ASTM E1527-05, the potential for vapor intrusion into a building and related indoor air exposure issues are not within the scope of a Phase I ESA dictated by ASTM E1527-05, some environmental professionals are already identifying VECs as RECs based solely on potential encroachment findings under ASTM E2600-10 or based solely on the fact that actual or even the potential VOC contamination exists under an adjacent property.[42]

Use Trusted Consultants and Environmental Counsel. Because of this uncertainty and the advice being provided to environmental consultants by certain lawyers and environmental information vendors to paper their files with recommendations to clients on vapor intrusion, the environmental consultant you use and the involvement of environmental legal counsel in the due diligence process are more important than ever. Use of a trusted consultant with whom you have a good relationship, whose judgment you trust, and who is not solely focused on their own liability risks is critical. Use of environmental attorneys to engage, direct and review environmental consultants and to review and negotiate their contracts and Phase I documents and other environmental due diligence reports and documents is advisable and may further protect the work product with an attorney client and attorney work product privilege. The latter may be even more crucial as consultants increase their contract and report disclaimer language, in an attempt to limit their liability and include in their files information or notes contrary to the interests of the client, thereby providing litigation "smoking guns".

> Case Study: "Dialog" Between Two Environmental Professionals Included in EDR VEC E-Newsletter.
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> Question: A Phase I in NYC revealed a 'laundry/cleaner' in the Sanborns/directories during in the 1930s. The property was completely demolished in the 1950s, and construction reportedly involved cutting into bedrock to put in the new buildings and basement. Recent geotechnical borings

[42] See further discussion on this issue in other sections of this White Paper.

confirm the subsurface bedrock conditions. Groundwater is at 17 to 20 feet bgs. I am explaining this in the report, but would like to say that it is not a REC. Comments?

Answer: Given the increasing importance of the vapor intrusion exposure pathway, it seems to me that writing off the presence of a historical laundry/cleaner facility without verifying that chlorinated solvents were not used is inappropriate. There could be solvent vapor present even in the absence of detectable groundwater or soil contamination. I'd strongly recommend including sub-slab soil vapor sampling as part of the follow up."[43]

5. Real Estate Purchase and Sale Agreements

The identification of actual or potential vapor intrusion on a property can make property less desirable (new take on "location, location, location"), impact property value, and add a stigma to the property and area. These potential risks provide a sufficient basis for many in the commercial real estate industry to re-define due diligence requirements. In addition to an expanded Phase I scope, this will lead to more detailed information requests to sellers and borrowers and warrant expanded disclosure language and representations, warranties and covenants in purchase and sale and loan documents.

Purchasers, investors, developers and lenders should address vapor intrusion in general and the responsibility for current or future remediation, liability, claims and litigation costs in transactions involving real estate and corporate stock transactions. This may include previously closed or undetermined environmental issues because the potential for vapor intrusion may also lead the state or EPA to re-open closed environmental actions or to require that responsible parties address the vapor intrusion pathway in historic environmental releases.

6. Lenders and Loan Documents

Lender Policies. A growing number of lenders and their environmental, financial or real estate counsel are requiring environmental consultants to specifically include E2600-10 Vapor Encroachment Screening or other method (e.g. standard regulatory database review along with local geological-hydrogeological data, i.e. current Phase I data), as part of the Phase I ESA scope of work in matters involving a purchase or lease of property by the lender itself for a branch bank, and in loan documents involving bank financed real estate transactions or corporate transactions involving commercial real estate.

Numerous banks now require vapor intrusion screening or assessment as part of the environmental due diligence with regard to properties on which their branch banks will be developed, and installation of a vapor barrier or other mitigation action if the potential vapor intrusion risk is identified. Several have also modified their risk management policies to include vapor intrusion as part of the Phase I assessment scope of work required of borrowers.

[43] EDR, *VEC Alert*, E-Newsletter, January, 2011.

Case Study: Internal Bank Recommendation Relating to Property to be Developed as Branch Bank Location – Prior Retail Fuel Facility Site, Dallas (2008). A bank's internal risk management department recommended that an indoor air quality modeling assessment be completed and that an impervious liner such as "Liquid Boot" be installed beneath the building foundation if the branch office building footprint was above the former underground storage tank pit. The environmental risk management department was also concerned regarding potential vapor intrusion from leaking petroleum storage tanks located on an auto dealership across the road from the proposed bank office development.

Case Study: Lease to Bank for Development of Branch Bank, Dallas (2011). See Lease paragraph 7 below.

Case Study: Wells Fargo Real Estate Technical Services Group (RETECHS) Approach. As reported by a Wells Fargo RETECHS employee in 2010, "Wells Fargo RETECHS understands the importance of possible vapor intrusion in transactions and is considering the formal addition of a vapor intrusion screening questionnaire with escalation based on the results of the questionnaire". Currently their policy requires pre-closing contingency or post-closing requirements within a defined time period on new loans for existing facilities and mitigation through engineering controls for new loans involving new construction. In foreclosure decisions and situations Wells Fargo considers vapor intrusion mitigation generally to be a deferred maintenance item for existing properties that are vacant or a pre-acquisition contingency if they are not.[44]

Case Study: Capital One Bank (2011). In a presentation as part of a 2011 EDR webinar on an Environmental Risk Specialist with Capital One stated that Bank One will incorporate vapor intrusion into its environmental due diligence. "We will require our consultants to include some form of a VE screen in the Phase I. Our SOW will be revised to include this VE requirement. We will not dictate how a consultant performs a VE screen. There are many scenarios where a standard regulatory database review (along with local geological-hydrogeological data) can be utilized to perform a screen". "From the Bank's perspective, the vapor intrusion/IAQ study really makes sense."[45]

Case Study: Environmental Bankers Association Vapor Intrusion Survey of its Members (2009). Seventy percent of respondents stated that vapor intrusion was an issue in real estate or trust transactions. If an environmental professional identified a VEC, seventy-five percent of the banks would require a Phase II and five percent would modify their loan terms. An earlier survey in 2007 of EBA members indicated that seventy-six percent of respondents did not have policies on vapor intrusion at that time but that eighty-six percent indicated that vapor intrusion was a concern. In 2007 ninety-one

[44]Dennis P. Firestone, RG, REM, Construction & Environmental Services, Wells Fargo and Company Real Estate Technical Services, *Screening for Vapor Intrusion Using the New ASTM E 2600-10 Standard: Panel Discussion* EDR sponsored event (2011).

[45] Michael Tartanella, Environmental Risk Specialist – AVP, Bank One, *Protecting Your Bank from Vapor Intrusion Liability*, EDR Vapor Intrusion Webinar, February 16, 2011. http://www.slideshare.net/derekshowerman/edrvi-webinar-021611-6963280

percent of the respondents indicated that less than five percent of their transactions were affected by vapor intrusion.[46]

Loan Agreements and Credit Transactions. The underlying collateral plays a key role in the underwriting at origination of a loan. Each bank or other lending institution has an individual business risk model to determine the feasibility or applicable of finalizing a proposed mortgage or asset-backed loan. Environmental risk is a credit risk and as such it is included in most lender liability business risk models. Environmental risks impact lenders by (i) impacting a borrower's ability to repay a loan or to fund its business, (ii) exposing lenders to litigation risk and direct environmental liability (even with the lender "safe harbor" provisions or 'security interest exemptions"), (iii) reducing the market value of the collateral property, (iv) presenting foreclosure complications or (v) stigmatizing the property or the lender or affecting the lenders brand or reputation.

In the current economic environment examiners from the federal deposit insurance corporation are asking more questions on lenders' environmental risks and expect lenders to perform, have in place and proactively enforce environmental risk evaluation procedures. Although the most common loan size threshold requiring a Phase I ESA is One-Million dollars, Phase I requirements are now expected to be applied more stringently and to include smaller loans.

Today environmental risk management is an integral part of the commercial underwriting process and a majority of larger banks have developed environmental policies that govern their lending practices. However, some larger banks and lending institutions and many medium or smaller banks and other lenders do not employ full-time environmental risk managers and rely solely on the opinion of or information from environmental consultants and environmental information vendors.

Lenders increased awareness of vapor intrusion through environmental consultants and environmental information vendors has led to inclusion of new requirements involving vapor intrusion in loan documents involving third party property.

Case Study: Loan Agreement Terms – Shopping Center, Dallas (2010). In 2010 one bank's environmental counsel attempted to include language in a real estate loan document requiring compliance with stringent California vapor intrusion requirements not applicable in Texas in relation to remediation of existing dry cleaner releases at a shopping center. Borrower shall conduct and complete, to the Lender's satisfaction, all remedial, removal and other actions necessary to cleanup and remove hazardous substances…to concentrations on and off the Property protective of human health and the environment, including but not limited to soil vapor values that do not result in indoor air concentrations in on-site or off-site indoor spaces that may result in exposure risks greater than 1×10^{-5}.

[46] Id.

Case Study: Loan Conditions, Dallas (2010). "Determine potential for vapor intrusion through sub-slab indoor air sampling because of historic uses of property and contamination of groundwater by PCBs and TCE".

7. Real Estate Lease Agreements

The human health issues raised by the potential for vapor intrusion will impact lease transactions and relationships with tenants. Potential tenants are already performing greater due diligence in certain lease transactions, particularly those involving shopping centers, and potential claims from tenants and building occupants present perhaps one of the most significant liability risk challenge in this area. Lease documents will need to address the potential indoor air/human health issues and responsibility for current or future liability or mitigation requirements related to vapor intrusion. Knowledge of vapor intrusion may also require notice to potential or existing tenants in certain states or under a standard of due care (e.g. New York State Tenant Notification Law discussed above).

Case Study: Lease Negotiation – Shopping Center, Dallas (2010). A potential tenant for a space in a strip shopping center property that had previously occupied by a dry cleaner insisted that the property owner conduct in-door air sampling for vapor intrusion prior to signing the lease. Despite a subsequent air sampling report identifying no vapor intrusion, the potential tenant decided not to lease the property based on the continued perceived potential for vapor intrusion and human health risk.

Case Study: Lease to Bank for Development of Branch Bank, Dallas (2011). During lease negotiations with a potential bank tenant that planned development of a branch bank on the property formerly occupied by a retail fuel operation, the bank insisted on the following lease language:

> Landlord shall reimburse Tenant any and all costs, including permitting and design costs, incurred by Tenant in connection with Tenant's construction, installation, operation and maintenance of a vapor ventilation system, vapor/liquid barrier, and other equipment which may be necessary or desirable (as recommended by the Engineer) for Tenant's operation at the Premises due to the prior or current existence of Hazardous Materials.

Case Study: Due Diligence and Negotiations Involving Warehouse Lease in Prior Eastman Kodak Complex (2009). The prospective tenant space was a building which had at one time been part of a much larger campus of operations for Eastman Kodak in Rochester, New York. The building had historically been occupied by Eastman Kodak and was utilized as a warehouse to store and finish Kodak products prior to distribution. Kodak operations included an underground storage tank used for the temporary storage of photo chemical rinse water which was generated by precious metal recovery operations within the building. Based on the prospective tenant's concern regarding potential indoor vapor intrusion and indoor issues that might affect its employees, soil vapor intrusion sampling was conducted for both sub-slab soil vapor and indoor air. Based on the results of the laboratory analysis, the sub-slab soil vapor VOC concentrations were compared

against the indoor air VOC concentrations from the same sampling area. These VOC concentrations were then compared to the New York State Department of Health Indoor Air Guidance Values and soil NYSDOH soil vapor/indoor air matrices to evaluate the recommended course of action for each sampling location, if any. The consultant report concluded that no additional actions were needed to address human exposures based on the non-detection in the indoor air samples and the low detections of VOCs in the sub-slab vapor samples. The costs of the indoor air quality testing were paid for by the landlord, and despite the report conclusions that the risk to indoor quality was low, lease terms were negotiated to ensure that all liability and risk relating to the indoor air quality and subsurface soil and groundwater impacts would be borne by the landlord.

8. Real Estate Development[47]

Brownfield Sites. Vapor intrusion is an exposure pathway that potentially affects thousands of Brownfield sites, and sites that have no known history of contamination or industrial activities. It is important for land revitalization stake holders involved in Brownfields redevelopment to recognize the potential for vapor intrusion in order to avoid liability, construction delays and expense. The key to cost-effective and comprehensive solutions to vapor intrusion is considering the issue early in the redevelopment process – before final building design and construction. Early consideration allows for more options for cleanup, prevention and abatement and ensures vapor intrusion is not a deal breaker when it comes to redevelopment.

Consideration of vapor intrusion along with other potential exposure pathways commonly evaluated during the Phase I and Phase II process (e.g., ingestion of or direct contact with soil and groundwater) can eliminate potential health risks and facilitate transactions. Early proactive evaluation of vapor intrusion can make available more options for mitigation and redevelopment. Most importantly, pre-construction mitigation measures are less expensive than post-construction mitigation and building retrofits. This can apply to both existing Brownfield properties and undeveloped Greenfield properties.

Case Study: Stigma of Potential for Methane Gas Vapor Intrusion Impacts Potential Site Development (2008). A warehouse office district trade center property in north Texas is developed on or near an area of subsurface methane gas reportedly resulting from a naturally occurring degradation process of organic materials in the area. As a consequence, the trade center property owners' association prescribed the use of a passive and protective environmental system in building structures to "provide protective measures for building structures from ecological systems that are inherently present in many types of soils, some of which may be present in the development such as naturally occurring bio-gas". The recommended protective environmental systems includes details on a liner under the foundation floor of buildings, a passive venting system under the foundation liner and a means to test conditions below and above the foundation liner consisting of monitoring probes. A prospective purchaser of property in the trade center who had signed a letter of intent for purchase of property to develop its headquarters building at the trade center decided to develop its headquarters elsewhere based on the

[47] EPA, *supra* note 1.

vapor intrusion stigma and perceived human health risk to the prospective purchaser's employees and visitors, and the seller's failure to agree on retention of liability, purchase price reduction or other proposed actions and agreement terms that would have moderated the perceived risk to the prospective purchaser.

Greenfield Sites. Even Greenfield properties that have not previously been occupied or developed may contain VOC contamination. Because groundwater plumes and soil gas can migrate laterally the contamination source need not be on the property to be developed to pose a potential vapor intrusion risk. The actual source of the vapor intrusion (e.g., landfill waste, contaminated soil or groundwater, or previous or current petroleum storage tanks) may be present on a neighboring property or on a property some distance away. Depending on the degree of contamination and geology, contaminants dissolved in groundwater plumes can flow beneath the property from sources located a mile or two up-gradient. Designing mitigation systems into the building and site plan and development can more cost-effectively address the potential vapor intrusion and avoid costly future claims and ease the future resale and refinance of the property.

CONCLUSION

Vapor intrusion is clearly becoming an issue warranting close attention in real estate and business transactions involving commercial property. Vapor intrusion standards and implied or statutory requirements for assessment, investigation, remediation or mitigation are evolving rapidly. Regulatory and technical guidance documents differ and often conflict regarding data requirements, collection methods, screening or evaluation criteria and their application. Because of this uncertainty and the advice being provided to environmental consultants by certain lawyers to paper their files with recommendations to clients on vapor intrusion, your choice of an environmental consultant and the involvement of environmental legal counsel in the due diligence process is more important than ever.

To prevent overly conservative burdensome requirements, property owners or potentially responsible parties must ensure that they remain in control of the process from the beginning. Because vapor intrusion is a rapidly developing field of science and policy, property owners/responsible parties and their real estate or financial services attorneys should consider involving environmental attorneys and professionals who understand the vapor intrusion exposure pathway, the state-of-the-art technology required to evaluate the pathway, the status of controversial issues, and how these might impact decisions at the property in question. By being proactive, parties can identify risks in advance, reduce those risks through preemptive actions, and propose a reasonable scope of work, resolution and agreement language to purchasers, lenders, tenants and landlords.

PRACTICE TIPS

1. Respect the risk of vapor intrusion; advise clients of the risk. They can choose to accept the risk or determine its viability and applicability to a particular transaction.

2. If it is a risk the client or environmental professional pursues, be alert to vapor intrusion issues on properties or neighboring properties with VOC's, SVOCs, etc. in the soil or groundwater.

3. Take control of the issue early and determine what if any action is appropriate or desired under applicable guidance and regulations based on the facts, or that may be recommended for tenant, occupant or neighbor relations, or your client's public relations and reputation.

4. Do not allow environmental consultants to drive the scope of work on your environmental due diligence, Phase I ESA, or Phase II Environmental Site Investigation.

5. If you or your client do not want vapor intrusion or other non-ASTM E1527-05 required issues such as mold, asbestos or lead-based paint to be included or commented on in your Phase I ESA report, clearly state this preference in writing as a direction to the environmental consultant when reviewing their proposal or negotiating their scope of work and contract.

6. Direct the environmental consultant to provide all reports and conclusions (whether sent electronically or in hard copy) in draft for review and discussion.

7. Direct the environmental consultant to exclude recommendations from the Phase I or Phase II or other environmental reports.

8. Banks, large real estate investors and companies that frequently lease or purchase properties for their business operations should develop their own specific Phase I environmental site assessment procedures compliant with the EPA rule for meeting the CERCLA "All Appropriate Inquiries" standard (40 CFR 312) and include specific and detailed direction on the desired Phase I ESA scope of work and how or whether vapor intrusion and other similar issues will be addressed.

9. Use environmental attorneys to engage, direct and review environmental consultants and to review and negotiate their contracts and Phase I documents and other environmental due diligence reports and documents to minimize risk and avoid liability and to protect the work product with an attorney client and attorney work product privilege. The latter may be even more crucial as consultants increase their contract and report disclaimer language, limit their liability and

include in their files information or notes contrary to the interests of the client providing litigation "smoking guns".

10. Coordinate vapor intrusion issues with environmental counsel to address the risk and liability that the potential for vapor intrusion presents in agreement language relating to real estate, lending, and corporate transactions.

11. Consider addressing a potential vapor intrusion issue early in the pre-development design of new buildings or in retrofitting existing buildings through mitigation measures. In many cases the remedy for potential vapor intrusion is not overly expensive (e.g. a vapor barrier and sub-slab depressurization) and may cost less than substantial investigation or other associated costs to further define the issue. This proactive response can also limit exposure to claims and avoid "smoking gun" sampling evidence data.

12. Use environmental attorneys for all things "environmental." An environmental practice is as detailed and technical as tax law or intellectual property law. If you would not attempt to practice in these areas or provide counsel to your client on tax or intellectual property issues, then you might not want to do so on environmental issues either.

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