Environmental Transactions and Brownfields Committee Newsletter

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MESSAGE FROM THE CHAIR

Amy L. Edwards
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Greetings from snowy Washington, D.C.! Hopefully, by the time you read this, you are starting to see signs of spring, wherever you may be. We have an interesting array of articles in our first quarter 2010 edition of the Environmental Transactions and Brownfields (ETAB) newsletter.

Connie Sue Martin of Bullivant Houser Bailey, PC, has prepared an article discussing brownfields grants for Indian tribes. She describes the types of grants that are available, how they can be used, and why they are so critically important in Indian country where economic reuse opportunities may be more limited than in urban areas.

A response to Richard Ericsson's article about the new Licensed Site Remediation Professional (LSRP) program in New Jersey is the second article in this newsletter. Robert Blauvelt of EWMA has written a thoughtful article about how environmental consulting firms are structuring their practices to avoid some of the ethical and advocacy concerns that Richard raised in his article and how these changes in the New Jersey program will hopefully lead to quicker and more cost-effective cleanups and more collaborative and interactive relationships with New Jersey regulators.

Norman Newman of Dann Pecar Newman & Kleiman has written a timely update about the changes that went into effect in Indiana last year incorporating risk-based approaches to cleanup in that state. The recent legislative changes also incorporate the federal liability exemptions for contiguous property owners and bona fide prospective purchasers. The legislation also addresses environmental restrictive covenants, covenants not to sue, and completion certificates.

Finally, Denise Kmetzo of Roux Associates has written a useful article about the importance of understanding the potential contribution of background chemicals to indoor air quality when conducting a vapor intrusion assessment. She compares typical indoor air background concentrations for a couple of substances (benzene and tetrachloroethylene) to standards frequently used by some state regulatory agencies.

If you have topics that you would like to discuss in a future newsletter, do not hesitate to contact me or one of the ETAB newsletter vice chairs.

LIKE TO WRITE?

The Environmental Transactions and Brownfields Committee welcomes the participation of members who are interested in preparing this newsletter.

If you would like to lend a hand by writing, editing, identifying authors, or identifying issues, please contact one of the editors:

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Environmental Transactions and Brownfields
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Thomas R. Doyle, Dean Calland, and Rob Gelblum, Co-Editors

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BROWNFIELDS REDEVELOPMENT AND GRANTS FOR INDIAN TRIBES

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Overview

Since its inception in 1995, the goal of the Environmental Protection Agency's (EPA's) Brownfields Program has been "to empower states, tribes, communities, and other stakeholders in economic development to work together in a timely manner to prevent, assess, safely clean up, and sustainably reuse brownfields." *Respecting Our Land, Revitalizing Our Communities* (Apr. 2008), EPA-560-R-08-002, *available at* http://www.epa.gov/brownfields/tribalreport08.pdf. Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties take development pressures off undeveloped open land, and both improve and protect the environment.

The federal Brownfields Program provides financial and technical assistance for brownfields revitalization, including annual competitive grants for environmental assessment, revolving loan funds (RLFs), cleanup, and job training; and noncompetitive funding for state and tribal response programs. Since the beginning of the Brownfields Program, EPA has awarded 1,255 assessment grants totaling $298.6 million, 230 revolving loan fund grants totaling $217.7 million, and 426 cleanup grants totaling $78.7 million—resulting in 11,779 properties assessed, 258 properties cleaned up, 544 properties representing 4,497 acres determined to be ready for productive reuse, and 316 properties redeveloped or with redevelopment under way. These projects have leveraged more than $11 billion in private investment and helped to attract more than 48,238 jobs. *EPA Brownfields Assessment, Revolving Loan Fund and Cleanup (ARC) Grant Proposal Guidelines: Key Modifications*, *available at* http://www.epa.gov/brownfields/publications/arc_factsheet.pdf.

The Brownfields Program was expanded in 2002, through the amendment of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) by the Small Business Liability Relief and Brownfields Revitalization Act, which boosted funding for assessment and cleanup, enhanced roles for state and tribal response programs, and clarified Superfund liability. The 2002 Brownfields amendments authorized, among other things, two main sources of funding that may assist tribes in revitalizing contaminated land in Indian country: Section 128(a) State and Tribal Response Program funding (which refers to the section of CERCLA that it falls under); and Section 104(k) competitive grant program funding.

Section 128(a) Tribal Response Program Grants

Section 128(a) Tribal Response Program grants may be used to create new or to enhance existing environmental response programs. The Brownfields amendments authorized funding for this program at $50 million per year, to be shared among states, tribes, and territories. The funding is awarded on an annual basis, with the primary goal of ensuring that response programs include, or are taking reasonable steps to include, the following four elements in their programs:

1. timely survey and inventory of brownfields sites;

2. oversight and enforcement authorities or other mechanisms and resources to ensure that a response action will protect human health and the environment;

3. mechanisms and resources to provide meaningful opportunities for public participation; and

4. mechanisms for approval of a cleanup plan and verification and certification that cleanup is complete.

Tribes use Section 128(a) Tribal Response Program funding for a variety of activities: tribal response programs that conduct assessments and provide oversight at properties, creation of codes and ordinances, development of inventories of properties, and education of their communities about the value of protecting and restoring tribal natural resources and community health.

To be eligible for Section 128(a) Tribal Response Program funding, a state or tribe must demonstrate that its response program includes, or is taking reasonable steps to include, the four elements of a response program described above, or be a party to a voluntary response program Memorandum of Agreement with EPA; and maintain and make available to the public a record of sites at which response actions have been completed within the previous year and are planned for in the upcoming year. 42 U.S.C. § 9628(b)(1)(C).

States and tribes are not required to provide matching funds for cooperative agreements under Section 128(a), with the exception of the Section 128(a) funds a state or tribe uses to capitalize a Brownfields revolving loan fund. 42 U.S.C. § 9604(k)(3).

Examples of activities being conducted by tribes with Section 128(a) funding include:

- **The Native Village of Port Heiden** initiated the development of a tribal response program. It focused its funding on developing an inventory of properties and a public record, obtaining technical training for staff members and conducting outreach and education to engage the community in environmental and brownfield issues.

- **The Mille Lacs Band of Ojibwe Tribe** assessed contamination at the former St. Croix girls camp that had for years been used as a dump site. Using its Section 128(a) funds, the tribe cleaned up the property and will return it to reuse as a school.

- **The Absentee Shawnee Tribe's** executive committee passed three codes to create the Office of Environmental Health (OEH) and Office of Environmental Protection (OEP): Brownfields Voluntary Redevelopment, Solid Waste, and Environmental Management.

- **The Seminole Tribe of Florida** provided oversight of limited soil removal at a property on the Big Cypress Seminole Indian Reservation. The property, once used for illegal dumping and vehicle storage in a rural section of the reservation, has been reopened and the tribe plans to develop a recreational resort there.

- **The Yukon River Inter-Tribal Watershed Council (YRITWC)** has used its Section 128(a) grant to survey environmental conditions in 37 watershed communities. YRITWC has identified and mapped more than 230 potential brownfields sites. Training is also a focus of the YRITWC grant, and it has brought together representatives from more than 30 communities, in three separate training workshops, to discuss the brownfields program, how to identify and document sites, and how to work together to establish a brownfields inventory. Finally, YRITWC has used its Section 128(a) funding to complement the watershed communities' EPA Indian Environmental General Assistance Program grants, extending services to areas that otherwise may not have brownfields funding.

Other tribes that have leveraged their Section 128(a) funding with other funding sources to build upon the success of established programs include the following:

- **The Gila River Indian Community** used Section 128(a) funding to assess a 160-acre property found to have soil and groundwater contamination, and then, with assistance from an EPA Brownfields cleanup grant, remediated the property, which is now home to a diabetes education and research center.

- **The Spirit Lake Nation** used EPA Brownfields grants to assess and clean up four idle properties, using the environmental expertise of tribal graduates from an EPA-funded Brownfields job training program.

- **The Rosebud Sioux Tribe** leveraged additional grants to supplement its Section 128(a) funding and complete several brownfields projects. They developed a brownfields inventory of 63 properties with Section 128(a) funding and then cleaned up 32 of those properties with an open dump grant from the Bureau of Indian Affairs (BIA).

Assessment, Revolving Loan Fund, and Cleanup Grants (ARC Grants)

The 104(k) competitive grants also are awarded through an annual competition. Most federally recognized tribes are eligible to apply for this funding, although in Alaska, only the Metlakatla Indian Community and an Alaska Native Regional Corporation or Alaska Native Village Corporation, as those terms are defined in the Alaska Native Claims Settlement Act, are eligible. 42 U.S.C. § 9604(k)(1). ARC grants may be used to address sites contaminated by petroleum and hazardous substances, pollutants, or contaminants (including hazardous substances commingled with petroleum). Opportunities for funding consist of Brownfields assessment grants (each funded up to $200,000 over three years), Brownfields revolving loan fund grants (each funded up to $1,000,000 over five years), and Brownfields cleanup grants (each funded up to $200,000 over three years).

In 2008, EPA modified key areas of its ARC grant proposal guidelines to create additional funding opportunities for communities, improve applicants' potential for success by permitting coalitions to apply for assessment grants, streamline guidelines, and help ensure grantee success through new proposal requirements.

Job Training Grants

Job training grants, competitively awarded on an annual basis, are also available to most federally recognized tribes. EPA initiated these grants to help residents located in areas affected by brownfields take advantage of jobs created by the assessment and

cleanup of those properties. Among other things, the grant funds may be used for:

- training residents in the handling and removal of hazardous substances, including training for jobs in sampling, analysis, and site remediation;
- training in the management of facilities at which hazardous substances, pollutants, contaminants, or petroleum contamination are located;
- training for response activities often associated with cleanups such as landscaping, demolition, and groundwater extraction;
- development/refinement of existing curricula for the training described in this section; and
- training participants in the techniques and methods for cleanup of leaking underground storage tank sites and other sites contaminated by petroleum products, asbestos abatement, or lead abatement where these topics are a component of a more comprehensive hazardous waste management training course or environmental technology training course.

Conclusion

As Congress recognized in the legislative history of the brownfields law, "The vast majority of contaminated sites across the nation will not be cleaned up by the Superfund program. Instead, most sites will be cleaned up under State authority." Unfortunately, tribal communities often lack funding to sustain environmental program capacity building and continue to need technical assistance and expertise. Additionally, many tribes seeking to address brownfields in their communities face problems that are found in many small or rural areas in the United States: rural locations typically do not have the technical resources that many larger communities have, nor the economic drivers associated with more dense populations that might spur cleanup and reuse. While the benefits of reusing existing buildings and infrastructure may be apparent, the funding to make the cleanup and reuse possible often is not present. Tribes may seek to return contaminated land to a noneconomic reuse (e.g., returning land to a culturally beneficial reuse), which often must be funded by the public sector or tribal government and which may not attract the interest of those with private cleanup dollars.

Despite the challenges, revitalization of contaminated lands is a challenge being addressed successfully in Indian country. With the assistance of grants and other resources available through EPA's Brownfields Program and through state and tribal programs, tribes can clean up and return contaminated land to productive use. By using the grants and tools available, tribes address their fundamental environmental and revitalization goals, enrich the health and welfare of their communities, and allow for the sustainable reuse of tribal land in a manner determined by the tribes themselves, rather than by the long-ago polluter who abandoned the site and left the tribe to deal with the legacy of contamination. The continued demand for brownfields cleanup and redevelopment in communities throughout the country, during economic times of increasingly limited state and tribal resources, makes access to federal funding critical.

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NEW JERSEY'S LSRP PROGRAM: AN ENVIRONMENTAL CONSULTANT'S PERSPECTIVE

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The December 2009 article by Richard Ericsson in this newsletter effectively summarized and thoughtfully elucidated a number of critical business and legal concerns associated with implementation of New Jersey's recently enacted Licensed Site Remediation Professional (LSRP) program. But to ensure a productive working relationship with an LSRP, several of Ericsson's points need to be considered by attorneys and their clients from the viewpoint of the program's licensed practitioners.

Responsiveness

In his article, Ericsson raises a valid concern regarding the ability of an LSRP to be an effective advocate for her or his client. The LSRP's code of conduct and license essentially mandates that he or she hold paramount the public (environmental) welfare. Client relationships and project commercial (financial) interests have become secondary to that requirement. A new business model is developing in response to this changed paradigm. For example, the company I work for, EWMA in Parsippany and West Windsor, and other firms in this arena are administratively separating their practices into LSRP and non-LSRP tiers. As with law firms and investment banks, environmental consulting organizations can establish mechanisms that protect a client's due diligence and compliance information. At EWMA, this includes restricting LSRP access to certain computer servers and drives containing due diligence site data, specially designated file folders for those strategic materials that should not be made available for LSRP review, and staff training to sensitize personnel to the need to segregate LSRP and non-LSRP assignments. In some cases, clients have elected to "outsource" the LSRP function and obtain regulatory oversight-related services from a different company. In fact, senior staff within EWMA that have extensive due diligence practices have elected not to obtain LSRP certification so as to continue to provide unencumbered transactional advice and support to their existing clients. It is an unfounded misconception that only the "best" consultants are becoming LSRPs.

With less emphasis on advocacy comes an advantage: responsiveness. The LSRP can devote his or her full attention to reviewing and approving work plans, reports, and the other documents needed to construct a basis for the issuance of a defensible and credible Remedial Action Outcome (RAO, formerly, the much coveted "no further action" letter). Recently at EWMA, a client who had opted into the program was able to obtain LSRP approval for a significant reduction in a remediation funding source. An EWMA LSRP also authorized for another client a substantial decrease in ongoing groundwater monitoring program requirements (number of wells, frequency of sampling). Both requests had been languishing at the New Jersey Department of Environmental Protection (NJDEP) for more than six months. Similarly, EWMA's LSRPs are able to prepare and file Industrial Site Recovery Act (ISRA) Remediation Certificates and associated Remediation Funding Source documentation that allows transactions to proceed to closing without department approval. This type of regulatory compliance flexibility is not only precisely what the Site Remediation Reform Act intended but also is an enormous benefit to those seeking to buy and sell commercial real estate in New Jersey.

Flexibility

Ericsson suggests that, with the threat of stiff penalties and license revocation, LSRPs will choose to be more conservative than NJDEP case managers in requiring new or additional work at a site. While such a prediction is reasonable given the nascent status of the LSRP program, over the long term, market and technical forces will exert counterbalancing pressures. Tension in client-consultant interactions usually is focused around developing consensus on how best to achieve compliance with regulatory requirements. In

pre-LSRP days, the consultant, acting as an advocate, would negotiate, plead, whine, and/or otherwise attempt to cajole the case manager into accepting an investigative or remedial approach that may not have been strictly compliant with department guidance or protocols, but still was consistent with NJDEP's human health and environment mandates. This technique remains valid; simply substitute the LSRP for the case manager. During its very extensive and productive stakeholder outreach program, the department repeatedly assured LSRP candidates that technically sound and well-reasoned variations from its guidance (particularly the tech regs—N.J.A.C. 7:26E) will not be grounds for negative audit findings or disciplinary action. In fact, the department now allows guidance from other states, EPA, and recognized authoritative sources (e.g., American Society for Testing and Materials) to be used in developing and implementing a remedial program so long as they are adequately documented and deemed to be technically competent and reliable.

This is clearly more leeway than traditionally has been given to case managers. Some LSRPs may feel that strict tech reg compliance is the only methodology that will be acceptable (i.e., safe). But those with a more holistic approach to achieving site objectives, and the confidence and technical skills to build a defensible and innovative remedial program that takes into account site- and client-specific factors, will be quickly favored in the marketplace. While there may be some overconservatism in the beginning as LSRPs and NJDEP define acceptable practice guidelines, in the mid-to-long term (as has occurred in Massachusetts and Connecticut) a reasonable performance envelope eventually will be established.

Finality

Ericsson's concern over how to address the three-year audit period precisely expresses the anxiety of those counting on a reliable end point to the process. However, NJDEP's ability to reopen closed cases has long been preserved in its "no further action letters" and guidance documents. Reopeners have included transmittal of false or misleading information, changes in regulatory or cleanup standards, and, more vaguely, the discovery of new information or conditions. The audit provisions of the LSRP program establish a three-year window for departmental review and, possibly, requirements for additional work. But several factors are in play that mitigate the uncertainty surrounding the audit. NJDEP has assured LSRPs and stakeholders that the auditing process will be focused on important, substantive project issues, not procedural or technical nitpicks (e.g., collecting a soil sample from an eight-inch interval versus a six-inch interval). Oversight fees are now knowable in advance (levied annually based on the number of areas of concern and the media impacted) rather than being subject to the whim of the case manager and technical team assigned to the site.

The audit is intended to be a constructive review of project performance and environmental protectiveness, with findings shared among LSRPs, clients, attorneys, and other interested parties. These will not be the old "gotcha" technical deficiency letters but rather will be directed to things that would improve the overall performance of the remedial program that has been implemented at the site. NJDEP reportedly has chosen for the audit teams those senior individuals who have a wide-ranging and in-depth understanding of all the issues associated with moving a site toward final cleanup and closure.

In addition, the department is strongly encouraging LSRPs to ask for guidance at critical decision points in the work. The department is assuring LSRPs that documents required for submittal prior to issuance of an RAO will be peer reviewed on a timely basis with useful feedback provided to the responsible party and LSRP. NJDEP has retained direct oversight of immediate environmental concerns (IECs)—those high-risk conditions representing a potential immediate threat to public health, such as a contaminated water supply well or migration of vapors into a building.

It is encouraging to note that in the formal and informal LSRP guidance for stakeholders the department

appears to be signaling a major cultural change in its management of site cleanups; from a command-and-control attitude to one that is (hopefully) more collaborative and interactive. While the details of the LSRP program remain to be defined, and there will undoubtedly be some growing pains, it is clear that this new way of doing business with NJDEP will be quicker, less bureaucratic, and more cost-effective.

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INDIANA ADOPTS RISK-BASED APPROACH TO REMEDIATION

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This paper concerns the ongoing efforts of the Indiana Department of Environmental Management (IDEM) to abandon its historically stringent remediation requirements and create a more practicable and feasible scheme of risk-based remediation. These efforts began almost a decade ago with IDEM's publication of its Risk Integrated System of Closure (RISC) Guidance for remediation of contaminated property. The RISC Guidance is a Nonrule Policy Document published by IDEM in February 2001. Since then IDEM has been fine-tuning its RISC Guidance in an effort to introduce greater consistency, flexibility, and risk-based practicability into its various remediation programs. The programs to which the RISC Guidance applies include voluntary remediation, leaking underground storage tanks, state cleanup, and Resource Conservation and Recovery Act closure and corrective action.

Since 2007 IDEM has been engaged in the process of revising and updating its RISC Guidance. The centerpiece of this effort is the recognition that complete removal of contaminants from some sites may not be practicable. This is a dramatic departure from where we were several years ago, when nothing short of complete removal of contamination was required in nearly all cases and neither feasibility nor practicability was a consideration.

In 2008 IDEM began the development of a hierarchy of alternative remediation options reflective of its new philosophy of flexibility and feasibility. These options include source controls, receptor controls, and institutional controls. All of these are alternatives to the traditional "dig and haul" and "pump and treat" methods of remediation for contaminated soil and groundwater.

Last year, the Indiana General Assembly weighed in on the subject of risk-based remediation of contamination when it enacted House Enrolled Act (HEA) 1162 (Public Law 78-2009). HEA 1162 became effective on July 1, 2009. It is an omnibus bill that addresses a variety of environmental issues and amends a number of environmental statutes.

Perhaps some in the legislature were concerned that IDEM was not moving quickly enough away from traditional methods of active remediation toward risk-based passive remediation. Others believed that there was some reluctance on the part of IDEM to recognize that passive remediation may be appropriate in certain cases. However, for whatever reason, with the enactment of HEA 1162, risk-based and site-specific assessment and remediation of contamination are now mandated by statute.

Specifically, HEA 1162 amends I.C. 13-25-5-8.5 to expressly recognize that passive measures, such as restrictive covenants and environmental restrictive ordinances, may be viable alternatives to active remediation for the management of risk and control of exposure to contamination in some cases. I.C. 13-25-5-8.5(e) now expressly provides that IDEM "shall consider and give effect to restrictive covenants and environmental restrictive ordinances in evaluating risk

based remediation proposals." It is believed that this provision is intended to eliminate the last vestiges of IDEM's resistance to the use of institutional controls as a legitimate means of remediation and to make clear that active removal and remediation are not required in all cases. Risk-based analysis is now part of Indiana's environmental assessment and remediation scheme by statute.

HEA 1162 also makes several other significant changes to Indiana's environmental statutes. Among these is the amendment of the definitions of "owner" and "operator" to exclude certain persons who are exempt from liability under recent amendments to the federal Superfund law. In other words, the contiguous property owner and bona fide prospective purchaser exemptions under 42 U.S.C. 9607(q) and (r) are now incorporated by reference into the Indiana environmental statutes concerning cleanup of petroleum spills and releases from leaking underground storage tanks. So one who is exempt from such cleanup liability under federal law is now also exempt from liability under Indiana law.

HEA 1162 also addresses certain issues relative to environmental restrictive covenants (ERCs). Such ERCs now must include a provision granting IDEM access to the property. Also, such ERCs must identify all IDEM files applicable to the property. Transferees of property subject to ERCs must be notified of the existence of the ERCs. A proposal for the creation of an institutional control registry was tabled and referred to the Environmental Quality Service Council for further study.

HEA 1162 also authorizes municipalities and counties to enact and enforce environmental restrictive ordinances that limit, regulate, or prohibit withdrawal, consumption, and use of contaminated groundwater. IDEM must be notified of the passage, amendment, or repeal of any such environmental restrictive ordinance. The new law also provides that the applicant for a permit issued by IDEM for any facilities, equipment, or devices regulated by clean air or clean water laws at the state level may not utilize such state permit unless the applicant also has obtained applicable local approvals.

HEA 1162 also addresses certain issues relative to covenants not to sue (CNTS) and completion certificates issued in connection with environmental remediation proceedings. The new law makes it clear that such a CNTS is not applicable to conditions existing on the property that were not addressed in the remediation plan or not disclosed to IDEM. Also a CNTS and completion certificate may be issued subject to conditions subsequent that must be performed or maintained after the CNTS and completion certificate are issued.

In December of last year, IDEM published its Interim Implementation Document (IID) for HEA 1162. This IID is intended to be a bridge between IDEM's 2001 RISC Guidance and a future revision thereof. As suggested by its title, this IID provides some insight into how IDEM intends to implement a policy of risk-based remediation as mandated by HEA 1162.

HEA 1162 is an important piece of legislation that makes several significant changes in Indiana environmental law, policy, and procedures. In particular, the mandate requiring IDEM to consider risk-based passive remediation where active remediation may not be feasible and the incorporation of certain federal liability exemptions into state environmental laws are beneficial to the regulated community in general and to the real estate development industry in particular.

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VAPOR INTRUSION ASSESSMENTS: CONSIDERING BACKGROUND SOURCES OF VOCS IN INDOOR AIR

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Vapor intrusion is a pathway assessed at brownfield and other sites impacted by subsurface volatile organic compound (VOC) contamination. Vapor intrusion assessments seek to determine whether VOCs from the subsurface are entering buildings and resulting in unsafe VOC exposures in indoor air to building occupants. These assessments are often confounded by the presence of VOC sources other than subsurface contamination. Other sources unrelated to the site, referred to herein as "background conditions," may include building materials (paints, adhesives, and carpeting), chemical products (heating oil, cleaning solutions, toner, adhesives, inks, and dyes), process chemicals (chlorinated solvents, degreasing agents, and alcohols), and ambient contamination (emissions from industrial facilities, landfills, gasoline stations, dry cleaners, and vehicle exhaust). Incorrect conclusions as to the source(s) of indoor air contamination and the failure to identify background conditions may result in unnecessary indoor air mitigation and subsurface remediation.

Indoor air concentrations associated with background conditions may exceed health risk-based levels. Because vapor mitigation is often required to reduce vapor intrusion-related indoor air concentrations to meet risk-based levels, understanding the contribution of background in a vapor intrusion assessment is critical in assessing whether subsurface vapor mitigation will improve indoor air quality. This article describes common sources of background indoor air contamination and typical residential background indoor air concentrations of two of the most prevalent and commonly confronted VOCs, benzene and tetrachloroethylene (PCE).

Sources of Background Indoor Air Contamination

When indoor air VOC concentrations exceed health-based targets in indoor air, there is a critical need to distinguish between background sources and concentrations, and site-related concentrations. The potential sources should be identified during presampling inspections and removed, if possible. Common background sources in residences, commercial buildings, industrial facilities, and ambient air are described below:

- Residential sources of VOCs include products, building materials, paints, glues, cleaning products, mothballs, nail polish remover, tobacco products, and furniture. Building materials including carpeting, vinyl flooring, plywood, and sheetrock are also sources of VOCs. Fuels, including home heating oil, gasoline-powered tools, vehicle exhaust in an attached garage, and stored fuels are common sources of VOCs in indoor air.

- Commercial building sources of VOCs include those identified for residences, and may also include toner, adhesives, inks, dyes, and chemicals stored or used directly. Commercial establishments that store and use VOCs, for example, dry cleaners, gas stations, and auto body shops, may have indoor air concentrations that are elevated, relative to residents. VOCs from former operations can remain in building materials including floors, walls, and ceiling tiles, as a continuing source, even after VOC-containing products have been removed. Furniture, cubicle walls, paint, and carpeting also can release VOCs into air.

- Background VOCs detected in industrial buildings include chemicals used in the facility. Industrial chemicals commonly detected in vapor intrusion assessments include chlorinated solvents or degreasing agents (tetrachloroethylene, trichloroethylene, and breakdown products). Active industrial facilities often store and use chemicals in bulk. In these cases, subsurface contamination may not contribute to significant indoor air concentrations, relative to indoor sources. Interior chemical spills may act as continuing sources of VOCs from impacted building materials.

- Ambient (outdoor) sources of VOCs may also affect indoor air quality. Sources of ambient contamination include emissions from industrial facilities, landfills, gasoline stations, dry cleaners, diesel motors, and automobile exhaust.

Background Residential Indoor Air Concentrations

VOC detections are so common that the California Environmental Protection Agency (CalEPA) states that indoor air data should be rejected if VOCs such as benzene and tetrachloroethylene are *not* detected, as they "should be found in both outdoor and indoor air, regardless of the occurrence of vapor intrusion" (CalEPA Interim Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air; revised Feb. 7, 2005). In order to isolate the effect of subsurface contamination in the structure to be assessed, one can compare actual indoor measurements against generic indoor air quality data. National surveys, state studies, and literature values should be considered in vapor intrusion assessments, when they are representative of conditions at the site. Indoor air data from nearby buildings unimpacted by the site may also be considered. Ranges of typical residential indoor air concentrations reported by three states in the northeastern United States are provided below. Fiftieth- and 90th-percentile background values are presented; the statistics used to assess site background concentrations should be consistent with applicable regulations and guidance. If it is established that indoor air concentrations result from vapor intrusion, agencies require that health risks be evaluated by comparison with state or federal target concentrations or conducting a risk assessment. U.S. EPA health risk-based target residential indoor air concentrations, provided in U.S. EPA's Subsurface Vapor Intrusion Guidance (Nov. 2002), assuming a cancer risk of 1 in 1,000,000, are provided below for comparison.

Benzene

Benzene is a common constituent in vapor intrusion studies because it is often found in groundwater plumes. Common sources of benzene in indoor air include fuels, paint supplies, tobacco smoke, and automobile emissions in attached garages. Nearby gasoline station and heavily traveled roadway emissions may also introduce benzene into indoor air.

Table 1: Typical Indoor Air Background Benzene Concentrations

Agency	Indoor Air Background Benzene Concentration ($\mu g/m^3$)	
	50th percentile	90th percentile
New York State Department of Health	2.1	15
Massachusetts Department of Environmental Protection	2.3	11
New Jersey Department of Environmental Protection	1-15	9-54
U.S. EPA Target Residential Risk-Based Concentration	0.31	

Benzene is typically present in indoor air, even in the absence of subsurface contamination. In fact, as shown in table 1, the ranges of background benzene concentrations exceed the U.S. EPA target residential indoor air concentration of 0.31 $\mu g/m^3$. Because background benzene concentrations often exceed health risk-based indoor air concentrations, it may be difficult to assess the contribution of subsurface contamination and the benefits of subsurface remediation.

Tetrachloroethylene (PCE)

PCE also is a common indoor air contaminant. Sources of PCE in residences include metal degreasers, adhesives glues, and dry cleaning. Nearby sources of PCE, including dry cleaner emissions, can also impact indoor air. Typical background concentrations of PCE are presented in table 2.

Similar to benzene, ranges of background PCE concentrations may exceed the U.S. EPA target residential indoor air concentration of 0.81 $\mu g/m^3$, indicating that people routinely breathe tetrachloroethylene in air at levels above risk-based concentrations. Therefore, remediation to reduce subsurface concentrations may not reduce indoor air concentrations below risk-based thresholds. Eliminating background sources, unrelated to the subsurface contamination, may be more efficient (and less costly) at reducing health risks.

Because the background air concentration may result in exposure to VOCs above health risk-based limits, understanding the contribution of background in a vapor intrusion assessment is critical in assessing whether vapor mitigation is warranted. Failure to identify background conditions may lead to needless subsurface mitigation. Targeted sampling and assessment strategies can help identify the significant source(s) of VOCs in indoor air and quantify background concentrations.

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Table 2: Typical Indoor Air Background Tetrachloroethylene Concentrations

Agency	Indoor Air Background Tetrachloroethylene Concentration ($\mu g/m^3$)	
	50th percentile	90th percentile
New York State Department of Health	0.3	2.9
Massachusetts Department of Environmental Protection	1.4	4.1
New Jersey Department of Environmental Protection	0.8-8.3	4-36
U.S. EPA Target Residential Risk-Based Concentration	0.81	