Environmental Bankers Association

EBA JOURNAL

Winter 2024 | Volume 9, Issue 1

ERM Certificate Program Launch

Contamination Discovery Rates

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Introduction

"Why Do I Need a Phase II Investigation?" How many times have we heard these words? Be it from our clients, loan officers, or borrowers, it is a common question because a Phase II investigation requires additional expenditures and time. From experience, environmental professionals inherently know what property types or features have a higher likelihood of contamination, and prior Environmental Bankers Association (EBA) studies (2012 and 2015) have provided pertinent information around the likelihood of contamination. Nevertheless, in 2023, a new study offering more in-depth research into the frequency of contamination was undertaken by fifteen EBA member firms. The resultant dataset is much larger than prior studies and provides conclusive evidence to substantiate the recommendation for additional investigation. This blind, unbiased data collected from Phase II investigations across multiple states promises to be extremely valuable to both environmental and commercial real estate professionals.

Due to the magnitude of this project, we offer sincere thanks to the fifteen participating EBA member firms which made this project possible: Partner Engineering and Science, AEI Consultants, AKT Peerless, Atlas, CBRE, EFI Global, Green Environmental Management, GZA, Molen & Associates, Nova Group, PM Environmental, Terracon, Tetra Tech, TGE Resources, and Wasatch Environmental.

About the 2023 Contamination Frequency Study

For this study, EBA members collected data from 1,755 properties across eleven specific property types/uses that had Phase II investigations completed within the past five years. Not only did this study examine more sites than the similar studies performed in 2015 and 2012 (which included 1,081 and 452 sites, respectively), more data points were collected from each site.

The goal of this study was multi-faceted. In addition to identifying CDRs for the property types/uses researched, the 2023 EBA study also collected data regarding other commonly asked questions, including:

- How often is overall contamination detected during Phase II investigations?
- What is the average cost of a Phase II investigation?
- Does contamination increase with the age of a feature?
- Does the presence of a crawl space mitigate vapor intrusion?
- What are the potential costs of remediation?

The contamination frequency rates identified in this study are referred to as Contamination Discovery Rates (CDRs). The term CDR—which represents how often contamination is found during a Phase II in terms of percentage, both above and below a regulatory standard—was coined by the EBA in 2023 in a presentation titled, “Phase II Data Analysis and Deep Dive.”

Study Findings

The cumulative data from the three EBA surveys has revealed that between 70% and 80% of Phase II investigations have some type of contamination detected, and between 40% and 54% of these sites have contamination detected above some regulatory standard (see **Table 1**). More specifically, the 2023 study found that some level of contamination was detected above the laboratory reporting limits in 80% of the sites and was identified above applicable regulatory levels in 54% of the sites. Since approximately one of every two sites in this study had contamination above regulatory standards, we now have statistical validation of the importance of conducting Phase II investigations. These findings also lend credence to the identification of various “red flags” as Recognized Environmental Conditions (RECs) in the Phase I ESA. They enable our industry to utilize real field data and statistics to quantify risk and allow us to make educated, risk-based credit determinations.

An interesting finding from the series of studies is the increasing frequency of contamination detected above regulatory levels in each subsequent study: a 6% increase from 2012 to 2015, and an additional 4% increase from 2015 to 2023. The data obtained suggests the cause of these increases is likely related to the higher frequency of soil gas sampling included within the scopes of work for the subsurface investigations included in this study.

Table 1: How Often Does a Phase II Detect Contamination?

Year	Number of Sites	Contamination Detected (%)	Contamination Detected Above Regulatory Standards (%)
2012	452	70%	40%
2015	1167	76%	44%
2023	1755	80%	54%

An additional objective of this study was to determine the CDRs for various media when sampled as part of a subsurface investigation. Media considered for the 2023 study included soil, groundwater, soil gas, and indoor air. Soil and soil gas were found to be the most frequently sampled. The study revealed that soil gas had the highest rate of contamination both below and above regulatory standards. This is likely due to the implementation of increasingly more stringent soil gas screening levels by numerous state agencies. Furthermore, sub-slab soil gas sampling can often be conducted in areas where access is limited and soil and/or groundwater sampling is not viable. Regardless, the data affirms the need for inclusion of soil gas sampling within the protocol of many subsurface investigations.

The data in **Table 2** shows that soil gas and groundwater are two of the most commonly impacted media types. The industry's understanding of soil gas as a pathway for contaminant migration has become more pronounced over the last decade. This data demonstrates that, of the almost 1,200 Phase II reports where soil gas was sampled, approximately 1 in 2 sites had soil gas impacts above a regulatory standard. Similarly, groundwater was impacted above a regulatory standard in more than 1 in 3 sites that were studied. These findings reinforce the importance of working with your consultant to determine the right media to sample during your Phase II ESA.

Table 2: How Often Does a Phase II ESA Detect Contamination and Where is it Typically Detected?

Media	Total Number of Sites	Contamination Detected	Contamination Detected Above Regulatory Standards (%)
Soil	1,341	73%	27%
Groundwater	700	65%	37%
Soil Gas	1,187	77%	47%
Indoor Air	495	37%	23%

CDRs for Property Types/Uses

The 2023 study provides a deep dive into property types/uses that are common contamination culprits. **Table 3** shows the total number of sites of each sensitive property type/use studied, the rate of contamination, and if they were above any regulatory standards. The most relevant category here are percentages that are above commercial/industrial regulatory standards, as we are largely working in the context of commercial real estate transactions. However, when multifamily residential properties are in question, the percentages above residential regulatory standards would apply. In either case, the commercial/industrial CDRs for off-site issues, dry cleaners, plating facilities, historical manufacturing sites, and metal fabrication sites are the highest.

Table 3: Contamination Discovery Rates (CDRs) by Property Type/Use

Property Type	Total # of Sites (n)	Contamination	Above Residential Reg.	Above Commercial / Industrial Reg.
Off-Site Issues	259	85%	47%	30%
Dry Cleaners	655	71%	40%	27%
Plating Facilities	55	82%	51%	27%
Historical Manufacturing	636	72%	38%	26%
Metal Fabrication	81	72%	46%	26%
Auto Service	634	66%	27%	19%
Heating Oil USTs	42	45%	26%	17%
USTs	1,177	65%	30%	15%
Commercial Print Shops	84	48%	26%	14%
ASTs – Bulk Storage	87	45%	24%	11%

CDR Breakdown by Media (Soil, Groundwater, Soil Gas, and Indoor Air)

The overall CDR for sensitive property types/uses is extremely beneficial because it tells us what the overall rate of contamination is. However, due to the nature of chemicals used on-site or the methods of storage, usage, and disposal, select media are more likely to be affected by property type/use. For this study, CDRs were calculated for each sensitive type/use for soil, groundwater, soil gas, and indoor air.

Of note, contamination in soil gas for all sensitive property types/uses, both above and below regulatory standards, was significantly higher than for other media. As previously discussed, this data affirms the need for inclusion of soil gas sampling within the protocol of many subsurface investigations.

The property types/uses with the highest commercial/industrial CDRs for soil contamination include metal fabrication, plating facilities, historical manufacturing, and heating oil USTs (see **Table 4**).

Table 4: Contamination in Soil

Property Type	Total # of Sites (n)	Contamination	Above Residential Reg.	Above Commercial / Industrial Reg.
ASTs – Bulk Storage	33	67%	33%	12%
Auto Service	273	73%	22%	12%
Commercial Print Shops	24	75%	33%	8%
Dry Cleaners	172	63%	21%	5%
Heating Oil USTs	14	64%	29%	14%
Historical Manufacturing	231	81%	30%	16%
Metal Fabrication	30	83%	53%	30%
Off-Site Issues	67	78%	24%	12%
Plating Facilities	23	87%	35%	17%
USTs	470	71%	26%	9%

The commercial/industrial CDR for groundwater contamination was highest for off-site issues, dry cleaners, historical manufacturing, USTs, and auto service (see **Table 5**).

Table 5: Contamination in Groundwater

PropertyType	Total # of Sites (n)	Contamination	Above Residential Reg.	Above Commercial / Industrial Reg.
ASTs – Bulk Storage	22	50%	27%	14%
Auto Service	118	58%	23%	16%
Commercial Print Shops	21	38%	24%	5%
Dry Cleaners	106	58%	41%	19%
Heating Oil USTs	10	40%	20%	10%
Historical Manufacturing	114	67%	40%	17%
Metal Fabrication	19	68%	32%	5%
Off-Site Issues	33	82%	52%	33%
Plating Facilities	5	100%	100%	0%
USTs	249	71%	40%	16%

Plating facilities, historical manufacturing, and off-site issues had the highest commercial/industrial CDR for soil gas (see **Table 6**).

Table 6: Contamination in Soil Gas

PropertyType	Total # of Sites (n)	Contamination	Above Residential Reg.	Above Commercial / Industrial Reg.
ASTs – Bulk Storage	19	32%	21%	16%
Auto Service	178	74%	42%	33%
Commercial Print Shops	23	52%	30%	30%
Dry Cleaners	281	86%	54%	44%
Heating Oil USTs	10	50%	40%	30%
Historical Manufacturing	203	80%	51%	47%
Metal Fabrication	22	77%	55%	36%
Off-Site Issues	114	93%	61%	39%
Plating Facilities	21	90%	67%	48%
USTs	313	70%	36%	27%

The commercial/industrial CDR for indoor air contamination ranked highest for off-site issues, metal fabrication, dry cleaners, and historical manufacturing (see **Table 7**).

Table 7: Contamination in Indoor Air

PropertyType	Total # of Sites (n)	Contamination	Above Residential Reg.	Above Commercial / Industrial Reg.
ASTs – Bulk Storage	13	0%	0%	0%
Auto Service	65	31%	18%	12%
Commercial Print Shops	16	12%	12%	12%
Dry Cleaners	96	55%	33%	26%
Heating Oil USTs	8	12%	12%	12%
Historical Manufacturing	88	41%	25%	20%
Metal Fabrication	10	30%	30%	30%
Off-Site Issues	45	80%	40%	31%
Plating Facilities	6	17%	17%	17%
USTs	145	21%	14%	10%

How Much Do Phase II Investigations Cost?

Of the 1,755 sites studied, we obtained Phase II investigation costs for 1,602 sites. The average cost of a Phase II investigation was $12,785 (see **Table 8**). The Phase II investigations encompassed a wide variety of property types and geographical locations, each with distinct scopes and purposes, all of which influenced the investigation costs. In this regard, the minimum Phase II cost was $4,100 and the maximum cost was $60,000. This data was collected from fifteen consultants who perform Phase II investigations nationwide, offering a well-rounded representation of its average ballpark cost. It's important to note that the Phase II costs collected represent the initial investigation performed at the property. Subsequent investigations may have occurred but were not factored into this study.

Table 8: Initial Phase II Cost

Number of Sites	1,602
Average Cost	$12,786
Minimum Cost	$4,100
Maximum Cost	$60,000

Does the Presence of Contamination Increase with Age?

The data from the EBA study told an interesting story about the correlation of contamination and age for dry cleaners (**Figure 1**) and USTs (**Figure 2**). These graphs show a positive correlation between age and contamination for these property types. In other words, as time progresses, contamination above regulatory standards was reported in greater frequency for these property types. It should be noted that releases above regulatory standards not only increased as time went by but were also reported in the early years of these property types, most notably less than ten years, and even less than five. The results are indicative that age is not the only factor determining risk for these property types.

Figure 1: Dry Cleaners – Does Contamination Increase with Age?

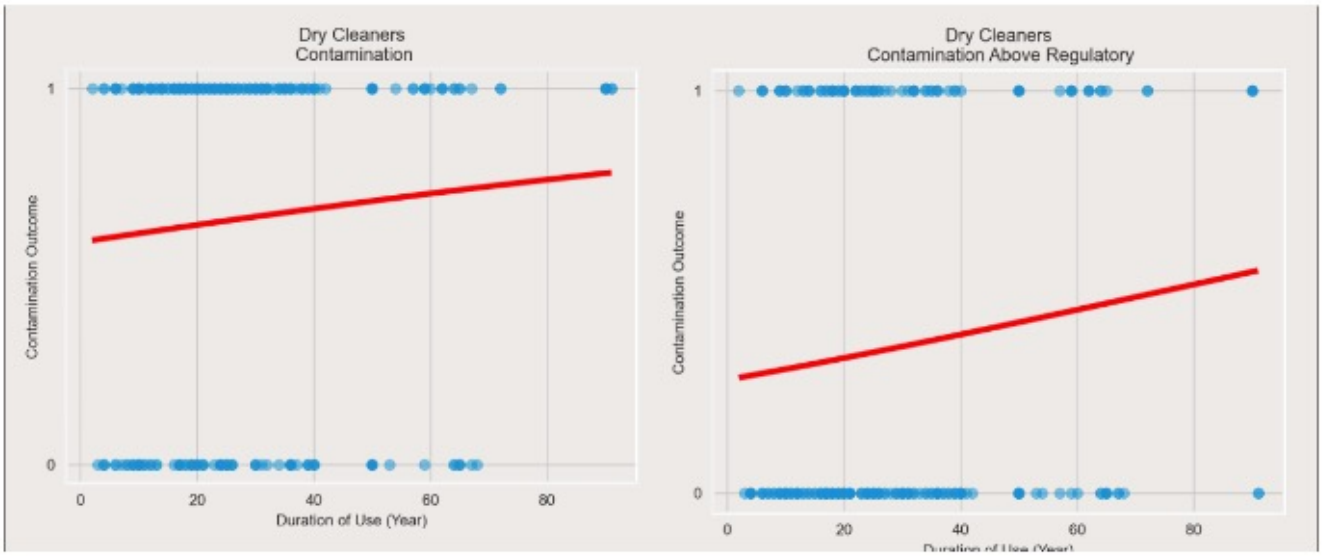
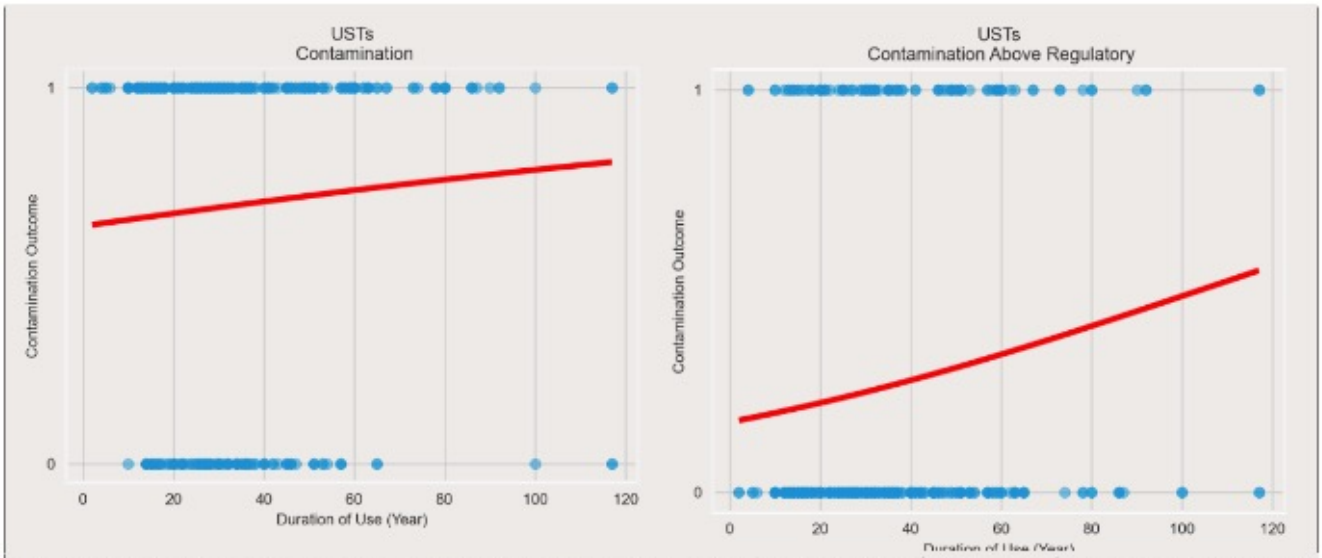


Figure 2: USTs - Does Contamination Increase with Age?

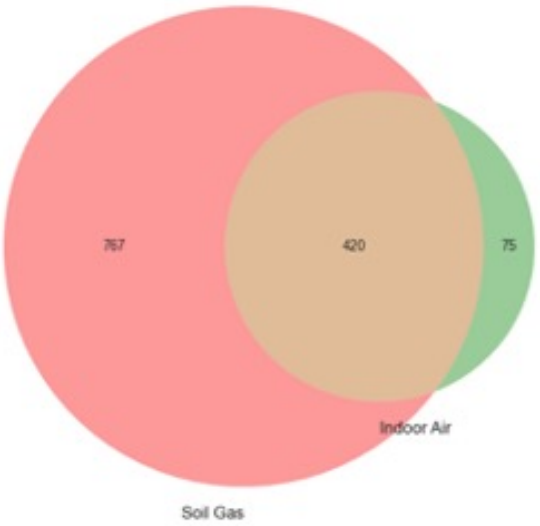


Figures 1 and 2 show the correlation between the presence and absence of contamination (on the Y-axis) in relation to the number of years an operation of concern (X-axis). The presence of contamination is marked on the Y-axis as "1" and the absence of contamination is marked on the Y-axis as "0".

Do Basements and Crawl Spaces Help Mitigate Vapor Intrusion?

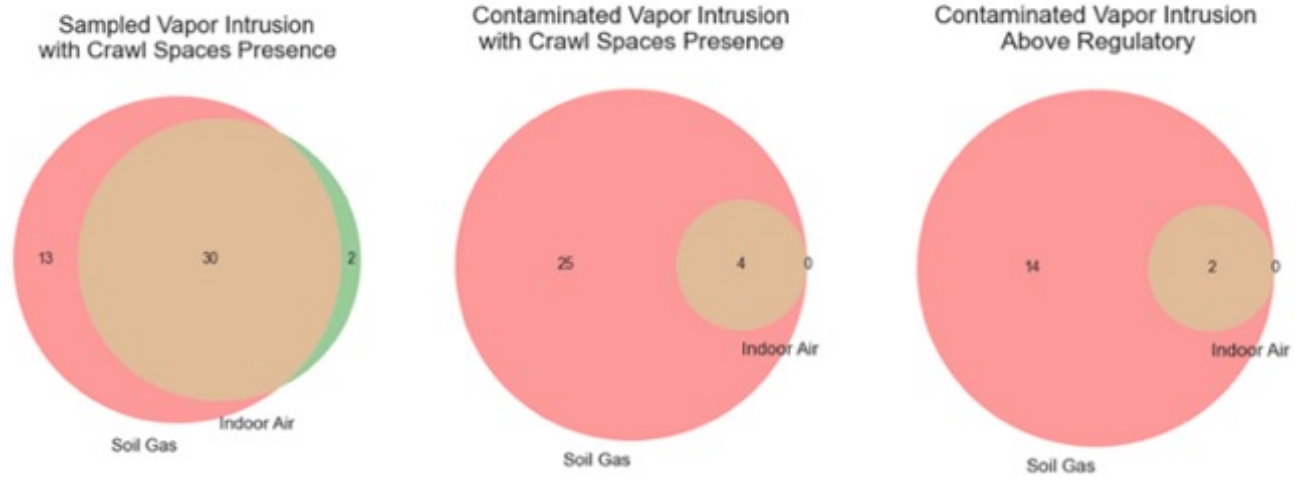
Environmental Professionals often surmise that the presence of a crawl space beneath a building may mitigate the effects of volatile contaminants to the indoor air inhalation exposure pathway. That supposition generally comes from the professional's experience or that of their firm/bank, which is limited for even the most seasoned veteran. However, the large data set generated during this study provides some viability to the theory. As seen in **Figure 3**, the number of properties in the data set where samples were collected for soil gas only (767), indoor air only (75), or both (420) was fairly robust, totaling 1,262 sites.

Figure 3: Sampled Vapor Intrusion



Although the number of sites constructed over crawl spaces where soil gas and/or indoor air samples were collected was smaller (45), the data still provides insight into the impacts a crawl space can have on vapor intrusion. Of the 45 crawl space sites where soil gas and/or indoor air samples were collected, contaminants were detected in soil gas at 25 sites and found in both soil gas and indoor air samples at only 4 sites (see **Figure 4**). The data is even more compelling when comparing contaminant concentrations to regulatory thresholds. Soil gas criteria were exceeded at 14 of those sites, and only two sites showed both soil gas and indoor air concentrations exceeding regulatory criteria.

Figure 4: The Impact of Crawl Spaces on Vapor Intrusion

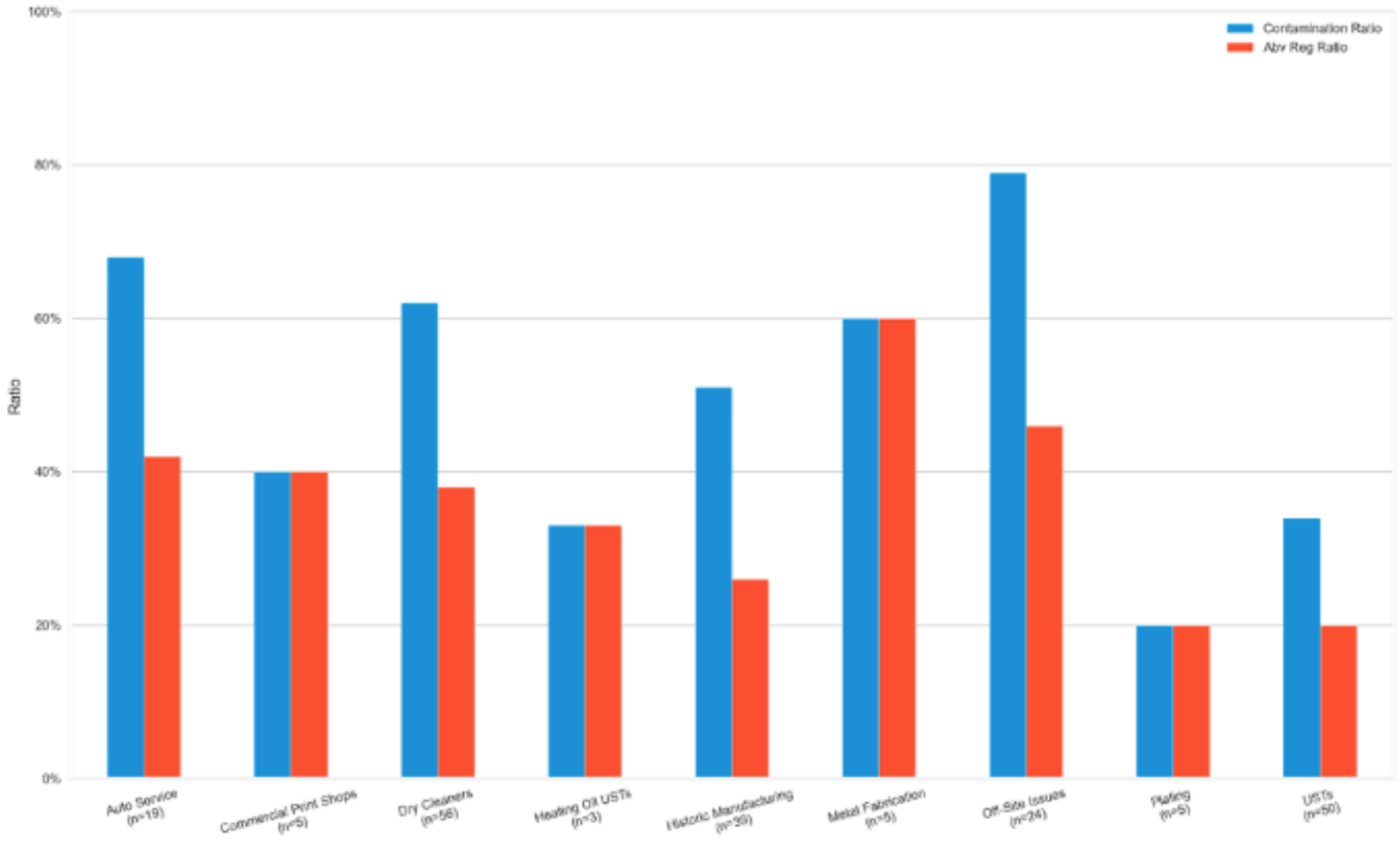


This data seems to support the theory that the presence of a crawl space, and even subsurface parking garages, can have a mitigating effect on volatile contaminants impacting indoor air.

Indoor Air Contamination Ratio by Property Type

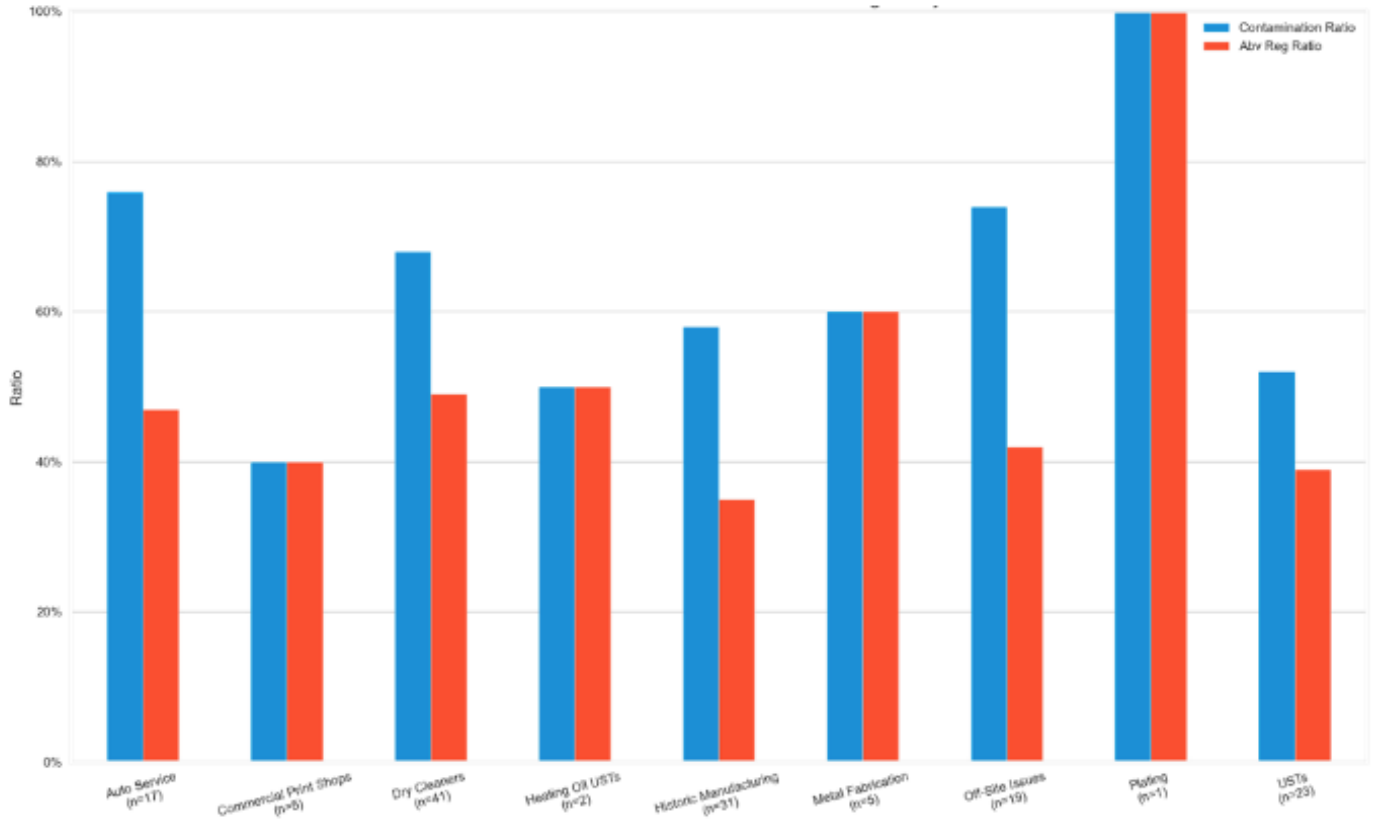
Regardless of property type, the data gathered during this study demonstrates that threats to indoor air inhalation when volatile contaminants are present is worthy of concern. When volatile contaminants are detected in soil gas, those same contaminants are frequently found in indoor air (see **Figure 5**).

Figure 5: Indoor Air Contamination Ratio by Property Type - When Soil Gas is Contaminated



That frequency was more pronounced at properties where soil gas was also found to exceed regulatory criteria (see **Figure 6**).

Figure 6: Indoor Air Contamination Ratio by Property Type - When Soil Gas is Contaminated Above Regulatory Ratio



Remedial Cost Estimates – What Does it Cost to Remediate Impacted Properties?

While this might seem like a simple question to answer, remedial cost data is not widely available and is extremely variable and complex. We asked our members to provide remedial cost estimate data for the eleven sensitive property types/uses in our study and were only able to collect 110 total data points. The data that was collected shows that remedial cost estimates vary greatly. Factors such as regionality, regulatory environment, and concurring contaminant plumes impact these numbers significantly. Additionally, these estimates are not reflective of final remedial costs. For risk managers who are tasked daily with quantifying the financial impact of contaminated properties to their transactions, this type of data is extremely valuable but was beyond the scope of this study. Additional research by the study participants is underway and will be available in the future.

Compliments to Lender/Consultant Decision Tree

The results of this study provide risk mangers one more layer of information when determining risk. There are multiple layers to the risk decision, and those layers have always included property type/use and CDRs. However, thanks to the dataset provided by the fifteen participant EBA firms (Figure 7), we can now assign a risk rating to property types. The CDRs naturally fall into the definition of a REC – the "likelihood of a release" – and this data, coupled with our personal experience, can help us better determine what is a REC in a Phase I ESA.

Figure 7: Participating EBA Firms in the Phase II Data Collection