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February 14, 2020

Subject: **Response to Agency Comments on *Vapor Intrusion Assessment and Work Plan* dated September 27, 2019, Tyco Fire Products LP, Stanton Street Facility, Marinette, Wisconsin, WID 006 125 215**

Dear Ms. Dodds,

On behalf of Tyco Fire Products LP (Tyco), Jacobs Engineering Group Inc. (Jacobs) has prepared this response to U.S. Environmental Protection Agency (EPA) and Wisconsin Department of Natural Resources (WDNR) (Agencies) comments on the document referenced above related to a vapor intrusion (VI) assessment at the site. The comments were provided in a letter attached to an email from Ms. Dodds delivered on December 19, 2019. For ease of review, the agency comments are presented in italics followed by the Tyco response in plain text.

Response to Comments

General Comments:

1. Vapor Intrusion (VI) Pathways: *A site investigation under Wisconsin Admin. Code Ch. NR 716 requires that the degree, nature and extent of contamination are defined to allow the selection of an appropriate remedial action. While past remedial actions implemented at the Stanton St. site minimize the potential for groundwater migration, the risk posed by chlorinated volatile organic compounds (CVOCs) in shallow groundwater and soil remains and should be evaluated for all potential pathways. This evaluation should include identifying buildings whose design (small enclosed offices) or occupancy (sensitive receptors) create spaces with an enhanced VI concern. Presuming that building use and occupants on this large property is not static, protocols being used to prevent future risks should be defined.*

Response: Tyco will further assess the potential VI pathways associated with the presence of CVOCs in shallow groundwater and/or soil at the site buildings. This will include considering future building use and occupancy and defining protocols to limit future VI-related risks. Findings from the follow-on VI assessment will help define to what extent potential risks are present and whether future risks may be present. Please note that the industrial nature of the facility, including its use of volatile organic compounds (VOCs) as part of manufacturing processes at several buildings within the facility, may significantly complicate results interpretation. For certain buildings, vapor intrusion-related contributions, if any, may represent a fraction of VOCs present in indoor air as a result of manufacturing activities. This fraction may not be readily quantifiable and its mitigation provide no tangible benefit. Additionally, WDNR indicates in its VI guidance that when a VOC is also a chemical used in a manufacturing process, Occupational Safety and Health Administration (OSHA) standards or other occupational inhalation

exposure guidelines apply to the occupational exposure in the indoor air as long as the VOC is used (WDNR 2018, Section 6.1).[1]

As will be further explained in the responses to comments below, EPA and WDNR's comments expand the scope of work and sampling efforts needed to complete the assessment under the approach proposed in the initial work plan (Jacobs 2019).[2] This is because of the increased number of additional buildings and utility lines that are proximate to monitoring wells where concentrations of VOCs are present at concentrations exceeding the lower screening levels recommended by EPA and WDNR (see Comment 4). The expansion in scope of work necessitates using a prioritization approach focused on buildings as an alternative to the initial work plan. To that end, use of the quantitative decision framework (QDF) as presented in Venable et al. (2015)[3] is proposed to assist with the prioritization process. Please note that indoor air sampling at Building 14 will proceed ahead of QDF preparation to address EPA and WDNR's concern noted in Comment 2.

The QDF will consist of scoring each site building (or portions of building) based on available information to assess the building's VI potential, including building-related information (e.g., occupancy, size) and subsurface-related information (source location and concentrations). The higher the score, the greater the potential for the VI pathway to be complete. Buildings with the highest scores will be prioritized for additional assessment. Uncertainty factors also will be assigned to quantify the confidence level in each piece of information needed to score the buildings. The QDF also can be used to identify buildings for which there are sufficient lines of evidence to rule out the VI pathway or conclude that it is unlikely. This approach is preferred when there is a large number of buildings warranting potential assessment within a given facility. Jacobs has successfully used this approach at large facilities in the United States. Additional information related to the QDF process is provided in Attachment A.

For the highest-scoring buildings, indoor air sampling is proposed to be conducted first. Indoor air sampling results combined with additional lines of evidence will help determine whether further assessment is needed, such as subslab soil gas sampling and the assessment of preferential pathways, or whether there is no evidence of indoor air concern related to VI. Consistent with both EPA and WDNR guidance, multiple indoor air sampling events may be needed to support this evaluation (EPA 2015, Section 6.4.1; WDNR 2018, Section 5.5.2, Table 5c).[4]

Although Wisconsin Administrative Code § NR 716.11(5)(g) requires subslab soil gas sampling when soil, soil gas, or groundwater indicates vapors may migrate to the foundation of an occupied building (WDNR 2017),[5] WDNR VI guidance also acknowledges that other site-specific conditions are permissible in this evaluation (WDNR 2018, Figure 3a). The approach consisting of sampling indoor air before subslab soil gas or preferential pathway samples is proposed here for the following reasons:

- As noted above, EPA and WDNR's recommendations increase the number of buildings that may require VI evaluations and ultimately will increase the timeframe needed to complete these. Sampling indoor air first in combination with a building survey before and/or at the time of sampling will help confirm within a relatively shorter timeframe whether potential VI concerns exist.

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[1] Wisconsin Department of Natural Resources (WDNR). 2018. "Addressing Vapor Intrusion at Remediation & Redevelopment Sites in Wisconsin, Wis. Stat. Ch. 292; Wis. Admin. Code Ch. NR 700." Remediation and Redevelopment Program, Publication RR-800. 105p., January. Accessed at https://dnr.wi.gov/files/PDF/pubs/rr/RR800.pdf.

[2] Jacobs Engineering Group Inc. (Jacobs). 2019. *Vapor Intrusion Assessment and Work Plan, Tyco Fire Products LP, Marinette, Wisconsin*. Technical Memorandum to U.S. Environmental Protection Agency and Wisconsin Department of Natural Resources, 65 p. September 27.

[3] Venable, P., T. Chaundhry, D. Caldwell, I. Rivera-Duarte, C. Lutes, L. Lund, and K. Hallberg. 2015. *A Quantitative Decision Framework for Assessing Navy Vapor Intrusion Sites*. Naval Facilities Engineering Command Engineering and Expeditionary Warfare Center, TR-NAVFAC-EXWC-EV-1603, 581 p. June. Accessed at https://clu-in.org/download/issues/vi/TR-NAVFAC-EXWC-EV-1603.pdf.

[4] U.S. Environmental Protection Agency (EPA). 2015. *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air*. Office of Solid Waste and Emergency Response (OSWER), OSWER Publication 9200.2-154, 267 p. June. Accessed at https://www.epa.gov/sites/production/files/2015-09/documents/oswer-vapor-intrusion-technical-guide-final.pdf.

[5] Wisconsin Department of Natural Resources (WDNR). 2017. *Groundwater Quality*. Wisconsin Administrative Code §NR 140. February. Accessed at https://docs.legis.wisconsin.gov/code/admin_code/nr/100/140.pdf.

- The proximity of the water table to building foundations increases the potential presence of VI-related preferential pathways (e.g., building sumps as noted in Comment 4 or utility conduits intercepting the groundwater table). These pathways cannot readily be identified through subslab soil gas sampling. Collecting samples from preferential pathways, such as water samples from sumps or air samples from sewer line cleanouts or manholes, may confirm whether VOCs are present; however, concentrations in these samples cannot readily be compared to screening levels or used to quantify risks to the indoor air. This is because the mere presence of VOCs in utility conduits does not necessarily indicate these VOCs are materially impacting indoor air. Ultimately, it is air sampling that helps determine whether inhalation risks may exist for the building occupants.

An updated work plan that includes the QDF assessment and revised VI sampling program will be prepared within 60 days.

2. Building 14: *The VI assessment of Building 14 is a priority considering occupancy, use, and proximity to monitoring well MW067S where trichloroethylene (TCE) is present in groundwater at 100 ppb* [parts per billion]*. WDNR guidance document RR800, Section 3.4 recommends that when TCE is a contaminant of concern, the demographics of potential receptors should be determined, and sampling done as soon as possible if women of child-bearing years (age range of 14 to 44) are present. If members of this sensitive population work in Building 14, the initial round of sampling should be completed as soon as possible. We recommend that a quick lab turnaround be used in such cases, and that the Agencies are provided with the results upon receipt from the lab.*

Response: Review of potential receptors at Building 14 indicates at least one receptor is meeting the above criteria; therefore, on behalf of Tyco, Jacobs has conducted air sampling, as follows:

- Five indoor air samples, including one duplicate, and one outdoor air sample were collected at Building 14 from the following locations:
  - One indoor air sample and a duplicate were collected from the office/lunchroom area in the central portion of the building.
  - One indoor air sample was collected from the wastewater treatment area in the eastern portion of the building.
  - One indoor air sample was collected from the groundwater treatment area in the western portion of the building.
  - One indoor air sample was collected in the extended western portion of the building where the Vibratory Shear Enhanced Processing units are located.
  - One outdoor (ambient) air sample was collected on the north side of the building near the air intake.
- The indoor and outdoor air samples were collected at breathing zone height into pre-evacuated, individually certified, 6-liter Summa canisters equipped with flow controllers set for a sampling duration of 8 hours, as is typical in non-residential settings (WDNR 2018, Section 5.4.3)[6]
- The samples were submitted to a laboratory under typical chain-of-custody protocol for gas chromatography-mass spectrometry (GC-MS) analysis of TCE and its common degradation products, cis-1,2-dichloroethene and vinyl chloride, using EPA TO-15 analytical method.

Because Building 14 is an active groundwater and wastewater treatment facility, water undergoing treatment could contribute VOCs to the building indoor air, which may not be related to the migration of vapors from the subsurface. Therefore, concurrent with the indoor air sampling event, water influent samples also were collected and analyzed for VOCs.

[6] Wisconsin Department of Natural Resources (WDNR). 2018. *Addressing Vapor Intrusion at Remediation & Redevelopment Sites in Wisconsin*. Wisconsin Statute Chapter 292; Wisconsin Administrative Code Chapter NR 700. Remediation and Redevelopment Program, Publication RR-800, 105 p. January. Accessed at https://dnr.wi.gov/files/PDF/pubs/rr/RR800.pdf.

The sampling occurred on February 11, 2020, based on canister availability from the laboratory. As discussed with EPA during a telephone call on February 6, 2020, indoor air sampling results will be provided in the next quarterly report, unless concentrations above indoor air vapor action levels (as defined by WDNR) are identified in which case results will be shared with the agencies after the data review is completed.

3. Indoor Air Sampling: *Indoor air sampling is not proposed in the VI Work Plan. Indoor air sampling for commercial or industrial spaces isn't necessarily recommended per RR800 and the guidance (Table 5c) states that this depends on sub-slab results. However, if there are women of childbearing years working in the buildings, indoor air samples should be taken during the first round of sampling to quickly assess the risk to these sensitive receptors. If that demographic does not exist, the decision regarding indoor air sampling can wait until after the sub-slab results are available. The location of indoor air samples should be chosen based in part on the results of the preferential pathway assessment, with some samples taken in rooms serviced by plumbing features.*

Response: It is Tyco's understanding that the need to prioritize action and conduct indoor air sampling in the above-described situation applies to instances where TCE may be present in indoor air (WDNR 2018, Section 3.4.1). The presence of a significant TCE source at the site has not been confirmed, and detections of TCE in groundwater are limited to three monitoring wells in the northwestern portion of the facility (Jacobs 2019, Table 2, Figure 3) near Building 14. As noted in response to Comment 2, indoor air from Building 14 was sampled on February 11, 2020.

Furthermore, as noted in response to Comment 1, the QDF approach is proposed to score each site building, with indoor air samples collected from the highest-scoring buildings. Subslab soil gas or preferential pathway samples may be collected, as needed, based on the indoor air sampling results and other lines of evidence.

Specific Comments:

4. Page 2, Section 2, paragraph 2: *A comprehensive evaluation of the potential for VI at this site should include areas where groundwater comes in contact with building foundations. The VI Work Plan did not provide any information on groundwater gradients within the containment system, nor did it contain an assessment of groundwater elevations in relation to the foundations of site buildings, including whether any of these buildings have features such as sumps that would increase the likelihood of VI. The description of the hydrogeologic setting on page 2, paragraph 2 states that groundwater within the containment area occurs within a few feet below ground surface. It also states that the operational criterion of the extraction wells is to maintain the water table at levels below the ground surface to prevent site flooding. It seems possible, given this situation, that the slabs of at least some of the buildings may be in contact with groundwater. If this is the case, it changes the criteria for screening for both chlorinated volatile organic compounds (CVOCs) and polar volatile organic compounds (PVOCs). For CVOCs, the threshold becomes the NR 140 Preventive Action Limit for all compounds, instead of the Enforcement Standard for PCE and TCE, and the groundwater vapor risk screening level (VRSL) for all other compounds.*

Response: Review of groundwater elevation data, including recent data collected in preparation for the 2019 annual report, indicates it is possible for groundwater to be in contact with building foundations.

The groundwater analytical data provided in the work plan (Jacobs 2019, Table 2) already compares VOC concentrations measured in the site monitoring wells to the Wisconsin Administrative Code § NR 140 preventive action limit (PALs). The attached figure, which is a revised version of the figure provided in the work plan (Jacobs 2019, Figure 3), shows locations where PAL exceedances were identified for at least one VOC at a given monitoring well during its last sampling event (2019, if available; otherwise past data). As shown on the revised figure, the number of monitoring wells near buildings where PAL exceedances were identified is substantially greater compared to those with VISL exceedances that were highlighted in the initial work plan.

Because of the expanded scope and the number of buildings near a PAL exceedance, Jacobs proposes to use the above-referenced QDF approach. As noted previously, this approach will help prioritize buildings for which assessment needs to be conducted first and those for which there is sufficient lines of evidence to rule out the VI pathway or conclude that it is unlikely. As previously mentioned above, note that VOC use as part of manufacturing processes at several buildings within the facility may complicate assessment. As indicated by WDNR guidance, OSHA standards or other occupational inhalation exposure guidelines are applicable for VOCs that are actively used.

5. Page 2, Section 2, paragraph 3: *A comprehensive evaluation of the potential for VI at this site should include areas with VOC impacted soil. Page 2, paragraph 3 states "RCRA* [Resource Conservation and Recovery Act] *facility investigations conducted through 2000 identified the presence of VOCs in site soil and groundwater of several areas at concentrations exceeding applicable screening levels and/or standards ... " and paragraph 4 states "VI can occur when VOC vapors in contaminated soil or groundwater migrate into the indoor space of overlying buildings." RR800 (Section 3) guidelines for determining whether vapor sampling is necessary includes a criterion for proximity to soil contamination in addition to those for utilities and groundwater. There are separate criteria for CVOCs (Section 3.4.2) and PVOCs (Section 3.5.3). Although this VI Work Plan considers utilities and groundwater, an assessment of whether buildings are within the screening distances to known areas of soil contamination is not provided.*

Response: The revised QDF evaluation will account for the soil data, some of which historically have exceeded applicable screening levels and/or standards. Please note that:

- The soil data were collected close to 20 years ago and therefore are not representative of contemporary conditions. The analysis primarily has focused on recent groundwater quality data whenever available. Historical soil data from the 2000 RCRA facility investigations were generally consistent with the groundwater data.
- The screening levels and/or standards historically used for evaluating VOC concentrations in soil in the 2000 RCRA facility investigations were either (1) the Wisconsin Administrative Code § NR 720.10 generic residual contaminant levels for soil based on the protection of groundwater (2) or equivalent values (i.e., for the protection of groundwater) based on EPA Region 3 risk-based concentrations for soil at industrial sites (URS Corporation 2001, Section 5).[7] These values should be not be construed as VI screening levels (which typically are not derived from soil data). In addition, historical exceedance of these values is not necessarily evidence of a continuing VI source.

6. Page 3, Section 2: *All subslab, sewer cleanout, manhole, and indoor air samples should be analyzed by Method TO-15 for the detection of VOCs.*

Response: Under the approach described in response to Comment 1, the QDF evaluation will be used to identify buildings for further evaluation or for which there are sufficient lines of evidence to rule out the VI pathway or conclude that it is unlikely. Indoor air sampling is proposed to be conducted first at high priority buildings, and indoor air sampling results combined with additional lines of evidence will help determine whether further assessment is needed, such as subslab soil gas sampling and the assessment of preferential pathways, or whether there is no evidence of indoor air concern related to VI. Tyco proposes to analyze indoor air samples for the VOCs detected above applicable screening levels in site groundwater and/or soil. Common biodegradation compounds also will be analyzed, as appropriate. The analytical list will be provided in the updated work plan.

7. Page 3, Section 2, bullet 2: *Another potential indoor air exposure pathway exists at the site, not necessarily due to VI but to the volatilization of chemicals from the wastewater treatment plant/pumping station in Building 14. The design of the area containing the treatment operations and secondary containment system and how it separates air movement from the office and lunchroom portion of the building should be described in more detail. Please include and evaluate this potential exposure pathway.*

[7] URS Corporation. 2001. *RCRA Facility Investigation, Tyco Suppressions Systems – Ansul, Stanton Street Facility, EPA ID#WID 006 125 215.* Report to Tyco Suppression Systems – Ansul. February 16.

Response: Pertinent information was collected as part of the indoor air sampling program conducted at Building 14 on February 11, 2020 (refer to response to Comment 2 and 16) and documented in a building survey form.

8. Page 3, Section 3: *The desktop evaluation of VI started with known areas of groundwater contamination and then evaluated whether buildings or utility lines were within screening distances to those areas. In the decision matrix in Section 3.1, the first bullet indicates that existing groundwater quality data were reviewed to identify shallow monitoring wells where the concentrations of one or more VOCs exceed calculated VI screening levels. The set of existing groundwater quality data appears to include sampling events from 2000 through 2019. Figure 3 illustrates locations where VOC sampling has occurred from 2000 through 2019 and no vapor intrusion screening level (VISL) exceedances exist. In some cases, this provides historical perspective on VOC contamination but does not define the current risk. Figure 3 should be updated to clarify the dates the samples were collected for the VISL evaluation.*

Response: The dates of the sampling results for each location are included in Table 2. A revised Figure 3 also is attached that includes the dates sampled.

As noted in the work plan (Jacobs 2019, Section 3.3), the VI desktop evaluation used VOC data from the most recent sampling event available for a given shallow monitoring well (i.e., screened at the water table) — typically, the 2009 (baseline groundwater sampling event before the barrier wall was fully in place), 2018 (required agency selected and approved barrier wall groundwater monitoring plan update [CH2M 2015] VOC sampling, conducted every 5 years), or 2019 (additional samples collected to supplement the 2019 VI assessment and work plan) sampling events. When no data were available from these periods, 2000 data were used corresponding to the RCRA facility investigations. For 2000 data, where higher detections or screening level exceedances were noted, those wells were typically re-sampled in 2019. For abandoned wells for which the last sampling event shows exceedance of VI screening levels, samples were collected from nearby replacement wells in 2019 or a temporary groundwater grab sample. For instance, 2000 data from former well MW005S (aka GW005S) located beneath Building 14 showed a VI screening level exceedance for TCE. Accordingly, a sample was collected in 2019 from nearby monitoring well MW067S to assess current risks. The results were used as the basis for conducting VI sampling at Building 14. Additional examples of sampling alternative wells are provided in the notes of the groundwater data summary table (Jacobs 2019, Table 2). In some cases, wells with screening level exceedances observed in 2009 and 2018 were sampled in 2019 (to the extent these wells were viable and accessible) to see if there were any changes in the concentrations.

9. Page 4, Section 3.1: *Sewer vapor concentrations fluctuate greatly within sewer lines due to water drag, slope changes or stack effect. Sewer cleanouts leading into the buildings should also be sampled simultaneously. Any detections of COCs in sewer cleanouts should be followed up with indoor air sampling.*

Response: As discussed in response to Comment 1, the proposed approach will focus on indoor air sampling at the buildings that score highest under the QDF. As indicated, subsequent sampling events may be needed to address potential temporal variability in indoor air concentrations. Temporal variability may be due in part to the preferential pathway concentration fluctuations described in this comment by EPA and WDNR, though a variety of other factors may also contribute to changes in indoor air concentrations (e.g., heating, ventilation, and air conditioning operation; barometric pressure; outside temperature; etc.). Assuming preferential pathway effects are materially significant, they should measurably impact indoor air concentrations. Sewer sampling may be conducted in the future should indoor air sampling data and other lines of evidence point to sewer lines as a possible vapor entry point. Note that Tyco completed significant improvements to the sewers over the last several years to minimize subsurface conveyance of stormwater and reduce the potential for groundwater infiltration into the existing stormwater system. From 2016 to 2018, three outfalls were abandoned and replaced with overland flow features and most of the industrial and storm sewers were lined with cure-in-place liners or abandoned. These activities are documented in September 27, 2019 Stormwater Improvement Construction Completion Report (Jacobs 2019). Tyco also completed lining efforts on their sanitary sewer

lines in 2019 to further minimize groundwater infiltration in those lines as well. These efforts are expected to have contributed to limiting sewer vapors as a concern for VI.

10. Page 6, Section 3.4.1, bullet 2: *If Tyco confirms a connection between sewer lines and Buildings 14 and 36, manhole sampling, sewer lateral cleanout and indoor air sampling should be completed. The paired data collection along with sub slab soil gas data will be put together to identify the dominant vapor migration flow path. The indoor air samples should be collected in restrooms or a room with a floor drain.*

Response: See response to Comment 9.

11. Page 7, bullet 1: *If Tyco confirms a connection between storm sewer lines and Building 62, sewer gas samples from the manhole and lateral cleanout connected to the building and indoor air sampling in room with a floor drain should be collected.*

Response: See response to Comment 9.

12. Page 7, Section 3.4.3: *High levels of ethyl benzene in groundwater warrant an investigation of the preferential pathway of all buildings potentially connected to sewer lines.*

Response: See response to Comment 9.

13. Page 7, Section 3.4.4: *It is not acceptable to evaluate the preferential pathways only for chlorinated solvents. All the manholes in the vicinity of TW-1 should also be evaluated for petroleum VOCs.*

Response: See response to Comment 9.

14. Page 8, Section 4.1: *The last paragraph of Section 4.1 describes the survey of the sewer lines within 100 feet of MW045S AND MW067S. In addition to drains and manholes, samples should be collected from cleanouts of any sewer penetrations to assess the potential for VI.*

Response: See response to Comment 9.

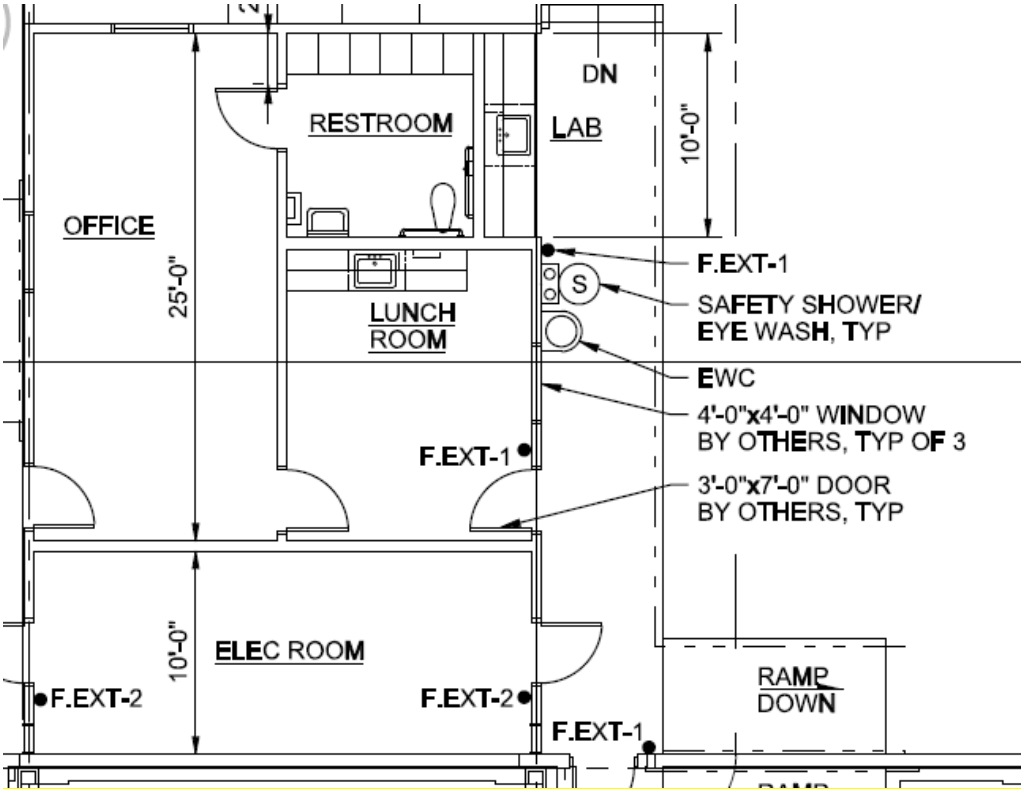
15. Page 8, Section 4.3: *Only one round of sampling has been proposed and references Table 5c of RR800. Table 5c specifies that one round may be appropriate for industrial buildings, however this is only appropriate for high volume sampling. Two to three sampling events is recommended for standard sampling. Because of the low toxic threshold of TCE, three rounds should be performed and at the time of year recommended in Table 5c (at least one round in the winter). For Building 14, a sample should be taken as soon as possible, another 2020 winter season, and a third later in 2020.*

Response: Tyco agrees with the proposed schedule for initial indoor air sampling at Building 14.

16. Page 9, Section 4.3, bullet 1: *Two sub-slab probes are proposed for installation in the "office and lunch room areas" of Building 14. The office is described to be "only 800 square feet" however, it is unclear if the lunch room is included, or if it is a separate space. Please clarify the square footage of each space and whether they are combined. Although two sampling locations may be sufficient for an 800 square foot area, additional information must be submitted to support this number. Building 14 was constructed in 2010 but the site had a long history before then. Please detail what activity occurred within the footprint of this building prior to construction that might have a bearing on the variability of sub-slab conditions and therefore the number of probes needed to characterize sub-slab vapor concentrations. This assessment should not delay the initial sampling in Building 14.*

Response: The approximately 800 square feet includes the office (approximately 300 square feet), lunch room (approximately 180 square feet), restroom (approximately 100 square feet), and electrical room (approximately 250 square feet), which are separately enclosed areas from the treatment area that constitute office- or support-type areas. Exhibit 1 provides a sketch of the space layout.

Exhibit 1. GWCTS Office and Support Areas



As noted in response to Comment 2, five indoor air samples, including one duplicate, and one outdoor air sample was initially collected at Building 14 on February 11, 2020. Subslab soil gas samples may be collected if indoor air sampling results indicate the potential for VI to be occurring as a result of vapor migrating from the subsurface. Initial review of readily available historical records was conducted and no other activities in the area of Building 14 were noted other than the area was used for parking and a former salt pile covered a portion of the area for a period of time. Additional review of site soil and groundwater data and the initial VI sampling event will be used to support the number and location of proposed subslab vapor samples, if any.

17. Page 9, Section 4.4: *Please provide the rationale for using 1-liter summa cannisters in lieu of more commonly used 6-liter cannisters.*

Response: The 6-liter canisters are used for indoor and outdoor air sampling. Both 1-liter and 6-liter canisters are commonly used for exterior or subslab soil gas sampling. Greater detection limits can be achieved using 6-liter canisters; however, 1-liter canisters are sufficient to achieve detection limits that are lower than the soil gas screening levels. Additional information is in Section 2.1 of Eurofins Air Toxics air sampling guide.[8]

18. Table 3, Building 41/42: *Paired indoor air sampling should be implemented where applicable.*

Response: Refer to responses to Comments 1 and 3 for details regarding the proposed approach.

19. Figures: *The scale of the figures in the report makes it difficult to review the information. Figures which show better detail of the layout of utilities should be submitted.*

[8] Eurofins Air Toxics. 2014. "Guide to Air Sampling, Canisters and Bags." 23p., June 27. Accessed at https://www.eurofinsus.com/media/161448/guide-to-air-sampling-analysis-2014-06-27_revised-logos.pdf.

Response: Revised figures will be provided as needed in the revised work plan.

We trust the enclosed response to comments meets with EPA's approval. Please contact Jeffrey Danko at 414-524-3344 if you have any question. Tyco is open to a call to discuss these responses to comments, if needed.

Regards,

Jacobs Engineering Group Inc.

Heather Ziegelbauer
Project Manager

Attachments
Revised Figure 3
Attachment – QDF

Copies to: Angela Carey/Wisconsin Department of Natural Resources
Rick Bethel/Johnson Controls
Joe Janeczek/Johnson Controls
Ryan Suennen/Tyco Fire Protection Products
Jeffrey Danko/Johnson Controls
Mariel Carter/Stephenson Public Library

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MW046S	
VOCs (µg/L)	5/3/2018
Benzene	76
Chlorobenzene	3,800
1,2-Dichlorobenzene	1,800
1,4-Dichlorobenzene	84
1,2-Dichloroethane	18 J
cis-1,2-Dichloroethene	390
Ethylbenzene	1,200
Methylene Chloride	110
Naphthalene	26
Toluene	3,900
Trichloroethene	66
Vinyl chloride	32
Xylenes, Total*	7,600
Acetone	3,900
4-Methyl-2-pentanone (MIBK)	130

MW117S	
VOCs (µg/L)	6/27/2019
Benzene	22
Chlorobenzene	370
Vinyl chloride	1.5 J

	MW006S***	MW118S
VOCs (µg/L)	10/29/2009	6/27/2019
Chlorobenzene	507	2.7
Chloromethane	26.1	0.32 U
1,2-Dichlorobenzene	105	1.3
Vinyl chloride	0.45 U	0.20 J

MW041S	
VOCs (µg/L)	5/3/2018**
Benzene	48 J
Chlorobenzene	1,500 J
1,2-Dichlorobenzene	170 J
1,4-Dichlorobenzene	24 J
Ethylbenzene	1,500 J
Xylenes, Total*	9,100 J

MW010S***	
VOCs (µg/L)	10/29/2009
Benzene	6.5 J
Chlorobenzene	190
1,2-Dichlorobenzene	1,400
1,4-Dichlorobenzene	26
1,2-Dichloroethane	16.1 J
Methylene Chloride	8 J
Naphthalene	351
Xylenes, Total*	1,258

	GW008S***	GW008S (GW Grab)
VOCs (µg/L)	9/13/2000	6/9/2019**
Chlorobenzene	130	63
1,2-Dichlorobenzene	110	240 J
1,4-Dichlorobenzene	17	17
Naphthalene	16 J	0.34 U

MW118S	
VOCs (µg/L)	6/27/2019
Benzene	86
Chlorobenzene	210
1,2-Dichlorobenzene	110
Methylene Chloride	10
Naphthalene	180

MW124S	
VOCs (µg/L)	6/26/2019
Benzene	2.2
Chlorobenzene	330
1,2-Dichlorobenzene	370
1,2-Dichloroethane	7.1
Methylene Chloride	2.0 J
Naphthalene	63
Vinyl chloride	0.75 J

	MW020S***	GW029S***	MW115S
VOCs (µg/L)	10/30/2009**	9/19/2000	6/26/2019
Benzene	2.1	9.2 U	0.97
Chlorobenzene	27.9	140	16
1,2-Dichlorobenzene	33	220	36
Ethylbenzene	2.5	240	1.3
Methylene Chloride	0.5 J	9 U	1.6 U
Naphthalene	10.9	14 U	0.58 J
Toluene	2.2	200	1.0 JB
Xylenes, Total*	1.8 U	1,950	0.22 U

MW003S	
VOCs (µg/L)	6/26/2019**
Benzene	3.3
Chlorobenzene	29
1,2-Dichloroethane	1.4
Vinyl chloride	1.3

TW001***	
VOCs (µg/L)	10/29/2009
Ethylbenzene	12,600
Methylene Chloride	94.9 J
Toluene	10,700
Xylenes, Total*	44,800

GW032S	
VOCs (µg/L)	9/18/2000
Benzene	2.1 J
Chlorobenzene	43
1,2-Dichlorobenzene	250

MW046S	
VOCs (µg/L)	10/28/2009
Chloromethane	0.98 J

MW048S
10/27/2009
All ND

GW047S	
VOCs (µg/L)	9/25/2000
Benzene	2

MW034S	
VOCs (µg/L)	10/30/2009
Methylene Chloride	0.51 J

MW009S
10/27/2009
All ND

MW043S
6/25/2019
All ND

MW042S
10/28/2009
All ND

GW004S
6/27/2019
No Exceedances

GW051S***	
VOCs (µg/L)	9/26/2000
Chlorobenzene	52
1,2-Dichlorobenzene	98
Ethylbenzene	150
Toluene	230
Xylenes, Total*	1,780
4-Methyl-2-pentanone (MIBK)	140

MW039S
10/30/2009
No Exceedances

GW040S	
VOCs (µg/L)	9/20/2000
Benzene	0.36 J

GW021S	
VOCs (µg/L)	9/20/2000
Benzene	0.42 J

MW067S		GW005S***
VOCs (µg/L)	6/27/2019	9/8/2000
Benzene	47	12
Chlorobenzene	1,800	26
1,2-Dichlorobenzene	1,100	130
1,4-Dichlorobenzene	35	1.9 U
cis-1,2-Dichloroethene	230	
Ethylbenzene	300	2.6 J
Methylene Chloride	7,400	26
Naphthalene	14 J	13
Toluene	1,500	25
Trichloroethene	100	16
Vinyl chloride	30	24
Xylenes, Total*	2,100	10.6 J
4-Methyl-2-pentanone (MIBK)	62 J	210

MW044S	
VOCs (µg/L)	10/29/2009
Chloromethane	3.5

MW011S	
VOCs (µg/L)	6/26/2019
Benzene	1.1
Chlorobenzene	150
1,4-Dichlorobenzene	21

	TW002***	GW-TW002 (GW Grab)
VOCs (µg/L)	10/29/2009	6/12/2019
Benzene	10.2 U	6.7 J
Chlorobenzene	991	750 J
Ethylbenzene	357	10 J
Methylene Chloride	20.3 J	1.6 UJ
Xylenes, Total*	3,430	9.4 J

GW012S
6/25/2019
No Exceedances

GW033S	
VOCs (µg/L)	9/18/2000
Benzene	0.25 J
Methylene Chloride	1.4

GW049S
9/26/2000
All ND

MW022S
10/28/2009
All ND

GW050S	
VOCs (µg/L)	9/22/2000**
Benzene	1.5
Methylene Chloride	2,700

MW065S
10/28/2009
All ND

MW064S	
VOCs (µg/L)	10/28/2009
Benzene	0.5 J

MW013S
10/27/2009
All ND

0 100 200 300
SCALE IN FEET

NOTES:

1. VISL = VAPOR INTRUSION SCREENING LEVEL
   J - INDICATES THE ANALYTE WAS POSITIVELY IDENTIFIED AND THE ASSOCIATED NUMERICAL VALUE IS THE APPROXIMATE CONCENTRATION OF THE ANALYTE IN THE SAMPLE.
   U - INDICATES THE ANALYTE WAS ANALYZED FOR BUT WAS NOT DETECTED ABOVE THE METHOD DETECTION LIMIT.
   ALL ND - ALL VOC RESULTS WERE NON DETECT.
   * XYLENES, TOTAL DATA FOR 200 AND 2009 ARE THE SUM OF THE META-, ORTHO-, AND PARA-XYLENE COMBINED OR THE RESULT OF THE DETECTED RESULT IF THE OTHERS WERE NON-DETECT OR THE HIGHEST NON-DETECT RESULT IF ALL WERE NON-DETECT.
   ** MAX VALUE BETWEEN PRIMARY AND DUPLICATE SAMPLES WAS REPORTED.
   *** WELL ABANDONED OR NOT VIABLE, ALTERNATIVE NEARBY WELL OR GROUNDWATER GRAB SAMPLE COLLECTED TO REPLACE OLDER DATA.
   GW005S - NEARBY REPLACEMENT MW067S
   TW001 - NEARBY REPLACEMENT MW041S AND MW045S
   MW006S - NEARBY REPLACEMENT MW118S
   GW008S - GROUNDWATER GRAB SAMPLE
   TW002 - TW002 GROUNDWATER GRAB SAMPLE
   MW010S - TW002 GROUNDWATER GRAB AND MW124S
   MW051S - NEARBY REPLACEMENT MW124S
   MW020S AND GW029S - NEARBY REPLACEMENT MW115S
2. MICROGRAMS PER LITER.
3. BOLDED VALUES INDICATE ATTAINMENT OR EXCEEDANCE OF THE WISCONSIN ADMINISTRATIVE CODE (WAC) NR 140 PREVENTATIVE ACTION LIMIT (PAL).
4. BLUE BORDER EXCEEDS SHALLOW WATER TABLE VISL SCREENING CRITERIA (ADJUSTMENT FOR RISK TO 10-5, AND TEMPERATURE, AND MODIFIED INDUSTRIAL GROUNDWATER ATTENUATION FACTOR TO ACCOUNT FOR SHALLOW WATER TABLE 10-3).
5. RED BORDER EXCEEDS INDUSTRIAL VISL SCREENING CRITERIA (ADJUSTMENT FOR RISK TO 10-5, TEMPERATURE, AND INDUSTRIAL GROUNDWATER ATTENUATION FACTOR 10-4) AND THE SHALLOW WATER TABLE VISL.
6. YELLOW SHADING INDICATES CONSTITUENTS POSSIBLY ATTRIBUTABLE TO CHEMDESIGN SPILLS.

LEGEND

- EW-5 OR BT-02 — EXTRACTION WELL OR TEST WELL
- MW002S OR MW115P — MONITORING WELL - SHALLOW OR PEAT
- MW002M — MONITORING WELL - MEDIUM
- MW002D — MONITORING WELL - DEEP (BEDROCK)
- PZ04 — PIEZOMETER
- VW-TB01 — VIBRATING WIRE PIEZOMETER
- SG1 — STAFF GAUGE
- WELLS PREVIOUSLY ABANDONED OR DESTROYED
- SHEET PILE WALL
- SLURRY WALL
- NO PAL OR VISL EXCEEDANCES
- PAL EXCEEDANCE(S)
- SHALLOW WATER TABLE VISL EXCEEDANCE(S)
- INDUSTRIAL AND SHALLOW WATER TABLE VISL EXCEEDANCE(S)
- GROUNDWATER GRAB SAMPLE LOCATION

FIGURE 3 - Revision 1
VAPOR INTRUSION ASSESSMENT LOCATIONS

TYCO FIRE PRODUCTS LP
MARINETTE, WISCONSIN

JACOBS

FILENAME: Figure3_09-2018_D3235600.dgn PLOT DATE: 2020\02\11 PLOT TIME: 4:34:31 PM

Attachment – Quantitative Decision Framework Overview

The Quantitative Decision Framework (QDF) developed by the U.S. Department of the Navy (Navy) in collaboration with Jacobs Engineering Group Inc. (formerly CH2M HILL, Inc.) (Venable et al. 2015) is proposed to determine a prioritization score for each building. The QDF provides a quantitative vapor intrusion (VI) decision framework through a step-by-step multiple lines of evidence weighting/scoring process. The development of this scoring process was based on a database analysis of Navy and U.S. Air Force sites nationwide impacted by chlorinated solvents. Venable et al. (2015) found that elevated indoor air concentrations attributable to VI in industrial buildings was associated with one or more of the following variables:

- Soil gas and groundwater volatile organic compound (VOC) concentrations significantly higher than default VI screening levels developed by the U.S. Environmental Protection Agency (EPA)
- Proximity to the location of the original VOC vadose zone release
- Small rooms (heating, ventilation, and air conditioning zones) with limited opportunity for dilution
- Atypical preferential pathways that facilitate significant vapor flow of VOCs into structures
- Fine-grained soil that retains VOCs close to the structure where they were released

The original QDF considers preferential pathways with a simple input of yes, no, or unknown. A more rigorous approach is proposed for the Tyco Fire Products LP Marinette, Wisconsin site, for which utilities as preferential pathways are of specific interest. In addition, the QDF will be adjusted to account for the shallow depth of groundwater at the site. The main elements of the QDF are:

- A flow chart showing the overall step-by-step process that provides “off-ramps” for cases of low VI potential and leads to scoring VI potential for other cases where a VI potential is present (Figure 1). An off-ramp also is provided for separate evaluation of atypical preferential pathways.
- Scoring VI potential, which allows a detailed evaluation of potential VI cases using multiple lines of evidence leading to a VI prioritization score. The range of weights in the scoring system are tailored to emphasize the importance of certain predictor variables identified in the data analysis, such as sample zone area, average subslab soil gas concentration (if available), average groundwater concentration, soil type, presence of atypical building-related preferential pathways, and distance to the point at which the chemicals were originally released. Figure 2 shows a sample scorecard.
- A separate and additional uncertainty score, which is computed based on the number of missing lines of evidence.

The total VI potential score can then be applied to make prioritization decisions for additional assessment and determine which buildings should be assessed first (see Figure 3).

After collecting indoor air data at buildings prioritized for additional assessment, the VI potential score and indoor air sampling data can be used to determine next steps (Figure 4). For instance, additional lines of evidence may be warranted to further rule out the VI pathway when a building has an elevated VI potential score, but indoor air concentrations that are below screening levels.

Reference:

Venable, P., T. Chaundhry, D. Caldwell, I. Rivera-Duarte, C. Lutes, L. Lund, and K. Hallberg. 2015. *A Quantitative Decision Framework for Assessing Navy Vapor Intrusion Sites*. Naval Facilities Engineering Command Engineering and Expeditionary Warfare Center, TR-NAVFAC-EXWC-EV-1603, 581 p. June. Accessed at https://clu-in.org/download/issues/vi/TR-NAVFAC-EXWC-EV-1603.pdf.

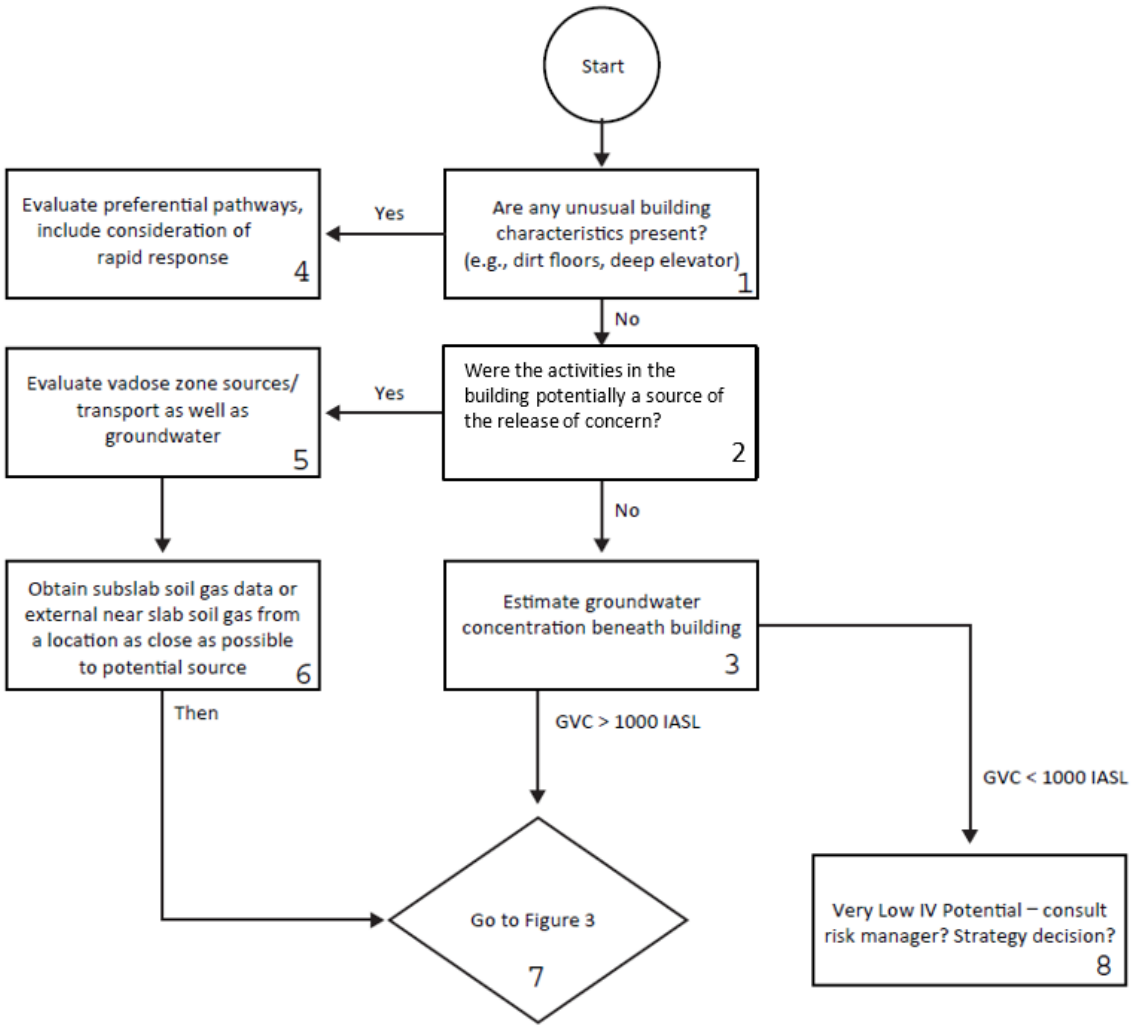

Figure 1. Quantitative Decision Framework – Groundwater Data Only

(After Venable et al. 2015, Figure 7-1)

Note: Refer to Figure 2 for information related to estimating groundwater vapor concentration (GVC) and indoor air screening level (IASL). The above approach will be adjusted to account for the shallow depth of groundwater at the site and absence of soil gas data.

Vapor Intrusion Potential Scorecard

Parameter	Range Observed	VI Prioritization Point Value	Interpretation
Sample Zone Area	**Area** < 100 ft^2	4	Smaller sample zones provide less potential for VOC dilution if contaminant flux (from either indoor or subslab sources) is equal.
	100 ft^2 < **Area** < 1000 ft^2	3	
	1000 ft^2 < **Area** < 10,000 ft^2 (or no information available)	2	
	10,000 ft^2 < **Area** < 100,000 ft^2	1	
	Area >100,000 ft^2	0	
Average Subslab Soil Gas (SSSG) Concentration	**SSSG** < [300 x Indoor Air (IA) VISL (chemical specific)]	0	Data analysis shows that concentrations above a minimum value in subslab are needed to observe any corresponding increase in indoor air concentrations.
	[300 x IA VISL] < **SSSG** < [2000 x IA VISL]	2	
	[2000 x IA VISL] < **SSSG** < [10,000 x IA VISL] (or no information available)	4	
	[10,000 x IA VISL] < **SSSG** < 100,000 x IA VISL]	6	
	SSSG > [100,000 x IA VISL]	8	
Average Groundwater Vapor Concentration **(GWVC)** (Deep soil gas concentration) (Calculated Using Interpolated Groundwater Concentration Beneath Sample Zone and Henry's Law or Results of Near Slab Soil Gas Sampling >15 ft below ground surface)	[100 x EPA IA VISL]>**GWVC**	0	Data analysis shows that concentrations above a minimum value in groundwater are needed to observe any corresponding increase in indoor air concentrations if groundwater is the source. When a strong vadose zone source is present, subslab concentrations may be substantially higher then would be expected based on groundwater results, but normally some groundwater impact would also be observed.
	[100 x EPA IA VISL (chemical specific)] < GWVC < [1,000 x EPA IA VISL (chemical specific)]	2	
	[1,000 x EPA IA VISL (chemical specific)] < **GWVC** < [10,000 x EPA IA VISL (chemical specific)] (or no information available)	4	
	[10,000 x IA VISL] < **GWVC** < [100,000 x EPA IA VISL]	6	
	GWVC > [100,000 x EPA IA VISL]	8	
Potential for vadose zone source near building?	Known or strongly suspected release of solvents within 200 ft of the building and fine soil type	3	Documented history of chlorinated solvent release at the building suggests potential vadose zone sources close to the foundation remains. One can assume likelihood of release based on documented long term, high volume use of chlorinated solvents in the building. Without a documented release, patterns of data in soil gas or groundwater suggesting a release point near the building, would generally suggest a vadose zone source. While the absence of detectable chlorinated solvents in bulk soil samples is not sufficient to rule out the presence of a VI source, the detection of chlorinated solvents in bulk soil would be a line of evidence pointing toward a vadose zone source. Cases where use of solvents was likely small volume, or incidental, such as barracks, classroom buildings, or office/HQ facilities would generally be categorized as "No known or strongly suspected release". Data analysis shows that fine soils tend to minimize the potential for natural attenuation through volatilization, leaching etc.
	Known or strongly suspected release of solvents within 200 ft of the building and coarse soil type (or insufficient information)	1	
	No known or strongly suspected releases of solvents within 200 ft of the building	0	
Sample zone on exterior wall of building?	Yes	2	Data analysis shows an association between exterior walls and higher indoor and subslab concentrations. Mechanism uncertain, see document.
	No	0	
Presence of atypical preferential pathway? (elevator shaft, tunnel, open soil visible beneath pit or wall etc.)	yes	3	Case studies suggest that the presence of ***atypical*** preferential pathways connecting an occupied space to a point of release or mass source are associated with many of the highest observed concentrations that are linked to vapor intrusion. Our analysis shows this effect for TCE.
	insufficient information	1	
	known to be absent	0	
Distance to Primary release point (from closest point within sample zone)	**Distance** < 10 ft	8	Data analysis shows an association between proximity to the primary release and higher subslab and indoor air concentrations.
	10 ft < **Distance** < 30 ft	6	
	30 ft < **Distance** < 100 ft	4	
	100 ft < **Distance** < 200 ft	2	
	Distance >200 ft	0	

Uncertainty Rating for each parameter above not known +1

Figure 2. Vapor Intrusion Potential Scorecard

(After Venable et al. 2015, Figure 7-3)

Note: The above approach will be adjusted to account for the shallow depth of groundwater at the site.

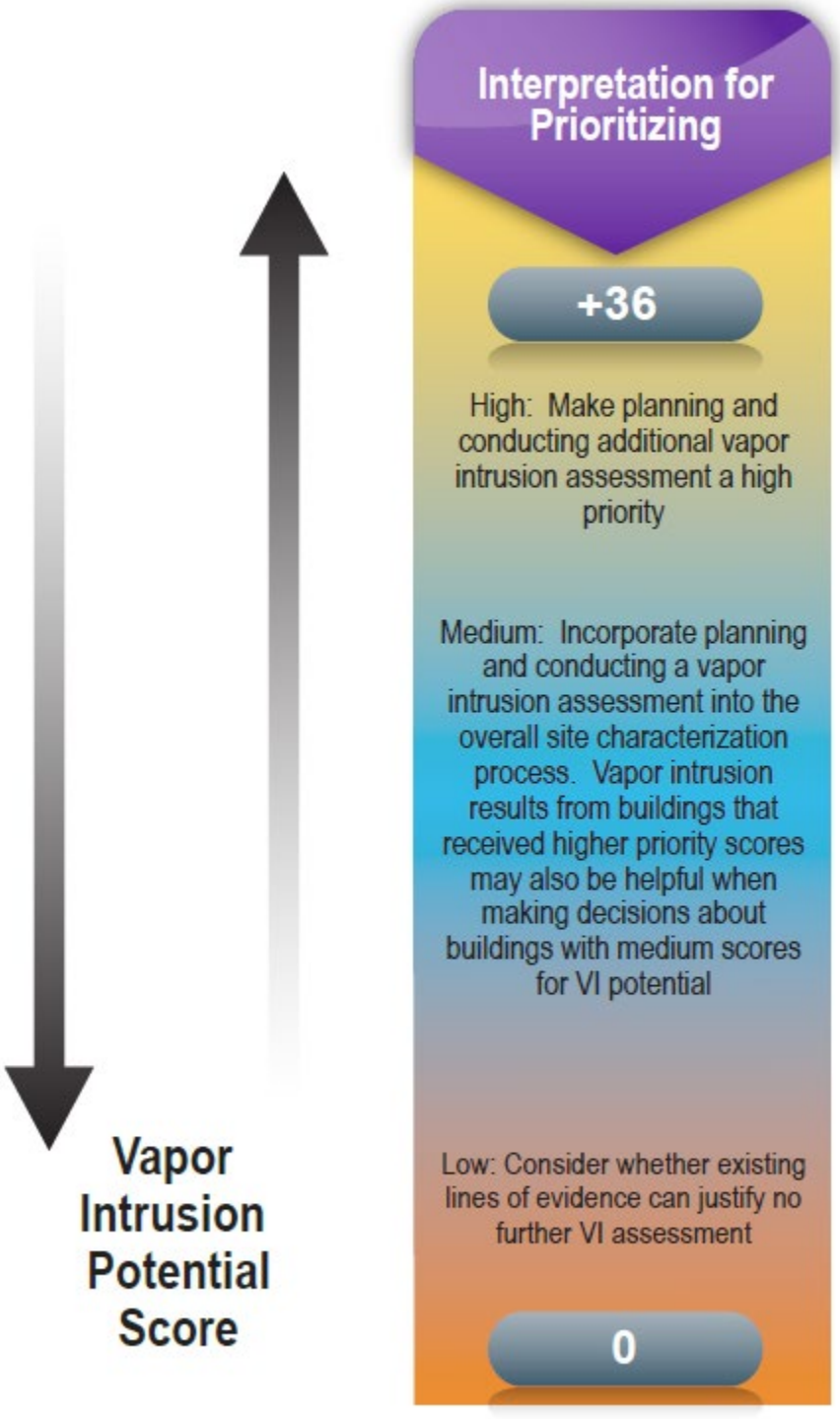

Figure 3. Interpretation of Total Vapor Intrusion Potential Score for Prioritizing Additional Assessment Efforts

(After Venable et al. 2015, Figure 7-5)
Note: Vapor intrusion potential score calculated from Figure 2.

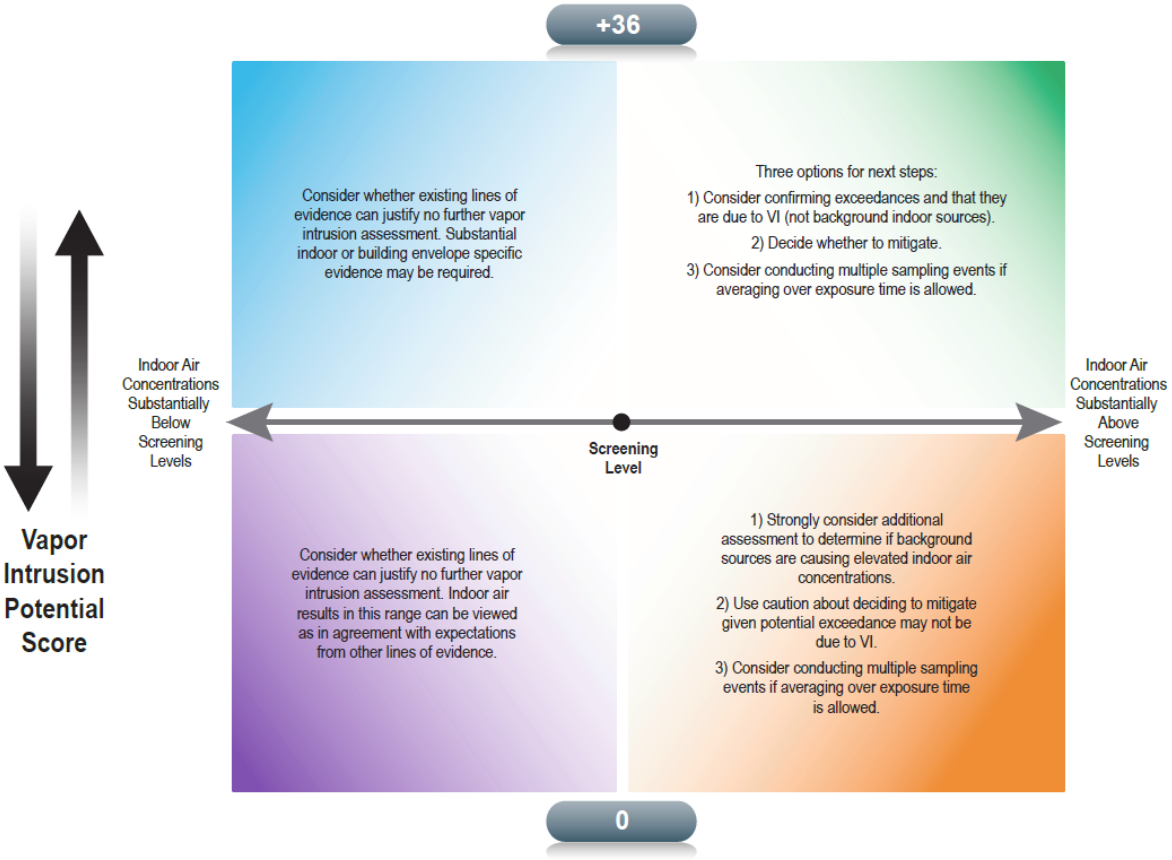

Figure 4. Interpretation of Scores for Vapor Intrusion Potential at Site with Indoor Air Data
(After Venable et al. 2015, Figure 7-6)
Note: Vapor intrusion potential score calculated from Figure 2.