Environmental Quality Office
Sustainability, Environment & Safety
Engineering

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January 26, 2019

Mr. Paul Owens
District Supervisor, Southeast Michigan District Office
MDEQ Remediation and Redevelopment Division
27700 Donald Court
Warren, Michigan 48092-2793
owensp@michigan.gov
VIA E-MAIL

Re: Ford Livonia Transmission Plant
Response to MDEQ Letter dated December 28, 2018

Dear Paul:

On behalf of Ford Motor Company (Ford), this letter and the attached memo from Arcadis dated January 26, 2019 respond to your December 28, 2018 letter regarding MDEQ review of data submitted during implementation of the MDEQ-approved Response Activity Plan-Vapor Intrusion Evaluation.

Additionally, per Ford's January 17, 2019 letter to MDEQ, Arcadis is still not able to schedule any further sampling as property owners have refused to allow access. This access is required to perform the sampling required by the MDEQ-approved Response Activity Plan-Vapor Intrusion Evaluation, MDEQ's November 27, 2018 letter, and MDEQ's December 28, 2018 letter.

If you have any questions, please feel free to contact me.

Sincerely,

Todd M. Walton
Manager, Global Site Assessment & Remediation

Cc: Mr. Kris Hinskey, Arcadis
Mr. Brian Negele, MDAG
Mr. Darren Bowling, MDEQ
Ms. Cyndi Mollenhour, MDEQ
Ms. Krista Reed, MDEQ
Ms. Beth Vens MDEQ
Mr. Brandon Alger, MDEQ

MEMO

ARCADIS Design & Consultancy for natural and built assets

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From:

Kris Hinskey

Mitch Wacksman

Joe Quinnan

Date:

January 26, 2019

Arcadis Project No.:

MI001454.0007

Subject:
Livonia Transmission Plant
Response to Michigan Department of Environmental Quality Comments
Regarding Vapor Intrusion Data Collection and December 3, 2018 Meeting.
36200 Plymouth Road, Livonia, Wayne County, Michigan
MDEQ Site ID No. 82002970

On behalf of Ford Motor Company (Ford), this response to comments has been prepared by Arcadis of Michigan, LLC for the Livonia Transmission Plant (LTP) site (the site). The Michigan Department of Environmental Quality (MDEQ) provided comments regarding data submitted to date from implementation of the Response Activity Plan – Vapor Intrusion Evaluation, which was "Approved with Modifications" by the MDEQ on August 30, 2018.

As background, Ford's Vapor Intrusion Evaluation requires multiple samples at most properties, spaced out both in terms of sampling location and time (*i.e.* quarterly sampling) allowing for development of an accurate, reliable picture of site conditions. These parameters, when combined with MDEQ's aggressive oversight and Ford's commitment to process improvement, will allow for appropriate characterization of LTP-related issues.

The first phase of vapor intrusion evaluation involved the collection of 91 ambient air (background), 324 sub-slab soil vapor, and 405 indoor air samples including duplicates. The assessment involved

collection of two or more samples at each of 55 residential properties and several samples at each of 26 commercial properties.

At the time of the letter from MDEQ (December 28, 2018) data had been received for approximately 820 samples in the off-site area; after removing the 26 samples that is later discussed in this letter (8 samples with low starting vacuum, 7 samples without measurable vacuum upon lab receipt, 2 samples with leak test issues, and 9 samples with other issues discussed by property below) approximately 794 samples remain. This represents roughly 3% of the total samples that will be removed from the data set.

The MDEQ comments point to several general issues as well as some specific technical/procedural elements related to the first round of off-site vapor intrusion evaluation sampling. We acknowledge that some of the comments point to sample acceptance criteria, which represent a small percentage of the samples that should be rejected. Going forward, our quality assurance/quality control program will identify that these samples should be "rejected" or not analyzed. In addition, data validation, which would be completed prior to submittal in a formal report, will be expedited to evaluate laboratory sample results to verify usability prior distribution.

There are a significant number of samples where the MDEQ has requested that we "Evaluate this and determine if data are valid" or annotated its summary table indicating the same. We accept the comment that in most cases, additional information is needed to verify that the samples meet data quality objectives; however, we do not agree that these data should be rejected outright. After reviewing the field notes and laboratory results from each of these samples we have determined that the majority of these samples (over 97%) are valid, meet data quality objectives, and provide representative data for the sampled locations. The key factors in evaluating whether samples meet data quality objectives and should be considered acceptable include the following criteria:

- Canister vacuum integrity – to be representative, final sample canister vacuum is checked in the field, and again upon acceptance at the laboratory. This ensures that the sample integrity is not compromised by a leaky sample vessel. The laboratory requires that the vacuum measurement we provide should be within 5 inches of mercury ("Hg) of the laboratory measurement, due to the limits in accuracy of the canister gauges.
- Reporting limits - the reporting limit is calculated at the laboratory based on the actual "ending canister vacuum". TO-15 prescribes the method of the calculation, and sample acceptance depends on achieving a reporting limit that is less than the project specific action levels.
- Canister sampling flow rate – MDEQ guidance recommends that samples should be obtained using flow rates that are less than 200 milliliters per minute (mL/min). Factors influence the sampling flow rate at each location, but provided that the guideline is met, samples should be accepted.
- Sampling duration –sampling methods prescribe specific sampling intervals to ensure that representative exposure duration is evaluated. Our standard operating procedure is to close the valve for the sample at the designated time, since the canister vacuum gauge is less precise than the flow controller.

Multiple comments were made in the text and table regarding canister vacuums as it relates to USEPA Method TO-15 requirements and MDEQ guidance, both prior to sampling and at the completion of sampling. These comments are addressed below to limit redundancy.

- **Beginning canister vacuum less than 26" Hg**: Both Eurofins' sampling guide and the Arcadis standard operating procedures included in the Quality Assurance Project Plan (QAPP) submitted to MDEQ indicates the starting canister vacuum for canisters should exceed 25" Hg. Arcadis' opinion is that our QAPP and Laboratory acceptance criterion is valid; however, section 4.2 of the MDEQ vapor intrusion guidance indicates the starting canister vacuum should be greater than 26" Hg. Based on the MDEQ comment, all samples where the "beginning canister vacuum" was less than 26" Hg (i.e., 25" Hg, 24" Hg), have been removed from the data set as these samples do not comply with the MDEQ guidance. This represents 8 out of approximately 820 samples as shown on the attached. Resampling will occur at these locations in the first quarter of 2019. Canisters with an initial vacuum less than 26" Hg (i.e., 25" Hg, 24" Hg) will not be use moving forward.

- **Ending canister vacuum near ambient conditions**: MDEQ guidance recommends a limit of 2" Hg for the ending vacuum on canisters. The key issue is whether there is residual vacuum after sampling and that the vacuum upon receipt at the lab is within 5" Hg of the measurement recorded in the field. This ensures that the sample represents conditions at the test site and that the canister did not leak in transit. While MDEQ guidance cites 2" Hg as a limit, the laboratory can determine reporting limits and verify usability at lower residual vacuum levels. None of the canisters with measurable vacuum, but levels above the 2" Hg threshold, demonstrated reporting limits above the RIASL. Therefore, all these samples are considered valid and usable. Obviously, a canister with no vacuum is a problem, as it is not possible to verify the integrity of the seal. Where the ending vacuum in a canister approaches ambient conditions (<1" Hg to 0" Hg), there is uncertainty that the desired sampling interval was achieved; however, the canister still contains sample from the site (MI DEQ 2013 Guidance Appendix G Section A 5.2). The indoor and ambient volatile organic compound (VOC) concentrations measured from a canister with an ending pressure near ambient pressure are useful since the integrity of the collected sample has not been compromised. These samples still provide value in evaluating conditions at a specific building and have been used for this purpose. Based on the MDEQ comment, we recommend that the samples with residual vacuum above the 2" Hg threshold be flagged, but the determination of usability should be made based on the reporting limit. Upon conference with the lab regarding the final vacuum in samples where the field measurement indicates zero residual vacuum, we recommended analysis due to concerns about timing/access of resampling. All samples where the "ending canister vacuum" was 0" Hg have been removed from the data set and will not be used for final decision making. This represents 7 samples. The key issue here is that the samples were not flagged appropriately, indicating that resampling was required. Resampling will occur at these locations in the first quarter of 2019.

- **Ending canister vacuum above 10" Hg**: Where ending canister vacuums for indoor and ambient samples were higher than 10" Hg, either the flow rate in the field was lower than the calibrated rate in the lab due to environmental conditions and/or due to possible change in the flow setting occurring during transport to the field. Alternatively, the flow controller may have experienced a plug or restriction over the course of the sampling interval, resulting in some uncertainty that the desired sampling interval was achieved. As a matter of protocol, the lab accounts for the ending pressure/vacuum when analyzing the sample and determines the reporting limit based on the volume of air added to pressurize the canister to obtain the sample. In no cases where the ending vacuum was above 10" Hg were the reporting limits above the RIASL concentration threshold, indicating that the samples were usable. Based on

the MDEQ comment, it would be appropriate to qualify or flag the laboratory result considering the ending vacuum and the laboratory determined reporting level. However, based on the reporting levels, we contend that all of the data are useful in this case.

- **Validity of Samples Between 10" Hg and 1" Hg:** Multiple comments were made indicating "Evaluate this and determine if data are valid" of samples where the ending canister vacuum was between 10" Hg and 1" Hg. After reviewing the field notes and laboratory results from each of these samples we have determined that the majority of these samples are valid, meet data quality objectives, and provide representative data for the sampled locations. The MDEQ 2013 guidance indicates that based on the ending vacuum sampling results could be biased or the collection time could be skewed but it does not indicate these samples are invalid. Multiple vapor intrusion guidance documents including MDEQ (2013), ITRC (2007), New Jersey (2016), California (2015) and USEPA (2015) include language on the importance of leaving some residual vacuum inside a sample canister but none of the guidance documents indicate that 5" Hg is the only acceptable ending vacuum for a valid sample. As discussed in Section 5.2 of MDEQ 2013, "Because of the normal fluctuations in the flow rate (due to changes in ambient temperature, pressure, and diaphragm instabilities) during sampling, the final vacuum will range between two and ten inches Hg". The gauges supplied for each canister are not built to provide a high level of precision; conversely, they are a guide to provide a rough estimate of vacuum and should be used to obtain a relative rate of change (MDEQ 2013 Guidance Appendix G Section A 5.1.5). These canisters are one part of the evaluation and allow for the timely collection of vapor intrusion data.

  There are several items that are critically important for the collection of valid samples using evacuated canisters; these include leak checks in the field, data yielding appropriate reporting limits for comparison to screening values and ensuring no leakage in transit. Each canister is leak checked prior to utilizing in the field. Reporting limits for samples collected with evacuated canisters are influenced by the needed pressurization of each canister prior to sample analysis via GC/MS. Regardless of the ending canister vacuum (between 10" Hg and 1" Hg) analytical detection limits have been sufficiently low to allow for data screening with MDEQ provided screening criteria deeming these data usable.

This memo provides summarizes the MDEQ comments in **bold text** followed by Ford's response to comment in *italics*.

Property Specific Comments

- **11770 Belden**: **There was a difference between the measured canister receipt vacuum at the lab and that on the chain of custody for a sample. Evaluate this and determine if data are valid.**

  Data from this sample were determined to be valid. The laboratory data package for 11770 Belden Court noted a discrepancy greater than 5" Hg in the canister vacuum measured in the field versus that measured at the lab for sample SSMP-11770Belden-03_110818. Upon reviewing the field notes for this event an error was noticed between the measured ending canister vacuum (5" Hg) and the value written on the chain of custody (15" Hg). Data for this sample were determined to be valid. At this property 4 additional sub-slab samples were collected that were not impacted by this issue.

- **34766 Standish: Sample SSMP-34766Standish-04 was not received at the lab on November 2, 2018, despite notation on the chain of custody. The sample was received on November 5, 2018 and analyzed then. Evaluate this and determine if**

data are valid.

There is no indication of SSMP-04 anywhere in the data package. There appears to be confusion regarding this property. The sample collected from the SSMP on this property (SSMP-34766Standish-01_103118) was received at the lab on 11/02/2018.

- **11701 Boston Post: Daily log states issues with PID used, results may not be representative.**

  Data from this property were determined to be representative. The PID is used for two items at each property; 1) air quality monitoring per Arcadis' health and safety plan and 2) to inform the laboratory where VOCs may be present in indoor air so they can pre-screen air samples and not impact their GC/MS and other analytical equipment. The PID readings recorded in no way impact the validity of data collected from this property.

- **12350 Belden: Initial canister pressure for IA-12350Belden-01 was -25, lower than typical starting pressure and will affect sample quality. This location should be re-sampled. Ending time for that canister is noted as 1433, is this the correct time, and if so, is too short to represent a working day. SSMP-12350Belden-04 was noted as not sealed completely initially and was repaired. Evaluate these issues and determine if data are valid.**

  Eight total indoor air samples were collected from this building. Sample IA-12350Belden-01 will be removed from the data set, leaving seven representative samples. Sample point SSMP-04 inside 12350 Belden Court was repaired prior to sampling; this sample has been removed from the data set. At this property eight additional sub-slab samples were collected that were not impacted by this issue. Resampling within this building is scheduled to occur during the first quarter of 2019.

- **12555 Belden: There was a difference between the measured canister receipt vacuum and that reported on the chain of custody for SSMP-12555Belden-03. Evaluate this and determine if data are valid.**

  Nine sub-slab soil vapor samples were collected from this property. Sample SSMP-12555Belden-03 has been removed from the dataset. Eight other sub-slab samples were collected from 12555 Belden that were not affected by this issue. This property will be resampled in the first quarter of 2019.

- **11672 Belden: There was a difference between the measured canister receipt vacuum and that reported on the chain of custody for AA-11672Belden-01. Evaluate this and determine if data are valid.**

  As indicated in the laboratory report and the daily log from 12/12/2018 included with the data package, sample AA-11672Belden-01_120418 was not analyzed due to a potential leak in transit as reported by the lab. A duplicate sample was collected from this location (Dup-11672Belden-03_120418) which will be used to evaluate ambient air conditions at this location from the time of sampling.

- **11801 Belden: SSMP-11801Belden-09 was resampled due to concerns ambient air may have gotten into tubing. If the sub-slab point was re-sampled the same day, the sample is likely not representative and should be re-sampled. SSMP-11801Belden-06 had issues with the helium testing and the syringe valve leaking, did this affect the quality of the sample?**

  Nine total sub-slab samples were collected at 11801 Belden Court. Sample SSMP-11801Belden-09 was resampled on the same day, this sample has been removed from the data set. At this property eight additional sub-slab samples were collected that were

not impacted by this issue. This property will be resampled during the first quarter of 2019.

As indicated in the field notes, the equipment used to helium leak test sample SSMP-11801Belden-06 was replaced. Helium reached a concentration of 18% in the shroud during the pre-testing for this sample and no helium was detected in the purged air, indicating the sample train had good integrity prior to sampling. Data from sample SSMP-11801Belden-06 are deemed valid.

- **34850 Standish: Sample identification was revised per an email request, evaluate this and determine if data are valid. A revised chain of custody was provided from the client, please review these changes and ensure sample quality was not affected. There was a difference between the measured canister receipt vacuum at the lab and that on the chain of custody for a sample. Evaluate this and determine if data arevalid.**

  Data for these samples were determined to be valid. At this property the date on the sample identification was revised via email. This revision was executed following Arcadis standard operating procedure and does not affect the validity of the sample.

  Upon reviewing the field notes for this event, a transcription error was noticed between the measured ending canister vacuum (5" Hg) and the value written on the chain of custody (8" Hg). As such the vacuum recorded in the field and at the lab are within acceptable range of each other. Data for this sample were determined to be valid.

- **12066 Boston Post: Indoor air samples were collected for a time period less than 24 hours, these samples may not be representative.**

  Although these samples were not deployed for a full 24-hours, they are valuable in evaluating site conditions and have yielded data with appropriate reporting limits to allow comparison to MDEQ provided screening values. Due to a logistical issue these sample canisters were deployed for a 21-hour period, these data points have been removed from the data set. This property will be resampled during the first quarter of 2019.

- **34550 Beacon: A revised chain of custody was submitted, evaluate this and determine if data are valid.**

  Data for this property were determined to be valid. The chain of custody was revised to fix a nomenclature issue. At this property the nomenclature on the chain of custody for sample seven was revised to indicate the sample was an "IAG" (indoor air from garage) instead of "IAF" (indoor air from first floor) to correct an error on the chain of custody. This revisions in sample identification nomenclature does not affect the quality of the sample. This sample is considered valid.

- **12141 Boston Post: Daily log shows that workers returned to site to "repair SSMP that was improperly installed" "between 1940-2015" and it appears the SSMP was sampled between 1855-1909. Therefore, the SSMP was sampled prior to the repair being made and the sample may not be representative or reliable. This location should be re-sampled.**

  Data for this property were determined to be valid. The issue noted in the field notes is referring to the flush mount cover that covers the SSMP while not in use. The cover was not sitting flush with the ground. This issue was fixed following sample collection. The

collection log indicates that the sample passed the pre-sampling integrity tests, confirming there was not an issue with the seal of the SSMP during sampling.

- **34851 Wadsworth: Boring log with data package for this address has the address of 34581 Wadsworth, verify which address this boring log is for.**

  The boring log and the utility checklist are incorrectly labeled. They both should be referring to 34851 Wadsworth and not 34581 Wadsworth. 34581 Wadsworth is outside the bounds of the investigation area and therefore was not sampled.

- **12036 Brewster: A revised chain of custody was submitted, evaluate this and determine if data are valid.**

  This sample is considered valid. The chain of custody was revised to correct the date included in the sample identification of the sub-slab sample. This revision in sample identification nomenclature does not affect the quality of the sample.

- **12088 Brewster: Several air samples were not received at the lab on the date the chain of custody stated. Samples were received at a later date. Evaluate this and determine if data are valid.**

  Data for this property were determined to be valid. The shipment was separated into multiple boxes with not all the samples arriving the same day. The samples were delivered to the lab within the 30-day hold time of a Summa can (per USEPA Compendium Method TO-15, 1999) and the data are valid.

- **34380 Beacon: Chain of custody showed sample AA-34380Beacon-01 was collected on October 24, 2018, but the date on sample tag was October 23, 2018. Verify the correct date of the sample. Daily log states on October 24, 2018, at 0915 "onsite, begin canister deployment" and at 0950 "offsite," but Indoor/Ambient air collection log sheet shows canisters were deployed between 0823 and 0847. Evaluate this and determine if data are valid.**

  Data for this property were determined to be valid. The chain of custody matches the air collection log sheets, indicating samples were collected between 0823 and 0847 on October 24, 2018. The daily log is marked with the incorrect time of collection and the sample tags were marked with the incorrect date of collection. These inconsistencies, however, do not affect the validity of the data from these samples as both the laboratory and Arcadis were able to positively identify each sample.

- **12100 Boston Post: SSMP-12100Bostonpost-02 on the Soil Vapor Collection Log Sheet had a notation "Registered above -30 to start sampling." What was the initial pressure of the canister and did it affect the sample quality?**

  Data for this sample were determined to be valid. This note indicates that the vacuum, as measured by the gauge, was shown as more negative than 30" Hg, likely indicating a slight offset in the gauge. This does not affect the integrity of the sample. At this property one additional sub-slab sample was collected that was not affected by this issue.

- **12001 Stark: SSMP-12001Stark-01 was not received at the lab on November 2, 2018, as the chain of custody stated but was received by the lab on November 5, 2018. Evaluate this and determine if data are valid.**

Data for this sample were determined to be valid. The shipment was separated into multiple boxes with not all the samples arriving the same day. The samples were delivered to the lab within the 30-day hold time of a Summa can (per USEPA Compendium Method TO-15, 1999) and the data are valid.

- **12034 Brewster: Soil Vapor Collection Log Sheet entry for SSMP-12034Brewster-01 is not legible for the helium post-purge sample reading. Provide this information.**

  The scan was of poor quality, on the original paper copy of the document it is legible as a zero.

- **11850 Boston Post: A revised chain of custody was submitted, evaluate this and determine if data are valid.**

  This sample is considered valid. The chain of custody was revised to correct the date included in the sample identification of the sub-slab sample. This revision in sample identification nomenclature does not affect the quality of the sample.

- **11864 Belden: SSMP-11864Belden-02 took 40 minutes for the sample to collect and final canister pressure was -14 in. Hg, indicating there was a problem with the sample collection. This location should be re-sampled.**

  This sample has been removed from the data set. At this property six additional sub-slab samples were collected that were not impacted by this issue. This property will be resampled in the first quarter of 2019.

- **12224 Belden: AA-12224Belden-06 sample identification was not provided on the sample tag. SSMP-12224Belden-07 sample identification was not provided on the sample tag. Evaluate these and determine if the sample is valid.**

  Data for this sample were determined to be valid. Each canister includes a unique identification number that can be used to aid in the positive identification of samples. Although the sample ID for some samples were not included on the sample tags, the laboratory was able to positively match the unique canister identification numbers included on the chain of custody to the canisters them self to identify the individual samples. These data are considered valid.

- **11921 Boston Post: A revised chain of custody was submitted, evaluate this and determine if data are valid.**

  Data for this property were determined to be valid. The chain of custody was revised to correct a transcription error on the canister identification number for sample IA-11921BostonPost-3_091918. This revision does not affect the quality of the sample, this sample is considered valid.

The enclosed spreadsheet lists residential and non-residential properties with errors that were repeated regularly. These errors should be evaluated and responded to by Ford. A written response, addressing each issue at each residential and non-residential address, is due to the MDEQ by January 31, 2019.

The following specific errors will require re-sampling by January 31, 2019, to correct the listed deficiency:

- **For all indoor and ambient air samples with a final canister pressure of "0" in. Hg at sample pickup, the sample is invalid since the amount of air inside the canister is unknown and the sample would not be reliable or representative.**

  As discussed in detail above, indoor air and ambient air samples that have gone to near ambient or ambient conditions have provided value in evaluating conditions at a specific building. Upon conference with the lab regarding the final vacuum in samples where the field measurement indicated zero residual vacuum, we recommended analysis due to concerns about timing/access of resampling. All samples where the "ending canister vacuum" was 0" Hg have been removed from the data set and will not be used for final decision making. This represents 7 samples of 496 indoor air or ambient air samples. Resampling will occur at these locations in the first quarter of 2019.

- **For all indoor and ambient air samples and soil-gas samples with a final canister pressure higher than -10 in. Hg, the sample is invalid since the amount of air inside the canister would not be reliable or representative.**

  As discussed in detail above, samples that have a final canister vacuum greater than 10" Hg (i.e., 11" Hg, 12" Hg) are valuable in evaluating site conditions and have yielded data with appropriate reporting limits to allow comparison to MDEQ provided screening values. Based on the MDEQ comment, it would be appropriate to qualify or flag the laboratory result considering the ending vacuum and the laboratory determined reporting level. However, based on the reporting levels, we contend that all the data are useful in this case. Resampling of all properties will occur during the first quarter of 2019.

- **For all indoor and ambient air samples and soil-gas samples with canister starting pressure lower than -26 in. Hg the samples are not typically reliable or representative.**

  Both Eurofins' sampling guide and the Arcadis standard operating procedures included in the Quality Assurance Project Plan (QAPP) submitted to MDEQ indicates the starting canister vacuum for canisters should exceed 25" Hg. Arcadis' opinion is that our QAPP and Laboratory acceptance criterion is valid; however, section 4.2 of the MDEQ vapor intrusion guidance indicates the starting canister vacuum should be greater than 26" Hg. Based on the MDEQ comment, all samples where the "beginning canister vacuum" was less than 26" Hg (i.e., 25" Hg, 24" Hg), have been removed from the data set as these samples do not comply with the MDEQ guidance. This represents 8 out of approximately 820 samples as shown on the attached. Resampling will occur at these locations in the first quarter of 2019. Canisters with an initial vacuum less than 26" Hg (i.e., 25" Hg, 24" Hg) will not be use moving forward.

Ford is also expected to provide the following information to the MDEQ by January 31, 2019:

- **For each address, when installing sub-slab monitoring points, a PID was used to take an initial reading. For those sub-slab monitoring points where readings were detected, provide a technical explanation for the reading.**

  The PID is used for air quality monitoring per Arcadis's health and safety plan during the installation of sub-slab monitoring points. The majority of PID readings recorded in the

field notes are of the ambient air space inside each property and in no way indicate the presence of VOCs sub-grade. PID readings were collected from a few of the drilled sub-slab monitoring points early in the sampling program; however, the laboratory analytical data did not corroborate the PID readings collected from these locations indicating the PID was elevated due to dust or moisture.

- **For all indoor and ambient air samples and soil-gas samples with a final canister pressure higher than -5 in. Hg and below -10 in. Hg, the sample should be evaluated to determine if the sample is valid. When canister pressure is above -5 in Hg. Sample dilution is greater than normal.**

  These samples were determined to be valid. The acceptability of these samples was reviewed to ensure project data quality objectives have been met. See detailed response regarding ending canister vacuum on Page 4.

- **For all indoor and ambient air samples and soil-gas samples with a final canister pressure lower than -5 in. Hg and higher than "0" in. Hg, the sample should be evaluated to determine if the sample is valid. When canister pressure is below -5 in. Hg, the flow rate begins to drop significantly and typically the sample quality is affected and skews the results in favor of the first portion of the sampling interval.**

  These samples were determined to be valid. The acceptability of these samples was reviewed to ensure project data quality objectives have been met. See collective response on ending canister vacuum on Page 4.

- **For each non-residential building, specifically provide the working shift hours (i.e. 8 hours, 10 hours, 12 hours, etc.) and ensure the indoor air samples are representative of this working shift.**

  Sample duration was chosen to match the approximate working hours at each property. During initial communication with each property owner or business manager the occupancy time for each non-residential building was discussed and used to decide on the applicability of 8-hour or 12-hour sample canisters for indoor air sampling. At some properties field staff were not granted access for the full 8-hour or 12-hour nominal period of the sample canisters, however, this yields a sample duration representative of the actual duration worked in that space. The hours of occupancy for each commercial building will be recorded during the second round of sampling which is scheduled to occur during the first quarter of 2019.

- **For all indoor and ambient air samples and soil-gas samples with canister starting pressure lower than -28 in. Hg and higher than -26 in. Hg the samples are not typically reliable or representative and may contain air from previous sampling locations and affect sample quality. Evaluate this and determine if data are valid.**

  Data from samples with starting canister vacuum between -28" Hg and 26" Hg are deemed valid. Section 4.2 of the MDEQ 2013 vapor intrusion guidance states "The initial canister vacuum should be at least -26 inches of mercury (Hg). If the initial vacuum is less than -26 inches Hg (i.e., between 0 inches Hg and -25 inches Hg), the canister should be rejected and returned to the laboratory." There is no discussion regarding canisters needing to exceed 28" Hg. Eurofins laboratory sampling guide (2014) and Arcadis standard operating procedure submitted to MDEQ as part of the QAPP state that canisters with a starting vacuum of 25" Hg or less measured using a rough vacuum gauge should not be utilized. Data from samples between 28" Hg and

26" Hg are deemed valid.

Additionally, individual canister certification ensures no carry over from previous sampling locations. Each canister for this project was cleaned and individually certified by filling with zero air and analyzing by GC/MS to ensure no contaminants were present in the canister above the certification level. After certification, the canisters are evacuated, and a leak test is performed on the canisters prior to sending to the field for collection.

- **For lab sheets with corrections, corrections should be legible and initialed by the person making the correction. Review all results and ensure entries are valid.**

  Comment noted. During our quality control process some revisions have been made to sample sheets. Moving forward all corrections will be done in single line strike out and initialed by the person making the revision.

Responses to MDEQ comments in tabular form (pages 5-6 of memo).

Column 1 – Chain of custody for sample(s) does not match entry on sample tag(s).

These samples have been deemed valid. While discrepancies between the chain of custody and sample tag have been noted by the laboratory, there have been enough lines of evidence for the laboratory to unequivocally identify each sample. These samples are considered valid for use in evaluating conditions in the space they are collected from.

Column 2 – Chain of custody information for sample(s) does not match information on canister regarding canister barcode.

These samples have been deemed valid. While discrepancies between the chain of custody and canister identification number have been noted by the laboratory, the sample identification number and sample tag allowed the laboratory to unambiguously identify each sample. These samples are considered valid for use in evaluating the space they are collected from.

Column 3 – Chain of custody not relinquished properly – signature, date and time missing.

In some of the early sampling events the chain of custody documents were not signed and/or dated and/or no time was provided. We recognize this as an error and this error has been rectified. Arcadis' SOP for maintaining sample chain of custody requires that the samples be under control of the person that obtained the samples, or other Arcadis personnel until the samples are relinquished. Other control checks have been used to ensure the samples have not been tampered with. All samples are held under lock and key in a heated off-site storage location where only Arcadis employees have access. From this location the sample containers are taken directly to FedEx for shipping. The ending vacuum of each sample canister is recorded in Arcadis field notes during sampling and on the chain of custody during shipping. The vacuum is then checked upon laboratory receipt to confirm each canister is in the same condition as when relinquished for shipping. Comparing the recorded vacuum on the sample log, chain of custody, and laboratory check-in allows for a quality control check to ensure the samples are in the same condition as when they left the hands of the field sampling crew. While chain of custody protocol regarding the signature and date was not followed for these properties, we contend that the samples were otherwise managed appropriately. Therefore, the laboratory data still provides information in evaluating the vapor intrusion pathway. Should the data have indicated a potential exposure issue an action still would have been taken. All properties will be resampled during the first quarter of 2019.

Column 4 – Indoor/Ambient air canister(s) – final canister(s) pressure "0", invalid sample(s).

As discussed in detail above, indoor air and ambient air samples that have gone to near ambient or ambient conditions have provided value in evaluating conditions at a specific building. Upon conference with the lab regarding the final vacuum in samples where the field measurement indicated zero residual vacuum, we recommended analysis due to concerns about timing/access of resampling. All samples where the "ending canister vacuum" was 0" Hg have been removed from the data set and will not be used for final decision making. This represents 7 samples of 496 indoor air or ambient air samples. Resampling will occur at these locations in the first quarter of 2019.

Column 5 – Indoor/Ambient air canister(s) – final canister(s) pressure higher than -5 in. Hg, sample may not be representative.

None of the samples in question demonstrated laboratory determined reporting limits above the RIASL concentration, indicating that the data are usable. The acceptability of these samples was reviewed to ensure project data quality objectives have been met. Additionally, see collective response on ending canister vacuum on Page 4.

Column 6 – Purge rate and volume – provide technical explanation for rate/volume used.

*All field notes were reviewed following receipt of MDEQ comments and it has been confirmed the purge rate and volume comply with the MDEQ guidance (2013). The MDEQ guidance (2013) which indicates in multiple locations that 1) at least three volumes of vapor should be purged from each sample point prior to sampling and 2) the rate for purging and sample collection should not exceed 200 ml/min. One volume of Arcadis's typical sample train (which has approximately 54-inches of ¼" outside diameter tubing) is 20 milliliters (ml) of vapor (interior tubing radius is 0.085"). One volume of the sample train is 20 milliliters (1.223 cubic inches) using the equation for volume of a cylinder (volume = pi * radius2 * length). Purge volumes have ranged from 100 ml to 200 ml to allow enough volume to conduct a pre-sampling helium leak test and the purging rate has been below 200 ml/min.*

Column 7 – Helium testing pre and/or post sample(s) show detections.

Field notes have been reviewed for all sub-slab samples collected, although some helium detections were noted, these do not indicate significant leakage during testing. Except for 2 of the 324 sub-slab samples collected as of the date of the letter, all samples were shown to follow the MDEQ standard operating procedure. Arcadis staff utilize a very sensitive helium detector (Dielectric MGD-2002) for real time tracer gas testing. This detector records helium concentrations in parts per million (ppm) first, then shifts to percent if/when the concentration reaches 10,000 ppm (i.e., 1% helium). Field recordings of low levels of helium (ppm range) are not indicative of a significant leak. The original sampling sheet presented two different units; the first was designed to show the shroud helium concentration in percent while the second was designed to show the purged concentration in ppm. Moving forward, the sampling sheet has been simplified to record both readings in percent only. All sample notes were reviewed following MDEQ comments. Except for three samples, all samples were shown to be in compliance with the MDEQ standard operating procedure (MDEQ 2013 Appendix F.3 Section 2.2) which indicates a leak of up to 10% is acceptable. As shown on the attached table there are two samples which did not pass the helium leak test (one sample where the concentration of helium was not recorded

properly [SSMP-11921BostonPost-1_092018], and a second where the calculated leakage was >10% [SSMP-11853Belden-01_110518]).

Column 8 – Helium testing pre or post not collected.

Field notes have been reviewed for all sub-slab samples collected, except for the two samples discussed in the previous comment, a helium leak test was successfully completed at each location. Although a pre/post reading may not have been recorded, it is confirmed that Arcadis staff conducted a helium leak test in the field prior to sampling at each location. Helium leak check methods were presented in the approved Quality Assurance Project Plan (QAPP). Helium tracer testing is performed prior to sampling to ensure any leaks found are rectified before collecting the sample. A helium leak test is performed at each sub-slab monitoring point for each round of sampling. The original sampling sheet used for the project was designed to show the detector was zeroed (pre-sample purge reading) and then to show the concentration of helium detected in purged air (post-sample purge reading). Moving forward, the sampling sheet has been simplified to show only the shroud helium concentration and the concentration of helium detected in the purged air, if any. The helium detector is zeroed between samples. Where staff filled out one column or the other on the sampling sheet the helium test was successfully completed but the zero reading was not recorded. This inconsistency in the way the helium test information was recorded does not impact the validity of the helium testing or the sampling results and will be rectified moving forward.

Column 9 – Indoor air/sub-slab starting canister(s) pressure lower than 28 in. Hg – sample(s) may not be representative.

Data from samples with starting canister vacuum between -28" Hg and 26" Hg are deemed valid. Section 4.2 of the MDEQ 2013 vapor intrusion guidance states "The initial canister vacuum should be at least -26 inches of mercury (Hg). If the initial vacuum is less than -26 inches Hg (i.e., between 0 inches Hg and -25 inches Hg), the canister should be rejected and returned to the laboratory." There is no discussion regarding canisters needing to exceed 28" Hg. Eurofins laboratory sampling guide (2014) and Arcadis standard operating procedure submitted to MDEQ as part of the QAPP state that canisters with a starting vacuum of 25" Hg or less measured using a rough vacuum gauge should not be utilized. Data from samples between 28" Hg and 26" Hg are deemed valid.

Both Eurofins' sampling guide and the Arcadis standard operating procedures included in the Quality Assurance Project Plan (QAPP) submitted to MDEQ indicates the starting canister vacuum for canisters should exceed 25" Hg. Arcadis' opinion is that our QAPP and Laboratory acceptance criterion is valid; however, section 4.2 of the MDEQ vapor intrusion guidance indicates the starting canister vacuum should be greater than 26" Hg. Based on the MDEQ comment, all samples where the "beginning canister vacuum" was less than 26" Hg (i.e., 25" Hg, 24" Hg), have been removed from the data set as these samples do not comply with the MDEQ guidance. This represents 8 out of approximately 820 samples as shown on the attached. Resampling will occur at these locations in the first quarter of 2019. Canisters with an initial vacuum less than 26" Hg (i.e., 25" Hg, 24" Hg) will not be use moving forward.

Ford should further review all data to ensure that all samples were installed and sampled correctly and that all data is reliable and representative. Please note resampling of air within crawl spaces is not required since this has been determined to not be representative of the volatilization to indoor air pathway. Re-sampling of sump water is also not required since sump water has been found to not be representative of groundwater concentrations representing the volatilization to indoor air pathway due to volatilization of water within the sump, therefore, sump data was not evaluated.

Ford and Arcadis have developed a systematic quality control/quality assurance approach to ensure all sample points are installed correctly and data are collected appropriately to provide reliable and representative data. Data validation will be completed in the future to ensure that data quality objectives and usability metrics are met with laboratory results prior to distribution. Resampling of crawl space air will not occur.

Address	Chain of custody for sample(s) does not match entry on sample tag(s)				Chain of custody information for sample(s) does not match information on canister with regard to canister barcode				Chain of custody not relinquished properly - signature, date and time missing				Indoor/Ambient air Canister(s) - final canister(s) pressure "0", invalid sample(s)				Indoor/Ambient air canister(s) - final canister(s) pressure higher than -5 in. Hg, sample may not be representative				Purge rate and volume - provide technical explanation for rate/volume used		Helium testing pre and/or post sample(s) show detections		Helium testing pre or post not collected		Indoor air/sub-slab starting canister(s) pressure lower than -28 in. Hg - sample(s) may not be representative			
	Original MDEQ Indication	Lab Able to Unequivocally Identify Sample			Original MDEQ Indication	Lab Able to Unequivocally Identify Sample			Original MDEQ Indication	COC Protocol Not Followed, Sampled Deemed Useful			Original MDEQ Indication	Samples Deemed Valid (Must have measurable vacuum upon lab reciept)			Original MDEQ Indication	Number of Samples Meeting Project Objectives			Original MDEQ Indication	Samples Compliant with MDEQ Guidance (at least 3 volumes, ≤ 200 ml/min)	Original MDEQ Indication	Sample Results Reliable Calculated leakage (leakage ≤ 10% per MDEQ 2013)	Original MDEQ Indication	All Sample Results Reliable (test successfully completed)	Original MDEQ Indication	Number of Canisters With Starting Vacuum Above -26" Hg (-26" Hg and greater is ok per MDEQ 2013)		
Totals		162	of	162		110	of	110		66	of	66		69	of	76		390	of	390			27	25	32	32		234	of	242
11770 Belden Court																	X	5	of	5	X	Yes			X	Yes	X	9	of	10
11710 Boston Post					X	5	of	5													X	Yes					X	5	of	5
11672 Belden Court																	X	7	of	7	X	Yes					X	15	of	15
11800 Belden Court																	X	9	of	9	X	Yes					X	20	of	21
34367 Capitol													X	7	of	8	X	5	of	5	X	Yes					X	9	of	10
11771 Belden Court																	X	5	of	5	X	Yes					X	10	of	11
12333 Belden Court																	X	7	of	7	X	Yes								
12087 Stark																	X	7	of	7	X	Yes								
34934 Standish					X	5	of	5									X	4	of	4	X	Yes	X	Yes - 0.3% leakage in 1 sample	X	Yes				
11850 Boston Post					X	5	of	5									X	4	of	4	X	Yes			X	Yes				
12124 Boston Post																	X	4	of	4	X	Yes	X	Yes - 2% leakage						
34380 Capitol					X	5	of	5									X	4	of	4	X	Yes	X	Yes - 0.1% leakage			X	12	of	12
11721 Boston Post																	X	4	of	4	X	Yes			X	Yes				
34851 Beacon									X	6	of	6							of	4	X	Yes								
12075 Brewster	X	5	of	5													X	4	of	4	X	Yes	X	Yes - 1% leakage						
34965 Wadsworth	X	6	of	6									X	5	of	5	X	5	of	5	X	Yes	X	Yes - 0.3% leakage in 1			X	6	of	6
11921 Boston Post	X	5	of	5									X	3	of	4	X	4	of	4	X	Yes	X	No - Not Recorded						
34940 Beacon													X	4	of	4	X	4	of	4	X	Yes	X	Yes - 0.3% leakage						
12224 Belden Court*	X	15	of	15													X	6	of	6										
12270 Belden Court*																	X	6	of	6										
35000 Plymouth*	X	11	of	11													X	6	of	6										
11877 Belden Court*					X	7	of	7									X	4	of	4										
11891/93 Belden Court*																	X	3	of	3										
11895 Belden Court*									X	COC was Signed							X	3	of	3										
11897 Belden Court*	X	10	of	10													X	4	of	4										
12034 Boston Post									X	7	of	7					X	5	of	5	X	Yes	X	Yes - 6% leakage						
34401 Capitol		5	of	5	X	COC matched can											X	4	of	4	X	Yes	X	Yes - 3% leakage						
34966 Standish													X	6	of	6	X	6	of	6	X	Yes	X	Yes - 1% leakage			X	8	of	8
34990 Wadsworth													X	5	of	5	X	5	of	5	X	Yes			X	Yes	X	7	of	8
34450 Beacon									X	8	of	8					X	5	of	5	X	Yes	X	Yes - 0% leakage	X	Yes				
11845 Boston Post	X	7	of	7													X	5	of	5	X	Yes	X	Yes - 0% leakage	X	Yes	X	7	of	7
11865 Boston Post																	X	4	of	4	X	Yes	X	Yes - 3% leakage	X	Yes				
34550 Beacon	X	11	of	11					X	11	of	11					X	8	of	8	X	Yes	X	Yes - 0% leakage	X	Yes				
34935 Wadsworth					X	7	of	7									X	5	of	5	X	Yes			X	Yes				
34450 Capitol													X	6	of	6	X	6	of	6	X	Yes			X	Yes				
11775 Boston Post	X	8	of	8									X	7	of	7	X	7	of	7	X	Yes			X	Yes	X	8	of	8
12017 Brewster																	X	4	of	4	X	Yes			X	Yes	X	5	of	5
12069 Stark	X	6	of	6													X	4	of	4	X	Yes			X	Yes	X	6	of	6
12131 Boston Post																	X	5	of	5	X	Yes	X	Yes - 0% leakage						
34891 Wadsworth																	X	5	of	5	X	Yes			X	Yes				
34920 Beacon													X	3	of	5					X	Yes	X	Yes - 3% leakage			X	5	of	5
12141 Boston Post	X	6	of	6													X	5	of	5	X	Yes			X	Yes	X	6	of	6
34851 Wadsworth													X	3	of	4					X	Yes					X	4	of	5
12036 Brewster																	X	4	of	4	X	Yes	X	Yes - 3% leakage						
34480 Capitol					X	7	of	7									X	5	of	5	X	Yes	X	Yes - 1%-5% leakage	X	Yes				
12088 Brewster																	X	5	of	5	X	Yes	X	Yes - 1%-5% leakage	X	Yes				
34380 Beacon																	X	5	of	5	X	Yes	X	Yes - 2% leakage	X	Yes				
12100 Boston Post													X	4	of	4	X	4	of	4	X	Yes	X	Yes - 0%-1% leakage	X	Yes	X	6	of	6
12001 Stark									X	5	of	5					X	4	of	4	X	Yes			X	Yes				
12034 Brewster									X	6	of	6					X	5	of	5	X	Yes								
12067 Boston Post					X	5	of	5	X	5	of	5					X	4	of	4	X	Yes	X	Yes - 0% leakage						
34600 Beacon	X	5	of	5									X	3	of	4	X	4	of	4	X	Yes			X	Yes				

Address	Chain of custody for sample(s) does not match entry on sample tag(s)				Chain of custody information for sample(s) does not match information on canister with regard to canister barcode				Chain of custody not relinquished properly - signature, date and time missing				Indoor/Ambient air Canister(s) - final canister(s) pressure "0", invalid sample(s)				Indoor/Ambient air canister(s) - final canister(s) pressure higher than -5 in. Hg, sample may not be representative				Purge rate and volume - provide technical explanation for rate/volume used		Helium testing pre and/or post sample(s) show detections		Helium testing pre or post not collected		Indoor air/sub-slab starting canister(s) pressure lower than -28 in. Hg - sample(s) may not be representative			
	Original MDEQ Indication	Lab Able to Unequivocally Identify Sample			Original MDEQ Indication	Lab Able to Unequivocally Identify Sample			Original MDEQ Indication	COC Protocol Not Followed, Sampled Deemed Useful			Original MDEQ Indication	Samples Deemed Valid (Must have measurable vacuum upon lab reciept)			Original MDEQ Indication	Number of Samples Meeting Project Objectives			Original MDEQ Indication	Samples Compliant with MDEQ Guidance (at least 3 volumes, ≤ 200 ml/min)	Original MDEQ Indication	Sample Results Reliable Calculated leakage (leakage ≤ 10% per MDEQ 2013)	Original MDEQ Indication	All Sample Results Reliable (test successfully completed)	Original MDEQ Indication	Number of Canisters With Starting Vacuum Above -26" Hg (-26" Hg and greater is ok per MDEQ 2013)			
34766 Standish	X	5	of	5	X				X	5	of	5					X	4	of	4	X	Yes	X	Yes - 2% leakage	X	Yes				
11701 Boston Post Road													X	4	of	4	X	5	of	5	X	Yes	X	Yes - 0% leakage	X	Yes				
11680 Boston Post Road					X	5	of	5					X	4	of	4			of	4	X	Yes			X	Yes				
12350 Belden Court																	X	9	of	9	X	Yes			X	Yes	X	17	of	18
11675 Belden Court																	X	6	of	6	X	Yes					X	11	of	12
34591 Beacon																	X	4	of	4										
12400 Belden Court					X	27	of	27	X	13	of	13					X	13	of	13	X	Yes			X	Yes				
11866 Boston Post	X	9	of	9	X	9	of	9									X	6	of	6	X	Yes								
12070 Boston Post													X	5	of	6	X	5	of	5	X	Yes								
12555 Belden Court																	X	6	of	6	X	Yes					X	16	of	16
11898 Belden Court																	X	5	of	5	X	Yes								
11701 Belden Court	X	18	of	18													X	9	of	9	X	Yes								
11801 Belden Court																	X	7	of	7	X	Yes								
12499 Belden Court																	X	5	of	5	X	Yes					X	10	of	10
34850 Standish																	X	3	of	3	X	Yes								
12250 Belden Court																	X	6	of	6	X	Yes					X	11	of	11
11876 Belden Court																	X	8	of	8	X	Yes								
12182 Belden Court																	X	4	of	4	X	Yes					X	9	of	9
11853 Belden Court																	X	6	of	6	X	Yes	X	No - 1 sample (of 6) at 10% leakage	X	Yes				
11864 Belden Court																	X	6	of	6	X	Yes			X	Yes				
35400 Plymouth																	X	10	of	10	X	Yes			X	Yes				
11700 Belden Court	X	18	of	18	X	18	of	18									X	9	of	9	X	Yes	X	Yes - 0% leakage						
34682 Beacon	X	7	of	7													X	5	of	5	X	Yes			X	Yes	X	7	of	7
12066 Boston Post		5	of	5	X	5	of	5									X	4	of	4	X	Yes	X	Yes - 0% leakage	X	Yes	X	5	of	5
* Not evaluated fully- complete QA/QC data not submitted to date																														