Health Consultation

MLC Former Delphi Division Property Off-Site Vapor Intrusion Investigation

Livonia, Wayne County, Michigan

EPA FACILITY ID: MID005356621

Prepared by
Michigan Department of Community Health

JULY 16, 2014

Prepared under a Cooperative Agreement with the
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Community Health Investigations
Atlanta, Georgia 30333

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Acronyms and Abbreviations

$\mu g/m^3$	micrograms per cubic meter
1,1-DCA	1,1-dichloroethane
1,1-DCE	1,1-dichloroethene
1,1,1-TCA	1,1,1-trichloroethane
ADAF	age-dependent adjustment factor
ATSDR	Agency for Toxic Substances and Disease Registry
cis-1,2-DCE	cis-1,2-dichloroethene
cMRL	chronic Minimal Risk Level
CREG	Cancer Risk Evaluation Guide
EPA	U.S. Environmental Protection Agency
GM	General Motors
HQ	Hazard Quotient
MCL	Maximum Contaminant Level
MDCH	Michigan Department of Community Health
MDEQ	Michigan Department of Environmental Quality
PCE	tetrachloroethene (perchloroethene)
PVC	polyvinyl chloride
RACER	Revitalizing Auto Communities Environmental Response Trust
RfC	Reference Concentration
RSL	Regional Screening Level for Chemical Contaminants at Superfund Sites
TCE	trichloroethene
trans-1,2-DCE	trans-1,2-dichloroethene
VC	vinyl chloride
VOC	volatile organic compound

Purpose and Health Issues

The purpose of this health consultation report is to formally document the public health evaluation and activities conducted for a residential vapor intrusion investigation. Although the contaminated groundwater plume had not been considered a potential health threat previously, new toxicity values for trichloroethene (TCE), as well as an increased understanding of the vapor intrusion pathway, prompted the need for this investigation. The U.S. Environmental Protection Agency (EPA) requested that the Michigan Department of Community Health (MDCH) assist with public health outreach to address any health concerns raised by the residents.

MDCH conducted this health consultation for the federal Agency for Toxic Substances and Disease Registry (ATSDR) under a cooperative agreement. ATSDR conducts public health activities (assessments/consultations, advisories, education) at sites of environmental contamination and concern. ATSDR is primarily an advisory agency. Therefore, its reports usually identify what actions are appropriate to be undertaken by the regulatory agency overseeing the site, other responsible parties, or the research or education divisions of ATSDR. As such, ATSDR recommendations may not encompass all types of federal and state requirements from a regulatory perspective. The purpose of a health consultation is not to evaluate or confirm regulatory compliance but to determine if any potentially harmful exposures are occurring or may occur in the future.

Summary

A chlorinated solvent groundwater plume migrated from a former General Motors facility under a residential neighborhood in Livonia (Wayne County), Michigan, prompting a vapor intrusion investigation. TCE and seven other volatile organic compounds (VOCs) were examined in the investigation. MDCH provided public health support for the investigation, helping to interpret soil gas and indoor air results for the homeowners.

Seventeen houses were identified for the investigation. Only 10 homeowners granted access. It is unknown if there is contamination in the soil gas or indoor air of the properties where access was not granted.

TCE in soil gas at one property exceeded the EPA screening level but there were no indoor air detections of the chemical in that home. A vapor mitigation system was installed in the house at this property. There were detections of trans-1,2-dichloroethene in the soil gas at two properties that exceeded the EPA screening level, but investigators concluded, after reviewing the data, that the detections did not represent true subsurface conditions.

TCE was detected in the indoor air of two homes at concentrations greater than the screening level. TCE in the soil gas at these properties did not exceed screening levels. Two other chemicals that may interact with TCE, 1,1,1-trichloroethane and tetrachloroethene, were detected in indoor air at one of these homes but at concentrations lower than their respective indoor air screening levels and below concentrations at which joint chemical action might be expected. It is likely that the indoor air detections were due to the use of consumer products containing these chemicals.

MDCH has reached the following conclusions:

- It is unlikely that vapor intrusion was occurring in the homes sampled in this investigation. When comparing detections in soil gas against those in indoor air, there was *no* pattern that indicated vapor intrusion was occurring.
- Concentrations of VOCs detected in the indoor air of homes sampled in this investigation are *not* expected to cause harm. The detections did not occur consistently. Chemicals detected in the same home on the same sampling date are *not* expected to interact and cause harm.

Next Steps:

1. The investigators provided the homeowners with their home's sampling results.
2. MDCH will provide the homeowners copies of this health consultation report.
3. The investigators, along with the U.S. Environmental Protection Agency and MDCH, will inform local officials about the results of the investigation and plans for future activities. The activities include continued monitoring of groundwater and soil gas to ensure conditions remain acceptable.

Background

On January 24, 2012, the U.S. Environmental Protection Agency (EPA) requested that MDCH provide public health input for a vapor intrusion investigation planned in Livonia (Wayne County), Michigan (Figure 1). "Vapor intrusion" occurs when vapors from groundwater or subsurface soil contamination move through the air spaces in the soil, enter a building through cracks or other openings in the building's foundation, and build up in the indoor air (EPA 2012c). Many factors, including fluctuations over time in outdoor barometric pressure, soil moisture (from precipitation) or building pressure (from heating, ventilation or air conditioning operation) can affect whether or not vapor intrusion occurs. Several sampling events over a period of varying conditions may be needed to fully evaluate the potential for vapors to enter a building.

A groundwater plume of trichloroethene (TCE) and related chlorinated hydrocarbon chemicals migrated from a former General Motors (GM) facility, the MLC Former Delphi Division Property, into a residential neighborhood (Figure 2). Groundwater monitoring data (GM 2002; CRA 2005, 2008, 2011, 2012a,b) indicated that the concentrations exceeded the Maximum Contaminant Level (MCL) for TCE in drinking water (5 micrograms per liter [EPA 2012a]), but the neighborhood is on municipal water, which is obtained from the Detroit River (City of Livonia 2012). Therefore, drinking water is *not* an exposure route of concern.

Previous to September 2011, TCE concentrations in the groundwater were below the EPA vapor intrusion screening levels in place during the earlier sampling events. However, the EPA updated toxicity values for TCE on September 28, 2011 (EPA 2011). The Reference Concentration (RfC) for TCE in air decreased significantly, resulting in more restrictive vapor intrusion screening levels. Additionally, the understanding of vapor intrusion has increased over the past decade. Multiple lines of evidence are necessary to assess the risk posed by this pathway. Due to these changes, EPA concluded that the TCE in groundwater could volatilize into the soil gas and potentially enter residential homes, resulting in indoor air concentrations that might pose a human health concern.

Figure 1: Site location for "MLC Former Delphi Division Property Off-Site Vapor Intrusion Investigation" conducted in 2012 in Livonia (Wayne County), Michigan (HMA 2012).

Figure 2: Detail of residential area affected by trichloroethene (TCE) groundwater plume from MLC Former Delphi Division property in Livonia (Wayne County), Michigan. (Mapped provided by Hamp, Mathews & Associates, Inc.)

Revitalizing Auto Communities Environmental Response Trust (RACER) is the current owner of the former GM facility. The EPA directed RACER to conduct an investigation to determine whether vapor intrusion was occurring or likely to occur at homes in the residential neighborhood (HMA 2012). RACER drafted an investigation and mitigation plan:

- During the investigation, RACER would collect soil gas samples, preferably from beneath the potentially affected homes (those buildings that were within the plume boundary), and indoor air samples (if permitted by the homeowner).
- If the soil gas samples at an individual address exceeded EPA screening levels, a vapor mitigation system would be installed.
- If the soil gas screening levels were not exceeded, but the indoor air samples exceeded screening levels, the source of the indoor air contamination would be investigated, and soil gas and indoor air resampled, to ensure that vapor intrusion was not occurring.
- If neither the EPA soil gas nor the indoor air screening levels were exceeded, a confirmation sampling event would occur. If the second round of sampling confirmed that there were no exceedances, then no further action would be necessary[1]. If the results from the second round of sampling indicated an exceedance, the findings would be evaluated to determine whether further sampling was necessary or a vapor mitigation system would be installed.

MDCH reviewed the investigation and mitigation plan and found the strategy to be protective of human health.

RACER identified 17 homes for potential inclusion in the investigation and notified the homeowners, requesting access for sampling. Only 10 homeowners granted access. Sampling began in February 2012, with confirmation sampling in April (when groundwater elevations were expected to be at their highest). Additional sampling occurred at one residence through August 2012. MDCH accompanied RACER on home visits to discuss sampling results and answer health-related questions.

Discussion

Environmental Contamination

Of the 17 homeowners that RACER contacted for this investigation, seven declined to participate after multiple attempts by RACER. If there is contamination in the soil gas or indoor air of their properties, the concentrations are not known.

Chemicals Targeted for Investigation

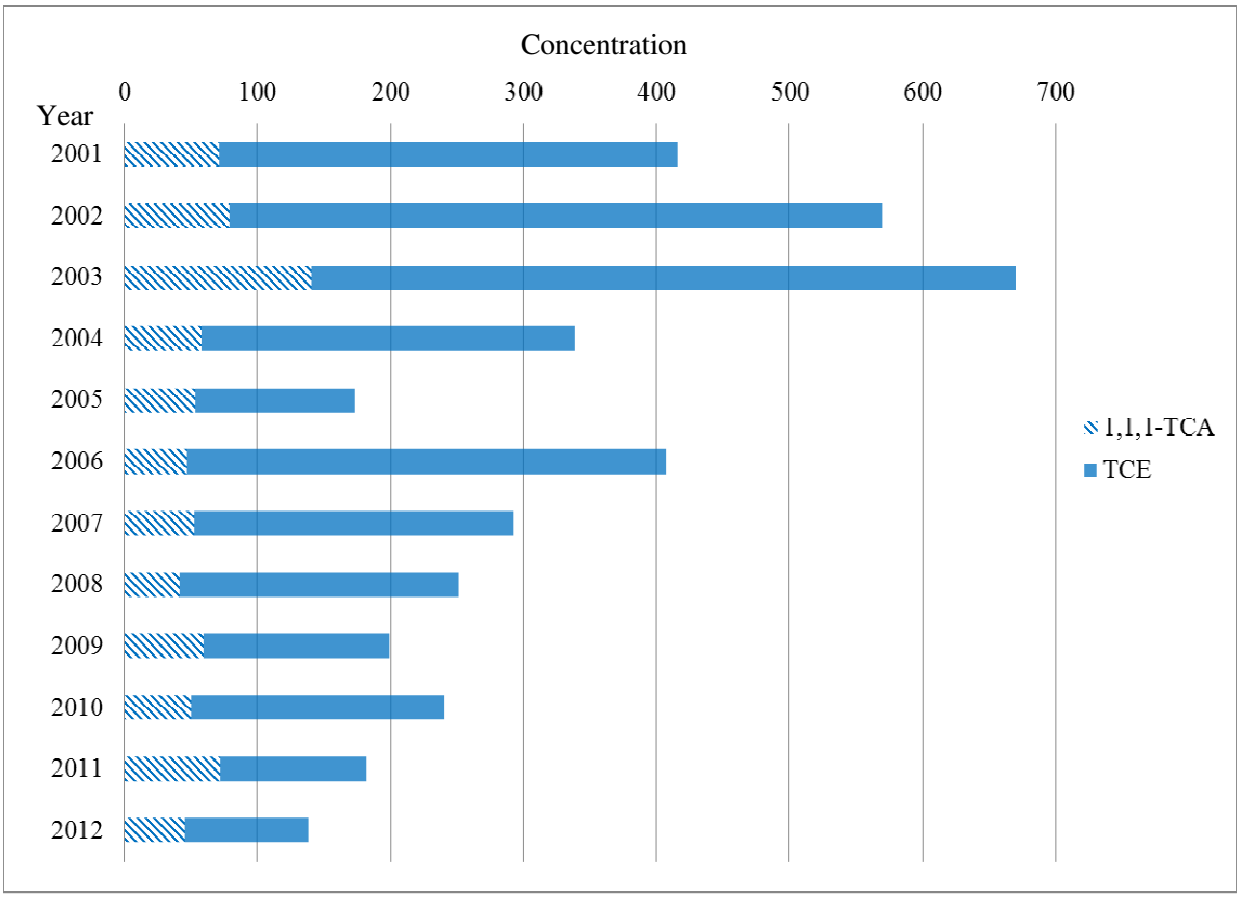
RACER, with concurrence from EPA, targeted eight volatile organic compounds (VOCs) for this investigation[2]:

chloroethane	trans-1,2-dichloroethene (trans-1,2-DCE)
1,1-dichloroethane (1,1-DCA)	1,1,1-trichloroethane (1,1,1-TCA)
1,1-dichloroethene (1,1-DCE)	trichloroethene (TCE)
cis-1,2-dichloroethene (cis-1,2-DCE)	vinyl chloride (VC)

[1] EPA may request future work should site conditions change or if chemical toxicity values become more restrictive.
[2] Compendium Method TO-15 (EPA 1999), which can identify and quantify more than 50 VOCs in soil gas or air, was the analytical method used for this investigation.

The investigation focused on these eight chemicals because they have been regularly present in the groundwater plume or are TCE degradants. Off-site groundwater monitoring data (GM 2002; CRA 2005, 2008, 2011, 2012a,b) have indicated that, over time (2001-2012), 1,1,1-TCA concentrations have remained relatively stable or decreased slightly whereas TCE concentrations have declined (Figure 3). Off-site monitoring also tested for cis-1,2-DCE and VC but those chemicals were rarely detected. See Appendix A for the maximum concentrations of 1,1,1-TCA, cis-1,2-DCE, TCE and VC detected in off-site groundwater.

Figure 3. Trend of maximum off-site monitoring well groundwater concentrations of 1,1,1-trichloroethane (1,1,1-TCA) and trichloroethene (TCE) at the MLC Former Delphi Division Property site, 2001-2012, in Livonia (Wayne County), Michigan. (Concentrations in micrograms per liter.)



References: GM 2002; CRA 2005, 2008, 2011, 2012a,b

The highest off-site concentrations of 1,1,1-TCA in the groundwater have tended to be beyond the "toe" of the TCE plume (south and east of the plume). The highest off-site concentrations of TCE in the groundwater have mostly been measured within the central portion of the narrow length of the TCE plume (at MW-213S [Figure 2]). The source area of contamination in the southeast area of the former GM facility was excavated in 2003 (CRA 2006). Therefore, it is likely that the plume is no longer being "fed" and that groundwater concentrations will continue to decrease, as shown in the trend in Figure 3.

Screening Levels for Soil Gas and Indoor Air

RACER used the EPA's Regional Screening Levels for Chemical Contaminants at Superfund Sites (RSLs; EPA 2012b) for comparison of the environmental data.[3] RACER compared indoor air data to the Residential Air RSL and applied the default EPA attenuation factor of 0.1 (i.e., divided by 0.1; EPA 2011) to the air RSL to derive a soil gas screening value. (An "attenuation factor" is the ratio of the indoor air concentration over the soil gas concentration and suggests how much of a barrier a foundation or slab may present to vapor intrusion. When used as the divisor, as was done to calculate the soil gas screening levels in this investigation, a higher attenuation factor results in a lower, and more protective, screening level.) RACER did not use the current Michigan Department of Environmental Quality (MDEQ) attenuation factor of 0.03 (MDEQ 2013) for this investigation because EPA was the lead regulatory agency for the site. As well, the 0.1 value was more protective, resulting in a lower [more stringent] soil gas screening value. EPA does not have a Residential Air RSL for cis-1,2-DCE, so RACER used the MDEQ Acceptable Indoor Air Value for Vapor Intrusion for that chemical, and adjusted it similarly for a soil gas screening level. Table 1 shows the soil gas and indoor air screening levels used in the investigation.[4]

Table 1. Soil gas and indoor air screening levels used for the 2012 vapor intrusion investigation regarding the MLC Former Delphi Division Property trichloroethene groundwater plume, Livonia (Wayne County), Michigan. (Units are micrograms per cubic meter.)

Chemical	Soil Gas Screening Level[A]	Indoor Air Screening Level
Chloroethane	100,000	10,000
1,1-Dichloroethane (1,1-DCA)	150	15
1,1-Dichloroethene (1,1-DCE)	2,100	210
cis-1,2-Dichloroethene (cis-1,2-DCE)	360	36[B]
trans-1,2-Dichloroethene (trans-1,2-DCE)	630	63
1,1,1-Trichloroethane (1,1,1-TCA)	52,000	5,200
Trichloroethene (TCE)	21	2.1
Vinyl chloride (VC)	16	1.6

References: EPA 2012b, MDEQ 2009

Notes:

A. Soil Gas Screening Level = Indoor Air Screening Level / 0.1
B. Value is the Michigan Department of Environmental Quality (2009) Acceptable Indoor Air Value for Vapor Intrusion.

[3] The RSLs for carcinogens are derived for a 10^{-6} (1 in one million) cancer risk. EPA allowed RACER to adjust the RSLs for a 10^{-5} (1 in 100,000) cancer risk, to maintain consistency with the state of Michigan's allowable cancer risk. Thus the RSLs for carcinogens were multiplied by 10. MDCH concluded that this action was still protective of public health.

[4] ATSDR also develops screening levels, called Comparison Values, for use in public health assessments. ATSDR soil gas screening levels are derived in the same way as above, by dividing the indoor air screening level by 0.1. ATSDR Comparison Values for air are only available for 1,1,1-TCA, TCE and VC . The chronic Comparison Value for TCE is equal to the EPA RSL. 1,1,1-TCA and VC do not have a Comparison Values for chronic exposure. The Comparison Values used to evaluate cancer risk for TCE and VC are discussed in the "Toxicological Evaluation" section of this document.

Soil Gas Data

RACER sampled soil gas on two separate sampling events at eight of the 10 properties to which they had access. Of the two properties tested only once, one was found to have TCE concentrations in the sub-slab soil gas above the screening level, but TCE was not detected in the indoor air. RACER arranged for a vapor mitigation system to be installed at that property. (More detail on the results for this property is provided later in this section). For the other property, RACER was able to gain access to that address only once. The sample results for that property were non-detect in the near-slab soil gas sample for the targeted chemicals (indoor air was not sampled).

Table 2 shows the results of the soil gas sampling conducted by RACER. Each exceedance occurred at a separate property. No property had a soil gas exceedance for more than one chemical, however several chemicals were detected in indoor air at one of the properties, as discussed in the "Indoor Air Data" section of this document.

Table 2. RACER's soil gas sampling results for residential properties overlying the trichloroethene plume from the MLC Former Delphi Division Property, Livonia (Wayne County), Michigan. (Sampling occurred in 2012. Units are micrograms per cubic meter.)

Chemical	No. Properties Sampled	No. Properties w/Detections	Concentration Range	Screening Level	No. Properties w/Exceedance
Chloroethane	10	0	ND	100,000	0
1,1-DCA	10	1	ND - 15	150	0
1,1-DCE	10	0	ND	2,100	0
cis-1,2-DCE	10	2	ND - 70	360	0
trans-1,2-DCE	10	5	ND - 70,000	630	2
1,1,1-TCA	10	6	ND - 86	52,000	0
TCE	10	6	ND - 230	21	1
VC	10	0	ND	16	0

Acronyms:

RACER	Revitalizing Auto Communities Environmental Response Trust		
1,1-DCA	1,1-dichloroethane	1,1-DCE	1,1-dichloroethene
cis-1,2-DCE	cis-1,2-dichloroethene	trans-1,2-DCE	trans-1,2-dichloroethene
1,1,1-TCA	1,1,1-trichloroethane	TCE	trichloroethene
VC	vinyl chloride	ND	not detected

Two homes exceeded the soil gas screening level for trans-1,2-DCE, with concentrations of 1,300 and 70,000 micrograms per cubic meter ($\mu g/m^3$). The exceedances occurred during the second sampling events, which were on the same date, for each home.

- For the home with the 1,300 $\mu g/m^3$ detection ("Home A"), the previous sampling showed no detection of trans-1,2-DCE in that sampling port. The second sampling port in that home had 220 $\mu g/m^3$ trans-1,2-DCE (about one third the screening level) at the first sampling event and no detection of the chemical at the second sampling event. A third soil-gas sampling event occurred at this home, with both sampling ports showing no detections of trans-1,2-DCE. RACER and MDCH reviewed the VOC data for all the homes, in an attempt to identify a potential source. None of the other targeted chemicals

showed a similar increase in concentration, nor were any of the chemicals detected in Home A's indoor air (sampled in the basement and on the main floor). Groundwater sampling conducted within 48 hours of the second soil gas sampling event showed no detections of trans-1,2-DCE. RACER concluded that the one-time exceedance of trans-1,2-DCE in the soil gas at Home A could not be explained, was probably anomalous, and that vapor intrusion likely was *not* occurring. MDCH and EPA concurred with this conclusion.

- For the home with the 70,000 $\mu g/m^3$ detection of trans-1,2-DCE ("Home B"), the previous sampling showed no detection of the chemical in either sampling port. The second sampling port had 7.1 $\mu g/m^3$ trans-1,2-DCE during the second sampling event (about 1/100th the screening level). Only for the second sampling event was trans-1,2-DCE detected in indoor air (discussed in the next section). Similar to the response for Home A, RACER and MDCH reviewed the VOC data for all the homes, in an attempt to identify the source. RACER conducted three more rounds of sampling at Home B, for a total of five sampling events. In an attempt to determine if the trans-1,2-DCE might have been released to the sewer by a nearby business, RACER also sampled soil gas in the front yard of Home B. There were no detections of trans-1,2-DCE in any of RACER's follow-up samples. During the last sampling event, an independent environmental company conducted side-by-side sampling with RACER ("third-party" sampling). No trans-1,2-DCE was detected in any of the third-party samples. RACER concluded that the one-time elevation of trans-1,2-DCE in the soil gas at Home B could not be explained, was probably anomalous, and that vapor intrusion likely was *not* occurring. MDCH and EPA concurred with this conclusion.

One home ("Home C," mentioned earlier in this section) exceeded the soil gas screening level for TCE, with three sub-slab samples reporting 49, 120, and 230 $\mu g/m^3$ during a single sampling event. Home C had a sump in the basement, which could act as an entry point from the subsurface to indoor air. Testing of the sump water showed no detections of TCE or other targeted chemicals. There were no indoor air detections, basement or main floor, of any targeted chemicals. Although vapor intrusion was *not* demonstrated, based on the non-detect indoor air results, RACER arranged for a vapor mitigation system to be installed at Home C. MDCH and EPA supported this protective measure.

During discussions with the analytical laboratory, RACER learned that there were elevated detections of tetrachloroethene (also known as perchloroethene, or PCE) in some soil gas and indoor air samples. PCE is not considered a chemical of concern in the contaminant plume coming from the former GM facility; it was detected only in 2003, at the detection limit of 1 microgram per liter (CRA 2005), in off-site groundwater samples collected yearly since 2000. Therefore, the source of the PCE is not known. As a precaution, RACER compared the PCE results for all the homes to the soil gas screening level of 420 $\mu g/m^3$. Of the 10 properties, five had detections of PCE in the soil gas, with one property ("Home D") exceeding the screening levels on each of three sampling events (490, 640, and 910 $\mu g/m^3$, respectively). RACER had collected the soil gas at Home D near the building's footprint ("near slab"), since the home was situated over a crawlspace (no basement or slab). There were no detections of PCE or the targeted chemicals in indoor air or crawlspace air. RACER concluded that vapor intrusion was *not* occurring at Home D. MDCH concurred with this conclusion.

Indoor Air Data

Two homeowners whose properties were sampled for soil gas did not grant access for indoor air sampling. RACER sampled indoor air on two separate sampling events at seven of the eight homes to which they had access. The eighth home (Home C) was the property with TCE soil gas above the EPA screening level at the first sampling event. There were no indoor air detections. This home was not re-sampled but instead received a vapor mitigation system.

Table 3 shows the results of the indoor air sampling conducted by RACER[5].

Table 3. RACER's indoor air sampling results for residential properties overlying the trichloroethene plume from the MLC Former Delphi Division Property, Livonia (Wayne County), Michigan. (Sampling occurred in 2012. Units are micrograms per cubic meter.)

Chemical	No. Properties Sampled	No. Properties w/Detections	Concentration Range	Screening Level	No. Properties w/Exceedance
Chloroethane	8	0	ND	10,000	0
1,1-DCA	8	0	ND	15	0
1,1-DCE	8	0	ND	210	0
cis-1,2-DCE	8	0	ND	36	0
trans-1,2-DCE	8	1	ND - 2.7	63	0
1,1,1-TCA	8	1	ND - 13	5,200	0
TCE	8	1	ND - 3.7	2.1	1
VC	8	0	ND	1.6	0

Acronyms:

RACER	Revitalizing Auto Communities Environmental Response Trust		
1,1-DCA	1,1-dichloroethane	1,1-DCE	1,1-dichloroethene
cis-1,2-DCE	cis-1,2-dichloroethene	trans-1,2-DCE	trans-1,2-dichloroethene
1,1,1-TCA	1,1,1-trichloroethane	TCE	trichloroethene
VC	vinyl chloride	ND	not detected

One home tested by RACER ("Home E") contained an indoor air concentration of TCE above the indoor air screening level. When RACER prepared Home E for its first sampling event, field staff discovered a hobby room on the first floor of the house with numerous craft supplies (e.g., markers, glues, air-brush equipment). There was concern that the materials could give off VOCs that would confound the interpretation of the air testing results. RACER elected not to remove the craft supplies, as there were too many, and sampled the air of the room with the door closed. They also sampled indoor air in the kitchen, which is in the main area of the house and on the same floor as the hobby room. The results from the first sampling event indicated no detections of any targeted chemicals in the kitchen and only TCE, at 3.7 $\mu g/m^3$ (almost twice the screening level), in the craft room. TCE was not detected in soil gas in the first sampling event. These results suggested that vapor intrusion was not occurring but that materials in the craft room were

[5] ATSDR Comparison Values for air are only available for 1,1,1-TCA, TCE and VC . The chronic Comparison Value for TCE is equal to the EPA RSL. 1,1,1-TCA and VC do not have a Comparison Values for chronic exposure. The Comparison Values used to evaluate cancer risk for TCE and VC are discussed in the "Toxicological Evaluation" section of this document.

impacting the indoor air. The results from the second sampling event indicated no detections of TCE in either the craft room or the kitchen air, but TCE was detected in soil gas at 1.5 $\mu g/m^3$ (less than 1/10th the screening level). RACER concluded that vapor intrusion was *not* occurring at Home E. MDCH and EPA concurred with this conclusion. MDCH provided information to the homeowner about reducing exposure when working with the craft supplies.

As discussed earlier, trans-1,2-DCE was detected at Home B in only the second round of indoor air sampling at a concentration below the EPA indoor screening level. During the last sampling event, third-party sampling did not find trans-1,2-DCE in indoor air. RACER concluded that the one-time elevation of trans-1,2-DCE in indoor air at Home B was probably anomalous and that vapor intrusion likely was not occurring. MDCH and EPA concurred with this conclusion.

The third-party sampling conducted at Home B detected TCE in the basement air at 0.95 $\mu g/m^3$ (about one half the screening level) and in the kitchen air at 4.3 $\mu g/m^3$ (twice the screening level). RACER's results, sampled at the same time, had no detections of TCE. Neither the third party nor RACER detected TCE in the soil gas, indicating that vapor intrusion likely was *not* occurring. Both the third party and RACER investigated further with their respective laboratories and their field notes to try to determine why the sample results were not similar, but no reason was apparent. RACER and MDCH conferred with EPA about the data for Home B; the groups concluded that vapor intrusion was *not* occurring but the TCE could not be explained. The homeowners chose not to have further sampling conducted. RACER provided information about potential VOC sources in consumer products. MDCH provided information about the toxicity of the VOCs to the homeowners.

As discussed earlier, the analytical laboratory alerted RACER to elevated concentrations of PCE in the soil gas. Therefore, RACER and MDCH reviewed the indoor air data for PCE. Two homes had detections of PCE: Homes B and E.

- PCE was detected in indoor air for three of the five sampling events that RACER conducted in Home B. The indoor air screening level for PCE is 42 $\mu g/m^3$; the highest concentration reported in Home B was 2.9 $\mu g/m^3$ (about 1/15th the screening level). PCE was detected in every soil gas sample for Home B, the maximum concentration being 100 $\mu g/m^3$ (about one fourth the soil gas screening level of 420 $\mu g/m^3$). RACER could not determine the source of the PCE. The third-party sampling that occurred in Home B did not report PCE results.
- PCE was detected in the indoor air once out of two sampling events for Home E, at 1 $\mu g/m^3$, well below the screening level. RACER could not determine the source of the PCE. No PCE was detected in the soil gas.

For this investigation, there is *not* a pattern that indicates vapor intrusion is occurring, when comparing detections in soil gas against those in indoor air. However, TCE was detected in two homes at concentrations exceeding the screening levels. Therefore, this report evaluates exposure to TCE and other chemicals of interest in the next sections.

Exposure Pathways Analysis

To determine whether persons are, have been, or are likely to be exposed to contaminants, MDCH evaluates the environmental and human components that could lead to human exposure. An exposure pathway contains five elements:

- a source of contamination
- contaminant transport through an environmental medium
- a point of exposure
- a route of human exposure
- a receptor population

An exposure pathway is considered complete if there is evidence, or a high probability, that all five of these elements are, have been, or will be present at a site. It is considered either a potential or an incomplete pathway if there is a lower probability of exposure or there is no evidence that at least one of the elements above are, have been, or will be present.

Table 4 shows the evaluation of the inhalation exposure pathway for the chemicals of interest in this investigation.

Table 4. Inhalation exposure pathway for off-site chemicals of interest at the MLC Former Delphi Division Property site, Livonia (Wayne County), Michigan.

Source	Environmental Medium	Chemicals of Interest	Exposure Point	Exposure Route	Exposed Population	Time Frame	Exposure Complete?
Former GM facility	Groundwater	TCE, other targeted chemicals	Indoor air	Inhalation	Residents living over the plume	Past	Unknown
						Present	Incomplete
						Future	Incomplete
Unidentified source	Soil gas	PCE	Indoor air	Inhalation	Residents living over the plume	Past	Unknown
						Present	Incomplete
						Future	Unknown
Unidentified source	Indoor air	TCE, other targeted chemicals, PCE	Indoor air	Inhalation	Residents living over the plume	Past	Unknown
						Present	Complete
						Future	Unknown

Acronyms: PCE perchloroethene TCE trichloroethene

TCE and other targeted chemicals in the groundwater plume from the former GM facility do *not* appear to be entering residential indoor air via vapor intrusion. Groundwater concentrations of these chemicals appear to be decreasing. Therefore, present and future exposure is not likely. It is possible, when groundwater concentrations of the chemicals were higher, that vapors could have entered indoor air in the past, but this cannot be determined.

PCE was detected in soil gas but is not associated with the groundwater plume from the former GM facility. There were screening level exceedances of PCE in soil gas at Home D but vapor intrusion likely was *not* occurring. Therefore, present exposure is not likely at this home. If soil gas concentrations were higher in the past, it is possible that vapors could have entered indoor air, but this cannot be determined. Because the source of the PCE is not known, the likelihood of future exposure cannot be determined.

Several VOCs were detected in indoor air samples, with only TCE exceeding its screening levels at two homes. The detections do not appear to be due to vapor intrusion, but may be due to consumer products that contain the chemicals. Past and future exposure to these chemicals cannot be determined, due to consumers changing the products they use and manufacturers changing formulations.

Toxicological Evaluation

Only TCE exceeded its RSL for indoor air. Therefore, its toxicity is reviewed here, to determine any likelihood of exposure causing a health threat. While VC was never detected in indoor air, it warrants discussion due to ATSDR's Comparison Value being lower than the laboratory's Reporting Limit for the chemical. The possibility of detected chemicals interacting with each other is also discussed.

Trichloroethene (TCE)

Trichloroethene (TCE, also known as trichloroethylene) is used mainly as a degreaser for metal parts, but also is found in typewriter correction fluid, paint removers, adhesives, and spot removers. It was once used as a general anesthetic agent and a drycleaning agent. It has a somewhat sweet odor, is liquid at room temperature, and is nonflammable. TCE evaporates easily and about half of the vapors break down within a week. If released to soil, TCE generally does not degrade there but travels to groundwater, where it does break down but at a slower rate than in air (ATSDR 1997).

People are usually exposed to TCE via the air or drinking water (ATSDR 1997). As indicated above, the chemical is present in various consumer products, the vapors of which can be inhaled during a product's use or as it is drying or curing. If TCE enters groundwater used as drinking water, people may be exposed. However, public drinking water, such as that supplied to the neighborhood in this investigation, is regulated under the National Primary Drinking Water Regulations and must be tested regularly to ensure compliance with EPA's Maximum Contaminant Levels (MCLs; EPA 2012a).

The EPA Residential Air Regional Screening Level (RSL) for TCE used in this investigation, 2.1 $\mu g/m^3$, is equal to the EPA RfC (EPA 2011) and the ATSDR chronic Minimal Risk Level (cMRL; ATSDR 2013b). The RfC and cMRL represent continuous long-term exposure concentrations below which adverse (non-cancer) human health effects would not be expected (ATSDR 2005, EPA 2013). The value for TCE is based on a short (three week) exposure window in which fetal heart malformations could occur. This critical toxic effect was observed in rats born to mothers that were exposed to TCE via drinking water during gestation. The results were extrapolated from the oral route of exposure to inhalation exposure. EPA calculated the human equivalent concentration for this effect to be 21 $\mu g/m^3$ (EPA 2011). Adjusting for possible animal-to-human differences and between-human differences resulted in an RfC of 2.1 (rounding to 2) $\mu g/m^3$. ATSDR has adopted this value for its cMRL (ATSDR 2013b), as it protects the most sensitive population: a developing fetus. The RfC is also protective of a co-critical effect, reduced thymus weights, which was seen in female mice exposed to TCE in drinking water for a month (EPA 2011).

EPA has determined that TCE is carcinogenic to humans, with the strongest evidence being for kidney cancer, followed by non-Hodgkin's lymphoma, and liver and biliary tract cancers. TCE exposure is associated with other cancers (bladder, esophageal, prostate, cervical, breast, and childhood leukemia), but the evidence is limited and not as strong (EPA 2011).[6]

ATSDR develops Comparison Values known as Cancer Risk Evaluation Guides (CREGs) to evaluate cancer risk. CREGs are media-specific values that are not expected to result in excess cancer in an exposed population (this assumes that an unexposed population already has some risk of developing cancer). CREGs are only available for adult exposures; there are no CREGs specific to children's exposures. CREGs assume that exposure is occurring for a lifetime. CREGs are not predictive of an exposed individual's likelihood of developing cancer. CREGs are derived using cancer slope factors and inhalation unit risks developing by EPA (ATSDR 2004c).

The TCE CREG is 0.24 $\mu g/m^3$ (ATSDR 2013a), meaning that at this exposure level, there would be a possible risk of one excess cancer out of one million people exposed. The reporting limit of TCE for the laboratory used in this investigation was 1.4 $\mu g/m^3$ (FiberTec 2012). A "reporting" (or "quantitation") limit is the minimum concentration at which a laboratory feels confident in the reported amount of the chemical in the sample. It is usually several times the value of the "method detection limit," which is the minimum concentration at which a laboratory feels confident that the chemical is actually present in the sample (EPA 1989). Therefore, in theory, a chemical could be detectable but not reportable (not quantifiable).

In this case, for those homes where TCE was "not detected" in the indoor air, it is possible that it was present but at less than 1.4 $\mu g/m^3$. (Note that it is also possible that TCE was not present *at all* in the homes where it was "not detected." The discussion here is for purposes of transparency.) If the TCE CREG is multiplied by 10 (resulting in 2.4 $\mu g/m^3$), then the theoretical cancer risk at that concentration is 1 in 100,000, which is the Michigan-specific acceptable cancer risk for environmental cleanup sites (SOM 1994). The possible risk of developing cancer at a lifetime TCE exposure concentration at the reporting limit of 1.4 $\mu g/m^3$ (which is between 0.24 and 2.4 $\mu g/m^3$) is between 1 in one million and 1 in 100,000.

There were no pregnant female occupants at the two homes that had indoor air detections of TCE in this investigation. Additionally, the TCE detections were not repeatable. RACER tested Home B five times and never found TCE in the indoor air. The third-party sampling at Home B detected TCE but the chemical's presence was not due to vapor intrusion nor could a source be identified. The TCE detection in Home E did not recur in the second round of sampling and was likely due to the craft supplies. It is possible, now that the homeowners have information about potential sources of VOCs and how to prevent exposure, that indoor air concentrations of TCE in

[6] EPA considers TCE to have a mutagenic mode of action for kidney carcinogenicity. In the absence of chemical-specific data to evaluate differences in susceptibility, EPA recommends that risk assessors apply an age-dependent adjustment factor (ADAF) when evaluating early-life exposure to carcinogens (EPA 2005). However, the ADAF only minimally increases the total cancer risk estimate for TCE, since the factor would only be applied for the kidney cancer component and not for the other cancers. Foregoing the adjustment will not significantly impact the lifetime cancer risk estimate (EPA 2011).

the homes have been reduced or eliminated since the investigation. MDCH does *not* expect the TCE that was detected in these homes to cause harm.

Vinyl Chloride (VC)

Most of the vinyl chloride (VC) produced in the United States is used to produce polyvinyl chloride (PVC), which is used to make a variety of plastics (pipes, wiring coatings, packaging), automotive parts, upholstery, and housewares. VC is also a breakdown product of higher chlorinated solvents, such as TCE and PCE. It has a mild, sweet odor and exists as a liquid under high pressure or at low temperatures. It is a colorless gas at room temperature, with the vapors breaking down in a few days. VC evaporates readily from water or soil if near the surface, but can migrate to groundwater (ATSDR 2006b).

People are most likely exposed to VC through the air near industrial facilities that make or use the chemical, from hazardous waste sites and landfills, or from tobacco smoke. If VC enters groundwater used as drinking water, people may be exposed orally (ATSDR 2006b). However, public drinking water, such as that supplied to the neighborhood in this investigation, is regulated under the National Primary Drinking Water Regulations and must be tested regularly to ensure compliance with EPA's MCLs (EPA 2012b).

The EPA Residential Air RSL for VC used in this investigation, 1.6 $\mu g/m^3$, is protective of a 10^{-5} (1 in 100,000) cancer risk (EPA 2012b). (The non-cancer Residential Air RSL for VC is 100 $\mu g/m^3$ [EPA 2012b].) EPA has determined that VC is carcinogenic to humans, based on epidemiological data from workers exposed to the chemical. The primary risk is for liver cancers, particularly angiosarcomas, but brain, lung, and some blood cancers are associated with exposure (ATSDR 2006b, EPA 2000).

There were no detections of VC in indoor air in any of the homes. The laboratory reporting limit was 0.89 $\mu g/m^3$ (FiberTec, 2012), which is lower than the RSL. However, the ATSDR CREG for VC is 0.11 µg/m3, which is lower than the reporting limit. As discussed for TCE, it is possible that VC was detectable in indoor air but not quantifiable. If the VC CREG is multiplied by 10 (resulting in 1.1 $\mu g/m^3$), then the theoretical cancer risk at that concentration is 1 in 100,000. The possible risk of developing cancer at a lifetime VC exposure concentration at the reporting limit of 0.89 $\mu g/m^3$ (which is less than 1.1 $\mu g/m^3$) is less than 1 in 100,000. Note that, similar to the discussion for TCE, it is possible that VC was not present *at all* in indoor air. The discussion here is for purposes of transparency.

Evaluation of Potential for Chemical Interaction

Because people are exposed to a mixture of chemicals at hazardous waste sites, rather than to one chemical at a time, there is the potential for chemicals to interact and cause a different health effect than would be expected from single-chemical exposure. This interaction can result in an "additive" effect, in which the actions of each chemicals are summed; a "synergistic" effect, in which the effect is greater-than-additive; or an "antagonistic" effect, in which the effect is less-than-additive (ATSDR 2004a).

It is more likely that compounds that cause the same health effect will interact, versus compounds that have different effects. ATSDR has completed several interaction profiles for

toxic substances, including one for 1,1,1-TCA, 1,1-DCA, PCE, and TCE (ATSDR 2004b). Although the critical toxic effect of TCE exposure is fetal cardiac malformations (EPA 2011), each of the chemicals in the profile can cause nervous system (via the parent compound) or liver and kidney effects (via reactive metabolites; ATSDR 2004b).

During this investigation, 1,1-DCA was not detected in indoor air. 1,1,1-TCA and PCE were co-detected in indoor air once in Home B. PCE and TCE were co-detected in indoor air in the same home on a different sampling date.

- The data to support joint interaction between 1,1,1-TCA and PCE are limited and considered "ambiguous." ATSDR scientists concluded that health assessors should calculate a Hazard Index to provide an indicator of the hazard of coexposure to these two chemicals (ATSDR 2004b). The Hazard Index for a chemical mixture is the sum of the Hazard Quotients (HQs) of its components. Risk assessors calculate HQs by dividing the expected dose of a chemical by its health-based screening level (EPA 1989). If a component has an HQ of less than 0.1, then it is not likely to be of concern for joint toxic action. If only one component's HQ exceeds 0.1 and approaches unity (1), the situation is not a mixtures problem, but that chemical should be evaluated further on its own (ATSDR 2004a). The concentrations of 1,1,1-TCA and PCE, when they were co-detected in Home B's indoor air, were 13 and 1.2 $\mu g/m^3$, respectively. Their individual HQs were 0.003 (13/5,200) and 0.03 (1.2/42), respectively. No interactions between the toxicities of 1,1,1-TCA and PCE are expected.
- PCE and TCE have similar metabolic pathways, suggesting that they may interfere with each other's metabolism in the body. Occupational studies indicated that workers exposed to both PCE and TCE had lower levels of trichloro-metabolites in the urine than workers exposed only to TCE at about the same concentration that occurred in the mixture. These data suggest that coexposure to PCE at fairly low exposure levels inhibits the metabolism of TCE in humans. The metabolites of PCE and TCE are considered to be responsible for the chemicals' toxicity to the liver and kidneys, however it is unclear whether the parent compounds or their metabolites (particularly TCE's metabolites) have the greater impact on neurotoxic effects. ATSDR scientists concluded that PCE had a less-than-additive effect on TCE whereas TCE had an additive effect on PCE and that health assessors should calculate a Hazard Index (ATSDR 2004b). The highest concentration of PCE measured in Home B, when it was co-detected with TCE, was 2.9 $\mu g/m^3$. This detection occurred in a different part of the house than did the TCE detection, but is being used here for a "worst-case" scenario. The highest TCE concentration, measured by the third-party consultant, was 4.3 $\mu g/m^3$. The individual HQs for PCE and TCE were 0.07 (2.9/42) and 2 (4.3/2.1), respectively. While no interactions between the toxicities of the two chemicals are expected, the HQ for TCE exceeded unity (1). TCE's toxicity was evaluated earlier in this document and is *not* expected to cause harm.

Children's Health Considerations

In general, children may be at greater risk than adults from exposure to hazardous substances at sites of environmental contamination. Children engage in activities such as playing outdoors and hand-to-mouth behaviors that could increase their intake of hazardous substances. They are shorter than most adults, and therefore breathe dust, soil, and vapors found closer to the ground.

Their lower body weight and higher intake rate results in a greater dose of hazardous substance per unit of body weight. The developing body systems of children can sustain permanent damage if toxic exposures are high enough during critical growth stages. Fetal development involves the formation of the body's organs. Injury during key periods of prenatal growth and development could lead to malformation of organs (teratogenesis), disruption of function, and premature death. Exposure of the mother could lead to exposure of the fetus, via the placenta, or affect the fetus because of injury or illness sustained by the mother (ATSDR 1998a). The implication for environmental health is that children can experience substantially greater exposures to toxicants in soil, water, or air than adults can.

The critical toxic effect of TCE exposure is heart malformations in the fetus. The data evaluated for this investigation do *not* support the possibility of that effect occurring here.

Community Health Concerns

Before the investigation began, MDCH facilitated several conference calls between RACER, the EPA, MDEQ, the Wayne County Health Department, and Livonia city officials, so that all agencies and officials would understand how the investigation would be conducted.

MDCH prepared a site-specific vapor intrusion fact sheet (Appendix B) for homeowners, to help them understand the issues and how public health interpretation of the results would proceed.

One resident asked whether past exposures could be determined. While it appeared that vapor intrusion was not occurring during the investigation, it cannot be said with certainty that it was not occurring in the past. Groundwater concentrations of the contaminants were higher in the past, which could have increased soil gas concentrations, but whether any such increase in the subsurface affected indoor air cannot be determined.

One resident asked whether digging in the yard, such as when setting posts (to a depth about four feet), could increase one's risk of exposure. Contact with any contaminated groundwater would not be expected at four feet, since depth to groundwater is about six to 10 feet (HMA 2012). Any contaminated soil gas, upon escaping to ambient air, would immediately mix with and disperse in the outdoor air. The contaminant would be very diluted and not cause harm.

One resident asked whether garden produce could accumulate the contamination, either through the roots or the foliage. There is no evidence that indicate the targeted chemicals in this investigation are taken up by plants in significant concentrations when contamination is present in groundwater or soil (ATSDR 1990, 1994, 1996, 1997, 1998b, 2006a, 2006b). However, research has shown that some foods can absorb TCE vapors past acceptable levels. This has been shown to happen in areas where TCE concentrations in air are elevated, such as industrial areas (ATSDR 1997). Plant or food uptake is not expected to occur in the neighborhood discussed in this report.

The homeowners of Home B asked how the 70,000 $\mu g/m^3$ detection of trans-1,2-DCE in the soil gas might affect ambient air as the gas escapes the soil. As discussed for the question regarding digging in the yard, any soil gas, upon escaping to ambient air, would immediately mix with and disperse in the outdoor air, not causing harm.

EPA has recommended that groundwater and soil gas continue to be monitored for at least five more years, to ensure that conditions remain acceptable. MDCH supports this health-protective recommendation.

Conclusions

It is unlikely that vapor intrusion is occurring in the homes sampled in this investigation. When comparing detections in soil gas against those in indoor air, there is *no* pattern that indicates vapor intrusion is occurring. Indoor air detections of VOCs may be due to the use of consumer products in the home.

Concentrations of VOCs detected in the indoor air of homes sampled in this investigation are *not* expected to cause harm. The detections did not occur consistently. Chemicals detected in the same home on the same sampling date are not expected to react with each other to cause harm.

Recommendations

1. Share individual results of the investigation with the respective homeowners.
2. Inform local officials of the outcome of the investigation and future plans.

Public Health Action Plan

1. RACER has provided each homeowner with their individual results.
2. MDCH has met with the homeowners and discussed the results from a public-health perspective.
3. MDCH will provide each homeowner with a copy of the health consultation report.
4. RACER and EPA will discuss the results of the investigation and future monitoring plans with local officials.

MDCH will remain available as needed for future consultation at this site.

If any citizen has additional information or health concerns regarding this health consultation, please contact MDCH's Division of Environmental Health at 1-800-648-6942.

If the homeowners who declined to participate in the investigation have questions about potential future sampling on their property, they should contact Mr Gregory Rudloff, the EPA project manager for the site, to understand their options.

Report Preparation

This Health Consultation was prepared by the Michigan Department of Community Health under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved agency methodology and the procedures existing at the time the health consultation was initiated. Editorial review was completed by the cooperative agreement partner. The ATSDR has reviewed this health consultation and concurs with its findings based on the information presented in this report. ATSDR's approval of this document has been captured in an electronic database, and the approving reviewers are listed below.

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Appendix A: Maximum groundwater concentrations of 1,1,1-trichloroethane, cis-1,2-dichloroethene, trichloroethene, and vinyl chloride in monitoring wells sampled off-site 2001-2012 at the MLC Former Delphi Division Property site, Livonia (Wayne County), Michigan.

Table A-1: Maximum groundwater concentrations of 1,1,1-trichloroethane (1,1,1-TCA), cis-1,2-dichloroethene (cis-1,2-DCE), trichloroethene (TCE), and vinyl chloride (VC) sampled off-site from 2001 through 2012 at the MLC Former Delphi Division Property site, Livonia (Wayne County), Michigan. (Concentrations in micrograms per liter.)

Year	No. Monitoring Wells Sampled	Max. Concentration (Well Location)			
		1,1,1-TCA	*cis-1,2-DCE*	*TCE*	*VC*
2001	28	71.3 (MW-206S)	4.7 (MW-202S)	344 (MW-213S)	ND[C]
2002	28	79 (MW-212S)	4.2 (MW-202S)	490 (MW-213S)	ND[C]
2003	32	140 (MW-302S)	4 (MW-202S)	530 (MW-302S)	ND[C]
2004	30	58 (MW-202S)	4.5J (MW-202S)[B]	280 (MW-213S)	ND[C]
2005	13	53 (MW-212S)	2.5J (MW 202S)[B]	120 (MW-202S)[D]	0.71J (MW-202S)[B]
2006	7[A]	47 (MW-213S)	10J (MW-213S)[B]	360 (MW-213S)	ND[C]
2007	6	52 (MW-217S)	ND[C]	240 (MW-213S)	8.4J (MW-213S)[B]
2008	6	41 (MW-217S)	ND[C]	210 (MW-213S)	ND[C]
2009	6	59 (MW-217S)	0.31J (MW-216S)[B]	140 (MW-213S)	ND[C]
2010	6	50 (MW-217S)	ND[C]	190 (MW-213S)	ND[C]
2011	6	72 (MW-217S)	ND[C]	110 (MW-213S)	ND[C]
2012	12	45 (MW-217S)	1.4 (MW-301S)	93 (MW-213S)	ND[C]
Notes:	[A]Deep wells (locations ending in "D") were no longer sampled starting 2006. Data indicated that the shallow wells were more greatly impacted by the contaminant plume.				
	[B]"J"-flagged values are estimates.				
	[C]"ND" indicates the chemical was not detected in the sample.				
	[D]MW-213S was not sampled in 2005.				

References: GM 2002; CRA 2005, 2008, 2011, 2012a,b

Appendix B: Vapor Intrusion Investigation fact sheet

Vapor Intrusion Investigation

Groundwater Contamination from the Former General Motors Plant on Eckles Road, Livonia, Michigan

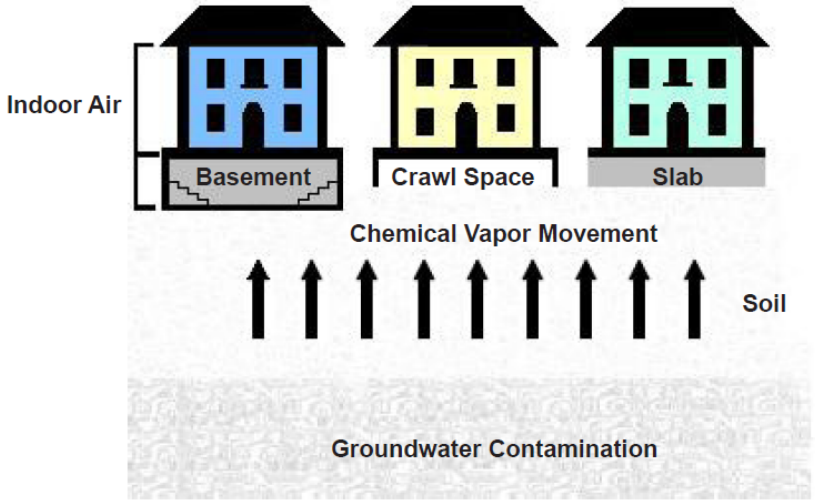
The U.S. Environmental Protection Agency (EPA) and Revitalizing Auto Communities Environmental Response Trust (RACER Trust) are planning to conduct a vapor intrusion investigation in your community. The vapor intrusion investigation involves collecting indoor air and soil gas samples at residential homes. In the past, General Motors (GM) and Motor Liquidation Company (MLC) conducted several groundwater investigations related to the former Delphi Chassis Stem Plant at 13000 Eckles Road in Livonia, MI.

The vapor intrusion investigation is necessary to ensure that groundwater contamination from the former Delphi plant site is not affecting the indoor air quality in homes.

What is vapor intrusion?

"Vapor intrusion" refers to the vapors produced by a chemical that has been spilled or leaked and has entered into the ground. The chemical may seep into the groundwater and be carried further away from the spill site.

Volatile organic compounds, or VOCs, are a group of chemicals that easily produce vapors that cause vapor intrusion. VOCs in groundwater may release vapors into the surrounding soil. The vapors can travel through soil and could enter buildings through cracks or other openings in the building's foundation.



What chemical is being investigated?

Trichloroethene, also known as trichloroethylene or TCE, is the main chemical of interest in this investigation. TCE is a common solvent, used in industrial settings and in common household items.

Groundwater sampling in the past has shown that there is a narrow area of contamination coming from the former GM property and underneath several homes in your community.

Previous investigations found no risk. What has changed?

Investigations conducted by GM and MLC over the years concluded that there was no exposure risk from drinking water, since the community is served by municipal water.

Please understand that your drinking water is not contaminated.

The drinking water in your community comes from the Great Lakes and is treated by the City of Detroit to ensure that it is safe to drink.

These earlier investigations also found no risk of vapor intrusion. However, scientific understanding of both vapor intrusion and TCE has increased in recent years. In September 2011, the EPA released updated reference values for TCE which resulted in lower acceptable exposure limits. This means that the TCE vapor intrusion potential to homes in your community needs to be re-evaluated. Samples of soil gas and indoor air will help answer the question of whether vapor intrusion is occurring.

Before the vapor intrusion investigation is conducted, EPA and RACER Trust staff will discuss what steps need to be taken so that the most accurate and up-to-date information is gathered. This will include looking at household products that might be contributing VOCs already to the indoor air. These items will be removed before the air sample is taken. Other simple steps may be necessary to make sure the sampling results are indicating vapor intrusion. RACER Trust will conduct the testing requested by EPA.

After the samples are analyzed at a lab, EPA and RACER Trust staff will provide you with the results. If it appears vapor intrusion is occurring, health department toxicologists will help you understand the results. RACER Trust will install any required mitigation systems (if needed) at no cost to the homeowner.

What does all this mean?

Once the investigation is completed, health department toxicologists will review indoor air results, toxicity of the chemicals, and other factors when evaluating any exposure. They will talk with you about the levels of TCE that were found.

Want more information?

To learn more about the vapor intrusion investigation, contact Rafael P. Gonzalez, EPA Public Affairs Specialist, at **312-886-0269** or by email at **gonzalez.rafaelp@epa.gov** or Grant Trigger, Michigan Cleanup Manager for RACER Trust at **313-670-6226** or by email at **gtrigger@racertrust.org**.

To learn more about TCE or other chemicals, contact Christina Bush at the Michigan Department of Community Health at **1-800-648-6942** or by email at **bushc6@michigan.gov**.

RACER

Michigan Department of Community Health

MDCH

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