Letter Health Consultation

Public Health Implications of Exposures to
Trichloroethylene at the Albea Americas, Inc. Facility--Follow-up Evaluation

POHATCONG VALLEY GROUNDWATER CONTAMINATION SUPERFUND SITE
WARREN COUNTY, NEW JERSEY

EPA FACILITY ID: NJD981179047

Prepared by
New Jersey Department of Health

JULY 11, 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

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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LETTER HEALTH CONSULTATION

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July 2, 2014

Joseph Rotola
Chief, Removal Action Branch
U.S. Environmental Protection Agency, Region 2
2890 Woodbridge Avenue
Edison, New Jersey 08837-3679

Dear Mr. Rotola:

At your request, this Letter Health Consultation (LHC) has been completed as a follow-up assessment for the Albea Americas, Inc. (AAI) facility located at 191 State Highway 31, in Washington Borough and Washington Township, Warren County, New Jersey. This LHC is a follow-up to the prior LHC dated August 1, 2013 and evaluates recent assessment data that reflects remedial measures implemented to mitigate vapor intrusion into the facility and reduce indoor air concentrations of trichloroethylene (TCE). This LHC provides discussion of public health implications, conclusions, and recommendations concerning present employee exposures to TCE in indoor air within this facility and evaluates exposures following the implementation of mitigation measures that were initiated in late June 2013 and completed in August 2013 to reduce facility employees' inhalation exposures to TCE.

Based on the review of data available through November 2013, the ATSDR and NJDOH have determined the current and future use of the AAI facility ***should not harm the health of facility employees*** if TCE concentrations in indoor air do not increase above the U.S. Environmental Protection Agency's (US EPA) site-specific health goal, which has been attained through mitigation measures implemented at the facility. Concentrations of TCE in the air within the facility are below the US EPA's site-specific health goal of 7 micrograms per cubic meter (µg/m3) of TCE in indoor air, which is considered to be protective for AAI employees (ATSDR 2013b). However, continued air testing and evaluation is necessary to further verify that TCE concentrations in indoor air remain below the US EPA's site-specific health goal.

Concerning this evaluation, the NJDOH and ATSDR recommend the following:

- Continued indoor air monitoring to ensure that TCE concentrations remain below the site-specific health goal for this facility;

- Continued remedial measures until the site-related vapor intrusion hazards in soil gas are removed; and

- A review of all soil gas and indoor air investigation data for the area immediately surrounding the facility to ensure all potential vapor intrusion receptors have been evaluated.

The remainder of this letter health consultation provides our assessment of the health risks to AAI facility employees, our conclusions, and recommendations based on the evaluation of the most current investigation data provided by the US EPA.

A LHC issued on August 1, 2013 provided an assessment of exposures, primarily to TCE, for the period of March through June 2013 prior to the implementation of current remedial measures. The LHC findings based on the available data through June 2013 categorized inhalation exposures to TCE in indoor air at the AAI facility as a ***public health hazard***. This determination was based on the US EPA's site-specific health goal of 7 $\mu g/m^3$ of TCE in indoor air to be protective for AAI employees (ATSDR 2013b).

Statement of Issues

In August 2013, the US EPA requested assistance from the federal Agency for Toxic Substances and Disease Registry (ATSDR) and the New Jersey Department of Health (NJDOH) in evaluating the possible public health implications of site-related indoor air contamination detected following remedial actions in June and July 2013 at the AAI facility. The facility was formerly owned and operated by a number of entities including American National Can and Pechiney Plastic Packaging Inc. (PPPI), and has been identified by US EPA as a source of groundwater contamination at the Pohatcong Valley Groundwater Contamination Superfund (PVGC) site. The PVGC site is situated within Washington Township, Franklin Township, Greenwich Township and Washington Borough in Warren County. Through a cooperative agreement with the ATSDR, the NJDOH reviewed environmental data[1] from July through November 2013 to prepare this health consultation. This health consultation determined the public health implications associated with inhalation exposures to TCE in indoor air from the TCE source area of the PVGC site following post-mitigation measures initiated in June 2013 and completed in August 2013.

Demographics

No one currently lives on the AAI property. There are approximately 250 employees who work throughout the AAI facility. Facility employees include male and female adults. The facility operates 24 hours a day for 6 days per week. The maximum work shift for employees at the AAI facility is 12 hours per day for 4 days per week for a maximum of approximately 48 hours per week. In the past, the facility operated 24 hours a day for 7 days per week.

[1] The ATSDR and NJDOH understand that additional data after November 2013 will continue to be collected at the AAI facility.

Environmental Contamination

The US EPA has divided the site investigation of the PVGC site into three operable units known as Operable Unit 1 (OU1), Operable Unit 2 (OU2) and Operable Unit 3 (OU3). OU1 and OU2 address groundwater contaminated with TCE and/or tetrachloroethylene (PCE). The Operable Unit 3 (OU3) study area is located within the borough of Washington and specifically focuses on the source areas believed to be contributing to predominant TCE contamination within groundwater.

The US EPA has conducted vapor intrusion (VI) sampling throughout the OU1 and OU2 study areas from 2006 to present. VI sampling included, but was not limited to, residential properties, public schools and daycare facilities. A number of these sampled properties are located downgradient, and in the vicinity of AAI. Widespread elevated indoor air levels of VOCs were not observed in the OU1 and OU2 study area. Limited VI issues in the OU1 and OU2 study area were addressed via the installation of mitigation systems at three properties. As part of OU3 remedial investigation requirements, a vapor intrusion investigation of the AAI facility was initiated in March 2013 by CDM Smith, the US EPA's OU3 Remedial Investigation/Feasibility Study Contractor. A soil vapor extraction system (SVE) was installed and operational at the facility in July 2013. Installation of Long-Term Sub-slab Depressurization (SSD) systems were completed by August 19, 2013. These SSD systems were installed as an enhancement to the SVE system installed in July 2013. The final mitigation system consists of one large SVE system with 16 extraction points and eight SSD systems with 10 extraction points located within the production area. Vapor intrusion occurring at the AAI facility continues to be monitored by the US EPA following the operation of these mitigation systems.

Soil Gas Assessment

A summary of soil gas results collected below the AAI facility by Environmental Resources Management (ERM), consultant to AAI and Environ, consultant to PPPI, on July 11 and 24, 2013 are presented in Table 1 below. A total of 17 soil gas samples were collected over a 24-hour period via Summa canisters. Samples were analyzed for volatile organic compounds (VOCs) using US EPA Method TO-15.

Table 1: Summary of Soil Gas TCE Concentrations Exceeding Environmental Comparison Values – July 2013
Albea Americas, Inc. Facility
191 State Highway 31, Washington Township, Warren County, New Jersey

Contaminant	Soil Gas Investigation Area	Soil Gas Concentration Range µg/m^3	Samples Exceeding Environmental Comparison Value	Environmental Comparison Value (1) µg/m^3
TCE	Facility Wide	120 – 262,000	16 of 17	150

(1) New Jersey Department of Environmental Protection (NJDEP) – Vapor Intrusion Technical Guidance: Non-Residential Soil Gas Screening Values, March 2013

This most recent soil gas data show that TCE concentrations are an order of magnitude lower compared with soil gas data collected by the US EPA in March and June 2013 and presented in the preceding Health Consultation dated August 1, 2013. However, TCE concentrations remain significantly above the NJDEP soil gas screening levels and continue to act as a source of vapor intrusion to the interior of the facility. The reduction in soil gas concentration may be attributable to the interim soil gas mitigation actions initiated in July 2013 until the SSD systems were completed by August 19, 2013.

Indoor Air Assessment

A summary of TCE indoor air results collected in July through November 2013 are presented in Table 2 below. Samples were collected by Environmental Resources Management (ERM), consultant to AAI, and by Environ, consultant to PPPI. Additional samples were collected by the US EPA. A total of 173 indoor air samples were collected over a 24-hour period via Summa canisters. An additional 38 samples were collected by Environ and the US EPA following the installation and operation of the SSD systems by August 19, 2013. Indoor air samples were analyzed using US EPA Method TO-15. Prior to the installation of the SSD systems, TCE concentrations in indoor air exceeded the US EPA's site-specific health goal of 7 $\mu g/m^3$ of TCE in indoor air for all sampling events.

For this evaluation, TCE concentrations in indoor air samples collected both pre- and post-operation of the SVE and SSD systems were compared to the US EPA's site-specific health goal of 7 micrograms per cubic meter ($\mu g/m^3$) to assess AAI employee exposures during their work day (see Table 2 below). This table illustrates TCE exposure concentrations for pre and post operation of the SSD systems which appears to have been successful in reducing TCE concentrations in indoor air within the AAI facility.

Based on the presented data within Table 2, the operation of the SSD systems in conjunction with the operation of the SVE system appears to be effective in reducing TCE concentrations in indoor air in the majority of the AAI facility, with the exception of the first floor office, to below the US EPA's site-specific health goal of 7 $\mu g/m^3$ for TCE. Regarding the first floor office identified as US EPA ID: IA-27 (CDM-IA-04), an expansion joint in the concrete floor near this location is believed to have been a pathway for subsurface vapors to enter the building, resulting in elevated TCE concentrations in indoor air. This expansion joint was sealed in October 2013 with two follow-up samples collected in October and November 2013 demonstrating TCE concentrations did not exceed the US EPA's site-specific health goal of 7 $\mu g/m^3$.

Chemical Properties and Health Effects from Exposures to TCE

The chemical properties and health effects from exposures to TCE have been provided in the preceding health consultation dated August 1, 2013 (ATSDR 2013b).

Table 2: Comparison of Indoor Air TCE Data with the Site-Specific Health Goal for Pre- and Post-Operation of the Long-Term Sub-Slab Depressurization Systems August 2013
Albea Americas, Inc. Facility
191 State Highway 31, Washington Township, Warren County, New Jersey

Pre-Operation of Long-Term Sub-slab Depressurization Systems Late June 2013 to Pre-August 19, 2013					
Worker Exposure Assumptions (1)	**Facility Location**	**TCE Indoor Air Concentration Range µg/m^3**	**Total Number of Samples**	**Number of Samples Exceeding Site-Specific Health Goal of 7 µg/m^3**	**Percent of Samples Exceeding Health Goal**
12 hrs/day at 4 days/week	Facility Wide	0.161 - 110	173	81	47%
Post-Operation of Long-Term Sub-slab Depressurization System Post-August 19, 2013					
Worker Exposure Assumptions (1)	**Facility Location**	**TCE Indoor Air Concentration Range µg/m^3**	**Total Number of Samples**	**Number of Samples Exceeding Site-Specific Health Goal of 7 µg/m^3**	**Percent of Samples Exceeding Health Goal**
12 hrs/day at 4 days/week	Facility Wide (2)	ND – 5.9	34	0	0%
12 hrs/day at 4 days/week	First Floor Office (3)	ND - 10	4	2	50%

(1) AAI employees are assumed to have been working at the facility for at least one year.
(2) Considered all areas of the AAI facility with the exception of the office.
(3) Exceedances repeat at location US EPA ID: IA-27 (CDM-IA-04) identified as an office on the first floor for two samples collected in August 2013. However, following the sealing of a concrete floor expansion joint near this office, two follow-up samples collected in October and November 2013 showed TCE concentrations were below the Site-Specific Health Goal of 7 µg/m^3.

Public Health Implications of Completed Exposure Pathways

Please refer to the preceding LHC dated August 1, 2013 for discussion on the evaluation of completed exposure pathway for AAI employees.

Non-Cancer Health Effects

Inhalation of TCE in Indoor Air

The US EPA identified two animal studies as the basis of their Reference Concentration (RfC) for non-cancer effects (US EPA 2011b). The ATSDR has adopted the US EPA's RfC for inhalation exposures to TCE (ASTDR 2013a). In these studies, where animals were exposed to TCE orally via drinking water, the most sensitive adverse effects involved the immune system and the developing fetus (Johnson et al. 2003, Keil et al. 2009). The US EPA used physiologically based pharmacokinetic (PBPK) modeling to convert the oral dose in animals to a human equivalent concentration (HEC) of TCE in air (US EPA 2011a). In addition, for one rat study, US EPA used the lower confidence limit of the benchmark dose response (BMDL01) to estimate the air concentration that would yield a one percent response rate for fetal cardiac malformations. The result of these transformations is an HEC99, BMDL01 of 21 $\mu g/m^3$. The HEC99 is the human exposure concentration for which there is a 99% likelihood that a randomly selected individual will have an internal dose less than or equal to, in this case, the BMDL01. To summarize, the US EPA predicts that there is a small risk of fetal heart malformations for pregnant women exposed to TCE at 21 $\mu g/m^3$. The US EPA used an uncertainty factor of 10 to obtain the RfC of 2 $\mu g/m^3$ (ATSDR 2012; US EPA 2013a).

US EPA also used a 30-week mouse study and identified a lowest observed adverse effect level (LOAEL) for decreased thymus weight as the health endpoint. PBPK modeling was used to derive 190 $\mu g/m^3$ as the HEC99, LOAEL. This concentration was divided by an uncertainty factor of 100 to derive the RfC (ATSDR 2012).

The US EPA also cites a third study (of lower confidence) in support of the RfC where female rats were exposed to TCE by administering the chemical in corn oil by gavage for a 104 week period (NTP 1988). The US EPA used PBPK modeling to convert the oral dose in animals to a HEC of TCE in air (US EPA 2013a). US EPA used the lower confidence limit of the BMDL05 to model (i.e., estimate) the air concentration that would yield a five percent response rate resulting in toxic nephropathy. The result of these transformations is an HEC99, BMDL05 of 30 $\mu g/m^3$. The HEC99 is the human exposure concentration for which there is a 99% likelihood that a randomly selected individual will have an internal dose less than or equal to, in this case, the BMDL05. To summarize, the US EPA predicts that there is a 5% risk of kidney damage to individuals with long term exposure to TCE at 30 $\mu g/m^3$ (US EPA 2013a).

The US EPA cites the 1988 study conducted by the NTP in support of their RfC for TCE where they have determined that humans exposed to TCE in air at 30 $\mu g/m^3$ are at risk of developing kidney damage.

When assessing an exposure risk to a contaminant of concern (COC), the US EPA recommends the 95 percent upper confidence limit (95% UCL) of the arithmetic mean should be used to determine the exposure point concentrations (EPC) for site-related contaminants (US EPA 1992). For this evaluation, TCE indoor air samples collected both pre- and post-operation of the SVE and SSD systems were used to determine the EPCs within the facility where workers are present during their work day. Due to the limited sample size for one location (first floor office) the 95% UCL could not be calculated to derive an EPC; therefore, the maximum TCE concentration was used as the EPC.

For the evaluation period for the pre-operation of the SVE and SSD systems, TCE concentrations varied significantly with average TCE concentrations near 13 µg/m^3. However, due to the varied TCE concentrations observed within the AAI facility during this period, a more conservative estimate for inhalation EPCs to employees was used which considers the 95% UCL and the maximum TCE concentration detected within the facility. These EPCs were adjusted to present a potential range of EPCs for TCE which facility employees may have been exposed as presented in Table 3 below.

Table 3: Summary of TCE Indoor Air Contaminant Concentrations and Exposure Point Concentration (EPC) TCE Inhalation Exposure Concentration Exceeding Health-Based Comparison Value – July through November 2013
Albea Americas, Inc. Facility
191 State Highway 31, Washington Township, Warren County, New Jersey

Number of Samples	Facility Location	TCE Indoor Air Concentration Range µg/m^3	TCE 95% UCL and Maximum EPC Range µg/m^3	*TCE EPC $_{adjusted\ range}$* µg/m^3	Health-Based Comparison Value [1] µg/m^3
Pre-Operation of Long-Term Sub-slab Depressurization (SSD) Systems					
173	Facility Wide	ND - 110	19.1 to 110 [2]	**5.5 to 31.4**	2 MRL
Post-Operation of Long-Term SSD Systems – August 19, 2013					
25	Facility Wide [3]	ND – 5.9	No Further Evaluation [5]		2 MRL
4	First Floor Office [4]	ND - 10	10 [6]	**2.9**	

(1) US EPA Reference Concentration (US EPA 2013a); ATSDR Minimal Risk Level (ATSDR 2013); ATSDR Cancer Risk Evaluation Guideline (ATSDR 2013).
(2) Based on the maximum TCE concentration detected within the facility for the July 9, 2013 to the August 19, 2013 evaluation period and the 95% UCL derived using US EPA's Pro UCL Version 4.00.00.
(3) Considered all areas of the AAI facility with the exception of the first floor office.
(4) Exceedances repeat at location US EPA ID: IA-27 (CDM-IA-04) identified as an office on the first floor for two samples collected in August 2013. However, following the sealing of a

concrete floor expansion joint near this office, two follow-up samples collected in October and November 2013 showed TCE concentrations were below the Site-Specific Health Goal of 7 $\mu g/m^3$.

(5) TCE indoor air concentrations did not exceed the US EPA's site-specific health goal of 7 $\mu g/m^3$; therefore, no further evaluation is required.

(6) Maximum TCE concentration of 10 $\mu g/m^3$ used to derive the EPC $_{adjusted}$ as the 95% UCL cannot be derived due to the limited sample size for this location.

ND – Not Detected

Sample Calculation – TCE EPC $_{adjusted\ range}$:

TCE EPC $_{adjusted\ 95\%UCL}$ =EPC$_{95\%UCL}$ x ET x EF

where EPC $_{adjusted\ 95\%UCL}$ = 95% UCL exposure concentration ($\mu g/m^3$);
ET = exposure time (hours/day); and
EF = exposure frequency (days/week)

TCE EPC $_{adjusted\ 95\%UCL}$** =19.1 $\mu g/m^3$ x 12 hrs/24 hr day x 4 days/7day week = **5.5 $\mu g/m^3$

TCE EPC $_{adjusted\ maximum}$ =EPC$_{maximum}$ x ET x EF

where $EPC_{adjusted\ maximum}$ = maximum exposure concentration ($\mu g/m^3$);
ET = exposure time (hours/day); and
EF = exposure frequency (days/week)

TCE EPC $_{adjustedmaximum}$** =110 $\mu g/m^3$ x 12 hrs/24 hr day x 4 days/7day week = **31.4 $\mu g/m^3$

TCE EPC $_{adjusted\ range}$ = 5.5 to 31.4 $\mu g/m^3$

To assess the severity of exposures and the degree to which workers within the facility may develop adverse health effects from inhalation exposures to TCE we compared the adjusted EPCs for TCE to the LOAELs from the previously described studies (Johnson et al. 2003, Keil et al. 2009). Following the operation of the SVE system in July 2013 and the operation of the SSD systems in August 2013, the adjusted EPCs for TCE for all areas of the AAI facility were below the LOAELs of 21 $\mu g/m^3$, 30 $\mu g/m^3$, and 190 $\mu g/m^3$ as presented in Table 4.

This indicates the operations of the SSD systems in conjunction with the SVE system appears to be successful in mitigating TCE levels in indoor air to below levels of health concern within the AAI facility. Long-term monitoring of this system will be required to assure TCE concentrations in indoor air remain below this site-specific health goal.

Inhalation exposures prior to the implementation of vapor intrusion mitigation measures, specifically the SSD systems in August 2013, may have placed pregnant workers, as well as any women of child-bearing age who became pregnant while employed at this facility, at an increased risk for fetal heart malformations to occur to their children. Additionally, regarding past exposures prior to the operation of the SVE system and the SSD systems, because the adjusted exposure point concentrations were shown to approach the LOAEL of 190 $\mu g/m^3$, facility workers may have been at risk for developing adverse health effects including damage to the immune system from reduced thymus weight. Information pertaining to past exposure

assessment is presented in the prior health consultation dated August 1, 2013 (ATSDR 2013b). As the adjusted exposure point concentration range for TCE in indoor air exceeded 30 µg/m^3, facility workers may have been at risk for developing kidney damage from inhalation exposures.

If continued monitoring ensures the SVE and SSD systems remain effective in reducing TCE concentrations to below the site-specific health goal of 7 µg/m^3, current and future exposures would not be considered harmful to facility employees. Current data demonstrate that operation of the SSD systems was necessary as the SVE system alone did not reduce TCE concentrations to below the site-specific health goal of 7 µg/m^3. While, TCE EPCs had significantly decreased throughout the facility for the period when the SVE system was put into operation (early July 2013 through pre-August 19, 2013), TCE EPCs still represented an inhalation hazard to facility employees. Facility employee exposed to higher concentrations of TCE during this interim remedial period (pre-SSD systems) would be at greater risk for developing adverse health effects.

Table 4: Comparison of Adjusted TCE Exposure Point Concentration (EPC) to Health Endpoints from Toxicological Studies
Albea Americas, Inc. Facility
191 State Highway 31, Washington Township, Warren County, New Jersey

Worker Exposure Assumptions (1)	Facility Location	*TCE EPC $_{adjusted\ range}$* µg/m^3 (2)	Increased Risk of Adverse Effect	
			Study 1: Fetal Heart Malformations (LOAEL 21 µg/m^3) **Support Study 3:** Toxic Nephropathy (LOAEL 30 µg/m^3)	**Study 2:** Adult Immunological Effects (LOAEL 190 µg/m^3)
Pre-Operation of Long-Term Sub-slab Depressurization System Late June 2013 to Pre-August 19, 2013				
12 hrs/day at 4 days/week	Facility Wide – Max. EPC	31.4	Yes	Yes
	Facility Wide – 95%UCL EPC	5.5 (3)	Yes (Slight)	No
Post-Operation of Long-Term Sub-slab Depressurization System Post-August 19, 2013				
12 hrs/day at 4 days/week	First Floor Office (US EPA ID: IA-27)	2.9 (4)	TBD(5)	TBD (5)

(1) AAI employees are assumed to have been working at the facility for at least one year.

(2) Values presented to demonstrate the range of inhalation exposure concentrations to which workers may be subjected.
(3) Based on 95% UCL derived using US EPA's Pro UCL Version 4.00.00 and the maximum detected TCE concentration adjusted for workplace exposures.
(4) Maximum TCE concentration of 10 $\mu g/m^3$ used to derive the $EPC_{adjusted}$ as an adjusted 95% UCL cannot be derived due to the limited sample size for this location.
(5) While TCE EPCs would not be considered to pose an increased risk for adverse health effects to employees for this evaluation period, the data set is too limited and would require additional monitoring before a final determination concerning employee exposures can be provided. At least one additional round of sampling would be required to determine a 95% UCL exposure point concentration for this location.

Cancer Health Effects

The U.S. Department of Health and Human Services, National Toxicology Program classifies TCE as reasonably anticipated to be a human carcinogen. In humans, occupational exposure to TCE was associated with excess incidences of several cancers, particularly liver cancer, non-Hodgkin lymphoma, and kidney cancer (NTP 2011). Animal studies showed that TCE exposure caused tumors in mice and rats at several different sites, including liver and kidney, by inhalation or oral exposure (NTP 2011). The International Agency for Research on Cancer (IARC) has determined that TCE is a probable human carcinogen based on epidemiological studies showing increased rates of liver cancer and non-Hodgkin lymphoma, primarily in workers who were exposed to TCE on the job, and animal studies showing increased numbers of liver and kidney tumors upon oral administration. The US EPA characterizes TCE as carcinogenic to humans by all routes of exposure (US EPA 2011). This conclusion is based on human epidemiology studies showing associations between human exposure to TCE and kidney cancer, non-Hodgkin lymphoma, and liver cancer.

The site-specific lifetime excess cancer risk (LECR) indicates the cancer potential of contaminants. LECR estimates are usually expressed in terms of excess cancer cases in an exposed population in addition to the background rate of cancer. For perspective, the lifetime risk of being diagnosed with cancer in the United States is 46 per 100 individuals for males, and 38 per 100 for females; the lifetime risk of being diagnosed with any of several common types of cancer ranges between 1 in 10 and 1 in 100 (ACS 2011). Typically, health guideline CVs developed for carcinogens are based on one excess cancer case per 1,000,000 individuals. The NJDOH considers estimated cancer risks of less than one additional cancer case among one million persons exposed as insignificant or no increased risk (expressed exponentially as 10^{-6}).

Based on our prior evaluation within the August 1, 2013 health consultation report, using the US EPA's Inhalation Unit Risk Factor $(4.1 \times 10^{-6}\ \mu g/m^3)^{-1}$ and the adjusted exposure point concentrations of TCE in indoor air, the range of LECRs were estimated to be approximately 4 in 1,000,000 to 6 in 1,000,000 for employees working at the AAI facility since it was acquired in 2010, which is considered no apparent increased risk when compared to the background risk of all or specific cancers (ATSDR 2013b). However, this cancer risk assessment would be

underestimated if AAI employees were also employed by the previous owners, PPPI, and worked within this facility during their term of employment where inhalation exposures to TCE in indoor air are assumed to have been similar and thus would have increased their exposure duration. The sampling results for July and November 2013 were not included in this LECR assessment as these results reflect lower TCE concentrations in indoor air due to the recent implementation of mitigation measures. As cancer typically takes several years to decades to develop, a LECR assessment based on recent post-mitigation data would not be relevant to characterize cancer risk from past exposure. If TCE concentrations in indoor air remain at current levels for the facility from this point forward, the LECR for future exposures would be approximately 1 in 1,000,000 for employees working at the AAI facility which is considered no apparent increased risk when compared to the background risk of all or specific cancers.

Conclusions and Recommendations

Based on the review of data available through November 2013, the NJDOH and ATSDR have determined the current and future use of the AAI facility should not harm the health of facility employees based on TCE concentrations in indoor air following the operation of both the SVE system and the SSD systems. However, as there is limited data for the assessment period following the operation of the SSD systems a long-term health evaluation cannot be determined at this time for facility employees. Given the high concentrations of TCE observed in indoor air as evaluated in the August 2013 LHC, it is recommended that additional monitoring and health risk evaluation continue to ensure TCE concentrations remain below the site-specific health goal for this facility. Monitoring of indoor air should continue until the source area below the building no longer poses a threat of vapor intrusion where it could cause harmful inhalation exposures to TCE in indoor air to facility employees. Additionally, periodic monitoring of the SVE and SSD systems should be performed to ensure these systems are operating in their intended capacity to prevent soil gas vapors from entering the interior of the facility, so that TCE concentrations in indoor air do not exceed the site-specific health goal of 7 $\mu g/m^3$. Remedial measures sealing the expansion joint in the concrete floor near the first floor office appears to have mitigated TCE vapors from migrating into the building in this area. As monitoring data is limited following the remedial measures taken for the first floor office locations, additional monitoring would be required to ensure these measures are successful where TCE levels in indoor air remain below the US EPA's site-specific goal of 7 $\mu g/m^3$.

Past exposures prior to the operation of the SVE and SSD systems (early July 2013 through pre-August 19, 2013 period) are considered a public health hazard to facility employees who were exposed TCE concentrations in indoor air ranging from the adjusted 95% UCL at 5.5 $\mu g/m^3$ to the adjusted maximum concentration at 31.4 $\mu g/m^3$. These past exposures would have placed pregnant women and women of child bearing age who become pregnant while employed at the facility at risk for fetal heart malformations to occur to their children. Employees exposed to TCE concentrations closer to the adjusted maximum concentration of 31.4 $\mu g/m^3$ would have been at a higher risk for developing adverse health effects than those exposed closer to the adjusted 95% UCL of 5.5 $\mu g/m^3$. Exposures near the adjusted maximum concentration of 31.4 $\mu g/m^3$ would be considered similar to past exposures cited in the prior health consultation dated August 1, 2013 as detailed below.

In this previous health consultation, past exposures to facility employees had been categorized as a public health hazard based on the elevated concentrations of TCE in indoor air. Past exposures would have placed pregnant women and women of child bearing age who become pregnant while employed at the facility at a higher risk for fetal heart malformations to occur to their children. Further, all employees working within the AAI facility were placed at a higher risk for health effects from inhalation exposures to TCE for both damage to the immune system from reduced thymus weight and for kidney damage based on US EPA supporting documentation.

Based on the findings following the implementation of SVE and SSD systems mitigation measures at the AAI facility, the NJDOH recommends the following:

1. Continued indoor air sampling and monitoring of all mitigation measures to ensure TCE in indoor air remains below a level that does not pose a health concern for all employees within the AAI facility. The ATSDR and NJDOH consider the US EPA's adjusted goal of 7 $\mu g/m^3$ for TCE in indoor air to be protective of public health for all AAI employees at this facility.[2]

2. Remediation measures should continue until the threat of vapor intrusion of TCE and other elevated soil gas contaminants is removed.

3. Additional monitoring of indoor air for the first floor office identified as US EPA ID: IA-27 (CDM-IA-04) is required in order to calculate an exposure point concentration based on a 95% UCL. A more conclusive exposure assessment to determine the associated health risk for this office location will be completed once additional air monitoring data is obtained.

4. Based on concentrations observed in soil gas below the AAI facility, the US EPA should review all soil gas and indoor air investigation data for the area immediately surrounding the facility to ensure all potential vapor intrusion receptors have been evaluated.

The NJDOH is not recommending biological testing since the results would not have any clinical relevance to individual workers as TCE exposure in indoor air have been significantly decreased where biological testing would not yield useful information and would not be able to specify the degree to which any particular employee has been exposed. Biological testing for TCE and its many breakdown products can be performed through blood and urine samples for up to approximately one week following exposures to high concentrations of TCE. This type of testing, however, also presents limitations as other similar chemicals can produce the same

[2] US EPA has determined that the RfC for TCE of 2 $\mu g/m^3$ can be adjusted to account for workplace exposures. As such, the health-protective goal for the AAl facility where employees currently work 12 hr shifts, 4 days per week would be 7 µg/m3 (2 µg/m3 = X µg/m3 x 12 hrs/24 hr day x 4 days/7day week) (US EPA, Personal Communication to Glenn Pulliam, NJDOH July 17, 2013).

breakdown products and limit the degree to which conclusions can be made about an employee's extent of work-related exposure. However workers wishing to discuss health concerns related to TCE exposure may contact the Rutgers Environmental and Occupational Health Sciences Institute (EOHSI) at 848-445-0123. The EOHSI clinic has physicians specializing in environmental and occupational medicine.

The NJDOH and ATSDR are available to review any additional data at the request of the US EPA and provide further guidance as appropriate. The NJDOH and ATSDR are also available to assist the NJDEP and the US EPA in communicating the health risks to the facility owner and workers. We have attached a site-specific fact sheet describing health risks due to TCE exposure.

If you have any questions regarding the findings presented in this letter, please contact me at 609-826-4920 or by email at Joe.Eldridge@doh.state.nj.us.

Sincerely,

Joseph Eldridge, M.P.H., Director
Consumer, Environmental and Occupational Health Service

c: Gregory V. Ulirsch, Leah Graziano, Elena Vaouli, ATSDR
Jerald Fagliano, Glenn Pulliam, NJDOH

Attachment

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REPORT PREPARATION

This Letter Health Consultation for the Pohatcong Valley Groundwater Contamination Superfund site (Albea Americas Facility), Warren County, New Jersey, was prepared by the New Jersey Department of Health under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with the approved agency methods, policies, and procedures existing at the date of publication. Editorial review was completed by the cooperative agreement partner. ATSDR has reviewed this document and concurs with its findings based on the information presented. ATSDR's approval of this document has been captured in an electronic database, and the approving agency reviewers are listed below.

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Possible Health Risks from Exposure to Trichloroethylene
Albea Americas, Incorporated Facility
Washington Township, Warren County, New Jersey

New Jersey Department of Health
July 2014

The New Jersey Department of Health (NJDOH) has prepared two health consultation documents which evaluate worker exposures to trichloroethylene (TCE) detected in the Albea Americas, Incorporated (AAI) facility. In the first report released in August 2013, the NJDOH recommended that TCE exposures be reduced or stopped immediately to protect the health of facility workers. This fact sheet was developed to complement the June 2014 follow-up health consultation which evaluates data after mitigation measures were taken and to provide guidance and information to workers about their exposure to TCE and possible health effects.

What is trichloroethylene (TCE)?

TCE is a nonflammable colorless liquid. It is used as a solvent to remove grease from metal parts. It is also found in adhesives, paint removers, and spot removers.

How might workers be exposed to TCE?

TCE in soil and groundwater beneath the AAI facility can evaporate into the indoor air of the building. Prior to the summer of 2013 before remedial actions were implemented to reduce TCE levels within the building, workers were exposed to TCE by breathing in vapors present within the building. Workers may also have been exposed to TCE by drinking contaminated water from production wells supplied to bathrooms.

What is being done to reduce the TCE levels within the AAI building?

Since the installation and operation of a sub-slab depressurization system within the building in August 2013, indoor air data provided by the US Environmental Protection Agency (US EPA) indicates that levels of TCE have decreased to acceptable levels in the building. Additionally, the bathrooms in the AAI facility are connected to a safe public water supply and are no longer using TCE contaminated water from the production wells. The NJDOH recommends continued indoor air sampling and monitoring of all mitigation measures to ensure that TCE in indoor air remains below a level that does not pose a health concern for employees within the AAI facility.

How can TCE affect the health of the workers?

The chance that exposure to a chemical can cause a health effect usually depends on the amount and the length of time of exposure. Breathing in or drinking large amounts of TCE may cause impaired heart function, unconsciousness, or damage to nerves, kidneys, and liver. Breathing in or drinking smaller amounts of TCE may cause fetal cardiac malformations in pregnant women, decreased immune system function, lung irritation, headaches, dizziness, or difficulty concentrating.

Prior to the installation of the mitigation system, the levels of TCE in indoor air at the AAI facility could have placed pregnant women and women of child bearing age who become pregnant while

employed at the facility at a higher risk for fetal heart malformations to occur to their children. All employees working within the AAI facility could have been at higher risk of health effects on the immune system and kidneys. As long as the mitigation system continues to operate properly, current and future exposures do not pose a health risk to workers at the AAI facility.

How likely is TCE to cause cancer?

Some experimental studies with mice and rats have suggested that high-level, long-term exposure to TCE may cause non-Hodgkin lymphoma, as well as liver, kidney, or lung cancer. Some studies of people exposed over long periods to high levels of TCE in drinking water or in workplace air have found evidence of increased liver, kidney, and lung cancer. The National Toxicology Program has determined that TCE is "reasonably anticipated to be a human carcinogen," and the International Agency for Research on Cancer (IARC) has determined that TCE is "probably carcinogenic to humans." Based on TCE levels in the air at the AAI facility and the length of time workers may have been exposed, the NJDOH estimates that past exposure at the facility would pose no apparent increase in cancer risk compared to the background risk of all or specific cancers.

Is there a medical test for TCE exposure?

Recent exposure to TCE can be detected in breath, blood, or urine. For small amounts of TCE, breath testing must occur within an hour or two after exposure. For large amounts of TCE, blood and urine tests can find TCE and its byproducts up to a week after exposure. Because exposure to other chemicals can produce similar byproducts in the body, test results do not absolutely prove exposure to TCE. Only a doctor or other medical professional familiar with these tests should give them. The NJDOH is not recommending biological testing since the results would not have any clinical relevance to individual workers.

Who should I talk to if I am concerned about my health or my child's health?

You should begin by discussing your concerns with your physician or your child's pediatrician. There are clinics that specialize in environmental health issues that your primary care provider may want to contact.

For adults: The Environmental and Occupational Health Clinical Center in Piscataway, NJ sees adults who have been exposed to contaminants occupationally or environmentally. They can be reached at (848) 445-0123.

For children: Pediatricians can contact the Mt. Sinai Medical Center's Pediatric Environmental Health Specialty Unit at (866) 265-6201.

For general questions: Contact the New Jersey Department of Health, Consumer, Environmental, and Occupational Health Service at 609-826-4984.

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