UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

July 21, 2015

Curtis Griffin, Ed.D.,
Superintendent of Schools
Hatboro-Horsham School District
229 Meetinghouse Road
Horsham, PA 19044

Re: Sampling of the Crooked Billet Elementary School
Meadowbrook Avenue Vapor Intrusion Site
Hatboro, Montgomery County, Pennsylvania

Dear Dr. Griffin:

In response to a request by Hatboro officials and with the cooperation of the Hatboro-Horsham School District, the United States Environmental Protection Agency (EPA) initiated an assessment to evaluate the potential for vapor intrusion at the Crooked Billet Elementary School. Vapor intrusion (VI) is the term used to describe the migration of chemical vapors from subsurface contaminated soils and groundwater into the indoor air spaces of overlying buildings through openings in the building foundation. Common sources of VI include petroleum products, dry cleaning solvents, and other industrial solvents and degreasers. The Borough's request was made in response to concerns regarding the school's proximity to the Raymark Superfund Site and other potential sources of contamination in the surrounding area.

Summary of EPA's Activities at the Crooked Billet Elementary School

- On February, 16, 2015, EPA toured the Crooked Billet Elementary School with school personnel to identify sampling locations for evaluating the potential for VI at the school.

- On March 11, 2015, representatives from the EPA, the Agency for Toxic Substances and Disease Registry (ATSDR) and the Hatboro-Horsham School District met with school faculty and parents to discuss plans to evaluate whether VI may be a concern at the school.

- On March 12, 2015, EPA returned to the school to install sampling ports for the purpose of collecting sub-slab vapor samples. OSC Chase and representatives from EPA's Environmental Response Team (ERT) oversaw the installation of sub-slab sampling ports by ERT's Scientific, Engineering, Response & Analytical Services (SERAS) contractor.

- On March 14, 2015, EPA and SERAS returned to the school to set up Summa canisters to collect 24-hour samples of sub-slab vapor, crawl space air, indoor air and ambient

(outdoor) air. A total of 37 canisters were deployed to collect samples. The sampling included the collection of 19 indoor, 5 crawl space, 8 sub-slab, 4 ambient air samples, and 1 quality control sample. In addition to collecting the 24-hour samples, air monitoring was conducted to evaluate real-time conditions and identify any potential indoor sources of VOCs or elevated levels of VOCs. No elevated levels of VOCs were detected during the monitoring throughout the school.

- On March 15, 2015, EPA and SERAS returned to the school to pick up the Summa canisters. The samples were transported to EPA's SERAS contractor's laboratory in Edison, NJ and analyzed for volatile organic compounds (VOCs) in accordance with an EPA-approved sampling and analysis plan.

- On May 20, 2015, EPA and ATSDR representatives attended a meeting held at the Crooked Billet Elementary School for the Raymark Superfund Site and answered questions from the public regarding the recent sampling of the school.

Summary of Sampling Results

EPA reviewed the results of the sampling conducted at the school and provided those results to ATSDR. ATSDR is a federal public health agency under the U.S. Department of Health and Human Services that provides assistance to EPA in evaluating potential human health risks associated with exposure to environmental contaminants. The enclosed Trip Report (May 2015) provides details regarding the sampling activities and includes the final validated results.

The sampling results were compared to EPA Regional Screening Levels (RSLs) for residential indoor air. The RSLs are standardized risk-based screening levels that were developed using cancer and non-cancer toxicity values for various chemicals and are based on standard exposure scenarios (air, drinking water, soil). The RSLs for a residential indoor air exposure scenario assume a 24-hour exposure for 365 days per year over the course of a lifetime. As a result, the RSL for residential air are generally considered conservative with respect to evaluating exposures at a school. Please note that the RSLs do not represent health effect levels, action levels, or cleanup levels but were developed rather as technical tools. If a chemical is detected at a concentration that exceeds an EPA RSL, further consideration by EPA and ATSDR toxicologists is warranted.

For carcinogenic chemicals, the screening levels correspond to an increased lifetime cancer risk of one in a million or expressed in scientific notation 1E-06. A risk of 1E-06 is the probability that up to one person, out of one million equally exposed people, would contract cancer if exposed continuously (24 hours per day) to the specific concentration of the chemical over 70 years (an assumed lifetime). For non-carcinogenic chemicals, i.e., those that that may have non-cancer health effects, screening levels are compared to a Hazard Index (HI) of 1. The HI is the ratio of the reasonable maximum exposure (chronic daily dose averaged over a lifetime) to a reference dose which is the concentration of the chemical where health effects are not expected. If the HI is more than 1 there is a potential for concern.

Five chemicals were detected in indoor air at the school at concentrations above their respective EPA RSL for a 1E-06 cancer risk, but below for non-cancer effects. While the screening levels were exceeded, the concentrations detected are considered to be within EPA's acceptable risk range. Exposure to the chemicals at the reported levels in indoor and ambient air are not expected to result in adverse health effects in children or adults. Additional information regarding these chemicals, the concentration and frequency of detections is included in the attached Meadowbrook Avenue Site Trip Report Supplement (July 2015) and the RSL Exceedance Table.

In summary, VOCs were found in the air samples collected from the ambient, indoor, crawl space and sub-slab. These results are what we expected and represent common ambient and indoor air contaminants. However, chlorinated VOCs, including trichloethene (TCE) and tetrachloroethene (PCE), were detected in some of the sub-slab samples, crawl space and indoor air samples, but the results were below levels of concern. Given the levels of chlorinated VOCs detected in the indoor air and sub-slab samples, vapor intrusion does not appear to pose a health risk to building occupants at this time.

While vapor intrusion concerns are limited and initial results did not identify VOCs in indoor air at levels that present a health concern, EPA and ATSDR agree that a second round of sampling should be conducted to confirm results and further evaluate the potential for vapor intrusion at the school. EPA will coordinate with school officials to schedule the sampling at a time that is convenient and will not impact school operations.

EPA and ATSDR are available to meet with you, interested faculty and parents to discuss the initial sampling results. Alex Mandell, EPA Community Involvement Coordinator, will continue to work with you regarding the scheduling of any upcoming meetings.

I apologize for the delay in providing you the final results and thank you for your cooperation and patience. Please do not hesitate to contact me at 215-814-3124 with questions you may have regarding this matter.

Sincerely,

Kelley Chase
EPA On-Scene Coordinator

Enclosure

cc: Kelli Sendel, Principal Crooked Billet School
Karl V. Markiewicz, PhD (ATSDR)
Kyle Schmeck (Montgomery County Health Dept.)
Colin R. Wade (PADEP)
Alex Mandell (EPA)

Meadowbrook Avenue Site
Trip Report Supplement
July 2015

With regards to SERAS Trip report (SERAS-262-DTR-052915), ERT Work Assignment Manager (WAM), Michael Hoppe comments are included below as a supplement.

Overview:
EPA has derived tables for indoor air using Regional Screening Levels (RSLs) for residential air (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/). The tables include generic screening levels for multiple exposure pathways (including air, drinking water and soil) and for chemicals with both carcinogenic (cancer) and non-carcinogenic (non-cancer) effects. The screening levels listed in the tables correspond to either a 10^{-6} risk level for carcinogens or a Hazard Quotient (HQ) of 1 for non-carcinogens. The generic screening levels are chemical-specific concentrations for individual contaminants that may warrant further investigation or site cleanup. It should be emphasized that these screening levels are not cleanup standards. Potential actions associated with these derived levels could include: continue monitoring (including sampling); adjustments to air handling systems; and installing mitigation systems.

Trichloroethene (TCE) and Tetrachloroethene (PCE) were identified as contaminants of potential concern at the Meadowbrook Avenue Site as TCE and PCE have been identified as contaminants of concern at several EPA remedial sites in the vicinity of the school. Based on the data collected at the school, TCE and PCE were detected in sub-slab samples, with TCE also being detected above the RSL in one indoor air sample in the school.

Other volatile organic compounds (VOCs) were detected in indoor air samples, some of which were also found in the ambient air, likely a contributing source.

Results:
Five chemicals, discussed below, were detected in indoor air at concentrations above their respective cancer screening levels for residential air.

TCE
The cancer screening level or RSL for residential air for TCE is 0.48 $\mu g/m^3$. TCE was detected at a concentration of 0.816 $\mu g/m^3$ in the indoor air sample collected from the corridor across from Room 107 (CBES-IA9). All other indoor air samples, including the samples collected from the crawl space in this portion of the building, were below the RSL for TCE.

TCE was detected in several of the sub-slab soil gas samples collected in other areas of the building. The maximum concentration of TCE detected was 34.3 $\mu g/m^3$ in the sub-slab sample collected in the basement stair area (CBES-SS1). TCE was detected at the corresponding indoor air sample for this location (CBES-IA1) at an estimated concentration of 0.307 $\mu g/m^3$ which is below the RSL.

TCE is a solvent used in industry to degrease metal parts and is an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers. TCE is a contaminant of concern at several EPA remedial sites in the vicinity of the school.

1,2-Dichloroethane

The cancer screening level or RSL for residential air for 1,2-dichloroethane is 0.11 $\mu g/m^3$. 1,2-dichloroethane was detected a concentration of 0.374 $\mu g/m^3$ in the indoor air sample collected from the nurse's office (CBES-IA8) and at a concentration of 0.214 $\mu g/m^3$ in the indoor air sample collected from the principal's office (CBES-IA17). Sub-slab results for 1,2-dichloroethane show no indication of a potential source below the slab. Other indoor sources should be considered and potentially investigated should additional sampling be performed.

1,2-dichloroethane is used in the production of vinyl chloride which is used to make a variety of plastic and vinyl products including polyvinyl chloride (PVC) pipes, furniture and automobile upholstery, wall coverings, housewares, and automobile parts. It is also used to as a solvent and is added to gasoline to remove lead.

Benzene

Benzene which has a cancer screening level or RSL for residential air of 0.36 $\mu g/m^3$ was detected in the majority of the indoor and ambient air samples. The maximum indoor air concentration detected was 0.782 $\mu g/m^3$ (CBES-IA14) and the maximum ambient concentration detected was 0.765 $\mu g/m^3$ (CBES-AA2).

Benzene is a common air pollutant in urban/suburban areas. The school is located in a neighborhood with heavy vehicular traffic and various industrial facilities both of which are potential sources of this chemical.

Some industries use benzene to make other chemicals which are used to make plastics, resins, and nylon and synthetic fibers. Benzene is also used to make some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Benzene is also found in crude oil, gasoline, and cigarette smoke.

Carbon Tetrachloride

Carbon tetrachloride which has a cancer screening level or RSL for residential air of 0.47 $\mu g/m^3$ was detected in the majority of the indoor and ambient air samples. The maximum indoor air concentration detected was 0.683 $\mu g/m^3$ (CBES-IA10) and the maximum ambient concentration detected was 0.576 $\mu g/m^3$ (CBES-AA2).

Carbon tetrachloride is another common air pollutant in urban/suburban areas. Carbon tetrachloride was used in the production of refrigeration fluid and propellants for aerosol cans, as a pesticide, as a cleaning fluid and degreasing agent, in fire extinguishers, and in spot removers. Because of its harmful effects, these uses are now banned and it is only used in some industrial applications.

Chloroform

Chloroform which has a residential air RSL for cancer of 0.12 $\mu g/m^3$ was detected at a concentration of 0.188 $\mu g/m^3$ in the indoor air sample collected from the gym/multipurpose room (CBES-IA10) and at an estimated level of 0.213 $\mu g/m^3$ in the indoor air sample from the basement stair area (CBES-IA1).

Chloroform can be generated as a by-product when certain chlorine containing cleaning/disinfecting agents, including household bleach, come in contact with naturally occurring water-borne organics. Other common indoor air sources of chloroform include chlorinated water and adhesive remover.

Elevated levels of TCE and PCE were found in some of the sub-slab samples. However, the corresponding indoor air sample results for these locations were below their respective RSL. The indoor air sample collected from the corridor across from Room 107 (CBES-IA9, TCE at 0.816 $\mu g/m^3$, which is above the RSL of 0.48 $\mu g/m^3$) had no corresponding sub-slab sample as it was located above a crawl space. PCE was detected at 163 $\mu g/m^3$ in the Pre-K Room 120 sub-slab sample (CBES-SS6), with the indoor air result of 0.539 $\mu g/m^3$ (CBES-IA14), which is below the RSL of 11 $\mu g/m^3$.

Additionally, "crawl space" samples (those with CBES-CS location identifiers), were collected in areas with earthen/uncovered ground surfaces. These areas are potentially providing less of a protective barrier than those with a continuous slab, however, there were no results for TCE and PCE above the RSL for the "crawl" space (indoor air) samples. Although, these results may suggest that vapor intrusion might not be occurring, further study is recommended to make any final determination.

Attached is an RSL Exceedance Table for indoor air results, in $\mu g/m^3$. Complete analytical results are included in the Analytical Report, presented as Appendix B of SERAS Trip Report SERAS-262-DTR-052915, submitted previously under another cover.

Next Steps:

- EPA OSC and ATSDR toxicologists will continue to review all sampling results, including the results discussed above that exceed the EPA RSLs, and make their recommendations for the Site.

- After discussion with the EPA OSC, a second round of sampling during the next heating season to confirm results and further evaluate the potential for vapor intrusion at the school is a likely course of action. Based on the results of the initial sampling, the list of analytes and number of sampling locations selected for the second round of sampling may be reduced, at the discretion of the EPA OSC and ERT WAM.

RSL Exceedance Table
SUMMA Canister Sample Results in $\mu g/m^3$
Meadowbrook Site
Hatboro, PA

Location	Sub-Location	Sample #	Analyte	Results ($\mu g/m^3$)		RSL ($\mu g/m^3$)
CBES-AA1	Bldg A South	262-0030	Benzene	0.755		0.36
		262-0031	Benzene	0.73		0.36
		262-0030	Carbon Tetrachloride	0.573		0.47
		262-0031	Carbon Tetrachloride	0.555		0.47
CBES-AA2	Bldg B North	262-0032	Benzene	0.736		0.36
		262-0033	Benzene	0.765		0.36
		262-0032	Carbon Tetrachloride	0.571		0.47
		262-0033	Carbon Tetrachloride	0.576		0.47
CBES-CS1	Basement CS1	262-0025	Benzene	0.38		0.36
		262-0025	Carbon Tetrachloride	0.525		0.47
		262-0025	Chloroform	0.211		0.12
CBES-CS2	Basement CS2	262-0026	Carbon Tetrachloride	0.515		0.47
		262-0026	Chloroform	0.182		0.12
CBES-CS3	Basement CS3	262-0027	Benzene	0.465		0.36
		262-0027	Carbon Tetrachloride	0.547	J	0.47
CBES-CS4	Office CS	262-0028	Carbon Tetrachloride	0.528		0.47
CBES-CS5	Girls Toilet Wall Panel	262-0029	Benzene	0.714		0.36
		262-0029	Carbon Tetrachloride	0.561	J	0.47
CBES-IA1	Basement Stair	262-0009	Carbon Tetrachloride	0.595	J	0.47
		262-0009	Chloroform	0.213	J	0.12
CBES-IA10	Multipurpose Rm 111	262-0018	Benzene	0.683		0.36
		262-0018	Carbon Tetrachloride	0.683		0.47
		262-0018	Chloroform	0.188		0.12
CBES-IA11	Storage	262-0019	Benzene	0.735		0.36
		262-0019	Carbon Tetrachloride	0.522		0.47
CBES-IA12	Cafeteria Rm	262-0020	Benzene	0.717		0.36
		262-0020	Carbon Tetrachloride	0.518		0.47
CBES-IA13	Music/Art Rm 123	262-0021	Benzene	0.715		0.36
		262-0021	Carbon Tetrachloride	0.501		0.47
CBES-IA14	Pre-K Rm 120	262-0022	Benzene	0.782		0.36
		262-0022	Carbon Tetrachloride	0.512		0.47

ug/m3 = micrograms per cubic meter
J = Compound estimated at concentration indicated

Prepared by EPA ERT

RSL Exceedance Table
SUMMA Canister Sample Results in µg/m^3
Meadowbrook Site
Hatboro, PA

Location	Sub-Location	Sample #	Analyte	Results (µg/m^3)		RSL (µg/m^3)
CBES-AA1	Bldg A South	262-0030	Benzene	0.755		0.36
		262-0031	Benzene	0.73		0.36
		262-0030	Carbon Tetrachloride	0.573		0.47
		262-0031	Carbon Tetrachloride	0.555		0.47
CBES-IA15	Kindergarten Rm 122	262-0023	Benzene	0.729		0.36
		262-0023	Carbon Tetrachloride	0.507		0.47
CBES-IA16	Music Rm 121	262-0024	Benzene	0.728		0.36
		262-0024	Carbon Tetrachloride	0.512		0.47
CBES-IA17	Principal Rm 105	262-0037	1,2-Dichloroethane	0.214		0.11
		262-0037	Benzene	0.631		0.36
		262-0037	Carbon Tetrachloride	0.487		0.47
CBES-IA2	Mech Room	262-0010	Benzene	0.694		0.36
	Mech Room (collocated)	262-0034	Benzene	0.764		0.36
	Mech Room	262-0010	Carbon Tetrachloride	0.588	J	0.47
	Mech Room (collocated)	262-0034	Carbon Tetrachloride	0.52		0.47
CBES-IA3	Office / Workroom	262-0011	Benzene	0.734		0.36
		262-0011	Carbon Tetrachloride	0.529		0.47
CBES-IA4	Library Rm 100	262-0012	Benzene	0.703		0.36
		262-0012	Carbon Tetrachloride	0.491		0.47
CBES-IA5	Girls Toilet	262-0013	Benzene	0.653		0.36
		262-0013	Carbon Tetrachloride	0.52		0.47
CBES-IA6	Classroom Rm 101	262-0014	Benzene	0.591		0.36
		262-0014	Carbon Tetrachloride	0.495	J	0.47
CBES-IA7	Faculty Rm 103	262-0015	Benzene	0.749		0.36
	Faculty Rm 103 (collocated)	262-0035	Benzene	0.749		0.36
	Faculty Rm 103	262-0015	Carbon Tetrachloride	0.568	J	0.47
	Faculty Rm 103 (collocated)	262-0035	Carbon Tetrachloride	0.51		0.47
CBES-IA8	Nurse Rm 107	262-0016	1,2-Dichloroethane	0.374		0.11
		262-0016	Benzene	0.722		0.36
		262-0016	Carbon Tetrachloride	0.527		0.47
CBES-IA9	Corridor/Across Rm 107	262-0017	Benzene	0.687		0.36
		262-0017	Carbon Tetrachloride	0.542		0.47
		262-0017	Trichloroethene	0.816		0.48

ug/m3 = micrograms per cubic meter
J = Compound estimated at concentration indicated

Prepared by EPA ERT