Letter Health Consultation

Review of Vapor Intrusion Pathway

GRANDVIEW HILLS ELEMENTARY SCHOOL

AUSTIN, TRAVIS COUNTY, TEXAS

JULY 28, 2008

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

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LETTER HEALTH CONSULTATION

Review of Vapor Intrusion Pathway

GRANDVIEW HILLS ELEMENTARY SCHOOL

Prepared By:

Texas Department of State Health Services
Under Cooperative Agreement with the
U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry

TEXAS DEPARTMENT OF STATE HEALTH SERVICES

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June 30, 2008

Mike Aplin
Senior Toxicologist
Texas Commission on Environmental Quality
12100 Park 35 Circle, MC-168
Austin, Texas 78753

RE: **Review of Vapor Intrusion Pathway**
Grandview Hills Elementary School
(formerly proposed elementary school #19)
12024 Vista Parke Drive
Austin, Travis County, Texas 78726

Mr. Aplin:

In response to a Texas Commission on Environmental Quality (TCEQ) request, the Texas Department of State Health Services (DSHS) reviewed sampling data to determine if any chemicals found in the subslab air could pose a potential health risk to the students, teachers, workers, and administrators attending or working inside Grandview Hills Elementary School.

Background and Statement of Issues

Grandview Hills Elementary School, (formerly known as proposed elementary school #19), is located at 12024 Vista Parke Drive, Austin, Texas and is part of the Leander Independent School District (ISD). Classrooms and administrative offices will be housed in buildings that were utilized from 1989 to 2006 as a chemical research and testing laboratory of surfactants and detergents. Work at the facility was done on the laboratory scale and used small volumes of chemicals [1].

Due to parental concerns about the prior usage of the buildings, the Leander ISD directed Weston Solutions, Inc. (Weston) to collect and analyze various types of environmental samples at the proposed school site. Upon completion of the sampling, Weston recommended that a subslab ventilation system be installed. The DSHS Health Assessment & Toxicology Program (HAT) reviewed the data collected by Weston in March and April 2007 and prepared a Health Consultation [2]. HAT did not address the subslab contaminants or the vapor intrusion pathway, as the installation and operation of the vacuum system would eliminate vapor intrusion as a potential exposure pathway for the school's occupants [2]. On April 18, 2008, personnel from the DSHS HAT Program toured the site and observed the vacuum system in operation.

Discussion

The intent of this report was to review sampling data and determine if any chemicals found in the subslab air could pose a potential health risk to the students, teachers, workers, and administrators attending or working inside the school. Subslab vapor data collected from beneath the building foundation in March and April 2007 and indoor air data collected in March 2007 were used in this analysis. These samples were collected before construction of the school was complete.

Vapor Intrusion Pathway

As there is no direct exposure to contaminants detected below the building, there is no risk of human health effects due to direct exposure to subslab contaminants. However, when there are volatile compounds detected in the soil or groundwater below a building, there is a potential for these compounds to migrate through the slab to the indoor air of the building by a process known as vapor intrusion, resulting in indirect exposure to subslab contaminants.

The vapor intrusion pathway was evaluated using attenuation factors. Corresponding indoor air data and subslab vapor data were matched based upon the location in which the samples were collected. Attenuation factors were then calculated by dividing the indoor air concentration by the subslab vapor concentration (Table 1). These attenuation factors were used to determine the potential for subslab contaminants to be transported into the indoor air, or if contaminants detected in the indoor air were the result of some other background sources. Information in the Environmental Protection Agency's (EPA's) Vapor Intrusion Database: Preliminary Evaluation of Attenuation Factors [3] was used in this evaluation.

EPA's Vapor Intrusion Database: Preliminary Evaluation of Attenuation Factors suggests two ways to determine if contaminants detected in the indoor air are due to vapor intrusion or are the result of other background sources. One way is to look at the value of the attenuation factor. Fate and transport of contaminants through the subslab should result in the concentration of the contaminant in the indoor air being less than that in the subslab [3]. Contaminants that have an indoor air concentration that exceeds their corresponding subslab vapor concentrations, and therefore have an attenuation factor greater than one, are likely the result of background sources of contamination. Therefore, any contaminants that had an attenuation factor of 1 or greater were removed from the vapor intrusion analysis.

In addition, contaminants with similar fate and transport models should move through the soil and into indoor air in a similar fashion, resulting in similar attenuation factors [3]. Consistency of attenuation factors can be evaluated by plotting the attenuation factor versus the subslab concentration. Notably different attenuation factors (more than an order of magnitude) indicate that background sources of contamination are influencing the indoor air. However, variability in attenuation factors can also be due to building characteristics.

Indoor Air Data

As previously stated, there is no direct exposure to subslab contaminants, and indoor air data are a better indicator of what exposure would be due to vapor intrusion from the subslab. Previously, we reviewed the indoor air data and determined that there were residual levels of chemicals associated with detergent formulation, fragrances, or common indoor pollutants from consumer-based products found in private homes, commercial buildings, and schools [2]. Indoor air data were evaluated using health-based screening values established by the Agency for Toxic Substances and Disease Registry (ATSDR), where available. When ATSDR screening values were not available, screening values derived by Environmental Protection Agency (EPA) Regions III, VI, and IX and knowledge of contaminant uses and observed environmental concentrations were utilized. For those contaminants

that exceeded health-based screening values, EPA's cancer slope factors, standard assumptions for children and adults (16 kg children with air intake rate of 10 m^3/day and 70 kg adults with air intake rate of 15.2 m^3/day), and a 6 year (children) or 25 year (adults) exposure scenario were used to estimate the theoretical cancer risk associated with breathing the air inside the school (Table 2).

Conclusions

Based upon the evaluation of the vapor intrusion pathway using attenuation factors, there were some contaminants present in the indoor air that are not likely to be linked to vapor intrusion, because their concentrations in the indoor air were equal to or greater than in the subslab air. However, the amount of variability in the attenuation factors makes it difficult to determine if vapor intrusion would occur without the subslab venting system operating.

As indoor air data are a better indicator of what exposure would be due to vapor intrusion from the subslab, we evaluated the available indoor air data using ATSDR's and EPA's health-based screening values to determine if chemicals found in the indoor air could pose a potential health risk to the students, teachers, workers, and administrators attending or working inside the school. Based upon the March 2007 indoor air data, we do not expect to see health effects in adults or children associated with exposure to chemicals in the Grandview Hills Elementary School or from areas on the school property. Therefore, exposure at the school site from past activities represents no apparent public health hazard. However, additional indoor air sampling is needed to evaluate any off-gassing from construction.

Recommendations

- The indoor air should be re-evaluated after construction of the school is complete but before the building opens for occupancy.
- To prevent or reduce the contamination of indoor air, Texas Voluntary Indoor Air Quality Guidelines for Government Buildings (DSHS Publication #2-10) should be followed. These guidelines consider public schools as government buildings.

If you have any questions, please contact us at (512) 458-7111 extension 3004 or 6039.

Sincerely,

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References

1. Weston Solutions, Inc. Environmental Assessment Report. Grandview Hills Elementary Property. Leander Independent School District. April 2007.

2. Agency for Toxic Substances and Disease Registry. Health Consultation. Leander Independent School District. Proposed Elementary School #19 (Grandview Hills Elementary). February 13, 2008.

3. Environmental Protection Agency. US EPA's Vapor Intrusion Database: Preliminary Evaluation of Attenuation Factors (DRAFT). March 4, 2008.

Acronyms and Abbreviations

ATSDR	Agency for Toxic Substances and Disease Registry
CDC	Centers for Disease Control
DSHS	Texas Department of State Health Services
e.g.	(*exempli gratia*) for example
EPA	United States Environmental Protection Agency
HAT	DSHS Health Assessment & Toxicology Program
ISD	Independent School District
TCEQ	Texas Commission on Environmental Quality
Weston	Weston Solutions, Inc.

Table 1. Attenuation factors calculated using the indoor air and subslab vapor data collected in March and April 2007.

2-Butanone (MEK)	0.30	0.11	0.68	0.26														
2-Methylbutane	0.10	0.05	0.15	0.39	0.06	0.36	0.10	0.41	0.14	0.11	0.65							
2-Propanol	0.42	0.45	0.47	0.71	0.19													
3-Methylhexane	2.12																	
Acetone	0.22	0.64	0.28	0.72	0.04	0.37	0.10	0.10	0.53	2.65	0.32	0.78	0.19	0.64	0.56	1.04	0.43	0.35	0.66
Acetylene	0.16																	
alpha-Pinene	1.45																	
Benzene	0.03	0.03	0.04	0.04	0.03	0.05	0.04	0.12	0.05	0.05	0.07							
Dichlorodifluoromethane	3.50	3.19	3.97	0.98	2.32	3.50	1.24	1.95	1.75	2.49	1.98	2.55	0.36	0.41	1.18	5.05	5.61	1.74	1.40
Ethane	0.78	0.72	0.80	0.75	1.48	1.67	0.67	0.68	0.72	0.13	0.70							
Ethanol	11.62	0.03	2.72															
Isobutane	0.27	0.32	0.07	0.32	0.18	0.56	0.38	0.35	0.29	0.12	0.27	0.35	0.29					
Isoheptane	1.07																	
Methanol	0.64	0.20	1.06															
Methylene chloride	0.06	0.54	0.54															
n-Butane	0.31	0.06	0.90	0.40	2.00	0.12	0.27	0.58	0.28	0.65								
n-Heptane	1.25																	
n-Pentane	0.06	0.05	0.11	0.25	0.05	0.18	0.11	0.18	0.07	0.07								
o-Xylene	0.01	0.00																
Propane	0.43	1.20	0.03	0.79	0.03	0.25	0.78	1.03	1.06	0.20	0.36							
Propylene	0.04	0.18	0.02															
Toluene	0.00	0.02	0.01	0.00	0.03	0.03	0.00	0.76	0.31	0.00	0.00							
Trichlorofluoromethane	0.38	0.10	0.11	0.13	0.24	0.36	0.21	0.28	0.06	0.07	0.06	0.08	0.10	0.13	0.31	0.09	0.49	

Table 2. Indoor air data that exceed cancer risk evaluation guidelines (CREGs). All other data points were below health-based screening values (where available) or those levels typically seen in buildings.

Contaminant	Maximum Concentration ($\mu g/m^3$)	CREG Value ($\mu g/m^3$)	Theoretical Cancer Risk[a]
Arsenic	0.006	0.0002	1.4×10^{-9} (child) 2.00×10^{-9} (adult)
Acetaldehyde	6.583	0.5	7.7×10^{-10} (child) 1.1×10^{-9} (adult)
Benzene	0.540	0.1	2.3×10^{-10} (child) 3.3×10^{-10} (adult)
Chromium	0.007	0.00008	4.5×10^{-9} (child)[b] 6.4×10^{-9} (adult)[b]
Methylene Chloride	37.502	3	7.9×10^{-10} (child) 1.2×10^{-9} (adult)

[a] theoretical cancer risks less than 1×10^{-6} are interpreted as "no increased risk for cancer"
[b] assumes all chromium present is hexavalent chromium

Certification

This health consultation, *Review of Vapor Intrusion Pathway Grandview Hills Elementary School,* was prepared by the Texas Department of State Health Services (DSHS) under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR) in accordance with approved methodologies and procedures existing at the time this health consultation was initiated. Editorial review was completed by the Cooperative Agreement partner.

Technical Project Officer, CAT, CAPEB, DHAC, ATSDR

The Division of Health Assessment and Consultation, ATSDR, has reviewed this public health assessment and concurs with its findings.

Team Lead, CAT, CAPEB, ATSDR