Health Consultation

McCOOK VOC VAPOR INTRUSION SITE

McCOOK, RED WILLOW COUNTY, NEBRASKA

SEPTEMBER 7, 2005

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

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.

You May Contact ATSDR TOLL FREE at
1-888-42ATSDR
or
Visit our Home Page at: http://www.atsdr.cdc.gov

HEALTH CONSULTATION

McCOOK VOC VAPOR INTRUSION SITE

McCOOK, RED WILLOW COUNTY, NEBRASKA

Prepared by:

U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Background

Dr. Jennifer Lowry, Director of the Kansas Poison Control Center and the Pediatric Environmental Health Specialty Unit (PEHSU), an affiliate of the University of Kansas Medical Center, contacted the Agency for Toxic Substances and Disease Registry (ATSDR). They requested that ATSDR review ambient air data collected in a house located in McCook, Red Willow County, Nebraska. The house sits over a groundwater plume containing volatile organic compounds (VOCs), most notably trichloroethylene (TCE). Dr. Lowry requested ATSDR to assess whether the measured ambient air levels of VOCs present inside the house posed a potential health hazard to the occupants. This request was presented to members of ATSDR's Strike Team on August 2, 2005, through ATSDR's Division of Regional Operations (Sue A. Casteel, Division of Regional Operations, ATSDR, Region 7, to ATSDR Strike Team, Division of Health Assessment and Consultation, ATSDR. Strike Team Request, 2005).

Discussion

ATSDR reviewed the analytical results of the collected indoor air samples and assessed whether the measured ambient air levels of VOCs present inside the house, could adversely impact the health of the occupants. Documented below are the results of ATSDR's review and assessment of the measured ambient air data.

Indoor Air Sampling

Laboratory analysis sheets indicated that Severn Trent Laboratories, Inc. (STL) analyzed indoor air samples from the residence for one specific sampling event in October 2004. Two separate indoor air samples were collected on October 23, 2004. Both samples were collected at the basement level of the house, one in a bedroom and the other in the storage room. STL analyzed the samples in its laboratory using EPA-2 TO-15 analytical method. Analysis included scanning for about 50 VOCs (including TCE) and reporting detections as parts per billion by volume (ppbv). Results of all analytes detected above laboratory reporting limits are displayed in Table 1, Appendix A.

EA Engineering Science and Technology, Inc. (EA Engineering) collected indoor air samples from the residence for two specific sampling events, both in February 2005 (EA Engineering 2005). Samples for both events were collected from three locations inside the house, two at the basement level (bedroom and storage room) and one at the main level (another bedroom).

Prior to both sampling events, EA Engineering conducted a preliminary walk-through of the home's interior, exterior, and garage to identify potential sources of VOCs. No significant contributors to VOCs were identified in the interior or exterior portions of the home; however,

no background air samples and sub-slab soil gas samples were collected to substantiate this observation (Kenneth S. Buchholz, U.S. Environmental Protection Agency [EPA], Region 7, to Steven Moeller, Staff Attorney, Nebraska Department of Environmental Quality. Letter: July 2005). EA Engineering also did not observe any indication of water intrusion or surficial moisture inside the home. Communication with one of the occupants indicated that the family no longer lived in the house on a permanent basis since January 6, 2005. The occupants randomly visited the house to do routine maintenance, which ceased when the family confirmed that they had not been in the house since January 29, 2005 (i.e., prior to the first sampling event on February 2, 2005).

EA Engineering collected the indoor air samples using 6-Liter SUMMA air canisters over a 24-hour time interval; however, this objective was not achieved on February 2, 2005. EA Engineering representatives noted that two of the canisters were collecting the air samples too fast due to either improperly calibrated flow controllers or leaks in the sampling train (EA Engineering 2005). Efforts were made to tighten the connections for both flow controllers; however, tightening did not further restrict airflow, suggesting improperly calibrated flow controllers. One air sample recorded a sample collection time of approximately 23 hours and 1 minute, whereas the other two recorded sample collection times were approximately 4 hours, 40 minutes and 7 hours, 16 minutes. Sample collection over a 24-hour interval is significant because the EPA Region 7 office suggested to EA Engineering that 24 hours represents a chronic-exposure scenario (EA Engineering 2005). Despite the sample collection periods being less than 24 hours, the indoor air samples collected on February 2, 2005, were consider valid but not representative of the chronic-exposure scenario. EA Engineering reperformed the air sampling event inside the house once again on February 28, 2005. At this time, the objective of collecting all indoor air samples over a 24-hour interval was successfully met.

After collecting the indoor air samples, EA Engineering sent the collected indoor air samples to Air Toxics, Ltd. for analysis. Air Toxics, Ltd. analyzed the samples in their laboratory using Modified EPA Method TO-15 GC/MS Full Scan, also referred to as TO-15-LL (low-level). Analysis included scanning for 60 VOCs, including TCE and TCE-daughter products, and reporting detections as ppbv and micrograms per cubic meter ($\mu g/m^3$). Reporting limits (i.e., method detection limits) varied for each sample depending on the volume of sample dilution required by the laboratory prior to analyzing the samples. Results of all analytes detected above laboratory reporting limits are displayed in Tables 2 and 3, Appendix A.

Public Health Implications

Of the VOCs detected in the house, six were selected for in-depth analyses. The selected VOCs included benzene, trichloroethylene, ethanol, 4-ethyltoluene, m/p-Xylene, and o-Xylene. The following is a discussion of the public health implications that could plausibly result from exposures to these six VOCs. Please note that the selection of a substance for an in-depth analysis or further public health evaluation does not imply a public health hazard exists. While

the relative toxicity of a chemical is important, the response of the human body to a chemical exposure is actually determined by several additional factors, including the magnitude (how much), the duration (how long), and the route of exposure (breathing, eating, drinking, or skin contact). Lifestyle factors (e.g., occupation and personal habits) have a major impact on these three elements of exposure. After exposure has occurred, individual characteristics such as age, sex, nutritional status, overall health, and genetic constitution will affect how a chemical is absorbed, distributed, metabolized, and eliminated from the body. Together, all these factors help determine the individual's physiological response to chemical exposures and what, if any, adverse health effects would occur as a result of the chemical exposures.

Benzene

The detected levels of benzene exceeded only one air CV, ATSDR's cancer risk evaluation guide (CREG). The CREG and other similar CVs are the most conservative of long-term health benchmarks because they are based on estimates of theoretical cancer risk; however, none of the levels of benzene measured in air exceeded any CVs for noncancer effects.

Benzene is a known human carcinogen and is classified as such by the National Toxicology Program (NTP), the International Agency for Research on Cancer (IARC), the EPA, and the American Conference of Governmental Industrial Hygienists (ACGIH). This classification is supported by studies of U.S. workers (the Pliofilm cohort) exposed to high levels of benzene (up to hundreds of ppm or hundred thousands of ppb) during rubber manufacture, mostly during the 1940s (Infante 1978; Infante et al. 1977). Taking this supporting evidence, cancer-based CVs for inhaled benzene are derived using the methodology of quantitative risk assessments. The methodology of quantitative risk assessments usually employs the use of EPA's cancer slope factors (CSFs) or inhalation unit risks (IURs). CSFs and IURs are computed on the basis of two limiting assumptions: zero-threshold for carcinogens and low-dose linearity. Applying the principles of linear regression and conservatism erred to protecting public health, a mathematical equation of a straight line is developed from the cancer incidence observed in high-dose animal or occupational studies. The slope of the resulting straight line is called a CSF for dose data or IUR for air concentration data. Moreover, the straight line can be extrapolated to any dose or air concentration, no matter how small, to give a corresponding estimate of cancer risk. Because no actual data points exist in the region of extrapolation (estimated risks of 10^{-4} and less), these estimates of cancer risk are theoretical and may not reflect the true or actual risk. In fact, the true risk is unknown and could be as low as zero (EPA 1986, 2003).

Although ATSDR recognizes the utility of numerical risk estimates in risk analysis, the agency considers such estimates in the context of the variables and assumptions involved in their derivation and in the broader context of biomedical opinion, host factors, and actual exposure conditions. However, the actual parameters of environmental exposures must be given careful consideration in evaluating the assumptions and variables relating to both toxicity and exposure (ATSDR 1993).

Benzene is present everywhere in the atmosphere (ATSDR 1997a). It has been identified in outdoor air samples of both rural and urban environments and in samples of indoor air. The detected levels of benzene in the house ranged from 0.22 to 0.51 ppbv. These levels are well within the norm of the daily median benzene concentrations reported by the Volatile Organic Compound National Ambient Database (1975–1985) for remote (0.16 ppb), rural (0.47 ppb), suburban (1.8 ppb), urban (1.8 ppb), indoor (1.8 ppb), and workplace air (2.1 ppb). Therefore, the detected levels of benzene could easily have originated from background or domestic sources. The outdoor air data in the ambient air database are representative of 300 cities in 42 states, while the indoor air data are representative of 30 cities in 16 states (Shah and Singh 1988).

Available studies, based on the inhalation of benzene, indicate no detectable excess of leukemia below cumulative exposures of 40 ppm-years[1] (Rinsky et al. 1987). This exposure would be numerically, if not biologically, equivalent to about 190 ppb, 24 hours a day, over a 70-year lifetime. However, this apparent threshold is most likely underestimated because it is based on underestimated exposures and the inclusion of all leukemias, not just acute myeloid leukemia (AML). AML is the only form of leukemia consistently associated with high benzene exposures. When only AML is considered, the estimated threshold was found to be at least 200 ppm-years (numerically equivalent to 950 ppb, 24 hours a day, over a 70-year lifetime), based on the original set of exposure estimates, and higher still later, using more accurate exposure estimates (Paustenbach et al. 1992; Wong 1995).

No unequivocally adverse health effects have been observed in animals or humans chronically exposed to 1,000 ppb (1 ppm) or less of benzene in air. The benzene levels measured inside the house were 3 to 4 orders of magnitude below this level. As cited earlier, the air data indicate that the benzene measured inside the house may be originating from background or domestic sources. Therefore, none of the benzene exposures inside the house would be expected to produce any adverse health effects of either a cancerous or noncancerous nature in the occupants.

Trichloroethylene

Sometimes ATSDR conducts an in-depth analysis of a chemical substance because the community has expressed concern about exposures to that particular substance (ATSDR 2005). Even in cases where comparison values have not been exceeded, a more in-depth review of the health effects data might be needed to adequately address the community health concern.

---

[1]The notation "ppm-year" represents a numerical attempt to integrate the levels and durations of exposure observed in occupational studies as a combined product. A worker exposed to 2 ppm for 20 years and one exposed to 20 ppm for 2 years both received the "same" cumulative exposure (i.e., expressed in ppm-years). The distinction is made between numerical and biological equivalence because, although an aspirin a day for 70 years would be numerically equivalent to 70 aspirin a day for 1 year, the two dose rates would produce very different biological effects. The first dose regimen might prevent cardiovascular disease, while the second would be lethal.

Residents at this site expressed a specific concern about the groundwater underneath their home. The groundwater contained high levels of TCE (about 300 ppb), making the residents very concerned about the possibility of TCE vapors diffusing from the groundwater and entering into their home.

ATSDR's intermediate Environmental Media Evaluation Guide (EMEG) for TCE in air is 100 ppb. The maximum detected ambient air level of TCE inside the house (25 ppbv) was approximately 4 times lower, even though it was measured inside the storage room. This area of the house is where residents are not likely to spend much time and where contributions from domestic sources (such as TCE-containing commercial products stored in the area) may well outweigh any potential contributions from vapor intrusion. ATSDR's intermediate EMEGs are human no-effect levels that are designed to be conservatively protective for exposure durations of up to 1 year. The inhalation intermediate EMEG[2] for TCE is 2,000 times lower than the lowest observed adverse effect level (LOAEL) on which it is based (50,000 ppb for decreased activity in the heart rate and sleep patterns of rats exposed to that level 5 days a week, 8 hours a day, for 6 weeks) and 300 times lower than the derived duration-adjusted, human equivalent concentration (HEC) of 44,200 ppb (ATSDR 1997b). The highest detected level of TCE inside the house (25 ppbv in the storage area) was about 1,800 times lower than these effect levels. The effect levels observed in chronic studies are comparable to those seen in intermediate studies; therefore, ATSDR's intermediate EMEG in air is probably protective for chronic or lifetime exposure, as well.

As to its potential carcinogenicity to humans, TCE is classified differently by different agencies. Based on sufficient animal data and limited human data, NTP classifies TCE as "reasonably anticipated to be a human carcinogen" (Class 2), and IARC classifies TCE as a probable human carcinogen (Class 2A). In contrast, ACGIH (2004) considers that TCE is "not suspected as a human carcinogen" (Class A5), because properly conducted epidemiological studies indicate that it does not convey a significant risk of cancer to humans, and the relevance of the animal data to humans is questionable. EPA's cancer risk assessment for TCE was withdrawn in 1989 and is still under review at this time. Because ATSDR's CREGs (cancer risk evaluation guides) are based on EPA's cancer slope factors or inhalation unit risks, ATSDR no longer has a CREG for TCE.

The absence of a CREG does not hinder ATSDR from assessing the likelihood that site-specific TCE exposures could cause cancer at this site. The animal data are of questionable relevance to humans because the induction by TCE of cancers in mice and rats is species-, sex-, and strain-specific, and requires doses exceeding anything humans might reasonably be expected to encounter. In addition, well-controlled human studies have indicated that TCE does not convey a

[2]After the HEC is reduced by a factor of 300, the intermediate EMEG equates to approximately 147 ppb. For extra conservatism to protect public health, the final intermediate EMEG was set to 100 ppb.

significant risk of cancer to humans. Therefore, considering that all of the ambient air levels of TCE in the house were lower than all available and relevant health-based screening values, it is highly unlikely that these TCE exposures would ever produce any adverse health effects, cancerous or otherwise, in the occupants of this house.

Substances without Comparison Values

Air CVs were not available for ethanol. Ethanol or ethyl alcohol is mostly used in alcoholic beverages in suitable dilutions. It is also used as a solvent in the laboratory and industry, in the manufacture of denatured alcohol and pharmaceutical products (e.g., rubbing compounds, lotions, tonics, colognes), in perfumery, and in organic synthesis. Moreover, it is an octane booster in gasoline and a pharmaceutic aid (i.e., a solvent). Because of its industrial uses, the Occupational Safety and Health Administration set its permissible exposure limit (PEL) for worker exposure at 1,000 ppm (parts per million). The PEL is an 8-hour time weighted average (TWA) air concentration to which workers may be safely exposed repeatedly during 40-hour work weeks (ACGIH 2005). If the 8-hour PEL is averaged over 24 hours, assuming no exposure for the remaining 16 hours, the resulting 24-hour TWA air concentration would be about 42 ppm or 42,000 ppb. The maximum detected level of ethanol (62 ppb) is 677 times (2 to 3 orders of magnitude) lower than this 24-hour-equivalent TWA-PEL. Therefore, none of the indoor air levels of ethanol detected inside the house are expected to cause any adverse health effects in the occupants who live in the house.

No CVs exist for 4-ethyltoluene. The substance was only detected once inside the house (during the October 2004 sampling event) at an ambient air level of 0.42 ppbv. According to the Registry of Toxic Effects of Chemical Substances database, the inhalation TCLo (similar to an inhalation LOAEL) was 5,000 mg/m^3 or 1,017 ppm (1,017,000 ppbv) in rats and rabbits treated to 4-ethyltoluene 6 hours a day for 100 days. The single detection of 4-ethyltoluene in this house was 2.4 million times lower than this TCLo. Therefore, ATSDR does not expect inhalation exposures to 4-ethyl toluene to cause any adverse health effects to the occupants of this house.

Finally, no air CVs were available for the individual ortho-, meta-, or para-isomers of xylene. However, total xylenes were detected inside the residence at a maximum level (1 ppbv) 100 times (2 orders of magnitude) lower than the CV (100 ppbv) used by both ATSDR and EPA for total xylenes. Therefore, none of the measured levels of the xylene isomers would be a public health concern.

Conclusions

1. All of the ambient air levels of VOCs measured inside this residence are well below all air CVs or health screening values for noncancer effects. They are also far below all exposure levels that ever have been associated with cancer effects in animals or humans. Therefore, the measured levels of VOCs pose a no-apparent public health hazard to the occupants of the house.

Recommendations

No public health actions or public health activities are recommended at this time.

Preparers of Report

Primary Author

Environmental Health Scientist	David S. Sutton, PhD, PE Exposure Investigations and Consultations Branch Division of Health Assessment and Consultation Agency for Toxic Substances and Disease Registry

Secondary Author

Toxicologist	Frank C. Schnell, PhD, DABT Exposure Investigations and Consultations Branch Division of Health Assessment and Consultation Agency for Toxic Substances and Disease Registry

Reviewers

Branch Chief	Susan Moore Exposure Investigations and Consultations Branch Division of Health Assessment and Consultation Agency for Toxic Substances and Disease Registry
Deputy Branch Chief	Donald Joe, MS, PE Exposure Investigations and Consultations Branch Division of Health Assessment and Consultation Agency for Toxic Substances and Disease Registry
Regional Representative, Region VII	Sue Casteel, MS Division of Regional Operations Agency for Toxic Substances and Disease Registry
Editors	Elizabeth Fortenberry and Rebecca Myers Office of Communication National Center for Environmental Health and Agency for Toxic Substances and Disease Registry

References

Agency for Toxic Substances and Disease Registry. Cancer policy framework. Atlanta: US Department of Health and Human Services; 1993 Jan. Available from URL: http://www.atsdr.cdc.gov/cancer.html

Agency for Toxic Substances and Disease Registry. August 1995. Toxicological profile for xylenes (update). Atlanta: US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry. September 1997a. Toxicological profile for benzene (update). Atlanta: US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry. September 1997b. Toxicological profile for trichloroethylene (update). Atlanta: US Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry. Public health assessment guidance manual (update). Atlanta: US Department of Health and Human Services, Public Health Service; 2005 Jan.

American Conference of Governmental Industrial Hygienists TLVs and BEIs. Threshold limit values for chemical substances and physical agents and biological exposure indices. Cincinatti, OH; 2005: p. 28

EA Engineering Science and Technology, Inc. Sampling report for indoor volatile organic compound air sampling at the . . . ., McCook, NE. Submitted to Amy Svoboda, Ogallala, NE. EA Project Number 14263.01. March 24, 2005.

Infante PF, Rinsky RA, Wagoner JK, et al. 1977. Leukemia in benzene workers. Lancet 2:76–8.

Infante PF. 1978. Leukemia among workers exposed to benzene. Tex Rep Biol Med 37:153–61.

Paustenbach DJ, Price PS, Ollison W, et al. 1992. Reevaluation of benzene exposure for the Pliofilm (rubber worker) cohort (1936-1976). J Toxicol Environ Health 36(3):177–223

Rinsky RA, Smith AB, Homung R, et al. 1987. Benzene and leukemia: an epidemiological risk assessment. N Eng J Med 316:1044–50.

Shah JJ, Singh HB. 1988. Distribution of volatile organic chemicals in outdoor and indoor air. Environ Sci Technol 22: 1381–8.

US Environmental Protection Agency. Guidelines for carcinogenic risk assessment. Federal Register 1986 Sept. 24;51(185):33992–4003.

US Environmental Protection Agency. March 2003. Draft final guidelines for carcinogen risk assessment final (external review draft). Risk Assessment Forum, Washington, DC, NCEA-F-0644A.

Wong O, Raabe GK. 1995. Cell-Type-Specific leukemia analysis in a combined cohort of more than 208,000 petroleum workers in the United States and the United Kingdom, 1937–1989. Regul Toxicol Pharmacol 21:307–21.

APPENDIX A

TABLES

TABLE 1 Sample Concentrations As Measured for Samples Collected on October 23, 2004

Sample ID	RYAN 1		STORAGE ROOM 1				**Ambient Air Comparison Values**			**In-Depth Analysis Required**
Sample Location	Bedroom (basement) NW corner 3-ft elevation		Storage Room (basement) between office and west wall 3-ft elevation							
Time Interval (hh:mm:ss)										
Dilution Factor										
Compound	Units		Units				Units			
	ppbv	µg/m^3	ppbv	µg/m^3			ppbv	µg/m^3		
Acetone	14	33	11	26			13,000	31,000	cEMEG	No
Benzene	0.22	0.7	0.51	1.6			0.03	0.1	CREG	Yes
							9.4	30	cRMEG	
2-Butanone	1.3	3.8	1.4	4.1			1,700	5,000	cRMEG	No
Chloromethane	0.46	0.95	0.4	0.83			50	100	cEMEG	No
Dichlorodifluoromethane	0.48	2.4	0.46	2.3			42	210	PRG	No
Ethylbenzene	0.25	1.1	0.22	0.96			230	1,000	cRMEG	
4-Ethyltoluene	0.42	2.1	<0.4	<2			None Available			Yes
Styrene	0.2	0.85	<0.2	<0.85			60	260	cEMEG	
Toluene	2.9	11	2.3	8.7			80	300	cEMEG	No
1,1,1-Trichloroethane	<0.2	<1.1	0.2	1.1			700	3,800	iEMEG	No
Trichloroethylene	9.8	53	25	130			100	540	iEMEG	Yes
Trichlorofluoromethane	0.75	4.2	0.79	4.4			130	730	PRG	No
1,2,4-Trimethylbenzene	0.92	4.5	0.66	3.2			1.3	6.2	PRG	No
Xylenes, total	1	4.3	1	4.3			100	1,300	cEMEG	No
m,p-Xylene	0.73	3.1	0.71	3.1			None Available			Yes
o-Xylene	0.3	1.3	0.29	1.3			None Available			Yes

Shading indicates the comparison values that are exceeded.

CREG: Cancer Risk Evaluation Guide
EMEG: Environmental Media Evaluation Guide (prefixes: a = acute, c = chronic, and i = intermediate)
PRG: Preliminary Remediation Goal
RMEG: Reference Dose Media Evaluation Guide (prefixes: a = acute, c = chronic, and i = intermediate)
ppbv: parts per billion by volume
µg/m^3: micrograms per cubic meter
<1 = "Not Detected" above the indicated laboratory reporting limit.

TABLE 2 Sample Concentrations As Measured for Samples Collected on February 2, 2005

Sample ID	RR-020205-1		SR-020205-2		AR-020205-3		**Ambient Air Comparison Values**			**In-Depth Analysis Required**
Sample Location	Bedroom (basement) NW corner 3-ft elevation		Storage Room (basement) between office and west wall 3-ft elevation		Bedroom (main floor) central 3-ft elevation					
Time Interval (hh:mm:ss)	23:01:05		3:39:54		7:15:46					
Dilution Factor	1.64		1.64		2.01					
Compound	Units		Units		Units		Units			
	ppbv	µg/m^3	ppbv	µg/m^3	ppbv	µg/m^3	ppbv	µg/m^3		
Acetone	5.6	13	6.3	15	5.8	14	13,000	31,000	cEMEG	No
Benzene	0.36	1.1	0.44	1.4	0.29	0.91	0.03	0.1	CREG	Yes
							9.4	30	cRMEG	
2-Butanone	<0.82	<2.4	0.82	2.4	<1	<3	1,700	5,000	cRMEG	No
Chloromethane	0.73	1.5	0.6	1.2	0.65	1.4	50	100	cEMEG	No
Ethanol	32	60	32	61	62 E	120 E	None Available			Yes
Freon 11	0.9	5	0.94	5.3	0.82	4.6	130	730	PRG	No
Freon 12	0.6	3	0.62	3.1	0.6	3	42	210	PRG	No
Toluene	0.72	2.7	0.82	3.1	0.74	2.8	80	300	cEMEG	No
1,1,1-Trichloroethane	0.29	1.6	0.36	1.9	0.28	1.6	700	3,800	iEMEG	No
Trichloroethylene	16	86	18	98	13	71	100	540	iEMEG	Yes
1,2,4-Trimethylbenzene	0.23	1.2	0.2	1	0.24	1.2	1.3	6.2	PRG	No
m,p-Xylene	0.3	1.3	0.29	1.3	0.33	1.4	None Available			Yes

Shading indicates comparison values for ambient air that are exceeded.

CREG: Cancer Risk Evaluation Guide
EMEG: Environmental Media Evaluation Guide (prefixes: a = acute, c = chronic, and i = intermediate)
PRG: Preliminary Remediation Goal
RMEG: Reference Dose Media Evaluation Guide (prefixes: a = acute, c = chronic, and i = intermediate)
ppbv: parts per billion by volume
µg/m^3: micrograms per cubic meter
<1 = "Not Detected" above the indicated laboratory reporting limit.
E = Detection exceeds instrument calibration range. Concentration is estimated.

TABLE 3 Sample Concentrations As Measured for Samples Collected on February 28, 2005

Sample ID	RR-022805-1		SR-022805-2		AR-022805-3		**Ambient Air Comparison Values**			**In-Depth Analysis Required**
Sample Location	Bedroom (basement) NW corner 3-ft elevation		Storage Room (basement) between office and west wall 3-ft elevation		Bedroom (main floor) central 3-ft elevation					
Time Interval (hh:mm:ss)	24:00:00		24:00:00		24:00:00					
Dilution Factor	1.46		1.71		1.87					
Compound	Units		Units		Units		Units			
	ppbv	µg/m^3	ppbv	µg/m^3	ppbv	µg/m^3	ppbv	µg/m^3		
Acetone	4.4	10	3.1	7.4	4.7	11	13,000	31,000	cEMEG	No
Benzene	0.27	0.86	0.43	1.4	0.26	0.83	0.03	0.1	CREG	Yes
							9.4	30	cRMEG	
Chloromethane	0.38	0.79	0.36	0.75	0.44	0.9	50	100	cEMEG	No
Ethanol	28	52	23	44	36	68	None Available			Yes
Freon 11	1.1	6.3	0.72	4	0.6	3.4	130	730	PRG	No
Freon 12	0.9	4.4	0.45	2.2	0.39	1.9	42	210	PRG	No
Toluene	0.59	2.2	0.62	2.3	0.86	3.2	80	300	cEMEG	No
1,1,1-Trichloroethane	0.22	1.2	0.17	0.92 J	0.18 J	0.99 J	700	3,800	iEMEG	No
Trichloroethylene	12	65	15	79	9.8	53	100	540	iEMEG	Yes
1,2,4-Trimethylbenzene	<0.15	<0.72	0.16 J	0.8 J	0.19	0.93	1.3	6.2	PRG	No
m,p-Xylene	<0.15	<0.65	0.2	0.87	0.21	0.91	None Available			Yes

Shading indicates comparison values for ambient air that are exceeded.

CREG: Cancer Risk Evaluation Guide
EMEG: Environmental Media Evaluation Guide (prefixes: a = acute, c = chronic, and i = intermediate)
PRG: Preliminary Remediation Goal
RMEG: Reference Dose Media Evaluation Guide (prefixes: a = acute, c = chronic, and i = intermediate)
ppbv: parts per billion by volume
µg/m^3: micrograms per cubic meter
<1 = "Not Detected" above the indicated laboratory reporting limit.
J = Reported concentration is estimated. Concentration was detected above the method detection limit, but below the reporting limit.