Health Consultation

A-Z SPORTS CARDS

DERRY, ROCKINGHAM COUNTY, NEW HAMPSHIRE

AUGUST 24, 2007

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
1-800-CDC-INFO
or
Visit our Home Page at: http://www.atsdr.cdc.gov

HEALTH CONSULTATION

A-Z SPORTS CARDS

DERRY, ROCKINGHAM COUNTY, NEW HAMPSHIRE

Prepared By:

New Hampshire Department of Environmental Services
Environmental Health Program
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

SUMMARY AND STATEMENT OF ISSUES

On February 27-28, 2007, the Environmental Protection Agency (EPA) collected indoor air samples from A-Z Sports Cards, located at 1½ East Broadway in Derry, Rockingham County, New Hampshire. The building (Lot number 3020) consists of several discrete business units, one of which is occupied by A-Z Sports Cards. The building is adjacent to a nearby former dry cleaning establishment, Shamrock Cleaners. The February EPA indoor air sampling event was conducted to determine whether VOCs below the Shamrock Cleaners (in soils & groundwater) were volatilizing and migrating into A-Z Sports Cards. EPA specifically analyzed two indoor air samples - one each collected from the basement and first floor of A-Z Sports Cards (1). EPA New England's Office of Site Remediation and Restoration, Emergency Planning and Response Section excavated soils containing volatile organic compounds (VOCs) from Shamrock Cleaners in April - May 2007.

The DES Environmental Health Program (EHP) used the air samples collected by EPA to complete this health consultation. The purpose of the health consultation is to determine if inhalation of indoor air inside A-Z Sports Cards presents a human health risk. After thorough analysis of all air data collected, EHP has concluded that adverse health effects are not expected to result from exposure to site-related indoor air contaminants in A-Z Sports Cards. The cumulative potential risk posed by all VOCs (site and non-site-related) in A-Z, however, is slightly elevated. This risk is likely overvalued, and additional sampling is recommended for confirmation.

PURPOSE

The Agency for Toxic Substances and Disease Registry (ATSDR) is a non-regulatory federal agency mandated by Congress to assess the public health impact of exposure to hazardous substances released to the environment. To fulfill its mandate, ATSDR enters into formal partnerships with state agencies throughout the nation to carry out site-related evaluations on environmental exposures and public health. For 18 years, ATSDR and the Environmental Health Program (EHP) have maintained a cooperative agreement to conduct these activities in the state. EHP is a non-regulatory program within the New Hampshire Department of Environmental Services (DES). It serves to assess the human health implications of hazardous chemical releases, and to make recommendations to protect the public health.

The purpose of this health consultation is to determine if inhalation of indoor air at A-Z Sports Cards presents a human health risk. It presents an evaluation of environmental data provided to EHP from air samples collected at A-Z Sports Cards located at 1½ East Broadway on February 27-28, 2007.

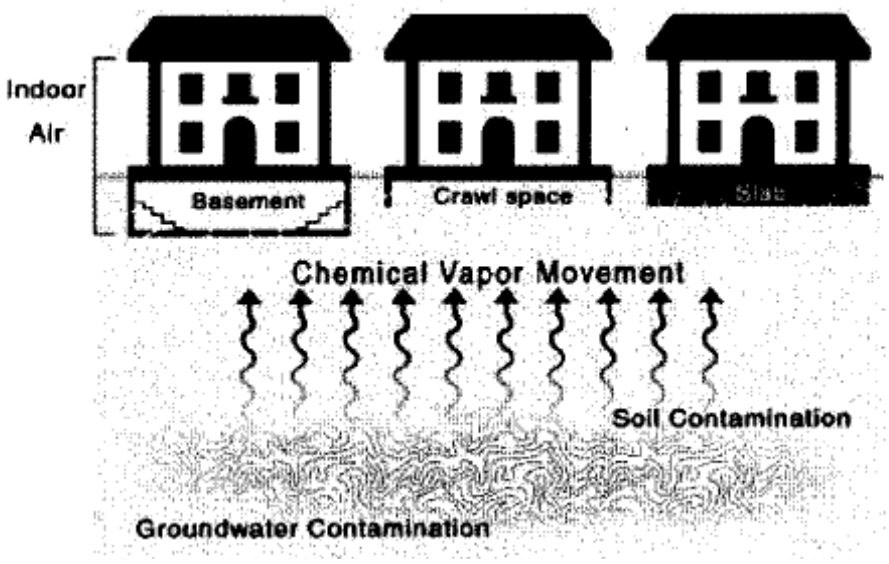
BACKGROUND

The former Shamrock Cleaners (site) was a dry-cleaning establishment that operated from approximately 1950 until 2001. From about 1984 through 2001, tetrachloroethylene

(also known as perchloroethylene, perc, or PCE) was used in dry-cleaning operations at the site. Prior to 1984 “Stoddard Solvent” based cleaners were used for dry-cleaning. In August 2005 the former Shamrock Cleaners building (Lot No. 3017) and an adjacent unoccupied apartment building (Lot 3018) were demolished. A DES contractor, Sanborn, Head & Associates (SHA), conducted a series of investigations to determine the extent of contamination at the site. These investigations identified contaminants in the groundwater, especially PCE, at levels that could impact the soil above the groundwater (2).

All soils contain gaps between their individual particles which are filled with either liquids (usually water) or gases. Soil gas is a term used to describe the gas that fills these voids. When VOCs contaminate and mix with groundwater, they tend to separate from a liquid phase into a soil gas phase. These soil gas contaminants can then migrate through the soil gaps and possibly enter confined building spaces (basements) through crawl spaces, plumbing holes, other floor holes (e.g., sumps) and foundation cracks. This could result in indoor air contamination. As a result of PCE contamination in site groundwater, SHA conducted soil gas testing at the site; commonly known as a soil-gas survey. This method is routinely used to determine the existence or extent of soil contamination (from a groundwater source in this case) (2, 3).

Figure 1 – Movement of contaminant vapors from groundwater into soil & indoor air (3).



The SHA soil-gas survey at the site identified PCE ranging from approximately 2500 to 16000 ppb (2). Due to these elevated soil-gas concentrations and historical groundwater contamination data detected at the site, it was decided that indoor air quality sampling and analysis should be conducted by the Environmental Protection Agency (EPA) at A-Z Sports Cards (A-Z). EPA also simultaneously collected an outdoor ambient air sample to be used for comparison purposes. This ambient air sample was later invalidated due to sample contamination and was omitted from consideration (1). EHP reviewed the EPA

report and evaluated the potential for adverse health effects to occur from indoor air exposures to site-related compounds including PCE and its breakdown components. EHP utilized site-specific information collected during a May 2, 2007 visit for purposes of evaluating this adult indoor air exposure; 10 hours per day, 350 days per year, for a 25-year duration (4).

DISCUSSION

A. Exposure Pathways

Human exposure to environmental contamination occurs only when there is a completed pathway. A *completed* pathway exists when the following five critical elements are present: 1) a source of contamination or release (subsurface soil & groundwater); 2) environmental fate and transport (contaminated soil/groundwater to indoor air); 3) a point or area of exposure (A-Z); 4) a route of human exposure (inhalation); and 5) a receptor population (A-Z employees). These five elements determine the extent of past, present, or future site-related exposures. In a *potential* exposure pathway, one or more of the critical elements may not be present, but information is insufficient to eliminate or exclude it. For example, an exposure could have occurred in the past, could be occurring at present, or could occur in the future. An exposure pathway is *eliminated* if one or more of the critical elements are missing. Eliminated exposure pathways may also be referred to as incomplete (5).

Table 1 presents the onsite pathway for A-Z (indoor air in the primary work area – where workers spend the majority of their time). This pathway is evaluated and discussed in the remaining sections of this health consultation. Public water is provided to this complex. Groundwater contamination at this site does not impact the quality of water supplied to residents. The drinking water, like all water supplied from public water sources, is considered safe for drinking, bathing, and other domestic uses.

Table 1. Potential Onsite Pathway for A-Z Sports Cards (Lot No. 3020) located in Derry, New Hampshire.

Source	Environmental Transport And Media	Exposure Point	Exposure Route	Exposed Population	Time Frame	Status
Contaminated Soil & Groundwater (Site)	Subsurface soil & Groundwater to **Indoor Air** through foundation	Indoor Air Onsite	Inhalation	Employees	Past	Completed
					Present	Completed
					Future	Potential

Contaminants are migrating from the site through subsurface soil and groundwater via a groundwater contaminant plume. Vapors emanating from the plume may penetrate the A-Z building foundation and mix with indoor air. Employees could be exposed by breathing contaminated indoor air.

B. Environmental Contamination Data

An integral element of every health consultation is a review of site-related environmental contamination. In the preceding section, one pathway for possible human exposure was identified (indoor air). This section examines indoor air contaminants that may pose a hazard to the A-Z employees. Environmental sampling preparation, procedures, and results provided in the report prepared by EPA dated April 16, 2007, are summarized below for this potential pathway (1).

On February 27, 2007, EPA conducted a pre-sampling inspection, product inventory and physical layout/condition assessment of the A-Z first floor work area and basement. These steps are conducted to identify potential sources of volatile organic compounds (VOCs), and to minimize the contribution of VOCs from common indoor sources or activities. At approximately 12:00 PM, they began to collect two 24-hour duration indoor air samples from the A-Z first floor (ledge above the staircase) and basement. Samples were collected in accordance with the EPA Region 1 Standard Operating Procedure for the Sampling of Trace Volatile Organic Compounds using Summa Polished Stainless Steel Canisters EPA-REG1-ESD/CAN-SAM-SOP, March 2001, Revision 2. The pre-evacuated 6-liter Summa canisters were fitted with mechanical flow controllers calibrated to 3ml/min (1).

The Summa canisters were subsequently gathered by EPA at approximately 12:00 PM on February 28, 2007 and verified to be below atmospheric pressure, thus indicating that the sample was properly collected. The samples were then transported to the EPA Laboratory, properly logged in, and analyzed for volatile organic compounds (VOCs) using EPA Method TO-15. Table 2 lists the concentrations of site-related VOCs that were detected in the indoor air samples (1).

Table 2: Concentration (ppbv) of Site-related VOC contaminants detected at A-Z Sports Cards (Lot No. 3020) located in Derry, New Hampshire on February 27-28, 2007 (1).

Contaminant	First Floor -Canister #15062 (ppbv)	Basement -Canister #14896 (ppbv)
Tetrachloroethylene	0.14	0.13
1,1,1-Trichloroethane	0.18	0.14

"ppbv" - parts-per-billion volume

C. Environmental Data Evaluation & Contaminants of Concern

After exposure pathways are identified and environmental data are summarized, site-related indoor air contaminants are evaluated. EHP uses a conservative, protective

approach to determine whether contaminant levels constitute a potential health hazard. Health-based comparison values (CVs) are used to identify pollutants unlikely to present a health concern. If a concentration is below the CV, the compound is eliminated from further analysis. The remaining contaminants are subjected to a thorough scientific literature review to determine whether or not their levels present a public health hazard (5).

CVs used in this report represent concentrations of contaminants that current scientific literature concludes are "harmless." CVs are conservative, represent “worst-case” exposure assumptions, and include ample safety factors in consideration of sensitive populations such as children, the elderly, and those with chronic respiratory disease. Therefore, CVs are protective of public health in most exposure situations. If a contaminant level is lower than its CV, it is unlikely that harmful effects will result. If a contaminant exceeds its CV, it is examined in greater detail. Because CVs are based on conservative assumptions, the presence of concentrations greater than a CV does not necessarily indicate that adverse health effects will occur among exposed populations (5).

Table 3 lists the VOC concentrations and their associated CVs used in this assessment. Table 3 also delineates the VOCs associated with site (PCE and PCE- related contaminants), as well as additional contaminants that were detected but not site-related. These concentrations represent the maximum level that an individual may be exposed to assuming a continuous 24-hour exposure. They also specifically represent levels collected in the first floor work area (where workers spend the bulk of their time) as well as the basement (where workers may only occasionally enter for brief periods) (4). As a conservative measure, site-related VOCs not detected during laboratory analysis were also included at one-half of their analytical detection limit (referred to as “estimated” in Table 3). For example, if the analytical device was unable to detect the target compound, EHP assigned a value on-half of the instrument’s lowest measurable quantity. These VOC concentrations were then compared to relevant ATSDR and EPA cancer and non-cancer air CVs. Bolded font indicates that the CV was exceeded (1, 5).

EHP compared the maximum actual or the “estimated” contaminant concentrations to their respective CVs. The comparison revealed that site-related concentrations of PCE, trichloroethylene (estimated), and vinyl chloride (estimated), exceeded their respective cancer CVs. EHP then conducted a site-specific risk assessment to determine if these concentrations represented a health concern to the A-Z employees. The conservative exposure scenario employed by EHP was based on an adult worker (owner, in this case) breathing indoor air for 10 hours per day, 350 days per year, over a 25-year duration of exposure (4). This scenario also assumed that the highest recorded actual or “estimated” contaminant concentrations were present throughout the first floor occupied by A-Z Sports Cards (1).

Table 3: Highest actual and estimated VOC concentrations (ppbv) and respective CVs detected in at A-Z Sports Cards (Lot No. 3020) located in Derry, New Hampshire on February 27-28, 2007 (1, 6, 7, 8, 9).

Contaminant	First Floor Canister #15062 (ppbv)	Basement Canister #14896 (ppbv)	Non-cancer CV (ppbv)	Cancer CV (ppbv)
Site-Related				
1,1,1-Trichloroethane	0.18	0.14	700 (c)	-
1,1-Dichloroethene	0.07 (estimated)	0.04 (estimated)	20 (c)	-
Chloroethane	0.7 (estimated)	0.41 (estimated)	4000 (a)	0.83 (f)
Tetrachloroethylene (PCE)	**0.14**	**0.13**	40 (b)	**0.046 (f)**
Trichloroethylene (TCE)	**0.07 (estimated)**	**0.042 (estimated)**	100 (c)	**0.003 (f)**
Vinyl Chloride	**0.07 (estimated)**	**0.041 (estimated)**	40 (a)	**0.04 (d)**
cis 1,2-Dichloroethene	0.07 (estimated)	0.04 (estimated)	9.3 (e)	-
trans-1,2-Dichloroethene	0.08 (estimated)	0.044 (estimated)	200 (c)	-
Non Site-Related				
1,2,4-Trimethylbenzene	**1.38**	**2.71**	***1.22 (a)**	-
1,3,5-Trimethylbenzene	**0.75**	**1.38**	***1.22 (a)**	-
1,3-Butadiene	**0.25**	**0.14**	0.9 (a**)**	**0.01 (d)**
4-Ethyltoluene	2.06	3.48	-	-
Benzene	**0.69**	**0.53**	3.0 (b)	**0.03 (d)**
Cyclohexane	0.16	0.12	1700 (a)	-
Dichlorodifluoromethane	0.81	0.71	-	-
Ethylbenzene	0.76	0.88	200 (a)	-
Hexane	0.60	0.52	200 (a)	-
m/p-Xylenes	2.63	3.35	23 (a)	-
Methyl Ethyl Ketone	0.76	0.86	1700 (a)	-
Methylene Chloride	**1.09**	**1.14**	300 (b)	**1.09 (f)**
o-Xylene	1.05	1.36	23 (a)	-
Styrene	0.04	0.07	60 (b)	-
Toluene	3.39	4.06	80 (b)	-
Trichlorofluoromethane	0.37	0.31	-	-
Trichlorotrifluoroethane	0.09	0.09	-	-

Comparison Value Sources
(a) EPA RfC
(b) ATSDR Chronic MRL/EMEG
(c) ATSDR Intermediate MRL/EMEG
(d) ATSDR CREG
(e) EPA Region 9 PRG
(f) EPA Region 3 RBC
"ppbv" - parts-per-billion volume
"-" - indicates that no comparison value has been established.
"estimated" – indicates the VOC was not detected by the laboratory, however EHP used ½ of the analytical detection limit as a conservative measure.
"*" – indicates the CV is provisional
"L" – indicates the contaminant concentration was that was below the laboratory instrument's calibration range and the concentration was reported as estimated.

D. Public Health Implications of Exposure - Site-Related VOCs

This section evaluates the public health implications of site-related indoor air contaminants measured at A-Z. Available sampling data indicate that of the eight site-related VOCs sampled, only PCE, trichloroethylene (estimated), and vinyl chloride (estimated) were detected above their respective cancer CVs (1, 7, 9). Of these three, only PCE was measured above its analytical detection limit (1). Following is a review of the scientific literature on the health effects of PCE.

PCE is a liquid chemical used for dry cleaning, metal-degreasing, and for making ingredients used in consumer products (water repellents, silicone lubricants, fabric finishers, spot removers, adhesives, and wood cleaners). PCE evaporates easily into the air and has a sharp, sweet odor. The odor threshold for PCE in air is approximately 1000 parts in 1 billion parts of air (1000 ppb) or more. Common background levels of PCE are several thousand times lower than those in some workplaces. Background levels found in outside ambient air are usually less than 1 ppb (10).

PCE is normally emitted into air by evaporation from industrial or dry cleaning operations that use this chemical. Clothes brought home from the dry cleaners (using PCE as the solvent) may release small amounts of PCE into the air as well. PCE can also be found in soil at contaminated sites. When PCE is present in soil, it can migrate through soil pores and contaminate ground water, where it can persist for many months without being broken down. Under certain conditions, however, bacteria will break down PCE to form other additional chemicals. These specific chemicals were included in EHP's analysis and are listed as "site-related" in Table 3 (10).

People can be exposed to PCE in air from environmental and occupational sources as well as consumer products. The amount of PCE entering your body depends on the level in air, how fast and deeply you are breathing, and how long you are exposed to it. The majority of inhaled PCE is immediately exhaled. The remainder is either metabolized (mostly by the liver) into other chemicals that leave your body within days, or is stored in body fat. PCE in fatty tissue remains in the body for several days or weeks before it is eliminated (10).

Exposure to PCE concentrations over 1000 times higher than those measured in the A-Z indoor air can cause dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, and death. These symptoms occur almost entirely in occupational or hobby environments. The OSHA limits for PCE is 100 parts in 1 million parts of air (100 ppm) for an 8-hour workday over a 40-hour workweek. Health effects from breathing PCE at low levels are not entirely certain, however, the risk from ambient air levels (usually less than 1 ppb) is minimal. Animal studies have shown that PCE at high dosages can cause liver and kidney damage and liver and kidney cancers. The relevance of these studies to humans is unclear. PCE has not been shown to cause cancer in people, but the International Agency for Research on Cancer (IARC) has classified it as probably carcinogenic to humans (10).

EHP evaluated an exposure scenario for adults exposed to site-related VOC indoor air contaminants at A-Z. Exposure to the concentration of PCE, as well as estimated levels of trichloroethylene, and vinyl chloride, does not pose a significant increased cancer risk among the A-Z employees and visitors. The cumulative theoretical excess lifetime cancer risk for all recorded and estimated concentrations of carcinogenic, site-related VOCs is also not significant.

Individual site-related VOC contaminant levels measured in the A-Z indoor air were all below established non-cancer CVs. As an additional conservative measure, the potential for non-carcinogenic health effects was evaluated by a comparison with the calculated inhalation average daily dose. In all cases, each calculated inhalation average daily dose was below a level of concern for a lifetime of continuous exposure at A-Z (5). The cumulative potential (all site-related VOCs added) for non-cancer health effects also did not indicate that employees and visitors would experience adverse health effects from these exposures.

E. Public Health Implications of Exposure - Non Site-Related VOCs

Available sampling data indicate that five of the seventeen "non-site-related" VOCs detected in the A-Z indoor air were above their respective CVs – 1,2,4 and 1,3,5-trimethylbenzene, 1,3-butadiene, benzene, and methylene chloride (1, 6, 7, 9). This section explores the possible sources of non-site-related VOCs, and evaluates their specific levels measured in A-Z.

According to DES Vapor Intrusion Guidance, background sources should always be considered when interpreting indoor air data. Background information is assembled by surveying the indoor sampling area for potential VOC sources (i.e., chemical containers, oil containers/tanks, cleaners, paint, etc.), and by collecting an outside ambient air sample to be used for comparison purposes (3). Unfortunately, EPA's ambient air background sample was contaminated during laboratory analysis (1). As an alternative, EHP utilized background ambient and indoor air levels published by NHDES, ATSDR, and New York State for comparison purposes.

The EPA "Survey of Occupied Dwelling" form prepared for A-Z indicated that several paint cans were identified in the basement prior to sampling. Two heating oil tanks were also identified on the far side of the basement (common basement shared with an adjacent tenant) (1). These indoor sources may account for portions of the non-site-related VOCs identified. Other possible underground VOC sources may include two nearby properties where leaking underground storage tanks were recently remediated – Cumberland Farms located on 22 East Broadway and D&J Automotive located on 1 West Broadway. Additional plausible sources of air contaminants are fugitive air emissions from the Cumberland Farms gasoline filling station (across the street) as well as vehicular traffic along Broadway (11).

The non-site-related VOCs 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, 1,3-butadiene, benzene, and methylene chloride were detected in A-Z at levels above their CVs (1, 6, 7, 9). Some of these indoor air data levels were, however, indicative of background concentrations normally found either in outside ambient air, or in common indoor air environments. Risks associated with such background concentrations would likely be experienced by the general population. The specific levels, respective background comparisons, and possible sources of indoor air contamination are listed below.

- The maximum indoor air level of 1,2,4-trimethylbenzene measured in A-Z (2.71 ppb in the basement) exceeded its provisional non-cancer CV (1, 6). This level is slightly higher than the 90th-percentile indoor air concentration (2.23 ppb) normally measured in buildings that heat with fuel oil (1, 12). The level measured on the A-Z first floor (1.38 ppb), however, was approximately 50% lower than in the basement (1). This suggests that a source of 1,2,4-trimethylbenzene vapors may be present in the basement. The exact source contributing to these increased levels, however, is unknown.
- The maximum indoor air level of 1,3,5-trimethylbenzene measured in A-Z (1.38 ppb in the basement) exceeded its provisional non-cancer CV (1, 6). This level is about twice the 90th-percentile indoor air concentration (0.77 ppb) normally measured in buildings that heat with fuel oil (1, 12). As with 1,2,4-trimethylbenzene, levels of 1,3,5-trimethylbenzene were approximately twice as high in the A-Z basement (1). This suggests that a source of 1,3,5-trimethylbenzene vapors may be present in the basement. The exact source contributing to these increased levels, however, is unknown.
- The maximum indoor air level of 1,3-butadiene measured in A-Z (0.25 ppb, first floor, 0.14 ppb basement) exceeded its cancer CV, but was nearly the same as average ambient background levels typically found in the ambient air of cities and suburbs in the US (0.30 ppb) (1, 7, 13). The level was also almost identical to levels measured in nearby buildings adjacent to the site (1).
- The A-Z indoor air benzene levels exceeded their cancer CV (0.69 ppb - first floor, and 0.53 ppb - basement), and were higher than average ambient background levels measured throughout New Hampshire (0.28 ppb) (1, 7, 14). These concentrations, however, were almost identical to indoor air levels measured in buildings that heat with fuel oil (50th percentile level – 0.69 ppb) and to those measured in six other buildings near the site (1, 12). It is plausible that A-Z's indoor air benzene levels may be indicative of background concentrations found in the general vicinity (possibly influenced by the close proximity of the Cumberland Farms gasoline filling station approximately one block away as well as vehicular traffic on Broadway) (11).
- The maximum indoor air level of methylene chloride measured in A-Z (1.14 ppb in the basement) exceeded its cancer CV (1, 9). This level was lower than indoor air levels measured in buildings that heat with fuel oil (75th percentile level – 1.81 ppb) (1, 12). As with 1,2,4-trimethylbenzene and 1,3,5-trimethylbenzene, the A-Z methylene chloride levels may have been influenced by basement area sources. A-Z shares a common basement with another company with similar methylene

chloride basement levels. Methylene chloride levels in the four other adjacent buildings sampled by EPA were 10-times lower (1).

NOTE: A "percentile" is a mathematical way to describe the distribution of data. The percentage of data that have a value below a given number is the percentile. For example, 75 percent of the data will have values less than the 75th percentile. The 50th percentile is also known as the median (half the numbers are less than or equal to the median value).

A review of the scientific literature on the specific health effects of 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, 1,3-butadiene, benzene, and methylene chloride is available in Appendix B.

E. Cumulative Risk: Site-Related and Non Site-Related VOCs

EHP considered the potential cumulative risk posed by levels of all VOCs measured in the indoor air at A-Z. Specifically, EHP evaluated the exposure scenario for A-Z's owner (10-hours/day, 7-days/week) using two potential VOC levels: the maximum actual; and "estimated" (4). The resultant theoretical excess lifetime cancer risk was slightly elevated (potential for 15 excess cancers per million persons exposed). The cumulative potential for non-cancer health effects also indicated a slightly elevated risk for adverse health effects to occur from these exposures.

Although a theoretical potential cumulative risk is evident, it is likely that this risk is overvalued for the following reasons:

- EPA samples were taken during the winter heating season. During warmer weather months, however, A-Z ventilates the building during store hours (front/rear doors remain open while a fan circulates air) (4). Outdoor air ventilation likely reduces the site-related VOCs (emanating from the subsurface), and VOCs from indoor sources.
- Site-related VOCs such as trichloroethylene and vinyl chloride were not measured in the indoor air of A-Z or any of the 24 total samples collected by EPA (from 8 buildings adjacent to the site) (1);
- Carcinogenic VOCs including benzene and 1,3-butadiene are not site-related, and were nearly the same as applicable background levels (1, 9, 13); and
- VOCs including 1,2,4-trimethylbenzene and 1,3,5-trimethylbenzene are not site-related, and their levels are likely influenced by indoor sources (1).

CHILD HEALTH CONSIDERATIONS

Children are at greater risk than adults from exposure to indoor air contaminants for several reasons. Children are smaller than adults, resulting in higher doses of chemical exposure per body weight. Children are often more sensitive to the effects of chemical exposures than adults and can sustain permanent damage if toxic exposures occur during critical growing stages. Finally, children depend on adults for risk identification and avoidance. Although this EHP evaluation focused on an adult exposure, conservative child-based CVs were also used to complete this health consultation for A-Z.

CONCLUSIONS

After thorough analysis of all air data collected, EHP concludes that adverse health effects are not expected to result from inhalation exposure to site-related VOCs in A-Z indoor air. The cumulative potential long-term risk (i.e., 25 years) posed by all levels of VOCs in A-Z, however, is slightly elevated. This risk is likely overvalued, and additional sampling is recommended for confirmation. Exposure to indoor air in A-Z is therefore an *indeterminate public health hazard.*

RECOMMENDATIONS

Based on the conclusions of this report, EHP makes the following recommendations:

- EHP staff will evaluate any additional site-related indoor air monitoring data that may become available.
- Collect additional samples from the first floor using the analytical Method TO-15 with SIM analysis. This analysis is capable of detecting VOC contaminants at a much lower level than Method TO-15.
- Collect a simultaneous ambient air sample for risk assessment comparison purposes.
- Prior to sampling, attempt to identify any additional sources of indoor air contaminants present in the A-Z basement. Potentially remove all likely sources of VOC contaminants.

PUBLIC HEALTH ACTION PLAN

Past Actions

- EPA collected environmental samples at the site on February 27-28, 2007.
- EPA conducted a removal action at Shamrock Cleaners property beginning in April, 2007.
- DES participated in an EPA Open House for the site on April 4, 2007 to discuss public health issues.

Present Actions

- EHP is continuing to evaluate indoor air quality data for other properties potentially impacted by Shamrock Cleaners.

Future Actions

- EHP will distribute this health consultation to EPA and DES.
- EHP will evaluate any new site-related environmental sampling data that becomes available.

PREPARERS OF THE REPORT

Report Author
Eric K. Abrams, M.S., Environmental Health Risk Assessor
New Hampshire Department of Environmental Services
Environmental Health Program
Air Resources Division
29 Hazen Drive
Concord, New Hampshire 03301

ATSDR Technical Project Officer
Jeff Kellam, Environmental Scientist
CDC/ATSDR
1600 Clifton Road, NE
Mailstop E-29
Atlanta, GA 30329-4018

ATSDR Regional Representatives
William Sweet, Ph.D., DABT, Senior Regional Representative
Division of Regional Operations, Region I
Agency for Toxic Substances and Disease Registry
U.S. Department of Health and Human Services
One Congress Street, Suite 1100
Boston, Massachusetts 02114-2023

Certification

This health consultation on the evaluation of air data for A-Z Sports Cards located at 1½ East Broadway was prepared by the New Hampshire Department of Environmental Services, Environmental Health Program, under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It was prepared in accordance with methods and procedures approved at the time the consultation was initiated. Editorial review was completed by the Cooperative Agreement partner.

Technical Project Officer, Cooperative Agreement Team, CAPEB, DHAC, ATSDR

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

Cooperative Agreement Team Leader, CAPEB, DHAC, ATSDR

REFERENCES

1. U.S. EPA. 2007. Final Report - Indoor Air Study: Derry New Hampshire. Office of Site Remediation & Restoration, Remedial Program, Environmental Protection Agency, New England. April 16, 2007.

2. Sanborn, Head & Associates, Inc. 2007. Additional Indoor Air and Groundwater Monitoring – Shamrock Cleaners Site. March, 2007.

3. New Hampshire Department of Environmental Services (NH DES). 2007. Vapor Intrusion Guidance. Concord, NH: NH DES, Waste Management Division, Site Remediation Programs. July, 2006. Available at: http://www.des.state.nh.us/orcb/doclist/pdf/vapor_intrusion.pdf Accessed on March 3, 2007.

4. NH DES. Site Visit & Personal Communication with Owner, A-Z Sports Cards. DES- Air Resources Division. May 2, 2007.

5. ATSDR (Agency for Toxic Substances and Disease Registry). 2005. Public Health Assessment Guidance Manual. Atlanta, Georgia: ATSDR, U.S. Department of Health and Human Services. Available at: http://www.atsdr.cdc.gov/HAC/phamanual/ Accessed on May 3, 2007.

6. U.S. EPA 2004. Integrated Risk Information System (IRIS). Office of Research and Development, National Center for Environmental Assessment, Environmental Protection Agency. March 26, 2007. Available at: http://www.epa.gov/iris/ Accessed on May 8, 2007.

7. ATSDR. 2005. Comparison Value Tables. Atlanta, Georgia: ATSDR, U.S. Department of Health and Human Services. Available at: http://www.atsdr.cdc.gov/mrls/index.html Accessed on May 8, 2007.

8. US EPA (United States Environmental Protection Agency). 2004. EPA Region 9 Preliminary Remediation Goal (PRG). October. Available at: http://www.epa.gov/region09/waste/sfund/prg/files/prgtable2004.xls Accessed on May 8, 2007.

9. US EPA (United States Environmental Protection Agency). 2007. EPA Region 3 Risk-Based Concentrations (RBC) Table. April, 2007. Available at: http://www.epa.gov/reg3hwmd/risk/human/rbc/RBCapr07.pdf Accessed on May 7, 2007.

10. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Tetrachloroethylene. Atlanta, Georgia. September 1997. Available at: http://www.atsdr.cdc.gov/toxprofiles/tp18.html. Accessed on May 10, 2007.

11. NH DES. OneStop Data Retrieval for D&J Automotive & Cumberland Farms. Concord, NH: DES, Waste Management. May, 2007. Available at: http://www2.des.state.nh.us/OneStop/ORCB_Site_Results.aspx?MASTERID=1165 http://www2.des.state.nh.us/OneStop/ORCB_Site_Results.aspx?MASTERID=1164

12. New York State Department of Health. 2005. Summary of Indoor and Outdoor Levels of Volatile Organic Compounds from Fuel Heated Homes in NYS -1997-2003. Revised November 14, 2005. Albany, NY. Available at: http://www.health.state.ny.us/environmental/indoors/air/fuel_oil.htm Accessed on May 17, 2007.

13. Agency for Toxic Substances and Disease Registry. Toxicological Profile for 1,3 Butadiene. Atlanta, Georgia. July, 1992. Available at: http://www.atsdr.cdc.gov/toxprofiles/tp28.html Accessed on May 15, 2007.

14. NH DES. *National Air Toxics Monitoring Program Grant Final Report*. NH DES, Air Resources Division. 2005.

15. U.S. National Library of Medicine. Hazardous Substances Databank. 1,3,5-Trimethylbenzene. National Institutes of Health. Bethesda, Maryland. Available at: http://toxnet.nlm.nih.gov/cgi-bin/sis/search/r?dbs+hsdb:@term+@rn+@rel+108-67-8 Accessed on June 26, 2007.

16. U.S. National Library of Medicine. Hazardous Substances Databank. 1,2,4-Trimethylbenzene. National Institutes of Health. Bethesda, Maryland. Available at: http://toxnet.nlm.nih.gov/cgi-in/sis/search/r?dbs+hsdb:@term+@rn+@rel+95-63-6 Accessed on June 25, 2007.

17. Scorecard. Chemical Profile Search for 1,2,4- Trimethylbenzene. Available at: http://scorecard.org/chemical-profiles/html/124trimethylbenzene.html Accessed on June 27, 2007.

18. US EPA (United States Environmental Protection Agency). 1994. Chemical Summary for 1,2,4-Trimethylbenzene. EPA Office of Pollution Prevention and Toxics. August, 1994. Available at: http://www.epa.gov/opptintr/chemfact/s_trimet.txt Accessed on June 27, 2007.

19. New Jersey Department of Health and Senior Services. 2000. Hazardous Substance fact Sheet – 1,3,5-Trimethylbenzene. Trenton, New Jersey. Available at: http://nj.gov/health/eoh/rtkweb/documents/fs/1928.pdf Accessed on: June 29, 2007.

20. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Benzene. Atlanta, Georgia. September 1997. Available at: http://www.atsdr.cdc.gov/toxprofiles/tp3.html Accessed on May 15, 2007.

21. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Methylene Chloride. Atlanta, Georgia. September 2000. Available at: http://www.atsdr.cdc.gov/toxprofiles/tp14.html Accessed on June 29, 2007.

APPENDIX A

Figure 1. Site Map - Derry, New Hampshire (2).

APPENDIX B

1. 1,2,4- and 1,3,5-trimethylbenzene

1,2,4-trimethylbenzene (a.k.a. pseudocumene) is used as an industrial solvent, paint thinner, and in the manufacture of dyes, perfumes, resins, chemical intermediates, and pharmaceuticals. 1,3,5-trimethylbenzene (a.k.a. mesitylene) is also used in chemical intermediates, dyes, solvent, paint thinner, as well as an UV oxidation stabilizer for plastics (15). Both 1,2,4- and 1,3,5-trimethylbenzene enter the environment primarily from gasoline evaporation and as an emission from gasoline-powered vehicles, municipal waste-treatment plants, and coal-fired power stations. Both chemicals are also emitted from many building materials including: vinyl & rubber molding, particle board, linoleum tile, tar paper, telephone cable, latex paint, foam & duct insulation, urethane sealant, adhesives, latex caulk, and carpet. The general population is exposed to these chemicals via inhalation of ambient air, ingestion of food/water, and dermal contact with vapors, food and other products. Consumers can be exposed to 1,2,4-and 1,3,5-trimethylbenzene concentrations ranging from 5.0 – 90.0 ppb while dispensing gasoline at self-serve stations (15, 16). A study conducted in Raleigh, NC during the summer of 1988 also revealed mean and maximum 1,2,4-trimethylbenzene concentrations of 3.2 ppb and 7.9 ppb respectively in vehicle air (17).

Inhalation of 1,2,4-trimethylbenzene at concentrations ranging between 5000-9000 parts-per million (ppm) causes headache, fatigue, and drowsiness. Long-term exposure to solvents containing 1,2,4-and 1,3,5-trimethylbenzene may cause nervousness tension & anxiety (18). The National Institute for Occupational Safety and Health (NIOSH) recommends an airborne exposure limit of 25 ppm averaged over a 10-hour work shift (19). No studies of the carcinogenic potential of 1,2,4 or 1,3,5-trimethylbenzene have been reported (17, 19).

2. 1,3-Butadiene

1,3-butadiene is a colorless gas with a mild gasoline-like odor that breaks down quickly in the air. In fact, half of 1,3-butadiene goes away from the air in about 2 hours during sunny weather. 1,3-butadiene is produced from petroleum and is used to make man-made rubber (car and truck tires) and plastics. 1,3-butadiene is also found in gasoline, automobile exhaust, cigarette smoke, and wood fires. Thus, it is often present at very low levels in the air around cities and towns. (13).

Studies on workers have shown that heart disease, blood disease, lung disease, and certain cancers are the principal health effects resulting from long-term exposure to low levels of 1,3-butadiene. These workers, however, were also exposed to other chemicals combined with 1,3-butadiene. The exact composition and proportion of these chemical combinations is unknown, as is which specific chemical (or chemicals) caused these effects. Inhalation of 1,3-butadiene is mildly narcotic in humans at low concentrations and may result in a feeling of lethargy and drowsiness (13).

3. Benzene

Benzene is commonly found in the environment with industrial processes being the main source. The general population is mainly exposed to benzene through breathing air containing benzene. Benzene levels in the air can also be from industrial emissions, waste and storage operations, motor vehicle exhaust (about 20% of the total nationwide exposure), and evaporation from gasoline service stations. Tobacco smoke also contains benzene. About half of the entire nationwide exposure to benzene results from smoking tobacco or from exposure to environmental ("secondhand") tobacco smoke (20).

Benzene causes problems in the blood. Human studies show that chronic inhalation exposure to benzene can result in harmful effects in the tissues that form blood cells, especially the bone marrow. Excessive exposure to benzene can be harmful to the immune system, increasing the chance for infection and perhaps lowering the body's defense against cancer of the blood-forming organs (leukemia). The U.S. Department of Health and Human Services (USDHHS) categorizes benzene as a known carcinogen (20).

4. Methylene chloride

Methylene chloride (a.k.a. dichloromethane) is widely used as an industrial solvent and paint stripper. It is also found in some aerosols, pesticide products, spray paints, automotive cleaners, household products, and is used in the manufacture of photographic film. Because methylene chloride evaporates easily, the greatest potential for exposure is via inhalation from its industrial and home usage. Background air levels are usually less than 1 part-per-billion (ppb), however, average air concentrations of 11 ppb (10-times higher than found in the DDA basement) have been documented in some urban locations (1, 21). The odor threshold for methylene chloride is about 200 ppm in air (21).

Inhalation of methylene chloride at levels near 800 ppm impairs reaction time and the ability to perform tasks requiring precise hand movements. Prolonged inhalation may also cause dizziness, nausea, tingling or numbness of the fingers and toes, and feelings of drunkenness. In most cases, effects disappear shortly after the exposure ends. High doses of methylene chloride may cause changes in the liver and kidney in animals, but similar effects have not been observed in humans. The current OSHA limit for an 8-hour workday is 25 ppm, and 125 ppm for 15 minute duration exposures. Studies indicate that mice exposed to high air concentrations of methylene chloride for a long duration increased the incidence of cancer in mice. There is, however, no clear evidence that methylene chloride causes cancer in humans. The EPA has determined that methylene chloride is a probable cancer causing agent in humans (21).