Health Consultation

DOWNTOWN SCHOOL MEMPHIS CITY SCHOOLS – UPDATE
STATE OF TENNESSEE DCERP SITE #79-212

MEMPHIS, SHELBY COUNTY, TENNESSEE

MARCH 13, 2003

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.

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HEALTH CONSULTATION

DOWNTOWN SCHOOL MEMPHIS CITY SCHOOLS – UPDATE
STATE OF TENNESSEE DCERP SITE #79-212

MEMPHIS, SHELBY COUNTY, TENNESSEE

Prepared by:

Tennessee Department of Health
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

Preface: The following document was prepared as an update to the Downtown School Memphis City Schools health consultation dated January 2, 2003, as called for in the recommendation for collecting and reviewing additional air quality data for the Drycleaner Environmental Response Program (DCERP) site #79-212.

BACKGROUND AND STATEMENT OF ISSUES

In November 2002, the Tennessee Department of Environment and Conservation (TDEC) Division of Superfund (DSF) requested that the Tennessee Department of Health (TDH), Communicable and Environmental Disease Services (CEDS), Environmental Health Studies and Services (EHSS), review a report on the Downtown School Vapor Monitoring Program (Pickering 2002). The report detailed air sampling results performed outside and inside the building. DSF wanted to know, "if the measured vapor concentrations would be a health hazard to children who will attend the new Downtown School in fall semester 2003."

On August 12, 1998, DCERP entered into an agreement with Nations Bank to perform a voluntary cleanup of the 10 North Fourth Street property owned by the bank. The property was the former site of Henry Loeb and Company Laundry and Memphis Steam Laundry Stable. A map dated 1907 details these structures. By the 1990s, the laundry and cleaners had been removed and an asphalt parking lot was in place. The property was later sold to the city of Memphis to be used as the site for a new elementary school.

The 10 North Fourth Street property, future home of the City of Memphis Downtown School (Figure 1), was investigated for contamination from its past use as a laundry. A series of investigations determined that soils contained tetrachloroethylene (PCE) and total petroleum hydrocarbons (TPH). Analysis of shallow groundwater detected contamination from tetrachloroethylene (PCE), trichloroethylene (TCE), total petroleum hydrocarbons (TPH), cis-1,2-dichloroethene (1,2-DCE), and vinyl chloride (VC).

In 1999, contaminated soil was removed from the site. Two 15 feet x 15 feet x 16 feet deep pits were excavated and hauled away. In 2001, another pit measuring 300 feet x 300 feet x 20 feet deep was dug and soil removed. Limestone fill was used to geotechnically improve the future building's footprint. A horizontal piping collection system that feeds a vertical recovery well was installed 20 feet below grade. This pump-and-treat system was designed to extract and reduce pollutants in the groundwater located 4 to 10 feet below grade. The Downtown (elementary) School building was then constructed on the site (Figure 1). The Downtown School building is not scheduled for classroom use until the fall semester 2003.

From June 28, 2002 to July 1, 2002, Pickering Environmental Consultants, Inc. (PECI), under the authorization of TDEC DCERP, performed a vapor monitoring study at the site. Seven (7) chemicals of concern (COC) were investigated: 1,2-dichloroethane, 1,1-dichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethene, tetrachloroethylene, trichloroethene, and vinyl chloride. In November 2002, TDH EHSS was asked to review the report in a written health consultation.

On December 10, 2002, representatives from Memphis City Schools, Pickering Environmental Consultants, Inc., TDEC DCERP, Memphis-Shelby County Health Department, and TDH EHSS

met. The purpose was for Pickering to present results of the vapor monitoring study conducted at the Downtown School June-July 2002 to an executive committee of the Memphis City School Board. Tennessee state government officials from the Department of Health and the Department of Environment and Conservation were in attendance to answer questions and provide assistance.

On January 2, 2003, the Agency for Toxic Substances and Disease Registry (ATSDR) certified and published the Downtown School Memphis City Schools (a.k.a. State of Tennessee DCERP Site #79-212) health consultation. This report, prepared by the TDH EHSS, concluded that: "The single air sampling event is not sufficient to rule out a health hazard; therefore, an indeterminate public health hazard is indicated for DCERP site #79-212 until additional data is available for review."

On the basis of a collaborative discussion between TDH EHSS, TDEC DCERP, and Pickering Environmental Consultants, Inc., additional air samples were collected. The resultant air quality data gathered from December 27-30, 2002, will be the focus of this Health Consultation Update.

DISCUSSION

Environmental Sampling

During the December 27-30, 2002, air sampling event, the Early Childhood Room 1085, Multipurpose/Café, and outdoor air (Figure 2) were sampled with SUMMA canisters. None of the SUMMA canisters measured a detectable level of any of the seven chemicals of concern. These findings, in accordance with the EPA approved method for air analysis of volatile organic compounds (VOCs), Method TO-15, are non-detect. The lowest detectable level a SUMMA canister can accurately measure, or its practical quantitation limit (PQL), for PCE is 6.78 micrograms per cubic meter ($\mu g/m^3$), for 1,1-DCE is 3.96 $\mu g/m^3$, and for 1,2-DCA is 4.05 $\mu g/m^3$. All of these PQLs are equivalent to 1 part per billion (ppb).

Emflux traps were also used to measure for chemicals of concern. This redundant sampling focused on determining whether chemical vapors were present or absent within the future school building. If vapors were present, this redundant sampling should precisely measuring the concentrations of the chemical vapors in different rooms. Emflux traps can detect chemicals at lower levels than SUMMA canisters. Fifteen Emflux samples were collected to determine air quality.

Three chemicals of concern were collected in detectable amounts: tetrachloroethylene (PCE), 1,1-dichloroethene (1,1-DCE), and 1,2-dichloroethane (1,2-DCA). PCE was detected in one (1) of the 15 Emflux traps at a flux rate of 17.72 nanograms per square meter per minute (ng/m^2-min). 1,1-DCE was measured in 10 of the 15 samples ranging from 2.14 to 28.66 ng/m^2-min. Two of the 15 samples detected 1,2-DCA from 1.37 to 1.84 ng/m^2-min. A flux rate is the amount of a chemical passing through a known area over time. In this case, flux rate is the amount of vapor passing through the concrete building foundation into the Emflux apparatus during the sampling event. The minimum detection level measurable by an Emflux trap for PCE is 1.75 ng/m^2-min, 1,1-DCE is 0.90 ng/m^2-min, and 1,2-DCA is 1.32 ng/m^2-min.

Tetrachloroethylene (PCE) and 1,1-dichloroethene (1,1-DCE) were scrutinized in the original health consultation because they were the only chemicals of concern detected during the first sampling event. The second sampling event in December 2002 found trace amounts of 1,2-dichloroethane. This result is not surprising as both 1,2-DCA and 1,1-DCE are degradation products of PCE.

Evaluation of the potential health risks in the original consultation were based on the maximum measured flux rates of PCE and 1,1-DCE. These flux rates reported in ng/m^2-min (nanograms per square meter per minute) were used to calculate vapor concentrations at a conservative ceiling height of only 5 feet (1.52 meters) which adjusts for breathing height. The vapor concentrations were reported in micrograms of chemical per cubic meter of air ($\mu g/m^3$) and in parts per billion (ppb).

Outdoor versus Indoor Air

Tetrachloroethylene has been known to pollute both outdoor and indoor air. Furthermore, elevated levels of PCE vapors have been measured in the air above known soil and groundwater contaminated sites. At the Downtown School site, the pollutant plume is known to extend under the school building but is not under the playground area. It would be expected that the closer to the contaminant plume one is, the higher the vapor concentrations would be.

Studies have shown that outdoor vapor concentrations are normally several times less than indoor vapor concentrations. This result is not surprising as PCE evaporates quickly and can leave breathable air heights where wind mixing can readily take place. Therefore, our concern of exposure to PCE, 1,1-DCE, or 1,2-DCA vapors is focused inside the Downtown School.

Comparing Indoor Air Chemical Vapor Concentrations

In this Health Consultation Update, the data presented in Table 1 is based on the measured vapor flux rates from the June-July 2002 and December 2002 sampling events. The data is presented with all unit labels the same as the previous Health Consultation. An important difference in Table 1 is that the concentrations reported are an eight-hour (8-hour) average with full ceiling height. As only one (1) Emflux trap was used to sample the Early Childhood Rm 1085 it is by default a maximum value (note that only 1,1-DCE was detected in the Early Childhood Rm 1085). The large-sized (858 m^2) Multipurpose/Café (Figure 3) was sampled with 11 Emflux traps plus one duplicate sample. Therefore, the Multipurpose/Café is an average value. It was computed with non-detect sample locations represented by one-half of the detection limit value.

The full ceiling height will effectively make all concentration values lower than previously reported; yet, no value is incorrect as the reduced ceiling height was a mathematical assumption. The Early Childhood Rm 1085 and other classrooms, with a 3.05 m ceiling height, will show higher vapor concentrations at identical flux rates than the Multipurpose/Café, with a 5.8 m ceiling height, because of vapor dilution into a larger volume room.

Federal guidelines are available for concentrations of PCE, 1,1-DCE, and 1,2-DCA in air. The calculated vapor concentrations for all PCE, 1,1-DCE, and 1,2-DCA are lower than ATSDR (2003) minimal risk levels (MRLs) and EPA Region 9 (2002b) preliminary remediation goals (PRGs).

TABLE 1

Comparison of vapor concentrations of PCE, 1,1-DCE, and 1,2-DCA calculated in Early Childhood Rm 1085 and Multipurpose/Café at Downtown School in Memphis from 6/28/02-7/01/02 and 12/27/02-12/30/02 to health guidance values (Pickering 2002 & 2003).

Room	Event Date	Chemical of Concern	72-hour accumulation Average Flux	8-hour area Concentration w/ full ceiling		ATSDR-MRL Inhalation		EPA Region 9 PRG Ambient Air
			ng/m^2-min	µg/m^3	ppb	ppb	µg/m^3	µg/m^3
Multi-purpose /Café	June July 2002	tetrachloroethylene	1.98	0.160	0.024	40 C	271 C	0.67 ca
		1,1-dichloroethene	0.635	0.050	0.130	20 I	79.3 I	520 nc
	Dec 2002	tetrachloroethylene	2.41	0.199	0.029	40 C	271 C	0.67 ca
		1,1-dichloroethene	5.40	0.460	0.116	20 I	79.3 I	520 nc
		1,2-dichloroethane	0.832	0.069	0.017	600 C	2,430 C	0.074 ca
Early Childhood Rm 1085	June July 2002	1,1-dichloroethene	1.2	0.188	0.047	20 I	79.3 I	520 nc
	Dec 2002	1,1-dichloroethene	5.35	0.842	0.212	20 I	79.3 I	520 nc

The shaded area is a comparison in parts per billion (ppb) of vapor concentrations to ATSDR inhalation guidelines; all values are below guidelines.

MRL = Minimal Risk Level is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse noncancer health effects over a specified duration of exposure. These substance-specific estimates, which are intended to serve as screening levels, are used to identify contaminants and potential health effects (ATSDR 2002a & 2003).

PRG = Preliminary Remediation Goals are risk-based tools that are intended to assist in initial screening-level evaluations of environmental measures. PRGs should be viewed as guidelines, not legally enforceable standards. PRGs are helpful in providing long-term targets to use during analysis of remedial activities (EPA 2002b).

C = Chronic exposure greater than 1 year; I = Intermediate duration exposure up to 1 year; ca = cancer value; nc = noncancer value

Several studies have been conducted to collect ambient air concentrations of PCE (ATSDR 1997). These studies detail what can be considered background levels of PCE in everyday air (ATSDR 1997). A compilation of U.S. ambient air monitoring data prior to 1981 demonstrated 0.16 ppb PCE in the air of rural and remote areas; and 0.79 ppb PCE in the air of urban and suburban areas. Canadian ambient air monitoring data showed 0.03-0.06 ppb PCE in rural areas and 0.03-0.73 ppb PCE in urban areas. Ambient air data from seven major U.S. cities measured background PCE levels between 0.29-0.59 ppb. These values compare favorably to the 0.024 and 0.029 ppb PCE measured in the two sampling events at Downtown School.

Several studies were conducted to collect ambient air concentrations of 1,1-DCE. These studies detail what can be considered background levels of DCE in air (ATSDR 1994). National Ambient Volatile Organic Compound Database ambient daily average for 1,1-DCE was listed at 4.6 ppb. EPA Total Exposure Assessment Measurement studies of 1,085 personal air samples collected over three seasons from 350 New Jersey residents ranged from 0.76-3.5 ppb. Another comparison value of 0.36 ppb was made from 30 air samples from Camden, New Jersey. These comparisons are all favorable to the maximum 0.212 ppb 1,1-DCE measured at Downtown School.

1,2-Dichloroethane has been found in ambient air samples for urban areas of the United States. Median daily atmospheric 1,2-DCA concentration in urban sites was reported at 0.012 ppb (1,214 samples) and 0.26 ppb (182 samples). A survey of seven urban locations reported 0.1-1.5 ppb of 1,2-DCA found in the air. In a 1987 survey of 35 homes in Kanawha Valley, West Virgina, the mean 1,2-DCA was 4.2 ppb. The 0.017 ppb 1,2-DCA discovered at Downtown School in December 2002 is well within what would be expected for an urban site.

Based on a literature review, the maximum calculated concentrations of PCE, 1,1-DCE, and 1,2-DCA inside Downtown School, located in the urban center of Memphis, Tennessee, are less than or comparable to data gathered for both outdoor and indoor urban locations across the U.S. and in Canada. The combination of chemical vapor concentrations below health guidance and within what would be expected through a literature search helps to construct a health statement for Downtown School.

Efforts to further Reduce Vapors

Two important activities will occur at Downtown School that favor reducing the trace amounts of chemical vapors measured in the building. The heating ventilation and air conditioning (HVAC) system will be in operation. As HVAC systems function they force outside air to mix with indoor air. This will result in reducing the accumulation of any vapor inside the school, regardless of whether the vapor is a drycleaner solvent or carbon dioxide from normal human respiration. Second, a groundwater pump-and-extraction remediation system is proposed for DCERP site #79-212. This system will capture the underground pollution and remove it from the site. As the amount of pollution in the ground is reduced the resulting vapors above that diluted amount should also be reduced. Both of these activities have strong potential to effectively minimize any threats at Downtown School where data already shows no apparent health hazard.

When the summer and winter sampling data are investigated together, PCE, 1,1-DCE, and 1,2-DCA, three of the seven chemicals of concern, were detected; therefore, human health concerns for only these three chemicals will be further discussed in this publication.

Tetrachloroethylene (PCE) $Cl_2C=CCl_2$

Tetrachloroethylene (PCE) is also commonly called perchloroethylene (PCE or PERC). PCE is a clear, colorless liquid said to produce a sharp, sweet smell. PCE is nonflammable and evaporates very readily at room temperature. Tetrachloroethylene is a synthetic chemical and is often used as a starting point for the manufacture of other chemicals (ATSDR 1997).

If PCE pollutes surface water or surface soil, PCE will mostly evaporate into the air and disperse. Tetrachloroethylene can travel through soil easily. If PCE gets into underground water, it can remain there for many months or years without breakdown.

People can detect the smell of PCE in the air at 1 part per million (ppm) or more. Background concentration of PCE in outdoor air is usually less than 1 part per billion (ppb). Tetrachloroethylene is used in certain consumer products including repellents, silicone lubricants, fabric finishers, spot removers, adhesives, and wood cleaners. Tetrachloroethylene has been widely used in the drycleaning industry for decades. Clothes brought home from drycleaners might release small amounts of PCE into the air. The significance of exposure to small amounts of PCE is unknown, but to date, these small amounts appear to be relatively harmless (ATSDR 1997).

After exposure to PCE, whether through breathing, drinking, eating, or touching, most PCE leaves the body from the lungs during exhalation. A small amount of PCE will be changed by the body, mainly in the liver, to other chemicals and removed from the body via urination. Tetrachloroethylene or changed PCE products can found in the blood or stored in body tissues, especially fat. The body burden of PCE after repeated exposure has been shown to increase. Storage of PCE in body fat can range from days to weeks prior to elimination.

The health effects of breathing air with low levels of PCE are not known. Most industry workers with known PCE exposures had symptoms of dizziness, sleepiness, and other nervous system effects (ATSDR 1997). Laboratory studies of mice and rats suggest that the liver and kidneys are the target organs of PCE.

Tetrachloroethylene can cross the placenta and distribute to the fetus and amniotic fluid. Tetrachloroethylene has been found in the breast milk of mothers exposed to PCE. The effects of exposing babies to PCE through breast milk are unknown. As of 1997, ATSDR reported finding no studies describing developmental effects of PCE inhalation (ATSDR 1997).

The cancer-causing potential of PCE has been extensively studied. In laboratory rats and mice, PCE has been shown to cause cancer when ingested or inhaled in large amounts. With many workers in the drycleaning industry, several studies provide evidence for a causal association between PCE and elevated risks of certain types of cancer (EPA 2002a). Tetrachloroethylene is listed by the International Agency for Research on Cancer (IARC) as a probable human

carcinogen. The National Toxicology Program (NTP) agrees, listing PCE as reasonably anticipated to be a human carcinogen (ATSDR 2002).

Introduced in the 1930s (Cowan 2002a), PCE is the solvent, or cleaning agent, most often used by professional drycleaners. PCE removes stains and dirt from all common types of fabric. PCE does not usually cause clothes to shrink or dyes to bleed. PCE is not flammable unlike many other common solvents. Additionally, PERC can be reclaimed after the drycleaning process and reused, helping to make it a cost-effective professional cleaner.

1,1-Dichloroethene (1,1-DCE) $CH_2=CCl_2$

Also called vinylidene chloride (VDC), 1,1-dichloroethene (1,1-DCE), is a clear, colorless liquid that evaporates readily at room temperature. 1,1-dichloroethene has a mild, sweet, chloroform-like odor and burns readily. 1,1-DCE is a synthetic chemical that is used in the manufacture of certain plastics including packing materials and flexible films. The 1,1-DCE reported in this consultation is thought to be a product of PCE breakdown. PCE was known to have been used in drycleaning at the site.

In surface soils 1,1-DCE readily evaporates into the air and disperses. 1,1-dichloroethene is broken down by reactive compounds formed by sunlight and lasts about 4 days in air. If in surface water, 1,1-DCE either evaporates into the air or percolates through soil with rainwater into underground water.

1,1-dichloroethene can enter the body through inhalation of polluted air. Low to moderate levels of 1,1-DCE will be excreted in urine from the body in 1-2 days as breakdown products. Some 1,1-DCE breakdown products such as dithioglycolic acid are more harmful than 1,1-DCE. In low concentrations, 1,1-DCE is not stored very much in the body (ATSDR 1994).

Limited animal laboratory studies of the effects of 1,1-DCE have suggested that its target organs are the liver and kidneys. 1,1-dichloroethene is not known to cause cancer (ATSDR 2003).

1,2-Dichloroethane (1,2-DCA) $ClCH_2$-CH_2Cl

Also called ethylene dichloride, 1,2-dichloroethane (1,2-DCA), is a clear liquid that is not found naturally in the environment. 1,2-DCA evaporates at room temperature and is known to have a pleasant smell and sweet taste. Today, 1,2-DCA is commonly manufactured for use in products that remove grease, glue, and dirt (ATSDR 1994). The 1,2-DCA found at DCERP site #79-212 is believed to be a degradation product from drycleaner solvents.

Small amounts of 1,2-DCA in water or soil will evaporate into the air. 1,2-DCA does not remain in the air, but this chemical is readily broken down by reacting with other compounds formed by the sun. 1,2-DCA found in soil from spills or improper disposal can travel through the ground into underground water. In water or soil, 1,2-DCA can persist for long periods of time. Only small amounts of 1,2-DCA have been shown to be taken up by plants or animals.

Experiments in animals showed that once breathed into the body, 1,2-DCA goes to many organs of the body, but usually leaves in the breath within 1 or 2 days. The breakdown products of 1,2-DCA leave the body quickly in urine. People accidentally exposed to large amounts of 1,2-DCA through breathing or swallowing often developed nervous system disorders or kidney disease. Longer-term exposure to low doses of 1,2-DCA also caused kidney disease in animals. Evidence from animal studies suggests that 1,2-DCA probably does not produce birth defects or affect reproduction. Exposure to 1,2-DCA has so far not been associated with cancer in humans (ATSDR 1994). 1,2-dichloroethane is listed by the International Agency for Research on Cancer (IARC) as 2B, possibly carcinogenic to humans because of limited human evidence and less than sufficient evidence in animals (ATSDR 2003).

Correction to Initial Consult dated January 2, 2003

Tim McCaffery from Pickering Environmental Consultants, Inc. helped TDH EHSS identify an error in the previous Downtown School Memphis City Schools (a.k.a. State of Tennessee DCERP site #79-212) health consultation that was published by ATSDR under a cooperative agreement with the TDH on January 2, 2003. The document reviewed air quality data from June 28 - July 1, 2002.

In the consult on Page 2 and under Conclusions 2 and 3, the maximum measured flux rates for PCE were stated at 161 ng/m^2-min and 1,1-DCE at 92 ng/m^2-min. The correct statement is that the absorbent media within the Emflux canisters measured exactly maximums of 161 ng of PCE and 96 (not 92) ng of 1,1-DCE over the entire 72-hour sampling event. Actual amounts of chemical were presented and incorrectly labeled as flux rates. The correct maximum flux rates were actually 12.27 ng/m^2-min for PCE and 3.73 ng/m2-min for 1,1-DCE. The June-July 2002 Multipurpose/Café 8-hour average flux rates were 1.98 µg/m^2-min and 5.40 µg/m^2-min for PCE and 1,1-DCE, respectively. The indoor air vapor concentrations were presented and discussed correctly. This labeling error does not change any of the health recommendations.

ATSDR Child Health Initiative

In 1996, the Agency for Toxic Substances and Disease Registry (ATSDR) launched an initiative to place a special agency-wide emphasis on environmental hazards to children's health and to emphasize child health in all agency programs and activities. The initiative was begun because of the special vulnerabilities of children when they are exposed to hazardous substances (ATSDR 1997, 1998).

Children six years old or younger are more sensitive to the effects of pollutants than adults. Children generally have lower body weights, breathe air closer to the ground, and are more often in contact with the ground than adults. At low levels of exposure a child's mental and physical growth may be affected. TDH used the potential exposure of young children to the PCE or DCE found in the air outside or inside in assessing the risks for the Downtown (elementary) School because school children often are the more susceptible population than the adult employees.

CONCLUSIONS

The air quality at Downtown School, Memphis City Schools, Memphis, Shelby County, Tennessee, was analyzed June 28-July 1, 2002, and again from December 27-30, 2002. Both sampling events yielded trace levels of drycleaner solvent or breakdown product vapors below federal health guidelines. Literature indicates that the calculated tetrachloroethylene (PCE), 1,1-dichloroethene (1,1-DCE), and 1,2-dichloroethane (1,2-DCA) vapor concentrations inside Downtown School are in-line with or below both outdoor and indoor ambient air monitoring data. No apparent public health hazard exists at Downtown School a.k.a. DCERP site #79-212.

RECOMMENDATIONS

None at this time.

PUBLIC HEALTH ACTION PLAN

1. The Tennessee DCERP will maintain project management and oversight for site #79-212. DCERP will periodically monitor the Downtown School indoor air quality to ensure no public health hazard develops over time.

2. An order has been placed for the groundwater pump-and-extraction remediation system that will be used to reduce the amount of pollution at DCERP site #79-212. This will remediate the groundwater pollution to reduce the amount of chemicals available to potentially volatilize and enter the Downtown School building.

3. TDH is available to assist Memphis City Schools with further health or environmental consultation in regard to DCERP site #79-212.

REFERENCES

ATSDR [Agency for Toxic Substances and Disease Registry]. 2003. Air comparison values. Atlanta: US Department of Health and Human Services.

ATSDR [Agency for Toxic Substances and Disease Registry]. 1998. Promoting children's health, progress report of the Child Health Workgroup, Board of Scientific Counselors. Atlanta: US Department of Health and Human Services.

ATSDR [Agency for Toxic Substances and Disease Registry]. 1997. Healthy children - toxic environments. Report of the Child Health Workgroup presented to the Board of Scientific Counselors. Atlanta: US Department of Health and Human Services.

ATSDR [Agency for Toxic Substances and Disease Registry]. 2003. Health Consultation: Downtown School Memphis City Schools (a/k/a State of Tennessee DCERP site #79-212) Memphis, Shelby County, Tennessee. Atlanta: US Department of Health and Human Services.

ATSDR [Agency for Toxic Substances and Disease Registry]. 2002a. Minimal risk levels (MRLs) for hazardous substances. Atlanta, GA: US Department of Health and Human Services. Available from URL: www.atsdr.cdc.gov/mrls.html [accessed Dec 18 2002].

ATSDR [Agency for Toxic Substances and Disease Registry]. 1994. Toxicological Profile for 1,1-dichloroethene. Atlanta: US Department of Health and Human Services.

ATSDR [Agency for Toxic Substances and Disease Registry]. 1994. Toxicological Profile for 1,2-dichloroethane. Atlanta: US Department of Health and Human Services.

ATSDR [Agency for Toxic Substances and Disease Registry]. 1997. Toxicological profile for tetrachloroethylene. Atlanta: US Department of Health and Human Services.

Cowan, Sally. [About.com]. 2002a. Sew News: Behind the counter. PRIMEDIA. Available from URL: sewing.about.com/library/sewnews/library/aafabr14.htm [accessed Dec 16, 2002].

EPA [Environmental Protection Agency]. 2002a. Design for the environment frequently asked questions about drycleaning. Washington, DC: US Environmental Protection Agency. Available from URL: www.epa.gov/dfe/pubs/garment/ctsa/factsheet/ctsafaq.htm [accessed Nov 26-Dec 17 2002].

EPA [Environmental Protection Agency]. 2002b. Region 9: Superfund preliminary remediation goals. Washington, DC: US Environmental Protection Agency. Available from URL: www.epa.gov/region09/waste/sfund/prg/index.htm [accessed Dec 18 2002].

Pickering. [Pickering Environmental Consultants, Inc.]. 2002. Report on vapor monitoring program of DCERP site #79-212, Memphis City Schools Downtown School, 10 North Fourth Street, Memphis, Tennessee, Project #15117.04. Memphis: Pickering Environmental Consultants, Inc.

Pickering. [Pickering Environmental Consultants, Inc.]. 2003. Second report on vapor monitoring program of DCERP site #79-212, Memphis City Schools Downtown School, 10 North Fourth Street, Memphis, Tennessee, Project #15117.04. Memphis: Pickering Environmental Consultants, Inc.

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FIGURE 1
Site diagram of Downtown School
Memphis, Shelby County, Tennessee
(Pickering 2002) (Mapquest.com)

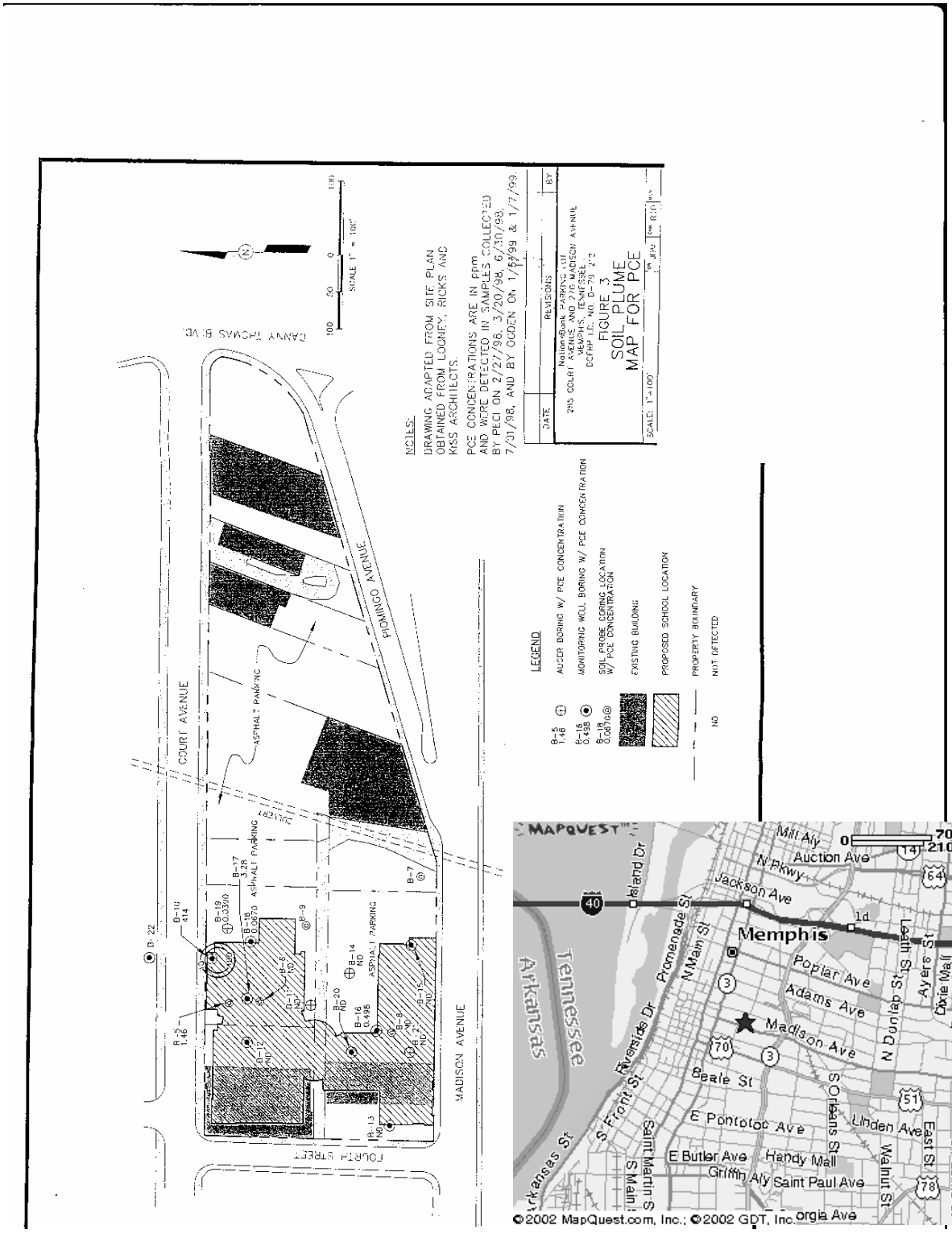

FIGURE 2
Photo of SUMMA canister sampling outside at Downtown School
Memphis, Shelby County, Tennessee
(Photo credit: Carol Tsagarakis, PECI – Dec. 2002)

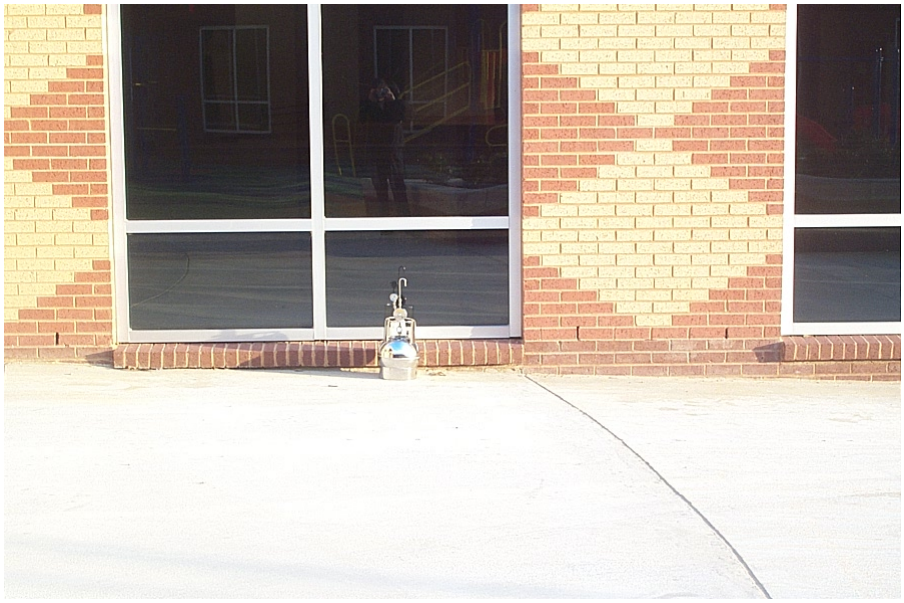

FIGURE 3
Photo of Emflux sampling in Multipurpose/Cafe at Downtown School
Memphis, Shelby County, Tennessee
(Photo credit: Carol Tsagarakis, PECI – Dec. 2002)

CERTIFICATION

This Memphis City Schools Health Consultation was prepared by the Tennessee Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the health consultation was begun.

Alan W. Yarbrough

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Technical Project Officer, SPS, SSAB, DHAC, ATSDR

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

Roberta Erlwein

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Chief, State Program Section, SSAB, DHAC, ATSDR