Health Consultation

COOPER'S POYNT ELEMENTARY SCHOOL

CAMDEN, CAMDEN COUNTY, NEW JERSEY

FEBRUARY 9, 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

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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

COOPER'S POYNT ELEMENTARY SCHOOL

CAMDEN, CAMDEN COUNTY, NEW JERSEY

Prepared by:

New Jersey Department of Health and Senior Services
Division of Public Health Protection and Emergency Preparedness

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

Summary

In December 2003, the New Jersey Department of Environmental Protection requested assistance from the New Jersey Department of Health and Senior Services in assessing potential indoor air exposures from total xylene at the Cooper's Poynt Elementary School, Camden, Camden County. This contaminant was thought to be related to a no. 2 fuel oil discharge from an underground storage tank located on school property. Fuel oil is comprised of a complex mixture of petroleum hydrocarbons, including xylenes. The discharge of no. 2 fuel oil from the leaking underground storage tank resulted in the contamination of on-site soil and groundwater, and free product was observed migrating towards the school building in the vicinity of classroom 102 used by pre-kindergarten children. Volatile chemicals in soil and groundwater can emit vapors that may migrate through subsurface soils and into indoor air spaces of overlying buildings. Due to potential vapor intrusion into the school building, indoor air samples were collected in September 2003. The results of this sampling event indicated a number of volatile organic compounds, including elevated concentrations of total xylene.

The New Jersey Department of Health and Senior Services, in consultation with the New Jersey Department of Environmental Protection, calculated a modified indoor air guideline concentration for total xylene using exposure assumptions for four-year old children. Since the concentration of total xylene detected in classroom 102 was more than twice the recommended modified indoor air guideline concentration, school officials suspended the use of classroom 102 and an adjacent room used by students and school employees.

Subsequent sampling, which included the collection of sub-slab soil gas, was performed in January 2004. Sampling results and observations made during a January 2004 site visit indicated that the source of contamination may not be totally attributable to the fuel oil discharge. The storage and/or use of cleaning products may be affecting the indoor air quality of the school. At the present time, there is ***"No Apparent Public Health Hazard"*** from indoor air exposures associated with the fuel oil discharge.

The New Jersey Department of Health and Senior Services evaluated potential health effects from indoor air contaminants detected in the school building. Although the mean and maximum concentrations of benzene and 1,3-butadiene exceeded their health-based comparison values, the concentrations are comparable to those from reported urban/suburban background concentrations, and additional adverse health effects are unlikely. Results of recent indoor air sampling conducted at the school indicated that total xylene concentrations were below the health-based comparison value. Benzene, 1,3-butadiene and total xylene are associated with automobile exhaust and the use and/or storage of cleaning products and solvents.

It is recommended that the federal "Indoor Air Quality Tools for Schools" program be implemented at the Cooper's Poynt Elementary School. The use of "green" alternative cleaning products and janitorial supplies should be considered in an effort to minimize exposures from volatile organic compounds to students and school employees.

Statement of Issues

In late December 2003, the New Jersey Department of Environmental Protection (NJDEP) requested assistance from the New Jersey Department of Health and Senior Services (NJDHSS) in assessing potential indoor air exposures from m-, p-, and o-xylene (xylenes or "total" xylene) at the Cooper's Poynt Elementary School, Camden, Camden County. This contaminant was thought to be related to a no. 2 fuel oil discharge from an underground storage tank (UST) located on school property. Other volatile organic compounds were also detected in the indoor air of the school. The discharge of no. 2 fuel oil from the leaking UST resulted in the contamination of on-site soil and groundwater. During the course of delineation of the contaminant plume, free product (i.e., fuel oil) was observed migrating towards the school building in the vicinity of classroom 102. Classroom 102 is used for pre-kindergarten (four-year old) children.

Through a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), the NJDHSS prepared the following Health Consultation for the Cooper's Poynt Elementary School. The purpose of this Health Consultation was to investigate the source of the indoor air contamination and evaluate associated public health implications. Concerned parents are encouraged to read this report in order to have a better understanding of school indoor air quality issues and remedial measures available to school and local health officials in addressing these issues.

Background

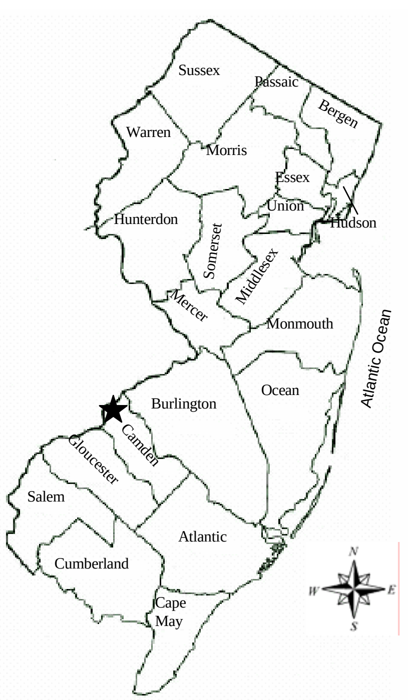

Figure 1: Location of Cooper's Poynt E.S.

Cooper's Poynt Elementary School is located at 3rd and State Streets in Camden, Camden County, New Jersey (see Figure 1). The NJDEP is providing oversight to the school on the remediation of environmental contamination associated with the discharge of no. 2 fuel oil from a 10,000 gallon UST. The SmithCo. Group Inc. (previously known as Honeyford and SmithCo Group) was retained by the Camden Board of Education to conduct remedial services associated with the leaking UST. Analytical results of samples collected from monitoring wells installed at the school identified free product in the groundwater beneath the school building. This prompted the collection of indoor air samples to determine contaminant levels in the school building. Volatile chemicals in soil and groundwater can emit vapors that may migrate through subsurface soils and into indoor air spaces of overlying buildings. The vapor intrusion pathway may be important for buildings with or without a basement. Vapors can accumulate in occupied spaces to concentrations that may pose safety hazards, health effects, or aesthetic problems (e.g., odors).

In September 2003, the SmithCo. Group Inc. collected five indoor air samples from several classrooms; ambient and indoor background air samples were also collected from an atrium (AT-111) and classroom 116, respectively (see Figure 2). All air samples were collected using SUMMA® canisters. The samples were analyzed for volatile organic compounds (VOCs) using United States Environmental Protection Agency (USEPA) Method TO-15. The results of this sampling event indicated a number of VOCs including elevated indoor air concentrations of total xylene, with the maximum concentration (261 micrograms of total xylene per cubic meter of air or $\mu g/m^3$) detected in classroom 102 (see Table 1). Fuel oil is comprised of a complex mixture of petroleum hydrocarbons, including xylenes.

As requested by the NJDEP, the NJDHSS calculated a modified indoor air guideline concentration for total xylene based on a specific school exposure scenario (see Appendix A). In consultation with the NJDEP, the NJDHSS recommended that 110 $\mu g/m^3$ be used as the modified indoor air guideline concentration for total xylene. This concentration was determined to be protective of both children and adults at the Cooper's Poynt Elementary School. Since the concentration of total xylene detected in classroom 102 was more than twice the recommended modified indoor air guideline concentration, school officials suspended the use of rooms 102 (classroom) and 103 (lunchroom) by students and school employees.

To further investigate the suspect source of indoor air contamination (including total xylene), the SmithCo. Group Inc. conducted indoor air and sub-slab soil gas sampling at the school in January 2004. Samples were collected from several rooms (including classroom 102) as well as the boiler room. Indoor air results indicated a maximum total xylene concentration of 13.10 $\mu g/m^3$ in classroom 101; xylene was not detected in classroom 102. Sub-slab soil gas samples obtained from classroom 101 indicated a maximum total xylene concentration of 18.80 $\mu g/m^3$. Complete indoor air and sub-slab soil gas sampling results from January 2004 are presented in Tables 2 and 3, respectively.

Site Visit

On January 2, 2004, a site visit was conducted at the Cooper's Poynt Elementary School. Individuals present were Julie Petix and Tariq Ahmed, NJDHSS; Kathleen Katz and Mohammed Qureshi, NJDEP; Robert Lentine, Camden County Division of Health; several members of the Cooper's Poynt Elementary School administrative staff; Craig Tyrrell and Amin Ayubcha, SmithCo Group, Inc.; and George Pulaski, EEJ Mechanical, Inc.

The site visit commenced at 10:30 am. Weather conditions were sunny, cold, and windy with temperatures in the mid 30s. Although students were not present due to

Christmas break/winter recess, a portion of the school was being used for child day care. Ms. Katz and Mr. Ayubcha verbally summarized site activities conducted by the SmithCo Group Inc. at the school. It was also noted that the school converted from oil to gas heat more than 10 years ago and that the fuel oil discharge was first detected in 1998. Ms. Katz stated that delineation of groundwater and soil contamination at the school had not been completed to date.

Both the exterior (i.e., outdoor location of the underground storage tank, below asphalt paving) and interior of the school building was inspected. Indoor areas observed included classroom 102, room 103 (referred to as the "lunchroom" where lunches are picked up by students), room 106 (boiler room); an outdoor atrium (AT 111), and classroom 116. The installation of a new fire door was noted in classroom 102. According to Mr. Pulaski, univents (pneumatic system) are located in each classroom. Each univent differs in effectiveness due to its age. At the time of the site visit, they were reportedly set at 100% recirculation. In several classrooms, particularly classroom 102, a cleaning/chemical/solvent odor was noticeable.

Following the site visit, school administrative staff expressed concern about the contamination and the timeliness of being informed of sampling results. NJDHSS staff provided suggestions to the SmithCo Group Inc. regarding air sampling locations (i.e., placement of SUMMA® canisters) and time frame (regular school hours, normal occupancy rather than during a weekend).

Past NJDHSS or ATSDR Activities

No previous activities have been conducted by the NJDHSS or ATSDR at the school.

Environmental Contamination

Indoor Air, Soil Gas

Results of indoor air sampling conducted at the Cooper's Poynt Elementary School by the SmithCo Group Inc. in September 2003 indicated elevated indoor air concentrations of xylenes as well as other VOCs (see Table 1). Field portable photoionization detector (PID) readings ranged from 3 - 3.8 on the first floor of the school. An indoor air quality survey was completed during this sampling event; a summary of findings are presented below:

Location	Chemical/Product	Observations
basement	glue	glue was being used for adhering floor tiles sump pump non-functioning, standing water observed
first floor	glue	glue was being used for adhering floor tiles unsual odors noted (Smith Annex gym, sewage drain clog); possible clog of septic system
room 106 (boiler room storage closet)	floor stripper, Ginn cleaner, floor finish, chalkboard cleaner, paint, wax stripper, floor guard, degreaser, lime remover, counter cleaner	

In January 2004, additional sampling (indoor air, sub-slab soil gas) was conducted by the SmithCo Group Inc.; VOC results are provided in Tables 2 and 3. During this sampling event, the following chemicals were found at the school:

Location	Chemical/Product	Observations
rooms 101, 102	sodium hypochlorite, mineral spirits, isoparaffinix solvent, 1-methyl-2-pyrrolidinone, petroleum gas	maintenance work completed on the exterior doors
room 103	sodium hypochlorite, mineral spirits, isoparaffinix solvent, 1-methyl-2-pyrrolidinone, petroleum gas	
room 106 (boiler room)		exterior door was open for work crew

Discussion

Assessment Methodology

In this section, exposure pathways were evaluated to determine whether children and adults could have been (past scenario), are (current scenario), or will be (future scenario) exposed to contaminants. In evaluating exposure pathways, NJDHSS investigated whether exposure to contaminated media has occurred, is occurring, or will occur through inhalation of contaminants.

An exposure pathway is a series of steps starting with the release of a contaminant in a media and ending at the interface with the human body. A completed exposure pathway consists of five elements:

1. source of contamination;
2. environmental media and transport mechanisms;
3. point of exposure;
4. route of exposure; and
5. receptor population.

The ATSDR and NJDHSS classify exposure pathways into three groups: 1) completed pathways, that is, those in which exposure has occurred, is occurring, or will occur; 2) potential pathways, that is, those in which exposure might have occurred, may be occurring, or may yet occur; and 3) eliminated pathways, that is, those that can be eliminated from further analysis because one of the five elements is missing and will never be present, or in which no contaminants of concern can be identified.

Exposure Pathways

There is a completed exposure pathway from VOCs in indoor air to children and adults at the Cooper's Poynt Elementary School.

Source of Indoor Air Contamination

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A leaking fuel oil UST was located on the Cooper's Poynt Elementary School property, adjacent to the exterior wall of rooms 101 and 102 (classrooms), 103 (lunchroom) and 106 (boiler room) (see Figure 2). Results of groundwater monitoring indicated free product beneath the school building. In September 2003, indoor air sampling was conducted at the school (see Table 1); in January 2004, indoor air and sub-slab soil gas sampling was conducted at the school (see Tables 2 and 3).

As previously mentioned, Table 3 provides the sub-slab soil gas data collected at the school in January 2004. Table 4 provides a comprehensive summary of VOCs detected in the school indoor air from samples obtained in September 2003 and January 2004. As shown in these tables, several VOCs (i.e., tetrachloroethylene, 1,3,5-trimethylbenzene, ethanol, tetrahydrofuran and 2-hexanol) detected in the soil gas were not detected in the indoor air of the school and, as such, will not be discussed further. The following VOCs were detected at the school in both the soil gas and indoor air: 2-butanone; dichlorodifluoromethane; ethylbenzene; 4-ethlytoluene; styrene; toluene; 1,2,4-trimethylbenzene; and xylenes.

Figure 3 shows the mean and maximum concentrations of VOCs detected on the first floor of the school building in comparison with mean sub-slab soil gas concentration. Both the mean and maximum indoor air concentrations of 2-butanone, dichlorodifluoromethane, ethylbenzene, styrene, toluene and total xylene were greater than that detected in the soil gas. Since subsurface vapors are typically diluted by 100 to

10,000 times before they enter indoor air, the detection of these VOCs cannot be fully attributable to the fuel oil discharge associated with the UST (USEPA 2002). Only concentrations of 4-ethyltoluene and 1,2,4-trimethylbenzene were detected in higher concentrations in the soil gas than that detected in the indoor air. They were not detected at levels, however, that can be fully attributable to soil gas. Although these substances may be constituents of fuel oil, they are also found in automobile exhaust and other products such as solvents (4-ethlytoluene) and dyes, perfumes and paint thinners (1,2,4-trimethylbenzene).

An August 2, 2004 letter from the NJDEP to the Camden Board of Education concluded that the VOCs detected in the indoor air of the Cooper's Poynt Elementary School are not attributable to the UST fuel oil discharge (see Appendix B).

There were a number of VOCs detected in the indoor air that were not detected in the soil gas: acetone; benzene; bromoethene; bromomethane; 1,3-butadiene; chloromethane; cyclohexane; 1,4-dichlorobenzene; n-heptane; n-hexane; methylene chloride; methyl-tert-butyl-ether (MTBE); trichlorofluoromethane; and 2,2,4-trimethylpentane. Although not related to the fuel oil discharge, the health implications of these contaminants were evaluated.

Health Guideline Comparison

Typically, as the first step in evaluating health hazards associated with completed exposure pathways, the concentration of each contaminant detected is compared to an established environmental guideline value. For contaminants exceeding these "screening" values, site-specific conditions are evaluated to determine likely exposure scenarios for a given exposure pathway. Since the environmental and health-based comparison values (CVs) are the same for indoor air contaminants, all contaminants were compared directly with health-based CVs.

The United States Department of Health and Human Services (USDHHS) has classified the carcinogenicity of contaminants typically found in the groundwater and indoor air at hazardous waste sites. Cancer classes are defined as follows:

1 = Known human carcinogen
2 = Reasonably anticipated to be a carcinogen
3 = Not classified

The cancer class of indoor air contaminants detected at the Cooper's Poynt Elementary School is provided in Table 5. The mean and maximum concentrations of each contaminant detected, along with the health-based CV, are also provided in Table 5.

For cancer class 3 contaminants, a comparison with the ATSDR Minimal Risk Level (MRL) was made. An MRL is an estimate of the daily human exposure to a hazardous substance that is likely to be without appreciable risk of adverse non-cancer health effects over a specified duration of exposure. When a MRL for a contaminant was unavailable, the USEPA Reference Concentration (RfC) or the USEPA Region 3 non-cancer risk-based concentration (RBC) was used. The RfC is an estimate of a continuous inhalation exposure to humans that is likely to be without an appreciable risk of deleterious effects during a lifetime. Non-cancer RBCs are contaminant concentrations corresponding to a fixed level of non-cancer risk (i.e., a Hazard Index of 1) in water, air, biota, and soil.

For cancer class 1 or 2 contaminants, ATSDR Cancer Risk Evaluation Guides (CREG) were used as the health-based CV. CREGs are media-specific CVs that are used to identify concentrations of cancer-causing substances that are unlikely to result in an increase of cancer rates in an exposed population. When a CREG for a contaminant was unavailable, the USEPA Region 3 cancer RBC was used. Cancer RBCs are contaminant concentrations corresponding to a fixed level of cancer risk (i.e., lifetime excess cancer risk of one in one million) in water, air, biota, and soil.

As shown in Table 5, the mean and maximum indoor air concentrations of acetone, bromoethene, 2-butanone, chloromethane, cyclohexane, dichlorodifluoromethane, ethylbenzene, n-hexane, methylene chloride, MTBE, styrene, toluene, trichlorofluoromethane and 1,2,4-trimethylbenzene were less than their corresponding health-based CV. As such, it is unlikely that inhalation of these VOCs would pose a risk to students and school employees of the Cooper's Poynt Elementary School. During the January 2004 indoor air sampling event, a maximum concentration of 160 $\mu g/m^3$ of n-heptane was detected in classroom 101. Although no health-based CV is available, this concentration is approximately 12,500 times lower than the United States Occupational Safety and Health Administration (OSHA) time-weighted average of 2,000,000 $\mu g/m^3$.[1] As such, adverse health effects associated with n-heptane exposures are unlikely.

Health-based CVs are also unavailable for 4-ethyltoluene and 2,2,4-trimethylpentane. Since 4-ethyltoluene is structurally similar to 1,3,5-trimethylbenzene or 1,2,4-trimethylbenzene, the dose-response value for these contaminants was used as a surrogate for 4-ethyltoluene (ATSDR 2003a). The concentration of 4-ethyltoluene detected in classroom 101 (January 2004) was below the health-based CV of 6.2 $\mu g/m^3$; as such, adverse health effects associated with 4-ethyltoluene exposures are unlikely. Health risks from exposure to 2,2,4-trimethylpentane could not be assessed. Both 4-ethyltoluene and 2,2,4-trimethylpentane may be constituents of fuel oil; they are also found in automobile exhaust and products such as solvents (4-ethlytoluene; 2,2,4-trimethylpentane) and thinners and household laundry products (2,2,4-trimethylpentane).

[1] Most of the federal OSHA standards (29 CFR 1910), including the indoor air contaminant limit for n-heptane, have been adopted under the New Jersey Public Employees Occupational Safety and Health (PEOSH) Act.

Both the mean and maximum concentrations of benzene, 1,3-butadiene and total xylene detected in the indoor air of the Cooper's Poynt Elementary School exceeded their corresponding health-based CV. Benzene, 1,3-butadiene and xylenes are common indoor and ambient air contaminants in urban/suburban areas (ATSDR 2003b); reported indoor and ambient air concentrations of benzene 1,3-butadiene and xylenes in the United States are as follows:

Contaminant	Max. Indoor Air Concentration at the School ($\mu g/m^3$)	Reported Ambient Air Concentration ($\mu g/m^3$)	Reported Indoor Air Concentration ($\mu g/m^3$)
benzene	3.5	1.44 - 4.76[1]; 19[2]; 6[3]	15[3]
1,3-butadiene	3.8	0.077 - 0.37[1]; 6.75 - 75[4]; 28[5]; 9.45[6]	11, 19[4]; 2.7 - 4.5[5]; 20.25[6]
total xylene	261	3 - 380[7]; 31[8]	10 - 47[9]; 4.3 - 14[10]

[1]National Air Toxics Assessment Data (1996), [2]USEPA (1987), [3]Wallace (1989), [4]Lofroth et al. (1989), [5]Brunnemann et al. (1990), [6]Stephens and Burleson (1967), [7]Merian and Zander (1982), [8]Seila et al. (1989), [9](m&p) Seifert and Abraham (1982), [10](m&p) Wallace (1986)

As shown above, the maximum indoor air concentration of benzene and 1,3-butadiene detected at the school was within the range of concentrations reported for indoor air. Although the concentrations of benzene and 1,3-butadiene exceeded their corresponding health-based CV, the risks associated with these concentrations are comparable to those from reported background concentrations. Therefore, any additional adverse health effects are unlikely from these exposures. The maximum indoor air concentration of total xylene detected in classroom 102 in September 2003 was above the range reported for indoor air concentrations. It should be noted that total xylene was not detected in this classroom during subsequent sampling (January 2004); total xylene concentrations detected elsewhere in the school were below the health-based CV (see Table 2).

A brief discussion of the toxicologic characteristics of these contaminants is presented in Appendix C.

Child Health Considerations

ATSDR's Child Health Initiative recognizes that the unique vulnerabilities of infants and children demand special emphasis in communities faced with contamination in their environment. Children are at greater risk than adults from certain kinds of exposures to hazardous substances. They are more likely to be exposed because they play outdoors and they often bring food into contaminated areas. They are shorter than adults, which means they breathe dust, soil, and heavy vapors closer to the ground. Children are also smaller, resulting in higher doses of chemical exposure per body weight. The developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages. Most important, children depend completely on adults for risk identification and management decisions, housing decisions, and access to medical care.

Based on indoor air sampling results from September 2003, the NJDHSS calculated a modified indoor air guideline concentration for total xylene for four-year old children attending classes in room 102. This concentration (110 $\mu g/m^3$) was determined to be protective of both children and adults. Since the concentration of total xylene detected in classroom 102 was more than twice the recommended modified indoor air guideline concentration, school officials suspended the use of rooms 102 (classroom) and 103 (lunchroom) by students and school employees.

Additional investigation of the suspect source of indoor air VOC contamination (including total xylene) was conducted in January 2004 and included the collection of sub-slab soil gas. Results indicated that the source of the VOCs detected in the indoor air cannot be fully attributable to the fuel oil discharge associated with the UST. Observations made during a January 2004 site visit indicated the storage and/or use of cleaning products may be affecting the indoor air quality of the school.

Conclusions

Based on the results of indoor air sampling conducted at the Cooper's Poynt Elementary School in September 2003, the NJDHSS calculated a modified indoor air guideline concentration for total xylene (110 $\mu g/m^3$) using exposure assumptions for four-year old children. Results of subsequent sampling, which included the collection of sub-slab soil gas, as well as observations made during a January 2004 site visit, indicated that the source of VOCs may not be totally attributable to the UST fuel oil discharge and may be from indoor sources. At the present time, there is ***"No Apparent Public Health Hazard"*** from indoor air exposures associated with the fuel oil discharge.

The NJDHSS evaluated potential health effects from exposures to the VOCs detected in the indoor air of the school building. The mean and maximum concentrations of benzene, 1,3-butadiene and total xylene exceeded their health-based CV. Since health risks associated with benzene and 1,3-butadiene are comparable to those from reported urban/suburban background concentrations, additional adverse health effects are unlikely. The maximum concentration of total xylene detected at the school in September 2003 was more than twice the recommended modified indoor air guideline concentration, and school officials suspended the use of affected rooms. Subsequent indoor air sampling indicated that total xylene concentrations were below the health-based CV. Benzene, 1,3-butadiene and total xylene are associated with automobile exhaust and the use and/or storage of cleaning products and solvents.

Recommendations

1. The Camden County Division of Health should provide assistance to the Camden Board of Education in implementing the USEPA "Indoor Air Quality Tools for Schools" program. The NJDHSS Indoor Environments Program is available to provide assistance with this program.

2. Once the "Indoor Air Quality Tools for Schools" program is implemented, the Camden Board of Education should conduct additional indoor air sampling to evaluate the effectiveness of the program.

3. The use of green/alternative cleaning products should be investigated and considered. The Camden Board of Education should consider the use of alternative cleaning and janitorial supplies in an effort to minimize exposure to VOCs found in cleaning products. Resources available on the Internet include:

   Healthy School Environments
   http://www.epa.gov/ebtpages/humachildrschoolenvironments.html

   Resource Links to Environmentally Friendly Cleaning Products
   http://www.epa.gov/oppt/epp/cleaner.htm

   Environmentally Preferable Purchasing Guides
   http://www.epa.gov/oppt/epp/documents/pfs.htm

   Reasons for Using Environmentally Friendly Cleaning Products
   http://www.epa.gov/oppt/epp/documents/clean/cleaning.htm

4. The remediation of the site under continuing NJDEP oversight should be completed as soon as feasible

Public Health Action Plan (PHAP)

The purpose of a PHAP is to ensure that this Health Consultation not only identifies public health hazards, but also provides a plan of action designed to mitigate and prevent adverse human health effects resulting from exposure to hazardous substances in the environment. Included is a commitment on the part of the ATSDR and the NJDHSS to follow up on this plan to ensure that it is implemented. The public health actions to be implemented by the ATSDR and NJDHSS are as follows:

Public Health Actions Taken

1. Results of indoor air and sub-slab soil gas sampling conducted at the school were evaluated by the NJDHSS.

2. Representatives of the NJDHSS conducted a site visit of the Cooper's Poynt Elementary School on January 2, 2004.

3. In August 2004, the NJDHSS Indoor Environments Program provided assistance to the Camden County Division of Health regarding indoor air quality issues.

Public Health Actions Planned

1. The Health Consultation will be provided to the Camden Board of Education and the Camden County Division of Health.

2. Representatives of the ATSDR and NJDHSS are available to discuss the results of this report with school officials and concerned parents.

Certification Page

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Preparers of Report:

Julie R. Petix, M.P.H., C.P.M., H.O.
Health Assessment and Consultation Project Manager

Tariq Ahmed, Ph.D., P.E.
Research Scientist II

Somia Aluwalia, M.S., Ph.D.
Research Scientist III

ATSDR Regional Representatives:

Arthur Block
Senior Regional Representative

Leah T. Escobar, R.S.
Associate Regional Representative

ATSDR Technical Project Officer:

Gregory V. Ulirsch, M.S.
Technical Project Officer
Superfund Site Assessment Branch
Division of Health Assessment and Consultation

Any questions concerning this document should be directed to:

Julie R. Petix, M.P.H., C.P.M., H.O.
Health Assessment and Consultation Project Manager
New Jersey Department of Health and Senior Services
Division of Public Health Protection and Emergency Preparedness
Consumer and Environmental Health Services
3635 Quakerbridge Road
P.O. Box 369
Trenton, New Jersey 08625-0369

Table 1: September 2003 indoor air sampling results, Cooper's Poynt Elementary School

Contaminant	Air Concentration ($\mu g/m^3$)						
	Room 101	Room 102	Room 103	Room 116	Room 201	Room 203	Atrium 111
Acetone	*	29	29	5	21	17	*
1,3-Butadiene	*	3.8	*	*	*	*	*
2-Butanone	*	3.8	20	2.4	*	*	*
Chloromethane	1.4	1.4	*	1.4	*	*	1.4
Cyclohexane	*	*	1.8	*	10	2.5	*
1,4-Dichlorobenzene	*	*	*	3.8	*	*	*
Dichlorodifluoromethane	3	3.1	3.4	2.7	3.3	2.9	2.8
Ethylbenzene	3.7	41	18.2	10	4.8	4.3	*
n-Heptane	*	*	4.9	*	12	2.6	*
n-Hexane	*	*	*	*	2.8	*	*
Methylene Chloride	*	*	*	*	1.8	*	*
MTBE	2.3	2.5	4.3	2.3	5.4	4	2
Styrene	*	*	3.4	*	*	*	*

Table 1: (Cont'd.)

Contaminant	Air Concentration (μg/m³)						
	Room 101	Room 102	Room 103	Room 116	Room 201	Room 203	Atrium 111
Toluene	3.1	3.7	3.4	6	3.4	2.8	1.9
2,2,4-Trimethylpentane	*	*	3	*	*	*	*
Total Xylene	21.1	261	110	52	29.7	27.8	*

*Not detected

Table 2: January 2004 indoor air sampling results, Cooper's Poynt Elementary School

Contaminant	Air Concentration (µg/m^3)								
	Room 100	Room 101	Room 102	Room 103	Room 104	Room 106	Room 116	Room 201	Atrium 111
Acetone	*	20	*	14	19	*	14	19	12
Benzene	1.8	3.5	*	2.8	2	*	2.1	2.1	1.9
Bromoethene	*	*	*	*	2.1	*	*	*	*
Bromomethane	*	*	*	*	*	*	3.3	*	*
2-Butanone	2.4	15	*	4.1	4.1	*	2.9	2.9	1.7
Chloromethane	*	*	1.1	*	1	1.1	*	*	*
Cyclohexane	2.3	55	2.5	4.5	2.3	*	*	21	*
1,4-Dichlorobenzene	*	*	*	*	*	*	6.6	*	*
Dichlorodifluoro methane	*	*	*	*	6.9	*	*	*	*
Ethylbenzene	*	3.9	*	*	*	*	*	*	*
4-Ethyltoluene	*	3.1	*	*	*	*	*	*	*
n-Heptane	5.7	160	*	12	3.7	*	2.6	31	*

Table 2: (Cont'd.)

Contaminant	Air Concentration (μg/m³)								
	Room 100	Room 101	Room 102	Room 103	Room 104	Room 106	Room 116	Room 201	Atrium 111
n-Hexane	2.2	35	1.9	4.6	1.9	*	1.9	6.7	*
Methylene Chloride	*	3.4	*	*	*	*	*	*	*
MTBE	2.2	3.6	3.1	6.5	3.3	*	3.5	3.6	2
Styrene	*	2.2	*	*	*	*	*	*	*
Toluene	*	120	*	7.9	4.5	2.9	4.9	5.7	3.7
Trichlorofluoromethane	*	*	*	*	3.4	*	*	*	*
1,2,4-Trimethylbenzene	*	4.4	*	3	*	*	*	*	*
2,2,4-Trimethylpentane	*	*	*	2.7	2.8	*	*	*	*
Total Xylene	*	13.1	*	5.2	2.5	*	3.7	5.2	2.3

*Not detected

Table 3: January 2004 sub-slab soil gas sampling results, Cooper's Poynt Elementary School

Contaminant	Air Concentration ($\mu g/m^3$)				
	Room 101	Room 102	Room 103	Room 106	Mean
2-Butanone	*	7.1	2.3	4.4	4.6
Dichlorodifluoromethane	2.7	2.9	2.6	2.5	2.68
Ethylbenzene	3.2	2.2	*	2.3	2.57
Ethanol	5.5	34	2.6	10	13.03
4-Ethyltoluene	*	12	12	*	12
2-Hexanone	*	*	*	2.2	2.2
Styrene	2.1	*	*	*	2.1
Tetrachloroethylene	3.5	*	5.3	*	4.4
Tetrahydrofuran	*	*	2.1	5.8	3.95
Toluene	18	11	11	14	13.5
1,2,4-Trimethylbenzene	27	23	23	14	21.75
1,3,5-Trimethylbenzene	*	5.4	4.8	*	5.1
Total Xylene	18.8	13.1	12.2	9.9	13.5

*Not detected

Table 4: Summary of September 2003 and January 2004 indoor air sampling results, Cooper's Poynt Elementary School

Contaminant	First Floor (μg/m^3)		Second Floor (μg/m^3)		Background[†] (μg/m^3)		Boiler room (μg/m^3)
	Mean	Maximum	Mean	Max	Ambient	Indoor	
Acetone	22.2	29	19	21	12	32	*
Benzene	2.53	3.5	2.1	2.1	1.9	2.1	*
Bromoethene	2.1	2.1	*	*	*	*	*
Bromomethane	*	*	*	*	*	3.3	*
1,3-Butadiene	3.8	3.8	*	*	*	*	*
2-Butanone	8.23	20	2.9	2.9	1.7	2.65	*
Chloromethane	1.23	1.4	*	*	1.4	1.4	1.1
Cyclohexane	11.4	55	11.17	21	*	*	*
1,4-Dichlorobenzene	*	*	*	*	*	5.2	*
Dichlorodifluoromethane	4.1	6.9	3.1	3.3	2.8	2.7	*
Ethylbenzene	16.7	41	4.55	4.8	*	10	*
4-Ethyltoluene	3.1	3.1	*	*	*	*	*
n-Heptane	37.26	160	15.2	31	*	2.6	*

Table 4: (Cont'd.)

Contaminant	First Floor (μg/m^3)		Second Floor (μg/m^3)		Background[†] (μg/m^3)		Boiler room (μg/m^3)
	Mean	Maximum	Mean	Max	Ambient	Indoor	
n-Hexane	9.12	35	4.75	6.7	*	1.9	*
Methylene Chloride	3.4	3.4	1.8	1.8	*	*	*
MTBE	3.48	6.5	4.33	5.4	2	2.9	*
Styrene	2.8	3.4	*	*	*	*	*
Toluene	23.77	120	3.97	5.7	2.8	5.45	2.9
Trichlorofluoromethane	3.4	3.4	*	*	*	*	*
1,2,4-Trimethylbenzene	3.7	4.4	*	*	*	*	*
2,2,4-Trimethylpentane	2.83	3	*	*	*	*	*
Total Xylene	68.82	261	20.9	29.7	2.3	27.85	*

*Not detected
[†]Room 116

Table 5: Comparison of indoor air concentrations from September 2003 and January 2004 with health guideline CVs

Contaminant	Cancer Class[1]	Mean ($\mu g/m^3$)	Maximum ($\mu g/m^3$)	ATSDR Chronic MRL[2] ($\mu g/m^3$)	USEPA RfC[3] ($\mu g/m^3$)	ATSDR CREG[4] ($\mu g/m^3$)	USEPA Region 3 RBC[5] ($\mu g/m^3$)	Exceeds the CV
Acetone	3	21	29	30,875	NA[6]	NA	3,285	No
Benzene	1	2.44	3.5	NA	NA	0.1	0.23	**Yes**
Bromoethene	*[7]	2.1	2.1	-[8]	3	NA	NA	No
1,3-Butadiene	1	3.8	3.8	NA	NA	0.03	0.063	**Yes**
2-Butanone	3	7.47	20	-	5,000	NA	5,110	No
Chloromethane	3	1.23	1.4	103	90	NA	94.9	No
Cyclohexane	3	11.32	55	-	6,000	NA	6,205	No
Dichlorodifluoromethane	3	3.77	6.9	-	-	NA	182.5	No
Ethylbenzene	3	12.65	41	-	1,000	NA	1,058.5	No
4-Ethyltoluene	-	3.1	3.1	-	-	-	-	
n-Heptane	-	29	160	-	-	-	-	
n-Hexane	3	7.87	35	2,114	200	NA	208.4	No

Table 5: (Cont'd.)

Contaminant	Cancer Class[1]	Mean ($\mu g/m^3$)	Maximum ($\mu g/m^3$)	ATSDR Chronic MRL[2] ($\mu g/m^3$)	USEPA RfC[3] ($\mu g/m^3$)	ATSDR CREG[4] ($\mu g/m^3$)	USEPA Region 3 RBC[5] ($\mu g/m^3$)	Exceeds the CV
Methylene Chloride	2	2.6	3.4	NA	NA	3	3.79	No
MTBE	3	3.71	6.5	2,523	3,000	NA	NA	No
Styrene	3	2.8	3.4	255	1,000	NA	1,043	No
Toluene	3	17.17	120	301	400	NA	416	No
Trichlorofluoromethane	3	3.4	3.4	-	NA	NA	730	No
1,2,4-Trimethylbenzene	3[9]	3.7	4.4	-	-	-	6.2	No
2,2,4-Trimethylpentane	-	2.83	3	-	-	-	-	
Total Xylene	3	52.84	261	1,302	100	NA	109.5	**Yes**

[1]DHHS Cancer Class: 1 = known human carcinogen; 2 = reasonably anticipated to be a carcinogen; 3 = not classified
[2]Minimal Risk Level
[3]Reference Concentration
[4]Cancer Risk Evaluation Guide
[5]Risk-based Concentrations
[6]NA = Not Applicable
[7]* = An evaluation under USEPA's IRIS program for carcinogenic potential is not available
[8]- = Not Available
[9]USEPA Region 3 RBC

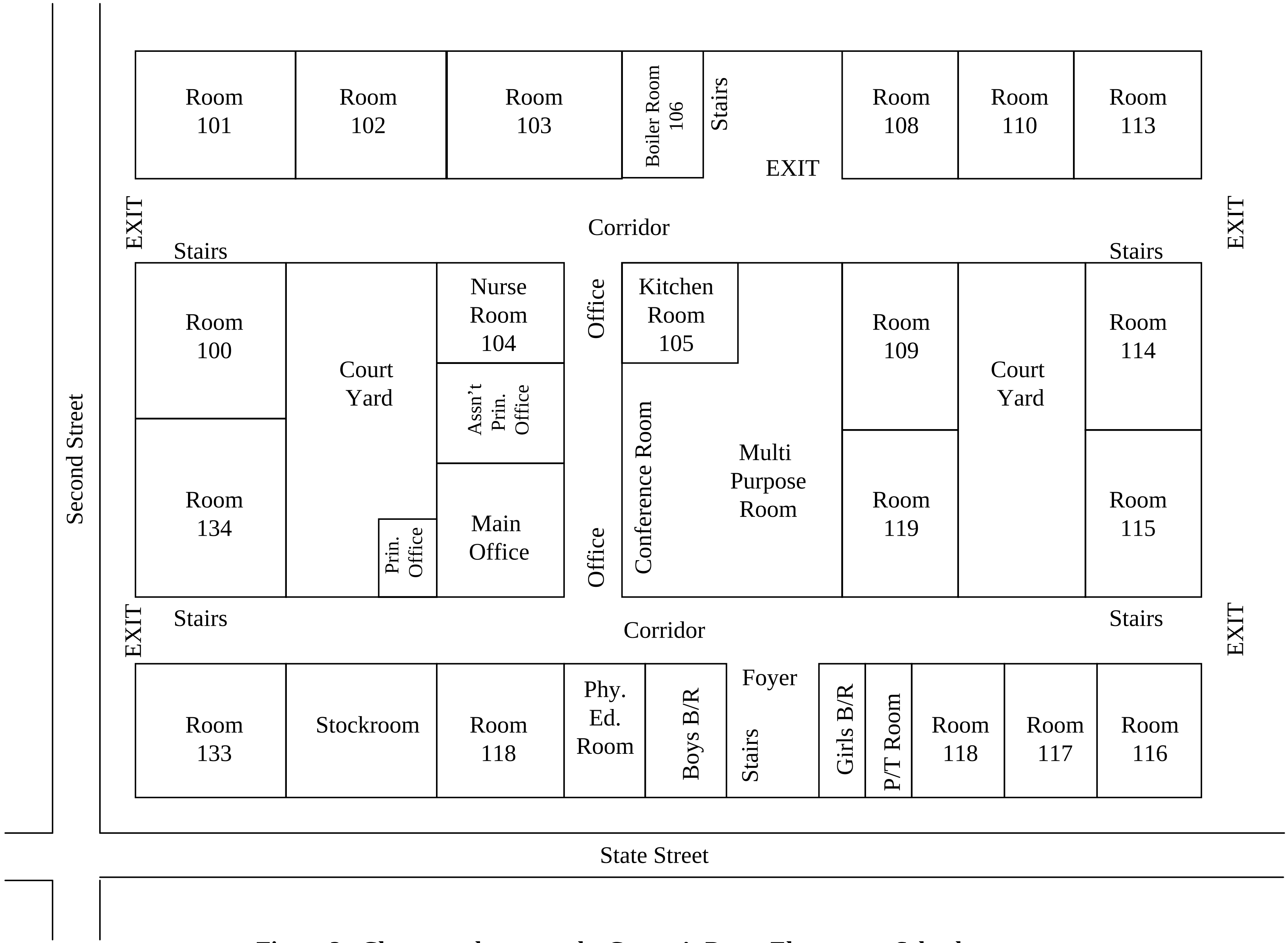

Figure 2: Classroom layout at the Cooper's Poynt Elementary School

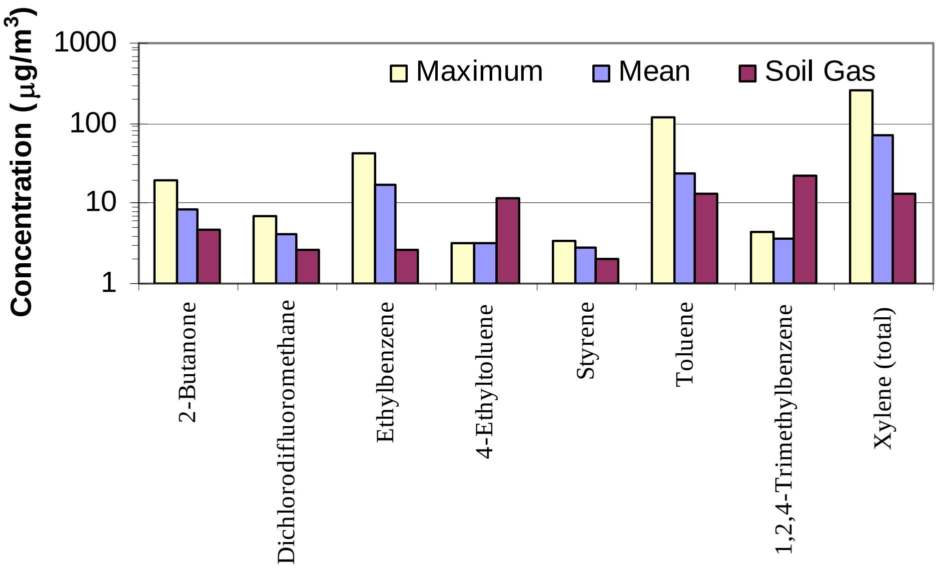

Figure 3: Maximum and mean indoor air and soil gas concentration of contaminants detected at the Cooper's Poynt Elementary School (September 2003 and January 2004)

APPENDIX A

State of New Jersey

DEPARTMENT OF HEALTH AND SENIOR SERVICES
DIVISION OF EPIDEMIOLOGY, ENVIRONMENTAL AND OCCUPATIONAL HEALTH
PO BOX 369
TRENTON, N.J. 08625-0369

www.state.nj.us/health

JAMES E. MCGREEVEY
Governor

CLIFTON R. LACY, M.D.
Commissioner

January 23, 2004

Linda Cullen
Unit Leader
Environmental Toxicology and Risk Assessment Unit
Bureau of Environmental Evaluation and Risk Assessment
New Jersey Department of Environmental Protection
P.O. Box 413
Trenton, New Jersey 08625

Dear Ms. Cullen:

This letter is in response to a New Jersey Department of Environmental Protection (NJDEP) request that the New Jersey Department of Health and Senior Services (NJDHSS) provide a modified indoor air guideline concentration for total xylene appropriate for the Cooper's Poynt Elementary School, 3rd and State Streets, Camden, Camden County, New Jersey. Beginning in 1998, discharge of No. 2 heating oil from the school's underground storage tank resulted in the contamination of soil and groundwater. During the course of delineation of the contaminant plume, free product was observed migrating towards the school building in the vicinity of classroom 102. Classroom 102 is used for pre-kindergarten (four-year old) children. Results of indoor air sampling conducted at the school in September 2003 by a consultant retained by the school administration indicated total xylene concentrations as high as 261 $\mu g/m^3$ (classroom 102).

In developing non-residential indoor air screening levels, the NJDEP typically adjusts the USEPA Region 3 ambient (residential) risk-based concentration (RBC). For total xylene, this adjustment results in an indoor air screening level of approximately 150 $\mu g/m^3$. This adjustment, however, reflects an adult exposure duration of 250 days per year for 25 years. Therefore, the NJDEP requested that the NJDHSS provide a modified indoor air guideline concentration for total xylene based on the risk posed to four-year old children attending classes in room 102.

The following table summarizes the concentrations of xylenes detected at the school as compared to available health-based guideline values. The maximum concentration detected exceeded available health-based guidelines of the U.S. Environmental Protection Agency (USEPA):

September 2003 Indoor Air Sampling at Cooper's Poynt E.S. Total Xylene (o-, m-, and p) in µg/m³					
Min. Conc. Detected	Max. Conc. Detected	ATSDR acute MRL[1]	ATSDR Chronic MRL[2]	USEPA Reg. 3 ambient air RBC (non-cancer)	USEPA RfC
20.1	261	4,335	433	110	100

ATSDR = Agency for Toxic Substances and Disease Registry; MRL = Minimal Risk Level; USEPA = U.S. Environmental Protection Agency; RBC = Risk Based Concentration; RfC = Reference Concentration; [1]respiratory effects; [2]neurologic effects

Following discussions with NJDEP, the NJDHSS calculated a modified indoor air guideline concentration for total xylene using the USEPA Region 3 ambient air formula for non-carcinogens, as adopted by the NJDEP. The modified equation, derived from the Region 3 formula by substituting child values, was used to calculate a non-residential indoor air guideline for children is as follows:

$$\text{Modified Guideline } (\mu g/m^3) = \frac{THQ * RfDi * BWc * ATnc * 1000 \frac{\mu g}{mg}}{EFc * EDc * IRc}$$

Where,
- THQ = target hazard quotient = 1;
- RfDi = reference dose inhalation (mg/kg/day);
- BWc = average body weight, child (kg);
- ATnc = averaging time, non-carcinogens (day);
- EFc = exposure frequency, child (day/year);
- EDc = exposure duration, child (year); and
- IRc = inhalation rate, child (m^3/day).

According to the USEPA Integrated Risk Information System (IRIS) database and the ATSDR Toxicological Profile for Xylene (ATSDR 2003), adequate human data on the carcinogenicity of xylenes are not available, and the available animal data are inconclusive as to the ability of xylenes to cause a carcinogenic response. For the purpose of this evaluation, xylenes are not considered human carcinogens.

The USEPA Region 3 Reference Dose Inhaled (RfDi) for xylenes is 0.03 mg/kg/day, based on protection against chronic, non-cancer health effects. The recommended inhalation rate for children between three to five years of age is 8.3 m^3/day (USEPA 1997, Exposure Factor Handbook, Table 5-23). Table 7-3 of the handbook provides the mean and standard deviation of boy and girl body weights. Since the mean body weight of girls was lower than that for boys, the mean girl body weight of 17.0 kg for four-year old girls was selected as a conservative value. To account for the Cooper's Poynt Elementary School exposure scenario, an exposure duration of 210 days (180 school days plus thirty days during the summer) was selected.

The modified indoor air guideline concentration was calculated as follows:

$$\text{Modified Guideline } (\mu g/m^3) = \frac{1*0.03\frac{mg}{kg*day}*17.0kg*\left(365\frac{day}{year}*1\,year\right)*1000\frac{\mu g}{mg}}{210\frac{day}{year}*1\,year*8.3\frac{m^3}{day}}$$

$$\cong 110\ \mu g/m^3$$

This modified non-residential indoor air guideline for children is lower than the NJDEP adjusted risk-based value of 150 $\mu g/m^3$ and similar to the USEPA Region 3 ambient (residential) RBC for adults. The use of 110 $\mu g/m^3$ as the modified indoor air guideline concentration should, therefore, be protective of both children and adults at the Cooper's Poynt Elementary School.

Please feel free to contact me or Julie Petix at (609) 584-5367 if you have any questions.

Sincerely,

Jerald A. Fagliano, M.P.H., Ph.D.
Program Manager
Hazardous Site Health Evaluation Program

c: Julie R. Petix, M.P.H., C.P.M., H.O., Health Assessment Project Manager
Gregory Ulirsch, Technical Project Officer, ATSDR
Arthur Block, Senior Regional Representative, ATSDR Region II
Diane Groth, NJDEP
Kathleen Katz, NJDEP

References:

ATSDR 2003. Toxicological Profile for Xylene. Agency for Toxic Substances and Disease Registry, Atlanta, Ga.

USEPA 1997. Exposure Factors Handbook: Volume I. EPA/600/P-95/002Fa, U.S. Environmental Protection Agency.

APPENDIX B

State of New Jersey
Department of Environmental Protection
Bureau of Southern Case Management
401 East State Street
PO Box 433
Trenton, NJ 08625-0433
Fax: (609) 777-4285

received
8-10-04

James E. McGreevey
Governor

Bradley M. Campbe
Commissioner

AUG 0 2 2004

Via REGULAR MAIL and CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. N. John Amato
Business Administrator
City of Camden Board of Education
201 North Front Street, 8 th Floor
Camden, NJ 08102

Re: Indoor Air Sampling Analyses at the Cooper's Poynt Elementary School site, Third and State Street, Camden, Camden County

NJDEP Case #: 98-03-10-1635-16
Name/Location of School Sampled: Cooper's Poynt Elementary School
Third and State Street, Camden, NJ
Block 21 Lot 124

Dear Mr. Amato:

The New Jersey Department of Environmental Protection (NJDEP) is writing to inform you of the results from the air samples collected at the Cooper's Poynt Elementary School on September 2, 2003 and January 2, 2004. By copy of this letter, followup on the aspect of air quality is being referred to the Camden County Health Department.

The NJDEP has been overseeing the remedial investigation and remedial actions associated with a discharge of # 2 heating oil from the underground storage tanks (USTs) at the Cooper's Poynt Elementary School building. Periodic sampling of the monitoring wells located on this site has identified contamination, specifically free product of # 2 heating oil in the ground water beneath the school building. The presence of free product in the ground water warranted action to assess indoor air contaminant levels. Consequently, at the direction of the Department, The SmithCo. Group, Inc., on behalf of City of Camden Board of Education, conducted air sampling and sub-slab soil gas sampling at the Cooper's Poynt Elementary School building.

On September 13, 2003, the City of Camden Board of Education collected six indoor air samples from classrooms 101, 102, 103, 116, 201 and 203 of the Cooper's Poynt Elementary School building and one outdoor air sample from the atrium (AT111), using summa canisters. All samples were analyzed for volatile organic compounds. Sample collection and analysis followed procedures outlined in Method T0-15 developed by the United States Environmental Protection Agency (USEPA). This method tests for fifty-two volatile organic compounds at very low levels.

As part of the air-sampling episode, an Indoor Air Building Survey questionnaire was also completed. These questions are designed to identify potential sources of air contamination associated with material stored in the classrooms of the school building.

The air sampling results of September 13, 2003 detected total xylenes in classrooms 101, 102, 103, 116, 201 and 203. Table 1, as enclosed in this letter, indicates the results of these air samples. The maximum concentration of total xylenes detected was 261 ug/m^3 in classroom 102. In order to determine the source of total xylenes detected in aforementioned classrooms, specifically classroom 102 and 103; the Department's Field Directive dated December 30, 2003 required City of Camden Board of Education to conduct sub-slab soil gas sampling beneath the concrete floor of classrooms 101, 102, 103 and beneath the floor of the boiler room. In addition, indoor air sampling from classrooms 100, 101, 102, 103, 104, 116, 201, boiler room (106) and one background sample from the atrium (AT111) was required to be conducted.

On January 8, 2004 and January 30, 2004, the City of Camden Board of Education submitted the results of the seven indoor and one outdoor air samples and the analytical results of the sub-slab soil gas samples, respectively. The analytical results of one indoor air sample (RM 106) were not included in the data package dated January 8, 2004. The Seven-Trent Laboratory reported that the analysis of this sample was cancelled by City of Camden Board of Education due to the low final pressure reading in the somma canister. Subsequently, on January 15, 2004, RM 106 was re-sampled and the analytical results were submitted on January 26, 2004. The analytical results of these sampling events are presented in the enclosed Table 2 and Table 3 (enclosed).

The Department, in consultation with the New Jersey Department of Health and Senior Services (NJDHSS) and the Camden County Health Department, has reviewed the results of the indoor air samples in conjunction with the sub-slab soil gas samples and has determined that the source of the compounds detected in the classroom is not attributable to the discharge from the # 2 heating oil tank. The NJDHSS provided the NJDEP with a final modified indoor air guideline concentration for total xylenes for a specific exposure scenario for the Cooper's Poynt Elementary School. They also mentioned during the January 2, 2004 site visit to the School that strong odors were obvious in several classrooms. The NJDHSS stated that these odors may be due to products used and stored in the classrooms and/or from cleaning products used in the classrooms. Therefore, the Department is referring this aspect of the case (indoor air quality within the building of Cooper's Ponyt Elementary School) to the Camden County Department of Health, who has jurisdiction over the indoor air quality within the school building. The Camden County Department of Health will be working with the NJDHSS to determine what actions need to be taken regarding the indoor air quality. If you have specific questions regarding indoor air quality or the compounds detected in the air samples from the Cooper's Poynt Elementary School Building, please contact Robert Lentine of the Camden County Health Department at (856) 374-6037.

If you have any questions regarding this letter, please feel free to contact Mohammad I. Qureshi at (609) 984-4892.

Sincerely,

Kevin F. Kratina

Kevin Kratina, Bureau Chief
Bureau of Southern Case Management

Enclosure: Air Sampling Summary Tables

c: Robert Lentine, Camden County Department of Health, w/ Air Sampling Summary Tables
Julie Petix, NJDHSS, w/ Air Sampling Summary Tables
Camden City Department of Health, w/ Air Sampling Summary Tables
Jeremee Johnson, Environmental Justice, w/ Air Sampling Summary Tables
Municipal Clerk, Camden City, w/ Air Sampling Summary Tables
Frank Ingram, w/ Air Sampling Summary Tables, Via Certified Mail
Mohammad I. Qureshi, BSCM, w/Air Sampling Summary Tables
Diane Groth, BEERA, w/Air Sampling Summary Tables
C. W. Mitchel Lewis, w/Air Sampling Summary Tables
Amine Ayubcha, w/Air Sampling Summary Tables

Indoor Air Results
Table 1

Contaminant	Indoor Air Results RM 101 13-Sep-03	Indoor Air Results RM 102 13-Sep-03	Indoor Air Results RM 103 13-Sep-03	Indoor Air Results RM 116 13-Sep-03	Indoor Air Results RM 201 13-Sep-03	Indoor Air Results RM 203 13-Sep-03	Outdoor Background Results AT 111 13-Sep-03
Acetone	ND	29.00	29.00	50.00	21.00	17.00	
Benzene							
Bromodichloromethane							
Bromoethene							
Bromoform							
Bromomethane (Methyl bromide)							
1,3-Butadiene		3.80					
2-Butanone (Methyl ethyl ketone)		3.80	20.00	2.40			
Carbon disulfide							
Carbon tetrachloride							
Chlorobenzene							
Chloroethane							
Chloroform							
Chloromethane (Methyl chloride)	1.40	1.40		1.40			1.40
3-Chloropropene (allyl chloride)							
2-Chlorotoluene (*o*-Chlorotoluene)							
Cyclohexane			1.80		10.00	2.50	
Dibenzofuran							
Dibromochloromethane							
1,2-Dibromoethane							
1,2-Dichlorobenzene							
1,3-Dichlorobenzene							
1,4-Dichlorobenzene				3.80			
Dichlorodifluoromethane	3.00	3.10	3.40	2.70	3.30	2.90	2.80
1,1-Dichloroethane							
1,2-Dichloroethane							
1,1-Dichloroethene							
1,2-Dichloroethene (cis)							
1,2-Dichloroethene (trans)							
1,2-Dichloropropane							
cis-1,3-Dichloropropene							
trans-1,3-Dichloropropene							
1,2-Dichlorotetrafluoroethane							
Ethylbenzene	3.70	41.00	18.20	10.00	4.80	4.30	
4-Ethyltoluene (*p*-Ethyltoluene)							
n-Heptane			4.90		12.00	2.60	

Indoor Air Results
Table 1

Contaminant	Indoor Air Results RM 101 13-Sep-03	Indoor Air Results RM 102 13-Sep-03	Indoor Air Results RM 103 13-Sep-03	Indoor Air Results RM 116 13-Sep-03	Indoor Air Results RM 201 13-Sep-03	Indoor Air Results RM 203 13-Sep-03	Outdoor Background Results AT 111 13-Sep-03
Hexachlorobutadiene							
n-Hexane					2.80		
Methylene chloride					1.80		
4-Methyl-2-pentanone (MIBK)							
Methyl *tert*-butyl ether (MTBE)	2.30	2.50	**4.30**	2.30	**5.40**	4.00	2.00
Styrene			3.40				
Tertiary butyl alcohol (TBA)							
1,1,2,2-Tetrachloroethane							
Tetrachloroethene (PCE)							
Toluene	3.10	3.70	3.40	6.00	3.40	2.80	1.90
1,2,4-Trichlorobenzene							
1,1,1-Trichloroethane							
1,1,2-Trichloroethane							
1,1,2-Trichloro-1,2,2-trifluoroethane							
Trichloroethene (TCE)							
Trichloromonofluoromethane							
1,2,4-Trimethylbenzene							
1,3,5-Trimethylbenzene							
2,2,4-Trimethylpentane			3.00				
Vinyl chloride							
Xylenes (*m* & *p*)	14.00	200.00	78.00	38.00	21.00	20.00	
Xylenes (*o*)	6.10	61.00	32.00	14.00	8.70	7.80	
Xylenes (total)	20.10	261.00	110.00	52.00	29.70	27.80	

Notes:

All results are reported in ug/m^3

Indoor Air Results
Table 2

Contaminant	Indoor Air Results RM 100 02-Jan-04	Indoor Air Results RM 101 2-Jan-04	Indoor Air Results RM 102 2-Jan-04	Indoor Air Results RM 103 2-Jan-04	Indoor Air Results RM 104 2-Jan-04	Indoor Air Results RM 106 (Boiler Room) Jan-15-04	Indoor Air Results RM 116 2-Jan-04	Indoor Air Results RM 201 2-Jan-04	Outdoor Background Results AT 111 2-Jan-04
Acetone		20.00		14.00	19.00		14.00	19.00	12.00
Benzene	1.8	3.50		2.80	2.00		**2.10**	**2.10**	**1.90**
Bromodichloromethane									
Bromoethene					2.10				
Bromoform									
Bromomethane (Methyl bromide)							3.30		
1,3-Butadiene									
2-Butanone (Methyl ethyl ketone)	2.4	15.00		4.10	4.10		2.90	2.90	1.70
Carbon disulfide									
Carbon tetrachloride									
Chlorobenzene									
Chloroethane									
Chloroform									
Chloromethane (Methyl chloride)			1.10		1.00	1.10			
3-Chloropropene (allyl chloride)									
2-Chlorotoluene (*o*-Chlorotoluene)									
Cyclohexane	2.3	55.00	2.50	4.50	2.30			21.00	
Dibenzofuran									
Dibromochloromethane									
1,2-Dibromoethane									
1,2-Dichlorobenzene									
1,3-Dichlorobenzene									
1,4-Dichlorobenzene							6.60		
Dichlorodifluoromethane					6.90				
1,1-Dichloroethane									
1,2-Dichloroethane									
1,1-Dichloroethene									
1,2-Dichloroethene (cis)									
1,2-Dichloroethene (trans)									
1,2-Dichloropropane									
cis-1,3-Dichloropropene									
trans-1,3-Dichloropropene									
1,2-Dichlorotetrafluoroethane									
Ethylbenzene		3.90							
4-Ethyltoluene (*p*-Ethyltoluene)		3.10							

Indoor Air Results
Table 2

Contaminant	Indoor Air Results RM 100 02-Jan-04	Indoor Air Results RM 101 2-Jan-04	Indoor Air Results RM 102 2-Jan-04	Indoor Air Results RM 103 2-Jan-04	Indoor Air Results RM 104 2-Jan-04	Indoor Air Results RM 106 (Boiler Room) Jan-15-04	Indoor Air Results RM 116 2-Jan-04	Indoor Air Results RM 201 2-Jan-04	Outdoor Background Results AT 111 2-Jan-04
n-Heptane	5.7	160.00		12.00	3.70		2.60	31.00	
Hexachlorobutadiene									
n-Hexane	2.2	35.00	1.90	4.60	1.90		1.90	6.70	1.80
Methylene chloride		3.40							
4-Methyl-2-pentanone (MIBK)									
Methyl *tert*-butyl ether (MTBE)	2.2	3.60	3.10	6.50	3.30		3.50	3.60	2.00
Styrene		2.20							
Tertiary butyl alcohol (TBA)									
1,1,2,2-Tetrachloroethane									
Tetrachloroethene (PCE)									
Toluene		120.00		7.90	4.50	2.90	4.90	5.70	3.70
1,2,4-Trichlorobenzene									
1,1,1-Trichloroethane									
1,1,2-Trichloroethane									
1,1,2-Trichloro-1,2,2-trifluoroethane									
Trichloroethene (TCE)									
Trichlorofloromethane (Freon 11)					3.40				
Trichloromonofluoromethane									
1,2,4-Trimethylbenzene		4.40		3.00					
1,3,5-Trimethylbenzene									
2,2,4-Trimethylpentane				2.70	2.80				
Vinyl chloride									
Xylenes (*m* & *p*)		9.60		5.20	2.50		3.70	5.20	2.30
Xylenes (*o*)		3.50							
Xylenes (total)		13.10		5.20	2.50		3.70	5.20	2.30

Notes:

All results are reported in ug/m^3

Sub-Slab Soil Gas Sampling Results
Table 3

Contaminant	Sub-Slab Soil Gas Results RM 101 15-Jan-04	Sub-Slab Soil Gas Results RM 102 15-Jan-04	Sub-Slab Soil Gas Results RM 103 15-Jan-04	Sub-Slab Soil Gas Results RM 106 15-Jan-04
Acetone		16.00	9.00	9.30
Benzene				
Bromodichloromethane				
Bromoethene				
Bromoform				
Bromomethane (Methyl bromide)				
1,3-Butadiene				
2-Butanone (Methyl ethyl ketone)		7.10	2.30	4.40
Carbon disulfide				
Carbon tetrachloride				
Chlorobenzene				
Chloroethane				
Chloroform				
Chloromethane (Methyl chloride)				
3-Chloropropene (allyl chloride)				
2-Chlorotoluene (*o* -Chlorotoluene)				
Cyclohexane				
Dibenzofuran				
Dibromochloromethane				
1,2-Dibromoethane				
1,2-Dichlorobenzene				
1,3-Dichlorobenzene				
1,4-Dichlorobenzene				
Dichlorodifluoromethane	2.70	2.90	2.60	2.50
1,1-Dichloroethane				
1,2-Dichloroethane				
1,1-Dichloroethene				
1,2-Dichloroethene (cis)				
1,2-Dichloroethene (trans)				
1,2-Dichloropropane				
cis-1,3-Dichloropropene				
trans-1,3-Dichloropropene				
1,2-Dichlorotetrafluoroethane				
Ethylbenzene	3.20	2.20		2.30
4-Ethyltoluene (*p* -Ethyltoluene)		12.00	12.00	
n -Heptane				
Hexachlorobutadiene				
n -Hexane				
Methylene chloride				
4-Methyl-2-pentanone (MIBK)				
Methyl *tert* -butyl ether (MTBE)				
Styrene	2.10			
Tertiary butyl alcohol (TBA)				
1,1,2,2-Tetrachloroethane				
Tetrachloroethene (PCE)	3.50		5.30	
Toluene	18.00	11.00	11.00	14.00
1,2,4-Trichlorobenzene				

Sub-Slab Soil Gas Sampling Results
Table 3

Contaminant	Sub-Slab Soil Gas Results RM 101 15-Jan-04	Sub-Slab Soil Gas Results RM 102 15-Jan-04	Sub-Slab Soil Gas Results RM 103 15-Jan-04	Sub-Slab Soil Gas Results RM 106 15-Jan-04
1,1,1-Trichloroethane				
1,1,2-Trichloroethane				
1,1,2-Trichloro-1,2,2-trifluoroethane				
Trichloroethene (TCE)				
Trichlorofloromethane (Freon 11)				
Trichloromonofluoromethane				
1,2,4-Trimethylbenzene	27.00	23.00	23.00	14.00
1,3,5-Trimethylbenzene		5.40	4.80	
2,2,4-Trimethylpentane				
Vinyl chloride				
Xylenes (*m* & *p*)	14.00	10.00	10.00	9.60
Xylenes (*o*)	4.80	3.10	3.20	3.30
Xylenes (total)	18.80	13.10	12.20	9.90
Ethanol	5.50	34.00	2.60	10.00
Tetrahydrofuran			2.10	5.80
2-Hexanone				2.20

Notes:

All results are reported in ug/m^3

Appendix C – Toxicological Summaries

The toxicological summaries provided below are based on ATSDR's ToxFAQs (http://www.atsdr.cdc.gov/toxfaq.html). Health effects are summarized for the contaminants that exceeded health guideline CVs for the Cooper's Poynt Elementary School.

Benzene. Benzene is a colorless liquid with a sweet odor. It evaporates into the air very quickly and dissolves slightly in water. It is flammable and is formed from both natural processes and human activities. Benzene is widely used in the United States; it ranks in the top 20 chemicals for production volume. Some industries use benzene to make other chemicals such as plastics, resins, and nylon and synthetic fibers. Benzene is also used to make rubber, lubricants, dyes, detergents, drugs, and pesticides. Natural sources of benzene include volcanoes and forest fires. Benzene is also a natural constituent of crude oil, gasoline, and cigarette smoke. Outdoor air contains low levels of benzene from tobacco smoke, automobile service stations, exhaust from motor vehicles, and industrial emissions. Indoor air generally contains higher levels of benzene from products such as glues, paints, furniture wax, and detergents.

Breathing very high levels of benzene can result in death, while high levels can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. Eating or drinking foods containing high levels of benzene can cause vomiting, irritation of the stomach, dizziness, sleepiness, convulsions, rapid heart rate, and death. The major effect of benzene from long-term (365 days or longer) exposure is on the blood. Benzene causes harmful effects on the bone marrow and can cause a decrease in red blood cells leading to anemia. It can also cause excessive bleeding and can affect the immune system, increasing the chance for infection. Some women who breathed high levels of benzene for many months had irregular menstrual periods and a decrease in the size of their ovaries. It is not known whether benzene exposure affects the developing fetus in pregnant women or fertility in men. Animal studies have shown low birth weights, delayed bone formation, and bone marrow damage when pregnant animals breathed benzene.

The Department of Health and Human Services (USDHHS) has determined that benzene is a known human carcinogen. Long-term exposure to high levels of benzene in the air can cause leukemia, cancer of the blood-forming organs.

1,3-Butadiene. 1,3-Butadiene is a chemical made from the processing of petroleum. It is a colorless gas with a mild gasoline-like odor. About 75% of the manufactured 1,3-butadiene is used to make synthetic rubber. Synthetic rubber is widely used for tires on cars and trucks. 1,3-Butadiene is also used to make plastics including acrylics. Small amounts are found in gasoline.

Most of the information on the health effects of 1,3-butadiene comes from studies where the exposure was from breathing contaminated air. Breathing very high levels of 1,3-butadiene for a short time can cause central nervous system damage, blurred vision, nausea, fatigue, headache, decreased blood pressure and pulse rate, and unconsciousness. There are no recorded cases of accidental exposures at high levels that caused death in humans, but this could occur. Breathing lower levels may cause irritation of the eyes, nose, and throat. Studies on workers who had longer exposures with lower levels have shown an increase in heart and lung damage, but these workers were also exposed to other chemicals. The chronic chronic health effect associated with 1,3-butadiene is unknown.

Animal studies show that breathing 1,3-butadiene during pregnancy can increase the number of birth defects. Other effects seen in animals that breathed low levels of 1,3-butadiene for one year include kidney and liver disease, and damaged lungs. Some deaths were reported. There is no information on the effects of eating or drinking 1,3-butadiene. Skin contact with liquid 1,3-butadiene can cause irritation and frostbite.

The USDHHS has determined that 1,3-butadiene may reasonably be anticipated to be a carcinogen. This is based on animal studies that found increases in a variety of tumor types from exposure to 1,3-butadiene. Studies on workers are inconclusive because the workers were exposed to other chemicals in addition to 1,3-butadiene.

Xylenes. Xylene is a colorless, sweet-smelling easily flammable liquid. It occurs naturally in petroleum and coal tar and is formed during forest fires. Xylene is used as a solvent and in the printing, rubber, and leather industries. It is also used as a cleaning agent, a thinner for paint, and in paints and varnishes. It is found in small amounts in airplane fuel and gasoline.

Xylene affects the brain. High levels from exposure for short periods (14 days or less) or long periods (more than 1 year) can cause headaches, lack of muscle coordination, dizziness, confusion, and changes in one's sense of balance. Exposure of people to high levels of xylene for short periods can also cause irritation of the skin, eyes, nose, and throat; difficulty in breathing; problems with the lungs; delayed reaction time; memory difficulties; stomach discomfort; and possibly changes in the liver and kidneys. It can cause unconsciousness and even death at very high levels.

Studies of unborn animals indicate that high concentrations of xylene may cause increased numbers of deaths, and delayed growth and development. In many instances, these same concentrations also cause damage to the mothers. It is unknown if xylene harms the unborn child if the mother is exposed to low levels of xylene during pregnancy.

The International Agency for Research on Cancer (IARC) has determined that xylene is not classifiable as to its carcinogenicity in humans. Human and animal studies have not shown xylene to be carcinogenic, but these studies are not conclusive and do not provide enough information to conclude that xylene does not cause cancer.