

Health Consultation

PUBLIC HEALTH EVALUATION OF ENVIRONMENTAL

SAMPLING DATA

AT

VETERAN'S FIELD

AND

EDGERTON ELEMENTARY SCHOOL

NEW LONDON, NEW LONDON COUNTY, CONNECTICUT

Connecticut DEP Remediation ID: 6437

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U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES

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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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Prepared by:

The Connecticut Department of Public Health
Under Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

The conclusions and recommendations in this health consultation are based on the data and information made available to the Connecticut Department of Public Health (CTDPH) and the Agency for Toxic Substances and Disease Registry (ATSDR). CTDPH and ATSDR will review additional information when received. The review of additional data could change the conclusions and recommendations listed in this document.

BACKGROUND AND STATEMENT OF ISSUE

In April 2005, the Agency for Toxic Substances and Disease Registry (ATSDR) was petitioned by a parent of an Edgerton Elementary School student, in New London, Connecticut to evaluate the public health significance of environmental sampling data at Veteran's Field and Edgerton Elementary School. The main focus of this health consultation will be evaluating soil sampling data from Veteran's Field. However, other environmental data such as soil, indoor air and dust wipe samples from Edgerton Elementary School and ambient air monitoring data from the Field will be evaluated as well.

Veteran's Field is located in the northwestern portion of the City of New London, Connecticut and consists of approximately 4.65 acres of land along the south side of Cedar Grove Avenue adjacent to the intersection of Cedar Grove Avenue and Georgianna Street (Appendix A). Edgerton Elementary School abuts the Field to the west. Residential properties abut the Field to the east, north, and south. Before remediation began in February 2005, the Field was almost entirely covered by grass. A paved walkway and concrete baseball dugouts were present in the western portion of the Field. A small, one-story concrete block building also was present in the eastern corner of the Field. A fence surrounds Veteran's Field on all sides (including one separating the Field from the Preschool Playground of Edgerton Elementary School) except for the southern boundary which is bordered by a stone wall.

Based on reports by city contractors, Veteran's Field was vacant land that was initially developed for recreational use by 1931 (HRP 2005). Land to the north, east, and south of the Field was developed sporadically for residential use as early as 1920. Land west of the Field was wooded land until Edgerton Elementary School was built around 1958. No current or historical use of the Field or the immediate surrounding properties for industrial/commercial purposes was identified. No record of the use, storage, or release of oil or other hazardous materials was identified for the Field. No information regarding the placement or origin of fill materials at the Field was identified, but it appears that the fill materials were in place by 1931.

A geotechnical study of the Veteran's Field property was conducted by a city contractor in September 2003 to identify structural specifications required for proposed temporary classrooms for Jennings Elementary School in New London (HRP 2005). This study identified fill materials in the eastern portion of the site that included "cinders and ashes." City contractors subsequently conducted a subsurface investigation in October 2003 to further evaluate the characteristics and distribution of fill materials and the potential for contamination to be present within the fill materials (HRP 2005). Fill materials of

environmental concern identified at the site consist of three separate types: 1) pure ash, 2) a gray granular material that consists mostly of slag and cinders, and 3) brown silty soil with some minor amounts of ash and/or slag. Testing conducted during this subsurface investigation identified concentrations of lead and arsenic that exceeded Connecticut's soil standards in fill materials less than 4 feet deep below ground surface (bgs).

City contractors later performed another round of soil sampling in February 2005 to fully characterize the contamination in the Veteran's Field property. Testing conducted during this investigation also identified concentrations of total lead and arsenic that exceeded Connecticut's soil standards in fill material less than 4 feet deep.

City contractors also sampled soil on the Edgerton School Property in December 2003 to characterize soil contamination across the property boundary. Three areas on the school grounds had soil samples where arsenic, lead, and polycyclic aromatic hydrocarbons (PAHs) levels exceeded state cleanup standards.

City contractors began remediating the Field in February 2005. The majority of the cleanup will be completed by the release of this health consultation in the summer of 2005. Workers are excavating contaminated soil as deep as 4 feet bgs, placing a geotextile liner above any remaining contaminated soil, and placing clean soil on top of the liner.

In March 2005, city contractors by request of the school parents, conducted indoor air and dust wipe monitoring in the Edgerton Elementary School, but found no contamination in the school (EHS 2005).

In April 2005, ATSDR was petitioned by an Edgerton Elementary School parent, in New London, Connecticut to evaluate the environmental sampling data of Veteran's Field and Edgerton Elementary School. There was concern that some of the soil contamination from the Field had migrated onto the School property and that the students and teachers were being exposed to the soil contamination.

Site Visit

The Connecticut Department of Public Health (CTDPH) staff did a site visit on April 6th 2005 of Veteran's Field along with Connecticut Department of Environmental Protection (CTDEP) staff. CTDPH and CTDEP met with city contractors who answered soil sampling and remediation questions about the Field. The weather was sunny, warm, and dry. CTDPH staff observed very minimal dust in the air. A water truck was available onsite to ensure that dust was not generated. Contractors were actively excavating contaminated soil from various areas of the Field. CTDPH observed the close proximity of the Edgerton Elementary Preschool Playground from the excavation work.

A site visit of Edgerton Elementary School was done on May 4, 2005. CTDPH staff and representatives from the New London Health Department (NLHD) met with the school nurse and principal as well as the custodian and asked questions about environmental

concerns in the school. CTDPH also toured the school, noting some minor maintenance and cleanliness issues. CTDPH also discussed rodent issues with the custodian. Rodent issues had been previously raised by concerned parents.

Another site visit of the school was performed on May 23, 2005. This site visit was performed in response to newly available soil sampling results from the school. CTDPH and NLHD staff observed the tree-lined area near the southern border of the school property which contained levels of arsenic in surface soil that exceeded state standards. Contractors had recently covered the area with crushed stone to prevent any contact with the soil. CTDPH and NLHD also observed the Preschool Playground area. Contractors moved the fence about 10 feet towards the Preschool Playground because of the planned remedial work on the final 50 feet of the Field immediately adjacent to the playground.

Demographics

The site is in New London, Connecticut whose population is approximately 25,671. The total area is approximately 10.76 square miles (U. S. Census Bureau 2000).

Edgerton Elementary School is a public school comprising of Pre K-5th grade students. Fifty-eight percent of the students are Hispanic and 26% are of African American origin based on the 2002-2003 year base statistics on National Center for Education Statistics (NCES). Over 90% of the students are on a free or reduced-priced lunch plan (NCES 2002).

Environmental Contamination and Health Comparison Values

Veteran's Field

Ambient Air Sampling Data

Two air-monitoring stations were set up by the city's contractor on the eastern and western boundaries of the Field on February 25th 2005 before remediation began on the Field. The air monitoring station will remain until the remedial activity is completed. A real time particulate matter (PM₁₀) 8-hour time weighted average measurement (TWA) is taken daily while remedial activity is taking place. PM₁₀ refers to particles smaller than 10 microns in diameter. Research shows that PM₁₀ can penetrate into sensitive regions of the respiratory tract. When the real time daily PM₁₀ 8 hour TWA reading is above the National Ambient Air Quality Standard (NAAQS) of 150 µg/m³, then daily ambient air laboratory samples are taken to analyze for total particulates, PM₁₀, arsenic, and lead for the next 4-5 days. In addition, soil wetting is increased. When the PM₁₀ 8-hour TWA readings fall below the 150µg/m³ limit, then ambient air laboratory sampling is discontinued. No daily readings are taken when it is raining.

There were only two days (April 4, 2005, and June 9, 2005) where real-time 8-hour TWA averages exceeded the 150 µg/m³ NAAQS. It is important to note, however, that the contractors had difficulty calibrating the ambient air monitoring pump on April 4, 2005.

Nevertheless, as a result of both exceedances, contractors took daily laboratory samples for 4 days following the exceedances to analyze for the above described analytes. The maximum PM₁₀ level sampled was 172.9 micrograms per square meter ($\mu\text{g}/\text{m}^3$) which was taken on June 9, 2005. All of the lead ambient air levels were below the NAAQS. The maximum total particulate level was 100 $\mu\text{g}/\text{m}^3$ (April 4, 2005). The maximum arsenic level in ambient air was 0.42 $\mu\text{g}/\text{m}^3$ (June 16, 2005). There is no NAAQS for total particulate and arsenic.

Soil Data

In October 2003, contractors for the city of New London sampled soil from several locations on Veteran's Field for various contaminants including lead, arsenic, and polycyclic aromatic hydrocarbons (PAHs). Samples were primarily analyzed for lead, arsenic, and PAHs, since these contaminants were known to be found in the soil on the site based on previous environmental investigations. Forty-three samples were taken at various depth intervals on the site. However, not every sample was analyzed for lead, arsenic, and PAHs. Table 1 gives a summary of the soil sampling data taken in Veteran's Field in October 2003.

As shown in Table 1, city contractors sampled the soil again for the same contaminants in several locations in February 2005 in Veteran's Field. Two hundred and twenty-seven samples were taken at various surface and depth intervals during this sampling event. With both data sets (October 2003 and February 2005), the contamination in the soil at from the surface to a depth of 8 feet was well characterized.

Approximately one-third of the surface soil samples (0-6 inches (in) below ground surface (bgs)) samples taken in October 2003 and February 2005) contained arsenic at levels that exceeded the Connecticut Remediation Standard Regulations Direct Exposure Criteria (CT RSRs). CT RSRs were developed to protect children and adults who have contact with soils on a daily basis for many years (30 years). The maximum arsenic concentration in the surface soil samples was 63.7 parts per million (ppm), about six times the CT RSR.

With regard to soils below the surface, samples taken at various depth intervals indicated arsenic levels exceeding the CT RSR. Approximately 20% of the subsurface soil samples had arsenic levels exceeding the CT RSR. The maximum arsenic level in the subsurface soil was 63.9 ppm, about six times the CT RSR.

One hundred and seventy-eight surface and subsurface soil samples were also analyzed for lead on Veteran's Field. None of the surface soil samples had lead levels exceeding the CT RSR. Roughly 15% of the subsurface soil samples had lead levels above the CT RSR. Exceedances for lead were found at various subsurface depth intervals. The maximum lead level in the subsurface soil was 17,000 ppm, about 42 times the CT RSR. The maximum concentration was found at 4-4.5 feet (ft) bgs.

Two soil samples (0-2 ft bgs) were analyzed for PAHs on Veteran's Field. One of the samples indicated PAH levels exceeding the CT RSRs. The PAHs detected that exceeded CT RSRs were benzo(a)anthracene, benzo(a)pyrene, and benzo(b) fluoranthene. As shown in Table 1, PAH concentrations only slightly exceeded CT RSRs.

Table 1. Summary of Subsurface and Surface Sample Results from Veteran's Field, October 2003 and February 2005.

Contaminant	Sample Date	Sample Depth (foot)	Concentration Range (ppm)	Number of Exceedances of Comparison Value/Number of Samples Taken	Comparison Value (ppm)	Comparison Value Source
Heavy Metals						
Arsenic	10/2003	0-0.5	54.6	1/1	10	CT RSR [^]
		0-2.0	<6.11-64.4	2/4		
		>0.5	<5.12-63.9	8/37		
	2/2005	0-0.5	<5.73-63.7	14/48		
		0-2.0	<5.89-50.1	3/5		
		> 0.5	<5.21-62.1	33/171		
Lead	10/2003	>0.5	BDL-2200	1/7	400	CT RSR
	2/2005	> 0.5	BDL-17000	29/171		
Polycyclic Aromatic Hydrocarbons						
Benzo(a)anthracene	2/2005	0-2	0.43-1.28	1/2	1	CT RSR
Benzo(a)pyrene	2/2005	0-2	0.42-1.02	1/2	1	CT RSR
Benzo(b)fluoranthene	2/2005	0-2	0.62-1.38	1/2	1	CT RSR

BDL=Below Detectable Limit

[^]Connecticut Remediation Standard Regulations Direct Exposure Criteria (CT RSRs). CT RSRs are soil standards that were developed to be protective of children and adults who have contact with soils on a daily basis for many years (30 years).

ppm=parts per million

< = Less than

> = Greater than

Edgerton Elementary School

Indoor Air Data

In late March 2005, contractors for the city of New London conducted indoor air and dust wipe sampling inside the Edgerton Elementary School. This sampling was done at the request of Edgerton Elementary School parents. Indoor air 8-hour and dust wipe sampling was performed on Wednesday, March 30, 2005. Samples were taken in several classrooms closest to the Field as well as the principal's office and the library. Teachers were told to keep their windows open to simulate a regular school day. Samples were tested for arsenic, lead, and cadmium at the request of the school's parents. All of the

indoor air and dust wipe samples were below detectable limits. The detectable limits were within appropriate ranges.

Soil Data

In December 2003, city contractors sampled surface and subsurface soil on the Edgerton Elementary School grounds to characterize soil contamination across the property boundary. Several surface and subsurface samples were taken and tested for arsenic, lead, and PAHs. As shown in a map of the site in Appendix A, there were only three areas where soil contamination levels exceed the CT RSRs: an asphalt covered area, the eastern edge of the Preschool Playground area, and a tree-lined area in the southern boundary of the school property. Contamination levels in these areas are described below and in Tables 2-4.

1. Asphalt Area

An asphalt-covered play area (basketball court) on the northwestern edge of the School had lead levels above CT RSR in subsurface soil beneath the asphalt in the 0-2 inch depth interval in one sample out of five. As shown in Table 2, this lead concentration level was 761 ppm. In addition, in one sample, PAHs (benzo(a)anthracene and benzo(a)pyrene) levels exceeded the CT RSRs. The maximum levels of PAH concentrations in this area were 7.96 ppm (benzo(a)anthracene).

Table 2. Summary of Subsurface Soil Sample Results from the Asphalt Area at Edgerton Elementary School, December 2003.

Contaminant	Sample Date	Sample Depth (foot)	Concentration Range (ppm)	Number of Exceedances of Comparison Value/Number of Samples Taken	Comparison Value (ppm)	Comparison Value Source
Lead	12/2003	0-2	5-761	1/5	400	CT RSR [^]
Benzo(a)anthracene	12/2003	0-2	7.96	1/1	1	CT RSR
Benzo(a)pyrene	12/2003	0-2	2.60	1/1	1	CT RSR

[^]Connecticut Remediation Standard Regulations Direct Exposure Criteria (CT RSRs). CT RSRs are soil standards that were developed to be protective of children and adults who have contact with soils on a daily basis for many years (30 years).
ppm=parts per million

2. Playground Area

In December 2003, city contractors sampled the soil in the Preschool Playground area of Edgerton Elementary School. A section of the Playground is actually part of the Veteran's Field property. However, it will be considered as part of Edgerton Elementary School for the sake of this health consultation. The section of the Playground that is actually part of Veteran's Field is a berm whose eastern edge slopes down to the main playground. City contractors installed a temporary fence in February 2005 that separated

this sloped area of the playground from the main playground area to allow for more room for remediation of the Field. In May 2005, city contractors moved the fence line further closer to the school to allow for even more room for remediation.

Soil samples at depth were taken throughout the playground while surface soil samples were only taken from the eastern edge of the playground. As shown in Table 3, three out of four surface samples taken in this area have arsenic levels that exceeded the CT RSR. Surface soil levels exceeding CT RSR for arsenic were generally observed around samples SS-3 and SS-4 in the Playground as shown in Appendix A. The maximum arsenic concentration for surface soil samples in this area was 25.4 ppm, which is roughly two and a half times the CT RSR. The average arsenic concentration in the surface soil was 16 ppm which exceeds the CT RSR. It should be noted that all of the four surface samples were taken in a limited area of the playground around the eastern edge of the playground fence. Surface soil samples (0-6 inches bgs) in the remainder of the playground were not taken.

City contractors also sampled soil in throughout the playground at a depth interval of 0-2 feet bgs. Most of these samples were actually taken at the 0-1 ft bgs depth. Since the depth intervals exceeded 6 inches, it was not possible to evaluate them as surface soil samples. Only one of the six soil samples had arsenic levels that exceeded the CT RSR. The maximum arsenic concentration for this depth interval in the playground is 43.9 ppm, which is approximately 4 times the CT RSR.

Seven soil samples were taken at depth intervals greater than 0.5 feet throughout the playground. Three of those seven soil samples had arsenic levels that exceeded the CT RSR. The maximum arsenic concentration for this depth interval in the playground is 110 ppm, which is 11 times the CT RSR.

Table 3. Summary of Soil Sample Results from the Preschool Playground at Edgerton Elementary School, December 2003.

Contaminant	Sample Date	Sample Depth (foot)	Concentration Range (ppm)	Number of Exceedances of Comparison Value/Number of Samples Taken	Comparison Value (ppm)	Comparison Value Source
Arsenic	12/2003	0-0.5	<5.78-25.4	3/4	10	CT RSR [^]
		0-2.0	<5.68-43.9	1/6		
		>0.5	<5.4-110	3/7		

[^]Connecticut Remediation Standard Regulations Direct Exposure Criteria (CT RSRs). CT RSRs are soil standards that were developed to be protective of children and adults who have contact with soils on a daily basis for many years (30 years).

ppm=parts per million

< = Less than

➤ = Greater than

3. Tree-lined area

A tree-lined area along the southern boundary of the school property had arsenic levels in soils that exceeded the CT RSR. Sampling points TB-40, 41, 47, 48, and 49 in Appendix A were located in the tree-lined area of Edgerton Elementary School. All samples were collected from the 0-2 ft depth interval and six out of 16 samples exceeded the CT RSR for arsenic. The maximum level of arsenic in this area was 17.2 ppm, about 1.5 times the CT RSR. However, the average arsenic concentration in this soil depth was 6.2 ppm, which does not exceed the CT RSR. Table 4 shows soil results from the tree-lined area.

Table 4. Summary of Subsurface Soil Sample Results from the Tree-lined Area at Edgerton Elementary School, December 2003.

Contaminant	Sample Date	Sample Depth (foot)	Concentration Range (ppm)	Number of Exceedances of Comparison Value/Number of Samples Taken	Comparison Value (ppm)	Comparison Value Source
Arsenic	12/2003	0-2.0	<5.26-17.2	6/16	10	CT RSR [^]

[^]Connecticut Remediation Standard Regulations Direct Exposure Criteria (CT RSRs). CT RSRs are soil standards that were developed to be protective of children and adults who have contact with soils on a daily basis for many years (30 years).

ppm=parts per million

< = Less than

DISCUSSION

Exposure Pathway Analysis

To evaluate potential exposures to soil contaminants in the Edgerton Elementary School and Veteran's Field properties, CTDPH evaluated the environmental data and considered how people might come into contact with contaminants in soil. The possible pathways of exposure are dermal, inhalation, and incidental ingestion. In other words, in order to be exposed to contaminants in soil, one must come into contact with the soil by touching the soil, breathing airborne soil particles, or eating soil adhered to fingers or food items.

Veteran's Field

Past Conditions (Before Soil Remediation Activities)

1. Surface Soils

Adults and children using the Field in the past were likely to be exposed to surface soil contaminated with arsenic during recreational activities like softball and soccer. Adult workers could have been exposed while doing activities like grass mowing or other landscaping. Small children who are spectators to recreational activities may have been exposed because they have more hand-to-mouth contact than older children and adults.

The primary exposure routes are considered to be dermal and ingestion. Inhalation is not considered to be a major pathway because most of the contaminated areas were covered with grass; this creates very low potential for excessively dry and dusty soil conditions. In addition, even after remedial activities began and soil was being disturbed, ambient air sampling data taken in February 2005 to present indicates that all but two of the daily 8-hour TWA ambient air data measurements for PM₁₀ were below the US EPA's National Ambient Air Quality Standards (NAAQS). Although there are two exceedances, the average overall daily 8-hour TWA PM₁₀ measurement is very low and does not exceed NAAQS. Exposure to surface soils by ingestion and dermal routes at Veteran's Field is considered to be a complete exposure pathway in the past and is evaluated further in the Public Health Implications Section.

2. Subsurface Soil

Results from subsurface soil samples indicate that arsenic, PAHs, and lead are present at levels above health-based comparison values at Veteran's Field (CT RSRs).

In the past, landscapers could have come into contact with subsurface soils but only during activities that penetrated into deep soils (e.g. planting trees or shrubs). Quantitative evaluation of doses and health impacts to landscapers or workers from past exposure to subsurface soils is difficult because we do not know where and how long activities may have occurred. CTDPH considers past exposure to subsurface soils to be a potential exposure pathway and it is not evaluated quantitatively in this health consultation.

Current and Future Conditions

1. Soil (Surface and Subsurface)

As of July 2005, the remediation of Veteran's Field is nearly complete. Even while the remediation was taking place (February 2005 to present), direct contact with soil by Edgerton Elementary School students is not expected because access to the Field is limited because the Field is fenced and locked. There had been concern among parents and teachers that contaminants from the Field had spread into the School. However, indoor air and dust wipe data from the School shows no exposure to contaminants from the Field. Therefore, exposure to soil and dust inside the school is not a complete pathway and is not evaluated further.

During remediation, contractors and construction workers could come into contact with the contaminated soil. They could be exposed by breathing airborne dust. However, the cleanup at Veteran's Field is being coordinated with CTDEP to ensure that worker exposure to surface and subsurface soils is minimized. In addition, we have no data to suggest that workers were exposed to contaminated soil. When remediation is complete, some contamination will remain at depths greater than four feet.

Therefore, if activities occur that disturb soil at Veteran's Field at depths greater than 4 feet, contact with contamination could occur. Soils in Veteran's Field are almost entirely

cleaned up to a depth of 4 ft bgs. In the future, we do not expect an exposure to occur as long as digging activities do not take place.

Edgerton Elementary School

Past Conditions

1. Surface Soil

The potential for exposure to surface soil also exists at Edgerton Elementary School in the past. There are two areas where arsenic, lead, or PAHs exceed the CT RSRs in surface soil samples. These areas are the eastern edge of the Preschool Playground and the tree-lined area previously described in the Environmental Contamination and Health Comparison Values section of this health consultation. However, since the tree-lined area is not a place where children typically play and was grass covered, in the past, exposure is considered to be very unlikely. Thus the tree-lined area will not be further evaluated. However, the Preschool Playground area is a place where the eastern edge is known to contain surface soil that is contaminated (although it is also grass covered). This area is a place where preschool students would likely have played several days a week during the school year. The potential for past exposure to that particular area will be evaluated further in the Public Health Implications Section.

2. Subsurface Soil

The potential for exposure to subsurface soil also exists at Edgerton Elementary School in the past. There are three areas where arsenic, lead, or PAHs exceed the CT RSRs in subsurface soil samples. These areas are the asphalt covered area (basketball court), the Preschool Playground and the tree-lined area previously described in the Environmental Contamination and Health Comparison Values section of this health consultation. The basketball ball court is covered by asphalt; therefore, exposure to soil beneath the asphalt is considered to be extremely unlikely. In the past, landscapers could have come into contact with subsurface soils in the tree-lined area and the Playground during activities that penetrated into deep soils (e.g. planting trees or shrubs and installing fence posts or footings for a deck). In summary, CTDPH considers exposure to subsurface soils in the past in the three areas at Edgerton Elementary School to be a potential exposure pathway, and it is not evaluated quantitatively in this health consultation.

Current and Future Conditions

1. Surface and Subsurface soil

Current and future exposure to surface and subsurface soil in the tree-lined area, the playground, and the asphalt-covered area is not considered to be a complete exposure pathway. As noted earlier, the Preschool Playground fence was moved in February, and access to the contaminated area is now restricted. In addition, remediation of the contaminated area in the Preschool Playground is nearly complete as of the release of this

health consultation. In addition, access to contaminated soil in the asphalt-covered area is restricted by the presence of asphalt. The tree-lined area is now also covered by crushed stone. Exposure to subsurface soils is not expected in these areas provided that digging or other activities that disturb the soil do not occur. In summary, CTDPH considers exposure to surface and subsurface soils in the current and future in the three areas at Edgerton Elementary School to be a potential exposure pathway, and it is not evaluated quantitatively in this health consultation.

Public Health Implications for Adults and Children

When determining the public health implications of exposure to hazardous contaminants, CTDPH considers how people might come into contact with contaminants and compares contaminant concentrations with health protective comparison values. When contaminant levels are below health-based comparison values, health impacts from exposure to those levels are unlikely. Contaminant levels exceeding comparison values do not indicate that health impacts are likely but instead warrant further evaluation. In this health consultation, CTDPH used Connecticut Remediation Standard Regulations direct contact residential soil standards (CT RSRs) as health protective screening values. As stated previously, these values are health-based levels developed to be protective of children and adults with frequent, long-term exposure to contaminants in soil. CTDPH only evaluated completed exposure pathways where surface soil contamination exceeded the CT RSRs.

Tables 1 and 3 indicate that arsenic was detected in surface soil at levels above the CT RSR at Veteran's Field and the eastern edge of the Preschool Playground of the Edgerton Elementary School. Exposure to surface soil in the past is a complete exposure pathway. General toxicology information on arsenic is provided in Appendix B.

Background levels of arsenic in soil range from about 1 to 40 mg/kg. Most of the samples from Edgerton Elementary School and Veteran's Field are below the maximum of the range of the background for arsenic and some of them exceed these background levels. Arsenic in soil may originate from the parent materials that form the soil, industrial wastes, or use of arsenical pesticides. Geological processes that may lead to high arsenic concentrations in rock and subsequently the surrounding soil include hydrothermal activity and pegmatite (volcanic rock) formation (ATSDR Toxicological Profile, 2000).

At Veteran's Field and the Preschool Playground of the Edgerton Elementary School, arsenic was detected in surface soil at levels exceeding the CT RSR. It is important to note, however, that CT RSRs were developed to be protective of young children and adults exposed to soil everyday over a long term. It is unlikely that such frequent and intense soil exposure would occur at either area because the grass cover would minimize direct contact with soil. In addition, during winter months, the ground would be frozen or snow-covered, and soil contact would be minimal. CTDPH evaluated cancer and noncancer health risks based on more realistic exposures to children and adults who may come into contact with soils at the Field and the Playground. CTDPH assumed that contact with soil occurs 5 days per week, 9 months out of the year, for 30 years for

Veteran's Field and 3 years for the Preschool Playground of the Edgerton Elementary School. Nine months was used instead of 12 because exposure would be limited in the winter months.

Veteran's Field

In Veteran's Field, arsenic was detected in approximately one-third of all samples at levels exceeding the CT RSR. The maximum exposure level is approximately six times the arsenic CT RSR of 10 ppm. Surface soil contamination seems to be randomly distributed all over the Field.

CTDPH used a central tendency soil exposure point concentration for evaluation of soil sampling data for Veteran's Field because it is more representative of the concentration to which people may be exposed over the long term than the maximum concentration. CTDPH relied upon the 95% Upper Confidence Limit (95% UCL) of the mean (an estimate of the central tendency), calculated using ProUCL (EPA 2001a). The 95% UCL provides a very conservative (health protective) estimate of the average (mean) concentration, especially for a small number of samples, which is the case at this site.

Given the above described assumptions about exposure frequency and duration and a 95% UCL exposure level of 15 ppm for arsenic, the average daily dose from ingestion and dermal contact was estimated to be 0.00006 mg/kg/day. This dose is below the Agency for Toxic Substances and Disease Registry's (ATSDR's) Minimum Risk Level (MRL) for chronic oral exposure of 0.0003 mg/kg/day and EPA's reference dose (RfD) which is also 0.0003 mg/kg/day. MRLs and RfDs are estimates of daily exposure to humans that are likely to be without harmful noncancer effects. Because the dose from the site is less than the MRL and RfD, noncancer effects from arsenic in soil at Veteran's Field are very unlikely. Dose and risk calculations are provided in Appendix C.

CTDPH also calculated theoretical cancer risks from long-term exposure to arsenic (Appendix C). The theoretical cancer risk from arsenic exposure is one excess cancer per 100,000 people, which represents a very small incremental risk above the background cancer rate of approximately 1 in 2 or 3 (NCI 2001). Therefore, we do not expect to see any cancer effects from past exposure to arsenic at Veteran's Field.

Preschool Playground at Edgerton Elementary School

In the Preschool Playground area, arsenic was detected in three out of four samples at levels exceeding CT RSR. The maximum exposure level is approximately two and a half times the arsenic CT RSR of 10 ppm.

CTDPH used the maximum arsenic concentration of 25.4 ppm for evaluation of soil sampling data for the Preschool Playground of the Edgerton Elementary School. This level was used because there were only 4 surface samples taken. When there are a small number of samples, the maximum concentration is typically used because it provides a

more conservative (health protective) estimate of the average concentration to which people may be exposed.

Given the above described assumptions about exposure frequency and duration and a maximum exposure level of 25.4 ppm, the average daily dose from ingestion and dermal contact was estimated to be 0.00011 mg/kg/day. This dose is below the Agency for Toxic Substances and Disease Registry's (ATSDR's) Minimum Risk Level (MRL) for chronic oral exposure of 0.0003 mg/kg/day and EPA's RfD which is also 0.0003 mg/kg/day. Because the dose from the site is less than the MRL and RfD, noncancer effects from arsenic in soil in the eastern edge of the Playground are very likely.

CTDPH also calculated theoretical cancer risks from exposure to arsenic (Appendix C) in the eastern edge of the playground. The theoretical cancer risk from arsenic exposure is seven excess cancers per 1,000,000 people, which represents a very small incremental risk above the background cancer rate of approximately 1 in 2 or 3 (NCI 2001). Therefore, we do not expect to see any cancer effects from arsenic exposure from this area of the playground.

Surface soil sampling (0-6 inch bgs) was not taken throughout the remaining areas of the playground. The shallowest soil samples that were taken (0-1 ft bgs) do not indicate contaminant levels above CT RSRs. However, there is some uncertainty regarding exposure because the most accessible surface soil (0-3 or 0-6 in) was not sampled. To better characterize the surface soil in this area, it is prudent to sample the first three or six inches of the soil for arsenic, lead, and PAHs.

EVALUATION OF COMMUNITY CONCERNS

- 1) Teachers and parents of children attending Edgerton Elementary School were concerned that they were being exposed to arsenic from Veteran's Field and several had rashes that they believed resulted from arsenic exposure from the soil in the Field.

During remediation at Veteran's Field, measures were taken to ensure that exposure to contaminated soil did not occur:

-A fence was placed around Veteran's Field limiting access. Soil wetting was also performed when necessary.

-Ambient air was sampled for arsenic.

-Particulate monitoring was performed.

-Indoor air and dust wipe sampling were performed at the School.

Data that we have reviewed indicates that the potential for exposure to soil to be very low. However, if you are concerned about a rash, please consult a medical

doctor. Therefore, it is very unlikely that rashes would have been caused by exposure to arsenic in soil.

- 2) Community members requested that they be informed of our recommendations in this health consultation. In addition, they requested that copies of the health consultation be available.

Copies of this health consultation, which contains a list of our recommendation, will be made available from our office once it is released.

- 3) Community members requested that more flyers be given out and posted when/if another open house is scheduled.

If CT DPH holds another open house, then additional flyers will be distributed.

- 4) Community members were concerned that more indoor and ambient air samples need to be taken in order to ensure that the school is safe.

None of the dust wipe and indoor air samples collected in March 2005 detected any contamination inside the School. Samples were taken in the classrooms closest to Veteran's Field in the middle of the week in the morning and after school. Teachers were told to keep the windows open to simulate a typical school day scenario. Sampling occurred while remediation was ongoing. We believe that the sampling already performed is satisfactory to detect any contamination in the School.

- 5) Some parents had their children's urine tested for arsenic. They were concerned that arsenic present in their children's urine was from exposure to the soil in Veteran's Field.

Urine arsenic tests typically analyze for both inorganic and organic arsenic. Inorganic arsenic is found in soil in Veteran's Field. Organic arsenic is found in seafood and is not toxic. However, the results from urine arsenic tests do not differentiate between organic and inorganic arsenic. Because arsenic exposure is so common in food, we would generally expect everyone to have some measurable amount of arsenic in his or her urine. If a urine sample is taken for arsenic analysis, it is recommended that a patient abstain from eating seafood for at least three days before the urine arsenic test.

ATSDR believes that levels above 200 µg/L can result in adverse health effects. They do not expect to see any health effects in children or adults with arsenic levels below 50 µg/L. However, there is uncertainty about whether health effects are expected when urine arsenic levels are between 50 and 200 µg/L.

- 6) Community members requested that educational material concerning arsenic testing and avoidance of seafood prior to testing be distributed.

Educational material is available in fact sheets that were distributed at the June 2005 open house, to the teacher's union, and to several area physicians. Fact sheets are also included in Appendix D and E of this health consultation. Copies of this health consultation as well as fact sheets are available by calling CTDPH at 860-509-7742.

CONCLUSIONS

Surface soil samples taken in October 2003 and February 2005 at Veteran's Field and the eastern edge of the Preschool Playground of the Edgerton Elementary show the presence of elevated levels of arsenic. Subsurface soil samples taken around Veteran's Field and the areas in Edgerton Elementary School (asphalt area, tree-lined area, and the eastern edge of the Preschool Playground) also show the presence of elevated arsenic levels. During remediation, two ambient air samples from Veteran's Field slightly exceeded national ambient air standards for PM₁₀. None of the dust wipe and indoor air samples taken inside Edgerton Elementary indicated any detectable levels of contamination. By July 2005, most of the contaminated soil to a depth of 4 feet bgs in Veteran's Field and the Preschool Playground has been cleaned up by city contractors.

CTDPH evaluated exposure doses and public health implications from exposure to arsenic in surface soils in the past using realistic exposure assumptions for Veteran's Field and the Preschool Playground of Edgerton Elementary. CTDPH did not assess doses and risks from exposure to subsurface soils from the School or Field, ambient air, or indoor air or wipe samples inside the School because it was not considered to be a complete exposure pathway.

For Veteran's Field and the Preschool Playground of Edgerton Elementary, CTDPH concludes that exposures are not likely to pose a noncancer health threat in the past. CTDPH also calculated theoretical cancer risks from exposure to contaminants at the site. Cancer risks from Veteran's Field and the Preschool Playground of Edgerton Elementary School do not present a significant risk above background. Therefore, CTDPH considers it to be unlikely that people have become sick from past exposure to the soil contamination.

Even though CTDPH has concluded that exposure to contaminated soil at the Field and the Preschool Playground is not likely to cause illness, CTDPH strongly supports the ongoing environmental cleanup. The soil concentrations exceed cleanup levels (CTRSRs), and cleanup of soils at the contaminated section of the Preschool Playground and Veteran's Field is prudent.

In addition, there is some uncertainty regarding the remaining areas of the Playground because surface soil has not been sampled and it is a very active area. Surface soil in the remaining areas of the playground have not been sampled (other than the eastern edge).

It is recommended the additional surface soil sampling be performed and evaluated in the remaining areas of the Playground not previously sampled.

ATSDR has a categorization scheme whereby the level of public health hazard at a site is assigned to one of five conclusion categories (Appendix F). CTDPH has concluded that surface soils at Veteran's Field as well as the Preschool Playground of Edgerton Elementary present no apparent public health hazard under past conditions because noncancer and cancer risk levels do not indicate that health effects from exposure to surface soils at either area are likely. Even though no apparent health threat exists, CTDPH has concluded that environmental cleanup is needed because contaminant concentrations exceed CT residential soil cleanup standards (CT RSRs) and future exposures should be prevented.

RECOMMENDATIONS

1. CTDPH recommends that the city maintain the crushed stone covering in the tree-lined area of Edgerton Elementary to prevent exposure to the soil underneath.
2. CTDPH recommends the city ensure that the eastern edge of the Preschool Playground of Edgerton Elementary be remediated to prevent future exposure.
3. CTDPH recommends that activities that would disturb soil deeper than 4 feet in Veteran's Field and the Preschool Playground area at Edgerton Elementary School be prohibited because contamination still remains in some areas at depth.
4. CTDPH recommends that the city ensure that the asphalt in the asphalt covered area be maintained because soil contamination is present beneath the asphalt.
5. CTDPH recommends that CTDEP continue to take actions in coordination with the city contractors at Veteran's Field to ensure that exposure to surface and subsurface soil is minimized during the remaining remedial activities.
6. CTDPH recommends that city contractors sample the surface soil at the remaining areas of the Playground where surface soils have not been characterized.

PUBLIC HEALTH PLAN

Actions Taken

1. CTDPH held a public availability session with the NLHD and CTDEP in June 2005 to provide information to the community residents and parents and teachers of Edgerton Elementary School about exposures and health impacts related to the environmental contaminant in Veteran's Field. CTDPH distributed 2 fact sheets at this session; one on general arsenic health concerns and the site, and one on Veteran's Field and environmental health concerns.

2. CTDPH responded to health questions and concerns from the NLHD, parents, teachers, school nurses, and physicians.
3. CTDPH distributed a fact sheet to the local teacher's union which addressed both general arsenic exposure concerns related to Veteran's Field as well as information on the usefulness of urine arsenic testing.
4. CTDPH participated in three site visits with CTDEP, NHLHD, and contractors to gather site related information about the Field. In addition, CTDPH also visited Edgerton Elementary School to meet with the NHLHD and the school custodian to discuss soil contamination issues as well as general maintenance and cleanliness issues.

Actions Planned

1. CTDPH will make this health consultation available to residents and property owners of the site.
2. CTDPH will continue to work with CTDEP and NLHD to respond to health questions and concerns regarding cleanup and future use of Veteran's Field.
3. CTDPH will review any additional data for this site and update this health consultation, if necessary.

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CERTIFICATION

The Health Consultation for the Evaluation of Environmental Data for Edgerton Elementary and Veteran's Field in New London, Connecticut was prepared by the Connecticut Department of Public Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It was completed in accordance with approved methodology and procedures existing at the time the health consultation was initiated. Editorial review was completed by the ATSDR Cooperative Agreement Partner.

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

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