

Health Consultation

REVIEW OF SEDIMENT DATA OF SYLVESTER'S
(A/K/A) GILSON ROAD SITE

NASHUA, HILLSBOROUGH COUNTY, NEW HAMPSHIRE

EPA FACILITY ID: NHD099363541

AUGUST 19, 2005

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Division of Health Assessment and Consultation
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

You May Contact ATSDR TOLL FREE at
1-888-42ATSDR

or

Visit our Home Page at: <http://www.atsdr.cdc.gov>

HEALTH CONSULTATION

REVIEW OF SEDIMENT DATA OF SYLVESTER'S (A/K/A) GILSON ROAD SITE

NASHUA, HILLSBOROUGH COUNTY, NEW HAMPSHIRE

EPA FACILITY ID: NHD099363541

Prepared by:

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

Table of Contents

Sylvester’s (a.k.a.) Gilson Road Site	1
Nashua, Hillsborough County, New Hampshire.....	1
Purpose.....	2
Background.....	2
Discussion	3
Sampling	3
Sediment Sample Location	4
Children’s Health Considerations	5
Conclusions.....	6
Recommendations.....	6
Public Health Action Plan.....	6
Author	7
Certification	9
APPENDIX A: Sediment Sampling Sites.....	10
APPENDIX B: Calculations	11

Purpose

The New Hampshire Department of Environmental Services, Bureau of Environmental and Occupational Health (BEOH) evaluated potential public health impacts associated with exposure to sediments in wetlands areas near the Sylvester's (a.k.a.) Gilson Road Site in Nashua, New Hampshire. This was done in response to a request by the Department of Environmental Services (DES), Hazardous Waste Remediation Bureau (HWRB), concerning possible impacts to off-site environmental media. This health consultation documents our assessment, conclusions, recommendations, and public health action plan. It was prepared in cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR).

Background

The 28-acre Gilson Road Site is located in a rural, residential area of Nashua, New Hampshire. The site originally operated as a commercial source of sand. During the late 1960s, the owner started illegally disposing wastes in a six-acre portion of the site. This included household waste, demolition materials, chemical sludge, and hazardous liquid waste. These wastes contaminated area groundwater with volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and metals.

During the late 1970s - early 1980s, the U.S. Environmental Protection Agency (EPA), and the State of New Hampshire, took action to mitigate the effects of illegal waste dumping at this site. This included removing numerous drums containing hazardous wastes and fencing the disposal area to restrict access to the site. A temporary groundwater interception and recirculation system was also installed to prevent contaminants from further impacting the aquifer. In addition, the City of Nashua extended the municipal water system to residential areas surrounding the site (1).

The Gilson Road Site was added to the National Priorities List in 1983. Since then, an impervious membrane cap and a slurry wall surrounding a 20-acre portion of the site have been constructed to prevent migration of contaminants to off-site groundwater. A ground-water treatment facility was constructed to remove contaminants. Active groundwater treatment was completed in 1996, and groundwater monitoring continues at the site. A public health assessment conducted in 1989 identified past exposures to site-related contaminants as a concern, and recommended continued environmental monitoring (2).

The New Hampshire DES initially requested that BEOH review results for sediment samples collected on 15 July 2003 to evaluate implications for human health (3). Upon review of this data (Table 1), BEOH identified concerns about potential "Hot Spots" of arsenic in wetlands areas downstream from the site. Subsequently, EPA/Region 1, ATSDR, and BEOH agreed on the need for additional arsenic data as part of this evaluation (4). This health consultation focuses on arsenic results for sediment samples collected on 15 July 2003 and 9 November 2004.

Table 1. Maximum Sediment Metal Concentrations (ppm) for Sylvester's Site, Nashua, New Hampshire and Comparison Values (ppm).

Metal	Maximum Concentration (ppm)	Comparison Value (ppm)	Comparison Value Reference
Arsenic (As)	1170	20	EMEG
Barium (Ba)	161	4000	RMEG
Cadmium (Cd)	7.7	10	EMEG
Chromium (Cr)	103	210	PRG
Lead (Pb)	193	400	RCMP
Mercury (Hg)	1.22	23	PRG
Selenium (Se)	3.67	300	EMEG
Silver (Ag)	ND(2.5)	300	RMEG

EMEG: ATSDR Environmental Media Evaluation Guide (Soil)

RCMP: NH DES Risk Characterization Management Policy

RMEG: Reference Dose Media Evaluation Guide

PRG: EPA Region 9 – Preliminary Remediation Goal

ppm: parts per million

Discussion

Sampling

During the two sampling events, 19 sediment samples, including 2 duplicate samples, were collected in wetland areas adjacent to the site (Appendix A). Sampling locations were similar in both sampling events, however, a greater percentage of the samples collected on 9 November 2004 were in proximity to the location of sample SED-2, which had the highest arsenic concentration in the initial sampling. Samples collected on 9 November 2004 were analyzed only for total arsenic (5, 6).

Arsenic concentrations ranged from 4.7 -1170 ppm in the first sampling round and from 4.7- 541 ppm in the second sampling round (Table 2). Thirteen of the 19 samples analyzed (68%) exceeded the ATSDR soil comparison value for arsenic (20 ppm). One sample was slightly below the comparison value, and the remaining five samples had arsenic concentrations at, or below, background levels (6, 7, 8,).

Table 2. Sediment Arsenic Concentrations (ppm) for the Sylvester's Site, Nashua,
New Hampshire

Sediment Sample Location	1 st Sample Round	2 nd Sample Round	HOT SPOT
SED-1	10.5	4.7	
SED-2 & SED-2 DUP	1170 (1170 dup.)	28.6	*
SED-2A	261	131	*
SED-3	73.5	19.9	
SED-4	663	390	*
SED-4 DUP	No sample taken	541	See SED-4
SED-5	39.1	No sample taken	
SED-6	7.33	No sample taken	
SED-7	4.7	No sample taken	
SED-9	7.33	No sample taken	
SED-1B	No sample taken	120	
SED-1C	No sample taken	69.5	
SED-2C	No sample taken	42.2	

First Sample Round: July 15, 2003

Second Sample Round: November 9, 2004

*- Indicates potential "hot spot"

Toxicological Evaluation

Exposure to a chemical at a concentration which exceeds its health-based comparison value does not necessarily mean that an individual will experience adverse health effects. It does mean that additional evaluation is required to determine if a health hazard actually exists. The locations where elevated arsenic levels were found are in proximity to residential areas downstream from the site. These wetlands are accessible to local residents, especially older children, who may be drawn to these areas for recreational activities.

Arsenic has been classified by EPA as a known human carcinogen based on sufficient evidence of carcinogenicity from human data (9). Ingestion of elevated levels of inorganic arsenic has been associated with increased risk for cancer of the liver, bladder, kidneys, prostate and lungs. A number of non-cancer adverse health effects have also been associated with exposure to inorganic arsenic. Skin changes, irritation of the stomach and intestines, and nerve damage to the extremities have been associated with ingestion of inorganic arsenic, but at higher doses than have been calculated for this pathway (10) at this site.

Hazard quotients and cancer risk estimates for incidental ingestion and dermal exposure pathways were derived using exposure parameters from the USEPA Exposure Factors Handbook and methodology described in the ATSDR Public Health Assessment Guidance Manual (11). Calculations are provided in Appendix B.

“Average” Arsenic Concentration

BEOH evaluated an exposure scenario for older child trespassers who may be exposed to arsenic in sediments through incidental ingestion and dermal contact while recreating in the general wetlands area. Exposure to an average arsenic concentration of 36.3 ppm, calculated by excluding the area “Hot Spots”, represents a slight increased theoretical cancer risk (the potential for 2.6 excess cancers per million exposed) for children who may recreate in these wetlands areas. This theoretical excess cancer risk is not considered to be significant.

The potential for non-carcinogenic health effects to occur was also evaluated through a direct comparison with the ATSDR Minimum Risk Level (MRL) of 3.0×10^{-4} mg/kg/day (identical value as the EPA’s Oral Reference Dose)(9). BEOH determined that the average daily dose calculated for arsenic did not exceed the established Reference Dose. It is unlikely, therefore, that trespassers recreating in these areas would experience adverse non-cancer type health effects as a result of these exposures.

“Hot Spots”

BEOH evaluated an exposure scenario for older children who may be exposed to arsenic in sediments through incidental ingestion and dermal contact while recreating in the specific areas where high arsenic levels have been identified. Exposure to the maximum arsenic concentration (1170 ppm) represents a low-to-moderate increased theoretical cancer risk for children who may recreate in these wetlands areas. This is based on the very conservative assumption that an older child will exclusively contact contaminated sediments in a “Hot Spot” area, and very likely over estimates the actual cancer risk for a trespasser who may access these areas.

The potential for oral and dermal non-carcinogenic health effects to occur was also evaluated through a direct comparison with the ATSDR MRL, and a literature review of the toxicological studies published by ATSDR. BEOH determined that the average daily dose calculated for arsenic did not exceed the established ATSDR MRL. It is unlikely, therefore, that adverse health effects would occur as a result of exposure to contaminated sediments.

Children’s Health Considerations

The New Hampshire BEOH evaluated potential exposures for children to site-related contaminants in accordance with the ATSDR Child Health Initiative. Children may have a greater health risk of exposure to hazardous substances released into the environment because they spend a good deal of time playing outdoors. Thus, children can have an increased likelihood of contacting harmful chemicals which are present in air, soil or water. Also, children depend on adults for risk identification and management decisions, and for access to medical care.

The northwest portion of the site, located east of Trout Brook Drive, and the wetland area at the confluence of Lyle Reed Brook and Trout Brook (located east of West Hollis Street) have been identified as “Hot Spots” for arsenic in sediment. Although there is a theoretical increased health

risk associated with children that contact contaminated sediment in these hot spots, the hot spots comprise only a small portion of the total wetlands area. It is unlikely that children would access these hot spots to an extent where there would be a significant health risk.

Conclusions

A conservative evaluation of available data, exposure to arsenic in wetlands sediments indicated that adverse health effects for older children, who are most likely to venture into these wetlands areas, are not expected. Therefore, BEOH considers exposure to arsenic-contaminated sediments at this site to pose no apparent public health hazard.

Sampling of wetland sediment indicated some areas with very high arsenic levels. It is unlikely that older children living near the site would have sufficient contact with these areas to put them at a health risk. There is a theoretical increased health risk associated with exposure to arsenic at these elevated concentrations. As a precaution, local residents should limit their exposure to contaminated sediments at these locations.

Recommendations

1. Limit exposure to contaminated sediments in the hot spot areas (e.g. SED-2, SED-2A & SED-4) for children living in adjacent residential neighborhoods.
2. Further characterization of wetlands sediments should be made to identify other potential “Hot Spots” in the area of the Sylvester’s Site.

Public Health Action Plan

The following actions have been completed, are on-going, or are planned for mitigating exposures to environmental contaminants and protecting public health at this site:

Completed Actions

- Site access restricted (fencing)
- Clean-up and disposal of on-site hazardous wastes
- Impervious cap installed on previous disposal area
- Slurry wall installed surrounding 20-acre portion of site
- Evaluation of arsenic in wetland areas downstream from the site

Ongoing Actions

- Long-term remediation and environmental monitoring

Planned Actions

- DES will continue long-term environmental monitoring
- BEOH will evaluate additional environmental data that become available

Author

Eric Abrams, Health Risk Assessor
Bureau of Environmental and Occupational Health
Office of the Commissioner
New Hampshire Department of Environmental Services
(603) 271-5870
e-mail: Eabrams@des.state.nh.us

References

1. USEPA (U.S. Environmental Protection Agency). 2004. Site Narrative for Sylvester's (a.k.a. Gilson Road). Boston, MA: Environmental Protection Agency, New England Region . May 4, 2004.
2. ATSDR (Agency for Toxic Substances and Disease Registry). 1989. Public Health Assessment for Sylvester's (Gilson Road Site). Atlanta, Georgia: Agency for Toxic Substances and Disease Registry, U.S. Department of Health and Human Services.
3. NH DES (New Hampshire Department of Environmental Services). Personal Communication with Andrew J. Hoffman, DES-Waste Management Division. October 10, 2003.
4. NH DES. 2004. Conference call: participants included ATSDR, U.S. EPA Region 1 and DES. September 17, 2004.
5. NH DES. 2004. Health Consultation for Sylvester's (Gilson Road Site). Concord, NH: DES, BEOH. August 16, 2004.
6. NH DES. 2004. Gilson Road Sediment Sampling Data. Concord, NH: DES, Waste Management Division. November 9, 2004.
7. NH DES. 2003. Gilson Road Sediment Sampling Data. Concord, NH: DES, Waste Management Division. July 15, 2003.
8. NH DES. 2001. Contaminated Sites Risk Characterization Management Policy. Concord, NH: NH Department of Environmental Services.
9. U.S. EPA 2004. Integrated Risk Information System (IRIS). Office of Research and Development, National Center for Environmental Assessment, Environmental Protection Agency. August 5, 2004.

10. ATSDR. 2000. Toxicological Profile for Arsenic. Atlanta, Georgia: Agency for Toxic Substances and Disease Registry, U.S. Department of Health and Human Services.
11. ATSDR. 2005. Public Health Assessment Guidance Manual. Atlanta, Georgia: Agency for Toxic Substances and Disease Registry, U.S. Department of Health and Human Services.

Certification

This Gilson Road public health consultation was prepared by the New Hampshire Department of Environmental Services, Bureau of Environmental and Occupational Health, under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with methods and procedures approved at the time the investigation was initiated. Editorial review was completed by the Cooperative Agreement partner.

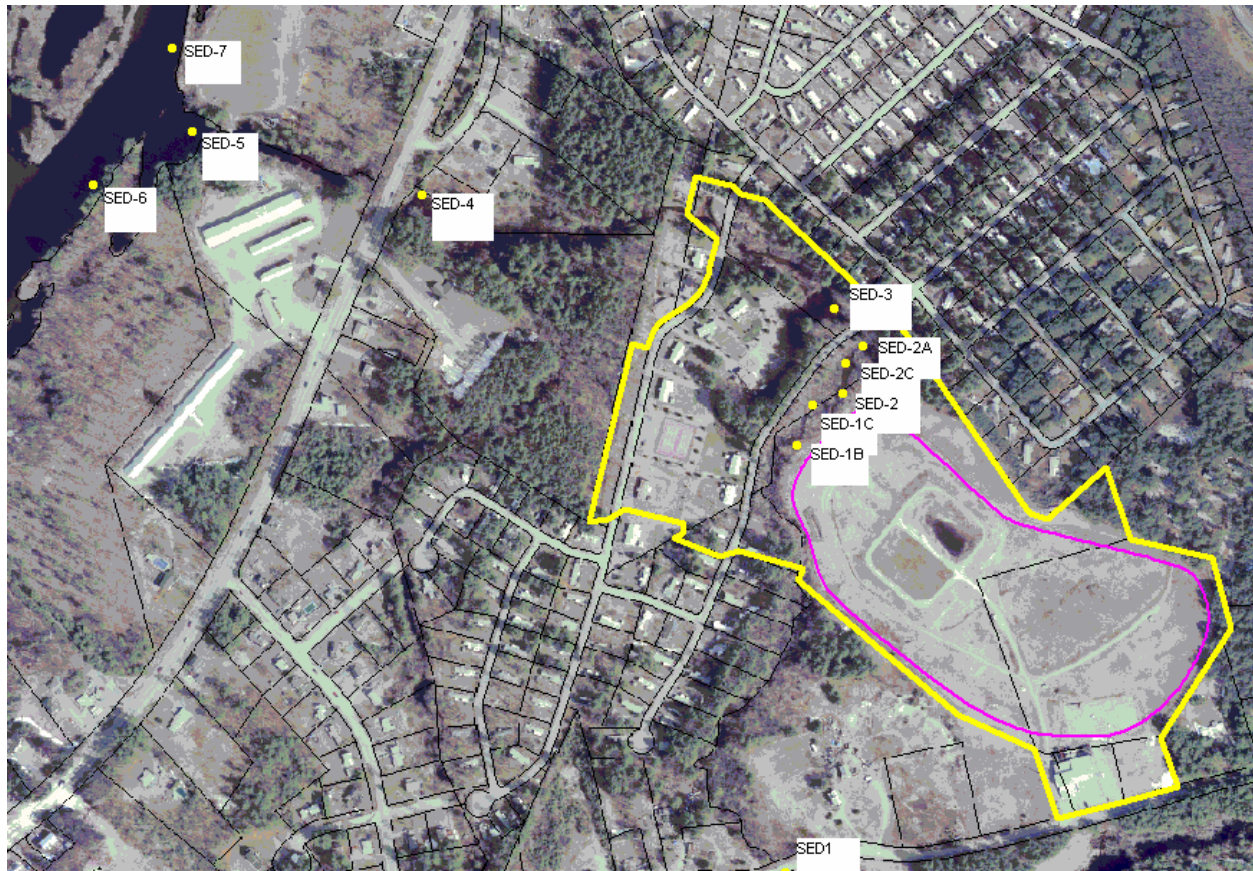
Technical Project Officer, Cooperative Agreement Team, SPAB, DHAC, ATSDR

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

Cooperative Agreement Team Leader, SPAB, DHAC, ATSDR

APPENDIX A: Sediment Sampling Sites

Figure 1. Locations of the 1st and 2nd Round Sediment Sampling Sites



APPENDIX B: Calculations

I. Cancer Risk

An elevated cancer risk is calculated by multiplying the Chronic Daily Intake due to ingestion (CDI_i) by the Cancer Slope Factor (SF). The incidental ingestion (CDI_i) is calculated by the following equation:

A. Incidental Ingestion

$$CDI_i = \frac{CS \times IR \times EF \times ED \times CF}{BW \times AT_c}$$

Where:

CDI_i =	Chronic Daily Intake due to ingestion (mg/kg body weight/day)
CS =	Chemical Concentration
CF =	Conversion Factor of: 10^{-6} kg/mg
EF =	Exposure Frequency = 40 days per year
ED =	Exposure Duration = 10 years
IR =	Ingestion Rate = 50 mg sediment/day
BW =	Body Weight = 53 kg
AT_c =	Averaging Time for cancer risk = 25,550 days

B. Dermal Contact

The CDI due to dermal contact with arsenic in sediment is calculated with the following equation:

$$CDI_d = \frac{CS \times SA \times AF \times EF \times ED \times DAF \times CF}{BW \times AT_c}$$

Where:

CDI_d =	Chronic Daily Intake for dermal exposure (mg/kg body weight/day)
CS =	Chemical Concentration
AF =	Skin Adherence Factor = 0.3 mg sediment/cm ²
DAF =	Dermal Absorption Factor = 0.03 (unitless)
CF =	Conversion Factor of: 10^{-6} kg/mg
EF =	Exposure Frequency = 40 days per year
ED =	Exposure Duration = 10 years
SA =	Skin Surface Area (available for contact) = 4,700 cm ²
BW =	Body Weight = 53 kg
AT_c =	Averaging Time for cancer risk = 25,550 days

C. Cancer Risk

$$\text{Cancer Risk} = \text{SF} (\text{CDI}_i + \text{CDI}_d)$$

Where:

SF =	Slope Factor = $1.5 (\text{mg/kg body weight/day})^{-1}$
CDI_i =	Chronic Daily Intake due to ingestion (mg/kg body weight/day)
CDI_d =	Chronic Daily Intake for dermal exposure (mg/kg body weight/day)

II. Non-Cancer Risk

The non-cancer risk is calculated by dividing the reference dose (RfD) by the Average Daily Dose (ADD) associated with incidental ingestion and dermal exposure to the contaminant.

A. Incidental Ingestion

The ADD for ingestion (i.e. ADD_i) is calculated with the following equation:

$$\text{ADD}_i = \frac{\text{CS} \times \text{IR} \times \text{EF} \times \text{ED} \times \text{CF}}{\text{BW} \times \text{AT}_{\text{nc}}}$$

Where:

ADD_i =	Average Daily Dose, ingestion (mg arsenic/kg body weight/day)
CS =	Chemical Concentration
EF =	Exposure Frequency = 40 days per year
ED =	Exposure Duration = 10 years
CF =	Conversion Factor of: 10^{-6} kg/mg
IR =	Ingestion Rate = 50 mg sediment/day
BW =	Body Weight = 53 kg
AT_{nc} =	Averaging Time for non-cancer effects = 3,650 days

B. Dermal Contact

The ADD for dermal contact (i.e. ADD_d) is calculated with the following equation:

$$\text{ADD}_d = \frac{\text{CS} \times \text{SA} \times \text{AF} \times \text{EF} \times \text{ED} \times \text{DAF} \times \text{CF}}{\text{BW} \times \text{AT}_{\text{nc}}}$$

Where:

ADD _d =	Average Daily Dose, dermal (mg arsenic/kg body weight/day)
CS =	Chemical Concentration
AF =	Adherence Factor = 0.3 mg sediment/cm ²
DAF =	Dermal Absorption Factor = 0.03 (unitless)
CF =	Conversion Factor of: 10 ⁻⁶ kg/mg
EF =	Exposure Frequency = 40 days per year
ED =	Exposure Duration = 10 years
SA =	Skin Surface Area (available for contact) = 4,700 cm ²
BW =	Body Weight = 53 kg
AT _{nc} =	Averaging Time for non-cancer risk = 3,650 days

C. Non-Cancer Risk

The non-cancer risk is expressed as a Hazard Index (HI) which is calculated by dividing the total ADD by the oral reference dose (RfD). The RfD is the dose that is associated with no adverse effects. The RfD for arsenic is 3.0 x 10⁻⁴ mg arsenic/kg body weight/day (IRIS). . The non-cancer risk for the combined ingestion and dermal exposure is calculated with the following equation:

$$HI = \frac{ADD_i + ADD_d}{RfD}$$

Where:

HI =	Hazard Index
ADD _i =	Average Daily Dose, ingestion in: mg/kg body weight/day
ADD _d =	Average Daily Dose, dermal in: mg/kg body weight/day
RfD =	Reference Dose (= 3.0 x 10 ⁻⁴ mg/kg body weight/day)