

Health Consultation

BEAR BROOK VILLA

ALLENSTOWN, MERRIMACK COUNTY, NEW HAMPSHIRE

SEPTEMBER 30, 2006

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

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HEALTH CONSULTATION

BEAR BROOK VILLA

ALLENSTOWN, MERRIMACK COUNTY, NEW HAMPSHIRE

Prepared by:

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

SUMMARY AND STATEMENT OF ISSUES

On July 21, 2006, the New Hampshire Department of Environmental Services (DES), Air Resources Division (ARD) was contacted by a resident of Bear Brook Villa Mobile Home Park (BBV) in Allenstown, Merrimack County, New Hampshire. The resident complained of respiratory and other symptoms (including difficulty breathing, sore throat, and nausea) that might be related to chemical and sewage odors emanating from the septic system leach field servicing the park. Representatives of the ARD Compliance Bureau visited the site to investigate the physical layout of the park, interview residents, and collect ambient air samples. The DES Subsurface Systems Bureau and the Water Supply Engineering Bureau have also responded to this resident's complaints.

The Environmental Health Program (EHP) was contacted to evaluate ambient air data from BBV for possible connections between air quality and the short-term health problems reported by area residents. EHP evaluated the exposure scenario and the environmental data that the Compliance Bureau collected. This health consultation presents an evaluation of the public health hazard from inhalation of ambient air in the vicinity of BBV. Based on the air sampling data collected, EHP concludes that adverse health effects are not expected to result from inhalation exposure to ambient air at BBV. Thus, EHP has categorized the site as "No Apparent Public Health Hazard" according to the Hazard Classification System developed by the Agency for Toxic Substances and Disease Registry.

PURPOSE

The Agency for Toxic Substances and Disease Registry (ATSDR) is a non-regulatory federal agency mandated by Congress to assess the public health impact of exposure to hazardous substances released to the environment. To fulfill its mandate, ATSDR enters formal partnerships with state agencies throughout the nation to carry out site-related evaluations on environmental exposures and public health. For 17 years, ATSDR and EHP have maintained a cooperative agreement to conduct these activities in the state. EHP is a non-regulatory program within DES. It functions independently of DES regulatory programs to assess the human health implications of hazardous chemical releases, and to make recommendations to protect the public health.

The purpose of this health consultation is to assess the public health significance of exposure to potential contaminants in ambient air near BBV. It evaluates the available environmental data made available to EHP from the recent air sampling event at that location. The operational adequacy and environmental compliance of the site's septic system is currently being investigated by the DES Subsurface Systems Bureau. The drinking water supplied to BBV residents is also being investigated by the DES Water Supply Engineering Bureau.

BACKGROUND

Bear Brook Villa is a mobile home park located approximately 500 feet west of Bear Brook State Park in Allenstown, New Hampshire. An area map is presented in Appendix A (1). Effluent from many homes in BBV is managed by a centrally-located, common septic system. Sections of the system's tanks, manhole covers, piping, leach fields, and vent pipes are located in subsurface portions of a green space within Chambers Circle. Additional individual-home septic systems and leach fields are located directly adjacent to several residences, including that of the complainant. The closest that a septic system vent pipe is located to any home is approximately 100-feet (2).

In mid-July, sulfuric acid was added to BBV's common septic system. According to DES e-mails, phone logs and interviews, residents reported experiencing respiratory symptoms shortly afterward. Residents reported that these health effects occur while in their homes, but otherwise subside. One resident, however, claimed that her symptoms did not subside, and diminished only when she was away from BBV. This individual resides in the western portion of BBV, outside of the Chambers Circle green space. The residence is situated in a low-lying section of the park, and has a leach field immediately adjacent to it. This particular leach field functions independently of the common system and was not chemically treated. For purposes of evaluating exposure, it is assumed that residents use their backyards for leisure and recreation, and that children play in the immediate area of BBV (2).

DISCUSSION

A. Exposure Pathways

Human exposure to environmental contamination occurs only when there is a completed pathway. A *completed* pathway exists when the following five critical elements are present: 1) a source of contamination or release (subsurface soil); 2) environmental fate and transport (ambient air); 3) a point or area of exposure (Bear Brook Villa); 4) a route of human exposure (inhalation); and 5) a receptor population (residents of Bear Brook Villa). These five elements largely determine the extent of past, present, or future site-related exposures. In a *potential* exposure pathway, one or more of the critical elements may not be present, but information is insufficient to eliminate or exclude it. For example, an exposure could have occurred in the past, could be occurring currently, or could occur in the future. An exposure pathway is *eliminated* if one or more of the critical elements are missing. Eliminated exposure pathways may also be referred to as incomplete. Characteristics of the BBV site make current and future exposures unlikely (8).

Table 1 presents onsite pathways for the BBV site. These pathways are analyzed and discussed in the remaining sections of this health consultation. Ambient air near residences in BBV is considered onsite.

Table 1. Onsite Pathways of Bear Brook Villa Mobile Home Park.

Source	Environmental Transport And Media	Exposure Point	Exposure Route	Exposed Population	Time Frame	Status
Septic System Vents	Subsurface soil to Ambient Air through septic system vent pipe	Ambient Air Onsite	Inhalation	Area Residents	Past	Potential
					Present	Potential
					Future	Potential

The sulfuric acid chemicals added to the BBV common septic tank have the potential to react with the tank contents. Vent pipes and manhole covers are conduits for septic vapors to reach the ground surface and pass into ambient air. If there are enough gaseous vapors emanating from the underground structures, then nearby residents could be exposed by breathing the air.

B. Environmental Contamination Data

An integral element of every public health consultation is a review of environmental contamination at the site. In the preceding section, one potential pathway for possible human exposure was identified (ambient air). This section examines onsite contaminants that may pose a hazard for area residents. Environmental sampling results are summarized below for this potential pathway. Sampling locations and parameters were selected based on: 1) reported health symptoms; 2) confirmed activities at the site (sulfuric acid added to the common septic tank); 3) potential chemical reactions in the affected septic system and subsurface soil; 4) DES field ambient air instrument readings {photoionization detector [PID] and flame ionization detector [FID]}; and 5) the prevailing wind direction during DES sampling (2).

1. *Onsite Ambient Air*

- a. On August 10, 2005, two ambient air samples were collected from immediately outside 68 Chambers Circle, and at the leach field vent pipe upwind from the nearest residence. These two-hour duration samples were collected and subsequently analyzed for sulfuric acid content by NIOSH Method 7903. Sulfuric acid was not detected at concentrations above the laboratory detection limit of 0.17 mg/m³ (3).
- b. On August 10, 2005, an ambient air grab sample was collected in a Silco summa canister. The sample was collected adjacent to a leach field vent pipe (directly upwind from the nearest mobile home in BBV). This sample represented a worst-case scenario for exposure. Samples were analyzed for volatile organic compounds (VOCs) by EPA Method TO-15. None of the

compounds were detected at levels above comparison values. Table 2 outlines the specific concentrations for each VOC compound sampled (3).

C. Environmental Data Evaluation & Contaminants of Concern

After exposure pathways are designated and environmental data are summarized, site-related ambient air contaminants are evaluated. EHP uses a protective approach to determine whether air contaminant levels constitute a potential health hazard. This two-step methodology evaluates potential contaminants identified in this health consultation. First, air monitoring data are gathered and a comprehensive list of possible site-related pollutants, or contaminants of concern (COC), is compiled. The environmental concentration of each contaminant is compared to health-based comparison values (CVs) to identify pollutants that do not have a realistic possibility of causing adverse health effects. These are eliminated from further analysis. In the second step, contaminants with levels that exceed CVs, or are of specific concern to the community, are subjected to a thorough scientific literature review to determine whether or not their levels present a public health hazard. Since CVs are based on conservative, protective assumptions, the presence of contaminants above their CVs does not necessarily mean that exposed individuals will experience adverse health effects (4).

Specific CVs employed in this health consultation coincide with the duration of exposure expected at the BBV. They reflect an *intermediate* exposure period of 15 to 365 days (4). When intermediate CVs were not available, more protective *chronic exposure* values were utilized. Given the short time period involved and because the primary contaminant of concern is a non-carcinogen, EHP used non-cancer CVs in this evaluation.

1. Onsite Ambient Air – Inhalation Pathway

Table 2. Ambient “Air Toxics” Concentrations and Respective CVs (5, 6, 7, 8)

Contaminant	Maximum Concentration (ug/m ³)	Non-Cancer CV (ug/m ³)
Sulfuric Acid	ND (Detection Limit 170)	200.0(1)
Chloromethane	1.0	400.0(2) intermediate
1,3 Butadiene	ND (Detection Limit 0.027)	2.0(3)
Acetonitrile	0.27	60.0(3)
Carbon disulfide	ND (Detection Limit 0.10)	700.0(3)
Methyl-t-butyl-ether	0.051	2000.0(2) intermediate
Methyl ethyl ketone	2.4	5000.0(3)
n-Hexane	0.097	700.0(3)
1,1,1-Trichloroethane	0.016	4000.0(2) intermediate
Benzene	0.16	20.0(2) intermediate
Carbon tetrachloride	0.48	200.0(2) chronic
Toluene	0.29	300.0(2) chronic
Ethylbenzene	0.057	1000.0(3)
Total Xylenes	0.13	200.0(2) chronic

Ethylene oxide	0.23	200.0 ₍₂₎ intermediate
Methylene chloride	0.11	1000.0 ₍₂₎ intermediate
Chloroform	0.065	200.0 ₍₂₎ intermediate
Trichloroethylene	ND (Detection Limit 0.13)	500.0 ₍₂₎ intermediate
2,2,4-Trimethylpentane	0.047	None Available
Tetrachloroethylene	ND (Detection Limit 0.18)	300.0 ₍₂₎ chronic
Styrene	ND (Detection Limit 0.048)	300.0 ₍₂₎ chronic
p-Dichlorobenzene	ND (Detection Limit 0.28)	0.31 ₍₄₎
Vinyl chloride	ND (Detection Limit 0.04)	80.0 ₍₂₎ intermediate
Acrylonitrile	ND (Detection Limit 0.12)	2.0 ₍₃₎
1,1-Dichloroethene	ND (Detection Limit 0.066)	80.0 ₍₂₎ intermediate
1,1-Dichloroethane	ND (Detection Limit 0.088)	520 ₍₃₎
1,2-Dichloroethane	ND (Detection Limit 0.077)	2000.0 ₍₂₎ chronic
1,2-Dichloropropane	ND (Detection Limit 0.057)	30.0 ₍₂₎ intermediate
cis-1,3-Dichloropropene	ND (Detection Limit 0.078)	0.48 ₍₃₎
trans-1,3-Dichloropropene	ND (Detection Limit 0.072)	0.48 ₍₃₎
1,2-Dibromomethane	ND (Detection Limit 0.21)	9.0 ₍₃₎
Chlorobenzene	ND (Detection Limit 0.16)	62.0 ₍₃₎
1,1,2,2-tetrachloroethane	ND (Detection Limit 0.50)	3000.0 ₍₂₎ intermediate

Comparison Value Sources

- (1) – ACGIH Threshold Limit Value (time-weighted average)
- (2) – ATSDR RMEG/MRL
- (3) – EPA Reference Concentration (RfC)
- (4) – EPA Region 9 Preliminary Remediation Goal (PRG)

D. Public Health Implications of Exposure

This section evaluates the public health implications of air contaminants measured at BBV. Available monitoring data indicate that air contaminant levels were all below the applicable health-based CVs. However, sulfuric acid was selected for further public health evaluation because: 1) it was specifically mentioned as a core COC in the initial resident complaint; and 2) DES confirmed that it was added to the onsite septic system. Following is a review of the scientific literature on the health effects of sulfuric acid.

1. Sulfuric Acid

Sulfuric acid is a clear, colorless, corrosive oily liquid. The odor threshold of sulfuric acid in air is estimated to be 100 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) of air. Sulfuric acid is found in the air as small droplets or attached to small particles. It dissolves in air moisture, and can remain suspended for varying periods of time. It can irritate the nose and throat and cause difficulties breathing if inhaled. Breathing small droplets of sulfuric acid in the air may make it more difficult to breathe. This effect is more likely to occur during exercise or among asthmatics. Common household exposures to sulfuric acid can

occur from mixing certain toilet bowl cleaners with water, or from cutting onions. This causes the chemical propanethiol S-oxide to react with water in the eyes forming sulfuric acid, which results in watery eyes (9).

When concentrated sulfuric acid is mixed with water, the temperature of the resultant solution increases. This increases the likelihood of fumes being created. The extent to which sulfuric acid affects the pH of water depends upon the amount added, and on the neutralizing capabilities of other substances in the solution (9). Sulfuric acid was added to the BBV's common septic system tank containing water and sewerage. The magnitude of the increase in temperature and pH level, and the extent of chemical reaction in the septic tank are determined by the amount added. This amount is unknown. It is plausible that gaseous vapors formed inside the septic tank as a result of increased temperature and chemical reactivity. As additional water and sewerage were added to the tank through normal use, the chemical reactions and pH levels would have declined. Thus, vapors emanating from the manholes, vent pipes, and leach fields would also diminish accordingly.

The present concentrations of sulfuric acid at BBV are not detectable by standard measuring instruments. Past levels of sulfuric acid in ambient air are unknown. Scientific literature shows that the lowest levels at which adverse health effects result from exposure to sulfuric acid are almost half that of the worst-case level (method detection limit of 170 ug/m³) measured at BBV. The particular study on which this level is based evaluated asthmatics over a two-day acute exposure period. Therefore, it is unlikely that residents living at BBV would experience adverse health effects as a result of these ambient air exposures. The site is categorized as "No Apparent Public Health Hazard."

CONCLUSIONS

1. The addition of chemicals to the BBV common septic system could have resulted in detectable contaminant levels in ambient air prior to ARD testing. However, these previous air contaminant levels are unknown.
2. Exposures to current contaminant levels measured in ambient air are not expected to result in adverse health effects. Therefore this pathway poses *no apparent public health hazard*.

RECOMMENDATIONS

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

- Cease use of chemical additives in the common BBV septic system.
- If respiratory effects continue, residents are encouraged to consult a board-certified allergist to explore alternative causes for their symptoms.

- EHP staff will evaluate any additional air monitoring data that may become available.

PREPARERS OF THE REPORT

Report Authors

Eric K. Abrams, M.S., Environmental Health Risk Assessor
Dennis Pinski, M.P.H., Supervisor, Environmental Health Program
John Colby, Jr., Ph.D., Environmental Epidemiologist
New Hampshire Department of Environmental Services
Environmental Health Program
Air Resources Division
29 Hazen Drive
Concord, New Hampshire 03301

ATSDR Technical Project Officer

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

ATSDR Regional Representatives

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

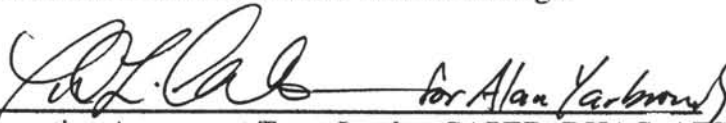
Certification

This health consultation on the evaluation of air data for the Bear Brook Villa Site was prepared by the New Hampshire Department of Environmental Services, Environmental Health Program, under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It was prepared in accordance with methods and procedures approved at the time the consultation was initiated. Editorial review was completed by the Cooperative Agreement partner.



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

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



for Alan Yarbrow

Cooperative Agreement Team Leader, CAPEB, DHAC, ATSDR

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APPENDIX A

Figure 1. Street Map for Bear Brook Village Area

