Commonwealth of Pennsylvania
Department of Environmental Protection
September 11, 2008

SUBJECT: Indoor Air Quality Sampling Results – Bishop Tube Site

TO: File

FROM: Dustin A. Armstrong
Project Officer
Environmental Cleanup
Southeast Regional Office

In April 2008, the Department collected samples to evaluate the vapor migration/intrusion pathway at the Bishop Tube site. Sampling was conducted at three private residences located adjacent to the former Bishop Tube property. This memorandum is intended to summarize the results of this sampling

Background

The Hazardous Sites Cleanup Program and its contractors have been investigating the former Bishop Tube site since 2001. The former Bishop Tube Company is located at 1 South Malin Road, East Whiteland Township, Chester County. A site location map is attached as Figure 1. The Department's investigations have revealed high concentrations of chlorinated solvents (primarily TCE and associated daughter products) in soils and groundwater on the site. Off-site groundwater and surface water contamination has also been confirmed. The Phase III Site Characterization Report focusing on groundwater, prepared by Baker Environmental, recommended evaluation of the vapor intrusion pathway because of the potential for migration of contaminated groundwater toward the nearby General Warren Village residential area. Results of shallow groundwater sampling performed east (across relative to the site) of Little Valley Creek have revealed eleveated concentrations of TCE and other site contaminants. Groundwater in this area is shallow (< 5 ft. below ground surface). These conditions result in a potential for vapor intrusion into buildings resulting from the groundwater to indoor air exposure pathway.

In January 2005 the Department collected an indoor air and ambient (outdoor) sample at 97 Village Way, the nearest residence to the Site. Results did not indicate indoor air concentrations of volatile organic compounds at levels of concern. However, a number of potentially site related contaminants were detected. The Department was not granted permission to collect a follow-up sample at the residence.

The Department performed sampling at 97 Village Way, and at two additional residences on March 25 and 26, 2008 to further evaluate the pathway. Homes sampled in this event are shown on Figure 2.

Procedures

Air (indoor and outdoor/ambient) samples and water samples were collected as part of the evaluation. Air sampling was performed using evacuated canisters and 24-hr regulators supplied by the Department's Air Toxics Section in Central Office. Water samples were collected from sump pits within the basements at 92 and 95 Village Way. Prior to sampling the basement areas were inspected for the presence of materials which could interfere with sampling results.

Water level readings were collected at the Stream Monitoring Point (SMP) wells located between the site and General Warren Village and weather conditions were recorded at the time of sampling. SMP water level data is attached as Appendix B.

Air samples were sent to the Department's Bureau of Laboratories (BOL) for analysis using BOL's VOA-6 analytical procedure. Water samples were sent to BOL for VOA-1 analysis. The results were reported to the homeowners in letters dated April 25, 2008. These letters are attached to this memorandum (Appendix F).

Discussion

Analytical results from the indoor air and sump sampling are attached to this document (Appendix E). Several volatile organic compounds were detected in the ambient (outdoor) and basement samples. No volatile organic compounds were detected in the two sump samples. The list of detected compounds was compared with compounds detected in groundwater at the Bishop Tube Site. The following chlorinated solvents detected in Bishop Tube site groundwater were detected in at least one indoor air sample (number in parenthesis indicates frequency of detection): tetrachloroethene (2), carbon tetrachloride(3), 1,1,1-trichloroethane (1), and trichloroethene(3). Tetrachloroethene, carbon tetrachloride, and trichloroethene were also detected in the ambient (outdoor) sample. In addition to the chlorinated solvents several other VOCs were detected in the indoor air samples. Like the chlorinated solvents, many of the other VOCs were also detected in the outdoor sample. From this data it is difficult to determine if the detected VOCs are attributable to vapor intrusion, outdoor conditions or to the routine storage of paints, cleaners, heating oil or other chemicals in the homes.

BOL data is reported in parts per billion volume (ppbv). For purposes of evaluating the sample results by comparing results to established standards, the data required conversion to milligrams per cubic meter (mg/m^3). This conversion is carried out through a two-step process using the following equations:

$$ppmv = ppbv/1000$$

Equation 1: Conversion to ppmv

$$mg/m^3 = ppmv \times mol.\ wt.\ of\ compound/24.45$$

Equation 2: Conversion to mg/m^3

Molecular weights of the compounds were obtained from the National Library of Medicine's Toxnet Hazardous Substances Databank (http://www.toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB). Converted air sampling data for detected analytes are included with this memorandum as Table 1. Residential Medium Specific Concentrations for Indoor Air Quality (MSC_{IAQ}) from the Department's Vapor Intrusion Guidance Document (January 2004) are listed in Table 1. With the exception of chloroform detected in the sample collected at 95 Village Way, none of the detected compounds from the indoor air samples exceeds the standards published in the guidance documents. It is suspected that chloroform detected in the samples is not attributable to vapor intrusion. Sources of chloroform in the home are typically attributable to use of treated (i.e. chlorinated) water, but also include chlorine bleach and other household cleaning products.

Water samples were collected from sump pump pits in the basements at 92 and 95 Village Way. (No sump pit is present at 97 Village Way.) No volatile organics were detected in the water samples collected from the sump pits. Results of the sump samples are included in Appendix C.

QA/QC Sampling Results

A trip blank sample was shipped to the lab with the other water samples collected on March 25. The trip blank was filled with organic-free deionized water provided by BOL. The results of the trip blank analysis are as Appendix D. No volatile organic compounds were detected in the trip blank sample.

A duplicate indoor air sample was collected at 97 Village Way by placing two evacuated canisters side-by-side for collection over the 24-hour period. Table 2 provides a comparison of the primary and duplicate sample results.

Conclusions/Recommendations

1. The results of the indoor air quality sampling conducted in March 2008 do not indicate an immediate threat to human health due to the groundwater to indoor air pathway.

2. Follow-up sampling at the three homes is recommended to confirm the results of the March sampling.

3. VOCs were not detected in water samples collected from sump pump pits at 92 and 95 Village Way. Samples should be collected at the time of follow-up IAQ sampling to verify that the sumps are not an open exposure pathway.

4. As additional groundwater data is generated through the off-site groundwater investigation and risk assessment, more indoor air and/or soil gas sampling will likely be required to assess the vapor intrusion pathway.

5. As land use on and down gradient from the former Bishop Tube property changes, the conceptual site model (CSM) should be updated and the vapor migration/intrusion pathway should be reevaluated to determine if further investigation is required.

List of Attachments

Figure 1 – Site Location
Figure 2 – Sampling Locaitons
Table 1 – IAQ Results Summary
Table 2 – QC Summary
Appendix A – Residential Questionnaires
Appendix B – Stream Monitoring Point (SMP)– water level information
Appendix C – Sump sample data reports
Appendix D – Trip blank sample data report
Appendix E – Individual sample data reports
Appendix F – Sample results letters

cc (w/o Appendices): Mr. Buterbaugh
Mr. Helverson (ATSDR)
Mr. DeFazio (CCHD)
Mr. Sheehan
Mr. Patel
East Whiteland Township

TABLES

Table 1
Bishop Tube Site IAQ Sampling
March 2008
Data Summary

		STANDARD	Indoor Air Sample			Indoor Air Sample			Indoor Air Sample		
		DEP (Res.)	92 Village Way			95 Village Way			97 Village Way		
	Mol. Wt.	(mg/m^3)	(ppbv)	ppmv	(mg/m^3)	(ppbv)	ppmv	(mg/m^3)	(ppbv)	ppmv	(mg/m^3)
n-Heptane	100.23	none	0.23	0.00023	0.00094286	0.29	0.00029	0.001189	0.095	0.000095	0.0003894
Cyclohexane	84.18	none	0.043	0.000043	0.00014805	0.084	0.000084	0.000289	0.037	0.000037	0.0001274
Toluene	92.14	0.56	0.66	0.00066	0.00248721	1	0.001	0.003769	0.53	0.00053	0.0019973
Styrene	104.15	1.4	0.03	0.00003	0.00012779	0.45	0.00045	0.001917	ND	ND	ND
m/p-Xylene	106.16	0.14	0.24	0.00024	0.00104206	0.48	0.00048	0.002084	0.11	0.00011	0.0004776
Tetrachloroethene	165.83	0.036	0.12	0.00012	0.00081389	0.12	0.00012	0.000814	ND	ND	ND
Propene	42.08	none	1.3	0.0013	0.00223738	0.79	0.00079	0.00136	1	0.001	0.0017211
1-Ethyl-4-methylbenzene	118.18	none	ND	ND	ND	0.059	0.000059	0.000285	0.058	0.000058	0.0002803
Carbon Disulfide	76.14	0.97	ND	ND	ND	ND	ND	ND	0.86	0.00086	0.0026781
Methylene Chloride	84.93	0.044	0.086	0.000086	0.00029873	0.078	0.000078	0.000271	0.055	0.000055	0.000191
Chloromethane	50.49	none	0.54	0.00054	0.00111512	0.48	0.00048	0.000991	0.42	0.00042	0.0008673
o-Xylene	106.16	0.14	0.081	0.000081	0.0003517	0.18	0.00018	0.000782	0.046	0.000046	0.0001997
Benzene	78.11	0.0027	0.24	0.00024	0.00076672	0.31	0.00031	0.00099	0.05	0.00005	0.0001597
1,1,2-Trichlorotrifluoroethane	187.38	42	0.084	0.000084	0.00064376	0.071	0.000071	0.000544	0.063	0.000063	0.0004828
Chloroform	119.38	0.00044	0.042	0.000042	0.00020507	0.12	0.00012	**0.000586**	0.038	0.000038	0.0001855
Carbon Tetrachloride	153.82	0.0014	0.095	0.000095	0.00059766	0.078	0.000078	0.000491	0.075	0.000075	0.0004718
1,1,1-Trichloroethane	133.42	2.9	0.55	0.00055	0.00300127	ND	ND	ND	ND	ND	ND
Ethylbenzene	106.16	0.019	0.093	0.000093	0.0004038	0.11	0.00011	0.000478	0.055	0.000055	0.0002388
MEK	72.11	1.4	0.51	0.00051	0.00150413	0.65	0.00065	0.001917	2	0.002	0.0058986
1,3,5-Trimethylbenzene	120.19	0.28	ND	ND	ND	0.082	0.000082	0.000403	0.058	0.000058	0.0002851
1,2,4-Trimethylbenzene	120.2	0.02	0.076	0.000076	0.00037363	0.24	0.00024	0.00118	0.2	0.0002	0.0009832
Dichlorodifluoromethane	120.91	0.24	0.55	0.00055	0.00271986	0.43	0.00043	0.002126	0.41	0.00041	0.0020275
Acetone	58.08	43	6.2	0.0062	0.01472785	6.9	0.0069	0.016391	10	0.01	0.0237546
n-Hexane	86.17	0.28	0.29	0.00029	0.00102206	0.45	0.00045	0.001586	0.13	0.00013	0.0004582
Trichloroethene	131.39	0.012	0.027	0.000027	0.00014509	0.043	0.000043	0.000231	0.03	0.00003	0.0001612
Trichlorofluoromethane	137.37	none	0.3	0.0003	0.00168552	0.32	0.00032	0.001798	0.9	0.0009	0.0050566

Notes:

ND - not detected
Exceedences of Act 2 MSCs shown in **bold**

Table 1
Bishop Tube Site IAQ Sampling
March 2008
Data Summary

		Ambient/Outdoor Air Sample		
		95 Village Way		
	Mol. Wt.	(ppbv)	ppmv	(mg/m^3)
n-Heptane	100.23	0.02	0.00002	8.19877E-05
Cyclohexane	84.18	ND	ND	ND
Toluene	92.14	0.15	0.00015	0.000565276
Styrene	104.15	ND	ND	ND
m/p-Xylene	106.16	ND	ND	ND
Tetrachloroethene	165.83	0.057	0.000057	0.000386598
Propene	42.08	0.61	0.00061	0.001049849
1-Ethyl-4-methylbenzene	118.18	ND	ND	ND
Carbon Disulfide	76.14	ND	ND	ND
Methylene Chloride	84.93	0.05	0.00005	0.000173681
Chloromethane	50.49	0.42	0.00042	0.000867313
o-Xylene	106.16	ND	ND	ND
Benzene	78.11	0.16	0.00016	0.000511149
1,1,2-Trichlorotrifluoroethane	187.38	0.06	0.00006	0.000459828
Chloroform	119.38	0.03	0.00003	0.000146479
Carbon Tetrachloride	153.82	0.058	0.000058	0.00036489
1,1,1-Trichloroethane	133.42	ND	ND	ND
Ethylbenzene	106.16	ND	ND	ND
MEK	72.11	0.31	0.00031	0.000914278
1,3,5-Trimethylbenzene	120.19	ND	ND	ND
1,2,4-Trimethylbenzene	120.2	ND	ND	ND
Dichlorodifluoromethane	120.91	0.38	0.00038	0.001879174
Acetone	58.08	3	0.003	0.00712638
n-Hexane	86.17	0.11	0.00011	0.000387677
Trichloroethene	131.39	0.078	0.000078	0.000419158
Trichlorofluoromethane	137.37	0.2	0.0002	0.001123681

Notes:

ND - not detected
Exceedences of Act 2 MSCs shown in **bold**

Table 2
Bishop Tube Site
Indoor Air Sampling
March 2008
QC Summary

	Primary (ppbv)	**Duplicate** (ppbv)	%
n-Heptane	0.095 J	0.22	
Cyclohexane	0.037 J	0.062 J	
Toluene	0.53	0.8	**66%**
Styrene	0.54 U	0.052 J	
m/p-Xylene	0.11 J	0.2 J	
Propene	1	0.77	77%
1-Ethyl-4-methylbenzene	0.058 J	0.13 J	
Carbon Disulfide	0.86	0.2 U	
Methylene Chloride	0.055 J	0.047 J	
Chloromethane	0.42	0.42	100%
o-Xylene	0.046 J	0.087 J	
Benzene	0.15 J	0.18 J	
1,1,2-Trichlorotrifluoroethane	0.063 J	0.065 J	
Chloroform	0.038 J	0.053 J	
Carbon Tetrachloride	0.075 J	0.07 J	
Ethylbenzene	0.055 J	0.1 J	
MEK	2	0.61	**31%**
1,3,5-Trimethylbenzene	0.058 J	0.22	
1,2,4-Trimethylbenzene	0.2 J	0.55	
Dichlorodifluoromethane	0.41	0.42	98%
Acetone	10	7	70%
n-Hexane	0.13 J	0.17 J	
Trichloroethene	0.03 J	0.05 J	
Trichlorofluoromethane	0.9	1.4	**64%**

Notes:

"J" value results not evaluated
% values <70% shown in **bold**

FIGURES

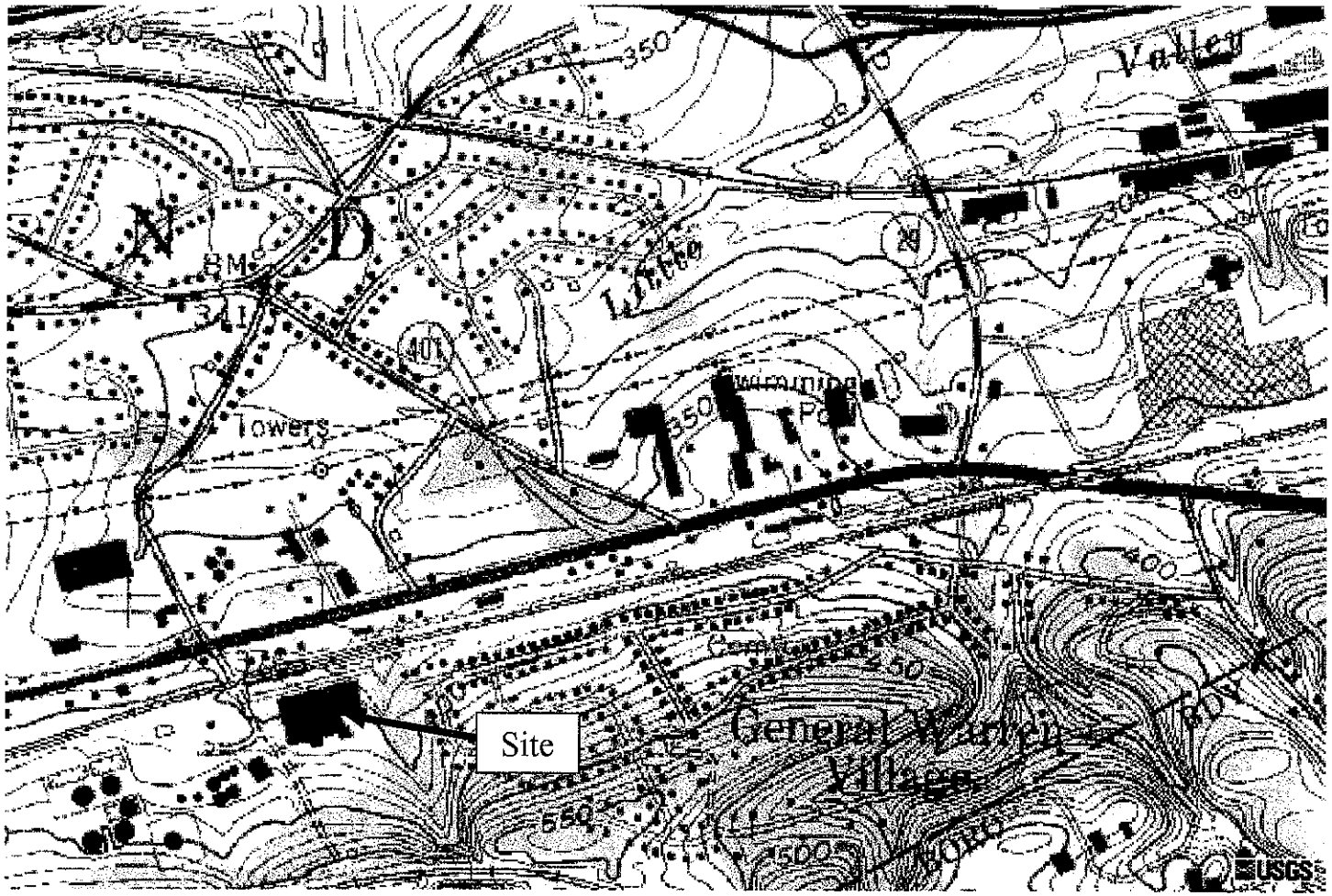
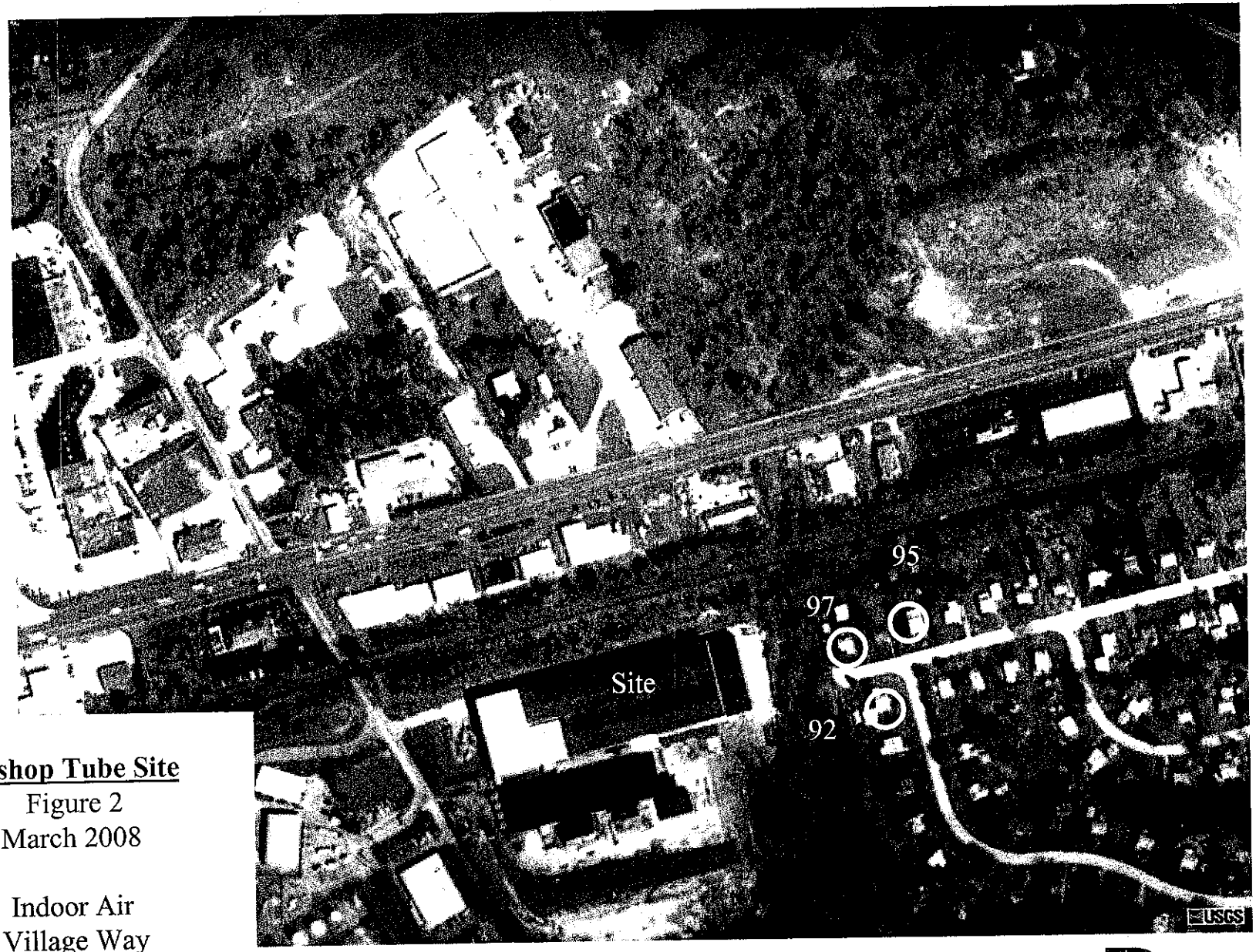


Figure 1
Bishop Tube
Site Location



Bishop Tube Site
Figure 2
March 2008

Indoor Air
Village Way
Sample Locations