

INDOOR AIR SOIL VAPOR INTRUSION STUDY REPORT

**Gruhn Engine Repair Site
Hampton Falls, NH**

July 2010

**U.S. ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND REGIONAL LABORATORY
OFFICE OF ENVIRONMENTAL MEASUREMENT & EVALUATION
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1.0 Introduction

The EPA New England, Office of Environmental Measurement and Evaluation (OEME), at the request of Ted Bazenas, On Scene Coordinator for the Gruhn Engine Repair Superfund Site in Hampton Falls, New Hampshire (NH), performed an indoor air sampling study on June 21, 2010. Samples were collected for volatile organic compounds (VOCs) inside one residential home. Alysha Lynch was the EPA sampling project manager for this study and was responsible for the following tasks: write the Sampling and Analysis Plan (SAP), communicate all aspects of the project to the OSC, coordinate laboratory analytical support with EPA Region 1 OEME laboratory personnel, prepare and collect ambient and indoor air canister samples, and prepare the final report for these activities. Peter Kahn assisted Alysha Lynch with sampling and documentation. Dan Curran operated the EPA Region 1 Laboratory GC/MS which was used to analyze indoor air and ambient air samples. This report will be distributed to Ted Bazenas and all other interested parties.

1.1 Background

Historical sources including previous reports by others indicated that the Site was first developed as a residential property in about 1953. Reportedly, the owner at the time (Mr. Harold Gruhn) was a pilot who repaired and cleaned small aircraft engines on a part-time basis out of his garage and the general exterior area just north of the garage between the early 1950s and 1973. The interior of the garage was said to have included among other things, a machining area, a "tank for solvents," and a "slop sink." The slop sink was connected to a 4-inch tile pipe that extended approximately 250 ft. to the east of the garage and discharged to an outfall location at the rear of the property.

Degreasing agents reportedly used by Mr. Gruhn to clean engines included tetrachloroethylene (PCE) and trichloroethylene (TCE). It is unclear as to the volume of PCE and TCE used by Mr. Gruhn; however, it has been surmised by others that he may have used at least 20 gallons of solvents per year. Degreasing solvents were reportedly stored outside and north of the garage.

Engines were hung from trees that border the northern rock wall property boundary and washed down in this location. Small engine repair activities ceased in 1973, at which time the slop sink and all other interior equipment was removed from the Site.

Trace concentrations of PCE and TCE were detected in a bedrock water supply well (Well #1) owned and operated by the neighboring Town of Seabrook, New Hampshire in 1988. In an attempt to identify the source of contamination, nearby residential water supply wells were tested for chlorinated VOCs (cVOCs). Tap water sampled from the Gruhn's bedrock water supply well in 1989 and 1991 indicated maximum PCE and TCE at concentrations of 3,750 micrograms per liter ($\mu\text{g/L}$) and 450 $\mu\text{g/L}$, respectively.

In 1989, EPA conducted a Preliminary Site Assessment of the Site including a reconnaissance of the Site and collection and analysis of three shallow soil samples from the area just north of the garage. Soil analytical results indicated that there were no cVOCs detected in shallow soil north of the garage.

In 1991, Whitman & Howard (now AECOM) conducted an initial hydrogeologic investigation of the Site, including a soil gas survey, test pit explorations, test borings completed with groundwater monitoring wells, and soil and groundwater sampling and analytical testing.

In August 1993, Whitman & Howard conducted additional investigations in part to further evaluate the contamination at the Site, but also to evaluate a new water supply well installed southeast of the Site. The investigation included installation of additional monitoring wells and soil and groundwater sampling and analytical testing. Consistent with the 1991 investigation, the highest concentration of PCE within the shallow overburden groundwater was observed at MW-3 (6,500 µg/L), which was screened in the shallow till. Concentrations declined downgradient from the MW-3 location to MW-

5S (across Weare Road to the west) with a PCE concentration in overburden groundwater of only 327 µg/L. The highest concentrations of PCE in groundwater within bedrock occurred at the Gruhn water supply well which historically had varied between 2,000 and 4,000 µg/L. Whitman & Howard noted that after pumping more than 32,000 gallon of water from the well as part of a pilot study, PCE concentrations were still approximately 2,000 µg/L. It was concluded that the Gruhn water supply well extended into bedrock and that it likely served as a preferential flow pathway for PCE and TCE to travel from the overburden to the bedrock aquifer.

As part of the 1993 investigation, Whitman & Howard conducted a pump test of Seabrook's bedrock water supply wells in which it was concluded that a hydraulic connection between the shallow overburden groundwater and the bedrock aquifer at the Site did not exist. No evidence of drawdown was observed in the on-site observation wells screened within the shallow overburden under pumping conditions.

An additional soil gas survey was performed in 1993 by Whitman & Howard which focused on the shallow soils (top 4 ft.) in the vicinity of the tile pipe outfall. Soil gas concentrations of PCE and TCE ranged between 1 and 380 ppb, with the highest concentration detected downgradient of the drain outfall. Whitman & Howard concluded that the outfall was not a major on-going source of contamination based on relatively low concentrations of TCE (4 µg/L) and cis-1,2-dichloroethene (cis-1,2-DCE, 28 µg/L) in groundwater in this area.

In December 1994, Whitman & Howard submitted a Remedial Action Plan (RAP) to NHDES describing a remedial system that was installed in 1994, which consisted of three on-site bedrock extraction wells and an off-site low profile air-stripper treatment facility. The objective of the treatment system included: (1) providing sufficient hydraulic control of the bedrock aquifer beneath the Gruhn property to limit migration of cVOCs to Seabrook's water supply well field and (2) providing for treatment of the contaminated bedrock aquifer. Extraction Well #1 is 135 ft. deep and extraction wells #2 and #3 are 133 ft. deep. Based on the previous finding that the shallow overburden groundwater system did not appear to be hydraulically connected to the bedrock aquifer, groundwater extraction and subsequent groundwater treatment were limited to the bedrock aquifer. The treatment system design was based on a maximum cVOC

concentration of 4,500 µg/L and a maximum flow rate of 50 gallons per minute (gpm). GZA conducted a Supplemental Site Investigation in September 2006 on behalf of NHDES whereby GZA concluded the following:

- Analytical testing results of soil samples collected by GZA did not indicate the presence of residual soil contamination that would serve as a significant source of cVOCs in groundwater in the following suspect areas: the vicinity of the garage, at the discharge of the outfall pipe, along the treeline north of the garage, and near the point of entry of the outfall pipe to the garage. However, concentrations of PCE, TCE, and/or their daughter products (trans-1,2-DCE and cis-1,2-DCE) in recent overburden groundwater samples from most Site and vicinity monitoring wells exceeded their Ambient Groundwater Quality Standards (AGQSs) during the 2006 sampling event.
- It appeared that the well MW-3 area north of the garage was influenced by a residual PCE source while the well MW-8S area east of the garage was influenced by a residual TCE source. The highest cVOC concentrations detected during the 2006 study were found in samples from MW-3 (PCE at 250 micrograms per liter [µg/L]), MW-8S and MW-9 (TCE at 310 µg/L and 110 µg/L, respectively), and GZ-110 (trans-1,2-DCE at 610 µg/L; cis-1,2-DCE at 890 µg/L). These monitoring wells are located near and to the west, north, and south of the garage. Detected concentrations of cVOCs in samples from these wells likely resulted from low level residual PCE/TCE soil contamination. The residual TCE source in the vicinity of well MW-8S is currently undefined. While cVOC concentrations have declined over time in overburden groundwater samples from MW-3 and MW-5S, there was no indication of improvement of groundwater quality in the samples collected from MW-2 and MW-9. Moreover, the groundwater quality at MW-1M has degraded relative to PCE and TCE since 2004.
- Historical groundwater quality information for bedrock well MW-5SB depicted a gradually increasing trend in TCE and dichloroethene (DCE) since fall 1995. The historical groundwater quality information at MW-5SB suggested that within the immediate vicinity of the Site, dissolved constituents are slowly migrating downward from the shallow overburden groundwater aquifer to the bedrock aquifer. The transport hydraulics and flow path for this migration of dissolved constituents to the bedrock aquifer was not investigated at the time.
- Methyl tertiary-butyl ether (MtBE) was detected in two wells (MW-1M and MW-9) located near the driveway at concentrations above its AGQS. It was concluded that the detected MtBE was likely from gasoline spillage onto the driveway from motor vehicles and had not been a contaminant of concern previously.

The objective of GZA's work discussed herein was to further evaluate potential PCE/TCE source(s) of contamination in groundwater at the Site through supplemental investigation of the leachfield area, confirmation of groundwater quality and contaminant trends through two additional sampling rounds and evaluation of the potential for soil vapor intrusion in up to three residential buildings including the Site.

GZA's investigation between November 2007 and January 2009 has included a geophysical survey, two rounds of additional groundwater quality monitoring at existing

monitoring wells, two rounds of soil vapor monitoring, and two rounds of indoor air quality monitoring as discussed in further detail herein.

Based on GZA's previous review of historical site use, existing groundwater quality data including data collected by GZA during 2006 and by others in the past, and the persistence of cVOCs in groundwater at the Site indicate the potential that the on-site septic system leach field may be a previously unidentified PCE source area. To further evaluate the location of the leach field in order to properly locate additional test borings, a geophysical study was performed by

Hager Geoscience, Inc (HGI) on December 7, 2007 using the combined approach of ground penetrating radar (GPR) and electromagnetic terrain conductivity (EM) techniques. The EM survey was performed using a GSSI GEM-300 terrain conductivity profiler and the GPR Survey was performed using a GSSI SIR-3000 GPR system.

In general, HGI concluded that the GPR data successfully located the probable limits of the current leach field. The location of the leach field was generally consistent with historical site sketches produced by others. The EM data did not identify any obvious anomalies and was generally found to be inconclusive with respect to the location of the leach field.

To obtain soil and overburden groundwater samples in the vicinity of the leach field, a total of four test borings were advanced including two borings situated on the western side (GZ-203 and GZ-204) and two borings situated on the eastern side (GZ-201 and GZ-202) of the leach field. Test borings were advanced by New Hampshire Boring, Inc. with a truck-mounted drill rig between December 26 and December 27, 2007. The focus of these additional test borings includes shallow overburden soils proximate to the leach field and the interface between geologic strata if observed.

GZA observed similar subsurface conditions as was observed by GZA in 2006 and others during prior explorations at the Site. All four of GZA's test borings were terminated in predominantly silty clay till. A sand to sand/silt stratum overlying the silty clay till was encountered at or near ground surface (below topsoil) at all boring locations, and ranged in thickness from 2 to 5 feet.

GZA collected two rounds of water level measurements and groundwater quality samples in January and July 2008 to evaluate groundwater quality and contaminant trends in existing on-site shallow overburden monitoring wells. The following describes the groundwater sampling and analyses performed.

Based on the August 2006 through July 2008 overburden groundwater level data, an overburden groundwater divide may be present in the backyard area of the Site to the east of the on-site residence. The predominant groundwater flow direction in the overburden near Weare Road and the residence/garage is to the southwest, as inferred from measurements at 12 wells. In the backyard, the predominant overburden groundwater flow direction may be to the east, based on water level data at MW-8S and GZ-109, although a more extensive network of monitoring wells would be needed to further assess groundwater flow directions in this area.

GZA collected two rounds of groundwater quality samples from 13 existing groundwater monitoring wells (MW-1M, MW-2, MW-3, MW-5S, MW-5SB, MW-7S, MW-8S, MW-9, GZ-101, GZ-102, GZ-104, GZ-109, and GZ-110) on January 7-8, 2008 and June 30-July 3, 2008. GZA notes that MW-5S and MW-2 were planned to be sampled during the January 2008 event; however, both of these locations were under standing water at the time and were not sampled.

The following summarizes the groundwater analytical results:

- In 2008, PCE was detected in overburden groundwater in two monitoring wells situated north-northwest of the garage (MW-3 and GZ-104), which is believed to be an original source area, and in one overburden groundwater monitoring well (MW-5S) situated downgradient and to the west of the original source area. The PCE concentration was higher in the sample collected during the January 2008 monitoring round at MW-3 (8,900 µg/L) compared to that of the 2006 round (250 µg/L). The PCE concentration in the subsequent July 2008 sampling round decreased to 76 µg/L. EAI indicated that there were no abnormalities noted in the sample analyses and review of the historical PCE concentrations at this location depict a wide fluctuation in PCE concentrations within this order of magnitude. The concentration fluctuations may be associated with nearby residual PCE source material periodically becoming mobilized in groundwater.

The concentration of PCE at the GZ-104 location increased modestly between 2006 and 2008; however, the concentration observed is within the same order of magnitude and is likely associated with nearby residual PCE source material proximate to MW-3. The PCE concentration in groundwater at this location (and periodically at MW-3) exceeds the RCMP GW-2 standard (80 µg/L), and, based on the exceedance, there continues to be a potential threat to indoor air quality from vapor intrusion of PCE in this area, as these wells are within 30 feet of the residential building and the average depth to groundwater at MW-3 is less than 15 feet deep.

PCE concentrations at the downgradient overburden monitoring well MW-5S were considerably lower than that observed at the MW-3 and GZ-104 locations and generally remained consistent between 2006 and 2008 at a concentration of 7 µg/L (July 2008), which was just above the AGQS.

PCE had been detected at low concentrations, which were below the AGQS at three additional wells (MW-1M, MW-8S, and MW-9) in 2006; however, PCE was not detected above laboratory reporting limits at these locations during either of the 2008 sampling rounds.

- The highest concentrations of TCE were detected in two overburden groundwater wells in 2008 including GZ-104 (42 µg/L in July 2008) and GZ-109 (56 µg/L in July 2008). Low concentrations of TCE were detected in the 2008 sampling rounds in monitoring wells MW-1M, MW-8S, and MW-9, and detected just above the AGQS, ranging between 6 µg/L and 8 µg/L (July 2008). Two separate residual source areas of TCE appear to exist, consistent with historical information, including one proximate and

coincident with the garage area and one proximate to the sink drain outlet along the east side of the Site. No groundwater monitoring wells are situated in a downgradient location relative to GZ-109 to evaluate the extent of TCE migration in overburden groundwater to the east; however, no potential receptors have been readily identified in the immediate vicinity as it appears to be undeveloped land. TCE had been detected in overburden groundwater at low concentrations in two additional wells (MW-3 and GZ-110) in 2006; however, TCE was not detected above laboratory reporting limits at these locations during either of the 2008 sampling rounds.

TCE had been consistently detected between 2006 and 2008 at an elevated concentration in bedrock groundwater at the only bedrock monitoring well at the Site (MW-5SB) at concentrations ranging between 40 µg/L and 44 µg/L. As indicated by GZA in our 2006 report, although previous pump test data (Whitman & Howard, 1993) did not indicate a discernible hydrogeologic connection between overburden and pumping the off-site bedrock water supply well, the historical groundwater quality information at MW-5SB suggests that within the immediate vicinity of the Site, dissolved constituents are slowly migrating downward from the shallow overburden groundwater aquifer to the bedrock aquifer. The migration of source materials and dissolved constituents in groundwater to the bedrock aquifer has not been evaluated.

- Other chlorinated VOC-related contaminants detected in groundwater included the PCE/TCE breakdown products trans- and cis-1,2 dichloroethene (DCE) at concentrations exceeding the AGQS the downgradient well MW-2. The DCE concentration at MW-2 increased modestly between 2006 and 2008, but within the same order of magnitude. DCE was also detected in groundwater at wells MW-1M, MW-5S, MW-5SB, and GZ104; however, the concentrations detected were well below the AGQS for DCE (70 µg/L). There currently is no GW-2 standard for DCE.
- MtBE had previously been detected in two wells (MW-1M and MW-9) located near the driveway at concentrations above its AGQS. In 2006, GZA concluded that the detected MtBE was likely from gasoline spillage onto the driveway from motor vehicles. The 2008 data indicated that MtBE was also detected in MW-2 and the concentrations of MtBE in all three wells were found to be below the AGQS.

On August 21, 2008, GZA performed a limited pre-sampling building inspection of both 35 and 39 Weare Road to view the structure, layout, and physical conditions and locate the interior/exterior sample points. GZA made the following observations:

- The Site (35 Weare Road) included a single-story, ranch-style building with an attached garage and a full basement, with an estimated 1,500-square-foot building footprint, which is occupied by a residential tenant. The building exterior is constructed on an approximate 4- to 6-inch poured concrete foundation with cement fibre composite clapboard exterior walls. Visible portions of the foundation appeared in fair condition with evidence of cracking. GZA observed that newer water supply pipes have been run through an older set of pipes, leaving areas exposed around the new, smaller diameter pipes where potentially vapors could enter the basement. Field screening with a PID indicated the total VOCs in air proximate to the open annulus around the pipe at the foundation wall to be 15 ppm. Also in the basement, GZA observed a sump filled with

standing water which appeared to discharge to the subsurface within the backyard via a discharge pipe. The pump did not appear operable at the time of GZA's site visit. Total VOCs as measured by the PID at this location were 6 ppm.

- The abutting property to the north (39 Weare Road) included a two-story split-ranch style building with a two-car garage underneath and a finished half basement. The home is estimated to be 1,500 square feet and is owner-occupied. The building exterior is constructed on an approximate 4- to 6-inch poured concrete foundation and has cement fibre composite clapboard exterior walls. The concrete foundation, where visible, appeared in good condition. GZA observed a sump in the basement portion of the home; however, according to the owner (Mr. Phil Sicard), the sump rarely collects water.
- Utilities for both homes included forced hot water fueled by fuel oil, private septic, and municipal water (off of Weare Road), and above-ground electric; and
- GZA did not observe evidence suggesting a sub-slab ventilation system or moisture barrier was present at either home.

GZA observed EAI install three on-site interior sub-slab sample collection points within the 35 Weare Road (SP-1 through SP-3), two on-site exterior soil vapor collection points along the southern exterior property boundary of 35 Weare Road (SP-4 and SP-5); and three off-site interior sub-slab sample collection points within the 39 Weare Road (SP-6 through SP-8) on August 25, 2008.

The soil vapor points SP-4 through SP-5 were completed to a maximum depth of 64 feet bgs using direct-push techniques and Geoprobe drill rig. A 6-inch length of ½-inch diameter stainless steel screen connected to Teflon tubing was installed at each location between 5.5 feet and 6.0 feet bgs with a glass bead annulus proximate to the screen. The soil vapor points were completed with flush mounted road-boxes.

The sub-slab vapor points SP-1 through SP-3 and SP-6 through SP-8 were completed to a maximum depth of 12 inches bgs and were manually driven using a drill rod with a hand-held hammer drill attachment. EAI cored through the approximate 2- to 3-inch thick foundations and installed a 6-inch length of ½-inch diameter stainless steel screen connected to Teflon tubing at each location with a glass bead annulus proximate to the screen. At all eight locations, a bentonite seal followed by a Portland Cement grout was placed above the glass bead annulus to the ground surface.

GZA conducted two rounds of sub-slab / soil vapor sampling on August 26, 2008 and January 27, 2009. Prior to sample collection, each collection point was purged using a portable vacuum pump. The potential for leaks associated with a faulty seal was checked by enriching the atmosphere in the immediate vicinity of the collection point with a tracer (helium) and field screening of the vapor sample for the presence of elevated concentrations (>10 percent [%]) of helium using a Dielectric MGD 2002 Helium Detector. If helium was detected at a concentration greater than 10%, the collection point was resealed with additional hydrated bentonite seal material. GZA notes that during the January 2009 sampling round, the Helium detector was found not

to be functioning properly. As a precaution, each of the six locations was re-sealed with bentonite.

Samples were collected using pre-evacuated 6-liter Summa® canisters. For each of the two rounds, a total of five samples in addition to a duplicate sample and an exterior ambient air sample were submitted to EAI's subcontractor, Columbia Analytical (Columbia) for analysis of VOCs by Method TO-15 and Helium by EPA 3C Modified. GZA notes that insufficient air volume was able to be extracted from the two exterior soil vapor probes (SP-4 and SP-5) and the interior SP-2 locations presumably due to higher silt content observed and the tightness of the formation that prevented readily available air flow. Based on discussions with NHDES, further investigation in this area was not warranted based on the information collected at the time.

Primary contaminants of concern that have exceeded the GW-2 standards in the past including PCE and TCE data results (and the predominant breakdown product DCE) were compared to the Residential Soil Vapor Screening Levels. The following provides a summary of the data results.

- Not unexpected, helium was detected in soil vapor in several samples for both rounds. However, in each case, the concentration detected was below 1% indicating that the integrity of the soil vapor samples was not compromised by significant leaks in the sample equipment that would have resulted in entrainment of ambient air into the sample.
- PCE was detected on site in both interior soil vapor collection points during both the sampling rounds with the highest concentration detected at the SP-3 location (northwestern corner of the basement, closest to the garage and original PCE source area proximate to wells MW-3/GZ-104) at 140 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). The PCE concentrations observed at the SP-3 location were generally consistent between the August and January sampling rounds and both exceeded the Residential Soil Vapor Screening Level for PCE of 68 $\mu\text{g}/\text{m}^3$. The concentrations observed indicate that there is a risk that PCE could potentially migrate into and accumulate within the basement of the home.

On-site TCE concentrations in soil vapor remained fairly consistent between the two rounds with the detected concentrations ranging between 0.97 $\mu\text{g}/\text{m}^3$ at SP-1 (August 2008) and 3.9 $\mu\text{g}/\text{m}^3$ at SP-3 (August 2008). The TCE concentrations observed were well below the Residential Soil Vapor Screening Level for TCE (54 $\mu\text{g}/\text{m}^3$).

No other chlorinated VOC-related contaminants (i.e., DCE) were detected above laboratory reporting limits.

Several other petroleum-related contaminants were detected above laboratory reporting limits, of which, however, none of these are a contaminant of concern.

- PCE was detected off site at 39 Weare Road during the August 2008 sampling round in two interior soil vapor collection points (the duplicate sample of SP-6 and SP-8); however, the concentrations observed were well below the Residential Soil Vapor

Screening Level for PCE. No other chlorinated VOC-related contaminants (i.e. DCE) were detected above laboratory reporting limits.

There were two compounds of concern for this project, PCE and TCE. These compounds and other VOCs detectable using the canister GC/MS TO15 EPA Method are listed in Table 1 with the EPA Regional Screening Levels (December 2009) to which detection limits and appropriate methods were selected. The collected data will be reviewed by an EPA risk assessor, who will determine if detected levels pose a risk to the home occupants.

2.0 Sampling Objective

On-Scene Coordinator, Ted Bazenas requested an indoor air assessment of the vapour intrusion pathways. At the residence, 24-hour indoor air samples were collected in the basement and on the first floor. The basement was selected because it is the first area of the building where soil gases will enter and it is also the area where air levels tend to be the highest. The sample collected on the home's first floor provides more data to evaluate the risk to occupants. A 24-hour background outdoor air sample that was collected on the same day indoor air samples were collected. For quality control purposes, a co-located canister sample was collected over a 24-hour period in the basement. All canister samples were analyzed for the VOCs listed on Table 1, particularly the target compounds PCE and TCE, using a GC/MS. Screening levels for all the VOCs detectable using the canister GC/MS method are provided on Table 1. These screening levels were provided by an EPA Region 1 risk assessor which are risk-based screening levels that are derived from equations combining exposure assumptions with chemical-specific toxicity values.

To obtain additional information about the homes being sampled, an Indoor Air Assessment Survey was completed by EPA with additional information provided by the homeowner. EPA asked the homeowner to close all windows and doors for a 12 - 24 hour period prior to the survey and during the 24-hour sampling period. The homeowner was also asked not to use any cleaning products or chemicals prior to and during the sampling event. The completed survey is provided in Appendix D.

2.1 Target Compounds

There are two compounds of concern for this project, TCE and PCE. They are based on the contaminants identified from the groundwater data that have the highest concentration, have the greatest potential to volatilize out of groundwater and migrate into the homes. Screening levels for these compounds and all the other VOCs detectable using the canister GC/MS method are provided on Table 1.

2.2 Data Use and Reporting

The results of the study are presented in this final report and will be provided to the EPA OSC and EPA Risk Assessor for review. The EPA OSC will forward the report to all other interested parties. This report describes the sampling and analytical procedures used for the study and the resulting data. In addition, all the sampling and quality assurance/quality control (QA/QC) data are reported in tabular form. The data reported in the laboratory's analytical report were further validated following the QC criteria described in Section 4.4. The air sampling and analytical techniques used for this study provided the necessary data to assist EPA with evaluating whether indoor air quality was adversely impacted.

3.0 Sampling Locations

Properties selected for the study were based on one or more of the following criteria:

- Property is located within the contaminated area
- Property owner agreed to participate in the study

At the residence, 24-hour indoor air samples were collected in the basement and on the first floor. The basement was selected because it is the first area of the building where soil gases will enter and it is also the area where air levels tend to be the highest. The first floor was also selected to characterize the indoor air quality in the primary living space. To obtain background data for comparison to the indoor air sampling results, a 24-hour canister air sample was collected outside the home. For quality control purposes, a collocated canister sample was co-located over a 24-hour period in the basement.

Photographs are provided in Appendix C showing the indoor air and outdoor air sample locations. To obtain additional information about the home being sampled, an Indoor Air Assessment Survey was completed with the home owner. The completed survey is provided in Appendix D. Detailed descriptions of the sampling locations are provided below.

Home 35 Weare Road

< Basement 24-Hour Indoor Air Samples

Canister #15061 was collected in the basement from 9:44 am on 6/21/10 to 9:44 am on 6/22/10, approximately 15 feet 9 inches from west wall, 25 feet from north interior wall, 8 feet 7 inches from the east wall, 18 feet from the south wall, and 1 foot 9 inches above the floor. Also at this location, Canister #14893 was collected as a duplicate sample for obtaining precision data. The canisters were located approximately in the center of the basement floor, which was poured concrete with few visible cracks.

< First Floor 24-Hour Indoor Air Sample

Canister #13494 was collected on the first floor in the living room from 9:34 am on

6/21/10 to 9:34 am on 6/22/10, 4 feet from the north interior wall, 11 feet 10 inches from the east wall, 7 feet 8 inches from west wall, and 3 feet 2 inches above the floor. EPA personnel asked the home owner to close the windows 12-24 hours prior to the survey as well as during the survey, but the windows were opened on the first floor as well as all doors. Also, the bedroom closest to the front door has recently been painted with latex paint.

< **Ambient/Background Air Sample**

Canister #22692 was collected outside from 9:28 am on 6/21/10 to 9:28 am on 6/22/10. The canister was placed on temporary fence post and was secured with heavy duty zip ties in the backyard. The location was approximately 23 feet west of the garage wall, 32 feet from the northeast corner of the garage, 17 feet 8 inches from the monitoring well labeled 8S, and the inlet was approximately 5 feet 5 inches above the ground.

4.0 Canister VOC Air Sampling and Analytical Methodologies

4.1 Description

EPA Region I Standard Operating Procedure (SOP) for Canister Sampling, ECASOP-Canister Sampling SOP4, August 31, 2007, Revision 4, was used to collect the air samples. Twenty four hour time-weighted average (TWA) indoor air samples were collected in evacuated 6-liter canisters using mechanical flow controllers, following the procedures described in Part 2 of the Region I SOP. Detailed descriptions of the quality assurance procedures are provided in Part 3, Section 14 of the referenced SOP.

The TWA indoor air samples were collected using a 6-liter canister with a mechanical flow controller calibrated to 3.6 ml/min. At the end of the 24-hour sampling period, the final canister pressure should have been below atmospheric pressure. For this study the final canister pressures were either -6 or -7 inches of mercury vacuum. As a result, the data collected are representative of 24-hour average concentrations.

The 24-hour indoor air and ambient air samples were brought back to the EPA laboratory, properly logged in on 6/22/10 and analyzed on, GC/MS following the EPA Region I Standard Operating Procedure, AIRCAN9.SOP. This analytical procedure was used to identify and quantify VOCs listed in Table 1. Prior to analyzing the canisters, they were pressurized with nitrogen. Indoor air concentrations can be higher than outside ambient air. Therefore, dilutions are made to keep concentrations within the calibration range. As a result, a dilution factor is calculated and applied to the data. When dilutions are made to samples, the compound reporting limits tend to be higher.

4.2 Canister Cleaning and Leak Certification Procedures

4.2.1 Canister Cleaning Procedure

Prior to the sampling event, all the canisters were cleaned by placing them in ovens maintained at 150°C, evacuated to at least 10^{-2} Torr and then pressurized with

humidified nitrogen to approximately 30 psig. This process was repeated three times. Detailed descriptions of these procedures are provided in the document entitled, "Canister Cleaning Standard Operating Procedures, ECASOP-Canister Cleaning SOP3, March 16, 2009, Revision 5."

4.2.2 Canister Leak Certification Procedure

At the end of the cleaning process described above, the canisters were evacuated to less than 10^{-2} Torr. A Pirani sensor was then used to measure the vacuum in each canister. The canisters were then placed on a shelf for at least 24 hours. At the conclusion of this period, the Pirani sensor was used again to measure the final canister vacuum which was compared to the initial reading to determine if the canisters show signs of leaking. Detailed descriptions of these procedures are provided in the document entitled, "Canister Leak Certification Standard Operating Procedures, ECASOP-Canister Leak SOP3, August 9, 2007, Revision 3."

4.2.3 Canister Cleanliness Certification Procedure

After all the canisters were certified leak free, each canister was pressurized with humidified nitrogen and then analyzed for contamination using the same GC/MS used to analyze the samples. Detailed descriptions of these procedures are provided in the document entitled, "Pressurized Canisters for Clean Certification Standard Operating Procedures, ECASOP-Canister Pressurizing SOP4, EPA-REG1-OEME/CANISTER-PREP-SOP, August 9, 2007, Revision 4."

Canisters were stored under pressure and evacuated on June 21, 2010 to less than 10^{-2} Torr. Detailed descriptions of these procedures are provided in the document entitled, "Canister Evacuation Standard Operating Procedures, ECASOP-Canister Evacuation SOP3, August 28, 2007, Revision 3."

4.3 Canister Flow Controller Cleaning and Calibration Procedures

4.3.1 Flow Controller Calibration Procedure

Flow controllers used with the 6-liter canisters were calibrated at the EPA Laboratory to 3.6 ml/min, following the procedures provided in the EPA Region I SOP for Canister Sampling, ECASOP-Canister Sampling SOP4, August 31, 2007, Revision 4, part 2, Section 14.1. Each flow controller was connected to a "dummy" evacuated canister and an Aalborg Electronic Mass Flow Meter, Model GFMs-010020, was attached to the flow controller's inlet port. As room air was drawn into the "dummy" canister, the flow controller needle valve was adjusted until the flow rate was maintained at the desired rate.

In the field, each canister pressure was checked prior to and after the sampling event. The ending pressures for the canisters were either -6 or -7 inches of mercury vacuum. This shows that representative samples were collected over the 24-hour sampling period.

4.3.2 Flow Controller Cleaning Procedure

After the flow controllers were calibrated they were cleaned. The flow controllers were placed in ovens maintained at 100°C and purged with humidified nitrogen for approximately one hour.

4.4 Canister Analysis Quality Control/Quality Assurance Results

4.4.1 Laboratory Blank

Humidified nitrogen was introduced into the analytical instrument inlet line prior to analyzing the canisters to serve as laboratory blanks. The laboratory blanks were analyzed to determine the background contamination present in the analytical system. Canister data were qualified as estimated and flagged with a "B", when the observed concentration in the sample was less than five times the concentration in the laboratory blank. Blank values were not subtracted from the reported sample concentrations.

The laboratory blank results are presented in the Laboratory Analytical Report, provided in Appendix A. One laboratory blank was analyzed with the samples and none of them detect compounds above their reporting limits, except for methyl ethyl ketone. Methyl ethyl ketone was only detected in the ambient air sample and the value was qualified with a "B".

4.4.2 Data Reproducibility/Precision Results

One canister was analyzed a second time for assessing analytical precision, namely: canister #13494 (Sample ID: AB07197). The same sample aliquot was withdrawn from the canisters and analyzed in a similar manner. Compounds having values above their reporting limits are reported in a table at the end of the Laboratory Analytical Report provided in Appendix A. The relative percent differences (RPD) were calculated and all were well below QC limits/acceptance criterion. Therefore, the analytical precision acceptance criterion has been satisfied and the data did not need to be qualified as estimated.

In addition, during the survey, one duplicate canister sample was collected over a 24-hour sampling period. Canister #14893 served as the duplicate sample and was collected in the basement. Tables 2 shows the comparison data of compounds detected above their reporting limits in both samples with calculated RPDs. The duplicate sample had calculated RPDs below the 25% acceptance criteria. Therefore, the sampling precision acceptance criterion has been satisfied and the data did not need to be qualified as estimated.

4.4.3 Data Accuracy Results

A quality control canister sample containing selected VOCs at known concentrations was analyzed with the canister samples to determine analytical accuracy. The results of the observed concentrations were compared to the known acceptable range and are reported in a table at the end of the Laboratory Analytical Report provided in Appendix

A. The observed concentrations for all the compounds are considered acceptable. Therefore, the associated data does not need to be qualified as estimated.

4.4.4 Canister Surrogate Spike Results

Prior to analyzing each canister sample, surrogate compounds, 1, 2 dichloroethane d4, bromofluorobenzene and toluene d8 were added to the analytical system. The percent recovery data for the surrogate compounds are reported with each sample data sheet in Appendix A. The results show the recoveries for the three surrogate compounds were all determined to be acceptable.

4.4.5 Chain of Custody

Chain of custody documentation was completed by Alysha Lynch. All canister samples were logged into the laboratory on June 22, 2010, transferring the sample custody to the laboratory personnel. Canisters were stored on the shelves in the hallway outside Room 174. A completed chain of custody form is included with the Laboratory Analytical Report provided in Appendix A.

4.4.6 Data Validation and Usability

The analytical report provided by the EPA Regional Laboratory was further validated by Alysha Lynch. The data reported by the laboratory were compared to the data quality performance criteria specified in Sections 4.4.1, 4.4.2, 4.4.3 and 4.4.4 to evaluate data usability. All data collected for this project are presented in this report and qualified as needed, no data were rejected. The data presented in this report are of acceptable quality to represent the levels of VOCs present at the indoor air and ambient air sampling locations. These levels may vary given differing site activities, environmental conditions and the time of year. Therefore, the data only represent the conditions prevailing at the time of sampling. The samples are collected to a final canister pressure below atmospheric pressure. In order to withdraw a sample volume for analysis, the canister must be pressurized with nitrogen for the GC/MS to perform the analysis. This procedure introduces a dilution factor resulting in a higher reporting limit. Therefore, in certain cases the reporting limit may be higher than the regional screening levels. However, the data is still valid and useable taking into account the sampling and analytical methodologies utilized for this project.

5.0 Meteorological Measurement

5.1 Ambient Air Meteorological Data

Meteorological data were obtained from the Pease International Tradeport Airport in Portsmouth, NH using the following NOAA web site, <http://cdo.ncdc.noaa.gov/qclcd>. The airport is approximately 10 miles north of Hampton Falls, NH. Three tables are provided in Appendix B showing the daily weather conditions for June 20 through June 22, 2010. The data shown include: hourly temperature, dew point, relative humidity, wind direction, wind speed, atmospheric pressure and precipitation amounts. During the sampling events that took place between June 21 (8:55 hours) and June 22 (10:55

hours) no precipitation was recorded and only trace amounts prior to sampling occurred on June 20th. The table below shows the average meteorological conditions for June 20, 21, 22, 2010.

DATE	Temp. (F)	Dew Point Temp. (F)	Relative Humidity (%)	Wind Speed (mph)	Wind Direction (degrees)	Barometric Pressure (inches Hg)
June 20	76	65	72	7	238	29.71
June 21	75	59	60	8	282	29.83
June 22	68	55	66	5	136.25	29.98

6.0 24-Hour Air Sampling Results and Discussions

On June 21, 2010, indoor air samples were collected at one residence located on the Gruhn Engine Repair Site. The residence sampled was located at 35 Weare Road. A 24-hour indoor air sample was collected in the basement and on the first floor. The basement was selected because it is the first area of the building where soil gases will enter and it is also the area where air levels tend to be the highest. The first floor was also selected to characterize the indoor air quality in the primary living space. Indoor air data will be compared to the 24-hour background outdoor air sample that was collected the day indoor air samples were collected. All canister samples were analyzed for the VOCs listed on Table 1A, particularly the target compounds PCE and TCE, using a GC/MS. VOCs detectable using the canister GC/MS method and their risk screening levels are provided on Table 1. The data presented in this report are of acceptable quality to represent the levels of VOCs present at the sampling locations under the specific conditions prevailing during sampling. These levels may vary given differing site activities, time of year and characteristics of the site and groundwater plume.

Beginning at 09:28 am on June 21, 2010, 24-hour indoor air canister samples were collected in the basement and on the first floor of the home. It was observed that the basement had a poured concrete floor which appeared to be well sealed. A number of potential pathways were observed in the basement during the indoor air study and if possible, should be sealed properly:

- a waterline that came through the west wall of the basement that was not well sealed and therefore could be a potential pathway for soil gas to enter the basement.
- a sump pump pit next to the bulk head entrance that had a pipe going to the concrete foundation that could also be a potential pathway.

The 24-hour air sampling analytical report is provided in Appendix A. Table 2 shows a summary of the 24-hour canister data for all compounds (target and non-target) detected above their reporting limits for samples collected from the ambient/background sampling locations and from the residence. Table 3 shows a summary of the 24-hour canister data for the target compounds collected at the residence. Table 4 shows a summary of the 24-hour canister data for all compounds (target and non-target) for both

the sample and the duplicate. The 24-hour ambient air canister data collected on June 21, 2010 for the target and non-target compounds are summarized in Table 5. Provided in Appendix D is the completed Indoor Air Building Survey for the residence.

6.1 PCE Sampling Results and Discussions

Considering PCE is one of the contaminants of concern, the 24-hour indoor air canister data were reviewed and compared to the EPA Regional Screening Level (RSL) for PCE in residential air, $0.41 \mu\text{g}/\text{m}^3$ (0.06 ppb/v). PCE was detected above the reporting limit in the basement sample. PCE was not detected above the reporting limit in the ambient air samples collected outside the home. The table below shows the results from the 24-hour canister samples analyzed using the GC/MS.

PCE Concentrations ($\mu\text{g}/\text{m}^3$)

35 Weare Rd.	
Basement	6.0
First Floor	ND (0.64)
Ambient Air	ND(0.58)

The basement indoor air concentrations were above the EPA RSL for PCE in residential air, $0.41 \mu\text{g}/\text{m}^3$ (0.06 ppb/v). The first floor and ambient samples did not have detections above the reporting limit. However, the reporting limit for the first floor (0.64 $\mu\text{g}/\text{m}^3$) for PCE was greater than the RSL.

6.2 TCE Sampling Results and Discussions

Considering TCE is one of the contaminants of concern, the 24-hour indoor air canister data were reviewed and compared to the EPA Regional Screening Level (RSL) for TCE in residential air, $1.2 \mu\text{g}/\text{m}^3$ (0.223 ppb/v). TCE concentrations were not detected in any of the samples above the screening levels. The table below shows the results from the 24-hour canister samples analyzed using the GC/MS.

TCE Concentrations ($\mu\text{g}/\text{m}^3$)

35 Weare Rd.	
Basement	0.80
First Floor	ND (0.51)
Ambient Air	ND(0.46)

The concentrations detected in the basement and first floor indoor air were not above the EPA RSL for TCE in residential air, $1.2 \mu\text{g}/\text{m}^3$ (0.223 ppb/v).

6.3 Non Target Compounds Sampling Results and Discussions

In addition to the target compounds detected in the indoor air and ambient air mentioned above, a number of non-target compounds were also detected. These results are presented below. The indoor air concentrations are compared to the ambient/background air concentrations to help determine if a source of these compounds exists inside the home.

35 Weare Road

Table 2 shows a summary of the 24-hour basement indoor air, duplicate basement indoor air, first floor indoor air, and the ambient non-target and target compound data, collected for this home. The compounds listed are those that were detected above or near the reporting limits in at least one of the samples. The non-target compounds detected in the basement and on the first floor were mostly associated with petroleum products, such as gasoline and oil. These compounds included: 1, 2, 4-trimethylbenzene, 1, 3, 5-trimethylbenzene, 4-ethyltoluene, benzene, cyclohexane, ethylbenzene, heptane, hexane, methyl-t-butyl ether, toluene, m/p-xylenes and o-xylene. One explanation is the home owner repairs motorcycles, lawn mowers, and snowblowers in the garage, which may account for the use of products containing these chemicals. Ethylbenzene, toluene, and hexane were reported in all three sample locations but appear to be much higher in the basement sample than the indoor air and ambient samples which indicates there could be a potential source located within the basement or below the sub-slab. Ethylbenzene is found in natural products such as coal tar and petroleum and in manufactured products such as inks, insecticides and paints. It is also used primarily to make styrene and used as a solvent and in fuels and releases into the air occur from burning oil, gas, and coal. Toluene occurs naturally in crude oil and is produced in the process of making gasoline and other fuels from crude oil and making coke from coal. It is also used in making paints, paint thinners, fingernail polish, lacquers, adhesives and rubber and in some printing and leather tanning processes and is found in automobile exhaust. Hexane is used in certain kinds of special glues used in the roofing, shoe and leather industries and contained in several consumer products, such as gasoline, quick-drying glues and rubber cement, used in various hobbies

1,2-dichloroethane, methylchloride and methylene chloride were also detected. These compounds can be found in household cleaning agents, solvents, paints, or glues. Refrigerants and aerosol sprays often contain carbon tetrachloride, dichlorodifluoromethane and trichlorotrifluoroethane which were also detected in the home. Methylchloride was detected in the basement, first floor sample, and ambient air at similar concentrations, which mostly comes from outdoor air due to the fact that the windows and doors were all open during the time of the study and it could be present at very low concentrations throughout the atmosphere

The concentrations detected for the non-target compounds in the basement were generally higher than the concentrations detected in the first floor sample as well as the ambient air sample. There have been studies showing levels of indoor pollutants can be 25% – 62% higher than outdoor air pollutant levels. During the survey a number of

products were observed stored in the basement area that may contain these compounds. The Indoor Air Building Survey completed by the home owner and EPA shows an inventory of the products stored in the basement and identifies using and/or storing the following products: weed killers and insecticides. These products were not removed during air sample collection. The survey also indicated the occupants do not smoke tobacco products and they do not dry clean their clothes.

TABLES

Table 1 – New Hampshire Department of Environmental Services Waste Management
Division Site Remediation Programs Revised June 2009 Vapor Intrusion
Screen Levels

Table 1A – EPA Region 1 TO15 Method Reported Target VOC List

Table 2 – 35 Weare Road 24-Hour Canister Air Sampling Results

Table 3 – 35 Weare Road Target Compound 24-hour Sampling Results

Table 4 – June 21, 2010 Duplicate Air Sampling Results

Table 5 – June 21, 2010 Ambient/Background Air Data Summary

**New Hampshire Department of Environmental Services
Waste Management Division Site Remediation Programs**

**Table 1
Revised June 2009
Vapor Intrusion Screening Levels**

Chemical	Residential Indoor Air Screening Levels ($\mu\text{g}/\text{m}^3$)	Commercial Indoor Air Screening Levels ($\mu\text{g}/\text{m}^3$)	Residential Soil Gas Screening Levels ($\mu\text{g}/\text{m}^3$)	Commercial Soil Gas Screening Levels ($\mu\text{g}/\text{m}^3$)	Groundwater to Indoor Air Screening Levels GW-2(1) ($\mu\text{g}/\text{L}$)
Benzene	1.9 ⁽²⁾	1.9 ⁽²⁾	95	95	2,000
Bromoform	2.4	11	120	550	2,000
Bromomethane	1.0	1.5	50	73	10
Carbon Tetrachloride	1.3 ⁽³⁾	1.3 ⁽³⁾	63	63	40
Chlorobenzene	10	15	500	730	2,000
Chloroform	1.0 ⁽³⁾	1.0 ⁽³⁾	49	49	100
Dichlorobenzene, 1,2-	40	58	2,000	2,900	20,000
Dichlorobenzene, 1,4-	160	230	8,000	12,000	50,000
Dichloroethane, 1,1-	100	150	5,000	7,300	10,000
Dichloroethane, 1,2-	0.8 ⁽³⁾	0.8 ⁽³⁾	40	40	300
Dichloroethylene, 1,1-	40	58	2,000	2,900	1,000
Dichloromethane (Methylene Chloride)	5.6 ⁽²⁾	26	280	1,300	1,000
Dichloropropane, 1,2-	0.9 ⁽³⁾	1.2	46	59	200
Ethylbenzene	200	290	10,000	15,000	50,000
Ethylene dibromide	1.5 ⁽³⁾	1.5 ⁽³⁾	77	77	700
Methyl ethyl ketone	1,000	1,500	50,000	73,000	50,000
Methyl isobutyl ketone	600	880	30,000	44,000	50,000
Methyl tert butyl ether (MTBE)	5.6 ⁽²⁾	15	280	770	10,000
Naphthalene	2.6 ⁽³⁾	2.6 ⁽³⁾	130	130	2,000
Styrene	200	290	10,000	15,000	50,000
Tetrachloroethane, 1,1,2,2-	1.4 ⁽³⁾	1.4 ⁽³⁾	69	69	1,000
Tetrachloroethylene (PCE)	1.4 ⁽³⁾	2.1	68	100	80
Toluene	1,000	1,500	50,000	73,000	50,000
Trichlorobenzene, 1,2,4-	3.7 ⁽³⁾	3.7 ⁽³⁾	190	190	1,000
Trichloroethane, 1,1,1-	1,000	1,500	50,000	73,000	50,000
Trichloroethane, 1,1,2-	1.1 ⁽³⁾	1.1 ⁽³⁾	55	55	500
Trichloroethylene (TCE)	1.3	6.1	67	310	100
Trimethylbenzene, 1,2,4-	4.3 ⁽²⁾	4.3 ⁽²⁾	220	220	3,000
Trimethylbenzene, 1,3,5-	1.7 ⁽²⁾	1.8	85	88	1,000
Vinyl chloride	0.5 ⁽³⁾	2.8	26	140	10
Xylenes (mixed isomers)	20	29	1,000	1,500	30,000

(1) Revised Risk Characterization and Management Policy GW-2 values.

(2) The screening values for these compounds are based on published background values.

(3) The risk based levels for these compounds are below the EPA TO-15 low level reporting limit and therefore the screening value is based on method reporting limit.

TABLE 1A

EPA Region I TO-15 VOC Reported Compounds	CAS No.	EPA RSL Residential Air (ug/m ³)	EPA RSL Industrial Air (ug/m ³)	Toxicity Basis
1, 1, 1-Trichloroethane	71-55-6	5200	22000	nc
1, 1, 2, 2-Tetrachloroethane	79-34-5	0.04	0.21	c
1, 1, 2-Trichloroethane	79-00-5	0.15	0.77	c
1, 1-Dichloroethane	75-34-3	1.5	7.7	c
1, 1-Dichloroethylene	75-35-4	210	880	nc
1, 2, 4-Trichlorobenzene	120-82-1	2.1	8.8	nc
1, 2, 4-Trimethylbenzene	95-63-6	7.3	31	nc
1, 2-Dibromoethane	106-93-4	0.004	0.02	c
1, 2-Dichlorobenzene	95-50-1	210	880	nc
1, 2-Dichloroethane	107-06-2	0.09	0.47	c
1, 2-Dichloropropane	78-87-5	0.24	1.2	c
1, 3, 5-Trimethylbenzene	108-67-8	6.3	26	nc
1, 3-Butadiene	106-99-0	0.08	0.41	c
1, 3-Dichlorobenzene (m-Dichlorobenzene)	541-73-1	NA	NA	NA
1,2-Dichlorobenzene (o-Dichlorobenzene)	95-50-1	210	880	nc
1, 4-Dichlorobenzene (p-Dichlorobenzene)	106-46-7	0.22	1.1	c
2-Hexanone	591-78-6	31	130	nc
4-Ethyl Toluene	622-96-8	NA	NA	NA
Acrylonitrile	107-13-1	0.04	0.18	c
Allyl Chloride	107-05-1	0.41	2.0	c
Benzene	71-43-2	0.31	1.6	c
Benzylchloride	100-44-7	0.05	0.25	c
Bromodichloromethane	75-27-4	0.07	0.33	c
Bromoform	75-25-2	2.2	11	c
Carbon Tetrachloride	56-23-5	0.16	0.82	c
Chlorobenzene	108-90-7	52	220	nc
Chloroethane (Ethyl chloride)	75-00-3	10000	44000	nc
Chloroform	67-66-3	0.11	0.53	c
Cyclohexane	110-82-7	6300	26000	nc
Dibromochloromethane	124-48-1	0.09	0.45	c
Dichlorodifluoromethane (F12)	75-71-8	210	880	nc
Dichlorotetrafluoroethane	76-14-2	NA	NA	NA
Ethylbenzene	100-41-4	0.97	4.9	c
Heptane	142-82-5	NA	NA	NA
Hexachloro-1, 3-butadiene (Hexachlorobutadiene)	87-68-3	0.11	0.56	c
Hexane (n-Hexane)	110-54-3	730	3100	nc
Methyl Ethyl Ketone (2-butanone)	78-93-3	5200	22000	nc
Methyl Isobutyl Ketone (4-methyl-2-pentanone)	108-10-1	3100	13000	nc
Methyl-t-butyl ether	1634-04-4	9.4	47	c
Methylbromide (Bromomethane)	74-83-9	5.2	22	nc
Methylchloride (Chloromethane)	74-87-3	94	390	nc
Methylene Chloride	75-09-2	5.2	26	c
Styrene	100-42-5	1000	4400	nc
Tetrachloroethene	127-18-4	0.41	2.1	c
Tetrahydrofuran	109-99-9	NA	NA	NA
Toluene	108-88-3	5200.00	22000.00	nc
Trichloroethene	79-01-6	1.2	6.1	c
Trichlorofluoromethane	75-69-4	730	3100	nc
Trichlorotrifluoroethane	76-13-1	NA	NA	NA
Vinyl Bromide	593-60-2	0.08	0.38	c
Vinylchloride	75-01-4	0.16	2.8	c
Cis-1, 2-Dichloroethene	156-59-2	NA	NA	NA
Cis-1, 3-Dichloropropene	542-75-6	0.61	3.1	c
m, p-Xylene (Xylene, mixture)	1330-20-7	100	440	nc
m-Xylene	108-38-3	730	3100	nc
p-Xylene	106-42-3	730	3100	nc
o-Xylene	95-47-6	730	3100	nc
Trans-1, 2-Dichloroethene	156-60-5	63	260	nc
Trans-1, 3-Dichloropropene	142-28-9	NA	NA	NA

NA = Not Available

nc = non-cancer health effect (for Hazard Quotient = 1)

c = cancer health effect (for 1×10^{-6} incremental lifetime cancer risk)

EPA RSL = EPA Regional Screening Level (December, 2009)

http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/Generic_Tables/index.htm

TABLE 2
35 WEARE ROAD, HAMPTON FALLS, NH
RESULTS SUMMARY

COMPOUND	INDOOR AIR BASEMENT		INDOOR AIR BASEMENT DUPLICATE		INDOOR AIR FIRST FLOOR		AMBIENT AIR OUTSIDE	
	(ppb/v)	(ug/m ³)	(ppb/v)	(ug/m ³)	(ppb/v)	(ug/m ³)	(ppb/v)	(ug/m ³)
	CANISTER #15061 21-Jun-10 24-HOUR AVE.		CANISTER #14893 21-Jun-10 24-HOUR AVE.		CANISTER #13494 21-Jun-10 24-HOUR AVE.		CANISTER #22692 21-Jun-10 24-HOUR AVE.	
Trichloroethylene	0.15	0.81	0.18	0.97	ND (0.09)	ND (0.51)	ND (0.09)	ND (0.46)
Tetrachloroethylene	0.89	6.0	0.82	5.6	ND (0.09)	ND (0.64)	ND (0.09)	ND (0.58)
1,2,4-Trimethylbenzene	5.1	25	4.7	23	0.13	0.64	ND (0.09)	ND (0.42)
1,2-Dichloroethane	0.20	0.81	0.18	0.73	ND (0.09)	ND (0.38)	ND (0.09)	ND (0.51)
1,3,5-Trimethylbenzene	1.4	6.9	1.3	6.4	0.15	0.74	ND (0.09)	ND (0.42)
4-Ethyltoluene	3.8	19	3.4	17	0.43	2.1	ND (0.09)	ND (0.42)
Benzene	3.5	11	3.3	10	0.53	1.7	ND (0.09)	ND (0.27)
Carbon Tetrachloride	0.13	0.82	0.12	0.76	0.09	0.54	0.10	0.63
Cyclohexane	3.1	11	2.9	10	0.41	1.4	ND (0.09)	ND (0.29)
Dichlorodifluoromethane	0.53	2.6	0.62	3.1	0.57	2.8	0.48	2.4
Ethylbenzene	4.2	18	3.9	17	0.53	2.3	0.07	0.3
Heptane	3.7	15	3.4	14	ND (0.09)	ND (0.39)	ND (0.09)	ND (0.35)
Hexane	12	42	11	39	1.4	4.90	0.18	0.63
Methyl Ethyl Ketone	ND (0.07)	ND (0.22)	ND (0.09)	ND (0.27)	ND (0.09)	ND (0.28)	0.22	0.65
Methyl-t-Butyl Ether	1.1	3.9	0.99	3.5	ND (0.09)	ND (0.39)	B	B
Methylchloride	0.29	0.60	0.30	0.62	0.52	1.1	ND (0.09)	ND (0.31)
Methylene Chloride	2.7	9.4	2.4	8.5	0.09	0.34	0.45	0.93
Toluene	25	94	25	94	0.09	15	0.09	0.32
Trichlorofluoromethane	ND (0.07)	ND (0.41)	ND (0.09)	ND (0.51)	0.3	1.5	0.33	1.2
Trichlorotrifluoroethane	0.08	0.61	0.07	0.59	ND (0.09)	ND (0.72)	0.07	1.6
m/p-Xylenes	14	61	13	56	2	9.5	0.22	0.57
o-Xylene	5.3	23	5.1	22	0.7	3.2	0.09	0.95
								0.40

NOTES:

- ND = Not detected above reporting limits; reporting limit in parentheses
- L = Estimated value, is below the calibration range
- B = Analyte is associated with the lab blank or trip blank concentration.
- Values are qualified when the observed concentration of the contamination in the sample extract is less than 5 times the concentration in the blank.
- Compounds in bold type are target compounds for project.

Table 3
June 21, 2010
35 Weare Road, Hampton Falls, NH
Target Compound Indoor Air 24-Hour Sampling Data

Sample Location	PCE (ppb/v)	TCE (ppb/v)
35 Weare Road		
<i>Basement</i>		
Indoor air 24-hour canister sample (canister #15061)	0.89	0.15
Indoor air 24-hour canister duplicate sample (canister #14839)	0.82	0.18
<i>First Floor</i>		
Indoor air 24-hour canister sample (canister #13494)	ND (0.09)	ND (0.09)
<i>Outside House (35 Weare Road)</i>		
Ambient air 24-hour canister sample (canister #22692)	ND (0.09)	ND (0.09)

NOTES:

ND = Not detected above reporting limits; reporting limit in parentheses

PCE = Tetrachloroethylene

TCE = Trichloroethylene

EPA Regional Residential Screening Level (December, 2009)

PCE: 0.41 ug/m³ (0.06 ppb/v)

TCE: 1.2 ug/m³ (0.223 ppb/v)

TABLE 4
June 21, 2010 DUPLICATE SAMPLING RESULTS
35 WEARE ROAD, HAMPTON FALLS, NEW HAMPSHIRE

COMPOUND	INDOOR AIR BASEMENT		INDOOR AIR BASEMENT DUPLICATE		RPD (%)
	CANISTER #15061 21-Jun-10 24-HOUR AVE. (ppb/v)	(ug/m ³)	CANISTER #14893 21-Jun-10 24-HOUR AVE. (ppb/v)	(ug/m ³)	
Trichloroethylene	0.15	0.81	0.18	0.97	18
Tetrachloroethylene	0.89	6.0	0.82	5.6	8
1,2,4-Trimethylbenzene	5.1	25	4.7	23	8
1,2-Dichloroethane	0.20	0.81	0.18	0.73	11
1,3,5-Trimethylbenzene	1.4	6.9	1.3	6.4	7
4-Ethyltoluene	3.8	19	3.4	17	11
Benzene	3.5	11	3.3	10	6
Carbon Tetrachloride	0.13	0.82	0.12	0.76	8
Chloroform	ND (0.07)	ND (0.36)	ND (0.09)	ND (0.44)	NA
Cyclohexane	3.1	11	2.9	10	7
Dichlorodifluoromethane	0.53	2.6	0.62	3.1	16
Ethylbenzene	4.2	18	3.9	17	7
Heptane	3.7	15	3.4	14	8
Hexane	12	42	11	39	9
Methyl Ethyl Ketone	ND (0.07)	ND (0.22)	ND (0.09)	ND (0.27)	NA
Methyl Isobutyl Ketone	ND (0.07)	ND (0.3)	ND (0.09)	ND (0.37)	NA
Methyl-t-Butyl Ether	1.1	3.9	0.99	3.5	11
Methylchloride	0.29	0.60	0.30	0.62	3
Methylene Chloride	2.7	9.4	2.4	8.5	12
Tetrahydrofuran	ND (0.07)	ND (0.22)	ND (0.09)	ND (0.27)	NA
Toluene	25	94	25	94	0
Trichlorotrifluoroethane	0.08	0.61	0.07 L	0.59 L	13
m/p-Xylenes	14	61	13	56	7
o-Xylene	5.3	23	5.1	22	NA

NOTES:

ND = Not detected above reporting limits; reporting limit in parentheses
NA = not applicable, concentrations for these compounds were either less than 10 times the reporting limit or not detected above the reporting limits to calculate an RPD
L = Estimated value, is below the calibration range
Compounds in bold type are target compounds for project.

TABLE 5
21-Jun-10
AMBIENT/BACKGROUND AIR DATA SUMMARY
HAMPTON FALLS, NH

COMPOUND	AMBIENT AIR OUTSIDE 35 WEARE RD. CANISTER #22692 21-Jun-10 24-HOUR AVE.			
	(ppb/v)		(ug/m ³)	
Trichloroethylene	ND (0.08)		ND (0.46)	
Tetrachloroethylene	ND (0.08)		ND (0.58)	
Carbon Tetrachloride	0.10		0.63	
Dichlorodifluoromethane	0.48		2.4	
Hexane	0.18		0.63	
Ethylbenzene	0.07	L	0.32	L
Methyl Ethyl Ketone	0.22	B	0.65	B
Methylchloride	0.45		0.93	
Methylene Chloride	0.09		0.32	
Toluene	0.33		1.2	
Trichlorofluoromethane	0.28		1.6	
Trichlorotrifluoroethane	0.07	L	0.57	L
m/p-Xylenes	0.22		0.95	
o-Xylene	0.09		0.40	

NOTES:

ND = Not detected above reporting limits; reporting limit in parentheses

L = Estimated value, is below the calibration range

B = Analyte is associated with the lab blank or trip blank concentration.

Values are qualified when the observed concentration of the contamination in the sample extract is less than 5 times the concentration in the blank.

Compounds in bold type are target compounds for project.

APPENDIX A

LABORATORY ANALYTICAL REPORT



United States Environmental Protection Agency
Office of Environmental Measurement & Evaluation
11 Technology Drive
North Chelmsford, MA 01863-2431

Laboratory Report

June 29, 2010

Ted Bzenas - OSRR02-2
US UPA New England R1

Project Number: 10060036
Project: Gruhn Engine Repair - Hampton Falls, NH
Analysis: Air Toxics by GC/MS
Analyst: Dan Curran *DC 6/29/10*

Analytical Procedure:

All samples were received and logged in by the laboratory according to the USEPA New England Laboratory SOP for Sample Log-in.

Sample analysis was done following the EPA Region I SOP, AIRCAN10.SOP.

Samples were analyzed by GC/MS using an ion trap mass spectrometer. Samples were introduced to the GC via an Entech preconcentrator using cryofocusing. Analysis SOP is based on Compendium Method TO-15, update January 1997.

Date Samples Received by the Laboratory: 06/22/2010

Data were reviewed in accordance with the internal verification procedures described in the EPA New England OEME Chemistry QA Plan.

Results relate only to the items tested or to the samples as received by the Laboratory. This analytical report shall not be reproduced except in full, without written approval of the laboratory.

Report contains multiple sections and each section is numbered independently.

If you have any questions please call me at 617-918-8340 .

Sincerely,

Daniel N. Boudreau 7/1/2010
Daniel N. Boudreau
Chemistry Team Leader

Qualifiers: RL = Reporting limit
ND = Not Detected above Reporting limit
NA = Not Applicable due to high sample dilutions or sample interferences
NC = Not calculated since analyte concentration is ND.
J = Estimated value
E = Estimated value exceeds the calibration range
L = Estimated value is below the calibration range
B = Analyte is associated with the lab blank or trip blank contamination. Values are qualified when the observed concentration of the contamination in the sample extract is less than 5 times the concentration in the blank.
R = No recovery was calculated since the analyte concentration is greater than four times the spike level.

Conversion of ppb/v to ug/m3 = $\text{ppb/v} \times (\text{mw}/24.45)$ 24.45 is based on T=25c and P = 760 mm Hg

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

Gruhn Engine Repair - Hampton Falls, NH

Air Toxics by GC/MS

Cannister ID:	15061	Lab Sample ID:	AB07195
Date of Collection:	6/21/2010	Matrix:	Air
Date of Analysis:	6/23/2010	Dilution Factor:	1.46
Sample Volume:	500 mL		

CAS Number	Compound	Concentration ppb/V	Concentration ug/m3	RL ppb/V	Qualifier
71-55-6	1,1,1-Trichloroethane	ND	ND	0.073	
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	0.073	
79-00-5	1,1,2-Trichloroethane	ND	ND	0.073	
75-34-3	1,1-Dichloroethane	ND	ND	0.073	
75-35-4	1,1-Dichloroethylene	ND	ND	0.073	
120-82-1	1,2,4-Trichlorobenzene	ND	ND	0.073	
95-63-6	1,2,4-Trimethylbenzene	5.1	25	0.073	
106-93-4	1,2-Dibromoethane	ND	ND	0.073	
95-50-1	1,2-Dichlorobenzene	ND	ND	0.073	
107-06-2	1,2-Dichloroethane	0.20	0.81	0.073	
78-87-5	1,2-Dichloropropane	ND	ND	0.073	
108-67-8	1,3,5-Trimethylbenzene	1.4	6.9	0.073	
106-99-0	1,3-Butadiene	ND	ND	0.15	
541-73-1	1,3-Dichlorobenzene	ND	ND	0.073	
106-46-7	1,4-Dichlorobenzene	ND	ND	0.073	
591-78-6	2-Hexanone	ND	ND	0.073	
622-96-8	4-Ethyltoluene	3.8	19	0.073	
107-13-1	Acrylonitrile	ND	ND	0.073	
107-05-1	Allyl Chloride	ND	ND	0.073	
71-43-2	Benzene	3.5	11	0.073	
100-44-7	Benzylchloride	ND	ND	0.073	
75-27-4	Bromodichloromethane	ND	ND	0.073	
75-25-2	Bromoform	ND	ND	0.073	
56-23-5	Carbon Tetrachloride	0.13	0.82	0.073	
108-90-7	Chlorobenzene	ND	ND	0.073	
75-00-3	Chloroethane	ND	ND	0.073	
67-66-3	Chloroform	ND	ND	0.073	
110-82-7	Cyclohexane	3.1	11	0.073	
124-48-1	Dibromochloromethane	ND	ND	0.073	
75-71-8	Dichlorodifluoromethane	0.53	2.6	0.073	
1320-37-2	Dichlorotetrafluoroethane	ND	ND	0.073	
100-41-4	Ethylbenzene	4.2	18	0.073	
142-82-5	Heptane	3.7	15	0.073	
87-68-3	Hexachloro-1,3-butadiene	ND	ND	0.073	
110-54-3	Hexane	12	42	0.36	
78-93-3	Methyl Ethyl Ketone	ND	ND	0.073	
108-10-1	Methyl Isobutyl Ketone	ND	ND	0.073	
1634-04-4	Methyl-t-Butyl Ether	1.1	3.9	0.073	
74-83-9	Methylbromide	ND	ND	0.073	
74-87-3	Methylchloride	0.29	0.60	0.073	
75-09-2	Methylene Chloride	2.7	9.4	0.073	
100-42-5	Styrene	ND	ND	0.073	
127-18-4	Tetrachloroethylene	0.89	6.0	0.073	
109-99-9	Tetrahydrofuran	ND	ND	0.073	

108-88-3	Toluene	25	94	0.36
79-01-6	Trichloroethylene	0.15	0.81	0.073
75-69-4	Trichlorofluoromethane	ND	ND	0.073
76-13-1	Trichlorotrifluoroethane	0.080	0.61	0.073
593-60-2	Vinyl Bromide	ND	ND	0.073
75-01-4	Vinylchloride	ND	ND	0.073
156-59-2	c-1,2-Dichloroethylene	ND	ND	0.073
10061-01-5	c-1,3-Dichloropropylene	ND	ND	0.073
1330-20-7	m/p-Xylenes	14	61	0.15
95-47-6	o-Xylene	5.3	23	0.073
156-60-5	t-1,2-Dichloroethylene	ND	ND	0.073
10061-02-6	t-1,3-Dichloropropylene	ND	ND	0.073

Surrogate Compounds	Recoveries (%)	QC Ranges
1,2-Dichloroethane,d4	118	68 - 138
Bromofluorobenzene	96	72 - 112
Toluene,d8	105	83 - 113

Comments: Toluene and hexane results are from a 7.31 fold dilution analyzed on 06/23/10.

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

Gruhn Engine Repair - Hampton Falls, NH

Air Toxics by GC/MS

Cannister ID:	14893	Lab Sample ID:	AB07196
Date of Collection:	6/21/2010	Matrix:	Air
Date of Analysis:	6/23/2010	Dilution Factor:	1.79
Sample Volume:	500 mL		

CAS Number	Compound	Concentration ppb/V	Concentration ug/m3	RL ppb/V	Qualifier
71-55-6	1,1,1-Trichloroethane	ND	ND	0.090	
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	0.090	
79-00-5	1,1,2-Trichloroethane	ND	ND	0.090	
75-34-3	1,1-Dichloroethane	ND	ND	0.090	
75-35-4	1,1-Dichloroethylene	ND	ND	0.090	
120-82-1	1,2,4-Trichlorobenzene	ND	ND	0.090	
95-63-6	1,2,4-Trimethylbenzene	4.7	23	0.090	
106-93-4	1,2-Dibromoethane	ND	ND	0.090	
95-50-1	1,2-Dichlorobenzene	ND	ND	0.090	
107-06-2	1,2-Dichloroethane	0.18	0.73	0.090	
78-87-5	1,2-Dichloropropane	ND	ND	0.090	
108-67-8	1,3,5-Trimethylbenzene	1.3	6.4	0.090	
106-99-0	1,3-Butadiene	ND	ND	0.18	
541-73-1	1,3-Dichlorobenzene	ND	ND	0.090	
106-46-7	1,4-Dichlorobenzene	ND	ND	0.090	
591-78-6	2-Hexanone	ND	ND	0.090	
622-96-8	4-Ethyltoluene	3.4	17	0.090	
107-13-1	Acrylonitrile	ND	ND	0.090	
107-05-1	Allyl Chloride	ND	ND	0.090	
71-43-2	Benzene	3.3	10	0.090	
100-44-7	Benzylchloride	ND	ND	0.090	
75-27-4	Bromodichloromethane	ND	ND	0.090	
75-25-2	Bromoform	ND	ND	0.090	
56-23-5	Carbon Tetrachloride	0.12	0.76	0.090	
108-90-7	Chlorobenzene	ND	ND	0.090	
75-00-3	Chloroethane	ND	ND	0.090	
67-66-3	Chloroform	ND	ND	0.090	
110-82-7	Cyclohexane	2.9	10	0.090	
124-48-1	Dibromochloromethane	ND	ND	0.090	
75-71-8	Dichlorodifluoromethane	0.62	3.1	0.090	
1320-37-2	Dichlorotetrafluoroethane	ND	ND	0.090	
100-41-4	Ethylbenzene	3.9	17	0.090	
142-82-5	Heptane	3.4	14	0.090	
87-68-3	Hexachloro-1,3-butadiene	ND	ND	0.090	
110-54-3	Hexane	11	39	0.45	
78-93-3	Methyl Ethyl Ketone	ND	ND	0.090	
108-10-1	Methyl Isobutyl Ketone	ND	ND	0.090	
1634-04-4	Methyl-t-Butyl Ether	0.99	3.5	0.090	
74-83-9	Methylbromide	ND	ND	0.090	
74-87-3	Methylchloride	0.30	0.62	0.090	
75-09-2	Methylene Chloride	2.4	8.5	0.090	
100-42-5	Styrene	ND	ND	0.090	
127-18-4	Tetrachloroethylene	0.82	5.6	0.090	
109-99-9	Tetrahydrofuran	ND	ND	0.090	

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

Gruhn Engine Repair - Hampton Falls, NH

Air Toxics by GC/MS

Cannister ID:	13494	Lab Sample ID:	AB07197
Date of Collection:	6/21/2010	Matrix:	Air
Date of Analysis:	6/28/2010	Dilution Factor:	1.88
Sample Volume:	500 mL		

CAS Number	Compound	Concentration ppb/V	Concentration ug/m3	RL ppb/V	Qualifier
71-55-6	1,1,1-Trichloroethane	ND	ND	0.094	
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	0.094	
79-00-5	1,1,2-Trichloroethane	ND	ND	0.094	
75-34-3	1,1-Dichloroethane	ND	ND	0.094	
75-35-4	1,1-Dichloroethylene	ND	ND	0.094	
120-82-1	1,2,4-Trichlorobenzene	ND	ND	0.094	
95-63-6	1,2,4-Trimethylbenzene	0.13	0.64	0.094	
106-93-4	1,2-Dibromoethane	ND	ND	0.094	
95-50-1	1,2-Dichlorobenzene	ND	ND	0.094	
107-06-2	1,2-Dichloroethane	ND	ND	0.094	
78-87-5	1,2-Dichloropropane	ND	ND	0.094	
108-67-8	1,3,5-Trimethylbenzene	0.15	0.74	0.094	
106-99-0	1,3-Butadiene	ND	ND	0.19	
541-73-1	1,3-Dichlorobenzene	ND	ND	0.094	
106-46-7	1,4-Dichlorobenzene	ND	ND	0.094	
591-78-6	2-Hexanone	ND	ND	0.094	
622-96-8	4-Ethyltoluene	0.43	2.1	0.094	
107-13-1	Acrylonitrile	ND	ND	0.094	
107-05-1	Allyl Chloride	ND	ND	0.094	
71-43-2	Benzene	0.53	1.7	0.094	
100-44-7	Benzylchloride	ND	ND	0.094	
75-27-4	Bromodichloromethane	ND	ND	0.094	
75-25-2	Bromoform	ND	ND	0.094	
56-23-5	Carbon Tetrachloride	0.086	0.54	0.094	L
108-90-7	Chlorobenzene	ND	ND	0.094	
75-00-3	Chloroethane	ND	ND	0.094	
67-66-3	Chloroform	ND	ND	0.094	
110-82-7	Cyclohexane	0.41	1.4	0.094	
124-48-1	Dibromochloromethane	ND	ND	0.094	
75-71-8	Dichlorodifluoromethane	0.57	2.8	0.094	
1320-37-2	Dichlorotetrafluoroethane	ND	ND	0.094	
100-41-4	Ethylbenzene	0.53	2.3	0.094	
142-82-5	Heptane	ND	ND	0.094	
87-68-3	Hexachloro-1,3-butadiene	ND	ND	0.094	
110-54-3	Hexane	1.4	4.9	0.094	
78-93-3	Methyl Ethyl Ketone	ND	ND	0.094	
108-10-1	Methyl Isobutyl Ketone	ND	ND	0.094	
1634-04-4	Methyl-t-Butyl Ether	ND	ND	0.094	
74-83-9	Methylbromide	ND	ND	0.094	
74-87-3	Methylchloride	0.52	1.1	0.094	
75-09-2	Methylene Chloride	0.099	0.34	0.094	
100-42-5	Styrene	ND	ND	0.094	
127-18-4	Tetrachloroethylene	ND	ND	0.094	
109-99-9	Tetrahydrofuran	ND	ND	0.094	

108-88-3	Toluene	3.9	15	0.094
79-01-6	Trichloroethylene	ND	ND	0.094
75-69-4	Trichlorofluoromethane	0.27	1.5	0.094
76-13-1	Trichlorotrifluoroethane	ND	ND	0.094
593-60-2	Vinyl Bromide	ND	ND	0.094
75-01-4	Vinylchloride	ND	ND	0.094
156-59-2	c-1,2-Dichloroethylene	ND	ND	0.094
10061-01-5	c-1,3-Dichloropropylene	ND	ND	0.094
1330-20-7	m/p-Xylenes	2.2	9.5	0.19
95-47-6	o-Xylene	0.74	3.2	0.094
156-60-5	t-1,2-Dichloroethylene	ND	ND	0.094
10061-02-6	t-1,3-Dichloropropylene	ND	ND	0.094

Surrogate Compounds	Recoveries (%)	QC Ranges
1,2-Dichloroethane,d4	116	68 - 138
Bromofluorobenzene	90	72 - 112
Toluene,d8	105	83 - 113

Comments:

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

Gruhn Engine Repair - Hampton Falls, NH

Air Toxics by GC/MS

Cannister ID:	22692	Lab Sample ID:	AB07198
Date of Collection:	6/21/2010	Matrix:	Air
Date of Analysis:	6/23/2010	Dilution Factor:	1.74
Sample Volume:	500 mL		

CAS Number	Compound	Concentration ppb/V	Concentration ug/m3	RL ppb/V	Qualifier
71-55-6	1,1,1-Trichloroethane	ND	ND	0.085	
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	0.085	
79-00-5	1,1,2-Trichloroethane	ND	ND	0.085	
75-34-3	1,1-Dichloroethane	ND	ND	0.085	
75-35-4	1,1-Dichloroethylene	ND	ND	0.085	
120-82-1	1,2,4-Trichlorobenzene	ND	ND	0.085	
95-63-6	1,2,4-Trimethylbenzene	ND	ND	0.085	
106-93-4	1,2-Dibromoethane	ND	ND	0.085	
95-50-1	1,2-Dichlorobenzene	ND	ND	0.085	
107-06-2	1,2-Dichloroethane	ND	ND	0.085	
78-87-5	1,2-Dichloropropane	ND	ND	0.085	
108-67-8	1,3,5-Trimethylbenzene	ND	ND	0.085	
106-99-0	1,3-Butadiene	ND	ND	0.17	
541-73-1	1,3-Dichlorobenzene	ND	ND	0.085	
106-46-7	1,4-Dichlorobenzene	ND	ND	0.085	
591-78-6	2-Hexanone	ND	ND	0.085	
622-96-8	4-Ethyltoluene	ND	ND	0.085	
107-13-1	Acrylonitrile	ND	ND	0.085	
107-05-1	Allyl Chloride	ND	ND	0.085	
71-43-2	Benzene	ND	ND	0.085	
100-44-7	Benzylchloride	ND	ND	0.085	
75-27-4	Bromodichloromethane	ND	ND	0.085	
75-25-2	Bromoform	ND	ND	0.085	
56-23-5	Carbon Tetrachloride	0.10	0.63	0.085	
108-90-7	Chlorobenzene	ND	ND	0.085	
75-00-3	Chloroethane	ND	ND	0.085	
67-66-3	Chloroform	ND	ND	0.085	
110-82-7	Cyclohexane	ND	ND	0.085	
124-48-1	Dibromochloromethane	ND	ND	0.085	
75-71-8	Dichlorodifluoromethane	0.48	2.4	0.085	
1320-37-2	Dichlorotetrafluoroethane	ND	ND	0.085	
100-41-4	Ethylbenzene	0.074	0.32	0.085	L
142-82-5	Heptane	ND	ND	0.085	
87-68-3	Hexachloro-1,3-butadiene	ND	ND	0.085	
110-54-3	Hexane	0.18	0.63	0.085	
78-93-3	Methyl Ethyl Ketone	0.22	0.65	0.085	B
108-10-1	Methyl Isobutyl Ketone	ND	ND	0.085	
1634-04-4	Methyl-t-Butyl Ether	ND	ND	0.085	
74-83-9	Methylbromide	ND	ND	0.085	
74-87-3	Methylchloride	0.45	0.93	0.085	
75-09-2	Methylene Chloride	0.091	0.32	0.085	
100-42-5	Styrene	ND	ND	0.085	
127-18-4	Tetrachloroethylene	ND	ND	0.085	
109-99-9	Tetrahydrofuran	ND	ND	0.085	

108-88-3	Toluene	0.33	1.2	0.085	
79-01-6	Trichloroethylene	ND	ND	0.085	
75-69-4	Trichlorofluoromethane	0.28	1.6	0.085	
76-13-1	Trichlorotrifluoroethane	0.074	0.57	0.085	L
593-60-2	Vinyl Bromide	ND	ND	0.085	
75-01-4	Vinylchloride	ND	ND	0.085	
156-59-2	c-1,2-Dichloroethylene	ND	ND	0.085	
10061-01-5	c-1,3-Dichloropropylene	ND	ND	0.085	
1330-20-7	m/p-Xylenes	0.22	0.95	0.17	
95-47-6	o-Xylene	0.091	0.40	0.085	
156-60-5	t-1,2-Dichloroethylene	ND	ND	0.085	
10061-02-6	t-1,3-Dichloropropylene	ND	ND	0.085	

Surrogate Compounds	Recoveries (%)	QC Ranges
1,2-Dichloroethane,d4	117	68 - 138
Bromofluorobenzene	91	72 - 112
Toluene,d8	100	83 - 113

Comments:

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

Gruhn Engine Repair - Hampton Falls, NH

Laboratory Blank

Cannister ID:	N/A	Lab Sample ID:	N/A
Date of Collection:	N/A	Matrix	Air
Date of Analysis:	6/23/2010	Dilution Factor:	1
Sample Volume:	500 mL		

CAS Number	Compound	Concentration ppb/V	Concentration ug/m3	RL ppb/V	Qualifier
71-55-6	1,1,1-Trichloroethane	ND	ND	0.05	
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	0.05	
79-00-5	1,1,2-Trichloroethane	ND	ND	0.05	
75-34-3	1,1-Dichloroethane	ND	ND	0.05	
75-35-4	1,1-Dichloroethylene	ND	ND	0.05	
120-82-1	1,2,4-Trichlorobenzene	ND	ND	0.05	
95-63-6	1,2,4-Trimethylbenzene	ND	ND	0.05	
106-93-4	1,2-Dibromoethane	ND	ND	0.05	
95-50-1	1,2-Dichlorobenzene	ND	ND	0.05	
107-06-2	1,2-Dichloroethane	ND	ND	0.05	
78-87-5	1,2-Dichloropropane	ND	ND	0.05	
108-67-8	1,3,5-Trimethylbenzene	ND	ND	0.05	
106-99-0	1,3-Butadiene	ND	ND	0.10	
541-73-1	1,3-Dichlorobenzene	ND	ND	0.05	
106-46-7	1,4-Dichlorobenzene	ND	ND	0.05	
591-78-6	2-Hexanone	ND	ND	0.05	
622-96-8	4-Ethyltoluene	ND	ND	0.05	
107-13-1	Acrylonitrile	ND	ND	0.05	
107-05-1	Allyl Chloride	ND	ND	0.05	
71-43-2	Benzene	ND	ND	0.05	
100-44-7	Benzylchloride	ND	ND	0.05	
75-27-4	Bromodichloromethane	ND	ND	0.05	
75-25-2	Bromoform	ND	ND	0.05	
56-23-5	Carbon Tetrachloride	ND	ND	0.05	
108-90-7	Chlorobenzene	ND	ND	0.05	
75-00-3	Chloroethane	ND	ND	0.05	
67-66-3	Chloroform	ND	ND	0.05	
110-82-7	Cyclohexane	ND	ND	0.05	
124-48-1	Dibromochloromethane	ND	ND	0.05	
75-71-8	Dichlorodifluoromethane	ND	ND	0.05	
1320-37-2	Dichlorotetrafluoroethane	ND	ND	0.05	
100-41-4	Ethylbenzene	ND	ND	0.05	
142-82-5	Heptane	ND	ND	0.05	
87-68-3	Hexachloro-1,3-butadiene	ND	ND	0.05	
110-54-3	Hexane	ND	ND	0.05	
78-93-3	Methyl Ethyl Ketone	0.085	0.25	0.05	
108-10-1	Methyl Isobutyl Ketone	ND	ND	0.05	
1634-04-4	Methyl-t-Butyl Ether	ND	ND	0.05	
74-83-9	Methylbromide	ND	ND	0.05	
74-87-3	Methylchloride	ND	ND	0.05	
75-09-2	Methylene Chloride	ND	ND	0.05	
100-42-5	Styrene	ND	ND	0.05	
127-18-4	Tetrachloroethylene	ND	ND	0.05	
109-99-9	Tetrahydrofuran	ND	ND	0.05	

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

AIR TOXIC QC REPORT

Gruhn Engine Repair - Hampton Falls, NH

Sample ID: AB07198

COMPOUND	QC-1 OBSERVED CONCENTRATION ppb/V	ACCEPTED VALUE ppb/V	QC LIMITS ppb/V
1,1,1-Trichloroethane	5.08	4.83	3.38 - 6.28
1,1,2,2-Tetrachloroethane	4.52	4.99	3.49 - 6.49
1,1,2-Trichloroethane	4.85	4.82	3.37 - 6.27
1,1-Dichloroethane	4.60	4.90	3.43 - 6.37
1,1-Dichloroethylene	4.80	4.78	3.35 - 6.21
1,2,4-Trichlorobenzene	2.90	4.09	2.86 - 5.32
1,2,4-Trimethylbenzene	4.64	5.04	3.53 - 6.55
1,2-Dichlorobenzene	4.45	4.97	3.48 - 6.46
1,2-Dichloropropane	4.28	4.85	3.39 - 6.31
1,3,5-Trimethylbenzene	4.88	4.87	3.41 - 6.33
1,3-Dichlorobenzene	4.42	5.00	3.5 - 6.50
Benzene	4.40	4.83	3.38 - 6.28
Carbon Tetrachloride	5.04	4.84	3.39 - 6.29
Chlorobenzene	4.24	4.86	3.40 - 6.32
Chloroethane	4.73	4.81	3.37 - 6.25
Chloroform	4.98	4.90	3.43 - 6.37
Dichlorodifluoromethane	4.13	4.05	2.84 - 5.27
Dichlorotetrafluoroethane	3.48	3.84	2.69 - 4.99
Ethylbenzene	4.24	4.88	3.42 - 6.34
Hexachloro-1,3-butadiene	3.49	4.41	3.09 - 5.73
Methylchloride	4.04	4.38	3.07 - 5.69
Methylene Chloride	4.72	4.91	3.44 - 6.38
Tetrachloroethylene	4.26	4.86	3.40 - 6.32
Toluene	4.12	4.83	3.38 - 6.28
Trichloroethylene	4.30	4.92	3.44 - 6.39
Trichlorofluoromethane	5.55	4.76	3.33 - 6.19
Vinylchloride	2.88	3.09	2.16 - 4.02
c-1,2-Dichloroethylene	4.83	4.80	3.36 - 6.24
m/p-Xylenes	4.65	4.97	3.48 - 6.46
o-Xylene	4.17	4.60	3.22 - 5.98

Comments:

US ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND LABORATORY

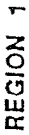
Laboratory Duplicate Results

Gruhn Engine Repair - Hampton Falls, NH

Sample ID: AB07197

COMPOUND	SAMPLE RESULT ppb/V	SAMPLE DUPLICATE RESULT ppb/V	PRECISION RPD %	QC LIMITS
1,2,4-Trimethylbenzene	0.13	0.13	0.0	50
1,3,5-Trimethylbenzene	0.15	0.15	0.0	50
4-Ethyltoluene	0.43	0.42	2.0	50
Benzene	0.53	0.53	0.0	50
Carbon Tetrachloride	0.086	0.084	2.0	50
Cyclohexane	0.41	0.39	5.0	50
Dichlorodifluoromethane	0.57	0.58	2.0	50
Ethylbenzene	0.53	0.51	4.0	50
Hexane	1.4	1.5	7.0	50
Methylchloride	0.52	0.51	2.0	50
Methylene Chloride	0.099	0.10	1.0	50
Toluene	3.9	3.8	3.0	50
Trichlorofluoromethane	0.27	0.28	4.0	50
m/p-Xylenes	2.2	2.1	5.0	50
o-Xylene	0.74	0.71	4.0	50

Comments:



CHAIN OF CUSTODY RECORD

[illegible]

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

APPENDIX B

METEOROLOGICAL DATA

**PEASE INTERNATIONAL TRADEPORT AIRPORT
PORTSMOUTH, NEW HAMPSHIRE**

Date	Time (LST)	Dry Bulb Temp (F)	Wet Bulb Temp (F)	Dew Point Temp (F)	Relative Humidity (%)	Wind Speed (MPH)	Wind Direction (degrees)	Wind Gusts (MPH)	Atmospheric Pressure (in. hg)	Precipitation Total (in)
6/20/2010	0:55	69	65	62	79	7	210		29.78	
	1:55	68	65	63	84	8	220		29.78	
	2:55	67	65	63	87	6	210		29.75	
	3:55	67	65	63	87	5	230		29.74	
	4:55	67	65	63	87	6	230		29.75	
	5:55	68	66	64	87	6	220		29.75	
	6:55	72	68	65	79	8	230		29.73	
	7:55	73	69	66	79	5	230		29.72	
	8:55	76	70	67	74	6	250		29.71	
	9:55	80	73	69	69	7	240		29.70	
	10:55	82	74	70	67	8	210		29.68	
	11:55	84	75	71	65	7	250		29.66	
	12:55	86	75	70	59	13	210	21	29.65	
	13:55	87	76	71	59	11	220		29.62	
	14:55	79	72	69	72	9	250		29.63	trace
	15:55	85	76	72	65	6	240		29.65	trace
	16:55	86	72	64	48	14	300		29.66	
	17:55	84	71	64	51	7	320		29.70	
	18:55	80	69	63	56	5	310		29.70	
	19:55	76	68	63	64	0	calm		29.71	
	20:55	74	67	63	69	6	310		29.73	
	21:55	70	65	62	76	5	290		29.74	
	22:55	70	65	62	76	6	300		29.74	
	23:55	69	65	62	79	6	240		29.74	
Average Total		76	69	65	72	7	249	21	29.71	trace

**PEASE INTERNATIONAL TRADEPORT AIRPORT
PORTSMOUTH, NEW HAMPSHIRE**

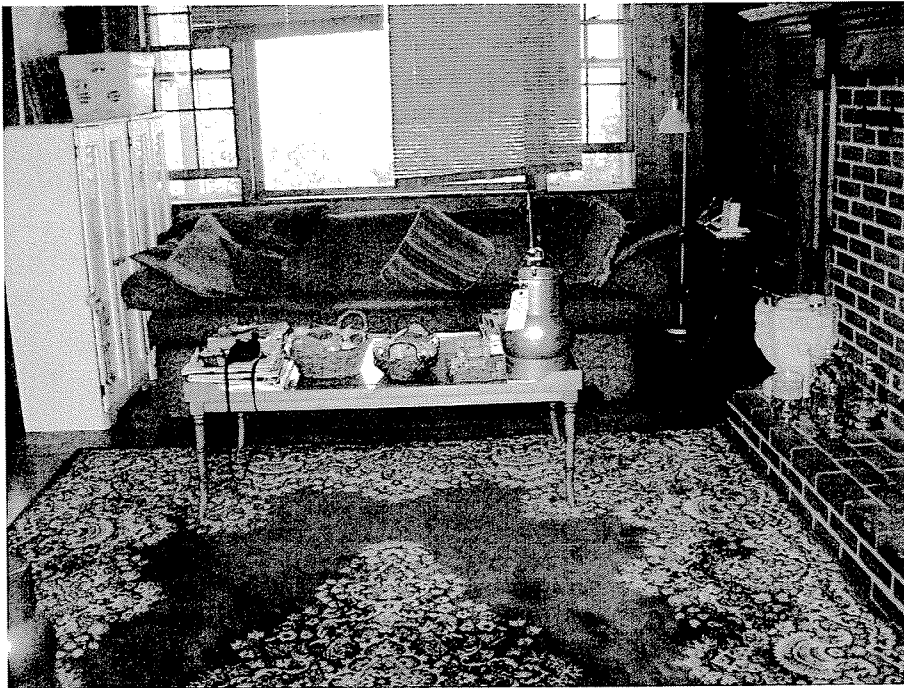
Date	Time (LST)	Dry Bulb Temp (F)	Wet Bulb Temp (F)	Dew Point Temp (F)	Relative Humidity (%)	Wind Speed (MPH)	Wind Direction (degrees)	Wind Gusts (MPH)	Atmospheric Pressure (in. hg)	Precipitation Total (in)
6/21/2010	0:55	67	64	62	84	3	250		29.74	
	1:55	66	63	61	84	0	calm		29.75	
	2:55	66	63	61	84	5	250		29.75	
	3:55	66	63	61	84	5	260		29.78	
	4:55	66	64	62	87	5	300		29.78	
	5:55	68	64	62	81	9	270		29.80	
	6:55	74	67	63	69	9	290		29.82	
	7:55	76	67	62	62	8	300		29.83	
	8:55	80	69	62	54	5	290		29.82	
	9:55	82	69	62	51	7	310		29.81	
	10:55	84	69	61	46	11	310		29.82	
	11:55	84	69	60	44	11	310		29.82	
	12:55	85	69	60	43	9	300		29.80	
	13:55	83	68	59	44	9	290		29.81	
	14:55	86	68	58	39	10	310		29.81	
	15:55	86	67	56	36	15	300		29.82	
	16:55	84	66	55	37	17	320		29.84	
	17:55	82	66	55	40	10	320		29.86	
	18:55	76	65	57	52	9	320		29.88	
	19:55	73	63	56	55	6	300		29.89	
	20:55	70	62	57	64	3	310		29.92	
	21:55	67	61	56	68	7	300		29.94	
	22:55	67	60	55	66	3	230		29.96	
	23:55	65	59	54	68	5	320		29.96	
Average Total		75	65	59	60	8	294		29.83	0

**PEASE INTERNATIONAL TRADEPORT AIRPORT
PORTSMOUTH, NEW HAMPSHIRE**

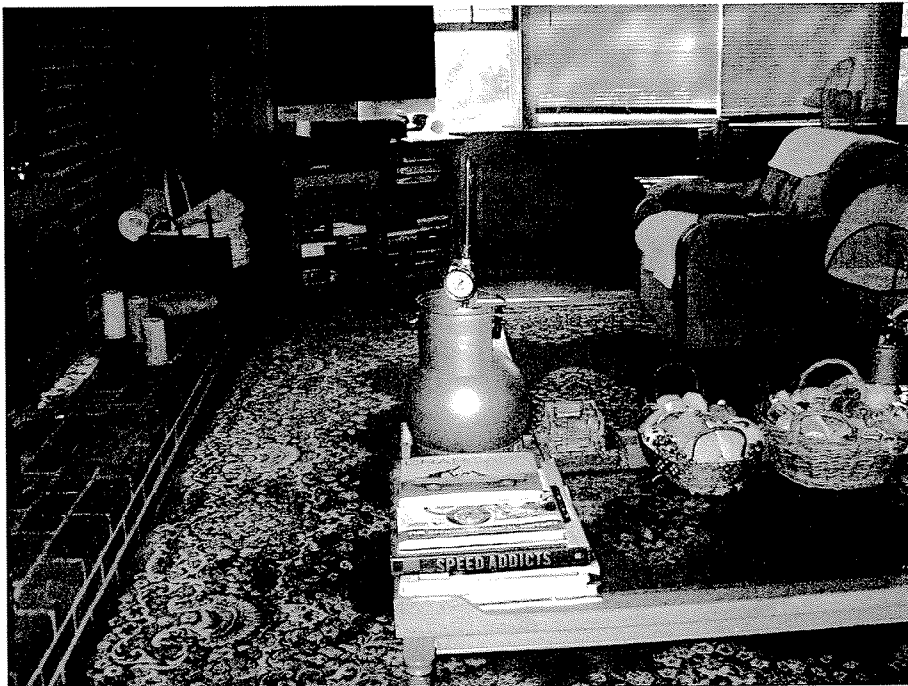
Date	Time (LST)	Dry Bulb Temp (F)	Wet Bulb Temp (F)	Dew Point Temp (F)	Relative Humidity (%)	Wind Speed (MPH)	Wind Direction (degrees)	Wind Gusts (MPH)	Atmospheric Pressure (in. hg)	Precipitation Total (in)
6/22/2010	0:55	62	58	54	75	6	330		29.96	
	1:55	61	57	54	78	3	300		29.96	
	2:55	60	56	53	78	0	calm		29.97	
	3:55	58	55	53	84	0	calm		29.99	
	4:55	58	55	53	84	0	calm		30.01	
	5:55	60	57	55	84	3	290		30.01	
	6:55	65	60	56	73	0	calm		30.03	
	7:55	69	61	55	61	5	310		30.03	
	8:55	74	63	56	54	0	calm		30.03	
	9:55	78	65	57	49	3	260		30.03	
	10:55	79	63	51	38	5	40		30.03	
	11:55	78	62	51	39	7	100		30.01	
	12:55	77	62	52	42	10	130		30.00	
	13:55	76	62	52	43	10	140		29.99	
	14:55	76	63	53	45	11	140		29.98	
	15:55	72	61	53	51	9	140		29.97	
	16:55	70	60	53	55	9	140		29.96	
	17:55	69	60	53	57	9	140		29.95	
	18:55	67	60	54	63	7	130		29.94	
	19:55	65	60	57	75	7	150		29.94	trace
	20:55	65	61	59	81	5	140		29.94	trace
	21:55	65	63	61	87	6	140		29.92	
	22:55	65	63	62	90	7	120		29.90	
	23:55	65	63	62	90	7	130		29.88	
Average Total		68	60	55	66	5	172		29.98	trace

APPENDIX C

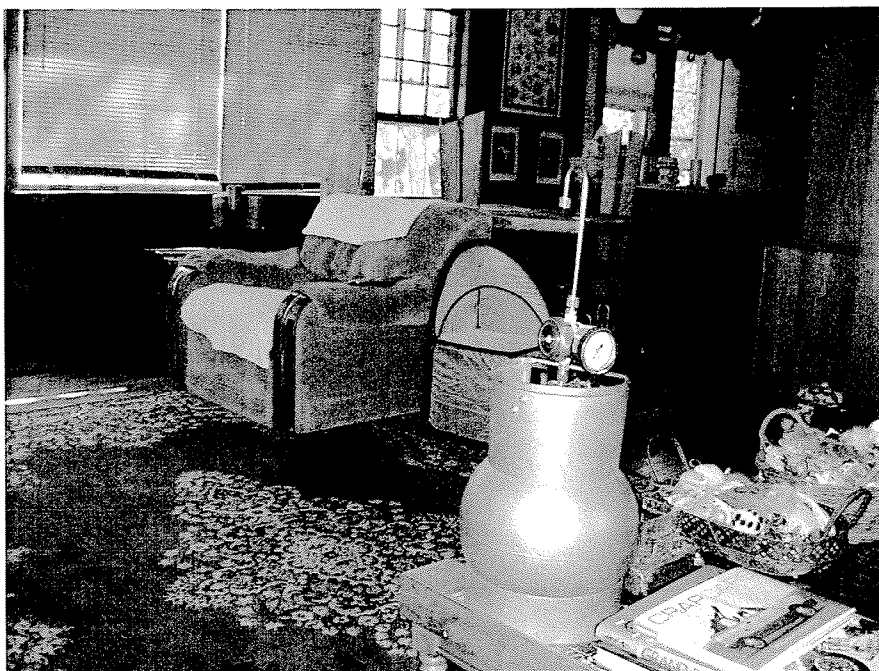
PHOTOGRAPHS



Photograph Description: View of the 24-hour indoor air canister on the first floor facing the west exterior wall.



Photograph Description: View of the 24-hour indoor air canister on the first floor facing the east exterior wall.



Photograph Description: View of the 24-hour indoor air canister on the first floor facing the east exterior wall.



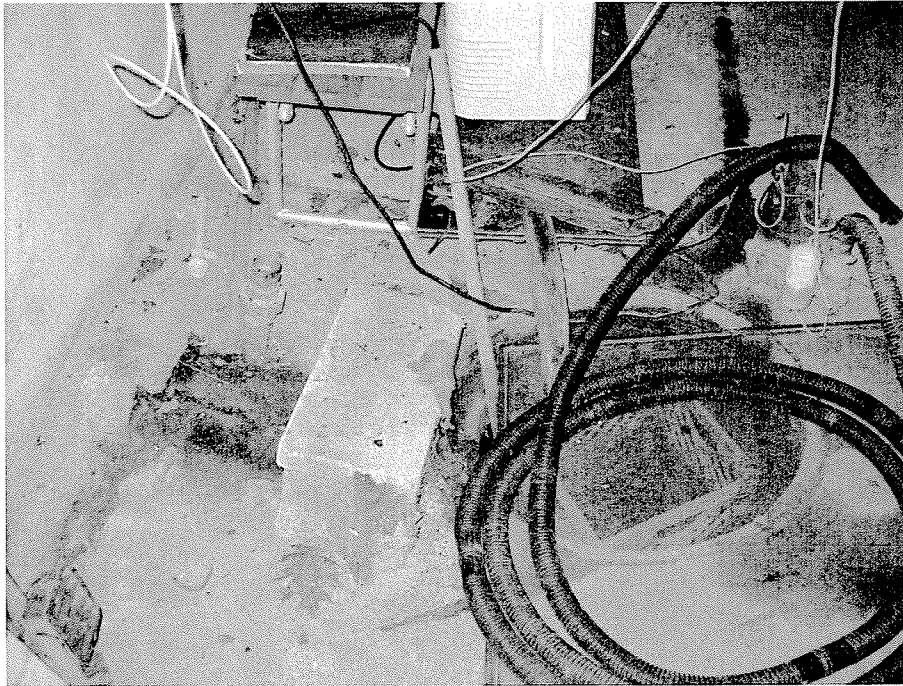
Photograph Description: View of the 24-hour indoor air canisters, including the duplicate, in the basement facing the north wall.



Photograph Description: View of the 24-hour indoor air canisters, including the duplicate, in the basement facing the east wall.



Photograph Description: View of the water line entering the basement which was located at the west wall near the basement stairs which appeared not to be well sealed.



Photograph Description: View of the sump pump and pipe which was located along the east wall next to the bulk head entrance. The sump pump had a 25 inches diameter and there was some standing water observed. The pipe next to the sump pump was 1 foot from the east wall and goes into the concrete foundation.



Photograph Description: View of the 24-hour ambient air canister facing west.

Indoor Air Assessment Survey
SURVEY OF OCCUPIED DWELLING

Date: 6/22/10

(1) Name: John and Lisa Pierce (did not tell cat survey with us)

Address: 35 Maine Rd

(2) Type of Structure: Ranch w/basement
Condominium, Townhouse, Single Family Home, Other _____

(3) Size of Structure: 1 floors 1 basement

(4) Age of Structure: 57 years

(5) Construction of Structure: Wood, brick, concrete, cinder block, other

(6) Number of Occupants: 2 Person (s) Duration of residency: Do not know

(7) Foundation: Concrete slab, footings on earth, other

(8) Unit Description: _____

Room	Furnishings (tables, chairs, etc.) none, light, moderate, heavy	Wall covering: none, paint (oil/water-based), wallpaper, paneling,	Month/year last painted or wallpapered
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<u>living room</u>	<u>hardwood floor, area rugs</u>	<u>wood paneling</u>	
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<u>Kitchen</u>	<u>open to living room</u>	<u>cabinets (small)</u>	
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<u>3 bedrooms</u>	<u>1 was empty 1 was master bed</u>	<u>water based paint</u>	<u>1 painted white w/ site</u>
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<u>attached garage</u>	<u>motorcycles, snowmobiles</u>	<u>used to repair bikes</u>	
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<u>hallway between house and garage</u>			
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Comments

SURVEY OF OCCUPIED DWELLING

- (9) Heating: Fuel type: electric, gas, oil, wood, coal, fireplace, other _____
Conveyance system: hot water, forced-air, other _____
- (10) Air Conditioning: Central air conditioning, window air conditioning unit (s),
other none
- (11) Ventilation: Fans: room, ceiling, attic ventilate using the fan only mode of your central air conditioning
or forced air heating system? (Yes/No)
Summer conditions: open window (never, rarely, usually) yes
- (12) Termite/Pesticide Treatment: None, yes, unknown
Type of pest controlled: none that we were aware of
- (13) Water Heater: Type: gas, electric, other _____
Location: basement, kitchen, garage, other _____
- (14) Cooking Applications: Electric, gas, exhaust hood present, other _____
- (15) Use of Consumer Products: Hardly Ever (less than once/month), Occasionally (about once/month),
Regularly (about once/week), Often (more than once/week)

Product

Frequency of Use

Spray-on deodorant	Hardly ever,	Occasionally,	Regularly,	Often
Aerosol deodorizers	Hardly ever,	Occasionally,	Regularly,	Often
Insecticides	Hardly ever,	Occasionally,	Regularly,	Often
Disinfectants	Hardly ever,	Occasionally,	Regularly,	Often
Window cleaners	Hardly ever,	Occasionally,	Regularly,	Often
Spray-on oven cleaners	Hardly ever,	Occasionally,	Regularly,	Often
Nail polish remover	Hardly ever,	Occasionally,	Regularly,	Often
Hair sprays	Hardly ever,	Occasionally,	Regularly,	Often

Home owner not able to respond to survey