

Health Consultation

FORMER GREEN HILLS CLEANERS UPDATE # 1

NASHVILLE, DAVIDSON COUNTY, TENNESSEE

JANUARY 21, 2009

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

Health Consultation: A Note of Explanation

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

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

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HEALTH CONSULTATION

FORMER GREEN HILLS CLEANERS UPDATE # 1
NASHVILLE, DAVIDSON COUNTY, TENNESSEE

Prepared By:

Tennessee Department of Health
under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

Foreword

This document summarizes an environmental public health investigation performed by Environmental Epidemiology of the State of Tennessee Department of Health. Our work is conducted under a Cooperative Agreement with the federal Agency for Toxic Substances and Disease Registry. In order for the Health Department to answer an environmental public health question, several actions are performed:

Evaluate Exposure: Tennessee health assessors begin by reviewing available information about environmental conditions at a site. We interpret environmental data, review site reports, and talk with environmental officials. Usually, we do not collect our own environmental sampling data. We rely on information provided by the Tennessee Department of Environment and Conservation, U.S. Environmental Protection Agency, and other government agencies, businesses, or the general public. We work to understand how much contamination may be present, where it is located on a site, and how people might be exposed to it. We look for evidence that people may have been exposed to, are being exposed to, or in the future could be exposed to harmful substances.

Evaluate Health Effects: If people have the potential to be exposed to contamination, then health assessors take steps to determine if it could be harmful to human health. We base our health conclusions on exposure pathways, risk assessment, toxicology, cleanup actions, and the scientific literature.

Make Recommendations: Based on our conclusions, we will recommend that any potential health hazard posed by a site be reduced or eliminated. These actions will prevent possible harmful health effects. The role of Environmental Epidemiology in dealing with hazardous waste sites is to be an advisor. Often, our recommendations will be actions items for other agencies. However, if there is an urgent public health hazard, the Tennessee Department of Health can issue a public health advisory warning people of the danger, and will work with other agencies to resolve the problem.

If you have questions or comments about this report, we encourage you to contact us.

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Introduction

DCERP Facility ID No. D-19-200 (Figure 1) is a former dry cleaning site located at 4106 B Hillsboro Pike in Nashville, Davidson County, Tennessee, 37215. The facility is a triangular leased space at the southwestern end of a stripmall shopping center (Figure 2). The drycleaner, Green Hills Cleaners, moved in 2006 to a different leased space at the same address. The drycleaner continues to provide cleaning services although the new leased space is a pick-up location only. All references to the “site” refer to the former Green Hills Cleaners location at 4106 B Hillsboro Pike.

The Tennessee Department of Health’s (TDH) Environmental Epidemiology Program (EEP) was initially contacted on May 5, 2008, by the Tennessee Department of Environment and Conservation (TDEC) Drycleaner Environmental Response Program (DCERP) to evaluate the results of indoor air sampling conducted within the former cleaner’s leased space. As part of their continued commitment to maintaining former drycleaner sites for safe new uses, the TDEC DCERP recommended indoor air sampling as a component of the Prioritization Investigation – Task Group B (PIB) activities conducted at the site (TVG 2008a).

TDH EEP published the Health Consultation: *Former Green Hills Cleaners, DCERP Site ID No. D-19-200, Nashville, Davidson County, Tennessee*, on September 8, 2008. The health consultation evaluated the potential for drycleaner-related chemicals to affect the health of future workers in the former cleaners lease space. The purpose of this update is to evaluate additional indoor air results collected in July 2008 from the former cleaner lease space and an adjacent basement lease space in the same strip shopping center. The additional indoor air samples were collected in response to the recommendations of the initial health consultation to resample the former cleaner’s space using lower method detection limits for chemicals analyzed and to obtain indoor air data from another leased space in the area of the former cleaner.

Background

The background for the initial health consultation prepared for the site can be found in the document: *Former Green Hills Cleaners, DCERP Site ID No. D-19-200, Nashville, Davidson County, Tennessee*.

The initial health consultation concluded that an indeterminate public health hazard existed within the lease space of the former Green Hills Cleaners because the initial March 2008 air sampling did not have low enough detection limits for 1,2-dichloroethane and vinyl chloride to evaluate these compounds against their respective cancer risk evaluation guide (CREG) screening values. The detection limits for the analysis of both samples were 0.4 ppb. The CREG values for both chemicals were below this detection limit. Additionally, it was concluded that an indeterminate health hazard existed in any adjacent leased space in the stripmall shopping center because no indoor air samples were collected in other lease spaces to evaluate potential risks to health.

Recommendations of the initial health consultation included advising TDEC DCERP to collect additional indoor air data in the former cleaners leased space with appropriately low detection limits. It was also recommended that TDEC DCERP should gather additional data with appropriately low detection limits to rule out the possibility of involuntary exposure of adjacent store employees to drycleaner solvent or breakdown product vapors.

Discussion

Introduction to Chemical Exposure

To determine whether persons have been or are likely to be exposed to chemicals, TDH EEP evaluates mechanisms that could lead to human exposure. An exposure pathway contains five parts:

- a source of contamination,
- contaminant transport through an environmental medium,
- a point of exposure,
- a route of human exposure, and
- a receptor population.

An exposure pathway is considered complete if there is evidence that all five of these elements have been, are, or will be present at the site. A pathway is considered potential if there is a lower probability of exposure (that is, information on one of the elements is missing). If there is no evidence that at least one of the five elements listed has been, is, or will be present at the site, then it is considered an incomplete exposure pathway.

Physical contact alone with a potentially harmful chemical in the environment by itself does not necessarily mean that a person will develop adverse health effects. A chemical's ability to affect public health is controlled by a number of other factors, including:

- the amount of the chemical that a person is exposed to (dose),
- the length of time that a person is exposed to the chemical (duration),
- the number of times a person is exposed to the chemical (frequency),
- the person's age and health status, and
- the person's diet and nutritional habits.

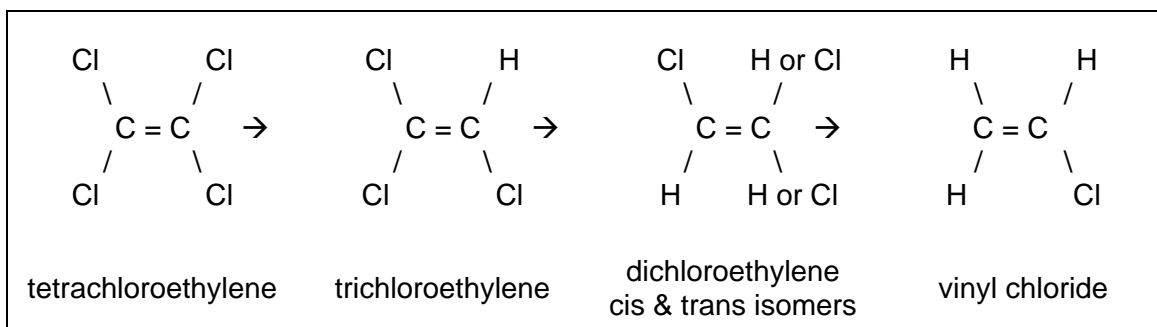
The purpose of this public health consultation is to examine any potential health hazard from tetrachloroethylene (PCE), trichloroethylene (TCE), and other drycleaner-related compounds present in other lease spaces. In the previous report, the detection limits for two drycleaner-related compounds, 1,2-dichloroethane (1,2-DCA) and vinyl chloride (VC), were greater than their respective Cancer Risk Evaluation Guide guidance values making evaluation difficult. This report discusses a follow up sampling event at the site and the detection limits obtained.

Based on the past data and recent data, a completed exposure pathway exists for inhalation of drycleaner solvent and breakdown products. The drycleaner solvent and breakdown products are

present in the indoor air because of vapor intrusion from contaminated groundwater beneath the site. These exposures are evaluated in more detail later in this section.

Drycleaner Solvent Explanation

The process of drycleaning is not truly dry, but it uses so little water that it has come to be known as drycleaning. Instead of water, chemical solvents are used in the cleaning process. The most commonly used solvent for drycleaning is tetrachloroethylene (PCE) or perc. It is colorless liquid and has sweet smell (ATSDR 1997). PCE is a volatile organic compound. It will quickly evaporate into a gas at room temperature. As its name implies, tetrachloroethylene has four chlorine anions on a two-carbon molecule. As these chlorine anions react, the molecule breaks down into other chlorinated volatile organics. Each of these breakdown products has slightly different chemical properties and toxicities. The following diagram is an example of how one chemical can breakdown to form another.



For example, PCE can breakdown to TCE, then to dichloroethylene (DCE), and then to vinyl chloride (VC). Each of these breakdown products can act independently. The only way to truly know the ratio of these breakdown products is to collect environmental samples. The drycleaner solvent, PCE, and all of its breakdown products plus their isomers were carefully considered in developing this report.

To evaluate exposure to a hazardous substance, health assessors often use health guidance values. If the chemical concentrations are below the guidance value, then health assessors can be reasonably certain that no adverse health effects will occur in people who are exposed. If concentrations are above the guidance values (ATSDR 2007a, 2008) for a particular chemical, then further site evaluation is needed.

ATSDR environmental media evaluation guidelines (EMEGs) and minimum risk levels (MRLs) are based on conservative assumptions about chemical exposure. EMEGs and MRLs consider non-cancer adverse health effects. Exposure durations are defined as acute (14 days or less), intermediate (15–365 days) and chronic (365 days or more) exposures. For cancer effects, ATSDR uses US Environmental Protection Agency (EPA) information to set their cancer risk evaluation guidelines (CREGs) for lifetime exposure.

Other health guidance values used to compare chemical concentration effects are comparison values. Comparison values are calculated concentrations of a substance in air, water, food, or soil that is unlikely to cause harmful health effects in exposed people. A comparison value is

used as a screening level during the public health assessment process. Substances found in amounts greater than their screening values may be selected for further detailed evaluation.

Environmental Sampling

On July 21, 2008, environmental consultant TVG, under the authorization of TDEC DCERP, performed a second indoor air monitoring event in two locations at the Former Green Hills Cleaners (Table 1). One location was in the lobby of the former drycleaner lease space and the second was in a basement lease space located two stripmall suites to the north of the former cleaner location (TVG 2008b). Both Summa canisters were deployed at the breathing height within their respective sampling locations. Similar to the initial indoor air sampling event, air samples were collected over a 24-hour time period and were analyzed by Environmental Science Inc. of Mount Juliet, Tennessee, using EPA Method TO-15 (TVG 2008b). Site conditions similar to the March indoor air sampling existed during the July indoor air sampling for the former cleaners lease space. The site remained unused and the air conditioning system was not operating. The basement sample was collected at a similar height as the sample in the cleaners. The air conditioning system was operating at the time of collection of the basement sample. The air conditioning system does not have the capability to draw in outdoor or “make up air.” The only air exchange occurs when the door to the basement room is open (TVG 2008c).

Drycleaner Solvents and Breakdown Products

The initial March 2008 indoor air samples detected very low concentrations of the drycleaner solvent PCE in both the former boiler room and former drycleaner machine area of the Green Hills Cleaners. Additionally, there were detections of one chemical breakdown product, TCE, in both indoor air samples. Therefore, a completed exposure pathway to indoor air would exist if the former cleaners lease space becomes occupied. All other chemical breakdown products of PCE were not detected in indoor air. All analytical detection limits were a fraction of a part per billion. Indoor air measurements are presented in Table 1. The initial March 2008 detections of PCE were 4.9 ppb and 5.9 ppb in the former boiler room and former drycleaning machine locations, respectively. TCE was measured at 0.76 ppb in the former boiler room and at 0.44 ppb in the former location of the drycleaning machines.

For the second sampling in July 2008, PCE was detected at 3.9 ppb in the former lobby of the Green Hills Cleaners. TCE was not detected in the former lobby sample. In the basement two lease spaces removed from the cleaner 22 ppb of PCE was detected. TCE was detected at a concentration of 0.48 ppb in the basement sample.

TABLE 1. Indoor air data for the former Green Hills Cleaners, Nashville, Davidson County, TN, leased space and adjacent leased space. Initial event samples were collected within the former cleaners leased space on March 24, 2008, over 24 hours with Summa canisters (TVG 2008a). Second event samples were collected in the lobby of the former cleaners leased space and in an adjacent basement leased space on July 21, 2008 over 24 hours using Summa canisters (TVG 2008b). Values reported in parts per billion (ppb). Health screening guidelines based on chronic exposure duration (ATSDR 2007, 2008) and EPA Risk-Based Concentrations (EPA 2008).

Chemical	Acronym	First Sampling Event		Second Sampling Event		ATSDR MRL/EMEG (unless noted) (non-cancer)	ATSDR CREG (unless noted) (10^{-6} excess cancer risk)
		03/24/08 Sample #1 Former Boiler Room	03/24/08 Sample #2 Former Machine Area	07/21/08 Sample #1 Former Lobby	07/21/08 Sample #2 Adjacent Basement		
		ppb	ppb	ppb	ppb	ppb	ppb
Tetrachloroethylene	PCE	4.9	5.9	3.9	22	40	0.06 ^{EPA}
Trichloroethylene	TCE	0.76	0.44	ND	0.48	7.4 ^{EPA}	0.9 ^{NY}
1,1-dichloroethylene	1,1-DCE	ND ¹	ND ¹	ND ²	ND ¹	20i	nc
cis-1,2-dichloroethylene	cis-1,2-DCE	ND ¹	ND ¹	ND ²	ND ¹	ngv	nc
trans-1,2-dichloroethylene	trans-1,2-DCE	ND ¹	ND ¹	ND ²	ND ¹	200i	nc
vinyl chloride	VC	ND ¹	ND ¹	ND ²	ND ¹	30i	0.04
1,1-dichloroethane	1,1-DCA	ND ¹	ND ¹	ND ²	ND ¹	ngv	0.38 ^{EPA}
1,2-dichloroethane	1,2-DCA	ND ¹	ND ¹	ND ²	ND ¹	600	0.01

Notes:

- ND¹ = not detected in the air sample (above the analytical detection limit of 0.4 ppb for compounds listed)
- ND² = not detected in the air sample (above the analytical detection limit of 0.2 ppb for compounds listed)
- NY = New York State Department of Health's guidance (used in absence of federal guidance) (NYSDOH 2006)
- EPA = EPA Region 3 Residential Indoor Air Screening Values (EPA 2008)
- i = ATSDR comparison intermediate value for 15-365 days exposure; typically higher than a chronic value
- nc = not classified as a carcinogen
- ngv = no guidance value available

Non-Cancer Evaluation

Like the concentrations of PCE and TCE (Table 1) from the initial March 24, 2008, sampling event (TVG 2008a), the concentrations of PCE and TCE in the second sampling event of July 21, 2008 (Table 1) were also below their respective Agency for Toxic Substances and Disease Registry (ATSDR) minimal risk levels (MRLs).

The ATSDR uses the no observed adverse effect level/uncertainty factor (NOAEL/UF) approach to derive non-cancer adverse health effect MRLs for hazardous substances. MRLs are set below levels that, based on current information, might cause adverse health effects in the people most sensitive to such substance induced effects. MRLs are derived for acute (1 to 14 days), intermediate (15 to 365 days), and chronic (greater than 365 days) exposure durations, and for the oral and inhalation routes of exposure. ATSDR does not use serious health effects (such as irreparable damage to the liver or kidneys, or birth defects) as a basis for establishing MRLs. Exposure to a level above the MRL does not mean that adverse health effects will occur (ATSDR 2007).

In this case, the PCE indoor air results were compared to the chronic PCE MRL of 40 ppb to represent an exposure over a longer period of time for individuals working in the former cleaner's space. In the case of TCE, there is not a chronic MRL published. Therefore, the results were compared to the EPA Risk-Base Concentrations (RBCs) (EPA 2008) published by the Oak Ridge National Laboratory (ORNL) for TCE of 7.4 ppb. Based on these comparisons, there is no apparent non-cancer health hazard at the site from drycleaner solvent or breakdown products.

Cancer Evaluation

Concentrations of PCE of 3.9 ppb from the former lobby and 22 ppb from the basement, and TCE of non-detect in the former lobby and 0.48 ppb in the basement, were also compared to ATSDR cancer risk evaluation guide (CREGs) for no more than one excess cancer in 1,000,000 people exposed during their lifetime (70 years). CREGs are calculated from EPA's cancer slope factors for oral exposures or unit risk values for inhalation exposures. These values are based on EPA evaluations and assumptions about hypothetical cancer risks at low levels of exposure.

ATSDR does not have a published CREG for PCE. However, EPA has a residential setting inhalation RBC for one excess cancer in 1,000,000 people of 0.06 ppb and one excess cancer in 10,000 people of 6 ppb for PCE. PCE concentrations in the former lobby are within this acceptable risk range, therefore the risk of cancer due to visiting the cleaner is low. However the PCE concentration in the basement is above this risk range. These cancer risk concentrations have been developed for chronic, lifelong exposure. A worker or visitor to the former cleaners leased space or the nearby basement would definitely have a shorter than lifetime exposure. An extremely low increased cancer risk would be expected for workers or visitors.

ATSDR does not have a published CREG for TCE. Because of this, EEP has adapted an indoor air guidance value for TCE of 0.9 ppb from the New York State Department of Health

(NYSDOH) for comparison purposes (NYSDOH 2006). TCE concentrations in both the former lobby and adjacent basement samples were below the NYSDOH guidance value of 0.9 ppb.

There are some drycleaner solvent breakdown products that have very low comparison values as some of the breakdown products are known or probable cancer-causing compounds. In the air samples analyzed, vinyl chloride and 1,2-DCA were not detected. The laboratory analytical detection limit for the former lobby sample was 0.2 ppb while the detection limit for the basement sample was 0.4 ppb. The representative health screening levels for cancer endpoints of VC and 1,2-DCA were less than the analytical detection level. Although, we would prefer to have had actual measurements to evaluate these two chemical vapors, based on their toxicology, it is unlikely that there would be any long-term health concerns at these levels.

The CREGs listed in Table 1 are for chronic, lifelong exposure. A worker or visitor to this site would have a shorter exposure. The toxicology of the carcinogen vinyl chloride (VC) is well understood. EPA's adult inhalation unit risk for VC is $4.4 \times 10^{-6} (\mu\text{g}/\text{m}^3)^{-1}$ (ATSDR 2007). Using the standard assumption of $\frac{1}{2}$ the analytical detection limit for the chemical concentration, one would expect about 1 additional excess cancer in 1 million persons, which is a very low risk, from a lifetime exposure to vinyl chloride for the former lobby area. For the basement area, the theoretical increased cancer risk is 2.2×10^{-6} from a lifetime exposure to VC. The toxicology of 1,2-DCA is less understood (ATSDR 2001). It is anticipated to be a human carcinogen, but the data is less certain. Perhaps due to this uncertainty, the lifetime inhalation unit risk for 1,2-DCA is $2.6 \times 10^{-5} (\mu\text{g}/\text{m}^3)^{-1}$ which yields a theoretical 1 in 100,000 increased cancer risk for the former lobby area, still a low risk. An increased cancer risk for the basement is 2.1×10^{-5} . Again, it is unlikely that there would be any long-term health concerns.

Concentrations of Other Compounds in Site Indoor Air

The indoor air samples collected in both the former lobby of the cleaners and in the adjacent basement also identified the presence of other compounds not related to drycleaning including acetone, benzene, chloromethane, chloroform, ethanol, ethylbenzene, freon-11, freon-12, Freon-113, heptane, tetrahydrofuran, toluene, 2-propanol, n-hexane, methylene chloride, 1,2,4-trimethylbenzene, 2,2,4-trimethylpentene, and x&p xylenes. Many of these compounds are associated with petroleum products, paint, or alcohols. A former gas station was located south of the former cleaner's space and many of the hydrocarbon-related chemicals could have originated from the activities conducted on this parcel. Concentrations of these compounds are below their respective screening value MRLs and CREGs. Therefore, the concentrations of these compounds at the site do not indicate a health hazard.

Ethanol and 2-Propanol in Indoor Air of Basement

Ethanol and 2-propanol concentrations were measured in the basement sample. The basement sample was located near an area of various shops which included a hair salon and a printer cartridge refilling business. The ethanol concentration in the basement sample was 2,300 ppb and the 2-propanol (isopropyl alcohol or rubbing alcohol) concentration was 120 ppb. Both of these chemicals are used as solvents and cleaners and are likely used in the cartridge refilling business and the hair salon (Alison Buford, DCERP, personal communication). Because these

chemicals are used in active businesses, the appropriate comparison value concentrations would be their respective National Institute of Occupational Safety and Health (NIOSH) and Occupational Health and Safety Administration (OSHA) Time Weighted Average (TWA). The NIOSH and OSHA exposure limits for ethanol and 2-propanol are established for up to a 10-hour workday during a 40-hour work week. The TWA's are 1,000 parts per million (ppm) for ethanol and 400 ppm for 2-propanol (NIOSH 1997). The concentrations of these two chemicals in the indoor air of the basement are well below their respective NIOSH and OSHA TWA exposure limits; therefore their concentrations do not indicate a health hazard in the basement.

Child Health Considerations

Children could be at greater risk than adults from certain kinds of exposure to hazardous substances (ATSDR 1997, 1998). Children have lower body weights than adults. Although children's lungs are usually smaller than adults, children breathe a greater relative volume of air compared to adults. If toxic exposure levels are high enough during critical growth stages, the developing body systems of children can sustain permanent damage. Finally, children are dependent on adults for access to housing, for access to medical care, and for risk identification. Thus, adults need as much information as possible to make informed decisions regarding their children's health.

In preparation of this health document, the health of children was thoughtfully considered. The lease space is currently vacant. The site is locked and no indications of trespassing were noted in this urban, well-travelled area. No physical hazards were present. If the lease space is redeveloped it will be likely for another retail or commercial business. Children are likely to spend a limited time in any retail or commercial business which would cause only a minimal exposure to drycleaner-related chemicals. No other health hazards unique to children were observed during this investigation of the Former Green Hills Cleaners.

Future Considerations

DCERP will continue to oversee the remediation of the site. A soil removal is planned which will remove PCE- and TCE-impacted soil at the rear of the building over an area defined by previous soil boring drilling to a depth of 11 feet below ground surface or to the top of bedrock (TVG 2008b). The soil removal will assist in preventing additional migration of a vapor plume into the former cleaners leased space. After soil removal and contaminant source reduction, future indoor air measurements would be anticipated to decrease.

Conclusions

1. No apparent public health hazard exists within the leased space of the former Green Hills Cleaners, DCERP facility ID #19-200, Nashville, Davidson County. Based on all the data reviewed, EEP has concluded that while minor exposures may potentially occur because of site conditions, exposures are not at levels that will likely cause health effects.

2. No apparent public health hazard exists in the adjacent basement leased space north of the facility due to the operation of the former cleaner. Although concentrations of PCE and TCE are higher than in the former cleaners leased space, PCE and TCE concentrations in the basement are lower than conservative comparison value concentrations for non-cancer effects. The PCE concentration in the basement is at a concentration that would create a low cancer effects health risk, especially for visitors. TCE concentrations are below a conservative cancer effects health risk screening value.
3. There is also no apparent public health hazard with respect to vinyl chloride and 1,2-DCA in the former cleaners and in the adjacent basement lease space. The July 2008 air sampling for drycleaner solvent and breakdown product vapors did not have low enough detection limits to allow determination of the cancer risk from these chemicals. The cancer risk at or below detection limits achieved in the July 2008 indoor air sampling would result in an extremely low risk of cancer.

Recommendations

None at this time.

Public Health Action Plan

1. TDEC DCERP has proposed a remedial action plan for the site which includes removal of contaminated soils at the rear of the former cleaners lease space. Once the contaminated soil source is removed, we would expect to see lower concentrations of PCE and TCE in indoor air.
2. This report and any needed explanation will be provided to the TDEC DCERP. This report will also be provided to the property owner, or a future lessee should the former cleaner space be redeveloped, and to the Green Hills Cleaners owner.
3. TDH EEP will continue to work with TDEC DCERP as the site continues through the DCERP regulatory process.
4. TDH EEP will be available to review additional data should the need arise.

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FIGURES

FIGURE 1 - Photo of the Former Green Hills Cleaners location (right center), 4106 Hillsboro Road. Nashville, Davidson County, Tennessee. Green Hills Cleaners moved next door (left center) to former location. (Photo credit: David Borowski, TDH, 05/06/08)



FIGURE 2 - View of retail establishments at the northern end of the shopping center, near the former cleaner location. (Photo credit: Joe George, TDH, 05/06/08)



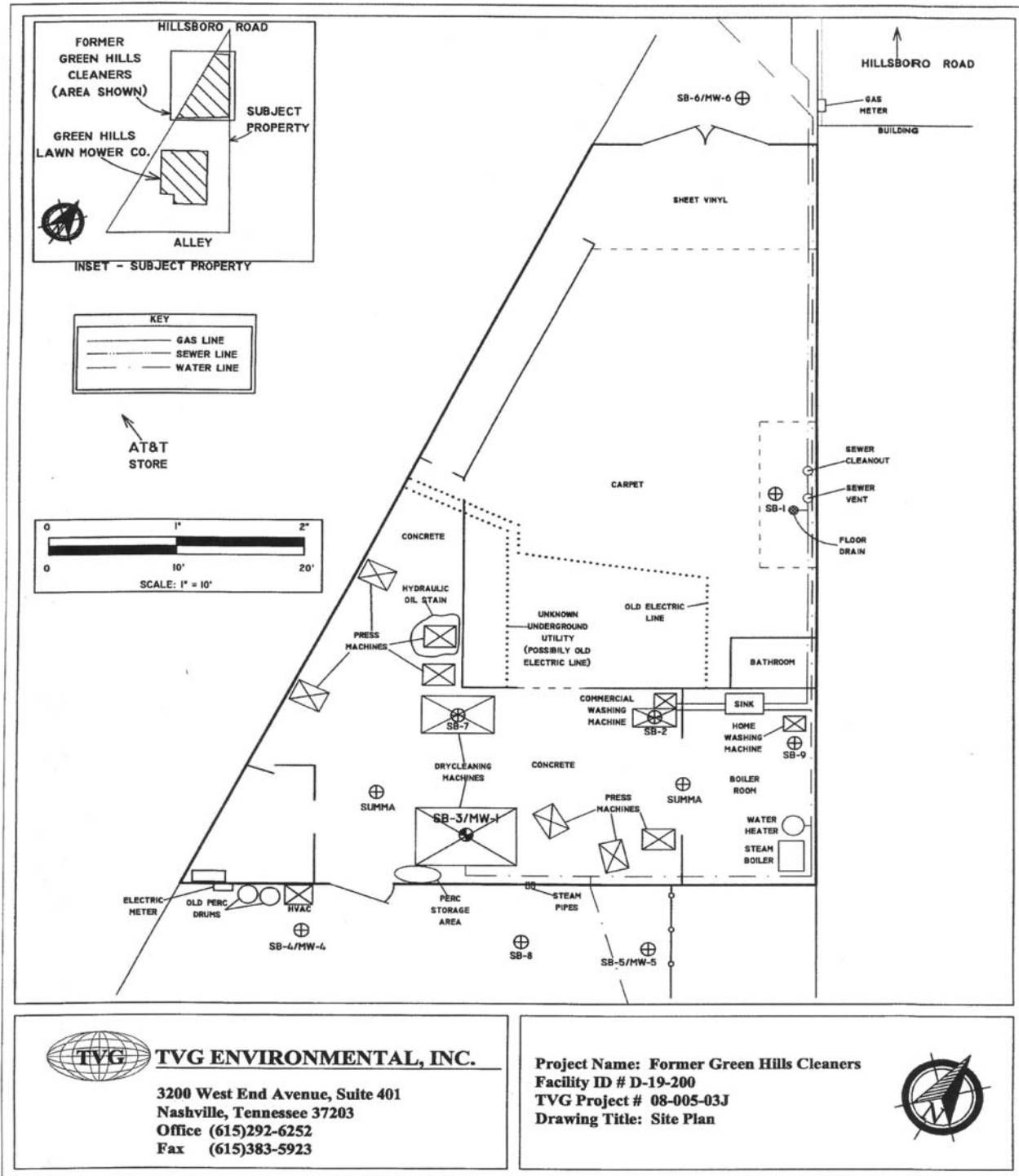


FIGURE 3 - Details of the Former Green Hills Cleaners Lease Space. Drawing Credit: TVG Environmental Inc., Phase 1 Solvent Impact Assessment, September 15, 2008.

Certification

This Public Health Consultation: *Former Green Hills Cleaners Update #1, DCERP Facility ID No. D-19-200, Nashville, Davidson County, Tennessee*, was prepared by the Tennessee Department of Health Environmental Epidemiology under a Cooperative Agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It was prepared in accordance with the approved methodology and procedures that existed at the time the health consultation was begun.



Technical Project Officer, CAT, SPAB, DHAC, ATSDR

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



Team Leader, CAT, SPAB, DHAC, ATSDR