

Health Consultation

Home Heating Oil Release Technical Review Of the Site Hazard Assessment Puyallup, Pierce County, Washington

March 29, 2007

Prepared by

The Washington State Department of Health
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry



Forward

The Washington State Department of Health (DOH) prepared this health consultation in cooperation with the Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR is part of the U.S. Department of Health and Human Services and is the principal federal public health agency responsible for health issues related to hazardous waste. This health consultation was prepared in accordance with methodologies and guidelines developed by ATSDR.

The purpose of this health consultation is to identify and prevent harmful human health effects resulting from exposure to hazardous substances in the environment. Health consultations focus on specific health issues so that DOH can respond to requests from concerned residents or agencies for health information on hazardous substances. DOH evaluates sampling data collected from a hazardous waste site, determines whether exposures have occurred or could occur, reports any potential harmful effects, and recommends actions to protect public health. The findings in this report are relevant to conditions at the site during the time of this health consultation, and should not necessarily be relied upon if site conditions or land use changes in the future.

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Glossary

Agency for Toxic Substances and Disease Registry (ATSDR)	The principal federal public health agency involved with hazardous waste issues, responsible for preventing or reducing the harmful effects of exposure to hazardous substances on human health and quality of life. ATSDR is part of the U.S. Department of Health and Human Services.
Aquifer	An underground formation composed of materials such as sand, soil, or gravel that can store and/or supply groundwater to wells and springs.
Carcinogen	Any substance that causes cancer.
Contaminant	A substance that is either present in an environment where it does not belong or is present at levels that might cause harmful (adverse) health effects.
Environmental Protection Agency (EPA)	United States Environmental Protection Agency.
Exposure	Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term [acute exposure], of intermediate duration, or long-term [chronic exposure].
Groundwater	Water beneath the earth's surface in the spaces between soil particles and between rock surfaces [compare with surface water].
Hazardous substance	Any material that poses a threat to public health and/or the environment. Typical hazardous substances are materials that are toxic, corrosive, ignitable, explosive, or chemically reactive.
Indeterminate public health hazard	The category used in ATSDR's public health assessment documents when a professional judgment about the level of health hazard cannot be made because information critical to such a decision is lacking.
Inhalation	The act of breathing. A hazardous substance can enter the body this way [see route of exposure].
Maximum Contaminant Level (MCL)	A drinking water regulation established by the federal Safe Drinking Water Act. It is the maximum permissible concentration of a contaminant in water that is delivered to the free flowing outlet of the ultimate user of a public water system. MCLs are enforceable standards.

Model Toxics Control Act (MTCA)	The hazardous waste cleanup law for Washington State.
Monitoring wells	Special wells drilled at locations on or off a hazardous waste site so water can be sampled at selected depths and studied to determine the movement of groundwater and the amount, distribution, and type of contaminant.
Organic	Compounds composed of carbon, including materials such as solvents, oils, and pesticides that are not easily dissolved in water.
Parts per billion (ppb)/Parts per million (ppm)	Units commonly used to express low concentrations of contaminants. For example, 1 ounce of trichloroethylene (TCE) in 1 million ounces of water is 1 ppm. 1 ounce of TCE in 1 billion ounces of water is 1 ppb. If one drop of TCE is mixed in a competition size swimming pool, the water will contain about 1 ppb of TCE.
Plume	A volume of a substance that moves from its source to places farther away from the source. Plumes can be described by the volume of air or water they occupy and the direction they move. For example, a plume can be a column of smoke from a chimney or a substance moving with groundwater.
Route of exposure	The way people come into contact with a hazardous substance. Three routes of exposure are breathing [inhalation], eating or drinking [ingestion], or contact with the skin [dermal contact].
Surface Water	Water on the surface of the earth, such as in lakes, rivers, streams, ponds, and springs [compare with groundwater].
Volatile organic compound (VOC)	Organic compounds that evaporate readily into the air. VOCs include substances such as benzene, toluene, methylene chloride, and methyl chloroform.

Summary and Statement of Issues

The Washington State Department of Health (DOH) conducted a health consultation after receiving a Site Hazard Assessment (SHA) from the Washington State Department of Ecology (Ecology). The routine SHA cited concerns regarding potential contamination of groundwater surrounding the site following cleanup of a home heating oil release in Puyallup, Washington.¹ Soil remediation has occurred; however, it is uncertain whether this work has eliminated every possible route of exposure (e.g., incidental ingestion, dermal contact, inhalation) because all appropriate tests of heating oil components were not conducted. It is also uncertain whether the selected soil cleanup level is protective of groundwater other than preventing the accumulation of free product on the water table. Groundwater contamination has not been well characterized to date although groundwater in the area is used for drinking water. Groundwater contaminated with home heating oil may also pose an indoor health risk. This health consultation is prepared under a cooperative agreement with ATSDR to address these potential exposure pathways.

Background

The Home Heating Oil Release site is located approximately 0.75 miles south of the Puyallup River in the flood plain of the Puyallup River Valley, Puyallup, Pierce County, Washington (Figure 1). The property is a 0.13-acre parcel in a residentially zoned area of the city; the surrounding area is generally level. It includes a single-story 988 square foot house constructed in 1925 and a detached two-story garage. An aboveground storage tank (AST) was located on the southwest exterior corner of the house, approximately three feet from the neighboring property to the west. The storage tank held approximately 270 gallons of heating oil. The fuel line from the storage tank to the furnace tunneled underneath the concrete block foundation and entered into the crawl space of the house.

On May 12, 2003, a furnace repair technician discovered a home heating oil release under the crawlspace of the home. The property owner initiated site characterization and remediation work two days later, and site activities were documented in Sound Environmental Strategies (SES)'s Cleanup Action Report.² The release is attributed to a broken fuel line that delivered fuel from the outside storage tank to the furnace inside the home. It is unknown when the fuel line failure occurred; however, SES identified an increasing trend in fuel consumption between 1997 and 2003. In 2003, more than 900 gallons of diesel fuel were delivered and consumed compared to an average of 500 gallons consumed per year through 1997.

On May 14, 2003, SES initiated a site characterization and remediation process.² Home heating oil had leaked under the west side of the house. Most of the soil in the property's backyard was excavated, as well as petroleum-contaminated soil (PCS) from under the house. PCS was also discovered west on the neighboring property so soils near and under the neighbor's house were excavated and hauled off for disposal. Remediators excavated a total of 690 tons of soil from both properties and disposed of the PCS at Fife Sand and Gravel.

The site overlies the Central Pierce County Aquifer, a federally designated sole source aquifer. The Tacoma-Pierce County Health Department (TPCHD) located drinking water wells within a two-mile radius of the site using the TPCHD's database. Wells located on the north side of the Puyallup River were not considered since they are unlikely to be hydraulically connected to groundwater on the south side of the river. Flow was not determined for the site although the direction of groundwater flow is expected to be north or northwest toward the Puyallup River. TPCHD considered all wells within the prescribed radius and south of the river as potentially downgradient. The nearest drinking water well was located about 2,900 feet to the north of the subject property.¹ The total population using groundwater for drinking water, from private and public supply wells, within a two-mile radius (excluding the area north of the Puyallup River), is in excess of 10,000 according to TPCHD's calculations.

Groundwater at the site was not adequately characterized with respect to flow direction, gradient, and contaminant concentrations as part of site remediation. Groundwater levels tend to fluctuate seasonally within the Puyallup River Valley, potentially hastening petroleum desorption from soil particles in contaminated soils and making the petroleum available to groundwater. TPCHD estimated that a substantial area is irrigated by groundwater wells within two miles of the property.

On May 25, 2006, staff from DOH Office of Environmental Health Assessments met to conduct a site visit at the site, where staff observed conditions and spoke with property owners. In general, DOH found that most of the property was reconstructed as described in the site remediation report (Figures 2 and 3). In discussions, the owners told staff that "someone" had sampled groundwater at two sites on their property. Repeated calls to SES were unsuccessful in obtaining any data.

Environmental Investigations

The highest concentration (71,000 ppm) of diesel range hydrocarbon-contaminated soil was located approximately six feet below ground surface (bgs) in soil directly under the valve of the AST. Soil concentrations of 36,000 ppm at the fence line at the west adjacent property, 17,000 ppm at the southwest exterior corner of the house and 3,200 ppm between the two houses were observed during site characterization.

Remediators encountered contamination to the maximum depth of excavation, approximately nine feet bgs, which is also the depth at which groundwater was observed. Indicative of contact with heating oil, the groundwater had a heavy red-stained sheen as reported by SES and TPCHD personnel.³ An estimated 21,300 gallons of groundwater was pumped from the excavation and disposed at Petroleum Reclaiming Services.

The site and the neighboring property to the west were backfilled with clean fill material after the extent of PCS had been defined and remediated. Laboratory analyses of soil samples collected from the southwest, west and western end of the north sidewall off-property indicated that the concentrations of home heating oil in the soils in these sidewalls were below Model Toxics

Control Act (MTCA) Method A cleanup criteria for diesel range hydrocarbons (2000 mg/kg for all unrestricted future land use).⁴ Once field personnel no longer observed red diesel in the soils, SES collected soil samples from the sidewall under the property house; results indicated that diesel concentrations in sidewall soils were below MTCA Method A cleanup criteria.

Compliance soil sampling after excavation confirmed that all diesel-contaminated soil above MTCA Method A Soil cleanup criteria, in contact with the groundwater zone near the AST, was removed. Diesel concentrations in the bottom of the excavation either were below MTCA Method A cleanup levels or were not detected. No known residual soil contamination above MTCA Method A cleanup levels remains on the site.

One of four tasks in the cleanup action proposed scope of work is to monitor groundwater, provide monitoring data, and report on results. This task was not conducted and effects of the home heating oil spill on groundwater in the area are unknown, although limited sampling was conducted recently.

Discussion

The site was contaminated with home heating oil from an aboveground storage tank, and soils were excavated to concentrations below MTCA's Method A Soil Cleanup Levels for unrestricted land use. For diesel range organics (DRO), this level is 2,000 mg/kg and is based on preventing the accumulation of free product on the groundwater. No known residual soil contamination above 2000 mg/kg remains on the site.²

According to MTCA, Diesel No. 2, fuel oil No 2, and light oil (including some bunker oils) are common examples of diesel range organics. Fuel oil No. 2 is equivalent to home heating oil.⁵

“To be in this range, 90 percent of the petroleum components need to be quantifiable using the NWTPH-Dx quantified against a diesel standard. Products such as jet fuel, diesel No. 1, kerosene, and heating oil may require analysis as both gasoline range organics (GRO) and DRO, depending on the range of petroleum components present as measured in NWTPH-HCID.”⁴

Although the release at the Matthews' site occurred from an aboveground storage tank containing home heating oil, investigators did not conduct NWTPH-HCID to establish the range of petroleum components present but assumed that the release consisted of DRO rather than GRO. Contaminant levels remaining at the site may be underestimated assuming only the presence of DRO.

Additionally, cleanup action at the site was conducted for DRO in soil without testing for DRO components. Ecology's MTCA cleanup regulation lists required testing for additives, other compounds and components of DRO including carcinogenic components of petroleum, such as benzene and PAHs (e.g., benzo(a)pyrene), and noncarcinogenic components, such as toluene, ethylbenzene, and naphthalenes.⁴ For carcinogens, Method A soil cleanup levels based on protection of groundwater for drinking water use are 0.03 mg/kg for benzene and 0.1 mg/kg for

PAHs (benzo(a)pyrene). For noncarcinogens, Method A soil cleanup levels based on protection of groundwater for drinking water use are 7 mg/kg for toluene, 6 mg/kg for ethylbenzene, 9 mg/kg for xylenes, and 5 mg/kg for total naphthalenes. SES' cleanup action at the site did not test soil levels of any of these compounds; thus, concentrations of the above compounds at the site are unknown.²

Petroleum products like home heating oil and its constituent components can pose a health risk if they are found in soils and enter drinking water or indoor air. Benzene and PAHs (benzo(a)pyrene) are known carcinogens and have been shown to cause cancer in laboratory animals and/or humans. Toluene exposure can lead to effects on the brain and nervous system; exposure to naphthalene can cause hemolytic anemia and has been shown to lead to damage of cells lining the nose or lungs of laboratory animals; exposure to ethylbenzene can cause eye and throat irritation in humans and liver and kidney damage, nervous system changes, and blood changes in laboratory animals; and exposure to xylene has been shown to cause changes in the liver and harmful effects on the kidneys, lungs, heart, and nervous system.^{6,7,8,9,10,11}

Direct contact (i.e., exposure to chemicals through ingestion or dermal contact) with home heating oil in soils is not an exposure pathway at the site. Consultants brought the lawn areas up to grade with topsoil and sod after excavation and replanted shrubs, trees and bushes in the yard. Consultants also formed and pored sidewalks, the patio, and an entry slab.² The above remediation efforts resulted in a barrier for direct contact with any remaining original soils.

Since soil contaminant concentrations after cleanup were not identified other than being lower than 2000 mg/kg, soil concentrations of DRO components may be above levels protective of groundwater even though the cleanup action report states that no residual groundwater contamination was apparent based on field observations.^{3,2} No groundwater samples have been collected in the surrounding area other than two groundwater samples obtained in the spring of 2006, as described by the property owners.¹ DOH was unable to obtain these results from SES, the remediation firm, despite repeated calls. Even if available, results from two groundwater samples would not be sufficient to characterize groundwater at this site. Until levels of petroleum hydrocarbons (including benzene, carcinogenic PAHs, toluene, ethylbenzene, xylenes, and naphthalenes) are determined in the groundwater, it is impossible to conclude if remaining diesel concentrations are below levels protective of citizens who drink water from potentially contaminated groundwater. The MTCA cleanup level for diesel range organics is 500 mg/L protective of potable water; i.e., drinking water, including groundwater. Thus, further investigation of the site is necessary to fill this data gap and to determine whether contaminants released at this site pose a health risk through exposure to groundwater.

Indoor air is another exposure pathway that may be important if any volatile organic compounds (VOCs) remain in soil or groundwater near the site.⁷ Vapor intrusion occurs when chemicals found in soil or groundwater get into indoor air through crawl spaces and cracks or other openings in the foundation. VOCs can enter homes and businesses found nearby an area of soil and/or groundwater contamination, potentially creating unhealthy indoor air quality. Investigation of vapor intrusion involves collecting soil, groundwater and soil gas samples to

determine if VOCs might pose an indoor air quality problem. No such sampling has occurred at the site. If groundwater or soil were found to be contaminated, testing for VOCs would be needed to fill this data gap.

Children's Health Considerations

The unique vulnerabilities of infants and children demand special attention in communities that have contamination of their water, food, soil, or air. The potential for exposure and subsequent adverse health effects often increases for younger children due, in part, to the fact that children drink more water, eat more food, and breathe more air (when compared pound for pound of body weight with adults). Additionally, the fetus is highly sensitive to many chemicals, particularly with respect to potential impacts on childhood development that can occur even when contaminant levels are much lower than amounts that cause other types of toxicity. For these reasons, DOH considers specific impacts that contaminants like home heating oil might have on children and other sensitive populations. Grandchildren visit the owner at the site.

Conclusions

There is not enough information available to determine if home heating oil and its components exist in groundwater at the site at levels that pose a human health risk via ingestion or inhalation. The site, therefore, poses an indeterminate public health hazard.

Recommendations

DOH recommends that the following actions be taken to assess whether the site poses a health risk to current occupants of the property or to nearby residents and/or the nearby commercial community:

- Within 30 days, identify and sample any drinking water wells potentially at risk from releases at the site.
- Determine the nature and extent of groundwater contamination associated with the site within 120 days and assess whether the levels pose a threat or potential threat to human health via ingestion or inhalation. If found in groundwater or soils, VOCs could pose an indoor air health risk and should be tested indoors. VOC contaminated groundwater, if used as a drinking water source, can be an inhalation risk (e.g., via showers) as well as an ingestion risk.

Public Health Action Plan

1. DOH is available to review investigation plans and evaluate health risks posed by the site when future investigation data become available.
2. DOH will post this health consultation report on its web site to make it available to the public and will provide copies of the report to Ecology, Tacoma-Pierce County Health Department, and the site owners.

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Figure 1. Home Heating Oil Release Site in Puyallup, Pierce County, Washington.

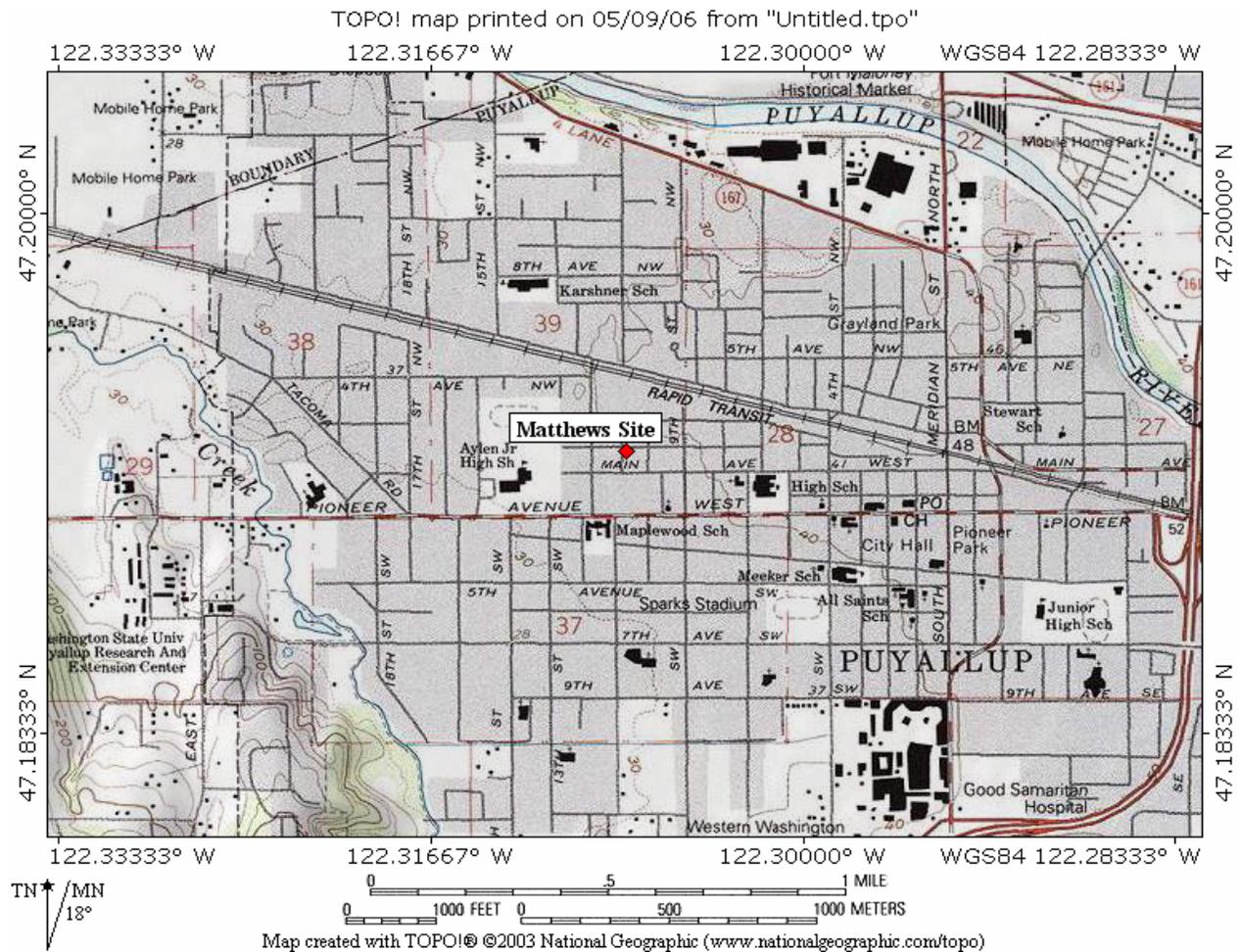
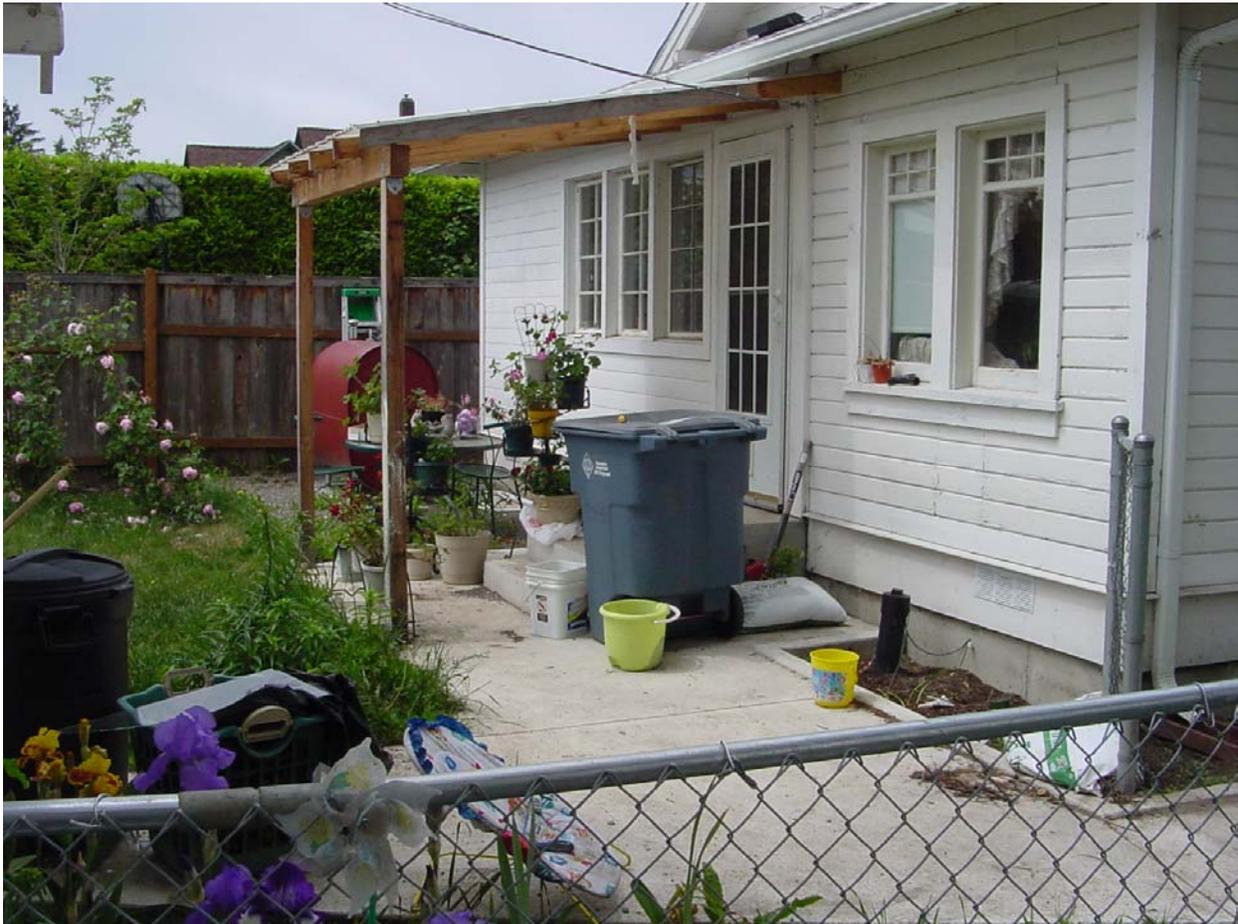


Figure 2. Backyard view of site, including replacement tank.



Figure 3. Patio view of site, after remediation.



Certification

This Home Heating Oil Release , Puyallup, Washington Health Consultation was prepared by the Washington State Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It was completed in accordance with approved methodology and procedures existing at the time the health consultation was initiated. Editorial review was completed by the Cooperative Agreement partner.

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

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