Health Consultation

Trichloroethylene (TCE) Contaminated Groundwater
Euclid and Woods Roads Area
Spokane County, Washington

January 9, 2009

Prepared by

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

DOH 334-202 January 2009

Foreword

The Washington State Department of Health (DOH) has 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

Acute	Occurring over a short time [compare with **chronic**].
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.
Chronic	Occurring over a long time (more than 1 year) [compare with **acute**].
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.
Dermal Contact	Contact with (touching) the skin (see route of exposure).
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.

Ingestion	The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way [see route of exposure].
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.
Media	Soil, water, air, plants, animals, or any other part of the environment that can contain contaminants.
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.
No apparent public health hazard	A category used in ATSDR's public health assessments for sites where human exposure to contaminated media might be occurring, might have occurred in the past, or might occur in the future, but where the exposure is not expected to cause any harmful health effects.
No public health hazard	A category used in ATSDR's public health assessment documents for sites where people have never and will never come into contact with harmful amounts of site-related substances.
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**].

Summary and Statement of Issues

The Washington State Department of Health (DOH) initiated this health consultation in August 2005 at the request of the Spokane Regional Health District (SRHD). In late 2004 and mid-2005, the U.S. Environmental Protection Agency (EPA) discovered trichloroethylene (TCE) above the federal drinking water standard in three private drinking water wells located east of the intersection of Euclid and Woods Roads in the Deep Creek area, west of Spokane, Washington. When notified about these findings in August 2005, DOH developed recommendations that would help reduce the resident's exposure to the TCE until EPA designed and installed water treatment systems.

EPA has taken a number of measures to test and reduce exposures since the TCE was first discovered. EPA:

- Installed water treatment systems at the properties served by the three wells where TCE levels exceed the drinking water standard to eliminate the residents' exposure to the TCE in tap water.
- Conducted additional private well testing.
- Installed eight shallow groundwater monitoring wells to investigate the possible source and extent of the TCE-contaminated groundwater.

In addition to those measures, EPA also expanded the testing in April 2006 to include perchlorate and n-nitrosodimethylamine (NDMA), two chemicals that can be associated with rocket and missile fuels. Perchlorate and NDMA were found at low levels at some locations in the TCE plume area. The source(s) of the TCE, perchlorate, and NMDA contamination are unknown.

DOH assessed potential health risks associated with the TCE, perchlorate, and NDMA found in the monitoring and private wells as the data became available from EPA from August 2005 through 2008. DOH's assessments of the results were provided to the community via EPA fact sheets and letters.

A number of community concerns about the health effects associated with the three chemicals were addressed by health professionals from DOH, SRHD, and physicians from the University of Washington Pediatric Environmental Health Specialty Unit (PEHSU). DOH, SRHD, and PEHSU staff also held an availability session in August 2006 to give Deep Creek community members an opportunity to further discuss their health concerns. DOH and SRHD also attended two EPA public meetings in June and September 2006 to address community health concerns.

This health consultation summarizes DOH's evaluation of the potential public health hazard posed only by the TCE found in wells in the vicinity of the intersection of Euclid and Woods Roads. A separate health consultation report will be prepared to address the perchlorate and NDMA found in drinking water wells in this area as well as across the broader Deep Creek area. This approach was selected in consultation with EPA and SRHD because the area where TCE has been found in groundwater is significantly

smaller than the area affected by perchlorate and NDMA thereby posing a health threat to only a small portion of the community. DOH prepares health consultation reports under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR).

Background

TCE contaminated groundwater was first discovered by EPA east of the intersection of Euclid and Woods Roads in January 2005 during a preliminary assessment (PA) and site inspection (SI) for the former Fairchild Nike Battery 87 site. The Fairchild Nike Battery 87 site, which consists of a control, launcher, and housing area, is a former Nike missile base. The control and launcher areas are located approximately four miles apart, northwest and southeast of the Euclid and Woods Roads intersection, respectively, and northwest of Fairchild Air Force Base (Figure1). Vehicle maintenance, corrosion control of missiles, and battery maintenance are reported to be the typical operations associated with the Nike facilities. Information about the operations, including waste handling, at the former Nike Battery 87 site is limited.

The private drinking water well where the TCE was first discovered is located approximately two miles southeast of the former control area, in a rural residential and agricultural area. The well was installed by the military in the late 1950s and continues to supply water to the former control area, which has been used periodically as residential property. At the time of the EPA PA/SI sampling, the control area was not occupied.(1)

TCE is a chlorinated solvent widely used as a degreasing agent. It is also found in consumer products including paint removers and adhesives. TCE is a common environmental contaminant found in groundwater. It has also been found in surface water, soil, and air. If released into shallow groundwater, TCE can evaporate, move through the soil, and enter overlying buildings where it can affect indoor air quality. Tap water containing TCE can also affect indoor air quality because the TCE evaporates from the water during showers and other water use.

Resource and Land Use

EPA reports that approximately 324 domestic drinking water wells are located within a four mile radius of the control area and 750 domestic drinking water wells are located within 4 miles of the launcher area. EPA also reports that no municipal drinking water wells are located within these areas. However, the Fairchild Nike Battery 87 site is located within one mile of the Spokane Valley Rathdrum Prairie Aquifer, a sole source aquifer, and within a designated wellhead protection area.(2) Land use in the vicinity is predominantly rural residential and agricultural.(3)

Geology/Hydrogeology

The Euclid and Woods Roads area lies within the Columbia River basin. Bedrock, consisting of basalt, generally lies within 1 to 4 feet of the ground surface. However,

there are some areas where sand, gravel, or clay extends to 20 feet below ground surface (bgs). Occasional clay layers exist within the basalt. Available well logs indicate that the basalt varies from medium hard to hard with a significant portion of the basalt described as fractured to highly fractured. Groundwater flow in basalt occurs through interconnected fractures. Groundwater flow direction in the fractured basalt is uncertain. However, some groundwater is moving toward Deep Creek where it discharges as springs.(4)

Groundwater Investigations and Private Well Testing

From 2005 through 2007, EPA conducted two groundwater investigations to determine the possible source(s) and extent of the TCE contamination in the shallow aquifer. They also conducted private well sampling at a number of locations to determine whether TCE might pose a health risk for the Euclid Road community. EPA's work and results are summarized below.

All of the water samples collected by EPA for TCE and NDMA analysis during the investigation and private well testing were analyzed using gas chromatography/mass spectrometry (GC/MS). Perchlorate was analyzed using IC/MS/MS (ion chromatography/mass spectrometry/mass spectrometry). Except for some of the early NDMA results in 2006, the results are acceptable for making a health determination. Some of the initial NDMA results were obtained by EPA using a non-standard analytical method, which resulted in some uncertainty about the NDMA results. However, EPA switched its analytical laboratory when it discovered this and subsequently a standard analytical method was used.

2005

TCE contaminated groundwater was first discovered by EPA east of the intersection of Euclid and Wood Roads in January 2005 when it received the results from a sample collected at the former military well in October 2004. When the sampling results from that well became available in January 2005, EPA discovered that it contained 130 micrograms per liter (ug/l) TCE, which exceeds the federal TCE drinking water standard of 5 ug/l.(5). The federal drinking water standards, also known as maximum contaminant levels (MCLs), are legally enforceable standards that apply to public water systems.(6)

In February 2005, EPA re-tested the former military well for volatile organic compounds (VOCs). TCE was the only VOC detected at the well, and the concentration (130 ug/l) remained unchanged from the October 2004 testing. An agricultural well located north of that well and a drinking water well located to the southeast was also tested by EPA in February 2005. The agricultural well, which was used for irrigation, contained 0.87 ug/l of TCE; no detectable level of TCE was found at the drinking water well.(3) The former military well was the shallowest of the three tested wells (182 feet deep) while the irrigation well was the deepest (400 feet deep) (Table 1). EPA reports, however, that the irrigation well caved to 100 feet and the pump is set at 99 feet.(3)

Although only the former military well contained TCE above the drinking water standard, EPA conducted additional groundwater testing at private wells in the vicinity of that well in June 2005 to determine if any other wells in the area might contain TCE. Water samples were collected from faucets near the well heads at ten locations and tested for VOCs including TCE. A water sample was also collected from the water tank at the control area.(3)

Except for one well that contained a very low level of methyl tertiary butyl ether (MTBE), which is a gasoline additive, the only VOC detected during the June 2005 groundwater sampling was TCE. TCE was detected in three of the ten tested wells - one domestic well, one irrigation well, and one livestock well. Only the domestic well, which is located about 700 feet southwest of the former military well, contained TCE (47 ug/l) above the 5 ug/l TCE MCL. The water tank at the control tower property, which is used for domestic purposes when occupied, also contained TCE but the level was less than the MCL.

In August 2005, EPA collected a sample from the kitchen and bathroom taps at the home that was supplied by the well where 47 ug/l TCE was found in June 2005. Two samples were collected at the kitchen tap; one sample was collected at the bathroom tap. TCE levels at the kitchen tap were 26.0 ug/l and 26.6 ug/l TCE, respectively, which is above the TCE MCL. The bathroom tap sample also contained TCE above the MCL at 25.2 ug/l. EPA also sampled a nearby domestic well in August 2005 that had not been previously sampled. Water samples were also collected from the kitchen and bathroom taps serviced by this well. TCE was detected at this other well at 53.9 ug/l. The kitchen and bathroom also contained TCE at 59.5 ug/l and 56.5 ug/l, respectively.

When EPA became aware of this situation, they contacted SRHD, who in consultation with DOH, recommended to EPA that the well owners obtain bottled water and open windows to reduce inhalation exposures during showering and other water uses (e.g. dish washing) until a treatment system could be installed to reduce or eliminate the TCE at the taps. This recommendation was made because most of the exposure associated with TCE in drinking water is through the ingestion and inhalation.

EPA installed water treatment systems in 2005 at two homes where groundwater was being used as a potable water source and reported that TCE levels in the treated water dropped below the drinking water standard. The third property was unoccupied and EPA was unable to install the third treatment system because the property owner would not allow the installation. However, the property owner reconsidered EPA's offer and a treatment system was installed at the third property in 2006.

EPA also sampled another 13 private wells and two springs in August 2005 that had not previously been sampled. No VOCs, including TCE, were detected in these other private wells. TCE, however, was detected in one of the spring samples at 12.9 ug/l.

EPA installed four monitoring wells along Euclid Road in November 2005 to determine the TCE concentrations in the uppermost water bearing zone, shallow groundwater flow

direction, and identify a possible source of the TCE. TCE levels in the monitoring wells ranged from 3.9 to 140 ug/l.

2006

In March and April 2006, EPA expanded the domestic wells testing and analyzed water samples for perchlorate and NDMA, which are chemicals associated with rocket fuels, to help them determine whether the TCE detected in the wells might be associated with the Nike Battery 87 site. Additional TCE testing was also done by EPA in September and December 2006.

The four shallow monitoring wells were tested for TCE in March 2006 with levels ranging from 0.87 to 210 ug/l TCE. TCE testing was also done in April 2006 at six private wells that EPA determined were the most potentially vulnerable private wells. Only two of the six private wells were found to contain detectable levels of TCE. One well contained 120 ug/l; the second well contained an estimated level of 0.24 ug/l.(7)

Some additional TCE testing in June 2006 indicated that the four shallow monitoring wells still contained elevated levels of TCE ranging from 4.3 to 210 ug/l. Water collected at an outside spigot at a nearby home contained 19 ug/l while a private well that was tested contained 150 ug/l TCE. (8) The home with the TCE in the outside spigot was one of the homes where a treatment system was installed. DOH understands that water at that spigot was untreated.

EPA conducted additional water testing at the monitoring wells in the last half of 2006 (September and December) and again found elevated TCE levels ranging from 6.8 to 190 ug/l. Some private wells were also retested in December 2006. However, only wells that previously contained TCE had detectable levels of TCE during that sampling event.(9) Two of the homes where treatment systems were installed were retested in December 2006. The TCE levels in treated water remained below the reporting limit of 1 ug/l.(10)

2007

EPA conducted additional water testing during the first half of 2007 (April for limited TCE testing and June for NDMA and perchlorate testing). Much of the early 2007 sampling was conducted to get further test results for determining whether there might be seasonal differences in the levels of TCE, perchlorate, and NDMA.

The three properties where the treatment systems were installed were retested in April and October 2007. The TCE levels in the treated water remained below the reporting limit of 1 ug/l.

The four shallow monitoring wells contained 3.4 to 200 ug/l TCE during the April 2007 testing. Only a few private wells were tested during that time. The untreated well water at the three properties where treatment systems were installed still contained TCE above the drinking water standard. None of the other tested private wells contained TCE above the

reporting level of 1 ug/l.(9;11)

EPA retested some private wells in October 2007 and again found the wells at the three properties where treatment systems were installed still contained TCE above the drinking water standard. None of the other tested private wells contained TCE above the reporting level of 1 ug/l.

EPA also installed four additional monitoring wells near Euclid Road in October 2007 to try to locate the source of the TCE and better define the shallow TCE plume. At that time, EPA tested all eight monitoring wells for TCE only and found levels ranging from non-detected (<1 ug/l TCE) to 160 ug/l.(12). The TCE results obtained from the October 2007 testing are provided on Figure 1. EPA also attempted to evaluate the groundwater to indoor air pathway in October 2007 using Gore sampling devices. However, EPA reports that this testing was not successful.

2008

EPA did not conduct any monitoring of the TCE treatment systems, private wells, or the monitoring wells in 2008. However, they did continue operations and maintenance of the TCE treatment systems, which included changing treatment system filters.

2009

EPA will be working with the Washington State Department of Ecology and SRHD to transition involvement at this site in 2009. These three agencies are working out the details of the transition plan, which will be shared with the community in the future.

Discussion

TCE has only been found in a relatively small area east of the intersection of Woods and Euclid Roads. Although EPA has obtained a significant amount of TCE data from its shallow monitoring well and private well testing, the source of the TCE contamination remains unknown and the boundaries of the shallow TCE plume remain undefined. The possible lateral and vertical extent of the TCE contamination in the deep groundwater is also unknown and is difficult to predict because the deeper portion of the subsurface consists of fractured basalts. Tracing contaminant plumes in fractured basalts is often impossible to do.

EPA has also installed, maintained, and tested the treatment systems at the three properties where TCE contaminated groundwater is being used as tap water. No TCE has been detected by EPA in the treated water above the reporting limit of 1.0 ug/l since the systems were installed in 2005 and 2006. However, the wells that supply those homes continue to have levels of TCE above the drinking water standard.

Many factors determine whether human health will be harmed by chemicals found in drinking water. These factors include the contaminant type, contaminant dose (how much), the duration of exposure (how long), and how a person comes in contact with the contaminants. Age, sex, diet, family traits, lifestyle, and state of health are other factors that affect how people will respond when exposed to contaminants.

When found in drinking water, TCE exposures can occur through ingestion, inhalation, and dermal contact. However, most of the exposure occurs through ingestion and inhalation.

There is a lot of scientific information about the health effects of TCE. Currently, however, no consensus has been reached about the quality of the available TCE health data and how to assess it. Much of the information about health effects has been obtained from high dose animal studies or occupational exposures where workers have accidentally been exposed to high doses of TCE. Many animal studies show that TCE and its metabolites (products of metabolism) can cause health effects (kidney toxicity and cancer, liver toxicity and cancer, and cancer). Studies of human populations suggest that TCE exposure might also cause human health effects. However, less is known about the possible human health effects associated with exposures to TCE.

Past Exposures

TCE was found in late 2004 and early 2005 in private drinking water wells east of the intersection of Euclid and Woods Roads. It is unknown how long the TCE had been there. As a result, the level and length of people's exposure is unknown. Where a known contamination source exists, it is sometimes possible to estimate the possible duration of past exposures and then assess possible past health risks. However, no source(s) of the TCE has been found by EPA to date in the Euclid and Woods Roads area so an evaluation of past exposure is not possible. As a result, past exposures to TCE in tap water pose an indeterminate public health hazard.

Current and Future Exposures

Since EPA installed the treatment systems at the three residences, drinking water tests in the Euclid and Woods Roads area suggests that TCE levels in tap water in the community are below the federal drinking water standard. As a result, TCE is currently considered a no apparent public health hazard.

It is expected that future TCE exposures will be similar to what we are seeing today at the three residences where elevated TCE levels were found in tap water if the drinking water treatment systems continue to be maintained and operated appropriately. It is unknown whether the levels of TCE in the other nearby wells will remain below the federal drinking water standard in the future or whether new drinking water wells, if installed, will have levels of TCE above the standard because there is only limited knowledge about the extent and movement of the TCE plume in the area. As a result, future exposures to TCE pose an indeterminate public health hazard.

EPA efforts to evaluate the groundwater to indoor pathway in October 2007 did not yield useful data. Consequently, it is unknown whether the pathway is completed. The groundwater to indoor air pathway, therefore, poses an indeterminate public health hazard.

Children's Health

Children can be uniquely vulnerable to the hazardous effects of volatile environmental contaminants, like TCE, if exposed to these chemicals in tap water, through drinking or bathing. When compared to adults, pound for pound of body weight, children drink more water, eat more food, and breathe more air. These facts lead to an increased exposure to contaminants. Additionally, the fetus is highly sensitive to many chemicals, particularly with respect to potential impacts on childhood development. For these reasons, DOH considers the specific impacts that contaminated tap water might have on children, as well as other sensitive populations.

Conclusions

1. The source and lateral and vertical extent of the TCE groundwater plume is unknown. Part of the reason for this is the complex geologic and hydrogeologic conditions.
2. TCE levels in tap water at residences in the vicinity of Woods and Euclid Roads currently pose no apparent public health hazard. However, the wells at the properties where treatment systems were installed continue to have levels of TCE above the federal drinking water standard.
3. Past exposures to TCE cannot be assessed because the duration and level of TCE exposure cannot be determined. As a result, the levels pose an indeterminate public health hazard.
4. Future exposures to TCE pose an indeterminate public health hazard because the lateral and vertical extent, direction, and future level of the TCE contamination are uncertain.
5. Subsurface conditions at the site suggest that the groundwater to indoor air pathway is a possible exposure pathway. Until further evaluation has been done, the pathway poses an indeterminate public health hazard.

Recommendations

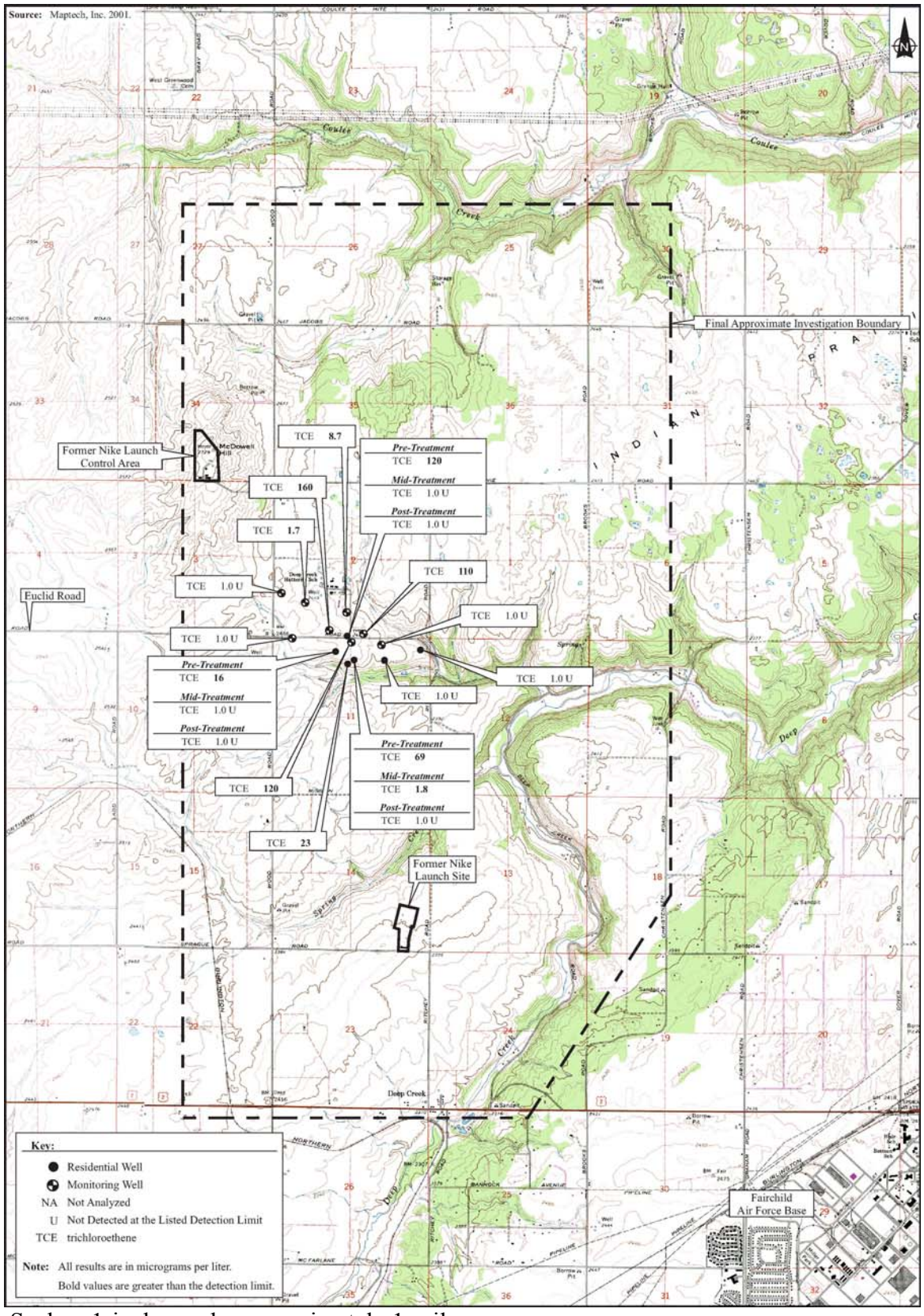
1. Continue operating and maintaining the drinking water treatment systems at the three residences where elevated TCE levels were found late 2004 and mid-2005.
2. TCE levels should continue to be monitored at the monitoring wells and private wells in the vicinity of Euclid and Woods Roads at an appropriate frequency to assess potential future exposure.
3. An assessment of the groundwater to indoor air pathway for TCE should be conducted either through conservative modeling using, for example, the Johnson and Ettinger model and/or soil gas or indoor air testing.
4. Because defining the lateral and vertical extent of TCE in the area is difficult, costly

and may not lead to definitive answers, institutional controls (e.g., deed restrictions, notification of local realtors, notices on well start cards) should be initiated to ensure that people do not use the TCE-contaminated groundwater as a tap water source now or in the future.

Public Health Action Plan

1. DOH will provide copies of this health consultation report to EPA, Ecology, SRHD, and residents along Euclid Road, who live near the TCE contaminated groundwater.
2. DOH will post this health consultation report on its web site to make it available to the general public.
3. EPA will continue working with Ecology and SRHD to complete the transition plan for future work regarding the TCE plume and existing water treatment systems installed at the three residences in 2005 and 2006.
4. SRHD has incorporated into its land use and liquid waste programs a "flagging" notification for any land use or well construction proposals within Sections 2, 3, 10, and 11 of Township 25, Range 40 in order to notify and require well water testing for TCE as a potential groundwater contaminant.
5. DOH will review groundwater monitoring and testing plans, data, and reports regarding the TCE contaminated groundwater.

Figure 1 – Euclid Road Groundwater Site, October 2007 TCE Results(12)



Scale: 1-inch equals approximately 1-mile

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Certification

This Euclid Road Health Consultation was prepared by the Washington State Department of Health under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It was completed in accordance with approved methodologies 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, (DHAC), ATSDR, has reviewed this public health consultation and concurs with the findings.

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References

1. Herrera Environmental Consultants. Emergency response sampling, Euclid Road ground water site, Spokane County, Washington. Seattle, Washington: Herrara Environmental Consultants; 2006 Feb.

2. Herrara Environmental Consultants. Combined preliminary assessment and site inspection report, Fairchild Nike Battery site, Spokane County, Washington. Seattle, Washington: Herrara Environmental Consultants; 2005 Jul.

3. Herrara Environmental Consultants. Combined preliminary assessment and site inspection report, Euclid Road Ground Water site, Spokane, Washington. Seattle, Washington: Herrara Environmental Consultants.; 2006 Jan.

4. Herrara Environmental Consultants. Combined preliminary assessment and site inspection report, Euclid Road ground water site, Spokane, Washington. Seattle, Washington: Herrara Environmental Consultants; 2006 Jan.

5. US Environmental Protection Agency. List of Drinking Water Contaminants & MCLs 2006 Sep 14 [cited 6 A.D. Oct 9] Available from http://www.epa.gov/safewater/mcl.html#mcls.

6. US Environmental Protection Agency. Office of Ground Water and Drinking Water: A Dictionary of Technical and Legal Terms Related to Drinking Water (Glossary) 2006 Feb 1 [cited 6 A.D. Oct 9] Available from http://iaspub.epa.gov/trs/trs_proc_qry.org_info?P_REG_AUTH_ID=1&P_DATA_ID=11566&P_VERSION=1&p_list_option_cd=INFO.

7. Ecology and Environment. Euclid Road Groundwater Site, April 2006 Sample Results Map. 200 Apr 10.

8. Ecology and Environment. Euclid Road Groundwater Site, June 2006 TCE Sample Results. 2006 Aug 3.

9. Ecology and Environment. Euclid Road Groundwater Site, Monitoring Well TCE Results Map. 2008 Mar 26.

10. Ecology and Environment. Euclid Road Groundwater Site, December 2006 TCE Sample Results. 2008 Jan 16.

11. Ecology and Environment. Euclid Road Groundwater Site, April 2007 Sampling Results Map. 2008 Jan 6.

12. Ecology and Environment. Euclid Road Groundwater Site, October 2007 Sample Results Map. 2007 Dec 21.