Public Health Assessment

Final Release

Van der Horst USA Corporation
Terrell, Kaufman County, Texas

EPA FACILITY ID: TXD007357932

Prepared by the
Texas Department of State Health Services

JULY 18, 2013

Prepared under a Cooperative Agreement with the
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Community Health Investigations
Atlanta, Georgia 30333

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment was prepared by ATSDR's Cooperative Agreement Partner pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund) section 104 (i)(6) (42 U.S.C. 9604 (i)(6)), and in accordance with our implementing regulations (42 C.F.R. Part 90). In preparing this document, ATSDR's Cooperative Agreement Partner has collected relevant health data, environmental data, and community health concerns from the Environmental Protection Agency (EPA), state and local health and environmental agencies, the community, and potentially responsible parties, where appropriate.

In addition, this document has previously been provided to EPA and the affected states in an initial release, as required by CERCLA section 104 (i)(6)(H) for their information and review. The revised document was released for a 60-day public comment period. Subsequent to the public comment period, ATSDR's Cooperative Agreement Partner addressed all public comments and revised or appended the document as appropriate. The public health assessment has now been reissued. This concludes the public health assessment process for this site, unless additional information is obtained by ATSDR's Cooperative Agreement Partner which, in the agency's opinion, indicates a need to revise or append the conclusions previously issued.

PUBLIC HEALTH ASSESSMENT

Van der Horst USA Corporation
Terrell, Kaufman County, Texas

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Prepared by:

Texas Department of State Health Services
Health Assessment and Toxicology Branch
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

Foreword

The Agency for Toxic Substances and Disease Registry (ATSDR) was established under the mandate of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980. This act, also known as the "Superfund" law, authorized the U. S. Environmental Protection Agency (EPA) to conduct clean-up activities at hazardous waste sites. EPA was directed to compile a list of sites considered potentially hazardous to public health. This list is termed the National Priorities List (NPL). Under the Superfund law, ATSDR is charged with assessing the presence and nature of health hazards to communities living near Superfund sites, helping prevent or reduce harmful exposures, and expanding the knowledge base about the health effects that result from exposure to hazardous substances [1].

In 1984, amendments to the Resource Conservation and Recovery Act of 1976 (RCRA) – which provides for the management of hazardous waste storage, treatment, and disposal facilities – authorized ATSDR to conduct Public Health Assessments at these sites when requested by the EPA, states, tribes, or individuals. The 1986 Superfund Amendments and Reauthorization Act broadened ATSDR's responsibilities in the area of Public Health Assessments and directed ATSDR to prepare a Public Health Assessment (PHA) document for each NPL site. In 1990, federal facilities were included on the NPL. ATSDR also conducts PHAs or Public Health Consultations when petitioned by concerned community members, physicians, state or federal agencies, or tribal governments [1].

The aim of these evaluations is to determine if people are being exposed to hazardous substances and, if so, whether that exposure is potentially harmful and should be eliminated or reduced. PHAs are carried out by environmental health scientists from ATSDR and from the states with which ATSDR has cooperative agreements. Because each NPL site has a unique set of circumstances surrounding it, the PHA process allows flexibility in document format when ATSDR and cooperative agreement scientists present their findings about the public health impact of the site. The flexible format allows health assessors to convey important public health messages to affected populations in a clear and expeditious way, tailored to fit the specific circumstances of the site.

Comments

If you have any questions, comments, or unanswered concerns after reading this report, we encourage you to send them to us. Letters should be addressed as follows:

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Summary

INTRODUCTION

The Van der Horst USA Corporation (Van der Horst) site is an inactive chromium and iron plating facility. The site is located at 410 and 419 East Grove Street in Terrell, Kaufman County, Texas. The site sits on approximately 4 acres of land and is located 300 yards from the center of downtown on the southeast boundary of the city. The Van der Horst site was proposed to the National Priorities List (NPL) on September 23, 2009, and was added to the final NPL on March 4, 2010.

Finished products associated with plating operations at the facility included pipeline cylinders used for transporting natural gas and cylinder bores for large diesel engines such as ones found in railroad locomotives. Plating operations resulted in chromium-contaminated wastewater and sludge.

Van der Horst ceased operations in December 2006 and the facility was abandoned in April 2007. A fire occurred at the facility on May 28, 2008, which led to further investigations and actions by the Texas Commission on Environmental Quality (TCEQ) and the U.S. Environmental Protection Agency (EPA) to identify and remove large quantities of liquid wastes remaining on the site.

During EPA's investigation, on-site drum, sump, vat, and monitoring well samples were collected. The drums, sumps, vats, and their contents have since been removed from the site. Additionally, EPA collected soil samples from on-site lagoons. Top soil on the site has been removed and replaced with clean fill, and grass was planted to prevent the movement of soil.

Off-site, EPA collected sediment samples from nearby Frazier Creek, Kings Creek, and a drainage ditch, located between the site and Frazier Creek.

Data evaluated in this Public Health Assessment (PHA) include 2008 and 2009 sampling results for monitoring wells, creek and drainage ditch sediment, soil samples collected from on-site lagoons, and one on-site soil sample, collected by the TCEQ, at the corner of South Delphine and East Grove Street. Samples also were collected from on-site drums, sumps, and vats. Based upon available information, we identified chromium as the primary contaminant of concern. Dermal contact and the incidental ingestion of chromium-contaminated creek and drainage ditch sediment were determined to be the main potential pathways of concern. On-site groundwater samples exceeded health based comparison values; however, the lack of information pertaining to off-site well water use and contamination prevented us from evaluating this as a potential exposure pathway.

Conclusions	The Texas Department of State Health Services (DSHS) and the Agency for Toxic Substances and Disease Registry (ATSDR) reached six conclusions in this Public Health Assessment (PHA):
Conclusion 1	Chromium concentrations detected in on-site groundwater are not expected to harm peoples' health.
Basis for Conclusion	Concentrations of chromium detected in on-site monitoring well samples exceed health-based comparison values but this groundwater is not used for potable purposes.
Next Steps	Conduct periodic sampling of the on-site monitoring wells as deemed necessary by the Environmental Protection Agency (EPA).
Conclusion 2	Evaluation of potential exposure to site-related contaminants in off-site residential wells was not possible.
Basis for Conclusion	The nearest off-site wells, in the direction of groundwater flow, are approximately 1.25 miles to the south and 1.5 miles to the east. Well use and sampling data were not available for these off-site wells.
Next Steps	We recommend the use of private wells down gradient of the site be determined and that these wells be sampled for site related contaminants as appropriate.
Conclusion 3	Exposure to chromium concentrations detected in creek and drainage ditch sediment are not likely to cause health effects.
Basis for Conclusion	Contaminants have been found in the drainage ditch and in Frazier and Kings Creeks. During our site visit we found the creek areas difficult to access due to vegetation. While it is possible people could access these areas, available evidence suggests that such exposures would be short-term and infrequent. We used appropriate site-specific exposure scenarios to determine the potential public health implications of such exposures. While exposure to site contaminants in the drainage ditch could have occurred in the past, this area will soon to be paved over as part of a highway project.
Next Steps	The DSHS will evaluate additional sampling data upon request.

Conclusion 4	People can no longer be exposed to hazardous materials in containers on the former facility property, located at 419 East Grove Street.
Basis for Conclusion	Exposure could have occurred in the past; however, the lack of historical information prevents evaluation of past exposures. Hazardous substances that were contained in drums, sumps, and vats on the former facility property are no longer on the site, eliminating continued source of possible exposure.
Next Steps	No public health actions are needed.
Conclusion 5	The public can no longer be exposed to soil contamination at the former lagoons, located at 410 East Grove Street.
Basis for Conclusion	Exposure could have occurred in the past; however, the lack of historical information prevents evaluation of past exposures. Samples collected by the EPA indicate that soil at the former lagoons was contaminated; however, the potential for exposure has been eliminated by removing the top 2 feet of soil, replacing the soil with backfill, and planting grass to minimize erosion.
Next Steps	No public health actions are needed.
Conclusion 6	The public can no longer be exposed to contaminated soil on the former main facility's property, located at 419 East Grove Street.
Basis for Conclusion	Exposure could have occurred in the past; however, the lack of historical information prevents the evaluation of past exposures. The Texas Commission on Environmental Quality (TCEQ) collected one soil sample, indicating elevated chromium concentrations may be present in soil on the site; however, the potential for exposure has been eliminated by removing the top 2 feet of soil, replacing the soil with backfill, and planting grass to minimize erosion.
Next Steps	No public health actions are needed.

FOR MORE INFORMATION

If you have concerns about your health, you should contact your health care provider. For more information about this PHA you can contact Amanda Kindt with the Texas Department of State Health Services at (800)-588-1248 x 3961.

Purpose and Health Issues

This Public Health Assessment (PHA) was prepared for the Van der Horst USA Corporation (Van der Horst) site under an Interagency Cooperative Agreement between the Agency for Toxic Substances and Disease Registry (ATSDR) and the Texas Department of State Health Services (DSHS). This PHA evaluated environmental sampling data collected by the U.S. Environmental Protection Agency (EPA) and the Texas Commission on Environmental Quality (TCEQ); the primary contaminant of concern associated with the Van der Horst site is chromium. This PHA presents conclusions about whether exposure to site contaminants at the levels found in the environment would be expected to harm people's health. The routes of exposure evaluated in this PHA include the ingestion of off-site chromium-contaminated water, the incidental ingestion of chromium-contaminated creek and drainage ditch sediment, and dermal (skin) contact with chromium-contaminated creek and drainage ditch sediment. [Note: Appendix A provides a list of acronyms and abbreviations used in this report, Appendix B provides information about the contaminants of concern, Appendix C provides information regarding the PHA process, Appendix D includes figures mentioned in the document, Appendix E includes tables mentioned in the document, Appendix F includes information on how we calculate estimated exposure doses, and Appendix G includes public comments and responses.]

Background

Site Description

The Van der Horst site is located in Terrell, Kaufman County, Texas. The main building was located at 419 East Grove Street and was demolished by EPA in 2009 [2]. The former facility wastewater treatment building is located at 410 East Grove Street [3]. The site is located on approximately 4 acres of unfenced land and is 300 yards from the center of downtown on the southeast boundary of the city [4]. North of the Van der Horst property lies a Union Pacific Railroad right-of-way. The south end of the site is bordered by East Grove Street while the east end of the site is bordered by the General Chemical Corporation's property. To the west the site is bordered by South Delphine Street [5].

Two creeks are within close proximity to the site. A drainage ditch connects the site to Frazier Creek which runs closest to the site. Frazier Creek is intermittent, thickly lined with trees, and is located about 500 feet north of the nearest residential area and about 800 feet east of the site. Water from Frazier Creek enters Kings Creek approximately 1.2 miles southeast of the site.

The City of Terrell purchases its water from the North Texas Municipal Water District, who obtains their water from lakes upstream from the site (Lake Lavon, Lake Texoma, and Jim Chapman Lake) [5].

There are seven schools and one park within 1 mile of the site. The closest residential area is located in the Stallings Addition, less than 1 mile southeast of the site. Two churches are located less than 1 mile from the site [5].

Site Operations and History

The Van der Horst facility was a hard-chrome (trivalent and hexavalent chromium) and iron electroplating facility in the 1950s. The facility operated until December 2006 and was abandoned in April 2007. Finished products associated with plating operations at the facility included pipeline cylinders used for transporting natural gas and cylinder bores for large diesel engines found in railroad locomotives [4].

Historical records indicate that Van der Horst had environmental regulatory violations. TCEQ records from 1968 indicate that the facility was discharging an estimated 43,200 gallons of wastewater per day into the drainage ditch located between the site and Frazier Creek. This drainage ditch empties into nearby Frazier Creek and then into Kings Creek. The Texas Parks and Wildlife Department (TPWD) documented levels of chromium in Van der Horst's discharged wastewater up to 353.6 parts chromium per million parts water (ppm or milligrams per Liter (mg/L)). Under Texas Water Quality Board (TWQB)[1] rules, discharged wastewater should not contain more than 1.0 mg/L of hexavalent chromium or 5.0 mg/L of trivalent chromium [4].

In order to meet the TWQB's discharge limits, Van der Horst requested approval to put the wastewater into unlined lagoons on their property, but was denied. In July 1969 records indicate that the City of Terrell was receiving all of Van der Horst's wastewater. However, in September 1969 the City of Terrell no longer accepted wastewater from Van der Horst unless it was treated. Van der Horst continued discharging wastewater into Frazier Creek until December 1969, when two settling lagoons were constructed to collect and hold the wastewater. These lagoons operated until May 1984 when the Texas Department of Water Resources[2] initiated closure of the lagoons. Soil was removed from both lagoons, and a closure certificate was issued in September 1986 [4].

In July 2005 Van der Horst received violations relating to the management of wastes inside the wastewater treatment building. The violations included failure to keep hazardous containers closed, failure to keep containers properly labeled and dated, and failure to maintain the facility to prevent the release of hazardous wastes [6].

Beginning March 16, 2006 a complaint investigation was conducted by the TCEQ. The complaint stated that the facility had been abandoned, local contractors had been entering the building and removing equipment, liquid was on the floor of the building, and wastes were left behind. At the time of the March 16, 2006 complaint investigation, the facility still had three employees though the site had not been in operation since March 3, 2006 [6]. On May 4, 2006 the facility phoned the TCEQ to inform them that Van der Horst had reopened with 12 employees [6].

On September 22, 2006, during a continuation of the March 11, 2006 complaint investigation, it was noted that site conditions had not changed. As a result the site was referred to TCEQ's

[1] The Texas Water Quality Board is a predecessor agency of TCEQ.
[2] The Texas Department of Water Resources is a predecessor agency of TCEQ.

enforcement division on November 20, 2006. The facility operated until December 26, 2006, when the owner filed for bankruptcy [7]. The buildings and the site were fully abandoned in April 2007 [4].

On May 27, 2008 the TCEQ performed a follow-up and complaint investigation at the abandoned facility. The main building was found to be in bad condition. There were missing areas in the roof, debris throughout the building, chemical wastes on the floor, and a gutter downspout was draining into the building. At the time of the investigation they observed a yellow liquid in the basement sump; a second sump contained a dark liquid [6].

On May 28, 2008 a pit containing spent kerosene in the main building of the facility caught fire and was extinguished by the Terrell Fire Department. The fire department had concerns about chemicals at the facility and requested assistance from the TCEQ to assess the site. On May 30, 2008 the TCEQ conducted a site investigation. Because of the severity of the hazard and unknown chemical contamination on site, the TCEQ contacted the EPA-Region 6 to assist [8].

During June 2008 the EPA began categorizing hazardous waste contained in abandoned drums on the site. The drums were staged within various locations inside the main Van der Horst building according to their contents. Also in June 2008, the EPA transported contents of the larger sump off the site. The EPA began remedial action (RA) in January 2009 and the drum contents were bulked with other waste from the site for disposal. In February 2009 the EPA removed the contents in the smaller sump and transported it off site by licensed waste disposal companies (Clean Harbors Baton Rouge, Louisiana and Chemical Reclamation Services, LLC Avalon, Texas). In March 2009 the drum and vat contents were transported to Texas Molecular in Deer Park, Texas [4].

Off-site sediment samples were collected by the EPA's Superfund Technical Assessment and Response Team (START-3)[3] program for the 2008 Site Inspection Report and during the EPA's RA in March 2009 [9]. The TCEQ collected three additional sediment samples from Frazier Creek. The EPA's START-3 collected 22 soil boring samples from 0 to 60 inches below the surface at the former on-site lagoon locations [4].

The main Van der Horst building was completely demolished in August 2009. More than 450 tons of concrete with and without rebar was transported off the site to Skyline RDF Landfill in Ferris, Texas [2]. Hazardous solid waste associated with the building was transported off the site to Waynoka, Oklahoma [10].

On September 23, 2009, the Van der Horst site was proposed to the National Priorities List (NPL) [11], and it was added to the final NPL on March 4, 2010 [12].

[3] The START program provides technical support to the EPA's site assessment activities. These activities include response, prevention, and preparedness, and include gathering and analyzing technical information, preparing technical reports on oil and hazardous substance investigations, and technical support for cleanup efforts.

Site Visits
On January 24, 2010 DSHS staff visited the former Van der Horst plating facility. The main building had been demolished and removed from the site. Contaminated soil, drums, sumps, and vats have also been removed, and the lagoons were backfilled. This portion of the former facility is now an empty, grass covered lot. Across East Grove Street, to the south, are two unfenced, abandoned buildings. One building is the former wastewater treatment building where wastewater from plating operations was treated and discharged. At the time of the site visit, the wastewater treatment building was open and not secured. Next to the second building were several 55-gallon drums with labels indicating they contained waste from removal activities at the site. Staff did not attempt to enter this building.

Due to dense vegetation, staff was not able to readily access Frazier Creek or Kings Creek to determine whether it was being used for recreational purposes at the time of the site visit.

Demographics
According to the 2000 U.S. Census, the total population of Terrell, Texas was 13,606 [13]. In 2010, the total population of Terrell, Texas was 15,816 [14].

Within 1 mile of the site there are 2,386 total housing units with a population of 6,854 individuals, which include 1,524 females between the ages of 15 to 44 and 753 children 6 years of age and younger. Additional demographic information for the area near the Van der Horst site is presented in Figure 2.

Land and Natural Resource Use
The surface soil in the area consists of moderately well drained, moderately permeable, silty loam from 0 to 5 inches below ground surface (bgs). Deeper soil consists of silty clay [5].

The depth to shallow groundwater at the site is approximately 6 feet bgs. Shallow groundwater follows the topography and flows in a southeasterly direction away from the site toward Kings Creek [5].

Information provided by the Texas Water Development Board (TWDB) indicates that within 4 miles of the site, there are 16 groundwater wells ranging from a depth of 50 feet to 403 feet bgs. Three of these wells are being used for domestic purposes and range in depth from 57 to 165 feet bgs, two are being used for industrial and aquaculture purposes, one is being used to provide water for livestock, and ten are not in use [5].

Surface water at the Van der Horst site flows eastward into the drainage ditch along East Grove Street to the intermittent Frazier Creek. Approximately 1.2 miles from the site, Frazier Creek enters the perennial Kings Creek, which flows south more than 20 miles into Cedar Creek Reservoir. Surface water north (upstream) of the site is a source of public drinking water for the City of Terrell. Some of the communities downstream of the site use surface water as their source of public drinking water. The intakes for these water supplies are more than 15 miles south-southeast of the site [5].

Community Health Concerns
As part of the PHA process, the DSHS and the ATSDR gather information on the site-related health-related concerns of the nearby community.

In March 2009 the EPA attended a community meeting held by the Stallings Addition Neighborhood Association. Community members expressed concerns about children being exposed to chromium by swimming in a nearby pond [15].

In April 2009 the DSHS attended another community meeting held by the Stallings Addition Neighborhood Association. At the meeting community members expressed concerns about an excess of cancer in the area.

Environmental Contamination Screening Process
We identify contaminants of concern by comparing contaminant concentrations to environmental guidelines. These guidelines are media-specific contaminant concentrations used to screen contaminants for further evaluation. While exceeding an environmental guideline does not necessarily mean a contaminant represents a public health threat, it does suggest the contaminant warrants further consideration. Non-cancer environmental guidelines are called Environmental Media Evaluation Guides (EMEGs) or Reference Dose Media Evaluation Guides (RMEGS) and are respectively based on the ATSDR's Minimal Risk Levels (MRLs) or the EPA's Reference Doses (RfDs). MRLs and RfDs are estimates of a daily human exposure to a contaminant that is unlikely to cause adverse non-cancer health effects. Cancer Risk Evaluation Guides (CREGs) are based on the EPA's chemical-specific cancer slope factors and an estimated lifetime cancer risk of one-in-one million persons exposed for a lifetime. We use standard assumptions to calculate appropriate environmental guidelines. Exceeding an environmental guideline does not mean the contaminant threatens people's health. It does however mean that the public health significance of the contaminant needs further evaluation. The public health significance of contaminants that exceed comparison values is evaluated in later sections of this report and is assessed by reviewing and integrating relevant toxicological information with plausible exposure scenarios. The comparison value that we used to determine whether this was a potential contaminant of concern was for chromium (VI) while the reported concentrations were for total chromium.

The presence of chemical contaminants in the environment does not always mean that people will come into contact with the chemical or that any contact with the chemical will harm people's health. Whether effects could occur depends on: (1) the toxicological properties of the contaminant; (2) how much of the contaminant people could be exposed to; (4) the way the contaminant gets into the body (e.g., breathing, eating, drinking, skin/eye contact); and (5) how often people are exposed. Characteristics such as age, sex, nutritional status, genetics, lifestyle, and health status also can influence how people react to such exposures.

The toxicological properties of the chemical, how people are exposed, how often they are exposed, and the amount that they are exposed to, all influence whether harm is possible. Thus, it is the potential contact people may have with chemicals that drives the PHA process. People can be exposed to contaminants by breathing, eating, drinking, or coming into physical contact with media (e.g., air, water, soil) containing the contaminant. The following sections examine the types of chemicals found at this site, the concentrations found in each of the media (e.g., air, water, and soil), whether there is any potential for exposure, and whether identified exposures could be sufficient to affect people's health.

Environmental Data

Data evaluated in this PHA include on-site monitoring well and off-site sediment sample data collected by the EPA's START-3 and the TCEQ during their field activities in 2008 and 2009. Groundwater samples were analyzed both for hexavalent chromium and total chromium (the sum of all chromium detected in a sample). Sediment sample results were reported as total chromium.

In preparing this report, the DSHS and the ATSDR relied on the data provided by the EPA and the TCEQ as being collected according to approved quality assurance project plans and assumed adequate quality assurance/quality control procedures were followed with regard to data collection, chain of custody, laboratory procedures, and data reporting.

Groundwater

In June 2008 the TCEQ installed and sampled two monitoring wells (MW-2 and MW-4) on the Van der Horst USA property. The monitoring well samples were analyzed for metals, but total chromium and hexavalent chromium were the only metals that exceeded health-based screening values. Barium was detected in duplicate monitoring well samples; however, the concentration of barium was not above comparison values. MW-2 had a total chromium concentration of 0.029 mg/L; hexavalent chromium was below the reported quantitation limit. MW-4 had hexavalent chromium and total chromium at concentrations of 0.189 mg/L and 0.399 mg/L, respectively. Chromium concentrations in water were compared to media-specific comparison values (EMEGs) for intermediate and chronic non-carcinogenic health effects, both for children and adults. For intermediate non-cancer health effects the comparison value was based on the ATSDR's intermediate MRL for hexavalent chromium (0.005 milligrams per kilograms per day (mg/kg/day)). For chronic non-cancer health effects the comparison value was based on ATSDR's chronic MRL for hexavalent chromium (0.0009 mg/kg/day). The concentration of chromium (VI) in MW-4 exceeded the chronic comparison value for both adults and children and the intermediate comparison value for children. [Appendix E, Table 1]. For a complete description of the derivation and meaning of these comparison values see Appendix C.

Sediment

During July 2008 the TCEQ collected three sediment samples from Frazier Creek [5]. In August 2008 the EPA collected four sediment samples from Frazier Creek (one background sample), and three sediment samples from Kings Creek [5]. During March 2009 the EPA collected eight sediment samples from Frazier Creek, seven samples from Kings Creek (including one background sample), and eight sediment samples from a drainage ditch that is located between the site and Frazier Creek [16]. The TCEQ collected samples from 1 to 4 inches in depth while the EPA collected samples from 0 to 1 inch. All sediment samples were analyzed for metals and the detected concentrations were compared to media-specific comparison values for intermediate and chronic non-carcinogenic health effects.

Frazier Creek

Detected concentrations of aluminum, cadmium, chromium[4], copper, and vanadium were found to exceed their respective intermediate EMEG for children exhibiting pica behavior (1-6 years of age) (Table 2). Some of the chromium concentrations also exceeded the chronic EMEG for a child. None of the metal concentrations exceeded adult comparison values.

Kings Creek

Detected concentrations of aluminum, cadmium, chromium, and vanadium were found to exceed their respective intermediate EMEG for children exhibiting pica behavior (Table 3). Some of the chromium concentrations exceeded the chronic EMEG for a child. None of the metal concentrations exceeded adult comparison values.

Drainage Ditch

Detected concentrations of aluminum, cadmium, chromium, copper, and vanadium were found to exceed their respective intermediate EMEG for children exhibiting pica behavior (Table 4). Chromium was the only metal to exceed both child and adult comparison values.

Pathways Analysis

People can be exposed to contaminants by breathing, eating, drinking, or coming into physical contact with media (e.g., air, water, soil) containing the contaminant. This section examines whether contaminants are present in areas where human exposures may occur; this is called a pathways analysis.

There are five main elements to an exposure pathway: (1) a source of contamination; (2) transport of the contamination from the source through an environmental media; (3) a place or point where people could contact the contaminant; (4) a plausible way (route) for the contaminant to get into the people; and (5) an identifiable exposed population. Exposure pathways can be completed, potential, or eliminated. A completed pathway has all five elements present and has occurred, is occurring, or will occur in the future. A potential pathway is one where the information for one of more of the elements is missing but may be completed later. Eliminated pathways are missing one or more elements and will never be completed. Thus, for exposures to occur, all five of these elements must be present. Based on available information, we have identified the following pathways for this site.

Groundwater

The monitoring well samples were analyzed for metals, but total chromium and hexavalent chromium were the only metals that exceeded health-based screening values. Detectable levels of total chromium and hexavalent chromium were found in monitoring wells on the site. Only three out of 16 private wells within 4 miles of the site are currently being used for domestic purposes, but information as to which of the wells are being used is not available at this time [5].

[4] the intermediate comparison value is based on ATSDR's intermediate MRLs for hexavalent chromium and the chronic comparison value is based on EPA's reference dose for hexavalent chromium.

Groundwater flows in a southeasterly direction; the nearest private well is located approximately 0.7 miles northeast of the site. We do not expect this well to be contaminated with site contaminants because it is up gradient. The next nearest wells are downgradient approximately 1.25 miles to the south and 1.5 miles to the east [5]. Information pertaining to site-related contaminants in down gradient off-site wells or whether these wells were being used for potable purposes was not available; thus, we have identified this as an indeterminate exposure pathway for off-site residents.

Sediment
We did not observe any activities in the creeks or drainage ditch that might lead to skin contact with or incidental ingestion of chromium-contaminated sediment. Although access is not restricted, during our site visit dense vegetation limited our ability to access these areas. Based on our observations, it is unlikely that young children could access these areas and if older children or adults were able to gain access, the exposure would likely be short-term and infrequent. Additionally, the drainage ditch where the highest sediment chromium concentrations were found is soon to be paved over as part of a highway project. Although the chromium samples were not speciated, and based on chromium's normal interaction in the environment, it is most likely in the less toxic trivalent form. For the purposes of this assessment, we have assumed the chromium to be in the more toxic hexavalent form. Even though access to these areas is difficult, we have classified this as a potential past, current, and future pathway.

Drums, Sumps, and Vats
Exposure to contaminants in drums, sumps, and vats located on or around the facility could have occurred in the past; however, these all have been removed [10]. Based on available information we have classified this as a past potential exposure pathway.

Lagoons
Upon closure of the lagoons in 1986, soil was removed and replaced with backfill. In March 2009 the EPA's START-3 collected twenty-two soil samples from 0 to 60 inches bgs from the location of the former lagoons at 410 East Grove Street. The soil sample results indicate that only the top 2 feet of soil was removed after closure of the lagoons in 1986. During the EPA's removal action, the top 2 feet of soil was removed, transported off the site, replaced with new top soil, and grass was planted to minimize erosion. Based on available information, we have classified this as a past potential exposure pathway.

Soil
The TCEQ collected one soil sample from 419 East Grove Street during a 2008 investigation. The soil sample had a detected chromium concentration of 208 milligrams per kilogram (mg/kg) [8]. During the EPA's removal activities, the top 2 feet of soil was removed and replaced with clean soil [10], thus exposure to contamination through soil is no longer a completed pathway [10]. Based on available information, we have classified this as a past potential exposure pathway.

Pond

Community members had expressed concerns about children being exposed to chromium by swimming in a nearby pond. Although sampling data for pond water were not available, the pond is southeast of the site and surface water runoff from the site flows away from the pond into Frazier Creek [4]. Based on available information we have eliminated this as a possible exposure pathway.

Public Health Implications

Contaminants of Concern

Exposure to sediment is the only exposure pathway that we were able to evaluate for current public health significance. Although past exposure to contaminants in soil or the lagoons was possible, information available for analysis is limited and these areas have been remediated and no longer pose a threat. We classified exposure to groundwater through private wells as an indeterminate exposure pathway because of the lack of data both on well water usage and contamination. We also eliminated exposure to contaminants in the pond as an exposure pathway based on the flow of surface water run-off.

Several metals were found in sediment from Frazier and Kings Creeks at concentrations exceeding their respective comparison values for children who exhibit pica behavior; however, based on site-specific exposure scenarios, we were able to eliminate most of the contaminants as contaminants of concern except chromium. The dense vegetation we found near these creeks limited our ability to access the areas and will likely limit access by others, including young children of the ages typically associated with pica behavior. In Frazier Creek, Kings Creek, and the drainage ditch, chromium was the only contaminant that exceeded the comparison value for non-pica children. In the drainage ditch chromium also exceeded its comparison value for adults. Assuming adults and older children could gain access to these areas, chromium remains the only contaminant of concern.

Adverse Health Effects of Chromium

Ingestion of large amounts of hexavalent chromium (0.57 mg/kg/day) has been known to cause stomach upsets, stomach ulcers, and kidney and liver damage. Some hexavalent chromium compounds are known to result in rashes and burns if they come into contact with a person's skin. Burns on the skin, resulting from chromium compounds, can encourage more absorption of chromium into the bloodstream. Dermal effects in the form of rashes (dermatitis) can occur both with ingestion and inhalation of chromium compounds. Most reported dermal effects occur in occupational settings when the individual is exposed to high levels of chromium over a short (1 day to 2 weeks) or intermediate (2 weeks to 1 year) time period; exposure to levels of chromium seen in the environment is not likely to result in these types of effects [17].

The effects chromium might have on children are not well documented but it is likely that they are similar to those seen in adults. What is not known is whether children differ in their susceptibility. It has not yet been determined, either through human or animal studies, if exposure to chromium causes birth defects or developmental effects in children. There is one animal study that shows that trivalent chromium is more likely to enter the body of a newborn than an adult (Sullivan et al., 1984). It is not known whether this also occurs with hexavalent chromium. Since studies with mice show that chromium can pass through the placenta to a fetus, where it can concentrate in tissue, pregnant women exposed to chromium might be able to transfer chromium from their blood to their baby [17].

Based on animal studies, the ATSDR established both chronic[5] and intermediate exposure MRLs for chromium (VI). The intermediate[6] MRL of 0.005 mg/kg/day is based on the observation of microcytic and hypochromic anemia in male rats exposed to various levels of chromium for up to 2-years. The intermediate MRL was obtained by dividing the identified effective dose of 0.52 mg chromium (VI)/kg body weight/day (mg/kg/day) by a composite uncertainty factor of 100 (10 for extrapolation from animals to humans and 10 for human variability) [17].

The chronic MRL of 0.0009 mg/kg/day is based on the observation of diffuse epithelial hyperplasia of the duodenum in mice exposed to different doses of chromium (VI) for 2 years. The chronic MRL was obtained by dividing identified effective dose of 0.09 mg/kg/day by a composite uncertainty factor of 100 (10 for extrapolation from animals to humans and 10 for human variability) [17].

The EPA has determined that hexavalent chromium is a human carcinogen by the inhalation route [18]. The National Toxicology Program (NTP) has determined there is strong evidence that hexavalent chromium is a human carcinogen when it is consumed in drinking water. This evidence is based on rodent research where rats and mice were given varying amounts of sodium dichromate dihydrate (14.3 parts per billion (ppb) up to 516 ppb) in drinking water [19]. The International Agency for Research on Cancer (IARC) has classified hexavalent chromium as a Group 1 human carcinogen. There is sufficient evidence to suggest that there is a link between hexavalent chromium compounds and cancer in people who work in and around chromate production, chromate pigment production, and chromium plating industries [20].

To determine whether exposures to chromium in sediment at this site could harm peoples' health, we used site-specific exposure scenarios to determine if the observed concentrations could be of potential public health concern [Appendix F]. For all child scenarios involving contact with sediment, we assumed an elementary school aged child would contact the sediment at a frequency of 2 times per week and an ingestion rate of 200 mg per visit; this ingestion rate, which usually refers to a full days exposure, is a conservative estimate for the type of exposure which might occur in these areas.

[5] A chronic exposure is an exposure duration over 1 year.
[6] An intermediate exposure is an exposure duration of 2 weeks up to 1 year.

Sediment

Dermal (Skin) Exposure

Currently there are not enough studies available to calculate a MRL, Lowest Observed Effect Level (LOAEL), or No Observed Effect Level (NOAEL) for dermal exposure to chromium and chromium compounds [17].

In 1994 a study was conducted to determine a dose-response relationship between potassium chromate and contact dermatitis. Using 54 volunteers, the study concluded that soil containing hexavalent chromium concentrations above 450 mg/kg and trivalent chromium concentrations above 165,000 mg/kg resulted in contact dermatitis in 99.99% of the population (Nethercott et al., 1994).

Because there are no available dermal comparison values, the DSHS compared the highest total chromium concentrations measured in the sediment samples to the study's dose-response value for hexavalent chromium (450 mg/kg). If the total chromium detected in samples is assumed to be hexavalent chromium, coming into contact with the highest concentration of contaminated sediment in Frazier Creek (638 mg/kg) and the Drainage Ditch (1,771 mg/kg) could result in dermal health effects such as contact dermatitis.

Dermal health effects could occur, but are not likely since people most likely would have short-term, infrequent contact with creek and drainage ditch sediment. Additionally, the chromium detected in the sediment is most likely in the less toxic trivalent form. If we assume chromium detected in the samples is in trivalent form, rather than the more toxic hexavalent form, and compare it to the Nethercott study's dose-response value (165,000 mg/kg), then health effects such as contact dermatitis would not be likely to occur.

Oral Exposure

<u>Frazier Creek</u>

Of the 14 sediment samples collected from Frazier Creek, two samples exceeded the intermediate hexavalent chromium EMEG for a child (250 mg/kg) and 10 exceeded the chronic EMEG for a child (50 mg/kg) (Table 2). Using the 95% Upper Confidence Limit (UCL) of the mean concentration of chromium detected in samples collected from Frazier Creek (227.2 mg/kg), we calculated an estimated exposure dose for elementary school aged children of 0.00033 mg/kg/day. The estimated exposure dose is below both the intermediate (0.005 mg/kg/day) and chronic (0.0009 mg/kg/day) MRLs for hexavalent chromium. Based on available information, infrequent contact with sediment from Frazier Creek would not be likely to cause adverse health effects in children.

<u>Kings Creek</u>

Nine sediment samples were collected from Kings Creek. Five had chromium concentrations exceeding the chronic hexavalent chromium EMEG for a child of 50 mg/kg (Table 3). Using the maximum concentration of chromium detected in samples collected from Kings Creek (136 mg/kg), we calculated an estimated exposure dose for elementary school aged children of 0.0002 mg/kg/day. The estimated exposure dose is below the chronic MRL for chromium (0.0009 mg/kg/day). Based on available information we would not expect infrequent contact with sediment from Kings Creek to cause adverse health effects in children. .

Drainage Ditch

Eight sediment samples were collected from the Drainage Ditch. Chromium concentrations detected in four of the samples exceeded the Chronic EMEG for adults (700 mg/kg), five exceeded the intermediate EMEG for children (250 mg/kg), and all eight samples contained chromium concentrations that exceeded the chronic EMEG for children (50 mg/kg) (Table 4).

Using the maximum concentration of chromium detected in the Drainage Ditch (1,171 mg/kg/day), we calculated an estimated exposure dose for elementary school aged children of 0.0017 mg/kg/day, a dose slightly greater than the chronic MRL for chromium (0.0009 mg/kg/day) and below the intermediate MRL for chromium (0.005 mg/kg/day). Based on available information, we would not expect infrequent contact with sediment from Kings Creek to cause adverse health effects in children.

Health Outcome Data

Health outcome data records certain health conditions that occur in populations. These data can provide information on the general health of communities living near a hazardous waste site. They also can provide information on patterns of specific health conditions. Some examples of health outcome databases are cancer registries, birth defects registries, and vital statistics. Information from local hospitals and other health care providers also can be used to investigate patterns of disease in a specific population. The DSHS and the ATSDR look at appropriate and available health outcome data when a completed exposure pathway or community concern exists.

For this PHA the DSHS Texas Cancer Registry (TCR) addressed the community's concern of excess cancer by preparing a cancer cluster report for zip codes 75160 and 75161. The analysis of incidence data for the zip codes from January 1, 1997-December 31, 2006 (the most current information available) did not find cancers of the prostate, breast, lung, colon and rectum, bladder, corpus and uterus, kidney and renal pelvis, non-Hodgkin's lymphoma, and stomach to be elevated, based on state rates, in both males and females [21].

Children's Health Considerations

In communities faced with air, water, or soil contamination, children could be at greater risk than adults from certain kinds of exposure to hazardous substances. A child's lower body weight and higher intake rate result in a greater dose of hazardous substance per unit of body weight. Sufficient exposure levels during critical growth stages can result in permanent damage to the developing body systems of children. Children are dependent on adults for access to housing, for access to medical care, and for risk identification; consequently, adults need as much information as possible to make informed decisions regarding their children's health. DSHS tries to determine risks for children by considering exposure scenarios specific to children.

ATSDR and DSHS evaluated the likelihood for children to be exposed to site contaminants at levels of health concern and found that children could be exposed to contaminants detected in on-site groundwater and off-site drainage ditch and creek sediment; however, we have not identified any situations where exposure is occurring at levels high enough to result in health effects.

Conclusions

Based on available information, the DSHS and the ATSDR have reached six conclusions in this health assessment:

1. *The DSHS and the ATSDR conclude that chromium concentrations detected in on-site groundwater are not expected to harm peoples' health.* Concentrations of total chromium and hexavalent chromium exceed health-based comparison values, but available information indicates that on-site groundwater is not used as a source of drinking water.

2. *The DSHS and the ATSDR conclude that there is a lack of information pertaining to off-site groundwater use and contamination; therefore, we were not able to evaluate the potential public health implications of this pathway.* The nearest off-site wells in the direction of groundwater flow are approximately 1.25 miles to the south and 1.5 miles to the east.

3. *The DSHS and the ATSDR conclude that exposure to chromium concentrations detected in creek and drainage ditch sediment are not likely to cause health effects.* Contaminants have been found in the drainage ditch and in Frazier and Kings Creeks. Access to these areas is limited; however, if people were able to visit these areas, available information suggests that these exposures would be short-term and infrequent. In addition, the drainage ditch where the highest concentrations were found is soon to be paved over as part of a highway project.

4. *The DSHS and the ATSDR conclude that the public can longer be exposed to hazardous materials in containments on the former facility property, located at 419 East Grove Street.* Exposure could have occurred in the past; however, there is a lack of historical information needed to evaluate past exposures. Hazardous substances that were contained in drums, sumps, and vats on the former facility property are no longer on the site, thus eliminating exposure.

5. *The DSHS and the ATSDR conclude that the public can no longer be exposed to soil contamination at the former lagoon locations. Past e*xposure may have been possible; however, there is a lack of historical information needed to evaluate past exposures. Samples collected by the EPA indicate that soil at the former lagoon locations were contaminated; however, the top 2 feet of soil

has been removed, replaced with clean soil, and grass was planted to minimize erosion, thus eliminating exposure.

6. *The DSHS and the ATSDR conclude that the public can no longer be exposed to contaminated soil on the former main facility's property, located at 419 East Grove Street.* Exposure could have occurred in the past; however, there is a lack of historical information needed to evaluate past exposures. The TCEQ collected one soil sample during an investigation and found chromium; however, the top 2 feet of soil has been removed, replaced with clean soil, and grass was planted to minimize erosion, thus eliminating exposure.

Recommendations

Although groundwater is a pathway of concern, the actual data available on off-site well use and the potential for contaminant migration is sparse. We recommend that wells down gradient of the site be surveyed and sampled to verify well use and to determine whether contaminants have migrated to areas where people might be exposed.

Public Health Action Plan

The public health action plan for the site contains a description of actions that have been or will be taken by the DSHS, the ATSDR, and other government agencies at the site. The purpose of the public health action plan is to ensure that this PHA both identifies public health hazards and provides a plan of action designed to mitigate and prevent harmful human health effects resulting from breathing, ingesting, or skin contact with hazardous substances found in the environment. Included is a commitment on the part of the DSHS and the ATSDR to follow up on this plan to ensure that it is implemented.

Actions Completed

1. In June 2008 the EPA categorized, sampled, and separated liquid waste on the Van der Horst site.
2. In June 2008 the EPA removed 140,000 gallons of chromium rinse water from the facility sump located in the basement of the main building.
3. On August 20, 2008 sediment samples were collected from Frazier Creek to help show overland water flow and contaminant migration.
4. On January 7, 2009 the EPA began removal of waste products from the site.
5. In April 2009 DSHS personnel attended a meeting to hear the communities' concerns about the site.
6. On April 9, 2009 the TCR completed a cancer cluster report for zip codes 75160 and 75161.

7. On September 23, 2009 Van der Horst was proposed to EPA's NPL.
8. On January 24, 2010 DSHS personnel visited the Van der Horst NPL site.
9. On March 4, 2010 Van der Horst became finalized to the NPL.
10. From November 28, 2012 to January 23, 2013, the public was given the opportunity to make comments regarding the conclusions and recommendations of this health assessment document.
11. Aquifer testing, performed by the EPA and the TCEQ, was accomplished the week of December 3, 2012.

Actions Planned

1. The EPA is planning to conduct a Remedial Investigation/Feasibility Study (RI/FS) that will address both the groundwater exposure pathway and the speciation of chromium detected in sediment.
2. The final version of this document will be made available to community members, city officials, the TCEQ, the EPA, and other interested parties.

Report Preparation

This Public Health Assessment for the Van der Horst USA Corporation NPL site was prepared by the Texas Department of State Health Services (DSHS) under a cooperative agreement with the federal Agency for Toxic Substances and Disease Registry (ATSDR). It has been prepared in accordance with approved agency methodology and procedures existing at the time the health assessment was initiated. Editorial review was completed by the cooperative agreement partner. ATSDR has reviewed this health assessment and concurs with its findings based on the information presented in this report. ATSDR's approval of this document has been captured in an electronic database, and the approving reviewers are listed below.

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References

1. Agency for Toxic Substances and Disease Registry. Public Health Assessment Guidance Manual. January 2005.
2. United States Environmental Protection Agency, Region VI, Pollution Report Number 30. Van der Horst USA Corp. Site. August 18, 2009. Available at http://www.epaosc.org/site/polrep_profile.aspx?site_id=4173&counter=11260. Last accessed October 29, 2012.
3. NPL Site Narrative for Van der Horst USA Corporation. EPA. Website. Available at http://www.epa.gov/superfund/sites/npl/nar1810.htm. Last accessed October 29, 2012.
4. United States Environmental Protection Agency. Hazard Ranking System Documentation Record: Van der Horst USA Corporation, Terrell, Kaufman County, Texas. September 2009.
5. Weston Solutions, Inc. Site Inspection Report for Van der Horst Site, Terrell, Kaufman County, Texas (excerpts). December 2008.
6. TCEQ Investigation Report. Bois D Arc Industries Inc. CN603405218, Van der Horst USA Corporation RN100574235. Investigation # 699858. May 27 2008-July 28, 2008.
7. TCEQ Investigation Report. Bois D Arc Industries Inc. CN603405218, Van der Horst USA Corporation RN100574235. Investigation # 700052. May 27 2008-July 28, 2008.
8. TCEQ Investigation Report. Crow Jr., Richard D. CN601909005, Van der Horst USA Corporation RN105537187. Investigation # 688315. May 27 2008-July 28, 2008.
9. Superfund Technical Assessment and Response Team Contracts. EPA. Website. Available at http://www.epa.gov/superfund/policy/contracts/7start.htm. Last accessed October 29, 2012.
10. United States Environmental Protection Agency, Region VI, Pollution Report Number 31. Van der Horst USA Corporation Site. August 25, 2010. Available at http://www.epaosc.org/site/polrep_profile.aspx?site_id=4173&counter=11364. Last accessed October 29, 2012.
11. EPA Updates Its National Priorities List of Superfund Sites – One Proposed in Texas. September 23, 2009. Website. Available at http://yosemite.epa.gov/opa/admpress.nsf/d0cf6618525a9efb85257359003fb69d/d9652ad98d22bcd28525763a00641151!OpenDocument. Last accessed October 29, 2012.
12. Final NPL Sites. EPA. Website. Available at http://www.epa.gov/superfund/sites/query/queryhtm/nplfin1.htm. Last accessed October 29, 2012.

13. U.S. Census Bureau. American Fact Finder. Fact Sheets for Kaufman County and Terrell, Texas. Available at http://factfinder.census.gov. Last accessed October 29, 2012.

14. North Central Texas Council of Governments. City of Terrell, Texas. Website. Available at http://www.nctcog.org/ris/census/2010/PL.asp?geo=city&area=72284. Last accessed October 29, 2012.

15. Stallings Addition Neighborhood Meeting Notes. March 2, 2009.

16. United States Environmental Protection Agency Region 6 Laboratory. Final Analytical Report. Van der Horst. Project #09SF145. 23 April 2009.

17. Agency for Toxic Substances and Disease Registry. Toxicological Profile for Chromium. U.S. Department of Health and Human Services. Agency for Toxic Substances and Disease Registry. September 2000.

18. Toxicological Review of Hexavalent Chromium. EPA IRIS. Website. Available at http://www.epa.gov/ncea/iris/toxreviews/0144tr.pdf. Last accessed October 29, 2012.

19. National Institutes of Environmental Health Sciences. Hexavalent Chromium in Drinking Water Causes Cancer in Lab Animals. Website. Available at http://www.niehs.nih.gov/news/releases/2007/hexavalent.cfm. Last accessed October 29, 2012.

20. Volume 49. Chromium, Nickel and Welding. World Health Organization. International Agency for Research on Cancer. Website. Available at http://monographs.iarc.fr/ENG/Monographs/vol49/mono49-6D.pdf. Last accessed October 29, 2012.

21. Texas Cancer Registry. Texas Department of State Health Services. Summary of Investigation into the Occurrence of Cancer, Zip Codes 75160 and 75161, Terrell, Kaufman County, Texas, 1997-2006. April 29, 2009.

Appendix A: Acronyms and Abbreviations

ATSDR	Agency for Toxic Substances and Disease Registry
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CREG	Cancer Risk Evaluation Guide
DSHS	Texas Department of State Health Services
e.g.	[*exempli gratia*]: for example
EMEG	Environmental Media Evaluation Guide
EPA	United States Environmental Protection Agency
etc.	et cetera
GI	Gastrointestinal
IARC	International Agency for Research on Cancer
i.e.	[*id est*]: that is
IUR	Inhalation Unit Risk
kg	kilogram
LOAEL	Lowest Observed Adverse Effect Level
µg/L	microgram per liter
$\mu g/m^3$	microgram per cubic meter
mg/kg	milligram per kilogram
mg/kg/day	milligram per kilogram per day
mg/L	milligram per liter
MRL	Minimal Risk Level
MW	Monitoring Well
ND	Not Detected
NOAEL	No Observed Adverse Effect Level
NPL	National Priorities List
NTP	National Toxicology Program
PHA	Public Health Assessment
ppb	parts per billion
ppbv	parts per billion by volume
ppm	parts per million
RA	Remedial Action
RCRA	Resource Conservation and Recovery Act of 1976
RfC	Reference Concentration
RfD	Reference Dose
RI/FS	Remedial Investigation/Feasibility Study
RMEG	Reference Media Evaluation Guide
START-3	EPA Superfund Technical Assessment and Response Team-Region 3
TCEQ	Texas Commission on Environmental Quality
TCR	Texas Cancer Registry
TPWD	Texas Parks and Wildlife Department
TWDB	Texas Water Development Board
TWQB	Texas Water Quality Board
UCL	Upper Confidence Limit

Van der Horst Van der Horst USA Corporation

Appendix B: Contaminants of Concern

Chromium

Based on available information, chromium was identified as the only contaminant of potential concern at this site. It is a naturally occurring element that can be found throughout the environment in rocks, plants, soil, and volcanic dust and gases in different forms (chromium 0, chromium III, and chromium VI) each with different toxicological properties. Trivalent chromium (III) is an essential nutrient required by the human body that helps the body use sugars, proteins, and fats [18]. Hexavalent chromium (VI) is considered to have the greatest potential to cause harm.

When chromium enters the environment, it is released into air, soil, and water mostly in trivalent and hexavalent forms. In air it generally remains present as fine dust particles for about 10 days or less. Rain and snow help remove the chromium particles from air onto the ground or into water. Most chromium entering water binds to sediment and settles to the bottom, while a small amount dissolves [18].

Much of the hexavalent chromium released into the environment is converted into the less toxic trivalent chromium; a process facilitated by the presence of organic compounds such as oxygen, manganese oxide, and moisture [18].

People can be exposed to chromium by breathing contaminated air, drinking contaminated water, or eating food or soil containing chromium; it also can be absorbed through the skin. The most likely way for the general population to be exposed is by eating foods containing chromium. Other sources of chromium exposure include consumer products such as household utensils, wood preservatives, cement, cleaning products, textiles, and tanned leather [18].

Once chromium is ingested, almost all of it will pass through the digestive tract and be eliminated. Only a very small amount (0.4-2.1%) will pass through the intestinal lining into the bloodstream. Once this chromium enters the bloodstream, it eventually ends up in the kidneys where it is eliminated [18].

Appendix C: The Public Health Assessment Process

The Public Health Assessment (PHA) process for NPL and other hazardous waste sites frequently involves the evaluation of multiple data sets. These data include available environmental data, exposure data, health effects data (including toxicologic, epidemiologic, medical, and health outcome data), and community health concerns.

Environmental Data
As the first step in the evaluation, ATSDR scientists review available environmental data to determine what contaminants are present in the various media to which people may be exposed (e.g., air, soil, sediment, dust, surface water, groundwater, vegetation, etc.) and at what concentrations. ATSDR generally does not collect its own environmental sampling data, but instead, reviews information provided by other federal or state agencies and/or their contractors, by individuals, or by potentially responsible parties [i.e., companies that may have generated the hazardous waste found at an NPL site, shippers that may have delivered hazardous waste to the site, and individuals or corporations that own (or owned) the property on which the site is located]. When the available environmental data is insufficient to make an informed decision about the public health hazard category of the site, the report will indicate what further sampling data is needed to fill the "data gaps."

Exposure Data
Pathway Analysis
The presence of hazardous chemical contaminants in the environment does not always mean that people who spend time in the area are likely to experience adverse health effects. Such effects are possible only when people in the area engage in activities that make it possible for a sufficient quantity of the hazardous chemicals to be transported into the body and absorbed into the bloodstream. This transport process is required in order for there to be a true exposure; thus, the assessment of real and potential exposures defines the real and potential health hazards of the site and drives the PHA process.

As the second step in the health assessment process, ATSDR scientists conduct an evaluation of the various site-specific pathways through which individuals may become truly exposed to site contaminants and be at risk for adverse health effects. Chemical toxicants can be transported into the body through the lungs, through the gastrointestinal (GI) tract, or directly through the skin by dermal absorption. People can be exposed to site contaminants by breathing air containing volatile or dust-borne contaminants, by eating or drinking food or water that contain contaminants from the site (or through hand-to-mouth activities with contaminated soil, dust, sediment, water, or sludge present on the hands), or by coming into direct skin-contact with contaminated soil, dust, sediment, water, or sludge resulting in dermal absorption of toxicants.

To conduct a pathways analysis ATSDR scientists review available information to determine whether people visiting the site or living nearby have been, currently are, or could be exposed (at some time in the future) to contaminants associated with this site. To determine whether people are exposed to site-related contaminants, investigators evaluate the environmental and human behavioral components leading to human exposure. The five (5) elements of each exposure pathway that agency scientists evaluate are:

1) The contaminant source (i.e., the reservoir from which contaminants are being released to various media),
2) The environmental fate and transport of contaminants (i.e., how contaminants may dissipate, decay, or move from one medium to another,
3) The exposure point or area (i.e., the location(s) where people may come in physical contact with site contaminants),
4) The exposure route (i.e., the means by which contaminant gets into the body at the exposure point or area), and
5) The potentially exposed population (i.e., a group of people who may come in physical contact with site contaminants).

Exposure pathways can be **complete**, **potential**, or **eliminated**. For a person to be exposed to site contaminants, at least one exposure pathway for those contaminants must be complete. A pathway is **complete** when all five elements in the pathway are present and exposure has occurred, is occurring, or will occur in the future. If one or more of the five elements of a pathway is missing, but could become completed at some point in the future, the pathway is said to be a **potential** pathway. A pathway is eliminated if one or more of the elements are missing and there is no plausible way of it ever being completed, then the pathway has been **eliminated**.

Exposure Assessment Scenarios

After pathways have been evaluated, ATSDR scientists construct a number of plausible exposure scenarios, depicting a range of exposure possibilities, in order to determine whether people in the community have been (or might be) exposed to hazardous materials from the site at levels that are of potential public health concern. To do this, they must take into consideration the various contaminants, the media that have been contaminated, the site-specific and media-specific pathways through which people may be exposed, and the general accessibility to the site. In some cases, it is possible to determine that exposures have occurred or are likely to have occurred in the past. However, a lack of appropriate historical data often makes it difficult to quantify past exposures. If scientists determine that combined exposures from multiple pathways (or individual exposures from a single pathway) are posing a public health hazard, ATSDR makes recommendations for actions that will eliminate or significantly reduce the exposure(s) causing the threat to public health.

Health Effects Data
Even when chemical contaminants come into contact with the lungs, the GI tract, or the skin, adverse health effects may not occur if the contaminant is present in a form that is not readily absorbed into the bloodstream or it does not pass readily through the skin into the bloodstream. Since exposure does not always result in adverse health effects it is important evaluate whether the exposure could pose a hazard to people in the community or to people who visit the site. The factors that influence whether exposure to a contaminant or contaminants could potentially result in adverse health effects include:

- The toxicological properties of the contaminant (i.e., the toxicity or carcinogenicity),
- The manner in which the contaminant enters the body (i.e., the route of exposure),
- How often and how long the exposure occurs (i.e., frequency and duration of exposure),
- How much of the contaminant actually gets into the body (i.e., the delivered dose),
- Once in (or on) the body, how much gets into the bloodstream (i.e., the absorbed dose),
- The number of contaminants involved in the exposure (i.e., the synergistic or combined effects of multiple contaminants), and
- Individual host factors predisposing to susceptibility (i.e., characteristics such as age, sex, body weight, genetic background, health status, nutritional status, and lifestyle factors that may influence how an individual absorbs, distributes, metabolizes, and/or excretes the contaminants).

Thus, as the third step in the health assessment process (often done in conjunction with the pathway analysis and exposure assessment scenarios described above); ATSDR scientists review existing scientific information to evaluate the possible health effects that may result from exposures to site contaminants. This information frequently includes published studies from the medical, toxicologic, and/or epidemiologic literature, ATSDR's Toxicologic Profiles for the contaminants, EPA's online Integrated Risk Information System database, the National Library of Medicine's Hazardous Substance Data Bank, published toxicology textbooks, or other reliable toxicology data sources.

Comparison Values
To simplify the health assessment process, ATSDR, EPA, Oak Ridge National Laboratories, and some of the individual states have compiled lists of chemical substances that have been evaluated in a consistent, scientific manner in order to derive toxicant doses (health guidelines) and/or toxicant concentrations (environmental guidelines), exposures to which, are confidently felt to be without significant risk of adverse health effects, even in sensitive sub-populations.

Health Guidelines
Health guidelines are derived from the toxicologic or epidemiologic literature with many uncertainty or safety factors applied to insure that they are amply protective of human health. They are generally derived for specific routes of exposure (e.g., inhalation, oral ingestion, or dermal absorption) and are expressed in terms of dose, with units of mg/kg/day.

Comparison values for non-cancer health effects under oral exposure routes are generally based on ATSDR's chronic oral MRLs or EPA's oral reference doses (RfDs). Chronic oral MRLs and RfDs are based on the assumption that there is an identifiable exposure dose (with units of mg/kg/day) for individuals, including sensitive subpopulations (such as pregnant women, infants, children, the elderly, or individuals who are immunosuppressed), that is likely to be without appreciable risk for non-cancer health effects over a specified duration of exposure.

Environmental Guidelines
Environmental guidelines for specific media (e.g., air, soil/sediment, food, drinking water, etc.) are often derived from health guidelines after making certain assumptions about 1) the average quantities of the specific media that a person may assimilate into the body per day (i.e., inhale, eat, absorb through the skin, or drink) and 2) the person's average body weight during the exposure period. Environmental guidelines are expressed as chemical concentrations in a specific medium with units such as micrograms per cubic meter ($\mu g/m^3$), milligrams per kilogram (mg/kg), micrograms per Liter (µg/L), parts per million (ppm), or parts per billion (ppb). If these values are based on ATSDR's oral MRLs, they are known as EMEGs; if they are based on EPA's RfDs, they are called reference dose media evaluation guides.

For airborne contaminants, ATSDR health assessors frequently use ATSDR's inhalation minimal risk levels (inhalation MRLs) or EPA's inhalation reference concentrations (RfCs). Inhalation MRLs and RfCs are all based on the assumption that there is an identifiable exposure concentration in air [with units of $\mu g/m^3$ or parts per billion by volume (ppbv)] for individuals, including sensitive subpopulations (such as pregnant women, infants, children, the elderly, or individuals who are immunosuppressed), that is likely to be without appreciable risk for non-cancer health effects over a specified duration of exposure. Since it is already in the form of a concentration in a particular medium, the inhalation MRL is also called the EMEG for air exposures.

These environmental guidelines are frequently referred to as "screening values" or "comparison values" since the contaminant concentrations measured at a Superfund or other hazardous waste site are frequently "compared" to their respective environmental guidelines in order to screen for those substances that require a more in-depth evaluation. Since comparison values are health-based (i.e., derived so as to be protective of public health) and they are frequently employed in conducting PHAs, they are frequently referred to as comparison values.

Other comparison value names have been coined by the various EPA Regions or other state or federal agencies including EPA Regional Screening Levels, EPA's health effects assessment summary tables, "dose-response values", California's "reference exposure levels", and Texas

Commission on Environmental Quality's "effects screening levels". These values are occasionally used when there are no published MRLs, RfDs, or RfCs for a given contaminant.

Comparison values for non-cancer effects (specifically ATSDR's oral and/or inhalation MRLs) may be available for up to three different exposure durations: acute (14 days or less), intermediate (15 to 365 days), or chronic (366 days or more). As yet, EPA calculates RfD or RfC comparison values only for chronic exposure durations.

Comparison Values for Cancer Effects
When a substance has been identified as a carcinogen, the lowest available comparison value usually proves to be the cancer risk evaluation guide (CREG). For oral exposures, the CREG (with units of mg/kg or ppm) is based on EPA's chemical-specific cancer slope factor (also referred to as oral slope factor) and represents the concentration that would result in a daily exposure dose (in mg/kg/day) that would produce a theoretical lifetime cancer risk of 1×10^{-6} (1 additional cancer case in 1 million people exposed over a 70-year lifetime).

For inhalation exposures, the CREG (in µg/m^3) is based on the EPA's inhalation unit risk (IUR) value and is calculated as CREG = $10^{-6} \div$ IUR. The inhalation CREG represents the ambient air concentration that, if inhaled continuously over a lifetime, would produce a theoretical excess lifetime cancer risk of 1×10^{-6} (1 additional cancer case in 1 million people exposed over a 70-year lifetime).

Imputed or Derived Comparison Values
The science of environmental health and toxicology is still developing, and sometimes, scientific information on the health effects of a particular substance of concern is not available. In these cases, ATSDR scientists will occasionally look to a structurally similar compound, for which health effects data are available, and assume that similar health effects can reasonably be anticipated on the basis of their similar structures and properties. Occasionally, some of the contaminants of concern may have been evaluated for one exposure route (e.g., the oral route) but not for another route of concern (e.g., the inhalation route) at a particular NPL site or other location with potential air emissions. In these cases ATSDR scientists may do what is called a route-to-route extrapolation and calculate the inhalation RfD, which represents the air concentration (in µg/m^3) that would deliver the same dose (in mg/kg/day) to an individual as the published oral RfD for the substance. This calculation involves making certain assumptions about the individual's inhalation daily volume (in cubic meters per day), which represents the total volume of air inhaled in an average day, the individual's body weight (in kilograms (kg)), a similarity in the oral and inhalation absorption fraction, and – once the contaminant has been absorbed into the bloodstream – that it behaves similarly whether it came through the GI tract or the lungs. Because of all the assumptions, route-to-route extrapolations are employed only when there are no available comparison values for one of the likely routes of exposure at the site.
Use of Comparison Values
When assessing the potential public health significance of the environmental sampling data collected at a contaminated site, the first step is to identify the various plausible site-specific pathways and routes of exposure based on the media that is contaminated (e.g., dust, soil, sediment, sludge, ambient air, groundwater, drinking water, food product, etc.). Once this is

done, maximum values for measured contaminant concentrations are generally compared to the most conservative (i.e., lowest) published comparison value for each contaminant. If the maximum contaminant concentration is below the screening comparison value, then the contaminant is eliminated from further consideration, but if the maximum concentration exceeds the screening comparison value, the contaminant is identified as requiring additional evaluation. However, since the screening comparison value is almost always based on a chronic exposure duration (or even a lifetime exposure duration, in the case of comparisons with CREG values) and the maximum contaminant concentration represents a single point in time (which would translate to an acute duration exposure), one cannot conclude that a single exceedance (or even several exceedances) of a comparison value constitutes evidence of a public health hazard. That conclusion can be reached only after it has been determined that peak concentrations are exceeding acute-exposure-duration comparison values, intermediate-term average concentrations are exceeding intermediate-exposure-duration comparison values, or long-term average concentrations are exceeding chronic-exposure-duration comparison values.

Community Health Concerns

If nearby residents are concerned about specific diseases in the community, or if ATSDR determines that harmful exposures are likely to have occurred in the past, health outcome data may be evaluated to see if illnesses are occurring at rates higher than expected and whether they plausibly could be associated with the hazardous chemicals released from the site. Health outcome data may include cancer incidence rates, cancer mortality rates, birth defect prevalence rates, or other information from state and local databases or health care providers. The results of health outcome data evaluations may be used to address community health concerns. However, since various disease incidence, mortality, and/or prevalence rates can (and do) fluctuate randomly over space and time, care must be taken not to attribute causality to a real or theoretical exposure possibility when rates are slightly higher than expected (any more than one would attribute a protective effect to an environmental exposure if disease rates were lower than expected).

ATSDR also needs to learn what people in the area know about the site and what concerns they may have about its impact on their health. Consequently, throughout the evaluation process, ATSDR actively gathers information and comments from the people who live or work near a site, including residents of the area, civic leaders, health professionals, and community groups. To ensure that the report responds to the community's health concerns, an early version is also distributed to the public for their comments. All the public comments that related to the PHA document are addressed in the final version of the report.

Conclusions
The PHA document presents conclusions about the nature and severity of the public health threat posed by the site. Conclusions take into consideration the environmental sampling data that have been collected, the available toxicologic data regarding the contaminants identified, the environmental media that are affected, and the potential pathways of exposure for the public. If health outcome data have been evaluated, conclusions are also presented regarding these data evaluations.

Recommendations
If the conclusions indicate that the site represents a public health hazard, the ATSDR will make recommendations to the state or federal environmental agencies regarding steps that can be taken to stop or reduce the exposures to the public. These steps are presented in the public health action plan for the site. However, if the public health threat is urgent, the ATSDR can issue a public health advisory, warning people of the danger. ATSDR can also recommend health education activities or initiate studies of health effects, full-scale epidemiology studies, exposure investigations, disease registries, disease surveillance studies, or research studies on specific hazardous substances.

Appendix D: Figures

Figure 1. Site Location and Facility Layout [5]

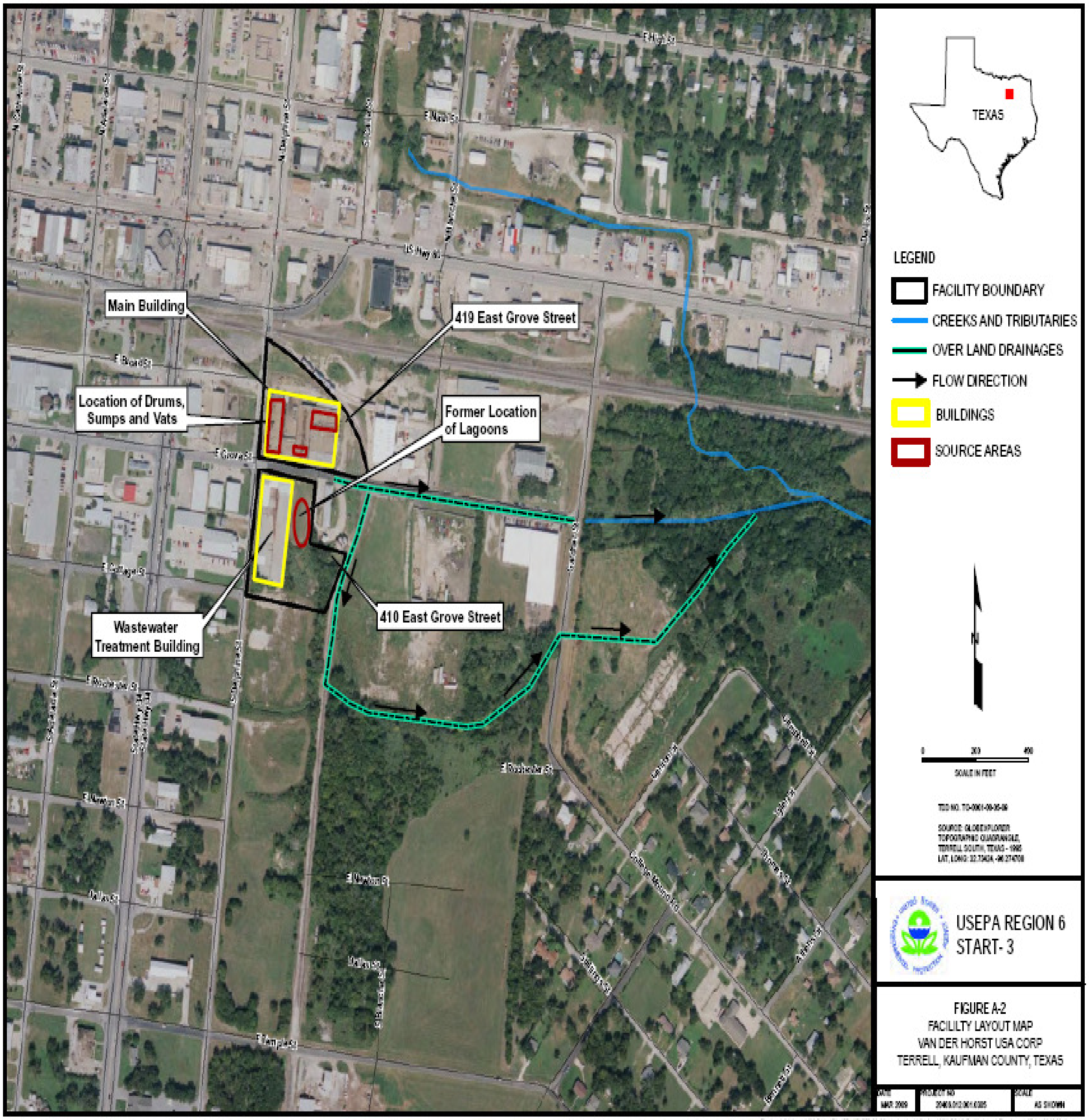
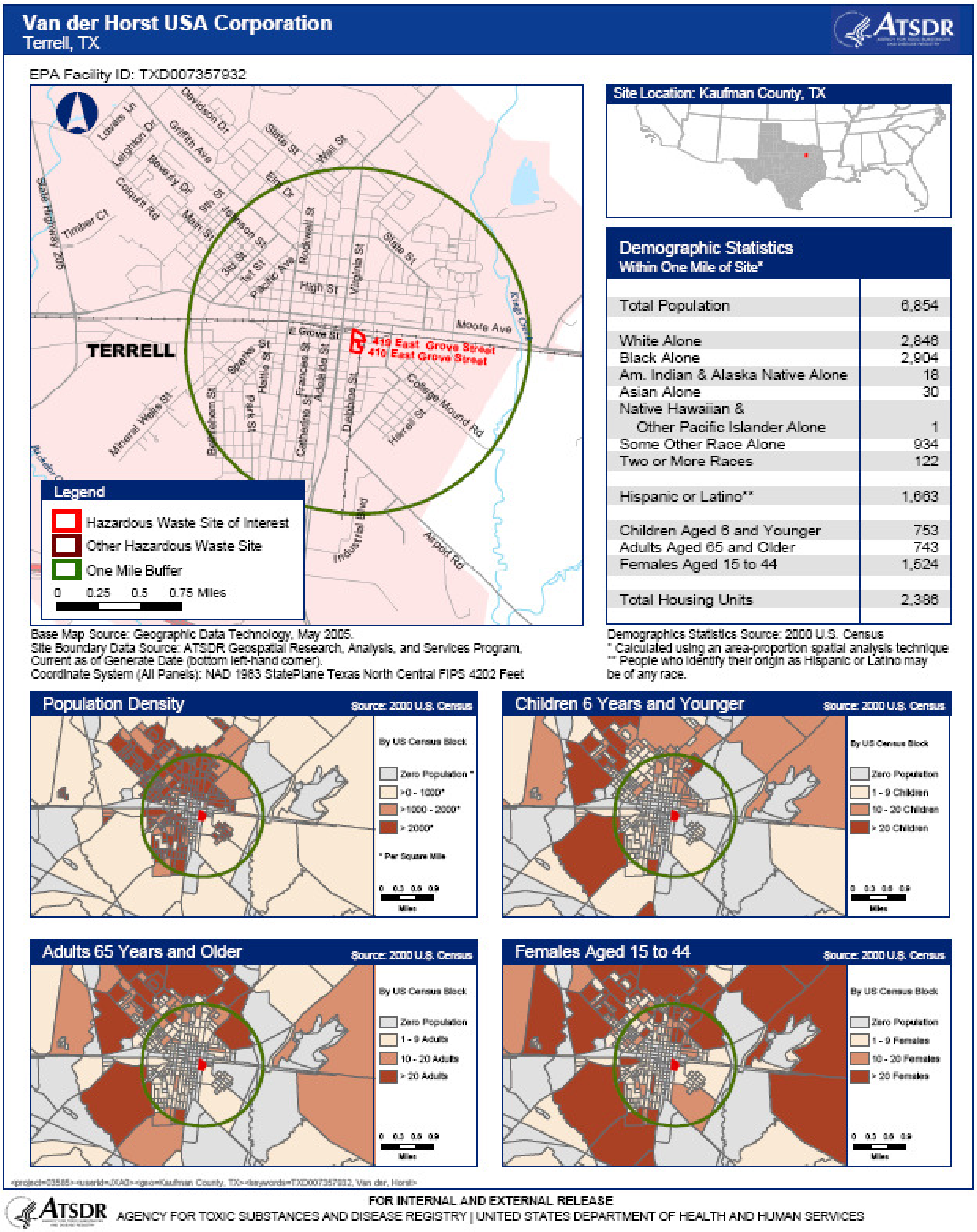


Figure 2. Site Location and Demographic Statistics



Appendix E: Tables

Table 1. Metals Detected in Groundwater Monitoring Wells that Exceed Comparison Values

Location	Contaminant	Concentration (mg/L)	Comparison Values for Water (mg/L)	Number exceeding Screening Value/Total Samples
MW - 2	Total Chromium	0.029	0.010 (Chronic EMEG Child)[α] 0.050 (Intermediate EMEG Child) 0.040 (Chronic EMEG Adult) 0.200 (Intermediate EMEG Adult)	1/1 0/1 0/1 0/1
MW - 4	Total Chromium	0.399	0.010 (Chronic EMEG Child) 0.050 (Intermediate EMEG Child) 0.040 (Chronic EMEG Adult) 0.200 (Intermediate EMEG Adult)	1/1 1/1 1/1 1/1
MW - 4	Hexavalent Chromium	0.189	0.010 (Chronic EMEG Child) 0.050 (Intermediate EMEG Child) 0.040 (Chronic EMEG Adult) 0.200 (Intermediate EMEG Adult)	1/1 1/1 1/1 0/1

MW = Monitoring Well
mg/L = milligram per liter
EMEG = Environmental Media Evaluation Guide
[α] = Comparison values used in this health consultation assume all chromium present in samples is hexavalent chromium, the more toxic form of chromium.
Monitoring Well Samples were collected during June 2008.

Table 2. Frazier Creek Sediment Sample Concentrations Compared to Comparison Values			
Contaminant	**Range (mg/kg)**	**Comparison Values for Soil (mg/kg)**	**Number exceeding Screening Value/Total Samples**
Aluminum	3,430-8,330	700,000 (Chronic EMEG Adult) 50,000 (Chronic EMEG Child) 2,000 (Intermediate EMEG Pica)	0/14 0/14 14/14
Cadmium	ND-1.1	70 (Chronic EMEG Adult) 5 (Chronic EMEG Child) 1 (Intermediate EMEG Pica)	0/14 0/14 1/14
Chromium	38.9-638	700 (Chronic EMEG Adult) $^{\alpha}$ 50 (Chronic EMEG Child) 250 (Intermediate EMEG Child) 10 (Intermediate EMEG Pica)	0/14 10/14 2/14 14/14
Copper	5.2-21.8	7,000 (Intermediate EMEG Adult) 500 (Intermediate EMEG Child) 20 (Intermediate EMEG Pica)	0/14 0/14 1/14
Vanadium	12.7-51.5	7,000 (Intermediate EMEG Adult) 500 (Intermediate EMEG Child) 20 (Intermediate EMEG Pica)	0/14 0/14 9/14

mg/kg = milligram per kilogram
EMEG = Environmental Media Evaluation Guide
ND = Not Detected
$^{\alpha}$ = Comparison values used in this health consultation assume all chromium present in sediment samples is hexavalent chromium, the more toxic form of chromium.
Sediment samples were collected from July 2008 - March 2009.

Table 3 Kings Creek Sediment Sample Concentrations Compared to Comparison Values			
Contaminant	**Range (mg/kg)**	**Comparison Values for Soil (mg/kg)**	**Number exceeding Screening Value/Total Samples**
Aluminum	2,210-6,850	700,000 (Chronic EMEG Adult) 50,000 (Chronic EMEG Child) 2,000 (Intermediate EMEG Pica)	0/9 0/9 9/9
Cadmium	ND-1.5	70 (Chronic EMEG Adult) 5 (Chronic EMEG Child) 1 (Intermediate EMEG Pica)	0/9 0/9 1/9
Chromium	14.8-136	700 (Chronic EMEG Adult) 50 (Chronic EMEG Child)$^{\alpha}$ 250 (Intermediate EMEG Child) 10 (Intermediate EMEG Pica)	0/9 5/9 0/9 9/9
Vanadium	20.9-90.8	7,000 (Intermediate EMEG Adult) 500 (Intermediate EMEG Child) 20 (Intermediate EMEG Pica)	0/9 0/9 4/9

mg/kg = milligram per kilogram
EMEG = Environmental Media Evaluation Guide
ND = Not Detected
$^{\alpha}$ = Comparison values used in this health consultation assume all chromium present in sediment samples is hexavalent chromium, the more toxic form of chromium.
Sediment samples were collected from July 2008 - March 2009.

Table 4 Drainage Ditch Sediment Sample Concentrations Compared to Comparison Values			
Contaminant	**Range (mg/kg)**	**Comparison Values for Soil (mg/kg)**	**Number exceeding Screening Value/Total Samples**
Aluminum	2,920-12,700	700,000 (Chronic EMEG Adult) 50,000 (Chronic EMEG Child) 2,000 (Intermediate EMEG Pica)	0/8 0/8 8/8
Cadmium	ND-4.2	70 (Chronic EMEG Adult) 5 (Chronic EMEG Child) 1 (Intermediate EMEG Pica)	0/8 0/8 4/8
Chromium	169-1,770	700 (Chronic EMEG Adult) $^{\alpha}$ 50 (Chronic EMEG Child) 250 (Intermediate EMEG Child) 4,000 (Intermediate EMEG Pica)	4/8 8/8 5/8 8/8
Copper	6.9-75.7	7,000 (Intermediate EMEG Adult) 500 (Intermediate EMEG Child) 20 (Intermediate EMEG Pica)	0/8 0/8 4/8
Vanadium	13.1-44.1	7,000 (Intermediate EMEG Adult) 500 (Intermediate EMEG Child) 20 (Intermediate EMEG Pica)	0/8 0/8 2/8

mg/kg = milligram per kilogram
EMEG = Environmental Media Evaluation Guide
ND = Not Detected
$^{\alpha}$ = Comparison values used in this health consultation assume all chromium present in sediment samples is hexavalent chromium, the more toxic form of chromium.
Sediment samples were collected from July 2008 - March 2009.

Appendix F: Exposure Dose Calculations

In this PHA, the DSHS evaluated one scenario in order to determine if there is a risk of adverse health effects when a person is exposed 2 days per week to chromium-contaminated sediment from Frazier Creek, Kings Creek, or the drainage ditch located between the site and Frazier Creek.

The exposure dose is calculated using the following equation:

$$\text{Dose} = \frac{\text{Concentration} \times \text{Intake Rate} \times \text{Exposure Frequency} \times \text{Conversion Factor}}{\text{Body Weight}}$$

Examples:

Using standard exposure assumptions (body weights of 30 kg for elementary school aged children, and 70 kg for an adult and ingestion rates of 150 mg soil/day for elementary school aged children, and 100 mg/day for adults), the geometric mean concentration of total chromium measured in Kings Creek and drainage ditch samples, and the 95% UCL of the mean concentration for Frazier Creek sediment samples, we calculated the estimated exposure doses for an elementary school aged child, exposed 2 days per week to determine if health effects could occur.

Frazier Creek:

- ***Elementary School Aged Child exposed to the 95% UCL of the mean for chromium measured in samples collected from Frazier Creek, exposed 2 days per week.***

$$\text{Dose} = \frac{227.2\ \frac{\text{mg chromium}}{\text{kg sediment}} \times 150\ \frac{\text{mg sediment}}{\text{day}} \times ([2\ \text{days/week} \times 50\ \text{weeks/1 year}]\ \text{x}30\ \text{years}) \times \frac{10^{-6}\text{kg}}{\text{mg sediment}}}{16\ \text{kg body weight}}$$

Dose = 0.00033 mg/kg/day

This dose is below the chronic MRL for chromium (0.0009 mg/kg/day), thus health effects are not expected to occur if an elementary school aged child is exposed to Frazier Creek sediment.

Kings Creek:

- ***Elementary School Aged Child exposed to the maximum chromium concentration measured in samples collected from Kings Creek, exposed 2 days per week.***

$$\text{Dose} = \frac{136\ \frac{\text{mg chromium}}{\text{kg sediment}} \times 150\ \frac{\text{mg sediment}}{\text{day}} \times ([2\ \text{days/week} \times 50\ \text{weeks/1 year}]\ \text{x}30\ \text{years}) \times \frac{10^{-6}\text{kg}}{\text{mg sediment}}}{16\ \text{kg body weight}}$$

Dose = 0.0002 mg/kg/day

This dose is below the chronic MRL for chromium (0.0009 mg/kg/day), thus health effects are not expected to occur if an elementary school aged child is exposed to Kings Creek sediment.

Drainage Ditch:

- ***Elementary School Aged Child exposed to the maximum concentration of chromium measured in samples collected from the drainage ditch, exposed 2 days per week.***

$$\text{Dose} = \frac{1{,}171 \frac{\text{mg chromium}}{\text{kg sediment}} \times 150 \frac{\text{mg sediment}}{\text{day}} \times ([2 \text{ days/week} \times 50 \text{ weeks/1 year}] \times 30 \text{ years}) \times 10^{-6} \frac{\text{kg}}{\text{mg sediment}}}{16 \text{ kg body weight}}$$

Dose = 0.0017 mg/kg/day

This dose is slightly above the chronic MRL for chromium (0.0009 mg/kg/day). Assuming infrequent contact, health effects are not expected to occur if an elementary school aged child is exposed to drainage ditch sediment.

The values used in estimating the exposure doses are shown below:

Variable	Value	Source of Value
95% UCL of the Mean for Total Chromium Detected in Sediment Samples-Used When More than 10 Samples Frazier Creek The Maximum Concentration of Total Chromium Detected in Sediment Samples-Used when Less than 10 Samples Kings Creek Drainage Ditch	227.2 mg/kg 136 mg/kg 1,171 mg/kg	95% UCL of the mean for total chromium concentrations detected in sediment samples from each location. The 95% UCL was calculated using ProUCL software. The maximum concentration of total chromium detected in sediment samples from each location.
Intake Rate – Elementary School Aged Child (7-11 years)	150 mg/day	The average amount of soil an elementary school aged child will ingest on a daily basis
Body Weight – Elementary School Aged Child	30 kg	Standard default, median body weight of an elementary aged child
Intake Rate – Adult	100 mg/day	The average amount of soil an adult will ingest on a daily basis
Body Weight – Adult	70 kg	Standard default, median body weight of an adult.
Exposure Frequency	2 days per week for 1 year	Professional judgment used to demonstrate a child playing in and around the creeks on the weekends
Conversion Factor	10^{-6} kg/mg	Conversion for sediment units

UCL = Upper Confidence Limit
mg/kg = milligram per kilogram
mg/day = milligrams per day
kg = kilograms
kg/mg = kilograms per milligrams

Appendix G: Public Comments and Reponses

From November 28, 2012 to January 23, 2013, this document was released to the public for review and comments. The DSHS mailed the document to local government officials, state and federal agencies, the Riter C. Hulsey Public Library, and the Stallings Addition Neighborhood Association. The DSHS additionally mailed 253 postcards to residents living near the site, informing them that the document was available for public comment.

Responses to comments are provided in *italics*.

Comment: The chromium concentrations in Table 1 exceeded the TCEQ's Permissible Control Limit (PCL) of 0.1 mg/L. If the PCL is exceeded, then some sort of action would be required under the Texas Risk Reduction Program.

Response: *The TCEQ informed DSHS that testing of the aquifer was accomplished the week of December 3, 2012. Results of the testing will determine the classification of the water contained in the aquifer as class I, II, or III. If the aquifer is found to be class I or class II, institutional controls will be implemented.*

On page 18, under the Actions Completed section, we noted that the aquifer testing was completed during the week of December 3, 2012.

Comment: It may be important to determine how much of the total chromium detected in the sediment samples is hexavalent chromium. Speciation of the sampling results would help determine if further action is required under the Texas Risk Reduction Program.

Response: *The DSHS did not have speciated chromium results available to review. We assumed all chromium detected was in the more toxic hexavalent form, a worst case scenario.*

On page 18, under the Actions Planned section, we noted that in the future the EPA will conduct an RI/FS that will address the speciation of chromium detected in sediment.

Comment: The PHA calls for residential well sampling downgradient to address an indeterminant exposure pathway.

Response: *The TCEQ informed DSHS that the groundwater pathway will be addressed further in the RI/FS. Depending on the sample results, the EPA and the TCEQ may implement institutional controls in the form of deed restrictions/notices for any off-site contaminated groundwater.*

On page 18, under the Actions Planned section, we have noted that the off-site groundwater exposure pathway will be addressed in the RI/FS.