Public Health Assessment for

PARKVIEW WELL GROUNDWATER CONTAMINATION SITE
GRAND ISLAND, HALL COUNTY, NEBRASKA
EPA FACILITY ID: NEN000704456
MAY 28, 2009

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
Agency for Toxic Substances and Disease Registry

THE ATSDR PUBLIC HEALTH ASSESSMENT: A NOTE OF EXPLANATION

This Public Health Assessment was prepared by ATSDR 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 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 30-day public comment period. Subsequent to the public comment period, ATSDR 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 which, in the agency's opinion, indicates a need to revise or append the conclusions previously issued.

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PUBLIC HEALTH ASSESSMENT

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Prepared by:

Site and Radiological Assessment Branch
Division of Health Assessment and Consultation
Agency for Toxic Substances and Disease Registry

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ACRONYMS

ATSDR	Agency for Toxic Substances and Disease Registry
CDC	Centers for Disease Control and Prevention
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CNH	Case New Holland
CREG	Cancer Risk Evaluation Guide
CVOCs	Chlorinated Volatile Organic Compounds
DHHS	U.S. Department of Health and Human Services
DWEL	Drinking Water Equivalent Level of EPA
EMEG	Environmental Media Evaluation Guide
EPA	U.S. Environmental Protection Agency
ISC	Industrial Services Corporation
LOAEL	Lowest-Observe-Adverse-Effect-Level
LTHA	Life-time Health Advisory
MCL	Maximum Contaminant Level
mg/kg	milligram [contaminant]/kilogram [medium]
MRL	Minimal Risk Level
NA	Not Applicable
NDEQ	Nebraska Department of Environmental Quality
NPL	National Priorities List
OU	Operable Unit
PA/SI	Preliminary Assessment/Site Investigation
PHA	Public Health Assessment
ppb	parts per billion (µg/kg or µg/L) [micrograms of contaminant per kilogram of medium or micrograms of contaminant per litre of medium]
ppbv	part per billion by volume
ppm	parts per million (mg/kg) [milligrams of contaminant per kilogram of medium]
PW3	municipal well #3 – located near Parkview subdivision
PWGC	Parkview Well Groundwater Contamination site
QA/QC	Quality assurance/quality control
RBCs	Risk-Based Concentrations for non-cancer hazards resulting from exposure to contaminants in residential soils
RfD	Reference Dose
RMEG	Reference Dose Media Evaluation Guide
SV	Screening Value
µg/kg	micrograms of contaminant per kilogram of medium
µg/kg/day	micrograms of contaminant per kilogram of body weight per day
µg/dL	micrograms of contaminant per deciliter of body fluid
µg/L	micrograms of contaminant per litre of medium
µg/m3	micrograms of contaminant per cubic meter of air

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EXECUTIVE SUMMARY

The Parkview Well Groundwater Contamination (PWGC) site is located in Grand Island, Hall County, Nebraska. The site contains two plumes of chlorinated volatile organic compounds. The areas affected by the plumes include residences, light industrial, and commercial businesses.

Groundwater from the plume areas is used by residents and businesses for drinking and other household and business purposes. Tetrachloroethylene, 1,1-dichloroethane, 1,2-dichloroethane, and 1,1-dichloroethene have been found in a public drinking water well and in residential water wells.

The Agency for Toxic Substances and Disease Registry (ATSDR) reviewed the environmental data available for the site and evaluated the exposure pathways through which the public could contact contaminants from the site.

A review of groundwater data indicate that in the past, the public was exposed to contaminants at concentrations above the U.S. Environmental Protection Agency (EPA) drinking water standards. Based upon the data reviewed, the concentrations of the contaminants in public and private drinking water supplies were unlikely to result in observable adverse health effects for business and residential users. The contaminated public water supply well is no longer in service and the known affected private wells have been provided filtration systems or removed from service and the residence connected to public water supplies. ATSDR concludes that those groundwater supplies to residences connected to municipal water or using a monitored and maintained whole house filter is currently safe to drink. However, unless the contamination in the plumes is remediated, long-term exposures to contaminated groundwater and soil gas could cause adverse health effects in the future. The greatest exposure would likely occur via inhalation to individuals performing excavation services, in the vicinity of the Industrial Services Corporation (ISC) facility, given the current concentrations of tetrachloroethylene (PCE) measured several feet below ground surface.

1. PURPOSE AND STATEMENT OF ISSUES

The Agency for Toxic Substances and Disease Registry (ATSDR) was established under the mandate of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980. This act, also known as the "Superfund" law, authorizes 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 hazardous to public health. This list is termed the National Priorities List (NPL). The 1986 Superfund Amendments and Reauthorization Act (SARA) directed ATSDR to prepare a public health assessment (PHA) for each NPL site.

The public health assessment process involves multiple steps, but consists of two primary technical components—the exposure evaluation and the health effects evaluation. These two components lead to making conclusions and recommendations and in identifying specific and appropriate public health actions to prevent or mitigate harmful exposures.

The exposure evaluation involves studying the environmental data and understanding if and under what conditions people might contact contaminated media (e.g., water, soil, air, food chain [biota]). The information compiled in the exposure evaluation is used to support the health effects evaluation, which includes a screening component, a more detailed analysis of site-specific exposure considerations and of the substance-specific information obtained from the toxicologic and epidemiologic literature. An additional consideration, although not always available, is an evaluation of health outcome data for the community of interest.

This PHA is a comprehensive review of available environmental sampling data and other site information on contaminant levels within the site and the potential health impact on the potentially impacted communities. It addresses past, present, and future public health concerns. This PHA presents conclusions about whether exposures are occurring and whether a health threat is present. In some cases, it is possible to determine whether exposures occurred in the past. However, lack of appropriate historical data often makes it difficult to quantify past exposures. If a threat to public health exists, recommendations are made to stop or reduce the threat to public health.

2. BACKGROUND

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal agency within the U.S. Department of Health and Human Services (DHHS). The agency is authorized by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) to conduct public health assessments of hazardous waste sites.

Summaries of data from following documents were used in preparation of this public health assessment:

- Parkview Well site – HRS Documentation Record
- Parkview Well Groundwater Contamination Site – Community Involvement Plan (July 2005)
- Parkview Well Site, Northern Study Area – Remedial Investigation Report (May 2006)
- Parkview Well Site, Southern Plume Study Area, Groundwater Operable Unit #1 – Final Focused Feasibility Study (July 2006)
- Parkview Well Groundwater Contamination Site, Southern Plume Study Area – Final Remedial Investigation Report (July 2006)
- Parkview Well Superfund Site Operable Unit 1 – Interim Record of Decision (September 2006)
- Parkview Well Superfund Site Operable Unit 2 – Remedial Investigation Report (June 2007)
- Parkview Well Superfund Site Operable Unit 2 – Record of Decision (September 2007)

2.1 Site Description and History

The Parkview Well Groundwater Contamination (PWGC) site is located in southwestern Grand Island, Hall County, Nebraska. The PWGC site is divided into two operable units (OU) by the Environmental Protection Agency (EPA) for logistical purposes. Operable Unit #1 is defined as the interim remedial action to address groundwater contamination within and near the Parkview Subdivision and to protect private and municipal wells impacted or threatened by the groundwater contamination. OU2 is defined as the site-wide final remedial action (areas not addressed in OU1); including the Southern Plume source area and remaining groundwater contamination. The site covers approximately 350 acres. For purpose of our discussions, ATSDR will discuss the site as a whole.

The PWGC site was formerly known as the Stolley Park Groundwater Contamination site. In 1999, routine monitoring of municipal wells detected chlorinated volatile organic compounds (CVOCs) in a municipal well (PW3) located near the Parkview subdivision. Over time the concentration of the detected CVOCs in PW3 increased. PW3 was removed from service in August 2001. The city sampled other public wells in the vicinity of the Parkview subdivision as well as 77 private wells within the subdivision from late 2001 to summer 2002. Samples taken from some of the private wells were shown to be contaminated with CVOCs.

Based on the previous sampling results the Nebraska Department of Environmental Quality (NDEQ) initiated a preliminary assessment/site investigation (PA/SI) in 2003. Concentrations of

CVOCs detected in some of PA/SI samples indicated that the extent of contamination was larger than previously thought. As a result the city sampled the private wells of residences not connected to city water. These samples indicated that the contamination had also affected the Castle Estates, Kentish Hills, and Mary Lane Estates subdivisions.

As part of its removal program the EPA sampled groundwater during October and November 2003. CVOCs were detected in those samples. Case New Holland's (CNH) consultants (CRA) conducted a comprehensive well survey and sampled private wells located east and south of the CNH facility from November 2003 to March 2004. CRA conducted additional off-site sampling from November to December 2003. From September 2003 to July 2004, CNH worked with private well owners, local plumbers, and the city to provide alternative water sources to those residences adversely impacted by groundwater contamination. The residents were offered bottled water and the opportunity to connect to city water with CNH covering the cost of the connection. In return the resident was required to agree to abandon the contaminated well. By July 2004 CNH had connected 69 residences to the city water supply. Some of the residents declined the connection. One resident connected to the city water supply at his or her own expense so that he or she could keep using his or her private wells.

In March 2004, CNH conducted an interim removal action at its burn and burial area. In August 2004, EPA took groundwater samples to further characterize the extent of contamination. They also took air samples to assess the potential for vapor intrusion into residences located above the plumes. The results of these samples indicated that the contamination had migrated east of Brentwood Lake and that private wells were contaminated with CVOCs above the maximum contaminant levels (MCLs). CVOCs attributable to the groundwater plume were not found at significant levels in the indoor air samples.

Based on previous sampling efforts, it appears that there are two groundwater plumes with separate sources in the vicinity of the Parkview subdivision. The northern plume originates from the CNH facility, and the southern plume originates near the intersection of Engleman Road and Husker Highway. The northern plume does not appear to contribute to site groundwater contaminants above EPA MCLs to the Parkview subdivision. However the southern plume contributes site groundwater contaminants above EPA MCLs to the Parkview subdivision.[TetraTech RIa]

The concentrations of CVOCs in many private wells were so high it lead to abandonment of those wells and connection to the municipal water supply. In addition, a municipal well was removed from service as the concentrations of contaminants approached MCLs. The well was eventually grouted and closed. EPA installed whole-house filtration systems in a few of the residences which could not feasibly be connected to the municipal water supply.

The Parkview Well Groundwater Contamination site was proposed to the National Priorities List (NPL) on September 23, 2004 and added to the final list on April 19, 2006. Inclusion on the NPL allowed federal funds and personnel to become available to further assess the nature and extent of the public health and environmental risk associated with the site.

2.2 Site Visits

ATSDR regional staff based in Kansas City, Kansas has visited the PWGC site several times over the past few years. They have attended several meetings conducted by the EPA. During some of these meetings ATSDR explained its role in the remedial process and solicited local community members to provide ATSDR their health-related concerns.

2.3 Demographics, Land Use, and Natural Resource Use

To understand the size, characteristics, location, and any unique vulnerabilities of on-site communities, ATSDR studied available demographics, land use, and natural resource use information.

2.3.1. Demographics

Demographic information helps identify and define the size, characteristics, locations (distance and direction), and possible susceptibility of known populations related to the site. Demographic information alone does not define exposure. However, since demographic data sets do provide information on potentially exposed populations, they can provide important information for determining site-specific exposure pathways.

According to data extrapolated from the 2000 U.S. Census, approximately 10,000 people reside within the boundaries of PWGC. About 7% of these individuals represent minority populations. Females of child-bearing age represent 20% of the population, while the elderly and children 6-years and younger represent 15% and 10% of the population, respectively. See Figures 1 and 2.

2.3.2. Land Use

The site includes land zoned as agricultural, single family residential, multi-family residential, and light manufacturing. Until the 1960s the site was agricultural with few commercial uses. In the mid-1970s single family residences were constructed and in the late 1980s, a golf course was constructed. Multi-family residences were built in 2003 and new development is continuing.

2.3.3. Natural Resource Use

The Platte River Valley ranges from 12 to 19 miles wide and crosses Hall County from the southwest to the northeast. Soils in the area have a relatively high permeability but low absorption which allows a moderate amount of water to move to the water table. Average annual precipitation is about 24 inches and annual average snowfall is about 25 inches. Groundwater flow in the area is generally east to northeast toward the Platte River and wells may produce yields from 400 to over 2,000 gallons per minute [Keech and Dreezen 1964]. Depth to groundwater generally ranges from about ten feet below ground surface (bgs) to about 150 feet bgs [USDA 2004]. Local water flow direction varies and can be greatly influenced by the use of irrigation during the summer months.

Grand Island is currently served by 26 production wells. Three of the wells are high-capacity wells (Parkview Well #1, #2, and Stolley Park). Those three wells supply approximately 20 percent of the water during times of peak demand (primarily during the summer months). Approximately 40,000 customers receive municipal water. Many neighborhoods, within the city limits of Grand Island, are not connected to city water. Outside of city limits, other neighborhoods and residences use private wells. All municipal wells were addressed in the OU1 interim remedial action [EPA 2006. EPA 2007].

Surface water bodies in the area include the Platte River and the Wood River. Surface water flow in the county is dominated by the Platte River. The direction of flow is southwest to northeast. The Wood River flows parallel to the Platte River.

3. ENVIRONMENTAL CONTAMINATION/PATHWAYS ANALYSIS

3.1 Introduction

Chemical contaminants in the environment do not always result in adverse health effects in people. Adverse health effects are possible only when people actually come into contact with the chemicals. It is this contact (exposure) that people have with the contaminants that determines the potential health hazards and drives the public health assessment process.

People can be exposed to contaminants by breathing, eating, drinking, or coming into direct contact with a substance containing the contaminant. This section reviews available information to determine whether people in the community have been, currently are, or could in the future be exposed to contaminants associated with the site.

To determine whether people are exposed to site-related contaminants, investigators evaluate the environmental and human components leading to human exposure. This analysis consists of evaluating the five elements of an exposure pathway:

- The source of contamination,
- How the contaminant is transported through an environmental medium,
- Where the exposure occurs,
- How the contaminant gets into the body, and
- Whether people are being exposed.

Exposure pathways can be complete, potential, or eliminated. See Appendix B, Tables 3 and 4. For a person to be exposed to a contaminant, the exposure pathway must be complete. A completed pathway is when all five elements in the pathway are present and exposure has occurred, is occurring, or will occur in the future. A potential pathway is missing at least one of the five elements, but could be complete in the future. An eliminated pathway is missing one or more elements and will never be completed.

Exposure does not always result in adverse health effects, so we must also evaluate whether the exposure could be sufficient to pose a hazard to people in the community. The factors that influence whether exposure to a contaminant or contaminants could or would result in adverse health effects include: site-specific conditions, individual lifestyle, and genetic factors that affect the route, magnitude, and duration of actual exposure—an environmental concentration alone will not cause an adverse health outcome.

When identifying plausible potential exposure scenarios, the first step is assessing the potential public health significance of the exposure. This is done by comparing contaminant concentrations to health-based screening values (SV) for both carcinogenic and noncarcinogenic end points. Screening values are media-specific chemical concentrations used to screen contaminants for further evaluation. Exceeding a SV does not necessarily mean that a contaminant represents a public health threat, but does suggest that the contaminant warrants further consideration. Also, a contaminant is considered for further evaluation if there is no SV for the contaminant.

Noncancer screening values are also known as environmental media evaluation guides (EMEGs) or reference dose media evaluation guides (RMEGs). They are based on ATSDR's minimal risk levels (MRLs) and EPA's reference doses (RfDs), respectively. MRLs and RfDs are estimates of daily human exposure to a contaminant that is unlikely to cause adverse noncancer health effects over a specified period of time. Cancer risk screening values are also known as carcinogenic risk evaluation guides (CREGs). They are based on EPA's chemical-specific cancer slope factors. CREGs represent either an excess individual lifetime cancer risk of one-in-one-million or one excess cancer case in a million exposed individuals. Standard assumptions are used to calculate appropriate screening values (ATSDR 2005). See appendix D section 3 of this document for more information.

3.2 Environmental Contamination

This subsection contains site-specific information about specific contaminants associated with the site; however, inclusion in this section does not imply that a particular contaminant represents a threat to public health. We relied on the information provided in the referenced documents and assumed that adequate quality assurance/quality control (QA/QC) procedures were followed with regard to data collection, chain-of-custody, laboratory procedures, and data reporting.

3.2.1 Groundwater

Municipal Wells

Four wells in the vicinity of the PWGC site are owned by the city [CRA 2006]. Routine monitoring of municipal wells detected chlorinated volatile organic compounds (CVOCs) in Parkview Well #3 (PW3). The contamination was first discovered in samples taken October 1999 and the concentrations of contaminants increased over time, resulting in closure of the well in August 2001. This closure was mainly driven by the concentration of tetrachloroethylene (PCE) and 1,1-dichloroethlene (DCE). The concentration of PCE was about 4.1 micrograms per liter (4.1 µg/L) at time of closure. This concentration is close to the maximum contaminant level (MCL) which is 5 µg/L. The maximum concentration of DCE reported was 13 µg/L which is above its MCL which is 7 µg/L.

Private Wells

Sampling data from the past indicate that private wells also contained PCE. In addition 1,2-dichloroethane (1,2-DCA); 1,1-dichloroethene (1,1-DCE); 1,1,1-trichloroethane (1,1,1-TCA); cis-1,1-DCE; and 1,1-DCA were detected in private wells. Table 1 is a summary of results from private well sampling events that have taken place at the PWGC site from September 2001 to late April 2007. PCE; 1,1-DCE; and 1,2-DCA were detected in excess of ATSDR's screening values (SV). ATSDR does not have an SV for 1,1-DCA and PCE is a probable carcinogen.

3.2.2 Indoor Air

Indoor air samples were collected from select residences within the site to determine if contaminants from the groundwater plume were migrating and accumulating under homes, potentially releasing to indoor air [TetraTech RIa]. The samples were analyzed for CVOCs. More detailed information on how and where the samples were taken can be found in the reference document. Table 2 provides a summary of the results from indoor air sampling at the site. Only the chlorinated volatile compounds commonly found in groundwater are listed in the table.

None of the compounds listed were in excess of ATSDR's screening values. In addition, the 1,1,1-trichloroethane that was detected in an indoor air sample in March 2004 at a concentration of 200 micrograms per cubic meter ($\mu g/m^3$), was not detected in a sub-slab vapor sample that was collected at the same time. This indicated that the contaminant detected in the indoor air did not originate from the contaminated groundwater plume. Tetrachloroethene (PCE) was found under the slab/basement of all homes (including background samples). Of the four homes sampled in 2004, PCE was not found in any of the indoor air samples. However, the detection limit was slightly above the EPA Region 9 preliminary remediation goal (PRG) of 0.32 $\mu g/m^3$ for ambient air. A home was sampled in 2005 at the request of the homeowner. PCE was found at a concentration of 6.4 $\mu g/m^3$ in indoor air. This contamination is not thought to be site-related because the location was more than 600 feet from areas of known contamination.

3.2.3 Soil Gas

During October 2006, soil gas samples were collected from 90 locations in the vicinity of the Industrial Services Corporation (ISC) building [TetraTech RIa] to characterize the source area. Samples were collected from depths of 4-16 feet below ground surface (bgs). The samples were analyzed for 1,1-DCE (1.3J parts per billion by volume (ppbv) to 85 ppbv); 1,1,1-TCA (<2 ppbv to 980 ppbv); and PCE (0.4J ppbv to 1,506 ppbv). The highest concentration of PCE was detected near the back door of the ISC building. The highest concentrations of 1,1-DCE and 1,1,1-TCA were detected in samples from beneath the building slab and may have been biased high compared to samples collected from elsewhere outside the building, perhaps because of higher vapor concentrations beneath the slab [TetraTech RIa]. This is probably due to dumping of the chemicals out the back door.

3.2.4 Surface Soil

Soil samples were taken in OU#2 to characterize site contamination. ATSDR considers contaminants found in the first three inches below ground surface (bgs) to be the most significant for human exposure. No samples were taken at depths less than 12 inches bgs.

3.3 Pathways Analysis

3.3.1 Groundwater

In the past, groundwater at the site had been used for drinking water, food preparation, bathing, and for commercial business purposes. The southern plume appears to originate from the property located at 3304 Engleman Road S [TetraTech RIb]. This property is currently occupied by ISC. Releases from this property appear to be the source of the PCE contamination within the PWGC site [EPA 2006]. The contaminated groundwater plumes likely migrate from southwest to northeast. The first human exposures to the site's contaminated groundwater, in OU#1, would have occurred from affected private wells in the area. As time progressed, the public wells (PW#3) were affected. Due to the plume's migration route, it is most likely that private wells contained contaminants at a higher concentration than the public water supply wells.

Contaminants, particularly volatile organic compounds that enter the home in potable water, present a situation in which residents could be exposed via multiple pathways. These include direct ingestion of water, inhalation of contaminant due to volatilization, and absorption of the contaminant through the skin during bathing. Thus for residences we would consider contaminated private water supplies pathways, in the past, to be a complete exposure pathway. However, until all residences with affected private drinking water supplies have been moved to municipal water (with decommissioning of contaminated private well) or provided appropriate filtration, the private well pathway remains completed. The contaminated public well is no longer active and the concentration of contaminants prior to deactivation was below the maximum contaminant level. Remaining public supply wells in the area of the plumes have been placed on emergency status. ATSDR therefore classifies the municipal water pathway as a past completed exposure pathway and as a future potential exposure pathway.

Monitoring well data indicate that groundwater within the contaminant plumes contain high concentrations of PCE and 1,1-DCE. While this is not considered a current potable water source, it is possible, in the future, for someone conducting excavation type activities to come into contact with these contaminated waters or the gases produced when the contaminants volatilize.

3.3.2 Indoor Air

Based on the limited data reviewed, vapor intrusion (indoor air) does not appear to be a significant pathway of exposure. Locations of detected contaminants and/or the concentration of the contaminant detected are not likely to result in exposures high enough to cause adverse health effects. However, should the contaminants detected in sub-slab samples, begin to seep into indoor air space and reach concentrations high enough, adverse health effects may be possible. ATSDR therefore classifies indoor air as a past, current, and future potential exposure pathway.

3.3.3. Soil Gas

ATSDR reviewed data received from soil gas sampling surveys. Soil gas samples were collected from beneath basement slabs. When viewed with the results of indoor air samples, indications

are that the soil gas pathway does not represent currently a significant pathway of exposure for site residents and workers. ATSDR does not routinely evaluate worker exposure. However, a worker performing excavation type activities, in areas of high contaminant concentration, such as near the ISC building, could possibly be exposed to releases via inhalation. Prolonged exposure to PCE in that area could potentially result in noncancer adverse health effects. The Occupational Safety and Health Administration (OSHA) has set a limit of 100 parts per million (ppm) for an 8-hour workday over a 40-hour workweek. PCE itself is a type of chemical that easily disperses in the air. Such dispersal causes the concentration of the chemical coming from the contaminated plume to be greatly reduced/diluted. The chemical is easily detected (smelled) at concentrations much lower than those concentrations which could possibly cause adverse health effects. Utility workers would most likely wear the proper protective equipment and have the hazard recognition training necessary to know when to remove themselves from areas where the concentration of the chemical is too high. ATSDR therefore characterizes soil gas as a future potential exposure pathway. In addition, ATSDR has not reviewed sampling data that indicates that the past concentrations of the contaminants in soil gas were of public health concern.

3.3.4 Surface Soil

Soil samples were not taken at depths less than 12 inches below ground surface. Due to lack of data this pathway was not analyzed.

3.4 Environmental Contamination and Pathways Analysis Summary

ATSDR has reviewed the available data from the aforementioned documents. Based upon its review ATSDR has determined that private well water represents the only completed pathway on the site. The following contaminants within this completed pathway will be looked at further: PCE; 1,1-DCA; 1,1-DCE; and 1,2-DCA. PCE, 1,1-DCE, and 1,2-DCA exceeded their respective screening values. When no screening values are available and to be as protective of public health as possible, ATSDR generally retains the contaminant for further evaluation. This is the case for 1,1-DCA.

PCE is the main contaminant of concern and ingestion is the primary route of exposure. PCE and 1,1-DCE in the contaminant plume could volatilize into the air during future excavation operations, resulting in exposure to workers. ATSDR does not routinely evaluation worker exposures. Workers usually have the appropriate personal protection equipment and hazard recognition training necessary to reduce their chances of significant exposure. The municipal water system is considered a past completed exposure pathway, and a future potential exposure pathway. The concentration of contaminants in the closed well prior to deactivation was below the maximum contamination level. The wells remaining in the area of the plume have been placed on emergency status and are not used for potable purposes.

4. TOXICOLOGIC EVALUATION/PUBLIC HEALTH IMPLICATIONS

4.1 Introduction

Health effects resulting from the interaction of an individual with a hazardous substance in the environment depend on several factors. One is the route of exposure, that is, whether the chemical is inhaled, ingested (swallowed), or touched by the skin (i.e., dermal contact). Other factors include how long the exposure occurs, the dose to which a person is exposed, and the amount of the substance that is actually absorbed. Mechanisms by which the environment or the body alters chemicals, as well as the combination of chemicals, are also important. Once exposure occurs, characteristics including a person's age, sex, nutritional status, genetics, lifestyle, and health status may influence how the body absorbs, distributes, metabolizes, and excretes contaminants.

Together, those factors and characteristics determine the health effects that could occur as a result of exposure to a contaminant. Much variation in those mechanisms exists among individuals. Because of the variation in mechanisms of exposure, ATSDR has made several assumptions to make a reasonable estimate of exposure levels for people at the Parkview Well Groundwater Contamination site.

4.2 Toxicologic Evaluation

Health Guidelines

To determine whether harmful effects are possible, ATSDR first compared the estimated exposure doses to health guideline doses for exposures to the contaminant under consideration. See Appendix B, Tables 5 and 6. The health guideline dose, or Minimal Risk Level (MRL), is an exposure level below which harmful health effects are not expected. If an ATSDR MRL is not available as a health guideline, then EPA's Reference Dose (RfD) or another appropriate health guideline is used. See appendix D for more information on how exposure doses are calculated and resulting estimates.[1]

ATSDR uses MRLs and other established health guidelines to rule out exposures that are too low to warrant further study because no health effects are expected. Put another way, when an exposure exceeds an MRL or other appropriate health guideline, it means that the dose is high enough to warrant additional evaluation. Exceeding an MRL or other health guideline does not mean, however, that ATSDR expects a harmful effect to occur. As noted, many other factors are involved.

If an estimated dose exceeds an MRL or other established health guideline, a more thorough evaluation is then performed to estimate risk of adverse health effects. This evaluation involves analysis of toxicological and epidemiological studies and may include the following:

[1] MRLs refer only to *noncancer* health effects and cannot be used to determine cancer risk.

- Comparing the chemical concentration in the environmental medium to concentrations that cause harmful effects to determine how close the concentrations are;
- Determining who is exposed and if they may be more sensitive to the chemical;
- Considering exposure through multiple media;
- Evaluating the location of the air sample in relation to where people actually live;
- Determining whether the toxicological effect in the study is applicable to people who are exposed;
- Considering different aspects of exposure in the study (e.g., dosing period, amount, frequency of exposure) and the applicability of those aspects to people who live at the site and their exposure;
- Considering the effect of uncertainty in exposure estimates; and
- Considering the effect of uncertainty in deciding possible harmful effects.

Tetrachloroethene (PCE)

PCE is used as a dry-cleaning solvent and metal degreasing agent. PCE is a volatile chemical that evaporates easily into the air and becomes a gas. PCE can move from the water into the air as a vapor when water is heated. [ATSDR 1997a] Residents, workers, and visitors were likely exposed to PCE contaminated municipal and private drinking water stores via inhalation, ingestion, and dermal contact. Exposure to PCE can occur in several ways. People can be exposed to PCE in the air during hot showers. Some PCE can be absorbed into the body when it is in contact with the skin. PCE in groundwater can evaporate into the soil above the groundwater and move as a vapor through the soil and into buildings located above the contaminated groundwater. The contaminants in the south plume appear to originate on the property currently occupied by the Independent Services Corporation (ISC). Workers performing excavation-type activities in the vicinity of the ISC building could become exposed, potentially, to PCE via inhalation. The use of personal protective equipment and proper hazard recognition training should greatly reduce the potential for such exposures to be significant.

The population served by the closed Parkview Municipal well No. 3 could have been exposed to PCE, during the period since the contaminants were detected until it was closed. However the contaminant concentrations do not represent a public health hazard and the period of exposure was relatively short, for example, PCE was detected in the well on August 2001 and was closed that same month. The maximum concentration of PCE detected in well water sampled by the city of Grand Island was 4.1 parts per billion (ppb) [TetraTech Rib]. This concentration does not exceed ATSDR screening values and the maximum contaminant level (MCL) for drinking water which is currently 5 ppb. The well was taken offline as a precaution and therefore is no longer used as a source of potable water.

The maximum concentration detected in residential well water was 170 ppb. The estimated exposure doses for adult and child populations are orders of magnitude below doses shown to cause adverse health effects in epidemiological studies. At these low concentrations adverse non-cancer health effects are not likely to be observed.

PCE is classified by the International Agency for Research on Cancer (IRAC) as a type 2A carcinogen. Type 2A carcinogens are probably carcinogenic to humans based on limited human evidence and sufficient evidence in animals. This means that although the carcinogenicity of PCE has been shown in animal models, the weight of evidence for carcinogenicity in humans is not definite.

EPA is reviewing the data on the potential of PCE to cause cancer in humans and has no cancer classification for the chemical on its Integrated Risk Information System (IRIS) database. However, based on communication from EPA, EPA does consider PCE to be potentially carcinogenic to humans. EPA's Office of Solid Waste and Emergency Response has indicated that cancer potency estimates from the California Environmental Protection Agency (CalEPA) represent the best available toxicity values and recommended that Regional Offices should use those values in the interim.

Significantly increased risk of carcinogenic health effects are not expected to populations which were potentially exposed to PCE at the site.

1,2-Dichloroethane (1,2-DCA)

1,2-DCA was detected in private well water samples at a maximum concentration of 3.1 ppb. The estimated exposure doses for potentially exposed populations are orders of magnitude below doses shown to cause adverse health effects in epidemiological studies. Adverse non-cancer health effects are not expected from those past exposures. Increased risk of cancer from these past exposures is not expected to occur.

1,1-Dichloroethene (DCE)

Users of potable water from private drinking wells may have been exposed to 1,1-DCE at concentrations up to 190 ppb. The resultant estimated exposure doses for potentially exposed populations is orders of magnitude below the no-observed-adverse-effect-level found in animal based epidemiological studies, therefore, no adverse health effects are expected to occur.

1,1-Dichloroethane (1,1-DCA)

1,1-DCA was detected in private drinking water wells at a maximum concentration of 36 ppb. ATSDR does not have any health guidelines for 1,1-DCA. An exposure dose was calculated for each potentially exposed population. The resultant doses were orders of magnitude below those shown to cause adverse health effects in epidemiological studies. Adverse health effects are not expected to occur.

4.3 Public Health Implications

In the past, some residents likely were exposed to the above mentioned contaminants. There is a chance that some private wells contained the contaminants at concentrations higher than those detected in the cited studies. However, based on the data reviewed, ATSDR has concluded that past and current exposures, if any, would not have likely resulted in observable adverse health

effects and the potential increased risk of developing cancer is low. Workers performing excavation-type activities on the ISC property (in the vicinity of the ISC building) could possibly be exposed to PCE. Hazard recognition training and the use of personal protective equipment should greatly reduce the risk of such exposures causing observable adverse health effects.

5. CHILD HEALTH CONSIDERATIONS

To ensure that the health of the nation's children is protected, ATSDR requires that public health assessments determine whether children are being exposed to site-related hazardous waste and whether contaminants may affect children's health.

In communities faced with air, water, or food contamination, the many physical differences between children and adults demand special emphasis. Children could be at greater risk than are adults from certain kinds of exposure to hazardous substances. Children play outdoors and sometimes engage in hand-to-mouth behaviors that increase their exposure potential. Children are shorter than are adults; this means they breathe dust, soil, and vapors close to the ground. A child's lower body weight and higher intake rate results in a greater dose of hazardous substance per unit of body weight. If toxic exposure levels are high enough during critical growth stages, the developing body systems of children can sustain permanent damage. Finally children are dependent on adults for access to housing, for access to medical care, and for risk identification. Thus adults need as much information as possible to make informed decisions regarding their children's health.

The evaluation performed by ATSDR at the Parkview Well Groundwater Contamination site indicates that while children are/were exposed to contaminants in potable water, it is unlikely that any are/were exposed to contaminants at concentrations high enough to cause observable adverse health effects. See Tables 7 and 8 in Appendix B.

6. EVALUATION OF HEALTH OUTCOME DATA/DISCUSSION OF COMMUNITY HEALTH-RELATED CONCERNS

ATSDR conducts a review of health outcome data when the toxicological evaluation indicates the likelihood of adverse health outcomes or when the community near the site expresses health concerns. The evaluation of health outcome data can give a general picture of the health of the community. It can also confirm or rule out the presence of a particular disease. A particular disease may not, however, necessarily be caused by hazardous substances in the environment. Other factors, such as personal hygiene habits, socioeconomic status, and occupation can also influence the development of disease. Inversely, the lack of elevated rates of disease does not rule out, necessarily, the possibility that a contaminant may have caused some illness or disease. Health outcome data for this site were not reviewed since adverse health effects are not expected to have occurred/occur.

Residents have expressed concerns about how their exposure to the chlorinated volatile organic compounds has or will affect their health and the health of their families. Concerns were expressed regarding the use of the contaminated water for non-potable purposes.

Based upon the data analyzed in this report, exposure to contaminants in affected groundwater sources would not have been high enough to cause any observable adverse health effects. This could change however, given the concentration of the contaminants in the groundwater plumes. As a precaution, residences and businesses should connect to safe municipal water supplies or install, monitor and maintain an appropriate whole house filtration system, at least until the plumes are remediated. If contamination concentrations are high enough, inhalation exposures following volatilization could be a problem in confined spaces.

The contaminants of concern at the Parkview Well Groundwater Contamination (PWGC) site are chlorinated volatile organic compounds (CVOCs). These chemicals tend to volatilize or evaporate into the atmosphere. Usually during irrigation, the CVOCs will quickly volatilize rather than be absorbed by plants. Research has shown that if CVOCs do manage to contact and become absorbed by plants, they will not accumulate in the plant tissues as they are transferred to the plant’s pores and then released into the atmosphere. CVOCs in surface water (i.e., a lake, pond, or pool) also quickly volatilize. As such, tetrachloroethylene (PCE) does not accumulate significantly in animals.

7. CONCLUSIONS

ATSDR has evaluated the releases of chlorinated volatile organic compounds into the environment at the Parkview Well Groundwater Contamination (PWGC) site Operable Units #1 and #2. The releases are believed to have occurred prior to the late 1990s based on sampling results.

Using the protocols developed by ATSDR to evaluate pathways of exposure to populations around potentially contaminated or contaminated sites, ATSDR considers the PWGC site hazard rankings as such:

- Past Conditions – VOCs were first detected at levels of potential concern in OU#1 during the late 1990s. The concentrations of the chemicals continued to increase resulting ultimately in the closing of a municipal well (PW#3) and providing alternate water supplies for residences with contaminated private wells (connection to safe municipal water or whole house carbon filtration and periodic monitoring). While the concentrations of the contaminants were at levels greater than EPA drinking water standards, estimated exposure doses do not indicate significant adverse carcinogenic and non-cancer health effects are likely. Therefore, ATSDR considers this pathway a **No Apparent Public Health Hazard** for past exposures.

- Current Conditions – Currently private wells within the affected area are periodically monitored and, if found to have contaminants at levels of health concern, are connected to municipal water or are provided with whole-house carbon filtration and periodic monitoring. For those businesses and residences currently receiving water from a municipal water supply or are using a properly monitored and maintained filtration system, ATSDR considers the groundwater pathway a **No Apparent Public Health Hazard** for current exposures.

- Future Conditions – Three municipal wells, as well as many private wells, within the site are in danger of becoming contaminated at and above levels of public health concern if nothing is done to address the contaminant plumes. Not all residences are connected to safe drinking water supplies, some have refused connection to the municipal water system, some have refused monitoring, and the concentration of PCE and 1,1-DCE in the contaminant plumes is high. Until the plumes are remediated, persons performing excavation-type activities in areas where the concentration of PCE in the plumes are high, are at risk of inhalation exposure to volatilizing compounds.

After reviewing available contamination data and considering pathways of exposure, ATSDR has determined that the chemicals of potential concern at the PWGC site are: Tetrachloroethylene (PCE); 1,1-dichloroethene (1,1-DCE); 1,2-dichloroethane (1,2-DCA); and 1,1-DCA. Elevated levels of chlorinated volatile organic compounds have resulted in ATSDR considering private drinking water (groundwater) as past completed exposure pathway.

In the past, some residents likely were exposed to the above mentioned contaminants. There is a chance that some private wells contained the contaminants at concentrations higher than those

detected in the cited studies. However, based on the data reviewed, ATSDR has concluded that past and current exposures, if any, would not have likely resulted in observable adverse health effects and increased risk of developing cancer is low.

8. RECOMMENDATIONS

During the PHA process, ATSDR makes recommendations about public health actions that the agency believes should be conducted at a hazardous waste site or in the community. These recommendations may be directed to other agencies or to ATSDR itself. In developing these recommendations, ATSDR consults with other agencies to ensure that someone is available to follow up on these recommendations, where appropriate. Following are ATSDR's recommendations for the Parkview Well Groundwater Contamination site.

The U.S. Environmental Protection Agency (EPA) should continue to monitor groundwater conditions at the site and provide residents with contaminated water supplies alternate water supplies (via connection to safe municipal water, if feasible, or provision of whole-house filtration systems with periodic monitoring). Deactivation of contaminated private wells is preferred.

Until contamination within the plumes is remediated, groundwater use controls should be put into place and enforced.

Until the contamination within the plumes is remediated, excavation-type activities in the vicinity of the plumes, with high concentrations of contaminants, should be controlled to decrease likelihood of exposure to high concentrations of PCE via inhalation.

Continue to educate residents regarding hazards posed from the use of water from contaminated private wells.

9. PUBLIC HEALTH ACTION PLAN

The purpose of the public health action plan is to ensure that this PHA not only identifies ATSDR's past activities at this site but also provides a course of action for mitigating or preventing exposures that may cause adverse human health effects.

9.1. Actions Completed or On-going at the Site

ATSDR Regional Operations staff have met with community members to gather their health concerns. The concerns expressed to ATSDR staff, are addressed in this document.

9.2. Actions Planned for the Site

ATSDR has not planned activities for the Parkview Well Groundwater Contamination site.

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12. APPENDICIES

APPENDIX A - Figures

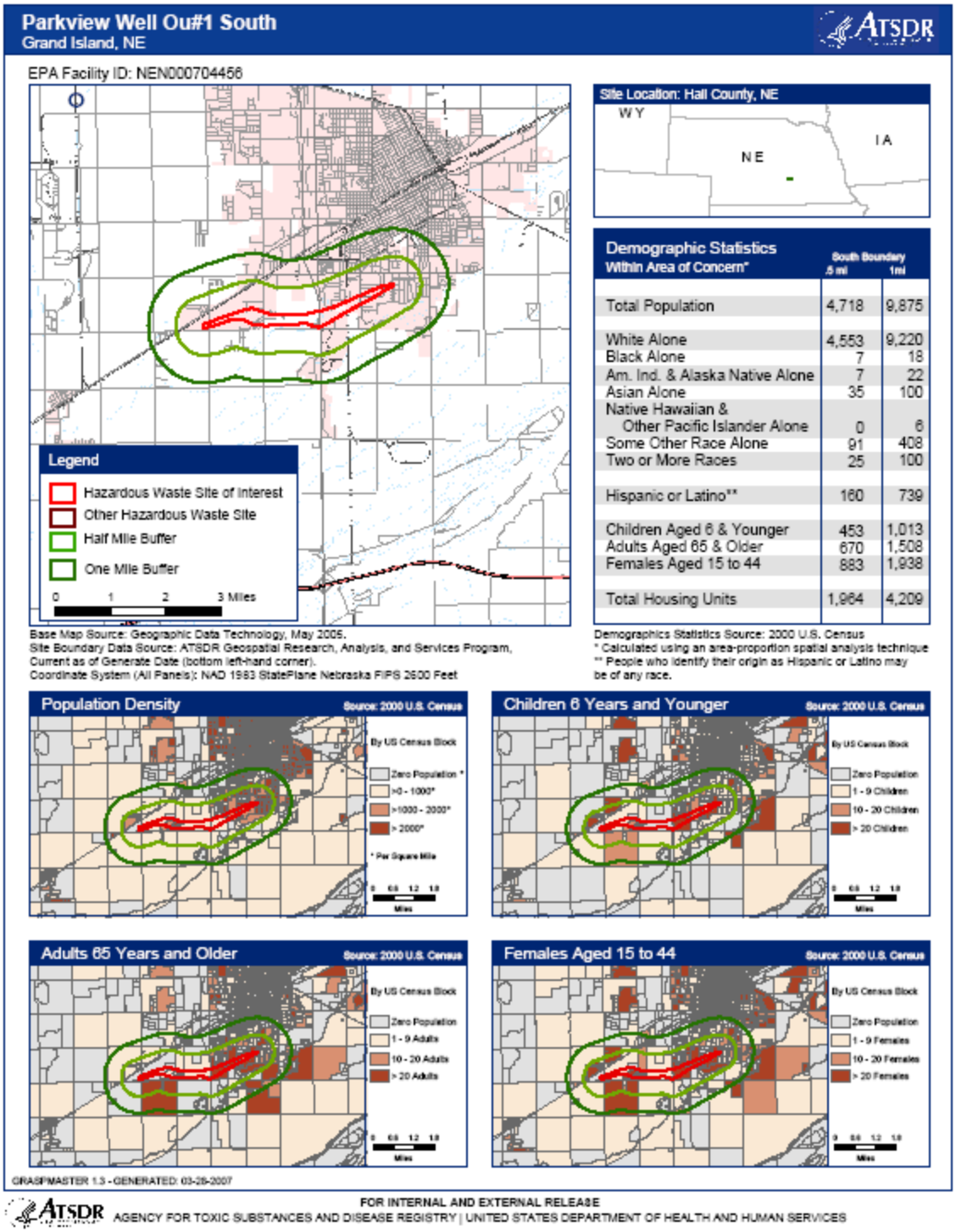

Figure 1 - Basic Demographic Map of population near Southern Plume

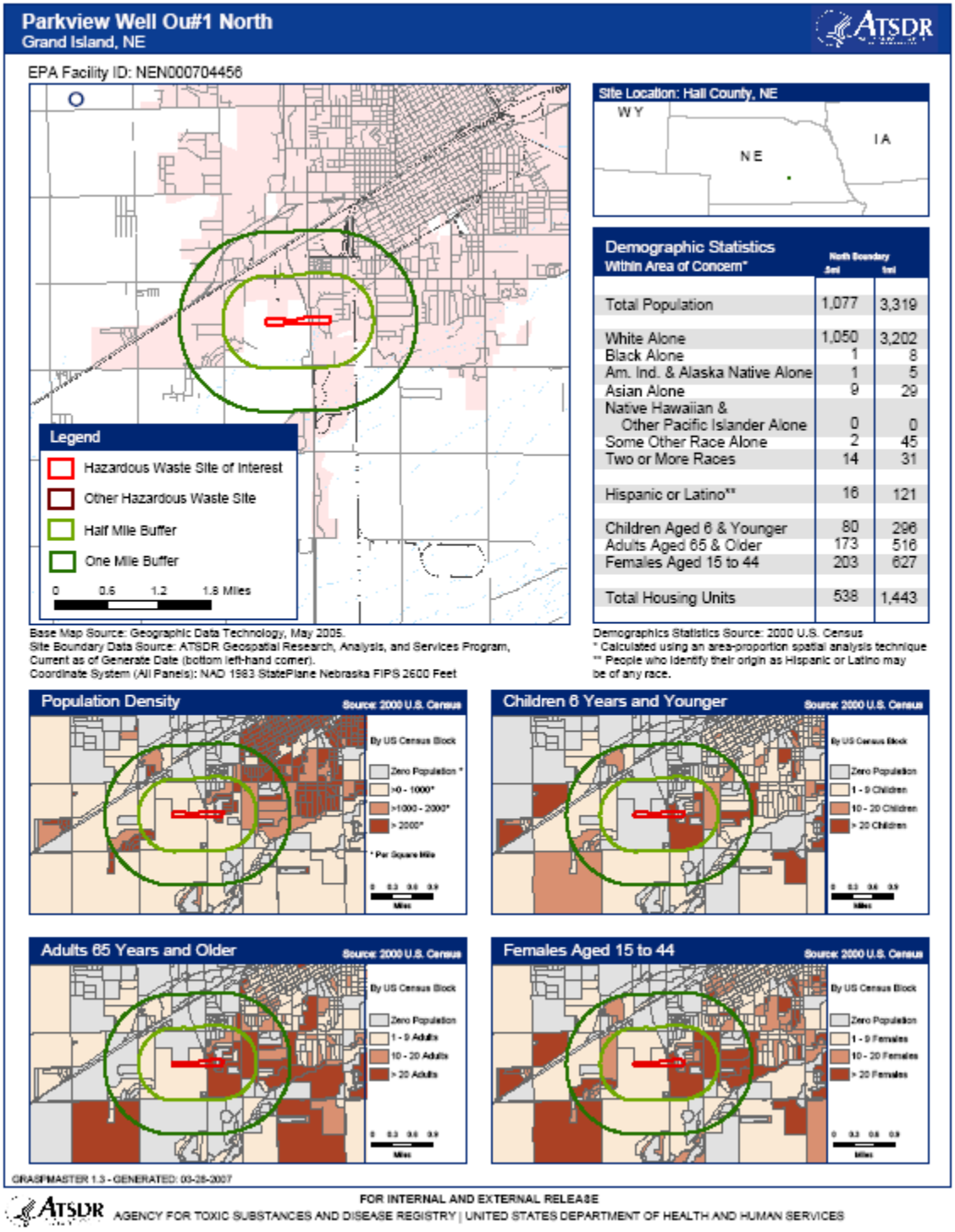

Figure 2 - Basic Demographic Map of population near the Northern Plume

APPENDIX B – Tables

Table 1 - Summary of Private Well Sampling Results at the Parkview Well Groundwater Contamination site

Contaminant	Concentration Range µg/L (ppb)		Location of Maximum Concentration	Sample Date of Maximum	Screening Value (SV) (ppb)	SV Type	Cancer Class	Exceeded?
	Minimum	Maximum						
1,1-Dichloroethane	ND	36	Marylane Subdivision	09/29/2003			C	NA
1,1-Dichloroethene	ND	190	Marylane Subdivision	09/29/2003	90	cEMEGc	Suspected	**Yes**
1,2-Dichloroethane	ND	3.1	Marylane Subdivision	09/29/2003	0.4	CREG	B2	**Yes**
1,1,1-Trichloroethane	ND	180	Castle Estates Subdivision	09/30/2003	200	LTHA	D	No
cis-1,2-Dichloroethene	ND	2	Marylane Subdivision	09/29/2003	70	LTHA	D	No
Tetrachloroethylene	ND	170	Marylane Subdivision	09/29/2003	5	MCL	2A	**Yes**

ND = Not detected or if present, the concentration was below the detection limit
Source of Information: TetraTech RIa (Tables 1-5 and 15)

Table 2 - Summary of Indoor Air Sampling Results (Living Space)

Contaminant	Concentration Range ($\mu g/m^3$)		Location of Maximum	Date of Maximum	Screening Value (SV) $\mu g/m^3$	Type of SV	Cancer Class	Exceeded
	Minimum	Maximum						
1,1-Dichloroethane	ND	ND					C	
1,1-Dichloroethene	ND	1.7	IA-009	August 2004	80	iMRL		No
1,1,1-Trichloroethane	ND	200	IA-007	August 2004	4,000	iMRL	D	No
Tetrachloroethylene	ND	6.4	2618-1	May 2005	300	cMRL	2A	No

Does not include concentrations in sub-slab vapors
$\mu g/m^3$ = micrograms/cubic meter
cMRL = chronic exposure duration minimal risk level
iMRL = intermediate exposure duration minimal risk level
Source of information: TetraTech RIa (Table 20)

Table 3 - Completed Exposure Pathways at the PWGC site

Completed Exposure Pathway Elements						
Pathway Name	**Source**	**Transport Medium**	**Point of Exposure**	**Route of Exposure**	**Exposed Population**	**Time**
Private Well Water	Contaminated Groundwater	Groundwater	Tap	Ingestion; Direct Contact; Inhalation (of volatilizing contaminants)	affected area residents and businesses	past
Private Well Water (without whole house filtration systems)	Contaminated Groundwater	Groundwater	Tap	Ingestion; Direct Contact; Inhalation (of volatilizing contaminants)	affected area residents and businesses	past, current future
Municipal Water (Supply wells in vicinity of plumes)	Contaminated Groundwater	Groundwater	Tap	Ingestion; Direct Contact; Inhalation (of volatizing contaminants)	affected area residents and businesses	past

Table 4 - Potential Exposure Pathways at the PWGC site

Potential Exposure Pathway Elements						
Pathway Name	**Source**	**Transport Medium**	**Point of Exposure**	**Route of Exposure**	**Exposed Population**	**Time**
Municipal Water (Supply wells in vicinity of plumes)	Contaminated Groundwater	Groundwater	Tap	Ingestion; Direct Contact; Inhalation (of volatilizing contaminants)	affected area residents and businesses	current future
Private Well Water (improperly maintained filter system)	Contaminated Groundwater	Groundwater	Tap	Ingestion; Direct Contact; Inhalation (of volatilizing contaminants)	affected area residents and businesses	present, future
Private Well Water (without whole house filtration systems)	Contaminated Groundwater	Groundwater	Tap	Ingestion; Direct Contact; Inhalation (of volatilizing contaminants)	affected area residents and businesses	current future
Indoor Air	Contaminated Groundwater	Air	Inside buildings	Inhalation	affected residences and businesses	past current future
Soil Gas	Contaminated Groundwater	Air	Outside locations where contaminants in groundwater may volatilize and crawl space	Inhalation		past, future

Table 5 - Summary of Exposure Dose Calculations for Exposure to Contaminants that Exceeded Screening Values in Completed Pathways at the PWGC site

	Contaminant	Maximum Concentration ppb	Maximum Concentration ppm	Weight kg	Ingestion Rate L/day	Exposure Factor	Exposure Dose	Cancer Class	Slope Factor	Cancer Risk	MRL Chronic mg/kg/day	MRL Intermediate mg/kg/day	MRL Acute mg/kg/day	RfD mg/kg/day	Non-Cancer Guideline Exceeded?
Child															
	1.1-Dichloroethane	36	0.036	18	1	1	0.002	C							
	1,1-Dichloroethene	190	0.19	18	1	1	0.010555556	Suspected			0.009			0.05	NA Yes
	1,2-Dichloroethane	3.1	0.0031	18	1	1	0.000172222	B2	9.10E-02	2.82E-05		0.2			No
	Tetrachloroethylene	170	0.17	18	1	1	0.009444444	2A					0.05	0.01	No
Adult															
	1.1-Dichloroethane	36	0.036	70	2	1	0.00.028571	C							
	1,1-Dichloroethene	190	0.19	70	2	1	0.005428571	Suspected			0.009			0.05	NA No
	1,2-Dichloroethane	3.1	0.0031	70	2	1	8.85714E-05	B2	9.10E-02	8.06E-06		0.2			No
	Tetrachloroethylene	170	0.17	70	2	1	0.004857143	2A					0.05	0.01	No

Table 6 - Estimation of Exposure Dose and Comparison to Health Guidelines (Exposures to Maximum Concentration of Contaminant)

	Contaminant	Oral	Inhalation	Dermal	Total Dose	**Cancer Class**	**Slope Factor**	**Cancer Risk**	**MRL Chronic mg/kg/day**	**MRL Intermediate mg/kg/day**	**MRL Acute mg/kg/day**	**RfD mg/kg/day**	**Non-Cancer Guideline Exceeded?**
Child													
	1,1-Dichloroethane	0.002		8.99889E-07	0.0020009	C							**NA**
	1,1-Dichloroethene	0.010555556	0.000944444	8.58327E-06	0.011508538	Suspected			0.009			0.05	**Yes**
	1,2-Dichloroethane	0.000172222		4.6146E-08	0.000172268	B2	9.10E-02	1.57E-05		0.2			**No**
	Tetrachloroethylene	0.009444444	0.003555556	2.29185E-05	0.013022919	2A					0.05	0.01	**Yes**
Adult													
	1,1-Dichloroethane	0.001028571		5.73556E-07	0.001029145	C							NA
	1,1-Dichloroethene	0.005428571	0.000369143	5.44198E-06	0.005803156	Suspected			0.009			0.05	No
	1,2-Dichloroethane	8.85714E-05		2.94117E-08	8.86008E-05	B2	9.10E-02	8.06E-06		0.2			No
	Tetrachloroethylene	0.004857143	0.001389714	1.46074E-05	0.006261465	2A					0.05	0.01	No

Table 7 - Estimation of Exposure Dose and Comparison to Health Guidelines (Exposure to Average Concentration of Contaminant)

	Contaminant	Oral	Inhalation	Dermal	Total Dose	Cancer Class	Slope Factor	Cancer Risk	MRL Chronic mg/kg/day	MRL Intermediate mg/kg/day	MRL Acute mg/kg/day	RfD mg/kg/day	Non-Cancer Guideline Exceeded?
Child													
	1,1-Dichloroethane	0.00055		2.47469E-07	0.000550247	C							NA
	1,1-Dichloroethene	0.003644444	0.000944444	2.94795E-06	0.004591837	Suspected			0.009			0.05	No
	1,2-Dichloroethane	3.66667E-05		9.82463E-09	3.66765E-05	B2	9.10E-02	3.34E-06		0.2			No
	Tetrachloroethylene	0.003233333	0.003555556	7.84622E-06	0.006796735	2A					0.05	0.01	No
Adult													
	1,1-Dichloroethane	0.000282857		2.54365E-07	0.000283112	C							NA
	1,1-Dichloroethene	0.001874286	0.000369143	3.0301E-06	0.002246459	Suspected			0.009			0.05	No
	1,2-Dichloroethane	1.88571E-05		1.00984E-08	1.88672E-05	B2	9.10E-02	1.72E-06		0.2			No
	Tetrachloroethylene	0.001662857	0.001389714	8.06486E-06	0.003060636	2A					0.05	0.01	No

Table 8 - Estimation of Exposure Dose and Comparison to Health Guidelines (At Exposure Point)

	Contaminant	Oral	Inhalation	Dermal	Total Dose	Cancer Class	Slope Factor	Cancer Risk	MRL Chronic mg/kg/day	MRL Intermediate mg/kg/day	MRL Acute mg/kg/day	RfD mg/kg/day	Non-Cancer Guideline Exceeded?
Child													
	1,1-Dichloroethane	0.000705556		3.17461E-07	0.000705873	C							NA
	1,1-Dichloroethene	0.006333333	0.000944444	5.12296E-06	0.007282901	Suspected			0.009			0.05	No
	1,2-Dichloroethane	4.22222E-05		1.13132E-08	4.22335E-05	B2	9.10E-02	3.84E-06		0.2			No
	Tetrachloroethylene	0.00495	0.003555556	0.000012012	0.008517568	2A					0.05	0.01	No
Adult													
	1,1-Dichloroethane	0.000362857		3.26307E-07	0.000363183	C							NA
	1,1-Dichloroethene	0.003257143	0.000369143	5.26571E-06	0.003631551	Suspected			0.009			0.05	No
	1,2-Dichloroethane	2.17143E-05		1.16285E-08	2.17259E-05	B2	9.10E-02	1.98E-06		0.2			No
	Tetrachloroethylene	0.002545714	0.001389714	1.23467E-05	0.003947775	2A					0.05	0.01	No

APPENDIX C – ATSDR Response to Public Comments

ATSDR Response to Comments Made on the Public Comment Release Draft of this Public Health Assessment

ATSDR made the previous version of this document available to the public for comment from April 1, 2008 until an extended period ending May 22, 2008. During this time ATSDR received comments from several individuals or groups. The comments received are summarized, grouped and addressed in this section of the document.

On page 8 on the draft ATSDR Report, the maximum concentration of PCE in Parkview Well No 3 is listed as 4.1 μg/L. On page 13 of the draft ATSDR Report, the maximum concentration is listed as 7.7 μg/L. We reviewed our records, and data provided by the City of Grand Island confirms that the highest concentration of PCE detected in municipal water was 4.1 μg/L in Parkview Well No. 3.

> The maximum concentration of PCE detected in the municipal well was 4.1 μg/L. The well was taken offline as a precaution to prevent exposures to the PCE as 4.1 μg/L was approaching the MCL of 5 μg/L. This error has been corrected in the text.

Page 8, Private Wells At the end of this paragraph states that, "TCE is a probable carcinogen", but carcinogenic information is not provided for the other contaminants identified. Please expand this discussion.

> The text should have stated that PCE is a probable carcinogen. TCE was detected in a private well at 1.9 μg/L, however the MCL for TCE is 5 μg/L. TCE is not a contaminant of concern (COC) at the Parkview Wells Groundwater Contamination (PWGC) site. The other COCs at the PWGC site are 1,2-dichlorothane which is a probable human carcinogen based on inadequate human studies and sufficient animal studies; 1,1-dichlorothene which is a suggestive carcinogen based on suggestive evidence of carcinogenic potential; and 1,1-dichloroethane which is a possible human carcinogen based on no human studies and limited animal studies. Based on estimated exposure doses, ATSDR does not expected any increased risk of developing carcinogenic health effects from exposure to these chemicals at the maximum concentrations detected for the estimated exposure periods. This information is discussed in the Toxicologic Evaluation section of the document.

Page 9, 3.2.3 Soil Gas Please put the information found in this paragraph into perspective for the reader, i.e., what does it mean?

> Contractors were conducting sampling in an effort to find the source of contamination on the ISC property. Results of the sampling showed two probable sources for the groundwater contamination. One of these was near a door to the

building leading to the outside. The area of high concentrations was relatively small and the concentration of the chemicals greatly decreased as you moved further away from the spot. This is an indication that the chemicals were likely dumped out the back door. The other area was near an overhead bay door.

Page 10, 3.3.1, para 2 It states in this paragraph that "we would consider both contaminated private and municipal water supplies pathways, in the **past** to be complete exposure pathways". The contaminated public well is no longer active and remaining wells have been placed on emergency status. Filtration systems for *some* private wells appear to be reducing contaminant concentrations. The NDHHS would therefore consider the municipal water supply to be a *past* and potential future exposure pathway, and private wells a *past*, present and potential future exposure pathway.

The contaminated municipal well was taken offline and is not used for potable purposes. In addition, the highest contaminant concentration detected prior to being taken offline was below the maximum contaminant level for drinking water. Therefore ATSDR considers the municipal well water pathway a past completed exposure pathway. The source of the contamination to the water supply has not been completely remediated. Therefore the potential for the remaining municipal wells in the vicinity of the contaminated plume exists. ATSDR considers this to be a potential present and future exposure pathway. Contaminated private water supplies are considered a past completed exposure pathway. Most but not all residences with contaminated or potentially contaminated have been hooked-up to municipal water or provided whole-house filtration. Not all contaminated wells have been decommissioned. Therefore ATSDR considers the private well pathway to be a present and future completed exposure pathway. The document text has been edited to reflect this change.

Page 10, 3.3.3, Soil Gas The NDHHS would consider soil gas a past exposure pathway as well.

ATSDR did not review any data which indicated that exposure to contaminants in soil gas at concentrations of public health concern occurred. ATSDR therefore classifies the soil gas pathway as a past indeterminate exposure pathway. The document has been modified to reflect this addition.

Page 10, 3.3.3, Soil Gas Please provide information to support the statement, "prolonged exposure to PCE in that area could potentially result in noncancer adverse health effects".

The type of exposure scenarios to which ATSDR is referring in the health assessment is trenching. Persons who dig into the ground over areas where there is a high concentration of PCE in the contaminated plume could be exposed to the contaminant through inhalation. Currently, based on data ATSDR reviewed, this location would be on a portion of the Industrial Services Corporation property.

The Occupational Safety and Health Administration (OSHA) has set a limit of 100 parts per million (ppm) for an 8-hour workday over a 40-hour workweek.

PCE itself is a type of chemical that easily disperses in the air. Such dispersal causes the concentration of the chemical coming from the contaminated plume to be greatly reduced/diluted. The chemical is easily detected (smelled) at concentrations much lower than those concentrations which could possibly cause adverse health effects. Utility workers would most likely wear the proper protective equipment and have the hazard recognition training necessary to know when to remove themselves from areas where the concentration of the chemical is too high.

Page 11, 3.4 The second sentence in this paragraph should read, "…represent the only completed *exposure* pathways *to contaminated media at the site*".

The text has been modified.

Page 11, 3.4 Please add a statement to this paragraph explaining why those contaminants without screening values will be looked at further (i.e., *to be protective of public health, due to the uncertainty surrounding these contaminants, etc.*).

The text has been modified.

Tables 3,4 and 5 No reference to these tables is provided in the document.

Text was modified to include reference to all included tables.

Table 1 It is unclear what the hierarchy is for selecting Screening Values. In some cases the MCL is utilized (PCE, TCE) in other cases it is not (1,1-DCE, 1,1,1-TCA, 1,2-DCA, and cis-1,2-DCE). Using the MCL for screening is consistent with the NDEQ VCP (Voluntary Cleanup Program) Remediation Goals Table. The NDHHS Risk Assessment Program would recommend either using this approach or a risk-based approach that looks at all exposure pathways, such as USEPA Region VI Human Health Medium-Specific Screening Levels Table. In addition, please alphabetize the contaminants in the table.

In determining what environmental guideline value to use, ATSDR follows the following general hierarchy:

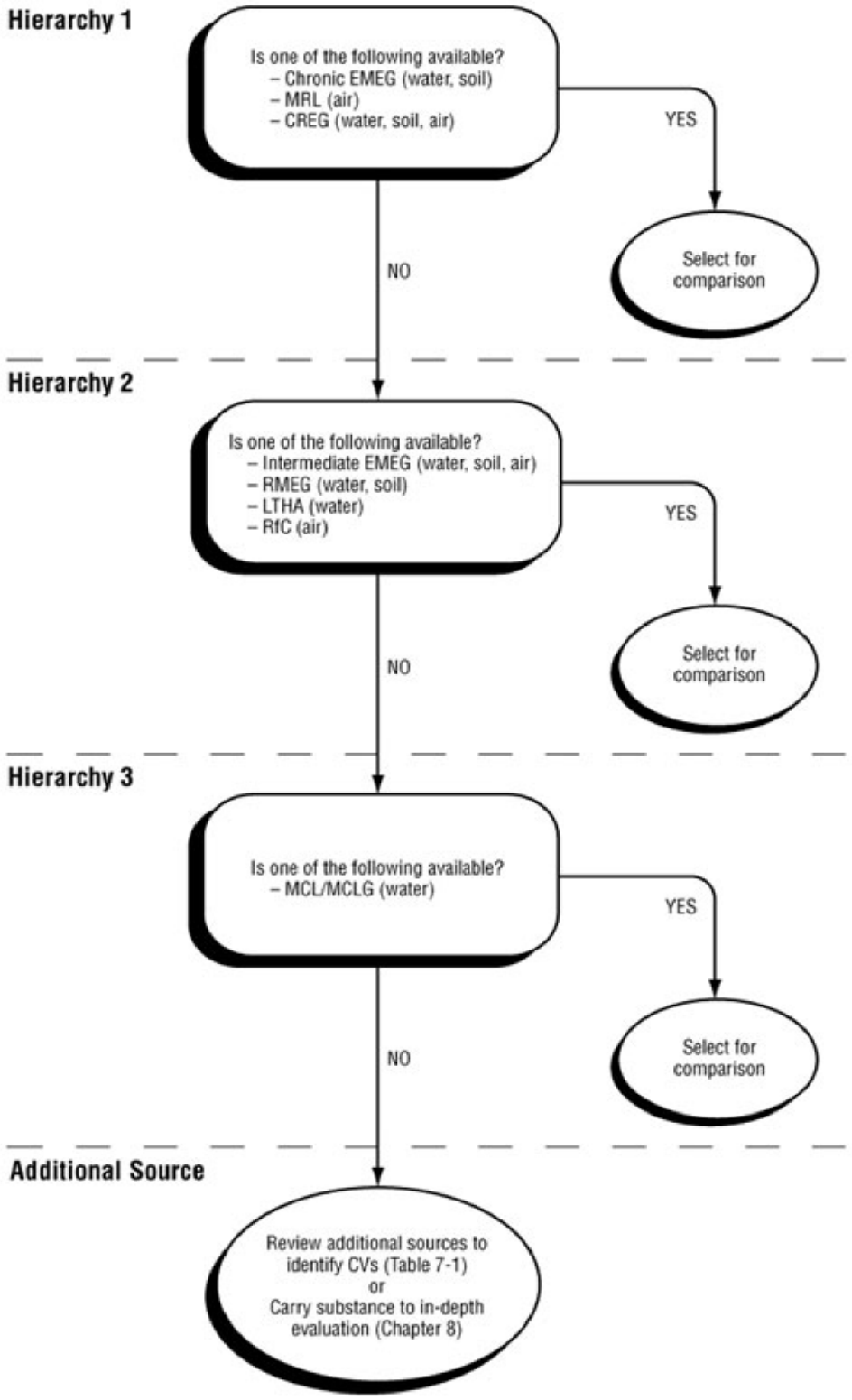

Figure 7-2. Environmental Guideline Hierarchy

Table 2 Please specify why a chronic Screening Value is used for PCE and intermediate Screening Values are used for 1,1-DCE and 1,1,1-TCA. In addition the SV selected for PCE is not conservative. Ambient air screening values from USEPA Region IX and the Region VI screening tables (though not directly comparable) are considerably lower, 3.2E-01 $\mu g/m^3$ and 3.3E-01 $\mu g/m^3$, respectively. Please explain.

See previous response.

Table 4 Shouldn't the last column include past exposure for the "Private Well Water" pathway, and past and present exposure for the "Soil Gas" pathway? Please clarify.

The table has been amended.

Table 5 Please provide the calculations to support the values presented.

The table has been amended.

Appendix D, page 53 To be transparent, please provide the actual calculations that were used to determine the exposure dose and provide values for all variables used in the calculations. In addition, show how these calculated doses are comparable to the selected Screening Values.

These values have now been included in tables 5 and 6.

CERCLA requires the ATSDR to complete public health assessments for NPL sites within one year of the date that the site is proposed for inclusion on the NPL. 42 U.S.C. § 9604(i)(6)(A). The Parkview Well site was proposed for inclusion on the NPL on September 23, 2004. 69 Fed. Reg. 56970-76 (Sept. 23, 2004). The agency's tardiness in completing the health assessment for the Parkview Well site is a disservice to the impacted communities.

ATSDR reviews sampling data as it is provided to the agency. During the one-year timeframe you refer to, the amount of data available was not totally representative of the site as extent of contamination, and site characterization was still on-going. Because the results of sampling events reviewed did not indicate an urgent public health hazard, ATSDR decided to wait until a more comprehensive dataset was available before preparing a public health assessment. This allowed ATSDR to make its determinations based on a better overall picture of the site. ATSDR staff have been working with EPA throughout the process. In addition, the following recurring language appears in ATSDR's annual appropriations bills and relieves ATSDR of the one year timing requirement specified in the statute:

> "Provided further, that in performing any such health assessment or health study, evaluation, or activity, the Administrator of ATSDR shall not be bound by the deadlines in Section 104(i)(6)(A)."

What was the time period assessed that led to the determination that past exposure to potentially contaminated drinking water does not appear to be a public health hazard?

> ATSDR reviewed data provided by the EPA. This data looked at contaminant levels in groundwater (based on sampling of public and private water supplies) dating from 1999. The Parkview Well No. 3 was taken offline in 2001. This precaution was taken before concentrations of the chemicals could reach levels of public health concern.
>
> ATSDR looked at exposure scenarios, estimated that exposure would most likely have occurred after 1990. Such assumptions are very protective of public health based upon site history. Based upon its analysis and the resulting exposure dose estimations (routine exposures), ATSDR believes that adverse non-carcinogenic and carcinogenic health effects are not likely to have occurred/be occurring/will occur from exposures to contaminants, even at the maximum concentration detected for the chemical.

What type of future exposure to PCE could be a public health hazard? Could people be exposed to PCE through lawn sprinkler systems?

> The type of exposure scenario to which ATSDR is referring in the health assessment is trenching. Persons who dig into the ground over areas where there is a high concentration of PCE in the contaminated plume could be exposed to the contaminant through inhalation. Currently, based on data ATSDR reviewed, this location would be on a portion of the Industrial Services Corporation property.
>
> The Occupational Safety and Health Administration (OSHA) has set a limit of 100 parts per million (ppm) for an 8-hour workday over a 40-hour workweek. PCE itself is a type of chemical that easily disperses in the air. Such dispersal causes the concentration of the chemical coming from the contaminated plume to be greatly reduced/diluted. The chemical is easily detected (smelled) at concentrations much lower than those concentrations which could possibly cause observable adverse health effects. Utility workers would most likely wear the proper protective equipment and have the hazard recognition training necessary to know when to remove themselves from areas where the concentration of the chemical is too high.
>
> With regard to lawn sprinkler systems, the concentration of the chemical in the groundwater would be greatly diluted, it does not accumulate in plants, and is broken down by sunlight [ATSDR 1997a]. Concentrations and exposures are not likely to be high enough to cause observable adverse health effects. The chemical can be smelled at concentrations much lower than those which could cause observable adverse health effects.

What restrictions on groundwater use is ATSDR recommending and why?

> Until contamination in groundwater has been remediated, ATSDR is recommending that all private wells in the vicinity of the contaminated plume be removed from service by capping and hooking up to the municipal water system which is monitored on a regular basis or use a whole house filtration system for potable water to prevent exposures to contaminants in the impacted groundwater. Since private wells may not be monitored on a regular basis it may be difficult to know the concentrations of contaminants to which individuals using those systems may be exposed. ATSDR also recommends that no new private wells for potable purposes be erected in the vicinity of the plume until the contamination is under control.

What type of education programs/methods are underway or planned?

> EPA is currently conducting educational activities through public forums such as public meetings and during the process of sampling individual private wells. Additional questions regarding EPA educational activities at the site should be referred to the EPA.
>
> In addition, ATSDR representatives have attended the meetings conducted by EPA and made themselves available to answer any specific health-related concerns residents may have had. If residents have any additional health-related concerns that they would like to discuss they may contact ATSDR toll-free (1-800-CDC-INFO).

The conclusions state it is unlikely that people became sick from drinking water in the past, but there is concern that people have become ill from inhalant exposure to the contaminants.

> PCE evaporates easily into the air and has a sharp, sweet odor. Most people smell the chemical at concentrations much lower than concentrations which would likely cause observable adverse health effects. More information on PCE-related exposures and potential health effects can be found in the ToxFAQs found on ATSDR's website. [http://www.atsdr.cdc.gov/toxfaq.html] These two-page fact sheets provide excellent information on the chemical and potential health effects resulting from exposure in a concise, easy to understand format.

The final PHA should incorporate data from Cargill's recent site investigation.

> ATSDR reviewed lab reports and summary tables from Cargill's site investigation and sampling events that took place from May through June, 2008.

The two groundwater plumes commingle in the Parkview Subdivision.

> ATSDR's statement that "it appears that there are two groundwater plumes with separate sources in the vicinity of the Parkview subdivision" is in line with the data, maps, and other information provided in the site's remedial investigation report [Tetra Tech RIa]. The Northern Study Area plume appears to originate at the Case New Holland property. The Southern plume appears to originate at the Industrial Services Corporation property. Figure 16 in the report shows the total CVOC plume map with the boundaries of the northern and southern plumes clearly indicated. Commingling is not indicated based on this information.
>
> ATSDR also reviewed the figure and data provided by the commenter. While the figure does show concentrations of total CVOCs within the area of the two plumes it does not demarcate the boundaries of the plumes nor does it show which plume contributed the CVOCs at the concentrations indicated.
>
> The text has not been modified.

The CNH Facility has contributed to exceedances of MCLs in groundwater in the Parkview Subdivision.

> ATSDR has reviewed the studies and reports listed in Section 2 of this public health assessment. ATSDR did not find information which supports the theory that the CNH Facility has contributed to concentrations of contaminants in groundwater in the Parkview Subdivision exceeding the maximum contaminant level (MCL). Information reviewed indicated that the CNH Facility contributed to contamination in Operable Unit 1 but that contamination was not necessarily within the Parkview Subdivision. The text has not been modified.

The health assessment fails to compare morbidity and mortality data.

> Health outcome data can help determine whether incidence rates of certain adverse health effects are higher than expected in an area potentially affected by hazardous substances migrating from a site. ATSDR conducts a review of health outcome data when the toxicological evaluation of a completed exposure pathway indicates the likelihood of adverse health outcomes. The evaluation of health outcome data can also provide a general picture of the health of a community, or it can confirm the presence of elevated levels of disease or illness in a community. That said, however, elevated rates of a particular disease might not necessarily be caused by hazardous substances in the environment. Other factors, such as personal habits (e.g., diet, smoking, and exercise), socioeconomic status, and occupation can also influence the development of disease.
>
> In a public health assessment, the Superfund law requires consideration of health outcome data. These data can include information on morbidity (illness) and mortality (death). The main requirements for evaluating health outcome data are the presence of a completed exposure pathway, sufficiently high contaminant levels to result in measurable

health effects, and a sufficient number of individuals in the completed exposure pathway population. Another important factor for health outcome data evaluation is a database in which disease rates for the population of concern can be identified.

Although completed exposure pathways exist at the Parkview Well Groundwater Contamination site, the contaminant levels do not indicate the likelihood of site-related health effects. Therefore, an evaluation of health outcome data was not conducted in this public health assessment.

The health assessment fails to protect children's health.

As noted in the document, ATSDR requires that public health assessments determine whether children are being exposed to site-related hazardous waste and whether contaminants may affect the children's health. The assessment finds that children in the impacted communities of Grand Island were likely exposed to chlorinated volatile organic compounds (CVOCs) in their domestic water. Those private wells which showed the highest concentration of the CVOCs have been connected to city water or provided whole-house filtration systems when such connection was not feasible. Most of those wells were discovered to be contaminated during a September 2003 sampling event and the effected residences were switched to a suitable water source by March 2004.

When evaluating the exposures children at the site may have received, ATSDR looked at such exposures occurring at the average concentrations of contaminants measured during the sampling event (Table 7) as well as the estimated exposure point concentration (Table 8). The estimated exposure point concentration was calculated as the arithmetic mean using the detected samples within the plume (the upper 95% confidence limit). Using this method, ATSDR estimated that the PCE exposure dose for a child would be 0.007-0.008 mg/kg/day. The estimated exposure to 1,1-DCE would be 0.005-0.007 mg/kg/day. When these estimated doses were compared to ATSDR health guidelines, the guideline values were not exceeded.

The public health assessment materially underestimates health risk.

ATSDR has added information regarding inhalation and dermal exposures to its exposure dose calculation tables. See Appendix B, Tables 6 through 8. Observable adverse health effects are not expected to occur in the previously exposed individuals based upon this information.

APPENDIX D – ATSDR Glossary of Environmental Health Terms

ATSDR Glossary of Environmental Health Terms

The Agency for Toxic Substances and Disease Registry (ATSDR) is a federal public health agency with headquarters in Atlanta, Georgia, and 10 regional offices in the United States. ATSDR's mission is to serve the public by using the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and diseases related to toxic substances. ATSDR is not a regulatory agency, unlike the U.S. Environmental Protection Agency (EPA), which is the federal agency that develops and enforces environmental laws to protect the environment and human health.

This glossary defines words used by ATSDR in communications with the public. It is not a complete dictionary of environmental health terms. If you have questions or comments, call ATSDR's toll-free telephone number, 1-888-42-ATSDR (1-888-422-8737).

Absorption
The process of taking in. For a person or animal, absorption is the process of a substance getting into the body through the eyes, skin, stomach, intestines, or lungs.

Acute
Occurring over a short time [compare with **chronic**].

Acute exposure
Contact with a substance that occurs once or for only a short time (up to 14 days) [compare with **intermediate duration exposure** and **chronic exposure]**.

Additive effect
A biologic response to exposure to multiple substances that equals the sum of responses of all the individual substances added together [compare with **antagonistic effect** and **synergistic effect]**.

Adverse health effect
A change in body function or cell structure that might lead to disease or health problems.

Aerobic
Requiring oxygen [compare with **anaerobic**].

Ambient
Surrounding (for example, *ambient* air).

Anaerobic
Requiring the absence of oxygen [compare with **aerobic**].

Analyte
A substance measured in the laboratory. A chemical for which a sample (such as water, air, or blood) is tested in a laboratory. For example, if the analyte is mercury, the laboratory test will determine the amount of mercury in the sample.

Analytic epidemiologic study
A study that evaluates the association between exposure to hazardous substances and disease by testing scientific hypotheses.

Antagonistic effect
A biologic response to exposure to multiple substances that is **less** than would be expected if the known effects of the individual substances were added together [compare with **additive effect** and **synergistic effect**].

Background level
An average or expected amount of a substance or radioactive material in a specific environment, or typical amounts of substances that occur naturally in an environment.

Biodegradation
Decomposition or breakdown of a substance through the action of microorganisms (such as bacteria or fungi) or other natural physical processes (such as sunlight).

Biologic indicators of exposure study
A study that uses (a) **biomedical testing** or (b) the measurement of a substance [an **analyte**], its **metabolite**, or another marker of exposure in human body fluids or tissues to confirm human exposure to a hazardous substance [also see **exposure investigation**].

Biologic monitoring
Measuring hazardous substances in biologic materials (such as blood, hair, urine, or breath) to determine whether exposure has occurred. A blood test for lead is an example of biologic monitoring.

Biologic uptake
The transfer of substances from the environment to plants, animals, and humans.

Biomedical testing
Testing of persons to find out whether a change in a body function might have occurred because of exposure to a hazardous substance.

Biota
Plants and animals in an environment. Some of these plants and animals might be sources of food, clothing, or medicines for people.

Body burden
The total amount of a substance in the body. Some substances build up in the body because they are stored in fat or bone or because they leave the body very slowly.

CAP
See **Community Assistance Panel**.

Cancer
Any one of a group of diseases that occurs when cells in the body become abnormal and grow or multiply out of control.

Cancer risk
A theoretical risk for getting cancer if exposed to a substance every day for 70 years (a lifetime exposure). The true risk might be lower.

Carcinogen
A substance that causes cancer.

Case study
A medical or epidemiologic evaluation of one person or a small group of people to gather information about specific health conditions and past exposures.

Case-control study
A study that compares exposures of people who have a disease or condition (cases) with people who do not have the disease or condition (controls). Exposures that are more common among the cases may be considered as possible risk factors for the disease.

CAS registry number
A unique number assigned to a substance or mixture by the American Chemical Society Abstracts Service.

Central nervous system
The part of the nervous system that consists of the brain and the spinal cord.

CERCLA [see **Comprehensive Environmental Response, Compensation, and Liability Act of 1980**]

Chronic
Occurring over a long time (more than 1 year) [compare with **acute**].

Chronic exposure
Contact with a substance that occurs over a long time (more than 1 year) [compare with **acute exposure** and **intermediate duration exposure**].

Cluster investigation
A review of an unusual number, real or perceived, of health events (for example, reports of cancer) grouped together in time and location. Cluster investigations are designed to confirm case reports; determine whether they represent an unusual disease occurrence; and, if possible, explore possible causes and contributing environmental factors.

Community Assistance Panel (CAP)
A group of people, from a community and from health and environmental agencies, who work with ATSDR to resolve issues and problems related to hazardous substances in the community. CAP members work with ATSDR to gather and review community health concerns, provide information on how people might have been or might now be exposed to hazardous substances, and inform ATSDR on ways to involve the community in its activities.

Completed exposure pathway [see **exposure pathway**].

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA)
CERCLA, also known as **Superfund**, is the federal law that concerns the removal or cleanup of hazardous substances in the environment and at hazardous waste sites. ATSDR, which was created by CERCLA, is responsible for assessing health issues and supporting public health activities related to hazardous waste sites or other environmental releases of hazardous substances.

Concentration
The amount of a substance present in a certain amount of soil, water, air, food, blood, hair, urine, breath, or any other media.

Contaminant
A substance that is either present in an environment where it does not belong or is present at levels that might cause harmful (adverse) health effects.

Delayed health effect
A disease or injury that happens as a result of exposures that might have occurred in the past.

Dermal
Referring to the skin. For example, dermal absorption means passing through the skin.

Dermal contact
Contact with (touching) the skin [see **route of exposure**].

Descriptive epidemiology
The study of the amount and distribution of a disease in a specified population by person, place, and time.

Detection limit
The lowest concentration of a chemical that can reliably be distinguished from a zero concentration.

Disease prevention
Measures used to prevent a disease or reduce its severity.

Disease registry
A system of ongoing registration of all cases of a particular disease or health condition in a defined population.

DOD
United States Department of Defense.

DOE
United States Department of Energy.

Dose (for chemicals that are not radioactive)
The amount of a substance to which a person is exposed over some time period. Dose is a measurement of exposure. Dose is often expressed as milligram (amount) per kilogram (a measure of body weight) per day (a measure of time) when people eat or drink contaminated water, food, or soil. In general, the greater the dose, the greater the likelihood of an effect. An Aexposure dose@ is how much of a substance is encountered in the environment. An Aabsorbed dose@ is the amount of a substance that actually got into the body through the eyes, skin, stomach, intestines, or lungs.

Dose (for radioactive chemicals)
The radiation dose is the amount of energy from radiation that is actually absorbed by the body. This is not the same as measurements of the amount of radiation in the environment.

Dose-response relationship
The relationship between the amount of exposure [**dose**] to a substance and the resulting changes in body function or health (response).

Environmental media
Soil, water, air, **biota** (plants and animals), or any other parts of the environment that can contain contaminants.

Environmental media and transport mechanism
Environmental media include water, air, soil, and **biota** (plants and animals). Transport mechanisms move contaminants from the source to points where human exposure can occur. The **environmental media and transport mechanism** is the second part of an **exposure pathway**.

EPA
United States Environmental Protection Agency.

Epidemiologic surveillance
The ongoing, systematic collection, analysis, and interpretation of health data. This activity also involves timely dissemination of the data and use for public health programs.

Epidemiology
The study of the distribution and determinants of disease or health status in a population; the study of the occurrence and causes of health effects in humans.

Exposure
Contact with a substance by swallowing, breathing, or touching the skin or eyes. Exposure may be short-term [**acute exposure**], of intermediate duration, or long-term [**chronic exposure**].

Exposure assessment
The process of finding out how people come into contact with a hazardous substance, how often and for how long they are in contact with the substance, and how much of the substance they are in contact with.

Exposure-dose reconstruction
A method of estimating the amount of people's past exposure to hazardous substances. Computer and approximation methods are used when past information is limited, not available, or missing.

Exposure investigation
The collection and analysis of site-specific information and biologic tests (when appropriate) to determine whether people have been exposed to hazardous substances.

Exposure pathway
The route a substance takes from its source (where it began) to its end point (where it ends), and how people can come into contact with (or get exposed to) it. An exposure pathway has five parts: a **source of contamination** (such as an abandoned business); an **environmental media and transport mechanism** (such as movement through groundwater); a **point of exposure** (such as a private well); a **route of exposure** (eating, drinking, breathing, or touching); and a **receptor population** (people potentially or actually exposed). When all five parts are present, the exposure pathway is termed a **completed exposure pathway**.

Exposure registry
A system of ongoing followup of people who have had documented environmental exposures.

Feasibility study
A study by EPA to determine the best way to clean up environmental contamination. A number of factors are considered, including health risk, costs, and what methods will work well.

Geographic information system (GIS)
A mapping system that uses computers to collect, store, manipulate, analyze, and display data. For example, GIS can show the concentration of a contaminant within a community in relation to points of reference such as streets and homes.

Grand rounds
Training sessions for physicians and other health care providers about health topics.

Groundwater
Water beneath the earth's surface in the spaces between soil particles and between rock surfaces [compare with **surface water**].

Half-life (t_2)
The time it takes for half the original amount of a substance to disappear. In the environment, the half-life is the time it takes for half the original amount of a substance to disappear when it is changed to another chemical by bacteria, fungi, sunlight, or other chemical processes. In the human body, the half-life is the time it takes for half the original amount of the substance to disappear, either by being changed to another substance or by leaving the body. In the case of radioactive material, the half life is the amount of time necessary for one half the initial number of radioactive atoms to change or transform into another atom (that is normally not radioactive). After two half lives, 25% of the original number of radioactive atoms remain.

Hazard
A source of potential harm from past, current, or future exposures.

Hazardous Substance Release and Health Effects Database (HazDat)
The scientific and administrative database system developed by ATSDR to manage data collection, retrieval, and analysis of site-specific information on hazardous substances, community health concerns, and public health activities.

Hazardous waste
Potentially harmful substances that have been released or discarded into the environment.

Health consultation
A review of available information or collection of new data to respond to a specific health question or request for information about a potential environmental hazard. Health consultations are focused on a specific exposure issue. Health consultations are therefore more limited than a public health assessment, which reviews the exposure potential of each pathway and chemical [compare with **public health assessment**].

Health education
Programs designed with a community to help it know about health risks and how to reduce these risks.

Health investigation
The collection and evaluation of information about the health of community residents. This information is used to describe or count the occurrence of a disease, symptom, or clinical measure and to estimate the possible association between the occurrence and exposure to hazardous substances.

Health promotion
The process of enabling people to increase control over, and to improve, their health.

Health statistics review
The analysis of existing health information (i.e., from death certificates, birth defects registries, and cancer registries) to determine if there is excess disease in a specific population, geographic area, and time period. A health statistics review is a descriptive epidemiologic study.

Indeterminate public health hazard
The category used in ATSDR's public health assessment documents when a professional judgment about the level of health hazard cannot be made because information critical to such a decision is lacking.

Incidence
The number of new cases of disease in a defined population over a specific time period [contrast with **prevalence**].

Ingestion
The act of swallowing something through eating, drinking, or mouthing objects. A hazardous substance can enter the body this way [see **route of exposure**].

Inhalation
The act of breathing. A hazardous substance can enter the body this way [see **route of exposure**].

Intermediate duration exposure
Contact with a substance that occurs for more than 14 days and less than a year [compare with **acute exposure** and **chronic exposure**].

In vitro
In an artificial environment outside a living organism or body. For example, some toxicity testing is done on cell cultures or slices of tissue grown in the laboratory, rather than on a living animal [compare with **in vivo**].

In vivo
Within a living organism or body. For example, some toxicity testing is done on whole animals, such as rats or mice [compare with **in vitro**].

Lowest-observed-adverse-effect level (LOAEL)
The lowest tested dose of a substance that has been reported to cause harmful (adverse) health effects in people or animals.

Medical monitoring
A set of medical tests and physical exams specifically designed to evaluate whether an individual's exposure could negatively affect that person's health.

Metabolism
The conversion or breakdown of a substance from one form to another by a living organism.

Metabolite
Any product of **metabolism**.

mg/kg
Milligram per kilogram.

mg/cm^2
Milligram per square centimeter (of a surface).

mg/m^3
Milligram per cubic meter; a measure of the concentration of a chemical in a known volume (a cubic meter) of air, soil, or water.

Migration
Moving from one location to another.

Minimal risk level (MRL)
An ATSDR estimate of daily human exposure to a hazardous substance at or below which that substance is unlikely to pose a measurable risk of harmful (adverse), noncancerous effects. MRLs are calculated for a route of exposure (inhalation or oral) over a specified time period (acute, intermediate, or chronic). MRLs should not be used as predictors of harmful (adverse) health effects [see **reference dose**].

Morbidity
State of being ill or diseased. Morbidity is the occurrence of a disease or condition that alters health and quality of life.

Mortality
Death. Usually the cause (a specific disease, condition, or injury) is stated.

Mutagen
A substance that causes **mutations** (genetic damage).

Mutation
A change (damage) to the DNA, genes, or chromosomes of living organisms.

National Priorities List for Uncontrolled Hazardous Waste Sites
(National Priorities List or **NPL)**
EPA's list of the most serious uncontrolled or abandoned hazardous waste sites in the United States. The NPL is updated on a regular basis.

No apparent public health hazard
A category used in ATSDR's public health assessments for sites where human exposure to contaminated media might be occurring, might have occurred in the past, or might occur in the future, but where the exposure is not expected to cause any harmful health effects.

No-observed-adverse-effect level (NOAEL)
The highest tested dose of a substance that has been reported to have no harmful (adverse) health effects on people or animals.

No public health hazard
A category used in ATSDR's public health assessment documents for sites where people have never and will never come into contact with harmful amounts of site-related substances.

NPL [see **National Priorities List for Uncontrolled Hazardous Waste Sites]**

Physiologically based pharmacokinetic model (PBPK model)
A computer model that describes what happens to a chemical in the body. This model describes how the chemical gets into the body, where it goes in the body, how it is changed by the body, and how it leaves the body.

Pica
A craving to eat nonfood items, such as dirt, paint chips, and clay. Some children exhibit pica-related behavior.

Plume
A volume of a substance that moves from its source to places farther away from the source. Plumes can be described by the volume of air or water they occupy and the direction they move. For example, a plume can be a column of smoke from a chimney or a substance moving with groundwater.

Point of exposure
The place where someone can come into contact with a substance present in the environment [see **exposure pathway**].

Population
A group or number of people living within a specified area or sharing similar characteristics (such as occupation or age).

Potentially responsible party (PRP)
A company, government, or person legally responsible for cleaning up the pollution at a hazardous waste site under Superfund. There may be more than one PRP for a particular site.

ppb
Parts per billion.

ppm
Parts per million.

Prevalence
The number of existing disease cases in a defined population during a specific time period [contrast with **incidence**].

Prevalence survey
The measure of the current level of disease(s) or symptoms and exposures through a questionnaire that collects self-reported information from a defined population.

Prevention
Actions that reduce exposure or other risks, keep people from getting sick, or keep disease from getting worse.

Public comment period
An opportunity for the public to comment on agency findings or proposed activities contained in draft reports or documents. The public comment period is a limited time period during which comments will be accepted.

Public availability session
An informal, drop-by meeting at which community members can meet one-on-one with ATSDR staff members to discuss health and site-related concerns.

Public health action
A list of steps to protect public health.

Public health advisory
A statement made by ATSDR to EPA or a state regulatory agency that a release of hazardous substances poses an immediate threat to human health. The advisory includes recommended measures to reduce exposure and reduce the threat to human health.

Public health assessment (PHA)
An ATSDR document that examines hazardous substances, health outcomes, and community concerns at a hazardous waste site to determine whether people could be harmed from coming into contact with those substances. The PHA also lists actions that need to be taken to protect public health [compare with **health consultation**].

Public health hazard
A category used in ATSDR's public health assessments for sites that pose a public health hazard because of long-term exposures (greater than 1 year) to sufficiently high levels of hazardous substances or **radionuclides** that could result in harmful health effects.

Public health hazard categories
Public health hazard categories are statements about whether people could be harmed by conditions present at the site in the past, present, or future. One or more hazard categories might be appropriate for each site. The five public health hazard categories are **no public health hazard**, **no apparent public health hazard**, **indeterminate public health hazard**, **public health hazard**, and **urgent public health hazard**.

Public health statement
The first chapter of an ATSDR **toxicological profile**. The public health statement is a summary written in words that are easy to understand. The public health statement explains how people might be exposed to a specific substance and describes the known health effects of that substance.

Public meeting
A public forum with community members for communication about a site.

Radioisotope
An unstable or radioactive isotope (form) of an element that can change into another element by giving off radiation.

Radionuclide
Any radioactive isotope (form) of any element.

RCRA [see **Resource Conservation and Recovery Act (1976, 1984)**]

Receptor population
People who could come into contact with hazardous substances [see **exposure pathway**].

Reference dose (RfD)
An EPA estimate, with uncertainty or safety factors built in, of the daily lifetime dose of a substance that is unlikely to cause harm in humans.

Registry
A systematic collection of information on persons exposed to a specific substance or having specific diseases [see **exposure registry** and **disease registry**].

Remedial investigation
The CERCLA process of determining the type and extent of hazardous material contamination at a site.

Resource Conservation and Recovery Act (1976, 1984) (RCRA)
This Act regulates management and disposal of hazardous wastes currently generated, treated, stored, disposed of, or distributed.

RFA
RCRA Facility Assessment. An assessment required by RCRA to identify potential and actual releases of hazardous chemicals.

RfD
See **reference dose**.

Risk
The probability that something will cause injury or harm.

Risk reduction
Actions that can decrease the likelihood that individuals, groups, or communities will experience disease or other health conditions.

Risk communication
The exchange of information to increase understanding of health risks.

Route of exposure
The way people come into contact with a hazardous substance. Three routes of exposure are breathing [**inhalation**], eating or drinking [**ingestion**], or contact with the skin [**dermal contact**].

Safety factor [see **uncertainty factor]**

SARA [see **Superfund Amendments and Reauthorization Act**]

Sample
A portion or piece of a whole. A selected subset of a population or subset of whatever is being studied. For example, in a study of people the sample is a number of people chosen from a larger population [see **population**]. An environmental sample (for example, a small amount of soil or water) might be collected to measure contamination in the environment at a specific location.

Sample size
The number of units chosen from a population or environment.

Screening value (SV)
Calculated concentration of a substance in air, water, food, or soil that is unlikely to cause harmful (adverse) health effects in exposed people. The SV is used as a comparison level during the public health assessment process. Substances found in amounts greater than their SVs might be selected for further evaluation in the public health assessment process.

Solvent
A liquid capable of dissolving or dispersing another substance (for example, acetone or mineral spirits).

Source of contamination
The place where a hazardous substance comes from, such as a landfill, waste pond, incinerator, storage tank, or drum. A source of contamination is the first part of an **exposure pathway**.

Special populations
People who might be more sensitive or susceptible to exposure to hazardous substances because of factors such as age, occupation, sex, or behaviors (for example, cigarette smoking). Children, pregnant women, and older people are often considered special populations.

Stakeholder
A person, group, or community who has an interest in activities at a hazardous waste site.

Statistics
A branch of mathematics that deals with collecting, reviewing, summarizing, and interpreting data or information. Statistics are used to determine whether differences between study groups are meaningful.

Substance
A chemical.

Substance-specific applied research
A program of research designed to fill important data needs for specific hazardous substances identified in ATSDR's **toxicological profiles**. Filling these data needs would allow more accurate assessment of human risks from specific substances contaminating the environment. This research might include human studies or laboratory experiments to determine health effects resulting from exposure to a given hazardous substance.

Superfund Amendments and Reauthorization Act (SARA)
In 1986, SARA amended CERCLA and expanded the health-related responsibilities of ATSDR. CERCLA and SARA direct ATSDR to look into the health effects from substance exposures at hazardous waste sites and to perform activities including health education, health studies, surveillance, health consultations, and toxicological profiles.

Surface water
Water on the surface of the earth, such as in lakes, rivers, streams, ponds, and springs [compare with **groundwater**].

Surveillance [see **epidemiologic surveillance**]

Survey
A systematic collection of information or data. A survey can be conducted to collect information from a group of people or from the environment. Surveys of a group of people can be conducted

by telephone, by mail, or in person. Some surveys are done by interviewing a group of people [see **prevalence survey**].

Synergistic effect
A biologic response to multiple substances where one substance worsens the effect of another substance. The combined effect of the substances acting together is greater than the sum of the effects of the substances acting by themselves [see **additive effect** and **antagonistic effect**].

Teratogen
A substance that causes defects in development between conception and birth. A teratogen is a substance that causes a structural or functional birth defect.

Toxic agent
Chemical or physical (for example, radiation, heat, cold, microwaves) agents that, under certain circumstances of exposure, can cause harmful effects to living organisms.

Toxicological profile
An ATSDR document that examines, summarizes, and interprets information about a hazardous substance to determine harmful levels of exposure and associated health effects. A toxicological profile also identifies significant gaps in knowledge on the substance and describes areas where further research is needed.

Toxicology
The study of the harmful effects of substances on humans or animals.

Tumor
An abnormal mass of tissue that results from excessive cell division that is uncontrolled and progressive. Tumors perform no useful body function. Tumors can be either benign (not cancer) or malignant (cancer).

ug/l
Microgram per liter

ug/m^3
Microgram per cubic meter; a measure of the concentration of a chemical in a known volume (a cubic meter) of air, soil, or water.

Uncertainty factor
Mathematical adjustments for reasons of safety when knowledge is incomplete. For example, factors used in the calculation of doses that are not harmful (adverse) to people. These factors are applied to the lowest-observed-adverse-effect-level (LOAEL) or the no-observed-adverse-effect-level (NOAEL) to derive a minimal risk level (MRL). Uncertainty factors are used to account for variations in people's sensitivity, for differences between animals and humans, and for differences between a LOAEL and a NOAEL. Scientists use uncertainty factors when they have some, but not all, the information from animal or human studies to decide whether an exposure will cause harm to people [also sometimes called a **safety factor**].

Urgent public health hazard
A category used in ATSDR's public health assessments for sites where short-term exposures (less than 1 year) to hazardous substances or conditions could result in harmful health effects that require rapid intervention.

Volatile organic compounds (VOCs)
Organic compounds that evaporate readily into the air. VOCs include substances such as benzene, toluene, methylene chloride, and methyl chloroform.

Other Glossaries and Dictionaries

Environmental Protection Agency
http://www.epa.gov/OCEPAterms/

National Center for Environmental Health (CDC)
http://www.nlm.nih.gov/medlineplus/mplusdictionary.html

National Library of Medicine (NIH)
http://www.nlm.nih.gov/medlineplus/mplusdictionary.html

APPENDIX E – Health Guidelines, Exposure Dose Estimation, Risk and Results of Exposure Dose Estimate Comparison to Health Guidelines

E.1. Health Guidelines

Health guidelines provide a basis for comparing estimated exposures with concentrations of contaminants in different environmental media (air, soil and water) to which people might be exposed.

Non-Cancer Health Effects

ATSDR has developed a **Minimal Risk Level (MRLs)** for contaminants of concern found at hazardous waste sites. The MRL is defined as an estimate of daily human exposure to a substance that is likely to be without an appreciable risk of adverse effects (non-carcinogenic) over a specified duration of exposure. MRLs are derived when reliable and sufficient data exist to identify the target organ(s) of effect or the most sensitive health effect(s) for a specified duration within a given route of exposure. MRLs are based only on noncancerous health effects, and do not consider carcinogenic effects, therefore, an MRL does not imply anything about the presence, absence, or level of cancer risk. MRLs are developed for different routes of exposure, like inhalation and ingestion, and for lengths of exposure, such as acute (less than 14 days), intermediate (15–364 days), and chronic (365 days or greater). Oral MRLs are expressed in units of milligrams of contaminant per kilogram of body weight per day (mg/kg/day). Because ATSDR has no methodology to determine amounts of chemicals absorbed through the skin, the Agency has not developed MRLs for dermal exposure. If an ATSDR MRL is not available as a health value, then EPA's Reference Dose (RfD) is used. The RfD is an estimate of daily human exposure to a contaminant for a lifetime below which (non-cancer) health effects are unlikely to occur (ATSDR 1992a).

Cancer Health Effects

The EPA classifies chemicals as Class A, Class B, Class C, Class D, or Class E. This classification defines a specific chemical's ability to cause cancer in humans and animals. According to EPA, Class A chemicals are known human carcinogens, and Class B chemicals are probable human carcinogens. Class B is further subdivided into two groups: Group B1 consists of chemicals for which there is limited evidence of carcinogenicity from epidemiologic studies in humans; and Group B2 consists of chemicals for which there is sufficient evidence of carcinogenicity in animals, but inadequate evidence or no data available from epidemiologic studies in humans. Group C chemicals are possible human carcinogens. Group D chemicals are not classifiable as to human carcinogenicity and Group E chemicals are those for which there is evidence that they are not carcinogenic to humans. For carcinogenic substances, EPA has established the Cancer Slope Factor (CSF) as a guideline. The CSF is used to determine the number of excess cancers resulting from exposure to a contaminant. The National Toxicology Program in its Annual Report on Carcinogens classifies a chemical as a "known human carcinogen" based on sufficient human data. Its classification of a chemical as being "reasonably anticipated to be a carcinogen (RAC) is based on limited human or sufficient animal data.

E.2. Description of Select Screening Values and Health Guidelines

Cancer Effect Level (CEL) is the lowest exposure level associated with the onset of carcinogenesis in experimental or epidemiological studies. CELs are always considered indicative of serious effects.

Cancer Risk Evaluation Guides (CREGs) are estimated concentrations of contaminants that are expected to cause no more than one excess cancer case for every million (1×10^{-6}) persons who are continuously exposed to the concentration for an entire lifetime. These concentrations are calculated from EPA's cancer slope factors, which indicate the relative potency of carcinogenic chemicals. Only chemicals that are known or suspected of being carcinogenic have CREG screening values. It should be noted that exposures equivalent to CREGs are not actually expected to cause one excess cancer in a million persons exposed over a lifetime. Nor does it mean that every person in the exposed population of one million has a 1-in-a-million chance of developing cancer from the specific exposure. Although commonly interpreted in precisely these ways, the CREGs reflect only a rough estimate of population risks, which should not be applied directly to any individual.

Environmental Media Evaluation Guide (EMEGs) are estimates of chemical concentrations that are not likely to cause an appreciable risk of deleterious, noncancerous health effects for fixed durations of exposure. These concentrations factor in estimates of receptor body weight and rates of ingestion. EMEGs might reflect several different types of exposure: acute (<14 days), intermediate (15-364 days), and chronic (>365 days). These concentrations are ultimately based on data published in ATSDR Toxicological Profiles for specific chemicals.

Lowest-Observed-Adverse-Effect-Level (LOAEL) is defined as the lowest dose of chemical in a study, or group of studies, that produces statistically or biologically significant increases in the frequency or severity of adverse effects between the exposed population and its appropriate control.

National Ambient Air Quality Standards (NAAQS) are developed by EPA to protect people and the environment from unhealthy and undesirable levels of air pollution. As of the writing of this report, EPA has promulgated NAAQS for seven pollutants (known as "criteria pollutants"). These standards have been developed specifically to protect the health and welfare of humans. To be conservative, these standards were designed to be protective of exposed persons, including most "sensitive" populations (e.g., persons with asthma).

Risk-Based Concentrations (RBCs) are derived by Region 3 of the U.S. Environmental Protection Agency (EPA) and represent concentrations of contaminants in tap water, ambient air, fish or soil (industrial or residential) that are considered unlikely to cause adverse health effects. They are derived using conservative exposure assumptions and EPA's Reference Doses, Reference Concentrations, or slope factors. RBCs are based either on cancer or non-cancer effects.

E.3. Exposure Dose Estimation

To link the site's human exposure potential with health effects that may occur under site-specific conditions, ATSDR estimates human exposure to the site contaminant from ingestion and/or inhalation of different environmental media (ATSDR 2005a). The following relationship is used to determine the estimated exposure to the site contaminant:

$$ED = (C \times IR \times EF) / BW$$

ED = exposure dose (mg/kg/day)
C = contaminant concentration (ppm)
IR = intake rate (l/day)
EF = exposure factor (unitless)
BW = body weight (kg)

For screening purposes it was assumed that body weights for adults and children are 70 kilograms (kg) and 18 kg, respectively. The maximum contaminant concentration detected at a site for a specific medium is used to determine the estimated exposure. Use of the maximum concentration will result in the most protective evaluation for human health. The ingestion rate of water from supplies used as potable water sources was assumed to be one litre per day for children and two litres per day for adults.

E.4. How Risk Estimates are Made

Non-Cancer Risks

For non-carcinogenic health risks, the contaminant intake was estimated using exposure assumptions for the site conditions. This dose was then compared to a risk reference dose (estimated daily intake of a chemical that is likely to be without an appreciable risk of health effects) developed by ATSDR and EPA.

Non-carcinogenic effects, unlike carcinogenic effects are believed to have a threshold, that is, a dose below which adverse health effects will not occur. As a result, the current practice is to identify, usually from animal toxicology experiments, a **No-Observed-Adverse-Effect-Level (NOAEL).** The NOAEL is defined as the dose of chemical at which there were no statistically or biologically significant increases in the frequency or severity of adverse effects seen between the exposed population and its appropriate control. Effects may be produced at this dose, but they are not considered to be adverse.

The NOAEL is then divided by an uncertainty factor (UF) to yield a risk reference dose. The UF is number which reflects the degree of uncertainty that exists when experimental animal data are extrapolated to the general human population. The magnitude of the UF takes into consideration various factors such as sensitive subpopulations (for example; children, pregnant women, and the elderly), extrapolation from animals to humans, and the incompleteness of available data. Thus, exposure doses at or below the risk reference dose are not expected to cause adverse health

effects because it is selected to be much lower than dosages that do not cause adverse health effects in laboratory animals.

The measure used to describe the potential for non-cancer health effects to occur in an individual is expressed as a ratio of estimated contaminant intake to the risk reference dose. If exposure to the contaminant exceeds the risk reference dose, there is concern for potential non-cancer health effects. As a rule, the greater the ratio of the estimated contaminant intake to the risk reference dose, the greater the level of concern. A ratio equal to or less than one is generally considered an insignificant (minimal) increase in risk.

Cancer Risks

Increased cancer risks were estimated by using site-specific information on exposure levels for the contaminant of concern and interpreting them using cancer potency estimates derived for that contaminant by EPA. An increased excess lifetime cancer risk is not a specific estimate of expected cancers. Rather, it is an estimate of the increase in the probability that a person may develop cancer sometime in his or her lifetime following exposure to that contaminant.

There is insufficient knowledge of cancer mechanisms to decide if there exists a level of exposure to a cancer-causing agent below which there is no risk of getting cancer, namely, a threshold level. Therefore, every exposure, no matter how low, to a cancer-causing compound is assumed to be associated with some increased risk. As the dose of a carcinogen decreases, the chance of developing cancer decreases, but each exposure is accompanied by some increased risk.

There is no general consensus within the scientific or regulatory communities on what level of estimated excess cancer risk is acceptable. Some have recommended the use of the relatively conservative excess lifetime cancer risk level of one in one million because of the uncertainties in our scientific knowledge about the mechanism of cancer. Others feel that risks that are lower or higher may be acceptable, depending on scientific, economic, and social factors. An increased lifetime cancer risk of one in one million or less is generally considered an insignificant increase in cancer risk.

E.5. Sources of Health Guideline Information

ATSDR has prepared toxicological profiles for many substances found at hazardous waste sites. Those documents present and interpret information on the substances. Health guidelines, such as ATSDR’s MRL and EPA’s RfD and CSF are included in the toxicological profiles. Those health guidelines are used by ATSDR health professionals in determining the potential for developing adverse non-carcinogenic health effects and/or cancer from exposure to a hazardous substance. The preparers of this public health assessment have reviewed the profiles for the contaminants of concern at the Parkview Well Groundwater Contamination site.

APPENDIX F – ATSDR Health Hazard Categories

ATSDR Public Health Hazard Categories

Depending on the specific properties of the contaminant, the exposure situations, and the health status of individuals, a **public health hazard** may occur. Using data from public health assessments, sites or pathways are classified using one of the following public health hazard categories.

Category 1: Urgent Public Health Hazard

Sites that pose a serious risk to the public's health as the result of short-term exposures to hazardous substances.

Category 2: Public Health Hazard

Sites that pose a public health hazard as the result of long-term exposures to hazardous substances.

Category 3: Potential/Indeterminate Public Health Hazard

Sites for which no conclusions about public health hazard can be made because data are lacking.

Category 4: No Apparent Public Health Hazard

Sites where human exposure to contaminated media is occurring or has occurred in the past, but the exposure is below a level of health hazard.

Category 5: No Public Health Hazard

Sites for which data indicate no current or past exposure or no potential for exposure and therefore no health hazard.