Public Health Assessment

Manning Canyon/Fairfield

Fairfield, Utah County, Utah

EPA ID: UT0008911690

August 24, 2011

Prepared By:

Environmental Epidemiology Program
Bureau of Epidemiology
Utah Department of Health
Under a Cooperative Agreement with the
Agency for Toxic Substances and Disease Registry

TABLE OF CONTENTS

SUMMARY

INTRODUCTION	The town of Fairfield is located in Utah County, Utah, about 36 miles southwest of Salt Lake City in the Cedar Valley. The town lies approximately 4.5 miles southeast of the Manning Canyon Mill Site, a former operating center of the Mercur Mining District, which sent gold ore to be processed at the mill. In 1898, the treatment of ore from the Mercur Mine was discontinued and the Manning Canyon Mill was primarily used for reprocessing tailings. A second mill was constructed on site in 1933 and was used for processing additional ore from the Mercur Mine as well as for reprocessing tailings. Both mills were in operation until 1937 and processed an average of 536 tons of material per day. It is estimated that approximately 720,000 cubic yards of mine tailings were left at the site when operations were completed. The Manning Canyon site covers over 1,470 acres (about 2.3 square miles) and originally contained six well-defined tailings deposits that covered approximately 66 acres. After the Manning Mill site was abandoned, two on-site tailings ponds were breached, allowing the tailings to move downgradient of the site. Because of the terrain in the area, these tailings were highly susceptible to wind and water erosion and, over several decades, have gradually migrated downgradient into the town of Fairfield. This Public Health Assessment (PHA) addresses only contamination that has migrated downhill from the former Manning Canyon Mill site and which is located on land not owned by the Bureau of Land Management (BLM). Previous investigations on BLM-owned land have resulted in remediation and this area does not pose additional threats to the people of Fairfield (see Site History).
CONCLUSION 1	Based on review of the sampling data, the Environmental Epidemiology Program (EEP) concludes that potential surface water resulting from runoff downgradient of the Mill Site had concentrations of arsenic and thallium that exceed Minimal Risk Level (MRL) values and therefore pose a health risk to the community.

BASIS FOR DECISION	The surface water is not used as potable water for Fairfield; therefore, chronic ingestion is not of concern. However, there is evidence that suggests that ditches and culverts containing surface water are used by children for play. Due to the fact that the risk from incidental ingestion in these scenarios may be significant, parents are advised to reduce or eliminate children's contact with contaminated surface water in these ditches.
NEXT STEPS	EEP will provide assistance to residents through health education and emphasize to residents the importance of exposure avoidance. EEP recommends annual sampling of surface water resulting from runoff to monitor arsenic and thallium concentrations to ensure that they are reduced below health standard values.
CONCLUSION 2	Analysis of the soil pathway showed that levels of arsenic in the soil were elevated above comparison values (CV) and thus have the potential to harm human health through ingestion or exposure to the soil in residential or non-residential properties.
BASIS FOR DECISION	The highest levels of soil contamination were measured in non-residential properties and would not result in exposure in the community unless these properties were sold and development allowed. Since this is the long-term goal in Fairfield, doses representative of future exposure to soil were calculated. Concentrations in residential properties also presented a risk to residents.
NEXT STEPS	Future health risks should be assessed prior to development of non-residential properties. In addition, zoning and institutional controls to limit exposure and therefore risk should be considered.
CONCLUSION 3	The ambient air pathway was not assessed due to insufficient data; therefore, no risk to human health could be concluded.
BASIS FOR DECISION	Ambient air samples collected by the U.S. Environmental Protection Agency (EPA) did not show concentrations of arsenic greater than the action level for air. However, there is some concern in the community that the samples collected are not indicative of true risk exposures in Fairfield, especially during the

	spring plowing season. During this season, a large amount of dust is created that moves across Highway 73 and into Fairfield.
NEXT STEPS	In order to fully evaluate this pathway and the potential risks that may result, additional air samples should be taken and analyzed during high exposure conditions. EEP has recommended that EPA conduct fugitive dust samples during the plowing of the fields in Fairfield.
FOR MORE INFORMATION	If you have concerns about your health or the health of your children, you should contact your health care provider. You may call the Utah Department of Health at (801) 538-6191 and ask for additional information about the Fairfield/Manning Canyon Public Health Assessment.

PURPOSE AND HEALTH ISSUES

The Environmental Epidemiology Program (EEP) of the Utah Department of Health (UDOH) prepared this Public Health Assessment (PHA) to evaluate the human health risks from potential exposure to Fairfield residents and visitors from contaminated mine tailings that have moved off-site into surface water, sediment, soil, and air originating at the Manning Canyon abandoned mine site. The EEP evaluates the human health risks of exposure to environmental contaminants in Utah through a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR).

The mission of ATSDR is to serve the public by applying the best science, taking responsive public health actions, and providing trusted health information to prevent harmful exposures and disease(s) related to toxic substances. The Mayor of Fairfield has requested that the EEP conduct this assessment to identify public health hazards posed by former milling and mining activities in Fairfield and the surrounding area. The PHA process serves as a mechanism to help ATSDR and state health departments determine where public health actions should be addressed and for whom.

The Manning Canyon/Fairfield site was brought to the attention of the EEP in the spring of 2009 through community concerns expressed about the concentrations of heavy metals in fugitive dust, water and soil in areas directly downgradient of the former mining site. Previous action taken by BLM from 1997-2007 resulted in remediation and containment of all contaminated tailings on the former mill site and the surrounding BLM-owned land. The current investigation focuses on mitigating risk from exposure to contamination on off-site, non-BLM land and to educate residents and visitors of Fairfield.

Fairfield is located in a valley 4.5 miles southeast of the Manning Canyon abandoned mine and tailings impoundments. During years following closure of the mill, tailings impoundments were breached, resulting in the migration of mine tailings into the town of Fairfield. Erosion due to flooding and heavy rains has resulted in continued movement of tailings into streams, roads, and properties in Fairfield. The Manning Canyon tailings contain elevated levels of arsenic, mercury, lead, thallium and other metals (BLM, 2008). The purpose of this health assessment is to evaluate whether exposures to elevated levels of these contaminants in the soil (in residential and recreational lots and beneath the road surface), groundwater, surface water (including a stream and canal), sediment, windblown dust, or in garden vegetables in Fairfield pose a health risk for residents, state park visitors, or to recreational users of adjacent open space areas.

BACKGROUND

The UDOH has a cooperative agreement with ATSDR to address environmental health issues related to exposure from hazardous waste sites and other facilities in Utah. In an effort to respond to the community concerns surrounding the Manning Canyon/Fairfield site, the EEP was asked by the Mayor of Fairfield to conduct an assessment to determine the potential health hazards to the residents from exposure to the mine tailings.

The town of Fairfield is located in Utah County, Utah, about 36 miles southwest of Salt Lake City in the Cedar Valley. Fairfield is situated at 4,880 feet above mean sea level (msl) near the southeast edge of the Oquirrh Mountain Range, about two miles from the mouth of Manning Canyon. The Manning Canyon Mill site is located at the head of the canyon at approximately 40.298643 N, -112.168007 W. The elevation at the former mill site is approximately 5,800 feet above msl. The Oquirrh Mountains rise to over 7,000 feet above msl to the north, west, and east of the mill site.

Tailings piles and settling ponds on the site were the original source of arsenic contamination. Near the southern portion of the tailings site, tailings ponds breached containment berms, allowing tailings to wash hundreds of yards down gradient, covering an area of about 135 acres. (EPA 2000b) Flood and spring run-off waters carried these contaminated deposits toward the town of Fairfield, exiting the Canyon through parallel drainage channels that run for about 3.5 miles in a southeasterly direction from the former mill site. The northern drainage channel historically passed through Big Spring, but a surface water diversion now channels flow to the grain fields north of Big Spring. The southern drainage channel is partially restricted by Highway 73 about 0.4 miles southwest of Fairfield. The pooling effect has resulted in the bulk of arsenic contamination being deposited along the drainage channels and in the ditches beside Highway 73. Contamination covers two major areas, a larger one just to the north of Big Spring, which covers about 140 acres in the W½ Sec 29 T6S, R2W, and one to the south of Big Spring, covering about 70 acres in the NW¼ Sec. 32 T6S, R2W.

The site is located on the southern end of the Oquirrh Mountain Range, which extends from the Great Salt Lake on the north to Five-Mile Pass on the south and is located in the eastern portion of the Basin and Range Physiographic Province (Hintze 1988). The predominant geologic formations at the former Manning Canyon Mill site are Upper Mississippian Great Blue Limestone and Manning Canyon Shale. Native soils at the Manning Canyon Mill site are Borvant Cobbly Loam; soils closer to Cedar Valley are Medburn Fine Sandy Loam (BLM 2001).

The majority of contamination near Fairfield is in well-drained Harding silt loam, with Woodrow and Bramwell silt loams in the town center and further upstream, respectively (USDA 2010).

The region is characterized by a semi-arid climate, with summer temperatures averaging up to 89º F and average winter temperatures as low as 12º F. The predominant wind blows steadily in a southwesterly direction at an average speed of about 1.9 mph. The average annual rainfall is 13.2 inches, with a 24-hour maximum rainfall of 0.6 inches. Fairfield receives an average of 36.2 inches of snowfall annually (Brough et al. 1987). The land surface slopes slightly down gradient towards the northeast.

The town of Fairfield receives much of its water supply from private wells, which draw ground water for drinking and domestic use from aquifers in the basin-fill sediments of Cedar Valley. Big Spring also serves as a municipal source of clean water for drinking, irrigation and domestic use. The basin-fill deposits permeated by Fairfield wells range in thickness from 500 to 1500 feet, increasing from west to east, and are composed primarily of late- to post-Lake Bonneville clay and sand from the Quaternary period. From west to east, the primary deposit type shifts from alluvial fan to lacustrine fine-grained deposits. These basin-fill aquifers are recharged by infiltration of flow from ephemeral streams that originate in the surrounding highlands, including the Oquirrh Mountains, Lake Mountains, and Thorpe Hills, as well as groundwater from fractured bedrock (USGS 1995). Groundwater below the town of Fairfield moves from west to east and, while it is at least 100 feet below ground surface (bgs) near the former mill site, it is less than 5 feet bgs in the town of Fairfield.

Several residential wells in the area are within the aquifer. According to the Needs Assessment (NA) conducted by the EEP in 2009, 73% of Fairfield residents reported having a well ranging in depth from 190 to 280 feet. Of these, 59% of residents surveyed use their wells for drinking, 50% for irrigation, and 45% for watering livestock. Approximately one-third of survey respondents reported that they water their garden with the current community irrigation system. While the majority of residents receive their water from private wells, some reported that they utilize the municipal water supply for drinking and domestic uses.

Manning Canyon is drained by two ephemeral washes: the eastern and western drainages. During large thunderstorms and spring snow-melt, water from these two washes flows down the Canyon, through Fairfield town and 2.5 miles beyond, ultimately discharging into the “Sinks,” a set of lakes near the center of the Cedar Canyon endorheic basin whose water level is representative of the basin-wide water table.

Land Use and Demographics

The town of Fairfield is located in Utah County, Utah, approximately 36 miles southwest of Salt Lake City. The town was established in 1855 as Frogtown and served as a stationing base for 3,500 Johnston’s Army soldiers in 1858-1859, which later became known as Camp Floyd. Frogtown became Fairfield in 1861, named after Amos Fielding, who participated in the establishment of the community.

The town contains residential, industrial, agricultural, and proposed commercial areas, including a museum, industrial park and recreational areas. The town of Fairfield incorporated in 2004 due to concerns about growth from surrounding communities (Utah County General Election 2004). Besides agriculture, Fairfield is a destination location for tourists of Camp Floyd State Park and home to a large construction landfill.

Several types of outdoor recreation are common in the desert area surrounding Fairfield, including target shooting activities, equestrian use, dispersed camping, organized group activity (Boy Scouts, church groups, unpermitted social gatherings), vehicle rock crawling activities, off-road vehicle (ORV) use, climbing, and mountain biking. Areas northwest of Fairfield and below the old railroad grade are used for dry land farming as well as outdoor recreation activities. The town receives its drinking water from numerous private wells, but many residents also utilize water from Big Spring, a natural drinking water source, which is flanked by the western and eastern drainages of Manning Canyon.

Due to the fact that Fairfield incorporated in 2004, there is no current census data for the town available; however, town records indicate that approximately 137 permanent residents call Fairfield home, with an average household size of approximately 3 people. An estimated 489 people live within a 4 mile radius of Fairfield. It is part of the Provo-Orem metropolitan area which, according to 2000 U.S. Census Bureau data for Utah County, has a population of 540,943. Orem is the closest large city[1] to Fairfield, with an estimated population of 92,505 in 2008. The population of Orem is predominantly white with less than eight percent having Asian, African American, American Indian, or Hispanic backgrounds. The average household size in the area is 3.4 persons per household (US Census Bureau 2010). The town of Fairfield would have a similar demographic profile.

Site History

The area now known as Fairfield was first settled in 1855 by John Carson and his four brothers. The settlement was originally known as Frogtown. The population increased dramatically when Johnston's U.S. Army garrisoned in Frogtown in 1859. The army then established Camp Floyd, which resulted in a further increase in population to over 7,000; comprising nearly one-third of the entire U.S. Army at the time. Camp Floyd provided troops for protection of the Pony Express lines that ran through the valley. The troops were recalled in 1861 at the outbreak of the Civil War. Currently, the Stagecoach Inn (now a museum), the Camp Floyd Commissary Building, and cemetery are the only remnants of the Army occupation.

In 1861, Frogtown was renamed Fairfield after Amos Fielding, who participated in establishing the community. In 2004, the town of Fairfield voted to incorporate due to concerns about growth from surrounding communities. It is estimated that the Fairfield area receives over 16,000 visitors each year (UDNR 2010). Points of interest include the former Camp Floyd site, as well as the numerous off-road trails and outdoor recreational areas.

[1]see Utah State Code Title 10, Chapter 2, Section 301(b) http://le.utah.gov/~code/TITLE10/htm/10_02_030100.htm

The Manning Canyon Mill Site and surrounding area (which includes the BLM's Five Mile Pass Special Recreation Management Area) are well visited and used for hiking, biking, camping, hunting and ORV use. The tailings and waste rock piles at the former mill site were especially popular for riding ORVs due to the variety of terrain and limited vegetation on-site. The BLM Salt Lake Field Office estimates an annual visitation of approximately 1,050 tourists and locals (Ford and Ingwell n.d.).

Manning Canyon History

The Mercur Mining District was originally established in 1870, sending gold ore to be processed at the adjacent Manning Canyon Mill. The Mill operated from approximately 1890 to 1937 and utilized a cyanide leach process to extract the gold. In 1898, the treatment of ore from the Mercur Mine was discontinued and the Manning Canyon Mill was primarily used for reprocessing tailings. A second mill was constructed on site in 1933 and was used for processing additional ore from the Mercur Mine and for reprocessing tailings. Both mills were in operation until 1937 and processed an average of 536 tons of material per day. It is estimated that approximately 720,000 cubic yards of mine tailings were left at the site when operations were completed. The Manning Canyon site covers over 1,470 acres (about 2.3 square miles) and originally contained six well-defined tailings deposits, which covered approximately 66 acres.

After the Manning Mill site was abandoned, two on-site tailings ponds were breached. Because of the terrain in the area, these tailings were highly susceptible to wind and water erosion and, over several decades, have gradually migrated down the canyon and into the town of Fairfield.

The Manning Canyon Mine is accessible via two gravel county roads. The first road is located in the eastern portion of Manning Canyon and intersects State Highway 73 in the White Hills Subdivision, approximately 2.5 miles north of Fairfield. The second road is located in the western portion of Manning Canyon and intersects State Highway 73 approximately 1.6 miles west southwest of Fairfield.

Previous Investigations

The BLM, EPA and the Utah Department of Environmental Quality (UDEQ) Division of Environmental Response and Remediation (DERR) conducted numerous investigations of the Manning Canyon Mine between 1997 and 2009. The investigations, as well as the results obtained, are summarized below. Local maps illustrating sampling locations for most collected samples are included in Appendix A.

BLM

In August 1997, the DERR and BLM sampled tailings at the historic mill site, discovering arsenic concentrations between 5,350 mg/kg to 6,510 mg/kg. In 1998 and 1999, the BLM and the State of Utah Abandoned Mine Reclamation Program conducted a Tailings Investigation and Removal Preliminary Assessment of the Manning Canyon Mill site. Approximately 100 soil samples were collected and analyzed using x-ray fluorescence (XRF). All the tailing piles were inventoried and sampled for heavy metals. Mill tailings at the Manning Canyon site were determined to contain high levels of arsenic, lead and mercury, each of which were deemed to pose a significant risk to public health. Arsenic is the contaminant that raised the most concern, as concentrations ranged from 2,000 to 12,000 mg/kg. The concentrations of arsenic found at Manning Canyon are 76 times higher than allowable risk levels (BLM 2008). As a result, the tailings would be harmful to those using the canyon for recreational purposes through all environmental pathways (i.e., ingestion, inhalation and dermal absorption).

Due to the fact that the area was so highly contaminated and widely dispersed, the remediation efforts that followed were broken into four phases (see Table 1).

Table 1. Phases of remediation for Manning Canyon (BLM 2001).

Phase	Remediation Action
I	Construction of surface diversion channels and consolidation of tailings into one repository
II	Construction of the repository and cap
III	Removal of the lower tailings area and placement into the repository which was then capped with an impermeable fabric
IV	Removal of additional tailings that were discovered during the main clean-up phase were placed in an extension of the already built repository

In 2001, the BLM prepared an engineering evaluation and cost analysis (EE/CA) for the Manning Canyon site. The EE/CA addressed contamination from the historic Manning Canyon Mill site down gradient to the former railroad grade, which is located approximately 1.4 miles west northwest of Fairfield. The preferred remedial alternative discussed in the EE/CA included consolidating waste material into a repository. From 2002-2004, the BLM and EPA completed a non-time critical removal action for the upper Manning Canyon drainage area, placing all waste material in an unlined repository with 24-inch capillary break covers (BLM 2001).

During cleanup, additional contaminated tailings were discovered. BLM conducted a geologic soil survey and removal site investigation in 2004, and an additional EE/CA in 2005. The new tailings were then placed in an extension of the previously constructed repository. The BLM completed reclamation of the former Manning Canyon Mill site (adding top soil and reintroducing native vegetation) in 2007. The reclamation prevents contaminated tailings from migrating off-site. Though contaminated tailings already exist in the drainage canals off-site, there is not expected to be any further migration from within BLM land.

EPA

The EPA conducted a removal evaluation of the lower Manning Canyon drainage and the town of Fairfield in 1999. A total of 211 samples were collected from the lower drainage and 1,190 samples were collected from the town. Elevated levels of arsenic were detected in the eastern and western drainages of Manning Canyon, down gradient of the former Manning Canyon Mill site. During this sampling, two residential properties in Fairfield were also found to contain arsenic in the soil that exceeded the emergency response action level of 500 mg/kg. These properties were remediated to a depth of 12 inches on May 30 – June 9, 2000 (EPA 2000b).

In July 2000, EPA evaluated the site for the purpose of preparing a Hazardous Ranking System (HRS) package, but due to the small population size it was not completed. Also in 2000, the EPA Region VIII Superfund Technical Assessment and Response Team (START) conducted an investigation in Fairfield to determine the extent of metals contamination from the Manning

Canyon site.

In 2002, the Site Inspection Work Plan was approved by the EPA. The remediation of the Manning Canyon site was completed by the BLM in 2007 at a cost of $10 million. The areas impacted by contamination down the canyon (comprising the town of Fairfield) were not included as part of this remediation, due to the fact that private residences are not under the jurisdiction of the BLM.

DERR/UDEQ

In September 2003, the DERR completed the initial site inspection. Elevated arsenic concentrations were detected in the ephemeral drainage west of Fairfield. In 2005, at the request of the Fairfield mayor, the DERR evaluated arsenic levels in and along roads in Fairfield using a portable x-ray fluorescence (XRF) device. Arsenic levels ranged in concentrations from less than 25 ppm to 6,900 ppm. Later, in 2008, the UDEQ sampled sediment and runoff water from the Manning Canyon drainage near the Cedar Valley Road. Both the sediment samples and runoff water contained elevated levels of a variety of heavy metals.

Surface Water Sampling

As part of its EE/CA in 2000, the EPA conducted sampling of surface water present in Big Spring near Fairfield. The spring currently supplies drinking water for at least some of the town's residents and supports a series of surface water impoundments from which irrigation water is diverted into a creek that flows eastward. The creek passes under Highway 73, through Stagecoach Inn State Park, under 1540 N, and then flows through the southern portion of Fairfield. The creek ultimately discharges into "The Sinks," a set of ponds near the central low point of Cedar Valley, located approximately 2.5 miles east southeast of Fairfield. In 2005, water samples were collected at four locations: Big Spring Pond, Utah County right-of-way below Big Spring, Utah County right-of-way southeast of Fairfield, and just north of the Latter-day Saint (LDS) church farmhouse. The location of each sample is shown in Figure 1, Appendix A. Surface water sampling of Big Spring Pond discovered arsenic levels of 15 µg/L (UDEQ 2006),
with arsenic levels in the other three locations of 19.6, 35.6, and 40.1 µg/L, respectively.

Further sampling during 2009 did not result in similar elevations in these areas. In addition, routine testing of Big Spring between 1979 and 2005 has detected arsenic at a maximum level of 1.2 micrograms per liter (µg/L); a concentration well below the EPA recommended maximum contaminant level (MCL) of 10 µg/L (UDEQ 2010; ATSDR 2004a).

In response to a call from the Mayor of Fairfield in 2008, UDEQ performed surface water sampling at seven additional locations along the Highway 73 ditches from Manning Canyon Road to 1540 N in Fairfield. All samples were delivered to DataChem Laboratories in Salt Lake City and analyzed for total metals and mercury. Sample locations are shown in Figure 1, Appendix A, with corresponding arsenic values tabulated in Table 2. Arsenic levels ranged from 20-9,000 µg/L. Thallium levels ranged from 1.6-570 µg/L (EPA 2008). Several samples had elevated levels of other metals, including mercury, chromium and lead (see Table 2, Appendix A for complete list). Only those that had concentrations above CV were discussed further in this document.

Groundwater Sampling
START Team 2, under the direction of EPA, analyzed groundwater samples collected by the Bureau of Reclamation (BOR) between November 1999 and February 2000. In total, nineteen water samples were collected and analyzed for metal concentrations. One group of seven water samples was collected in December 1999, and another group of twelve water samples was collected in February 2000. Water samples were collected from Big Spring Creek along the south edge of Fairfield, and from numerous wells in the Fairfield area. These samples were submitted for laboratory analysis of the 23 Target Analyte List (TAL) metals and mercury by EPA SW-846, Methods 6010 and 7471, respectively. The arsenic content ranged from <3.28 µg/L to 8.0 µg/L (see Table 3, Appendix B). None of the water analysis results exceeded the risk-based screening levels.

A current sampling of the groundwater is needed to not only confirm the presence of arsenic, but also determine concentrations trends in order to effectively determine potential health effects.

Soil Sampling
The most comprehensive soil sampling of the site was completed in 1999-2000 by START and included several hundred samples from the town of Fairfield and the surrounding area.

Prior to sampling, properties were divided into a number of zones, depending on property size and layout. Moderately sized properties (e.g., 200 feet by 200 feet) were divided into two zones, and larger properties were divided into as many as 20 zones. A five-point composite sample was collected from each zone by combining surface soil (0 to 2 inches deep) from five separate locations into one sample container. The five composite sample locations were at the four corners and middle of each zone. In addition, three depth samples were typically collected from a single location near the middle of each zone at depths of 6 inches, 12 inches, and 18 inches. Background samples were collected approximately three miles northwest of Fairfield at approximately 1800 feet east and 400 feet north of the southwest corner of Section 7, T. 6 S., R. 7 W. Surface soil samples were collected using decontaminated stainless steel spoons or disposable plastic spoons. All samples were labeled with the letter F for Fairfield, a three digit property number assigned by URS Operating Services (UOS), the letter Z and one or two digits for the zone number, the letter C for surface composite or D for depth samples, and two digits identifying sample depth.

Sampling locations were grouped into three categories, depending on land use: 1)vacant properties, 2)building or home on property that is close to a roadway, or 3)close proximity to a body of water (stream, river or waterway). Of samples in the first category, those properties which were vacant at the time of testing, 75% had arsenic levels above the CV of 20 ppm (ATSDR 2004b). In the second category, 61% tested above the CV for arsenic. Seventy-nine percent of samples from the third category taken tested above the CV. Sample analytical results are found in Table 4, Appendix B)

Samples from two residential properties in the Town of Fairfield in 1999 contained arsenic in the soil that exceeded 500 milligrams ppm and therefore met the EPA requirement for emergency removal action (480-570 ppm). The larger lot encompasses about five acres and is located in the southeast corner of the northern contaminated area. Composite sampling showed a maximum concentration of 1300 ppm. The second property covers a slightly smaller area and is located at the extreme southeast edge of the southern contaminated area. Confirmatory sampling showed arsenic at 610 ppm. The two properties were remediated during the summer and fall of 2000, with backfilling and reseeding complete in October 2000 (EPA 2000b; 2000c).

In connection with the START sampling of privately owned properties in Fairfield, three potato samples were collected from a garden with known arsenic contamination. Potato samples were divided into three groups representing different consumption scenarios including washed and peeled, washed and unpeeled, and unwashed and unpeeled. Evaluation of this data by an EPA toxicologist with the assumption that these potatoes would comprise 25% of a person's diet identified that the washed and peeled and washed and unpeeled potatoes would result in a cancer risk below EPA's level of concern (EPA 2000a). It should be noted, however, that exposure from ingestion of these potatoes can incrementally increase body burden and risk if arsenic exposures from other sources are occurring and are significant.

In July 2005, the DERR conducted soil testing at six locations in and along roads in Fairfield using a portable XRF device. Arsenic levels ranged from less than 25 ppm to 6,900 ppm. A city map with sampling locations and results is shown in Appendix A, Figure 2.

On December 12, 2006 and under the guidance of the EPA, START Team 3 sampled the road base at various locations along W 1540 N and the Allen Ranch Road near Highway 73, collecting a total of 41 samples. A Geoprobe® sampler and hand auger were used to collect chip seal, blacktop, and soil samples up at 6, 12, 18 and 24 inches of depth. All of the road base material samples were subsequently analyzed for metals by START personnel using an x-ray fluorescence (XRF) instrument. All locations contained arsenic concentrations at some depth and amounts ranged from ND (non-detect) to 7,620 ppm (see Table 5 for analytical results) (UOS 2007b).

Air Sampling

EPA Region 8 contracted with the START Team 3 to collect airborne dust samples to determine if fugitive dust contained arsenic at levels high enough to pose a possible health risk through mobilization into air by winds and traffic in the summer of 2005. All samples were collected using DataRam units placed in fields using a Global Positioning System (GPS) navigation device (sample locations are shown in Figure 3 of Appendix A). Each unit was monitored throughout the day to prevent tampering, observe field conditions, and ensure the units were functioning correctly. At the end of the day, the total operating time and time weighted average dust concentrations were recorded for each unit. Filters remained in the units until the end of sampling to ensure that a sufficient sample volume was collected for analysis. (UOS 2005) As a result, total run times varied. Both total run times and sample volumes are shown in Table 6, Appendix B. Following the sample collection, 12 filter cassettes samples were sent via FedEx to Paragon Analytics for analysis.

All samples were analyzed for total arsenic by acid digestion of the entire filter. The lab reporting limit was 1 microgram (µg) and the method detection limit was 0.00053 µg. Total arsenic levels were non-detect at the reporting level for all samples except one collected over a three-day period, which had an arsenic concentration of 1.1 µg. When divided by the volume of air sampled at the location, the result is 0.3 micrograms per cubic meter (µg/m^3), which is well below the 10 µg/m^3 action level for arsenic (UOS 2007a).

There has been some concern in the community that the samples collected during this period are not representative of actual exposure, especially in spring and fall when the agricultural fields adjacent to Manning Canyon are plowed, resulting in an excess of dust that blankets the town. In order to address this concern, EEP will work with EPA and UDEQ to collect additional air samples for analysis to fully evaluate this pathway.

DISCUSSION

Nature and Extent of Contamination

Initial sampling of the Manning Canyon site in 1997 revealed high levels of arsenic. The source of the contamination was identified as leftover tailings from the Manning Canyon Mill. During gold extraction, a cyanide solution is used to leach out the gold, leaving behind fine-grained tailings. Since gold-rich ore deposits often also contain arsenic compounds, leftover tailings may pose a health risk if not properly contained. In the case of the Manning Canyon Mill site, containment of the tailings was not maintained, allowing flooding and spring runoff to erode the tailings pile over several decades, gradually carrying arsenic-laden sediments downgradient toward Fairfield. Although the former mill site was remediated in 2001-2004, tailings had already been migrating down the canyon for many years, resulting in contamination of land beyond the remediation area and within the Fairfield town limits.

Detections of arsenic in the Fairfield town area were first noted in 1999, with elevated levels found along the north and south drainage ditches and in the adjacent grain fields. High concentrations were also detected in the soil of two residential properties, which were remediated the following year. In 2006, additional soil sampling of fields along the town roads and Big Spring Creek was conducted by UDEQ to determine the boundaries of the contaminated areas. Available data suggest that substantial contamination exists at the terminal drainage settling areas to the north and south of Big Spring Creek. It should be noted that these areas are not connected to the flow of Big Spring Creek. Settling to the north of Big Spring Creek has resulted in surface contamination of approximately 140 acres, with concentrations up to 2,300 ppm, with tailings flowing through the Highway 73 culvert and following the ephemeral drainage pathway for about 1.2 miles eastward along 2000 North. Contamination on the south side, however, is more severe and covers about 70 acres. A pooling effect has created a concentrated deposit of arsenic at the junction of the south drainage ditch and Highway 73. Arsenic contamination has been washed further northward along the drainage channels on either side of Highway 73. Additional soil testing conducted in April of 2009 suggests that areas of contamination remain at varying soil depths with concentrations of up to 1300 ppm.

Several private wells were tested by the EPA in 1999 and 2000, but none had arsenic levels above the 10.0 µg/L MCL (EPA 2000b). Likewise, Big Spring Pond was tested in 2005 and determined to not be contaminated (UDEQ 2010). Surface water from Big Spring Creek tested in 2005 also found levels well below the arsenic MCL (UDEQ 2010). However, more recent sampling in 2008 determined that, during periods of ephemeral stream flow, ditches alongside Highway 73 can contain surface water and sediment concentrations of arsenic up to 9,000 ppb (see Appendix B, Table 2) (EPA 2008). At the junction of Highway 73 and 1540 North in Fairfield, contaminated sediment from these ditches mixes with Big Spring Creek and is dispersed about 250 yards eastward along this channel. This location is downstream from the source of Fairfield's drinking water.

Several air samples were collected throughout the Fairfield area in 2007, none of which contained arsenic over the action level of 10 µg/m^3 (see Appendix B, Table 6). Additional air sampling has been requested during periods of elevated dust levels, such as during plowing or ORV use on private property to the west of the town.

Exposure Pathways Analysis

To determine if nearby residents, visitors, and workers are exposed to contaminants related to a site, ATSDR evaluates the environmental and human components that lead to human exposure. An exposure pathway consists of five elements (ATSDR 2005):

(1) A source of contamination;
(2) Transport through an environmental medium;
(3) A point of exposure;
(4) A route of human exposure; and
(5) A receptor population.

ATSDR categorizes an exposure pathway as either *completed, potential, or eliminated*. In a *completed* exposure pathway, all five elements exist and indicate that exposure to a contaminant has occurred in the past, is occurring, or will occur in the future. In a *potential* exposure pathway, at least one of the five elements has not been confirmed, but it may exist. Exposure to a contaminant may have occurred in the past, may be occurring, or may occur in the future. An exposure pathway can be *eliminated* if at least one of the five elements is missing and will never be present (ATSDR 2005).

When an exposure pathway is identified, CV for air, soil, or drinking water are used as guidelines for selecting contaminants that require further evaluation (ATSDR 2005). To protect susceptible populations, the CV for children are used when available.

There are two main routes of exposure identified at the Manning Canyon/Fairfield site. The first is the soil pathway (residential and non-residential), particularly in those areas that have structures (i.e., homes or other buildings) on them, as this is where the highest arsenic exposure would be expected. The second is the surface water pathway; exposure to arsenic and thallium could result from incidental ingestion in children playing in ditches with contaminated waters.

The ambient air pathway is another pathway of concern; however, additional samples are needed to better quantify exposure and thus evaluate health risks.

Completed Exposure Pathways

Residential Soils: past, present, and future exposure

In the town of Fairfield, concentrations of arsenic are above CV in residential soils; therefore, exposure to the community is likely, depending on how the soils are used (e.g. if residents plant vegetable gardens and consume the vegetables) and the concentrations of contaminants in each specific residential soil. Using this information, all five elements have existed in the past, may currently exist and have the potential to exist in the future for Fairfield residents with arsenic concentrations in soils surrounding their homes and businesses:

Exposure element	Manning Canyon/Fairfield
1) A source of contamination……………….....	Manning Canyon Site
2) Transport through environmental medium...	migration of arsenic through soil from canyon onto residential properties
3) A point of exposure………………………..	contact with contaminated soil in yards or food grown in contaminated soil
4) A route of human exposure…………….….	ingestion through food grown in soil and inhalation of dust
5) A receptor population……………………...	residents in contaminated area

Future exposure to arsenic may also occur in an unknown number of areas where currently no structural buildings or homes exist. It is the intent of the community to grow. If these contaminated areas are sold and homes and buildings constructed, then the exposure from the arsenic concentrations in the soil would be a possible pathway of exposure. At the time these parcels are sold and construction begins, additional sampling and review would be needed to determine the number of new residents affected through contaminated soil.

Surface Water: past, present, and future exposure

Potential exposures from the surface water pathway cannot be excluded because there are a variety of small streams that run adjacent to the Manning Canyon land. Surface water, as defined by UDOH, includes any body of water that is accessible at any time of year without excavation. Migration of contaminants into surface water has occurred; sampling conducted has shown that the surface water, including seasonal accumulation in ditches, has been contaminated with arsenic and thallium above CV. A route of human exposure and the exposed population may include children playing in the stream and ditches during the summer months.

Exposure element	Manning Canyon/Fairfield
1) A source of contamination...........................	Manning Canyon Site
2) Transport through environmental medium...	migration of arsenic and thallium through canyon during spring run-off into surface water of ditches
3) A point of exposure.....................................	contact with water in contaminated ditch water
4) A route of human exposure..........................	incidental ingestion of contaminated water
5) A receptor population..................................	children playing in ditches

Estimated exposure doses and the health effects associated with exposure to arsenic and other potential contaminants will be discussed in the "Exposure Dose Estimates and Toxicological Evaluation" section of this document.

Potential Exposure Pathways

Non-Residential Soil: future exposure

Currently, the only completed pathways are those where people are exposed to arsenic in soil from areas where homes or buildings are constructed. However, there are also parcels of land without buildings or homes where high concentrations of arsenic have been detected in the soil. If these parcels are sold and homes are buildings constructed upon them, there is the potential for exposure to the community. Using this logic, two pathway elements currently exist for soil: 1) the source of contamination (migration of contamination from Manning Canyon) and 2) its transport through an environmental medium (soil). Additional samples will need to be taken if and when these parcels are sold and construction begins to assess the exposure and determine the potential for the additional three exposure elements may exist in the future.

Exposure element	Manning Canyon/Fairfield
1) A source of contamination............................	Manning Canyon Site
2) Transport through environmental medium..	migration of arsenic in soil from canyon onto non-residential properties
3) A point of exposure......................................	unknown at present
4) A route of human exposure..........................	unknown at present
5) A receptor population...................................	unknown at present

Ambient Air: past, present and future exposure

When winds are heavy in the Manning Canyon area, dry top soil has the potential to move in the form of dust, moving the contaminants into ambient (outdoor) air in the form of fugitive dust. The highest potential for the creation of dust is in the arid summer months and during plowing of fields adjacent to the mill site (spring and fall). It is at these times that contaminants become airborne and nearby residents and workers may be exposed by breathing contaminated ambient outdoor air.

A limited amount of sampling has occurred, which showed that the concentrations of arsenic in the air of Fairfield do not pose a significant health risk to residents during the kinds of conditions present at the time of sampling. However, due to the time of year when the original sampling was performed, additional sampling needs to occur in order to effectively evaluate this pathway. If sufficient levels of arsenic are found to be present in the dust, it is plausible that ambient air contamination exists. Therefore, without further sampling data only two elements of this pathway have been confirmed, 1) the source of contamination (airborne arsenic that originated from contaminated soil) and 2) its transport through an environmental medium (air). The other three elements may exist in the future, following completion of adequate sampling, should it occur.

Exposure element	Manning Canyon/Fairfield

1) A source of contamination............................Manning Canyon Site
2) Transport through environmental medium.. ambient air/fugitive dust
3) A point of exposure...................................... unknown at present
4) A route of human exposure.......................... unknown at present
5) A receptor population.................................. unknown at present

Eliminated Exposure Pathways

Remediated Residential Soils: past exposure

Due to the detection of arsenic concentrations in two residential properties west of Highway 73 that exceeded the threshold range for immediate and substantial danger to humans (480-570 ppm), a removal action was initiated by EPA to remediate these two properties. The properties were evaluated for their soil arsenic concentrations. The highest levels of arsenic (1300 ppm) were located in the larger property where at least 700 pounds of potatoes were harvested in 1999. Remediation efforts on this property focused on the immediate areas surrounding the house (Zones 2 and 3), where the majority of exposure would occur. Removal of the soil to a depth of 12 inches was completed in Zone 2 (the property where the house is located) while soil was removed to variable depths (up to 18 inches) in the garden area of Zone 3. The contaminated soils from these areas were excavated and replaced with clean soils.

In the area surrounding the garden of the second property, arsenic in soils was found at a concentration of 610 ppm and the top 18 inches of soil was excavated and replaced with clean soil as well (EPA 2000b; 2000c).

These two properties now represent an eliminated exposure pathway, as at least one of the five required elements has been remediated and will never be present, effectively eliminating exposure.

Exposure element	Manning Canyon/Fairfield
1) A source of contamination.................................	Manning Canyon Site
2) Transport through environmental medium.........	migration of arsenic through soil
3) A point of exposure...	eliminated at present
4) A route of human exposure................................	eliminated at present
5) A receptor population..	eliminated at present

Public Health Implications

Levels of contaminants that exceed comparison values will not necessarily cause adverse health effects upon exposure. The potential for exposed persons to experience adverse health effects depends on many factors, including:

(1) The amount of each chemical to which a person is or has been exposed;
(2) How long a person is exposed;
(3) The route by which a person is exposed (inhalation, ingestion, or dermal absorption);
(4) The health condition of the person;
(5) The nutritional status of the person; and

(6) Exposure to other chemicals (such as cigarette smoke or chemicals in the work place).

The public health implications of the arsenic contamination at the site will be better understood following a thorough toxicological evaluation of the sampling data.

Evaluation Process

EEP will examine the types and concentrations of each chemical of concern for each media type (soil, groundwater, air, etc.) in which the chemical was measured. ATSDR and EPA CV will then be used to screen for chemicals of concern that would warrant further evaluation for a possible risk to human health. Comparison values are media-specific concentrations of contaminants that can be reasonably assumed to be harmless when assuming default conditions of exposure. These values are generally conservative concentrations used to ensure the protection of sensitive populations, most notably pregnant women and developing children. Values of contaminants that exceed the CV do not indicate that a health risk exists; it merely indicates that further evaluation is required for these chemicals.

Exposure Dose Estimates and Toxicological Evaluation

The primary contaminant of concern for the Fairfield/Manning Canyon site is arsenic. However, mercury and thallium were also concerns of the community, as determined by the Needs Assessment (see Appendix E). Since these chemicals are present at concentrations that may be of potential health concern for adults and children residing or working in the area, appropriate actions to protect human health need to be taken. Ingestion of surface water contaminated by arsenic may be occurring at the present time. Exposure doses for children and adults are calculated and reported below.

For present and future exposure, incidental ingestion of surface water and sediment from contaminated drainage canals is the most likely exposure pathway. Other potential exposure pathways include soil ingestion, inhalation of ambient air or dust, and consuming food grown in contaminated soil. The completed and potential pathways described above will be assessed using exposure doses calculated from the highest arsenic levels found associated with each pathway. Exposure doses are then compared with health guidelines. These guidelines are conservative health-protective values that have been developed using human exposure data when it is available from scientific literature. When human data is not available, animal exposure data is used. Health guidelines used in this report include ATSDR's MRL and EPA's Reference Doses (RfDs). Exposure doses that are lower than the MRL or RfD are considered to be without appreciable risk to human health. When a calculated exposure dose exceeds the health guidelines, the exposure dose is then compared to values from individual studies documented in scientific literature that have reported health effects. These values may be No Observable Adverse Effect Levels (NOAEL) or Lowest Observable Adverse Effect Levels (LOAEL). If a contaminant has been determined by the scientific literature to be cancer causing (carcinogenic), a cancer risk is also estimated (ATSDR 2005). The calculations for determining exposure dose for oral ingestion can be found in Appendix C.

Arsenic

Arsenic is a naturally occurring odorless, tasteless element widely distributed in the earth's crust in the form of inorganic compounds and is used industrially as a wood preservative (ATSDR

2008b). Organic arsenic compounds, such as those used as pesticides on cotton fields and orchards, may also be present in the environment. Arsenic enters drinking water supplies from natural deposits in the earth or from agricultural and industrial practices. Exposure to arsenic can occur by ingesting small amounts present in food and water, by breathing air containing arsenic, working in a job that involves arsenic production or use, or living in an area with unusually high natural levels of arsenic in rock (ATSDR 2008b). ATSDR derived a chronic non-cancer oral MRL of 3.0×10^{-4} mg/kg/day[1] for inorganic arsenic by dividing the identified chronic NOAEL of 8.0×10^{-4} mg/kg/day (obtained from human epidemiologic studies) by an uncertainty factor of three to account for the lack of data on reproductive toxicity and to account for some uncertainty as to whether the NOAEL accounts for all sensitive individuals.

Inorganic arsenic is a known carcinogen. Arsenic has been linked to cancer of the bladder, lungs, skin, kidneys, nasal passages, liver and prostate (ATSDR 2008b). Non-cancer effects of exposure to arsenic include thickening and discoloration of the skin, stomach pain, nausea, vomiting, diarrhea, numbness in hands and feet, partial paralysis and blindness (ATSDR 2008b). An investigation of cancer incidence in the Fairfield area was not completed due to an absence of census information for the newly incorporated town. Due to the difficulty in detecting an increased cancer rates for such a small population, only the known number of cancer incidences in the Fairfield area will be reported in this document (see Cancer Incidence).

Exposure doses were calculated for both children and adults and compared to ATSDR's MRL. The MRL is considered an estimate of the daily human oral exposure to arsenic that is likely to be without appreciable risk or adverse non-cancer health effects. Calculations take into account an expected dermal absorption rate of less than 1 percent. Bioavailability of local arsenic deposits has not been studied, thus, a conservative estimate of 95% was used in the calculations.

According to sampling results, the highest concentration of arsenic on properties where buildings currently exist or which are in close proximity to roads is 6900 mg/kg. It should be noted that of the three samples at this concentration, two were along Highway 73 outside of Fairfield, and the third was found in road base samples taken on Highway 73 that were six inches below the asphalt layer. As this roadway is currently paved, contamination is capped and therefore the risk of exposure is low at this time. However; site visits found several areas of Highway 73 that had large potholes, indicating a breach in the containment of arsenic. The city of Fairfield is responsible for the maintenance of Highway 73. As of August 17, 2011, this stretch of Highway 73 is now in good repair. It is our recommendation that this stretch of road remain well-maintained.

Exposure doses were calculated for this concentration as it is possible that this exposure could occur in the future. Incidental soil ingestion rates were estimated at 100 and 200 milligrams per day for adults and children, respectively. Based on these rates, maximum exposure doses for accidental ingestion and absorption of contaminated soil were calculated to be 9.9×10^{-3} mg/kg/day for adults and 8.6×10^{-2} mg/kg/day for children. These exposure doses are well above the chronic oral MRL for arsenic exposure, which is set at 3.0×10^{-4} mg/kg/day, and the acute oral MRL, which is set at 5.0×10^{-3} mg/kg/day. Exposure doses do not, however, exceed

[1]Milligrams of contaminate exposure per kilogram of body weight per day

the LOAEL for gastrointestinal effects (i.e., nausea, diarrhea and abdominal cramps) from an intermediate exposure (0.05 mg/kg/day) (Mizuta et al. 1956; Franzblau and Lilis 1989). Therefore, in children and adults who are prone to ingest soil at a rate of at least 100 mg/day, the potential for adverse health effects (i.e., effects to gastrointestinal system) exists on properties with elevated arsenic concentrations in soil, especially if exposure occurs more frequently (on a daily instead of weekly basis).

The excess risk of cancer from exposure to a chemical is described in terms of the chance that an exposed individual will develop cancer because of that exposure by age 70 (EPA 2011). For each contaminant of concern, excess cancer risk is calculated from the daily exposure dose of the chemical from the site averaged over a lifetime (ED) and the slope factor (SF) for the chemical, as follows:

$$\text{Excess Cancer Risk} = ED \times SF$$

In general, excess cancer risks that are below about 1 chance in 1,000,000 (1×10^{-6}) to be so small as to be negligible, and risks above 1 chance in 10,000 (1×10^{-4}) to be sufficiently large that some sort of remediation is desirable. Excess cancer risks that range between 1×10^{-6} and 1×10^{-4} are generally considered to be acceptable. For example, a theoretical cancer risk of 2×10^{-6} indicates the possibility of an excess of two cancer cases in a population of one million due to an exposure.

An excess cancer risk from the highest exposure dose to arsenic in soil was calculated for both children and adults using the most conservative exposure duration to mimic risk. The excess cancer risk was determined to be 5.7×10^{-2} and 6.6×10^{-3} for children and adults, respectively. Both cancer risks for children and adults exceed the acceptable range, indicating that the amount of arsenic potentially swallowed through incidental ingestion of soil is associated with an increased risk of developing cancer by age 70. It must be noted, however, that this concentration was along a roadway that is currently considered capped by asphalt but is slowly degrading. Should the road surface continue to break down, the potential for exposure, as well as excess cancer risk could occur. Due to this increased risk, it is recommended that the potential for exposure to the arsenic contaminated soils, especially at this location, be reduced or eliminated.

The highest concentration of arsenic on vacant properties that are privately owned is 2,800 mg/kg. The highest concentration of soil arsenic on properties which border drinking water sources is also 2,800 mg/kg. Because these properties may eventually be developed, future exposure to Fairfield residents is possible and exposure doses for accidental soil ingestion were calculated. Based on ingestion rates of 100 and 200 mg/day for adults and children, maximum exposure doses were calculated to be 4.0×10^{-3} mg/kg/day for adults and 3.5×10^{-2} mg/kg/day for children, both well above chronic and oral MRL for arsenic exposure. Therefore, there is a significant risk to human health if these properties are not properly remediated before development and occupation.

Due to the seasonal nature of the standing surface waters that occur in the first 700 feet of Big Ditch Creek east of highway 73, we have estimated a liberal potential exposure dose to residents during this period. The arsenic exposure dose for residents through incidental ingestion of 45 mL of contaminated ditch water and sediment for three hours per day, twenty times a year was calculated to be 3.85 x 10^{-5} mg/kg/day for children. This exposure dose is less than the MRL for arsenic exposure (3 x 10^{-4} mg/kg/day); therefore current sampling of surface water indicates that the risk for health effects is low for children accidentally consuming this water while playing in the canals (ATSDR 2005).

The analysis of arsenic in fugitive dust/ambient air resulted in one sample with a detected value (0.3 µg/m^3) above the CREG value (0.0002 µg/m^3) but not above the action value (10 µg/m^3). Exposure to arsenic by this route could potentially result in an adverse health effect. However, since additional air samples are currently being collected and analyzed by EPA, a comprehensive evaluation of adverse health effects, if they exist, will be discussed at that time.

Mercury

Mercury was not a contaminant of concern during sampling but was found to exceed comparison values for children (Appendix A, Table 2). In addition, mercury was listed as a concern in the community needs assessment.

Mercury is a shiny, silver-white, odorless liquid that, when heated, evaporates into a colorless, odorless gas. The largest sources of inorganic mercury in the environment are mining ore deposits, burning coal and waste, and manufacturing plants. Mercury is also found in thermometers, dental fillings, batteries, and cosmetic and antiseptic creams.

Human exposure to mercury occurs mainly through drinking contaminated water, breathing vapors in air from spills or incinerators, or breathing contaminated workplace air. Mercury in a mother's body may pass transplacentally to a fetus or to an infant through breast milk, causing such harmful effects as brain damage, mental retardation, seizures, and inability to speak (ATSDR 1999).

Although human cancer data are inadequate for establishing a relationship between mercury exposure and cancer, the EPA has determined that mercuric chloride and methylmercury are possible human carcinogens. The EPA established an MCL for mercury in drinking water of 2 ppb.

Exposure doses for ingesting surface water contaminated with mercury at the highest concentration detected during sampling were estimated for children, who could be exposed while playing in the ditches during runoff. Based on the highest concentration of mercury measured during sampling (33 µg/L), exposure doses for children were calculated at 2.1 x 10^{-8} mg/kg/day. The MRL for mercury is 6.8 x 10^{-3} mg/kg/day. Therefore, due to the fact that the mercury exposure dose is well below the established MRL value, no adverse health effects are likely at the mercury concentrations found in surface water samples.

Thallium

Although thallium was not a contaminant of concern initially, and was not found to exceed comparison values in many of the samples collected and analyzed, it was listed as a contaminant of concern in the community needs assessment and was therefore discussed in this section to address the concern of the residents of Fairfield.

Pure thallium is a bluish-white, odorless, tasteless metal that occurs in trace amounts in the earth. It is used industrially in the manufacture of electronic devices, switches and closures for the semiconductor industry, as well as in the manufacture of special glass and certain medical procedures. The United States ceased producing the metal in 1984.

Thallium enters the environment primarily from coal-burning and smelting, and is resistant to degradation. It is absorbed by plants and becomes more concentrated as it moves up the food chain. Human exposure to thallium occurs mainly through eating food contaminated with thallium, breathing contaminated workplace air, living near hazardous waste sites, or smoking cigarettes. Children with pica habits may also be exposed to high concentrations of thallium through contaminated soil. Harmful health effects such as vomiting, diarrhea, hair loss, and effects on the nervous system, lungs, heart, liver and kidneys are known to be associated with thallium ingestion (ATSDR 1992).

No human or animal studies are available which document carcinogenic effects of breathing, ingesting or touching thallium; it has therefore not been classified as to its carcinogenicity. Likewise, there is no MRL for thallium. The EPA designated maximum contaminant level (MCL) for thallium in drinking water is 0.002 mg/L (EPA 1994).

Thallium concentrations recorded from seasonal surface water samples (Table 3) indicates a potential health hazard for children due to incidental ingestion while playing in these areas during periods when surface water accumulation occurs.

Multiple Chemical Exposure Evaluation

The potential for the toxic effects from the chemical mixture interactions of the contaminants found in surface water at the Manning Canyon/Fairfield site were evaluated. The health impact of exposure to chemical mixtures and the potential for combined action of chemicals is a concern and was evaluated using the Hazard Index (HI), which is a summation of the hazard quotients for all chemicals to which an individual has been exposed. To obtain a hazard quotient, calculated exposure doses for individual chemicals are divided by respective MRL or comparison values. If the HI is less than 1.0, it is highly unlikely that significant additive or toxic interactions would occur. If the HI is greater than 1.0, further evaluation is necessary (ATSDR 2005).

If the HI for the chemical mixture at this site is greater than 1.0, the estimated doses for each individual chemical will then be compared to their NOAELs or comparable values. Doses of chemicals that are less than one-tenth of their respective NOAELs are unlikely to contribute to significant additive or interactive effects with other chemicals in the mixture.

Calculations used concentrations of contaminants in water samples gathered in 2008, and included arsenic, barium, chromium, cadmium, mercury and thallium. Exposure doses were estimated only for children, since adults are not expected to be incidentally ingesting surface water. A summation of hazard quotients for intermittent, accidental ingestion of surface water resulted in a combined HI of 0.146. Based on the calculated HI, it is unlikely that significant additive or toxic interactions would occur from occasional contact with ephemeral ditch water on either side of Highway 73.

Cancer Incidence

The EEP did not conduct an investigation of cancer incidence in the Manning Canyon/Fairfield area because the town was incorporated in 2004 and has not yet been represented as a separate community for census purposes. Furthermore, during the period 2003-2007, less than twenty cases of cancer were diagnosed within the Fairfield municipality. Accurate cancer incidence calculations are therefore not possible at this time. Still, cancer effects may exist within the site boundaries and will be evaluated by the UDOH once comprehensive data is available.

CHILD'S HEALTH CONSIDERATIONS

ATSDR recognizes that the unique vulnerabilities of infants and children demand special emphasis in communities faced with contamination of their water, soil, air, or food. Children are at a greater risk than are adults from certain kinds of exposures to hazardous substances emitted from waste sites and emergency events. Children are more likely to be exposed because they play outdoors and because they often bring food into contaminated areas. They are more likely to come into contact with dust, soil, and heavy vapors close to the ground. Due to their larger surface area to body weight ratio, children are more vulnerable to toxicants absorbed through the skin. Furthermore, the developing body systems of children can sustain permanent damage if toxic exposures occur during critical growth stages.

In the community of Fairfield, children are generally at higher risk of exposure to contaminated soil and water. Not only will children ingest, inhale and absorb a higher dosage of arsenic and thallium from the environment as a result of their daily activities, but they are also more susceptible to the adverse health effects resulting from such exposure. Recommendations for action are therefore focused first on children and aimed at reducing overall chronic exposure to these contaminants.

COMMUNITY HEALTH CONCERNS

The EEP conducted a Needs Assessment in 2009 to evaluate the public health concerns associated with contaminated water, soil and air within the town of Fairfield from the Manning Canyon/Fairfield site in Fairfield, Utah. As part of the process, the EEP staff conducted various site visits, attended town meetings, and distributed a survey. The goal of the needs assessment was to document and respond accordingly to community questions and concerns regarding the site.

The results of the community needs assessment have been compiled and are presented in this document (see Appendix E). The community will have another opportunity to express concerns during any educational activities held in the community (i.e., public forums and meetings) as well as during the public release of this document, which requires a public comment period.

CONCLUSIONS

In the small community of Fairfield, UDOH's purpose is to serve the public by using the best science, taking responsive public health actions and providing trusted health information to the public to prevent people from residing in close proximity to hazards and coming into contact with harmful toxic substances.

Surface Water
The EEP concludes that the accidental ingestion that occurs when playing and swimming in the contaminated ditches could harm children's health. The EEP further notes that the water in these ditches, though contaminated with thallium levels deemed hazardous, are seasonal and therefore the health risks associated with thallium exposure is only relevant during times when these ditches fill with water. Therefore, it is recommended that parents reduce children's exposures in surface water by reducing or eliminating the duration that children play in the contaminated ditches.

Soil Pathway
Both the residential and non-residential soil pathways have the potential to adversely affect the health of residents or visitors exposed to the high arsenic concentration found in the soil. The highest arsenic soil concentrations were found in non-residential soils, and exposure doses were calculated to estimate likely exposure if these areas were developed for residential or commercial use. When concentrations for both residential and non-residential soils were evaluated to estimate exposure doses for the population, both doses exceeded chronic MRL values for arsenic, representing the potential for significant health risks to those exposed as well as a public health hazard. The ingestion of arsenic directly through contaminated soil increases the risk of developing cancer in the future and therefore prolonged exposure in either residential or non-residential settings should be minimized or eliminated.

The EEP concludes that inhalation of arsenic may occur during arid periods when the wind picks up dry top soils and carries it in dust as well as during plowing of fields adjacent to the town of Fairfield. Although data has been collected for this pathway, additional seasonal sampling is needed to adequately evaluate this pathway as to its risk to the community. Because of the lack of data currently available, the information needed to make a decision is not available at this time. The EEP will collaborate with EPA and UDEQ in the event that additional samples are collected and analyzed for contaminants. In order to reach a health based conclusion, the EEP needs additional ambient air and fugitive dust samples to be collected during times when increased dust is prevalent (i.e. during plowing season). In the interim, the following actions are being taken:

- Residents with respiratory health concerns should not engage in strenuous outdoor activities (i.e., exercising, gardening) during windy conditions when dust is present or likely.
- Coordinate with EPA and UDEQ to perform additional air sampling during active field plowing to better quantify levels of exposure and whether these levels result in an increased health risk to the community.

RECOMMENDATIONS

Based upon EEP's review of the Manning Canyon/Fairfield soil, surface water and air data and the concerns expressed by community members, the following recommendations are appropriate and protective of the health of residents in the community. Based on the conclusions of this report, the EEP recommends the following public health protective action:

Surface Water

- Reduce children's exposure to thallium in surface water by limiting the duration that children play in the contaminated ditches.

Residential Soil

- Reduce exposure to residential soil in yards by coordinating with EPA and UDEQ to monitor soil levels.

Non-residential Soil

- Developers of contaminated parcels need to remediate arsenic concentrations to levels below health screening values, especially on land that may be sold in the future for proposed building and growth. In addition, zoning and institutional controls, such as soils ordinance or other land use control imposed by the town of Fairfield, to limit both exposure and risk should be considered.

Ambient Air

- Residents with respiratory health concerns should not engage in strenuous outdoor activities (i.e., exercising, gardening) during windy conditions when dust is present or likely.
- Coordinate with EPA and UDEQ to perform additional air sampling during active field plowing to better quantify levels of exposure and whether these levels result in an increased health risk to the community.

PUBLIC HEALTH ACTION PLAN

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

Public health actions that have been taken at the site include:

- Capping of the tailings ponds to prevent future dam breaches

- Stakeholder agency site visit
- Completion of ATSDR Public Health Assessment
- Public meeting with federal and state agency stakeholders and the community of Fairfield
- EEP conducted a Needs Assessment survey in the community to determine resident concerns
- Additional air samples have been collected and are currently being analyzed by EPA

Public health actions that will be implemented at the site include:

- EEP will participate in a public meeting with other stakeholders and the community to explain the results of the PHA and address any community concerns.
- EEP will make copies of the finalized PHA available to interested residents through various public buildings in Fairfield. Upon finalization, the document will also be able to be accessed electronically through the EEP website at http://health.utah.gov/enviroepi/activities/hha/hhamain.htm.
- EEP will provide continued health education (in the form of fact sheets, flyers and pamphlets) to the community on health effects from contaminant exposure and on ways to reduce or eliminate specific exposures.
- EEP will remain available to address any public health questions or concerns regarding this issue for residents, visitors and the general public following this report’s final release.
- EEP will coordinate with federal and state agencies to ensure additional air samples are collected when activities occur which increase the amount of dust exposure to Fairfield and assess these samples to quantify the risk to human health from exposure.
- EEP will develop baseline rates of outcomes of concern for Fairfield and conduct periodic review of trends of those outcomes to determine if there are increasing rates.

AUTHORS

Report Prepared By:

G. Eli Morey, MPH
Epidemiologist
Environmental Epidemiology Program
Bureau of Epidemiology
Utah Department of Health

Christina R. McNaughton, Ph.D.
Health Hazard Assessment Manager
Environmental Epidemiology Program
Bureau of Epidemiology
Utah Department of Health

Stacey Anderson, MPH
Epidemiologist
Environmental Epidemiology Program
Bureau of Epidemiology
Utah Department of Health

Designated Reviewers:

Jennifer Brown, M.S., J.D.
Director, Bureau of Epidemiology
Utah Department of Health

B. Gregory Williams, MPH
Manager, Environmental Public Health Tracking
Environmental Epidemiology Program
Utah Department of Health

Craig J. Dietrich, Ph.D.
Health Hazard Assessment Manager
Environmental Epidemiology Program
Utah Department of Health

CERTIFICATION

CERTIFICATION

This Public Health Assessment, **Manning Canyon/Fairfield, Utah County, Utah**, was prepared by the Utah Department of Health under a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR). It is in accordance with approved methodology and procedures existing at the time the public health assessment was begun. Editorial review was completed by the Cooperative Agreement partner.

Sam LeFevre
Utah Department of Health, Environmental Epidemiology Program Manager

"This report was supported by funds from a cooperative agreement with the Agency for Toxic Substances and Disease Registry, U.S. Department of Health and Human Services. This document has not been reviewed and cleared by ATSDR."

Jennifer Brown, JD, MS
Utah Department of Health, Bureau Director Bureau of Epidemiology

UTAH APPLETREE
ATSDR's Partnership to Promote Localized Efforts to Reduce Environmental Exposures

REFERENCES

Agency for Toxic Substances and Disease Registry (ATSDR). 2008a. *Toxicological Profile for Cadmium (Update)*. Atlanta: U.S. Department of Health and Human Services. September 2008.

Agency for Toxic Substances and Disease Registry (ATSDR). 2008b. *Toxicological Profile for Arsenic (Update)*. Atlanta: U.S. Department of Health and Human Services. January 2008.

Agency for Toxic Substances and Disease Registry (ATSDR). 2007a. *Toxicological Profile for Barium (Update)*. Atlanta: U.S. Department of Health and Human Services. August 2007.

Agency for Toxic Substances and Disease Registry (ATSDR). 2007b. *Toxicological Profile for Lead (Update)*. Atlanta: U.S. Department of Health and Human Services. August 2007.

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. *Public Health Assessment Guidance Manual (Update)*. Atlanta, Georgia. January 2005.

Agency for Toxic Substances and Disease Registry (ATSDR). 2004a. *Drinking Water Comparison Values (Update)*. Atlanta: U.S. Department of Health and Human Services. June 2004.

Agency for Toxic Substances and Disease Registry (ATSDR). 2004b. *Soil Comparison Values (Update)*. Atlanta: U.S. Department of Health and Human Services. June 2004.

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. *Toxicological Profile for Mercury (Update)*. Atlanta: U.S. Department of Health and Human Services. March 1999.

Agency for Toxic Substances and Disease Registry (ATSDR). 1992. *Toxicological Profile for Thallium (Update)*. Atlanta: U.S. Department of Health and Human Services. July 1992.

Brough, R. Clayton, Jones, Dale L., Stevens, Dale J. 1987. *Utah's Comprehensive Weather Almanac*; Publishers Press, Salt Lake City, Utah.

Bureau of Land Management (BLM). 2008. *Manning Canyon.* U.S. Department of the Interior. Available online at http://www.blm.gov/ut/st/en/fo/salt_lake/more/hazardous_materials/manning_canyon.html. Accessed on 2/23/2011.

Bureau of Land Management (BLM). 2001. *Final Engineering Evaluation/Cost Analysis, Manning Canyon Mill Site.* Ridolfi Engineers Inc., Seattle, WA.

Ford, K. and T. Ingwell. No date. *BLM Manning Canyon Tailings Removal Action*. Denver Federal Center, Denver, Colorado.

Franzblau, A. and R. 1989. Acute Arsenic Intoxication from Environmental Arsenic Exposure. *Archives of Environmental Health* 44(6): 385-390.

Hintze, Lehi F. 1988. *Special Publication 7, Geologic History of Utah*; Brigham Young University.

Mizuta N, Mizuta M, Ito F, Ito T, Uchida H, Watanabe Y, Akama H, Murakami R, Hayashi F, Nakamura K, Yamaguchi R, Mizuia W, Oishi S, Matsumura H. 1956. An Outbreak of Acute Arsenic Poisoning Caused by Arsenic-Contaminated Soy Sauce (Shoyu): A Clinical Report of 220 cases. *Bulletin of the Yamaguchi Medical School.* 4(2-3): 131-149.

United States Department of Agriculture (USDA). 2010. *Web Soil Survey*. Natural Resources Conservation Service Soil Survey Staff, Washington, DC. Available online at http://websoilsurvey.nrcs.usda.gov. Accessed 3/3/2010.

URS Operating Services, Inc. (UOS). 2007a. *Manning Canyon - Fairfield Site - Trip Report. August 2007.*

URS Operating Services, Inc. (UOS). 2007b. *Trip Report, for the Manning Canyon-Fairfield project. February 2007*.

URS Operating Services, Inc. (UOS). 2005. Technical Standard Operating Procedures for the Superfund Technical Assessment and Response Team (START), EPA Region 8. September 2005.

U.S. Census Bureau. 2010. *2008 American Community Survey 1-Year Estimates*. Available online at: http://www.census.gov/acs/www. Last accessed on March 31, 2010.

U.S. Environmental Protection Agency (EPA). 2008. *Sample Report: Fairfield Arsenic/Lead/Mercury Samplings*. Denver, Colorado.

U.S. Environmental Protection Agency (EPA). 2000a. Imminent and Substantial Endangerment to the Health of Residents Exposed to Arsenic in Fairfield, Utah, by Susan Griffin. February 17, 2000.

U.S. Environmental Protection Agency (EPA). 2000b. *Manning Canyon Pollution Report.* Denver, Colorado.

U.S. Environmental Protection Agency (EPA). 2011. Risk Characterization: Excess Cancer Risk. Accessed 3/23/2011 from http://www.epa.gov/region8/r8risk/hh_risk.html#cancer

U.S. Environmental Protection Agency (EPA). 2000c. *Sampling Analysis Report for Fairfield, Utah.* October 19, 2000. Denver, Colorado.

U.S. Environmental Protection Agency (EPA). 1994. Thallium sulfate. EPA Coversheet. Integrated Risk Information System (IRIS). Office of Health and Environmental Assessment, U.S. Environmental Protection Agency, Cincinnati, OH.

U.S. Geological Survey (USGS). 1995. *Ground Water Atlas of the United States: Arizona, Colorado, New Mexico, Utah, HA 730-C.*

Utah County General Election, Official Results 2004. Accessed October 1, 2009. http://www.co.utah.ut.us/Dept/ClerkAud/Elections/ElectRslts/2004_gen/index.htm#1

Utah Department of Environmental Quality (UDEQ), Division of Drinking Water. 2010. *Routine Chemical Analysis Report for WS001 Fairfield Spring 6570, April 14, 2005.*

Utah Department of Environmental Quality (UDEQ), Division of Environmental Response and Remediation. 2006. *Site Inspection Analytical Results Report.* Salt Lake City, Utah.

Utah Division of Natural Resources (UDNR). 2010. Utah State Park Visitation. Available online at: http://stateparks.utah.gov/about/visitation. Last accessed on February 23, 2011.

APPENDICES

APPENDIX A – MAPS OF STUDY AREA

Figure 1. Locations of sampling sites in Fairfield for surface water and soil. Sample dates include December 2000, April 2006 and April 2009.

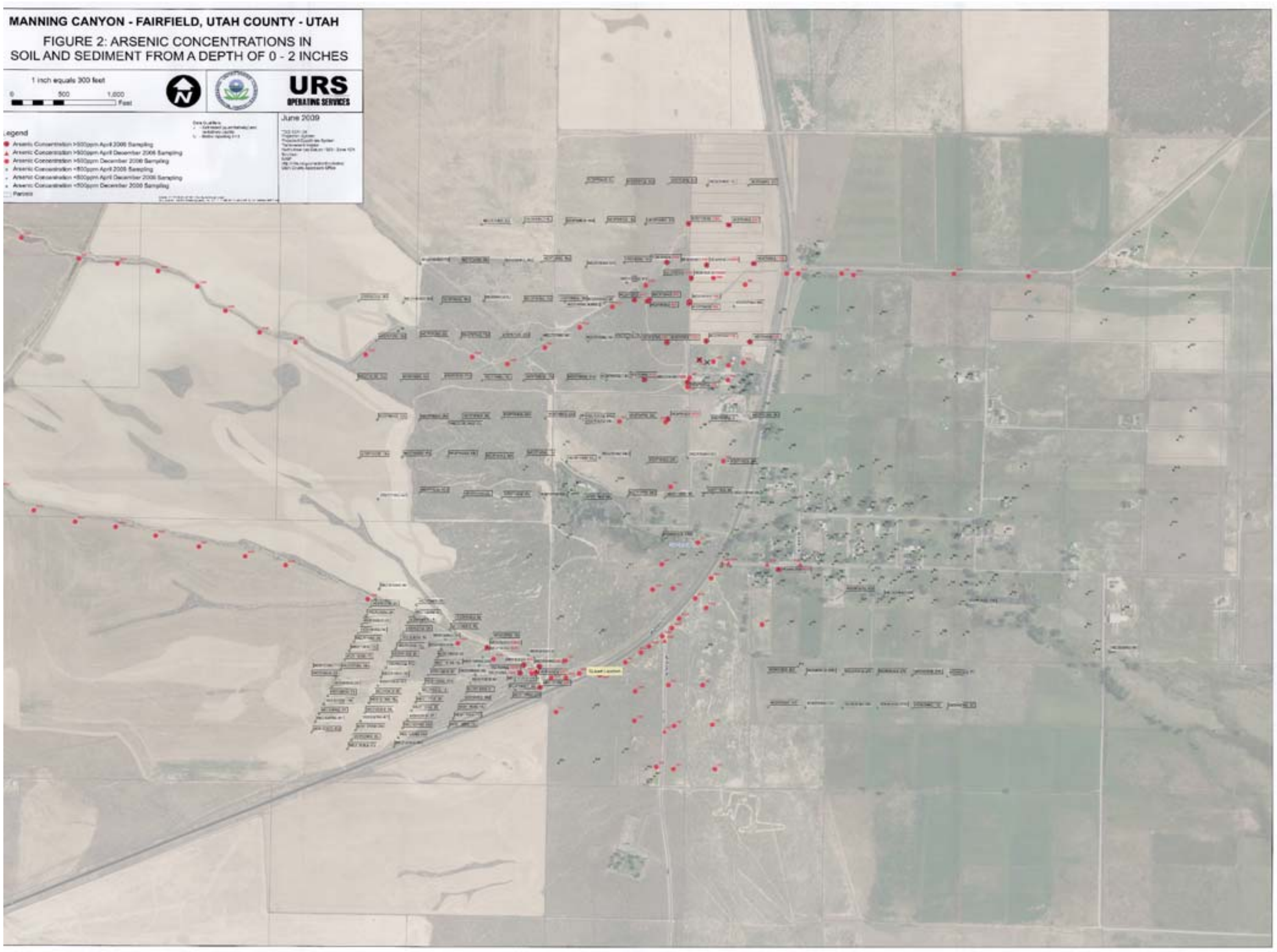


Figure 2. Sampling locations for XRF road base samples collected by UDEQ along roads subject to truck traffic, July 2005.

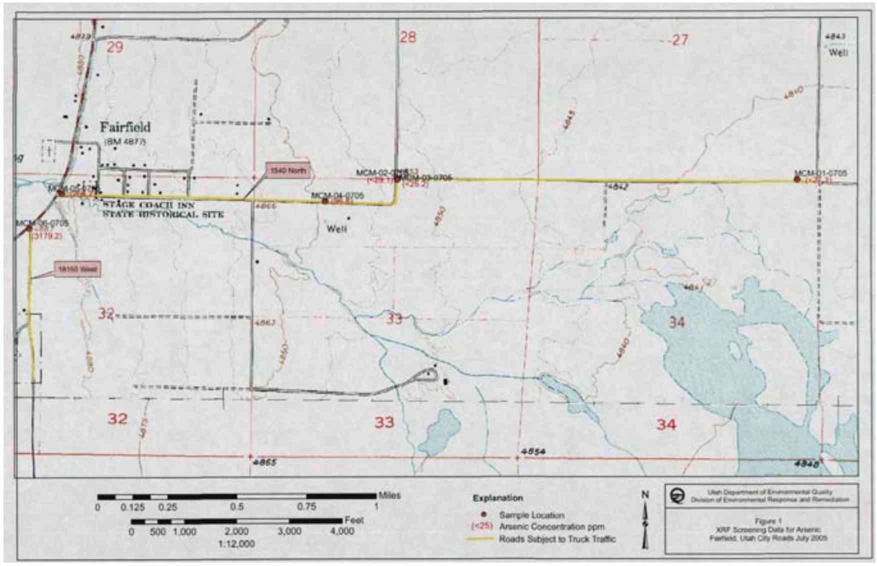


Figure 3. Sampling locations for all fugitive air samples collected by START 3 in August 2007. Arsenic concentrations are tabulated in Table 5

APPENDIX B – TABLES OF STUDY DATA

Table 2. Analytical Results from sesonal, standing surface water samples taken in Fairfield,

February 2008. Values are total metal concentrations and are reported in µg/L (ppb).

Analyte	S1-Fairfield	S2-Fairfield	S3-Fairfield	S4-Fairfield	S5-Fairfield	S6-Fairfield	S7-Fairfield*	Chronic EMEG for children (µg/L)
Aluminum	13,000	39,000	110,000	66,000	57,000	66,000	11,000	10,000
Arsenic	20	1,300	2,800	1,700	9,000	5,000	2,000	3
Barium	150	1,100	4,500	1,500	3,500	2,900	410	2,000
Cadmium	0.66	2.0	13	4.4	3.9	4.4	0.64	1
Chromium	11	28	89	52	50	53	12	10
Iron	10,000	25,000	66,000	43,000	48,000	47,000	10,000	-
Lead	12	37	220	88	79	84	17	-
Mercury	0.0467	3.67	5.52	7.63	33	17	6.26	3
Thallium	1.6	120	230	160	570	330	110	2.0†

* Sample S7-Fairfield was used in exposure dose calculations for incidental ingestion in children. According to information gathered from the community, children are not known to play at any other surface water sample locations.
† MCL value reported, EMEG/MRL not available

Table 3. Water analytical results for Arsenic, Barium, Lead and Mercury collected from several private wells and surface wells in the Town of Fairfield, 1999-2000. Concentrations are in µg/L (ppb).

Sample ID	Location (UOS Property #)	Arsenic	Barium	Lead	Mercury
0.2 Mile East Green Barn	East of Property 012	3.3 U	7.4	1.6	0.10
0.3 Mile East Green barn	East of Property 012	8.0	38	2.5	0.048
Mel Frandsen Well South of Barn	South of Property 011	5.5	53	2.9	0.043
F008 Deep Well in Pasture	008	3.3 U	47	0.99 U	0.042
F008 Shallow Well in Yard	008	3.3 U	83	1.9	0.055
F011 Shallow	011	3.9	74	1.6	0.043 U
F011 Deep	011	3.3 U	58	0.99 U	0.043 U
Green Barn Stream	011	7.3	34	1.8	0.069
F014	014	7.7	94	3.3	0.040
F022 Flowing	022	3.3 U	65	1.5	0.043 U
F025 Deep	025	4.4	43	4.4	0.043 U
F027 Durrant	027	3.3 U	100	0.99 U	0.040 U
F034	034	3.3 U	62	1.3	0.054
Stream Behind Wilson House	050	5.5	35	0.99 U	0.064
Stream West Hwy 73	066	3.3 U	31	1.3	0.047
South	076	3.3 U	28	0.99 U	0.040 U
North	076	3.3 U	30	0.99 U	0.040 U
F105 Deep	105	3.3 U	35	2.0	0.043 U
F105 Shallow	105	3.3 U	26	1.0	0.043 U
Stream 100 Ft West Hwy 73	114	3.3 U	31	2.7	0.051
R125 Deep North	125	3.9	44	2.4	0.043 U
ATSDR CV		10.0	7,000	15	10.0

µg/L Micrograms per liter (parts per billion)
U not detected above method reporting level. The detection limit is reported

Table 4. XRF arsenic results for soil samples collected in Fairfield in 1999, 0-2 inches deep.

Sample Concerns	Sample ID	Sample Date	[Arsenic] (mg/kg)
Samples collected within close proximity to water ways (streams, lakes and rivers)	F010Z3	12/18/1999	**310**
	F014Z1	12/17/1999	ND
	F030Z4	12/03/1999	**280**
	F049Z5	12/03/1999	**210**
	F049Z6	12/03/1999	**170**
	F049Z7	12/03/1999	**250**
	F066SEDG	01/05/2000	**910**
	F066Z1	12/15/1999	**150**
	F066Z2	12/15/1999	**99 J**
	F071Z1	12/03/1999	**170**
	F071Z5	12/03/1999	**320**
	F072Z1	01/05/2000	**200**
	F078Z4	12/10/1999	ND
	F078ZC	01/05/2000	**2,800**
	F080Z1	12/15/1999	ND
	F082Z2	12/13/1999	ND
	F082Z3	12/13/1999	**60 J**
	F114Z10	12/11/1999	**80**
	F114Z14	12/11/1999	**31 J**
Samples collected from vacant property and land	F001Z2	12/06/1999	**490**
	F001Z3	12/06/1999	**680**
	F001Z4	12/06/1999	**760**
	F001Z5	12/06/1999	**550**
	F002Z1	12/09/1999	**920**
	F002Z2	12/09/1999	**180**
	F002Z3	12/09/1999	**230**
	F003Z1	12/09/1999	**300**
	F003Z2	12/09/1999	**150**
	F003Z3	12/09/1999	**320**
	F003Z4	12/09/1999	**260**
	F005Z1	12/09/1999	**380**
	F006Z1	12/09/1999	**78 J**
	F007Z1	12/18/1999	**200**
	F007Z2	12/18/1999	**180**
	F009Z1	12/14/1999	**89 J**
	F010SEDG	01/05/2000	**54 J**
	F010Z1	12/18/1999	**47 J**
	F010Z2	12/18/1999	**65 J**
	F013Z1	12/14/1999	ND

	F014Z2	12/17/1999	ND
	F014Z3	12/17/1999	ND
Samples collected from vacant property and land (cont'd)	F016Z1	12/21/1999	ND
	F022Z1	12/18/1999	ND
	F024Z3	12/14/1999	ND
	F024Z4	12/14/1999	ND
	F028Z3	12/14/1999	ND
	F029Z1	12/04/1999	ND
	F029Z2	12/04/1999	ND
	F030Z2	12/03/1999	**190**
	F030Z3	12/03/1999	**190**
	F031Z1	12/03/1999	**53 J**
	F031Z2	12/03/1999	**220**
	F031Z3	12/03/1999	**110 J**
	F032Z1	12/03/1999	ND
	F032Z2	12/03/1999	**320**
	F032Z3	12/03/1999	**73**
	F032Z4	12/03/1999	**62**
	F033Z1	12/05/1999	**39**
	F034Z1	12/14/1999	ND
	F035Z1	12/06/1999	**60 J**
	F037Z2	12/05/1999	**66**
	F042Z2	12/06/1999	**44 J**
	F042Z3	12/06/1999	ND
	F042Z4	12/06/1999	**80 J**
	F042Z5	12/06/1999	**86 J**
	F042Z6	12/06/1999	**140 J**
	F049Z3	12/03/1999	**53 J**
	F049Z4	12/03/1999	**55 J**
	F062Z1	12/15/1999	**560**
	F086Z1	12/19/1999	**320**
	F087Z1	12/19/1999	**53 J**
	F077Z1	12/16/1999	ND
	F077Z2	12/16/1999	ND
	F077Z3	12/16/1999	**2,800**
	F077Z4	12/16/1999	**1,300**
	F078Z10	12/10/1999	**120 J**
	F078Z1	12/11/1999	**190**
	F078Z2	12/10/1999	**350**
	F078Z5	12/10/1999	ND
	F078Z6	12/10/1999	**230**
	F078Z7	12/10/1999	**140 J**
	F078Z8	12/10/1999	**120 J**
	F080Z2	12/15/1999	ND

	F081Z1	12/15/1999	**280**
	F081Z2	12/15/1999	ND
	F082Z4	12/13/1999	**72 J**
	F108Z7	12/07/1999	**350**
Samples collected from vacant property and land (cont'd)	F110Z1	12/17/1999	**410**
	F111Z1	12/16/1999	**100 J**
	F091Z2	12/19/1999	**300**
	F091Z3	12/19/1999	**120**
	F092Z1	12/21/1999	**47 J**
	F092Z2	12/21/1999	**28 J**
	F092Z3	12/21/1999	**52 J**
	F092Z4	12/21/1999	ND
	F095Z1	12/21/1999	ND
	F101Z1	12/13/1999	**680**
	F101Z2	12/13/1999	**1,300**
	F108Z2	12/07/1999	**1,500**
	F108Z4	12/07/1999	**310**
	F108Z5	12/07/1999	**510**
	F108Z6	12/07/1999	**230**
	F123Z1	12/13/1999	**260**
	F123Z2	12/13/1999	**67**
	F112Z1	12/17/1999	**200**
	F113Z1	12/07/1999	**100 J**
	F113Z6	12/07/1999	**1,100**
	F114Z12	12/13/1999	ND
	F114Z13	12/13/1999	**520**
	F114Z15	12/11/1999	ND
	F114Z16	12/11/1999	**1,300**
	F114Z17	12/11/1999	**29 J**
	F114Z18	12/11/1999	ND
	F114Z19	12/11/1999	**750**
	F114Z4	12/10/1999	**520**
	F114Z5	12/10/1999	**560**
	F114Z6	12/10/1999	**340**
	F114Z7	12/10/1999	**730**
	F114Z8	12/10/1999	**120 J**
	F114Z9	12/11/1999	**180**
	F122Z1	12/16/1999	ND
	F122Z2	12/16/1999	ND
	F125Z4	01/05/2000	**74 J**
	FBKGZ1	12/15/1999	ND
	FDITCH	12/17/1999	**140 J**

Samples collected from property and land with a home or building structure, or from roadways in proximity to these properties.	F001Z1	12/06/1999	**2,300**
	F008Z1	12/17/1999	**58 J**
	F008Z2	12/17/1999	ND
	F008Z3	12/17/1999	**83 J**
	F011Z1	12/16/1999	ND
	F033Z4	12/05/1999	**32 J**
	F023Z1	12/18/1999	ND
	F023Z2	12/18/1999	ND
	F023Z1	12/18/1999	ND
	F023Z2	12/18/1999	ND
	F023Z3	12/18/1999	ND
	F024Z1	12/14/1999	ND
	F024Z2	12/14/1999	ND
	F028Z1	12/14/1999	ND
	F028Z2	12/14/1999	ND
	F030Z1	12/03/1999	**100 J**
	F033Z2	12/05/1999	ND
	F033Z3	12/05/1999	**28 J**
	F050Z1	12/03/1999	ND
	F043Z1	12/05/1999	**77**
	F043Z2	12/05/1999	**33 J**
	F044Z1	12/04/1999	ND
Samples collected from property and land with a home or building structure, or from roadways in proximity to these properties. (cont'd)	F044Z2	12/05/1999	ND
	F045Z1	12/05/1999	ND
	F045Z2	12/05/1999	ND
	F045Z3	12/05/1999	ND
	F046Z1	12/05/1999	ND
	F046Z2	12/05/1999	ND
	F046Z3	12/05/1999	**33 J**
	F048Z1	12/05/1999	**51 J**
	F048Z2	12/05/1999	ND
	F048Z3	12/05/1999	**30 J**
	F048Z4	12/05/1999	19 J
	F049Z1	12/03/1999	**100 J**
	F049Z2	12/03/1999	ND
	F063Z1	12/13/1999	**390**
	F050Z2	12/03/1999	ND
	F050Z3	12/03/1999	ND
	F051Z1	12/04/1999	ND
	F051Z2	12/04/1999	ND
	F051Z3	12/04/1999	**63 J**
	F051Z4	12/04/1999	ND
	F051Z5	12/04/1999	ND
	F052Z1	12/04/1999	**100**

Samples collected from property and land with a home or building structure, or from roadways in proximity to these properties. (cont'd)	F052Z2	12/04/1999	ND
	F052Z3	12/04/1999	**120**
	F053Z1	12/04/1999	ND
	F053Z2	12/04/1999	**47 J**
	F053Z3	12/04/1999	**61 J**
	F053Z4	12/04/1999	**31 J**
	F055Z1	12/13/1999	ND
	F055Z2	12/13/1999	**72 J**
	F055Z3	12/13/1999	**63 J**
	F055Z4	12/13/1999	ND
	F056Z1	12/11/1999	**33 J**
	F056Z2	12/11/1999	**30 J**
	F056Z3	12/11/1999	**27 J**
	F057Z1	12/11/1999	19 J
	F057Z2	12/11/1999	19 J
	F057Z3	12/11/1999	19 J
	F058Z1	12/11/1999	**74**
	F061Z1	12/15/1999	ND
	F061Z2	12/15/1999	ND
	F061Z3	12/15/1999	ND
	F076Z4	12/07/1999	**710**
	F068Z1	12/14/1999	**40 J**
	F068Z2	12/14/1999	**32 J**
	F068Z3	12/14/1999	**33 J**
	F071Z2	12/03/1999	**52 J**
	F071Z3	12/03/1999	**160**
	F071Z4	12/03/1999	**42 J**
	F072Z2	01/05/2000	**180**
	F073Z1	12/07/1999	**400**
	F073Z2	12/07/1999	**740**
	F073Z3	12/08/1999	**260**
	F073Z4	12/08/1999	**220**
	F073Z5	12/08/1999	**360**
	F073Z6	12/08/1999	**360**
	F073Z7	12/08/1999	**530**
	F073Z8	12/08/1999	**590**
	F074Z1	12/07/1999	**400**
	F075Z1	12/08/1999	**55 J**
	F075Z2	12/08/1999	**290**
	F076Z1	12/07/1999	**550**
	F076Z2	12/07/1999	**880**
	F076Z3	12/07/1999	**1,300**
	F091Z1	12/19/1999	**82 J**
	F078Z3	12/10/1999	**320**

Samples collected from property and land with a home or building structure, or from roadways in proximity to these properties. (cont'd)	F078Z9	12/10/1999	**170 J**
	F078ZD	12/19/1999	**450**
	F079Z1	01/05/2000	**1,200**
	F082Z1	12/13/1999	ND
	F084Z1	01/05/2000	**2,300**
	F085Z1	01/05/2000	**1,500**
	F108Z1	12/07/1999	**1,100**
	F108Z3	12/07/1999	**6,400**
	F113Z2	12/07/1999	**6,900**
	F113Z3	12/07/1999	**730**
	F113Z4	12/07/1999	**700**
	F113Z5	12/07/1999	**560**
	F114Z11	12/11/1999	ND
	F114Z1	12/07/1999	ND
	F114Z2	12/07/1999	ND
	F114Z3	12/07/1999	ND
	F124Z2	12/18/1999	**120 J**
	F125Z1	12/13/1999	**210**
	F125Z2	12/13/1999	**170**
	F125Z3	01/05/2000	**130 J**
	F125ZRD	01/05/2000	**310**
	F150Z1	02/29/2000	**223**
	F150Z2	02/29/2000	**190**
	F150Z3	02/29/2000	**425**
ATSDR CV for arsenic in soil			20

J: Analyte was not detected above the analytical detection limit of the laboratory equipment.
ND: Non-detect above method reporting level.

Table 5. Additional Fairfield road base samples collected by START and analyzed by XRF. December 2006. Thirty-seven samples were collected in ten locations, all at six inches of depth.

Sample Collection Area	Number of Locations Sampled	Arsenic Concentration (ppm)
N 1850 W	2	730
		2,600
Near Highway 73	5	100
		130
		140
		580
		3,200
W 1540 N	3	ND
		3,700
		6,900

ND: Non-detect above method reporting level.

Table 6. Air sample results collected from DataRam units in Fairfield, August 2007.

Sample ID	Volume Sampled (Liters)	Total Arsenic Concentration on Filter(μg/m^3)	CREG value for Arsenic in Air (μg/m^3)
MC10716	1,070.0	1 U*	-
MC20716	1,275.0	1 U*	-
MC30716	1,215.0	1 U*	-
MC40716	1,195.0	1 U*	-
MC50716	1,157.5	1 U*	-
MC60716	402.5	1 U*	-
MC10719	3,520.0	1 U*	-
MC20719	3,512.5	**1.1**	0.0002
MC30719	3,472.5	1 U*	-
MC40719	3,440.0	1 U*	-
MC50719	3,422.5	1 U*	-
MC60719	3,410.0	1 U*	-

*U = not detected above method reporting level.

APPENDIX C – CALCULATIONS

Exposure Dose (ED) calculation for surface water [ATSDR 2005]:

ED = (C x IR x EF) / BW

Where: C = Contaminant concentration (mg/liter)

IR = Intake rate of contaminated water (liter/day)
= 45 mL/day for a child

EF = Exposure Factor; an exposure factor of "0.00684" was used for this health assessment (1 represents daily exposure to the contaminant, 365 days per year, whereas in this case, we assume that the child plays in the surface water for three hours only 20 times per year.

BW = Body Weight (kg)
= 16 kg for a child

Exposure Dose (ED) calculation for incidental ingestion of soil [ATSDR 2005]:

ED = (C x IR x EF x CF) / BW

Where: C = Contaminant concentration (mg/kg)

IR = Intake rate of contaminated soil (kg/day)
= 100 mg/day for an adult
= 200 mg/day for a child

EF = Exposure Factor; an exposure factor of "1" was used for this health assessment (1 represents daily exposure to the contaminant rather than intermittent exposure. This assumes that the person is spending time in the yard, gardening or playing each day).

CF = Conversion Factor (10^{-6} mg/kg)

BW = Body Weight (kg)
= 70 kg for an adult
= 16 kg for a child

APPENDIX D - ACRONYMS AND TERM DEFINITIONS

ATSDR Agency for Toxic Substances and Disease Registry

Background Level The amount of a chemical that occurs naturally in a specific environment.

BLM Bureau of Land Management

Cancer Classes Each health organization has a separate method of cancer classification:

Environmental Protection Agency (EPA) (Based on 1986 cancer assessment guidelines):

A = Human Carcinogen.
B1 = Probable Human Carcinogen (based on limited human and sufficient animal studies).
B2 = Probable Human Carcinogen (based on inadequate human and sufficient animal studies).
C = Possible Human Carcinogen (no human studies and limited animal studies).
D = Unlikely to be a Human Carcinogen
E = Evidence of non-carcinogenicity in humans

Environmental Protection Agency (EPA) (Based on 2003 cancer assessment guidelines):

CA = Carcinogenic to humans
LI = Likely human carcinogen (cancer potential established; but limited human data)
SU = Suggestive evidence (human or animal data suggestive)
IN = Inadequate (data inadequate to assess)
NO = Robust data indicate no human carcinogen.

International Agency for Research on Cancer (IARC)

1 = Carcinogenic to Humans (sufficient human evidence).
2A = Probably Carcinogenic to Humans (limited human evidence; sufficient evidence in animals).
2B = Possibly Carcinogenic to Humans (limited human evidence; less than sufficient evidence in animals).
3 = Not Classifiable
4 = Probably Not Carcinogenic to Humans

National Toxicology Program (NTP)

1 = Known Human Carcinogen
2 = Reasonably anticipated to be a carcinogen
3 = Not Classified

Completed Exposure Pathway A way in which humans can be exposed to a contaminant associated with a site. An exposure pathway is a description of the way a chemical moves from a source to where people can come into contact with it. A completed exposure pathway has all of the 5 following elements:

1) A source of contamination
2) Transport through environmental medium
3) A point of exposure
4) A route of human exposure
5) An exposed population

CREG **Cancer Risk Evaluation Guides** are based on a contaminant concentration estimated to increase the cancer risk in a population by one individual in one million people over a lifetime exposure ($1x10^{-6}$).

CV A **comparison value** is a calculated concentration of a substance in air, water, food, or soil that is unlikely to cause harmful (adverse) health effects in exposed people. The CV is used as a screening level during the public health assessment process.

DERR Department of Environmental Response and Remediation

DOE United States Department of Energy

EE/CA Engineering Evaluation and Cost Analysis prepared by the Bureau of Land Management

EEP Environmental Epidemiology Program at the Utah Department of Health

EMEG **Environmental Media Evaluation Guides** are media-specific comparison values used to select contaminants of interest at hazardous waste sites. EMEGs are derived from Minimal Risk Levels (MRLs), developed by the Agency for Toxic Substances and Disease Registry (ATSDR), and are an estimate of human exposure to a compound that is not expected to cause noncancerous health effects at that level for a specified period. They are intended to protect the most sensitive individuals (i.e. children). MRLs are guidelines and are not used to predict adverse health effects. MRLs do not take into account carcinogenic effects, chemical interactions, or multiple routes of exposure.

ENDORHEIC BASIN An **endorheic basin** is a watershed from which there is no outflow of water.

EPA The **U.S**. **Environmental Protection Agency** is the federal agency that develops and enforces environmental laws to protect the environmental and public health.

EPHTN **Environmental Public Health Tracking Network** oversees the ongoing collection, integration, analysis, and interpretation of data about environmental hazards, exposure to environmental hazards, and health effects potentially related to exposure to environmental hazards

Exposure Dose At some sites, the existing conditions may result in exposures that differ from those used to derive Comparison Values such as the EMEG. In these situations, the health assessor can calculate site-specific exposures more accurately using an exposure dose. The exposure dose can then be compared to the appropriate toxicity values (MRL, RfC, RfD).

Hazard Index A sum of the hazard quotients for substances (in a given exposure) that affect the same organ or organ system.

Hazard Quotient The ratio of the potential exposure to the MRL or specific comparison value. A Hazard Quotient of less than 1 means that no adverse health effects are expected as a result of exposure. If the Hazard Quotient is greater than 1, then adverse health effects are possible.

Health-Based see "Screening values."

LOAEL The **Lowest Observable Adverse Effect Level** is the lowest exposure level of a chemical that produces significant increases in frequency or severity of adverse effects.

LTHA **Lifetime Health Advisory** for drinking water from EPA.

LTSM Long-term Surveillance and Maintenance

MCL A **Maximum Contaminant Level** is an enforceable standard calculated by the United States Environmental Protection Agency. The MCL is the highest level of a contaminant that is allowed in drinking water.

MRL A **Minimal Risk Level** is defined as an estimate of daily human exposure to a chemical that is likely to be without an appreciable risk of deleterious non-cancer health effects over a specified duration of exposure. Thus, MRLs provide a measure of the toxicity of a chemical.

MSL Mean Sea Level

NA Needs Assessment

ND Chemicals that are **not detected** in a sample above a certain limit, usually the quantitation limit for the chemical in the sample.

NIOSH National Institute for Occupational Safety and Health.

NOAEL The **No Observable Adverse Effect Level** is the exposure level of chemical that produces no significant increases in frequency or severity of adverse effects. Effects may be produced at this dose, but they are not considered to be adverse.

NPDWR **National Primary Drinking Water Regulations** are legally enforceable standards that apply to public water systems. Primary standards are available on the web at: http://www.epa.gov/safewater/mcl.html

NPL site The National Priorities List is a list published by EPA ranking all the Superfund sites. Superfund is the common name for the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), a federal law enacted in 1980. This law was preauthorized in 1986 as the Superfund Amendments and Reauthorization Act. CERCLA enables EPA to respond to hazardous waste sites that threaten public health and the environment. A site must be added to the NPL site list before remediation can begin under Superfund.

NTP The **National Toxicology Program** is part of the Department of Health and Human Services. NTP develops and carries out tests to predict whether a chemical will cause harm to humans.

OSHA Occupational Safety and Health Administration.

PEL **Permissible Exposure Limit** for a hazardous substance or condition in the workplace as defined by the Occupational Safety and Health Administration (OSHA) General Industry Air Contaminants Standard (29 CFR 1910.1000).

PHA **Public Health Assessment.** 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.

PHAP Public Health Action Plan

Potential Exposure Pathway A possible way in which people can be exposed to a contaminant associated with a site. An Exposure pathway is a description of the way a chemical moves from a source to where people can come into contact with it. A potential exposure pathway has 4 of the 5 following elements:

1) a source of contamination
2) transport through environmental medium
3) a point of exposure

4) a route of human exposure
5) a receptor population

PPM Parts Per Million

PRG Preliminary Remediation Goals. Used for EPA Planning Purposes only.

Public Health Hazard The category ATSDR assigns to sites that pose a health hazard to the public as the result of long-term exposures to hazardous substances. See "Public Health Hazard Categories".

Public Health Hazard Categories Categories defined by ATSDR and used in public health assessments that assess if people could be harmed by conditions present at a site in the past, present or future. One or more hazard categories may be assigned to a site. The five categories are:

Urgent Public Health Hazard
Public Health Hazard
Indeterminate Public Health Hazard
No Apparent Public Health Hazard
No Public Health Hazard

REL **Recommended Exposure Limit** for a hazardous substance or condition in the workplace as defined by the National Institute for Occupational Safety and Health (NIOSH).

RMEG **Reference Dose Media Evaluation Guides** are media-specific comparison values used to select contaminants of interest at hazardous waste sites. RMEGs are derived from reference doses (RfDs), developed by the U.S. Environmental Protection Agency (EPA), and are an estimate of human exposure to a compound that is not expected to cause noncancerous health effects at that level for a specified period. They are intended to protect the most sensitive individuals (i.e. children). RfDs are guidelines and are not used to predict adverse health effects. RfDs do not take into account carcinogenic effects, chemical interactions, or multiple routes of exposure.

Screening Values Screening Values are health-based and media-specific concentrations that are used to select environmental contaminants for further evaluation in public health assessments. These values are not valid for other types of media, nor do concentrations above these values indicate that a health risk actually exists (agency that developed the value is in parenthesis for the examples below):

Examples of Comparison Values for non-cancer health effects

EMEG-c	**=**	**Environmental Media Evaluation Guide for chronic (more than 365 days)exposure (ATSDR).**
EMEG-I	=	Environmental Media Evaluation Guide for intermediate exposure (ATSDR).
EMEG-u	=	Environmental Media Evaluation Guides that are unpublished are designated with an asterisk by the authors of this health assessment and used only in the absence of published comparison values and are calculated using equations outlined in Appendix B.
RMEG	=	Reference Dose Media Evaluation Guide (ATSDR).
NPDWR	=	National Primary Drinking Water Regulations (EPA) accessed on web at: www.epa.gov/safewater/mcl.html
LTHA	=	Lifetime health advisory for drinking water (EPA).

Example of a Screening values for cancer health effects

CREG	=	Cancer Risk Evaluation Guide for $1x10^{-6}$ excess cancer risk (ATSDR).

SDWA **The Safe Drinking Water Act** is the main federal law that ensures the quality of Americans' drinking water. SDWA was originally passed by Congress in 1974 to protect public health by regulating the nation's public drinking water supply.

SDWS **National Secondary Drinking Water Standards** or secondary standards are non-enforceable guidelines that regulate contaminants that may cause cosmetic or aesthetic effects in drinking water.

START The EPA Region VIII **Superfund Technical Assessment and Response Team**

UCHD Utah County Health Department

UCR Utah Cancer Registry

UDEQ Utah Department of Environmental Quality

UDOH Utah Department of Health

UOS URS Operating Service

WHO World Health Organization

XRF X-ray fluorescence

ZCTA **Zip Code Tabulation Areas** are generalized area representations of U.S. Postal Service (USPS) ZIP Code service areas.

APPENDIX E – NEEDS ASSESSMENT

March 4, 2010

Manning Canyon/Fairfield Needs Assessment

The Utah Department of Health (UDOH) Office of Environmental Epidemiology (EEP) is currently conducting a Public Health Assessment (PHA) to evaluate the public health risk associated with contaminated water, soil and air within the town of Fairfield from the Manning Canyon/Fairfield site in Fairfield, Utah, under a cooperative agreement with the Agency for Toxic Substance and Disease Registry (ATSDR). As part of the process, the EEP staff has conducted various site visits and attended town meetings. The goal of this needs assessment is to document and respond accordingly to the communities questions and concerns regarding the site.

Social Demographics

The town of Fairfield is located in Utah County, Utah, approximately fifty miles southwest of Salt Lake City. The town was established in 1855 as Frogtown and served as a stationing base for 3,500 Johnston's Army soldiers in 1858-1859, which later became known as Camp Floyd. Frogtown became Fairfield in 1861, named after Amos Fielding, who participated in the establishment of the community.

The town contains residential, commercial, industrial, and agricultural areas, including a museum, industrial park and recreational areas. The town of Fairfield incorporated in 2004 due to concerns about growth from surrounding communities (Utah County General Election 2004). Besides agriculture, it is a destination location for tourists of Camp Floyd State Park and home to a large construction landfill.

Due to the fact that Fairfield incorporated in 2004, there is no current census data for the town available; however, town records indicate that approximately 137 permanent residents call Fairfield home. It is part of the Provo-Orem metropolitan area which, according to 2000 U.S. Census Bureau data for Utah County, has a population of 368,536. Orem is the closest large city to Fairfield, with an estimated population of 84,324 in 2000. The population of Orem is predominantly white with less than three percent having Asian, African American or Hispanic backgrounds. The average household size in the area is 3.57 persons per household (US Census Bureau 2000). The town of Fairfield would have a similar geographic and ethnic diversity.

Historical Data

The historical Manning Canyon Mill site is located within the Mercur Mining District and processed gold ore from approximately 1890 to 1937. A gold amalgamation mill was constructed at the site in 1890 and was eventually converted to a cyanide leach process. In 1898 the Manning Canyon Mill began reprocessing tailings and the Golden Gate Mill was built. The Golden Gate Mill was moved to Mercury in 1937 and the Manning Canyon Mill was abandoned. After the mill site was abandoned, two on-site settling ponds were breached and tailings washed down the eastern and western drainages of Manning Canyon and into the city of Fairfield.

- In August 1997, the DERR and BLM sampled tailings at the historic mill site. Arsenic concentrations ranged from 5,350 mg/kg to 6,510 mg/kg.
- In 1998, the BLM conducted a Tailings Investigation and Removal Preliminary Assessment at the Manning Canyon site.

- In August 1999, the Manning Canyon site was discovered and entered into CERCLIS.
- In December 1999, removal evaluation was conducted by the EPA. A total of 1,134 soil samples were collected and analyzed. Elevated levels of arsenic were detected, down gradient of the historic Manning Canyon Mill Site in the eastern and western drainages. Two residential properties in the city of Fairfield exceeded the emergency response action level of 500 mg/kg and were remediated.
- In July 2000, the EPA evaluated the site for the purpose of preparing a Hazardous Ranking System (HRS) package. Based on the small population of Fairfield in 2000, the HRS package was not completed.
- In April 2001, an Abbreviated Preliminary Assessment (APA) was completed.
- In 2001, the BLM prepared an Engineering Evaluation and cost analysis (EE/CA) for the Manning Canyon site. The EE/CA addressed contamination from the historic Manning Canyon Mill site down gradient to the former railroad grade, which is located approximately 1.3 miles northwest of Fairfield.
- In January 2002, a Site Inspection Work Plan was approved by EPA.
- In September 2003, the DERR completed the initial Site Inspection sampling. Elevated arsenic concentrations were detected in the ephemeral drainage west of Fairfield.
- From 2002-2004, the BLM completed a non-time critical Removal Action for the upper Manning Canyon drainage area.
- In July 2005, the DERR, at the request of the Fairfield Major, evaluated arsenic levels in and along roads in Fairfield with a portable XRF. Arsenic levels were evaluated at six locations and ranged in concentration from less than 25 ppm to 3,180 ppm
- In 2007, EPA conducted air sampling and did not find elevated arsenic levels in fugitive dust.
- UDEQ, on behalf of EPA, sampled sediment and runoff water from the Manning Canyon drainage near the Cedar Valley Road on February 26, 2008. Both sediment samples and runoff water contained elevated levels of a variety of heavy metals.
- The analytical results report was received by UDEQ in October 2008. The “Endangerment Evaluation” section described elevated arsenic and lead concentrations in Fairfield creek, which could pose a high non-cancer hazard for children who may play/swim in the creek. UDEQ personnel met with the Fairfield Mayor, Utah County Commissioners and the Utah County Health Department to discuss the sampling results.
- Mayor Gilles of Fairfield had expressed his hope that EPA would require the BLM to clean-up contaminated properties, especially those on BLM properties that are the likely source of contaminated sediment out wash in Fairfield. DERR requested that EPA consider taking remedial action in Fairfield based upon the recently identified high non-cancer hazard.

- On March 11, 2009, UDEQ, EPA, State dignitaries, State and local Health Departments, BLM, and UDOT meet with the Major to discuss possible options.

Goal

Document and respond accordingly to the community's questions and concerns regarding the site.

Objectives

Provide Fairfield town with recommendations from the health assessment by May 2010, health education will be provided to address the concerns of the residents.

Community Concerns

The Manning Canyon/Fairfield site was brought to the attention of the EEP in the spring of 2009 through community concerns expressed about the concentrations of heavy metals in both dust and soil in areas directly down wind and stream of the former mining site.

The Utah Department of Health (UDOH) developed a needs assessment tool and distributed it in June 2009 to PO Box holders within the Town of Fairfield. The needs assessment tool was created in hopes of reaching the needs of Fairfield residents and will be used in this needs assessment.

The UDOH needs assessment tool was sent to 45 resident addresses in the Fairfield community. Of the 45 needs assessments that were mailed out, 22 were completed and returned to the UDOH. According to the needs assessment the residents of Fairfield expressed a number of concerns. The major concern the community believes they are facing today is heavy metal contamination, with the main source being arsenic.

Of those surveyed, time of residence ranges from 5 years to 59 years. Of the people that responded to the needs assessment, 68.2% answered that they or their children participate in outdoor activities that place them in contact with areas they believe to have high levels of contamination. The majority of residents in the affected area claim their children do not play in or around the main stream going through town (59.1%), with 50% of households containing children.

According to the survey, 72.7% of residents have a well, ranging in depth from 190 to 280 feet. Fifty-nine percent of residents surveyed use their wells for drinking, 50% for irrigation purposes and 45% for watering live stock. Seventy-three percent of surveyed residents also have a vegetable garden, with 32% of those surveyed saying they water or care for their garden with the current community irrigation system, which is believed to contain heavy metals.

The following comments are those of the residents in Fairfield that responded to the 2009 UDOH needs assessment. The comments are divided into the following categories: concerns, knowledge, attitudes/beliefs, and practices/behaviors:

<u>Concerns:</u>

- The roads are chip sealed, the road base was brought in from the tailing piles in Manning Canyon, and tests show high concentrations of arsenic in the road base. The chip seal has broken up in many places exposing the road base. Dry hot weather causes dust from the road to become air borne. Breathing the dust can't be good.

- The continuation of the contamination, when spring runoff occurs, of arsenic down into the town.
- Air pollution from dust containing arsenic.
- The new dump
- Not being able to pave the road to the dump because the government says it has too much arsenic.
- Run off on the roads and the dust the big trucks cause when that run off dries and they drive on it.
- Arsenic and everything else.
- All these lawsuits and none of the money is coming back to our town, where is it going?
- Sick water.

<u>Knowledge:</u>

- Over 7000 school children visit the area each year.
- You can drive along the highway and see right where the contamination starts and ends, nothing grows were contamination is.

<u>Attitude/Beliefs:</u>

- The city council is the greatest concern facing our community.
- There are no contaminated tailings coming from Mercur.
- The town of Fairfield needs a chance to grow.

<u>Practices/Behaviors:</u>

- I jog/walk around town on the arsenic contaminated roads with my small animals.

Implementation

Members of the community feel their health is in jeopardy due to the arsenic contamination throughout Fairfield. UDOH is conducting a health assessment to determine if there are health-risks from the arsenic exposure, the results of the public health assessment will be distributed to the residents upon completion.

The health educator will continue to monitor the reports and research of the findings in Fairfield and will conduct health education as needed. The health educator will work with the Utah County Health Department and Fairfield town officials to ensure the messages and materials are appropriate for the community.

Upon completion of the investigation a fact sheet will be developed and distributed to the residents. The fact sheet will address resident concerns, contain information about the environmental testing/sampling process along with the results, and an outlook for the future. Information on how residents can obtain a complete copy of the health consultation will be provided.

Recommendations

As a result of this community needs assessment and the concerns of the Fairfield resident it is recommended that the UDOH along with ATSDR (Agency for Toxic Substance and Disease Registry) prepare a public health assessment.

A Public Health Assessment is a way to respond quickly to a need for health information on toxic substances and to make recommendations for actions to protect the public's health in a community. Staff evaluate information available about toxic material at the site, determine whether people may be exposed and how, and report what harm exposure might cause.

Public Health Assessments may consider:

- what the levels (or "concentrations") of hazardous substances are;
- whether people might be exposed to contamination and how (through "exposure pathways" such as breathing air, drinking or contacting water, contacting or eating soil, or eating food)
- what harm the substances might cause to people (or the contaminants' "toxicity")
- whether working or living nearby might affect people's health
- other dangers to people, such as unsafe buildings, abandoned mine shafts, or other physical hazards

What happens after the Health Assessment process?

Every Health Assessment includes conclusions about public health hazards and recommendations for actions to protect the public's health. Recommendations cover many activities by EPA, state environmental and health agencies, and ATSDR.
For example, Recommendations can contribute to:

- site cleanup
- keeping people away from contamination and physical dangers for example, by fencing the site
- giving residents acceptable drinking water
- relocating exposed people
- community environmental health education for residents and health care providers to inform them about site contaminants, harmful health effects, and ways to reduce or prevent health effects
- an ATSDR or state health study

Manning Canyon/Fairfield

Community Needs Assessment Questionnaire

The Utah Department of Health, Environmental Epidemiology program, is providing Fairfield residents with this community needs assessment questionnaire, in order to determine possible health questions, concerns and/or comments regarding the heavy metal exposure in your town. These and other health questions will be answered in a public health consultation.

Name: ________________________________
Telephone #: ________________________________
Address: ________________________________
____
____

1. What is your current occupation? ________________________________
   What is your spouse's occupation? ________________________________

2. How long have you resided in Fairfield? ________________________________

3. Do you have children living in the home? Yes No
   If yes, how many? ________________________________
   And, what are their ages: ________________________________

4. Do you or your children participate in outdoor activities that place you in contact with areas you believe have high contamination? Yes No

5. Do your children play in or around the stream? Yes No

6. What contaminants are you most concerned about in your community?
   ____________ ____________ ____________
   ____________ ____________ ____________

7. Do you have a vegetable garden? Yes No
   If yes, what water source do you use to water your garden?
   ____

8. Do you have a well? Yes No
   If yes, how deep is your well? _____feet ____Don't know
   How is your well used? (circle all that apply)
      Drinking
      Irrigating garden
      Watering livestock
      Other: _____________

9. What do you consider to be the greatest environmental concern facing your community today?
   (Please circle just one)
   a. air pollution
   b. water pollution
   c. soil contamination
   d. other: ___________________________

Questions/Comments/Concerns:

____
____
____
____
____

☐ Please feel free to contact me for further comments/questions/concerns

☐ Please do not contact me further

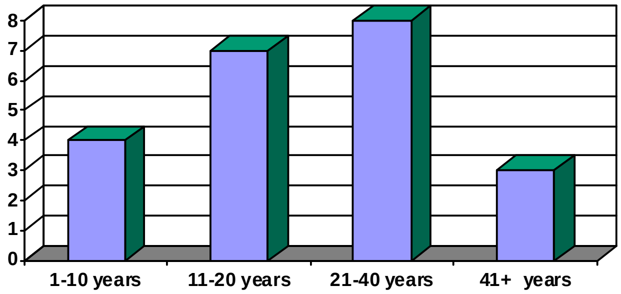
Thank you for taking the time to complete this needs assessment. Please return this form in the postage paid envelope provided at your earliest convenience. If you have any questions, please give me a call, Monday-Thursday 7am-5:30 pm at (801) 538-6191.

Thank You,

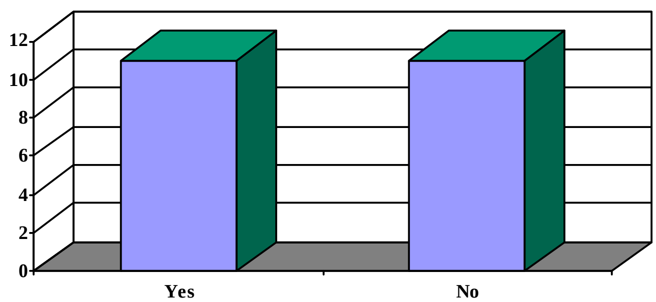
McKell Drury
Health Educator
Environmental Epidemiology Program
Utah Department of Health

Manning Canyon/ Fairfield
Detailed Community Needs Assessment Findings

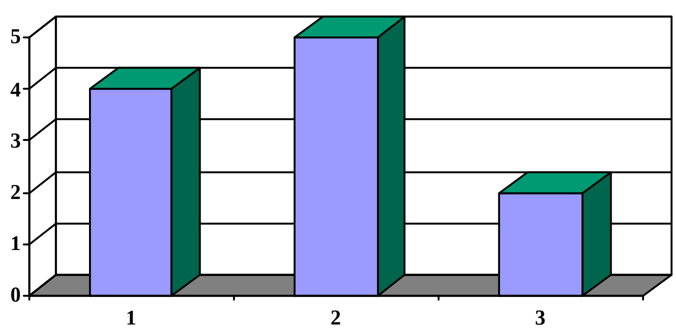
1. How long have you resided in Fairfield?



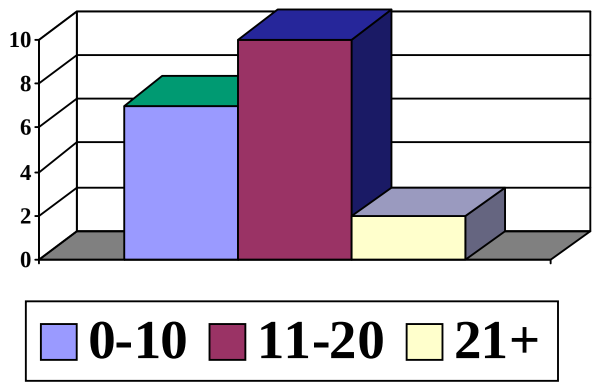
2. Do you have children living in the home?



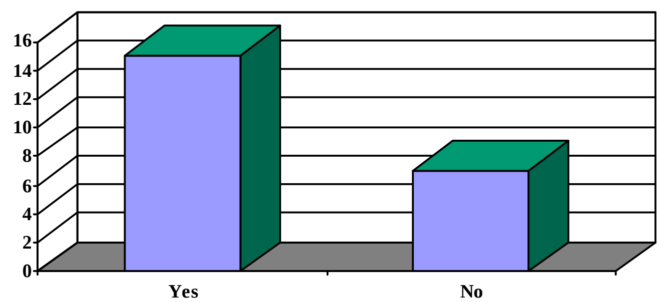
If Yes, how many?



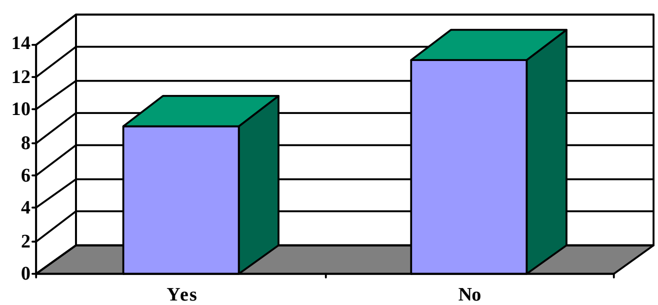
3. In which of the following age group categories do they fit?



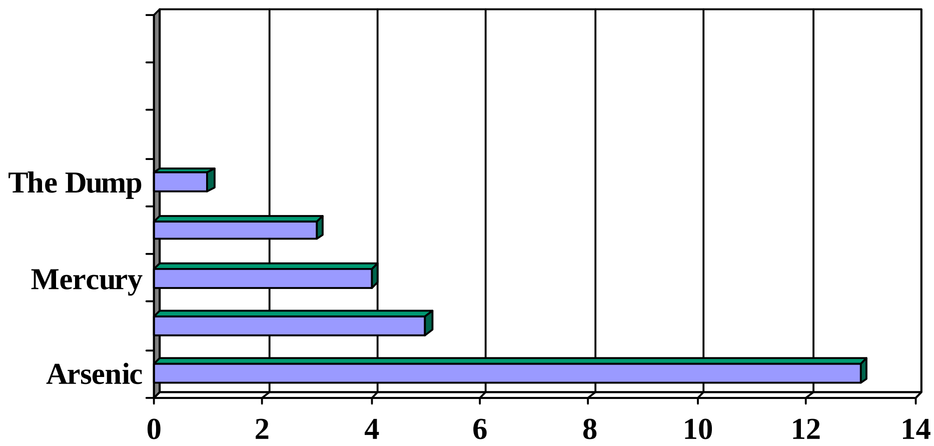
4. Do you or your children participate in outdoor activities that place you in contact with areas you believe have high contamination?



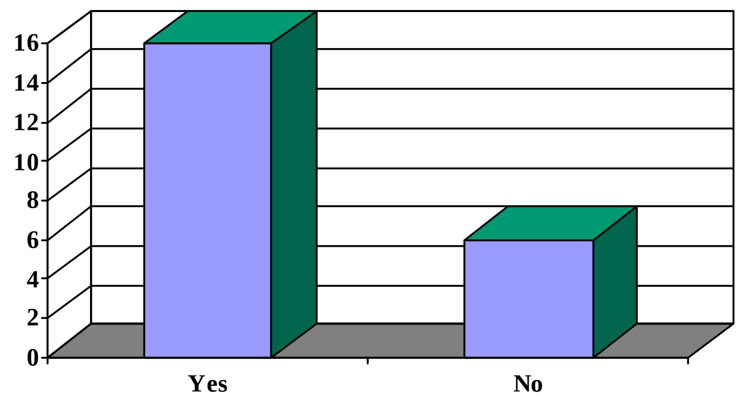
5. Do your children play in or around the stream?



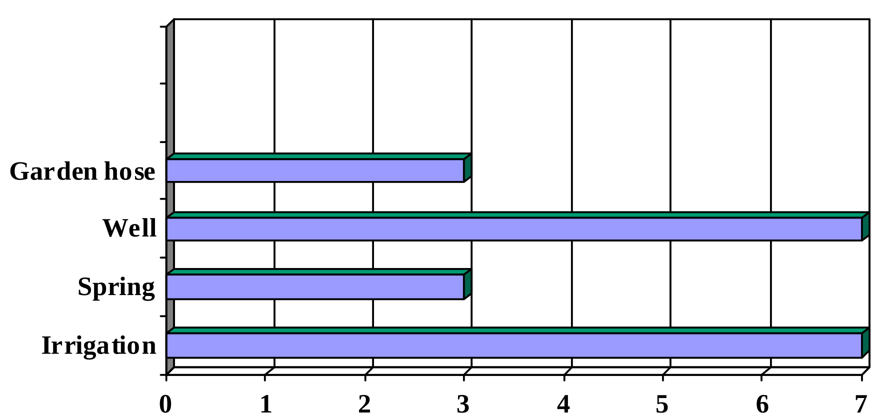
6. What do you think are the greatest health concerns facing your neighborhood?



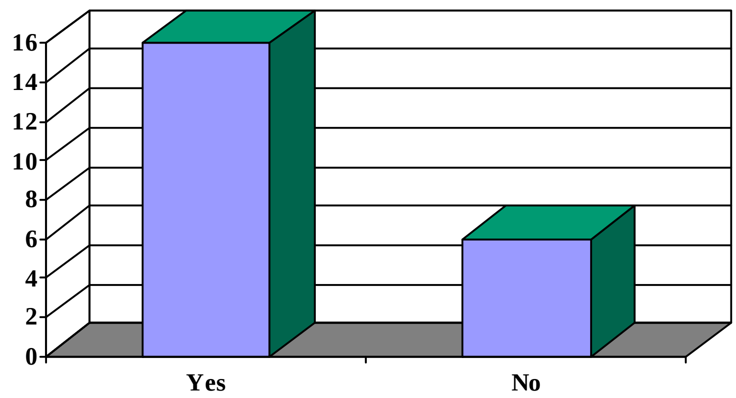
6. Do You have a vegetable garden?



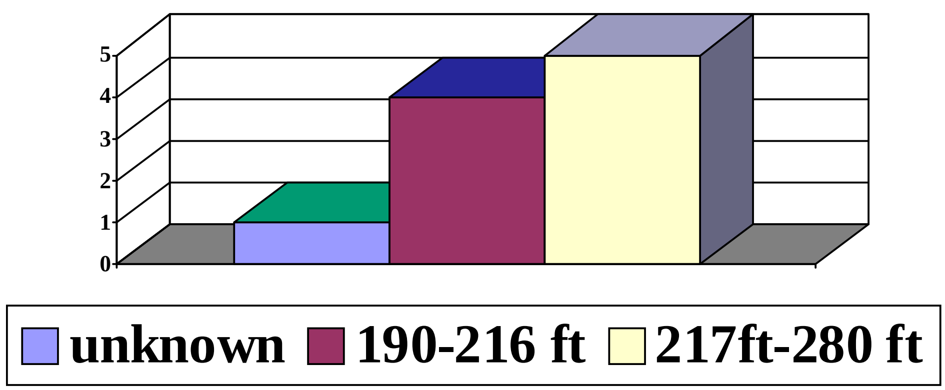
If yes, what water source do you use to water your garden?



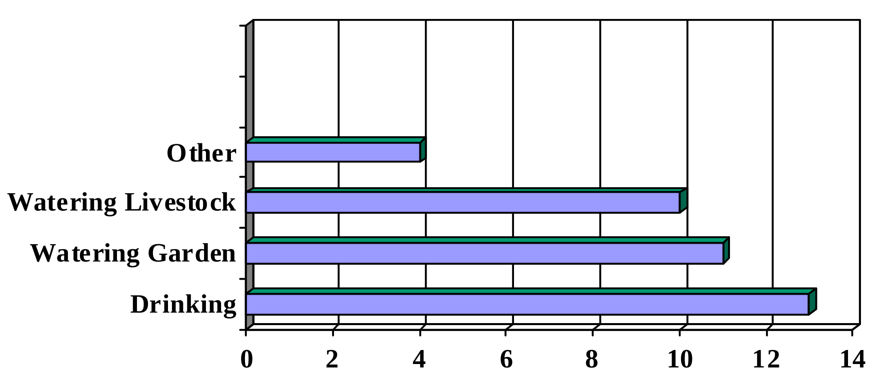
8. Do you have a well?



If yes, how deep is your well?



How is your well used?



9. What do you consider to be the greatest environmental concern facing your community today?