

# **US EPA Environmental Investigations in McFarland, California: A Summary Report**

**McFarland Study Area  
McFarland, California  
September 2009**

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**United States Environmental Protection Agency**

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# List of Acronyms and Abbreviations

|                               |   |                             |   |
|-------------------------------|---|-----------------------------|---|
| <b>ASTM</b> .....             | American Society for Testing and Materials  | <b>µg/l</b> .....           | Micrograms per liter  |
| <b>ATSDR</b> .....            | Agency for Toxic Substances and Disease Registry  | <b>µm</b> .....             | Micron  |
| <b>bgs</b> .....              | below ground surface  | <b>MCL</b> .....            | Maximum contaminant level   |
| <b>CAALs</b> .....            | California Archived Action Levels for drinking water (now called "Notification Levels") | <b>MITC</b> .....           | Methyl isothiocyanate   |
| <b>CAFO</b> .....             | Confined Animal Feeding Operations  | <b>MMWC</b> .....           | McFarland Mutual Water Company  |
| <b>CARB</b> .....             | California Air Resources Board  | <b>MRL</b> .....            | Minimum risk level  |
| <b>CAS</b> .....              | Chemical Abstract Services  | <b>NAAQS</b> .....          | National Ambient Air Quality Standard                                 |
| <b>CDPR</b> .....             | California Department of Pesticide Regulation   | <b>NATA</b> .....           | National-level Air Toxics Assessment                                  |
| <b>CFR</b> .....              | Code of Federal Regulation  | <b>ND</b> .....             | Not detected  |
| <b>CT</b> .....               | Central tendency  | <b>NO<sub>2</sub></b> ..... | Nitrite   |
| <b>DBCP</b> .....             | Dibromochloropropane  | <b>NO<sub>3</sub></b> ..... | Nitrate   |
| <b>DHS</b> .....              | California Department of Health Services  | <b>NQP</b> .....            | Water Quality Property  |
| <b>DTSC</b> .....             | Department of Toxic Substances Control  | <b>OEHHA</b> .....          | Office of Environmental Health Hazard Assessment                      |
| <b>EPA</b> .....              | Environmental Protection Agency   | <b>OPP</b> .....            | Office of Pesticides Program  |
| <b>HA</b> .....               | Health Advisories   | <b>PAH</b> .....            | Polynuclear aromatic hydrocarbon                                      |
| <b>HBSL</b> .....             | Health-based screening level  | <b>PCB</b> .....            | Polychlorinated biphenyl  |
| <b>IRED</b> .....             | Interim Reregistration Eligibility Document   | <b>pg/g</b> .....           | Picograms per gram  |
| <b>IRIS</b> .....             | Integrated Risk Information System  | <b>PM</b> .....             | Particulate matter  |
| <b>KCEHSD</b> .....           | Kern County Environmental Health Services Department                                    | <b>PM-10</b> .....          | Particulate matter with a mass median diameter of 10 microns or less  |
| <b>KCHD</b> .....             | Kern County Health Department   | <b>PM-2.5</b> .....         | Particulate matter with a mass median diameter of 2.5 microns or less |
| <b>mg/kg</b> .....            | Milligrams per kilogram   | <b>ppb</b> .....            | Parts per billion   |
| <b>mg/l</b> .....             | Milligrams per liter  | <b>ppm</b> .....            | Parts per million   |
| <b>µg/m<sup>3</sup></b> ..... | Micrograms per cubic meter  | <b>PRG</b> .....            | Preliminary remediation goal  |
|                               |   | <b>PUR</b> .....            | Pesticide Use Report  |
|                               |   | <b>QA</b> .....             | Quality assurance   |
|                               |   | <b>QC</b> .....             | Quality control   |

- R9** ..... Region 9
- RED** ..... Reregistration Eligibility Document
- REL** ..... Reference exposure level
- RfD** ..... Reference dose
- RME** ..... Reasonable maximum exposure
- SJVAPCD** ..... San Joaquin Valley Air Pollution Control District
- SOC** ..... Synthetic organic compound
- TEQ** ..... Toxic equivalence
- TSP** ..... Total suspended particulates
- UCL** ..... Upper confidence limit
- USEPA R9** ..... United States Environmental Protection Agency Region 9
- USGS** ..... United States Geological Survey
- VOC** ..... Volatile organic compound

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# 1 Introduction

The United States Environmental Protection Agency Region 9 (USEPA R9) evaluated environmental conditions in McFarland, California, from 1996 to 2002 in response to a request for assistance from some residents in the community. USEPA R9 conducted drinking water, soil, and outdoor air sampling to expand on previous investigations completed by the California Department of Health Services (DHS) and the Kern County Environmental Health Services Department (KCEHSD). For the years of 1988 to 2001, the Cancer Registry of Central California concluded that childhood cancer rates in McFarland are no higher than would be expected, and are similar to other communities in California (Mills, 2004).

The purpose of this report is to summarize the findings of USEPA R9's sampling and analysis and to present USEPA R9's interpretation of those results from a public health perspective in relation to the chemicals detected in the McFarland environment. Thus, the report is organized as follows:

- Chapter 2: **Background** information about McFarland and a brief summary of sampling and analysis performed in McFarland prior to USEPA R9's McFarland Study Area investigation.
- Chapter 3: information on **When, Where, and How US EPA's McFarland Sampling and Analysis Was Conducted**
- Chapter 4: the **Criteria Used by USEPA R9 to Evaluate McFarland Test Results**
- Chapter 5: USEPA R9's **Findings of McFarland Study Area Investigation**
- Chapter 6: USEPA R9's **Public Health Discussion of Significant Findings in McFarland's Drinking Water, Soil, and Outdoor Air**
- Chapter 7: **Conclusions and Summary**
- Chapter 8: list of **References**

Complete details regarding USEPA R9's investigations have been described elsewhere and will not be reiterated in this report. The following reports present USEPA's findings in detail:

## **Drinking Water:**

*McFarland Drinking Water Investigation: U.S. EPA Evaluation of Phase I and 2 Results*, January 2001 (author: US Environmental Protection Agency Region 9).

## **Soil:**

*McFarland Soil Investigation Phase 1 Summary Report, Volume I*, August 2000 (author: US Environmental protection Agency Region 9).

*McFarland Soil Investigation Phase 2 Summary Report*, May 2007 (author: Catherine Clarkin Consulting, prepared for US Environmental Protection Agency Region 9).

## **Outdoor Air:**

*McFarland Outdoor Air Investigation Summary Report*, September 2008 (author: Catherine Clarkin Consulting, prepared for US Environmental Protection Agency Region 9)

A complete list of documents prepared by or for USEPA R9 in support of sampling and analysis efforts, including field sampling plans and quality assurance plans, can be found at the end of this report (Section 8).

## 2 Background

From 1984 through 1991, KCEHSD and DHS conducted a series of studies in McFarland, California, in response to the discovery of a childhood cancer cluster. During these studies, which included environmental sampling and epidemiological and health investigations, USEPA R9 provided technical assistance to DHS. The studies concluded that there were no unusual levels of contaminants in McFarland. The cause of the childhood cancers was undetermined. After the conclusion of the state's investigation, seven new cases of childhood cancer were reported by DHS in 1996 (DHS 1996). For the years of 1988 to 2001, the Cancer Registry of Central California concluded that childhood cancer rates in McFarland are no higher than would be expected, and are similar to other communities in California (Mills, 2004).

In 1995, a group of McFarland residents petitioned USEPA R9 for assistance in further evaluating the community's environment. Its petition lists the community's concerns about exposure to pesticides and hazardous wastes, potentially contaminated drinking water, the continued cases of cancer, and other health concerns. In response to the petition, USEPA R9 agreed to conduct additional drinking water, soil, and outdoor air sampling to evaluate environmental conditions in McFarland that were present at the time of sample collection.

### 2.1 Site Description

McFarland is located in Kern County (latitude 35°40' N, longitude 119°13' W), about 22 miles north of Bakersfield in the southern part of the San Joaquin Valley (Figure 2-1). To the east are the Sierra Nevada Mountains and to the west and south are the Diablo and Tumbler ranges (Coast Ranges). Highway 99 and the Southern Pacific Railroad bisect McFarland in a northwest-southeast direction.

McFarland is predominantly residential, although a number of commercial facilities are in McFarland and along the outskirts of town. Numerous small businesses are situated along the west side of Highway 99. The McFarland Co-Op Cotton Gin was located on the northwest outskirts of town, but was shut down before outdoor air sampling began. West

of McFarland are four dairies, and another dairy is located to the southeast of the city. An electricity generating plant, the Delano Co-Gen Plant, which burns primarily agricultural waste as an energy source, is located north of McFarland.

McFarland's economy is closely linked with the agricultural industry; many of the town's residents are employed as professional farm laborers. The town is surrounded by cropland, pastures, and orchards. The major crops grown in the McFarland area include grapes, almonds, and oranges.

#### 2.1.1 How McFarland Gets Its Drinking Water

At the time of sampling, the McFarland Mutual Water Company (MMWC) supplied drinking water to McFarland through a delivery system that comprises approximately 1,700 water connections. The system included four active wells (Well #2, #4, #6, and the Garzoli Well) and a 750,000-gallon storage tank. Water from the wells fed into a single system of interconnected pipes that provide water on demand to users. The depths of the wells ranged from 600 to 1,400 feet below ground surface (bgs).

All of the wells had chlorination/disinfection systems designed to kill any harmful bacteria that may have been in the water. Well #6 used gas chlorination to disinfect the water and to remove hydrogen sulfide, a naturally-occurring compound that imparts an unpleasant odor to some ground water sources of drinking water. Wells #2 and #4 had nitrate removal systems designed to reduce the level of nitrates in the water.

#### 2.1.2 Composition of McFarland Soil

McFarland is located in the southern part of the San Joaquin Valley of the Great Valley Geomorphic Province, bounded by the Sierra Nevada Mountains to the east, and the Diablo and Tumbler ranges to the west. The McFarland area lies on relatively flat terrain that gently slopes to the northwest. The most common soil type is known as "McFarland Loam," comprised of a deep, well-drained loam on floodplains and alluvial fans predominantly derived from granitic rock. McFarland Loam has a moderate permeability and a high water capacity.

### 2.1.3 San Joaquin Valley Air Basin

McFarland is located within the San Joaquin Valley air basin which extends from San Joaquin County in the north to Kern County in the south. The California Air Resources Board (CARB) and the San Joaquin Valley Air Pollution Control District (SJVAPCD) monitor air quality throughout the basin. At the time of this investigation, the basin was referred

to as a nonattainment area for airborne PM-10 [particulate matter with a diameter of 10 microns ( $\mu\text{m}$ ) or less] and ozone because the concentrations of these contaminants in the valley exceed national outdoor air quality standards. The Clean Air Act and Amendments of 1990 define a “nonattainment area” as a locality where air pollution levels persistently exceed National Ambient Air Quality Standards (NAAQS; 40 Code of Federal Regulations [CFR] 50).

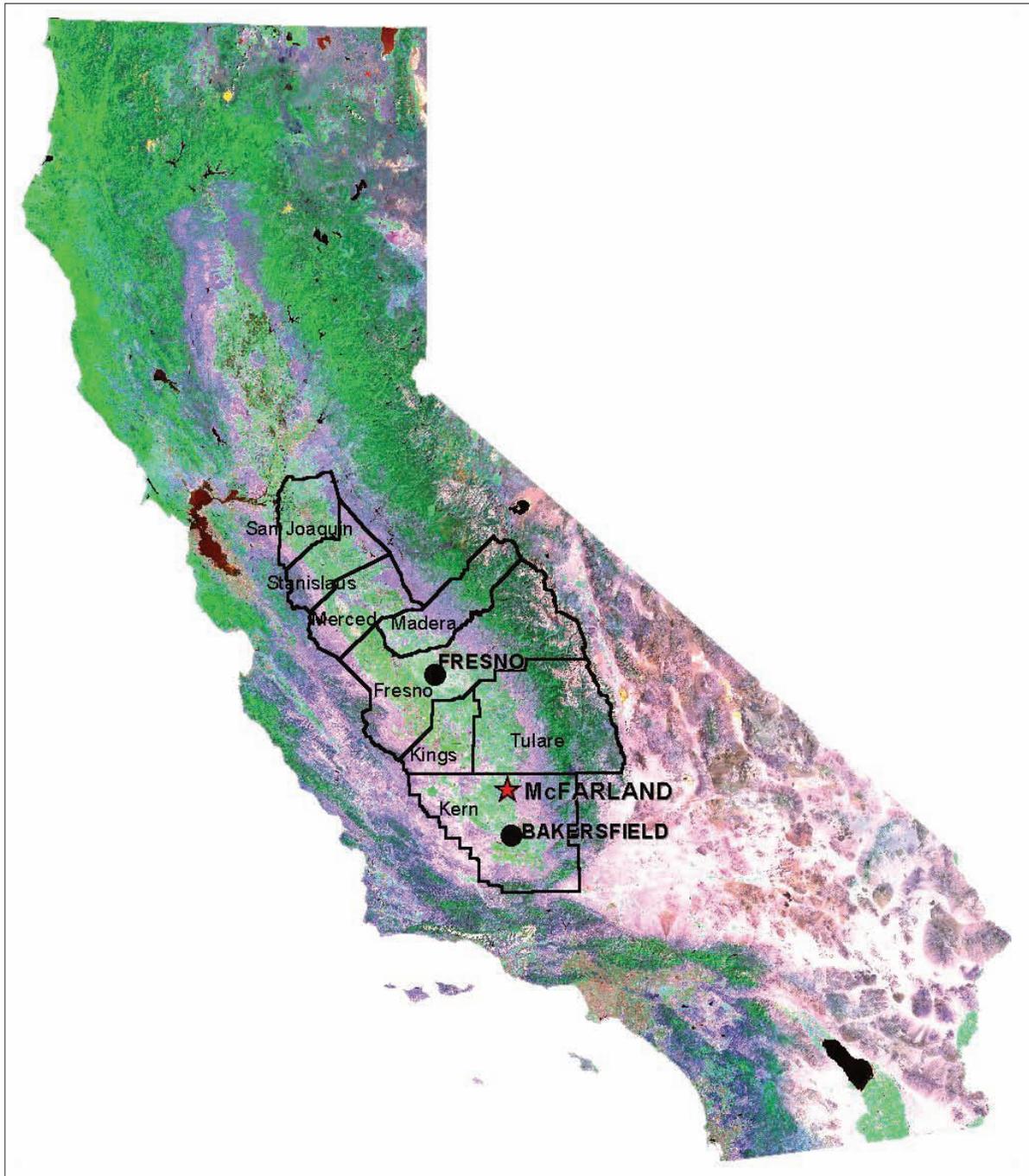


Figure 2-1

**San Joaquin Valley  
McFarland Outdoor Air Investigation**  
McFarland, California

FinalAir.001275.0011.01SR.b  
(Orig. Dr. No: 09.0101.MFSA.XX.k)  
Proj. No.: 001275.0011.01SR  
Date: 08/29/2005  
File:McAir Final 2005 CD

## 2.2 Previous Environmental Sampling Studies

### 2.2.1 Drinking Water

Under the federal Safe Drinking Water Act and its implementing regulations, and the California Safe Drinking Water Act and related laws, all public water providers in California are required to perform regular sampling of water from the water systems for all classes of drinking water contaminants.

The MMWC has performed all monitoring required by the state. Nitrate, arsenic, and dibromochloropropane (DBCP) had been detected previously at varying levels in some MMWC wells, and some of the levels have exceeded the state and federal maximum contaminant levels. To reduce the concentrations of these contaminants, MMWC added nitrate removal systems to two of the wells (Well #2 and Well #4). The company also discontinued use of, or abandoned, some of the wells; constructed new wells; and reconfigured other wells. In 1996, the MMWC collected and analyzed samples as required by the federal and state Safe Drinking Water Acts. The test results in 1996 indicated that the water system was meeting all federal and state MCLs.

### 2.2.2 Soil

From 1985 to 1989, KCEHSD and DHS, with USEPA R9 assistance, conducted several soil investigations to determine if unusual levels of soil contamination were present in McFarland (DHS 1988; KCEHSD 1987; USEPA 1990). The studies analyzed soils from a variety of locations, including cancer case homes, control homes, schools, parks, and commercial/industrial facilities. The soils were analyzed for metals, pesticides, and volatile organic compounds (VOCs). The results of the analyses were compared to background concentrations typical for soils in California and in other areas of the country. None of the soil studies found unusually high levels of soil contamination.

### 2.2.3 Outdoor Air

#### Vehicular Exhaust

Carbon monoxide, a stable component of exhaust from internal combustion engines, is an indicator of overall pollution due to motor vehicle use. Kern County Health Department (KCHD) monitored carbon monoxide in McFarland during February, July, and December 1986. The results indicated that McFarland had lower motor vehicle emissions than the San Francisco Bay Area (Coye and Goldman, 1991).

#### Pesticide Monitoring Studies

Before August 1991, as part of CARB's sampling and monitoring efforts, CARB collected data on four pesticides in McFarland:

- Ethyl parathion, a restricted organophosphate insecticide widely used prior to September 1991;
- Azinphos methyl, a nonrestricted organophosphate insecticide;
- Benomyl, a nonrestricted pesticide used as a systemic fungicide on a wide variety of crops; and
- Captan, a restricted pesticide that is used as a broad-spectrum fungicide on a wide variety of crops.

California Department of Pesticide Regulation (CDPR) concluded that the available monitoring data for various monitored pesticides were limited; the data were insufficient to determine if outdoor air levels in McFarland were different from other rural locations in the McFarland area or in the rest of California. The available data did suggest that levels of pesticides in air in urban areas of the Central Valley, such as Bakersfield and Fresno, were less than those in air in rural areas.

CARB continued to collect samples in Kern County from 1991 to 1995 for azinphos methyl, benomyl, and captan and added samples for mancozeb and methyl isothiocyanate (MITC; Baker et al., 1996). Mancozeb was used primarily as a fungicide on potatoes. Methyl isothiocyanate (MITC) is the primary breakdown product of metam-sodium and has pesticidal properties as a fumigant. Metam-sodium was used primarily as a soil fumigant on tomatoes. Outdoor air samples and samples collected adjacent to fields (application site samples) were analyzed for all of these pesticides. Results indicated the following:

- Azinphos methyl was detected in outdoor air samples (at a mean concentration that exceeds mean background levels) and in application site samples;
- Benomyl was detected in outdoor air samples (at a maximum concentration that was less than mean background levels) and in application site samples;
- Captan and its breakdown product tetrahydrophthalimide were not detected in outdoor air samples but were detected in application site samples;
- Mancozeb was not detected in outdoor air samples but was detected in application site samples; and
- MITC was detected in outdoor air samples (at a mean concentration that exceeds mean background levels) and in application samples.

# 3 When, Where, and How USEPA R9's McFarland Sampling and Analysis Were Conducted

**Drinking Water:** USEPA R9 tested McFarland drinking water for more than 300 substances and sampled 33 locations (6 wells or tanks and 27 faucet locations) within the McFarland drinking water system. USEPA R9 went beyond a typical drinking water sampling by including a large number of unregulated substances (i.e., substances without established drinking water standards), such as pesticides.

**Soil:** During the Phase 1 soil sampling event, USEPA R9 collected 391 surface and subsurface soil samples at 21 locations and tested for more than 200 substances. During Phase 2, USEPA R9 collected an additional 71 samples at 9 locations and tested for more than 200 substances.

**Outdoor Air:** Outdoor air sampling involved collection of hundreds of air samples at two locations over the course of four sampling events and the analysis of over 150 substances. Additionally, USEPA R9 performed meteorological monitoring and PM-10 monitoring nearly continuously throughout the air investigation. Additional sampling and analysis of 15 indoor dust samples collected at two schools during 3 sampling events was conducted in conjunction with outdoor air sampling. Indoor dust samples were analyzed for a subset of substances analyzed in outdoor air samples.

## 3.1 Sampling Dates

Sampling and analysis for the USEPA R9 McFarland Study Area Investigation spanned 1997 to 2002. Both the drinking water sampling and soil sampling were conducted in two phases. For drinking water, the first phase focused on the drinking water supply system and the second phase focused on tap water as well as the supply system. For soil, the first phase gave a broad picture of potential contaminants and locations, and the second phase focused sample efforts toward likely areas of exposure.

The outdoor air sampling was conducted during four sampling events over the course of nearly a year. Unlike soil and water, which will have relatively consistent concentrations of chemicals over the course of days, months, and sometimes

even years, outdoor air contamination can change from day to day. Concentrations of chemicals in outdoor air can vary on a day-to-day basis depending factors such as wind speed and direction, precipitation, changes in traffic density, and nearby application of pesticides. By spreading outdoor air sampling across multiple events for nearly a year, USEPA R9 attempted to identify the range of concentrations and types of chemicals in outdoor air to which McFarland residents were exposed.

### Sampling events occurred as follows:

#### Drinking Water:

Phase 1: July 1997 (4 active and 1 inactive drinking water wells and the 750,000-gallon storage tank were sampled)

Phase 2: June 1998 (all 4 active drinking water wells, the 750,000 gallon storage tank, and tap water from 27 residential and public locations throughout McFarland)

#### Soil:

Phase 1: February 1999

Phase 2: October 2000

#### Outdoor Air:

Event 1: July 8-26, 2001

Event 2: December 28, 2001 - January 16, 2002

Event 3: March 3-19, 2002

Event 4: May 2-24, 2002

Indoor dust screening at McFarland Middle School and Browning Road School was also performed during the outdoor air investigation:

Event 2: December 28, 2001 to January 16, 2002

Event 4: May 2 to 24, 2002 (short-term dust samples only)

Event 4B: June 13, 2002 (long-term dust samples only)

PM-10 was monitored continuously from August 30, 2001 to June 12, 2002. Meteorological monitoring was also conducted continuously from July 8, 2001 to June 13, 2002.

## 3.2 Sampling Locations

For drinking water, soil, and outdoor air, sampling locations encompassed areas of contamination (e.g., industrial facilities) and places where people, especially children, spend significant amounts of time (e.g., schools, parks, and homes).

**Drinking water:** During 2 rounds of the drinking water investigation, samples were collected at 4 active and 1 inactive drinking water wells throughout McFarland and the 750,000-gallon storage tank. In addition, USEPA R9 collected and analyzed tap water from 27 residential and public locations throughout the MMWC public water supply system:

- 15 private residences
- 6 public schools
- 2 public parks
- 1 public gymnasium
- 1 public library
- 1 health center
- 1 church

**Soil:** During Phase 1 of the soil investigation, USEPA R9 collected multiple soil samples at 21 locations throughout McFarland:

- 4 schools
- 2 parks
- 6 commercial/industrial facilities
- 8 residences, and
- the drainage basin in the northeast section of town near closed Well #5

Based on results of Phase 1 sampling USEPA R9 collected samples at the following locations during Phase 2 of the soil investigation:

- 2 schools
- 1 park
- 4 commercial/industrial facilities
- 1 residence, and
- the former location of closed Well #5

**Outdoor Air:** During 4 events over the course of a year, USEPA R9 conducted outdoor air sampling at Browning Road School (Station 1) and McFarland Middle School (Station 2). Multiple air samplers were used to accommodate the different sampling and analysis requirements. The setup and operation of the air samplers at each station was facilitated by the construction of a platform connected to an electrical power supply and telecommunications. Each platform was designed to comply with applicable state and federal construction standards.

## 3.3 How Samples Were Collected and Analyzed

For nearly all substances analyzed in McFarland samples, USEPA R9 used state of the art, field proven, peer reviewed sampling and analytical methods. In most cases, these methods were standard USEPA methods. Using these methods ensured that data were received in a standardized format, thus data packages could undergo rigorous quality assurance review (data validation). For some substances, a standard USEPA method was not available. In these cases, methods were selected to give the best quality data possible and additional quality assurance measures were undertaken. Data generated from these non-standard methods were also subjected to data validation.

Further details on sample collection, analysis and quality assurance/quality control (QA/QC) procedures are available in the individual drinking water, soil and outdoor air investigation reports.

Analyzed substances were the following:

- **Pesticides** (including herbicides, insecticides, fungicides, etc.): drinking water, soil, outdoor air
- **Metals/Minerals**: drinking water, soil, outdoor air
- **Polynuclear Aromatic Hydrocarbons (PAHs)**: drinking water, soil, outdoor air
- **Volatile Organic Compounds (VOCs)**: drinking water, soil, outdoor air
- **Disinfection Byproducts**: drinking water only
- **Dioxin/Furan & Polychlorinated Biphenyl (PCB) Congeners**: drinking water, soil, outdoor air

- **Other Synthetic Organic Compounds (SOCs)** (e.g., industrial chemicals, plasticizers, etc.): drinking water, soil, outdoor air
- **Microbial Agents**: drinking water only
- **Anions**: drinking water only
- **Radionuclides**: drinking water only
- **Water Quality Parameters**: drinking water only.

Additional details, including specific analyte lists and methods, are available in the individual drinking water, soil and outdoor air investigation reports.

# 4 Health-Based Criteria Used by USEPA R9 to Evaluate the Public Health Significance of McFarland Test Results

In general, USEPA R9 determined the public health significance of compounds detected in McFarland's drinking water, soil, and air by comparing concentrations observed in McFarland's environmental media to one or more of the following:

- standards promulgated by a federal or state regulatory agency, such as USEPA, to be protective of human health and the environment (e.g., Maximum Contaminant Levels for drinking water, Ambient Air Quality Standards for outdoor air),
- health-based screening levels (HBSLs) developed by USEPA, or a similar agency, to be protective of human health (e.g., Preliminary Remediation Goals, Reference Exposure Levels), and
- acceptable human health risk ranges developed by USEPA for assessment of potential risks from environmental exposures.

Because this was a wide-ranging investigation of an unusually large number of analytes in drinking water, soil and outdoor air, it was necessary to use health-protective standards and/or screening levels from a number of different environmental programs in assessing the potential for public health impacts from the compounds detected in McFarland.

Any compound detected in one or more of McFarland's environmental media was considered to not pose a significant public health impact if its concentration in that media was in compliance with a promulgated standard or was less than a relevant HBSL. Compounds present at concentrations exceeding either a standard or HBSL were subject to additional evaluation(s) which included one or more of the following:

- repeated sampling to confirm elevated concentrations,
- comparison to typical background levels, and/or
- risk screening calculations and comparison of estimated risks to acceptable human health risk ranges.

## 4.1 Drinking Water

Under the Safe Drinking Water Act, USEPA sets legal limits for approximately 90 contaminants in drinking water; these legal limits are called Maximum Contaminant Levels (MCLs). The goal of primary MCLs is to protect drinking water quality by limiting the levels of specific contaminants that can adversely affect public health. For some drinking water contaminants, California has set more stringent "California MCLs" that are more protective of human health than the federal limits. All drinking water distributed in California must comply with federal and state MCL standards. For purposes of evaluating the data collected in McFarland, USEPA R9 compared results to both sets of standards, using the more stringent standard available at the time.

Many of the substances tested by USEPA R9 in McFarland's drinking water did not have an associated federal or California MCLs. For these substances, USEPA R9 compared results of the drinking water analysis to HBSLs. These health-based screening levels are developed by federal and state agencies for assessment of health risks in drinking water. For substances where children are known to be more sensitive (e.g., nitrates, lead), relevant drinking water standards and health-based screening levels are set specifically to protect children.

HBSLs used to assess the health protectiveness of McFarland's drinking water – when MCLs were not available - included the following:

- Drinking Water Health Advisories (HAs), set by USEPA
- California Archived Action Levels (CAALs) for drinking water, set by California EPA
- Preliminary Remediation Goals (PRGs), set by USEPA R9.

**Drinking Water Health Advisories:** Health Advisories for drinking water are concentrations of specific substances that are considered to be without appreciable health risk for specific exposure periods ranging from one day to an entire lifetime. Shorter-term HAs (i.e., 1 day and 10 day) are specifically oriented to protecting children. In contrast to drinking water standards, HAs are not enforceable but are considered nationally applicable guidance for promoting the safety of drinking water.

**California Drinking Water Action Levels:** Action levels, now called notification levels are set by the California Department of Health Services (DHS) as health-based criteria and are derived in much the same way as U.S. EPA Health Advisories. Similar to the Health Advisories, CAALs for drinking water are not enforceable but are considered state-wide guidance for the protection of drinking water sources.

**Preliminary Remediation Goals:** Tap water PRGs (U.S. EPA 1999b) are concentrations of specific substances that can be present in drinking water without posing an appreciable health risk to people, including children and other sensitive members of the community, consuming that tap water. PRGs are health-conservative screening levels developed in accordance with peer-reviewed national guidance on risk assessment (USEPA 1991). They were developed by USEPA R9 using standard toxicity values for each substance and conservative (i.e., health-protective) assumptions about human exposure to those substances in drinking water, soil and ambient air, based on the type of site use. For example, tap water PRGs assume daily exposure to drinking water through ingestion, inhalation and dermal contact, for 350 days each year over a period of 30 years. Since most residential situations involve exposures that are less frequent or for shorter duration than these assumptions, the PRGs are likely to represent drinking water screening levels that are conservatively protective of human health for most people. This is especially true when using residential PRGs for risk-based screening of tap water at parks and schools, where typical exposures are much less frequent than 350 days/year and of much shorter duration than 30 years.

USEPA R9 uses PRGs to determine if the concentrations of specific substances in drinking water are low enough that they clearly do not pose a significant health risk; these concentrations are those that are less than their respective PRGs. Because of the conservative nature of the PRGs, EPA R9 believes the presence of a substance at a concentration greater than its PRG does not necessarily mean that substance poses a significant risk. Rather, presence at a concentration above the PRG indicates that additional evaluation of that substance

in that location may be warranted to determine if it does pose a potentially significant health threat. This is especially relevant for carcinogens (substances capable of increasing an individual's risk of developing cancer) because their PRGs are set at a level corresponding to a  $1 \times 10^{-6}$  (1-in-one million) excess lifetime cancer risk. This risk level represents the extreme lower end of the acceptable risk range used by EPA; the upper end is at  $10^{-4}$  (~100-in-one-million). Therefore, potentially carcinogenic substances may be present at concentrations above their PRGs and still not pose an excess cancer risk outside of the risk range.

A tiered approach was used to assess the potential health significance of compounds detected in McFarland's drinking water. MCLs were the first choice for comparison to results; if an MCL was not available for a specific compound one of the HBSLs was used according to the hierarchy:

1. HAs first,
2. then CAALs, and
3. lastly PRGs.

In evaluating the potential health significance of substances that were detected in one or more samples, USEPA R9 concluded that levels that were at or below primary drinking water standards (the more stringent of either federal or California MCLs) were in compliance with the Safe Drinking Water Act and therefore did not pose an appreciable health risk to people consuming McFarland's drinking water. For those substances lacking a primary drinking water standard, USEPA R9 concluded that levels that are at or below the relevant HBSL also did not pose an appreciable health risk to people using McFarland drinking water.

## 4.2 Soil

USEPA R9 compared all results of soil sampling in McFarland to USEPA's 1999 residential and industrial soil Preliminary Remediation Goals (PRGs) (U.S. EPA 1999b). PRGs are HBSLs used by USEPA R9 to determine if compounds present in the environment may create a potential health risk. Substances that are present in the environment only at concentrations less than their PRGs are not considered to present a potential health risk. Residential soil PRGs were the HBSLs used for results of samples collected from residences, as well as public areas, such as schools and parks. Industrial PRGs were used for commercial and industrial properties. In a few instances, Trespasser PRGs were developed and used for risk screening evaluation of potential exposures to soil contaminants at abandoned properties.

Soil PRGs (U.S. EPA 1999b) are analogous to tap water PRGs in that they are concentrations of specific compounds that can be present in soil without posing an appreciable health risk to people in either a residential or an industrial setting. Residential PRGs assume daily exposure to soil, through incidental ingestion, inhalation and dermal contact, for 350 days each year over a period of 30 years. Industrial PRGs assume similar contact with soil: 250 days (that is, 5 working days per week for 50 weeks) per year for a 25-year working career. Since most residential and industrial/commercial situations involve exposures that are less frequent or for shorter duration than these assumptions, the PRGs are likely to represent soil screening levels that are conservatively protective of human health for most people. This is especially true when using residential PRGs for risk-based screening of exposures at parks and schools, where typical exposures are much less frequent than 350 days/year and of much shorter duration than 30 years.

As with the tap water PRGs, USEPA R9 uses soil PRGs to determine if the concentrations of specific compounds in soil are low enough that they clearly do not pose a significant health risk; these concentrations are those that are less than their respective PRGs. As with the tap water PRGs, USEPA R9 believes the presence in soil of a compound at a concentration greater than its PRG does not necessarily pose a significant risk, rather, it indicates that additional evaluation may be warranted to determine if there is a potentially significant health threat.

For results exceeding PRGs, USEPA R9 performed a more detailed risk evaluation, involving a closer look at potential exposures, calculation of cancer risk (in the case of carcinogens), and comparison to risk limits. Specifically, USEPA R9 took the following steps to evaluate the health risk:

- For abandoned commercial properties, USEPA R9 developed more realistic Trespasser PRGs, which took into account more realistic levels of potential exposure to substances on an abandoned site.
- For carcinogens exceeding PRGs, USEPA R9 calculated the associated excess lifetime cancer risk and compared that cancer risk estimate to the USEPA's acceptable risk range.

### 4.3 Outdoor Air

Similar to the drinking water and soil investigations, for those chemicals detected in McFarland's outdoor air USEPA R9 primarily used health-based screening levels to distinguish concentrations that warranted further assessment from those that did not pose a potentially significant health risk. The McFarland Outdoor Air HBSLs were either adopted directly

from the USEPA R9 PRGs or, when an existing PRG was not available, were developed using the USEPA methodology for setting PRGs for the Superfund program (USEPA, 1991). As with the tap water and soil HBSLs, USEPA or California EPA toxicity values for each chemical were combined with exposure assumptions for a reasonable maximum exposure in a residential setting, including the assumption that children and other sensitive members of the community could be exposed to the chemicals by breathing the air for at least 30 years. USEPA HBSLs are conservatively designed to be protective of human health. Thus, the presence of the chemicals detected in McFarland above their respective HBSLs does not necessarily mean that these chemicals pose a significant health risk. Instead, HBSL exceedances identify which chemicals merit a more thorough risk-based screening evaluation. Additional details on the development of chronic HBSLs are provided in Outdoor Air Investigation report.

The following hierarchy was used in setting chronic HBSLs for pesticides:

- Region 9 PRG: The first choice for an outdoor air HBSL was generally a USEPA R9 ambient air PRG (USEPA 2002), where these existed.
- PRG-equivalent: If no PRG existed, or if the toxicity value used to develop the PRG did not represent the most recent scientific data available, an outdoor air PRG-equivalent was developed using standard USEPA R9 PRG methodology (USEPA, 1991). Toxicity values used for developing PRG-equivalents came from up-to-date USEPA Office of Pesticides Program (OPP) toxicity value determinations. Sources of OPP toxicity values that were consulted were the following:
  - » OPP Reference Dose (RfD) Tracking Report (February 1997) (<http://ace.orst.edu/info/npic/tracking.htm>)
  - » OPP Reregistration Eligibility Documents (REDs) (EPA, various) (<http://www.epa.gov/pesticides/reregistration/status.html>).
  - » OPP report on Chemicals Evaluated for Carcinogenic Potential (June 2003)

If OPP had completed a RED, or similar, toxicity review subsequent to the most recent IRIS review, the toxicity value from OPP's RED, or Interim RED (IREDD), was used to develop a PRG-equivalent.

For VOCs and other non-pesticide chemicals, HBSLs generally are set to the **lower** (i.e., most protective of health) of either the USEPA R9 PRG or the Office of Air Quality Planning Standards Prioritized Dose-Response Values.

There was one exception to this procedure. The HBSL for lead was set to the California Ambient Air Quality Standard 1.5 micrograms per cubic meter ( $\mu\text{g}/\text{m}^3$ ).

**Short-term Exposures:** Acute health effects (those occurring after only a very short exposure, e.g., hours or days) typically develop only in response to much higher exposure concentrations (usually 100-fold or greater) than do chronic effects. Therefore, measured exposure concentrations that are below chronic HBSLs are not expected to pose significant acute health risks. For those chemicals detected in outdoor air at concentrations greater than chronic HBSLs, acute health-based screening levels (i.e., *acute HBSLs*) from the following sources were used:

- Acute Reference Exposure Levels (RELs) developed by the Office of Environmental Health Hazard Assessment (OEHHA) of the California Environmental Protection Agency
- Acute Minimum Risk Levels (MRLs) developed by the Agency for Toxic Substances and Disease Registry (ATSDR)

**Particulate Matter:** Particulate matter (PM) concentrations in McFarland outdoor air were compared to state and federal outdoor air quality standards, which are also health-based screening levels. For this investigation, the outdoor air in McFarland was evaluated for three types of PM: PM-10, PM-2.5, and total suspended particulates (TSP). PM is a mixture of solid and liquid particles found in the air. PM-10 is PM of small size (less than 10  $\mu\text{m}$  in diameter or 1/7 the wide of a human hair) and is more likely to be respired (breathed-in) and trapped in the lungs than larger particles. PM-2.5, similar to PM-10, is even smaller particles, those of diameters less than 2.5  $\mu\text{m}$ . PM-2.5 is also likely to be respired and trapped in the lungs. TSP is “total suspended particulates” and represents all non-volatile airborne matter that can be collected using a filter and vacuum collection device.

Because PM-10 and PM-2.5 represent respirable dust, both the state of California and the federal USEPA have established outdoor air quality standards for these parameters, as shown

Table 4-1: Outdoor Air Quality Standards\*

| Type               | PM-10                       |                              | PM-2.5                      |                             |
|--------------------|-----------------------------|------------------------------|-----------------------------|-----------------------------|
|                    | California                  | Federal                      | California                  | Federal                     |
| Short-term (24-hr) | 50 $\mu\text{g}/\text{m}^3$ | 150 $\mu\text{g}/\text{m}^3$ | --                          | 65 $\mu\text{g}/\text{m}^3$ |
| Long-term (annual) | 20 $\mu\text{g}/\text{m}^3$ | 50 $\mu\text{g}/\text{m}^3$  | 12 $\mu\text{g}/\text{m}^3$ | 15 $\mu\text{g}/\text{m}^3$ |

\* Standards in place at time of sampling.

$\mu\text{g}/\text{m}^3$  = microgram/cubic meter

PM-10 = particulate matter with a mass median diameter of 10 microns or less

PM-2.5 = particulate matter with a mass median diameter of 2.5 microns or less

in Table 4-1. Outdoor air quality standards are set at the federal and state level to protect the public health and the environment from pollutants. The standards shown in effect at the time sampling occurred and were considered by the State and Federal government as the levels above which breathing the air may cause adverse health effects.

Unlike PM, TSP includes both respirable particles and larger particles that are not likely to cause health effects because they do not remain trapped in the lungs. Because the health effects of the same concentration of TSP from different locations may differ depending on the size distribution and chemical composition of the TSP, neither the state nor federal government have established action levels or outdoor air quality standards for TSP.

**Comparison to Regional Air Quality Data:** In order to understand the McFarland outdoor air sampling results in the context of the greater San Joaquin Valley, USEPA R9 compared the results to CARB sampling data from the Valley for the years 2001 and 2002. For each chemical detected above an HBSL where CARB data were available, the minimum, maximum, mean, and median concentrations for McFarland for the entire investigation were compared to the same statistics for the CARB data for 2001 and 2002 separately and for each San Joaquin Valley CARB sampling station separately (CARB, 2002; CARB, 2003).

The comparison of the McFarland data to the CARB data provides information as to whether concentrations of chemicals in McFarland’s outdoor air are similar to those in other nearby cities and towns. Because of differences in sampling schedules and methods, the comparison of the data sets from CARB and McFarland is best viewed as a relative, rather than quantitative comparison. That is, if one set of results is generally higher than the other, then USEPA R9 would conclude that the concentration of that chemical in that location might be generally higher than in the other location. However, the magnitude of the difference in concentrations between the two monitoring locations overall would not be determined. The greater the differences in concentrations between two monitoring locations, the more confidence there is in concluding that a true difference exists.

# 5 Findings of McFarland Drinking Water, Soil and Outdoor Air Investigations

## 5.1 Findings of the Drinking Water Investigation

Table 5-1 provides a summary of the substances analyzed in each media and indicates whether a substance was detected, and if so, at a concentration above the screening or action level.

Most of the more than 340 substances tested by USEPA R9 were not detected in any of the samples collected from McFarland's drinking water wells, storage tank, and distribution system (including private residences, public buildings, schools, and parks). Most of the substances which were found in one or more samples were present at levels in compliance with drinking water standards or the health-based screening criteria used for the McFarland project. It should be noted that although high lead levels were found in "first draw" samples from a few faucets, the lead levels of all the drinking water samples (after running the water) were below levels of health concern. This is a common condition for many water systems, especially in older homes (see the "Lead" discussion below for a complete details).

Many of the substances that were found in McFarland's drinking water are naturally present in groundwater (e.g., naturally-occurring minerals and metals such as arsenic, iron, and magnesium), or result from disinfection of the water supply, and were therefore expected to be present. Some substances were found that are not naturally present (e.g., synthetic organic compounds and inorganics that are not naturally-occurring). All of these substances found in the drinking water were detected below - or are treated to be in compliance with - applicable drinking water standards or the health-based screening criteria used for the project. As has been known for years, nitrate levels in two of McFarland's drinking water wells require treatment to meet the drinking water standards (see "Nitrate/Nitrite" discussion below).

The following section contains specific discussions on the following substances which were detected in McFarland's drinking water one or more times at concentrations in excess of their drinking water standards or HBSLs:

- Lead
- Nitrate/Nitrite
- Arsenic

Table 5-1: Summary of Analytes and Detections by Media

| CAS-num       | Analyte          | Soil | DW | Air | Indoor Dust |
|---------------|------------------|------|----|-----|-------------|
| <b>Metals</b> |                  |      |    |     |             |
| 7429-90-5     | Aluminum         | X    | X  |     |             |
| 7440-36-0     | Antimony         | X    | X  |     |             |
| 7440-38-2     | Arsenic          | #    | X  | #   | X           |
| 7440-39-3     | Barium           | X    | X  |     |             |
| 7440-41-7     | Beryllium        | X    | X  |     |             |
| 7440-43-9     | Cadmium          | X    | X  | #   | X           |
| 7440-70-2     | Calcium          | X    | X  |     |             |
| 7440-47-3     | Chromium (total) | X    | X  | #   | X           |
| 18540-29-9    | Chromium (VI)    |      | 0  |     |             |
| 7440-48-4     | Cobalt           | X    | X  |     |             |
| 7440-50-8     | Copper           | X    | X  |     |             |
| 7439-89-6     | Iron             | X    | X  |     |             |

Table 5-1: Summary of Analytes and Detections by Media

| CAS-num                 | Analyte                               | Soil | DW | Air | Indoor Dust |
|-------------------------|---------------------------------------|------|----|-----|-------------|
| 7439-92-1               | Lead                                  | #    | #  | X   | X           |
| 7439-95-4               | Magnesium                             | X    | X  |     |             |
| 7439-96-5               | Manganese                             | X    | X  | #   | X           |
| 7439-97-6               | Mercury                               | X    | X  |     |             |
| 7440-02-0               | Nickel                                | X    | X  |     |             |
| 7440-09-7               | Potassium                             | X    | X  |     |             |
| 7782-49-2               | Selenium                              | X    | X  |     |             |
| 7440-22-4               | Silver                                | X    | X  |     |             |
| 7440-23-5               | Sodium                                | X    | X  |     |             |
| 7440-28-0               | Thallium                              | X    | X  |     |             |
| 7440-31-5               | Tin                                   | X    | 0  |     |             |
| 7440-62-2               | Vanadium                              | X    | X  |     |             |
| 7440-66-6               | Zinc                                  | X    | X  | X   | X           |
| <b>Other inorganics</b> |                                       |      |    |     |             |
| 7664-41-7               | Ammonia (NH <sub>3</sub> -N) modified | X    |    |     |             |
| 1332-21-4               | Asbestos                              |      | 0  |     |             |
| 57-12-5                 | Cyanide                               | 0    | 0  |     |             |
| APPL0008                | Cyanide W                             |      | 0  |     |             |
| 16984-48-8              | Fluoride                              |      | X  |     |             |
| 14797-55-8              | Nitrate, Nitrogen                     | X    | X  |     |             |
| 14797-65-0              | Nitrite, Nitrogen                     | X    | 0  |     |             |
| 14808-79-8              | Sulfate                               |      | X  |     |             |
| 18496-25-8              | Sulfide                               |      | 0  |     |             |
| <b>PAHs</b>             |                                       |      |    |     |             |
| 83-32-9                 | Acenaphthene                          | 0    | 0  | X   | 0           |
| 208-96-8                | Acenaphthylene                        | 0    | 0  | X   | X           |
| 120-12-7                | Anthracene                            | X    | 0  | X   | 0           |
| 56-55-3                 | Benzo(a)anthracene                    | X    | 0  | X   | 0           |
| 50-32-8                 | Benzo(a)pyrene                        | #    | 0  | X   | 0           |
| 205-99-2                | Benzo(b)fluoranthene                  | X    | 0  | 0   | X           |
| 192-92-2                | Benzo(e)pyrene                        |      |    | 0   | 0           |
| 191-24-2                | Benzo(g,h,i)perylene                  | X    | 0  | 0   | 0           |
| 207-08-9                | Benzo(k)fluoranthene                  | X    | 0  | 0   | 0           |
| 218-01-9                | Chrysene                              | X    | 0  | X   | 0           |
| 191-07-1                | Coronene                              |      |    | 0   | 0           |
| 53-70-3                 | Dibenzo(a,h)anthracene                | 0    | 0  | 0   | 0           |
| 206-44-0                | Fluoranthene                          | X    | 0  | X   | X           |
| 86-73-7                 | Fluorene                              | 0    | 0  | X   | 0           |
| 193-39-5                | Indeno(1,2,3-cd)pyrene                | X    | 0  | 0   | 0           |
| 91-20-3                 | Naphthalene                           | 0    | 0  | X   | 0           |
| 85-01-8                 | Phenanthrene                          | X    | 0  | X   | X           |

Table 5-1: Summary of Analytes and Detections by Media

| CAS-num               | Analyte                      | Soil | DW | Air | Indoor Dust |
|-----------------------|------------------------------|------|----|-----|-------------|
| 129-00-0              | Pyrene                       | X    | 0  | X   | X           |
| <b>PCBs</b>           |                              |      |    |     |             |
| 12674-11-2            | Aroclor 1016 (PCB)           | 0    | 0  |     |             |
| 11104-28-2            | Aroclor 1221 (PCB)           | 0    | 0  |     |             |
| 11141-16-5            | Aroclor 1232 (PCB)           | 0    | 0  |     |             |
| 53469-21-9            | Aroclor 1242 (PCB)           | 0    | 0  |     |             |
| 12672-29-6            | Aroclor 1248 (PCB)           | 0    | 0  |     |             |
| 11097-69-1            | Aroclor 1254 (PCB)           | X    | 0  |     |             |
| 11096-82-5            | Aroclor 1260 (PCB)           | X    | 0  |     |             |
| 1336-36-3             | Aroclor 1268 (PCB)           | 0    |    |     |             |
| <b>PM</b>             |                              |      |    |     |             |
| PM-10                 | PM-10                        |      |    | #   |             |
| PM-2.5                | PM-2.5                       |      |    | #   |             |
| TSP                   | TSP                          |      |    | X   |             |
| <b>Radionuclides</b>  |                              |      |    |     |             |
| 12587-46-1            | Gross Alpha                  |      | 0  |     |             |
| 12587-47-2            | Gross Beta                   |      | X  |     |             |
| 13982-63-3            | Radium 226                   |      | X  |     |             |
| 15262-20-1            | Radium 228                   |      | X  |     |             |
| 14859-67-7            | Radon 222                    |      | #  |     |             |
| 7440-61-1             | Uranium                      |      | X  |     |             |
| 13968-55-3/13966-29-5 | Uranium 233/234              |      | X  |     |             |
| 7440-61-1             | Uranium 238                  |      | X  |     |             |
| <b>SOCs</b>           |                              |      |    |     |             |
| 30560-19-1            | Acephate                     | 0    | 0  |     |             |
| 50594-66-6            | Acifluorfen                  | 0    | 0  |     |             |
| 15972-60-8            | Alachlor (Alanex, Lasso)     |      | 0  |     |             |
| 116-06-3              | Aldicarb                     | 0    | 0  |     |             |
| 1646-88-4             | Aldicarb sulfone (Sulfocarb) |      | 0  |     |             |
| 1646-87-3             | Aldicarb sulfoxide           |      | 0  |     |             |
| 309-00-2              | Aldrin                       | 0    | 0  |     |             |
| 834-12-8              | Ametryn (Evik)               |      | 0  |     |             |
| 2032-59-9             | Aminocarb (Maticil)          | 0    |    |     |             |
| 33089-61-1            | Amitraz                      | 0    |    |     |             |
| 61-82-5               | Amitrole                     | 0    |    |     |             |
| 1610-17-9             | Atraton (Gesatamin)          |      | 0  |     |             |
| 1912-24-9             | Atrazine (Aatrex)            |      | 0  |     |             |
| 86-50-0               | Azinphos-methyl (Guthion)    | 0    | 0  | X   | 0           |
| 101-27-9              | Barban (Carbyne)             | 0    |    |     |             |
| 114-26-1              | Baygon (Propoxur)            | 0    | 0  |     |             |

Table 5-1: Summary of Analytes and Detections by Media

| CAS-num    | Analyte   | Soil | DW | Air | Indoor Dust |
|------------|---|------|----|-----|-------------|
| 43121-43-3 | Bayleton (Rofon)  |      | X  |     |             |
| 1861-40-1  | Benefin (Benfluralin)   |      | 0  |     |             |
| 17804-35-2 | Benomyl   | X    | 0  |     |             |
| 25057-89-0 | Bentazon  | 0    | 0  |     |             |
| 65-85-0    | Benzoic acid  | 0    |    |     |             |
| 82657-04-3 | Biphenthrin   | 0    |    |     |             |
| 108-60-1   | Bis(2-chloro-1-methylethyl)ether (2,2'-Oxybis(1-chloropropane)) | 0    |    |     |             |
| 111-91-1   | Bis(2-chloroethoxy)methane                                      | 0    |    |     |             |
| 111-44-4   | Bis(2-chloroethyl)ether   | 0    |    |     |             |
| 505-60-2   | Bis(2-chloroethyl)sulfide (mustard gas)                         | 0    |    |     |             |
| 63283-80-7 | Bis(2-chloroisopropyl)ether                                     | 0    |    |     |             |
| 117-81-7   | Bis(2-ethylhexyl)phthalate (Di(2-ethylhexyl)phthalate)          | X    | #  |     |             |
| 314-40-9   | Bromacil  | X    | 0  | 0   | 0           |
| 28772-56-7 | Bromadiolone  |      | 0  |     |             |
| 83463-62-1 | Bromochloroacetonitrile   |      | 0  |     |             |
| 101-55-3   | 4-Bromodiphenylether (4-bromophenylphenylether)                 | 0    |    |     |             |
| 1689-84-5  | Bromoxynil (Brominex)   |      | 0  |     |             |
| 23184-66-9 | Butachlor (Weedout)   |      | 0  |     |             |
| 85-68-7    | Butyl benzyl phthalate  | X    | 0  |     |             |
| 2008-41-5  | Butylate  |      | X  |     |             |
| 2425-06-01 | Captafol  | 0    |    |     |             |
| 133-06-2   | Captan (Orthocide)  | 0    | 0  |     |             |
| 63-25-2    | Carbaryl (Seven)  | 0    | 0  |     |             |
| 86-74-8    | Carbazole   | 0    |    |     |             |
| 1563-66-2  | Carbofuran (Furasul)  | 0    | 0  |     |             |
| 5234-68-4  | Carboxin (Vitavax)  |      | 0  |     |             |
| 133-90-4   | Chloramben  | 0    | 0  |     |             |
| 57-74-9    | Chlordane (ortho chlor)   | X    | 0  |     |             |
| 5103-71-9  | alpha-Chlordane   | X    | 0  | 0   | 0           |
| 5566-34-7  | gamma-Chlordane   | X    | 0  | 0   | X           |
| 106-47-8   | 4-Chloroaniline   | 0    |    |     |             |
| 510-15-6   | Chlorobenzilate (Benz-O-Chlor)                                  |      | 0  |     |             |
| 59-50-7    | p-Chloro-m-cresol (4-Chloro-3-methylphenol)                     | 0    |    |     |             |
| 91-58-7    | 2-Chloronaphthalene   | 0    |    |     |             |
| 2675-77-6  | Chloroneb (Terraneb)  |      | 0  |     |             |
| 95-57-8    | 2-Chlorophenol  | 0    |    |     |             |
| 7005-72-3  | 4-Chlorophenyl-phenylether (3-methyl-4-chlorophenol)            | 0    |    |     |             |

Table 5-1: Summary of Analytes and Detections by Media

| CAS-num    | Analyte                                  | Soil | DW | Air | Indoor Dust |
|------------|--|------|----|-----|-------------|
| 76-06-2    | Chloropicrin (Pic-Clor)                  | 0    | X  |     |             |
| 1897-45-6  | Chlorothalonil (Daconil, Bravo)          | 0    | 0  |     |             |
| 1982-47-4  | Chloroxuron (Tenoran)                    | 0    |    |     |             |
| 101-21-3   | Chlorpropham (CIPC)                      | 0    | 0  |     |             |
| 2921-88-2  | Chlorpyrifos                             | X    | 0  | X   | X           |
| 5598-15-2  | Chlorpyrifos oxon                        |      |    | X   | 0           |
| 56-72-4    | Coumaphos (Meldone)                      | 0    |    |     |             |
| 156-62-7   | Cyanamide (Calcium cyanamide)            | 0    |    |     |             |
| 21725-46-2 | Cyanazine                                | 0    | 0  | 0   | 0           |
| 1134-23-2  | Cycloate (Ro-neet)                       |      | 0  |     |             |
| 68359-37-5 | Cyfluthrin (Baythroid)                   | 0    |    | 0   | X           |
| 1861-32-1  | DCCA di and monometabolites (Dacthal)    | 0    | 0  |     |             |
| 75-99-0    | Dalapon, sodium salt (Dalacide)          | 0    | 0  |     |             |
| 8065-48-3  | Demeton-O.S. (Systox)                    | 0    | 0  |     |             |
| 919-86-8   | Demeton-S                                | 0    |    |     |             |
| 141-28-6   | Di(2-ethylhexyl)adipate                  |      | 0  |     |             |
| 333-41-5   | Diazinon                                 | 0    | 0  | X   | 0           |
| 962-58-3   | Diazinon oxon                            | 0    |    | 0   | 0           |
| 132-64-9   | Dibenzofuran                             | 0    |    |     |             |
| 109-64-8   | 1,3-Dibromopropane                       |      | 0  |     |             |
| 3252-43-5  | Dibromoacetone                           |      | 0  |     |             |
| 1918-00-9  | Dicamba (Banvel)                         | 0    | 0  |     |             |
| 99-30-9    | Dichloran (Botran, DCNA)                 | 0    |    | X   | 0           |
| 541-25-3   | Dichloro(2-chlorovinyl)arsine            | 0    |    |     |             |
| 91-94-1    | 3,3'-Dichlorobenzidine                   | 0    |    |     |             |
| 51-36-5    | 3,5-Dichlorobenzoic acid                 |      | 0  |     |             |
| 72-54-8    | Dichlorodiphenyldichloroethane (DDD)     | X    | 0  | 0   | 0           |
| 72-55-9    | Dichlorodiphenyldichloroethylene (DDE)   | X    | 0  | X   | 0           |
| 50-29-3    | Dichlorodiphenyltrichloroethane (DDT)    | X    | 0  | 0   | X           |
| 120-83-2   | 2,4-Dichlorophenol                       | 0    | 0  |     |             |
| 94-75-7    | 2,4-Dichlorophenoxyacetic acid (2,4-D)   | 0    | 0  |     |             |
| 94-82-6    | 2,4-Dichlorophenoxybutyric acid (2,4-DB) | 0    | 0  |     |             |
| 19719-28-9 | 2,4-Dichlorophenylacetic acid            | 0    | 0  |     |             |
| 120-36-5   | Dichloroprop (2,4-DP)                    | 0    | 0  |     |             |
| 62-73-7    | Dichlorvos (DDVP)                        | 0    | 0  |     |             |
| 115-32-2   | Dicofol                                  | X    | X  | X   | X           |
| 60-57-1    | Dieldrin                                 | #    | 0  | 0   | 0           |
| 84-66-2    | Diethyl phthalate                        | X    | X  |     |             |
| 60-51-5    | Dimethoate                               | 0    | 0  | 0   | 0           |
| 1113-02-6  | Dimethoxon                               |      |    | 0   | 0           |
| 105-67-9   | 2,4-Dimethylphenol                       | X    |    |     |             |

Table 5-1: Summary of Analytes and Detections by Media

| CAS-num    | Analyte   | Soil | DW | Air | Indoor Dust |
|------------|---|------|----|-----|-------------|
| 131-11-3   | Dimethyl phthalate                                | 0    | 0  |     |             |
| 84-74-2    | Di-n-butyl phthalate                              | X    | X  |     |             |
| 534-52-1   | 4,6-Dinitro-o-cresol (4,6-Dinitro-2-methylphenol) | 0    |    |     |             |
| 51-28-5    | 2,4-Dinitrophenol                                 | 0    | 0  |     |             |
| 121-14-2   | 2,4-Dinitrotoluene                                | 0    | 0  |     |             |
| 606-20-2   | 2,6-Dinitrotoluene                                | 0    | 0  |     |             |
| 117-84-0   | Di-n-octyl phthalate                              | X    |    |     |             |
| 88-85-7    | Dinoseb (Premerg)                                 | X    | 0  |     |             |
| 957-51-7   | Diphenamid (Dymid)                                |      | 0  |     |             |
| 85-00-7    | Diquat (Aquacide)                                 |      | 0  |     |             |
| 298-04-4   | Disulfoton (Di-Syston)                            | 0    | 0  |     |             |
| 2497-06-5  | Disulfoton sulfone                                |      | 0  |     |             |
| 2497-07-6  | Disulfoton sulfoxide                              |      | 0  |     |             |
| TDP        | Dithiocarbamate pesticides (total)                | 0    | 0  |     |             |
| 330-54-1   | Diuron  | X    | 0  |     |             |
| 115-29-7   | Endosulfan (Tobacco spray)                        | 0    | 0  |     |             |
| 959-98-8   | Endosulfan I (alpha)                              | 0    | 0  |     |             |
| 33213-65-9 | Endosulfan II                                     | 0    | 0  | X   | 0           |
| 1031-07-8  | Endosulfan sulfate                                | X    | 0  |     |             |
| 145-73-3   | Endothall (ETH)                                   |      | 0  |     |             |
| 72-20-8    | Endrin (Hexadrin)                                 | X    | 0  |     |             |
| 7421-93-4  | Endrin aldehyde                                   | 0    | 0  |     |             |
| 53494-70-5 | Endrin ketone                                     | X    |    |     |             |
| 55283-68-6 | Ethalfuralin (Sonalin)                            | 0    |    |     |             |
| 563-12-2   | Ethion  | 0    |    |     |             |
| 13194-48-4 | Ethoprop (Prephos)                                | 0    | 0  |     |             |
| 759-94-4   | S-Ethyl dipropylthiocarbamate                     |      | 0  |     |             |
| 2104-64-5  | Ethyl p-nitrophenyl phenylposphorothioate (EPN)   | 0    |    |     |             |
| 96-45-7    | Ethylene thiourea (ETU)                           |      | 0  |     |             |
| 2593-15-9  | Etridiazole (Terrazole)                           |      | 0  |     |             |
| 22224-92-6 | Fenamiphos  | 0    | 0  | 0   | 0           |
| 31972-44-8 | Fenamiphos sulfone                                |      |    | 0   | 0           |
| 31972-43-7 | Fenamiphos sulfoxide                              |      |    | 0   | 0           |
| 60168-88-9 | Fenarimol (Dodine)                                | 0    | 0  | 0   | 0           |
| 115-90-2   | Fensulfthion                                      | 0    |    |     |             |
| 55-38-9    | Fenthion  | 0    |    |     |             |
| 101-42-8   | Fenuron   | 0    |    |     |             |
| 2164-17-2  | Fluometuron                                       | 0    |    |     |             |
| 59756-60-4 | Fluridone (Sonar)                                 |      | 0  |     |             |
| 133-07-3   | Folpet  | 0    |    |     |             |
| 69806-50-4 | Fusilade (Fluazifop butyl)                        |      | X  |     |             |

Table 5-1: Summary of Analytes and Detections by Media

| CAS-num     | Analyte                                     | Soil | DW | Air | Indoor Dust |
|-------------|---|------|----|-----|-------------|
| 1071-83-6   | Glyphosate (Honcho)                         | X    | 0  |     |             |
| 76-44-8     | Heptachlor (Fennotox)                       | 0    | X  | 0   | 0           |
| 1024-57-3   | Heptachlor epoxide                          | 0    | X  |     |             |
| 118-74-1    | Hexachlorobenzene (HCB)                     | 0    | 0  | X   | 0           |
| 319-84-6    | alpha-Hexachlorocyclohexane (HCH)           | 0    | 0  |     |             |
| 319-85-7    | beta-Hexachlorocyclohexane (HCH)            | 0    | X  |     |             |
| 319-86-8    | delta-Hexachlorocyclohexane (HCH)           | 0    | X  |     |             |
| 58-89-9     | gamma-Hexachlorocyclohexane (HCH) (Lindane) | 0    | X  |     |             |
| 77-47-4     | Hexachlorocyclopentadiene (HEX)             | 0    | 0  |     |             |
| 51235-04-2  | Hexazinone (Velpar)                         |      | 0  |     |             |
| 16655-82-6  | 3-Hydroxycarbofuran                         |      | 0  |     |             |
| 7600-50-2   | 5-Hydroxydicamba                            | 0    | 0  |     |             |
| 138261-41-3 | Imidacloprid                                | 0    |    |     |             |
| 36734-19-7  | Iprodione (Rorval)                          | X    | 0  |     |             |
| 78-59-1     | Isophorone                                  | 0    | 0  |     |             |
| 330-55-2    | Linuron                                     | 0    | 0  |     |             |
| 121-75-5    | Malathion                                   | 0    | 0  |     |             |
| 93-65-2     | MCPP  | 0    |    |     |             |
| 24307-26-4  | Mepiquat chloride (Pix)                     |      | 0  |     |             |
| 150-50-5    | Merphos                                     | 0    | 0  |     |             |
| 78-48-8     | Merphos oxide (Tribufos, DEF)               | 0    | 0  | 0   | 0           |
| 2032-65-7   | Mesurool (Methiocarb)                       | 0    | 0  |     |             |
| 57837-19-1  | Metalaxyl (Apron)                           | 0    | 0  | 0   | 0           |
| 6734-80-1   | Metam sodium (Vapam)                        |      | 0  |     |             |
| 10265-92-6  | Methamidophos (Monitor)                     | 0    | 0  |     |             |
| 950-37-8    | Methidathion (Supracide)                    | 0    | 0  | X   | 0           |
| 16752-77-5  | Methomyl (Lannate)                          | 0    | 0  |     |             |
| 72-43-5     | Methoxychlor                                | 0    | 0  |     |             |
| 613-93-4    | Methyl benzamide                            |      |    | X   | 0           |
| 94-74-6     | 2-Methyl-4-chlorophenoxyacetic acid (MCPA)  | 0    | 0  |     |             |
| 624-83-9    | Methyl isocyanate (MIC)                     | X    | 0  |     |             |
| 90-12-0     | 1-Methylnaphthalene                         |      | 0  |     |             |
| 91-57-6     | 2-Methylnaphthalene                         | 0    | X  |     |             |
| 950-35-6    | Methyl paraoxon                             |      | 0  | 0   | 0           |
| 298-00-0    | Methyl parathion                            | 0    | 0  | 0   | 0           |
| 95-48-7     | 2-Methylphenol                              | X    |    |     |             |
| 106-44-5    | 4-Methylphenol                              | X    |    |     |             |
| 51218-45-2  | Metolachlor (Dual)                          |      | 0  |     |             |
| 21087-64-9  | Metribuzin                                  |      | 0  |     |             |
| 7786-34-7   | Mevinphos (Phosdrin)                        | 0    | 0  | 0   | 0           |
| 315-18-4    | Mexacarbate                                 | 0    |    |     |             |

Table 5-1: Summary of Analytes and Detections by Media

| CAS-num    | Analyte                                    | Soil | DW | Air | Indoor Dust |
|------------|--|------|----|-----|-------------|
| 113-48-4   | MGK 264 (Octacide 264)                     |      | 0  |     |             |
| 2212-67-1  | Molinate (Ordram)                          |      | 0  |     |             |
| 150-68-5   | Monuron (Chlorfenidim)                     | 0    |    |     |             |
| 88671-89-0 | Myclobutanil (Systhane, Rally)             | 0    | 0  | X   | X           |
| 300-76-5   | Naled (Bromex)                             | 0    | 0  |     |             |
| 15299-99-7 | Napropamide (Devrinol)                     |      | 0  |     |             |
| 555-37-3   | Neburon                                    | 0    |    |     |             |
| 88-74-4    | 2-Nitroaniline                             | 0    |    |     |             |
| 99-09-2    | 3-Nitroaniline                             | 0    |    |     |             |
| 100-01-6   | 4-Nitroaniline                             | 0    |    |     |             |
| 88-75-5    | 2-Nitrophenol                              | 0    |    |     |             |
| 100-02-7   | 4-Nitrophenol                              | 0    | 0  |     |             |
| 62-75-9    | N-Nitrosodimethylamine                     | 0    | 0  |     |             |
| 621-64-7   | N-Nitrosodi-n-propylamine                  | 0    | 0  |     |             |
| 86-30-6    | N-Nitrosodiphenylamine                     | 0    | 0  |     |             |
| 3734-49-4  | cis-Nonachlor                              |      | 0  |     |             |
| 39765-80-5 | trans-Nonachlor                            |      | X  |     |             |
| 27314-13-2 | Norflurazon (Predict)                      | 0    | 0  | 0   | 0           |
| 19044-88-3 | Oryzalin (Snapshot)                        | X    | 0  |     |             |
| 19666-30-9 | Oxadiazon (Ronstar)                        | 0    | 0  | 0   | 0           |
| 23135-22-0 | Oxamyl (Vydate)                            | 0    | 0  |     |             |
| 961-22-8   | Oxon of azinphos-methyl                    |      |    | X   | 0           |
| 301-12-2   | Oxydemeton-methyl                          | 0    |    |     |             |
| 17040-19-6 | Oxydemeton-methyl sulfone                  |      |    | 0   | 0           |
| 42874-03-3 | Oxyfluorfen (Goal)                         | X    | 0  | X   | 0           |
| 311-45-5   | Paraoxon                                   |      |    | 0   | 0           |
| 4685-14-7  | Paraquat                                   | 0    | 0  |     |             |
| 56-38-2    | Parathion (ethyl)                          | 0    | 0  | 0   | 0           |
| 82-68-8    | PCNB (Pentachloronitrobenzene, Terrachlor) | 0    | 0  |     |             |
| 1114-71-2  | Pebulate (Tillam)                          |      | 0  |     |             |
| 40487-42-1 | Pendimethalin (Prowl)                      | 0    | 0  | X   | 0           |
| 87-86-5    | Pentachlorophenol (PCP)                    | 0    | 0  |     |             |
| 14797-73-0 | Perchlorate                                |      | 0  |     |             |
| 52645-53-1 | Permethrin (Pounce)                        | 0    | 0  | X   | X           |
| 72-56-0    | Perthane (Ethylan)                         | X    |    |     |             |
| 198-55-8   | Perylene                                   |      |    | 0   | 0           |
| 298-02-2   | Phorate (Thimet)                           | 0    | 0  | 0   | 0           |
| 2588-04-7  | Phorate sulfone                            |      |    | 0   | 0           |
| 75-44-5    | Phosgene (carbonyl chloride)               | 0    |    |     |             |
| 732-11-6   | Phosmet (Prolate)                          | 0    | 0  | X   | 0           |
| 3735-33-9  | Phosmet oxon                               |      |    | X   | 0           |

Table 5-1: Summary of Analytes and Detections by Media

| CAS-num     | Analyte  | Soil | DW | Air | Indoor Dust |
|-------------|--|------|----|-----|-------------|
| 1918-02-1   | Picloram                                       | 0    | 0  |     |             |
| 51-03-6     | Piperonyl Butoxide                             | 0    |    | 0   | X           |
| 41198-08-7  | Profenofos (Curacron)                          | 0    | 0  | 0   | 0           |
| 1610-18-0   | Prometon (Pramitol)                            |      | 0  |     |             |
| 7287-19-6   | Prometryn (Caparol)                            | 0    | 0  | 0   | 0           |
| 23950-58-5  | Pronamide (Kerb)                               |      | 0  |     |             |
| 1918-16-7   | Propachlor (Bexton)                            | 0    | 0  |     |             |
| 2312-35-8   | Propargite (Omite)                             | 0    | 0  | X   | X           |
| 139-40-2    | Propazine (Milogard)                           |      | 0  |     |             |
| 122-42-9    | Propham  | 0    |    |     |             |
| 60207-90-1  | Propiconazole (Tilt)                           | 0    |    |     |             |
| 103-64-1    | n-Propylbenzene                                |      | 0  |     |             |
| 299-84-3    | Ronnel (Trolene)                               | 0    | 0  |     |             |
| 1982-49-6   | Siduron  | 0    |    |     |             |
| 122-34-9    | Simazine (Princep)                             | 0    | 0  | X   | 0           |
| 1014-70-6   | Simetryn                                       |      | 0  |     |             |
| 22248-79-9  | Stirofos (Tetrachlor vinphos)                  | 0    | 0  |     |             |
| 57-24-9     | Strychnine                                     | 0    |    |     |             |
| 35400-43-2  | Sulprofos (Belstar)                            | 0    |    |     |             |
| 107534-96-3 | Tebuconazole                                   | 0    |    |     |             |
| 34014-18-1  | Tebuthiuron (Spike)                            | 0    | 0  |     |             |
| 5902-51-2   | Terbacil (Sinbar)                              |      | 0  |     |             |
| 13071-79-9  | Terbufos (Counter)                             |      | 0  |     |             |
| 886-50-0    | Terbutryn (Prebane)                            |      | 0  |     |             |
| 961-11-5    | Tetrachlorovinphos                             | 0    |    |     |             |
| 116-29-0    | Tetradifon (tedion)                            | 0    |    |     |             |
| 28249-77-6  | Thiobencarb (Bolero)                           |      | 0  |     |             |
| 23564-05-8  | Thiophanate-methyl (Domain)                    |      | 0  |     |             |
| 34643-46-4  | Tokuthion (Prothiophos)                        | 0    |    |     |             |
| 8001-35-2   | Toxaphene (Camphochlor)                        | X    | 0  |     |             |
| 545-06-2    | Trichloroacetoneitrile                         |      | 0  |     |             |
| 327-98-0    | Trichloronate (Agritox)                        | 0    |    |     |             |
| 95-95-4     | 2,4,5-Trichlorophenol                          | 0    |    |     |             |
| 88-06-2     | 2,4,6-Trichlorophenol (Dowicide)               | 0    | 0  |     |             |
| 93-76-5     | 2,4,5-Trichlorophenoxyacetic acid (2,4,5-T)    | 0    | 0  |     |             |
| 93-72-1     | 2,4,5-Trichlorophenoxy propionic acid (Silvex) | 0    | 0  |     |             |
| 41814-78-2  | Tricyclazole (Beam)                            |      | 0  |     |             |
| 1582-09-8   | Trifluralin                                    | 0    | 0  | X   | 0           |
| 1929-77-7   | Vernolate (Vernam)                             |      | 0  |     |             |
| 50471-44-8  | Vinclozoline                                   | 0    |    |     |             |
| 137-30-4    | Zinc dimethyldithiocarbamate (Ziram)           | 0    | 0  |     |             |

Table 5-1: Summary of Analytes and Detections by Media

| CAS-num     | Analyte                                 | Soil | DW | Air | Indoor Dust |
|-------------|---|------|----|-----|-------------|
| <b>VOCs</b> |   |      |    |     |             |
| 67-64-1     | Acetone                                 | X    | X  |     |             |
| 107-13-1    | Acrylonitrile                           |      | 0  |     |             |
| 107-05-1    | Allyl chloride (3-chloro-1-propene)     |      | 0  |     |             |
| 71-43-2     | Benzene                                 | X    | 0  | #   |             |
| 100-51-6    | Benzyl alcohol                          | 0    |    |     |             |
| 100-44-7    | Benzyl chloride                         |      |    | 0   |             |
| 108-86-1    | Bromobenzene                            |      | 0  |     |             |
| 74-97-5     | Bromochloromethane                      |      | 0  |     |             |
| 74-83-9     | Bromomethane (Methyl bromide)           | X    | 0  | #   |             |
| 78-93-3     | 2-Butanone (MEK)                        | X    | 0  |     |             |
| 104-51-8    | n-Butylbenzene                          |      | 0  |     |             |
| 135-98-8    | sec-Butylbenzene                        |      | 0  |     |             |
| 98-06-6     | tert-Butylbenzene                       |      | 0  |     |             |
| 75-15-0     | Carbon disulfide                        | 0    | 0  |     |             |
| 56-23-5     | Carbon tetrachloride                    | 0    | 0  | #   |             |
| 108-90-7    | Chlorobenzene                           | 0    | 0  | 0   |             |
| 109-69-3    | 1-Chlorobutane                          |      | 0  |     |             |
| 75-00-3     | Chloroethane (Ethylchloride)            | X    | 0  | X   |             |
| 74-87-3     | Chloromethane (Methyl chloride)         | 0    | 0  | #   |             |
| 95-49-8     | 2-Chlorotoluene                         |      | 0  |     |             |
| 106-43-4    | 4-Chlorotoluene                         |      | 0  |     |             |
| 98-82-8     | Cumene (Isopropylbenzene)               |      | 0  |     |             |
| 99-87-6     | p-Cymene                                |      | 0  |     |             |
| 96-12-8     | 1,2-Dibromo-3-chloropropane (DBCP)      | X    | X  |     |             |
| 74-95-3     | Dibromomethane                          |      | 0  |     |             |
| 106-93-4    | 1,2-Dibromoethane (EDB)                 | 0    | X  | 0   |             |
| 541-73-1    | m-Dichlorobenzene (1,3-Dichlorobenzene) | X    | 0  | 0   |             |
| 106-46-7    | p-Dichlorobenzene (1,4-Dichlorobenzene) | 0    | 0  | #   |             |
| 95-50-1     | o-Dichlorobenzene (1,2-Dichlorobenzene) | 0    | 0  | 0   |             |
| 110-57-6    | trans-1,4-Dichloro-2-butene             |      | 0  |     |             |
| 75-71-8     | Dichlorodifluoromethane (Freon 12)      |      | 0  | X   |             |
| 75-34-3     | 1,1-Dichloroethane                      | 0    | 0  | 0   |             |
| 107-06-2    | 1,2-Dichloroethane                      |      | X  | 0   |             |
| 75-35-4     | 1,1-Dichloroethene                      | 0    | 0  | 0   |             |
| 156-59-2    | cis-1,2-Dichloroethylene                | 0    | 0  | 0   |             |
| 156-60-5    | trans-1,2-Dichloroethylene              | 0    | 0  | 0   |             |
| 78-87-5     | 1,2-Dichloropropane                     |      | 0  | 0   |             |
| 142-28-9    | 1,3-Dichloropropane                     | 0    | 0  |     |             |
| 594-20-7    | 2,2-Dichloropropane                     |      | 0  |     |             |
| 513-88-2    | 1,1-Dichloro-2-propanone                |      | 0  |     |             |

Table 5-1: Summary of Analytes and Detections by Media

| CAS-num    | Analyte   | Soil | DW | Air | Indoor Dust |
|------------|---|------|----|-----|-------------|
| 563-58-6   | 1,1-Dichloropropene                               |      | 0  |     |             |
| 542-75-6   | 1,3-Dichloropropene (Telone)                      | 0    | 0  |     |             |
| 10061-01-5 | cis-1,3-Dichloropropene                           |      | 0  | 0   |             |
| 10061-02-6 | trans-1,3-Dichloropropene                         |      | 0  | 0   |             |
| 76-14-2    | 1,2-Dichloro-1,1,2,2-tetrafluoroethane            |      |    | 0   |             |
| 60-29-7    | Diethyl ether (ethyl ether, ether)                |      | 0  |     |             |
| 97-63-2    | Ethyl methacrylate                                |      | 0  |     |             |
| 100-41-4   | Ethylbenzene                                      | 0    | 0  | X   |             |
| 50-00-0    | Formaldehyde                                      | 0    |    | #   |             |
| 87-68-3    | Hexachlorobutadiene                               | 0    | 0  | 0   |             |
| 67-72-1    | Hexachloroethane                                  | 0    | 0  |     |             |
| 67-56-1    | Methanol  | X    |    |     |             |
| 108-10-1   | Methyl isobutyl ketone (4-methyl-2-pentanone)     | X    | 0  |     |             |
| 556-61-6   | Methyl isothiocyanate (MITC) (Trapex)             | 0    | 0  | X   |             |
| 96-33-3    | Methylacrylate                                    |      | 0  |     |             |
| 126-98-7   | Methylacrylonitrile                               |      | 0  |     |             |
| 75-09-2    | Methylene chloride (dichloromethane)              | X    | X  | #   |             |
| 1634-04-4  | Methyl-tert-butyl ether (MTBE)                    | X    | 0  |     |             |
| 98-95-3    | Nitrobenzene                                      | 0    | 0  |     |             |
| 79-46-9    | 2-Nitropropane                                    |      | 0  |     |             |
| 108-95-2   | Phenol  | X    |    |     |             |
| 100-42-5   | Styrene   | 0    | 0  | X   |             |
| 630-20-6   | 1,1,1,2-Tetrachloroethane                         |      | 0  |     |             |
| 79-34-5    | 1,1,2,2-Tetrachloroethane                         |      | 0  | 0   |             |
| 127-18-4   | Tetrachloroethylene (Perc)                        | 0    | 0  | 0   |             |
| 108-88-3   | Toluene   | X    | 0  | X   |             |
| 87-61-6    | 1,2,3-Trichlorobenzene                            | X    | 0  |     |             |
| 120-82-1   | 1,2,4-Trichlorobenzene                            | X    | 0  | 0   |             |
| 71-55-6    | 1,1,1-Trichloroethane                             | 0    | 0  | 0   |             |
| 79-00-5    | 1,1,2-Trichloroethane                             | 0    | 0  | 0   |             |
| 79-01-6    | Trichloroethylene (TCE)                           | 0    | 0  | 0   |             |
| 75-69-4    | Trichlorofluoromethane (Freon 11)                 |      | 0  | X   |             |
| 96-18-4    | 1,2,3-Trichloropropane                            |      | X  |     |             |
| 918-00-3   | 1,1,1-Trichloro-2-propanone                       |      | 0  |     |             |
| 76-13-1    | 1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113) |      | 0  | X   |             |
| 95-63-6    | 1,2,4-Trimethylbenzene                            |      | 0  | X   |             |
| 108-67-8   | 1,3,5-Trimethylbenzene                            |      | 0  | X   |             |
| 75-01-4    | Vinyl chloride                                    | 0    | 0  | 0   |             |
| 108-38-3   | m-Xylene  |      | 0  | X   |             |
| 95-47-6    | o-Xylene  |      | 0  | X   |             |
| 106-42-3   | p-Xylene  |      | 0  | X   |             |

Table 5-1: Summary of Analytes and Detections by Media

| CAS-num                           | Analyte                                 | Soil | DW | Air | Indoor Dust |
|-----------------------------------|---|------|----|-----|-------------|
| 1330-20-7                         | Xylenes                                 | X    |    |     |             |
| <b>VOC/DIBP</b>                   |   |      |    |     |             |
| 79-08-3                           | Bromoacetic acid                        |      | X  |     |             |
| 5589-96-3                         | Bromochloroacetic acid (BCAA)           |      | X  |     |             |
| 75-27-4                           | Bromodichloromethane (Trihalomethane)   | 0    | X  |     |             |
| 75-25-2                           | Bromoform (Trihalomethane)              | 0    | X  |     |             |
| 75-87-6                           | Chloral Hydrate (trichloroacetaldehyde) |      | X  |     |             |
| 79-11-8                           | Chloroacetic acid                       |      | X  |     |             |
| 67-66-3                           | Chloroform                              | X    | X  | 0   |             |
| 631-64-1                          | Dibromoacetic acid (DBAA)               |      | X  |     |             |
| 124-48-1                          | Dibromochloromethane                    | 0    | X  |     |             |
| 79-43-6                           | Dichloroacetic acid (DCAA)              |      | X  |     |             |
| 3018-12-0                         | Dichloroacetonitrile                    |      | X  |     |             |
| 76-03-9                           | Trichloroacetic acid (TCAA)             |      | X  |     |             |
| <b>Other Inorganics/DIBP</b>      |   |      |    |     |             |
| 7782-50-5                         | Chlorine                                |      | X  |     |             |
| <b>Microbial</b>                  |   |      |    |     |             |
| Coliform-fecal                    | Coliform - fecal                        |      | X  |     |             |
| Coliform-total                    | Coliform - total                        |      | X  |     |             |
| Cryptosporidium                   | Cryptosporidium                         |      | 0  |     |             |
| CHV                               | Culturable human viruses                |      | 0  |     |             |
| Ecoli                             | E. coli                                 |      | 0  |     |             |
| Giardia                           | Giardia                                 |      | 0  |     |             |
| HPC                               | Heterotrophic plate count               |      | X  |     |             |
| <b>Water Quality Properties</b>   |   |      |    |     |             |
| 497-19-18                         | Alkalinity as CaCO <sub>3</sub> , total |      | X  |     |             |
| MBAS                              | Anionic surfactant (MBAS)               |      | 0  |     |             |
| Conductance                       | Conductance                             |      | 0  |     |             |
| 471-34-1                          | Hardness as CaCO <sub>3</sub>           |      | X  |     |             |
| Odor                              | Odor                                    |      | X  |     |             |
| Odor-NA thiosulf                  | Odor with sodium thiosulfate            |      | X  |     |             |
| pH                                | pH                                      |      | X  |     |             |
| 10-34-4                           | Specific conductance (EPA 120.1)        |      | 0  |     |             |
| Temp                              | Temperature                             |      | X  |     |             |
| 10-33-3                           | Total dissolved solids (TDS)            |      | #  |     |             |
| <b>Dioxin/Furan/PCB Congeners</b> |   |      |    |     |             |
| 3268-87-9                         | OCDD                                    | X    | 0  | X   | X           |
| 39001-02-0                        | OCDF                                    | X    |    | X   | X           |

Table 5-1: Summary of Analytes and Detections by Media

| CAS-num    | Analyte   | Soil | DW | Air | Indoor Dust |
|------------|---|------|----|-----|-------------|
| 35822-39-4 | 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-HpCDD) | X    | 0  | X   | X           |
| 67562-39-4 | 1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-HpCDF)     | X    | 0  | X   | X           |
| 55673-89-7 | 1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-HpCDF)     | 0    | 0  | X   | X           |
| 39227-28-6 | 1,2,3,4,7,8- Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-HxCDD)     | X    | 0  | X   | X           |
| 57653-85-7 | 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-HxCDD)      | X    | 0  | X   | X           |
| 19408-74-3 | 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-HxCDD)      | X    | 0  | X   | X           |
| 70648-26-9 | 1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-HxCDF)          | X    | 0  | X   | X           |
| 57117-44-9 | 1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-HxCDF)          | X    | 0  | X   | X           |
| 72918-21-9 | 1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-HxCDF)          | 0    | 0  | 0   | X           |
| 60851-34-5 | 2,3,4,6,7,8-Hexachlorodibenzofuran (2,3,4,6,7,8-HxCDF)          | X    | 0  | X   | X           |
| 40321-76-4 | 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-PeCDD)         | 0    | 0  | X   | X           |
| 57117-41-6 | 1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-PeCDF)             | 0    |    | X   | 0           |
| 57117-31-4 | 2,3,4,7,8-Pentachlorodibenzofuran (2,3,4,7,8-PeCDF)             | X    | 0  | X   | X           |
| 1746-01-6  | 2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD)              | 0    | 0  | 0   | 0           |
| 51207-31-9 | 2,3,7,8-Tetrachlorodibenzofuran (2,3,7,8-TCDF)                  | X    | 0  | X   | X           |
| 2051-60-7  | PCB 1 (2-Chlorobiphenyl)  |      | 0  |     |             |
| 16605-91-7 | PCB 5 (2,3-Dichlorobiphenyl)                                    |      | 0  |     |             |
| 15862-07-4 | PCB 29 (2,4,5-Trichlorobiphenyl)                                |      | 0  |     |             |
| 2437-79-8  | PCB 47 (2,2',4,4'-Tetrachlorobiphenyl)                          |      | 0  |     |             |
| 32598-13-3 | PCB 77 (3,3',4,4'-Tetrachlorobiphenyl)                          | 0    |    | X   | X           |
| 52663-62-4 | PCB 82 (2,2',3,3',4-Pentachlorobiphenyl)                        | X    |    |     |             |
| 60233-25-2 | PCB 98 (2,2',3',4,6-Pentachlorobipenyl)                         |      | 0  |     |             |
| 32598-14-4 | PCB 105 (2,3,3',4,4'-Pentachlorobiphenyl)                       | 0    |    | X   | X           |
| 74472-37-0 | PCB 114 (2,3,4,4',5-Pentachlorobiphenyl)                        | 0    |    |     |             |
| 31508-00-6 | PCB 118 (2,3',4,4',5-Pentachlorobiphenyl)                       | 0    |    | X   | X           |
| 65510-44-3 | PCB 123 (2,3',4,4',5'-Pentachlorobiphenyl)                      | 0    |    |     |             |
| 57465-28-8 | PCB 126 (3,3',4,4',5-Pentachlorobiphenyl)                       | 0    |    | X   | 0           |
| 60145-22-4 | PCB 154 (2,2',4,4',5,6'-Hexachlorobiphenyl)                     |      | 0  |     |             |
| 38380-08-4 | PCB 156 (2,3,3',4,4',5-Hexachlorobiphenyl)                      | 0    |    | X   | X           |

Table 5-1: Summary of Analytes and Detections by Media

| CAS-num    | Analyte  | Soil | DW | Air | Indoor Dust |
|------------|--|------|----|-----|-------------|
| 69782-90-7 | PCB 157 (2,3,3',4,4',5'-Hexachlorobiphenyl)      | 0    |    | X   | X           |
| 52663-72-6 | PCB 167 (2,3',4,4',5,5'-Hexachlorobiphenyl)      | 0    |    |     |             |
| 32774-16-6 | PCB 169 (3,3',4,4',5,5'-Hexachlorobiphenyl)      | 0    |    | X   | 0           |
| 52663-71-5 | PCB 171 (2,2',3,3',4,4',6-Heptachlorobiphenyl)   |      | 0  |     |             |
| 35065-29-3 | PCB 180 (2,2',3,4,4',5,5'-Heptachlorobiphenyl)   |      |    | X   | X           |
| 39635-31-9 | PCB 189 (2,3,3',4,4',5,5'-Heptachlorobiphenyl)   | 0    |    |     |             |
| 40186-71-8 | PCB 201 (2,2',3,3',4,5',6,6'-Octachlorobiphenyl) |      | 0  |     |             |

Note:

X = Detected

0 = Analyzed but not detected

# = Detected above screening level

blank = Not analyzed

DW = Drinking water

### 5.1.1 Lead

When McFarland's drinking water was tested for lead two different samples were taken from each home and building. A "first draw" sample was collected at each location to represent the initial water that comes out of the pipes after the faucet has not been used for six hours or more (e.g., the first water used in the morning or when the water has not been used until returning home in the afternoon). "First draw" water usually has the highest lead levels because lead is deposited into the water from corroding pipes and faucets when water has been sitting for six hours or more.

A second "flushed" sample was taken after running the water for a few minutes to let the pipes clear. This "flushed" sample is more typical of tap water used throughout the day. A "flushed" water sample usually has lower lead levels because water has not been sitting in the pipes and therefore does not pick up lead from corroding plumbing materials.

The "first draw" water samples from four sampling locations in McFarland were close to or above the lead HBSL, which was a drinking water Action Level. The highest "first draw" lead level was 166 micrograms per liter/parts per billion ( $\mu\text{g}/\text{l}$  ppb), which is more than 10 times higher than the protective Action Level of 15  $\mu\text{g}/\text{l}$  (ppb), and was found in one of the 15 private homes that were tested. "First draw" lead levels above or close to the Action Level were also found in 3 other homes or buildings. Although these lead levels are near the Action Level, they are not unusual for "first draw" samples from a home or building in a community such as McFarland. Elevated lead levels in "first draw" tap water samples are a fairly common situation in many communities, especially those with older homes.

Lead levels in all of the "flushed" samples were well below the Action Level of 15  $\mu\text{g}/\text{l}$  (ppb). In most of the homes and buildings tested, "flushed" tap water had lead levels below 0.5  $\mu\text{g}/\text{l}$  (ppb), which is 30 times lower than the Action Level. In addition, the lead levels in water samples from the wells and storage tank supplying drinking water to McFarland, were all well below 15  $\mu\text{g}/\text{l}$  (ppb).

### 5.1.2 Nitrate and Nitrite

Nitrate ( $\text{NO}_3$ ) and nitrite ( $\text{NO}_2$ ) are nitrogen-oxygen chemicals which combine with various organic and inorganic compounds. These chemicals are important for farming because they supply nitrogen, an essential nutrient for plants, in the form of fertilizers. Sometimes excess nitrate from fertilizer can leach into groundwater used as drinking water sources. This is a common environmental problem in many agricultural communities or communities where agriculture has occurred in the past.

The USEPA has set a drinking water quality standard MCL, specifically to protect very young infants, who are the most sensitive to nitrate/nitrite poisoning. The MCL for nitrate at the time of sampling was 10 milligrams per liter (10  $\text{mg}/\text{l}$  = 10 parts per million, 10 ppm).

It has been known for many years that two of the wells supplying drinking water for McFarland have relatively high nitrate levels (Wells #2 and #4). Nitrate removal systems were installed on Well #2 in November 1985 and on Well #4 in May 1988. When USEPA R9 tested McFarland's drinking water, samples were taken from these wells both before and after the nitrate removal systems ("pre-treatment" and "post-treatment"). These tests showed that pre-treatment samples contained nitrate at levels up to 19.5  $\text{mg}/\text{l}$  (ppm), but that nitrate levels in post-treatment water, at sampling locations which represent water going into the McFarland distribution system, were less than 10  $\text{mg}/\text{l}$  (ppm), therefore in compliance with the MCL. Nitrate levels in drinking water from the other two wells (Well #6 and Garzoli) and from the storage tank were also in compliance with the MCL, as were all other drinking water samples taken in McFarland (i.e., nitrate levels were less than 10  $\text{mg}/\text{l}$  [ppm]). Nitrite was not detected in any of the drinking water samples collected by U.S. EPA during both phases of the drinking water investigation.

### 5.1.3 Arsenic

As would be expected for a naturally-occurring element, arsenic was found in all four wells and in all of the drinking water samples collected in McFarland. Arsenic levels in these samples ranged from 0.48 to 18.2  $\mu\text{g}/\text{l}$  (ppb). The lowest levels were found in Wells #2 and #4, and the highest levels were found in groundwater from the Garzoli Well and in tap water at some private residences. Levels above 10  $\mu\text{g}/\text{l}$  are not in compliance with the federal MCL for arsenic.

## 5.2 Findings of the Soil Investigation

### 5.2.1 Summary of Phase 1 and 2 Results by Site

There were 2 phases to the soil investigation.

**Phase 1:** The first phase was intended as an overall survey of McFarland soil and focused specifically on schools, parks, homes and current or former commercial/industrial facilities. In phase 1, 391 soil samples from 4 schools, 2 parks, 6 commercial/industrial facilities, 8 residences and a drainage basin were tested for over 300 chemicals. Most of the chemicals for which USEPA R9 tested the soil were not found in any of the soil samples. Many of the chemicals that were observed are those that occur naturally in soil (e.g., metals and minerals such as arsenic, iron and manganese). A few chemicals, including arsenic, dieldrin and dioxins/furans were observed in one or more samples at concentrations exceeding their HBSLs.

**Phase 2:** The second phase was undertaken to follow up on HBSL exceedances observed during the first phase and to further assess potential human exposures to these chemicals in soil. During Phase 2, surface and subsurface soils were tested for more than 200 chemicals including metals; minerals and other inorganics; VOCs; and SOCs, such as pesticides, herbicides, agricultural chemicals, PCBs, and dioxins and furans. Phase 2 soil sampling locations included 2 schools, a park, 4 commercial/industrial facilities, 1 residence and the location of the former Well #5.

As was the case in Phase 1, most of the substances tested for were not found in any of the 64 soil samples collected during the Phase 2 soil sampling in McFarland. Many of the substances that were found in soil samples occur naturally in soil (e.g., metals and minerals such as arsenic, iron, and manganese) and were expected to be present in McFarland's soil. The extensive testing during both phases also found some substances that are not naturally occurring or were at a level greater than a screening level.

For Phase 2, Elmo Highway Complex - Tri Cal Facility, Elmo Highway Complex - Renteria Facility, Browning Road School, Closed Well #5, and Residence F had no substances detected above their respective PRGs. Sites that had detections of one or more substances above the HBSLs were the following: Elmo Highway Complex - Kirkpatrick and Sons, Mouser (McFarland) Park, McFarland High School, and the former Sunshine Service Station.

### 5.2.2 The Elmo Highway Complex

Soil was sampled at three industrial/commercial properties in the Elmo Highway Complex during Phase 2.

**Kirkpatrick and Sons Potato Shed:** The northernmost facility in the Elmo Highway Complex, the Kirkpatrick and Sons Potato Shed was historically used as a warehouse to store fertilizers. Dieldrin was detected at this site at concentrations greater than the Industrial PRG in three samples during Phase 2. Dieldrin had also been detected during Phase 1 sampling.

**Tri Cal Facility:** The Tri Cal facility was used to store methyl bromide, chloropicrin, glue, and plastics. No analyzed substances were found at concentrations above industrial or residential PRGs at this location during Phase 2. Dieldrin had been identified at two sampling locations at concentrations above industrial PRGs during Phase 1.

**Renteria Facility:** The southernmost facility within the Elmo Highway Complex, the Renteria Farm Contracting facility was formerly a plant nursery used for the packaging of bare root roses and also may have been used for the raising of root stock. Concerns at this facility were that dioxins and other products of incomplete combustion may have resulted from the burning of potentially pesticide-laden materials during a fire at the Renteria facility, and by the possible historical burning of pesticide-laden trash in the two present-day pits. No substances were found at concentrations exceeding industrial PRGs during either Phase 1 or Phase 2.

### 5.2.3 Mouser (McFarland) Park

Geophysical anomalies, which possibly indicated buried metal debris, were observed during the Phase 1 investigation at Mouser Park. To direct excavation, another geophysical survey was conducted during Phase 2 using a flux gate magnetometer, and the soil was sampled for petroleum hydrocarbons. Various metal objects were found at depths of 0 to 1.5 meters bgs and were removed.

Samples were collected from the excavated area containing metal debris. One sample contained lead at 769 milligrams per kilogram (mg/kg), exceeding the Residential PRG of 130 mg/kg. No other samples collected from this site during Phase 2 exceeded residential PRGs. Dieldrin had been identified in one Phase 1 sample at a concentration greater than the Residential PRG, but was not detected in any sample during Phase 2.

### 5.2.4 Browning Road School

Browning Road School is located on former agricultural land. No analyzed substances were found at concentrations exceeding residential PRGs at this location during Phase 2. During Phase 1, benzo(a)pyrene was detected in a single sample at a concentration greater than the Residential PRG.

### 5.2.5 McFarland High School

Dioxins/furans/PCBs were detected at concentrations exceeding the Residential PRG in two samples from the football field during Phase 2. During Phase 1, dioxins and furans were detected at concentrations exceeding the Residential PRG in one sample from the baseball field. No other analyzed substances were found at concentrations exceeding residential PRGs at this site during either sampling event.

### 5.2.6 Former Sunshine Service Station

The Sunshine Service Station was abandoned and fenced at the time of sampling (Catherine Clarkin Consulting, 2007). Arsenic was detected in two samples (42 and 79 mg/kg) at concentrations greater than the Residential non-cancer PRG of 22 mg/kg and the Industrial cancer PRG of 1.6 mg/kg. Arsenic had also been detected above the Residential PRG during Phase 1. During Phase 2, lead was detected in three samples and a duplicate above the Residential PRG of 130 mg/kg; in two of these samples and the duplicate, the lead concentration was also above the Industrial PRG of 1,000 mg/kg.

### 5.2.7 Closed Well #5

Closed Well #5 is no longer used to supply drinking water, and the area around the well is fenced to prevent access. This area was not specifically sampled during Phase 1, although the drainage basin immediately to the south and the Elmo Highway Complex to the north were sampled during Phase 1. No analyzed substance in any sample from Phase 2 exceeded Residential PRG concentrations in this area.

### 5.2.8 Residence F

Residence F is on former agricultural land in the northeastern section of McFarland. Benzo(a)pyrene, a product of incomplete combustion, was not detected in Phase 2, but was detected in one sample at a concentration exceeding the Residential PRG in Phase 1. No other analyzed substance was detected during either phase at a concentration exceeding the Residential PRG.

## 5.3 Findings of the Outdoor Air Investigation

Of the 145 chemicals tested in outdoor air over the course of a year, 66 were not detected in any of the samples collected at either the McFarland Middle School or the Browning Road School sampling stations. Of the 79 detected chemicals, 68 were detected only at concentrations that were below their HBSLs. The remaining 11 chemicals were detected one or more times at concentrations exceeding their HBSLs. Figure 5-1 provides a summary of chemical sampling results.

The majority of chemicals were never detected above HBSLs in any sample. Results in each category are summarized as follows:

- In the Base/Neutral Pesticides/PAH category, no chemicals were detected above their respective HBSLs. Of the 71 chemicals in this category, 32 were detected at least once and 39 were never detected.
- In the Formaldehyde category, formaldehyde was detected in 68 of 73 samples collected; all detections were greater than the HBSL.
- In the Metals category, 4 of 6 metals were detected above their respective HBSLs in at least one sample. All the metals were detected in multiple samples.
- In the Volatile Organic Compounds category, 6 chemicals were detected above their respective HBSLs in at least one sample. Of the 42 VOCs analyzed, 19 were detected at least once and 23 were never detected.

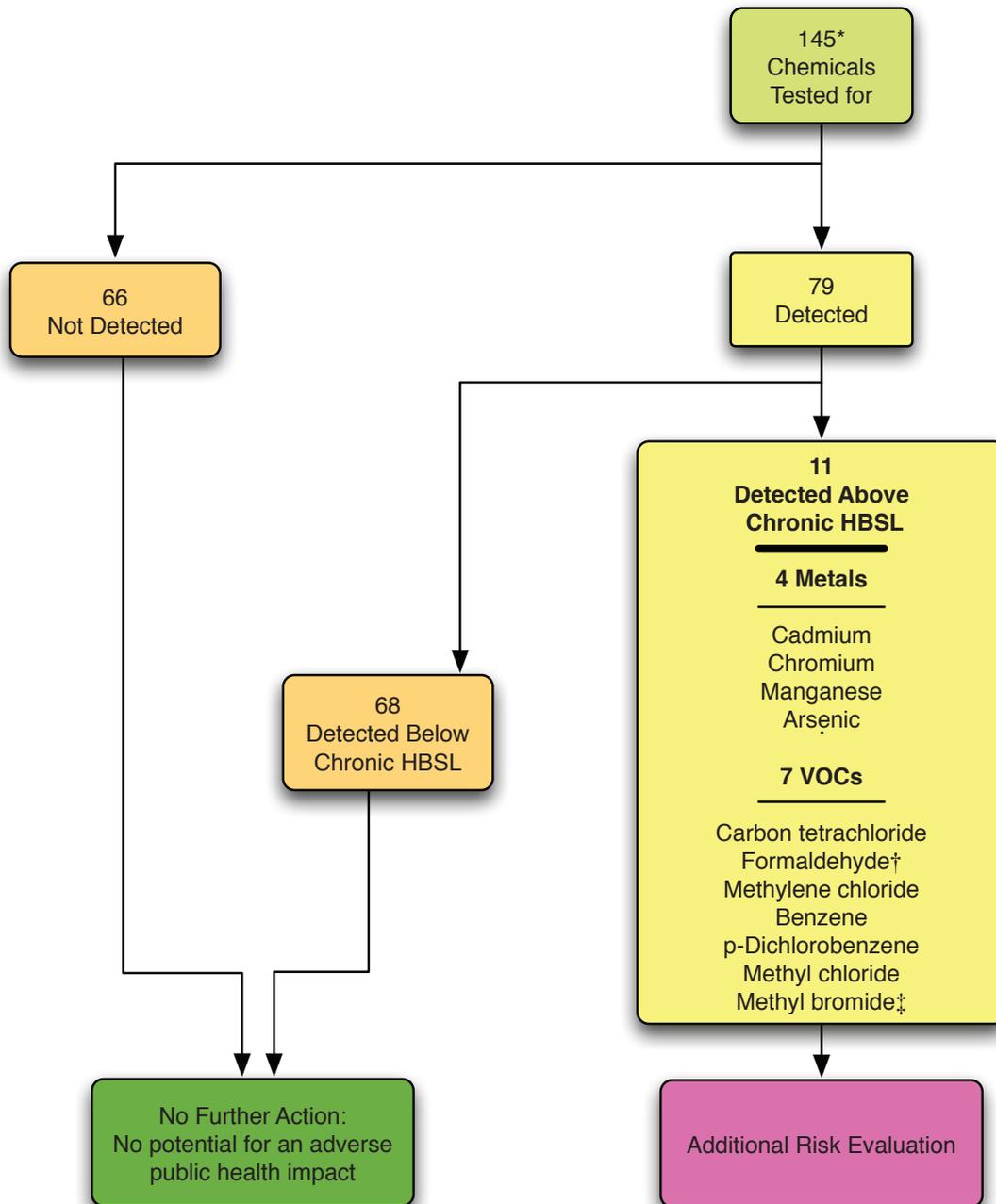
Dioxins/furans/PCBs were detected in all six samples analyzed. In no case did the concentration exceed the HBSL.

## Chemicals Present in Outdoor Air at Concentrations Greater than HBSLs

The chemicals discussed in this section are those that were detected at least once above their respective HBSL.

### 5.3.1 Formaldehyde

Concentrations of formaldehyde in outdoor air samples collected in McFarland ranged from not detected to 20  $\mu\text{g}/\text{m}^3$ . All 68 detections in the 73 samples analyzed were at levels greater than the HBSL of 0.23  $\mu\text{g}/\text{m}^3$ .



Notes:

VOC: Volatile organic compound

HBSL: Health-based screening level

\*The number of chemicals tested for includes chemicals that co-elute (that is, chemicals that are detected and quantified together). It also includes all chlorinated dioxins, furans, and PCBs (polychlorinated biphenyls), which are evaluated as an aggregate when determining risk and comparing to screening levels.

†Formaldehyde was analyzed separately from other VOCs.

‡Methyl bromide was analyzed as a VOC, but is also a pesticide.

**Figure 5-1**  
**Summary of Chemical Sampling Results in Outdoor Air**

McFarland, California

### 5.3.2 Arsenic

Concentrations of arsenic in outdoor air samples collected in McFarland ranged from not detected to 0.011  $\mu\text{g}/\text{m}^3$ . All 64 detections in the 76 samples analyzed were at levels greater than the HBSL of 0.00045  $\mu\text{g}/\text{m}^3$ .

### 5.3.3 Cadmium

Concentrations of cadmium in outdoor air samples collected in McFarland ranged from 0.000022 to 0.0056  $\mu\text{g}/\text{m}^3$ . Cadmium was detected in all 76 samples and three of detected concentrations were above the HBSL of 0.0011  $\mu\text{g}/\text{m}^3$ .

All cadmium detected levels above the HBSL occurred during Event 4, two at Browning Road School and one at McFarland Middle School. Otherwise, cadmium was consistently identified at low levels at both stations throughout the investigation. The two highest concentrations occurred during the dust storm on May 19-20, 2002, when maximum levels for many naturally-occurring inorganics occurred.

### 5.3.4 Chromium (total)

Concentrations of chromium in outdoor air samples collected in McFarland ranged from not detected to 0.083  $\mu\text{g}/\text{m}^3$ . All 58 detections in 76 samples were at levels greater than the HBSL of 0.00016  $\mu\text{g}/\text{m}^3$ . Concentrations of chromium in samples collected concurrently were typically very similar at the two sampling stations, suggesting macroscale source contributions in McFarland.

In general, results were highest during Event 4. Because quantitation limits were elevated during Event 2, it is not possible to determine if seasonal/event differences occurred. However, results during Events 1 and 3 were very similar. As with the other metals, the highest concentrations shown in Figure 5-2 occurred during the dust storm on May 19-20, 2002.

### 5.3.5 Manganese

Concentrations of manganese in outdoor air samples collected in McFarland ranged from 0.0009 to 0.63  $\mu\text{g}/\text{m}^3$ . Manganese was detected in all 76 samples and five of the detections were at levels greater than the HBSL of 0.051  $\mu\text{g}/\text{m}^3$ .

Some differences in concentrations between the two stations were noted for samples collected concurrently, suggesting microscale source conditions might have existed for short periods. Overall, however, macroscale conditions predominated.

Some seasonal differences in manganese concentrations were noted, with lowest concentrations occurring during Event 2. This could be associated with generally lower concentrations

of TSP during this event. As with other metals, the highest concentrations occurred during the dust storm on May 19-20, 2002.

Temporary peaks in concentrations, such as exceedances of the HBSL at Station 2 during Event 3, suggest possible di-thiocarbamate spraying. However, mancozeb and manganese sulfate, two known manganese-containing pesticides, were not known to have been applied during the peak periods based on the pesticide use report (PUR) database (CDPR, 2001; CDPR 2002).

### 5.3.6 Benzene

Concentrations of benzene in outdoor air samples collected in McFarland ranged from not detected to 1.3  $\mu\text{g}/\text{m}^3$ . All 66 detections in 76 samples were at levels greater than the HBSL of 0.23  $\mu\text{g}/\text{m}^3$ .

As discussed in detail in the Outdoor Air Investigation report, microscale source contributions were identified for benzene. The generally higher concentrations at the Browning Road School station could be associated with closer proximity to Highway 99, unidentified localized source(s), or other causes.

No obvious seasonal pattern was observed for benzene concentrations. Although the most non-detect results occurred during the May sampling event, the quantitation limit was 0.64  $\mu\text{g}/\text{m}^3$ , which is above many of the detected results from other sampling events.

### 5.3.7 Carbon Tetrachloride

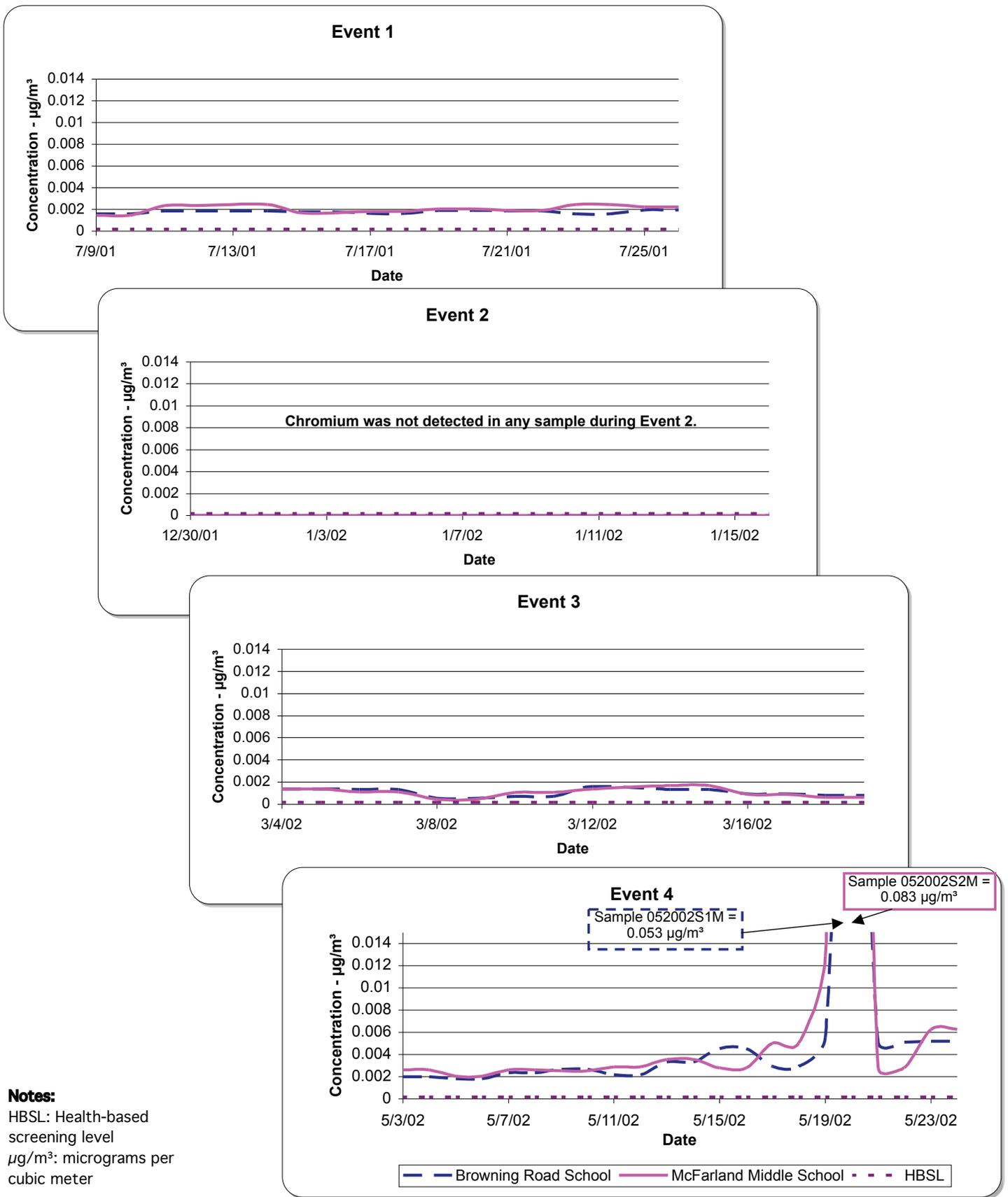
Concentrations of carbon tetrachloride in outdoor air samples collected in McFarland ranged from not detected to 1.8  $\mu\text{g}/\text{m}^3$ . All 24 detections in 76 samples were at levels greater than the HBSL of 0.13  $\mu\text{g}/\text{m}^3$ .

Concentrations of carbon tetrachloride in samples collected concurrently were typically very similar at the two sampling stations, suggesting macroscale source conditions in McFarland.

Carbon tetrachloride concentrations were highest during Event 4 (May 2002) and lowest during Event 3 (March 2002).

### 5.3.8 p-Dichlorobenzene

Concentrations of p-dichlorobenzene in outdoor air samples collected in McFarland ranged from not detected to 110  $\mu\text{g}/\text{m}^3$ . There was only one detection in the 76 samples collected and it was at a level greater than the HBSL of 0.31  $\mu\text{g}/\text{m}^3$ . All 75 non-detect results had quantitation limits exceeding the HBSL; in these samples, the data do not allow for the determination of exceedances of the HBSL.



**Notes:**  
 HBSL: Health-based screening level  
 $\mu\text{g}/\text{m}^3$ : micrograms per cubic meter

**Figure 5-2**  
**Chromium Concentrations in McFarland Air**

### 5.3.9 Methyl Bromide

Concentrations of methyl bromide in outdoor air samples collected in McFarland ranged from not detected to 13  $\mu\text{g}/\text{m}^3$ . Methyl bromide was detected in 33 of 76 samples collected; in two samples, the detected concentration exceeded the HBSL of 5.2  $\mu\text{g}/\text{m}^3$ .

As discussed in detail in the Outdoor Air Investigation report, microscale source contributions were identified for methyl bromide during three of the four sampling events. The difference could be due to the presence of a localized source, such as pesticide applications near one or the other sampling station.

Methyl bromide concentrations were highest during Event 1 (July 2001). During this timeframe, known methyl bromide applications occurred in the area. While methyl bromide was reported in the PUR for the period from July 1, 2001 to June 30, 2002 only once, it has historically been used more frequently, especially during November, when sampling did not occur. Despite the one reported application, USEPA R9 detected methyl bromide in multiple samples during the McFarland Outdoor Air Investigation.

### 5.3.10 Methyl Chloride

Concentrations of methyl chloride in outdoor air samples collected in McFarland ranged from 0.78 to 8.0  $\mu\text{g}/\text{m}^3$ . Methyl chloride was detected in all 76 samples collected; in 54 of samples the detected concentration exceeded the HBSL of 1.1  $\mu\text{g}/\text{m}^3$ .

Concentrations of methyl chloride were highly consistent across the two sampling stations, with the exception of the first few days of sampling during Event 1. Seasonal variations in methyl chloride concentrations from natural sources (e.g., bacterial degradation) are expected, with the highest concentrations expected during the warmest months.

### 5.3.11 Methylene Chloride

Concentrations of methylene chloride in outdoor air samples collected in McFarland ranged from not detected to 24  $\mu\text{g}/\text{m}^3$ . Methylene chloride was detected in 46 of the 76 samples collected; in two samples the detected concentration exceeded the HBSL of 4.1  $\mu\text{g}/\text{m}^3$ .

Concentrations of methylene chloride were generally consistent across the two sampling stations, with some higher concentrations detected at the Browning Road School sampling station during Event 3 (March 2002), suggesting microscale sources during this event only.

## Particulate Matter

### 5.3.12 PM-10 Results

When daily average concentrations over the ten month period were compared to the California short-term standard of 50  $\mu\text{g}/\text{m}^3$ , the standard was exceeded 125 times. As shown in Figure 5-3, over half of the daily averages that exceeded the California standard occurred during the dry fall months of September, October, and November. The daily average concentration for the 24-hour period from 8:00 AM May 19 to 8:00 AM May 20, 2002, was 400  $\mu\text{g}/\text{m}^3$ , exceeding the federal short-term (24-hour average) standard of 150  $\mu\text{g}/\text{m}^3$ . This occurred during a dust storm. This windblown dust event covered a large area from the southern end of the Central Valley to Fresno. On no other day did the daily average concentration exceed the federal short-term standard.

USEPA R9 estimated an annual average to obtain a long-term value for PM-10 to understand what might be the health effects of chronic exposure. Based on the collected 10-month data, the average value of 56  $\mu\text{g}/\text{m}^3$  was above the federal (50  $\mu\text{g}/\text{m}^3$ ) and state (20  $\mu\text{g}/\text{m}^3$ ) yearly standards that were in place at the time of sampling. The average was also similar to the rest of the San Joaquin Valley. The two-year average PM-10 concentration in the San Joaquin Valley based on data collected by CARB was 59  $\mu\text{g}/\text{m}^3$  (CARB, 2003).

### 5.3.13 PM-2.5 Results

For PM-2.5, outdoor air samples were collected in 15- to 22-day periods only at McFarland Middle School only during the air sampling events.

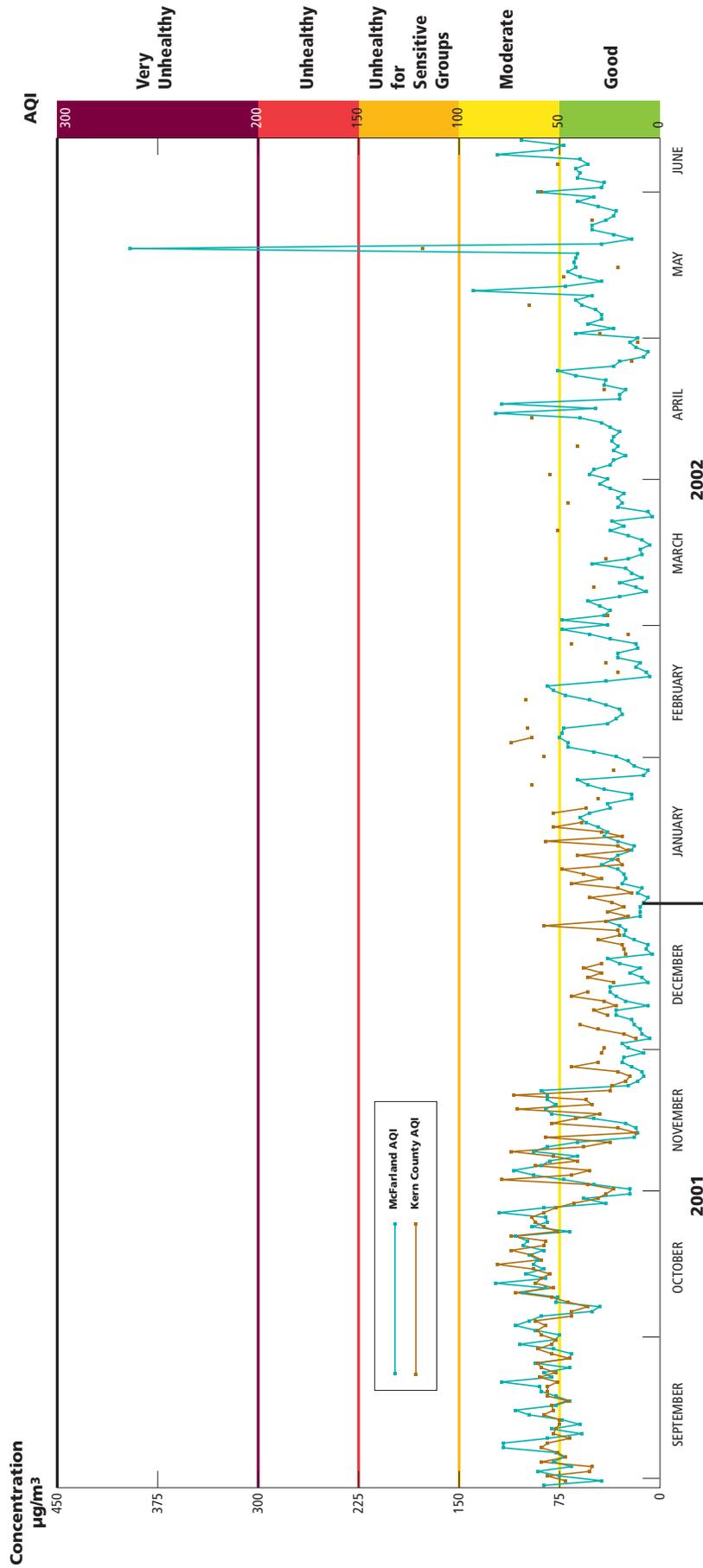
As with PM-10, the highest concentration occurred during the dust storm, May 19-20, 2002. However, no samples exceeded the federal short-term standard for PM-2.5 that was in place at the time of sampling.

Because PM-2.5 samples were collected only during limited periods during the course of the investigation, it is not possible to estimate the average long-term exposure for PM-2.5 based on averaging only the data collected. Moreover, a calculated average PM-2.5 derived from incomplete data might underestimate the actual average concentration, because no samples were collected during the peak months of September, October, and November. Therefore, the data do not support comparison to the long-term outdoor air quality standards.

### 5.3.14 TSP Results

TSP samples were collected at both sampling stations during all outdoor air sampling events. The maximum concentration occurred during the May 19-20, 2002 dust storm.

**Figure 5-3: Daily Air Quality Index for PM<sub>10</sub> for McFarland and Kern County**  
 (8/30/01 to 6/12/02)



- **PM<sub>10</sub>** = Particulate matter with a diameter of 10 microns or less.
- The **Air Quality Index (AQI)** is a conversion of a measured pollutant concentration to a number on a scale of 0 to 500. An index value of 100 corresponds to the national air quality standard established under the Clean Air Act. For PM<sub>10</sub>, an index value of 100 corresponds to 150 micrograms per cubic meter (µg/m<sup>3</sup>).

# 6 Public Health Discussion of Significant Findings in McFarland's Drinking Water, Soil, and Outdoor Air

## 6.1 Drinking Water

### 6.1.1 "First Draw" Lead

Babies, children, and pregnant women are very sensitive to exposure to high levels of lead. It is especially important to avoid making infant formula using water that contains high lead levels. Since the results of the drinking water investigation showed high levels of lead in some of McFarland's "first draw" drinking water samples, USEPA R9 suggested two very effective ways of reducing lead levels in drinking water:

1. **Flush the pipes before drinking or cooking with tap water.** Do not drink or cook with water that has been sitting in the pipes for more than 6 hours. Anytime the water in a faucet has not been used for six hours or longer, run the water from the cold-water tap until it gets as cold as it will get. (This could take as little as five to thirty seconds if there has been recent heavy water use such as showering or toilet flushing. Otherwise, it could take two minutes or longer). The more time water has been sitting in a pipe, the more likely higher lead levels will be present in the water.
2. **Use only cold water for drinking and cooking.** Use only water from the cold-water tap for drinking, cooking, and especially making infant formula. Hot water from the tap is likely to contain higher levels of lead.

These two actions are very effective in reducing lead levels in drinking water and can be very important to the health of families in McFarland. Most of the lead in household water usually comes from the plumbing in the house, not from the local water supply, as shown by the fact that the lead levels in samples from McFarland's wells and storage tank were very low.

### 6.1.2 Nitrate and Nitrite

The results of USEPA R9 testing of McFarland drinking water for nitrates and nitrites lead to the following conclusions:

1. Elevated nitrate levels above the MCL of 10 mg/l (ppm) are present in groundwater supplying two of McFarland's drinking water wells (Wells #2 and #4).

Therefore, these two wells require nitrate removal systems to reduce nitrates to levels that are in compliance with the nitrate MCL in order to protect the health of infants and young children.

2. The nitrate removal systems, which have been in place on Wells #2 and #4 since 1985 and 1988, effectively reduce nitrate levels in drinking water supplied by these wells to meet the nitrate MCL of 10 mg/l (ppm). These nitrate removal systems need to continue to be routinely operated, maintained, and monitored.
3. The drinking water supplied to McFarland is in compliance with the nitrate drinking water standard of 10 mg/l (ppm). This is shown by the post-treatment sample results from Wells #2 and #4 and by all the sample results from Well #6, the Garzoli Well, the storage tank, and from 27 public and private locations throughout the town.

### 6.1.3 Arsenic

Most of the drinking water samples collected in McFarland during this investigation did not meet the revised arsenic MCL of 10 µg/l (i.e., arsenic levels are greater than 10 µg/l [ppb]).

The U.S. Geological Service (USGS) has surveyed public water systems in the U.S. and published statistics on arsenic levels in the public water supply. The USGS results put the arsenic levels observed in McFarland's drinking water system (0.48 - 18.2 µg/l [ppb]) into some perspective. The study concluded that the highest levels of arsenic in drinking water systems are found in the Western U.S. and that 13.6% of all public water systems have arsenic concentrations exceeding 5 µg/l (ppb), 7.6% exceed 10 µg/l (ppb) and 3.1% exceed 20 µg/l (ppb). The study indicated that the lower San Joaquin Valley is one of many areas in the Western U.S. where 10% or more of groundwater samples can be expected to have an arsenic level greater than 10 µg/l (ppb) and that some areas of the lower San Joaquin Valley have groundwater levels greater than 50 µg/l (ppb).

As of the date of this report, USEPA R9 has received an update from the CDPH which notes that McFarland currently has 3 active drinking water wells. The Garzoli Well, one of the 3 wells currently active, is out of compliance with the revised MCL with arsenic levels about 15 ppb and is under a compliance order issued by CDPH. The public water supply has been granted funds under Prop. 84 to install wellhead treatment but the project is stalled due to California's budget crisis

## 6.2 Soil

### 6.2.1 Elmo Highway Complex - Kirkpatrick and Sons Potato Shed

During Phase 2 the chlorinated pesticide dieldrin was detected in soil from three of five sample locations at concentrations greater than the industrial PRG (150 micrograms per kilogram [ $\mu\text{g}/\text{kg}$ ]); two of the exceedances occurred in surface samples and the third in a sample collected 1 to 2 feet bgs. Concentrations for the three exceedances ranged from 270 to 2,500  $\mu\text{g}/\text{kg}$ ; these results are similar to results from Phase 1, in which there were four exceedances of the Industrial PRG, ranging from 200 to 4,000  $\mu\text{g}/\text{kg}$ . No other analyzed substances were detected above residential or industrial PRGs in any sample collected during either phase.

The maximum detected dieldrin concentrations exceeded the Industrial PRG. Therefore, USEPA R9 performed a more detailed risk screening evaluation by calculating the excess cancer risk associated with exposure to dieldrin-containing soil at this site. Using standard assumptions about worker exposure (U.S. EPA 1991) and using the maximum detected value (2,500  $\mu\text{g}/\text{kg}$ ) as the assumed exposure concentration, USEPA R9 calculated an excess cancer risk of  $1.7 \times 10^{-5}$  (17-in-one-million) for any workers who would be present at the site daily over a 25 year career. Risks for a worker whose career at the facility spans less than 25 years will be correspondingly lower. This risk estimate is within the mid-range of USEPA's acceptable risk range of  $10^{-6}$  (~1-in-one-million) to  $10^{-4}$  (~100-in-one-million). USEPA R9, therefore, concluded that the dieldrin concentrations observed at the Kirkpatrick and Sons property do not represent a significant public health threat.

### 6.2.2 Elmo Highway Complex - Tri Cal Facility

During Phase 2, no analyzed substances were detected at the Tri Cal facility at concentrations above the industrial PRGs. The Phase 2 sampling did not confirm detections of dieldrin that were found during Phase 1, suggesting that the dieldrin contamination is not widespread. During Phase 1,

dieldrin concentrations in surface and near-surface (1 to 2 feet bgs) soils ranged from non-detect to 340  $\mu\text{g}/\text{kg}$ . Only the maximum dieldrin concentration of 340  $\mu\text{g}/\text{kg}$ , detected in a single sample collected at 1 to 2 feet bgs during Phase 1, exceeded the Industrial PRG of 150  $\mu\text{g}/\text{kg}$ .

Since dieldrin was detected during Phase 1 at a concentration exceeding the Industrial PRG in one near-surface sample, USEPA R9 conducted a more detailed risk screening evaluation by calculating excess cancer risk and evaluating exposure assumptions. Using the standard assumptions about worker exposure (U.S. EPA 1991) and using the maximum detected value (340  $\mu\text{g}/\text{kg}$ ) as the assumed exposure concentration, USEPA R9 calculated an excess cancer risk of  $2.3 \times 10^{-6}$  (2.3-in-one-million) for a worker at this site. This risk estimate is at the extreme lower end of USEPA's acceptable risk range of  $10^{-6}$  (~1-in-one-million) to  $10^{-4}$  (~100-in-one-million).

Actual exposure is likely to be significantly less than the assumptions used to calculate the risk. Based on the August 2005 USEPA R9 property status review and site reconnaissance (Catherine Clarkin Consulting, 2007), which found that workers visit the property only two or three times a week, workers are likely exposed significantly less than 8 hours a day and 250 days per year. Thus, USEPA R9 concluded that the dieldrin concentrations observed at the Tri Cal property during Phase 1 do not represent a significant public health threat.

### 6.2.3 Mouser (McFarland) Park

During Phase 2, lead was detected in one sample at 2 to 4 feet bgs at a concentration of 769 mg/kg, which is greater than the Residential PRG of 130 mg/kg. No other substances were detected at concentrations greater than residential PRGs. The Phase 1 detection of dieldrin in surface soil at a concentration greater than the Residential PRG, was not confirmed during Phase 2, suggesting that any dieldrin contamination is not widespread in Mouser Park.

Lead: The single lead detection above a Residential PRG at Mouser (McFarland) Park occurred in a subsurface sample (2-4 feet bgs). USEPA R9 does not consider soil that is below 2 feet bgs to be readily accessible. Therefore, it is not likely that anyone using the park will be routinely exposed to this concentration of lead. USEPA R9 concluded that this single detection of lead at a concentration greater than the Residential PRG does not represent a significant public health threat.

Dieldrin: The maximum detected dieldrin concentration at Mouser (McFarland) Park from a surface soil sample collected during Phase 1 exceeded the Residential PRG of 28  $\mu\text{g}/\text{kg}$ .

Therefore, USEPA R9 performed a more detailed risk screening evaluation by calculating the excess cancer risk associated with exposure to dieldrin-containing soil at this site. Using standard assumptions for residential exposure, which assume exposure 350 days/year for 30 years (U.S. EPA 1991), and the maximum detected value (82 µg/kg) as the assumed exposure concentration, USEPA R9 calculated an excess cancer risk at this site of  $2.9 \times 10^{-6}$  (2.9-in-one-million). This risk estimate is at the extreme lower end of USEPA's acceptable risk range of  $10^{-6}$  (~1-in-one-million) to  $10^{-4}$  (~100-in-one-million).

Since this is a park, not a personal residence, actual exposure is likely to be significantly less than the daily exposure assumptions used to calculate the risk. USEPA R9, therefore, concluded that the dieldrin concentrations observed at Mouser (McFarland) Park do not represent a significant public health threat.

#### 6.2.4 Browning Road School

No analyzed substances, notably no benzo(a)pyrene, were detected at concentrations greater than the residential PRGs in any of the samples collected during Phase 2. One surface soil sample contained 47.4 µg/kg benzo(a)pyrene, which is less than the Residential PRG of 56 µg/kg. During Phase 1, this substance was detected at 260 µg/kg in the same area.

The maximum detected benzo(a)pyrene concentration at Browning Road School exceeded the Residential PRG. Therefore, USEPA R9 performed a more detailed risk screening evaluation by calculating the excess cancer risk associated with exposure to benzo(a)pyrene-containing soil at this site. Using standard assumptions for residential exposure, which assume exposure 350 days/year for 30 years, (U.S. EPA 1991) and the maximum detected value (260 µg/kg) as the assumed exposure concentration, USEPA R9 calculated an excess cancer risk at this site of  $4.6 \times 10^{-6}$  (4.6-in-one-million). This risk estimate is at the lower end of USEPA's acceptable risk range of  $10^{-6}$  (~1-in-one-million) to  $10^{-4}$  (~100-in-one-million).

Since this is a school, where attendance is for fewer than 350 days/year and for much shorter than 30 years, actual exposure for children at the school is likely to be significantly less than the assumptions used to calculate the risk. In addition, school employees' exposure is also likely to be less – it is more likely to be similar to the exposure assumptions used to develop industrial PRGs. Therefore, USEPA R9 concluded that the benzo(a)pyrene detections in soil at Browning Road School do not represent a significant public health threat.

#### 6.2.5 McFarland High School

During Phase 2, dioxins/furans/PCBs were detected at concentrations greater than the Residential PRG of 3.9 pg/g

in two composite samples collected from the football field; dioxin/furan/PCB concentrations in these composites were 9.6 and 5.4 pg/g Toxic Equivalence (TEQ). In addition, the Phase 2 composite samples collected from the area around home plate and the outfield area of the baseball field contained dioxins/furans/PCB concentrations of 3.7 and 3.1 pg/g TEQ, respectively. During Phase 1 sampling, dioxins and furans had been detected in the football field at concentrations just below the Residential PRG and in the baseball field in one sample at a concentration (8.7 pg/g TEQ) greater than this PRG. No other analyzed substance was detected above the residential PRGs during either phase. .

Football Field: Dioxin/furan and dioxin/furan/PCB total TEQ concentrations at the football field exceeded the Residential PRG in some samples. Therefore, USEPA R9 performed a more detailed risk evaluation by calculating the excess cancer risk and evaluating exposure assumptions. Using the standard assumptions for residential exposure, which assume exposure 350 days/year for 30 years, and the maximum detected concentration (9.6 pg/g TEQ) as the assumed exposure concentration, USEPA R9 calculated an excess cancer risk of  $2.5 \times 10^{-6}$  (2.5-in-one-million). This risk estimate is at the extreme lower end of USEPA's acceptable risk range of  $10^{-6}$  (~1-in-one-million) to  $10^{-4}$  (~100-in-one-million).

Considering that the exposure assumptions of 350 days/year for 30 years are likely to significantly overestimate actual exposure conditions at the football field, the actual risk is expected to be less. Therefore, USEPA R9 concluded that the dioxin/furan detections at the football field do not represent a significant public health threat.

Baseball Diamond: Dioxins and furans were detected at a total TEQ concentration greater than the Residential PRG in one sample collected from the baseball diamond. Therefore, USEPA R9 performed a more detailed risk screening evaluation by calculating the excess cancer risk and evaluating exposure assumptions. Using the standard assumptions for residential exposure, which assume exposure 350 days/year for 30 years, and the maximum detected concentration (8.6 pg/g TEQ) as the assumed exposure concentration, USEPA R9 calculated an excess cancer risk of  $2.2 \times 10^{-6}$  (2.2-in-one-million). This risk estimate is also at the extreme lower end of EPA's acceptable risk range of  $10^{-6}$  (~1-in-one-million) to  $10^{-4}$  (~100-in-one-million).

Considering that the exposure assumptions of 350 days/year for 30 years are likely to significantly overestimate actual exposure conditions at the baseball diamond, the actual risk is expected to be less. Therefore, USEPA R9 concluded that the dioxin/furan detections at the baseball field do not represent a significant public health threat.

### 6.2.6 Former Sunshine Service Station

Arsenic, cadmium, lead, and PAHs were detected in at least one sample above their respective residential or industrial PRGs.

**Arsenic:** Arsenic was detected at a concentration greater than its cancer Industrial PRG (1.6 mg/kg) in all samples, and was detected at concentrations (42 and 79 mg/kg) greater than its non-cancer Residential PRG of 22 mg/kg in two samples during Phase 2 and in one sample at a concentration (28 mg/kg) greater than its Residential non-cancer PRG during Phase 1. These three detections were also greater than the typical arsenic background levels in soils found in California, but other detections were within the typical range of background concentrations. Therefore, USEPA R9 determined that further risk evaluation was necessary. The further evaluation involved comparing estimated exposure concentrations for the two phases to trespasser PRGs, and calculating the excess cancer risk to trespassers.

Using the exposure assumptions described in Section 3.3.2, USEPA R9 calculated the following Trespasser PRGs for arsenic in soil based on the carcinogenicity of arsenic:

- Reasonable Maximum Exposure (RME) Trespasser PRG: 16 mg/kg
- Central Tendency (CT) Trespasser PRG: 170 mg/kg

The maximum detected concentration for arsenic in soil at this site was 79 mg/kg, which was assumed to be the average daily exposure concentration. This concentration exceeds the RME Trespasser PRG, but is less than the CT Trespasser PRG. Therefore, EPA R9 calculated the excess cancer risk associated with this maximum detected assumed exposure concentration for a frequent (RME) trespasser. This calculated excess cancer risk was  $4.9 \times 10^{-6}$  (4.9-in-one-million). This risk estimate is at the lower end of EPA's acceptable risk range of  $10^{-6}$  (~1-in-one-million) to  $10^{-4}$  (~100-in-one-million).

Based on this risk screening evaluation, USEPA R9 concluded that the arsenic concentrations observed at the former Sunshine Service Station, while elevated over residential soil screening levels, do not represent a significant public health threat. This conclusion applies to current (i.e., trespasser) uses of the abandoned property. In the event that alternative uses (e.g., industrial, residential, recreational/park) for the property are considered in the future, this conclusion should be reviewed in that context.

The property owner and Kern County were notified that these arsenic levels exceed both residential and industrial risk screening levels and that further evaluation should be performed before the site is re-used.

**Cadmium:** The cadmium concentration exceeded the Residential PRG in a single sample from the two phases of soil sampling, and the magnitude of this exceedance was marginal (a 9.5 mg/kg cadmium concentration versus the PRG level of 9.0 mg/kg); all other samples collected during both phases had cadmium concentrations less than its residential and industrial PRGs. USEPA R9 determined that this fact, in and of itself, is sufficient to conclude that the cadmium at this location does not represent a significant public health threat. This conclusion is reinforced by a more realistic and appropriate risk-based screening for this property, accomplished by comparison to the Industrial soil PRG (810 mg/kg); the maximum detected cadmium concentration (9.5 mg/kg) was significantly less than this industrial PRG.

**Lead:** During Phase 2, lead was detected at a concentration greater than the Industrial PRG of 1,000 mg/kg in two surface soil samples and one duplicate; lead concentrations ranged from 1,300 to 2,100 mg/kg in these samples. In an additional sample, the lead concentration (515 mg/kg) was greater than the Residential PRG (130 mg/kg), but not the Industrial PRG. Lead was not detected at a concentration greater than either the Industrial or the Residential PRG in any soil sample collected during Phase 1. Because lead was detected at concentrations greater than its Industrial PRG, EPA R9 performed an additional risk screening evaluation, which involved comparing the estimated exposure concentration to trespasser PRGs.

The California Department of Toxic Substances Control (DTSC) version of the lead model, LeadSpread 7 (DTSC 2000), was used in the risk screening evaluation since it has the capability to generate soil PRGs, in addition to predicting blood lead concentrations for teenaged trespassers at the former service station. The resulting Trespasser PRG values for lead in soil are the following:

- RME Trespasser PRG: 1,846 mg/kg
- CT Trespasser PRG: 11,900 mg/kg

The maximum detected lead concentration occurred at a location where duplicate surface soil samples were analyzed; the average lead concentration at this location was 1,860 mg/kg. This maximum lead concentration is only slightly greater than the PRG (1,846 mg/kg) for the RME trespasser scenario and significantly less than the PRG (11,900 mg/kg) for the CT trespasser. Thus, potential health risks would not be significantly elevated for a person trespassing on the property

124 days/year for a 6 year period (REM Trespasser exposure scenario). Risks for a CT trespasser - on the property 52 days/year for 4 years - would be much lower. Since the RME trespasser PRG is so conservative in its exposure assumptions, USEPA does not view its slight exceedance by the maximum lead concentration as indicating a potentially significant health risk even for this potentially highly exposed individual.

Based on this risk evaluation, USEPA R9 concluded that the lead concentrations observed at the former Sunshine Service Station, while elevated over residential and industrial soil screening levels in some locations on the abandoned and fenced property, do not represent a significant public health threat. As with arsenic, in the event that alternative uses (e.g., industrial, residential, recreational/park) for the property are considered in the future, this conclusion should be reviewed in that context.

The property owner and Kern County have been notified that these lead levels exceed both residential and industrial risk screening levels and that further evaluation should be performed before the site is re-used.

**PAHs:** During Phase 2, benz(a)anthracene was detected at concentrations (878 and 921 µg/kg) greater than the Residential PRG of 610 µg/kg in one sample and its duplicate; both concentrations were less than its Industrial PRG (2,900 µg/kg). Benzo(a)pyrene was detected at concentrations (67 and 151 µg/kg) greater than the Residential PRG of 56 µg/kg in two samples, but less than the Industrial PRG of 290 µg/kg. These two PAHs had not been detected in any soil samples collected at the former Sunshine Service Station during Phase 1.

PAHs are products of incomplete combustion and are minor components of gasoline. Although the concentrations of the two PAHs at the former service station exceeded their Residential soil PRG levels, the magnitude of the exceedance was small. In the unlikely event this property is developed for residential use without undergoing any remediation, the resultant excess cancer risks from residential exposure would range from  $2 \times 10^{-6}$  to  $2.5 \times 10^{-6}$  (2 to 2.5-in-one-million), which are at the extreme lower end of the risk range.

This is a former industrial facility; therefore, a more appropriate risk-based screening is accomplished by comparison to PRGs for industrial soil. The maximum detected concentrations of benz(a)anthracene and benzo(a)pyrene were both well below their respective industrial PRGs (2,900 µg/kg for benz(a)anthracene and 290 µg/kg for benzo(a)pyrene).

Since the concentrations of benz(a)anthracene and benzo(a)pyrene were less than the industrial PRGs, USEPA R9 concluded that these PAH detections do not represent a significant public health threat

### 6.2.7 Residence F

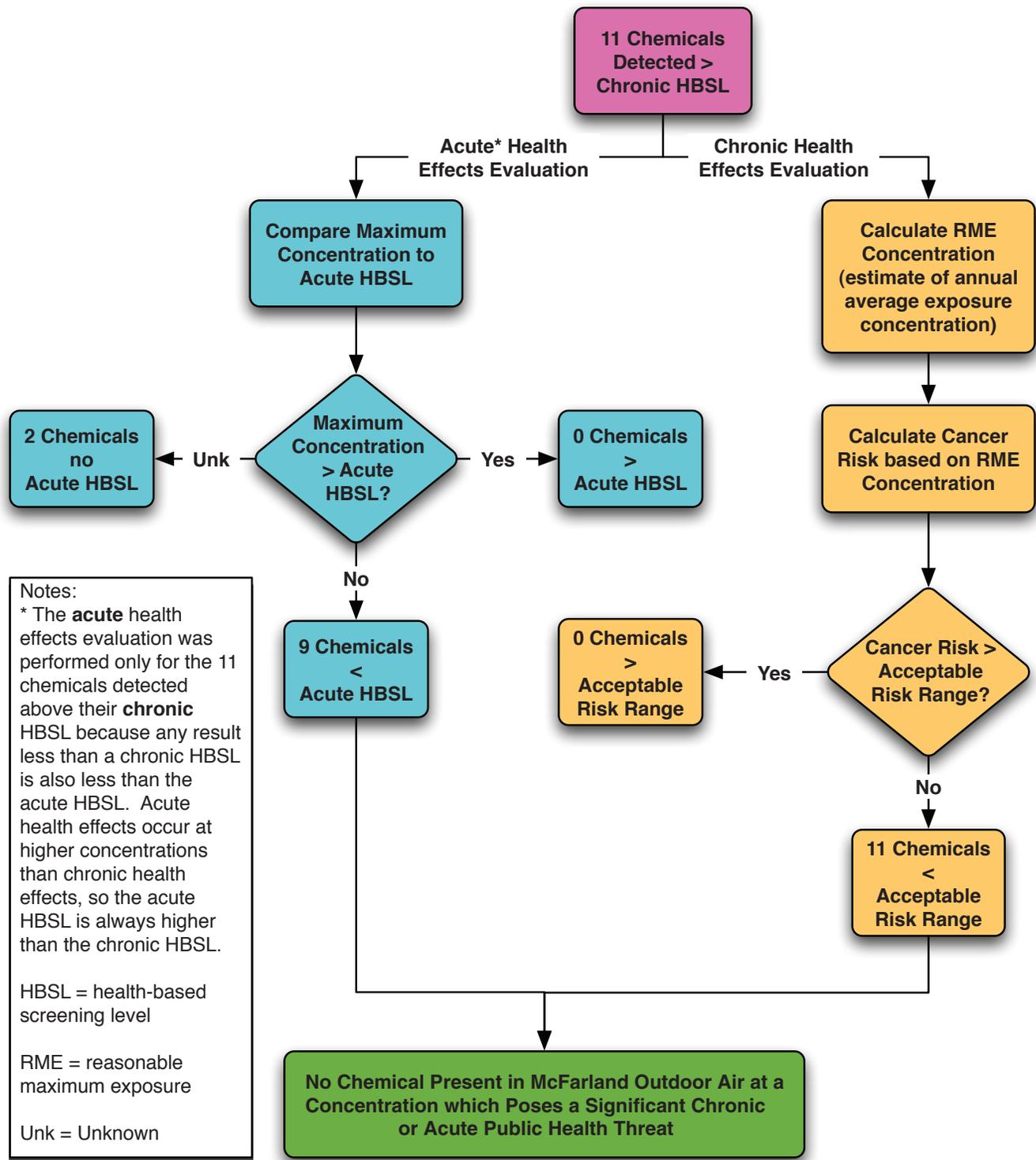
At Residence F, benzo(a)pyrene was detected in one surface soil sample at a concentration (110 µg/kg) greater than the Residential PRG of 56 µg/kg during Phase 1. Benzo(a)pyrene was not detected in any of the samples collected during Phase 2, indicating that this contaminant is not likely widespread on the property.

Although the benzo(a)pyrene concentration in this single Phase 1 sample marginally exceeded the Residential PRG, it would not result in a significantly elevated cancer risk even if it reflected a relatively continuous exposure level over 350 days/year for a 30 year residential exposure duration. The associated excess cancer risk for residential exposure would be  $2 \times 10^{-6}$  (2-in-one-million), which is at the extreme lower end of USEPA R9's  $10^{-6}$  (~1-in-one-million) to  $10^{-4}$  (~100-in-one-million) acceptable risk range. Therefore, USEPA R9 concluded that this single detection of a benzo(a)pyrene concentration greater than the Residential PRG does not represent a significant public health threat.

## 6.3 Outdoor Air

USEPA R9 used a tiered risk screening approach to determine if any of the chemicals detected in McFarland's outdoor air posed a potential long-term health risk (refer to Figure 6-1). In the initial screening step, the maximum detected concentration for each chemical was compared to that chemical's HBSL for chronic exposure. If the maximum detected concentration was less than the chronic HBSL, USEPA R9 concluded that chemical did not pose a potential health risk, either for acute or chronic exposures, and the chemical was not given further consideration. Chemicals for which one or more detections exceeded their respective chronic HBSLs were subjected to a more detailed risk screening process, which is described on a chemical-by-chemical basis below. There were eleven chemicals detected one or more times at concentrations exceeding chronic HBSLs, and both PM-10 and PM-2.5 were detected at levels of potential health concern:

- Arsenic
- Benzene
- Cadmium
- Carbon tetrachloride
- Chromium



**Figure 6-1**  
**Health Risk Evaluation of Chemical Results in Outdoor Air**  
 McFarland, California

- Formaldehyde
- Manganese
- Methyl bromide
- Methyl chloride
- Methylene chloride
- p-Dichlorobenzene

USEPA R9 performed further risk screening evaluation by calculating the excess lifetime cancer risk or the non-cancer hazard index posed by chronic exposure under residential conditions to each of the 11 chemicals detected above their respective chronic HBSLs. The risk of developing cancer or a non-cancer health effect was calculated by considering the toxicity of the substance, its concentration in air, characteristics of the substance (e.g., volatility), how much air an individual breathes on a daily basis, and other factors related to chronic residential exposure (USEPA, 1991). These factors were the same as those used to develop the chronic HBSLs used to screen the maximum detected values.

The potential significance of excess lifetime cancer risks was evaluated by comparison to USEPA's target risk range for Superfund remedial actions. This acceptable risk range spans  $10^{-6}$  (~1-in-one-million) to  $10^{-4}$  (~100-in-one-million). For non-cancer health effects, USEPA concluded that a hazard index less than 1.0 represented an exposure that would not be expected to pose an appreciable health risk over the course of a lifetime. As the hazard index increases above 1.0 the likelihood that a health effect may develop increases, especially for sensitive members of the population.

Before calculating cancer risks or hazard indices, USEPA first used the collected data to estimate a long-term exposure

concentration. As a conservative approach, USEPA estimated the annual average concentration of a chemical detected above a HBSL in McFarland air by calculating the RME concentration using the 95-percent upper confidence limit (95% UCL) of the mean of the collected data. This is a statistically-derived, estimate of the annual average concentration of each chemical in McFarland air; it represents a conservative estimate of the concentration a person might be exposed to on a regular basis, over the long-term (chronic exposure).

### 6.3.1 Formaldehyde

Formaldehyde is both directly emitted into the atmosphere and formed in the atmosphere as a result of photochemical reaction. It is found in some pesticides used as disinfectants. Formaldehyde occurs naturally in forest fires, animal waste, microbial products of biological systems, and plant volatiles. It is an ozone precursor and hazardous air pollutant. Based on the 1996 National-level Air Toxics Assessment (NATA) performed by USEPA, almost 90 percent of the formaldehyde found in the urban areas of California is attributed to on-road and non-road mobile sources. In rural areas of California, about 60 percent of the formaldehyde is attributable to area and non-point sources, according to NATA 1996.

In McFarland, formaldehyde concentrations were lowest during the winter sampling event, Event 2 (December 2001/January 2002). Possible explanations for the lower concentrations are atmospheric chemical reaction by nitric acid reduction and other types of secondary chemical reactions.

Because formaldehyde was more frequently detected above its HBSL than any other chemical, USEPA R9 performed a detailed interpretation of the results, including examination of possible sources and comparison to concentrations detected in the air of other areas in the San Joaquin Valley. As shown

Table 6-1: Comparison of CARB Data and McFarland Data for Formaldehyde

| Location                         | Year      | Number of Samples | Mean ( $\mu\text{g}/\text{m}^3$ ) | Median ( $\mu\text{g}/\text{m}^3$ ) | Maximum ( $\mu\text{g}/\text{m}^3$ ) | Minimum ( $\mu\text{g}/\text{m}^3$ ) |
|----------------------------------|-----------|-------------------|-----------------------------------|-------------------------------------|--------------------------------------|--------------------------------------|
| McFarland                        | 2001/2002 | 73                | 6.8                               | 6.8                                 | 20                                   | ND (0.14)                            |
| 1st St, Fresno                   | 2001      | 30                | 5.3                               | 4.0                                 | 32                                   | 1.5                                  |
|                                  | 2002      | 32                | 5.1                               | 4.3                                 | 22                                   | 1.4                                  |
| 5558 California Ave, Bakersfield | 2001      | 35                | 4.2                               | 3.3                                 | 17                                   | 0.74                                 |
|                                  | 2002      | 36                | 3.9                               | 4.2                                 | 6.6                                  | 0.86                                 |
| Hazelton St, Stockton            | 2001      | 33                | 1.8                               | 1.6                                 | 7.7                                  | 0.74                                 |
|                                  | 2002      | 32                | 2.5                               | 2.2                                 | 7.5                                  | 0.74                                 |

CARB = California Air Resources Board

$\mu\text{g}/\text{m}^3$  = micrograms per cubic meter

ND = not detected (quantitation limit is in parentheses)

Reference: CARB 2002, 2003

in Table 6-1, mean and median outdoor air concentrations of formaldehyde in McFarland were higher than the concentrations found by CARB in Fresno, Stockton, and Bakersfield, which are larger urban areas in the San Joaquin Valley. No significant seasonal variations were observed in the CARB study.

The Central California Ozone Study (SJVAPCD, 2000) observed similar or higher summertime (2000) concentrations of formaldehyde in other San Joaquin Valley rural communities. Sampling was conducted in rural areas, including Angiola, Arvin, and Trimmer.

Unique local characteristics in McFarland could account for the generally higher observed concentrations of formaldehyde. Such characteristics include potential formaldehyde emissions from sources such as animal feed and waste products from confined animal feeding operations (CAFO) and non-road vehicle auto exhaust. Formaldehyde is also emitted from refineries, oil/gas production, and in cigarette smoke. While more reported point sources of formaldehyde emissions existed near Bakersfield in Kern County, larger numbers of area and mobile sources may have been near McFarland at the time of sampling. At the time of this investigation, there was a cluster of eight dairies within five miles of McFarland, including four within 1.5 miles. There is also a primarily upwind waste treatment facility in Delano (five miles north of McFarland). Formaldehyde may be transformed to ozone at lower rates in rural areas than in urban areas, thus contributing to the observed formaldehyde concentrations in McFarland.

The mean formaldehyde concentration in McFarland was higher than CARB's for Fresno (ratio 1.3), Bakersfield (ratio 1.7) and Stockton (ratio 3.2). The excess lifetime cancer risk

associated with exposure to the 95% UCL concentration for 30 years was  $8.8 \times 10^{-5}$  (or 88 in one-million), within USEPA's cancer risk range of  $10^{-6}$  to  $10^{-4}$ .

### 6.3.2 Arsenic

Arsenic was selected as a chemical for analysis in McFarland primarily because it is a component of certain pesticides historically used in McFarland (e.g., cacodylic acid). According to the ATSDR (ATSDR, 2005), anthropogenic sources are greater contributors to atmospheric arsenic than are naturally occurring sources. It is also a naturally occurring component of the soil in the San Joaquin Valley.

Despite some minor or short-term differences in results at the two sampling stations, the overall results at the two stations were very similar, suggesting macroscale source contributions in McFarland. Concentrations did not vary greatly with season or sampling event; however, short-term spikes in arsenic concentrations occurred during Events 3 and 4. As with the other metals detected during the investigation, peak arsenic concentrations occurred during a dust storm on May 19-20, 2002.

CARB typically monitors for arsenic; however, data were not available for 2001/2002. In Table 6-2 summary results from various CARB sampling locations in the San Joaquin Valley from the year 2000 are compared to the McFarland results, collected in 2001/2002. Median results from McFarland and Modesto are similar, while the median concentrations in Fresno and Bakersfield are lower. The maximum concentration detected in McFarland is higher than at any other location, because the McFarland sampling captured the May 19 and 20 dust storm where high concentrations of dust and associated metals were observed.

Table 6-2: Comparison of CARB Data and McFarland Data for Arsenic

| Location                         | Year      | Number of Samples | Mean ( $\mu\text{g}/\text{m}^3$ ) | Median ( $\mu\text{g}/\text{m}^3$ ) | Maximum ( $\mu\text{g}/\text{m}^3$ ) | Minimum ( $\mu\text{g}/\text{m}^3$ ) |
|----------------------------------|-----------|-------------------|-----------------------------------|-------------------------------------|--------------------------------------|--------------------------------------|
| McFarland                        | 2001/2002 | 76                | 0.0011                            | 0.00072                             | 0.011                                | 0.00025                              |
| 1st St, Fresno                   | 2000      | 16                | NA                                | 0.0001                              | 0.0077                               | 0.0002                               |
| 5558 California Ave, Bakersfield | 2000      | 19                | NA                                | 0.00012                             | 0.0029                               | 0.0002                               |
| 14th St, Modesto                 | 2000      | 18                | NA                                | 0.0007                              | 0.0027                               | 0.0003                               |

CARB = California Air Resources Board

$\mu\text{g}/\text{m}^3$  = micrograms per cubic meter

Reference: CARB 2002, 2003

The excess lifetime cancer risk associated with exposure to the outdoor air arsenic concentration in McFarland for 30 years was  $2.7 \times 10^{-6}$ . This risk estimate is at the lower end of USEPA's acceptable risk range of  $10^{-6}$  (-1-in-one-million) to  $10^{-4}$  (-100-in-one-million). Based on this risk evaluation, USEPA R9 concluded that the arsenic concentrations observed in McFarland air do not represent a significant public health threat from long-term exposure.

### 6.3.3 Cadmium

Cadmium was selected as a chemical for analysis in McFarland primarily because it was detected in McFarland soil during earlier sampling (Catherine Clarkin Consulting, 2007). According to ATSDR (ATSDR, 1999), cadmium occurs naturally in soil and dust can be entrained in air to contribute to atmospheric cadmium. However, anthropogenic sources of cadmium in the atmosphere typically dominate and include the following: smelting operations, coal and oil boilers and thermal power plants, municipal and sewage sludge incinerators, and solid waste incinerators (ATSDR, 1999). None of these major industrial sources exists in McFarland; however, an electricity generating plant, the Delano Co-Gen Plant, which burns primarily agricultural waste as an energy source, is located north of McFarland.

Cadmium is not included in the routine air monitoring performed by CARB and therefore data from the San Joaquin Valley were not available for comparison to the McFarland Outdoor Air Investigation data.

The excess lifetime cancer risk associated with exposure to the cadmium concentration in McFarland's outdoor air for 30 years was  $1.5 \times 10^{-7}$ , which is less than the lower end of USEPA's cancer risk range of  $10^{-6}$  (-1-in-one-million) to  $10^{-4}$

(-100-in-one-million). Based on this risk evaluation, USEPA R9 concluded that the cadmium concentrations observed in McFarland air do not represent a significant public health threat from long-term exposure.

### 6.3.4 Chromium (total)

Chromium was selected as a chemical for analysis in McFarland primarily because it was detected in McFarland soil during earlier sampling (Catherine Clarkin Consulting, 2007). Sources of chromium in the atmosphere are chromium that occurs naturally in soil, power plants, and plating shops (ATSDR, September 2000).

In Table 6-3, summary results from various CARB sampling locations in the San Joaquin Valley from the 2001 and 2002 are compared to the McFarland results, collected in 2001/2002. Median results from McFarland are lower than in other communities. The mean McFarland concentration is similar to the other monitoring locations. The maximum chromium concentration detected in McFarland is higher than at any other location, because the McFarland sampling included the dust storm, occurring on May 19 and 20, 2002, when high concentrations of dust and associated metals were observed.

The excess lifetime cancer risk associated with exposure to the chromium concentration in McFarland's outdoor air for 30 years was  $3.6 \times 10^{-5}$ . This risk estimate is in the middle of USEPA's acceptable risk range of  $10^{-6}$  (-1-in-one-million) to  $10^{-4}$  (-100-in-one-million). Based on this risk evaluation, USEPA R9 concluded that the chromium (total) concentrations observed in McFarland air do not represent a significant public health threat from long-term exposure.

Table 6-3: Comparison of CARB Data and McFarland Data for Chromium (total)

| Location                         | Year      | Number of Samples | Mean ( $\mu\text{g}/\text{m}^3$ ) | Median ( $\mu\text{g}/\text{m}^3$ ) | Maximum ( $\mu\text{g}/\text{m}^3$ ) | Minimum ( $\mu\text{g}/\text{m}^3$ ) |
|----------------------------------|-----------|-------------------|-----------------------------------|-------------------------------------|--------------------------------------|--------------------------------------|
| McFarland                        | 2001/2002 | 76                | 0.0037                            | 0.0018                              | 0.083                                | ND (0.00008)                         |
| 1st St, Fresno                   | 2001      | 32                | 0.0035                            | 0.003                               | 0.012                                | 0.001                                |
|                                  | 2002      | 29                | 0.004                             | 0.003                               | 0.011                                | 0.001                                |
| 5558 California Ave, Bakersfield | 2001      | 39                | 0.0033                            | 0.003                               | 0.008                                | 0.001                                |
|                                  | 2002      | 36                | 0.0053                            | 0.005                               | 0.012                                | 0.001                                |
| Hazelton St, Stockton            | 2001      | 35                | 0.0037                            | 0.003                               | 0.014                                | 0.001                                |
|                                  | 2002      | 35                | 0.0065                            | 0.005                               | 0.031                                | 0.001                                |

CARB = California Air Resources Board

$\mu\text{g}/\text{m}^3$  = micrograms per cubic meter

ND = not detected (quantitation limit is in parentheses)

Reference: CARB 2002, 2003

Chromium exists in nature in 2 forms: Cr VI and Cr III, with Cr III usually being the dominant form. Of the 2 forms, only Cr VI is considered carcinogenic by inhalation. Chromium analyses for the McFarland Outdoor Air Investigation did not distinguish between the 2 forms of chromium thus the concentrations reported herein are for total chromium. Since information on the Cr VI concentration is not available, this risk screening evaluation assumes that all of the airborne chromium detected during the investigation is carcinogenic and the cancer potency value used is that for Cr VI; the excess lifetime cancer risk estimate of  $3.6 \times 10^{-5}$  reflects these assumptions. The actual Cr VI concentrations are likely to be significantly lower and therefore this risk calculation is likely a significant overestimation of actual risks from airborne chromium in McFarland.

### 6.3.5 Manganese

Manganese was included on the target chemical list because it is a component of some dithiocarbamate pesticides historically used in McFarland. In addition, manganese was selected for analysis because it was detected in McFarland soil during earlier sampling (Catherine Clarkin Consulting, 2007).

Of the 76 air samples collected during the investigation, only 5 exhibited a manganese concentration greater than the HBSL. The 2 highest manganese concentrations ( $0.63$  and  $0.53 \mu\text{g}/\text{m}^3$ ) were recorded during an unusually intense dust storm on May 19 and 20, 2002. Excluding the manganese concentrations from this unusual event, the manganese concentration in McFarland's outdoor air is  $0.047 \mu\text{g}/\text{m}^3$ , which is less than the HBSL. Even including these unusual concentrations, the concentration ( $0.068 \mu\text{g}/\text{m}^3$ ) represents only a slight exceedance of its HBSL, resulting in a hazard index of 1.3.

The observed manganese concentrations in McFarland are not unusual for San Joaquin Valley outdoor air. Monitoring by the CARB in Fresno and Bakersfield during the same time-frame as the McFarland Outdoor Air Investigation reported mean airborne manganese concentrations ranging  $0.028$  to  $0.044 \mu\text{g}/\text{m}^3$  (similar to the 95% UCL with the dust storm concentrations excluded) and 90<sup>th</sup> percentile manganese concentrations ranging  $0.050$  to  $0.074 \mu\text{g}/\text{m}^3$  (similar to the 95% UCL concentration with the dust storm concentrations included).

Taking into account the influence of the May 19 and 20, 2002 dust storm, similar airborne concentrations in other San Joaquin Valley communities and a hazard index value only slightly elevated above 1.0, USEPA R9 concluded that the manganese concentrations observed in McFarland air do not represent a significant public health threat from long-term exposure.

### 6.3.6 Benzene

According to ATSDR (ATSDR, September 2005), benzene is ubiquitous in the atmosphere. In the absence of an industrial source, such as a chemical production facility, its presence in outdoor air results primarily from gasoline vapors and automobile exhaust. Cigarette smoke is another significant source of human exposure to benzene. Benzene was selected as a chemical for analysis in McFarland primarily because the vehicles on Highway 99, a very heavily trafficked highway running through the center of town, likely contribute benzene to the outdoor air.

In Table 6-4, summary results from various CARB sampling locations in the San Joaquin Valley from the 2001 and 2002 are compared to the McFarland results, collected in 2001/2002. Mean and median results from McFarland are

Table 6-4: Comparison of CARB Data and McFarland Data for Benzene

| Location                         | Year      | Number of Samples | Mean ( $\mu\text{g}/\text{m}^3$ ) | Median ( $\mu\text{g}/\text{m}^3$ ) | Maximum ( $\mu\text{g}/\text{m}^3$ ) | Minimum ( $\mu\text{g}/\text{m}^3$ ) |
|----------------------------------|-----------|-------------------|-----------------------------------|-------------------------------------|--------------------------------------|--------------------------------------|
| McFarland                        | 2001/2002 | 76                | 0.56                              | 0.51                                | 1.3                                  | ND (0.64)                            |
| 1st St, Fresno                   | 2001      | 30                | 1.9                               | 1.3                                 | 9.9                                  | 0.26                                 |
|                                  | 2002      | 30                | 2.0                               | 0.86                                | 7.0                                  | 0.26                                 |
| 5558 California Ave, Bakersfield | 2001      | 31                | 1.8                               | 1.1                                 | 5.7                                  | 0.45                                 |
|                                  | 2002      | 30                | 1.6                               | 1.2                                 | 4.2                                  | 0.32                                 |
| Hazelton St, Stockton            | 2001      | 31                | 1.5                               | 1.3                                 | 5.1                                  | 0.48                                 |
|                                  | 2002      | 28                | 1.7                               | 1.1                                 | 4.8                                  | 0.58                                 |

CARB = California Air Resources Board

$\mu\text{g}/\text{m}^3$  = micrograms per cubic meter

ND = not detected (quantitation limit is in parentheses)

Reference: CARB 2002, 2003

lower than in other communities. The maximum concentration detected in McFarland is also lower than in other communities.

The excess lifetime cancer risk associated with exposure to the benzene concentration in McFarland's outdoor air for 30 years was  $2.7 \times 10^{-6}$ . This risk estimate is at the lower end of USEPA R9's acceptable risk range of  $10^{-6}$  (~1-in-one-million) to  $10^{-4}$  (~100-in-one-million). Based on this risk evaluation, USEPA R9 concluded that the benzene concentrations observed in McFarland air do not represent a significant public health threat from long-term exposure.

### 6.3.7 Carbon Tetrachloride

Carbon tetrachloride was selected for analysis in samples collected from McFarland primarily because it is a persistent compound that was used until 1986 as a grain fumigant (ATSDR, August 2005).

In Table 6-5 summary results for carbon tetrachloride from various CARB sampling locations in the San Joaquin Valley from 2001 and 2002 are compared to the McFarland results, collected in 2001/2002. Mean and median concentrations from McFarland are similar to other communities. The maximum concentration detected in McFarland is approximately twice as high as in the other communities.

The excess lifetime cancer risk associated with exposure to the carbon tetrachloride concentration in McFarland's outdoor air for 30 years was  $6.0 \times 10^{-6}$ . This risk estimate is at the lower end of USEPA's acceptable risk range of  $10^{-6}$  (~1-in-one-million) to  $10^{-4}$  (~100-in-one-million). Based on this risk evaluation, USEPA R9 concluded that the carbon tetrachloride concentrations observed in McFarland air do not represent a significant public health threat from long-term exposure.

### 6.3.8 p-Dichlorobenzene

p-Dichlorobenzene (a.k.a., 1,4-dichlorobenzene) is widely used in room freshener, toilet deodorizer, and moth-repellent products (ATSDR, September 2004). Therefore, its source in McFarland outdoor air may be its uses in indoor applications.

The only valid McFarland result for p-dichlorobenzene ( $110 \mu\text{g}/\text{m}^3$ ) was significantly higher than all sample results from the CARB samples collected in the San Joaquin Valley. The maximum concentration in a CARB San Joaquin Valley sample collected during 2001 and 2002 was  $1.2 \mu\text{g}/\text{m}^3$ .

The excess lifetime cancer risk associated with exposure to the p-dichlorobenzene concentration in McFarland's outdoor air for 30 years was  $7.7 \times 10^{-6}$ . This risk estimate is near the lower end of USEPA's acceptable risk range of  $10^{-6}$  (~1-in-one-million) to  $10^{-4}$  (~100-in-one-million). Based on this risk evaluation, USEPA R9 concluded that the p-dichlorobenzene concentrations observed in McFarland air do not represent a significant public health threat from long-term exposure.

### 6.3.9 Methyl bromide

Methyl bromide is present in the atmosphere as both a naturally occurring and a human-made compound. The primary source of naturally occurring methyl bromide is the ocean; therefore, low levels of this compound are found in the atmosphere worldwide. The primary human-made source of methyl bromide is its use as a pesticide (ATSDR, September 1992); this is the reason for its inclusion on the list of chemicals for analysis in McFarland air. Combustion of unleaded gasoline is another known source.

Table 6-5: Comparison of CARB Data and McFarland Data for Carbon Tetrachloride

| Location                         | Year      | Number of Samples | Mean ( $\mu\text{g}/\text{m}^3$ ) | Median ( $\mu\text{g}/\text{m}^3$ ) | Maximum ( $\mu\text{g}/\text{m}^3$ ) | Minimum ( $\mu\text{g}/\text{m}^3$ ) |
|----------------------------------|-----------|-------------------|-----------------------------------|-------------------------------------|--------------------------------------|--------------------------------------|
| McFarland                        | 2001/2002 | 76                | 0.74                              | 0.63                                | 1.8                                  | ND (1.3)                             |
| 1st St, Fresno                   | 2001      | 30                | 0.54                              | 0.57                                | 0.75                                 | 0.38                                 |
|                                  | 2002      | 31                | 0.56                              | 0.57                                | 0.69                                 | 0.44                                 |
| 5558 California Ave, Bakersfield | 2001      | 31                | 0.54                              | 0.57                                | 0.76                                 | 0.44                                 |
|                                  | 2002      | 30                | 0.58                              | 0.57                                | 0.69                                 | 0.50                                 |
| Hazelton St, Stockton            | 2001      | 31                | 0.55                              | 0.57                                | 0.76                                 | 0.44                                 |
|                                  | 2002      | 28                | 0.57                              | 0.57                                | 0.69                                 | 0.50                                 |

CARB = California Air Resources Board

$\mu\text{g}/\text{m}^3$  = micrograms per cubic meter

ND = not detected (quantitation limit is in parentheses)

Reference: CARB 2002, 2003

The quantitation limits in the McFarland investigation were approximately an order of magnitude greater than those in the CARB studies. Therefore, because many of the results in both studies were non-detects, the results from McFarland and CARB are not comparable.

While methyl bromide was reported in the PUR for the period from July 1, 2001 to June 30, 2002 only once, it has historically been used more frequently, especially during November, when sampling did not occur. Despite the one reported application, USEPA R9 detected it in multiple samples during the McFarland Outdoor Air Investigation.

While 2 of the detections were at concentrations greater than the HBSL, the remainder were at lower levels and the average methyl bromide concentration in McFarland's outdoor air of  $1.0 \mu\text{g}/\text{m}^3$  is significantly below the HBSL, yielding a hazard index of 0.19. Based on this risk evaluation, USEPA R9 concluded that the methyl bromide concentrations observed in McFarland air do not represent a significant public health threat from long-term exposure.

### 6.3.10 Methyl chloride

The presence of methyl chloride in the atmosphere is primarily due to production from natural sources, such as the oceans and biomass combustion (ATSDR, December 1998). It was included on the list of chemicals for analysis in McFarland air due to its possible production during agricultural burning.

Methyl chloride is not included in the routine air monitoring performed by CARB and therefore data from the San Joaquin Valley were not available for comparison to the McFarland Outdoor Air Investigation data.

The excess lifetime cancer risk associated with exposure to the methyl chloride concentration in McFarland's outdoor air for 30 years was  $1.5 \times 10^{-6}$ . This risk estimate is at the extreme lower end of USEPA's acceptable risk range of  $10^{-6}$  (~1-in-one-million) to  $10^{-4}$  (~100-in-one-million). Based on this risk evaluation, USEPA R9 concluded that the methyl chloride concentrations observed in McFarland air do not represent a significant public health threat from long-term exposure.

### 6.3.11 Methylene chloride

Methylene chloride is used as a solvent in a wide variety of industries and as a paint stripper. It was included on the McFarland Air chemical list because it is used as a grain disinfectant. Methylene chloride can also be found in some aerosol products and is used in the manufacture of photographic film (ATSDR, 2001).

In Table 6-6, summary results for methylene chloride from various CARB sampling locations in the San Joaquin Valley from the years 2001 and 2002 are compared to the McFarland results, collected in 2001/2002. Mean and median concentrations from McFarland were similar to other monitoring locations. The maximum concentration detected in McFarland was several times higher than at other monitoring locations.

The excess lifetime cancer risk associated with exposure to the methylene chloride concentration in McFarland's outdoor air for 30 years was  $2.8 \times 10^{-7}$  which is less than the lower end of USEPA's acceptable risk range of  $10^{-6}$  (~1-in-one-million) to  $10^{-4}$  (~100-in-one-million). Based on this risk evaluation, USEPA R9 concluded that the methylene chloride concentrations observed in McFarland air do not represent a significant public health threat from long-term exposure.

Table 6-6: Comparison of CARB Data and McFarland Data for Methylene Chloride

| Location                         | Year      | Number of Samples | Mean ( $\mu\text{g}/\text{m}^3$ ) | Median ( $\mu\text{g}/\text{m}^3$ ) | Maximum ( $\mu\text{g}/\text{m}^3$ ) | Minimum ( $\mu\text{g}/\text{m}^3$ ) |
|----------------------------------|-----------|-------------------|-----------------------------------|-------------------------------------|--------------------------------------|--------------------------------------|
| McFarland                        | 2001/2002 | 76                | 1.1                               | 0.29                                | 24                                   | ND (0.69)                            |
| 1st St, Fresno                   | 2001      | 30                | 0.94                              | 0.17                                | 1.4                                  | 1.7*                                 |
|                                  | 2002      | 31                | 0.83                              | 0.69                                | 2.8                                  | 0.17                                 |
| 5558 California Ave, Bakersfield | 2001      | 31                | 0.90                              | 0.17                                | 4.2                                  | 1.7                                  |
|                                  | 2002      | 30                | 0.35                              | 0.35                                | 0.69                                 | 0.17                                 |
| Hazelton St, Stockton            | 2001      | 31                | 0.94                              | 1.7                                 | 2.4                                  | 1.7                                  |
|                                  | 2002      | 28                | 0.49                              | 0.35                                | 2.1                                  | 0.17                                 |

CARB = California Air Resources Board

$\mu\text{g}/\text{m}^3$  = micrograms per cubic meter

ND = not detected (detection limit in parentheses)

Reference: CARB 2002, 2003

\* The CARB website lists a minimum value greater than the maximum value for 2001 data from Fresno with no explanation.

### 6.3.12 Risk Screening Evaluation for Acute Health Effects

The potential for substances detected in samples of McFarland's outdoor air to pose acute health hazards was also evaluated during the health screening process.

Acute health effects are those that occur after short-term (hours or days) exposure at high concentrations, and, unless debilitating, they generally subside quickly after exposure stops. Examples of typical acute health effects are eye and throat irritation, cough, headache, and dizziness. Some developmental and reproductive effects can also occur after acute exposure to some chemicals, if the exposure occurs at critical times during gestation or development.

Acute health effects are generally only a concern when exposures occur that are significantly higher than those associated with chronic health effects. Thus if measured concentrations in outdoor air are less than a substance's chronic HBSL there is no concern about acute health effects potentially developing. Therefore acute health hazard screening focused on the chemicals with one or more detections exceeding a chronic HBSL and cases where appropriate acute HBSLs were available.

Screening for the potential acute health hazards was accomplished by comparison of the maximum detected concentration for each chemical to one or more acute health-based screening levels from the following sources:

- Acute Reference Exposure Levels (RELs) developed by the Office of Environmental Health Hazard

Assessment of the California EPA ([http://www.oehha.ca.gov/air/acute\\_rels/allAcRELS.html](http://www.oehha.ca.gov/air/acute_rels/allAcRELS.html)),

- Acute Minimum Risk Levels (MRLs) developed by ATSDR (<http://www.atsdr.cdc.gov/mrls/index.html> - bookmark02).

Acute RELs and/or an Acute MRLs were found for 9 of the 11 substances that were detected in outdoor air one or more times at concentrations greater than their chronic HBSLs. For each of these nine, the maximum detected concentration was compared to the more stringent of either the Acute REL or Acute MRL to screen for the potential for that compound to pose an acute health hazard. If the maximum detected concentration was lower than the acute health hazard screening level, it was concluded that substance does not pose a potential acute health hazard in McFarland's air.

As shown in Table 6-7, for all of the nine chemicals with available acute health screening levels, the maximum detected concentrations were lower than the more stringent of either Acute RELs or Acute MRLs. Therefore, USEPA R9 concluded that the outdoor air arsenic, benzene, carbon tetrachloride, chromium, p-dichlorobenzene, formaldehyde, methyl bromide, methyl chloride and methylene chloride concentrations observed during the investigation did not pose a potential acute health hazard.

Table 6-7: Comparison of Maximum Concentration of Chemicals Detected in McFarland Outdoor Air to Acute Toxicity Screening Levels

| Chemical             | Acute REL ( $\mu\text{g}/\text{m}^3$ ) | Acute MRL ( $\mu\text{g}/\text{m}^3$ ) | Maximum ( $\mu\text{g}/\text{m}^3$ ) |
|----------------------|--|--|--------------------------------------|
| Arsenic              | 0.19                                   | NA                                     | 0.011                                |
| Benzene              | 1,300                                  | 29                                     | 1.3                                  |
| Carbon tetrachloride | 1,900                                  | 189                                    | 1.8                                  |
| Chromium (total)     | NA                                     | 1*                                     | 0.083                                |
| p-Dichlorobenzene    | NA                                     | 12,000                                 | 110                                  |
| Formaldehyde         | 94                                     | 49                                     | 20                                   |
| Methyl bromide       | 3,900                                  | 194                                    | 13                                   |
| Methyl chloride      | NA                                     | 1,030                                  | 8.0                                  |
| Methylene chloride   | 14,000                                 | 2,080                                  | 24                                   |

Acute REL = Acute Reference Exposure Level, developed the Office of Environmental Health Hazard Assessment (OEHHA) of the California EPA.

Acute MRL = Acute Minimum Risk Level, developed by the Agency for Toxic Substances and Disease Registry (ATSDR).

NA = Not available.

\* Acute REL is for Cr(VI) in the particulate form.

# 7 Conclusions and Summary

## 7.1 Introduction

An investigation of environmental conditions in McFarland, California was performed by USEPA R9 from 1996 to 2002. This environmental investigation comprised 2 phases of sampling and analysis of the town's drinking water, 2 phases of sampling and analysis of soil at various locations throughout town and 4 outdoor air sampling events conducted over the course of a year at 2 locations in town.

Drinking water was sampled from 33 locations in McFarland and analyzed for over 340 different chemical substances. Soil was collected from 21 locations throughout town and analyzed for over 300 chemical substances. Outdoor air samples were collected at 2 locations during 4 sampling events over a 1 year period and analyzed for over 145 chemical substances and air quality parameters.

## 7.2 Summary of Findings and Conclusions

### 7.2.1 Drinking Water

In Phase 1 (July 1997) of the drinking water investigation, all active and inactive McFarland Mutual Water Company (MMWC) drinking water wells (Wells #1, #2, #4, #6, and the Garzoli Well) and a 750,000-gallon storage tank were sampled. Samples were analyzed for metals and other inorganics, disinfection byproducts, volatile organic compounds (VOCs), synthetic organic chemicals (SOCs), radionuclides, microbial agents, and dioxins/furans. In Phase 2 (June - December 1998), all four active MMWC wells (Wells #2, #4, #6, and the Garzoli Well), the 750,000-gallon storage tank, and tap water from 27 residential and public locations throughout the MMWC public water supply system were sampled. Tap water sampling was conducted at 15 private residences, six public schools, two public parks, one public gymnasium, a public library, a health center, and a church. Samples were analyzed for metals and other inorganics, disinfection byproducts, VOCs, SOCs, radionuclides, microbial agents, and dioxins/furans.

Most of the more than 340 substances tested by USEPA were not detected in any of the samples collected from McFarland's drinking water. Most of the substances which were found in one or more samples were present at levels in compliance with drinking water standards or health-based screening criteria. There were 3 notable exceptions:

- Nitrate in groundwater at 2 drinking water wells.
- Arsenic in groundwater.
- Lead in "first draw" samples from some homes.

***Nitrate:*** Elevated nitrate levels - levels in excess of the nitrate MCL (10 mg/l) - were present in groundwater supplying two of McFarland's drinking water wells (Wells #2 and #4). Nitrate removal systems, which were installed in the 1980s and were in place on these wells, effectively reduce nitrate levels in drinking water supplied by these wells to meet the nitrate MCL. ***Conclusion:*** These nitrate removal systems need to continue to be routinely operated, maintained, and monitored to ensure that nitrate in drinking water remains below levels of potential health concern.

***Arsenic:*** Arsenic is a naturally-occurring metal which is typically present at elevated levels in groundwater in the Western U.S. so the finding of arsenic in all of the drinking water samples in McFarland was expected. All of the drinking water samples tested during the investigation were in compliance with the existing 50 mg/l MCL for arsenic. However, arsenic levels in many of the drinking water samples exceeded a proposed MCL of 10 mg/l, which has subsequently been adopted by USEPA. ***Conclusion:*** As of the date of this report, the Garzoli Well, one of the 3 drinking water wells currently active in McFarland, is out of compliance with the revised MCL. Garzoli Well arsenic levels are about 15 ppb and are under a CDPH compliance order; installation of a wellhead treatment system is currently stalled due to California's budget crisis.

***Lead:*** High levels of lead were found in "first draw" samples from a few residential faucets; these lead levels were significantly in excess of the MCL for lead. This is a common condition for many water systems, especially in older homes

where lead from solder can leach into drinking water that stands in pipes for long periods of time (e.g., overnight).

**Conclusion:** Because of this finding, McFarland residents have been advised about the need to flush their water pipes before drinking water or using it for cooking, especially if the faucets have not been used recently.

The lead levels of all the drinking water samples obtained after running the water were below levels of health concern.

### 7.2.2 Soil

Expanding on prior soil studies by county and state agencies, USEPA R9 Soil Investigation focused on possible soil contamination associated with specific activities in McFarland. Activities that may have contaminated McFarland soil were identified by interviews with community members and by examining state and local agency files regarding facilities that may have used hazardous substances and or agricultural pesticides. Based on this historical information, USEPA R9 sampled surface and subsurface soils at 21 sites: various industrial/commercial properties at the Elmo Highway Complex and South Industrial Complex, two service stations, two cotton gins, four schools, two parks, eight residences, and the drainage basin in the northeast section of town near Closed Well #5.

During the Phase 1 Soil Investigation, USEPA R9 collected 391 soil samples from 103 soil borings at the 21 site locations. Samples were collected at depths ranging from the surface to 50 feet below ground surface (bgs). Surface and subsurface soils were tested for metals and other inorganics, VOCs, pesticides, herbicides, agricultural chemicals, PCBs, and dioxins/furans.

Most of the hazardous substances that were found during the Phase 1 investigation were present at concentrations less than the HBSLs used by USEPA R9 to screen the potential health significance of substances in McFarland soil. The only substances that were detected at concentrations greater than their relevant Residential or Industrial HBSLs were:

- Arsenic,
- Dieldrin,
- Benzo(a)pyrene (a PAH), and
- Dioxin/furan congeners.

During Phase 2 of the soil investigation, USEPA R9 followed up on the HBSL exceedances observed during Phase 1 by collecting soil samples from the Elmo Highway Complex, Mouser (McFarland) Park, Browning Road School, McFarland High School, the former Sunshine Service Station, the former location of closed Well #5, and Residence F. Sample

locations were selected to confirm the soil analytical results of arsenic, dieldrin, benzo(a)pyrene, and dioxin/furan congeners detected at concentrations greater than their respective HBSLs in Phase 1 and to provide additional information about the presence of contaminants at the sites. Phase 2 surface and subsurface soils were tested for metals, minerals and other inorganics, VOCs, pesticides, herbicides, agricultural chemicals, PCBs, and dioxins/furans.

Only a limited number of substances were detected at concentrations exceeding their respective HBSLs during either phase of soil sampling. All HBSL exceedances occurred in very localized areas:

- Arsenic at the former Sunshine Service Station, an abandoned and closed property at the time of sampling,
- Benzo(a)pyrene at Browning Road School, Residence F and the former Sunshine Service Station,,
- Cadmium at the former Sunshine Service Station,
- Dieldrin at Kirkpatrick & Sons and the Tri-Cal Facility (both properties located in the Elmo Highway Complex) and at Mouser (McFarland) Park,
- Dioxins/Furans at McFarland High School, and
- Lead at Mouser (McFarland) Park and the former Sunshine Service Station.

***Kirkpatrick and Sons Potato Shed (Elmo Highway Complex):*** Dieldrin was detected in soil at levels above the Industrial HBSL (150 µg/kg) at the Kirkpatrick and Sons property during both phases; HBSL exceedances ranged 200 to 4,000 µg/kg. A risk screening evaluation calculated an excess cancer risk of  $1.7 \times 10^{-5}$  for any workers who would be present at the site daily over a 25 year career. **Conclusion:** This risk estimate is within the mid-range of USEPA's acceptable risk range ( $10^{-6}$  to  $10^{-4}$ ) leading to the conclusion that these dieldrin concentrations do not represent a significant public health threat for workers at the Kirkpatrick and Sons property.

***Tri-Cal Facility (Elmo Highway Complex):*** At the Tri-Cal property, dieldrin was detected above the Industrial HBSL (130 µg/kg) in one sample during Phase 1; this finding was not confirmed during Phase 2, suggesting that any contamination is not widespread. The single HBSL exceedance was 340 µg/kg. A risk screening evaluation calculated an excess cancer risk of  $2.6 \times 10^{-6}$  for any workers who would be present at the site daily over a 25 year career. **Conclusion:** This risk estimate is at the extreme lower end of USEPA's acceptable risk range ( $10^{-6}$  to  $10^{-4}$ ) leading to the conclusion that this dieldrin detection does not represent a significant public health threat for workers at the Tri-Cal property.

***Mouser (McFarland) Park:*** During Phase 2, lead was detected in one subsurface (2 to 4 feet bgs) sample at a concentration (769 mg/kg) greater than the Residential HBSL (130 mg/kg). The Phase 1 detection of dieldrin in surface soil at a concentration greater than the Residential HBSL was not confirmed during Phase 2, suggesting that dieldrin contamination is not widespread in Mouser Park.

***Lead:*** The single lead detection above a HBSL at Mouser (McFarland) Park occurred in a subsurface sample (2-4 feet bgs). ***Conclusion:*** USEPA R9 does not consider soil that is below 2 feet bgs to be readily accessible and concluded that this single detection greater than the Residential HBSL does not represent a significant public health threat.

***Dieldrin:*** Dieldrin was detected above the Residential HBSL (28 µg/kg) in one sample during Phase 1; the HBSL exceedance was 82 µg/kg. Phase 2 sampling did not confirm this finding suggesting any contamination is not widespread. A risk screening evaluation calculated an excess cancer risk of  $2.9 \times 10^{-6}$  for anyone present continuously at the park over a 30 year period. ***Conclusion:*** This risk estimate is at the extreme lower end of USEPA's acceptable risk range ( $10^{-6}$  to  $10^{-4}$ ) and since actual exposure will be significantly less than assumed by the risk screening evaluation, it does not represent a significant public health threat for people recreating at the park.

***Browning Road School:*** Benzo(a)pyrene was detected at a concentration (260 µg/kg) greater than its Residential HBSL (56 µg/kg) in one sample during Phase 1 and in one Phase 2 sample at a lower concentration (47 µg/kg). A risk screening evaluation calculated an excess cancer risk of  $4.6 \times 10^{-6}$  for anyone present continuously at this area of the school over a 30 year period. ***Conclusion:*** This risk estimate is at the lower end of USEPA's acceptable risk range ( $10^{-6}$  to  $10^{-4}$ ) and since actual exposure will be significantly less than assumed, USEPA R9 concludes it does not represent a significant public health threat at the school.

***McFarland High School:*** Dioxin-like compounds (dioxins/furans/PCBs) were detected at levels greater than the dioxin Residential HBSL (3.9 pg/g) at the athletic fields during both phases of soil sampling. During Phase 1, dioxins/furans were detected just below the Residential HBSL at the football field and in one baseball field sample at a concentration (8.6 pg/g TEQ) greater than the PRG. During Phase 2, concentrations at the football field were 9.6 and 5.4 pg/g in two composites. Baseball field composite samples collected around home plate and the outfield area contained concentrations of 3.7 and 3.1 pg/g TEQ, respectively.

***Football Field:*** A risk screening evaluation of the football field dioxin-like compounds calculated an excess cancer risk of  $2.5 \times 10^{-6}$  based on the maximum detected concentration and a residential exposure scenario (continuous exposure for 30 years). ***Conclusion:*** This risk estimate is at the extreme lower end of USEPA's acceptable risk range ( $10^{-6}$  to  $10^{-4}$ ) and since actual exposure during football activities will be significantly less than assumed, USEPA R9 concludes it does not represent a significant public health threat for athletes at the school.

***Baseball Diamond:*** Using the maximum detected concentration of dioxin-like compounds (8.6 pg/g at home plate) and residential exposure assumptions (continuous exposure for 30 years), a risk screening evaluation calculated an excess cancer risk of  $2.2 \times 10^{-6}$ . ***Conclusion:*** This risk estimate is also at the extreme lower end of USEPA's acceptable risk range ( $10^{-6}$  to  $10^{-4}$ ) and since actual exposure during baseball activities will be significantly lower than assumed, it also does not represent a significant public health threat for athletes at the school.

***Former Sunshine Service Station:*** Arsenic, cadmium, lead, and PAHs were detected in at least one sample above a Residential or Industrial HBSL during one or both phases of the soil investigation.

***Arsenic:*** Arsenic was detected at a concentration greater than its cancer Industrial HBSL (1.6 mg/kg) in all samples, and was detected at concentrations greater than its non-cancer Residential HBSL (22 mg/kg) in one sample during Phase 1 and two samples during Phase 2; these concentrations ranged 28 to 79 mg/kg. These three detections were also greater than the typical background levels found in California, although other arsenic detections were within background.

Since the former Sunshine Service Station is abandoned, a further risk screening evaluation for arsenic was performed by assessing a trespasser scenario. A risk screening exercise calculated an excess cancer risk of  $4.9 \times 10^{-6}$  for frequent trespassers exposed to the maximum detected arsenic concentration (79 mg/kg). ***Conclusion:*** This risk estimate is at the lower end of USEPA's acceptable risk range of ( $10^{-6}$  to  $10^{-4}$ ), indicating these arsenic concentrations do not represent a significant public health threat under current conditions. Arsenic in soil at the former service station could pose significantly higher risks in the future under alternative uses for the property (e.g., industrial, residential, recreational/park), therefore this conclusion should be reviewed then in that context. Because of this concern, the property owner and Kern County were notified that these arsenic levels exceed both residential and industrial risk screening levels and that further evaluation should be performed before the site is re-used.

**Cadmium:** The cadmium concentration in a single sample from the two soil investigation phases exceeded the Residential PRG; the magnitude of this exceedance was marginal (a 9.5 mg/kg cadmium concentration versus the HBSL level of 9.0 mg/kg). **Conclusion:** Therefore, USEPA R9 concluded that the cadmium at this location does not represent a significant public health threat. A more realistic and appropriate risk-based screening for this property, comparison to the Industrial soil HBSL (810 mg/kg), showed the maximum detected cadmium concentration to be significantly less than the industrial PRG.

**Lead:** During Phase 2, lead was detected at a concentration greater than the Industrial HBSL (1,000 mg/kg) in two surface soil samples and one duplicate (concentrations ranged 1,300 to 2,100 mg/kg) and the lead concentration in an additional sample (515 mg/kg) was greater than the Residential HBSL (130 mg/kg). There were no lead detections greater than either HBSL during Phase 1.

As with arsenic, a further risk screening evaluation focused on the trespasser scenario. The Calif DTSC LeadSpread model was used to calculate Trespasser PRGs for comparison to the area of the former service station most highly contaminated with lead. The lead concentration at this location (1,860 mg/kg) is only slightly greater than the PRG for the RME trespasser scenario (1,846 mg/kg) and significantly less than the PRG for the CT trespasser (11,900 mg/kg). Thus, potential health risks would not be significantly elevated for an RME trespasser on the property 124 days/year for a 6 year period. Risks for a CT trespasser - on the property 52 days/year for 4 years - would be much lower. USEPA does not view the slight RME trespasser PRG exceedance by the maximum lead concentration as indicating a potentially significant health risk because the exposure scenario is so conservative in its exposure assumptions. **Conclusion:** USEPA R9 therefore concluded that the lead detections at the former Sunshine Service Station, while elevated over residential and industrial soil screening levels in some locations on the abandoned property, do not represent a significant public health threat under current conditions. As with arsenic, in the event that use of the property changes (e.g., industrial, residential, recreational/park) in the future, this conclusion should be reviewed in that context. Because of this concern, the property owner and Kern County were notified that these lead levels exceed both residential and industrial risk screening levels and that further evaluation should be performed before the site is re-used.

**PAHs:** During Phase 2, benz(a)anthracene was detected in one sample and its duplicate at concentrations (878 and 921 µg/kg) greater than the Residential HBSL (610 µg/kg); both were less than its Industrial HBSL (2,900 µg/kg). Benzo(a)pyrene was detected in two samples at concentrations (67 and 151 µg/kg) greater than the Residential HBSL (56 µg/kg), but less than the Industrial HBSL of 290 µg/kg. Neither PAH had been detected during Phase 1 and all detections were well below their respective Industrial HBSLs (2,900 µg/kg for benz(a)anthracene and 290 µg/kg for benzo(a)pyrene). **Conclusion:** In the unlikely event this property is developed for residential use without any remediation, excess cancer risks for future residents would range  $2 \times 10^{-6}$  to  $2.5 \times 10^{-6}$ , both of which are at the extreme lower end of the acceptable risk range. USEPA R9 therefore concluded that these PAH detections do not represent a significant public health threat.

**Residence F:** At Residence F, benzo(a)pyrene was detected in one surface soil sample at a concentration (110 µg/kg) greater than the Residential HBSL (56 µg/kg) during Phase 1, but was not detected in any of the samples collected during Phase 2. Benzo(a)pyrene therefore does not appear to be a widespread contaminant at the property. A risk screening evaluation calculated an excess cancer risk of  $2 \times 10^{-6}$  for residents over a 30 year period. **Conclusion:** This risk estimate is at the extreme lower end of USEPA's acceptable risk range ( $10^{-6}$  to  $10^{-4}$ ) leading to the conclusion that this does not represent a significant public health threat for residents.

### 7.2.3 Outdoor Air

Outdoor air sampling was conducted at McFarland Middle School and Browning Road School during four different agricultural seasons: July 2001, December 2001 through January 2002, March 2002, and May 2002. During these periods, USEPA collected more than 900 air samples and tested them for 145 substances. In addition, limited indoor dust sampling was also conducted to see if chemicals from the outdoor air were also present in the indoor environment.

Of the 145 chemicals analyzed for, 66 were not detected at all and another 68 were present only at concentrations that were below their respective chronic HBSLs. The remaining 11 chemicals represented those that were found one or more times at concentrations in air greater than their chronic HBSLs. These 11 were subjected to further assessment and risk screening evaluation. All 11 were determined to be present at concentrations in air that are within USEPA's acceptable risk range. Most were also found to be present in McFarland's air at concentrations typical of other areas in California where routine monitoring is conducted.

Methyl bromide was the only pesticide found at a concentration greater than its chronic HBSL; a subsequent risk screening evaluation showed the detected concentrations to be within its acceptable risk range. Arsenic, cadmium, manganese, and chromium were the only metals detected above their chronic HBSLs; again a follow-up risk screening evaluation indicated the concentrations of these metals were within their acceptable risk ranges. These are all naturally-occurring metals and the maximum detected concentrations for these metals all occurred during a dust storm in May 2002 that created high levels of particulates in the air. Benzene, carbon tetrachloride, methyl chloride, methylene chloride, and paradichlorobenzene were the only VOCs detected one or more times at concentrations greater than chronic HBSLs; as with the other compounds exceeding HBSLs, a subsequent risk screening evaluation concluded the concentrations of all these VOCs were within their acceptable risk ranges. Although detected levels were within the acceptable risk range, average concentrations of formaldehyde in the air in McFarland were 1.3 to 3.2 times higher than average concentrations in urban areas of the San Joaquin Valley, such as Fresno and Stockton.

Further details on each of the 11 compounds for which there were HBSL exceedances are presented below.

**Formaldehyde:** Formaldehyde was detected more frequently above its HBSL than any other outdoor air analyte. Comparison to CARB monitoring data showed that mean and median outdoor air formaldehyde concentrations in McFarland during sampling were higher than the concentrations in, Fresno, Stockton, and Bakersfield during 2001 and 2002; however during 2000, the Central California Ozone Study observed similar or higher summertime concentrations of formaldehyde in other San Joaquin Valley communities. **Conclusion:** A risk screening evaluation estimated the excess lifetime cancer risk associated with outdoor air exposure to the McFarland 95% UCL concentration for 30 years was  $8.8 \times 10^{-5}$  (or 88 in one-million); this risk is within USEPA's acceptable risk range of  $10^{-6}$  to  $10^{-4}$ .

**Arsenic:** Arsenic levels in outdoor air were compared to CARB monitoring data from the year 2000 (2001-2002 CARB data were not available); McFarland median levels were similar to those from Modesto and higher than median concentrations in Fresno and Bakersfield. The maximum concentration detected in McFarland is higher than in the CARB 2000 data, because of the May 19-20, 2002 dust storm. A risk screening evaluation showed the excess lifetime cancer risk associated with exposure to the outdoor air arsenic concentration in McFarland for 30 years to be  $2.7 \times 10^{-6}$ . **Conclusion:** This risk estimate is at the extreme lower end of USEPA's acceptable risk range of  $10^{-6}$  to  $10^{-4}$ , leading to the

conclusion that the arsenic concentrations observed in McFarland air do not represent a significant public health threat from long-term exposure.

**Cadmium:** Cadmium is not included in the routine air monitoring performed by CARB and therefore data from the San Joaquin Valley were not available for comparison to the McFarland Outdoor Air Investigation data. The results of a risk screening evaluation for cadmium in McFarland's outdoor air during sampling yielded an excess lifetime cancer risk of  $1.5 \times 10^{-7}$  for a 30 year residential exposure. **Conclusion:** This risk is below (less than) the lower end of USEPA's acceptable risk range ( $10^{-6}$  to  $10^{-4}$ ); USEPA R9 concluded that the cadmium concentrations observed in McFarland air do not represent a significant public health threat from long-term exposure.

**Chromium:** Comparing results from CARB sampling in the San Joaquin Valley during 2001 and 2002 to the McFarland results indicated that median results from McFarland were lower than in other communities while the mean McFarland concentration was similar to the CARB communities. As with the other naturally-occurring metals, the maximum chromium concentration detected in McFarland was higher because of the dust storm, occurring on May 19 and 20, 2002. A risk screening evaluation showed the excess lifetime cancer risk associated with exposure to the chromium concentration in McFarland's outdoor air for 30 years was  $3.6 \times 10^{-5}$ . **Conclusion:** This risk estimate is in the middle of USEPA's acceptable risk range of  $10^{-6}$  to  $10^{-4}$ , but is likely to be an overestimate because it assumed that all of the airborne chromium detected during the investigation was the carcinogenic Cr VI form, whereas actual Cr VI concentrations are likely to be significantly lower and therefore this risk calculation is likely a significant overestimation.

**Manganese:** Measured manganese levels exceeded its chronic HBSL in 5 of the 76 air samples collected during the investigation. The 2 highest concentrations were recorded during the unusually intense dust storm on May 19-20, 2002. Excluding the manganese concentrations from this unusual event, the average manganese concentration observed in McFarland's outdoor air was  $0.047 \mu\text{g}/\text{m}^3$ , which is less than the HBSL. Even including these unusual concentrations, the concentration ( $0.068 \mu\text{g}/\text{m}^3$ ) represents only a slight exceedance of its HBSL, resulting in a hazard index of 1.3. These manganese concentrations in McFarland are typical for the San Joaquin Valley; CARB monitoring in Fresno and Bakersfield during the same time reported mean airborne manganese concentrations similar to the 95% UCL in McFarland (dust storm concentrations excluded) and 90th percentile manganese concentrations similar to the

95% UCL concentration with the dust storm concentrations included. **Conclusion:** Therefore, USEPA R9 concluded that the manganese concentrations observed in McFarland air do not represent a significant public health threat from long-term exposure.

**Benzene:** Results from 2001-2002 CARB monitoring in the San Joaquin Valley showed mean and median benzene concentrations in McFarland were lower than in other communities; the maximum concentration detected in McFarland was also lower. Based on a risk screening evaluation, the excess lifetime cancer risk associated with exposure to the benzene concentration in McFarland's outdoor air for 30 years was  $2.7 \times 10^{-6}$ . **Conclusion:** This risk estimate is at the extreme lower end of USEPA's  $10^{-6}$  to  $10^{-4}$  acceptable risk range. USEPA R9 concluded that the benzene concentrations observed in McFarland air do not represent a significant public health threat from long-term exposure.

**Carbon Tetrachloride:** Mean and median carbon tetrachloride concentrations in McFarland during 2001-2002 were similar to other communities in the San Joaquin Valley as shown by comparison to CARB monitoring data; the maximum concentration detected in McFarland was approximately twice as high as in the other communities. The excess lifetime cancer risk associated with exposure to the carbon tetrachloride concentration in McFarland's outdoor air for 30 years was  $6.0 \times 10^{-6}$ . **Conclusion:** This risk estimate is at the lower end of USEPA's acceptable risk range of  $10^{-6}$  to  $10^{-4}$ . Based on this risk screening evaluation, USEPA R9 concluded that the carbon tetrachloride concentrations observed in McFarland air do not represent a significant public health threat from long-term exposure.

**p-Dichlorobenzene:** There was only one valid McFarland result for p-dichlorobenzene ( $110 \mu\text{g}/\text{m}^3$ ); this was significantly higher than all sample results from the CARB samples collected in the San Joaquin Valley during 2001 and 2002 (maximum  $1.2 \mu\text{g}/\text{m}^3$ ). A risk screening evaluation for p-dichlorobenzene showed the excess lifetime cancer risk associated with exposure in McFarland's outdoor air for 30 years was  $7.7 \times 10^{-6}$ . **Conclusion:** This risk estimate is near the lower end of USEPA's acceptable risk range of  $10^{-6}$  to  $10^{-4}$ , leading USEPA R9 to conclude that the p-dichlorobenzene concentrations observed in McFarland air do not represent a significant public health threat from long-term exposure.

**Methyl bromide:** Because of differences in quantitation limits it is not possible to compare the results from the McFarland outdoor air sampling to those from CARB. Only 2 of the methyl bromide detections during sampling were at concentrations greater than the HBSL, the remainder were at lower levels. The methyl bromide concentration in

McFarland's outdoor air of  $1.0 \mu\text{g}/\text{m}^3$  is significantly below the HBSL, yielding a hazard index of 0.19. **Conclusion:** Based on this risk comparison, USEPA R9 concluded that the methyl bromide concentrations observed in McFarland air do not represent a significant public health threat from long-term exposure.

**Methyl chloride:** Methyl chloride is not included in the routine air monitoring performed by CARB and therefore no data from other communities were available for comparison to the McFarland data. The methyl chloride risk screening evaluation showed the excess lifetime cancer risk associated with exposure to the methyl chloride in McFarland's outdoor air for 30 years was  $1.5 \times 10^{-6}$ . **Conclusion:** This risk estimate is at the extreme lower end of USEPA's  $10^{-6}$  to  $10^{-4}$  acceptable risk range, leading USEPA R9 to conclude that the methyl chloride concentrations observed in McFarland air do not represent a significant public health threat from long-term exposure.

**Methylene chloride:** Comparison to 2001-2002 CARB monitoring data from the San Joaquin Valley indicated that mean and median concentrations methylene chloride concentrations in McFarland were similar to those of other communities. The maximum concentration detected in McFarland was several times higher than at the CARB monitoring locations. The excess lifetime cancer risk estimated in the risk screening evaluation showed exposure to the methylene chloride concentration in McFarland's outdoor air for 30 years was  $2.8 \times 10^{-7}$  which is less than the lower end of USEPA's acceptable risk range of ( $10^{-6}$  to  $10^{-4}$ ). **Conclusion:** USEPA R9 therefore concluded that the methylene chloride concentrations observed in McFarland air do not represent a significant public health threat from long-term exposure.

**Risk Screening for Acute Health Effects Via Airborne Exposures:** The potential for substances detected at elevated concentrations in McFarland's outdoor air to pose acute health hazards was also evaluated by comparison of their maximum detected concentrations to acute HBSLs, either Acute RELs from Cal/EPA OEHHA or Acute MRLs from ATSDR. For all of the nine chemicals with available acute HBSLs, the maximum detected concentrations were lower than the more stringent of either Acute RELs or Acute MRLs. **Conclusion:** USEPA R9 concluded that the outdoor air arsenic, benzene, carbon tetrachloride, chromium, p-dichlorobenzene, formaldehyde, methyl bromide, methyl chloride and methylene chloride concentrations observed during the investigation did not pose a potential acute health hazard.

### 7.2.4 Particulate Matter

PM-10 concentrations exceeded both short- and long-term health standards by the state of California. PM-2.5 concentrations did not exceed the federal short-term standard, and the limited data did not support comparison to long-term standards. However, assuming that concentrations of PM-2.5 are higher during the windy, dry, and dusty fall months when no samples were collected, it is likely that the long-term PM-2.5 standards were also exceeded.

Various health problems have been associated with exposure to PM when it is above the standards. Particulate matter, especially PM-2.5 is small enough to get into the lungs, where it can aggravate respiratory conditions such as asthma and bronchitis. Sensitive populations, such as people with heart or lung disease, the elderly, and children are at the high risk from exposure to both PM-10 and PM-2.5.

In addition to health problems, PM is also a major cause of reduced visibility or haze. Particles can be carried long distances by wind and settle on ground, water, and structures, which can cause damage to sensitive forests and farm crops, and changes in diversity of ecosystems.

The air quality in McFarland is similar to the general air quality throughout the San Joaquin Valley. Geography, weather, and PM sources across the entire area affect air quality. The Valley is the largest air basin in the country at 25,000 square miles, and is surrounded on three sides by mountains. These mountains trap air pollution, swirling it around but not allowing it to flow out of the valley. The typically hot and dry weather in the valley increases the formation of some types of air pollution. In addition, the weather also creates high pressure zones in the atmosphere contributing to temperature inversions, an effect that further tends to trap and stagnate air.

In 2002, the valley had the third highest concentration of PM nationwide, ranking behind Phoenix, Arizona, and the greater Los Angeles area. Sources of PM may include dust and pollution from construction practices, agricultural practices (including burning), paved and unpaved roads, and residential wood burning. PM in the San Joaquin Valley is also formed in the atmosphere, when ammonia from sources such as cattle and chicken waste combines with other gases (nitrates) that are generated by many sources, including motor vehicles, diesel trucks, power plants, and manufacturing facilities.

Federal, state, and local agencies are working together to improve air quality in the San Joaquin Valley as a whole, which USEPA R9 believes will benefit the McFarland area. At the federal level, USEPA has approved the San Joaquin Air District's 2003 air pollution control plan, which will reduce particulate matter in the valley. More information can be accessed at <http://www.epa.gov/region9air/sjvalleypm/>. USEPA has national efforts to reduce PM and also a fuel and vehicle program. More information can be accessed at <http://www.epa.gov/air/urbanair/pm/effrt1.html> and <http://www.epa.gov/otaq/>.

At the state level, California sets standards and implements programs for motor vehicle emissions, smog checks and agricultural burning through the CARB and Bureau of Automotive Repair.

At the local level, the San Joaquin Valley Air Pollution Control District regulates air pollution from stationary sources, such as factories and plants, as well as from wood burning fireplaces, stoves and heaters. The District also conducts public education and outreach efforts aimed at reducing exposure to particulate matter.

## 7.3 Summary of Conclusions from a Public Health Perspective

### 7.3.1 Drinking Water

Potential public health issues related to McFarland's drinking water were either currently under control by the water purveyor at the time of the USEPA investigation or were amenable to easy control by affected homeowners. These potential issues relate to elevated nitrate and arsenic levels in groundwater used for drinking water and elevated lead levels in "first draw" water at some homes. The elevated nitrate levels in groundwater were being controlled by wellhead treatment. The arsenic situation at one well, the Garzoli Well, is an exceedance of the revised MCL and there is a project for wellhead control bringing this well into compliance, although the project was on-hold due to the state's funding crisis. First draw lead in older homes presumably remains a potential health issue and McFarland residents are encouraged to continue flushing water pipes before consuming or cooking with water that has been sitting in pipes for an extended period of time.

### 7.3.2 Soil

No significant community-wide public health issues/threats were identified in the soil sampling results under current exposure conditions; this conclusion specifically includes potential trespasser exposures at some commercial/industrial facilities. There is the potential for significantly elevated risks should property uses change at the former Sunshine Service Station (abandoned) and Elmo Highway Complex facilities. Property owners and the county have been advised to re-evaluate soil conditions at these properties in the event they are used more frequently in the future, especially if residential development is considered.

### 7.3.3 Outdoor Air

In general, the outdoor air quality issues observed in McFarland are reflective of those throughout the San Joaquin Valley air basin. There continue to be a number of well recognized potential health issues related to San Joaquin Valley air quality, some of which were highlighted by the Air Investigation results, and these are being addressed by the San Joaquin Valley Air Quality Management District, especially related to particulate matter and associated inorganics and VOCs.

*Chronic Exposures:* A cancer risk evaluation of these chemicals at an estimated annual average concentration showed that none are likely to result in an increased cancer risk above the upper end of USEPA's acceptable cancer risk range of  $10^{-6}$  to  $10^{-4}$ . Based on this risk evaluation, USEPA R9 concluded that no chemical observed in McFarland air represented a significant public health threat from long-term exposure.

*Acute Exposures:* No chemical detected in McFarland outdoor air was found at a concentration exceeding acute health screening levels.

*Particulate Matter:* Similar to the rest of the San Joaquin Valley, PM levels, measured as PM-10 and PM-2.5, in McFarland exceeded both chronic, and on occasion, acute health standards. Local and state agencies have programs in place to improve air quality throughout the San Joaquin Valley.

In summary:

- PM concentrations in McFarland are often at unhealthy levels; however, the concentrations are similar to those in other parts of the San Joaquin Valley. State and local agencies have programs in place to help improve air quality throughout the San Joaquin Valley.
- With the exception of methyl bromide, no pesticides were detected in McFarland outdoor air at concentrations of potential health concern. Although methyl bromide was detected above its HBSL in some samples, the estimated annual average concentration based on this sampling would not result in a significantly increased cancer risk.
- Formaldehyde concentrations in outdoor air were higher than expected.
- No VOCs, SVOCs, pesticides, or metals were detected at concentrations resulting in an excess cancer risk outside USEPA's acceptable risk range.
- No chemicals were found at levels resulting in acute health concerns.

### 7.3.4 Conclusion

Overall, McFarland's environment appears to be generally similar to that of other towns in the San Joaquin Valley.

The most significant finding from a public health perspective was that PM levels in McFarland, both PM-10 and PM-2.5, exceeded chronic, and on occasion, acute health standards. This is a typical situation for San Joaquin Valley and both local and state agencies have programs in place to improve air quality throughout the San Joaquin Valley.

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