Wylam, Alabama Hexavalent Chromium Risk Analysis

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Final 02/23/22

TABLE OF CONTENTS

List of Figures……………………………………………………………..……3

List of Tables…......................................………………………………………...4

Executive Summary ……………………………….……………………......5

1.0 Introduction……………………………………………………………........9

2.0 Data Collection Study Design, Analysis, and Selection of
Chemicals of Potential Concern…………………………….………………...13

3.0 Exposure Assessment……………………………………………………16

4.0 Hazard Assessment and Dose-Response Assessment…………………18

5.0 Risk Characterization……………………………………………………...26

6.0 Uncertainty Assessment………………………………………………..31

7.0 Summary Findings………………………………………………………40

8.0 References………………………………………………………………42

9.0 Glossary…………………………………………………………………..48

LIST OF FIGURES

Figure 1 Wylam Study Area……………………………………................………51

LIST OF TABLES

Table 1.2-1. 2018 Census Estimates for Wylam, AL (Zip Code 35224)……………………………………………53

Table 2.9-1. Chemicals Detected During the Wylam, AL Special Air Sampling Study……………………………………………………………54

Table 3.1-1. Chemicals of Potential Concern Identification and Exposure Point Concentration Determination for the Wylam, AL Air Sampling Study……………………………………………………55

Table 4.1-1. Chemicals Deleted from the Chemicals of Potential Concern Due to a Lack of Toxicity Estimates for the Wylam, AL Air Sampling Study……………………………………………………56

Table 4.1.1-1. Chronic Dose-Response Toxicity Values for the Wylam, AL Chemicals of Potential Concern……………………………………57

Table 4.4-1. Short-term Dose-Response Concentrations for the Wylam, AL Chemicals of Potential Concern……………………………………58

Table 5.1-1. Chronic Cancer Risks for the Wylam, AL Air Chemicals of Potential Concern……………………………………………………59

Table 5.1-2. Chronic non-Cancer Hazard and Toxicity Analysis for the Wylam, AL Air Sampling Study……………………………………60

Table 6-1. Percentage of Hexavalent Chromium Associated with Each Total Chromium Concentrations Identified in the Wylam, AL Study……………………………………………………………………61

Table 6-2. Difference Analysis Hexavalent Chromium Concentrations Compared to That of Total Chromium in the Wylam, AL Study……………………………………………………………………63

EXECUTIVE SUMMARY

The United States Environmental Protection Agency's (EPA) particulate matter speciation program was established in 1997 to complement the particulate matter of less than 2.5 microns ($PM_{2.5}$) federal reference method (FRM) mass network (USEPA, 1997a). Whereas the "mass" monitors tell you the amount and size of particles in a sample, the speciation network provides information on the chemical composition of the particles. The speciation program includes the Speciation Trends Network (STN) and Chemical Speciation Network (CSN) sites. The speciation network currently consists of 52 STN sites and about 100 CSN sites. All speciation network sites are State and Local Air Monitoring Stations (SLAMS) deployed by State, Local, and Tribal agencies to allow flexibility in meeting local air monitoring needs. The Wylam site in Birmingham, AL (Air Quality System # 01-073-2003, see Figure 1) is a supplemental CSN site operated by the Jefferson County Department of Health (JCDH) in Birmingham, Alabama. The Wylam CSN provides information on various metals that may be present in particles.

During a review of 2000-2016 data, the EPA noted total chromium (Cr) results at the Wylam, AL CSN site appeared to be substantially higher than all other speciation network sites across the country. Further investigation of past Cr data from this site also showed fairly high historical annual averages with a potential increasing trend in 2016. Since the speciation network only provides data on total chromium, a special study was implemented between April 2018 and April 2019 to determine if hexavalent chromium (Cr^{6+}), a carcinogenic form of Cr, was elevated and posing potentially increased risks to residents in the area. Some typical sources of Cr^{6+} in the atmosphere are chromate chemicals used as rust inhibitors in cooling towers and emitted as mists, particulate matter emitted during manufacturing processes, and chromic acid mist releases from the plating industry (ATSDR, 1993).

This special study measured Cr^{6+} and certain additional metals in total suspended particulate (TSP) in addition to the ongoing $PM_{2.5}$ metals speciation sampling. Meteorological measurements (wind speed, wind direction, temperature, humidity, and pressure) were also taken on site. EPA Region 4, in conjunction with EPA's Office of Air Quality Planning and Standards (OAQPS), EPA's national contract lab Eastern Research Group (ERG), and JCDH developed a standard operating procedure (SOP) and quality assurance project plan (QAPP) for the study. The Cr^{6+} sampling and analysis method was developed by ERG which also performed laboratory analysis of the samples. JCDH provided two manual PM samplers (one for Cr^{6+} and another for the speciated metals, both in the form of TSP) and staff level support to operate the samplers and collect and send samples to the laboratory for analysis. EPA's OAQPS provided funding for the study and management of the national contract with ERG. Together, EPA's OAQPS and Region 4 provided oversight during the study and developed this risk assessment.

Study Purpose: Using the data collected during the April 2018 to April 2019 special study of Cr^{6+} and other metals at the Wylam monitor, a risk assessment was conducted to inform the need for subsequent steps such as pursuing risk reduction activities where data show potentially unacceptable impacts. The purpose of this monitoring study was to determine the level to which Wylam, AL, residents in the vicinity of the Wylam CSN monitor are potentially being exposed to Cr^{6+} concentrations in ambient air and the risks that those exposures may pose. The 2018 population in Wylam (a neighborhood west of Birmingham, AL) was 5,168 and evenly split among males (2,549) and females (2,619). The majority (48.5%) age group was between 20-54 years of age while 23.4% of the population were <19 years of age. The racial makeup of the Wylam community was 37% white, 61.8 % black, and 1.2% of the remaining population spread among several groups (American Indian, Chinese, and Latino). The median income in Wylam was $35,346.

Exposure Analysis: Chronic exposure was evaluated using the median, average, and 95th percentile Upper Confidence Limit (95UCL) on the arithmetic mean concentrations of the 1-year special study data as estimates of long–term exposure for each Chemical of Potential Concern (COPC). The use of the 95UCL of the arithmetic mean as the exposure concentration (EC) for inhalation risk reflects a conservative estimate of chronic (long-term) exposure when limited data are available (such as a one-year monitoring study). The EC for each COPC was calculated based on the distribution of each chemical's sampling data using ProUCL version 5.1.00. Additionally, short-term exposure was analyzed by comparing the maximum concentration detected during the year for each COPC to all short-term toxicological exposure concentrations for each chemical.

Toxicity Analysis: The toxicity values used for this study are listed in USEPA OAQPS' Toxicity Tables for Chronic and Acute Exposure (USEPA, 2018). The OAQPS toxicity values are compiled and prioritized from many sources including the EPA, the Agency for Toxic Substances and Disease Registry (ATSDR), the State of California, and other government bodies, and were used in this study to represent the toxicity of the COPCs. Toxicity values for chronic (or long term), acute (or one-time or short duration), or sub-chronic (or short-term) exposures were applied. Cancer risk and non-cancer hazards were assessed. When chemicals lacked specific toxicity information, surrogate values were adopted and carried through the assessment for risk screening purposes.

Risk Characterization: The risk characterization for chronic exposures was conducted by combining the relevant toxicity criteria with the ECs estimated from the April 2018 – April 2019 monitoring data. The ECs used to estimate potential cancer risks and chronic noncancer hazard were the 95UCL of the arithmetic mean to account for the use of limited monitoring data (1-year) to represent lifetime exposures (70-years). ATSDR's acute (1- to 14-day) minimal risk levels (from OAQPS's Table 2, USEPA, 2018) were compared to maximum concentrations detected at the monitoring site to assess potential for acute effects.

Risk Findings: Hexavalent chromium levels ranged from 0.0000055 ug/m^3 to 0.044 ug/m^3 and were detected in 98% of the valid samples. The ProUCL 95UCL was 0.0102 ug/m^3 based on a lognormal distribution. The corresponding estimated cancer risk at the monitoring location was 1x10^{-4} (100 in one million; rounded to one significant figure per EPA guidance; USEPA 2004a). The other carcinogenic chemicals associated with the study were all in the 10^{-6} risk range or lower. Thus, hexavalent chromium represented >95% of the risks. In protecting public health with an ample margin of safety, EPA strives to provide maximum feasible protection against risks to health from hazardous air pollutants by protecting the greatest number of persons possible to an individual lifetime risk level no higher than 1×10^{-6} (one in one million) and limiting to no higher than approximately 1×10^{-4} (one-hundred in one million) the estimated risk that a person living near a source would have if exposed to the maximum pollutant concentrations for 70 years. These goals are described in the preamble to the benzene National Emissions Standards for Hazardous Air Pollutants (NESHAP) rulemaking (54 Federal Register 38044, September 14, 1989) and are the goals incorporated by Congress for EPA's residual risk program under Clean Air Act (CAA) section 112(f). The key steps in the development of the 1×10^{-4} to 1×10^{-6} carcinogenic risk range are described in Exhibit 27-4 of the ATRA Reference library (USEPA, 2004a).

Non-cancer health effects associated with the COPCs together approximate a 0.5 Hazard Index (HI; rounded to one significant figure per EPA guidance – EPA 2004(a)). The highest Hazard Quotient (HQ) of 0.2 was associated with manganese, followed by Cr^{6+} with an HQ of 0.1 (note that an HI equal to or less than 1 indicates that noncancer effects are not likely to occur). A comparison of each chemical's maximum concentration in any 24-hour sample to its corresponding acute benchmark (where available) indicates that acute effects are not expected.

There were no chronic cancer or noncancer toxicity values for inhalation exposure to total chromium. However, both total and hexavalent chromium were measured during the April 2018 to April 2019 special study. During that timeframe, hexavalent chromium constituted an average of 9% of the total chromium measured.

There are a number of uncertainties associated with this analysis that should be considered when making risk management decisions such as:

- the use of one year's worth of monitoring data to represent a lifetime of exposure;
- the time residents spend in the immediate vicinity of the monitor (see Figure 1, the assessment assumes around the clock exposure for a full lifetime);
- the portion of TSP collected during the special study that is well inhaled;
- the proportion of measured hexavalent chromium that may come from potential sources in the area;

- potential exposure concentrations may be higher when in closer proximity to an emission source and, conversely, lower in other areas than those measured at the Wylam monitor (samples were only collected at the Wylam monitoring site); and
- no data on “background” levels of airborne hexavalent chromium in the area.

The Uncertainty Section of this risk assessment discusses these and other uncertainties in more detail.

Next Steps:

Hexavalent chromium is a hazardous air pollutant (HAP) regulated under the Clean Air Act (CAA). Generally, large industrial sources of HAPs (and some small sources) are regulated under the CAA. Although there are a number of potential sources of chromium in the area, the key source(s) of, and their contribution to, the measured hexavalent chromium concentrations at the Wylam monitor are not known with certainty. EPA will fund JCDH to reestablish and run its special monitor at the Wylam air monitor site to determine current metals concentrations (including hexavalent chromium concentrations) and will work with JCDH and others to identify potential sources of any elevated concentrations and possible opportunities to reduce them.

1.0 INTRODUCTION

1.1 Background

Wylam is a neighborhood in western Birmingham, Alabama (Jefferson County) and is located at latitude 33.506°N and longitude -86.925°W with an elevation of 656 feet above mean sea level. Wylam was founded as a mining town, housing employees of the nearby coal mines and steel mills. It was incorporated in 1900 and was annexed into Birmingham in 1910. Wylam is therefore a suburban neighborhood and according to the Neighborhood Scout's research, has an income that is lower than 88.9% of U.S. neighborhoods. Furthermore, 43.2% of the children are below the federal poverty line and a higher rate of childhood poverty than 88.2% of U.S. neighborhoods.

1.2 Wylam, AL Demographic Analysis

According to the 2018 estimate from the United States Census Bureau, the number of people in Wylam, AL was 5,168 (Table 1.2-1). The ratio of men to women in the Wylam area is roughly equal with 2,549 men and an estimated female population of 2,619. The median age of people living in Wylam was 39. The number of people under the age of 5 was 383. As for ages 5-19, there were 828 (16 percent of the total population [5,168]). As for the seniors of the community, there were 484 individuals at ages 60-64 and 381 persons at ages 65-74. The estimated White population in the Wylam community was 1,914, which is 37 percent of the total population. The estimated Black/African American population was 3,192, which is 61.8 percent of Wylam's total population. At the last survey, the total Asian population in the community was 19, while the American Indian-Alaska Native population totaled 11 and Hispanic or Latino persons totaled 19.

As of 2018, the number of children in elementary school totaled 389, while 196 students attended high school. Also note that 201 individuals were attending undergraduate college, while 342 individuals graduated from college in 2018 (122-White and 220-Black). The median household income in the community was $35,346 (the mean household income was $40,702). The median family income was $40,407 while the mean family income was $40,702.

Persons living in poverty in Wylam were estimated at 25% compared to the United States poverty level of 11.8% (U.S. Census Bureau, 2018).

1.3 General Discussion of Potential Metals Sources in the Area

According to the Toxics Release Inventory (TRI), an EPA program that tracks the environmental releases and on- and off-site management of certain toxic chemicals for facilities that meet specific criteria, there were a number of facilities in the Jefferson County, AL, area that worked with metals, including chromium, during the years 2018 and 2019 (the years that overlap the special Wylam study). In addition to large facilities that reported to TRI such as the US Steel facility in Fairfield, AL, there are other smaller sources that work with metals as well, such as Alabama Hard Surfacing in Wylam (which is in the process of upgrading their air pollution control equipment). This study did not attempt to identify all the potential sources of, or contributions to, metals concentrations measured during the special study. As mentioned previously, monitoring for hexavalent chromium and other metals will be reestablished at the Wylam monitoring site to determine if any metal concentrations are currently elevated. If so, a further goal will be to identify potential sources of any such concentrations.

1.5 Problem Definition and Study Design

EPA's speciation program was established in 1997 to complement the $PM_{2.5}$ Federal Reference Method mass network (which includes the Speciation Trends Network (STN) and Chemical Speciation Network (CSN which are supplemental speciation sites). The purpose of the speciation network is to provide information on the chemical composition that make up the particles (the "mass" monitors only tell you the amount and size of the particles, not what chemicals make up the particles. The Speciation program currently consists of 52 trends sites and about 100 CSN sites.

The supplemental sites are State and Local Air Monitoring Stations (SLAMS) deployed by State, Local and Tribal agencies to allow flexibility in meeting local air monitoring needs. The Wylam site (AQS # 01-073-2003) is a supplemental CSN site operated by the Jefferson County Department of Health (JCDH). JCDH operates the monitors and collects and submits samples to EPA's contract laboratory for analysis.

During a review of the CSN data, EPA noted total chromium (Cr) data at the Wylam, AL CSN site appears to be substantially higher than all other CSN sites. Total chromium concentrations measured at the Wylam CSN monitor from 2001-2020 (see Appendix D, Figure 1) have increased and decreased over the years. Most recently, concentrations appear to be among the lower measured during the 20 years of data collection. Total chromium measurements continue to be collected at the Wylam monitor.

Although the monitoring network provides data relative to total chromium, this study sought to determine if hexavalent chromium (Cr^{6+}), which is a carcinogenic form of Cr, was elevated thereby potentially causing increased risks to residents in the area. Cr^{6+} is one of the valence states (+6) of elemental Cr. It is usually produced by an industrial process. It is clearly established that inhaled Cr^{6+} is a human carcinogen, resulting in an increased risk of lung cancer. The respiratory tract is the major target organ for Cr^{6+}toxicity for acute (up to one day), sub-chronic (between one day and a lifetime), and chronic (lifetime) inhalation exposures. Chronic inhalation exposure to Cr^{6+} in humans results in effects on the respiratory tract. Chronic human exposure to high levels of Cr^{6+} by inhalation exposure may also produce effects on the liver, kidney, gastrointestinal and immune systems, and possibly the blood (USEPA, 2016).

Chromium metal is added to alloy steel to increase hardenability and corrosion resistance. A major source of worker exposure to Cr^{6+} occurs during "hot work" such as welding on stainless steel and other alloy steels containing chromium metal. Cr^{6+} compounds may be used as pigments in dyes, paints, inks, and plastics. It also may be used as an anticorrosive agent added to paints, primers, and other surface coatings. The Cr^{6+} compound chromic acid is used to electroplate chromium onto metal parts to provide a decorative or protective coating (U.S. Department of Labor, 2020).

The primary sources of Cr^{6+} in the atmosphere are based on chromate chemicals used as rust inhibitors in cooling towers and emitted as mists, particulate matter emitted during manufacturing processes and the general use of metal chromates, and chromic acid mist releases from the plating industry (ATSDR, 1993).

The purpose of this study was to determine if Wylam, AL residents were potentially exposed to Cr^{6+} levels in air that may pose elevated health risks. Therefore, this risk analysis will be used to identify potential for health effects within the sampling area followed by determination of next steps. In addition, the risk characterization may provide insight, in conjunction with other information, in helping to understand whether there may be potential disproportionate impacts to the Wylam community.

The air monitoring location for this study was located at 1242 Jersey Street, Birmingham, AL 35224 as identified in Figure 3. Jefferson County Department of Health (JCDH) collected all ambient air samples for this study while laboratory analyses for TSP HAP Metals (EPA IO-3.5) and hexavalent chromium (ASTM D7614) were performed by Eastern Research Group (ERG) of Morrisville, North Carolina. ERG is an EPA approved lab and therefore all sampling preparation, shipping, and analyses were in accordance with the lab’s standard operating procedures. Samples were collected for the entire 2018 year on a 1- in 3-day schedule resulting in 86 samples. The metals and Cr^{6+} sample results were used to determine if ambient levels are elevated and to identify potential sources in the area contributing to elevated concentrations. (Note that samples were only collected at the Wylam monitoring site for this study and no data on “background” levels of airborne hexavalent chromium or other metals were determined for the area).

1.6 Organization of This Report

The remainder of this report is organized into five principal sections:

- Section 2 provides data collection and analysis which includes details for the monitor used in this assessment along with sampling and analysis specifics. Meteorological data for the entire study area was assessed elsewhere in the general Wylam Assessment document. Overall, chemicals of potential concern (COPCs) were selected.

- Section 3 contains the exposure assessment wherein the chemicals of potential concern were further reduced and carried through the remainder of the risk assessment. The risk assessment will focus on chronic (lifetime) exposures although this section also discusses sub-chronic (one day to less than lifetime) and acute (minutes to one day) exposures.

- Section 4 contains the toxicity assessment which includes the potential health effects and the dose-response information associated with the chemicals of potential concern.

- Section 5 summarizes and discusses the risk assessment results for each chemical of potential concern detected.

- Section 6 summarizes important sources of uncertainty in this assessment and their potential impacts on the risk estimates.

- Section 7 presents the conclusions of the risk assessment.

References are provided in Section 8 followed by Section 9, a glossary of important acronyms and terms. The appendices provide supporting detail for the risk assessment including A) monitoring data, B) ProUCL statistical results, C) chemical-specific health effects. Overall, although extensive, this risk assessment is intended to comply with available guidance (USEPA, 2004a) in support of the goals outlined in Section 1.6 herein.

2.0 DATA COLLECTION STUDY DESIGN, ANALYSIS, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN

This section first summarizes the design and analytical methodology for the study. Next the pollutant sources are reviewed for the Wylam, AL area. Last of all, the data are discussed followed by the Chemicals of Potential Concern (COPC) selection process which narrows the list of chemicals to the primary cancer and non-cancer drivers. The COPCs are then carried forward for further evaluation in the risk assessment. No Tentatively Identified Compounds (TICs) were selected as COPCs given the uncertainties in the identity of these compounds.

2.1 Monitoring Study Participants

In 2018, the JCDH in conjunction with Region 4 Environmental Protection Agency (EPA-R4) and the Office of Air Quality Planning and Standards (OAQPS), identified a monitoring location for metals and Cr^{6+} sampling in Wylam, AL. The monitor was established and operated by JCDH while all samples were sent to ERG for laboratory analysis.

2.2 Monitoring Location

After consultation between the study participants, the sampling location, 1242 Jersey Street, Birmingham, AL 35224, was selected.

2.3 Monitoring Equipment

The monitoring site consisted of a TSP sampler to collect ambient metals and Cr^{6+} air samples. The sampling apparatus was furnished by ERG and JCDH. All monitoring equipment was operated in accordance with EPA Standard Operating Procedures.

2.4 Sample Collection/Analysis

Each sample was collected by JCDH staff and shipped to ERG for analysis using Method EPA IO-3.5 and ASTM D7614. The data were validated and reported within 45-days after the end of the sampling month. ERG entered all data into Air Quality System (AQS). The project's sampling plan is outlined in the "Quality Assurance Project Plan for the Wylam, Alabama Monitoring Study" (USEPA-R4, 2018).

2.5 Sampling Duration and Frequency

A full year metals and Cr^{6+} sampling regime was executed at the sampling location beginning on April 26th of 2018 and ending on April 30th of 2019. A modified 1- in 3-day collection schedule was used for all samples which would provide ample samples to understand the nature of any contamination emanating from sources within the area both by days-of-the-week as well as seasons-of-the-year. The project collected approximately 86 samples (Note: samples were not collected on weekends due to JCDH staff work schedule policies). The prevailing winds in the area were from the southwest.

The data obtained during the study were sufficient in both quantity and quality to provide a representative sampling of what metals are in the ambient air and at what concentrations they exist. All collected samples were analyzed by ERG using the appropriate analytical method to identify the targeted pollutants as well as their respective concentrations. A list of monitored/analyzed pollutants and their respective concentrations across the study can be found in Appendix A.

2.7 Analytical Air Sampling Results

Appendix A contains a detailed output of the year-long analytical data (24-hour samples collected from April 26, 2018 through April 30, 2019) for the monitoring site. Table 2.9-1 summarizes the list of analytes detected. There were 12 chemicals detected during sampling including Cr^{6+}, arsenic, nickel, cadmium, beryllium, manganese, lead, antimony, cobalt, mercury, selenium, and total Cr. Cr^{6+} was detected in 98% of valid samples; all other chemicals were detected in valid samples at a 100% frequency.

2.8 Detection Limits

According to ERG, all detection limits were provided as Method Detection Limits (MDLs) per chemical for each sample analyzed. While detection below the MDL was possible, the measurement reliability is lower. Overall, MDLs are determined at the ERG laboratory using 40 CFR, Part 136 Appendix B procedures (USEPA, 2013) in accordance with the specifications presented in the NATTS TAD (UATMP, 2007). MDLs and corresponding Sample Quantitation Limits (SQLs) are provided in the laboratory data results appendix of this report.

2.9 Selection of Chemicals of Potential Concern

Although this study focused on hexavalent chromium, it was also important to determine if other HAPs were available at concentrations that might have the potential to contribute to health risks. Therefore, other HAP metals were considered including arsenic, nickel, cadmium, beryllium, manganese, lead, antimony, cobalt, mercury, and selenium. Once the monitoring was complete, the basic steps used in the selection process to identify Chemicals of Potential Concern (COPCs) were as follows:

1. Chemicals with no toxicity data available were removed from calculations but were retained in the uncertainty section and were analyzed using surrogate toxicity values where available.
2. Chemicals with surrogate toxicity estimates were carried through the risk assessment process for comparability with other risk documents and as a generally conservative step.

3. Analytical replicates were averaged in the risk assessment.
4. Chemicals identified at concentrations below the respective detection limits were carried through the COPC selection process using ½ of the detection limit.
5. Chemicals that were not detected in greater than 10% of the samples per monitor were not included in the COPCs.
6. Subsequent to selection of COPCs, the risk assessment then used reported values below the detection limit "as is" and, for true non-detects, a value of ½ the sample quantitation limit was used as a conservative surrogate of concentration per EPA guidance (USEPA 2004a).[1]

Descriptive statistics were calculated such that for each chemical reported at the monitor, the following information was determined:

- the frequency at which the chemical was detected at the monitor;
- the average and median concentrations as well as the standard deviation per chemical; and
- the maximum and minimum detected concentrations.

Table 2.9-1 provides the results of the COPC selection process for the Wylam monitor. For chemicals detected at a detection frequency of 10% or greater, a statistical summary was created including the range of the detected concentrations, frequency of detections, average concentrations, standard deviations, detection limit (DL) ranges, and the median concentrations. Table 3.1-1 details the 95UCL along with the data's distribution as provided by EPA's ProUCL software for each COPC. The 95UCL was carried through the risk assessment process. Tables 4.1-1 summarizes the list of chemicals that did not have inhalation toxicity information (total chromium) but that will be further examined in the uncertainty section.

The COPCs that were detected in more than 90% of valid samples included Cr^{6+}, arsenic, nickel, cadmium, beryllium, manganese, lead, antimony, cobalt, mercury, and selenium. All these chemicals were detected at between 98% and 100% frequency of valid samples.

2.10 Summary of COPCs

All of the COPCs were found at levels above their respective detection limits. The distribution of the data for each chemical was best characterized as lognormal according to EPA's ProUCL.

[1] The ATRA Reference Library (see: https://www.epa.gov/fera/risk-assessment-and-modeling-air-toxics-risk-assessment-reference-library) recommends the use of ½ the quantitation limit as the metric for evaluating nondetects.

3.0 EXPOSURE ASSESSMENT

Exposure assessment is the process that characterizes the route, duration, intensity, and frequency of contact with a chemical by a potential receptor. In this assessment, the receptors of interest were individuals that may reside within the Wylam, AL monitoring area, and the principal exposure route of interest was inhalation. The exposure durations evaluated include chronic (lifetime), sub-chronic (1-day up to chronic), and acute (up to 1 day). For chronic analysis, exposures to continuously low levels of pollutants over a lifetime were evaluated. For sub-chronic exposures, maximum detected concentrations were compared the ATSDR acute MRL if available. For acute exposures, the highest 24-hour monitored metal hazardous air pollutant (HAP) concentration detected was compared to the most stringent of the short-term health risk-related comparison levels. If a 24-hour monitored metal HAP concentration exceeded the noncancer-based comparison level for that metal HAP, a sub-chronic or acute HQ was calculated using the maximum monitored metal HAP concentration and the sub-chronic or acute exposure comparison level for the metal HAP. The acute HQ is the ratio of the potential exposure to the HAP (represented, in this case, by the maximum monitored metal HAP concentration) to the level at or below which no adverse effects are expected (represented by the sub-chronic or acute exposure comparison level).

Metals are associated with a variety of health effects that are reviewed in detail in EPA OAQPS' Health Effects Notebooks, EPA's Integrated Risk Information System (IRIS) Toxicology Reviews, the Agency for Toxic Substances and Disease Registry (ATSDR) Toxicological Profiles, the World Health Organization's International Programme for Chemical Safety (WHO/IPCS) Environmental Health Criteria documents, and metal toxicology reviews (USEPA, 2007).

3.1 Chronic Exposures

In this assessment, chronic exposure was evaluated based on the 95th percentile Upper Confidence Limit (95UCL) based on the arithmetic mean concentration for each COPC as measured at the monitor in individual samples. The 95UCL was selected to reflect a more conservative estimate of chronic exposure whereby there is 95% certainty that the true mean is not above the 95UCL concentration (USEPA, 2006 and Gilbert, 1987). Therefore, the 95UCL is typically used as a conservative estimate of the true mean concentration because there is insufficient monitoring data to calculate the true mean.

The following conservative assumptions were used in the assessment of chronic exposure at both the median and 95UCL exposure concentrations:

- A person lives, works, or otherwise is exposed to the ambient air measured at the monitoring location for 24 hours per day, 7 days per week, for a 70-year lifetime.

- The air that the person breathes, both while indoors and outdoors, contains the same concentrations of pollutants measured in the Wylam study.

- Air quality, as reflected by the monitoring results, was assumed to remain relatively constant over the entire 70-year lifetime of a person living in the area.

To estimate the concentration of chemicals a person is exposed to over a 70-year span of time, the monitoring data can be evaluated in several ways such as the arithmetic mean, the median, the highest value measured in the dataset, etc.

In air toxics risk assessments, it is common to use the 95% Upper Confidence Limit (95UCL) based on the arithmetic mean of a limited dataset (in this study, one year's worth of data) as a conservative surrogate estimate of lifetime exposure (in this case, the 70-year average concentration at the Wylam Monitoring Site). This health protective approach provides a level of confidence that the true lifetime exposure is unlikely to be higher than the average concentration you would get if you had 70 years of monitoring data.

The 95UCL on the mean for each COPC was calculated based on the distribution of the chemical's sampling data using ProUCL version 5.1.002 (USEPA, 2002b). Appendix B contains a detailed output of ProUCL's statistical analyses.

Table 3.1-1 provides the 95UCL calculations per chemical for the Wylam sampling results. It is notable that the chemical with the highest 95UCL concentration was manganese (0.064 ug/m^3) followed by Cr^{6+} (0.0102 ug/m^3).

As an alternate to the 95UCL of the arithmetic mean, the median concentrations of each COPC are also provided for comparison with the 95UCL concentration. None of the 95UCLs were above their respective maximum concentrations.

3.2 Short-term Exposures

Health effects due to short-term exposure to air pollutants are also possible if concentrations are sufficiently high. Health effects that persons may experience due to 8-hour acute versus 1-14 day short–term exposures to high levels of airborne contaminants can vary significantly from those experienced after long-term exposure to low doses, depending on the contaminant and its concentration. For example, a substance that produces an increase in cancer rates after exposure to low concentrations for a long period of time might also cause immediate and severe eye irritation if present at sufficiently high levels for a short period of time (USEPA, 1997c).

Methods to assess short-term health effects, however, are not well established. As a conservative approach for this study, the highest individual concentration for each pollutant measured (as determined by composite 24-hour monitoring samples) was compared to acute and sub-chronic benchmark concentrations. Reliance on maximum measured concentrations to evaluate the potential for adverse effects from short-term exposures, as opposed to upper confidence limits of means, treats each sample independently, thus avoiding the potential to "average out" spikes in concentration.

In a secondary screening approach, where the ATSDR acute MRL is the sub-chronic acute screening concentration, if the maximum concentration is greater than the associated MRL, the maximum concentration is replaced by a 14-day surrogate (i.e., four-24-hour samples will be averaged and compared to the acute MRL). This effort is intended to align the exposure concentration more closely with the 14-day acute MRL definition.

All short-term exposure benchmarks were acquired from EPA's Office of Air Quality, Planning, and Standards (OAQPS) via internet download (see Table 2, USEPA, 2018). There are numerous short-term data sources for the information provided by OAQPS as discussed in Section 4.

4.0 HAZARD IDENTIFICATION AND DOSE-RESPONSE ASSESSMENT

Hazard identification is the process of determining whether exposure to a chemical can potentially cause an increase in the incidence of an adverse health consequence in humans.

4.1 Chronic Dose-Response Information Sources

Dose-response assessments (carcinogenic and non-carcinogenic) for chronic exposure (either by inhalation or ingestion) for the HAP reported in the emissions inventory for this source category are based on the EPA Office of Air Quality Planning and Standards' (OAQPS) existing recommendations for HAPs (USEPA, 2018). This information has been obtained from various sources and prioritized according to (1) conceptual consistency with EPA risk assessment guidelines and (2) level of peer review received. The prioritization process was aimed at incorporating the best available science with respect to dose-response information. The recommendations are based on the following sources, in order of priority:

1) **U.S. Environmental Protection Agency (EPA).** EPA has developed dose-response assessments for chronic exposure for many HAPs. These assessments typically provide a qualitative statement regarding the strength of scientific data and specify a reference concentration (RfC, for inhalation) to protect against effects other than cancer and/or an inhalation unit risk estimate (IUR, for inhalation) to estimate the probability of developing cancer. The RfC is defined as an "estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a

lifetime." The IUR is defined as "the upper-bound excess cancer risk estimated to result from continuous lifetime exposure to an agent at a concentration of 1 $\mu g/m^3$ in air." The SF is "an upper bound, approximating a 95 percent confidence limit, on the increased cancer risk from a lifetime exposure to an agent. This estimate, [is] usually expressed in units of proportion (of a population) affected per mg/kg-day…"

EPA disseminates dose-response assessment information in several forms, based on the level of review. The Integrated Risk Information System (IRIS) is an EPA database that contains scientific health assessment information, including dose-response information. All IRIS assessments since 1996 have also undergone independent external peer review. The current IRIS process includes review by EPA scientists, interagency reviewers from other federal agencies, and the public, as well as peer review by independent scientists external to EPA. New IRIS values are developed, and old IRIS values are updated as new health effects data become available. Refer to the IRIS Agenda for detailed information on status and scheduling of current individual IRIS assessments and updates. EPA's science policy approach, under the current carcinogen guidelines, is to use linear low-dose extrapolation as a default option for carcinogens for which the mode of action (MOA) has not been identified. Future EPA dose-response assessments that identify nonlinear MOAs where appropriate will be used (once peer reviewed) in air toxics risk assessments. At this time, however, there are no available carcinogenic dose-response assessments for inhalation exposure that are based on a nonlinear MOA.

2) **U.S. Agency for Toxic Substances and Disease Registry (ATSDR).** ATSDR, which is part of the US Department of Health and Human Services, develops and publishes Minimal Risk Levels (MRLs) for inhalation and oral exposure to many toxic substances. As stated on the ATSDR web site: "Following discussions with scientists within the Department of Health and Human Services (HHS) and the EPA, ATSDR chose to adopt a practice similar to that of the EPA's Reference Dose (RfD) and Reference Concentration (RfC) for deriving substance specific health guidance levels for non-neoplastic endpoints." The MRL is defined as "an estimate of daily human exposure to a substance that is likely to be without an appreciable risk of adverse effects (other than cancer) over a specified duration of exposure." ATSDR describes MRLs as substance-specific estimates to be used by health assessors to select environmental contaminants for further evaluation.

3) **California Environmental Protection Agency (CalEPA).** The CalEPA Office of Environmental Health Hazard Assessment has developed dose-response assessments for many substances, based both on carcinogenicity and health effects other than cancer. The process for developing these assessments is similar to that used by EPA to develop IRIS values and incorporates extensive external scientific peer review. As

stated in the CalEPA Technical Support Document for developing their chronic assessments, the guidelines for developing chronic inhalation exposure levels incorporate many recommendations of the U.S. EPA (USEPA, 1994) and the NAS (NAS, 1994). The noncancer information includes available inhalation health risk guidance values expressed as chronic inhalation reference exposure levels (RELs). CalEPA defines the REL as "the concentration level at or below which no health effects are anticipated in the general human population." CalEPA's quantitative dose-response information on carcinogenicity by inhalation exposure is expressed in terms of the URE, defined similarly to EPA's URE.

For certain HAPs, the dose-response information, based on this prioritization, is limited. To address data gaps and avoid underestimating risk, additional changes were made to some of the chronic inhalation exposure values as follows:

1) **Manganese**. The EPA considers the ATSDR MRL for manganese (Mn) the most appropriate chronic inhalation reference value to be used in risk assessments. There is an existing IRIS RfC for Mn (USEPA, 1993), and ATSDR published an assessment of Mn toxicity which includes a chronic inhalation reference value (i.e., an ATSDR Minimal Risk Level, MRL) (ATSDR, 2012). Both the 1993 IRIS RfC and the 2012 ATSDR MRL were based on the same study (Roels et al., 1992); however, ATSDR used updated dose-response modeling methodology (benchmark dose approach) and considered recent pharmacokinetic findings to support their MRL derivation. Because of the updated methods, EPA has determined that the ATSDR MRL is the appropriate health reference value to use in risk assessments.

2) **Lead.** The primary National Ambient Air Quality Standard (NAAQS) for lead is considered to be protective of potential health effects, to include susceptible populations. The NAAQS, developed using the EPA Integrated Exposure, Uptake, Biokinetic Model, was preferred over the RfC for noncancer adverse effects because the NAAQS for lead was developed using more recent toxicity and dose-response information on the noncancer adverse impacts of lead. The NAAQS for lead was set to protect the health of the most susceptible children and other potentially at-risk populations against an array of adverse health effects, most notably including neurological effects, particularly neurobehavioral and neurocognitive effects (which are the effects to which children are most sensitive). The lead NAAQS, a rolling 3-month average level of lead in total suspended particles, is used as a long-term comparison value in the risk assessment.

3) **Nickel compounds.** To provide a conservative estimate of the potential cancer risks, the EPA considers the IRIS URE value for nickel subsulfide (which is considered the most potent carcinogen among all nickel compounds) to be the most appropriate value to be used in risk assessments. Based on consistent views of major scientific bodies, such

as the National Toxicology Program (NTP) in their 14th Report of the Carcinogens (RoC) (NTP, 2016), the International Agency for Research on Cancer (IARC, 1990), and other international agencies (WHO, 1991) that consider all nickel compounds to be carcinogenic, all nickel compounds are considered to have the potential of being carcinogenic to humans. The 14th RoC states that “the combined results of epidemiological studies, mechanistic studies, and carcinogenic studies in rodents support the concept that nickel compounds generate nickel ions in target cells at sites critical for carcinogenesis, thus allowing consideration and evaluation of these compounds as a single group.” Although the precise nickel compound (or compounds) responsible for carcinogenic effects in humans is not always clear, studies indicate that nickel sulfate and the combinations of nickel sulfides and oxides encountered in industrial emissions of nickel mixtures cause cancer in humans (these studies are summarized in a review by Grimsrud and Anderson, 2010). The major scientific bodies mentioned above have also recognized that there may be differences in the toxicity and/or carcinogenic potential across the different nickel compounds. For this reason, and given that there are two additional URE values[2] derived for exposure to mixtures of nickel compounds (as a group) that are 2-3 fold lower than the IRIS URE for nickel subsulfide, the EPA considers it reasonable, in some instances (e.g., when high quality data are available on the composition of nickel emissions from a specific source category), to use a value that is 50 percent of the IRIS URE for nickel subsulfide for providing an estimate of the lower end of the plausible range of cancer potency values for different mixtures of nickel compounds. Therefore, to be thorough in screening nickel sampling results, the IUR for nickel subsulfide will be used in as a surrogate in assessing potential for adverse health effects due to nickel exposure.

4) **Pollutant Groups.** In the case of HAP groups such as mercury compounds, antimony compounds and others, the most conservative dose-response value in the chemical group is used as a surrogate for other compounds in the group for which dose-response values are not available. This is done to examine, under conservative assumptions, whether those HAPs that lack dose-response values may pose an unacceptable risk and require further examination.

4.1.1 Cancer Potency

A cancer toxicity value represents the potential for a chemical to pose a risk of developing cancer. This value can be matched with environmental exposure data to estimate health risks. For carcinogens, inhalation toxicity measurements

[2] Two UREs (other than the current IRIS values) have been derived for nickel compounds as a group: one developed by the California Department of Health Services (http://www.arb.ca.gov/toxics/id/summary/nickel_tech_b.pdf) and the other by the Texas Commission on Environmental Quality (http://www.tceq.texas.gov/assets/public/implementation/tox/dsd/facts/nickel_&_compounds.pdf).

are generally expressed as a risk per unit concentration (e.g., the units of an IUR are risk per µg/m^3) or, for oral exposures, as a risk per daily intake (e.g., the units of the SF are risk per mg/kg–day).

In hazard identification of carcinogens under the 1986 USEPA guidelines, human data, animal data, and supporting evidence are combined to characterize the weight–of–evidence (WOE) regarding the chemical's potential as a human carcinogen into one of several categories:

Group A – Carcinogenic to Humans: Agents with adequate human data to demonstrate the causal association of the agent with human cancer (typically epidemiological data).

Group B – Probably Carcinogenic to Humans: Agents with sufficient evidence (i.e., indicative of a causal relationship) from animal bioassay data, but either limited (i.e., indicative of a possible causal relationship, but not exclusive of alternative explanations) human evidence (Group B1), or with little or no human data (Group B2).

Group C – Possibly Carcinogenic to Humans: Agents with limited animal evidence and little or no human data.

Group D – Not Classifiable as to Human Carcinogenicity: Agents without adequate data either to suggest or refute the suggestion of human carcinogenicity.

Group E – Evidence of Non–carcinogenicity for Humans: Agents that show no evidence for carcinogenicity in at least two adequate animal tests in different species or in both adequate epidemiologic and animal studies.

Weight-of-evidence determinations for carcinogenicity developed by the International Agency for Research on Cancer (IARC) were used for carcinogens not characterized by USEPA. Carcinogens are categorized by IARC as Group 1 (agents carcinogenic to humans), Group 2A (probable human carcinogen), and Group 2B (possible human carcinogen).

The IUR represents an estimate of the increased cancer risk from a lifetime (assumed to be 70 years) of continuous exposure to a concentration of one unit of exposure. Also note that only those substances that are known or suspected human carcinogens were considered in calculating incremental cancer risks (USEPA WOE groups A, B, or C, or IARC WOE classifications of 1, 2A or 2B).

Table 4.1.1-1 contains the chronic inhalation carcinogenic toxicity values for all carcinogenic COPCs associated with the Wylam study. The table also lists the EPA and IARC WOE for each chemical as well as the source of the information provided.

4.1.2 Chronic Non-cancer Effects

For non–cancer effects, inhalation toxicity values are generally expressed as a concentration in air (e.g., a RfC in units of µg/m^3 air). The RfC considers toxic effects for both the respiratory system (portal of entry) and for effects peripheral to the respiratory system (extra respiratory effects). The inhalation RfC is analogous to the oral Reference Dose (RfD) and is similarly intended for use in risk assessments for health effects known or assumed to be produced through a nonlinear (presumed threshold) mode of action.

RfCs are generally derived according to *Methods for Derivation of Inhalation Reference Concentrations and Application of Inhalation Dosimetry* (USEPA, 1994). Because RfCs can also be derived for the non-carcinogenic health effects of substances that are also carcinogenic, it is essential to consider the full range of potential outcomes resulting from exposure (i.e., cancer and non-cancer effects).

Table 4.1.1-1 contains the chronic non-carcinogenic toxicity values for all the COPCs associated with the Wylam study.

4.2 Short-term Dose Response Information Sources

Short-term toxicity values cover a wide spectrum of potential health effects, ranging from mild irritation to life threatening conditions. Several acute toxicity values may be available for the same substance to address different short–term effects on health while sub-chronic effects are adopted from ATSDR acute (1- to 14-day exposures) toxicity concentrations. Available short-term toxicity values are provided for use in Air Toxics Risk Assessments by OAQPS; the underlying sources are described below:

California Acute Reference Exposure Levels (RELs). The California Environmental Protection Agency (CalEPA) has developed acute dose-response reference values for many substances, expressing the results as acute inhalation RELs.

> The acute REL is defined by CalEPA as "the concentration level at or below which no adverse health effects are anticipated for a specified exposure duration (OEHHA, 2015). RELs are based on the most sensitive, relevant, adverse health effect reported in the medical and toxicological literature. RELs are designed to protect the most sensitive individuals in the population by the inclusion of margins of safety. Since margins of safety are incorporated to address data gaps and uncertainties, exceeding the REL does not automatically indicate an adverse health impact." Acute RELs are developed for 1-hour (and 8-hour) exposures. The values incorporate uncertainty factors similar to those used in deriving EPA's inhalation RfCs for chronic exposures.

Acute Exposure Guideline Levels (AEGLs). AEGLs are developed by the National Advisory Committee (NAC) on Acute Exposure Guideline Levels (NAC/AEGL) for Hazardous Substances and then reviewed and published by the National Research Council. As described in the Committee's Standing Operating Procedures, AEGLs "represent threshold exposure limits for the general public and are applicable to emergency exposures ranging from 10-min to 8-h." Their intended application is "for conducting risk assessments to aid in the development of emergency preparedness and prevention plans, as well as real time emergency response actions, for accidental chemical releases at fixed facilities and from transport carriers." The document states that "the primary purpose of the AEGL program and the NAC/AEGL Committee is to develop guideline levels for once-in-a-lifetime, short-term exposures to airborne concentrations of acutely toxic, high-priority chemicals." In detailing the intended application of AEGL values, the document states, "It is anticipated that the AEGL values will be used for regulatory and nonregulatory purposes by U.S. Federal and State agencies, and possibly the international community in conjunction with chemical emergency response, planning, and prevention programs. More specifically, the AEGL values will be used for conducting various risk assessments to aid in the development of emergency preparedness and prevention plans, as well as real-time emergency response actions, for accidental chemical releases at fixed facilities and from transport carriers."

The NAC/AEGL defines AEGL-1 and AEGL-2 as:

> "AEGL-1 is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic non-sensory effects. However, the effects are not disabling and are transient and reversible upon cessation of exposure."
>
> "AEGL-2 is the airborne concentration (expressed as ppm or mg/m^3) of a substance above which it is predicted that the general population, including susceptible individuals, could experience irreversible or other serious, long-lasting adverse health effects or an impaired ability to escape."
>
> "Airborne concentrations above AEGL-1 represent exposure levels that can produce mild and progressively increasing but transient and nondisabling odor, taste, and sensory irritation or certain asymptomatic, non-sensory effects. With increasing airborne concentrations above each AEGL, there is a progressive increase in the likelihood of occurrence and the severity of effects described for each corresponding AEGL. Although the AEGL values represent threshold levels for the general public, including susceptible subpopulations, such as infants, children, the elderly, persons with asthma, and those with other illnesses, it is recognized that individuals, subject to unique or idiosyncratic responses, could experience the effects described at concentrations below the corresponding AEGL."

Emergency Response Planning Guidelines (ERPGs). The American Industrial Hygiene Association (AIHA) has developed ERPGs for acute exposures at three different levels of severity. These guidelines represent concentrations for exposure of the general population (but not particularly sensitive persons) for up to 1-hour associated with effects expected to be mild or transient (ERPG-1), irreversible or serious (ERPG-2), and potentially life-threatening (ERPG-3).

ERPG values are described in their supporting documentation as follows: "ERPGs are air concentration guidelines for single exposures to agents and are intended for use as tools to assess the adequacy of accident prevention and emergency response plans, including transportation emergency planning, community emergency response plans, and incident prevention and mitigation."

ERPG-1 and ERPG-2 values are defined by AIHA's Standard Operating Procedures as follows:

> "ERPG-1 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing more than mild, transient health effects or without perceiving a clearly defined objectionable odor."

"ERPG-2 is the maximum airborne concentration below which nearly all individuals could be exposed for up to 1 hour without experiencing or developing irreversible or other serious adverse health effects or symptoms that could impair an individual's ability to take protective action."

The U.S. Agency for Toxic Substances and Disease Registry (ATSDR). ATSDR develops chronic, intermediate and acute minimal risk levels (MRLs) for some contaminants. An acute MRL is a sub-chronic benchmark that is considered protective of exposures lasting from 24-hours to 14-days (ATSDR, 2002).

National Institute for Occupational Safety and Health (NIOSH). As part of its mission to study and protect worker health, NIOSH determines concentrations of substances that are immediately dangerous to life or health (IDLHs). IDLHs were originally determined for 387 substances in the mid-1970's as part of the Standards Completion Program (SCP), a joint project by NIOSH and the Occupational Safety and Health Administration (OSHA), for use in assigning respiratory protection equipment. NIOSH is currently evaluating the scientific adequacy of the criteria and procedures used during the SCP for establishing IDLHs. In the interim, the IDLHs have been reviewed and revised. NIOSH maintains an on-line database of IDLHs, including the basis and references for both the current and original IDLH values (as paraphrased from the SCP draft technical standards). The OAQPS Table 2 provides IDLH values divided by 10 to more closely match the mild-effect levels developed by other sources with methodology used to develop levels of concern under Title III of the

Superfund Amendments and Reauthorization Act, and their use in the accidental release prevention requirements under section 112(r) of the Clean Air Act.

4.2.1 Short-term Hazard Toxicity Values

Hazard identification and dose-response assessment information for short-term inhalation exposure assessments is based on the existing recommendations of OAQPS for HAPs (USEPA, 2018). When the benchmarks are available, the results from acute screening assessments are compared to both “no effects” reference levels for the general public, such as the California Reference Exposure Levels (RELs), and to emergency response levels, such as Acute Exposure Guideline Levels (AEGLs) and Emergency Response Planning Guidelines (ERPGs), with the recognition that the ultimate interpretation of any potential risks associated with an estimated exceedance of a particular reference level depends on the definition of that level and any limitations expressed therein. If comparison concentrations are not provided by the sources discussed above, immediately dangerous to life or health (NIOSH) values are provided as surrogate comparison concentrations. Comparisons among different available inhalation health effect reference values (both acute and chronic) for selected HAPs can be found in an EPA document of graphical arrays (USEPA, 2009).

The potential for short-term effects from exposure to airborne COPCs were evaluated. The method used for estimating the risks from routine short-term exposures to the concentrations of most toxic substances found in ambient air samples is done by comparing the maximum concentration detected per HAP to the screening concentrations per the hierarchy provided above.

Table 4.4-1 compares the maximum concentrations detected for each COPC to its corresponding benchmark screening concentration(s) which were compiled by OAQPS (see Table 2: USEPA, 2018). COPCs without toxicity values were not listed in the table. Since all samples were taken over a 24-hour period, MRLs (protective of 24-hr to 14-day exposures) were compared to maximum concentration as a sub-chronic comparison. There were no detected concentrations that exceeded its corresponding acute or sub-chronic benchmark levels (Table 4.4-1).

5.0 RISK CHARACTERIZATION

The risk characterization integrates the information from the exposure assessment and toxicity assessment steps in the risk assessment to provide an estimate of the magnitude of potential risks and hazards, while defining the strength of the conclusions based on the uncertainty in the information used to generate these estimates. For this risk assessment the risk characterization combined the exposure concentrations with the chronic and short-term toxicity data to provide a quantitative estimate of the potential health impacts. The chronic or lifetime evaluation addresses both cancer and non-cancer health effects. The remainder of this section is divided into three subsections: one for details of the risk characterization for chronic exposure; another for the evaluation of short-term exposures; and a risk summary section. A detailed assessment of the uncertainty in the risk characterization is provided in the Uncertainty Section (Section 6).

5.1 Risk Characterization for Chronic Exposures

The risk characterization for chronic exposures was conducted by combining the relevant toxicity criteria with the exposure concentrations (EC) estimated from the monitoring data for the Wylam study. The 95UCL exposure case was selected to represent a conservative estimate of exposure and is based on the 95UCL concentrations of the COPCs in air.

In this assessment, risk estimates for COPCs with a cancer endpoint were expressed in terms of the probability of contracting cancer from a lifetime of continuous exposure (70-year lifespan) to a constant air concentration of each COPC. Cancer risk for each COPC at the monitoring location was derived as follows:

$$Risk_x = EC_x \text{ x } IUR_x \quad \text{Equation 5-1}$$

Where:

$Risk_x$ = the risk of the X^{th} COPC at a monitor;
EC_x = the exposure point concentration of the COPC (i.e., 95UCL air concentration); and
IUR_x = the inhalation unit risk of the COPC.

When multiple carcinogens were present simultaneously, the individual risks were summed to create a total cancer risk, as follows:

$$\text{Risk}_{\text{total}} = \sum (Risk1 + Risk2 + \ldots.Riskx) \quad \text{Equation 5-2}$$

Estimates of cancer risk were expressed as a probability, represented in scientific notation as a negative exponent of 10. For example, an additional lifetime risk of developing cancer of 1 chance in 1,000,000 (or one additional cancer per 1,000,000 persons exposed over a lifetime) is written as $1 \text{x} 10^{-6}$ or 1E–06.

In contrast to cancer risks, non-cancer hazards are not expressed as a probability of an individual suffering an adverse non-cancer effect. Instead, non-cancer hazard to individuals is expressed in terms of the hazard quotient (or HQ), defined as the ratio between the estimated EC and the Reference Concentration

(RfC). For a given air toxic, exposures below the RfC (HQ<1) are not likely to be associated with adverse health effects. With exposures increasingly greater than the RfC, the potential for adverse effects increases. HQs were calculated as follows:

$$HQ_x = \frac{EC_x}{RfC_x}$$

Equation 5-3

Where:

HQ_x = the hazard quotient of the X^{th} COPC at the monitor;
EC_x= the exposure concentration of the COPC (i.e., 95UCL air concentration); and
RfC_x = the reference concentration of the COPC.

When multiple non-carcinogens were present simultaneously, the individual HQs are summed to create a hazard index (HI), as follows:

$$HI = \sum (HQ1 + HQ2 + HQ3 + \ldots .HQ_x)$$

Equation 5-4

Where:

HI = the hazard index of the COPCs at the monitor; and
HQ1 = the Hazard Quotients of COPCs 1 through x.

The HI is a measure of the potential for an adverse health effect from all of the COPCs combined. Different pollutants may cause different adverse health effects or act by different mechanisms of action; therefore, it is often inappropriate to sum HQs associated with different toxicological endpoints (USEPA, 2004a). When the HI exceeded a value of 1, the aggregate hazard from exposure to multiple COPCs was assessed by adding the individual HQs for COPCs that act by a similar mechanism of action or impact the same target organ for the critical effect (the result is called a Target Organ Specific Hazard Index or TOSHI). Unless otherwise noted, the HI's presented in this Section are the sums of all HQs for the COPCs identified. This calculation conservatively assumes that all of the COPCs have similarities in their mechanisms of action or target organs for the critical effect. The results of this TOSHI analysis will identify the both the toxicological endpoints on which the TOSHI was based and the COPCs that were included in the TOSHI.

In the risk discussion, the total cancer risk (Table 5.1-1) and HI (Table 5.1-2) were presented based on all COPCs selected. Also, the risk drivers were identified based on COPCs that exceed a cancer risk level of $1x10^{-6}$ or an HQ of 0.1. The use of risk drivers helps to focus the risk assessment on those COPCs with the greatest potential to impact human health. Using a HQ of 0.1 to screen out non-cancer risk drivers provides a means to identify COPCs that significantly may contribute to a HI that exceeds a value of 1, at which point, there is a potential for an adverse non-cancer health effect. Likewise, limiting risk drivers to chemicals that pose a cancer greater than $1x10^{-6}$ helps to focus attention on only the highest potential carcinogenic risks.

The 2 tables in Section 5 present the risk and hazard estimates for all compounds with quantitative toxicity estimates for the Wylam study. Table 5.1-1 provides the 95UCL cancer risk estimates for each chemical along with its percent contribution to the total risks. Tables 5.1-2 provides the 95UCL non-cancer HQs.

According to Table 5.1-1, the total 95UCL cancer risk for all chemicals is $1x10^{-4}$ (rounded to one significant digit, per EPA guidance) with Cr^{6+} contributing 94% of the risk (i.e., $1x10^{-4}$). The next highest risk contributor was arsenic at 4% of the risk ($6x10^{-6}$). The EPA (2005) WOE for Cr^{6+} was CH (carcinogenic to humans) while the arsenic EPA (1986) WOE was A (human carcinogen). The IARC WOE in both cases was 1 (carcinogenic to humans). The cancer IUR estimate for Cr^{6+} was from EPA's IRIS database while arsenic's IUR is from CAL EPA.

Per Table 5.1-2, the total 95UCL non-cancer HI was 0.5 (rounded to one significant digit, per EPA guidance). This HI was primarily due to manganese (0.21) followed by Cr^{6+} (0.10). The other chemicals were an order of magnitude lower. The primary target organ for Cr^{6+} is the respiratory system (similar to 4 out of 11 of the other chemicals). The confidence in the Cr^{6+} study was rated at medium (i.e., medium confidence in the RfC). Similarly, the target organ for manganese is the Neurological system (similar to three of the other chemicals) with medium confidence in the RfC.

5.2 Short-term Hazard Characterization

Non-cancer short-term health effects were estimated in much the same way as hazard assessments for non-cancer health effects. Maximum detected concentrations of each contaminant (CA_{max}) were compared to the associated short-term benchmark concentrations (AB) resulting in the calculation of hazard quotients ($HQ_{short\text{-}term}$):

$$HQ_{\text{short-term}} = \frac{CA_{\max}}{AB}$$

Equation 5-5

Note: Both CA_{max} and AB are expressed in the same units.

The acute toxicity characterizations were based on a comparison of the maximum detected concentrations for each COPC to its respective acute screening level. Similarly, sub-chronic screening levels or acute MRLs were utilized since they represent concentrations with no adverse effects associated with a 1- to 14-day exposure. The assessment of acute exposures is not as well developed as the chronic evaluation, leading to a relatively higher degree of uncertainty in the resulting hazard estimates. Nevertheless, HQs were calculated for each COPC.

The assessment of acute hazards is not as well developed as the chronic evaluation, leading to a relatively higher degree of uncertainty in the risk estimates. Nevertheless, HQs were calculated for each COPC.

Table 4.4-1 compares all short-term screening levels with their respective maximum concentrations for the study. There were no short-term HQs identified that alone or combined to result in a HI greater than 1.

5.3 Risk Characterization Summary

The risk assessment evaluated the potential for adverse human health impacts from acute, sub-chronic, and chronic exposures to COPCs selected at the monitoring location in Wylam, AL. All COPCs were detected in 98% to 100% of the valid samples collected and were thus retained for quantitative risk evaluation.

For the chronic risk assessment, risk estimates and hazards were calculated based on the 95UCL of the arithmetic mean and toxicity estimates. For the sub-chronic analysis, maximum concentrations per chemical were compared to acute MRLs while similarly, the acute analysis compared various acute screening levels to the maximum concentrations detected for each COPC.

The 95UCL risks generally approximated the 10^{-6} risk level except for Cr^{6+} whose risk was $1x10^{-4}$ (rounded to one significant figure, per EPA guidance) This risk was at the upper end of the EPA's acceptable risk range and represented 94% of the total risks for the monitor's data set. The only other chemicals to present with risks within the EPA risk range were arsenic ($6x10^{-6}$) and nickel ($1x10^{-6}$) (Table 5.1-1).

The total non-cancer 95UCL hazard index was 0.5, driven primarily by manganese (0.2) and Cr^{6+} (0.1) as provided in Table 5.1-2.

Therefore, no chronic non-carcinogenic concerns were identified during this study since all individual HQ's combined totaled 0.5 which was below the 1.0 Hazard Index threshold. (Table 5.1-2). No acute hazards were identified.

Additional chemical-specific toxicity information relative to the COPCs that represent the highest risks are provided in Appendix C.

6.0 UNCERTAINTY ASSESSMENT

This section identifies and characterizes the main sources of uncertainty in this risk evaluation. Beginning with general uncertainties associated with the risk assessment process and finally concluding with those associated with this study.

6.1 General Risk Assessment Process Uncertainties

In this section, separate discussions are provided on uncertainty associated with cancer potency factors and for noncancer reference values. Cancer potency values are derived for chronic (lifetime) exposures. Noncancer dose-response values are generally derived for chronic exposures (up to a lifetime) but may also be derived (per EPA definitions) for acute (less than 24-hours), short-term (from 24-hours up to 30-days), and sub-chronic (30-days up to 10 percent of lifetime) exposure durations, all of which are derived based on an assumption of continuous exposure throughout the duration specified. For the purposes of assessing all potential health risks associated with the emissions included in an assessment, both chronic (cancer and noncancer) and acute/short term (noncancer) dose-response values are described in more detail below.

Although every effort is made to identify peer-reviewed dose-response values for all COPCs identified in this assessment, some HAPs have no peer-reviewed values. Since exposures to these pollutants cannot be included in a quantitative risk estimate, an understatement of risk for these pollutants at estimated exposure levels is possible. To help alleviate this potential underestimation, where HAP similarity with a HAP for which a dose-response value is available, that existing value is used as a surrogate for the assessment of the HAP for which no value is available. It is noted that generally speaking, HAPs of greatest concern due to environmental exposures and hazards are those for which dose-response assessments have been performed, reducing the likelihood of understating risks. Further, HAPs not included in the quantitative assessment are assessed qualitatively and considered in the risk characterization that informs the risk management decisions.

Additionally, chronic dose-response values for certain compounds included in the assessment may be under EPA IRIS review. In those cases, revised assessments may determine in the future that these pollutants are more or less potent than currently thought.

6.1.1 Cancer Assessment Uncertainties

The discussion of dose-response uncertainties in the estimation of cancer risk below focuses on the uncertainties associated with the specific approach currently used by the EPA to develop cancer potency factors. In general, these same uncertainties attend the development of cancer potency factors by CalEPA, the source of peer-reviewed cancer potency factors used where EPA-developed values are not yet available. To place this discussion in context, a quote was provided from the EPA's *Guidelines for Carcinogen Risk Assessment* (herein referred to as *Cancer Guidelines,* see: USEPA, 2005a) "The primary goal of EPA actions is protection of human health; accordingly, as an Agency policy, risk assessment procedures, including default options that are used in the absence of scientific data to the contrary, should be health protective." The approach adopted in this document is consistent with this approach as described in the *Cancer Guidelines*.

For cancer endpoints, EPA usually derives an oral slope factor for ingestion and a unit risk value for inhalation exposures. These values allow estimation of a lifetime probability of potentially developing cancer given long-term exposures to the pollutant. Depending on the pollutant being evaluated, EPA relies on both animal bioassay and epidemiological studies to characterize cancer risk. As a science policy approach, consistent with the *Cancer Guidelines*, EPA uses animal cancer bioassays as indicators of potential human health risk when other human cancer risk data are unavailable.

Extrapolation of study data to estimate potential risks to human populations is based upon EPA's assessment of the scientific database for a pollutant using EPA's guidance documents and other peer-reviewed methodologies. The EPA *Cancer Guidelines* describe the Agency's recommendations for methodologies for cancer risk assessment. EPA believes that cancer risk estimates developed following the procedures described in the *Cancer Guidelines* and outlined below generally provide an upper bound estimate of risk. That is, EPA's upper bound estimates represent a plausible upper limit to the true value of a quantity (although this is usually not a true statistical confidence limit). In some circumstances, the true risk could be as low as zero; however, in other circumstances the risk could also be greater.[3] When developing an upper bound estimate of risk and to provide risk values that do not underestimate risk, EPA generally relies on conservative default approaches.[4] EPA also uses the upper bound (rather than lower bound or central tendency) estimates in its assessments, although it is noted that this approach can have limitations for some uses (e.g. priority setting, expected benefits analysis).

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[3] The exception to this is the URE for benzene, which is considered to cover a range of values, each end of which is considered to be equally plausible, and which is based on maximum likelihood estimates.

[4] According to the NRC report Science and Judgment in Risk Assessment (NRC, 1994) "[Default] options are generic approaches, based on general scientific knowledge and policy judgment, that are applied to various elements of the risk-assessment process when the correct scientific model is unknown or uncertain." The 1983 NRC report Risk Assessment in the Federal Government: Managing the Process defined default option as "the option chosen on the basis of risk assessment policy that appears to be the best choice in the absence of data to the contrary" (NRC, 1983, p. 63). Therefore, default options are not rules that bind the Agency; rather, the Agency may depart from them in evaluating the risks posed by a specific substance when it believes this to be appropriate. In keeping with EPA's goal of protecting public health and the environment, default assumptions are used to ensure that risk to chemicals is not underestimated (although defaults are not intended to overtly overestimate risk). See EPA, 2004b, An Examination of EPA Risk Assessment Principles and Practices, EPA/100/B-04/001.

Such health risk assessments have associated uncertainties, some of which may be considered quantitatively, and others which generally are expressed qualitatively. Uncertainties may vary substantially among cancer risk assessments associated with exposures to different pollutants, since the assessments employ different databases with different strengths and limitations and the procedures employed may differ in how well they represent actual biological processes for the assessed substance. Some of the major sources of uncertainty and variability in deriving cancer risk values are described more fully below.

(1) The qualitative similarities or differences between tumor responses observed in experimental animal bioassays and those which would occur in humans are a source of uncertainty in cancer risk assessments. In general, EPA does not assume that tumor sites observed in an experimental animal bioassay are necessarily predictive of the sites at which tumors would occur in humans.[5] However, unless scientific support is available to show otherwise, EPA assumes that tumors in animals are relevant in humans, regardless of target organ concordance. For a specific pollutant, qualitative differences in species responses can lead to either under-estimation or over-estimation of human cancer risks.

(2) Uncertainties regarding the most appropriate dose metric for an assessment can also lead to differences in risk predictions. For example, the measure of dose is commonly expressed in units of mg/kg/d ingested or the inhaled concentration of the pollutant. However, data may support development of a pharmacokinetic model for the absorption, distribution, metabolism, and excretion of an agent, which may result in improved dose metrics (e.g., average blood concentration of the pollutant or the quantity of agent metabolized in the body). Quantitative uncertainties result when the appropriate choice of a dose metric is uncertain or when dose metric estimates are themselves uncertain (e.g., as can occur when alternative pharmacokinetic models are available for a compound). Uncertainty in dose estimates may lead to either over or underestimation of risk.

(3) For the quantitative extrapolation of cancer risk estimates from experimental animals to humans, EPA uses scaling methodologies (relating expected response to differences in physical size of the species), which introduce another source of uncertainty. These methodologies are based on both biological data on differences in rates of process according to species size and empirical comparisons of toxicity between experimental animals and humans. For a particular pollutant, the quantitative difference in cancer potency between experimental animals and humans may be either greater

[5] Per the EPA Cancer Guidelines: “The default option is that positive effects in animal cancer studies indicate that the agent under study can have carcinogenic potential in humans.” and “Target organ concordance is not a prerequisite for evaluating the implications of animal study results for humans.”

than or less than that estimated by baseline scientific scaling predictions due to uncertainties associated with limitations in the test data and the correctness of scaled estimates.

(4) EPA cancer risk estimates, whether based on epidemiological or experimental animal data, are generally developed using a benchmark dose (BMD) analysis to estimate a dose at which there is a specified excess risk of cancer, which is used as the point of departure (or POD) for the remainder of the calculation. Statistical uncertainty in developing a POD using a benchmark dose (BMD) approach is generally addressed though use of the 95 percent lower confidence limit on the dose at which the specified excess risk occurs (the BMDL), decreasing the likelihood of understating risk. EPA has generally utilized the multistage model for estimation of the BMDL using cancer bioassay data (see further discussion below).

(5) Extrapolation from high to low doses is an important source of uncertainty in cancer risk assessment. EPA uses different approaches to low dose risk assessment (i.e., developing estimates of risk for exposures to environmental doses of an agent from observations in experimental or epidemiological studies at higher dose) depending on the available data and understanding of a pollutant's mode of action (i.e., the manner in which a pollutant causes cancer). EPA's *Cancer Guidelines* express a preference for the use of reliable, compound-specific, biologically based risk models when feasible; however, such models are rarely available. The mode of action for a pollutant (i.e., the manner in which a pollutant causes cancer) is a key consideration in determining how risks should be estimated for low-dose exposure. A reference value is calculated when the available mode of action data shows the response to be nonlinear (e.g., as in a threshold response). A linear low-dose (straight line from POD) approach is used when available mode of action data supports a linear (e.g., non-threshold) response or as the most common default approach when a compound's mode of action is unknown. Linear extrapolation can be supported by both pollutant-specific data and broader scientific considerations. For example, EPA's *Cancer Guidelines* generally consider a linear dose-response to be appropriate for pollutants that interact with DNA and induce mutations. Pollutants whose effects are additive to background biological processes in cancer development can also be predicted to have low-dose linear responses, although the slope of this relationship may not be the same as the slope estimated by the straight-line approach.

EPA most frequently utilizes a linear low-dose extrapolation approach as a baseline science-policy choice (a "default") when available data do not allow a compound-specific determination. This approach is designed to not underestimate risk in the face of uncertainty and variability. EPA believes that linear dose-response models, when appropriately applied as part of EPA's cancer risk assessment process, provide an upper bound estimate of risk and generally provide a health protective approach. Note that another source of uncertainty is the characterization of low-dose nonlinear, non-threshold relationships. The National Academy of Sciences (NAS, 1994) has encouraged the exploration of sigmoidal type functions (e.g., log-probit models) in representing dose-response relationships due to the variability in response within human populations. Another National Research Council report (NRC, 2006) suggests that models based on distributions of individual thresholds are likely to lead to sigmoidal-shaped dose-response functions for a population. This report notes sources of variability in the human population: "One might expect these individual tolerances to vary extensively in humans depending on genetics, coincident exposures, nutritional status, and various other susceptibility factors..."   Thus, if a distribution of thresholds approach is considered for a carcinogen risk assessment, application would depend on ability of modeling to reflect the degree of variability in response in human populations (as opposed to responses in bioassays with genetically more uniform rodents). Note also that low dose linearity in risk can arise for reasons separate from population variability: due to the nature of a mode of action and additivity of a chemical's effect on top of background chemical exposures and biological processes.

As noted above, EPA's current approach to cancer risk assessment typically utilizes a straight-line approach from the BMDL. This is equivalent to using an upper confidence limit on the slope of the straight-line extrapolation. The impact of the choice of the BMDL on bottom line risk estimates can be quantified by comparing risk estimates using the BMDL value to central estimate BMD values, although these differences are generally not a large contributor to uncertainty in risk assessment (Subramaniam, et al., 2006). It is important to note that earlier EPA assessments, including the majority of those for which risk values exist today, were generally developed using the multistage model to extrapolate down to environmental dose levels and did not involve the use of a POD. Subramaniam et. al. (2006) also provide comparisons indicating that slopes based on straight line extrapolation from a POD do not show large differences from those based on the upper confidence limit of the multistage model.

(6) Cancer risk estimates do not generally make specific adjustments to reflect the variability in response within the human population — resulting in another source of uncertainty in assessments. In the diverse human population, some individuals are likely to be more sensitive to the action of a carcinogen than the typical individual, although compound-specific data to evaluate this variability are generally not available. There may also be important life stage differences in the quantitative potency of carcinogens and, with the exception of the recommendations in EPA's Supplemental Cancer Guidance for carcinogens with a mutagenic mode of action, risk assessments do not generally quantitatively address life stage differences. However, one approach used commonly in EPA assessments that may help address variability in response is to extrapolate human response from results observed in the most sensitive species and sex tested, resulting

typically in the highest URE which can be supported by reliable data, thus supporting estimates that are designed not to underestimate risk in the face of uncertainty and variability.

6.1.2 Chronic non-Cancer Assessment Uncertainties

Chronic noncancer reference values represent chronic exposure levels that are intended to be health protective. That is, EPA and other organizations, such as the Agency for Toxic substances and disease Registry (ATSDR), which develop noncancer dose-response values use an approach that is intended not to underestimate risk in the face of uncertainty and variability. When there are gaps in the available information, uncertainty factors (UFs) are applied to derive reference values that are intended to be protective against appreciable risk of deleterious effects. Uncertainty factors are commonly default values[6] (e.g., factors of 10 or 3) used in the absence of compound-specific data. Where data are available, uncertainty factors may also be developed using compound-specific information. When data are limited, more assumptions are needed, and more default factors are used. Thus, there may be a greater tendency to overestimate risk—in the sense that further study might support development of reference values that are higher (i.e., less potent) because fewer default assumptions are needed. However, for some pollutants it is possible that risks may be underestimated.

For noncancer endpoints related to chronic exposures, EPA derives a reference dose (RfD) for exposures via ingestion, and a reference concentration (RfC) for inhalation exposures. As stated in the IRIS Glossary, these values provide an estimate (with uncertainty spanning perhaps an order of magnitude) of daily oral exposure (RfD) or of a continuous inhalation exposure (RfC) to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime. To derive values that are intended to be "without appreciable risk," EPA's methodology relies upon an uncertainty factor (UF) approach (USEPA, 1993, and USEPA, 1994) which includes consideration of both uncertainty and variability.

EPA begins by evaluating all of the available peer-reviewed literature to determine noncancer endpoints of concern, evaluating the quality, strengths and limitations of the available studies. EPA typically chooses the relevant endpoint that occurs at the lowest dose, often using statistical modeling of the available data, and then determines the appropriate POD for derivation of the reference value. A POD is determined by (in order of preference): (1) a statistical estimation using the BMD approach; (2) use of the dose or concentration at which the toxic response was not significantly elevated (no observed adverse effect level - NOAEL); or (3) use of the lowest observed adverse effect level (LOAEL).

A series of downward adjustments using default UFs is then applied to the POD to estimate the reference value (USEPA, 2002c). While collectively termed “UFs”, these factors account for a number of different quantitative considerations when utilizing observed animal (usually rodent) or human toxicity data in a risk assessment. The UFs are intended to account for: (1) variation in susceptibility among the members of the human population (i.e., inter-individual variability); (2) uncertainty in extrapolating from experimental animal data to humans (i.e., interspecies differences); (3) uncertainty in extrapolating from data obtained in a study with less-than-lifetime exposure (i.e., extrapolating from sub-chronic to chronic exposure); (4) uncertainty in extrapolating from a LOAEL in the absence of a NOAEL; and (5) uncertainty when the database is incomplete or there are problems with applicability of available studies. When scientifically sound, peer-reviewed assessment-specific data are not available, default adjustment values are selected for the individual UFs. For each type of uncertainty (when relevant to the assessment), EPA typically applies an UF value of 10 or 3 with the cumulative UF value leading to a downward adjustment of 10- to 3000-fold from the selected POD. An UF of 3 is used when the data do not support the use of a 10-fold factor. If an extrapolation step or adjustment is not relevant to an assessment (e.g., if applying human toxicity data and an interspecies extrapolation is not required) the associated UF is not used. The major adjustment steps are described more fully below.

(1) Heterogeneity among humans is a key source of variability as well as uncertainty. Uncertainty related to human variation is considered in extrapolating doses from a subset or smaller-sized population, often of one sex or of a narrow range of life stages (typical of occupational epidemiologic studies), to a larger, more diverse population. In the absence of pollutant-specific data on human variation, a 10-fold UF is used to account for uncertainty associated with human variation. Human variation may be larger or smaller; however, data to examine the potential magnitude of human variability are often unavailable. In some situations, a smaller UF of 3 may be applied to reflect a known lack of significant variability among humans.

(2) Extrapolation from results of studies in experimental animals to humans is a necessary step for the majority of chemical risk assessments. When interpreting animal data, the concentration at the POD (e.g., NOAEL, BMDL) in an animal model (e.g., rodents) is extrapolated to estimate the human response. While there is long-standing scientific support for the use of animal studies as indicators of potential toxicity to humans, there are uncertainties in such extrapolations. In the absence of data to the contrary, the typical approach is to use the most relevant endpoint from the most sensitive species and the most sensitive sex in assessing risks to the average human. Typically, compound specific data to evaluate relative sensitivity in humans versus rodents are lacking, thus leading to uncertainty in this extrapolation. Size-related differences (allometric relationships) indicate that typically humans are more sensitive than rodents when compared on a mg/kg/day basis. The default choice of 10 for the interspecies UF is consistent with these

differences. For a specific chemical, differences in species responses may be greater or less than this value.

Pharmacokinetic models are useful to examine species differences in pharmacokinetic processing and associated uncertainties; however, such dosimetric adjustments are not always possible. Information may not be available to quantitatively assess toxicokinetic or toxicodynamic differences between animals and humans, and in many cases a 10-fold UF (with separate factors of 3 for toxicokinetic and toxicodynamic components) is used to account for expected species differences and associated uncertainty in extrapolating from laboratory animals to humans in the derivation of a reference value. If information on one or the other of these components is available and accounted for in the cross-species extrapolation, a UF of 3 may be used for the remaining component.

(3) In the case of reference values for chronic exposures where only data from shorter durations are available (e.g., 90-day sub-chronic studies in rodents) or when such data are judged more appropriate for development of an RfC, an additional UF of 3- or 10-fold is typically applied unless the available scientific information supports use of a different value.

(4) Toxicity data are typically limited as to the dose or exposure levels that have been tested in individual studies; in an animal study, for example, treatment groups may differ in exposure by up to an order of magnitude. The preferred approach to arrive at a POD is to use BMD analysis; however, this approach requires adequate quantitative results for a meaningful analysis, which is not always possible. Use of a NOAEL is the next preferred approach after BMD analysis in determining a POD for deriving a health effect reference value. However, many studies lack a dose or exposure level at which an adverse effect is not observed (i.e., a NOAEL is not identified). When using data limited to a LOAEL, a UF of 10- or 3-fold is often applied.

(5) The database UF is intended to account for the potential for deriving an under-protective RfD/RfC due to a data gap preventing complete characterization of the chemical’s toxicity. In the absence of studies for a known or suspected endpoint of concern, a UF of 10- or 3-fold is typically applied.

6.1.3 Acute non-Cancer Assessment Uncertainties

Many of the UFs used to account for variability and uncertainty in the development of acute reference values are quite similar to those developed for chronic durations. For acute reference values, though, individual UF values may be less than 10. UFs are applied based on chemical- or health effect-specific information or based on the purpose of the reference value. The UFs applied in acute reference value derivation include: 1) heterogeneity among humans; 2) uncertainty in extrapolating from animals to humans; 3) uncertainty in LOAEL to NOAEL adjustments; and 4) uncertainty in accounting for an incomplete database on toxic effects of potential concern. Additional adjustments are often applied to account for uncertainty in extrapolation from observations at one exposure duration (e.g., 4 hours) to arrive at a POD for derivation of an acute reference value at another exposure duration (e.g., 1-hour).

Not all acute dose-response values are developed for the same purpose and care must be taken when interpreting the results of an acute assessment of human health effects relative to the reference value or values being exceeded. Where relevant to the estimated exposures, the lack of dose-response values at different levels of severity should be factored into the risk characterization as potential uncertainties.

6.2 Wylam Risk Assessment Study Uncertainties

This section identifies and characterizes the main sources of uncertainty in the Wylam risk assessment. It is important to recognize that this assessment of uncertainty is primarily qualitative.

This study did not seek to address particle size distribution. For health risk assessment purposes, particle size is important as the aerodynamic size and associated composition of particles also determine their behavior in the human respiratory system (USEPA, 1996). However, only TSP samples were collected and there was no analysis performed to determine what portion of the samples were respirable. As such, the risks presented may be overestimated if a significant portion of the measured PM is due to large, less inhalable, particles. This study also did not seek to establish measured background concentrations for the COPCs in the study area; thus, it is not known to what extent background concentrations play in the estimated risk values. Last of all, note that “acute” may denote exposure times varying from a few minutes to two weeks. The time frame for the value is critical because the safe dose (or the dose that produces some defined effect) may vary substantially with the length of exposure. For this study, short-term exposures were separated into two categories, First, “acute” exposures were categorized as ranging up to 24-hours. This was followed by “sub-chronic” exposures which ranged from 1- to 14-days. The latter of which could have been divided into “short-term” (from 24-hours up to 30-days) and “sub-chronic” (30-days up to 1-year). However, the term “sub-chronic” was selected to roughly coincide with ATSDR’s acute MRL.

6.2.1 Specific Metal Toxicity Assessment Uncertainties

The uncertainties associated with several of the metals identifies in this study are provided below.

1) This assessment used Nickel Sulfide as a conservative surrogate IUR for the total Nickel detected in the samples, resulting in a corresponding risk level of $6x10^{-6}$. Speciation sampling was not available to identify the actual

form of nickel present and thus this conservative approach may cause the study's risks to be higher than the true risk.

2) Antimony was identified in this sampling study, but toxicity information is not available. Nevertheless, for the purposes of this study, Antimony Trioxide was used as a surrogate since it is the only form of Antimony that is toxic (RfC = 0.2 μg/m^3). This approach is conservative and may cause the study's hazard index to be higher than the true hazard index.
3) Lead was analyzed in this risk assessment using its RfC which is based on the National Ambient Air Quality Standard which is a rolling 3-month average of 0.15 μg/m^3. OAQPS provides this RfC in its Table 1. It is noted that lead is considered a B2 carcinogen by EPA and 2B by IARC although an IUR value is not available.
4) Arsenic risks were above the 10^{-6} level. Nevertheless, urban background levels may be an important contributor to measured concentrations (ATSDR, 2007).
5) Chemicals without toxicity estimates for cancer and non-cancer endpoints were identified in this study and thus corresponding risks and/or hazards could not be estimated. In a few instances (as described above), the toxicity values for a surrogate chemical were used to estimate risks. The use of surrogates may cause an over- or under-estimation in the calculated risks/hazards.

6.2.2 Sampling, Analytical, and Potential Exposure Uncertainties

Sampling errors were entered into the Air Quality System database but were then caveated or flagged and, in certain instances, were omitted from the risk assessment. Also, sampling data were collected on a modified 1- in 3-day schedule with no samples collected on weekends for logistical reasons. Sampling data reported as "Not Detected" (ND) were carried through the risk assessment at a surrogate concentration equaling ½ the sample quantitation limit (see footnote 1 above). It is unknown how the missing weekend data affect the risk estimates.

It is important to note that this risk assessment only evaluated air concentrations of metals at the Wylam monitor site. As one moves away from the monitor, concentrations may change (either higher or lower).

7.0 SUMMARY FINDINGS

The purpose of this study was to determine the level to which Wylam, AL residents were being exposed to Cr^{6+} concentrations in ambient air and the risks that those exposures may pose. Additionally, other metals were also examined for potential contributions to the risks/hazards within the study area.

Hexavalent chromium levels ranged from just above the detection limit (0.0000055 µg/m^3) to 0.044 µg/m^3, was present in 98% of the samples, and was estimated to make up 9% of the total chromium measured. The ProUCL 95UCL was 0.0102 µg/m^3 based on a lognormal distribution.

According to the chronic cancer assessment, the total risk was $1x10^{-4}$ (rounded to one significant digit, per EPA guidance) The other carcinogenic chemicals associated with the study were all in the 10^{-6} risk range or lower. Thus, hexavalent chromium represented >94% of the risks. This means that, for every 1,000,000 people exposed at the levels measured at the monitor, up to 100 *might* develop cancer over their lifetime. The calculated risks are *in excess* of a person's chance of developing cancer for reasons *other than* the chemical exposures being evaluated. In general, EPA considers excess cancer risks for HAPs that are at or below 100-in-1million to be in the range of acceptability.

The non-cancer assessment showed that non-carcinogens approximated a hazard index (HI) of 0.5. The highest hazard quotient was associated with manganese (0.2) followed by hexavalent chromium (0.1). An HI equal to or less than 1 indicates that noncancer effects are not likely to occur. Since the HI was less than 1, further target organ-specific hazard index (TOSHI) analyses were not developed.

The acute analysis compared each chemical's maximum concentration to its corresponding acute benchmark and found that acute effects were not expected.

With any assessment, there are limitations. The risk estimates provided here are based on 12 months of metal HAP monitoring data collected at one monitoring site. The monitor was sited at the CSN site due to the past elevated historical total chromium concentrations at that location. For the purpose of this assessment, it was assumed that metal HAP concentrations measured at the monitor were representative of potential public exposure concentrations and that the measured metal HAP concentrations were representative of metal HAP concentrations that would be stable for daily exposure over many years.

Hexavalent chromium is a hazardous air pollutant (HAP) regulated under the Clean Air Act (CAA). Generally, large industrial sources of HAPs (and some small sources) are regulated under the CAA. The source(s) of, and their contribution to, the measured hexavalent chromium at the Wylam monitor is not known with certainty.

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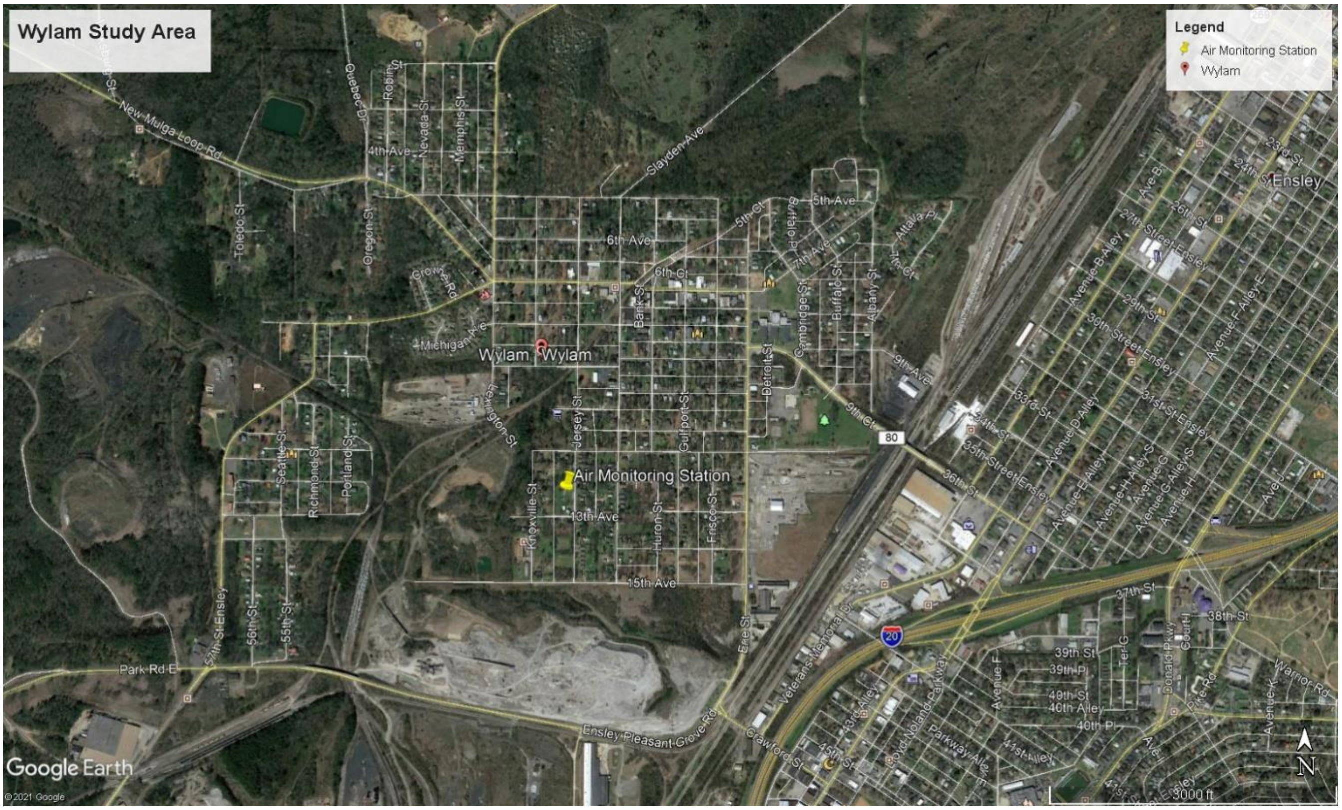
9.0 GLOSSARY

95UCL	95^{th} Percentile Upper Confidence Limit on the Mean
ADAF	Age-dependent Adjustment Factor
AEGLs	Acute Exposure Guidance Levels
AQS	Air Quality System
As	Arsenic
ATSDR	Agency for Toxic Substances and Disease Registry
Be	Beryllium
BW	Body Weight
CARD	Cardiovascular effects
CAS	Chemical Abstract Service
Cd	Cadmium
Co	Cobalt
COC	Chemicals of Concern
COPCs	Chemicals of Potential Concern
CPS_o	Oral Cancer Potency Slope
Cr	Chromium
Cr^{6+}	Hexavalent Chromium
CSN	Chemical Speciation Network
DEV	Developmental Effects
EC	Exposure Concentration
EPA	Region 4 U.S. Environmental Protection Agency
ERPGs	Emergency Response Planning Guidelines
HAP	Hazardous Air Pollutant
HCl	Hydrochloric Acid
HEAST	Health Effects Assessment Summary Table
HEM	Hematological Effect
HEP	Hepatic Effect
Hg	Mercury
HI	Hazard Index
HQ	Hazard Quotient
IARC	International Agency for Research on Cancer
IMM	Immunological Effect
IR	Inhalation Rate
JCDH	Jefferson County Department of Health
MMOA	Mutagenic Mode of Action
Mn	Manganese
MRLs	Minimum Risk Levels

NEI	National Exposure Inventory
NEUR	Neurological Effect
Ni	Nickel
OAQPS	Office of Air Quality, Planning and Standards
Pb	Lead
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RELs	Reference Exposure Levels
RfC	Reference Concentration
RfD_o	Oral Reference Dose
RME	Reasonable Maximum Exposure
RPR	Reproductive Effect
RSP	Respiratory Effect
Sb	Antimony
Se	Selenium
SQL	Sample Quantitation Limit
STN	Speciation Trend Network
TICs	Tentatively Identified Compounds
TOSHI	Target Organ Specific Hazard Index
TRI	Toxic Release Inventory
UCL	Upper Confidence Limit
URE	Unit Risk Estimate
USEPA-R4	US Environmental Protection Agency - Region 4
WOE	Weight of Evidence

Figures
Wylam, AL Hexavalent Chromium Study

Figure 1. Location of Wylam Air Monitor



Wylam, AL Hexavalent Chromium Study
Tables

Table 1.2-1. 2018 Census Estimates for Wylam, AL (Zip Code 35224)

Wylam Census Overview

Population Component	Persons
Total Population	5168
Male	2549
Female	2619

Wylam Age Overview

Age Group	Persons (Percentage)
Under 5 years	383 (7.4%)
5 to 9 years	275 (5.3%)
10 to 14 years	297 (5.7%)
15 to 19 years	256 (5.0%)
20 to 54 years	2,505 (48.5%)
55 to 59 years	352 (6.8%)
60 to 64 years	484 (9.4%)
65 to 74 years	381 (7.4%)
75 to 84 years	166 (3.2%)
85 years and over	69 (1.3%)
Median age (years)	38.8

Wylam Educational Overview

Education Level	Persons
Kindergarten	127
Elementary Schhol Grades 1-4	143
Elementary Schhol Grades 5-8	246
High School Grades 9-12	196
College Undergraduate	201
Population 5-9 yrs old (Enrolled in school)	275 (257)
Population 10-14 yrs old (Enrolled in school)	297 (288)
Population 15-17 yrs old (Enrolled in school)	176 (167)
Population 18-19 yrs old (Enrolled in school)	80 (41)
Population 20-24 yrs old (Enrolled in school)	445 (59)
Population 25-34 yrs old (Enrolled in school)	666 (37)
Population 35 and over (Enrolled in school)	2846 (130)
Pop 18-24 (Enrolled in College or Grad School)	525 (100)
White High School Graduate	993
White Bachelor's Degree	122
Black High School Graduate	2080
Black Bachelor's Degree	220

Wylam Racial Overview

Race	Persons (Percentage)
White	1,914 (37.0%)
Black or African American	3,192 (61.8%)
American Indian and Alaska Native	11 (0.2%)
Chinese	19 (0.4%)
Hispanic or Latino	19 (0.4%)
Some other race	13 (0.3%)

Wylam Income Overview

Income Range	Households (Percentage)
Households Total Less than $10,000	243 (11.7%)
Households Total $10,000 to $14,999	210 (10.1%)
Households Total $15,000 to $24,999	391 (18.8%)
Households Total $25,000 to $34,999	204 (9.8%)
Households Total $35,000 to $49,999	374 (18%)
Households Total $50,000 to $74,999	383 (18.4%)
Households Total $75,000 to $99,999	170 (8.2%)
Households Total $100,000 to $149,999	73 (3.5%)
Households Total $150,000 to $199,999	29 (1.4%)
Households Total $200,000 or more	0 (0%)

Wylam Income Overview

Family/Household Characteristics	Income Level (dollars)
Median Household Income (dollars)	35346
Mean Household Income (dollars)	40702
Mean Families Income (dollars)	40702
Median Families Income (dollars)	42407
Nonfamily Households Mean Income (dollars)	26457
Persons in Poverty (percent)	25% vs 11.8% in US

The data provided are estimates for 2018 from the United States Census Bureau. The data is based on Wylam, AL's zip code (35224). See: https://data.census.gov/cedsci/

Table 2.9-1. Chemicals Detected During the Wylam, AL Special Air Sampling Study

Chemical	CAS	Detection Frequency (>10%)	Range of Detected Concentrations (µg/m^3)	Median Conc. µg/m	Average Conc. µg/m^3	Standard Deviation
Hexavalent Chromium	18540-29-9	79/81 or 98%	0.0000055 - 0.044	0.00023	0.0025	0.00075
Arsenic	7440-38-2	80/80 or 100%	0.00021 - 0.017	0.0011	0.0014	0.00021
Nickel	12035-72-2	80/80 or 100%	0.00027 - 0.021	0.0015	0.0021	0.00031
Cadmium	7440-43-9	80/80 or 100%	0.000027 - 0.0015	0.00010	0.00013	0.00002
Beryllium	7440-41-7	80/80 or 100%	0.0000026 - 0.0001	0.000014	0.000019	0.000018
Manganese	7439-96-5	80/80 or 100%	0.00202 - 0.27	0.032	0.052	0.056
Lead	7439-92-1	80/80 or 100%	0.00047 - 0.026	0.0029	0.0036	0.00039
Antimony	1309-64-4	80/80 or 100%	0.00025 - 0.0044	0.00090	0.0013	0.00011
Cobalt	7440-48-4	80/80 or 100%	0.000025 - 0.00099	0.00014	0.00017	0.00014
Mercury	7439-97-6	80/80 or 100%	0.0000063 - 0.000048	0.000015	0.000018	0.0000089
Selenium	7782-49-2	80/80 or 100%	0.00011 - 0.0011	0.00039	0.00042	0.00020
Chromium	16065-83-1	80/80 or 100%	0.0014 - 0.3	0.0091	0.028	0.005

Data provided by Eastern Research Group per analysis of samples taken by Jefferson County Department of Public Health from April through April, 2018-2019. Frequency Detected excludes "Non-detects" and "Invalid" Samples. ProUCL v 5.1.002 was utilized to calculate the 95% Upper Confidence on the Mean concentrations as well as Standard Deviations, Medians, and Averages of valid samples.

Table 3.1-1. Chemicals of Potential Concern Identification and Exposure Point Concentration Determination for the Wylam, AL Air Sampling Study

Chemical	CAS	Detection Frequency (>10%)	Range of Detected Concentrations (µg/m^3)	Average Conc. µg/m^3	95% UCL (Lognormal Dist.) Conc. µg/m^3	ProUCL Suggested 95% UCL Distribution for the Detected Chemicals	Chemical of Potential Concern
Hexavalent Chromium	18540-29-9	79/81 or 98%	0.0000055 - 0.044	0.0025	0.010	95% H-UCL	X
Arsenic	7440-38-2	80/80 or 100%	0.00021 - 0.017	0.0014	0.0014	95% H-UCL	X
Nickel	12035-72-2	80/80 or 100%	0.00027 - 0.021	0.0021	0.0025	95% H-UCL	X
Cadmium	7440-43-9	80/80 or 100%	0.000027 - 0.0015	0.00013	0.00014	95% H-UCL	X
Beryllium	7440-41-7	80/80 or 100%	0.0000026 - 0.0001	0.000019	0.000022	95% Approximate Gamma UCL	X
Manganese	7439-96-5	80/80 or 100%	0.00202 - 0.27	0.0524	0.064	95% Approximate Gamma UCL	X
Lead	7439-92-1	80/80 or 100%	0.00047 - 0.026	0.0036	0.0041	95% H-UCL	X
Antimony	1309-64-4	80/80 or 100%	0.00025 - 0.0044	0.0013	0.0018	95% Chebyshev (Mean, Sd) UCL	X
Cobalt	7440-48-4	80/80 or 100%	0.000025 - 0.00099	0.00017	0.00019	95% Approximate Gamma UCL	X
Mercury	7439-97-6	80/80 or 100%	0.0000063 - 0.000048	0.000018	0.000019	95% Approximate Gamma UCL	X
Selenium	7782-49-2	80/80 or 100%	0.00011 - 0.0011	0.00042	0.00046	95% Student's-t UCL	X

Chemical concentration data were obtained from Eastern Research Group (ERG) and reflect data collected by Jefferson County Department of Public Health. The 95 percentile Upper Confidence Limits for the mean per chemical, Distribution for the Detected Chemicals, and Median Concentrations were calculated using ProUCL (see: https://www.epa.gov/land-research/proucl-software). If a chemical was "Not Detected", 1/2 detection limit was assumed for the chemical on that day. The "Chemicals of Potential Concern" column indicates (X) that the chemical was retained because it was detected above detection limit in at least 10% of the samples.

Table 4.1-1. Chemicals Deleted from the Chemicals of Potential Concern Due to a Lack of Toxicity Estimates for the Wylam, AL Air Sampling Study

Chemical	CAS	Detection Frequency (>10%)	Range of Detected Concs. ($\mu g/m^3$)	Average Conc. ($\mu g/m^3$)	95% UCL (Lognormal Distribution) Conc. $\mu g/m^3$	95 UCL Distribution Statistic (Lognormal Distribution)
Chromium	16065-83-1	80/80 or 100%	0.0014 - 0.3	0.027	0.040	95% H-UCL

Chromium will be evaluated in the Uncertainty Section because although it was detected in 93% of the samples, it does not have toxicity estimates.

Table 4.1.1-1. Chronic Dose-Response Toxicity Values for the Wylam, AL Chemicals of Potential Concern

Chemical	CAS	95% UCL (Lognormal Distribution) µg/m^3	Median Conc. µg/m^3	IUR (1/µg/m^3)	EPA WOE	Source	IARC WOE	RfC (µg/m^3)	Source
Hexavalent Chromium	18540-29-9	0.010	0.00023	0.012	CH	IRIS	1	0.1	IRIS
Arsenic	7440-38-2	0.0014	0.0011	0.0043	A	CAL	1	0.015	CAL
*Nickel**	12035-72-2	0.0025	0.0015	0.00048	A	IRIS		0.09	ATSDR
Cadmium	7440-43-9	0.00014	0.00010	0.0018	B1	IRIS	1	0.01	ATSDR
Beryllium	7440-41-7	0.000022	0.000014	0.0024	LH	IRIS	1	0.02	IRIS
Manganese	7439-96-5	0.064	0.032					0.3	ATSDR
*Lead**	7439-92-1	0.0041	0.0029					0.15	NAAQS
*Antimony**	1309-64-4	0.0018	0.00090					0.2	IRIS
Cobalt	7440-48-4	0.00019	0.00014					0.1	ATSDR
Mercury	7439-97-6	0.000019	0.000015					0.3	IRIS
Selenium	7782-49-2	0.00046	0.00039					20	CAL

*For risk assessment purposes, note that *Antimony* levels are evaluated, and Antimony Trioxide was used as a surrogate. The non-cancer Reference Concentration (RfC) for *Lead* is based on the Lead National Ambient Air Quality Standard which is a rolling 3-month average of 150 ng/m^3. The Inhalation Unit Risk (IUR) for *Nickel* is based the IUR for Nickel Subsulfide and the RfC is from Nickel Compounds.

The cancer Inhalation Unit Risk (IUR: gray column) values were acquired from the Office of Air Quality Planning and Standards (Table 1). IARC WOE = weight-of-evidence for carcinogenicity in humans (1 - carcinogenic; 2A – probably carcinogenic; 2B - possibly carcinogenic; 3 - not classifiable; 4 - probably not carcinogenic). EPA WOE using the 1986 guidelines (as superseded for specific compounds by the 1999 interim guidelines): A - human carcinogen; B1 - probable carcinogen, limited human evidence; B2 - probable carcinogen, sufficient evidence in animals; C - possible human carcinogen; D - not classifiable E - evidence of non-carcinogenicity. EPA WOE using the 1999 guidelines: CH - carcinogenic to humans; LH - likely to be carcinogenic; SE - suggestive evidence for carcinogenicity; InI - inadequate information to determine carcinogenicity; NH - not likely to be carcinogenic). Source: Office of Air Quality, Planning and Standards, Table 1, see http://www2.epa.gov/fera/dose-response-assessment-assessing-health-risks-associated-exposure-hazardous-air-pollutants. Abbreviations: IRIS = Integrated Risk Information System, CAL=California EPA, ATSDR=Agency for Toxic Substances and Disease Registry, and NAAQS=National Ambient Air Quality Standard.

Table 4.4-1. Short-term Dose-Response Concentrations for the Wylam, AL Chemicals of Potential Concern

Chemical	CAS	Max. Conc. µg/m³	AEGL-1 (1-h) µg/m³	source	AEGL-1 (8-h) µg/m³	source	AEGL-2 (1-h) µg/m³	source	AEGL-2 (8-h) µg/m³	source	ERPG-1 µg/m³	ERPG-2 µg/m³	sub-Chronic Screening Levels µg/m³	REL µg/m³	IDLH/10 µg/m³	TEEL-0 µg/m³	TEEL-1 µg/m³	Final Acute Screening Level (µg/m³)	Max. Conc. > Acute?
Hexavalent Chromium	18540-29-9	0.044													1500			**1500**	
Arsenic	7440-38-2	0.017												0.2	500			**0.2**	
Nickel	7440-02-0	0.021												6	1000			**6**	
Cadmium	7440-43-9	0.0015											**0.03**		900			**0.03**	
Beryllium	7440-41-7	0.00010										25			400			**25**	
Manganese	7439-96-5	0.27													50000			**50000**	
Lead	7439-92-1	0.026													10000			**10000**	
Antimony	7440-36-0	0.0044													5000			**5000**	
Cobalt	7440-48-4	0.0010													2000			**2000**	
Mercury	7439-97-6	0.000048				i	1700	i	330	i		2000		0.6				**0.6**	
Selenium	7782-49-2	0.0011													100			**100**	

Short-term Toxicity Dose-Response Values for Screening Risk Assessments (9/18/2014). AEGL = Acute exposure guideline levels for mild effects (AEGL-1) and moderate effects (AEGL-2) for 1- and 8-hour exposures. Source abbreviations indicate the AEGL's status: f = final, i=interim, and p=proposed. ERPG = US DOE Emergency Removal Program guidelines for mild or transient effects (ERPG-1) and irreversible or serious effects (ERPG-2) for 1-hour exposures. Acute MRL (aka sub-chronic) = ATSDR minimum risk levels for no adverse effects for 1 to 14-day exposures. REL = California EPA reference exposure level for no adverse effects. Most, but not all, RELs are for 1-hour exposures. IDLH/10 = One-tenth of levels determined by NIOSH to be imminently dangerous to life and health, approximately comparable to mild effects levels for 1-hour exposures. Source: Office of Air Quality Planning and Standards, see http://www2.epa.gov/fera/sources-acute-dose-response-information. The "Max. > Acute?" column would identify instances where the maximum concentration detected exceeds any of its corresponding acute exposure guidelines. See Air Toxics Risk Assessment Reference Library Volume 1, pages 12-26 through 12-30.

Table 5.1-1. Chronic Cancer Risks for the Wylam, AL Air Chemicals of Potential Concern

Chemical	CAS	IUR (1/µg/m³)	EPA WOE	Source	IARC WOE	Median Concentration µg/m³	95% UCL (Lognormal Distrubution) µg/m³	95% UCL (Lognormal Distrubution) Risk	% of Total Max Risk (>1%)	Accum. Total Risks (<96%)	10^{-6} Screening Conc. µg/m³	95% UCL Exceeds Screen? (Fail)
Hexavalent Chromium	18540-29-9	0.012	CH	IRIS	1	**0.00023**	0.010	1.2E-04	**94.10%**	94.10%	0.0000083	**Fail**
Arsenic	7440-38-2	0.0043	A	CAL	1	**0.0011**	0.0014	6.0E-06	**4.72%**	98.82%	0.0002	**Fail**
*Nickel**	12035-72-2	0.00048	A	IRIS		**0.0015**	0.0025	1.2E-06	**0.94%**	99.76%	0.0021	**Fail**
Cadmium	7440-43-9	0.0018	B1	IRIS	1	**0.00010**	0.00014	2.5E-07	**0.20%**	99.96%	0.0006	
Beryllium	7440-41-7	0.0024	LH	IRIS	1	**0.000014**	0.000022	5.3E-08	**0.04%**	100.00%	0.0004	
							Total	1.3E-04				

*For risk assessment purposes, the Inhalation Unit Risk (IUR) for Nickel is based the IUR for Nickel Subsulfide. Risks listed in RED (and Chemical name in light blue) fall on the high end of EPA's risk range (10^{-4} thru 10^{-6}). The chronic toxicity Inhalation Unit Risks (IUR) were acquired from the Office of Air Quality Planning and Standards (Table 1). Risk Calculation Methodology: See Air Toxics Risk Assessment Reference Library Volume 1, pages 13-5 through 13-7. The Accumulated Total Risk values are in pink generally including up to 90% of the risk.

Table 5.1-2. Chronic non-Cancer Hazard and Toxicity Analysis for the Wylam, AL Air Sampling Study

Chemical	CAS	95% UCL (Lognormal) µg/m^3	RfC (µg/m^3)	Source	95% UCL (Lognormal) Hazard Quotients	% of Hazard Index	Target Organ	Target Effect	EPA Confidence in RfC
Manganese	7439-96-5	0.064	0.3	ATSDR	0.21	44%	Neurological	Impairment of neuro-behavioral function	Medium
Hexavalent Chromium	18540-29-9	0.010	0.1	IRIS	0.10	21%	Respiratory	Particles: Lactate dehydrogenase in bronchioalveolar lavage fluid; Acid Mist/Aerosols: Nasal septum atrophy	Study: Medium RfC: Medium
Arsenic	7440-38-2	0.0014	0.015	CAL	0.093	19%	Developmental	Decr fetal wt, incr incidences of intrauterine growth retardation and skeletal malformations in mice	NA
Nickel	7440-02-0	0.0025	0.09	ATSDR	0.028	6%	Respiratory	NOAEL for respiratory effects in rats	NA
Lead	7439-92-1	0.0041	0.15	NAAQS	0.027	6%	Neurological	Nervous system effects	NA
Cadmium	7440-43-9	0.00014	0.01	ATSDR	0.014	3%	Kidney/Respiratory	Kidney effects (proteinuria) and respiratory effects (reduction in forced vital capacity and reduction in peak expiratory flow rate) in occupationally exposed humans	NA
Antimony	7440-36-0	0.0018	0.2	IRIS	0.0090	2%	Respiratory	Pulmonary toxicity, chronic interstitial inflammation	Study: Medium Database: Medium RfC: Medium
Cobalt	7440-48-4	0.00019	0.1	ATSDR	0.0019	0.4%	Respiratory	NOAEL for respiratory effects in humans	NA
Beryllium	7440-41-7	0.000022	0.02	IRIS	0.0011	0.2%	Respiratory	Beryllium sensitization and progression to chronic beryllium disease	Study: Medium Database:Medium RfC: Medium
Mercury	7439-97-6	0.000019	0.3	IRIS	0.000065	0.01%	Neurological	Hand tremor; increases in memory disturbances; slight subjective and objective evidence of autonomic dysfunction	Study: Medium Database: Medium RfC: Medium
Selenium	7782-49-2	0.00046	20	CAL	0.000023	0.005%	Skin/Neurological/Liver/Hematologic	Clinical selenosis (skin) in humans/clinical selenosis (CNS) in humans/clinical selenosis (liver) in humans/clinical selenosis (blood) in humans	NA
			Hazard Index		0.49				

The chronic toxicity Reference Concentrations (RfCs: gray column) were acquired from the Office of Air Quality Planning and Standards, Table 1, see http://www2.epa.gov/fera/dose-response-assessment-assessing-health-risks-associated-exposure-hazardous-air-pollutants). Target Organ definitions were derived from Integrated Risk Information System (IRIS: http://www.epa.gov/iris). Reference Exposure Levels Target Organ definitions were derived from California's Office of Environmental Health Hazard Assessment (CAL, see: http://www.oehha.ca.gov/air/allrels.html). Source abbreviations are as follows: IRIS = Integrated Risk Information System; ATSDR = US Agency for Toxic Substances and Disease Registry; and CAL = California EPA.

Table 6-1. Percentage of Hexavalent Chromium Associated with Each Total Chromium Concentrations Identified in the Wylam, AL Study

Chemical	26-Apr-18 (µg/m^3)	29-Apr-18 (µg/m^3)	3-May-18 (µg/m^3)	9-May-18 (µg/m^3)	15-May-18 (µg/m^3)	17-May-18 (µg/m^3)	20-May-18 (µg/m^3)	23-May-18 (µg/m^3)	29-May-18 (µg/m^3)	4-Jun-18 (µg/m^3)
Chromium	0.114	0.00263	0.0553	0.022	0.00874	0.0148	0.00261	Invalid	Invalid	0.0259
Hexavalent Chromium	0.00993	0.000047	0.00141	0.000211	0.0000496	0.000131	ND	0.000369	0.00436	0.000286
Concentration Diff (Cr^{6+} to Cr)	0.10	0.0026	0.054	0.022	0.0087	0.015				0.026
	7-Jun-18 (µg/m^3)	10-Jun-18 (µg/m^3)	13-Jun-18 (µg/m^3)	19-Jun-18 (µg/m^3)	25-Jun-18 (µg/m^3)	28-Jun-18 (µg/m^3)	1-Jul-18 (µg/m^3)	4-Jul-18 (µg/m^3)	10-Jul-18 (µg/m^3)	16-Jul-18 (µg/m^3)
	0.00449	0.0988	0.129	0.00923	0.0428	Invalid	0.00227	0.00642	0.00227	0.0676
	0.0000158	0.00601	0.0086	0.0000515	0.0013	Invalid	0.0000315	0.000173	0.000011	0.00222
	0.0045	0.093	0.12		0.042		0.0022	0.0062	0.0023	0.065
	19-Jul-18 (µg/m^3)	22-Jul-18 (µg/m^3)	25-Jul-18 (µg/m^3)	31-Jul-18 (µg/m^3)	6-Aug-18 (µg/m^3)	9-Aug-18 (µg/m^3)	12-Aug-18 (µg/m^3)	15-Aug-18 (µg/m^3)	21-Aug-18 (µg/m^3)	27-Aug-18 (µg/m^3)
	0.00496	0.0102	0.00258	0.00705	0.0711	0.0674	0.00241	0.0155	0.0605	0.0285
	Invalid	0.000248	0.00000769	0.000162	0.00359	0.00645	0.0000246	0.000238	0.00112	0.00101
		0.010	0.0026	0.0069	0.068	0.061	0.0024	0.015	0.059	0.027
	31-Aug-18 (µg/m^3)	6-Sep-18 (µg/m^3)	12-Sep-18 (µg/m^3)	18-Sep-18 (µg/m^3)	21-Sep-18 (µg/m^3)	24-Sep-18 (µg/m^3)	27-Sep-18 (µg/m^3)	3-Oct-18 (µg/m^3)	9-Oct-18 (µg/m^3)	12-Oct-18 (µg/m^3)
	0.00804	0.0034	0.00791	0.00377	0.0341	0.00307	0.0665	0.012	0.0126	0.00471
	0.00018	0.000231	0.000104	0.0000187	0.00322	0.000017	0.0101	0.000211	0.0000371	0.0000798
	0.0079	0.0032	0.0078	0.0038	0.031	0.0031	0.056	0.012	0.013	0.0046
	15-Oct-18 (µg/m^3)	18-Oct-18 (µg/m^3)	23-Oct-18 (µg/m^3)	30-Oct-18 (µg/m^3)	2-Nov-18 (µg/m^3)	5-Nov-18 (µg/m^3)	8-Nov-18 (µg/m^3)	14-Nov-18 (µg/m^3)	20-Nov-18 (µg/m^3)	26-Nov-18 (µg/m^3)
	0.00939	0.00139	0.00366	0.0089	0.0644	0.00245	0.00637	0.00221	Invalid	Invalid
	0.00031	0.0000114	Invalid	0.000325	0.00893	0.0000352	0.00039	0.0000092	0.0015	0.000422
	0.0091	0.0014		0.0086	0.055	0.0024	0.0060	0.0022		
	29-Nov-18 (µg/m^3)	5-Dec-18 (µg/m^3)	11-Dec-18 (µg/m^3)	14-Dec-18 (µg/m^3)	17-Dec-18 (µg/m^3)	20-Dec-18 (µg/m^3)	26-Dec-18 (µg/m^3)	1-Jan-19 (µg/m^3)	7-Jan-19 (µg/m^3)	10-Jan-19 (µg/m^3)
	0.302	0.0569	0.00683	0.00293	0.00178	0.00757	0.0024	Invalid	0.0478	0.00279
	0.044	0.00771	0.000405	0.0000197	0.00000986	0.000128	0.0000139	0.0000418	0.00185	0.0000474
	0.26	0.049	0.0064	0.0029	0.0018	0.0074	0.0024		0.046	0.0027
	16-Jan-19 (µg/m^3)	22-Jan-19 (µg/m^3)	25-Jan-19 (µg/m^3)	28-Jan-19 (µg/m^3)	31-Jan-19 (µg/m^3)	6-Feb-19 (µg/m^3)	11-Feb-19 (µg/m^3)	14-Feb-19 (µg/m^3)	17-Feb-19 (µg/m^3)	21-Feb-19 (µg/m^3)
	0.00267	0.00319	0.00719	0.149	0.0101	0.0231	0.0144	0.117	0.002	0.0139
	0.0000122	0.0000261	0.000308	0.0244	Invalid	0.00174	0.00329	0.0321	0.0000169	0.000675
	0.0027	0.0032	0.0069	0.12		0.021	0.011	0.085	0.0020	0.013
	27-Feb-19 (µg/m^3)	5-Mar-19 (µg/m^3)	8-Mar-19 (µg/m^3)	11-Mar-19 (µg/m^3)	14-Mar-19 (µg/m^3)	20-Mar-19 (µg/m^3)	26-Mar-19 (µg/m^3)	29-Mar-19 (µg/m^3)	1-Apr-19 (µg/m^3)	4-Apr-19 (µg/m^3)
	0.0515	0.00195	0.0322	0.0227	0.0072	0.00466	0.0512	0.0163	0.00246	0.0163
	0.0025	0.00000635	0.000837	0.00149	0.00011	0.0000405	0.00399	0.00101	ND	0.000224
	0.049	0.0019	0.031	0.021	0.0071	0.0046	0.047	0.015		0.016
	10-Apr-19 (µg/m^3)	16-Apr-19 (µg/m^3)	19-Apr-19 (µg/m^3)	22-Apr-19 (µg/m^3)	25-Apr-19 (µg/m^3)	30-Apr-19 (µg/m^3)	MIN Conc. (µg/m^3)	Max Conc. (µg/m^3)	Avg Conc. (µg/m^3)	SD (µg/m^3)
	0.0273	0.00738	0.00846	0.00398	0.0178	0.0328	0.0014	0.30	0.028	7.58
	0.0000977	0.000153	0.0000895	0.000108	0.000285	0.00241	0.0000064	0.044	0.0026	0.089
	0.027	0.0072	0.01	0.0039	0.018	0.030	0.001	0.258	0.025	

Each Jefferson County Department of Health sample was analyzed by Each Eastern Research Group for both Total Chromium and Hexavalent Chromium. Therefore, to understand the proportion of Hexavalent Chromium associated with each sample's Total Chromium, this table provides a comparison per sampling episode along with establishing an Average Percentage of 9%. No comparisons were made when either chemical was "Not Detected". Similarly, "Invalid" samples were also omitted from comparisons.

Table 6-2. Difference Analysis Hexavalent Chromium Concentrations Compared to That of Total Chromium in the Wylam, AL Study

Chemical	26-Apr-18 (μg/m^3)	29-Apr-18 (μg/m^3)	3-May-18 (μg/m^3)	9-May-18 (μg/m^3)	15-May-18 (μg/m^3)	17-May-18 (μg/m^3)	20-May-18 (μg/m^3)	23-May-18 (μg/m^3)	29-May-18 (μg/m^3)	4-Jun-18 (μg/m^3)
Chromium	0.114	0.00263	0.0553	0.022	0.00874	0.0148	0.00261	Invalid	Invalid	0.0259
Hexavalent Chromium	0.00993	0.000047	0.00141	0.000211	0.0000496	0.000131	*ND*	0.000369	0.00436	0.000286
Concentration Diff (cr6+ to Cr)	9%	2%	3%	1%	1%	1%				1%

	7-Jun-18 (μg/m^3)	10-Jun-18 (μg/m^3)	13-Jun-18 (μg/m^3)	19-Jun-18 (μg/m^3)	25-Jun-18 (μg/m^3)	28-Jun-18 (μg/m^3)	1-Jul-18 (μg/m^3)	4-Jul-18 (μg/m^3)	10-Jul-18 (μg/m^3)	16-Jul-18 (μg/m^3)
	0.00449	0.0988	0.129	0.00923	0.0428	Invalid	0.00227	0.00642	0.00227	0.0676
	0.0000158	0.00601	0.0086	0.0000515	0.0013	Invalid	0.0000315	0.000173	0.000011	0.00222
	0.4%	6%	7%	1%	3%		1%	3%	0.5%	3%

	19-Jul-18 (μg/m^3)	22-Jul-18 (μg/m^3)	25-Jul-18 (μg/m^3)	31-Jul-18 (μg/m^3)	6-Aug-18 (μg/m^3)	9-Aug-18 (μg/m^3)	12-Aug-18 (μg/m^3)	15-Aug-18 (μg/m^3)	21-Aug-18 (μg/m^3)	27-Aug-18 (μg/m^3)
	0.00496	0.0102	0.00258	0.00705	0.0711	0.0674	0.00241	0.0155	0.0605	0.0285
	Invalid	0.000248	0.00000769	0.000162	0.00359	0.00645	0.0000246	0.000238	0.00112	0.00101
		2%	0.3%	2%	5%	10%	1%	2%	2%	4%

	31-Aug-18 (μg/m^3)	6-Sep-18 (μg/m^3)	12-Sep-18 (μg/m^3)	18-Sep-18 (μg/m^3)	21-Sep-18 (μg/m^3)	24-Sep-18 (μg/m^3)	27-Sep-18 (μg/m^3)	3-Oct-18 (μg/m^3)	9-Oct-18 (μg/m^3)	12-Oct-18 (μg/m^3)
	0.00804	0.0034	0.00791	0.00377	0.0341	0.00307	0.0665	0.012	0.0126	0.00471
	0.00018	0.000231	0.000104	0.0000187	0.00322	0.000017	0.0101	0.000211	0.0000371	0.0000798
	2%	7%	1%	0.5%	9%	1%	15%	2%	0.3%	2%

	15-Oct-18 (μg/m^3)	18-Oct-18 (μg/m^3)	23-Oct-18 (μg/m^3)	30-Oct-18 (μg/m^3)	2-Nov-18 (μg/m^3)	5-Nov-18 (μg/m^3)	8-Nov-18 (μg/m^3)	14-Nov-18 (μg/m^3)	20-Nov-18 (μg/m^3)	26-Nov-18 (μg/m^3)
	0.00939	0.00139	0.00366	0.0089	0.0644	0.00245	0.00637	0.00221	Invalid	Invalid
	0.00031	0.0000114	Invalid	0.000325	0.00893	0.0000352	0.00039	0.0000092	0.0015	0.000422
	3%	1%		4%	14%	1%	6%	0.4%		

	29-Nov-18 (μg/m^3)	5-Dec-18 (μg/m^3)	11-Dec-18 (μg/m^3)	14-Dec-18 (μg/m^3)	17-Dec-18 (μg/m^3)	20-Dec-18 (μg/m^3)	26-Dec-18 (μg/m^3)	1-Jan-19 (μg/m^3)	7-Jan-19 (μg/m^3)	10-Jan-19 (μg/m^3)
	0.302	0.0569	0.00683	0.00293	0.00178	0.00757	0.0024	Invalid	0.0478	0.00279
	0.044	0.00771	0.000405	0.0000197	0.00000986	0.000128	0.0000139	0.0000418	0.00185	0.0000474
	15%	14%	6%	1%	1%	2%	1%		4%	2%

	16-Jan-19 (μg/m^3)	22-Jan-19 (μg/m^3)	25-Jan-19 (μg/m^3)	28-Jan-19 (μg/m^3)	31-Jan-19 (μg/m^3)	6-Feb-19 (μg/m^3)	11-Feb-19 (μg/m^3)	14-Feb-19 (μg/m^3)	17-Feb-19 (μg/m^3)	21-Feb-19 (μg/m^3)
	0.00267	0.00319	0.00719	0.149	0.0101	0.0231	0.0144	0.117	0.002	0.0139
	0.0000122	0.0000261	0.000308	0.0244	Invalid	0.00174	0.00329	0.0321	0.0000169	0.000675
	0.5%	1%	4%	16%		8%	23%	27%	1%	5%

	27-Feb-19 (μg/m^3)	5-Mar-19 (μg/m^3)	8-Mar-19 (μg/m^3)	11-Mar-19 (μg/m^3)	14-Mar-19 (μg/m^3)	20-Mar-19 (μg/m^3)	26-Mar-19 (μg/m^3)	29-Mar-19 (μg/m^3)	1-Apr-19 (μg/m^3)	4-Apr-19 (μg/m^3)
	0.0515	0.00195	0.0322	0.0227	0.0072	0.00466	0.0512	0.0163	0.00246	0.0163
	0.0025	0.00000635	0.000837	0.00149	0.00011	0.0000405	0.00399	0.00101	ND	0.000224
	5%	0.3%	3%	7%	2%	1%	8%	6%		1%

	10-Apr-19 (μg/m^3)	16-Apr-19 (μg/m^3)	19-Apr-19 (μg/m^3)	22-Apr-19 (μg/m^3)	25-Apr-19 (μg/m^3)	30-Apr-19 (μg/m^3)	Min Conc. (μg/m^3)	Max Conc. (μg/m^3)	Avg Conc. (μg/m^3)	SD (μg/m^3)
	0.0273	0.00738	0.00846	0.00398	0.0178	0.0328	0.0014	0.30	0.028	7.58
	0.0000977	0.000153	0.0000895	0.000108	0.000285	0.00241	0.0000064	0.044	0.0026	0.089
	0.4%	2%	1%	3%	2%	7%	0.5%	15%	9%	

Each Jefferson County Department of Health sample was analyzed by Each Eastern Research Group for both Total Chromium and Hexavalent Chromium. Therefore, to understand the proportion of Hexavalent Chromium associated with each sample's Total Chromium, this table provides a comparison per sampling episode along with establishing an Average Percentage of 9%. No comparisons were made when either chemical was "Not Detected". Similarly, "Invalid" were also omitted from comparisons.

Appendix A
Wylam, AL Hexavalent Chromium Study
Monitoring Data

The following data resulted from samples taken at the Wylam supplemental Chemical Speciation Network site (AQS # 01-073-2003), operated by the Jefferson County Department of Health. The sampling period was from April of 2018 through April 2019.

The following provides information respect to the use (or not) of certain COPC samples in the risk assessment calculations:

1. The 12/10/18 sample (marked in yellow; field and replicate) was collected over a 26-hour period rather than a 24-hour period. While the study plan indicates samples should be collected 24 hours ± 1 hour, this sample were included in the risk assessment since the extra two hours should not skew the answer much and, on balance, keeping what is otherwise a valid sample is better than discarding it for a 1-hour discrepancy.
2. The 7/4/18 hexavalent Cr sample marked in red is invalid; it was not used in the calculations because the transport temperature was out of spec (marked “TT”).
3. Samples and their replicates were averaged, and that number was used in the analysis (not the higher of the two numbers).
4. Values reported “U” were used as is.
5. The 8/9/2018 sample has a sample ID marked “RE1”. The initial analysis of this sample failed, so it was reanalyzed by the lab and the results shown were used in the assessment.
6. Other directions regarding the use of certain samples are provided in the “Notes” column on the right.
7. Samples at the bottom of the table marked in grey are invalid and were not used.
8. Other qualifiers in the sample set are listed here:

AQS QUALIFIER	**DESCRIPTION**
Y	Elapsed Sample Time out of Spec.
TT	Transport Temperature is Out of Spec.
LAB/ANALYST NOTE	**DESCRIPTION**
A-01, D	Post spike not added, result obtained by dilution
A-01a, D	Analyzed after 24hr extraction hold time, result obtained by dilution.
B	Analyte is found in the associated blank as well as in the sample (CLP B-flag).
CE	Not Reportable due to a co-eluting compound
D	Result obtained by dilution.
D-01	This result obtained by diluting and reanalyzing the sample.
FB-01	Field Blank value above acceptable limit.
U	Under Detection Limit

Final 2/23/22

LABSAMPID	SAMPDATE	ANALYTE	SAMPLE TYPE	RESULT	DL	UNITS	STATUS	NULL CODE	QUALIFIERS	LNOTE-ANOTE MERGE	SQL ng/m3		NOTE
8050227-03	4/26/2018	Antimony	Field Sample	0.401	0.151	ng/m3	Reported				0.4802		
8050227-04	4/29/2018	Antimony	Field Sample	1.71	0.151	ng/m3	Reported				0.4802		
8050227-04	4/29/2018	Antimony	Replicate (R1)	1.7	0.151	ng/m3	Reported				0.4802		
8050829-02	5/2/2018	Antimony	Field Sample	0.902	0.151	ng/m3	Reported				0.4802		
8051109-02	5/8/2018	Antimony	Field Sample	1.93	0.151	ng/m3	Reported				0.4802		
8051716-03	5/14/2018	Antimony	Field Sample	1.23	0.151	ng/m3	Reported				0.4802		
8052315-03	5/17/2018	Antimony	Field Sample	0.835	0.151	ng/m3	Reported				0.4802		
8052315-04	5/20/2018	Antimony	Field Sample	0.779	0.151	ng/m3	Reported				0.4802		
8052315-04	5/20/2018	Antimony	Replicate (R1)	0.776	0.151	ng/m3	Reported				0.4802		
8060714-02	6/4/2018	Antimony	Field Sample	0.899	0.151	ng/m3	Reported				0.4802		
8061224-02	6/7/2018	Antimony	Field Sample	4.22	0.151	ng/m3	Reported				0.4802		
8061528-02	6/10/2018	Antimony	Field Sample	0.573	0.151	ng/m3	Reported				0.4802		
8061914-01	6/13/2018	Antimony	Field Sample	0.786	0.151	ng/m3	Reported				0.4802		
8062215-02	6/19/2018	Antimony	Field Sample	0.874	0.151	ng/m3	Reported				0.4802		
8062808-02	6/25/2018	Antimony	Field Sample	0.797	0.151	ng/m3	Reported				0.4802		
8070617-02	7/1/2018	Antimony	Field Sample	0.689	0.151	ng/m3	Reported				0.4802		
8070617-02	7/1/2018	Antimony	Replicate (R1)	0.683	0.151	ng/m3	Reported				0.4802		
8071119-02	7/4/2018	Antimony	Field Sample	1.83	0.151	ng/m3	Reported				0.4802		
8071310-04	7/10/2018	Antimony	Field Sample	0.887	0.151	ng/m3	Reported				0.4802		

8071905-03	7/16/2018	Antimony	Field Sample	0.418	0.151	ng/m3	Reported				0.4802
8072422-02	7/18/2018	Antimony	Field Sample	1.78	0.151	ng/m3	Reported				0.4802
8072528-02	7/22/2018	Antimony	Field Sample	0.721	0.151	ng/m3	Reported				0.4802
8073127-02	7/25/2018	Antimony	Field Sample	3.78	0.151	ng/m3	Reported				0.4802
8080313-02	7/31/2018	Antimony	Field Sample	0.447	0.151	ng/m3	Reported				0.4802
8080921-02	8/6/2018	Antimony	Field Sample	0.946	0.151	ng/m3	Reported				0.4802
8081520-02RE1	8/9/2018	Antimony	Field Sample	0.64	0.151	ng/m3	Reported				0.4802
8081520-03	8/12/2018	Antimony	Field Sample	1.21	0.151	ng/m3	Reported				0.4802
8082131-02	8/15/2018	Antimony	Field Sample	0.901	0.151	ng/m3	Reported				0.4802
8082405-02	8/21/2018	Antimony	Field Sample	0.554	0.151	ng/m3	Reported				0.4802
8083010-02	8/27/2018	Antimony	Field Sample	1	0.151	ng/m3	Reported				0.4802
8090523-02	8/30/2018	Antimony	Field Sample	0.568	0.151	ng/m3	Reported				0.4802
8091124-02	9/5/2018	Antimony	Field Sample	0.985	0.151	ng/m3	Reported				0.4802
8091827-04	9/11/2018	Antimony	Field Sample	1.3	0.151	ng/m3	Reported				0.4802
8092521-03	9/17/2018	Antimony	Field Sample	1.7	0.151	ng/m3	Reported				0.4802
8092521-04	9/20/2018	Antimony	Field Sample	1.59	0.151	ng/m3	Reported				0.4802
8092620-02	9/23/2018	Antimony	Field Sample	0.844	0.151	ng/m3	Reported				0.4802

8100219-02	9/26/2018	Antimony	Field Sample	0.58	0.151	ng/m3	Reported				0.4802
8100510-02	10/2/2018	Antimony	Field Sample	3.49	0.151	ng/m3	Reported				0.4802
8101114-02	10/8/2018	Antimony	Field Sample	0.612	0.151	ng/m3	Reported				0.4802
8101626-02	10/11/2018	Antimony	Field Sample	0.537	0.151	ng/m3	Reported				0.4802
8101626-02	10/11/2018	Antimony	Replicate (R1)	0.541	0.151	ng/m3	Reported				0.4802
8101730-04	10/14/2018	Antimony	Field Sample	1.19	0.151	ng/m3	Reported				0.4802
8102327-02	10/17/2018	Antimony	Field Sample	0.866	0.151	ng/m3	Reported				0.4802
8102621-02	10/22/2018	Antimony	Field Sample	3.09	0.151	ng/m3	Reported				0.4802
8110103-02	10/29/2018	Antimony	Field Sample	3.38	0.151	ng/m3	Reported				0.4802
8110618-02	11/1/2018	Antimony	Field Sample	0.248	0.151	ng/m3	Reported				0.4802
8110618-02	11/1/2018	Antimony	Replicate (R1)	0.25	0.151	ng/m3	Reported				0.4802
8110720-02	11/4/2018	Antimony	Field Sample	0.557	0.151	ng/m3	Reported				0.4802
8111510-02	11/7/2018	Antimony	Field Sample	0.99	0.151	ng/m3	Reported				0.4802
8111604-04	11/13/2018	Antimony	Field Sample	0.64	0.151	ng/m3	Reported				0.4802
8120439-02	11/28/2018	Antimony	Field Sample	1.64	0.151	ng/m3	Reported				0.4802
8120719-03	12/4/2018	Antimony	Field Sample	0.397	0.151	ng/m3	Reported				0.4802

8121312-02	12/10/2018	Antimony	Field Sample	0.885	0.151	ng/m3	Reported		Y		0.4802	26 hour sampling time (should have been 24 hours). Use these results.
8121312-02	12/10/2018	Antimony	Replicate (R1)	0.885	0.151	ng/m3	Reported		Y		0.4802	
8121923-02	12/13/2018	Antimony	Field Sample	1.08	0.151	ng/m3	Reported				0.4802	
8122114-02	12/16/2018	Antimony	Field Sample	0.63	0.151	ng/m3	Reported				0.4802	
8122815-02	12/19/2018	Antimony	Field Sample	2.71	0.151	ng/m3	Reported				0.4802	
9010324-02	12/25/2018	Antimony	Field Sample	2.98	0.151	ng/m3	Reported				0.4802	
9010929-02	1/6/2019	Antimony	Field Sample	3.69	0.151	ng/m3	Reported				0.4802	
9011548-02	1/9/2019	Antimony	Field Sample	4.3	0.151	ng/m3	Reported				0.4802	
9011548-02	1/9/2019	Antimony	Replicate (R1)	4.26	0.151	ng/m3	Reported				0.4802	
9011813-02	1/15/2019	Antimony	Field Sample	0.893	0.151	ng/m3	Reported				0.4802	
9012424-02	1/21/2019	Antimony	Field Sample	1.25	0.151	ng/m3	Reported				0.4802	
9012922-02	1/24/2019	Antimony	Field Sample	0.518	0.151	ng/m3	Reported				0.4802	
9013106-01	1/27/2019	Antimony	Field Sample	1.8	0.151	ng/m3	Reported				0.4802	
9020515-03	1/30/2019	Antimony	Field Sample	1.3	0.151	ng/m3	Reported				0.4802	
9020515-03	1/30/2019	Antimony	Replicate (R1)	1.3	0.151	ng/m3	Reported				0.4802	

9020814-02	2/5/2019	Antimony	Field Sample	1.15	0.151	ng/m3	Reported				0.4802
9021410-02	2/10/2019	Antimony	Field Sample	0.723	0.151	ng/m3	Reported				0.4802
9021923-02	2/13/2019	Antimony	Field Sample	0.84	0.151	ng/m3	Reported				0.4802
9022106-02	2/16/2019	Antimony	Field Sample	0.662	0.151	ng/m3	Reported				0.4802
9022620-02	2/20/2019	Antimony	Field Sample	0.346	0.151	ng/m3	Reported				0.4802
9030111-01	2/26/2019	Antimony	Field Sample	2.56	0.151	ng/m3	Reported				0.4802
9030711-01	3/4/2019	Antimony	Field Sample	0.371	0.151	ng/m3	Reported				0.4802
9031218-02	3/7/2019	Antimony	Field Sample	1.37	0.151	ng/m3	Reported				0.4802
9031218-02	3/7/2019	Antimony	Replicate (R1)	1.36	0.151	ng/m3	Reported				0.4802
9031317-01	3/10/2019	Antimony	Field Sample	1.49	0.151	ng/m3	Reported				0.4802
9031918-02	3/13/2019	Antimony	Field Sample	0.979	0.151	ng/m3	Reported				0.4802
9032208-02	3/19/2019	Antimony	Field Sample	2.9	0.151	ng/m3	Reported				0.4802
9032806-02	3/25/2019	Antimony	Field Sample	0.645	0.135	ng/m3	Reported				0.4293
9032806-02	3/25/2019	Antimony	Replicate (R1)	0.653	0.135	ng/m3	Reported				0.4293
9040229-02	3/28/2019	Antimony	Field Sample	1.57	0.135	ng/m3	Reported				0.4293
9040336-03	3/31/2019	Antimony	Field Sample	0.6	0.135	ng/m3	Reported				0.4293
9040945-02	4/3/2019	Antimony	Field Sample	1.9	0.135	ng/m3	Reported				0.4293

9041214-02	4/9/2019	Antimony	Field Sample	1.13	0.135	ng/m3	Reported				0.4293
9041214-02	4/9/2019	Antimony	Replicate (R1)	1.13	0.135	ng/m3	Reported				0.4293
9041815-02	4/15/2019	Antimony	Field Sample	4.38	0.135	ng/m3	Reported				0.4293
9042319-02	4/18/2019	Antimony	Field Sample	0.577	0.135	ng/m3	Reported				0.4293
9042418-02	4/21/2019	Antimony	Field Sample	0.574	0.135	ng/m3	Reported				0.4293
9043022-02	4/24/2019	Antimony	Field Sample	0.879	0.135	ng/m3	Reported				0.4293
9050319-03	4/29/2019	Antimony	Field Sample	1.03	0.135	ng/m3	Reported				0.4293
8050227-03	4/26/2018	Arsenic	Field Sample	0.539	0.0362	ng/m3	Reported				0.1151
8050227-04	4/29/2018	Arsenic	Field Sample	1.4	0.0362	ng/m3	Reported				0.1151
8050227-04	4/29/2018	Arsenic	Replicate (R1)	1.4	0.0362	ng/m3	Reported				0.1151
8050829-02	5/2/2018	Arsenic	Field Sample	1.49	0.0362	ng/m3	Reported				0.1151
8051109-02	5/8/2018	Arsenic	Field Sample	1.79	0.0362	ng/m3	Reported				0.1151
8051716-03	5/14/2018	Arsenic	Field Sample	1.3	0.0362	ng/m3	Reported				0.1151
8052315-03	5/17/2018	Arsenic	Field Sample	1.59	0.0362	ng/m3	Reported				0.1151
8052315-04	5/20/2018	Arsenic	Field Sample	0.986	0.0362	ng/m3	Reported				0.1151
8052315-04	5/20/2018	Arsenic	Replicate (R1)	0.932	0.0362	ng/m3	Reported				0.1151
8060714-02	6/4/2018	Arsenic	Field Sample	0.906	0.0362	ng/m3	Reported				0.1151

8061224-02	6/7/2018	Arsenic	Field Sample	1.57	0.0362	ng/m3	Reported				0.1151
8061528-02	6/10/2018	Arsenic	Field Sample	0.781	0.0362	ng/m3	Reported				0.1151
8061914-01	6/13/2018	Arsenic	Field Sample	0.89	0.0362	ng/m3	Reported				0.1151
8062215-02	6/19/2018	Arsenic	Field Sample	1.35	0.0362	ng/m3	Reported				0.1151
8062808-02	6/25/2018	Arsenic	Field Sample	0.93	0.0362	ng/m3	Reported				0.1151
8070617-02	7/1/2018	Arsenic	Field Sample	0.613	0.0362	ng/m3	Reported				0.1151
8070617-02	7/1/2018	Arsenic	Replicate (R1)	0.622	0.0362	ng/m3	Reported				0.1151
8071119-02	7/4/2018	Arsenic	Field Sample	1.47	0.0362	ng/m3	Reported				0.1151
8071310-04	7/10/2018	Arsenic	Field Sample	1.72	0.0362	ng/m3	Reported				0.1151
8071905-03	7/16/2018	Arsenic	Field Sample	0.905	0.0362	ng/m3	Reported				0.1151
8072422-02	7/18/2018	Arsenic	Field Sample	1.18	0.0362	ng/m3	Reported				0.1151
8072528-02	7/22/2018	Arsenic	Field Sample	0.765	0.0362	ng/m3	Reported				0.1151
8073127-02	7/25/2018	Arsenic	Field Sample	2.85	0.0362	ng/m3	Reported				0.1151
8080313-02	7/31/2018	Arsenic	Field Sample	0.604	0.0362	ng/m3	Reported				0.1151
8080921-02	8/6/2018	Arsenic	Field Sample	1.75	0.0362	ng/m3	Reported				0.1151
8081520-02RE1	8/9/2018	Arsenic	Field Sample	1.11	0.0362	ng/m3	Reported				0.1151
8081520-03	8/12/2018	Arsenic	Field Sample	1.32	0.0362	ng/m3	Reported				0.1151

8082131-02	8/15/2018	Arsenic	Field Sample	1.16	0.0362	ng/m3	Reported				0.1151
8082405-02	8/21/2018	Arsenic	Field Sample	1.1	0.0362	ng/m3	Reported				0.1151
8083010-02	8/27/2018	Arsenic	Field Sample	1.13	0.0362	ng/m3	Reported				0.1151
8090523-02	8/30/2018	Arsenic	Field Sample	0.761	0.0362	ng/m3	Reported				0.1151
8091124-02	9/5/2018	Arsenic	Field Sample	2.25	0.0362	ng/m3	Reported				0.1151
8091827-04	9/11/2018	Arsenic	Field Sample	2.01	0.0362	ng/m3	Reported				0.1151
8092521-03	9/17/2018	Arsenic	Field Sample	2.17	0.0362	ng/m3	Reported				0.1151
8092521-04	9/20/2018	Arsenic	Field Sample	1.23	0.0362	ng/m3	Reported				0.1151
8092620-02	9/23/2018	Arsenic	Field Sample	0.824	0.0362	ng/m3	Reported				0.1151
8100219-02	9/26/2018	Arsenic	Field Sample	0.679	0.0362	ng/m3	Reported				0.1151
8100510-02	10/2/2018	Arsenic	Field Sample	3.65	0.0362	ng/m3	Reported				0.1151
8101114-02	10/8/2018	Arsenic	Field Sample	0.639	0.0362	ng/m3	Reported				0.1151
8101626-02	10/11/2018	Arsenic	Field Sample	0.395	0.0362	ng/m3	Reported				0.1151
8101626-02	10/11/2018	Arsenic	Replicate (R1)	0.387	0.0362	ng/m3	Reported				0.1151
8101730-04	10/14/2018	Arsenic	Field Sample	1.48	0.0362	ng/m3	Reported				0.1151
8102327-02	10/17/2018	Arsenic	Field Sample	0.969	0.0362	ng/m3	Reported				0.1151
8102621-02	10/22/2018	Arsenic	Field Sample	2.69	0.0362	ng/m3	Reported				0.1151

8110103-02	10/29/2018	Arsenic	Field Sample	2.2	0.0362	ng/m3	Reported				0.1151
8110618-02	11/1/2018	Arsenic	Field Sample	0.379	0.0362	ng/m3	Reported				0.1151
8110618-02	11/1/2018	Arsenic	Replicate (R1)	0.386	0.0362	ng/m3	Reported				0.1151
8110720-02	11/4/2018	Arsenic	Field Sample	0.646	0.0362	ng/m3	Reported				0.1151
8111510-02	11/7/2018	Arsenic	Field Sample	0.775	0.0362	ng/m3	Reported				0.1151
8111604-04	11/13/2018	Arsenic	Field Sample	0.605	0.0362	ng/m3	Reported				0.1151
8120439-02	11/28/2018	Arsenic	Field Sample	1.43	0.0362	ng/m3	Reported				0.1151
8120719-03	12/4/2018	Arsenic	Field Sample	0.513	0.0362	ng/m3	Reported				0.1151
8121312-02	12/10/2018	Arsenic	Field Sample	0.705	0.0362	ng/m3	Reported		Y		0.1151
8121312-02	12/10/2018	Arsenic	Replicate (R1)	0.723	0.0362	ng/m3	Reported		Y		0.1151
8121923-02	12/13/2018	Arsenic	Field Sample	0.722	0.0362	ng/m3	Reported				0.1151
8122114-02	12/16/2018	Arsenic	Field Sample	0.535	0.0362	ng/m3	Reported				0.1151
8122815-02	12/19/2018	Arsenic	Field Sample	1.56	0.0362	ng/m3	Reported				0.1151
9010324-02	12/25/2018	Arsenic	Field Sample	1.84	0.0362	ng/m3	Reported				0.1151
9010929-02	1/6/2019	Arsenic	Field Sample	17	0.0362	ng/m3	Reported				0.1151
9011548-02	1/9/2019	Arsenic	Field Sample	0.662	0.0362	ng/m3	Reported				0.1151
9011548-02	1/9/2019	Arsenic	Replicate (R1)	0.666	0.0362	ng/m3	Reported				0.1151

9011813-02	1/15/2019	Arsenic	Field Sample	1.17	0.0362	ng/m3	Reported				0.1151
9012424-02	1/21/2019	Arsenic	Field Sample	1.43	0.0362	ng/m3	Reported				0.1151
9012922-02	1/24/2019	Arsenic	Field Sample	0.355	0.0362	ng/m3	Reported				0.1151
9013106-01	1/27/2019	Arsenic	Field Sample	1.36	0.0362	ng/m3	Reported				0.1151
9020515-03	1/30/2019	Arsenic	Field Sample	1.52	0.0362	ng/m3	Reported				0.1151
9020515-03	1/30/2019	Arsenic	Replicate (R1)	1.52	0.0362	ng/m3	Reported				0.1151
9020814-02	2/5/2019	Arsenic	Field Sample	0.662	0.0362	ng/m3	Reported				0.1151
9021410-02	2/10/2019	Arsenic	Field Sample	1.33	0.0362	ng/m3	Reported				0.1151
9021923-02	2/13/2019	Arsenic	Field Sample	1.03	0.0362	ng/m3	Reported				0.1151
9022106-02	2/16/2019	Arsenic	Field Sample	0.774	0.0362	ng/m3	Reported				0.1151
9022620-02	2/20/2019	Arsenic	Field Sample	0.834	0.0362	ng/m3	Reported				0.1151
9030111-01	2/26/2019	Arsenic	Field Sample	1.62	0.0362	ng/m3	Reported				0.1151
9030711-01	3/4/2019	Arsenic	Field Sample	0.266	0.0362	ng/m3	Reported				0.1151
9031218-02	3/7/2019	Arsenic	Field Sample	0.81	0.0362	ng/m3	Reported				0.1151
9031218-02	3/7/2019	Arsenic	Replicate (R1)	0.821	0.0362	ng/m3	Reported				0.1151
9031317-01	3/10/2019	Arsenic	Field Sample	1.08	0.0362	ng/m3	Reported				0.1151
9031918-02	3/13/2019	Arsenic	Field Sample	1.08	0.0362	ng/m3	Reported				0.1151

9032208-02	3/19/2019	Arsenic	Field Sample	1.24	0.0362	ng/m3	Reported				0.1151
9032806-02	3/25/2019	Arsenic	Field Sample	0.688	0.0349	ng/m3	Reported				0.1110
9032806-02	3/25/2019	Arsenic	Replicate (R1)	0.689	0.0349	ng/m3	Reported				0.1110
9040229-02	3/28/2019	Arsenic	Field Sample	1.17	0.0349	ng/m3	Reported				0.1110
9040336-03	3/31/2019	Arsenic	Field Sample	0.554	0.0349	ng/m3	Reported				0.1110
9040945-02	4/3/2019	Arsenic	Field Sample	1.17	0.0349	ng/m3	Reported				0.1110
9041214-02	4/9/2019	Arsenic	Field Sample	1.02	0.0349	ng/m3	Reported				0.1110
9041214-02	4/9/2019	Arsenic	Replicate (R1)	0.991	0.0349	ng/m3	Reported				0.1110
9041815-02	4/15/2019	Arsenic	Field Sample	1.54	0.0349	ng/m3	Reported				0.1110
9042319-02	4/18/2019	Arsenic	Field Sample	0.532	0.0349	ng/m3	Reported				0.1110
9042418-02	4/21/2019	Arsenic	Field Sample	0.208	0.0349	ng/m3	Reported				0.1110
9043022-02	4/24/2019	Arsenic	Field Sample	0.982	0.0349	ng/m3	Reported				0.1110
9050319-03	4/29/2019	Arsenic	Field Sample	1.05	0.0349	ng/m3	Reported				0.1110
8050227-03	4/26/2018	Beryllium	Field Sample	0.00259	0.00142	ng/m3	Reported				0.0045
8050227-04	4/29/2018	Beryllium	Field Sample	0.00789	0.00142	ng/m3	Reported				0.0045
8050227-04	4/29/2018	Beryllium	Replicate (R1)	0.00799	0.00142	ng/m3	Reported				0.0045
8050829-02	5/2/2018	Beryllium	Field Sample	0.104	0.00142	ng/m3	Reported				0.0045

8051109-02	5/8/2018	Beryllium	Field Sample	0.0495	0.00142	ng/m3	Reported				0.0045
8051716-03	5/14/2018	Beryllium	Field Sample	0.0321	0.00142	ng/m3	Reported				0.0045
8052315-03	5/17/2018	Beryllium	Field Sample	0.0245	0.00142	ng/m3	Reported				0.0045
8052315-04	5/20/2018	Beryllium	Field Sample	0.00698	0.00142	ng/m3	Reported				0.0045
8052315-04	5/20/2018	Beryllium	Replicate (R1)	0.00816	0.00142	ng/m3	Reported				0.0045
8060714-02	6/4/2018	Beryllium	Field Sample	0.0168	0.00142	ng/m3	Reported				0.0045
8061224-02	6/7/2018	Beryllium	Field Sample	0.0349	0.00142	ng/m3	Reported				0.0045
8061528-02	6/10/2018	Beryllium	Field Sample	0.0172	0.00142	ng/m3	Reported				0.0045
8061914-01	6/13/2018	Beryllium	Field Sample	0.0154	0.00142	ng/m3	Reported				0.0045
8062215-02	6/19/2018	Beryllium	Field Sample	0.085	0.00142	ng/m3	Reported				0.0045
8062808-02	6/25/2018	Beryllium	Field Sample	0.0178	0.00142	ng/m3	Reported				0.0045
8070617-02	7/1/2018	Beryllium	Field Sample	0.00494	0.00142	ng/m3	Reported				0.0045
8070617-02	7/1/2018	Beryllium	Replicate (R1)	0.0051	0.00142	ng/m3	Reported				0.0045
8071119-02	7/4/2018	Beryllium	Field Sample	0.00702	0.00142	ng/m3	Reported				0.0045
8071310-04	7/10/2018	Beryllium	Field Sample	0.0104	0.00142	ng/m3	Reported				0.0045
8071905-03	7/16/2018	Beryllium	Field Sample	0.00868	0.00142	ng/m3	Reported				0.0045
8072422-02	7/18/2018	Beryllium	Field Sample	0.0167	0.00142	ng/m3	Reported				0.0045

8072528-02	7/22/2018	Beryllium	Field Sample	0.00714	0.00142	ng/m3	Reported				0.0045
8073127-02	7/25/2018	Beryllium	Field Sample	0.014	0.00142	ng/m3	Reported				0.0045
8080313-02	7/31/2018	Beryllium	Field Sample	0.0077	0.00142	ng/m3	Reported				0.0045
8080921-02	8/6/2018	Beryllium	Field Sample	0.0187	0.00142	ng/m3	Reported				0.0045
8081520-02RE1	8/9/2018	Beryllium	Field Sample	0.0106	0.00142	ng/m3	Reported				0.0045
8081520-03	8/12/2018	Beryllium	Field Sample	0.00594	0.00142	ng/m3	Reported				0.0045
8082131-02	8/15/2018	Beryllium	Field Sample	0.0326	0.00142	ng/m3	Reported				0.0045
8082405-02	8/21/2018	Beryllium	Field Sample	0.0219	0.00142	ng/m3	Reported				0.0045
8083010-02	8/27/2018	Beryllium	Field Sample	0.0489	0.00142	ng/m3	Reported				0.0045
8090523-02	8/30/2018	Beryllium	Field Sample	0.0133	0.00142	ng/m3	Reported				0.0045
8091124-02	9/5/2018	Beryllium	Field Sample	0.00625	0.00142	ng/m3	Reported				0.0045
8091827-04	9/11/2018	Beryllium	Field Sample	0.00838	0.00142	ng/m3	Reported				0.0045
8092521-03	9/17/2018	Beryllium	Field Sample	0.0181	0.00142	ng/m3	Reported				0.0045
8092521-04	9/20/2018	Beryllium	Field Sample	0.0315	0.00142	ng/m3	Reported				0.0045
8092620-02	9/23/2018	Beryllium	Field Sample	0.0154	0.00142	ng/m3	Reported				0.0045
8100219-02	9/26/2018	Beryllium	Field Sample	0.00525	0.00142	ng/m3	Reported				0.0045
8100510-02	10/2/2018	Beryllium	Field Sample	0.017	0.00142	ng/m3	Reported				0.0045

8101114-02	10/8/2018	Beryllium	Field Sample	0.022	0.00142	ng/m3	Reported				0.0045
8101626-02	10/11/2018	Beryllium	Field Sample	0.00651	0.00142	ng/m3	Reported				0.0045
8101626-02	10/11/2018	Beryllium	Replicate (R1)	0.00696	0.00142	ng/m3	Reported				0.0045
8101730-04	10/14/2018	Beryllium	Field Sample	0.0314	0.00142	ng/m3	Reported				0.0045
8102327-02	10/17/2018	Beryllium	Field Sample	0.00406	0.00142	ng/m3	Reported				0.0045
8102621-02	10/22/2018	Beryllium	Field Sample	0.0112	0.00142	ng/m3	Reported				0.0045
8110103-02	10/29/2018	Beryllium	Field Sample	0.021	0.00142	ng/m3	Reported				0.0045
8110618-02	11/1/2018	Beryllium	Field Sample	0.00424	0.00142	ng/m3	Reported				0.0045
8110618-02	11/1/2018	Beryllium	Replicate (R1)	0.00364	0.00142	ng/m3	Reported				0.0045
8110720-02	11/4/2018	Beryllium	Field Sample	0.00578	0.00142	ng/m3	Reported				0.0045
8111510-02	11/7/2018	Beryllium	Field Sample	0.00525	0.00142	ng/m3	Reported				0.0045
8111604-04	11/13/2018	Beryllium	Field Sample	0.00258	0.00142	ng/m3	Reported				0.0045
8120439-02	11/28/2018	Beryllium	Field Sample	0.0212	0.00142	ng/m3	Reported				0.0045
8120719-03	12/4/2018	Beryllium	Field Sample	0.00817	0.00142	ng/m3	Reported				0.0045
8121312-02	12/10/2018	Beryllium	Field Sample	0.00752	0.00142	ng/m3	Reported		Y		0.0045
8121312-02	12/10/2018	Beryllium	Replicate (R1)	0.00746	0.00142	ng/m3	Reported		Y		0.0045
8121923-02	12/13/2018	Beryllium	Field Sample	0.00936	0.00142	ng/m3	Reported				0.0045

8122114-02	12/16/2018	Beryllium	Field Sample	0.00259	0.00142	ng/m3	Reported				0.0045
8122815-02	12/19/2018	Beryllium	Field Sample	0.0185	0.00142	ng/m3	Reported				0.0045
9010324-02	12/25/2018	Beryllium	Field Sample	0.00742	0.00142	ng/m3	Reported				0.0045
9010929-02	1/6/2019	Beryllium	Field Sample	0.0178	0.00142	ng/m3	Reported				0.0045
9011548-02	1/9/2019	Beryllium	Field Sample	0.0125	0.00142	ng/m3	Reported				0.0045
9011548-02	1/9/2019	Beryllium	Replicate (R1)	0.0115	0.00142	ng/m3	Reported				0.0045
9011813-02	1/15/2019	Beryllium	Field Sample	0.00522	0.00142	ng/m3	Reported				0.0045
9012424-02	1/21/2019	Beryllium	Field Sample	0.0108	0.00142	ng/m3	Reported				0.0045
9012922-02	1/24/2019	Beryllium	Field Sample	0.00447	0.00142	ng/m3	Reported				0.0045
9013106-01	1/27/2019	Beryllium	Field Sample	0.00976	0.00142	ng/m3	Reported				0.0045
9020515-03	1/30/2019	Beryllium	Field Sample	0.0151	0.00142	ng/m3	Reported				0.0045
9020515-03	1/30/2019	Beryllium	Replicate (R1)	0.0162	0.00142	ng/m3	Reported				0.0045
9020814-02	2/5/2019	Beryllium	Field Sample	0.0141	0.00142	ng/m3	Reported				0.0045
9021410-02	2/10/2019	Beryllium	Field Sample	0.0223	0.00142	ng/m3	Reported				0.0045
9021923-02	2/13/2019	Beryllium	Field Sample	0.0293	0.00142	ng/m3	Reported				0.0045
9022106-02	2/16/2019	Beryllium	Field Sample	0.00442	0.00142	ng/m3	Reported				0.0045
9022620-02	2/20/2019	Beryllium	Field Sample	0.00466	0.00142	ng/m3	Reported				0.0045

9030111-01	2/26/2019	Beryllium	Field Sample	0.0364	0.00142	ng/m3	Reported				0.0045
9030711-01	3/4/2019	Beryllium	Field Sample	0.0038	0.00142	ng/m3	Reported				0.0045
9031218-02	3/7/2019	Beryllium	Field Sample	0.0374	0.00142	ng/m3	Reported				0.0045
9031218-02	3/7/2019	Beryllium	Replicate (R1)	0.0382	0.00142	ng/m3	Reported				0.0045
9031317-01	3/10/2019	Beryllium	Field Sample	0.00979	0.00142	ng/m3	Reported				0.0045
9031918-02	3/13/2019	Beryllium	Field Sample	0.0209	0.00142	ng/m3	Reported				0.0045
9032208-02	3/19/2019	Beryllium	Field Sample	0.0162	0.00142	ng/m3	Reported				0.0045
9032806-02	3/25/2019	Beryllium	Field Sample	0.0212	0.00291	ng/m3	Reported				0.0093
9032806-02	3/25/2019	Beryllium	Replicate (R1)	0.0206	0.00291	ng/m3	Reported				0.0093
9040229-02	3/28/2019	Beryllium	Field Sample	0.0568	0.00291	ng/m3	Reported				0.0093
9040336-03	3/31/2019	Beryllium	Field Sample	0.023	0.00291	ng/m3	Reported				0.0093
9040945-02	4/3/2019	Beryllium	Field Sample	0.045	0.00291	ng/m3	Reported				0.0093
9041214-02	4/9/2019	Beryllium	Field Sample	0.00652	0.00291	ng/m3	Reported				0.0093
9041214-02	4/9/2019	Beryllium	Replicate (R1)	0.00605	0.00291	ng/m3	Reported				0.0093
9041815-02	4/15/2019	Beryllium	Field Sample	0.0254	0.00291	ng/m3	Reported				0.0093
9042319-02	4/18/2019	Beryllium	Field Sample	0.0324	0.00291	ng/m3	Reported				0.0093
9042418-02	4/21/2019	Beryllium	Field Sample	0.00326	0.00291	ng/m3	Reported				0.0093

9043022-02	4/24/2019	Beryllium	Field Sample	0.0556	0.00291	ng/m3	Reported				0.0093
9050319-03	4/29/2019	Beryllium	Field Sample	0.0409	0.00291	ng/m3	Reported				0.0093
8050227-03	4/26/2018	Cadmium	Field Sample	0.0412	0.00487	ng/m3	Reported				0.0155
8050227-04	4/29/2018	Cadmium	Field Sample	0.265	0.00487	ng/m3	Reported				0.0155
8050227-04	4/29/2018	Cadmium	Replicate (R1)	0.267	0.00487	ng/m3	Reported				0.0155
8050829-02	5/2/2018	Cadmium	Field Sample	0.105	0.00487	ng/m3	Reported				0.0155
8051109-02	5/8/2018	Cadmium	Field Sample	0.318	0.00487	ng/m3	Reported				0.0155
8051716-03	5/14/2018	Cadmium	Field Sample	0.1	0.00487	ng/m3	Reported				0.0155
8052315-03	5/17/2018	Cadmium	Field Sample	0.153	0.00487	ng/m3	Reported				0.0155
8052315-04	5/20/2018	Cadmium	Field Sample	0.0654	0.00487	ng/m3	Reported				0.0155
8052315-04	5/20/2018	Cadmium	Replicate (R1)	0.0673	0.00487	ng/m3	Reported				0.0155
8060714-02	6/4/2018	Cadmium	Field Sample	0.153	0.00487	ng/m3	Reported				0.0155
8061224-02	6/7/2018	Cadmium	Field Sample	0.317	0.00487	ng/m3	Reported				0.0155
8061528-02	6/10/2018	Cadmium	Field Sample	0.0665	0.00487	ng/m3	Reported				0.0155
8061914-01	6/13/2018	Cadmium	Field Sample	0.0677	0.00487	ng/m3	Reported				0.0155
8062215-02	6/19/2018	Cadmium	Field Sample	0.1	0.00487	ng/m3	Reported				0.0155
8062808-02	6/25/2018	Cadmium	Field Sample	0.0514	0.00487	ng/m3	Reported				0.0155

8070617-02	7/1/2018	Cadmium	Field Sample	0.0571	0.00487	ng/m3	Reported				0.0155
8070617-02	7/1/2018	Cadmium	Replicate (R1)	0.0541	0.00487	ng/m3	Reported				0.0155
8071119-02	7/4/2018	Cadmium	Field Sample	0.132	0.00487	ng/m3	Reported				0.0155
8071310-04	7/10/2018	Cadmium	Field Sample	0.0888	0.00487	ng/m3	Reported				0.0155
8071905-03	7/16/2018	Cadmium	Field Sample	0.0541	0.00487	ng/m3	Reported				0.0155
8072422-02	7/18/2018	Cadmium	Field Sample	0.116	0.00487	ng/m3	Reported				0.0155
8072528-02	7/22/2018	Cadmium	Field Sample	0.0705	0.00487	ng/m3	Reported				0.0155
8073127-02	7/25/2018	Cadmium	Field Sample	0.289	0.00487	ng/m3	Reported				0.0155
8080313-02	7/31/2018	Cadmium	Field Sample	0.0453	0.00487	ng/m3	Reported				0.0155
8080921-02	8/6/2018	Cadmium	Field Sample	0.0573	0.00487	ng/m3	Reported				0.0155
8081520-02RE1	8/9/2018	Cadmium	Field Sample	0.0496	0.00487	ng/m3	Reported				0.0155
8081520-03	8/12/2018	Cadmium	Field Sample	0.112	0.00487	ng/m3	Reported				0.0155
8082131-02	8/15/2018	Cadmium	Field Sample	0.138	0.00487	ng/m3	Reported				0.0155
8082405-02	8/21/2018	Cadmium	Field Sample	0.0806	0.00487	ng/m3	Reported				0.0155
8083010-02	8/27/2018	Cadmium	Field Sample	0.0996	0.00487	ng/m3	Reported				0.0155
8090523-02	8/30/2018	Cadmium	Field Sample	0.0299	0.00487	ng/m3	Reported				0.0155
8091124-02	9/5/2018	Cadmium	Field Sample	0.0535	0.00487	ng/m3	Reported				0.0155

8091827-04	9/11/2018	Cadmium	Field Sample	0.136	0.00487	ng/m3	Reported				0.0155
8092521-03	9/17/2018	Cadmium	Field Sample	0.0921	0.00487	ng/m3	Reported				0.0155
8092521-04	9/20/2018	Cadmium	Field Sample	0.123	0.00487	ng/m3	Reported				0.0155
8092620-02	9/23/2018	Cadmium	Field Sample	0.0824	0.00487	ng/m3	Reported				0.0155
8100219-02	9/26/2018	Cadmium	Field Sample	0.054	0.00487	ng/m3	Reported				0.0155
8100510-02	10/2/2018	Cadmium	Field Sample	0.153	0.00487	ng/m3	Reported				0.0155
8101114-02	10/8/2018	Cadmium	Field Sample	0.301	0.00487	ng/m3	Reported				0.0155
8101626-02	10/11/2018	Cadmium	Field Sample	0.0601	0.00487	ng/m3	Reported				0.0155
8101626-02	10/11/2018	Cadmium	Replicate (R1)	0.0598	0.00487	ng/m3	Reported				0.0155
8101730-04	10/14/2018	Cadmium	Field Sample	0.104	0.00487	ng/m3	Reported				0.0155
8102327-02	10/17/2018	Cadmium	Field Sample	0.0704	0.00487	ng/m3	Reported				0.0155
8102621-02	10/22/2018	Cadmium	Field Sample	0.259	0.00487	ng/m3	Reported				0.0155
8110103-02	10/29/2018	Cadmium	Field Sample	1.53	0.00487	ng/m3	Reported				0.0155
8110618-02	11/1/2018	Cadmium	Field Sample	0.0318	0.00487	ng/m3	Reported				0.0155
8110618-02	11/1/2018	Cadmium	Replicate (R1)	0.0311	0.00487	ng/m3	Reported				0.0155
8110720-02	11/4/2018	Cadmium	Field Sample	0.0674	0.00487	ng/m3	Reported				0.0155
8111510-02	11/7/2018	Cadmium	Field Sample	0.116	0.00487	ng/m3	Reported				0.0155

8111604-04	11/13/2018	Cadmium	Field Sample	0.0899	0.00487	ng/m3	Reported				0.0155
8120439-02	11/28/2018	Cadmium	Field Sample	0.12	0.00487	ng/m3	Reported				0.0155
8120719-03	12/4/2018	Cadmium	Field Sample	0.0353	0.00487	ng/m3	Reported				0.0155
8121312-02	12/10/2018	Cadmium	Field Sample	0.167	0.00487	ng/m3	Reported		Y		0.0155
8121312-02	12/10/2018	Cadmium	Replicate (R1)	0.165	0.00487	ng/m3	Reported		Y		0.0155
8121923-02	12/13/2018	Cadmium	Field Sample	0.12	0.00487	ng/m3	Reported				0.0155
8122114-02	12/16/2018	Cadmium	Field Sample	0.0542	0.00487	ng/m3	Reported				0.0155
8122815-02	12/19/2018	Cadmium	Field Sample	0.215	0.00487	ng/m3	Reported				0.0155
9010324-02	12/25/2018	Cadmium	Field Sample	0.155	0.00487	ng/m3	Reported				0.0155
9010929-02	1/6/2019	Cadmium	Field Sample	0.26	0.00487	ng/m3	Reported				0.0155
9011548-02	1/9/2019	Cadmium	Field Sample	0.223	0.00487	ng/m3	Reported				0.0155
9011548-02	1/9/2019	Cadmium	Replicate (R1)	0.22	0.00487	ng/m3	Reported				0.0155
9011813-02	1/15/2019	Cadmium	Field Sample	0.0639	0.00487	ng/m3	Reported				0.0155
9012424-02	1/21/2019	Cadmium	Field Sample	0.157	0.00487	ng/m3	Reported				0.0155
9012922-02	1/24/2019	Cadmium	Field Sample	0.0436	0.00487	ng/m3	Reported				0.0155
9013106-01	1/27/2019	Cadmium	Field Sample	0.115	0.00487	ng/m3	Reported				0.0155
9020515-03	1/30/2019	Cadmium	Field Sample	0.117	0.00487	ng/m3	Reported				0.0155

9020515-03	1/30/2019	Cadmium	Replicate (R1)	0.112	0.00487	ng/m3	Reported				0.0155
9020814-02	2/5/2019	Cadmium	Field Sample	0.0978	0.00487	ng/m3	Reported				0.0155
9021410-02	2/10/2019	Cadmium	Field Sample	0.0668	0.00487	ng/m3	Reported				0.0155
9021923-02	2/13/2019	Cadmium	Field Sample	0.0749	0.00487	ng/m3	Reported				0.0155
9022106-02	2/16/2019	Cadmium	Field Sample	0.053	0.00487	ng/m3	Reported				0.0155
9022620-02	2/20/2019	Cadmium	Field Sample	0.0266	0.00487	ng/m3	Reported				0.0155
9030111-01	2/26/2019	Cadmium	Field Sample	0.15	0.00487	ng/m3	Reported				0.0155
9030711-01	3/4/2019	Cadmium	Field Sample	0.0484	0.00487	ng/m3	Reported				0.0155
9031218-02	3/7/2019	Cadmium	Field Sample	0.117	0.00487	ng/m3	Reported				0.0155
9031218-02	3/7/2019	Cadmium	Replicate (R1)	0.117	0.00487	ng/m3	Reported				0.0155
9031317-01	3/10/2019	Cadmium	Field Sample	0.108	0.00487	ng/m3	Reported				0.0155
9031918-02	3/13/2019	Cadmium	Field Sample	0.0701	0.00487	ng/m3	Reported				0.0155
9032208-02	3/19/2019	Cadmium	Field Sample	0.243	0.00487	ng/m3	Reported				0.0155
9032806-02	3/25/2019	Cadmium	Field Sample	0.125	0.0331	ng/m3	Reported				0.1053
9032806-02	3/25/2019	Cadmium	Replicate (R1)	0.125	0.0331	ng/m3	Reported				0.1053
9040229-02	3/28/2019	Cadmium	Field Sample	0.121	0.0331	ng/m3	Reported				0.1053
9040336-03	3/31/2019	Cadmium	Field Sample	0.0537	0.0331	ng/m3	Reported				0.1053

9040945-02	4/3/2019	Cadmium	Field Sample	0.161	0.0331	ng/m3	Reported				0.1053
9041214-02	4/9/2019	Cadmium	Field Sample	0.0834	0.0331	ng/m3	Reported				0.1053
9041214-02	4/9/2019	Cadmium	Replicate (R1)	0.0816	0.0331	ng/m3	Reported				0.1053
9041815-02	4/15/2019	Cadmium	Field Sample	0.109	0.0331	ng/m3	Reported				0.1053
9042319-02	4/18/2019	Cadmium	Field Sample	0.0524	0.0331	ng/m3	Reported				0.1053
9042418-02	4/21/2019	Cadmium	Field Sample	0.079	0.0331	ng/m3	Reported				0.1053
9043022-02	4/24/2019	Cadmium	Field Sample	0.0841	0.0331	ng/m3	Reported				0.1053
9050319-03	4/29/2019	Cadmium	Field Sample	0.137	0.0331	ng/m3	Reported				0.1053
8050227-03	4/26/2018	Chromium	Field Sample	114	3.27	ng/m3	Reported				10.3986
8050227-04	4/29/2018	Chromium	Field Sample	2.63	3.27	ng/m3	Reported			U	10.3986
8050227-04	4/29/2018	Chromium	Replicate (R1)	2.65	3.27	ng/m3	Reported			U	10.3986
8050829-02	5/2/2018	Chromium	Field Sample	55.3	3.27	ng/m3	Reported				10.3986
8051109-02	5/8/2018	Chromium	Field Sample	22	3.27	ng/m3	Reported				10.3986
8051716-03	5/14/2018	Chromium	Field Sample	8.74	3.27	ng/m3	Reported				10.3986
8052315-03	5/17/2018	Chromium	Field Sample	14.8	3.27	ng/m3	Reported				10.3986
8052315-04	5/20/2018	Chromium	Field Sample	2.61	3.27	ng/m3	Reported			U	10.3986
8052315-04	5/20/2018	Chromium	Replicate (R1)	2.58	3.27	ng/m3	Reported			U	10.3986

8060714-02	6/4/2018	Chromium	Field Sample	25.9	3.27	ng/m3	Reported				10.3986
8061224-02	6/7/2018	Chromium	Field Sample	4.49	3.27	ng/m3	Reported				10.3986
8061528-02	6/10/2018	Chromium	Field Sample	98.8	3.27	ng/m3	Reported				10.3986
8061914-01	6/13/2018	Chromium	Field Sample	129	3.27	ng/m3	Reported				10.3986
8062215-02	6/19/2018	Chromium	Field Sample	9.23	3.27	ng/m3	Reported				10.3986
8062808-02	6/25/2018	Chromium	Field Sample	42.8	3.27	ng/m3	Reported				10.3986
8070617-02	7/1/2018	Chromium	Field Sample	2.27	3.27	ng/m3	Reported			U	10.3986
8070617-02	7/1/2018	Chromium	Replicate (R1)	2.22	3.27	ng/m3	Reported			U	10.3986
8071119-02	7/4/2018	Chromium	Field Sample	6.42	3.27	ng/m3	Reported				10.3986
8071310-04	7/10/2018	Chromium	Field Sample	2.27	3.27	ng/m3	Reported			U	10.3986
8071905-03	7/16/2018	Chromium	Field Sample	67.6	3.27	ng/m3	Reported				10.3986
8072422-02	7/18/2018	Chromium	Field Sample	4.96	3.27	ng/m3	Reported				10.3986
8072528-02	7/22/2018	Chromium	Field Sample	10.2	3.27	ng/m3	Reported				10.3986
8073127-02	7/25/2018	Chromium	Field Sample	2.58	3.27	ng/m3	Reported			U	10.3986
8080313-02	7/31/2018	Chromium	Field Sample	7.05	3.27	ng/m3	Reported				10.3986
8080921-02	8/6/2018	Chromium	Field Sample	71.1	3.27	ng/m3	Reported				10.3986
8081520-02RE1	8/9/2018	Chromium	Field Sample	67.4	3.27	ng/m3	Reported				10.3986

8081520-03	8/12/2018	Chromium	Field Sample	2.41	3.27	ng/m3	Reported			U	10.3986
8082131-02	8/15/2018	Chromium	Field Sample	15.5	3.27	ng/m3	Reported				10.3986
8082405-02	8/21/2018	Chromium	Field Sample	60.5	3.27	ng/m3	Reported				10.3986
8083010-02	8/27/2018	Chromium	Field Sample	28.5	3.27	ng/m3	Reported				10.3986
8090523-02	8/30/2018	Chromium	Field Sample	8.04	3.27	ng/m3	Reported				10.3986
8091124-02	9/5/2018	Chromium	Field Sample	3.4	3.27	ng/m3	Reported				10.3986
8091827-04	9/11/2018	Chromium	Field Sample	7.91	3.27	ng/m3	Reported				10.3986
8092521-03	9/17/2018	Chromium	Field Sample	3.77	3.27	ng/m3	Reported				10.3986
8092521-04	9/20/2018	Chromium	Field Sample	34.1	3.27	ng/m3	Reported				10.3986
8092620-02	9/23/2018	Chromium	Field Sample	3.07	3.27	ng/m3	Reported			U	10.3986
8100219-02	9/26/2018	Chromium	Field Sample	66.5	3.27	ng/m3	Reported				10.3986
8100510-02	10/2/2018	Chromium	Field Sample	12	3.27	ng/m3	Reported				10.3986
8101114-02	10/8/2018	Chromium	Field Sample	12.6	3.27	ng/m3	Reported				10.3986
8101626-02	10/11/2018	Chromium	Field Sample	4.71	3.27	ng/m3	Reported				10.3986
8101626-02	10/11/2018	Chromium	Replicate (R1)	4.6	3.27	ng/m3	Reported				10.3986
8101730-04	10/14/2018	Chromium	Field Sample	9.39	3.27	ng/m3	Reported				10.3986
8102327-02	10/17/2018	Chromium	Field Sample	1.39	3.27	ng/m3	Reported			U	10.3986

8102621-02	10/22/2018	Chromium	Field Sample	3.66	3.27	ng/m3	Reported				10.3986	
8110103-02	10/29/2018	Chromium	Field Sample	8.9	3.27	ng/m3	Reported				10.3986	
8110618-02	11/1/2018	Chromium	Field Sample	64.4	3.27	ng/m3	Reported				10.3986	
8110618-02	11/1/2018	Chromium	Replicate (R1)	69	3.27	ng/m3	Reported				10.3986	
8110720-02	11/4/2018	Chromium	Field Sample	2.45	3.27	ng/m3	Reported			U	10.3986	
8111510-02	11/7/2018	Chromium	Field Sample	6.37	3.27	ng/m3	Reported				10.3986	
8111604-04	11/13/2018	Chromium	Field Sample	2.21	3.27	ng/m3	Reported			U	10.3986	
8120439-02	11/28/2018	Chromium	Field Sample	302	6.54	ng/m3	Reported			D-01	20.7972	D-01 is the same as D
8120719-03	12/4/2018	Chromium	Field Sample	56.9	3.27	ng/m3	Reported				10.3986	
8121312-02	12/10/2018	Chromium	Field Sample	6.83	3.27	ng/m3	Reported		Y		10.3986	
8121312-02	12/10/2018	Chromium	Replicate (R1)	6.9	3.27	ng/m3	Reported		Y		10.3986	
8121923-02	12/13/2018	Chromium	Field Sample	2.93	3.27	ng/m3	Reported			U	10.3986	
8122114-02	12/16/2018	Chromium	Field Sample	1.78	3.27	ng/m3	Reported			U	10.3986	
8122815-02	12/19/2018	Chromium	Field Sample	7.57	3.27	ng/m3	Reported				10.3986	
9010324-02	12/25/2018	Chromium	Field Sample	2.4	3.27	ng/m3	Reported			U	10.3986	
9010929-02	1/6/2019	Chromium	Field Sample	47.8	3.27	ng/m3	Reported				10.3986	
9011548-02	1/9/2019	Chromium	Field Sample	2.79	3.27	ng/m3	Reported			U	10.3986	

9011548-02	1/9/2019	Chromium	Replicate (R1)	2.81	3.27	ng/m3	Reported			U	10.3986
9011813-02	1/15/2019	Chromium	Field Sample	2.67	3.27	ng/m3	Reported			U	10.3986
9012424-02	1/21/2019	Chromium	Field Sample	3.19	3.27	ng/m3	Reported			U	10.3986
9012922-02	1/24/2019	Chromium	Field Sample	7.19	3.27	ng/m3	Reported				10.3986
9013106-01	1/27/2019	Chromium	Field Sample	149	3.27	ng/m3	Reported				10.3986
9020515-03	1/30/2019	Chromium	Field Sample	10.1	3.27	ng/m3	Reported				10.3986
9020515-03	1/30/2019	Chromium	Replicate (R1)	10	3.27	ng/m3	Reported				10.3986
9020814-02	2/5/2019	Chromium	Field Sample	23.1	3.27	ng/m3	Reported				10.3986
9021410-02	2/10/2019	Chromium	Field Sample	14.4	3.27	ng/m3	Reported				10.3986
9021923-02	2/13/2019	Chromium	Field Sample	117	3.27	ng/m3	Reported				10.3986
9022106-02	2/16/2019	Chromium	Field Sample	2	3.27	ng/m3	Reported			U	10.3986
9022620-02	2/20/2019	Chromium	Field Sample	13.9	3.27	ng/m3	Reported				10.3986
9030111-01	2/26/2019	Chromium	Field Sample	51.5	3.27	ng/m3	Reported				10.3986
9030711-01	3/4/2019	Chromium	Field Sample	1.95	3.27	ng/m3	Reported			U	10.3986
9031218-02	3/7/2019	Chromium	Field Sample	32.2	3.27	ng/m3	Reported				10.3986
9031218-02	3/7/2019	Chromium	Replicate (R1)	30.5	3.27	ng/m3	Reported				10.3986
9031317-01	3/10/2019	Chromium	Field Sample	22.7	3.27	ng/m3	Reported				10.3986

9031918-02	3/13/2019	Chromium	Field Sample	7.2	3.27	ng/m3	Reported				10.3986
9032208-02	3/19/2019	Chromium	Field Sample	4.66	3.27	ng/m3	Reported				10.3986
9032806-02	3/25/2019	Chromium	Field Sample	51.2	6.95	ng/m3	Reported				22.1010
9032806-02	3/25/2019	Chromium	Replicate (R1)	54.3	6.95	ng/m3	Reported				22.1010
9040229-02	3/28/2019	Chromium	Field Sample	16.3	6.95	ng/m3	Reported				22.1010
9040336-03	3/31/2019	Chromium	Field Sample	2.46	6.95	ng/m3	Reported			U	22.1010
9040945-02	4/3/2019	Chromium	Field Sample	16.3	6.95	ng/m3	Reported				22.1010
9041214-02	4/9/2019	Chromium	Field Sample	27.3	6.95	ng/m3	Reported				22.1010
9041214-02	4/9/2019	Chromium	Replicate (R1)	27.8	6.95	ng/m3	Reported				22.1010
9041815-02	4/15/2019	Chromium	Field Sample	7.38	6.95	ng/m3	Reported				22.1010
9042319-02	4/18/2019	Chromium	Field Sample	8.46	6.95	ng/m3	Reported				22.1010
9042418-02	4/21/2019	Chromium	Field Sample	3.98	6.95	ng/m3	Reported			U	22.1010
9043022-02	4/24/2019	Chromium	Field Sample	17.8	6.95	ng/m3	Reported				22.1010
9050319-03	4/29/2019	Chromium	Field Sample	32.8	6.95	ng/m3	Reported				22.1010
8050227-03	4/26/2018	Cobalt	Field Sample	0.196	0.0842	ng/m3	Reported				0.2678
8050227-04	4/29/2018	Cobalt	Field Sample	0.0864	0.0842	ng/m3	Reported				0.2678
8050227-04	4/29/2018	Cobalt	Replicate (R1)	0.085	0.0842	ng/m3	Reported				0.2678

8050829-02	5/2/2018	Cobalt	Field Sample	0.308	0.0842	ng/m3	Reported				0.2678
8051109-02	5/8/2018	Cobalt	Field Sample	0.365	0.0842	ng/m3	Reported				0.2678
8051716-03	5/14/2018	Cobalt	Field Sample	0.186	0.0842	ng/m3	Reported				0.2678
8052315-03	5/17/2018	Cobalt	Field Sample	0.201	0.0842	ng/m3	Reported				0.2678
8052315-04	5/20/2018	Cobalt	Field Sample	0.0531	0.0842	ng/m3	Reported			U	0.2678
8052315-04	5/20/2018	Cobalt	Replicate (R1)	0.0537	0.0842	ng/m3	Reported			U	0.2678
8060714-02	6/4/2018	Cobalt	Field Sample	0.167	0.0842	ng/m3	Reported				0.2678
8061224-02	6/7/2018	Cobalt	Field Sample	0.243	0.0842	ng/m3	Reported				0.2678
8061528-02	6/10/2018	Cobalt	Field Sample	0.205	0.0842	ng/m3	Reported				0.2678
8061914-01	6/13/2018	Cobalt	Field Sample	0.225	0.0842	ng/m3	Reported				0.2678
8062215-02	6/19/2018	Cobalt	Field Sample	0.658	0.0842	ng/m3	Reported				0.2678
8062808-02	6/25/2018	Cobalt	Field Sample	0.137	0.0842	ng/m3	Reported				0.2678
8070617-02	7/1/2018	Cobalt	Field Sample	0.0414	0.0842	ng/m3	Reported			U	0.2678
8070617-02	7/1/2018	Cobalt	Replicate (R1)	0.0407	0.0842	ng/m3	Reported			U	0.2678
8071119-02	7/4/2018	Cobalt	Field Sample	0.0915	0.0842	ng/m3	Reported				0.2678
8071310-04	7/10/2018	Cobalt	Field Sample	0.086	0.0842	ng/m3	Reported				0.2678
8071905-03	7/16/2018	Cobalt	Field Sample	0.17	0.0842	ng/m3	Reported				0.2678

8072422-02	7/18/2018	Cobalt	Field Sample	0.123	0.0842	ng/m3	Reported				0.2678
8072528-02	7/22/2018	Cobalt	Field Sample	0.0982	0.0842	ng/m3	Reported				0.2678
8073127-02	7/25/2018	Cobalt	Field Sample	0.117	0.0842	ng/m3	Reported				0.2678
8080313-02	7/31/2018	Cobalt	Field Sample	0.0735	0.0842	ng/m3	Reported			U	0.2678
8080921-02	8/6/2018	Cobalt	Field Sample	0.213	0.0842	ng/m3	Reported				0.2678
8081520-02RE1	8/9/2018	Cobalt	Field Sample	0.162	0.0842	ng/m3	Reported				0.2678
8081520-03	8/12/2018	Cobalt	Field Sample	0.0676	0.0842	ng/m3	Reported			U	0.2678
8082131-02	8/15/2018	Cobalt	Field Sample	0.263	0.0842	ng/m3	Reported				0.2678
8082405-02	8/21/2018	Cobalt	Field Sample	0.179	0.0842	ng/m3	Reported				0.2678
8083010-02	8/27/2018	Cobalt	Field Sample	0.171	0.0842	ng/m3	Reported				0.2678
8090523-02	8/30/2018	Cobalt	Field Sample	0.0762	0.0842	ng/m3	Reported			U	0.2678
8091124-02	9/5/2018	Cobalt	Field Sample	0.0623	0.0842	ng/m3	Reported			U	0.2678
8091827-04	9/11/2018	Cobalt	Field Sample	0.108	0.0842	ng/m3	Reported				0.2678
8092521-03	9/17/2018	Cobalt	Field Sample	0.148	0.0842	ng/m3	Reported				0.2678
8092521-04	9/20/2018	Cobalt	Field Sample	0.232	0.0842	ng/m3	Reported				0.2678
8092620-02	9/23/2018	Cobalt	Field Sample	0.0729	0.0842	ng/m3	Reported			U	0.2678
8100219-02	9/26/2018	Cobalt	Field Sample	0.118	0.0842	ng/m3	Reported				0.2678

8100510-02	10/2/2018	Cobalt	Field Sample	0.113	0.0842	ng/m3	Reported				0.2678
8101114-02	10/8/2018	Cobalt	Field Sample	0.159	0.0842	ng/m3	Reported				0.2678
8101626-02	10/11/2018	Cobalt	Field Sample	0.0689	0.0842	ng/m3	Reported			U	0.2678
8101626-02	10/11/2018	Cobalt	Replicate (R1)	0.0676	0.0842	ng/m3	Reported			U	0.2678
8101730-04	10/14/2018	Cobalt	Field Sample	0.207	0.0842	ng/m3	Reported				0.2678
8102327-02	10/17/2018	Cobalt	Field Sample	0.0534	0.0842	ng/m3	Reported			U	0.2678
8102621-02	10/22/2018	Cobalt	Field Sample	0.14	0.0842	ng/m3	Reported				0.2678
8110103-02	10/29/2018	Cobalt	Field Sample	0.236	0.0842	ng/m3	Reported				0.2678
8110618-02	11/1/2018	Cobalt	Field Sample	0.13	0.0842	ng/m3	Reported				0.2678
8110618-02	11/1/2018	Cobalt	Replicate (R1)	0.126	0.0842	ng/m3	Reported				0.2678
8110720-02	11/4/2018	Cobalt	Field Sample	0.0443	0.0842	ng/m3	Reported			U	0.2678
8111510-02	11/7/2018	Cobalt	Field Sample	0.067	0.0842	ng/m3	Reported			U	0.2678
8111604-04	11/13/2018	Cobalt	Field Sample	0.0946	0.0842	ng/m3	Reported				0.2678
8120439-02	11/28/2018	Cobalt	Field Sample	0.55	0.0842	ng/m3	Reported				0.2678
8120719-03	12/4/2018	Cobalt	Field Sample	0.153	0.0842	ng/m3	Reported				0.2678
8121312-02	12/10/2018	Cobalt	Field Sample	0.989	0.0842	ng/m3	Reported		Y		0.2678
8121312-02	12/10/2018	Cobalt	Replicate (R1)	0.988	0.0842	ng/m3	Reported		Y		0.2678

8121923-02	12/13/2018	Cobalt	Field Sample	0.193	0.0842	ng/m3	Reported				0.2678
8122114-02	12/16/2018	Cobalt	Field Sample	0.0249	0.0842	ng/m3	Reported			U	0.2678
8122815-02	12/19/2018	Cobalt	Field Sample	0.126	0.0842	ng/m3	Reported				0.2678
9010324-02	12/25/2018	Cobalt	Field Sample	0.0777	0.0842	ng/m3	Reported			U	0.2678
9010929-02	1/6/2019	Cobalt	Field Sample	0.193	0.0842	ng/m3	Reported				0.2678
9011548-02	1/9/2019	Cobalt	Field Sample	0.0766	0.0842	ng/m3	Reported			U	0.2678
9011548-02	1/9/2019	Cobalt	Replicate (R1)	0.0773	0.0842	ng/m3	Reported			U	0.2678
9011813-02	1/15/2019	Cobalt	Field Sample	0.0597	0.0842	ng/m3	Reported			U	0.2678
9012424-02	1/21/2019	Cobalt	Field Sample	0.0802	0.0842	ng/m3	Reported			U	0.2678
9012922-02	1/24/2019	Cobalt	Field Sample	0.101	0.0842	ng/m3	Reported				0.2678
9013106-01	1/27/2019	Cobalt	Field Sample	0.313	0.0842	ng/m3	Reported				0.2678
9020515-03	1/30/2019	Cobalt	Field Sample	0.141	0.0842	ng/m3	Reported				0.2678
9020515-03	1/30/2019	Cobalt	Replicate (R1)	0.14	0.0842	ng/m3	Reported				0.2678
9020814-02	2/5/2019	Cobalt	Field Sample	0.107	0.0842	ng/m3	Reported				0.2678
9021410-02	2/10/2019	Cobalt	Field Sample	0.117	0.0842	ng/m3	Reported				0.2678
9021923-02	2/13/2019	Cobalt	Field Sample	0.352	0.0842	ng/m3	Reported				0.2678
9022106-02	2/16/2019	Cobalt	Field Sample	0.0373	0.0842	ng/m3	Reported			U	0.2678

9022620-02	2/20/2019	Cobalt	Field Sample	0.0615	0.0842	ng/m3	Reported			U	0.2678
9030111-01	2/26/2019	Cobalt	Field Sample	0.273	0.0842	ng/m3	Reported				0.2678
9030711-01	3/4/2019	Cobalt	Field Sample	0.0417	0.0842	ng/m3	Reported			U	0.2678
9031218-02	3/7/2019	Cobalt	Field Sample	0.196	0.0842	ng/m3	Reported				0.2678
9031218-02	3/7/2019	Cobalt	Replicate (R1)	0.196	0.0842	ng/m3	Reported				0.2678
9031317-01	3/10/2019	Cobalt	Field Sample	0.117	0.0842	ng/m3	Reported				0.2678
9031918-02	3/13/2019	Cobalt	Field Sample	0.153	0.0842	ng/m3	Reported				0.2678
9032208-02	3/19/2019	Cobalt	Field Sample	0.154	0.0842	ng/m3	Reported				0.2678
9032806-02	3/25/2019	Cobalt	Field Sample	0.0932	0.0771	ng/m3	Reported				0.2452
9032806-02	3/25/2019	Cobalt	Replicate (R1)	0.146	0.0771	ng/m3	Reported				0.2452
9040229-02	3/28/2019	Cobalt	Field Sample	0.235	0.0771	ng/m3	Reported				0.2452
9040336-03	3/31/2019	Cobalt	Field Sample	0.0474	0.0771	ng/m3	Reported			U	0.2452
9040945-02	4/3/2019	Cobalt	Field Sample	0.223	0.0771	ng/m3	Reported				0.2452
9041214-02	4/9/2019	Cobalt	Field Sample	0.159	0.0771	ng/m3	Reported				0.2452
9041214-02	4/9/2019	Cobalt	Replicate (R1)	0.153	0.0771	ng/m3	Reported				0.2452
9041815-02	4/15/2019	Cobalt	Field Sample	0.184	0.0771	ng/m3	Reported				0.2452
9042319-02	4/18/2019	Cobalt	Field Sample	0.139	0.0771	ng/m3	Reported				0.2452

9042418-02	4/21/2019	Cobalt	Field Sample	0.0452	0.0771	ng/m3	Reported			U	0.2452	
9043022-02	4/24/2019	Cobalt	Field Sample	0.178	0.0771	ng/m3	Reported				0.2452	
9050319-03	4/29/2019	Cobalt	Field Sample	0.242	0.0771	ng/m3	Reported				0.2452	
8050227-01	4/26/2018	Hexavalent Chromium	Field Sample	9.93	0.08	ng/m3	Reported			D	0.2544	
8050227-02	4/29/2018	Hexavalent Chromium	Field Sample	0.047	0.004	ng/m3	Reported				0.0127	
8050829-01	5/2/2018	Hexavalent Chromium	Field Sample	1.41	0.01	ng/m3	Reported			D	0.0318	
8051109-01	5/8/2018	Hexavalent Chromium	Field Sample	0.211	0.004	ng/m3	Reported				0.0127	
8051716-01	5/14/2018	Hexavalent Chromium	Field Sample	0.0496	0.004	ng/m3	Reported			FB-01	0.0127	Use reported value per ATRA
8052315-01	5/17/2018	Hexavalent Chromium	Field Sample	0.131	0.004	ng/m3	Reported				0.0127	
8052315-02	5/20/2018	Hexavalent Chromium	Field Sample	ND	0.004	ng/m3	Reported			U, CE	0.0127	Use 1/2 SQL
8053025-01	5/23/2018	Hexavalent Chromium	Field Sample	0.369	0.004	ng/m3	Reported				0.0127	
8060108-01	5/29/2018	Hexavalent Chromium	Field Sample	4.36	0.04	ng/m3	Reported			D	0.1272	
8060108-01	5/29/2018	Hexavalent Chromium	Replicate (R1)	4.31	0.04	ng/m3	Reported			D	0.1272	
8060714-01	6/4/2018	Hexavalent Chromium	Field Sample	0.286	0.004	ng/m3	Reported				0.0127	
8061224-01	6/7/2018	Hexavalent Chromium	Field Sample	0.0158	0.004	ng/m3	Reported				0.0127	

8061528-01	6/10/2018	Hexavalent Chromium	Field Sample	6.01	0.0833	ng/m3	Reported			D	0.2649	
8061914-03	6/13/2018	Hexavalent Chromium	Field Sample	8.6	0.167	ng/m3	Reported			D	0.5311	
8062215-01	6/19/2018	Hexavalent Chromium	Field Sample	0.0515	0.004	ng/m3	Reported				0.0127	
8062808-01	6/25/2018	Hexavalent Chromium	Field Sample	1.3	0.02	ng/m3	Reported			D	0.0636	
8070617-01	7/1/2018	Hexavalent Chromium	Field Sample	0.0315	0.004	ng/m3	Reported				0.0127	
8071119-01	7/4/2018	Hexavalent Chromium	Field Sample	0.173	0.004	ng/m3	Reported		TT		0.0127	Sample is invalid
8071310-01	7/10/2018	Hexavalent Chromium	Field Sample	0.011	0.004	ng/m3	Reported				0.0127	
8071310-01	7/10/2018	Hexavalent Chromium	Replicate (R1)	0.0106	0.004	ng/m3	Reported				0.0127	
8071905-01	7/16/2018	Hexavalent Chromium	Field Sample	2.22	0.04	ng/m3	Reported			D	0.1272	
8072528-01	7/22/2018	Hexavalent Chromium	Field Sample	0.248	0.004	ng/m3	Reported				0.0127	
8073127-01	7/25/2018	Hexavalent Chromium	Field Sample	0.00769	0.004	ng/m3	Reported				0.0127	
8080313-01	7/31/2018	Hexavalent Chromium	Field Sample	0.162	0.004	ng/m3	Reported				0.0127	
8080921-01	8/6/2018	Hexavalent Chromium	Field Sample	3.59	0.08	ng/m3	Reported			D	0.2544	
8081520-01	8/9/2018	Hexavalent Chromium	Field Sample	6.45	0.1	ng/m3	Reported			D	0.3180	
8081520-01	8/9/2018	Hexavalent Chromium	Replicate (R1)	6.62	0.1	ng/m3	Reported			D	0.3180	

8081520-04	8/12/2018	Hexavalent Chromium	Field Sample	0.0246	0.004	ng/m3	Reported				0.0127
8082131-01	8/15/2018	Hexavalent Chromium	Field Sample	0.238	0.004	ng/m3	Reported				0.0127
8082405-01	8/21/2018	Hexavalent Chromium	Field Sample	1.12	0.016	ng/m3	Reported			D	0.0509
8082405-01	8/21/2018	Hexavalent Chromium	Replicate (R1)	1.1	0.016	ng/m3	Reported			D	0.0509
8083010-01	8/27/2018	Hexavalent Chromium	Field Sample	1.01	0.016	ng/m3	Reported			D	0.0509
8090523-01	8/30/2018	Hexavalent Chromium	Field Sample	0.18	0.004	ng/m3	Reported				0.0127
8091124-01	9/5/2018	Hexavalent Chromium	Field Sample	0.231	0.004	ng/m3	Reported				0.0127
8091124-01	9/5/2018	Hexavalent Chromium	Replicate (R1)	0.231	0.004	ng/m3	Reported				0.0127
8091827-01	9/11/2018	Hexavalent Chromium	Field Sample	0.104	0.004	ng/m3	Reported				0.0127
8092521-01	9/17/2018	Hexavalent Chromium	Field Sample	0.0187	0.004	ng/m3	Reported				0.0127
8092521-02	9/20/2018	Hexavalent Chromium	Field Sample	3.22	0.04	ng/m3	Reported			D	0.1272
8092620-01	9/23/2018	Hexavalent Chromium	Field Sample	0.017	0.004	ng/m3	Reported				0.0127
8092620-01	9/23/2018	Hexavalent Chromium	Replicate (R1)	0.0141	0.004	ng/m3	Reported				0.0127
8100219-01	9/26/2018	Hexavalent Chromium	Field Sample	10.1	0.1	ng/m3	Reported			D	0.3180
8100510-01	10/2/2018	Hexavalent Chromium	Field Sample	0.211	0.004	ng/m3	Reported				0.0127

8101114-01	10/8/2018	Hexavalent Chromium	Field Sample	0.0371	0.004	ng/m3	Reported				0.0127
8101626-01	10/11/2018	Hexavalent Chromium	Field Sample	0.0798	0.004	ng/m3	Reported				0.0127
8101626-01	10/11/2018	Hexavalent Chromium	Replicate (R1)	0.0776	0.004	ng/m3	Reported				0.0127
8101730-01	10/14/2018	Hexavalent Chromium	Field Sample	0.31	0.004	ng/m3	Reported				0.0127
8102327-01	10/17/2018	Hexavalent Chromium	Field Sample	0.0114	0.004	ng/m3	Reported				0.0127
8110103-01	10/29/2018	Hexavalent Chromium	Field Sample	0.325	0.004	ng/m3	Reported				0.0127
8110618-01	11/1/2018	Hexavalent Chromium	Field Sample	8.93	0.1	ng/m3	Reported			D	0.3180
8110720-01	11/4/2018	Hexavalent Chromium	Field Sample	0.0352	0.004	ng/m3	Reported				0.0127
8111510-01	11/7/2018	Hexavalent Chromium	Field Sample	0.39	0.004	ng/m3	Reported				0.0127
8111604-01	11/13/2018	Hexavalent Chromium	Field Sample	0.0092	0.004	ng/m3	Reported				0.0127
8112710-01	11/19/2018	Hexavalent Chromium	Field Sample	1.5	0.02	ng/m3	Reported			D	0.0636
8112904-01	11/25/2018	Hexavalent Chromium	Field Sample	0.422	0.004	ng/m3	Reported				0.0127
8112904-01	11/25/2018	Hexavalent Chromium	Replicate (R1)	0.424	0.004	ng/m3	Reported				0.0127
8120439-01	11/28/2018	Hexavalent Chromium	Field Sample	44	0.3	ng/m3	Reported			D	0.9540
8120719-01	12/4/2018	Hexavalent Chromium	Field Sample	7.71	0.08	ng/m3	Reported			D	0.2544

8121312-01	12/10/2018	Hexavalent Chromium	Field Sample	0.405	0.004	ng/m3	Reported		Y		0.0127
8121312-01	12/10/2018	Hexavalent Chromium	Replicate (R1)	0.41	0.004	ng/m3	Reported		Y		0.0127
8121923-01	12/13/2018	Hexavalent Chromium	Field Sample	0.0197	0.004	ng/m3	Reported				0.0127
8122114-01	12/16/2018	Hexavalent Chromium	Field Sample	0.00986	0.004	ng/m3	Reported				0.0127
8122815-01	12/19/2018	Hexavalent Chromium	Field Sample	0.128	0.004	ng/m3	Reported				0.0127
8122815-01	12/19/2018	Hexavalent Chromium	Replicate (R1)	0.128	0.004	ng/m3	Reported				0.0127
9010324-01	12/25/2018	Hexavalent Chromium	Field Sample	0.0139	0.004	ng/m3	Reported				0.0127
9010824-01	1/3/2019	Hexavalent Chromium	Field Sample	0.0418	0.004	ng/m3	Reviewed				0.0127
9010929-01	1/6/2019	Hexavalent Chromium	Field Sample	1.85	0.016	ng/m3	Reported			D	0.0509
9010929-01	1/6/2019	Hexavalent Chromium	Replicate (R1)	1.83	0.016	ng/m3	Reported			D	0.0509
9011548-01	1/9/2019	Hexavalent Chromium	Field Sample	0.0474	0.004	ng/m3	Reported				0.0127
9011813-01	1/15/2019	Hexavalent Chromium	Field Sample	0.0122	0.004	ng/m3	Reported				0.0127
9012424-01	1/21/2019	Hexavalent Chromium	Field Sample	0.0261	0.004	ng/m3	Reported				0.0127
9012922-01	1/24/2019	Hexavalent Chromium	Field Sample	0.308	0.004	ng/m3	Reported				0.0127
9012922-01	1/24/2019	Hexavalent Chromium	Replicate (R1)	0.312	0.004	ng/m3	Reported				0.0127

9013106-02	1/27/2019	Hexavalent Chromium	Field Sample	24.4	0.2	ng/m3	Reported			D	0.6360
9020814-01	2/5/2019	Hexavalent Chromium	Field Sample	1.74	0.016	ng/m3	Reported			D	0.0509
9020814-01	2/5/2019	Hexavalent Chromium	Replicate (R1)	1.77	0.016	ng/m3	Reported			D	0.0509
9021410-01	2/10/2019	Hexavalent Chromium	Field Sample	3.29	0.04	ng/m3	Reported			D	0.1272
9021923-01	2/13/2019	Hexavalent Chromium	Field Sample	32.1	0.2	ng/m3	Reported			D	0.6360
9022106-01	2/16/2019	Hexavalent Chromium	Field Sample	0.0169	0.004	ng/m3	Reported				0.0127
9022620-01	2/20/2019	Hexavalent Chromium	Field Sample	0.675	0.004	ng/m3	Reported				0.0127
9022620-01	2/20/2019	Hexavalent Chromium	Replicate (R1)	0.671	0.004	ng/m3	Reported				0.0127
9030111-02	2/26/2019	Hexavalent Chromium	Field Sample	2.5	0.0173	ng/m3	Reported			D	0.0550
9030711-02	3/4/2019	Hexavalent Chromium	Field Sample	0.00635	0.00386	ng/m3	Reported				0.0123
9030711-02	3/4/2019	Hexavalent Chromium	Replicate (R1)	0.00473	0.00386	ng/m3	Reported				0.0123
9031218-01	3/7/2019	Hexavalent Chromium	Field Sample	0.837	0.00386	ng/m3	Reported				0.0123
9031317-02	3/10/2019	Hexavalent Chromium	Field Sample	1.49	0.00965	ng/m3	Reported			D	0.0307
9031918-01	3/13/2019	Hexavalent Chromium	Field Sample	0.11	0.00386	ng/m3	Reported				0.0123
9031918-01	3/13/2019	Hexavalent Chromium	Replicate (R1)	0.109	0.00386	ng/m3	Reported				0.0123

9032208-01	3/19/2019	Hexavalent Chromium	Field Sample	0.0405	0.00386	ng/m3	Reported				0.0123	
9032806-01	3/25/2019	Hexavalent Chromium	Field Sample	3.99	0.0386	ng/m3	Reported			A-01a, D	0.1227	Lab indicates that result should be acceptable; use reported value
9040229-01	3/28/2019	Hexavalent Chromium	Field Sample	1.01	0.00772	ng/m3	Reported			A-01a, D	0.0245	Lab indicates that result should be acceptable; use reported value
9040336-01	3/31/2019	Hexavalent Chromium	Field Sample	ND	0.00386	ng/m3	Reported			U	0.0123	USE 1/2SQL (this is a true nondetect; the lab's computer system automatically flags this as "U")
9040945-01	4/3/2019	Hexavalent Chromium	Field Sample	0.224	0.00386	ng/m3	Reported				0.0123	
9040945-01	4/3/2019	Hexavalent Chromium	Replicate (R1)	0.21	0.00386	ng/m3	Reported				0.0123	
9041214-01	4/9/2019	Hexavalent Chromium	Field Sample	0.0977	0.00386	ng/m3	Reported				0.0123	
9041815-01	4/15/2019	Hexavalent Chromium	Field Sample	0.153	0.00386	ng/m3	Reported				0.0123	

9042319-01	4/18/2019	Hexavalent Chromium	Field Sample	0.0895	0.00386	ng/m3	Reported				0.0123
9042418-01	4/21/2019	Hexavalent Chromium	Field Sample	0.108	0.00386	ng/m3	Reported				0.0123
9043022-01	4/24/2019	Hexavalent Chromium	Field Sample	0.285	0.00386	ng/m3	Reported				0.0123
9043022-01	4/24/2019	Hexavalent Chromium	Replicate (R1)	0.287	0.00386	ng/m3	Reported				0.0123
9050319-01	4/29/2019	Hexavalent Chromium	Field Sample	2.41	0.0193	ng/m3	Reported			D	0.0614
8050227-03	4/26/2018	Lead	Field Sample	1.03	0.0657	ng/m3	Reported				0.2089
8050227-04	4/29/2018	Lead	Field Sample	6.27	0.0657	ng/m3	Reported				0.2089
8050227-04	4/29/2018	Lead	Replicate (R1)	6.27	0.0657	ng/m3	Reported				0.2089
8050829-02	5/2/2018	Lead	Field Sample	7.17	0.0657	ng/m3	Reported				0.2089
8051109-02	5/8/2018	Lead	Field Sample	9.95	0.0657	ng/m3	Reported				0.2089
8051716-03	5/14/2018	Lead	Field Sample	3.25	0.0657	ng/m3	Reported				0.2089
8052315-03	5/17/2018	Lead	Field Sample	5.91	0.0657	ng/m3	Reported				0.2089
8052315-04	5/20/2018	Lead	Field Sample	4.73	0.0657	ng/m3	Reported				0.2089
8052315-04	5/20/2018	Lead	Replicate (R1)	4.66	0.0657	ng/m3	Reported				0.2089
8060714-02	6/4/2018	Lead	Field Sample	2.92	0.0657	ng/m3	Reported				0.2089
8061224-02	6/7/2018	Lead	Field Sample	15.2	0.0657	ng/m3	Reported				0.2089
8061528-02	6/10/2018	Lead	Field Sample	1.66	0.0657	ng/m3	Reported				0.2089

8061914-01	6/13/2018	Lead	Field Sample	2.08	0.0657	ng/m3	Reported				0.2089
8062215-02	6/19/2018	Lead	Field Sample	4.84	0.0657	ng/m3	Reported				0.2089
8062808-02	6/25/2018	Lead	Field Sample	2.01	0.0657	ng/m3	Reported				0.2089
8070617-02	7/1/2018	Lead	Field Sample	3.12	0.0657	ng/m3	Reported				0.2089
8070617-02	7/1/2018	Lead	Replicate (R1)	3.09	0.0657	ng/m3	Reported				0.2089
8071119-02	7/4/2018	Lead	Field Sample	6.5	0.0657	ng/m3	Reported				0.2089
8071310-04	7/10/2018	Lead	Field Sample	3.1	0.0657	ng/m3	Reported				0.2089
8071905-03	7/16/2018	Lead	Field Sample	1.63	0.0657	ng/m3	Reported				0.2089
8072422-02	7/18/2018	Lead	Field Sample	2.99	0.0657	ng/m3	Reported				0.2089
8072528-02	7/22/2018	Lead	Field Sample	1.73	0.0657	ng/m3	Reported				0.2089
8073127-02	7/25/2018	Lead	Field Sample	3.51	0.0657	ng/m3	Reported				0.2089
8080313-02	7/31/2018	Lead	Field Sample	1.02	0.0657	ng/m3	Reported				0.2089
8080921-02	8/6/2018	Lead	Field Sample	2.24	0.0657	ng/m3	Reported				0.2089
8081520-02RE1	8/9/2018	Lead	Field Sample	1.7	0.0657	ng/m3	Reported				0.2089
8081520-03	8/12/2018	Lead	Field Sample	2.85	0.0657	ng/m3	Reported				0.2089
8082131-02	8/15/2018	Lead	Field Sample	3.12	0.0657	ng/m3	Reported				0.2089
8082405-02	8/21/2018	Lead	Field Sample	3.37	0.0657	ng/m3	Reported				0.2089

8083010-02	8/27/2018	Lead	Field Sample	2.42	0.0657	ng/m3	Reported				0.2089
8090523-02	8/30/2018	Lead	Field Sample	0.971	0.0657	ng/m3	Reported				0.2089
8091124-02	9/5/2018	Lead	Field Sample	1.48	0.0657	ng/m3	Reported				0.2089
8091827-04	9/11/2018	Lead	Field Sample	2.62	0.0657	ng/m3	Reported				0.2089
8092521-03	9/17/2018	Lead	Field Sample	1.77	0.0657	ng/m3	Reported				0.2089
8092521-04	9/20/2018	Lead	Field Sample	4.48	0.0657	ng/m3	Reported				0.2089
8092620-02	9/23/2018	Lead	Field Sample	1.91	0.0657	ng/m3	Reported				0.2089
8100219-02	9/26/2018	Lead	Field Sample	0.736	0.0657	ng/m3	Reported				0.2089
8100510-02	10/2/2018	Lead	Field Sample	4.02	0.0657	ng/m3	Reported				0.2089
8101114-02	10/8/2018	Lead	Field Sample	4.34	0.0657	ng/m3	Reported				0.2089
8101626-02	10/11/2018	Lead	Field Sample	0.893	0.0657	ng/m3	Reported				0.2089
8101626-02	10/11/2018	Lead	Replicate (R1)	0.889	0.0657	ng/m3	Reported				0.2089
8101730-04	10/14/2018	Lead	Field Sample	3.1	0.0657	ng/m3	Reported				0.2089
8102327-02	10/17/2018	Lead	Field Sample	1.12	0.0657	ng/m3	Reported				0.2089
8102621-02	10/22/2018	Lead	Field Sample	6.93	0.0657	ng/m3	Reported				0.2089
8110103-02	10/29/2018	Lead	Field Sample	25.9	0.0657	ng/m3	Reported				0.2089
8110618-02	11/1/2018	Lead	Field Sample	1.28	0.0657	ng/m3	Reported				0.2089

8110618-02	11/1/2018	Lead	Replicate (R1)	1.28	0.0657	ng/m3	Reported				0.2089
8110720-02	11/4/2018	Lead	Field Sample	1.71	0.0657	ng/m3	Reported				0.2089
8111510-02	11/7/2018	Lead	Field Sample	1.94	0.0657	ng/m3	Reported				0.2089
8111604-04	11/13/2018	Lead	Field Sample	1.65	0.0657	ng/m3	Reported				0.2089
8120439-02	11/28/2018	Lead	Field Sample	3.96	0.0657	ng/m3	Reported				0.2089
8120719-03	12/4/2018	Lead	Field Sample	1.12	0.0657	ng/m3	Reported				0.2089
8121312-02	12/10/2018	Lead	Field Sample	2.3	0.0657	ng/m3	Reported		Y		0.2089
8121312-02	12/10/2018	Lead	Replicate (R1)	2.33	0.0657	ng/m3	Reported		Y		0.2089
8121923-02	12/13/2018	Lead	Field Sample	3.09	0.0657	ng/m3	Reported				0.2089
8122114-02	12/16/2018	Lead	Field Sample	3.9	0.0657	ng/m3	Reported				0.2089
8122815-02	12/19/2018	Lead	Field Sample	5.05	0.0657	ng/m3	Reported				0.2089
9010324-02	12/25/2018	Lead	Field Sample	3.24	0.0657	ng/m3	Reported				0.2089
9010929-02	1/6/2019	Lead	Field Sample	11.7	0.0657	ng/m3	Reported				0.2089
9011548-02	1/9/2019	Lead	Field Sample	1.36	0.0657	ng/m3	Reported				0.2089
9011548-02	1/9/2019	Lead	Replicate (R1)	1.35	0.0657	ng/m3	Reported				0.2089
9011813-02	1/15/2019	Lead	Field Sample	1.32	0.0657	ng/m3	Reported				0.2089
9012424-02	1/21/2019	Lead	Field Sample	4.54	0.0657	ng/m3	Reported				0.2089

9012922-02	1/24/2019	Lead	Field Sample	1.32	0.0657	ng/m3	Reported				0.2089
9013106-01	1/27/2019	Lead	Field Sample	3.89	0.0657	ng/m3	Reported				0.2089
9020515-03	1/30/2019	Lead	Field Sample	4.13	0.0657	ng/m3	Reported				0.2089
9020515-03	1/30/2019	Lead	Replicate (R1)	4.14	0.0657	ng/m3	Reported				0.2089
9020814-02	2/5/2019	Lead	Field Sample	1.94	0.0657	ng/m3	Reported				0.2089
9021410-02	2/10/2019	Lead	Field Sample	1.95	0.0657	ng/m3	Reported				0.2089
9021923-02	2/13/2019	Lead	Field Sample	3.07	0.0657	ng/m3	Reported				0.2089
9022106-02	2/16/2019	Lead	Field Sample	1.45	0.0657	ng/m3	Reported				0.2089
9022620-02	2/20/2019	Lead	Field Sample	0.469	0.0657	ng/m3	Reported				0.2089
9030111-01	2/26/2019	Lead	Field Sample	4.8	0.0657	ng/m3	Reported				0.2089
9030711-01	3/4/2019	Lead	Field Sample	0.702	0.0657	ng/m3	Reported				0.2089
9031218-02	3/7/2019	Lead	Field Sample	2.64	0.0657	ng/m3	Reported				0.2089
9031218-02	3/7/2019	Lead	Replicate (R1)	2.62	0.0657	ng/m3	Reported				0.2089
9031317-01	3/10/2019	Lead	Field Sample	4.15	0.0657	ng/m3	Reported				0.2089
9031918-02	3/13/2019	Lead	Field Sample	2.34	0.0657	ng/m3	Reported				0.2089
9032208-02	3/19/2019	Lead	Field Sample	7.64	0.0657	ng/m3	Reported				0.2089
9032806-02	3/25/2019	Lead	Field Sample	1.41	0.108	ng/m3	Reported				0.3434

9032806-02	3/25/2019	Lead	Replicate (R1)	1.41	0.108	ng/m3	Reported				0.3434
9040229-02	3/28/2019	Lead	Field Sample	3.22	0.108	ng/m3	Reported				0.3434
9040336-03	3/31/2019	Lead	Field Sample	1.12	0.108	ng/m3	Reported				0.3434
9040945-02	4/3/2019	Lead	Field Sample	5.59	0.108	ng/m3	Reported				0.3434
9041214-02	4/9/2019	Lead	Field Sample	1.81	0.108	ng/m3	Reported				0.3434
9041214-02	4/9/2019	Lead	Replicate (R1)	1.78	0.108	ng/m3	Reported				0.3434
9041815-02	4/15/2019	Lead	Field Sample	4.69	0.108	ng/m3	Reported				0.3434
9042319-02	4/18/2019	Lead	Field Sample	2.2	0.108	ng/m3	Reported				0.3434
9042418-02	4/21/2019	Lead	Field Sample	1.3	0.108	ng/m3	Reported				0.3434
9043022-02	4/24/2019	Lead	Field Sample	2.99	0.108	ng/m3	Reported				0.3434
9050319-03	4/29/2019	Lead	Field Sample	4.6	0.108	ng/m3	Reported				0.3434
8050227-03	4/26/2018	Manganese	Field Sample	127	0.194	ng/m3	Reported				0.6169
8050227-04	4/29/2018	Manganese	Field Sample	11.9	0.194	ng/m3	Reported				0.6169
8050227-04	4/29/2018	Manganese	Replicate (R1)	11.9	0.194	ng/m3	Reported				0.6169
8050829-02	5/2/2018	Manganese	Field Sample	151	0.194	ng/m3	Reported				0.6169
8051109-02	5/8/2018	Manganese	Field Sample	98.7	0.194	ng/m3	Reported				0.6169
8051716-03	5/14/2018	Manganese	Field Sample	29.9	0.194	ng/m3	Reported				0.6169

8052315-03	5/17/2018	Manganese	Field Sample	53.8	0.194	ng/m3	Reported				0.6169
8052315-04	5/20/2018	Manganese	Field Sample	8.17	0.194	ng/m3	Reported				0.6169
8052315-04	5/20/2018	Manganese	Replicate (R1)	8.12	0.194	ng/m3	Reported				0.6169
8060714-02	6/4/2018	Manganese	Field Sample	46	0.194	ng/m3	Reported				0.6169
8061224-02	6/7/2018	Manganese	Field Sample	38.4	0.194	ng/m3	Reported				0.6169
8061528-02	6/10/2018	Manganese	Field Sample	111	0.194	ng/m3	Reported				0.6169
8061914-01	6/13/2018	Manganese	Field Sample	139	0.194	ng/m3	Reported				0.6169
8062215-02	6/19/2018	Manganese	Field Sample	46.4	0.194	ng/m3	Reported				0.6169
8062808-02	6/25/2018	Manganese	Field Sample	96.3	0.194	ng/m3	Reported				0.6169
8070617-02	7/1/2018	Manganese	Field Sample	5.53	0.194	ng/m3	Reported				0.6169
8070617-02	7/1/2018	Manganese	Replicate (R1)	5.49	0.194	ng/m3	Reported				0.6169
8071119-02	7/4/2018	Manganese	Field Sample	15.6	0.194	ng/m3	Reported				0.6169
8071310-04	7/10/2018	Manganese	Field Sample	7.98	0.194	ng/m3	Reported				0.6169
8071905-03	7/16/2018	Manganese	Field Sample	63.1	0.194	ng/m3	Reported				0.6169
8072422-02	7/18/2018	Manganese	Field Sample	20.1	0.194	ng/m3	Reported				0.6169
8072528-02	7/22/2018	Manganese	Field Sample	17.8	0.194	ng/m3	Reported				0.6169
8073127-02	7/25/2018	Manganese	Field Sample	10.6	0.194	ng/m3	Reported				0.6169

8080313-02	7/31/2018	Manganese	Field Sample	15.3	0.194	ng/m3	Reported				0.6169
8080921-02	8/6/2018	Manganese	Field Sample	105	0.194	ng/m3	Reported				0.6169
8081520-02RE1	8/9/2018	Manganese	Field Sample	75.9	0.194	ng/m3	Reported				0.6169
8081520-03	8/12/2018	Manganese	Field Sample	7.29	0.194	ng/m3	Reported				0.6169
8082131-02	8/15/2018	Manganese	Field Sample	43.1	0.194	ng/m3	Reported				0.6169
8082405-02	8/21/2018	Manganese	Field Sample	79.7	0.194	ng/m3	Reported				0.6169
8083010-02	8/27/2018	Manganese	Field Sample	119	0.194	ng/m3	Reported				0.6169
8090523-02	8/30/2018	Manganese	Field Sample	49.3	0.194	ng/m3	Reported				0.6169
8091124-02	9/5/2018	Manganese	Field Sample	14.1	0.194	ng/m3	Reported				0.6169
8091827-04	9/11/2018	Manganese	Field Sample	18.1	0.194	ng/m3	Reported				0.6169
8092521-03	9/17/2018	Manganese	Field Sample	19.2	0.194	ng/m3	Reported				0.6169
8092521-04	9/20/2018	Manganese	Field Sample	65.2	0.194	ng/m3	Reported				0.6169
8092620-02	9/23/2018	Manganese	Field Sample	11.3	0.194	ng/m3	Reported				0.6169
8100219-02	9/26/2018	Manganese	Field Sample	58.5	0.194	ng/m3	Reported				0.6169
8100510-02	10/2/2018	Manganese	Field Sample	34.1	0.194	ng/m3	Reported				0.6169
8101114-02	10/8/2018	Manganese	Field Sample	98.8	0.194	ng/m3	Reported				0.6169
8101626-02	10/11/2018	Manganese	Field Sample	11.4	0.194	ng/m3	Reported				0.6169

8101626-02	10/11/2018	Manganese	Replicate (R1)	11.3	0.194	ng/m3	Reported				0.6169
8101730-04	10/14/2018	Manganese	Field Sample	32.4	0.194	ng/m3	Reported				0.6169
8102327-02	10/17/2018	Manganese	Field Sample	3.5	0.194	ng/m3	Reported				0.6169
8102621-02	10/22/2018	Manganese	Field Sample	20.3	0.194	ng/m3	Reported				0.6169
8110103-02	10/29/2018	Manganese	Field Sample	93	0.194	ng/m3	Reported				0.6169
8110618-02	11/1/2018	Manganese	Field Sample	92.3	0.194	ng/m3	Reported				0.6169
8110618-02	11/1/2018	Manganese	Replicate (R1)	91.9	0.194	ng/m3	Reported				0.6169
8110720-02	11/4/2018	Manganese	Field Sample	8.69	0.194	ng/m3	Reported				0.6169
8111510-02	11/7/2018	Manganese	Field Sample	15.2	0.194	ng/m3	Reported				0.6169
8111604-04	11/13/2018	Manganese	Field Sample	2.45	0.194	ng/m3	Reported				0.6169
8120439-02	11/28/2018	Manganese	Field Sample	272	0.194	ng/m3	Reported				0.6169
8120719-03	12/4/2018	Manganese	Field Sample	58.3	0.194	ng/m3	Reported				0.6169
8121312-02	12/10/2018	Manganese	Field Sample	7.91	0.194	ng/m3	Reported		Y		0.6169
8121312-02	12/10/2018	Manganese	Replicate (R1)	7.92	0.194	ng/m3	Reported		Y		0.6169
8121923-02	12/13/2018	Manganese	Field Sample	14.9	0.194	ng/m3	Reported				0.6169
8122114-02	12/16/2018	Manganese	Field Sample	2.02	0.194	ng/m3	Reported				0.6169
8122815-02	12/19/2018	Manganese	Field Sample	30.2	0.194	ng/m3	Reported				0.6169

9010324-02	12/25/2018	Manganese	Field Sample	8.91	0.194	ng/m3	Reported				0.6169
9010929-02	1/6/2019	Manganese	Field Sample	74.1	0.194	ng/m3	Reported				0.6169
9011548-02	1/9/2019	Manganese	Field Sample	7.37	0.194	ng/m3	Reported				0.6169
9011548-02	1/9/2019	Manganese	Replicate (R1)	7.34	0.194	ng/m3	Reported				0.6169
9011813-02	1/15/2019	Manganese	Field Sample	8.03	0.194	ng/m3	Reported				0.6169
9012424-02	1/21/2019	Manganese	Field Sample	14.4	0.194	ng/m3	Reported				0.6169
9012922-02	1/24/2019	Manganese	Field Sample	7.07	0.194	ng/m3	Reported				0.6169
9013106-01	1/27/2019	Manganese	Field Sample	166	0.194	ng/m3	Reported				0.6169
9020515-03	1/30/2019	Manganese	Field Sample	21.1	0.194	ng/m3	Reported				0.6169
9020515-03	1/30/2019	Manganese	Replicate (R1)	20.8	0.194	ng/m3	Reported				0.6169
9020814-02	2/5/2019	Manganese	Field Sample	39.7	0.194	ng/m3	Reported				0.6169
9021410-02	2/10/2019	Manganese	Field Sample	30.1	0.194	ng/m3	Reported				0.6169
9021923-02	2/13/2019	Manganese	Field Sample	138	0.194	ng/m3	Reported				0.6169
9022106-02	2/16/2019	Manganese	Field Sample	2.83	0.194	ng/m3	Reported				0.6169
9022620-02	2/20/2019	Manganese	Field Sample	15.6	0.194	ng/m3	Reported				0.6169
9030111-01	2/26/2019	Manganese	Field Sample	102	0.194	ng/m3	Reported				0.6169
9030711-01	3/4/2019	Manganese	Field Sample	3.24	0.194	ng/m3	Reported				0.6169

9031218-02	3/7/2019	Manganese	Field Sample	62.4	0.194	ng/m3	Reported					0.6169
9031218-02	3/7/2019	Manganese	Replicate (R1)	62.7	0.194	ng/m3	Reported					0.6169
9031317-01	3/10/2019	Manganese	Field Sample	20.9	0.194	ng/m3	Reported					0.6169
9031918-02	3/13/2019	Manganese	Field Sample	32.3	0.194	ng/m3	Reported					0.6169
9032208-02	3/19/2019	Manganese	Field Sample	37.7	0.194	ng/m3	Reported					0.6169
9032806-02	3/25/2019	Manganese	Field Sample	64.8	0.771	ng/m3	Reported					2.4518
9032806-02	3/25/2019	Manganese	Replicate (R1)	63.6	0.771	ng/m3	Reported					2.4518
9040229-02	3/28/2019	Manganese	Field Sample	54.9	0.771	ng/m3	Reported					2.4518
9040336-03	3/31/2019	Manganese	Field Sample	13.7	0.771	ng/m3	Reported					2.4518
9040945-02	4/3/2019	Manganese	Field Sample	170	0.771	ng/m3	Reported					2.4518
9041214-02	4/9/2019	Manganese	Field Sample	272	0.771	ng/m3	Reported					2.4518
9041214-02	4/9/2019	Manganese	Replicate (R1)	268	0.771	ng/m3	Reported					2.4518
9041815-02	4/15/2019	Manganese	Field Sample	24.9	0.771	ng/m3	Reported					2.4518
9042319-02	4/18/2019	Manganese	Field Sample	37.1	0.771	ng/m3	Reported					2.4518
9042418-02	4/21/2019	Manganese	Field Sample	5.38	0.771	ng/m3	Reported					2.4518
9043022-02	4/24/2019	Manganese	Field Sample	69.4	0.771	ng/m3	Reported					2.4518
9050319-03	4/29/2019	Manganese	Field Sample	113	0.771	ng/m3	Reported					2.4518

8050227-03	4/26/2018	Mercury	Field Sample	0.0116	0.0152	ng/m3	Reported			U	0.0483	
8050227-04	4/29/2018	Mercury	Field Sample	0.0112	0.0152	ng/m3	Reported			U	0.0483	
8050227-04	4/29/2018	Mercury	Replicate (R1)	0.0104	0.0152	ng/m3	Reported			U	0.0483	
8050829-02	5/2/2018	Mercury	Field Sample	0.0351	0.0152	ng/m3	Reported				0.0483	
8051109-02	5/8/2018	Mercury	Field Sample	0.0355	0.0152	ng/m3	Reported			B	0.0483	Use reported value per ATRA
8051716-03	5/14/2018	Mercury	Field Sample	0.014	0.0152	ng/m3	Reported			B, U	0.0483	Use reported value per ATRA
8052315-03	5/17/2018	Mercury	Field Sample	0.0298	0.0152	ng/m3	Reported				0.0483	
8052315-04	5/20/2018	Mercury	Field Sample	0.0166	0.0152	ng/m3	Reported				0.0483	
8052315-04	5/20/2018	Mercury	Replicate (R1)	0.0152	0.0152	ng/m3	Reported				0.0483	
8060714-02	6/4/2018	Mercury	Field Sample	0.0274	0.0152	ng/m3	Reported				0.0483	
8061224-02	6/7/2018	Mercury	Field Sample	0.0283	0.0152	ng/m3	Reported				0.0483	
8061528-02	6/10/2018	Mercury	Field Sample	0.0122	0.0152	ng/m3	Reported			U	0.0483	
8061914-01	6/13/2018	Mercury	Field Sample	0.0213	0.0152	ng/m3	Reported				0.0483	
8062215-02	6/19/2018	Mercury	Field Sample	0.0147	0.0152	ng/m3	Reported			U	0.0483	
8062808-02	6/25/2018	Mercury	Field Sample	0.0277	0.0152	ng/m3	Reported				0.0483	
8070617-02	7/1/2018	Mercury	Field Sample	0.019	0.0152	ng/m3	Reported				0.0483	

8070617-02	7/1/2018	Mercury	Replicate (R1)	0.0136	0.0152	ng/m3	Reported			U	0.0483
8071119-02	7/4/2018	Mercury	Field Sample	0.017	0.0152	ng/m3	Reported				0.0483
8071310-04	7/10/2018	Mercury	Field Sample	0.00955	0.0152	ng/m3	Reported			U	0.0483
8071905-03	7/16/2018	Mercury	Field Sample	0.00876	0.0152	ng/m3	Reported			U	0.0483
8072422-02	7/18/2018	Mercury	Field Sample	0.0331	0.0152	ng/m3	Reported				0.0483
8072528-02	7/22/2018	Mercury	Field Sample	0.00839	0.0152	ng/m3	Reported			U	0.0483
8073127-02	7/25/2018	Mercury	Field Sample	0.00985	0.0152	ng/m3	Reported			U	0.0483
8080313-02	7/31/2018	Mercury	Field Sample	0.00625	0.0152	ng/m3	Reported			U	0.0483
8080921-02	8/6/2018	Mercury	Field Sample	0.0222	0.0152	ng/m3	Reported				0.0483
8081520-02RE1	8/9/2018	Mercury	Field Sample	0.0132	0.0152	ng/m3	Reported			U	0.0483
8081520-03	8/12/2018	Mercury	Field Sample	0.0111	0.0152	ng/m3	Reported			U	0.0483
8082131-02	8/15/2018	Mercury	Field Sample	0.0151	0.0152	ng/m3	Reported			U	0.0483
8082405-02	8/21/2018	Mercury	Field Sample	0.00753	0.0152	ng/m3	Reported			U	0.0483
8083010-02	8/27/2018	Mercury	Field Sample	0.0108	0.0152	ng/m3	Reported			U	0.0483
8090523-02	8/30/2018	Mercury	Field Sample	0.00784	0.0152	ng/m3	Reported			U	0.0483
8091124-02	9/5/2018	Mercury	Field Sample	0.0194	0.0152	ng/m3	Reported				0.0483
8091827-04	9/11/2018	Mercury	Field Sample	0.0183	0.0152	ng/m3	Reported				0.0483

8092521-03	9/17/2018	Mercury	Field Sample	0.0102	0.0152	ng/m3	Reported			U	0.0483
8092521-04	9/20/2018	Mercury	Field Sample	0.0118	0.0152	ng/m3	Reported			U	0.0483
8092620-02	9/23/2018	Mercury	Field Sample	0.0165	0.0152	ng/m3	Reported				0.0483
8100219-02	9/26/2018	Mercury	Field Sample	0.00914	0.0152	ng/m3	Reported			U	0.0483
8100510-02	10/2/2018	Mercury	Field Sample	0.04	0.0152	ng/m3	Reported				0.0483
8101114-02	10/8/2018	Mercury	Field Sample	0.00941	0.0152	ng/m3	Reported			U	0.0483
8101626-02	10/11/2018	Mercury	Field Sample	0.0158	0.0152	ng/m3	Reported				0.0483
8101626-02	10/11/2018	Mercury	Replicate (R1)	0.014	0.0152	ng/m3	Reported			U	0.0483
8101730-04	10/14/2018	Mercury	Field Sample	0.0104	0.0152	ng/m3	Reported			U	0.0483
8102327-02	10/17/2018	Mercury	Field Sample	0.0105	0.0152	ng/m3	Reported			U	0.0483
8102621-02	10/22/2018	Mercury	Field Sample	0.0156	0.0152	ng/m3	Reported				0.0483
8110103-02	10/29/2018	Mercury	Field Sample	0.0307	0.0152	ng/m3	Reported				0.0483
8110618-02	11/1/2018	Mercury	Field Sample	0.00778	0.0152	ng/m3	Reported			U	0.0483
8110618-02	11/1/2018	Mercury	Replicate (R1)	0.00913	0.0152	ng/m3	Reported			U	0.0483
8110720-02	11/4/2018	Mercury	Field Sample	0.0064	0.0152	ng/m3	Reported			U	0.0483
8111510-02	11/7/2018	Mercury	Field Sample	0.0266	0.0152	ng/m3	Reported				0.0483
8111604-04	11/13/2018	Mercury	Field Sample	0.0132	0.0152	ng/m3	Reported			U	0.0483

8120439-02	11/28/2018	Mercury	Field Sample	0.0347	0.0152	ng/m3	Reported				0.0483
8120719-03	12/4/2018	Mercury	Field Sample	0.012	0.0152	ng/m3	Reported			U	0.0483
8121312-02	12/10/2018	Mercury	Field Sample	0.0426	0.0152	ng/m3	Reported		Y		0.0483
8121312-02	12/10/2018	Mercury	Replicate (R1)	0.028	0.0152	ng/m3	Reported		Y		0.0483
8121923-02	12/13/2018	Mercury	Field Sample	0.0143	0.0152	ng/m3	Reported			U	0.0483
8122114-02	12/16/2018	Mercury	Field Sample	0.00981	0.0152	ng/m3	Reported			U	0.0483
8122815-02	12/19/2018	Mercury	Field Sample	0.0202	0.0152	ng/m3	Reported				0.0483
9010324-02	12/25/2018	Mercury	Field Sample	0.0141	0.0152	ng/m3	Reported			U	0.0483
9010929-02	1/6/2019	Mercury	Field Sample	0.0223	0.0152	ng/m3	Reported				0.0483
9011548-02	1/9/2019	Mercury	Field Sample	0.0201	0.0152	ng/m3	Reported				0.0483
9011548-02	1/9/2019	Mercury	Replicate (R1)	0.0177	0.0152	ng/m3	Reported				0.0483
9011813-02	1/15/2019	Mercury	Field Sample	0.0105	0.0152	ng/m3	Reported			U	0.0483
9012424-02	1/21/2019	Mercury	Field Sample	0.0138	0.0152	ng/m3	Reported			U	0.0483
9012922-02	1/24/2019	Mercury	Field Sample	0.00876	0.0152	ng/m3	Reported			U	0.0483
9013106-01	1/27/2019	Mercury	Field Sample	0.0363	0.0152	ng/m3	Reported				0.0483
9020515-03	1/30/2019	Mercury	Field Sample	0.0226	0.0152	ng/m3	Reported				0.0483
9020515-03	1/30/2019	Mercury	Replicate (R1)	0.0236	0.0152	ng/m3	Reported				0.0483

9020814-02	2/5/2019	Mercury	Field Sample	0.0192	0.0152	ng/m3	Reported				0.0483
9021410-02	2/10/2019	Mercury	Field Sample	0.0206	0.0152	ng/m3	Reported				0.0483
9021923-02	2/13/2019	Mercury	Field Sample	0.0475	0.0152	ng/m3	Reported				0.0483
9022106-02	2/16/2019	Mercury	Field Sample	0.00867	0.0152	ng/m3	Reported			U	0.0483
9022620-02	2/20/2019	Mercury	Field Sample	0.0111	0.0152	ng/m3	Reported			U	0.0483
9030111-01	2/26/2019	Mercury	Field Sample	0.0162	0.0152	ng/m3	Reported				0.0483
9030711-01	3/4/2019	Mercury	Field Sample	0.0167	0.0152	ng/m3	Reported				0.0483
9031218-02	3/7/2019	Mercury	Field Sample	0.0254	0.0152	ng/m3	Reported				0.0483
9031218-02	3/7/2019	Mercury	Replicate (R1)	0.024	0.0152	ng/m3	Reported				0.0483
9031317-01	3/10/2019	Mercury	Field Sample	0.0156	0.0152	ng/m3	Reported				0.0483
9031918-02	3/13/2019	Mercury	Field Sample	0.0145	0.0152	ng/m3	Reported			U	0.0483
9032208-02	3/19/2019	Mercury	Field Sample	0.0251	0.0152	ng/m3	Reported				0.0483
9032806-02	3/25/2019	Mercury	Field Sample	0.0235	0.0148	ng/m3	Reported				0.0471
9032806-02	3/25/2019	Mercury	Replicate (R1)	0.0122	0.0148	ng/m3	Reported			U	0.0471
9040229-02	3/28/2019	Mercury	Field Sample	0.0178	0.0148	ng/m3	Reported				0.0471
9040336-03	3/31/2019	Mercury	Field Sample	0.008	0.0148	ng/m3	Reported			U	0.0471
9040945-02	4/3/2019	Mercury	Field Sample	0.0188	0.0148	ng/m3	Reported				0.0471

9041214-02	4/9/2019	Mercury	Field Sample	0.00993	0.0148	ng/m3	Reported			U	0.0471
9041214-02	4/9/2019	Mercury	Replicate (R1)	0.0103	0.0148	ng/m3	Reported			U	0.0471
9041815-02	4/15/2019	Mercury	Field Sample	0.0248	0.0148	ng/m3	Reported				0.0471
9042319-02	4/18/2019	Mercury	Field Sample	0.0123	0.0148	ng/m3	Reported			U	0.0471
9042418-02	4/21/2019	Mercury	Field Sample	0.00888	0.0148	ng/m3	Reported			U	0.0471
9043022-02	4/24/2019	Mercury	Field Sample	0.0152	0.0148	ng/m3	Reported				0.0471
9050319-03	4/29/2019	Mercury	Field Sample	0.0212	0.0148	ng/m3	Reported				0.0471
8050227-03	4/26/2018	Nickel	Field Sample	2.55	1.21	ng/m3	Reported				3.8478
8050227-04	4/29/2018	Nickel	Field Sample	0.645	1.21	ng/m3	Reported			U	3.8478
8050227-04	4/29/2018	Nickel	Replicate (R1)	0.634	1.21	ng/m3	Reported			U	3.8478
8050829-02	5/2/2018	Nickel	Field Sample	2.61	1.21	ng/m3	Reported				3.8478
8051109-02	5/8/2018	Nickel	Field Sample	12.5	1.21	ng/m3	Reported				3.8478
8051716-03	5/14/2018	Nickel	Field Sample	1.14	1.21	ng/m3	Reported			U	3.8478
8052315-03	5/17/2018	Nickel	Field Sample	21.2	1.21	ng/m3	Reported				3.8478
8052315-04	5/20/2018	Nickel	Field Sample	0.709	1.21	ng/m3	Reported			U	3.8478
8052315-04	5/20/2018	Nickel	Replicate (R1)	0.71	1.21	ng/m3	Reported			U	3.8478
8060714-02	6/4/2018	Nickel	Field Sample	1.17	1.21	ng/m3	Reported			U	3.8478

8061224-02	6/7/2018	Nickel	Field Sample	1.62	1.21	ng/m3	Reported				3.8478
8061528-02	6/10/2018	Nickel	Field Sample	1.94	1.21	ng/m3	Reported				3.8478
8061914-01	6/13/2018	Nickel	Field Sample	2.38	1.21	ng/m3	Reported				3.8478
8062215-02	6/19/2018	Nickel	Field Sample	3.02	1.21	ng/m3	Reported				3.8478
8062808-02	6/25/2018	Nickel	Field Sample	2.28	1.21	ng/m3	Reported				3.8478
8070617-02	7/1/2018	Nickel	Field Sample	0.581	1.21	ng/m3	Reported			U	3.8478
8070617-02	7/1/2018	Nickel	Replicate (R1)	0.592	1.21	ng/m3	Reported			U	3.8478
8071119-02	7/4/2018	Nickel	Field Sample	0.947	1.21	ng/m3	Reported			U	3.8478
8071310-04	7/10/2018	Nickel	Field Sample	1.08	1.21	ng/m3	Reported			U	3.8478
8071905-03	7/16/2018	Nickel	Field Sample	2.22	1.21	ng/m3	Reported				3.8478
8072422-02	7/18/2018	Nickel	Field Sample	1.51	1.21	ng/m3	Reported				3.8478
8072528-02	7/22/2018	Nickel	Field Sample	0.667	1.21	ng/m3	Reported			U	3.8478
8073127-02	7/25/2018	Nickel	Field Sample	0.572	1.21	ng/m3	Reported			U	3.8478
8080313-02	7/31/2018	Nickel	Field Sample	0.592	1.21	ng/m3	Reported			U	3.8478
8080921-02	8/6/2018	Nickel	Field Sample	2.27	1.21	ng/m3	Reported				3.8478
8081520-02RE1	8/9/2018	Nickel	Field Sample	1.85	1.21	ng/m3	Reported				3.8478
8081520-03	8/12/2018	Nickel	Field Sample	0.386	1.21	ng/m3	Reported			U	3.8478

8082131-02	8/15/2018	Nickel	Field Sample	1.79	1.21	ng/m3	Reported				3.8478
8082405-02	8/21/2018	Nickel	Field Sample	1.8	1.21	ng/m3	Reported				3.8478
8083010-02	8/27/2018	Nickel	Field Sample	1.5	1.21	ng/m3	Reported				3.8478
8090523-02	8/30/2018	Nickel	Field Sample	1.16	1.21	ng/m3	Reported			U	3.8478
8091124-02	9/5/2018	Nickel	Field Sample	1.09	1.21	ng/m3	Reported			U	3.8478
8091827-04	9/11/2018	Nickel	Field Sample	0.98	1.21	ng/m3	Reported			U	3.8478
8092521-03	9/17/2018	Nickel	Field Sample	1.47	1.21	ng/m3	Reported				3.8478
8092521-04	9/20/2018	Nickel	Field Sample	2.09	1.21	ng/m3	Reported				3.8478
8092620-02	9/23/2018	Nickel	Field Sample	0.721	1.21	ng/m3	Reported			U	3.8478
8100219-02	9/26/2018	Nickel	Field Sample	1.44	1.21	ng/m3	Reported				3.8478
8100510-02	10/2/2018	Nickel	Field Sample	2.17	1.21	ng/m3	Reported				3.8478
8101114-02	10/8/2018	Nickel	Field Sample	1.5	1.21	ng/m3	Reported				3.8478
8101626-02	10/11/2018	Nickel	Field Sample	0.541	1.21	ng/m3	Reported			U	3.8478
8101626-02	10/11/2018	Nickel	Replicate (R1)	0.541	1.21	ng/m3	Reported			U	3.8478
8101730-04	10/14/2018	Nickel	Field Sample	1.27	1.21	ng/m3	Reported				3.8478
8102327-02	10/17/2018	Nickel	Field Sample	0.333	1.21	ng/m3	Reported			U	3.8478
8102621-02	10/22/2018	Nickel	Field Sample	1.81	1.21	ng/m3	Reported				3.8478

8110103-02	10/29/2018	Nickel	Field Sample	3.11	1.21	ng/m3	Reported				3.8478
8110618-02	11/1/2018	Nickel	Field Sample	1.68	1.21	ng/m3	Reported				3.8478
8110618-02	11/1/2018	Nickel	Replicate (R1)	1.62	1.21	ng/m3	Reported				3.8478
8110720-02	11/4/2018	Nickel	Field Sample	1.24	1.21	ng/m3	Reported				3.8478
8111510-02	11/7/2018	Nickel	Field Sample	1.16	1.21	ng/m3	Reported			U	3.8478
8111604-04	11/13/2018	Nickel	Field Sample	0.291	1.21	ng/m3	Reported			U	3.8478
8120439-02	11/28/2018	Nickel	Field Sample	5.24	1.21	ng/m3	Reported				3.8478
8120719-03	12/4/2018	Nickel	Field Sample	2.11	1.21	ng/m3	Reported				3.8478
8121312-02	12/10/2018	Nickel	Field Sample	5.85	1.21	ng/m3	Reported		Y		3.8478
8121312-02	12/10/2018	Nickel	Replicate (R1)	5.95	1.21	ng/m3	Reported		Y		3.8478
8121923-02	12/13/2018	Nickel	Field Sample	8.06	1.21	ng/m3	Reported				3.8478
8122114-02	12/16/2018	Nickel	Field Sample	0.271	1.21	ng/m3	Reported			U	3.8478
8122815-02	12/19/2018	Nickel	Field Sample	0.926	1.21	ng/m3	Reported			U	3.8478
9010324-02	12/25/2018	Nickel	Field Sample	0.647	1.21	ng/m3	Reported			U	3.8478
9010929-02	1/6/2019	Nickel	Field Sample	3.92	1.21	ng/m3	Reported				3.8478
9011548-02	1/9/2019	Nickel	Field Sample	0.798	1.21	ng/m3	Reported			U	3.8478
9011548-02	1/9/2019	Nickel	Replicate (R1)	0.789	1.21	ng/m3	Reported			U	3.8478

9011813-02	1/15/2019	Nickel	Field Sample	1.17	1.21	ng/m3	Reported			U	3.8478
9012424-02	1/21/2019	Nickel	Field Sample	0.74	1.21	ng/m3	Reported			U	3.8478
9012922-02	1/24/2019	Nickel	Field Sample	1.36	1.21	ng/m3	Reported				3.8478
9013106-01	1/27/2019	Nickel	Field Sample	3.62	1.21	ng/m3	Reported				3.8478
9020515-03	1/30/2019	Nickel	Field Sample	1.09	1.21	ng/m3	Reported			U	3.8478
9020515-03	1/30/2019	Nickel	Replicate (R1)	1.08	1.21	ng/m3	Reported			U	3.8478
9020814-02	2/5/2019	Nickel	Field Sample	1.2	1.21	ng/m3	Reported			U	3.8478
9021410-02	2/10/2019	Nickel	Field Sample	2.43	1.21	ng/m3	Reported				3.8478
9021923-02	2/13/2019	Nickel	Field Sample	3.37	1.21	ng/m3	Reported				3.8478
9022106-02	2/16/2019	Nickel	Field Sample	0.516	1.21	ng/m3	Reported			U	3.8478
9022620-02	2/20/2019	Nickel	Field Sample	0.788	1.21	ng/m3	Reported			U	3.8478
9030111-01	2/26/2019	Nickel	Field Sample	2.63	1.21	ng/m3	Reported				3.8478
9030711-01	3/4/2019	Nickel	Field Sample	0.458	1.21	ng/m3	Reported			U	3.8478
9031218-02	3/7/2019	Nickel	Field Sample	1.89	1.21	ng/m3	Reported				3.8478
9031218-02	3/7/2019	Nickel	Replicate (R1)	1.92	1.21	ng/m3	Reported				3.8478
9031317-01	3/10/2019	Nickel	Field Sample	1.61	1.21	ng/m3	Reported				3.8478
9031918-02	3/13/2019	Nickel	Field Sample	1.69	1.21	ng/m3	Reported				3.8478

9032208-02	3/19/2019	Nickel	Field Sample	1.31	1.21	ng/m3	Reported				3.8478
9032806-02	3/25/2019	Nickel	Field Sample	1.41	1.18	ng/m3	Reported				3.7524
9032806-02	3/25/2019	Nickel	Replicate (R1)	1.39	1.18	ng/m3	Reported				3.7524
9040229-02	3/28/2019	Nickel	Field Sample	1.6	1.18	ng/m3	Reported				3.7524
9040336-03	3/31/2019	Nickel	Field Sample	0.463	1.18	ng/m3	Reported			U	3.7524
9040945-02	4/3/2019	Nickel	Field Sample	3.14	1.18	ng/m3	Reported				3.7524
9041214-02	4/9/2019	Nickel	Field Sample	4.67	1.18	ng/m3	Reported				3.7524
9041214-02	4/9/2019	Nickel	Replicate (R1)	4.6	1.18	ng/m3	Reported				3.7524
9041815-02	4/15/2019	Nickel	Field Sample	2.78	1.18	ng/m3	Reported				3.7524
9042319-02	4/18/2019	Nickel	Field Sample	2.72	1.18	ng/m3	Reported				3.7524
9042418-02	4/21/2019	Nickel	Field Sample	0.906	1.18	ng/m3	Reported			U	3.7524
9043022-02	4/24/2019	Nickel	Field Sample	1.6	1.18	ng/m3	Reported				3.7524
9050319-03	4/29/2019	Nickel	Field Sample	2.72	1.18	ng/m3	Reported				3.7524
8050227-03	4/26/2018	Selenium	Field Sample	0.25	0.0582	ng/m3	Reported				0.1851
8050227-04	4/29/2018	Selenium	Field Sample	0.19	0.0582	ng/m3	Reported				0.1851
8050227-04	4/29/2018	Selenium	Replicate (R1)	0.201	0.0582	ng/m3	Reported				0.1851
8050829-02	5/2/2018	Selenium	Field Sample	0.789	0.0582	ng/m3	Reported				0.1851

8051109-02	5/8/2018	Selenium	Field Sample	0.824	0.0582	ng/m3	Reported				0.1851
8051716-03	5/14/2018	Selenium	Field Sample	0.622	0.0582	ng/m3	Reported				0.1851
8052315-03	5/17/2018	Selenium	Field Sample	0.345	0.0582	ng/m3	Reported				0.1851
8052315-04	5/20/2018	Selenium	Field Sample	0.383	0.0582	ng/m3	Reported				0.1851
8052315-04	5/20/2018	Selenium	Replicate (R1)	0.351	0.0582	ng/m3	Reported				0.1851
8060714-02	6/4/2018	Selenium	Field Sample	0.699	0.0582	ng/m3	Reported				0.1851
8061224-02	6/7/2018	Selenium	Field Sample	1.03	0.0582	ng/m3	Reported				0.1851
8061528-02	6/10/2018	Selenium	Field Sample	0.535	0.0582	ng/m3	Reported				0.1851
8061914-01	6/13/2018	Selenium	Field Sample	0.236	0.0582	ng/m3	Reported				0.1851
8062215-02	6/19/2018	Selenium	Field Sample	0.766	0.0582	ng/m3	Reported				0.1851
8062808-02	6/25/2018	Selenium	Field Sample	0.36	0.0582	ng/m3	Reported				0.1851
8070617-02	7/1/2018	Selenium	Field Sample	0.24	0.0582	ng/m3	Reported				0.1851
8070617-02	7/1/2018	Selenium	Replicate (R1)	0.236	0.0582	ng/m3	Reported				0.1851
8071119-02	7/4/2018	Selenium	Field Sample	0.481	0.0582	ng/m3	Reported				0.1851
8071310-04	7/10/2018	Selenium	Field Sample	0.345	0.0582	ng/m3	Reported				0.1851
8071905-03	7/16/2018	Selenium	Field Sample	0.287	0.0582	ng/m3	Reported				0.1851
8072422-02	7/18/2018	Selenium	Field Sample	1.05	0.0582	ng/m3	Reported				0.1851

8072528-02	7/22/2018	Selenium	Field Sample	0.477	0.0582	ng/m3	Reported				0.1851
8073127-02	7/25/2018	Selenium	Field Sample	0.634	0.0582	ng/m3	Reported				0.1851
8080313-02	7/31/2018	Selenium	Field Sample	0.371	0.0582	ng/m3	Reported				0.1851
8080921-02	8/6/2018	Selenium	Field Sample	0.333	0.0582	ng/m3	Reported				0.1851
8081520-02RE1	8/9/2018	Selenium	Field Sample	0.396	0.0582	ng/m3	Reported				0.1851
8081520-03	8/12/2018	Selenium	Field Sample	0.574	0.0582	ng/m3	Reported				0.1851
8082131-02	8/15/2018	Selenium	Field Sample	0.53	0.0582	ng/m3	Reported				0.1851
8082405-02	8/21/2018	Selenium	Field Sample	0.352	0.0582	ng/m3	Reported				0.1851
8083010-02	8/27/2018	Selenium	Field Sample	0.404	0.0582	ng/m3	Reported				0.1851
8090523-02	8/30/2018	Selenium	Field Sample	0.138	0.0582	ng/m3	Reported				0.1851
8091124-02	9/5/2018	Selenium	Field Sample	0.195	0.0582	ng/m3	Reported				0.1851
8091827-04	9/11/2018	Selenium	Field Sample	0.391	0.0582	ng/m3	Reported				0.1851
8092521-03	9/17/2018	Selenium	Field Sample	0.444	0.0582	ng/m3	Reported				0.1851
8092521-04	9/20/2018	Selenium	Field Sample	0.608	0.0582	ng/m3	Reported				0.1851
8092620-02	9/23/2018	Selenium	Field Sample	0.486	0.0582	ng/m3	Reported				0.1851
8100219-02	9/26/2018	Selenium	Field Sample	0.199	0.0582	ng/m3	Reported				0.1851
8100510-02	10/2/2018	Selenium	Field Sample	0.456	0.0582	ng/m3	Reported				0.1851

8101114-02	10/8/2018	Selenium	Field Sample	0.342	0.0582	ng/m3	Reported				0.1851
8101626-02	10/11/2018	Selenium	Field Sample	0.37	0.0582	ng/m3	Reported				0.1851
8101626-02	10/11/2018	Selenium	Replicate (R1)	0.387	0.0582	ng/m3	Reported				0.1851
8101730-04	10/14/2018	Selenium	Field Sample	0.461	0.0582	ng/m3	Reported				0.1851
8102327-02	10/17/2018	Selenium	Field Sample	0.196	0.0582	ng/m3	Reported				0.1851
8102621-02	10/22/2018	Selenium	Field Sample	0.232	0.0582	ng/m3	Reported				0.1851
8110103-02	10/29/2018	Selenium	Field Sample	0.56	0.0582	ng/m3	Reported				0.1851
8110618-02	11/1/2018	Selenium	Field Sample	0.155	0.0582	ng/m3	Reported				0.1851
8110618-02	11/1/2018	Selenium	Replicate (R1)	0.185	0.0582	ng/m3	Reported				0.1851
8110720-02	11/4/2018	Selenium	Field Sample	0.24	0.0582	ng/m3	Reported				0.1851
8111510-02	11/7/2018	Selenium	Field Sample	0.249	0.0582	ng/m3	Reported				0.1851
8111604-04	11/13/2018	Selenium	Field Sample	0.478	0.0582	ng/m3	Reported				0.1851
8120439-02	11/28/2018	Selenium	Field Sample	0.459	0.0582	ng/m3	Reported				0.1851
8120719-03	12/4/2018	Selenium	Field Sample	0.153	0.0582	ng/m3	Reported				0.1851
8121312-02	12/10/2018	Selenium	Field Sample	0.889	0.0582	ng/m3	Reported		Y		0.1851
8121312-02	12/10/2018	Selenium	Replicate (R1)	0.916	0.0582	ng/m3	Reported		Y		0.1851
8121923-02	12/13/2018	Selenium	Field Sample	0.273	0.0582	ng/m3	Reported				0.1851

8122114-02	12/16/2018	Selenium	Field Sample	0.408	0.0582	ng/m3	Reported				0.1851
8122815-02	12/19/2018	Selenium	Field Sample	0.535	0.0582	ng/m3	Reported				0.1851
9010324-02	12/25/2018	Selenium	Field Sample	0.517	0.0582	ng/m3	Reported				0.1851
9010929-02	1/6/2019	Selenium	Field Sample	0.541	0.0582	ng/m3	Reported				0.1851
9011548-02	1/9/2019	Selenium	Field Sample	0.151	0.0582	ng/m3	Reported				0.1851
9011548-02	1/9/2019	Selenium	Replicate (R1)	0.178	0.0582	ng/m3	Reported				0.1851
9011813-02	1/15/2019	Selenium	Field Sample	0.261	0.0582	ng/m3	Reported				0.1851
9012424-02	1/21/2019	Selenium	Field Sample	0.151	0.0582	ng/m3	Reported				0.1851
9012922-02	1/24/2019	Selenium	Field Sample	0.259	0.0582	ng/m3	Reported				0.1851
9013106-01	1/27/2019	Selenium	Field Sample	0.538	0.0582	ng/m3	Reported				0.1851
9020515-03	1/30/2019	Selenium	Field Sample	0.26	0.0582	ng/m3	Reported				0.1851
9020515-03	1/30/2019	Selenium	Replicate (R1)	0.301	0.0582	ng/m3	Reported				0.1851
9020814-02	2/5/2019	Selenium	Field Sample	0.319	0.0582	ng/m3	Reported				0.1851
9021410-02	2/10/2019	Selenium	Field Sample	0.315	0.0582	ng/m3	Reported				0.1851
9021923-02	2/13/2019	Selenium	Field Sample	0.405	0.0582	ng/m3	Reported				0.1851
9022106-02	2/16/2019	Selenium	Field Sample	0.229	0.0582	ng/m3	Reported				0.1851
9022620-02	2/20/2019	Selenium	Field Sample	0.165	0.0582	ng/m3	Reported				0.1851

9030111-01	2/26/2019	Selenium	Field Sample	0.42	0.0582	ng/m3	Reported				0.1851
9030711-01	3/4/2019	Selenium	Field Sample	0.332	0.0582	ng/m3	Reported				0.1851
9031218-02	3/7/2019	Selenium	Field Sample	0.311	0.0582	ng/m3	Reported				0.1851
9031218-02	3/7/2019	Selenium	Replicate (R1)	0.324	0.0582	ng/m3	Reported				0.1851
9031317-01	3/10/2019	Selenium	Field Sample	0.377	0.0582	ng/m3	Reported				0.1851
9031918-02	3/13/2019	Selenium	Field Sample	0.357	0.0582	ng/m3	Reported				0.1851
9032208-02	3/19/2019	Selenium	Field Sample	0.439	0.0582	ng/m3	Reported				0.1851
9032806-02	3/25/2019	Selenium	Field Sample	0.46	0.0621	ng/m3	Reported				0.1975
9032806-02	3/25/2019	Selenium	Replicate (R1)	0.461	0.0621	ng/m3	Reported				0.1975
9040229-02	3/28/2019	Selenium	Field Sample	0.549	0.0621	ng/m3	Reported				0.1975
9040336-03	3/31/2019	Selenium	Field Sample	0.887	0.0621	ng/m3	Reported				0.1975
9040945-02	4/3/2019	Selenium	Field Sample	0.634	0.0621	ng/m3	Reported				0.1975
9041214-02	4/9/2019	Selenium	Field Sample	0.294	0.0621	ng/m3	Reported				0.1975
9041214-02	4/9/2019	Selenium	Replicate (R1)	0.29	0.0621	ng/m3	Reported				0.1975
9041815-02	4/15/2019	Selenium	Field Sample	0.456	0.0621	ng/m3	Reported				0.1975
9042319-02	4/18/2019	Selenium	Field Sample	0.383	0.0621	ng/m3	Reported				0.1975
9042418-02	4/21/2019	Selenium	Field Sample	0.113	0.0621	ng/m3	Reported				0.1975

9043022-02	4/24/2019	Selenium	Field Sample	0.594	0.0621	ng/m3	Reported				0.1975
9050319-03	4/29/2019	Selenium	Field Sample	0.562	0.0621	ng/m3	Reported				0.1975

8053025-02	5/24/2018	Antimony	Field Sample			ng/m3	Invalid	AG			
8053025-02	5/24/2018	Arsenic	Field Sample			ng/m3	Invalid	AG			
8053025-02	5/24/2018	Beryllium	Field Sample			ng/m3	Invalid	AG			
8053025-02	5/24/2018	Cadmium	Field Sample			ng/m3	Invalid	AG			
8053025-02	5/24/2018	Chromium	Field Sample			ng/m3	Invalid	AG			
8053025-02	5/24/2018	Cobalt	Field Sample			ng/m3	Invalid	AG			
8053025-02	5/24/2018	Lead	Field Sample			ng/m3	Invalid	AG			
8053025-02	5/24/2018	Manganese	Field Sample			ng/m3	Invalid	AG			
8053025-02	5/24/2018	Mercury	Field Sample			ng/m3	Invalid	AG			
8053025-02	5/24/2018	Nickel	Field Sample			ng/m3	Invalid	AG			
8053025-02	5/24/2018	Selenium	Field Sample			ng/m3	Invalid	AG			
8060108-02	5/30/2018	Antimony	Field Sample			ng/m3	Invalid	AN			
8060108-02	5/30/2018	Arsenic	Field Sample			ng/m3	Invalid	AN			
8060108-02	5/30/2018	Beryllium	Field Sample			ng/m3	Invalid	AN			
8060108-02	5/30/2018	Cadmium	Field Sample			ng/m3	Invalid	AN			

8060108-02	5/30/2018	Chromium	Field Sample			ng/m3	Invalid	AN		
8060108-02	5/30/2018	Cobalt	Field Sample			ng/m3	Invalid	AN		
8060108-02	5/30/2018	Lead	Field Sample			ng/m3	Invalid	AN		
8060108-02	5/30/2018	Manganese	Field Sample			ng/m3	Invalid	AN		
8060108-02	5/30/2018	Mercury	Field Sample			ng/m3	Invalid	AN		
8060108-02	5/30/2018	Nickel	Field Sample			ng/m3	Invalid	AN		
8060108-02	5/30/2018	Selenium	Field Sample			ng/m3	Invalid	AN		
8070333-01	6/28/2018	Hexavalent Chromium	Field Sample			ng/m3	Invalid	AN		
8070333-02	6/29/2018	Antimony	Field Sample			ng/m3	Invalid	AR		
8070333-02	6/29/2018	Arsenic	Field Sample			ng/m3	Invalid	AR		
8070333-02	6/29/2018	Beryllium	Field Sample			ng/m3	Invalid	AR		
8070333-02	6/29/2018	Cadmium	Field Sample			ng/m3	Invalid	AR		
8070333-02	6/29/2018	Chromium	Field Sample			ng/m3	Invalid	AR		
8070333-02	6/29/2018	Cobalt	Field Sample			ng/m3	Invalid	AR		
8070333-02	6/29/2018	Lead	Field Sample			ng/m3	Invalid	AR		
8070333-02	6/29/2018	Manganese	Field Sample			ng/m3	Invalid	AR		
8070333-02	6/29/2018	Mercury	Field Sample			ng/m3	Invalid	AR		

8070333-02	6/29/2018	Nickel	Field Sample			ng/m3	Invalid	AR		
8070333-02	6/29/2018	Selenium	Field Sample			ng/m3	Invalid	AR		
8072422-01	7/18/2018	Hexavalent Chromium	Field Sample			ng/m3	Invalid	AN		
8102621-01	10/22/2018	Hexavalent Chromium	Field Sample			ng/m3	Invalid	AJ		
8112710-02	11/20/2018	Antimony	Field Sample			ng/m3	Invalid	AJ		
8112710-02	11/20/2018	Arsenic	Field Sample			ng/m3	Invalid	AJ		
8112710-02	11/20/2018	Beryllium	Field Sample			ng/m3	Invalid	AJ		
8112710-02	11/20/2018	Cadmium	Field Sample			ng/m3	Invalid	AJ		
8112710-02	11/20/2018	Chromium	Field Sample			ng/m3	Invalid	AJ		
8112710-02	11/20/2018	Cobalt	Field Sample			ng/m3	Invalid	AJ		
8112710-02	11/20/2018	Lead	Field Sample			ng/m3	Invalid	AJ		
8112710-02	11/20/2018	Manganese	Field Sample			ng/m3	Invalid	AJ		
8112710-02	11/20/2018	Mercury	Field Sample			ng/m3	Invalid	AJ		
8112710-02	11/20/2018	Nickel	Field Sample			ng/m3	Invalid	AJ		
8112710-02	11/20/2018	Selenium	Field Sample			ng/m3	Invalid	AJ		
8112904-02	11/26/2018	Antimony	Field Sample			ng/m3	Invalid	AJ		
8112904-02	11/26/2018	Arsenic	Field Sample			ng/m3	Invalid	AJ		

8112904-02	11/26/2018	Beryllium	Field Sample			ng/m3	Invalid	AJ			
8112904-02	11/26/2018	Cadmium	Field Sample			ng/m3	Invalid	AJ			
8112904-02	11/26/2018	Chromium	Field Sample			ng/m3	Invalid	AJ			
8112904-02	11/26/2018	Cobalt	Field Sample			ng/m3	Invalid	AJ			
8112904-02	11/26/2018	Lead	Field Sample			ng/m3	Invalid	AJ			
8112904-02	11/26/2018	Manganese	Field Sample			ng/m3	Invalid	AJ			
8112904-02	11/26/2018	Mercury	Field Sample			ng/m3	Invalid	AJ			
8112904-02	11/26/2018	Nickel	Field Sample			ng/m3	Invalid	AJ			
8112904-02	11/26/2018	Selenium	Field Sample			ng/m3	Invalid	AJ			
9010824-02	1/3/2019	Antimony	Field Sample			ng/m3	Invalid	BJ			
9010824-02	1/3/2019	Arsenic	Field Sample			ng/m3	Invalid	BJ			
9010824-02	1/3/2019	Beryllium	Field Sample			ng/m3	Invalid	BJ			
9010824-02	1/3/2019	Cadmium	Field Sample			ng/m3	Invalid	BJ			
9010824-02	1/3/2019	Chromium	Field Sample			ng/m3	Invalid	BJ			
9010824-02	1/3/2019	Cobalt	Field Sample			ng/m3	Invalid	BJ			
9010824-02	1/3/2019	Lead	Field Sample			ng/m3	Invalid	BJ			
9010824-02	1/3/2019	Manganese	Field Sample			ng/m3	Invalid	BJ			

9010824-02	1/3/2019	Mercury	Field Sample			ng/m3	Invalid	BJ		
9010824-02	1/3/2019	Nickel	Field Sample			ng/m3	Invalid	BJ		
9010824-02	1/3/2019	Selenium	Field Sample			ng/m3	Invalid	BJ		
9020515-01	1/30/2019	Hexavalent Chromium	Field Sample			ng/m3	Invalid	AN		

Appendix B

Wylam, AL Hexavalent Chromium Study

ProUCL Statistical Results

The following calculations were produced using ProUCL 5.1.002 Statistical Software for Environmental Applications for Data Sets with and without Non-detect Observations (See: https://www.epa.gov/land-research/proucl-software).

Antimony

General Statistics

Total Number of Observations	80	Number of Distinct Observations	78
		Number of Missing Observations	0
Minimum	2.4900E-4	Mean	0.00132
Maximum	0.00438	Median	9.0150E-4
SD	0.00101	Std. Error of Mean	1.1316E-4
Coefficient of Variation	0.767	Skewness	1.64
Mean of logged Data	-6.86	SD of logged Data	0.659

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution (0.05)

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.00151	95% Adjusted-CLT UCL (Chen-1995)	0.00153
		95% Modified-t UCL (Johnson-1978)	0.00151

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00151	95% Jackknife UCL	0.00151
95% Standard Bootstrap UCL	0.00151	95% Bootstrap-t UCL	0.00153
95% Hall's Bootstrap UCL	0.00152	95% Percentile Bootstrap UCL	0.00151
95% BCA Bootstrap UCL	0.00153		
90% Chebyshev(Mean, Sd) UCL	0.00166	95% Chebyshev(Mean, Sd) UCL	0.00181
97.5% Chebyshev(Mean, Sd) UCL	0.00203	99% Chebyshev(Mean, Sd) UCL	0.00245

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	0.00181

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Arsenic

General Statistics

Total Number of Observations	80	Number of Distinct Observations	76
		Number of Missing Observations	0
Minimum	2.0800E-4	Mean	0.00135
Maximum	0.017	Median	0.00108
SD	0.00187	Std. Error of Mean	2.0915E-4
Coefficient of Variation	1.386	Skewness	7.615

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.952	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk P Value	0.0136	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0879	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.0991	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Logged Statistics

Minimum of Logged Data	-8.478	Mean of logged Data	-6.861
Maximum of Logged Data	-4.075	SD of logged Data	0.611

Lognormal Maximum likelihood Estimates (MLEs)

MLE Mean	0.00126	MLE Standard Deviation	8.5034E-4
MLE Median	0.00105	MLE Skewness	2.325
MLE Coefficient of Variation	0.673	80% MLE Quantile	0.00175
90% MLE Quantile	0.00229	95% MLE Quantile	0.00286
99% MLE Quantile	0.00434		

Lognormal Minimum Variance Unbiased Estimates (MVUEs)

MVUE Mean	0.00126	MVUE SD	8.3897E-4

MVUE Median	0.00105	MVUE SEM	9.2923E-5

Assuming Lognormal Distribution

95% H-UCL	0.00144	90% Chebyshev (MVUE) UCL	0.00154
95% Chebyshev (MVUE) UCL	0.00166	97.5% Chebyshev (MVUE) UCL	0.00184
99% Chebyshev (MVUE) UCL	0.00218		

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00169	95% Jackknife UCL	0.0017
95% Standard Bootstrap UCL	0.00169	95% Bootstrap-t UCL	0.00232
95% Hall's Bootstrap UCL	0.00306	95% Percentile Bootstrap UCL	0.00176
95% BCA Bootstrap UCL	0.00208		
90% Chebyshev(Mean, Sd) UCL	0.00198	95% Chebyshev(Mean, Sd) UCL	0.00226
97.5% Chebyshev(Mean, Sd) UCL	0.00266	99% Chebyshev(Mean, Sd) UCL	0.00343

Suggested UCL to Use

95% H-UCL	0.00144

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Beryllium

General Statistics

Total Number of Observations	80	Number of Distinct Observations	75
		Number of Missing Observations	0

Minimum	2.5800E-6	Mean	1.8992E-5
Maximum	1.0400E-4	Median	1.4750E-5
SD	1.7886E-5	SD of logged Data	0.849
Coefficient of Variation	N/A	Skewness	2.359

Gamma GOF Test

A-D Test Statistic	0.792	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.769	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0825	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.101	Data appear Gamma Distributed at 5% Significance Level

Data appear to Follow Approximate Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.561	k star (bias corrected MLE)	1.511
Theta hat (MLE)	1.2167E-5	Theta star (bias corrected MLE)	1.2571E-5
nu hat (MLE)	249.8	nu star (bias corrected)	241.7
MLE Mean (bias corrected)	1.8992E-5	MLE Sd (bias corrected)	1.5452E-5
		Approximate Chi Square Value (0.05)	206.7
Adjusted Level of Significance	0.047	Adjusted Chi Square Value	206.1

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	2.2207E-5	95% Adjusted Gamma UCL (use when n<50)	2.2271E-5

Suggested UCL to Use

95% Approximate Gamma UCL	2.2207E-5

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Cadmium

General Statistics

Total Number of Observations	80	Number of Distinct Observations	75
		Number of Missing Observations	0
Minimum	2.6600E-5	Mean	1.3060E-4
Maximum	0.00153	Median	9.9800E-5
SD	1.7324E-4	Std. Error of Mean	1.9369E-5
Coefficient of Variation	1.326	Skewness	6.884

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.957	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk P Value	0.0317	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0777	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.0991	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Logged Statistics

Minimum of Logged Data	-10.53	Mean of logged Data	-9.224
Maximum of Logged Data	-6.482	SD of logged Data	0.657

Lognormal Maximum likelihood Estimates (MLEs)

MLE Mean	1.2234E-4	MLE Standard Deviation	8.9814E-5
MLE Median	9.8621E-5	MLE Skewness	2.598
MLE Coefficient of Variation	0.734	80% MLE Quantile	1.7138E-4
90% MLE Quantile	2.2877E-4	95% MLE Quantile	2.9040E-4
99% MLE Quantile	4.5428E-4		

Lognormal Minimum Variance Unbiased Estimates (MVUEs)

MVUE Mean	1.2195E-4	MVUE SD	8.8399E-5
MVUE Median	9.8356E-5	MVUE SEM	9.7626E-6

Assuming Lognormal Distribution

95% H-UCL	1.4139E-4	90% Chebyshev (MVUE) UCL	1.5123E-4
95% Chebyshev (MVUE) UCL	1.6450E-4	97.5% Chebyshev (MVUE) UCL	1.8291E-4
99% Chebyshev (MVUE) UCL	2.1908E-4		

Nonparametric Distribution Free UCLs

95% CLT UCL	1.6246E-4	95% Jackknife UCL	1.6283E-4
95% Standard Bootstrap UCL	1.6279E-4	95% Bootstrap-t UCL	2.0671E-4
95% Hall's Bootstrap UCL	2.8972E-4	95% Percentile Bootstrap UCL	1.6496E-4
95% BCA Bootstrap UCL	1.8533E-4		
90% Chebyshev(Mean, Sd) UCL	1.8870E-4	95% Chebyshev(Mean, Sd) UCL	2.1502E-4
97.5% Chebyshev(Mean, Sd) UCL	2.5155E-4	99% Chebyshev(Mean, Sd) UCL	3.2331E-4

Suggested UCL to Use

95% H-UCL	1.4139E-4

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Chromium

General Statistics

Total Number of Observations	80	Number of Distinct Observations	79
		Number of Missing Observations	0
Minimum	0.00139	Mean	0.0277

Maximum	0.302	Median	0.00907
SD	0.0447	Std. Error of Mean	0.005
Coefficient of Variation	1.616	Skewness	3.635

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.939	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk P Value	0.00132	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.087	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.0991	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Logged Statistics

Minimum of Logged Data	-6.578	Mean of logged Data	-4.463
Maximum of Logged Data	-1.197	SD of logged Data	1.315

Lognormal Maximum likelihood Estimates (MLEs)

MLE Mean	0.0274	MLE Standard Deviation	0.059
MLE Median	0.0115	MLE Skewness	16.46
MLE Coefficient of Variation	2.154	80% MLE Quantile	0.0349
90% MLE Quantile	0.0622	95% MLE Quantile	0.1
99% MLE Quantile	0.246		

Lognormal Minimum Variance Unbiased Estimates (MVUEs)

MVUE Mean	0.0268	MVUE SD	0.0535
MVUE Median	0.0114	MVUE SEM	0.00515

Assuming Lognormal Distribution

95% H-UCL	0.0402	90% Chebyshev (MVUE) UCL	0.0423
95% Chebyshev (MVUE) UCL	0.0493	97.5% Chebyshev (MVUE) UCL	0.059
99% Chebyshev (MVUE) UCL	0.078		

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0359	95% Jackknife UCL	0.036
95% Standard Bootstrap UCL	0.0359	95% Bootstrap-t UCL	0.0404
95% Hall's Bootstrap UCL	0.0425	95% Percentile Bootstrap UCL	0.0365
95% BCA Bootstrap UCL	0.0384		
90% Chebyshev(Mean, Sd) UCL	0.0427	95% Chebyshev(Mean, Sd) UCL	0.0495
97.5% Chebyshev(Mean, Sd) UCL	0.0589	99% Chebyshev(Mean, Sd) UCL	0.0775

Suggested UCL to Use

95% H-UCL	0.0402

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Cobalt

General Statistics

Total Number of Observations	80	Number of Distinct Observations	74
		Number of Missing Observations	0
Minimum	2.4900E-5	Mean	1.6588E-4
Maximum	9.8850E-4	Median	1.3950E-4
SD	1.4032E-4	SD of logged Data	0.671
Coefficient of Variation	0.846	Skewness	3.414

Gamma GOF Test

A-D Test Statistic	0.783	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.762	Data Not Gamma Distributed at 5% Significance Level

K-S Test Statistic	0.0901	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.101	Data appear Gamma Distributed at 5% Significance Level	

Data appear to Follow Approximate Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.294	k star (bias corrected MLE)	2.216
Theta hat (MLE)	7.2310E-5	Theta star (bias corrected MLE)	7.4845E-5
nu hat (MLE)	367	nu star (bias corrected)	354.6
MLE Mean (bias corrected)	1.6588E-4	MLE Sd (bias corrected)	1.1142E-4
		Approximate Chi Square Value (0.05)	312
Adjusted Level of Significance	0.047	Adjusted Chi Square Value	311.2

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1.8855E-4	95% Adjusted Gamma UCL (use when n<50)	1.8899E-4

Suggested UCL to Use

95% Approximate Gamma UCL	1.8855E-4

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Hex Chromium

General Statistics

Total Number of Observations	81	Number of Distinct Observations	77
		Number of Missing Observations	0
Minimum	5.5400E-6	Mean	0.00252
Maximum	0.044	Median	2.3100E-4

SD	0.00675	Std. Error of Mean	7.5009E-4
Coefficient of Variation	2.678	Skewness	4.522

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.953	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk P Value	0.0147	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0781	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.0985	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Logged Statistics

Minimum of Logged Data	-12.1	Mean of logged Data	-8.256
Maximum of Logged Data	-3.124	SD of logged Data	2.322

Lognormal Maximum likelihood Estimates (MLEs)

MLE Mean	0.00385	MLE Standard Deviation	0.0569
MLE Median	2.5981E-4	MLE Skewness	3271
MLE Coefficient of Variation	14.78	80% MLE Quantile	0.00183
90% MLE Quantile	0.00509	95% MLE Quantile	0.0118
99% MLE Quantile	0.0576		

Lognormal Minimum Variance Unbiased Estimates (MVUEs)

MVUE Mean	0.00344	MVUE SD	0.0313
MVUE Median	2.5130E-4	MVUE SEM	0.00146

Assuming Lognormal Distribution

95% H-UCL	0.0102	90% Chebyshev (MVUE) UCL	0.0078
95% Chebyshev (MVUE) UCL	0.00978	97.5% Chebyshev (MVUE) UCL	0.0125
99% Chebyshev (MVUE) UCL	0.0179		

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00376	95% Jackknife UCL	0.00377

95% Standard Bootstrap UCL	0.00374	95% Bootstrap-t UCL	0.00491
95% Hall's Bootstrap UCL	0.00468	95% Percentile Bootstrap UCL	0.00381
95% BCA Bootstrap UCL	0.00419		
90% Chebyshev(Mean, Sd) UCL	0.00477	95% Chebyshev(Mean, Sd) UCL	0.00579
97.5% Chebyshev(Mean, Sd) UCL	0.00721	99% Chebyshev(Mean, Sd) UCL	0.00998

Suggested UCL to Use

95% H-UCL	0.0102

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Lead

General Statistics

Total Number of Observations	80	Number of Distinct Observations	74
		Number of Missing Observations	0
Minimum	4.6900E-4	Mean	0.00355
Maximum	0.0259	Median	0.00289
SD	0.00353	Std. Error of Mean	3.9488E-4
Coefficient of Variation	0.995	Skewness	3.956

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.988	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk P Value	0.917	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0554	**Lilliefors Lognormal GOF Test**

5% Lilliefors Critical Value	0.0991	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Logged Statistics

Minimum of Logged Data	-7.665	Mean of logged Data	-5.922
Maximum of Logged Data	-3.654	SD of logged Data	0.718

Lognormal Maximum likelihood Estimates (MLEs)

MLE Mean	0.00347	MLE Standard Deviation	0.00285
MLE Median	0.00268	MLE Skewness	3.019
MLE Coefficient of Variation	0.821	80% MLE Quantile	0.00491
90% MLE Quantile	0.00673	95% MLE Quantile	0.00874
99% MLE Quantile	0.0143		

Lognormal Minimum Variance Unbiased Estimates (MVUEs)

MVUE Mean	0.00346	MVUE SD	0.00279
MVUE Median	0.00267	MVUE SEM	3.0714E-4

Assuming Lognormal Distribution

95% H-UCL	0.00408	90% Chebyshev (MVUE) UCL	0.00438
95% Chebyshev (MVUE) UCL	0.00479	97.5% Chebyshev (MVUE) UCL	0.00537
99% Chebyshev (MVUE) UCL	0.00651		

Nonparametric Distribution Free UCLs

95% CLT UCL	0.0042	95% Jackknife UCL	0.00421
95% Standard Bootstrap UCL	0.00421	95% Bootstrap-t UCL	0.00454
95% Hall's Bootstrap UCL	0.00529	95% Percentile Bootstrap UCL	0.00428
95% BCA Bootstrap UCL	0.00449		
90% Chebyshev(Mean, Sd) UCL	0.00474	95% Chebyshev(Mean, Sd) UCL	0.00527
97.5% Chebyshev(Mean, Sd) UCL	0.00602	99% Chebyshev(Mean, Sd) UCL	0.00748

Suggested UCL to Use

95% H-UCL	0.00408

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Manganese

General Statistics

Total Number of Observations	80	Number of Distinct Observations	79
		Number of Missing Observations	0
Minimum	0.00202	Mean	0.0524
Maximum	0.272	Median	0.0324
SD	0.0558	SD of logged Data	1.17
Coefficient of Variation	1.065	Skewness	1.905

Gamma GOF Test

A-D Test Statistic	0.653	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.782	Data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.108	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.103	Data Not Gamma Distributed at 5% Significance Level

Data appear to Follow Approximate Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.999	k star (bias corrected MLE)	0.97
Theta hat (MLE)	0.0525	Theta star (bias corrected MLE)	0.054
nu hat (MLE)	159.8	nu star (bias corrected)	155.1

MLE Mean (bias corrected)	0.0524	MLE Sd (bias corrected)	0.0532
		Approximate Chi Square Value (0.05)	127.3
Adjusted Level of Significance	0.047	Adjusted Chi Square Value	126.9

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	0.0638	95% Adjusted Gamma UCL (use when n<50)	0.064

Suggested UCL to Use

95% Approximate Gamma UCL	0.0638

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Mercury

General Statistics

Total Number of Observations	80	Number of Distinct Observations	74
		Number of Missing Observations	0
Minimum	6.2500E-6	Mean	1.7521E-5
Maximum	4.7500E-5	Median	1.5150E-5
SD	8.9340E-6	SD of logged Data	0.478
Coefficient of Variation	N/A	Skewness	1.164

Gamma GOF Test

A-D Test Statistic	0.972	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.755	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0819	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.1	Data appear Gamma Distributed at 5% Significance Level

Data appear to Follow Approximate Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.477	k star (bias corrected MLE)	4.318
Theta hat (MLE)	3.9132E-6	Theta star (bias corrected MLE)	4.0579E-6
nu hat (MLE)	716.4	nu star (bias corrected)	690.8
MLE Mean (bias corrected)	1.7521E-5	MLE Sd (bias corrected)	8.4319E-6
		Approximate Chi Square Value (0.05)	630.9
Adjusted Level of Significance	0.047	Adjusted Chi Square Value	629.8

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1.9187E-5	95% Adjusted Gamma UCL (use when n<50)	1.9218E-5

Suggested UCL to Use

95% Approximate Gamma UCL	1.9187E-5

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Nickel

General Statistics

Total Number of Observations	80	Number of Distinct Observations	75
		Number of Missing Observations	0
Minimum	2.7100E-4	Mean	0.00214
Maximum	0.0212	Median	0.0015
SD	0.0028	Std. Error of Mean	3.1252E-4
Coefficient of Variation	1.306	Skewness	4.908

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.976	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk P Value	0.427	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0642	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.0991	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Logged Statistics

Minimum of Logged Data	-8.213	Mean of logged Data	-6.516
Maximum of Logged Data	-3.854	SD of logged Data	0.796

Lognormal Maximum likelihood Estimates (MLEs)

MLE Mean	0.00203	MLE Standard Deviation	0.00191
MLE Median	0.00148	MLE Skewness	3.657
MLE Coefficient of Variation	0.941	80% MLE Quantile	0.00289
90% MLE Quantile	0.00411	95% MLE Quantile	0.00548
99% MLE Quantile	0.00944		

Lognormal Minimum Variance Unbiased Estimates (MVUEs)

MVUE Mean	0.00202	MVUE SD	0.00186
MVUE Median	0.00147	MVUE SEM	2.0324E-4

Assuming Lognormal Distribution

95% H-UCL	0.00245	90% Chebyshev (MVUE) UCL	0.00263
95% Chebyshev (MVUE) UCL	0.00291	97.5% Chebyshev (MVUE) UCL	0.00329
99% Chebyshev (MVUE) UCL	0.00404		

Nonparametric Distribution Free UCLs

95% CLT UCL	0.00265	95% Jackknife UCL	0.00266
95% Standard Bootstrap UCL	0.00266	95% Bootstrap-t UCL	0.00314
95% Hall's Bootstrap UCL	0.00509	95% Percentile Bootstrap UCL	0.00269

95% BCA Bootstrap UCL	0.00293		
90% Chebyshev(Mean, Sd) UCL	0.00308	95% Chebyshev(Mean, Sd) UCL	0.0035
97.5% Chebyshev(Mean, Sd) UCL	0.00409	99% Chebyshev(Mean, Sd) UCL	0.00525

Suggested UCL to Use

95% H-UCL	0.00245

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Selenium

General Statistics

Total Number of Observations	80	Number of Distinct Observations	76
		Number of Missing Observations	0
Minimum	1.1300E-4	Mean	4.2203E-4
Maximum	0.00105	Median	3.8700E-4
SD	2.0280E-4	SD of logged Data	0.487
Coefficient of Variation	0.481	Skewness	1.029

Normal GOF Test

Shapiro Wilk Test Statistic	0.923	**Normal GOF Test**
5% Shapiro Wilk P Value	6.3278E-5	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.0901	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0991	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	4.5977E-4	95% Adjusted-CLT UCL (Chen-1995)	4.6211E-4
		95% Modified-t UCL (Johnson-1978)	4.6020E-4

Suggested UCL to Use

95% Student's-t UCL 4.5977E-4

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test

When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Appendix C
Wylam, AL Hexavalent Chromium Study
Chemical-specific Health Effects

The chemical-specific health effect information provided below is limited to the chemicals that were the largest contributor to the cancer risks and noncancer hazard. Additionally, citations are provided to facilitate access to extended information relative to the remaining chemicals from the study.

Chromium and Hexavalent Chromium

Chromium occurs in the environment primarily in two valence states, trivalent chromium (Cr III) and hexavalent chromium (Cr VI). Exposure may occur from natural or industrial sources of chromium. Chromium III is much less toxic than chromium (VI). The respiratory tract is also the major target organ for chromium (III) toxicity, similar to chromium (VI). Chromium (III) is an essential element in humans. The body can detoxify some amount of chromium (VI) to chromium (III). The respiratory tract is the major target organ for chromium (VI) toxicity, for acute (short-term) and chronic (long-term) inhalation exposures. Shortness of breath, coughing, and wheezing were reported from a case of acute exposure to chromium (VI), while perforations and ulcerations of the septum, bronchitis, decreased pulmonary function, pneumonia, and other respiratory effects have been noted from chronic exposure. Human studies have clearly established that inhaled chromium (VI) is a human carcinogen, resulting in an increased risk of lung cancer. Animal studies have shown chromium (VI) to cause lung tumors via inhalation exposure.

A full discussion of chromium and hexavalent chromium can be found at https://www.epa.gov/sites/production/files/2016-09/documents/chromium-compounds.pdf and in the literature (see: WHO, 1988 and ATSDR, 2012a).

Arsenic

Arsenic, a naturally occurring element, is found throughout the environment; for most people, food is the major source of exposure. Acute (short-term) high-level inhalation exposure to arsenic dust or fumes has resulted in gastrointestinal effects (nausea, diarrhea, abdominal pain); central and peripheral nervous system disorders have occurred in workers acutely exposed to inorganic arsenic. Chronic (long-term) inhalation exposure to inorganic arsenic of humans is associated with irritation of the skin and mucous membranes and effects in the brain and nervous system. Chronic oral exposure to elevated levels of inorganic arsenic has resulted in gastrointestinal effects, anemia, peripheral neuropathy, skin lesions, hyperpigmentation, and liver or kidney damage in humans. Inorganic arsenic exposure of humans, by the inhalation route, has been shown to be strongly associated with lung cancer, while ingestion of inorganic arsenic by humans has been linked to a form of skin cancer and also to bladder, liver, and lung cancer. EPA has classified inorganic arsenic as a human carcinogen. Arsine is a gas consisting of arsenic and hydrogen. It is extremely toxic to humans, with headaches, vomiting, and abdominal pains occurring within a few hours of exposure. EPA has not classified arsine for carcinogenicity.

A full discussion of arsenic can be found at https://www.epa.gov/sites/production/files/2016-09/documents/arsenic-compounds.pdf and in the literature (see: ATSDR, 2007a and WHO, 2001).

Manganese

Manganese is naturally occurring in the environment. Manganese is essential for normal physiologic functioning in humans and animals, and exposure to low levels of manganese in the diet is considered to be nutritionally essential in humans. Chronic (long-term) exposure to high levels of manganese by inhalation in humans may result in central nervous system (CNS) effects. Visual reaction time, hand steadiness, and eye-hand coordination were affected in chronically-exposed workers. A syndrome named manganese may result from chronic exposure to higher levels; manganese is characterized by feelings of weakness and lethargy, tremors, a mask-like face, and psychological disturbances. Respiratory effects have also been noted in workers chronically exposed to manganese bearing particles by inhalation.

A full discussion of manganese can be found at https://www.epa.gov/sites/production/files/2016-10/documents/manganese.pdf and in the literature (see: WHO, 1981 and ATSDR, 2012b).

Nickel
A full discussion of nickel can be found at https://www.epa.gov/sites/production/files/2016-09/documents/nickle-compounds.pdf and in the literature (see: ATSDR, 2005d and WHO, 1991a).

Cadmium
A full discussion of cadmium can be found at https://www.epa.gov/sites/production/files/2016-09/documents/cadmium-compounds.pdf and in the literature (see: NRC, 1997, Elinder, 1985, WHO, 1992, OECD, 1994, WHO, 1991c, and ATSDR, 2005a).

Beryllium
A full discussion of beryllium can be found at https://www.epa.gov/sites/production/files/2016-09/documents/beryllium-compounds.pdf and in the literature (see: WHO, 1990 and ATSDR, 2002b).

Lead
A full discussion of lead can be found at https://www.epa.gov/sites/production/files/2016-09/documents/lead-compounds.pdf and in the literature (see: Cholak et al., 1961, ATSDR, 1999a, the EPA NAAQS web site, CDC's NHANES System, 2018a, WHO, 1977, ATSDR, 2019, and WHO, 1995).

Antimony
A full discussion of antimony can be found at https://www.epa.gov/sites/production/files/2016-09/documents/antimony-compounds.pdf and in the literature (see: USEPA, 2000 and ATSDR, 1992).

Cobalt
A full discussion of cobalt can be found at https://www.epa.gov/sites/production/files/2016-09/documents/cobalt-compounds.pdf and in the literature (see: WHO, 2005, EPA, 1992, and ATSDR, 2004).

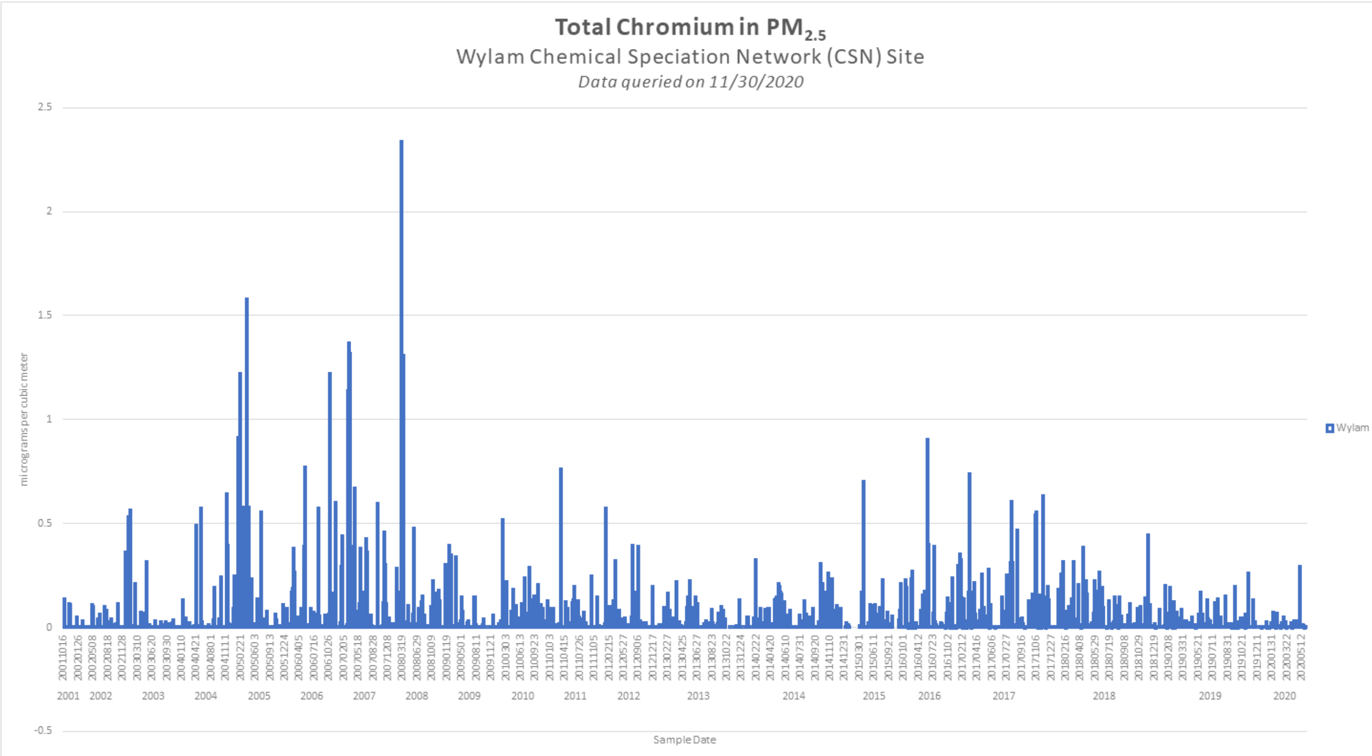
Mercury
A full discussion of mercury can be found at https://www.epa.gov/sites/production/files/2016-09/documents/mercury-compounds.pdf and in the literature (see: WHO, 1991b and ATSDR, 1999b).

Selenium
A full discussion of selenium can be found at https://www.epa.gov/sites/production/files/2016-09/documents/selenium-compounds.pdf and in the literature (see: WHO, 1987 and ATSDR, 2003).

Appendix D

Wylam, AL Hexavalent Chromium Study

Total Chromium Temporal Analysis


Total Chromium in $PM_{2.5}$
Wylam Chemical Speciation Network (CSN) Site
Data queried on 11/30/2020
micrograms per cubic meter
Sample Date
Wylam