Preliminary Risk Assessments for Three Art Glass Manufacturing Facilities

Office of Air Quality Planning and Standards
Office of Air and Radiation
U.S. Environmental Protection Agency
November 2019

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Acronyms

95UCL	95th percentile upper confidence level
AEGL	acute exposure guideline level
AQS	Air Quality System
ATSDR	U.S. Agency for Toxic Substances and Disease Registry
CalEPA	California Environmental Protection Agency
ERPG	Emergency Response Planning Guideline
HAP	hazardous air pollutant
HQ	hazard quotient
IRIS	Integrated Risk Information System
LOAEL	lowest-observed-adverse-effect-level
MDL	minimum detection limit
MRL	minimal risk level
NAAQS	National Ambient Air Quality Standards
NOAEL	no-observed-adverse-effect-level
PB-HAP	persistent, bioaccumulative hazardous air pollutant
PWGC	Paul Wissmach Glass Company (PWGC)
REL	reference exposure level
RfC	reference concentration
RfD	reference dose
TOSHI	target-organ-specific hazard index
URE	unit risk estimate

1 Introduction

The art glass industry uses metals as raw materials in making specialty colored glass. Many of these metals are emitted during the glass-making process and are hazardous air pollutants (HAPs). In early 2015, a U.S. Forest Service study showed high levels of metals in tree moss near an art glass facility in Portland, Oregon (see https://www.fs.fed.us/research/urban-webinars/using-moss/). In October 2015, the Oregon Department of Environmental Quality conducted ambient air monitoring that confirmed high levels of cadmium and arsenic in the air near several art glass facilities in Portland (see https://www.oregon.gov/deq/aq/pages/air-quality-map.aspx). The U.S. Environmental Protection Agency (EPA), concerned that other art glass facilities around the country might emit similarly high levels of arsenic, cadmium, or other metals, began to investigate potentially high emissions of metals from art glass facilities across the country.

In early 2016, EPA identified 14 art glass facilities as potentially emitting metals that are HAPs. After gathering additional information, eight art glass facilities were identified as using metal HAPs as raw materials. In April 2016, the Oregon Environmental Quality Commission adopted a temporary rule that required controls to reduce metal HAP emissions from art glass manufacturing facilities. This temporary rule applied to two Oregon facilities – two of the eight facilities. (A permanent state rule was subsequently adopted in September 2016.) Of the remaining six facilities, three were selected for ambient monitoring of metal HAPs[1]:

- Kokomo Opalescent Glass in Indiana was selected in light of a Finding of Violation issued by EPA Region 5 in April 2016 and subsequent initial ambient monitoring results.

- Kopp Glass in Pennsylvania and Paul Wissmach Glass Company (PWGC) in West Virginia were selected because, based on the information collected, they use the greatest amount of metal HAPs as raw materials.

In coordination with state and local air programs and the facilities, EPA performed ambient monitoring of 11 metal HAPs and, for the Kokomo site, hexavalent chromium. This document describes the preliminary risk assessments EPA conducted using the monitoring data to evaluate the potential human health risks posed by emissions of metal HAPs from these art glass facilities.

Ambient monitoring of the metal HAPs was conducted at the sites for 24-hour periods on a 1-in-3-day schedule[2] for up to 1 year, for the periods shown in Table 1. In addition, from January 31, 2017, through June 30, 2017, hexavalent chromium was sampled concurrently at the Kokomo Opalescent Glass site to characterize the relationship of hexavalent chromium to total chromium. Each sample was collected over a 24-hour period. Almost all of the PM_{10} (particulate matter 10 µm or less in diameter) metals were detected in all collected samples; beryllium (PM_{10}), mercury (PM_{10}), and selenium (PM_{10}) were detected in 98%, 99%, and >99% of the samples, respectively.

[1]The other three art glass manufacturing facilities are World Kitchen in Charleroi, Pennsylvania; Youghiogheny Opalescent Glass Co. in Connellsville, Pennsylvania; and Blenko Glass Co. in Milton, West Virginia.
[2] Daily sampling was conducted for the first two months at Kokomo and Kopp Glass.

Table 1. Period of Ambient Monitoring at Each Site

Site Name	Site No.	Ambient Monitoring Period	No. of Months	HAPs Measured
Kokomo	18-067-0005	June 10, 2016 to June 30, 2017	12	11 metal HAPs plus Cr^{6+}
Kopp A	42-003-KOPA	April 1, 2017 to October 13, 2017	6½	11 metal HAPs
Kopp B	42-003-KOPB	July 30, 2017 to October 13, 2017	3	11 metal HAPs
PWGC	54-103-PWGC	April 19, 2017 to November 30, 2017	7½	11 metal HAPs

EPA conducted preliminary risk assessments to investigate, based on the monitoring data collected, whether metal HAP levels measured near the facilities are elevated compared to health risk-based criteria. We present the methods we used to conduct the risk assessment in Section 2. Ambient monitoring data are summarized in Section 3, and the results of the preliminary risk assessments are presented in Section 4. We then discuss the assessments in Section 5.

2 Methods

In the following sections, we describe the methods for conducting the preliminary risk assessments for each facility based on the ambient monitoring data collected near each facility. Methods for collecting measurements at the air monitors are included in Appendix A.

2.1 Treatment of Monitoring Data

This section describes treatment of the monitoring data for initial comparisons and for use in calculating risk estimates.

We used all of the monitoring data available from the three sites: Kokomo Opalescent Glass Figure 1); Kopp Art Glass (Figure 2); and Paul Wissmach Glass Company (PWGC, Figure 3). For Kokomo Opalescent Glass, 1 year of monitoring data was available; for Kopp Glass A, 6 months of data were available and for Kopp Glass B, 3 months; for PWGC, 7 months of data were available.

2.1.1 Treatment of Non-Detects in Monitoring Data

For the monitoring data, when a nondetect for a given metal measurement occurred (i.e., where no value was measureable), and where fewer than 10% non-detects for measurements of a given metal occurred over the study period (i.e., 90% or more measurements), we used ½ the laboratory minimum detection limit (MDL) for data analysis purposes. All data collected at each of the four monitoring sites met these criteria. If a value below the laboratory MDL was reported, we used that value.[3]

[3]Note that nondetects are generally reported as “ND” in the data reports and values below the laboratory MDL are usually flagged with the qualifier “MD.”

Figure 1. Kokomo Opalescent Glass and Air Monitoring Site.

Figure 2. Kopp Art Glass and Air Monitoring Sites.

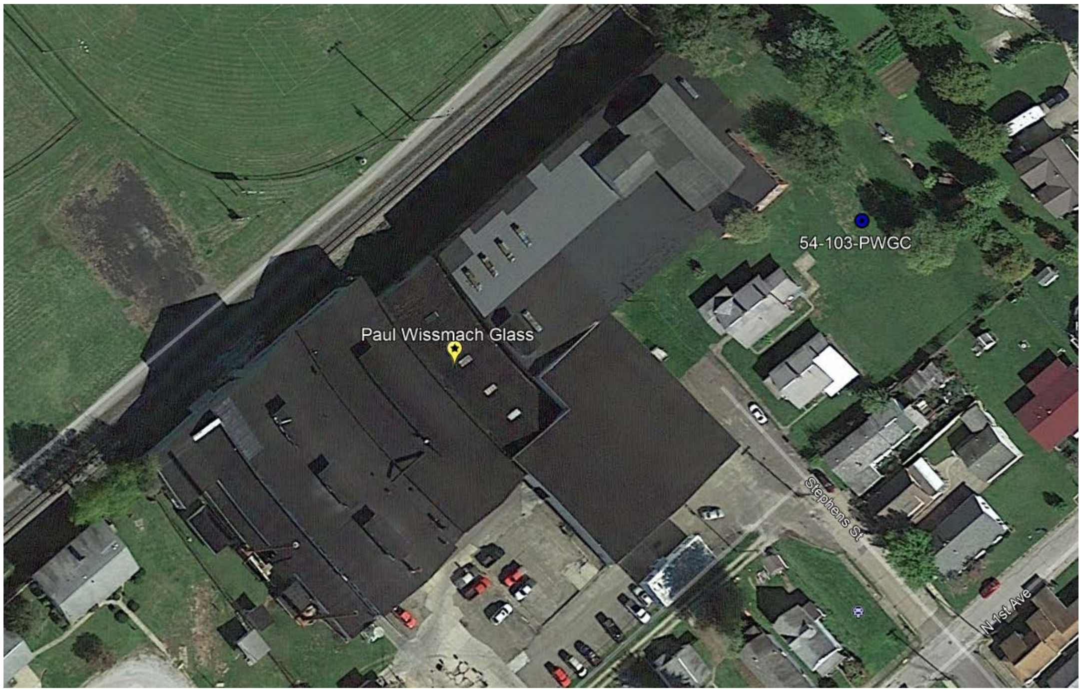

Figure 3. Paul Wissmach Glass Company and Air Monitoring Site.

2.1.2 Use of the 95th Percentile Upper Confidence Level (95UCL) of the Mean

We calculated the 95th percentile upper confidence level (95UCL) of the mean of the air concentration data for each metal HAP for each site, including hexavalent chromium (Cr^{6+}) for the Kokomo site. The 95UCL of the mean is a value that, 95% of the time, equals the true average concentration. The 95UCL of the mean typically is used as a conservative estimate of the true average concentration and, therefore, is considered an appropriate value to use for preliminary risk assessments such as this one, where monitoring data are limited and where the purpose is to determine if further investigation is warranted.[4]

We used the 95UCL of the mean of the monitored metal HAP concentrations as the estimated exposure concentration for each metal HAP to calculate cancer risk estimates and chronic noncancer hazard indices.

2.2 Approach for Chronic Inhalation Assessment

To investigate whether the metal HAP levels measured are elevated compared to health risk-based criteria for chronic exposure, first we compared the 95UCL of the mean of the monitored metal HAP concentrations to the most stringent of the long-term health risk-related comparison levels. The cancer-based comparison level represents an increased risk of 1-in-1 million from exposure to a HAP over a lifetime and is calculated from the inhalation unit risk estimate (URE) for each HAP. The noncancer-based comparison level is the chronic noncancer dose-response

[4]This approach is adopted from the EPA's School Air Toxics Initiative. (https://www3.epa.gov/ttnamti1/airtoxschool.html) and applied in the final analyses (e.g., in https://www.epa.gov/north-birmingham-project/north-birmingham-air-toxics-risk-assessment).

value. The comparison levels, which are shown in Table 2, conservatively presume continuous exposure over a lifetime.

Table 2. Cancer-Based and Chronic Noncancer-Based Comparison Levels for Metal HAPs

CAS No.	Metal HAP	Cancer-Based Comparison Level[a] (ng/m^3)	Source of URE[b]	Noncancer-Based Comparison Level (ng/m^3)	Source
7440-36-0	Antimony	--	--	200[c]	EPA (RfC)
7440-38-2	Arsenic	0.23	EPA	15	CalEPA (REL)
7440-41-7	Beryllium	0.42	EPA	20	EPA (RfC)
7440-43-9	Cadmium	0.56	EPA	10	ATSDR (MRL)
1854-02-99	Chromium, hexavalent	0.08	EPA	100	EPA (RfC)
7440-48-4	Cobalt	--		100	ATSDR (MRL)
7439-92-1	Lead	--		150	EPA (NAAQS)
7439-96-5	Manganese	--		300	ATSDR (MRL)
7439-97-6	Mercury	--		300	EPA (RfC)
7440-02-0	Nickel	2.1[d]	EPA	90	ATSDR (MRL)
7782-49-2	Selenium	--		20000	EPA (RfC)

Note: CAS = Chemical Abstracts Service, HAP = hazardous air pollutant, URE = unit risk estimate, EPA = U.S. Environmental Protection Agency, RfC = reference concentration, CalEPA = California Environmental Protection Agency, REL = reference exposure level, ATSDR = U.S. Agency for Toxic Substances and Disease Registry, MRL = minimal risk level, NAAQS = National Ambient Air Quality Standards.
[a]Cancer-based comparison levels reflect an increased risk level of 1-in-1 million.
[b]For each metal, the source of the inhalation URE is the EPA IRIS Program (https://cfpub.epa.gov/ncea/iris_drafts/atoz.cfm?list_type=alpha).
[c]The comparison level for antimony is the RfC for antimony trioxide.
[d]The comparison level for nickel is based on the inhalation URE for nickel subsulfide.

To develop these comparison levels, we used EPA risk assessment guidance and precedents.[5] The comparison levels are based on the following health effects information: exposure concentrations and risk estimates developed and assessed by EPA, the U.S. Agency for Toxic Substances and Disease Registry (ATSDR), and the California Environmental Protection Agency (CalEPA). These agencies recognize the need to account for potential differences in sensitivity or susceptibility of different groups (e.g., asthmatics) or lifestages/ages (e.g., young children or the elderly) to the adverse effects associated with a particular pollutant so that the resulting comparison levels are relevant for potentially sensitive groups and for the broader population. Sources of chronic dose-response information are described in more detail in Appendix B.

Because the 95UCL of the mean of the monitored metal HAP concentrations exceeded the cancer-based comparison level for one or more of the metal HAPs, we calculated cancer risk estimates. To do this, we used the 95UCL of the mean concentration and the inhalation URE to

[5]The development of long-term comparison levels and of individual sample screening levels is described in detail in USEPA (2009).

estimate cancer risks for each metal HAP for which a URE is available. We then summed the inhalation cancer risk estimates.

If the 95UCL of the mean of the monitored metal HAP concentrations exceeded the noncancer-based comparison level for one or more of the metal HAPs, we calculated chronic hazard quotients (HQs) using the 95UCL of the mean concentration and the noncancer dose-response value for each metal HAP. We then calculated target-organ-specific hazard indices (TOSHIs) by summing the chronic HQs for HAPs that affect the same target organ or organ system.

2.3 Approach for Acute Inhalation Assessment

To investigate whether the metal HAP levels measured are elevated compared to health risk-based criteria for acute exposure, first we compared the 24-hour monitored metal HAP concentrations to the most stringent of the short-term health risk-related comparison levels. (Comparison levels are the noncancer dose-response values for acute exposures.) For the comparison levels shown in Table 3, we selected acute dose-response values from the sources described in Appendix C.

Table 3. Acute Exposure Comparison Levels

CAS No.	Metal Compound	CalEPA REL (1-hour)	ATSDR Acute MRL (1- to 14-day exposure)	ERPG-2
7440-36-0	Antimony[a]	--	1,000 ng/m^3	--
7440-38-2	Arsenic	200 ng/m^3	--	--
7440-41-7	Beryllium	--	--	25,000 ng/m^3
7440-43-9	Cadmium[b]	--	30 ng/m^3	--
1854-02-99	Chromium (hexavalent)	--	--	--
7440-48-4	Cobalt	--	--	--
7439-92-1	Lead	--	--	--
7439-96-5	Manganese	--	--	--
7439-97-6	Mercury (elemental)[c]	600 ng/m^3	--	--
7440-02-0	Nickel	--	--	--
7782-49-2	Selenium	5,000 ng/m^3	--	--

Note: CAS = Chemical Abstracts Service, CalEPA = California Environmental Protection Agency, REL = reference exposure level, ATSDR = U.S. Agency for Toxic Substances and Disease Registry, MRL = minimal risk level, ERPG = Emergency Response Planning Guideline.

[a]The comparison level for antimony is the ATSDR acute MRL for antimony trioxide.

[b]For cadmium compounds, additional acute values are: AEGL-1 (1-hr) of 100,000 ng/m^3; AEGL-1 (8-hr) of 41,000 ng/m^3; AEGL-2 (1-hr) of 760,000 ng/m^3; AEGL-2 (8-hr) of 200,000 ng/m^3. The most stringent value is shown in the table and was used for the initial comparison.

[c]For elemental mercury, additional acute values are: AEGL-2 (1-hr) of 1,700,000 ng/m^3; AEGL-2 (8-hr) of 330,000 ng/m^3; ERPG-2 of 2,100,000 ng/m^3. The most stringent value is shown in the table and was used for the initial comparison.

If a 24-hour monitored metal HAP concentration exceeded the noncancer-based comparison level for that metal HAP, we calculated an acute HQ using the maximum monitored metal HAP concentration and the 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 acute exposure comparison level).

2.4 Screening-Level Multipathway Exposure and Risk Assessment

Four of the metal HAPs measured at the monitoring sites (arsenic, cadmium, lead, and mercury) are known to be persistent, bioaccumulative HAPs (PB-HAPs). We did not have sufficient data to estimate the potential for human health risks due to exposure via ingestion. Lack of data on metal HAP emission rates and facility emission release characteristics prevented us from conducting a tiered multipathway screening assessment for any of the PB-HAPs except lead.

To evaluate the potential multipathway risk from emissions of lead compounds, we compared the 95UCL of the mean concentration of lead measured at each monitor to the level of the current National Ambient Air Quality Standard (NAAQS) for lead. Values below the level of the primary (health-based) lead NAAQS are considered to have a low potential for multipathway risk.

3 Ambient Monitoring Data

Ambient monitoring data for each site are provided in Appendix D.

Figure 4 displays the 24-hour cadmium concentrations measured during the sampling period for each monitoring site and shows the days and sites with the highest measured cadmium levels.

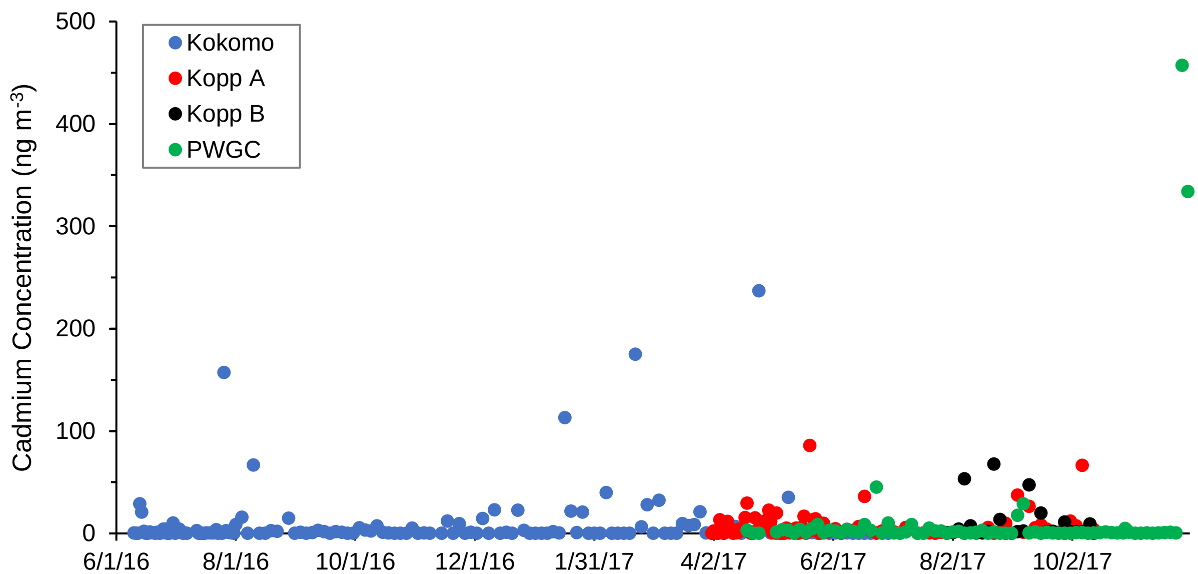

Figure 4. Time Series Graph of Cadmium Concentration Data for Each Monitoring Site

4 Risk Assessment Results

This section presents the results of the risk assessments we performed based on the ambient monitoring data collected near each facility.

For the chronic risk assessments, we used the 95UCL of the mean concentration for each metal HAP at each monitoring site (as documented in Appendix E). The results of the concurrent sampling of hexavalent and total chromium at the Kokomo Opalescent Glass site (January 31, 2017 through June 30, 2017) indicate that approximately 4% of total chromium measured is hexavalent chromium. For the cancer risk estimates for Kokomo Opalescent Glass, we used the 95UCL of the mean concentration of hexavalent chromium monitored. We did not measure hexavalent chromium concentrations at the monitoring sites near the other two facilities, and we recognize that the portion that is hexavalent chromium could be 0–100% of the total chromium measured. Because the furnace types, processes, and raw materials used at each art glass facility are unique to the facility, we did not make an assumption about hexavalent chromium emissions at Kopp Glass or PWGC and did not include hexavalent chromium in the cancer risk estimates for these two facilities.

4.1 Cancer Risk Results

For cadmium, the 95UCL of the mean concentration of the monitored metal HAPs exceeded the cancer-based comparison level at each of the three facilities, which is equivalent to a 1-in-1 million increased cancer risk. Therefore, we estimated inhalation cancer risks using the 95UCL and the inhalation URE for each metal HAP for which one exists. We then summed the cancer risks to determine if the sum of the cancer risk estimates is greater than 1-in-1 million or greater than 100-in-1 million.

Results for the PWGC site were the highest, and the estimated risk is approximately 5×10^{-5}, or 50-in-1 million, with cadmium as the risk driver (85%), followed by arsenic (13%) and nickel (2%). A cancer risk of 50-in-1 million means that, for every 1 million people exposed at the levels measured at the monitor, 50 of those people 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 below about 1-in-1 million negligible and excess cancer risks ranging from 1-in-1 million to 100-in-1 million acceptable. Maximum cancer risk estimates at each site are shown in Table 4. Cadmium was the primary contributor to the total cancer risks at each site.

Table 4. Summary of Chronic Inhalation Risk Assessment Results

Site Name	Monitoring Site No.	Maximum Cancer Risk Estimates	Maximum Screening TOSHI
Kokomo	18-067-0005	30-in-1 million	1
Kopp A	42-003-KOPA	30-in-1 million	<1
Kopp B	42-003-KOPB	40-in-1 million	2
PWGC	54-103-PWGC	50-in-1 million	3

Note: TOSHI = target-organ-specific hazard index.

4.2 Chronic Noncancer Hazard Results

Two sites had TOSHIs greater than 1: PWGC and Kopp B. The maximum chronic noncancer TOSHI occurred at the PWGC monitoring site. The maximum TOSHI at the PWGC site was 3, with cadmium as the driver and the kidney as the target organ. The maximum TOSHI at the Kopp B site was 2, with cadmium as the driver and the kidney as the target organ. In both cases, the maximum TOSHI is also the maximum hazard index (HI) for cadmium (i.e., no other metal HAPs contributed to this TOSHI). The HI of greater than 1 indicates that the measured concentrations of cadmium exceed the ATSDR chronic minimal risk level (MRL), an estimate of the daily human exposure to cadmium that is likely to be without appreciable risk of adverse noncancer health effects for exposures of 1 year or more. Kidney damage is the primary adverse effect expected from long-term inhalation exposure to cadmium concentrations above the ATSDR chronic health benchmark.

Maximum TOSHIs at the other two sites were 1 and less than 1. A TOSHI equal to or less than 1 indicates that noncancer effects are not likely to occur.

4.3 Acute Noncancer Hazard Results

At each of the four sites, over the duration of the monitoring periods, three or more daily monitored concentrations of cadmium were above the ATSDR acute (1- to 14-day) MRL of 30 ng/m^3. The dates for which a daily cadmium concentration was greater than 30 ng/m^3 are shown in Table 5. For these occurrences, where possible, we calculated 14-day maximum average cadmium concentrations. Because data collection was typically every third day, we calculated as close to a 14-day maximum average concentration as possible; we calculated 12-day and 15-day maximum average cadmium concentrations for all except one set of data, for which we calculated a 13-day maximum average concentration (these calculations are documented in Appendix F). We then calculated maximum acute HQs by comparing those concentrations to the acute (1- to 14-day) ATSDR MRL for cadmium. The resulting acute HQs are shown in Table 5.

Table 5. Maximum Acute (1- to 14-day) Hazard Quotients for Cadmium

Site Name	Site No.	Date	Maximum Daily Concentration (ng/m^3)	Maximum Acute HQ (12-day exposure)	Maximum Acute HQ (15-day exposure)
Kokomo	18-067-0005	7/26/2016	157	<1	<1
		2/06/2017	39.9	<1	1
		2/21/2017	175	2	1
		4/25/2017	237	2	2
Kopp A	42-003-KOPA	5/21/2017	85.8	<1[a]	<1
		6/18/2017	36.1	<1	<1
		10/07/2017	66.3	<1	<1
Kopp B	42-003-KOPB	8/08/2017	53.3	<1	<1
		8/23/2017	67.8	<1	<1
		9/10/2017	47.4	<1	<1
PWGC	54-103-PWGC	6/24/2017	45.2	<1	<1
		11/27/2017	457	5	4
		11/30/2017	334		

Note: HQ = hazard quotient.
[a]Based on a 13-day average concentration; data were available to support calculation of a 13-day average concentration but not a 14-day average concentration.

Acute HQs were greater than 1 near two facilities, Kokomo and PWGC, during their respective monitoring periods, with a maximum acute HQ of 5 for PWGC. (Note that this result is driven by very high monitored values on two days in late November 2017. Further examination of operating conditions on these two days may be warranted.) An acute HQ greater than 1 indicates that the measured concentrations exceed the ATSDR acute MRL, an estimate of the daily human exposure to a hazardous substance likely to be without appreciable risk of adverse noncancer health effects for an exposure duration of 1 to 14 days. Lung damage is the primary adverse effect expected from inhalation exposure to cadmium concentrations above the ATSDR acute MRL.

We evaluated wind direction on the four days with the highest 24-hour measured concentrations of cadmium. Wind roses were created using data from nearby meteorological stations for those four days (2/21/17 and 4/25/17 at Kokomo and 11/27/17 and 11/30/17 at PWGC) to determine the wind speeds and directions on those days (Figure 5 and Figure 6, respectively).

For Kokomo, the monitor was located to the northwest of the facility (Figure 1). On 2/21/17, the wind blew predominantly from the south to the north, and blew from the southeast to the northwest (toward the monitor) about 16% of the day (Figure 5). On 4/25/17, the wind was blowing from the southeast to the northwest (toward the monitor) about 90% of the day (Figure 5).

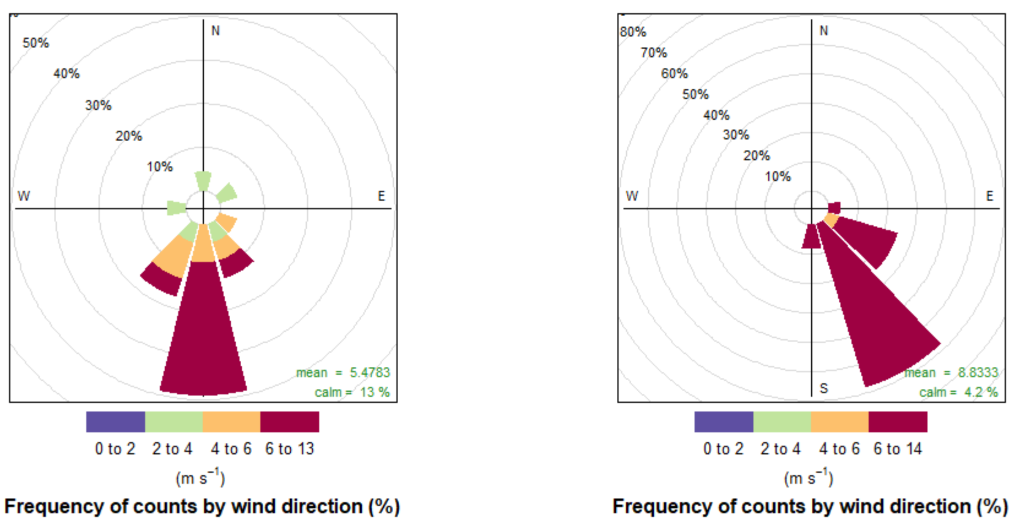

Figure 5. Wind Roses from a Nearby Meteorological Station (Kokomo Municipal Airport) to the Kokomo Facility for 2/21/17 (Left) and 4/25/17 (Right).

At PWGC, the monitor was located to the northeast of the facility (Figure 3). On the two sampling days with the highest 24-hour measured concentrations of cadmium (11/27/17 and 11/30/17), the wind blew from the southwest to the northeast (toward the monitor) 45% to 55% of the day (Figure 6).

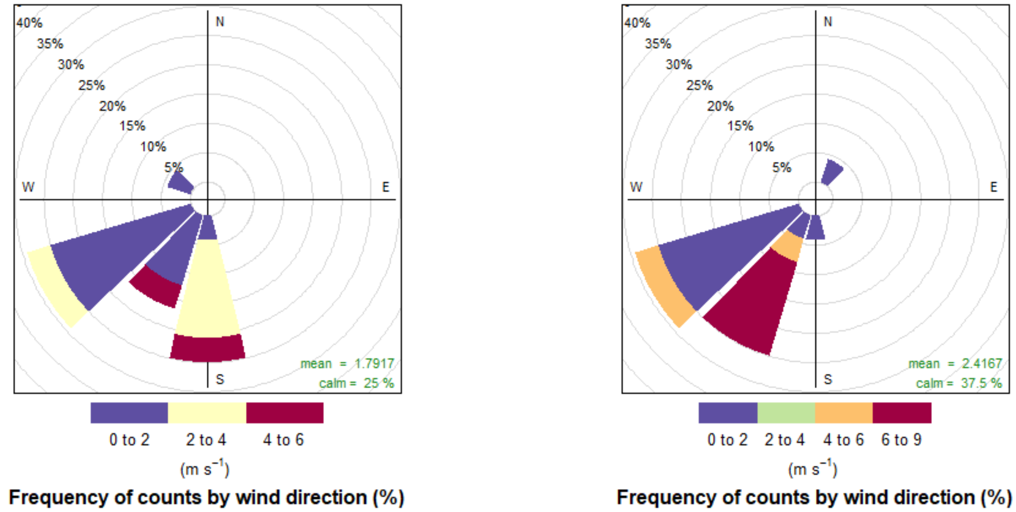

Figure 6. Wind Roses from a Nearby Meteorological Station (AQS site 390130006) to the PWGC Facility on 11/27/17 (Left) and 11/30/17 (Right).

Given the wind directions on these four days and no other known emission sources of cadmium in the area, assuming the measured cadmium at both monitoring locations is emitted by the nearby art glass facility is reasonable.

4.4 Screening-Level Multipathway Risk Assessment Results

As noted in Section 2.4, for arsenic, cadmium, and mercury, we did not have sufficient data to estimate the potential for human health risks due to exposure via ingestion. We therefore did not perform a screening-level multipathway risk assessment.

To evaluate the potential for effects from emissions of lead, the 95UCL of the mean lead concentrations (0.023 µg/m^3) was compared to the NAAQS for lead (0.15 µg/m^3). Results indicated that, based on the air monitoring data collected, the NAAQS for lead would not be exceeded at any of the three facilities.

5 Discussion

The maximum cancer risk estimates associated with metal HAPs ranged from 30-in-1 million to 50-in-1 million. This means that, for every 100,000 people exposed at the levels measured at the monitor, up to 5 *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 below 100-in-1 million to be in the range of acceptability. Important to note is that hexavalent chromium concentrations were measured only at Kokomo. Because we did not measure hexavalent chromium concentrations at PWGC or Kopp Glass, we did not include hexavalent chromium in the cancer risk estimates for these two facilities.

Results of the chronic noncancer risk assessment show exceedances of the ATSDR chronic MRL for cadmium, with a TOSHI of 3 at the PWGC site and a TOSHI of 2 at the Kopp B site, for the data collection periods (7 months and 3 months, respectively). These TOSHIs were due to cadmium. The maximum 95UCL of the mean concentration for cadmium was 25 ng/m^3, at the PWGC monitoring site. Kidney damage is the primary health effect expected from cadmium inhalation at concentrations above the ATSDR chronic MRL (ATSDR 2012). The most sensitive chronic health effect of cadmium inhalation exposure is proteinuria (protein in the urine, a sign of kidney damage).

Results of the acute risk assessment show that maximum 12- to 15-day concentrations of cadmium were as high as 159 ng/m^3 and, therefore, exceeded the ATSDR acute (1- to 14-day) MRL of 30 ng/m^3. In addition, maximum 1-day concentrations of cadmium were as high as 457 ng/m^3. Lung damage is the primary health effect expected from inhalation exposure to cadmium at concentrations above the ATSDR acute MRL (ATSDR 2012).

For the four days with the highest measured cadmium concentrations during the monitoring periods, wind direction/speed data indicate that the nearby art glass manufacturing facilities are the likely contributors of these elevated concentrations.

With any assessment, there are limitations. The risk estimates provided here are based on 6 to 12 months of metal HAP monitoring data collected at four monitoring sites located near three art glass facilities. For the purpose of the assessment, we assumed that metal HAP concentrations measured at the monitors are representative of potential public exposure concentrations. Monitors were sited near each facility. Due to practical constraints in siting, though, a monitoring site may not represent the location that would be expected to receive the highest metal HAP emissions; alternatively, a monitoring site located on plant property may measure levels higher than those representative of potential public exposure. We also assume that the measured metal HAP concentrations are representative of metal HAP concentrations that would be expected on a daily basis and over many years. Due to batch processing and variability in the amounts, types, and colors of glass produced each year, metal HAP emission levels might vary from month to month and from year to year.

The types of metal HAPs emitted to air and the emission levels of the metal HAPs also are likely to vary by facility, depending on factors including use of metal HAPs, amount and type of raw materials, manufacturing process, and use of emission controls. Therefore, the findings for the three facilities are not translatable to other art glass manufacturing facilities.

When used in glass making, however, cadmium might be emitted to air at levels that could pose a potential health concern. Other metal HAPs, if used in glass production, also might be emitted to air at levels that could pose a potential health concern. Because several of the metal HAPs, including cadmium, are PB-HAPs, ingestion exposure might also be a potential concern.

Based on the findings of the preliminary assessments, further investigation of metal HAP emissions from these art glass facilities may be warranted.

6 References

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U.S. Environmental Protection Agency. 2009. Schools Air Toxics Monitoring Activity (2009), Uses of Health Effects Information in Evaluating Sample Results. https://www3.epa.gov/air/sat/pdfs/UsesOfHealthEffectsInfoinEvalSampleResults.pdf.

APPENDIX A. AIR MONITORING DOCUMENTATION

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Appendix A-1: Air Monitoring Summary: Kokomo Opalescent Glass

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Kokomo, Indiana Air Monitoring Summary

Dispersion Modeling to Support Monitor Siting

Kokomo Opalescent Glass (KOG) is an art glass manufacturing facility located at 1310 South Market Street in Kokomo, Indiana that uses heavy metal compounds to color glass. The U.S. Environmental Protection Agency (EPA) conducted a dispersion modeling analysis of KOG to assist with plans to site an air quality monitor(s) near the facility. Information used to characterize emissions from the facility was based on aerial maps and material from an EPA enforcement inspection conducted in March 2016.

The inspection showed that pollutants of concern were emitted primarily from the glass melting furnace located in the main manufacturing building. These emissions were released from openings in the furnace into the building where they exited through a roof vent directly above.

AERMOD model version 15181, as applied in the Lakes Environmental AERMOD View software, was used to conduct this analysis. Five years (2010–2014) of meteorological data from Indianapolis, Indiana surface and Lincoln, Illinois upper air was applied. These data were preprocessed by the Indiana Department of Environmental Management (IDEM). Based on the inspection information, the emissions were modeled as a roof vent using the rain cap beta option in AERMOD. Additionally, building downwash was modeled. Data for nine buildings were included.

Detailed information on the exit temperature of the emissions leaving the roof vent was not available. Consequently, based on a molten pot material temperature of about 1600 degrees K, we modeled two emission scenarios, 1000K and 500K. Given the uncertainty, this allowed us to determine how sensitive the modeling results are to exit temperature differences. The following model inputs were used in this analysis:

> Stack emission = 1.0 g/s (generic unit emission rate, not actual emissions)
> Stack height = 12.0 m
> Stack location = 573894.13 m E 4480391.22 m N
> Stack exit velocity = 0.001 m/s
> Stack diameter = 1.0 m
> Stack exit temperature = 1000K/500K

Modeled receptors were placed around the facility outside of the property boundary and extended well into surrounding neighborhoods. Results showed the highest concentrations are very close to the facility, just to the northeast. Peak concentrations for the 1000 degrees K and 500 degrees K stack exit temperatures occurred in the same area (see Figure 1 and Figure 2).

Monitor Siting

EPA worked collaboratively with IDEM to evaluate the dispersion modeling results and site an air quality monitor to evaluate the impact of the facility. IDEM's air monitoring program scouted the area surrounding the facility and identified several potential monitoring site locations, as shown in Figure 3. IDEM also assessed whether the locations would meet typical ambient air monitoring siting criteria, have electric availability to operate the monitor, and whether access agreements could be obtained from the property owners.

Figure 1. Simulation using 500 degrees K exit temperature. Blue indicates building included in downwash simulation. Peak receptor area is identified in red. Light green to darker green indicates decreasing concentrations.

Figure 2. Simulation using 1000 degree K exit temperature. Blue indicates building included in downwash simulation. Peak receptor area is identified in red. Light green to darker green indicates decreasing concentrations.

Figure 3. The yellow stars show the initial locations evaluated for potential siting of the air monitor near KOG

Figure 3 shows the five potential monitoring site locations initially assessed by IDEM. After evaluating the local infrastructure and property access, IDEM installed the air monitor in the location identified in Figure 4. Figure 5 through Figure 8 show IDEM installing the air monitoring equipment in the northwestern portion of KOG's property.

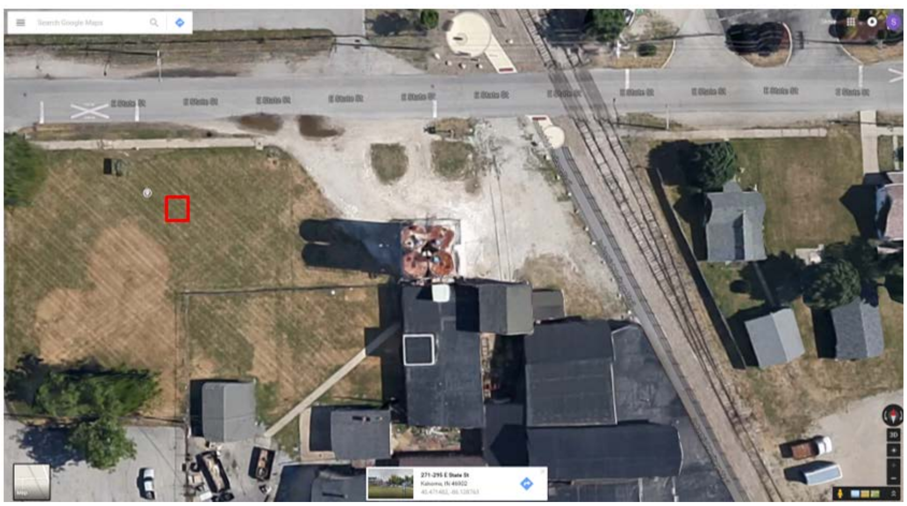

Figure 4**. The red box shows where the air monitoring station was installed near KOG.**

Figure 5. KOG monitoring site – West

Figure 6. KOG monitoring site – East

Figure 7. KOG monitoring site – Southwest

Figure 8. KOG monitoring site – Southeast

Collection of Samples

Metals: IDEM collected filter-based air samples at the KOG site from June 10, 2016 to June 30, 2017. Due to uncertainties in the level of metals concentrations that would be measured, and considering the daily variability of emissions (due to process and metals usage of the facility) and changes in wind direction, IDEM collected daily 24-hour composite total suspended particulate (TSP) filter samples from the beginning of the study through the end of July 2016. Starting August 1, 2016, IDEM reduced the sample frequency of TSP samples to a 1-in-3 day schedule and remained on the 1-in-3 day sample scheduled for the remainder of the sampling period. IDEM concluded sampling for metals on June 30, 2017.

> **Chromium:** Due to EPA's concerns about the potential for chromium VI emissions at art glass facilities, IDEM began collecting ambient air samples every third day for chromium analysis starting on January 31, 2017. IDEM concluded sampling for chromium VI on June 30, 2017.

MET: No onsite meteorological data (wind speed/wind direction) were collected at the KOG monitoring site. The meteorological station nearest the KOG facility is located at Kokomo Municipal Airport.

Analysis of Samples

Initially, air filter samples were analyzed for metals using XRF at UC-Davis. Because most of the samples collected during first several weeks showed levels of metals below the detection limits for the XRF method, all filters collected at KOG also were analyzed using ICP-MS by the ERG laboratory. Because of the lower detection limits provided by the ICP-MS method, the report, *Preliminary Risk Assessments for Three Art Glass Manufacturing Facilities*, presents only the ICP-MS data from KOG.

Quality Assurance

The operation and maintenance of the routine TSP air sampling was included in IDEM's approved Quality Assurance Project Plan (QAPP). Information about the analysis of the samples for metals and chromium, conducted by EPA's contract laboratories, also was included in existing quality assurance documentation. Therefore, no project-specific QAPP was developed for the KOG monitoring study.

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Appendix A-2: Kopp Glass Sampling Plan

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FSP Worksheet #1: Title and Approval Page

FIELD SAMPLING PLAN (FSP)

Final

Preparation Date – March 16, 2016

Document Title – ***HAP Metals Monitoring Study, Kopp Glass, Pittsburgh PA***

Prepared for:
U.S. Environmental Protection Agency

Prepared by:
Darrell Stern Jr.
Allegheny County Health Department / Air Quality Program
301 39th Street, Pittsburgh PA 15201

Review Signature:	Darrell Stern Jr.	03/28/2017
	Darrell Stern/Monitoring Section Manager,	Date
Approval Signature:	Alice H. Chow	3/28/17
	Alice Chow, Associate Director, R3 APD - OAMA	Date
Approval Signature:	Kia Hence	3/28/17
	Kia Hence, QA Officer, R3 APD – OAMA	Date

CONTENTS

EXECUTIVE SUMMARY

This ambient sampling study will be conducted on the property of Kopp Glass to determine emissions of HAP metals during normal operating conditions at the plant. The Air Quality Program applied the Aermod dispersion model to determine monitoring locations that would maximize the potential to encounter particulate emissions from the plant. Considering the modeling results, the Program selected a site on Kopp Glass property, to the north west of the plant, approximately 283 feet from the main stack.

Sampling will be conducted using a Thermo Scientific Partisol 2025 sampler configured to collect PM_{10}. Each sample will be collected over a 24-hour period. Sampling will take place over a six-month period. Sampling frequency will be daily during the initial 2 months of sampling. Frequency will be reduced to every three days for the final 4 months of sampling. The exposed samples, along with all relevant flow and sample volume data, will be shipped to the EPA contract laboratory (ERG) for analysis by ICP-MS.

The EPA will examine initial sampling results. If detectable quantities of total chromium are detected, the EPA may request a second Thermo Scientific Partisol 2025 sampler to be installed to specifically sample for hexavalent chromium using specially prepared sample media per ASTM method D7614-12. Each of these samples would be collected for 24 hours. Hexavalent sampling days would be scheduled according the plant schedule and when batches containing chromium are planned to be melted.

FSP Worksheet #2 & 3: Field Sampling Plan Identifying Information

(UFP-QAPP Manual Section 2.2.4 and 2.3.1)

This project-specific air monitoring field sampling plan (FSP) was prepared using elements of the *Uniform Federal Policy for Quality Assurance Plans (UFP-QAPP)* (EPA 2005) and United States (U.S.) Environmental Protection Agency (EPA) *Guidance for Quality Assurance Project Plans, EPA QA/G-5* (EPA 2002).

Site Name: Kopp Glass
Site Address: 2108 Palmer Street, Pittsburgh PA 15218
Site latitude and longitude coordinates: 40°25'04.0" N, 79°53'10.1" W
AQS ID (if applicable): N/A
Lead Organization/Air Monitoring Agency: Allegheny County Health Department
Contract Laboratory Name: ERG
Contract Laboratory Address: 601 Keystone Park Drive 700, Morrisville, NC 27560-9998

List organizational partners (stakeholders) and identify the connection with lead organization (i.e. air monitoring agency):

Organization Partners/Stakeholders	Connection/ Role
EPA Region 3	Coordination between stakeholders, review and approval of sampling plans
EPA OAQPS	Project planning and final data analysis
Contract Laboratory	Sample analysis
ACHD	Supply and install equipment, conduct sampling, submit samples for laboratory analysis
Kopp Glass, Pittsburgh PA	Art glass facility and sampling location

Distribution List

FSP Recipients	Title	Organization	E-mail Address
Jayme Graham	AQP Program Chief	ACHD	jayme.graham@alleghenycounty.us
Darrell Stern	AQP Monitoring Section Manager	ACHD	darrell.stern@alleghenycounty.us
Dan Nadzam	AQP Monitoring Section QA Supervisor	ACHD	daniel.nadzam@alleghenycounty.us
Gary Marecic	Mix/Melt Manager	Kopp Glass	gmarecic@koppglass.com
Alice H. Chow	Associate Director	EPA Region 3	chow.alice@epa.gov
Kia Hence	QA Coordinator	EPA Region 3	hence.kia@epa.gov
Howard Schmidt	Air Toxics Technical Lead	EPA Region 3	schmidt.howard@epa.gov
Carol Ann Gross-Davis	Environmental Scientist	EPA Region 3	gross-davis.carolann@epa.gov
Elizabeth Gaige	Air Toxics	EPA Region 3	Gaige.elizabeth@epa.gov
Lewis Weinstock	Group Leader	EPA OAQPS	weinstock.Lewis@epa.gov
David M. Shelow	National Air Toxics Ambient Monitoring Program Manager	EPA OAQPS	shelow.david@epa.gov

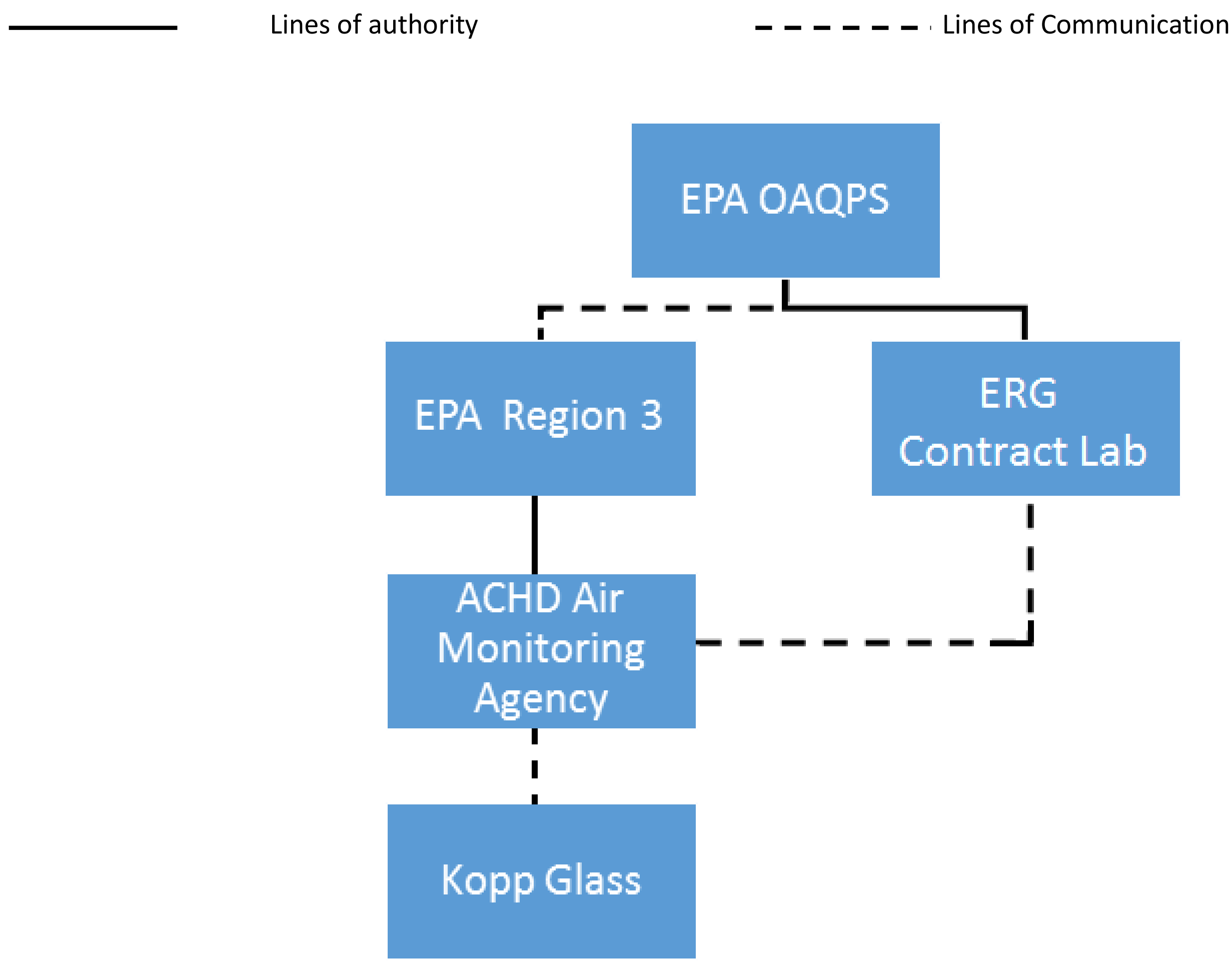
FSE Worksheet #4: Project Personnel

(UFP-QAPP Manual Sections 2.3.2)

This worksheet is used to identify key project personnel for each organization performing tasks defined in this FSE. Add additional spaces for personnel as needed.

Name	Project Title/Role
Darrell Stern, ACHD	Monitor siting and installation, air sampling, laboratory submission of exposed samples and sampling data
Dan Nadzam, ACHD	Field sampling quality assurance
Alice H. Chow, EPA R3	EPA regional liaison for project coordination
Kia Hence, EPA R3	EPA regional QA coordinator for field sampling
Lewis Weinstock, EPA OAQPS	OAQPS project oversight
David Shelow, EPA, OAQPS	OAQPS project oversight and laboratory coordination
Julie Swift, ERG laboratory	ERG laboratory program manager
Gary Marecic, Kopp Glass	Melt/Mix Manager and Kopp Glass facility contact

FSP Worksheet #5: Project Organizational Chart
(UFP-QAPP Manual Section 2.4.1)



FSP Worksheet #6 & 7: Communication Pathways

(UFP-QAPP Manual Section 2.4.2)

This worksheet should be used to document specific issues (communication drivers) that will trigger the need to communicate with other project personnel or stakeholders. Its purpose is to ensure there are procedures in place for providing the appropriate notifications and generating the appropriate documentation when handling important communications. Examples are provided below; additional drivers may be added as needed.

Communication Driver	Organization	Name	Contact Information	Procedure (timing, pathway, documentation, etc.)
Field/sampling issue	ACHD	Paul Crisson	412 578 7988	Notify Darrell Stern
Filter shipment/receiving issue/ CoC	ACHD	Darrell Stern	412 578 8143	Communicate any issues to ERG as soon as practicable.
Site access issue	Kopp Glass	Gary Marecic	412 501 0222	Contact ACHD for any site issues
FSP changes prior to field work	ACHD	Darrell Stern	412 578 8143	Communicate with EPA R3 & OAQPS on any significant changes to the field sampling plan
FSP changes during project execution	ACHD	Darrell Stern	412 578 8143	
Field equipment corrective actions	ACHD	Darrell Stern	412 578 8143	Notify EPA R3 of any field equipment issues
Laboratory issue	ERG	Julie Swift	919 468 7924	Notify OAQPS of any laboratory issues
QA field issue	ACHD	Dan Nadzam	412 578 7964	Notify Darrell Stern

Identify key project personnel associated with each organization, contractor, and subcontractor participating in responsible roles; discuss their specific roles and responsibilities. Key personnel may include:

Title/Role	Organization	Responsibilities
Field Technician	ACHD	Monitor installation, maintenance, filter installation and retrieval
Filed Operations Supervisor	ACHD	Filter preparation, chain of custody and shipping of exposed samples
Laboratory Analyst	Randy Mecurio – ERG	Task Lead for metal analysis/ERG
Laboratory Project officer	Julie Swift – ERG	Program Manager/ERG
EPA R3 QA Manager	Kia Hence	Review field sampling plan
EPA R3 point of contact	Alice Chow	Facilitate coordination of project between monitoring agency and OAQPS
EPA OAQPS point of contact	Lewis Weinstock David Shelow	Provide project oversight and serve as a liaison between ERG contract laboratory and agency
Facility point of contact	Kopp Glass	Site access issues, electricity issues for sampler operation, plant operations information and planned batch runs with HAP metal content

FSP Worksheet #10: Conceptual Model

(UFP-QAPP Manual Section 2.5.2)

This project is being initiated to characterize emissions of HAP (Hazardous Air Pollutants) metals from Art Glass Facilities. For this project, "Art Glass Facility" is defined as a glass production facility that uses any quantity of HAP metals in batch recipes and that has a furnace that is continuously heated. Kopp Glass satisfies these requirements and has been manufacturing colored glass using HAP metals as raw ingredients at the current location since 1926. Kopp Glass plans to install an electric melter during late March or early April. Actual melting using the new device will happen sometime after that. Production levels will not change. For instance, the glass compositions melted in the electric melter will not have to be melted in the 12-pot furnace or stand-alone single pot furnace. As proficiency is gained in utilizing the melter, it is expected to lead to a reduction in the amounts of raw materials that are melted. Once the electric melter is in use, the existing gas fired furnaces will be used proportionately less, reducing the emissions from natural gas combustion at the facility.

The monitoring site is located to the north west of the plant, approximately 283 feet away from the main stack and is situated in a secure, fenced in area owned by Kopp Glass. The sampling area is bordered on the north, south and west by residential area and is bordered on the east by the Kopp Glass facility as well as other businesses. Although the sampling site is generally upwind of the plant in respect to regional prevailing winds, mapping with the Aermod dispersion model indicates that the monitor is in an area that represents emitted particulate concentrations equal to or greater than that of the closest residences in other directions. The Aermod model run was conducted using meteorological data from the Pittsburgh International Airport (PITT) from years 2012 through 2016 (figure 1).

The sampling project will be conducted over a 6-month period with the first sample being scheduled for April 1, 2017. Each sample will be collected over a 24-hour period from midnight to midnight. During the first two months of the project, samples will be collected daily. During the final four months of the project, samples will be collected every three days. The default sampling schedule will be EPA's 3-day particulate sampling schedule (https://www3.epa.gov/ttn/amtic/files/ambient/pm25/calendar2017.pdf). The program may deviate from this schedule based on batch run information received from Kopp Glass. It is desirable to conduct ambient sampling when batches containing heavy metals are being melted. The EPA will monitor results of the sampling as the project is ongoing. Since the primary sampling and analysis method (HAP metals by ICP-MS) measures un-Speciated or total chromium, the EPA may determine that total chromium is measured in sufficient quantities to warrant the addition of a second sampler that will utilize special sample media for the collection of hexavalent chromium. If this second monitor is necessary, the sampling schedule will be dynamic, based on information from Kopp Glass as to when melts will be conducted with batches containing chromium.

Sampling will be conducted using Thermo Scientific model 2025 sequential samplers. The initial sampler will be configured to sample PM_{10}, using a bypass tube in place of an internal cyclone. Flow rate will be maintained at 16.7 slpm during sampling. Sample media will be 47mm MTL brand Teflon filters which will be supplied by ACHD. If hexavalent chromium sampling is necessary, a second Thermo Scientific 2025 sampler will be used as a TSP sampler with the sample cassette being affixed externally at the inlet. Flow rate will be maintained at 15 slpm during sampling. Hexavalent chromium sample cassettes will be prepared and shipped to the Program by ERG Laboratory.

FSP Worksheet #10: Conceptual Site Model (continued)

(UFP-QAPP Manual Section 2.5.2)

On a weekly basis, exposed 47mm Teflon sample filters will be shipped to ERG laboratories for HAP metals analysis. Each sample filter and blank filter will be sealed inside of new, individual Millipore Petri Slides (Cat. Num. PD1504700). Field blanks will be sent to ERG laboratory at a rate of one per week. Each field blank filter will be placed in a sample cassette and will be installed into the Thermo Scientific magazine along with the sample filters. The field blank will be automatically shuffled to the exposed filter magazine after the last loaded sample is completed, thus being exposed to the same path and handling procedures as the sample filters. Three filter blanks per filter lot will also be supplied. These filter blanks will be transferred from the original container directly to clean petri slides with minimal handling.

Hexavalent Chromium sampling media in preassembled cassettes will be shipped 1 to 2 weeks in advance of the scheduled sampling day and will arrive via overnight delivery service in a chilled cooler. The sample cassettes will be removed from the cooler when received and placed in a freezer until the sample installation day (the day prior to the sampling day), at which time the sample media will be transported to the sampling site in a chilled cooler and installed in the sampler. The exposed sample cassette will be removed from the sampler as early as possible (no later than 12 noon) on the day following the sampling event. The sample will be transported to Program headquarters in a chilled cooler and immediately transferred to a freezer. Once per week, the exposed hexavalent sample cassettes will be shipped in a chilled cooler by overnight service to ERG laboratory for analysis.

For all samples, ERG's chain of custody sheets will be used to document sample custody (Fig 2 and 3).

Laboratory Analysis:

Duties and responsibilities of this project will be divided between the Allegheny County Health Department (ACHD) and ERG laboratory. Installation, maintenance and operation of the sampling equipment will be the responsibility of ACHD. ACHD will supply samplers and 47mm sample filters for the initial effort. ERG laboratory will be responsible for analysis of the 47mm sample filters for HAP metals by ICP-MS and will also provide sample media and analytical support for any hexavalent chromium sampling. Sampling and analysis for hexavalent chromium will be conducted as per ASTM method D7614-12, Determination of Total Suspended Particulate (TSP) Hexavalent Chromium in Ambient Air Analyzed by Ion Chromatography (IC) and Spectrophotometric Measurements.

Analytes of concern are listed on the Target Compounds Table in *Worksheet #30: Analytical Services.*

FSP Worksheet #10: Conceptual Site Model (continued)
(UFP-QAPP Manual Section 2.5.2)

Figure 1 – Aermod Modeling Results. Isopleths are 2 to 40 µg/m^3 by 2µg/m^3 increments

FSP Worksheet #10: Conceptual Site Model (continued)
(UFP-QAPP Manual Section 2.5.2)

Figure 2- ERG Chain of Custody Sheet – HAP Metals

ERG

601 Keystone Park Drive, Suite 700, Morrisville, NC 27560

Chain of Custody

Page ________ of ________

SITE	KOPP GLASS	Relinquished by:	
	http://www.koppglass.com/home/		
	2108 Palmer Street	Date/Time:	
	Pittsburgh, PA 15218	Received by:	
c/o	301 39th Street		
	Pittsburgh, PA 15201	Date/Time:	

#	Filter ID	Date	ANALYSES PM2.5 (ICPMS)			Volume (m^3)	Comments	ERG LIMS ID (Lab use only)
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								

FSP Worksheet #10: Conceptual Site Model (continued)

(UFP-QAPP Manual Section 2.5.2)

Figure 3- ERG Chain of Custody Sheet – Hexavalent Chromium

ERG Ambient Hexavalent Chromium Sample Data Sheet

ERG

ERG Lab ID # ______

AMBIENT HEXAVALENT CHROMIUM DATA SHEET

Lab Pre-Sampling

Site Code: ______ Collection Date: ______
City/State: ______ Primary Event (Y/N): ______
AQS Code: ______ Collocated Event (Y/N): ______

Field Setup

Site Operator: ______ System #: ______
Set-Up Date: ______ Elapsed Timer Reset (Y/N): ______
Collection Date: ______
Batch I.D. No.: ______
Initial Rotameter Setting (C.O. B.): ______ (After 5 minutes warm-up)
Programmed Start Time: ______ Programmed End Time: ______

Field Recovery

Recovery Date: ______ Recovery Time: ______
Final Rotameter Reading (C.O.B.): ______ (After 5 minutes warm-up)
Elapsed Time: ______ Status: Valid Void (Circle one)

Lab Recovery

Received by: ______ Date: ______ Refrigerator No: ______
Status: Valid Void (Circle one) Temperature: ______
If void, why: ______
Collection Time (Minutes): ______
x̄ Flowrate (L/min): ______
Total Volume of Air Sampled (m^3): ______

Worksheet #22: Field Quality Control
(UFP-QAPP Manual Section 2.6.2)

All QA/QC procedures for this project will meet the requirements of the instrument manual, ACHD's approved $PM_{2.5}$ QAPP and SOP and EPA's School Air Toxics QAPP and SOP for hexavalent chromium sampling and analysis.

Equipment	Activity	Frequency	Acceptance Criteria	Corrective Action
R&P 2025 (PM_{10})	Flow check (16.67 Lpm)	Every 30 days	±4% (percent difference)	See QAPP & SOP
R&P 2025 (PM_{10})	Inlet and flow path cleaning	Every 30 days		
R&P 2025 (TSP)	Flow verification (15.0 Lpm)	Every 30 days	±4% (percent difference)	See hexavalent chromium SOP
R&P 2025	Leak Test	Every 30 days	Pass / Fail	Replace O-rings in flow path

Worksheet #30: Analytical Services

(UFP-QAPP Manual Section 3.5.2.3)

Analytical Services

Laboratory Name: Eastern Research Group, Inc
Laboratory Contact Name: Julie L. Swift
Analytical Instruments: Inductively Coupled Plasma Mass Spectrometry (ICP-MS) and Ion Chromatography (IC) UV/VIS detector
Analysis Methods: Compendium Method IO-3.5/EQL-0512-202 and ASTM D7614 – 12
Lab Reference SOP: ERG-MOR-085
Lab Reference QAPP: 2017 Support for the EPA National Monitoring Programs (EPA Contract No. EP-D-14-030)
Data Storage Location: ERG, 601 Keystone Park Drive, Suite 700, Morrisville, NC 27560

Target Compounds

Comparison levels for Art Glass monitoring data. Levels are chronic cancer and noncancer health benchmarks. The most stringent is chosen for initial comparison.

CAS Number	Target Metal Compound	Reported Unit	Lab MDL	Screening Level (ng/m^3)	Cancer-based Comparison Level,[a] (ng/m^3)	Noncancer-based Comparison Level (ng/m^3)
7440-36-0	Antimony	ng/m^3	0.016	200 (Rfc)	-	200[b] (RfC)
7440-38-2	Arsenic	ng/m^3	0.040	0.23 (URE)	0.23 (IUR)	15 (REL)
7440-41-7	Beryllium	ng/m^3	0.001	0.42 (URE)	0.42	20 (RfC)
7440-43-9	Cadmium	ng/m^3	0.002	0.56 (URE)	0.56	10 (MRL)
7440-47-3	Chromium	ng/m^3	3.59	N/A		
7440-48-4	Cobalt	ng/m^3	0.079	100 (Rfc)		100 (MRL)
7439-92-1	Lead	ng/m^3	0.028	150 (Rfc) rolling 3-month average		150 (NAAQS)
7439-96-5	Manganese	ng/m^3	0.113	300 (Rfc)		300 (MRL)
7439-97-6	Mercury	ng/m^3	0.016	300 (Rfc)		300 (RfC)
7440-02-0	Nickel	ng/m^3	0.230	2.1 (URE)	2.1[c] (IUR)	90 (MRL)
7782-49-2	Selenium	ng/m^3	0.036	20000 (Rfc)		20000 (RfC)
1854-02-99	Hexavalent Chromium	ng/m^3	0.0037	0.08 (URE)	0.08 (IUR)	100 (RfC)

[a] Cancer-based comparison level reflects an increased risk level of 1 in a million.
[b] The comparison level for antimony is the RfC for antimony trioxide.
[c] The comparison level for nickel is based on the IUR for nickel subsulfide.

FSP Worksheet #26: Sample Handling System and Data

(UFP-QAPP Manual Appendix A)

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT		
Activity	**Personnel/Organization Responsible**	**Comment**
Filter supply HAP Metals	Darrell Stern / ACHD	47 mm Teflon filters
Filter supply Cr^{6+}	Julie Swift/ ERG	47 mm ashless, cellulose filters
Sample Collection	Darrell Stern / ACHD	24 – hour samples, 1/1-day schedule for first two months, 1/3-day schedule thereafter
Sample retrieval Cr^{6+}	Darrell Stern / ACHD	Pick up samples next day by noon local standard time (See Cr^{6+}SOP)
Coordination of Shipment	Darrell Stern / ACHD	
Type of Shipment/Carrier	Darrell Stern / ACHD	United Parcel Service (Note: transport Cr^{6+} samples in an ice cooler before and after sampling.)
Sample Chain of Custody (metals)	Darrell Stern / ACHD	Metals 47 mm Teflon filters originate at ACHD
Sample Chain of Custody (Cr^{6+})	Julie Swift / ERG	Cr^{6+}sample media originate at ERG
SAMPLE RECEIPT AND ANALYSIS		
Activity	**Personnel/Organization Responsible**	**Comment**
Sample Receipt	Julie Swift/ERG	
Sample Custody and Storage	Julie Swift/ERG	
Sample Preparation	Julie Swift/ERG	
Sample Determinative Analysis	Julie Swift/ERG	
SAMPLE RECOVERY		
Activity	**Criteria**	**Comment**
Filter Holding Time (post sampling) ICP-MS metals	No criteria	No filter holding time requirement for metals sampling
Filter Holding Time (post sampling) Cr^{6+}	≤ 21 days before analysis	Filters in cold storage (-18°C) immediately after sampling
Activity	**Personnel/Organization Responsible**	**Comment**
Sample Retention/Archival HAP metals and Cr^{6+} of samples	Julie Swift/ERG	Analysis method for ICP-MS and IC are destructive. Entire filter is consumed in sample preparation – no sample retention/archival.
DATA MANAGEMENT – performed by contract laboratory		
Activity	**Format**	**Deliverable**
Data Package	Excel and PDF file	15 days after the end of the month

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Appendix A-3: Paul Wissmach Glass Sampling Plan

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FSP Worksheet #1: Title and Approval Page

FIELD SAMPLING PLAN (FSP)

Preparation Date April 6, 2017
Document Title – HAP Metals Monitoring Study, Wissmach Glass, Paden City, WV

Prepared for:
U.S. Environmental Protection Agency

Prepared by:
Tim J. Carroll
WV Department of Environmental Protection, Division of Air Quality
601 57th St., SE
Charleston, WV 25304

Approval Signature:	Tim J. Carroll (signed) Tim J. Carroll, Assistant Director, WVDEP-DAQ	04/06/2017 Date
Approval Signature:	Alice H. Chow (signed) Alice Chow, Associate Director, R3 APD - OAMA	04/06/17 Date
Approval Signature:	Alice H. Chow for (signed) Kia Hence, QA Officer, R3 APD – OAMA	04/06/17 Date

CONTENTS

EXECUTIVE SUMMARY

The WV Department of Environmental Protection, Division of Air Quality (DAQ) will be conducting PM10 ambient air sampling in Paden City, WV for subsequent laboratory analysis of the samples by USEPA contractor ERG Inc., to assess ambient concentrations of metals.

Sampling will be conducted using a Thermo Scientific Partisol 2025i sampler configured to collect PM_{10}. Each sample will be collected over a 24-hour period. Sampling will take place over a six-month period. Sampling frequency will be every three days on the national sampling schedule. The sampler will be equipped with a meteorological system capable of collecting wind speed and wind direction data. The exposed samples, along with all relevant flow and sample volume data, will be shipped to the EPA contract laboratory (ERG) for analysis by ICP-MS.

The EPA and DAQ will examine initial sampling results. If elevated levels of total chromium are detected during the initial sampling period, EPA and the DAQ will discuss the need for sampling for hexavalent chromium.

FSP Worksheet #2 & 3: Field Sampling Plan Identifying Information

(UFP-QAPP Manual Section 2.2.4 and 2.3.1)

This project-specific air monitoring field sampling plan (FSP) was prepared using elements of the *Uniform Federal Policy for Quality Assurance Plans (UFP-QAPP)* (EPA 2005) and United States (U.S.) Environmental Protection Agency (EPA) *Guidance for Quality Assurance Project Plans, EPA QA/G-5* (EPA 2002).

Site Name: Wissmach Glass
Site Address: 499 Stephen St., Paden City, WV 26159
Site latitude and longitude coordinates: 39.60794 - 80.933625
AQS ID (if applicable): N/A
Lead Organization/Air Monitoring Agency: USEPA/ V Department of Environmental Protection Division of Air Quality
Contract Laboratory Name: ERG, Inc.
Contract Laboratory Address: 601 Keystone Park Drive 700, Morrisville, NC 27560-9998

List organizational partners (stakeholders) and identify the connection with lead organization (i.e. air monitoring agency):

Organization Partners/Stakeholders	Connection/ Role
EPA Region 3	Coordination between stakeholders, review and approval of sampling plans
EPA OAQPS	Project planning and final data analysis and distribution to Region and state
Contract Laboratory	Perform metals analysis of collected PM10 samples
Paul Wismach Glass, Inc.	Provide sampling location, production, and metals usage data

Distribution List

FSP Recipients	Title	Organization	E-mail Address
Alice Chow	Office of Air Monitoring and Analysis	USEPA Region 3	chow.alice@epa.gov
Kia Hence	Office of Air Monitoring and Analysis	USEPA Region 3	hence.kia@epa.gov
Howard Schmidt	Office of Air Monitoring and Analysis	USEPA Region 3	schmidt.howard@epa.gov
Lew Weinstock	Office of Air Quality Planning and Standards	USEPA OAQPS	weinstock.lewis@epa.gov
David Shelow	Office of Air Quality Planning and Standards	USEPA OAQPS	Shelow.david@epa.gov
Tim Carroll	Assistant Director, Air Monitoring Charleston	WVDEP-DAQ	tim.j.carroll@wv.gov
Renu Chakrabarty	Air Toxics Coordinator	WVDEP-DAQ	Renu.M.Chakrabarty@wv.gov
Eric Weisenborn	Assistant Director, NPRO	WVDEP-DAQ	Eric.P.Weisenborn@wv.gov
Jim Ebert	Environmental Resource Specialist 2, NPRO	WVDEP-DAQ	James.P.Ebert@wv.gov
Jon Wharton	Environmental Resource Specialist 2, NPRO	WVDEP-DAQ	James.P.Ebert@wv.gov
Elizabeth Gaige	Air Toxics	EPA Region 3	Gaige.elizabeth@epa.gov
Carol Ann Gross-Davis	Environmental Scientist	EPA Region 3	gross-davis.carolann@epa.gov
Mark Feldmeier	President	Wissmach Glass	wissmach@frontier.com
Dan Lynch	Plant Manager	Wissmach Glass	wissmach@frontier.com

FSE Worksheet #4: Project Personnel

(UFP-QAPP Manual Sections 2.3.2)

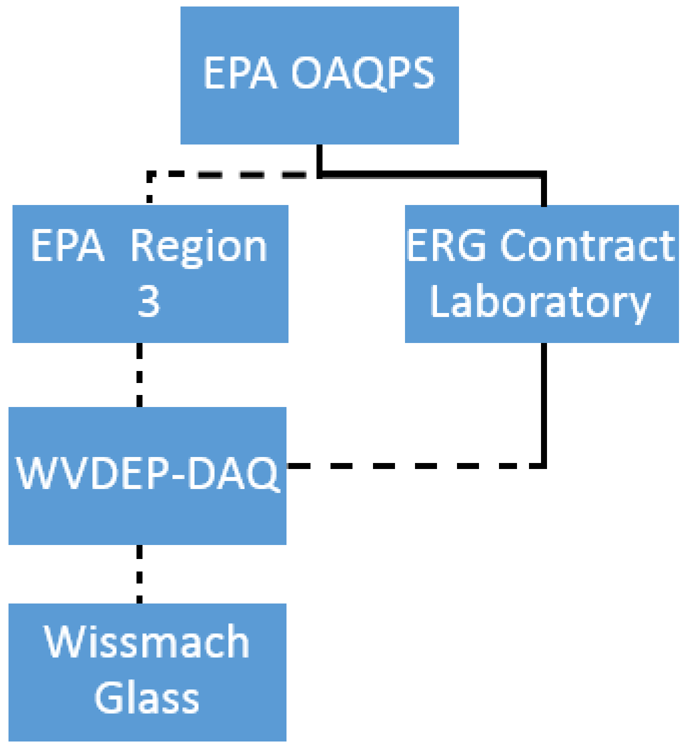
This worksheet is used to identify key project personnel for each organization performing tasks defined in this FSE. Add additional spaces for personnel as needed.

Name	Project Title/Role
Alice Chow, USEPA Region 3	EPA regional liaison for project coordination
Kia Hence, USEPA Region 3	EPA regional QA coordinator for field sampling
Lew Weinstock, USEPA OAQPS	USEPA OAQPS project oversight
David Shelow	USEPA OAQPS project oversight and laboratory coordination
Julie Swift, ERG laboratory	ERG laboratory program manager
Tim Carroll	WVDEP DAQ coordination of state ambient sampling
Renu Chakrabarty	WVDEP DAQ air toxics coordinator and facility liaison
Eric Weisenborn	WVDEP DAQ coordination of field sampling operations by NPRO
Jim Ebert	WVDEP DAQ coordination of sampler installation, QA, sample tracking and shipping
Jon Wharton	WVDEP DAQ sampler installation, site operation
Dan Lynch	Plant Manager Wissmach Glass facility contact

FSP Worksheet #5: Project Organizational Chart
(UFP-QAPP Manual Section 2.4.1)

Provide a concise organizational chart for the project, including reporting relationships between all organizations involved in the project. Charts must include lines of responsibility and lines of communication. *See example below.*

Lines of authority ———— Lines of Communication - - - - - -



FSP Worksheet #6 & 7: Communication Pathways

(UFP-QAPP Manual Section 2.4.2)

This worksheet should be used to document specific issues (communication drivers) that will trigger the need to communicate with other project personnel or stakeholders. Its purpose is to ensure there are procedures in place for providing the appropriate notifications and generating the appropriate documentation when handling important communications. Examples are provided below; additional drivers may be added as needed.

Communication Driver	Organization	Name	Contact Information	Procedure (timing, pathway, documentation, etc.)
Field/sampling issue	WVDEP-DAQ	James Ebert	304-238-1220	Notify Tim Carroll
Filter shipment/receiving issue/ COC	WVDEP-DAQ	James Ebert	304-238-1220	Notify Tim Carroll
Site access issue	Wissmach Glass	Dan Lynch, Plant Manager	304-337-2253	Contact Jim Ebert for any site issues
FSP changes prior to field work	WVDEP-DAQ	Tim Carroll	304-558-0499	Communicate with EPA R3 & OAQPS on any changes to the field sampling plan
FSP changes during project execution	WVDEP-DAQ	Tim Carroll	304-558-0499	
Field equipment corrective actions	WVDEP-DAQ	Tim Carroll	304-558-0499	Notify EPA R3 of any equipment issues
Laboratory issue	ERG	Julie Swift	919 468 7924	Notify OAQPS of any laboratory issues
QA field issue	WVDEP-DAQ	James Ebert	304-238-1220	Notify Tim Carroll

Key personnel:

Title/Role	Organization	Responsibilities
Site Operator	WVDEP-DAQ	Operate & maintain air sampling site, perform quality assurance activities
Field Operations Supervisor	WVDEP-DAQ	Identify, coordinate/perform corrective actions and sampler QA audits
Laboratory Analyst	Randy Mecurio – ERG	Task Lead for metal analysis/ERG
Laboratory Project officer	Julie Swift – ERG	Program Manager/ERG
EPA R3 QA Manager	Kia Hence	Review field sampling plan
EPA R3 point of contact	Alice Chow	Facilitate coordination of project between monitoring agency and OAQPS
EPA OAQPS point of contact	Lewis Weinstock David Shelow	Provide project oversight and serve as a liaison between ERG contract laboratory and agency
Facility point of contact:	Paul Wissmach Glass	Site access issues, electricity issues for sampler operation, plant operations information and planned batch runs with HAP metal content

FSP Worksheet #10: Conceptual Model

(UFP-QAPP Manual Section 2.5.2)

The U.S. Forest Service (USFS), in a pilot study, found moss collected from trees around art glass manufacturers in the Portland area had much higher concentrations of heavy metals than other areas in the city. The Oregon Department of Environmental Quality (ODEQ) set up air monitoring systems to collect 24-hour air samples every few days over a 30-day period in October 2015. The results showed high levels of cadmium and arsenic in the air suggesting that the metals found in the monitoring were coming in large part from an art glass manufacturing facility. Elevated cadmium levels were also found in proximity to another glass manufacturer. Thus, OAQPS has identified 14 other similar facilities, which may manufacture art glass and may use metals in their processes. USEPA has identified Paul Wissmach Glass, Inc. in Paden City, WV as one of the facilities. To assess and characterize potential emissions and ambient air impacts of metals from Paul Wissmach Glass, Inc., USEPA has proposed ambient air sampling around the facility. The WVDEP-DAQ is providing support by acquiring an air monitoring site and providing, installing, and operating a PM10 sequential monitor, collecting samples and shipping them to a USEPA contract laboratory; ERG, Inc. USEPA will provide support and funding for metals analysis of the sample by ERG, Inc.

Samples will be collected using a Thermo Environmental Instruments, Inc, Partisol Plus Sequential configured for PM10. Samples will be collected on 47mm Teflon filters supplied by the DAQ. The sampling will be conducted for 6 months in duration. Sampling will be conducted on the national once every three-day schedule, and the sample collected for a 24-hour period from midnight to midnight. After 6 months of sampling, continuation of the project will be dependent upon the metals concentrations observed in the samples and availability of resources. Adding sampling for hexavalent chromium (Cr^{6+}) will be considered after review of the PM10 total chromium values and will consider the availability of both instrumentation and personnel to conduct such sampling.

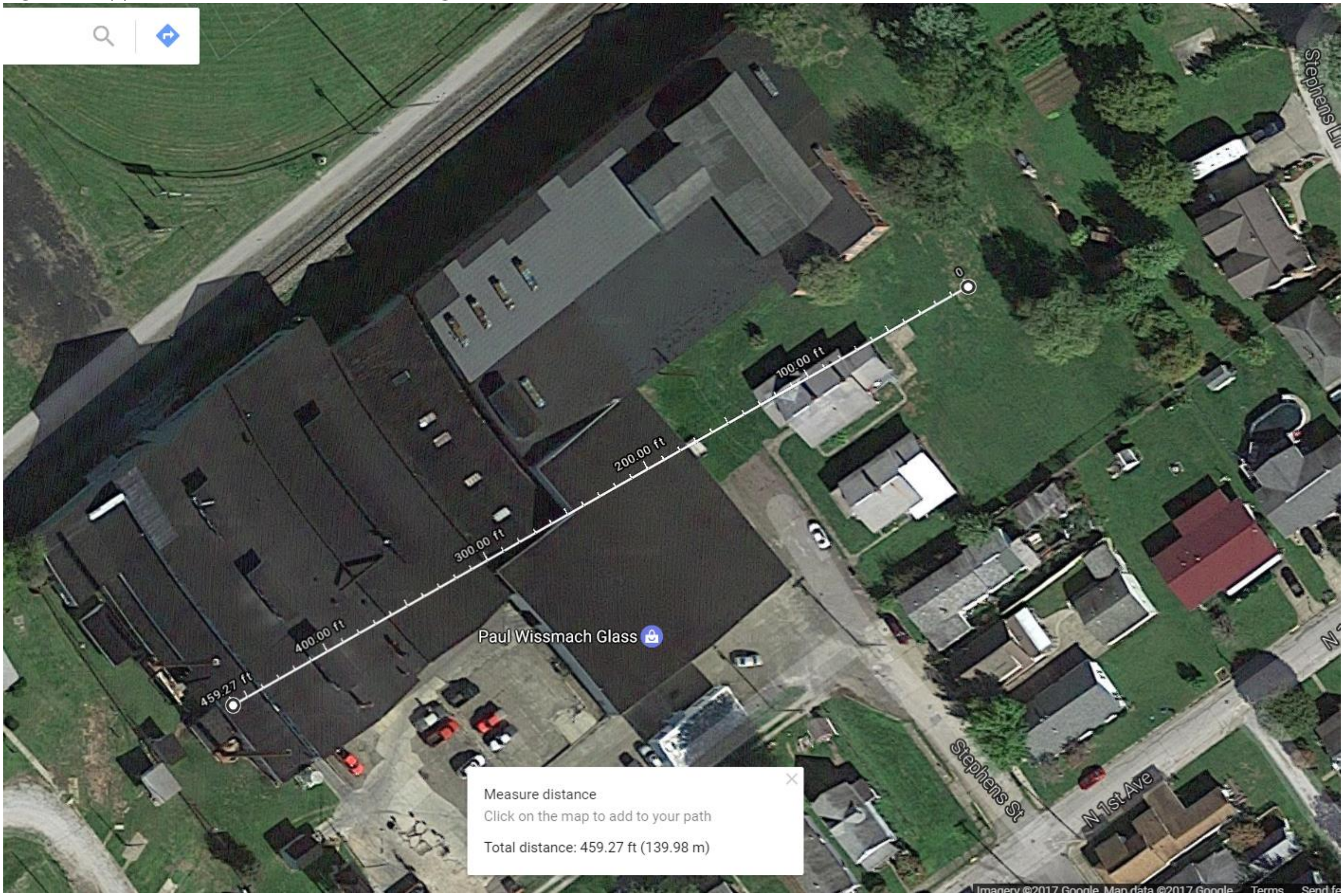
The site is situated at 499 Stephens St. in Paden City, WV approximately 60 feet from the northeast corner of Paul Wissmach Glass, Inc. and approximately 460 feet northeast from the tall stacks of Wissmach Glass, Inc, in the back yard of a one-story home and grounds owned by the facility. The site is bordered on the north by a grassy yard and trees, on the west by a portion of the facility, on the south by single story house, and on the east by a yard and trees. The specific location of the site or sampling area is shown in Figure 1.

On a bi-monthly or monthly basis, exposed 47mm Teflon sample filters will be shipped to ERG laboratories for HAP metals analysis. Each sample filter or field blank placed in an Analyslide®. On a bi-monthly or monthly basis a field blank will be installed into the Thermo Scientific magazine along with the sample filters. The field blank will be automatically shuffled to the exposed filter magazine after the last loaded sample is completed, thus being exposed to the same path and handling procedures as the sample filters. These filter blanks will be transferred from the original container directly to clean petri slides with minimal handling and shipped with the sampled filters to ERG. For all samples, ERG's chain of custody sheets will be used to document sample custody (example form Figure 2).

The WVDEP-DAQ will be solely responsible for sampler operation and maintenance and sample collection. USEPA's contract laboratory, ERG Inc., will be responsible for analysis of the samples. Analytes of concern are listed on the Target Compounds Table in *Worksheet #30: Analytical Services.*

FSP Worksheet #10: Conceptual Site Model (continued)
(UFP-QAPP Manual Section 2.5.2)

Figure 1: Approximate location of monitoring site



FSP Worksheet #10: Conceptual Site Model (continued)
(UFP-QAPP Manual Section 2.5.2)

Figure 1: Example ERG Chain of Custody

ERG
Eastern Research Group, Inc.

Chain of Custody

601 Keystone Park Drive, Suite 700, Morrisville, NC 27560

Page __________ of __________

SITE			ANALYSES			**Relinquished by:**			
AQS Code						**Date/Time:**			
Submitter:						**Received by:**			
						Date/Time:			
#	**Filter ID**	**Date**	**TSP (ICPMS)**	**PM10 (ICPMS)**	**PM10 (XRF)**	**Sample Volume (m^3)**	**Comments**	**ERG LIMS ID (Lab use only)**	
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									

Worksheet #22: Field Quality Control
(UFP-QAPP Manual Section 2.6.2 & 3.5.2.3)

The QA/QC procedure for this project will meet the requirements of the $PM_{2.5}$ instrument manual, $PM_{2.5}$ QAPP and applicable $PM_{2.5}$ SOPs.

Equipment	Activity	Frequency	Acceptance Criteria	Corrective Action
R&P 2025i (PM_{10})	Flow check	Every 30 days	±4% (percent difference)	See QAPP & SOP
R&P2025i (PM_{10})	Cleaning the downtube	Monthly	N/A	See QAPP & SOP
R&P 2025	External Leak Test	Every 30 days	Pass / Fail	Conduct internal leak test

Worksheet #30: Analytical Services
(UFP-QAPP Manual Section 3.5.2.3)

Analytical Services

Laboratory Name: USEPA contract laboratory Eastern Research Group, Inc. (ERG)
Laboratory Contact Name: Julie L. Swift
Analytical Instrument: Inductively Coupled Plasma Mass Spectrometry (ICP-MS)
Analysis Method: Compendium Method IO-3.5
Lab Reference SOP: ERG-MOR-085
Lab Reference QAPP: 2017 Support for the EPA National Monitoring Programs (EPA Contract No. EP-D-14-030)
Data Storage Location: ERG, 601 Keystone Park Drive, Suite 700, Morrisville, NC 27560

Target Compounds
Comparison levels for Art Glass monitoring data. Levels are chronic cancer and noncancer health benchmarks. The most stringent is chosen for initial comparison.

CAS Number	Target Metal Compound	Reported Unit	Lab MDL	Screening Level (ng/m^3)	Cancer-based Comparison Level,[a] (ng/m^3)	Noncancer-based Comparison Level (ng/m^3)
7440-36-0	Antimony	ng/m^3	0.016	200 (Rfc)	-	200[b] (RfC)
7440-38-2	Arsenic	ng/m^3	0.040	0.23 (URE)	0.23 (IUR)	15 (REL)
7440-41-7	Beryllium	ng/m^3	0.001	0.42 (URE)	0.42	20 (RfC)
7440-43-9	Cadmium	ng/m^3	0.002	0.56 (URE)	0.56	10 (MRL)
7440-47-3	Chromium	ng/m^3	3.59	N/A		
7440-48-4	Cobalt	ng/m^3	0.079	100 (Rfc)		100 (MRL)
7439-92-1	Lead	ng/m^3	0.028	150 (Rfc) rolling 3-month average		150 (NAAQS)
7439-96-5	Manganese	ng/m^3	0.113	300 (Rfc)		300 (MRL)
7439-97-6	Mercury	ng/m^3	0.016	300 (Rfc)		300 (RfC)
7440-02-0	Nickel	ng/m^3	0.230	2.1 (URE)	2.1[c] (IUR)	90 (MRL)
7782-49-2	Selenium	ng/m^3	0.036	20000 (Rfc)		20000 (RfC)
1854-02-99	Hexavalent Chromium	ng/m^3	0.0037	0.08 (URE)	0.08 (IUR)	100 (RfC)

[a] Cancer-based comparison level reflects an increased risk level of 1 in a million.
[b] The comparison level for antimony is the RfC for antimony trioxide.
[c] The comparison level for nickel is based on the IUR for nickel subsulfide.

FSP Worksheet #26: Sample Handling System and Data

(UFP-QAPP Manual Appendix A)

Use this worksheet to identify components of the project-specific sample handling system. Record personnel (and their organizational affiliations) who are primarily responsible for ensuring proper handling, custody, and storage of field samples from the time of collection, to laboratory delivery, to final sample disposal.

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT		
Activity	**Personnel/Organization Responsible**	**Comment**
Filter supply HAP Metals	Diane Burgess/WVDEP-DAQ Guthrie Laboratory	47 mm Teflon filters
Sample Collection	James Ebert, Jon Wharton/WVDEP-NPRO	24 – hour samples, 1/3day schedule
Coordination of Shipment	James Ebert, Jon Wharton/WVDEP-NPRO	
Type of Shipment/Carrier	James Ebert, Jon Wharton/WVDEP-NPRO	United Parcel Service Ground
Sample Chain of Custody	James Ebert, Jon Wharton/WVDEP-NPRO	
SAMPLE RECEIPT AND ANALYSIS		
Activity	**Personnel/Organization Responsible**	**Comment**
Sample Receipt	Julie Swift, ERG, Inc.	
Sample Custody and Storage	Julie Swift, ERG, Inc.	
Sample Preparation	Julie Swift, ERG, Inc.	
Sample Determinative Analysis	Julie Swift, ERG, Inc.	
SAMPLE ARCHIVING		
Activity	**Criteria**	**Comment**
Filter Holding Time (post sampling) ICP-MS metals	No criteria	No filter holding requirement for metals sampling
Filter Holding Time (post sampling) Chromium 6^{+}	NA	Only HAP metals sampled
Activity	**Personnel/Organization Responsible**	**Comment**
Sample Disposal	Julie Swift ERG, Inc.	Sample consumed in analysis
DATA MANAGEMENT – performed by contract laboratory		
Activity	**Format**	**Deliverable**
Data Package	Excel and PDF file	Per USEPA schedule

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APPENDIX B. SOURCES OF CHRONIC DOSE-RESPONSE INFORMATION

Dose-response assessments (carcinogenic and noncarcinogenic) for chronic exposure (either by inhalation or ingestion) for HAPs are based on existing recommendations for HAPs by the EPA Office of Air Quality Planning and Standards (OAQPS) (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 into our assessments 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) or reference dose (RfD, for ingestion) to protect against effects other than cancer and/or a unit risk estimate (URE, for inhalation) or slope factor (SF, for ingestion) 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 RfD is "an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily oral exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime." The URE is defined as "the upper-bound excess cancer risk[6] estimated to result from continuous lifetime exposure to an agent at a concentration of 1 µg/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 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.

2. **U.S. Agency for Toxic Substances and Disease Registry (ATSDR).** ATSDR, which is part of the U.S. 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 website: "following discussions with scientists within the

[6]Upper-bound lifetime cancer risk is a likely upper limit to the true probability that a person will contract cancer over a 70-year lifetime due to a given hazard (such as exposure to a toxic chemical). This risk can be measured or estimated in numerical terms (for example, one chance in a hundred).

Department of Health and Human Services (HHS) and EPA, ATSDR chose to adopt a practice similar to that of 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 significant external scientific peer review. As stated in the CalEPA Technical Support Document for developing their chronic assessments (CalEPA 2008), the guidelines for developing chronic inhalation exposure levels incorporate many recommendations of EPA (USEPA 1994) and the National Academies of Sciences, Engineering, and Medicine (NRC 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 (CalEPA 2009) is expressed in terms of the URE, defined similarly to EPA's URE.

References

California Environmental Protection Agency. 2008. Technical Support Document For the Derivation of Noncancer Reference Exposure Levels. https://oehha.ca.gov/media/downloads/crnr/appendixd1final.pdf.

California Environmental Protection Agency. 2009. Technical Support Document for Cancer Potency Factors 2009. https://oehha.ca.gov/air/crnr/technical-support-document-cancer-potency-factors-2009.

National Research Council. 1994. Science and Judgment in Risk Assessment. The National Academies Press. Washington, D.C.

U.S. Environmental Protection Agency. 1994. Methods for Derivation of Inhalation Reference Concentrations and Application of Inhalation Dosimetry. EPA/600/8-90/066F. Office of Research and Development. https://www.epa.gov/risk/methods-derivation-inhalation-reference-concentrations-and-application-inhalation-dosimetry.

U.S. Environmental Protection Agency. 2018. Office of Air Quality Planning and Standards. Prioritized Chronic Dose-Response Values (6/18/2018). https://www.epa.gov/fera/dose-response-assessment-assessing-health-risks-associated-exposure-hazardous-air-pollutants.

APPENDIX C. SOURCES OF ACUTE DOSE-RESPONSE INFORMATION

Hazard identification and dose-response assessment information for acute 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), recognizing 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. 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).

ATSDR Acute (1- to 14-day) minimal risk levels (MRLs). ATSDR adopted a practice similar to that of EPA's reference dose (RfD) and reference concentration (RfC) for deriving substance-specific health guidance levels for non-neoplastic endpoints. An MRL is an estimate of the daily human exposure to a hazardous substance likely to be without appreciable risk of adverse noncancer health effects over a specified duration of exposure.

ATSDR uses the no-observed-adverse-effect level/uncertainty factor (NOAEL/UF) approach to derive MRLs for hazardous substances. They are set below levels that, based on current information, might cause adverse health effects in the people most sensitive to such substance-induced effects. Acute MRLs are derived for acute (1- to 14-day) exposure durations, and for the oral and inhalation routes of exposure. MRLs are generally based on the most sensitive substance-induced endpoint considered to relevant to humans. ATSDR does not use serious health effects (such as irreparable damage to the liver or kidneys or birth defects) as a basis for establishing MRLs. Exposure to a level above the MRL does not mean that adverse health effects will occur.

MRLs are intended to serve as a screening tool to help public health professionals decide where to look more closely.

California Acute Reference Exposure Levels (RELs). CalEPA has developed acute dose-response reference values for many substances, expressing the results as acute inhalation RELs. CalEPA (CalEPA 2016) defines the acute REL as "the concentration level at or below which no adverse health effects are anticipated for a specified exposure duration. 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 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 (NRC 2001), 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 nonsensory 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, nonsensory 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 (AIHA 2018) 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."

References

American Industrial Hygiene Association. 2018. 2018 Emergency Response Planning Guidelines/Workplace Environmental Exposure Levels Handbook. https://www.aiha.org/get-involved/AIHAGuidelineFoundation/EmergencyResponsePlanningGuidelines/Documents/2018%20ERPG-WEEL%20Handbook%20(ERPG).pdf.

California Environmental Protection Agency. 2016. Office of Environmental Health Hazard Assessment. All Acute Reference Exposure Levels developed by OEHHA as of June 2016. https://oehha.ca.gov/air/general-info/oehha-acute-8-hour-and-chronic-reference-exposure-level-rel-summary.

National Research Council. 2001. Standing Operating Procedures for Developing Acute Exposure Guideline Levels for Hazardous Chemicals. The National Academies Press. Washington, D.C.

U.S. Environmental Protection Agency. 2009. Graphical Arrays of Chemical-Specific Health Effect Reference Values for Inhalation Exposures [Final Report]. EPA/600/R-09/061, 2009. http://cfpub.epa.gov/ncea/cfm/recordisplay.cfm?deid=211003.

U.S. Environmental Protection Agency. 2018. Office of Air Quality Planning and Standards. Acute Dose-Response Values for Screening Risk Assessments (6/18/2018). https://www.epa.gov/fera/dose-response-assessment-assessing-health-risks-associated-exposure-hazardous-air-pollutants.

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APPENDIX D. METAL HAP CONCENTRATIONS MEASURED AT ART GLASS MANUFACTURING FACILITIES

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Appendix D-1: Art Glass Assessment Concentrations

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Appendix D-1. Art Glass Assessment Concentrations[a]

Sample Date	Average 24-Hour Wind Speed (mph)	Average 24-Hour Wind Direction (°)	Antimony (PM_{10})	Arsenic (PM_{10})	Beryllium (PM_{10})	Cadmium (PM_{10})	Chromium (PM_{10})	Chromium VI (TSP)	Cobalt (PM_{10})	Lead (PM_{10})	Manganese (PM_{10})	Mercury (PM_{10})	Nickel (PM_{10})	Selenium (PM_{10})
Kokomo Monitoring Station (18-067-0005)														
6/10/16	10.38	204.78	1.04	0.813	0.024	0.497	3.36	NS	0.489	2.56	16.9	0.021	65.8	2.03
6/11/16	13.42	255.05	0.86	0.828	0.022	0.126	3.56	NS	0.629	2.78	16.9	0.016	10.8	1.01
6/12/16	9.08	6.23	1.11	1.22	0.012	0.101	3.33	NS	0.384	3.19	11.7	0.011	2.12	0.947
6/13/16	5.33	130.67	3.86	1.14	0.025	28.8	7.04	NS	7.54	3.16	19.9	0.015	3.14	11.7
6/14/16	8.96	131.62	3.37	1.24	0.014	20.6	7.33	NS	47.8	4.2	22.4	0.017	27.8	10.9
6/15/16	8.79	223.32	1.23	0.595	0.006	1.93	3.23	NS	0.312	1.13	4.49	0.01	0.751	2.07
6/16/16	13.71	311.36	0.433	0.449	0.007	0.052	2.36	NS	0.366	1.7	7.52	0.01	0.901	0.791
6/17/16	9.75	37.59	0.806	0.613	0.01	0.109	3.17	NS	0.28	2.66	12.5	0.011	0.76	0.603
6/18/16	6.88	92.40	2.28	1.14	0.01	1.34	4.98	NS	4.59	3.08	13.8	0.014	0.94	2.32
6/19/16	6.42	222.77	1.11	1.8	0.008	0.677	1.7	NS	5.18	3.01	7.41	0.013	0.681	1.3
6/20/16	12.38	233.80	0.55	0.584	0.01	0.391	3.06	NS	0.287	1.77	10.2	0.009	1.75	0.985
6/21/16	9.17	290.88	0.449	0.61	0.008	0.082	3.22	NS	0.38	1.41	11.5	0.011	2.39	0.816
6/22/16	8.08	212.68	1.22	0.947	0.008	0.929	4.17	NS	2.23	2.02	11.7	0.012	4.12	2.24
6/23/16	7.79	327.15	0.584	0.485	0.008	0.136	3.26	NS	0.751	1.63	8.62	0.008	2.39	0.901
6/24/16	6.92	81.68	1.5	0.798	0.084	0.531	6.68	NS	0.189	5.18	11.2	0.012	2.54	1.96
6/25/16	6.46	150.97	5.88	1.5	0.01	4.03	4.94	NS	14.6	4.53	13.8	0.012	4.77	3.32
6/26/16	8.75	216.32	1.24	1.38	0.007	4.11	2.49	NS	3.46	2.18	6.18	0.007	0.743	5.48
6/27/16	9.54	288.77	0.906	0.604	0.008	0.066	3.59	NS	0.91	1.66	13.6	0.012	3.38	0.955
6/28/16	10.08	344.61	0.393	0.668	0.008	0.072	2.21	NS	0.125	2.67	7.77	0.007	0.885	0.301
6/29/16	4.71	319.94	1.03	0.622	0.006	0.663	2.72	NS	0.196	4.63	7.05	0.013	1.22	1.84
6/30/16	3.29	262.06	3.08	0.756	0.009	10.1	4.12	NS	2.2	2.66	12.9	0.018	1.89	15.7
7/1/16	10.79	327.11	0.01	0.001	ND	0.002	1.52	NS	0.011	0.098	0.083	0.004	0.171	ND
7/2/16	2.54	31.78	2	2.23	0.003	1.64	3.2	NS	0.061	3.72	5.82	0.013	0.326	0.597
7/3/16	7.38	110.84	1.35	1.61	0.0008	4.23	4.29	NS	0.056	3.61	2.81	0.013	0.277	2.25
7/4/16	4.88	104.88	2.35	1.95	0.002	1.42	5.08	NS	4.72	4.55	5.26	0.007	0.664	4.09
7/5/16	5.00	290.71	1.46	2.53	0.004	0.168	4.45	NS	0.641	2.98	5	0.008	2.97	1.08

[a] All concentrations are in ng/m^3
ND: Non-detect
NS: No sample taken

Appendix D-1. Art Glass Assessment Concentrations[a]

Sample Date	Average 24-Hour Wind Speed (mph)	Average 24-Hour Wind Direction (°)	Antimony (PM_{10})	Arsenic (PM_{10})	Beryllium (PM_{10})	Cadmium (PM_{10})	Chromium (PM_{10})	Chromium VI (TSP)	Cobalt (PM_{10})	Lead (PM_{10})	Manganese (PM_{10})	Mercury (PM_{10})	Nickel (PM_{10})	Selenium (PM_{10})
Kokomo Monitoring Station (18-067-0005)														
7/6/16	8.21	239.74	0.536	0.677	0.002	0.367	3.02	NS	0.245	1.23	4.2	0.009	1.41	74.2
7/7/16	8.21	228.14	0.007	0.013	ND	0.003	1.62	NS	0.019	0.027	0.167	0.005	0.129	0.004
7/8/16	10.04	275.99	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
7/9/16	10.38	311.73	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
7/10/16	2.75	340.90	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
7/11/16	6.83	163.25	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
7/12/16	9.79	204.05	1.36	0.949	0.048	2.59	4.42	NS	0.632	2.49	23.7	0.011	1.44	5.03
7/13/16	10.17	227.30	0.35	0.594	0.04	0.081	3.72	NS	0.402	1.77	16.6	0.011	1.51	0.791
7/14/16	11.63	262.91	0.272	0.334	0.006	0.034	2.96	NS	0.826	1.08	13.6	0.011	2.86	0.459
7/15/16	9.63	292.52	0.575	0.558	0.006	0.066	4.55	NS	1.11	1.63	19.9	0.013	3.31	0.773
7/16/16	4.25	343.36	0.657	0.54	0.0009	0.069	2.3	NS	0.168	1.04	3.27	0.008	1.74	0.264
7/17/16	9.67	196.21	0.93	1.15	0.004	0.325	2.29	NS	0.362	1.93	7.3	0.009	0.541	0.953
7/18/16	9.25	261.75	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
7/19/16	2.04	5.81	1.62	1.89	0.008	0.234	2.44	NS	0.324	2.83	11.3	0.008	0.898	1.24
7/20/16	3.96	3.13	3.27	0.941	0.01	0.512	3.43	NS	1.51	2.21	12.9	0.013	0.954	1.8
7/21/16	6.67	220.73	0.94	1.14	0.016	0.279	4.42	NS	0.115	1.83	8.4	0.008	0.856	1.74
7/22/16	7.00	291.31	1.5	0.478	0.006	3.63	3.63	NS	1.12	1.11	6.3	0.009	4.02	0.873
7/23/16	3.04	274.86	1.02	0.796	0.004	0.095	3.09	NS	0.445	2.51	5.59	0.011	2.5	0.834
7/24/16	10.75	210.86	0.637	0.517	0.011	0.903	2.76	NS	0.184	1.18	5.66	0.005	0.7	0.956
7/25/16	6.38	307.78	0.546	0.275	0.007	0.127	2.9	NS	0.348	1.44	7.6	0.011	2.62	0.506
7/26/16	3.46	22.26	3.22	0.876	0.009	157	3.78	NS	2.56	3.58	11.5	0.013	1.68	30.4
7/27/16	2.63	346.67	1.11	3.88	0.009	2.71	4.2	NS	0.781	2.96	12.1	0.014	5.76	1.29
7/28/16	1.50	350.87	2.15	1.64	0.014	1.02	4.12	NS	2.08	5.28	14.6	0.016	4.69	1.32
7/29/16	3.13	26.52	1.38	1.11	0.008	0.849	3.84	NS	1.44	4.68	9.68	0.011	4.43	1.41
7/30/16	3.83	347.68	0.732	0.804	NS	0.243	1.72	NS	0.16	1.93	3.1	0.007	0.828	1.09
7/31/16	3.54	327.40	0.914	1.41	0.0006	0.182	2.27	NS	0.267	2.49	3.13	0.005	1.82	0.766

[a] All concentrations are in ng/m^3

ND: Non-detect

NS: No sample taken

Appendix D-1. Art Glass Assessment Concentrations[a]

Sample Date	Average 24-Hour Wind Speed (mph)	Average 24-Hour Wind Direction (°)	Antimony (PM_{10})	Arsenic (PM_{10})	Beryllium (PM_{10})	Cadmium (PM_{10})	Chromium (PM_{10})	Chromium VI (TSP)	Cobalt (PM_{10})	Lead (PM_{10})	Manganese (PM_{10})	Mercury (PM_{10})	Nickel (PM_{10})	Selenium (PM_{10})
Kokomo Monitoring Station (18-067-0005)														
8/1/16	1.58	14.82	2.01	1.73	0.009	8.57	2.74	NS	0.742	3.59	13.6	0.013	5.09	12
8/4/16	4.58	185.39	8.04	1.55	0.014	15.8	4.58	NS	0.414	3.45	16.8	0.017	1.4	11.7
8/7/16	4.33	9.50	2.18	0.819	0.002	0.132	1.73	NS	0.089	1.7	6.88	0.009	0.325	0.346
8/10/16	3.75	109.23	1.75	1.39	0.01	66.7	3.75	NS	0.382	2.54	35.9	0.012	1.23	91.9
8/13/16	10.88	234.70	0.402	0.369	0.003	0.067	1.89	NS	0.333	1.17	3.98	0.005	0.675	0.455
8/16/16	10.67	250.12	0.275	0.372	ND	0.137	2.02	NS	0.323	0.725	2.23	0.005	0.91	0.619
8/19/16	7.21	224.80	0.7	0.485	0.004	2.66	2.78	NS	0.1	1.63	5.07	0.008	0.434	9.98
8/22/16	1.92	6.56	1.31	0.634	0.003	1.86	3.08	NS	0.386	1.94	6.54	0.01	1.81	0.931
8/25/16	7.46	244.18	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
8/28/16	3.00	35.87	1.58	1.49	0.005	14.7	4.72	NS	0.208	2.45	4.28	0.016	1.8	104
8/31/16	5.71	333.17	0.59	0.8	0.002	0.131	2.39	NS	0.702	1.85	5	0.01	1.77	0.699
9/3/16	6.71	77.30	1.07	2.47	0.0004	0.999	2.06	NS	0.051	2.64	3.68	0.01	0.454	1.82
9/6/16	9.54	214.14	0.793	0.771	0.008	0.137	2.12	NS	0.117	1.75	9.38	0.011	0.686	0.605
9/9/16	6.88	195.98	1.38	0.847	0.003	0.81	6	NS	1.03	1.51	4.79	0.013	6.22	1.65
9/12/16	5.54	154.49	4.12	1.42	0.004	2.86	42.9	NS	4.11	2.19	39.6	0.018	0.71	6.26
9/15/16	8.13	90.83	1.9	0.626	0.003	1.7	2.66	NS	1.69	2.16	18.2	0.011	0.737	2.15
9/18/16	5.33	241.52	1.5	1.15	ND	0.12	1.57	NS	0.085	2.64	3.86	0.013	0.665	9.37
9/21/16	3.33	56.80	2.64	1.39	0.011	1.74	3.59	NS	0.362	5.37	12.2	0.021	1.31	4.19
9/24/16	7.58	83.12	1.3	1.12	0.005	0.95	3.61	NS	0.105	4.01	6.86	0.011	0.626	4.28
9/27/16	13.58	241.98	0.418	0.263	0.007	0.063	2.48	NS	0.263	1.15	18	0.011	2.09	0.293
9/30/16	9.88	53.02	0.572	0.316	ND	0.071	1.47	NS	0.042	1.26	2.36	0.006	0.245	0.35
10/3/16	3.00	13.34	2.16	1.51	0.056	5.35	7.81	NS	1.66	4.03	9.69	0.017	5.46	4.94
10/6/16	7.79	164.00	2.99	1.48	0.019	3.32	7.54	NS	0.605	3.25	15.7	0.018	1.9	4.28
10/9/16	4.00	60.80	2.61	2.08	0.01	2.39	4.87	NS	2.94	4.05	32.8	0.021	2.03	7.66
10/12/16	14.17	217.75	1.22	0.863	0.023	7.4	3.11	NS	0.289	2.29	18	0.017	0.952	14.1
10/15/16	10.58	181.79	1.31	1.34	0.01	1.01	3.59	NS	0.109	2.64	7.89	0.01	1.24	20.3

[a] All concentrations are in ng/m^3
ND: Non-detect
NS: No sample taken

Appendix D-1. Art Glass Assessment Concentrations[a]

Sample Date	Average 24-Hour Wind Speed (mph)	Average 24-Hour Wind Direction (°)	Antimony (PM_{10})	Arsenic (PM_{10})	Beryllium (PM_{10})	Cadmium (PM_{10})	Chromium (PM_{10})	Chromium VI (TSP)	Cobalt (PM_{10})	Lead (PM_{10})	Manganese (PM_{10})	Mercury (PM_{10})	Nickel (PM_{10})	Selenium (PM_{10})
Kokomo Monitoring Station (18-067-0005)														
10/18/16	15.33	228.31	0.556	0.494	0.016	0.286	2.4	NS	0.151	1.55	14.7	0.014	0.7	0.713
10/21/16	12.79	336.88	0.328	0.245	0.004	0.039	3.02	NS	0.046	1.24	3.86	0.019	0.548	0.126
10/24/16	7.67	340.17	0.684	0.557	0.01	0.094	2.6	NS	0.113	1.85	9.43	0.01	0.631	0.318
10/27/16	10.92	304.83	0.517	0.507	0.005	0.073	2.03	NS	0.186	1.86	6.99	0.006	1.05	0.495
10/30/16	10.42	343.03	0.756	0.622	0.005	5.13	1.96	NS	0.091	1.45	4.36	0.007	0.448	0.462
11/2/16	11.29	209.69	0.832	0.753	0.022	0.159	3	NS	0.252	2.64	20.7	0.014	1.14	0.623
11/5/16	3.79	266.03	2.8	5.92	0.007	0.253	2.83	NS	0.148	3.9	9.81	0.019	1.09	0.476
11/8/16	8.33	250.96	1.78	1.08	0.012	0.155	2.92	NS	0.53	2.74	10.4	0.014	1.78	0.81
11/11/16	9.88	353.05	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
11/14/16	7.79	196.55	1.25	0.962	0.019	0.203	2.42	NS	0.185	3.01	12.6	0.012	0.82	0.621
11/17/16	11.75	161.99	2.23	2.3	0.029	11.9	5.72	NS	1.33	5.4	23.3	0.021	1.28	2.92
11/20/16	13.58	287.09	0.245	0.22	0.003	0.039	1.47	NS	0.042	1.34	4.26	0.006	0.266	0.24
11/23/16	9.67	151.07	10.4	2.63	0.008	9.48	35.1	NS	0.52	4.87	5.83	0.021	1.19	7.23
11/26/16	7.88	258.95	0.573	0.56	0.003	0.107	1.46	NS	0.052	1.49	3.53	0.006	0.504	0.543
11/29/16	13.83	189.74	1.67	0.62	0.008	1.16	7.53	NS	2.37	1.66	15	0.012	0.946	1.24
12/2/16	10.71	267.50	0.374	0.212	0.002	0.046	3.66	NS	0.537	1	4.71	ND	3.85	0.325
12/5/16	8.65	175.55	0.992	0.436	0.003	14.5	2.53	NS	0.149	1.54	1.98	ND	0.753	24
12/8/16	20.38	281.70	0.219	0.173	0.01	0.045	4.01	NS	0.874	0.988	11.8	ND	6.71	0.273
12/11/16	12.61	169.05	5.74	1.25	0.009	22.8	17.6	NS	0.21	2.96	4.17	0.002	1.1	46.1
12/14/16	12.17	257.59	0.337	0.263	0.011	0.06	2.77	NS	0.194	1.28	7.26	0.002	3.31	0.329
12/17/16	7.04	342.50	0.687	0.607	0.002	1.11	6.38	NS	0.052	2.21	2.1	0.002	0.235	1.37
12/20/16	11.58	209.52	1.04	0.631	0.013	0.113	2.21	NS	0.111	2.39	5.53	0.006	0.828	0.917
12/23/16	10.08	172.58	3.43	1.16	0.013	22.7	10.5	NS	0.282	2.77	6.07	0.007	0.529	15.9
12/26/16	17.50	222.75	0.788	0.576	0.005	2.75	3.8	NS	0.066	0.873	1.72	ND	0.294	4.01
12/29/16	20.96	273.75	0.234	0.173	0.004	0.071	6.25	NS	0.628	3.82	3.06	0.014	2.55	0.348
1/1/17	4.75	68.41	1.89	0.506	0.005	0.23	2.35	NS	0.063	4.12	4.58	0.019	0.54	0.839

[a] All concentrations are in ng/m^3
ND: Non-detect
NS: No sample taken

Appendix D-1. Art Glass Assessment Concentrations[a]

Sample Date	Average 24-Hour Wind Speed (mph)	Average 24-Hour Wind Direction (°)	Antimony (PM_{10})	Arsenic (PM_{10})	Beryllium (PM_{10})	Cadmium (PM_{10})	Chromium (PM_{10})	Chromium VI (TSP)	Cobalt (PM_{10})	Lead (PM_{10})	Manganese (PM_{10})	Mercury (PM_{10})	Nickel (PM_{10})	Selenium (PM_{10})
Kokomo Monitoring Station (18-067-0005)														
1/4/17	23.39	278.33	0.134	0.145	0.004	0.027	2.33	NS	0.728	0.671	2.91	0.014	2.74	0.278
1/7/17	10.17	268.24	0.281	0.328	0.003	0.064	2.94	NS	0.855	1.29	5.51	0.016	3.68	0.353
1/10/17	22.25	193.78	0.645	0.452	0.005	1.54	3.23	NS	0.257	1.03	2.48	0.028	1.12	3.43
1/13/17	10.00	31.02	0.649	0.443	0.013	0.291	2.74	NS	0.079	2.11	8.14	0.016	0.592	1.62
1/16/17	8.50	113.30	6.33	1.8	0.007	113	6.45	NS	2.81	5	60.1	0.036	0.484	464
1/19/17	8.83	130.26	6.47	0.77	0.006	21.7	3.16	NS	0.444	2.18	6.03	0.023	0.573	31.7
1/22/17	7.88	31.62	1.5	1.21	0.004	0.616	2.37	NS	0.149	11.6	2.61	0.011	0.754	1.39
1/25/17	15.63	204.08	2.79	1.12	0.01	20.7	31.8	NS	1.04	7.66	7.2	0.013	3.59	115
1/28/17	15.63	266.63	0.231	0.173	0.004	0.052	3.34	NS	0.751	1.29	3.01	0.006	5.79	0.332
1/31/17	19.75	258.87	0.23	0.095	0.003	0.038	4.25	0.0948	0.885	0.613	3.54	0.007	5.78	0.289
2/3/17	11.54	289.67	0.537	0.283	0.009	0.062	2.98	0.0139	0.579	1.72	10.6	0.011	1.99	0.244
2/6/17	9.91	165.64	2.13	1.32	0.013	39.9	3.64	0.115	0.261	3.76	8.26	0.023	0.654	219
2/9/17	14.00	275.50	0.448	0.237	0.004	0.063	2.14	0.0425	0.182	1.59	5.39	0.011	0.841	0.389
2/12/17	17.00	315.45	0.854	0.667	0.004	0.124	2.19	0.0088	0.091	2.46	3.57	0.009	0.465	1.02
2/15/17	11.92	320.15	0.532	0.222	0.009	0.116	2.31	0.0115	0.199	1.8	10.7	0.007	1.34	0.262
2/18/17	11.65	227.02	1.26	1.57	0.013	0.202	2.46	0.0049	0.132	3.86	10.1	0.012	1.43	1.08
2/21/17	5.48	175.55	4.06	2.64	0.02	175	8.33	0.298	0.667	6.17	17.5	0.025	2.34	2.19
2/24/17	16.92	205.18	1.18	1.19	0.015	6.37	14.1	NS	0.271	2.08	8.68	0.016	1.59	37.3
2/27/17	8.17	173.26	10	0.781	0.011	28	4.36	0.613	1.27	2.58	21	0.033	0.695	12.4
3/2/17	14.13	290.16	0.273	0.204	0.003	0.064	3.3	NS	0.84	0.921	3.81	0.006	2.26	0.342
3/5/17	14.83	165.36	7.62	0.906	0.01	32.4	4.07	0.0935	4.34	3.55	11.1	0.022	0.73	19.3
3/8/17	20.74	245.99	0.273	0.208	0.009	0.059	2.47	0.0269	0.707	1	6.01	0.005	3.33	0.21
3/11/17	9.21	332.55	0.299	0.242	0.004	0.101	1.97	NS	0.162	1.53	7.5	0.009	0.686	0.076
3/14/17	12.58	353.28	1.25	0.267	0.002	0.093	1.88	0.0047	0.21	2	3.87	0.004	0.715	0.135
3/17/17	10.71	180.78	1.56	0.941	0.007	9.41	6.66	0.571	0.125	3.4	5.21	0.016	1.48	3.74
3/20/17	10.57	102.27	7.08	1.1	0.006	7.46	8.2	0.669	1.47	3.33	6.08	0.01	1.49	15.9

[a] All concentrations are in ng/m^3
ND: Non-detect
NS: No sample taken

Appendix D-1. Art Glass Assessment Concentrations[a]

Sample Date	Average 24-Hour Wind Speed (mph)	Average 24-Hour Wind Direction (°)	Antimony (PM_{10})	Arsenic (PM_{10})	Beryllium (PM_{10})	Cadmium (PM_{10})	Chromium (PM_{10})	Chromium VI (TSP)	Cobalt (PM_{10})	Lead (PM_{10})	Manganese (PM_{10})	Mercury (PM_{10})	Nickel (PM_{10})	Selenium (PM_{10})
Kokomo Monitoring Station (18-067-0005)														
3/23/17	11.75	129.03	17.4	1.15	0.023	8.67	17.9	0.787	34	3.93	54.2	0.058	1.24	9.61
3/26/17	10.83	187.50	0.59	0.589	0.004	20.9	3.06	0.28	0.114	1.46	2.12	0.009	0.595	1.58
3/29/17	14.63	79.19	1.68	0.452	0.007	0.413	2.72	NS	0.416	1.82	6.07	0.01	1.01	0.661
4/1/17	5.96	3.50	0.938	0.62	0.004	0.093	2.2	NS	0.073	1.7	3.41	0.01	0.753	0.188
4/4/17	14.58	292.54	0.635	0.592	0.003	0.075	2.32	0.0459	0.41	1.69	3.42	0.01	2.02	0.704
4/7/17	15.46	308.56	0.573	0.104	0.005	0.025	2.1	NS	0.11	0.855	3.51	0.008	0.549	0.144
4/10/17	16.46	204.67	0.69	0.533	0.013	2.79	2.99	0.0374	0.25	1.69	9.25	0.01	1.33	3.95
4/13/17	8.87	91.09	15.2	2.06	0.025	6.78	8.35	0.126	8.57	6.8	36	0.035	5.68	8.96
4/16/17	15.13	259.10	0.402	0.49	0.009	0.065	2.42	0.0242	0.162	1.28	7.13	0.01	0.824	0.569
4/19/17	9.25	197.51	1.04	0.89	0.015	3	4.11	0.177	0.196	2.78	10.1	0.015	0.785	8.25
4/22/17	12.38	54.34	0.557	0.482	0.009	0.197	2.45	NS	0.103	4.87	6.19	0.009	0.509	0.299
4/25/17	8.83	138.80	13.3	1.09	0.039	237	11.8	0.25	0.728	4.56	19.9	0.021	1.2	328
4/28/17	8.04	133.14	1.85	0.856	0.006	6.96	7.68	0.883	0.248	3.69	6.46	0.01	0.662	3.61
5/1/17	20.58	216.36	0.273	0.184	0.007	0.249	2.19	0.0304	0.091	0.664	5.76	0.011	0.618	0.374
5/4/17	17.83	48.09	0.264	0.243	0.002	0.048	2.2	0.0408	0.043	0.803	1.04	0.006	0.289	0.548
5/7/17	12.08	320.20	0.298	0.224	0.004	0.041	2.36	0.0148	0.047	1.25	3.29	0.006	0.363	0.209
5/10/17	6.46	88.65	2.56	4.57	0.021	35.1	3.83	0.0572	0.244	3.97	15.5	0.015	1.15	204
5/13/17	7.29	279.00	1.15	1.74	0.014	0.168	3.66	0.0187	0.95	3.77	13.9	0.011	4.61	1.23
5/16/17	13.58	205.68	1.02	0.936	0.029	0.448	3.42	0.0101	0.342	2.95	20.9	0.012	1.15	1.59
5/19/17	12.63	54.97	1.52	0.492	0.013	0.187	2.61	NS	0.313	1.45	5.81	0.008	0.824	0.969
5/22/17	8.17	228.49	0.541	0.316	0.012	0.546	1.77	0.0534	0.768	1.15	11.6	0.006	2.19	0.701
5/25/17	13.63	312.27	0.616	0.633	0.006	0.085	2.36	0.0673	0.465	1.79	8.58	0.005	2.46	0.679
5/28/17	8.83	223.77	1.75	1.97	0.007	0.287	2.64	0.0191	0.263	3.08	5.01	0.01	1.16	1.45
5/31/17	10.48	276.17	0.625	0.396	0.018	0.077	4.26	0.0348	0.976	1.57	12.8	0.008	4.37	0.501
6/3/17	6.08	219.41	3.32	2	0.044	0.253	4.2	NS	0.764	4.87	31.2	0.018	1.46	1.44
6/6/17	10.33	22.85	3	0.569	0.019	0.104	3.08	0.0118	0.2	4.01	16.4	0.015	1.21	0.494

[a] All concentrations are in ng/m^3

ND: Non-detect

NS: No sample taken

Appendix D-1. Art Glass Assessment Concentrations[a]

Sample Date	Average 24-Hour Wind Speed (mph)	Average 24-Hour Wind Direction (°)	Antimony (PM_{10})	Arsenic (PM_{10})	Beryllium (PM_{10})	Cadmium (PM_{10})	Chromium (PM_{10})	Chromium VI (TSP)	Cobalt (PM_{10})	Lead (PM_{10})	Manganese (PM_{10})	Mercury (PM_{10})	Nickel (PM_{10})	Selenium (PM_{10})
Kokomo Monitoring Station (18-067-0005)														
6/9/17	13.25	231.67	0.849	0.769	0.029	0.242	3.78	0.0136	0.419	3.04	21.7	0.016	1.88	0.91
6/12/17	11.38	215.01	0.62	0.682	0.017	0.084	2.87	0.0205	0.128	1.52	12.7	0.009	0.682	0.735
6/15/17	6.58	263.19	0.55	0.684	0.007	0.195	4.31	0.0299	0.361	1	5.45	0.01	1.51	0.988
6/18/17	15.27	242.41	0.25	0.323	0.004	0.175	3.72	0.0561	0.307	0.854	4.89	0.014	1.76	0.895
6/21/17	2.67	21.32	1.13	0.63	0.009	0.207	2.81	0.0279	2.02	1.85	9.38	0.017	1.2	1.51
6/24/17	12.08	270.95	0.316	0.367	0.007	0.093	3.29	0.0274	0.563	3.64	8.65	0.014	2.44	0.643
6/27/17	5.13	290.11	0.433	0.434	0.004	0.07	4.83	0.103	0.683	1.22	6.03	0.012	6.55	0.565
6/30/17	7.83	214.46	0.459	0.708	0.005	0.123	3.21	NS	0.103	0.763	4.87	0.007	1.15	0.792

[a] All concentrations are in ng/m^3
ND: Non-detect
NS: No sample taken

Appendix D-1. Art Glass Assessment Concentrations[a]

Sample Date	Average 24-Hour Wind Speed (mph)	Average 24-Hour Wind Direction (°)	Antimony (PM_{10})	Arsenic (PM_{10})	Beryllium (PM_{10})	Cadmium (PM_{10})	Chromium (PM_{10})	Chromium VI (TSP)	Cobalt (PM_{10})	Lead (PM_{10})	Manganese (PM_{10})	Mercury (PM_{10})	Nickel (PM_{10})	Selenium (PM_{10})
Kopp Monitoring Station A (42-003-KOPA)														
4/1/17	5.93	308.76	0.553	0.39	0.002	0.122	1.74	NS	0.023	0.898	1.82	0.027	0.436	0.099
4/2/17	2.02	95.82	1.97	1.46	0.005	2.37	3.63	NS	0.07	4.11	12.8	0.021	1.01	1.96
4/3/17	3.22	110.55	5.52	1.74	0.03	2.19	7.74	NS	0.283	14	111	0.042	1.74	2.79
4/4/17	7.28	243.94	0.998	0.375	0.003	0.222	2.4	NS	0.044	1.36	4.54	0.012	0.651	0.497
4/5/17	4.44	89.41	4.79	0.499	0.008	13.1	3.77	NS	0.124	3.39	11.4	0.033	2.41	12.5
4/6/17	5.52	244.25	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
4/7/17	8.43	307.96	0.506	0.255	0.002	0.039	2.1	NS	0.043	1.03	2.4	0.01	0.519	0.129
4/8/17	3.14	3.81	1.92	1.42	0.005	7.59	3.46	NS	0.096	4.5	11.6	0.042	1.13	11.2
4/9/17	3.06	148.69	16.9	5.6	0.023	11.6	11.6	NS	0.188	24.7	140	0.061	1.08	7.28
4/10/17	4.29	190.53	4.1	3.29	0.033	1.7	12.9	NS	0.276	26.4	148	0.053	2.2	3.31
4/11/17	3.17	181.19	10	5.13	0.038	3.71	11.4	NS	0.303	26.4	120	0.079	3.24	17.2
4/12/17	4.49	318.84	1.13	0.665	0.007	0.105	2.4	NS	0.077	2.41	8.46	0.025	0.803	0.564
4/13/17	2.02	23.11	2.25	0.507	0.006	0.316	2.58	NS	0.074	2.17	6.89	0.033	1.02	0.404
4/14/17	1.80	1.14	12.2	2.33	0.022	0.707	5.61	NS	0.209	8.66	34.8	0.087	2.38	1.1
4/15/17	3.09	162.40	5.97	6.09	0.034	4.22	7.3	NS	0.271	19.3	79.2	0.068	1.84	31.6
4/16/17	5.49	204.21	2.8	0.936	0.008	3.11	2.34	NS	0.067	4	8.45	0.025	0.686	1.65
4/17/17	3.34	342.70	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
4/18/17	2.61	97.98	4.49	1.01	0.024	15.4	4.82	NS	0.154	7.03	31.1	0.034	6.74	57.5
4/19/17	4.36	170.58	16	1.15	0.028	29.5	4.45	NS	0.234	8.13	35.3	0.04	3.6	10
4/20/17	4.35	166.00	5.62	1.05	0.009	1.85	2.61	NS	0.09	3.74	13.9	0.027	0.589	1.67
4/21/17	5.14	285.26	1.23	0.578	0.005	0.17	2.69	NS	0.073	1.89	7.59	0.03	4.88	0.734
4/22/17	3.39	334.09	0.677	0.811	0.0006	0.067	1.66	NS	0.032	1.63	2.66	0.02	0.22	1.28
4/23/17	2.62	82.48	3.03	0.867	0.003	15.2	2.61	NS	0.056	3.24	7.3	0.024	0.374	5.71
4/24/17	3.20	103.66	3.33	0.941	0.008	2.87	4.18	NS	0.105	6.59	25.5	0.035	0.896	9.17
4/25/17	2.56	101.09	3.9	0.646	0.002	2.63	2.49	NS	0.05	1.59	4.11	0.025	0.443	4.74
4/26/17	2.26	80.93	3.46	1.76	0.01	4.91	5.03	NS	0.157	6.02	32	0.042	1.74	4.4

[a] All concentrations are in ng/m^3
ND: Non-detect
NS: No sample taken

Appendix D-1. Art Glass Assessment Concentrations[a]

Sample Date	Average 24-Hour Wind Speed (mph)	Average 24-Hour Wind Direction (°)	Antimony (PM_{10})	Arsenic (PM_{10})	Beryllium (PM_{10})	Cadmium (PM_{10})	Chromium (PM_{10})	Chromium VI (TSP)	Cobalt (PM_{10})	Lead (PM_{10})	Manganese (PM_{10})	Mercury (PM_{10})	Nickel (PM_{10})	Selenium (PM_{10})
Kopp Monitoring Station A (42-003-KOPA)														
4/27/17	3.65	148.29	8.18	2.13	0.025	8.2	13	NS	0.313	27	135	0.093	2.27	3.1
4/28/17	2.33	25.53	3.46	1.55	0.012	12.1	4.26	NS	0.201	6.86	44.9	0.025	2.31	15.3
4/29/17	2.88	280.02	4.84	1.71	0.007	12.2	3.3	NS	0.076	9.99	30.7	0.047	0.51	21.7
4/30/17	3.37	175.41	7.66	1.65	0.013	22.6	3.68	NS	0.094	8.15	30.7	0.031	0.868	6.5
5/1/17	5.20	176.84	9.04	1.07	0.011	11.2	3.74	NS	0.132	6.89	18.5	0.023	1.39	5.04
5/2/17	7.74	263.96	0.493	0.159	0.004	0.411	2.19	NS	0.045	1.11	6.59	0.016	0.527	0.469
5/3/17	4.53	325.26	1.03	0.397	0.004	0.271	2.53	NS	0.159	1.59	5.74	0.016	0.599	0.302
5/4/17	4.65	106.53	26	1.38	0.012	19.7	4.05	NS	0.106	11.6	21.9	0.026	0.749	4.82
5/5/17	4.32	354.68	1.72	0.57	0.001	1.02	4.12	NS	0.075	4.53	4.87	0.023	2.22	11.3
5/6/17	7.18	306.13	0.376	0.371	0.006	0.018	1.77	NS	0.024	0.531	0.733	0.011	0.212	0.168
5/7/17	6.67	309.98	0.37	0.398	0.004	0.045	1.47	NS	0.048	1.08	2.07	0.013	0.507	0.245
5/8/17	4.29	329.68	0.963	0.51	0.006	0.128	2.38	NS	0.056	1.43	5.43	0.023	0.609	0.716
5/9/17	2.65	58.76	6.11	3.24	0.034	5.03	7.75	NS	0.192	17.3	74.9	0.058	2	5.8
5/10/17	2.01	359.96	4.87	2.87	0.04	2.26	7.6	NS	0.274	12	54.1	0.035	2.63	5.74
5/11/17	1.87	52.92	3.15	1.22	0.012	0.386	1.87	NS	0.071	7.48	10.7	0.02	0.934	0.942
5/12/17	2.57	96.40	2.19	1.75	0.002	2.07	5.15	NS	0.607	3.03	14.2	0.029	7.92	5.89
5/13/17	2.42	355.30	2.26	1.36	0.003	0.888	3.2	NS	0.072	3.58	4.95	0.013	0.755	4.59
5/14/17	5.49	325.67	3.07	3.16	0.011	5.05	3.94	NS	0.234	10.3	31.2	0.036	1.12	3.72
5/15/17	3.81	344.16	1.89	0.615	0.006	0.142	3.29	NS	0.099	2.01	8.6	0.014	1.37	0.212
5/16/17	2.68	144.49	6.61	4.37	0.051	3.2	12	NS	0.425	19.3	173	0.03	3.67	5.38
5/17/17	3.73	183.44	4.92	5.84	0.05	6.15	9.8	NS	0.39	27.6	112	0.049	3.94	5.6
5/18/17	4.40	190.71	7.68	3.33	0.044	16.7	7.75	NS	0.283	34.2	62.9	0.046	2.67	5.44
5/19/17	3.17	314.42	1.63	1.76	0.014	0.308	3.97	NS	0.144	2.94	13.5	0.025	2.53	1.27
5/20/17	2.83	54.22	3.56	1.29	0.005	2.4	2.44	NS	0.071	2.8	7.05	0.022	0.638	6.56
5/21/17	3.96	136.41	24.2	10.6	0.012	85.8	5.38	NS	0.109	16.4	29.1	0.028	1.11	30.6
5/22/17	4.33	295.67	5.09	4.25	0.009	2.83	3.96	NS	0.261	7.96	23.5	0.026	2.94	2.13

[a] All concentrations are in ng/m^3
ND: Non-detect
NS: No sample taken

Appendix D-1. Art Glass Assessment Concentrations[a]

Sample Date	Average 24-Hour Wind Speed (mph)	Average 24-Hour Wind Direction (°)	Antimony (PM_{10})	Arsenic (PM_{10})	Beryllium (PM_{10})	Cadmium (PM_{10})	Chromium (PM_{10})	Chromium VI (TSP)	Cobalt (PM_{10})	Lead (PM_{10})	Manganese (PM_{10})	Mercury (PM_{10})	Nickel (PM_{10})	Selenium (PM_{10})
Kopp Monitoring Station A (42-003-KOPA)														
5/23/17	3.14	110.16	14.1	6.34	0.016	13.6	5.11	NS	0.179	9.56	28.7	0.027	1.7	86.9
5/24/17	4.27	103.29	5.65	7.71	0.005	14	3.65	NS	0.073	6.59	8.5	0.01	0.823	38.5
5/25/17	3.44	190.18	7.43	1.86	0.002	3.12	2.22	NS	0.102	1.38	4.9	0.009	0.627	0.7
5/26/17	4.67	313.45	2.17	0.855	0.004	0.186	2.52	NS	0.162	2.07	5.39	0.013	0.784	0.408
5/27/17	1.59	71.77	3.29	9.16	0.01	3.01	4.18	NS	0.075	10	31.1	0.029	0.69	9.81
5/28/17	2.68	195.18	4.72	14.8	0.008	9.83	2.73	NS	0.054	17.4	19.1	0.019	0.73	107
5/29/17	3.65	265.44	1.48	2.4	0.007	2.36	2.13	NS	0.141	4.34	15.6	0.022	0.405	1.7
5/30/17	3.89	205.58	3.46	1.81	0.016	1.43	3.55	NS	0.411	5.06	28.2	0.025	1.22	3.41
5/31/17	3.73	162.25	2.96	2.41	0.017	2.95	3.87	NS	0.221	8.24	27.1	0.064	1.76	19.4
6/3/17	3.24	9.07	12.8	6.15	0.06	4.58	9.39	NS	0.31	31.8	109	0.054	1.66	46
6/6/17	4.54	319.36	0.782	0.598	0.005	0.073	1.97	NS	0.05	1.72	5.48	0.043	0.587	0.464
6/9/17	2.99	307.06	4.75	2.22	0.01	3.86	3.58	NS	0.174	10.9	19.1	0.03	1.09	52.8
6/12/17	3.15	187.69	10.2	16	0.068	2.78	6.78	NS	0.202	30.2	91.5	0.049	1.62	7.19
6/15/17	3.27	136.94	16.5	13.7	0.011	6.55	3.06	NS	0.117	8.75	26.2	0.029	0.841	3.78
6/18/17	5.48	171.87	5.19	1.79	0.006	36.1	2.05	NS	0.052	4.48	7.15	0.026	0.4	31.3
6/21/17	2.90	3.77	3.25	3.26	0.019	2.58	4.8	NS	0.288	15.4	71.3	0.07	1.38	6.41
6/24/17	4.92	294.04	1.02	0.88	0.003	0.24	2.09	NS	0.167	1.86	5.19	0.024	0.458	1.75
6/27/17	4.62	283.92	1.27	0.908	0.005	2.39	3.42	NS	0.145	3.38	9.2	0.02	1.24	23.2
6/30/17	3.43	170.33	5.47	8.83	0.018	5.19	3.81	NS	0.159	20.6	62.8	0.027	1.32	15.9
7/3/17	2.45	34.60	3.55	3.48	0.023	1.23	4.97	NS	0.168	16.2	47.6	0.028	0.886	5.26
7/6/17	2.20	99.39	4.32	1.92	0.01	0.529	3.63	NS	0.11	8.21	59.9	0.041	0.697	1.67
7/9/17	2.38	146.60	3.97	4.02	0.018	5.82	3.87	NS	0.095	28.4	52	0.057	0.716	3.57
7/12/17	3.43	199.55	2.43	1.85	0.012	4.55	2.88	NS	0.104	6.56	13.5	0.025	1.1	14.9
7/15/17	2.89	351.72	1.37	1.17	0.003	0.088	2.56	NS	0.044	2.63	4.45	0.098	0.521	1.99
7/18/17	2.03	358.26	2.74	1.68	0.014	0.478	3.61	NS	0.171	5.54	18.1	0.03	3.18	1.49
7/21/17	2.47	155.21	1.67	1.67	0.011	0.468	3.38	NS	0.124	5.62	15.6	0.044	1.45	1.94

[a] All concentrations are in ng/m^3

ND: Non-detect

NS: No sample taken

Appendix D-1. Art Glass Assessment Concentrations[a]

Sample Date	Average 24-Hour Wind Speed (mph)	Average 24-Hour Wind Direction (°)	Antimony (PM_{10})	Arsenic (PM_{10})	Beryllium (PM_{10})	Cadmium (PM_{10})	Chromium (PM_{10})	Chromium VI (TSP)	Cobalt (PM_{10})	Lead (PM_{10})	Manganese (PM_{10})	Mercury (PM_{10})	Nickel (PM_{10})	Selenium (PM_{10})
Kopp Monitoring Station A (42-003-KOPA)														
7/24/17	4.35	283.95	1.17	0.463	0.003	0.079	2.42	NS	0.096	1.14	7.21	0.031	1.1	0.65
7/27/17	2.23	207.81	3.34	3.7	0.035	0.994	6.25	NS	0.213	24.6	70.2	0.034	1.93	2.82
7/30/17	2.00	354.65	2.96	2.06	0.003	0.174	2.05	NS	0.054	3.92	4.96	0.028	0.707	0.863
8/2/17	2.57	134.46	3.18	3.84	0.031	1.11	5.46	NS	0.233	17.9	50.5	0.038	2.08	3.63
8/5/17	4.13	282.50	0.993	0.639	0.002	2.54	1.55	NS	0.043	8.33	2.62	0.024	0.332	1.41
8/8/17	2.93	347.70	1.94	1.56	0.004	0.12	2.71	NS	0.064	1.82	6.27	0.023	0.668	1.35
8/11/17	2.50	148.32	3.99	7.42	0.019	5.44	3.66	NS	0.111	13.6	42.7	0.025	0.935	31
8/14/17	2.43	202.05	4.48	2.83	0.013	1.08	4.19	NS	0.113	16.9	25.2	0.046	1.14	7.88
8/17/17	2.85	168.67	10.2	5.02	0.026	2.8	6.79	NS	0.212	17	52.7	0.028	10	2.44
8/20/17	1.88	116.79	4.59	5	0.02	5.84	4.98	NS	0.094	76	51.2	0.037	0.956	5.02
8/23/17	2.83	336.64	1.49	1.2	0.004	0.155	3.23	NS	0.075	2.23	8.85	0.014	0.942	0.626
8/26/17	1.78	21.68	4.65	2.38	0.003	1.41	4.44	NS	0.077	10.2	9.49	0.017	1.47	5.68
8/29/17	3.12	94.37	10.5	0.959	0.006	9.63	3.58	NS	0.109	9.8	11.1	0.01	2.63	41.5
9/1/17	1.88	352.89	1.26	0.409	0.003	0.151	1.73	NS	0.047	2.7	4.83	0.022	0.374	0.488
9/4/17	4.25	169.10	6.92	3.97	0.029	37.3	3.35	NS	0.081	22.9	38.6	0.039	0.588	117
9/7/17	3.32	265.73	1.3	0.777	0.003	0.969	2.72	NS	0.095	2.37	5.05	0.028	1.02	0.814
9/10/17	2.05	58.17	2.38	0.923	0.003	26.3	2.06	NS	0.04	5.17	10.8	0.026	0.496	4.08
9/13/17	2.35	305.63	3.31	4.62	0.009	5.25	4.77	NS	0.147	7.38	40	0.027	1.46	23.9
9/16/17	1.41	16.20	8.63	4.35	0.004	8.32	4.14	NS	0.126	8.75	12.7	0.05	2.38	15
9/19/17	1.83	73.59	6.04	4.94	0.015	4.1	5.62	NS	0.178	12.6	37.5	0.027	2.36	7.28
9/22/17	1.53	2.83	5.73	2.23	0.019	0.765	8.89	NS	0.225	8.12	84	0.03	3.09	1.8
9/25/17	1.41	339.28	16.6	2.62	0.022	0.981	7.96	NS	0.228	18.1	67.4	0.029	2.81	2.45
9/28/17	3.70	328.25	0.824	0.26	0.005	0.063	1.99	NS	0.065	1.49	7.3	0.02	0.696	0.553
10/1/17	1.80	57.38	6.03	4.98	0.014	11.9	3.76	NS	0.084	9.96	29.9	0.031	0.806	2.49
10/4/17	2.85	179.09	4.67	28	0.097	7.19	7.4	NS	0.272	20.3	93.3	0.037	1.94	9.1
10/7/17	3.30	156.68	14.8	10.6	0.014	66.3	4.45	NS	0.103	18.8	36.4	0.034	1.08	148

[a] All concentrations are in ng/m^3
ND: Non-detect
NS: No sample taken

Appendix D-1. Art Glass Assessment Concentrations[a]

Sample Date	Average 24-Hour Wind Speed (mph)	Average 24-Hour Wind Direction (°)	Antimony (PM_{10})	Arsenic (PM_{10})	Beryllium (PM_{10})	Cadmium (PM_{10})	Chromium (PM_{10})	Chromium VI (TSP)	Cobalt (PM_{10})	Lead (PM_{10})	Manganese (PM_{10})	Mercury (PM_{10})	Nickel (PM_{10})	Selenium (PM_{10})
Kopp Monitoring Station A (42-003-KOPA)														
10/10/17	1.56	34.90	2.04	1.82	0.006	0.371	3.76	NS	0.084	2.98	10.5	0.02	1.76	2.27
10/11/17	2.12	26.59	3.38	10	0.009	6.53	2.99	NS	0.112	6.06	14	0.021	1.25	10.5
10/12/17	2.93	104.32	1.62	3.14	0.003	0.321	2.81	NS	0.068	6.38	7.62	0.019	0.788	0.831
10/13/17	3.73	115.65	16	27.8	0.007	3.93	3.13	NS	0.134	24.3	13.4	0.01	1.03	33

[a] All concentrations are in ng/m^3
ND: Non-detect
NS: No sample taken

Appendix D-1. Art Glass Assessment Concentrations[a]

Sample Date	Average 24-Hour Wind Speed (mph)	Average 24-Hour Wind Direction (°)	Antimony (PM_{10})	Arsenic (PM_{10})	Beryllium (PM_{10})	Cadmium (PM_{10})	Chromium (PM_{10})	Chromium VI (TSP)	Cobalt (PM_{10})	Lead (PM_{10})	Manganese (PM_{10})	Mercury (PM_{10})	Nickel (PM_{10})	Selenium (PM_{10})
Kopp Monitoring Station B (42-003-KOPB)														
7/30/17	2.00	354.65	3.49	2.19	0.004	0.697	2.29	NS	0.062	6.4	4.98	0.019	0.73	1.24
8/2/17	2.57	134.46	2.66	3.81	0.031	0.738	5.93	NS	0.227	17.4	51.5	0.041	2.11	3.62
8/5/17	4.13	282.50	1.07	0.656	0.002	4.27	1.71	NS	0.05	8.64	2.71	0.016	0.331	2.41
8/8/17	2.93	347.70	18.4	2.95	0.005	53.3	3.76	NS	0.309	5.97	6.51	0.026	23.3	175
8/11/17	2.50	148.32	3.78	2.81	0.02	7.19	3.68	NS	0.122	14.8	48	0.035	1.2	20.5
8/14/17	2.43	202.05	3.07	2.78	0.013	0.447	4.21	NS	0.126	17.8	28.5	0.035	1.18	1.42
8/17/17	2.85	168.67	2.5	2.14	0.022	0.363	6.06	NS	0.19	13.8	52.9	0.025	1.54	1.73
8/20/17	1.88	116.79	3.51	5.15	0.02	1.86	4.72	NS	0.09	76.6	51.9	0.028	0.819	4.26
8/23/17	2.83	336.64	6.6	3.29	0.006	67.8	3.62	NS	0.09	25.5	8.23	0.023	1.14	142
8/26/17	1.78	21.68	5.01	2.94	0.003	13.4	3.98	NS	0.063	16	7.58	0.019	0.718	29.7
8/29/17	3.12	94.37	0.815	0.449	0.003	0.08	2.26	NS	0.071	1.6	10.5	0.007	0.489	0.308
9/1/17	1.88	352.89	0.83	0.385	0.002	0.101	1.57	NS	0.035	2.33	3.92	0.021	0.383	0.43
9/4/17	4.25	169.10	1.78	3.54	0.028	1.49	2.5	NS	0.07	18.1	35.9	0.039	0.674	1.96
9/7/17	3.32	265.73	1.78	0.781	0.003	2.27	3.19	NS	0.079	2.77	5.39	0.021	1.52	1.08
9/10/17	2.05	58.17	1.55	0.884	0.003	47.4	2.13	NS	0.032	4.89	8.74	0.023	0.543	4.1
9/13/17	2.35	305.63	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
9/16/17	1.41	16.20	6.39	4.31	0.004	19.7	3.58	NS	0.101	9.27	12.3	0.036	1.19	23.9
9/19/17	1.83	73.59	3.03	2.06	0.013	1.35	5.14	NS	0.149	9.06	32.4	0.03	2.01	1.91
9/22/17	1.53	2.83	10.3	2.73	0.021	1.83	8.72	NS	0.225	10	78.4	0.031	3.02	3.92
9/25/17	1.41	339.28	13.6	2.24	0.019	0.467	7.74	NS	0.194	17.4	58.8	0.026	2.58	1.59
9/28/17	3.70	328.25	6.74	6.45	0.007	11.1	2.33	NS	0.104	6.33	6.75	0.019	0.829	3.99
10/1/17	1.80	57.38	3.18	4.03	0.013	1.7	3.1	NS	0.085	9.61	31	0.02	0.64	0.993
10/4/17	2.85	179.09	3.33	3.41	0.096	1.28	6.52	NS	0.242	18.5	88	0.033	1.92	2.41
10/7/17	3.30	156.68	3.27	3.58	0.011	1.24	3.48	NS	0.083	10.5	30.6	0.032	0.78	1.24
10/10/17	1.56	34.90	3.76	3.77	0.005	1.75	3.85	NS	0.115	4.87	9.85	0.023	1.84	7.86
10/11/17	2.12	26.59	3	2.64	0.018	9.07	2.95	NS	0.146	6.82	14.3	0.021	1.12	15.6

[a] All concentrations are in ng/m^3
ND: Non-detect
NS: No sample taken

Appendix D-1. Art Glass Assessment Concentrations[a]

Sample Date	Average 24-Hour Wind Speed (mph)	Average 24-Hour Wind Direction (°)	Antimony (PM_{10})	Arsenic (PM_{10})	Beryllium (PM_{10})	Cadmium (PM_{10})	Chromium (PM_{10})	Chromium VI (TSP)	Cobalt (PM_{10})	Lead (PM_{10})	Manganese (PM_{10})	Mercury (PM_{10})	Nickel (PM_{10})	Selenium (PM_{10})
Kopp Monitoring Station B (42-003-KOPB)														
10/12/17	2.93	104.32	1.51	0.886	0.002	0.989	2.06	NS	0.052	5.48	5.39	0.019	0.685	0.764
10/13/17	3.73	115.65	0.928	0.542	0.003	0.106	3.22	NS	0.139	2.28	13	0.009	1.09	0.3

[a] All concentrations are in ng/m^3
ND: Non-detect
NS: No sample taken

Appendix D-1. Art Glass Assessment Concentrations[a]

Sample Date	Average 24-Hour Wind Speed (mph)	Average 24-Hour Wind Direction (°)	Antimony (PM_{10})	Arsenic (PM_{10})	Beryllium (PM_{10})	Cadmium (PM_{10})	Chromium (PM_{10})	Chromium VI (TSP)	Cobalt (PM_{10})	Lead (PM_{10})	Manganese (PM_{10})	Mercury (PM_{10})	Nickel (PM_{10})	Selenium (PM_{10})
Paul Wissmach Glass Company (54-103-PWGC)														
4/19/17	2.97	178.35	25.6	2.36	0.015	2.83	6.33	NS	3.97	2.25	7.03	0.028	1.75	15.9
4/22/17	4.08	18.12	0.532	2.1	0.002	0.084	2.02	NS	0.389	1.31	2.9	0.033	0.37	2.27
4/25/17	2.26	27.27	0.027	0.02	ND	0.007	1.22	NS	0.008	0.026	0.181	0.008	0.129	0.018
5/1/17	5.71	219.71	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
5/4/17	3.31	85.51	2.93	0.583	0.004	1.43	2.7	NS	0.367	1.44	4.16	0.015	0.525	1.01
5/7/17	4.03	221.37	14	1.19	0.002	3.64	6.18	NS	0.183	1.92	4.89	0.113	0.253	2.52
5/10/17	1.60	131.58	7.83	2.01	0.008	2.89	7.59	NS	0.292	3.6	20.2	0.019	0.736	2.82
5/13/17	2.20	109.72	1.4	5.91	0.005	0.265	3.84	NS	0.118	19.9	4.93	0.013	0.913	0.675
5/16/17	2.04	127.60	27.5	2.54	0.013	3.82	11.9	NS	6.87	3.17	30.7	0.027	1.82	4.91
5/19/17	1.50	181.44	16.3	1.29	0.007	1.17	5.41	NS	2.1	1.36	17.5	0.019	0.999	1.27
5/22/17	2.85	214.18	21.9	1.77	0.003	4.53	4.2	NS	1.36	1.66	10.9	0.033	2.09	1.34
5/25/17	3.07	179.76	35.7	3.13	0.002	8.59	6.67	NS	0.459	1.64	7.28	0.025	0.336	4.87
5/28/17	2.39	139.71	5.81	1.63	0.005	0.859	6.45	NS	0.078	2.2	4.95	0.015	0.474	1.63
5/31/17	2.50	139.70	33.9	3.48	0.007	2.8	2.92	NS	0.326	2.82	13.4	0.017	0.356	6.45
6/3/17	1.21	107.11	7.9	1.3	0.011	2.33	2.59	NS	0.319	2.94	13.6	0.016	0.405	15.2
6/6/17	1.49	164.45	5.76	0.658	0.003	0.288	1.69	NS	0.12	1.04	3.18	0.01	0.302	1.49
6/9/17	1.64	149.55	22.9	2.62	0.01	3.84	4.21	NS	3.15	8.13	12.7	0.022	0.491	4.5
6/12/17	1.46	159.47	13.5	1.5	0.009	2.07	5.61	NS	0.476	2.49	11.2	0.015	0.41	3.04
6/15/17	1.98	124.18	14.3	1.59	0.006	1.27	3.68	NS	0.692	1.55	4.68	0.017	0.3	2.36
6/18/17	3.28	197.52	24	4.58	0.007	8.65	12.3	NS	3.24	4.93	7.82	0.061	0.415	5.8
6/21/17	1.56	146.81	31.5	1.78	0.008	2.77	7.97	NS	3.8	2.05	20.3	0.02	0.505	1.93
6/24/17	5.80	239.97	13	2.49	0.004	45.2	6.82	NS	0.973	1.87	8.52	0.031	6.7	2.58
6/27/17	2.33	184.05	8.44	0.812	0.002	0.375	3.08	NS	0.598	1.02	8.12	0.015	0.656	0.554
6/30/17	2.59	190.77	24.4	2.39	0.006	9.96	2.9	NS	0.7	2.38	7.59	0.015	0.713	15.2
7/3/17	1.23	126.24	1.04	1	0.008	0.267	2.78	NS	0.12	3.92	13.7	0.012	0.646	0.899
7/6/17	0.94	96.33	1.05	0.673	0.002	0.183	1.58	NS	0.065	0.686	4.99	0.005	0.272	0.62

[a] All concentrations are in ng/m^3

ND: Non-detect

NS: No sample taken

Appendix D-1. Art Glass Assessment Concentrations[a]

Sample Date	Average 24-Hour Wind Speed (mph)	Average 24-Hour Wind Direction (°)	Antimony (PM_{10})	Arsenic (PM_{10})	Beryllium (PM_{10})	Cadmium (PM_{10})	Chromium (PM_{10})	Chromium VI (TSP)	Cobalt (PM_{10})	Lead (PM_{10})	Manganese (PM_{10})	Mercury (PM_{10})	Nickel (PM_{10})	Selenium (PM_{10})
Paul Wissmach Glass Company (54-103-PWGC)														
7/9/17	1.46	123.08	3.66	0.675	0.003	1.29	2.54	NS	0.046	1.66	4.98	0.012	0.354	2.63
7/12/17	1.80	160.24	24.3	3.88	0.007	8.67	4.19	NS	0.34	1.86	15.7	0.011	9.49	47
7/15/17	1.16	86.22	1.76	1.06	0.002	0.124	1.8	NS	0.13	1.63	3.38	0.018	0.482	1.09
7/18/17	1.25	128.43	7.92	1.12	0.006	0.178	1.59	NS	0.066	3.66	5.6	0.008	0.467	1.45
7/21/17	1.39	120.50	21.7	3.27	0.006	5.13	1.51	NS	0.148	5.51	3.27	0.012	0.245	3.05
7/24/17	2.59	220.05	9.83	1.2	0.004	2.11	2.28	NS	0.358	2.17	4.01	0.036	0.69	2.21
7/27/17	1.54	141.08	15.2	1.09	0.007	2.21	3.8	NS	1.19	3.03	7.03	0.008	0.619	36
7/30/17	1.34	135.85	0.676	0.904	0.003	0.115	1.89	NS	0.032	1.82	2.11	0.015	0.412	1.43
8/2/17	1.35	149.00	15.3	1.09	0.01	1.23	4.96	NS	0.861	2.8	8.77	0.015	0.47	191
8/5/17	3.87	229.90	15.5	3.29	0.002	2.07	5.62	NS	0.118	1.97	7.7	0.018	0.508	182
8/8/17	2.41	348.94	0.745	1.34	0.003	0.144	1.55	NS	0.032	1.09	2.51	0.012	0.38	12.5
8/11/17	1.39	115.77	3.62	0.934	0.004	0.426	1.98	NS	0.116	1.91	4.01	0.011	0.315	3.26
8/14/17	1.89	89.70	7.71	1.14	0.005	0.888	3.02	NS	1.03	2.38	6.24	0.012	0.733	4.95
8/17/17	1.82	108.26	5.18	1.09	0.003	2.58	3.49	NS	1.09	2.19	9.44	0.019	0.567	3.98
8/20/17	1.61	97.59	0.61	0.603	0.002	0.223	1.62	NS	0.036	3.33	2.31	0.015	0.141	0.782
8/23/17	1.91	188.86	4.03	0.607	0.002	1.18	3.06	NS	1.52	1.88	6.53	0.012	0.937	1.28
8/26/17	2.36	14.26	0.806	1.92	0.007	0.103	1.78	NS	0.052	2.52	4.37	0.016	0.515	1.03
8/29/17	1.89	88.27	0.339	0.307	0.005	0.093	1.56	NS	0.061	0.806	4.32	0.01	0.354	0.297
9/1/17	5.72	57.93	0.547	0.417	0.006	0.116	1.77	NS	0.078	1.67	5.29	0.009	0.528	0.41
9/4/17	2.29	123.98	38	2.47	0.008	17.5	4.84	NS	0.184	10.9	5.02	0.015	0.356	7.03
9/7/17	2.46	178.66	37.9	1.78	0.006	29	10.6	NS	6.31	2.67	7.65	0.016	0.384	6.59
9/10/17	1.64	112.59	0.74	1.27	0.002	0.24	1.3	NS	0.03	2.85	2.35	0.009	0.235	0.378
9/13/17	1.37	134.56	19.9	0.753	0.004	1.34	4.99	NS	7.8	1.35	24.8	0.007	0.293	4.48
9/16/17	1.68	97.54	2.29	0.778	0.002	0.102	1.18	NS	0.209	1.62	2.1	0.005	0.326	1.01
9/19/17	1.84	108.69	4.77	0.927	0.006	0.946	1.77	NS	0.256	1.97	12.5	0.009	0.56	1.54
9/22/17	1.54	72.99	1.22	1.04	0.018	0.313	2.73	NS	0.132	2.34	8.44	0.008	0.544	4.32

[a] All concentrations are in ng/m^3

ND: Non-detect

NS: No sample taken

Appendix D-1. Art Glass Assessment Concentrations[a]

Sample Date	Average 24-Hour Wind Speed (mph)	Average 24-Hour Wind Direction (°)	Antimony (PM_{10})	Arsenic (PM_{10})	Beryllium (PM_{10})	Cadmium (PM_{10})	Chromium (PM_{10})	Chromium VI (TSP)	Cobalt (PM_{10})	Lead (PM_{10})	Manganese (PM_{10})	Mercury (PM_{10})	Nickel (PM_{10})	Selenium (PM_{10})
Paul Wissmach Glass Company (54-103-PWGC)														
9/25/17	1.67	96.48	9.17	1.19	0.009	0.23	1.91	NS	1.03	3.96	15.5	0.025	5.42	3.66
9/28/17	2.76	147.16	1.27	0.483	0.011	0.149	1.84	NS	0.155	0.981	8.01	0.025	0.479	1.42
10/1/17	2.56	71.45	0.674	0.871	0.007	0.077	1.75	NS	0.057	1.89	4.94	0.015	0.301	0.315
10/4/17	1.42	163.36	29.9	1.3	0.015	0.796	3.38	NS	4.36	2.46	22.7	0.012	0.527	4.03
10/7/17	1.70	136.95	7.66	1.22	0.006	0.789	2.35	NS	1.09	2.2	6.36	0.012	0.95	4.38
10/10/17	1.07	97.14	0.732	0.828	0.002	0.106	1.45	NS	0.057	1.45	2.54	0.011	0.297	0.618
10/13/17	1.03	122.46	9.04	1.41	0.004	0.3	1.48	NS	0.574	0.982	3.66	0.01	0.886	0.716
10/16/17	3.84	211.59	8.77	0.883	0.002	0.755	2	NS	0.558	1.03	2.96	0.017	0.748	7.77
10/19/17	1.64	130.76	26.7	1.63	0.01	1.38	2.97	NS	1.02	2.74	12.1	0.013	5.12	10.5
10/22/17	1.38	123.92	9.19	2.22	0.007	0.662	1.49	NS	0.163	7.14	5.31	0.01	0.408	1.04
10/25/17	2.48	204.20	22.5	0.939	0.004	0.275	1.43	NS	0.669	1.06	7.05	0.013	1.74	1
10/28/17	2.51	198.33	14.7	1.49	0.003	0.274	2.01	NS	0.337	11.9	4.93	0.009	0.776	0.809
10/29/17	1.96	179.45	26.5	0.957	0.002	4.74	8.06	NS	0.166	475	3.08	0.014	0.32	2.4
10/30/17	7.77	244.34	65.5	2.54	0.012	2.94	16.4	NS	0.776	232	11.8	0.027	1.75	4.53
10/31/17	2.54	178.48	42.4	1.15	0.007	1.07	7.61	NS	5.81	15.4	14	0.012	1.38	1.56
11/3/17	1.24	162.31	2.41	1.65	0.003	0.177	1.59	NS	0.151	1.95	3.39	0.008	0.503	0.787
11/6/17	2.54	182.19	1.78	0.323	0.0004	0.076	1.44	NS	0.304	0.977	1.41	0.005	0.229	0.418
11/9/17	1.75	118.94	17.1	2.27	0.008	0.408	9.61	NS	3.75	11.3	22.6	0.026	34.3	2.3
11/12/17	1.27	91.38	1.63	1.09	0.008	0.222	3.45	NS	0.093	2.89	6.12	0.012	0.41	1.14
11/15/17	2.00	99.95	11.9	0.955	0.006	0.522	6.84	NS	0.219	2.48	11.8	0.011	0.391	1.34
11/18/17	1.56	135.35	3.42	0.907	0.005	0.799	5.04	NS	0.279	1.99	5.12	0.009	0.544	1.74
11/21/17	2.56	167.43	40.1	2.69	0.012	0.871	9.3	NS	0.954	3.86	11.8	0.013	1.43	3.06
11/24/17	0.96	153.02	3.09	0.514	0.007	0.404	1.73	NS	0.252	3.26	6.96	0.013	0.35	0.819
11/27/17	0.91	171.93	26.8	1.21	0.013	457	4.52	NS	0.694	3.98	21	0.022	2.5	132
11/30/17	3.50	93.47	24.9	1.52	0.013	334	3.77	NS	0.293	4.88	17.1	0.027	0.843	150

[a] All concentrations are in ng/m^3
ND: Non-detect
NS: No sample taken

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Appendix D-2: Art Glass Assessment Replicate Data

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Appendix D-2. Primary and Replicate Concentrations

Pollutant	Sample Date	Primary Value	Replicate Value	MDL	Units	ERG Source ID
Kokomo Monitoring Station (18-067-0005)						
Antimony	11/30/16	1.02	1.04	0.017	ng/m³ Air	6110336-01
Antimony	12/5/16	1.47	1.46	0.017	ng/m³ Air	6110336-26
Antimony	12/5/16	1.58	1.58	0.017	ng/m³ Air	6110336-62
Antimony	2/15/17	0.332	0.328	0.017	ng/m³ Air	7020934-07
Antimony	5/12/17	0.548	0.537	0.016	ng/m³ Air	7041414-12
Antimony	5/12/17	1.25	1.26	0.016	ng/m³ Air	7041414-17
Antimony	5/12/17	10.2	10	0.016	ng/m³ Air	7041414-20
Antimony	5/30/17	0.301	0.299	0.016	ng/m³ Air	7041414-24
Antimony	8/2/17	3.2	3.25	0.016	ng/m³ Air	7071208-03
Arsenic	11/30/16	0.813	0.813	0.039	ng/m³ Air	6110336-01
Arsenic	12/5/16	2.52	2.53	0.039	ng/m³ Air	6110336-26
Arsenic	12/5/16	1.49	1.49	0.039	ng/m³ Air	6110336-62
Arsenic	2/15/17	0.241	0.245	0.039	ng/m³ Air	7020934-07
Arsenic	5/12/17	0.278	0.283	0.04	ng/m³ Air	7041414-12
Arsenic	5/12/17	0.777	0.781	0.04	ng/m³ Air	7041414-20
Arsenic	5/12/17	1.59	1.57	0.04	ng/m³ Air	7041414-17
Arsenic	5/30/17	0.25	0.242	0.04	ng/m³ Air	7041414-24
Arsenic	8/2/17	3.18	3.26	0.04	ng/m³ Air	7071208-03
Beryllium	11/30/16	0.022	0.024	0.001	ng/m³ Air	6110336-01
Beryllium	12/5/16	0.005	0.004	0.001	ng/m³ Air	6110336-26
Beryllium	12/5/16	0.005	0.005	0.001	ng/m³ Air	6110336-62
Beryllium	2/15/17	0.004	0.004	0.001	ng/m³ Air	7020934-07
Beryllium	5/12/17	0.009	0.009	0.001	ng/m³ Air	7041414-12
Beryllium	5/12/17	0.012	0.013	0.001	ng/m³ Air	7041414-17
Beryllium	5/12/17	0.01	0.011	0.001	ng/m³ Air	7041414-20
Beryllium	5/30/17	0.005	0.004	0.001	ng/m³ Air	7041414-24
Beryllium	8/2/17	0.019	0.019	0.001	ng/m³ Air	7071208-03
Cadmium	11/30/16	0.494	0.497	0.002	ng/m³ Air	6110336-01
Cadmium	12/5/16	0.161	0.168	0.002	ng/m³ Air	6110336-26
Cadmium	12/5/16	14.6	14.7	0.002	ng/m³ Air	6110336-62
Cadmium	2/15/17	0.039	0.039	0.002	ng/m³ Air	7020934-07
Cadmium	5/12/17	0.059	0.062	0.002	ng/m³ Air	7041414-12
Cadmium	5/12/17	0.2	0.202	0.002	ng/m³ Air	7041414-17
Cadmium	5/12/17	28.2	28	0.002	ng/m³ Air	7041414-20
Cadmium	5/30/17	0.104	0.101	0.002	ng/m³ Air	7041414-24
Cadmium	8/2/17	2.57	2.58	0.002	ng/m³ Air	7071208-03
Chromium	11/30/16	3.37	0	4.18	ng/m³ Air	6110336-01
Chromium	12/5/16	4.44	4.45	4.18	ng/m³ Air	6110336-26
Chromium	12/5/16	4.7	4.72	4.18	ng/m³ Air	6110336-62
Chromium	2/15/17	2.96	0	4.18	ng/m³ Air	7020934-07
Chromium	5/12/17	2.97	0	3.59	ng/m³ Air	7041414-12
Chromium	5/12/17	2.4	0	3.59	ng/m³ Air	7041414-17
Chromium	5/12/17	4.36	4.36	3.59	ng/m³ Air	7041414-20
Chromium	5/30/17	1.97	0	3.59	ng/m³ Air	7041414-24
Chromium	8/2/17	4.75	4.8	3.59	ng/m³ Air	7071208-03

Appendix D-2. Primary and Replicate Concentrations

Pollutant	Sample Date	Primary Value	Replicate Value	MDL	Units	ERG Source ID
Kokomo Monitoring Station (18-067-0005)						
Cobalt	11/30/16	0.486	0.489	0.097	ng/m³ Air	6110336-01
Cobalt	12/5/16	0.643	0.641	0.097	ng/m³ Air	6110336-26
Cobalt	12/5/16	0.203	0.208	0.097	ng/m³ Air	6110336-62
Cobalt	2/15/17	0.047	0	0.097	ng/m³ Air	7020934-07
Cobalt	5/12/17	0.135	0.132	0.079	ng/m³ Air	7041414-17
Cobalt	5/12/17	0.573	0.579	0.079	ng/m³ Air	7041414-12
Cobalt	5/12/17	1.27	1.27	0.079	ng/m³ Air	7041414-20
Cobalt	5/30/17	0.163	0.162	0.079	ng/m³ Air	7041414-24
Cobalt	8/2/17	0.281	0.288	0.079	ng/m³ Air	7071208-03
Lead	11/30/16	2.6	2.56	0.034	ng/m³ Air	6110336-01
Lead	12/5/16	2.96	2.98	0.034	ng/m³ Air	6110336-26
Lead	12/5/16	2.42	2.45	0.034	ng/m³ Air	6110336-62
Lead	2/15/17	1.22	1.24	0.034	ng/m³ Air	7020934-07
Lead	5/12/17	2.61	2.58	0.028	ng/m³ Air	7041414-20
Lead	5/12/17	3.84	3.86	0.028	ng/m³ Air	7041414-17
Lead	5/12/17	1.71	1.72	0.028	ng/m³ Air	7041414-12
Lead	5/30/17	1.52	1.53	0.028	ng/m³ Air	7041414-24
Lead	8/2/17	15.2	15.4	0.028	ng/m³ Air	7071208-03
Manganese	11/30/16	16.8	16.9	0.143	ng/m³ Air	6110336-01
Manganese	12/5/16	5.03	5	0.143	ng/m³ Air	6110336-26
Manganese	12/5/16	4.35	4.28	0.143	ng/m³ Air	6110336-62
Manganese	2/15/17	3.83	3.86	0.143	ng/m³ Air	7020934-07
Manganese	5/12/17	21.2	21	0.113	ng/m³ Air	7041414-20
Manganese	5/12/17	10.6	10.6	0.113	ng/m³ Air	7041414-12
Manganese	5/12/17	10.1	10.1	0.113	ng/m³ Air	7041414-17
Manganese	5/30/17	7.41	7.5	0.113	ng/m³ Air	7041414-24
Manganese	8/2/17	70.8	71.3	0.113	ng/m³ Air	7071208-03
Mercury	11/30/16	0.017	0.021	0.017	ng/m³ Air	6110336-01
Mercury	12/5/16	0.007	0	0.017	ng/m³ Air	6110336-26
Mercury	12/5/16	0.012	0	0.017	ng/m³ Air	6110336-62
Mercury	2/15/17	0.013	0.019	0.017	ng/m³ Air	7020934-07
Mercury	5/12/17	0.032	0.033	0.016	ng/m³ Air	7041414-20
Mercury	5/12/17	0.011	0	0.016	ng/m³ Air	7041414-17
Mercury	5/12/17	0.01	0	0.016	ng/m³ Air	7041414-12
Mercury	5/30/17	0.009	0	0.016	ng/m³ Air	7041414-24
Mercury	8/2/17	0.062	0.07	0.016	ng/m³ Air	7071208-03
Nickel	11/30/16	66	65.8	1.02	ng/m³ Air	6110336-01RE1
Nickel	12/5/16	3.01	2.97	0.204	ng/m³ Air	6110336-26
Nickel	12/5/16	1.32	1.8	0.204	ng/m³ Air	6110336-62
Nickel	2/15/17	0.566	0.548	0.204	ng/m³ Air	7020934-07
Nickel	5/12/17	2	1.99	0.23	ng/m³ Air	7041414-12
Nickel	5/12/17	1.44	1.43	0.23	ng/m³ Air	7041414-17
Nickel	5/12/17	0.7	0.695	0.23	ng/m³ Air	7041414-20
Nickel	5/30/17	0.673	0.686	0.23	ng/m³ Air	7041414-24
Nickel	8/2/17	1.37	1.38	0.23	ng/m³ Air	7071208-03

Appendix D-2. Primary and Replicate Concentrations

Pollutant	Sample Date	Primary Value	Replicate Value	MDL	Units	ERG Source ID
Kopp Monitoring Stations A/B (42-003-KOPA, 42-003-KOPB)						
Antimony	6/8/17	4.85	4.79	0.016	ng/m³ Air	7050501-09
Antimony	6/15/17	8.2	8.18	0.016	ng/m³ Air	7050501-34
Antimony	7/11/17	2.29	2.26	0.016	ng/m³ Air	7060201-03
Antimony	8/2/17	3.2	3.25	0.016	ng/m³ Air	7071208-03
Antimony	8/10/17	1.9	1.87	0.016	ng/m³ Air	7080401-07
Antimony	8/10/17	1.17	1.17	0.016	ng/m³ Air	7080401-05
Antimony	9/1/17	4.47	5.04	0.016	ng/m³ Air	7082424-06RE1
Antimony	9/1/17	3.08	3.07	0.016	ng/m³ Air	7082424-13
Antimony	9/22/17	2.53	2.5	0.016	ng/m³ Air	7092018-07
Antimony	9/22/17	10.1	10.2	0.016	ng/m³ Air	7092018-01
Arsenic	6/8/17	0.498	0.499	0.04	ng/m³ Air	7050501-09
Arsenic	6/15/17	2.1	2.13	0.04	ng/m³ Air	7050501-34
Arsenic	7/11/17	1.35	1.36	0.04	ng/m³ Air	7060201-03
Arsenic	8/2/17	3.18	3.26	0.04	ng/m³ Air	7071208-03
Arsenic	8/10/17	0.525	0.528	0.04	ng/m³ Air	7080401-07
Arsenic	8/10/17	0.452	0.463	0.04	ng/m³ Air	7080401-05
Arsenic	9/1/17	2.82	2.78	0.04	ng/m³ Air	7082424-13
Arsenic	9/1/17	2.86	3.08	0.04	ng/m³ Air	7082424-06RE1
Arsenic	9/22/17	5.03	5.02	0.04	ng/m³ Air	7092018-01
Arsenic	9/22/17	2.11	2.14	0.04	ng/m³ Air	7092018-07
Beryllium	6/8/17	0.008	0.008	0.001	ng/m³ Air	7050501-09
Beryllium	6/15/17	0.025	0.025	0.001	ng/m³ Air	7050501-34
Beryllium	7/11/17	0.004	0.003	0.001	ng/m³ Air	7060201-03
Beryllium	8/2/17	0.019	0.019	0.001	ng/m³ Air	7071208-03
Beryllium	8/10/17	0.003	0.003	0.001	ng/m³ Air	7080401-07
Beryllium	8/10/17	0.002	0.003	0.001	ng/m³ Air	7080401-05
Beryllium	9/1/17	0.014	0.014	0.001	ng/m³ Air	7082424-06RE1
Beryllium	9/1/17	0.013	0.013	0.001	ng/m³ Air	7082424-13
Beryllium	9/22/17	0.024	0.022	0.001	ng/m³ Air	7092018-07
Beryllium	9/22/17	0.025	0.026	0.001	ng/m³ Air	7092018-01
Cadmium	6/8/17	13.2	13.1	0.002	ng/m³ Air	7050501-09
Cadmium	6/15/17	8.24	8.2	0.002	ng/m³ Air	7050501-34
Cadmium	7/11/17	0.894	0.888	0.002	ng/m³ Air	7060201-03
Cadmium	8/2/17	2.57	2.58	0.002	ng/m³ Air	7071208-03
Cadmium	8/10/17	0.624	0.644	0.002	ng/m³ Air	7080401-07
Cadmium	8/10/17	0.08	0.079	0.002	ng/m³ Air	7080401-05
Cadmium	9/1/17	0.441	0.447	0.002	ng/m³ Air	7082424-13
Cadmium	9/1/17	0.992	1.08	0.002	ng/m³ Air	7082424-06RE1
Cadmium	9/22/17	0.36	0.363	0.002	ng/m³ Air	7092018-07
Cadmium	9/22/17	2.8	2.8	0.002	ng/m³ Air	7092018-01
Chromium	6/8/17	3.8	3.77	3.59	ng/m³ Air	7050501-09
Chromium	6/15/17	13	13	3.59	ng/m³ Air	7050501-34
Chromium	7/11/17	3.3	0	3.59	ng/m³ Air	7060201-03
Chromium	8/2/17	4.75	4.8	3.59	ng/m³ Air	7071208-03
Chromium	8/10/17	2.38	0	3.59	ng/m³ Air	7080401-05

Appendix D-2. Primary and Replicate Concentrations

Pollutant	Sample Date	Primary Value	Replicate Value	MDL	Units	ERG Source ID
Kopp Monitoring Stations A/B (42-003-KOPA, 42-003-KOPB)						
Chromium	8/10/17	2	0	3.59	ng/m³ Air	7080401-07
Chromium	9/1/17	4.19	4.52	3.59	ng/m³ Air	7082424-06RE1
Chromium	9/1/17	4.25	4.21	3.59	ng/m³ Air	7082424-13
Chromium	9/22/17	6.83	6.79	3.59	ng/m³ Air	7092018-01
Chromium	9/22/17	6.11	6.06	3.59	ng/m³ Air	7092018-07
Cobalt	6/8/17	0.125	0.124	0.079	ng/m³ Air	7050501-09
Cobalt	6/15/17	0.312	0.313	0.079	ng/m³ Air	7050501-34
Cobalt	7/11/17	0.074	0	0.079	ng/m³ Air	7060201-03
Cobalt	8/2/17	0.281	0.288	0.079	ng/m³ Air	7071208-03
Cobalt	8/10/17	0.093	0.096	0.079	ng/m³ Air	7080401-05
Cobalt	8/10/17	0.101	0	0.079	ng/m³ Air	7080401-07
Cobalt	9/1/17	0.125	0.126	0.079	ng/m³ Air	7082424-13
Cobalt	9/1/17	0.114	0.116	0.079	ng/m³ Air	7082424-06RE1
Cobalt	9/22/17	0.19	0.19	0.079	ng/m³ Air	7092018-07
Cobalt	9/22/17	0.213	0.212	0.079	ng/m³ Air	7092018-01
Lead	6/8/17	3.4	3.39	0.028	ng/m³ Air	7050501-09
Lead	6/15/17	26.9	27	0.028	ng/m³ Air	7050501-34
Lead	7/11/17	3.63	3.58	0.028	ng/m³ Air	7060201-03
Lead	8/2/17	15.2	15.4	0.028	ng/m³ Air	7071208-03
Lead	8/10/17	2.81	2.8	0.028	ng/m³ Air	7080401-07
Lead	8/10/17	1.16	1.14	0.028	ng/m³ Air	7080401-05
Lead	9/1/17	17	19.5	0.028	ng/m³ Air	7082424-06RE1
Lead	9/1/17	17.7	17.8	0.028	ng/m³ Air	7082424-13
Lead	9/22/17	13.9	13.8	0.028	ng/m³ Air	7092018-07
Lead	9/22/17	17.1	17	0.028	ng/m³ Air	7092018-01
Manganese	6/8/17	11.4	11.4	0.113	ng/m³ Air	7050501-09
Manganese	6/15/17	137	135	0.113	ng/m³ Air	7050501-34
Manganese	7/11/17	5.06	4.95	0.113	ng/m³ Air	7060201-03
Manganese	8/2/17	70.8	71.3	0.113	ng/m³ Air	7071208-03
Manganese	8/10/17	8.37	8.26	0.113	ng/m³ Air	7080401-07
Manganese	8/10/17	7.11	7.21	0.113	ng/m³ Air	7080401-05
Manganese	9/1/17	25.8	27.1	0.113	ng/m³ Air	7082424-06RE1
Manganese	9/1/17	28.6	28.5	0.113	ng/m³ Air	7082424-13
Manganese	9/22/17	52.8	52.9	0.113	ng/m³ Air	7092018-07
Manganese	9/22/17	53.3	52.7	0.113	ng/m³ Air	7092018-01
Mercury	6/8/17	0.025	0.033	0.016	ng/m³ Air	7050501-09
Mercury	6/15/17	0.085	0.093	0.016	ng/m³ Air	7050501-34
Mercury	7/11/17	0.012	0	0.016	ng/m³ Air	7060201-03
Mercury	8/2/17	0.062	0.07	0.016	ng/m³ Air	7071208-03
Mercury	8/10/17	0.026	0.031	0.016	ng/m³ Air	7080401-05
Mercury	8/10/17	0.028	0.028	0.016	ng/m³ Air	7080401-07
Mercury	9/1/17	0.035	0.036	0.016	ng/m³ Air	7082424-06RE1
Mercury	9/1/17	0.035	0.035	0.016	ng/m³ Air	7082424-13
Mercury	9/22/17	0.026	0.025	0.016	ng/m³ Air	7092018-07
Mercury	9/22/17	0.024	0.028	0.016	ng/m³ Air	7092018-01

Appendix D-2. Primary and Replicate Concentrations

Pollutant	Sample Date	Primary Value	Replicate Value	MDL	Units	ERG Source ID
Kopp Monitoring Stations A/B (42-003-KOPA, 42-003-KOPB)						
Nickel	6/8/17	2.46	2.41	0.23	ng/m³ Air	7050501-09
Nickel	6/15/17	2.3	2.27	0.23	ng/m³ Air	7050501-34
Nickel	7/11/17	0.767	0.755	0.23	ng/m³ Air	7060201-03
Nickel	8/2/17	1.37	1.38	0.23	ng/m³ Air	7071208-03
Nickel	8/10/17	1.1	1.1	0.23	ng/m³ Air	7080401-05
Nickel	8/10/17	1.12	1.1	0.23	ng/m³ Air	7080401-07
Nickel	9/1/17	1.18	1.18	0.23	ng/m³ Air	7082424-13
Nickel	9/1/17	1.16	1.23	0.23	ng/m³ Air	7082424-06RE1
Nickel	9/22/17	1.53	1.54	0.23	ng/m³ Air	7092018-07
Nickel	9/22/17	10.2	10	0.23	ng/m³ Air	7092018-01
Selenium	6/8/17	12.6	12.5	0.036	ng/m³ Air	7050501-09
Selenium	6/15/17	3.17	3.1	0.036	ng/m³ Air	7050501-34
Selenium	7/11/17	4.76	4.59	0.036	ng/m³ Air	7060201-03
Selenium	8/2/17	6.5	6.41	0.036	ng/m³ Air	7071208-03
Selenium	8/10/17	0.572	0.65	0.036	ng/m³ Air	7080401-05
Selenium	8/10/17	1.07	0.991	0.036	ng/m³ Air	7080401-07
Selenium	9/1/17	8.13	8.79	0.036	ng/m³ Air	7082424-06RE1
Selenium	9/1/17	1.39	1.42	0.036	ng/m³ Air	7082424-13
Selenium	9/22/17	2.55	2.44	0.036	ng/m³ Air	7092018-01
Selenium	9/22/17	1.73	1.73	0.036	ng/m³ Air	7092018-07

Pollutant	Sample Date	Primary Value	Replicate Value	MDL	Units	ERG Source ID
Paul Wissmach Glass Company (54-103-PWGC)						
Antimony	7/27/17	24.1	24	0.016	ng/m³ Air	7070334-06
Antimony	8/11/17	9.73	9.83	0.016	ng/m³ Air	7080409-09
Antimony	10/12/17	8.04	9.17	0.016	ng/m³ Air	7100525-10
Antimony	11/9/17	8.59	8.77	0.016	ng/m³ Air	7110617-06
Antimony	12/15/17	17.2	17.1	0.016	ng/m³ Air	7120537-03
Arsenic	7/27/17	4.62	4.58	0.04	ng/m³ Air	7070334-06
Arsenic	8/11/17	1.2	1.2	0.04	ng/m³ Air	7080409-09
Arsenic	10/12/17	1.18	1.19	0.04	ng/m³ Air	7100525-10
Arsenic	11/9/17	0.903	0.883	0.04	ng/m³ Air	7110617-06
Arsenic	12/15/17	2.27	2.27	0.04	ng/m³ Air	7120537-03
Beryllium	7/27/17	0.007	0.007	0.001	ng/m³ Air	7070334-06
Beryllium	8/11/17	0.005	0.004	0.001	ng/m³ Air	7080409-09
Beryllium	10/12/17	0.008	0.009	0.001	ng/m³ Air	7100525-10RE1
Beryllium	11/9/17	0.003	0.002	0.001	ng/m³ Air	7110617-06
Beryllium	12/15/17	0.008	0.008	0.001	ng/m³ Air	7120537-03
Cadmium	7/27/17	8.61	8.65	0.002	ng/m³ Air	7070334-06
Cadmium	8/11/17	2.1	2.11	0.002	ng/m³ Air	7080409-09
Cadmium	10/12/17	0.232	0.23	0.002	ng/m³ Air	7100525-10
Cadmium	11/9/17	0.742	0.755	0.002	ng/m³ Air	7110617-06
Cadmium	12/15/17	0.416	0.408	0.002	ng/m³ Air	7120537-03
Chromium	7/27/17	12.3	12.3	3.59	ng/m³ Air	7070334-06
Chromium	8/11/17	2.29	0	3.59	ng/m³ Air	7080409-09
Chromium	10/12/17	1.98	0	3.59	ng/m³ Air	7100525-10
Chromium	11/9/17	2	0	3.59	ng/m³ Air	7110617-06
Chromium	12/15/17	9.69	9.61	3.59	ng/m³ Air	7120537-03
Cobalt	7/27/17	3.22	3.24	0.079	ng/m³ Air	7070334-06
Cobalt	8/11/17	0.36	0.358	0.079	ng/m³ Air	7080409-09
Cobalt	10/12/17	1.04	1.03	0.079	ng/m³ Air	7100525-10
Cobalt	11/9/17	0.596	0.558	0.079	ng/m³ Air	7110617-06
Cobalt	12/15/17	3.74	3.75	0.079	ng/m³ Air	7120537-03
Lead	7/27/17	4.92	4.93	0.028	ng/m³ Air	7070334-06
Lead	8/11/17	2.16	2.17	0.028	ng/m³ Air	7080409-09
Lead	10/12/17	4	3.96	0.028	ng/m³ Air	7100525-10
Lead	11/9/17	1.03	1.03	0.028	ng/m³ Air	7110617-06
Lead	12/15/17	11.3	11.3	0.028	ng/m³ Air	7120537-03
Manganese	7/27/17	7.82	7.82	0.113	ng/m³ Air	7070334-06
Manganese	8/11/17	4.01	4.01	0.113	ng/m³ Air	7080409-09
Manganese	10/12/17	15.7	15.5	0.113	ng/m³ Air	7100525-10
Manganese	11/9/17	2.97	2.96	0.113	ng/m³ Air	7110617-06
Manganese	12/15/17	22.8	22.6	0.113	ng/m³ Air	7120537-03
Mercury	7/27/17	0.054	0.061	0.016	ng/m³ Air	7070334-06
Mercury	8/11/17	0.023	0.036	0.016	ng/m³ Air	7080409-09
Mercury	10/12/17	0.021	0.025	0.016	ng/m³ Air	7100525-10
Mercury	11/9/17	0.012	0.017	0.016	ng/m³ Air	7110617-06
Mercury	12/15/17	0.019	0.026	0.016	ng/m³ Air	7120537-03

Appendix D-2. Primary and Replicate Concentrations

Pollutant	Sample Date	Primary Value	Replicate Value	MDL	Units	ERG Source ID
Paul Wissmach Glass Company (54-103-PWGC)						
Nickel	7/27/17	0.418	0.415	0.23	ng/m³ Air	7070334-06
Nickel	8/11/17	0.68	0.69	0.23	ng/m³ Air	7080409-09
Nickel	10/12/17	5.52	5.42	0.23	ng/m³ Air	7100525-10
Nickel	11/9/17	0.737	0.748	0.23	ng/m³ Air	7110617-06
Nickel	12/15/17	34.2	34.3	0.23	ng/m³ Air	7120537-03
Selenium	7/27/17	5.88	5.8	0.036	ng/m³ Air	7070334-06
Selenium	8/11/17	2.11	2.21	0.036	ng/m³ Air	7080409-09
Selenium	10/12/17	3.62	3.66	0.036	ng/m³ Air	7100525-10
Selenium	11/9/17	7.57	7.77	0.036	ng/m³ Air	7110617-06
Selenium	12/15/17	2.28	2.3	0.036	ng/m³ Air	7120537-03

APPENDIX E. MAXIMUM AND 95TH PERCENTILE UCL OF THE MEAN CONCENTRATIONS FOR EACH METAL HAP AT EACH MONITORING SITE

Table E-1. Maximum and 95th Percentile UCL of the Mean Concentrations for Each Metal HAP at Each Monitoring Site

Metal HAP[a]	Site	% Detected	Maximum Concentration (ng/m^3)	95UCL[b] of the Mean (ng/m^3)
Antimony	18-067-0005	100%	17.4	2.15
	42-003-KOPA	100%	26	5.85
	42-003-KOPB	100%	18.4	5.62
	54-103-PWGC	100%	65.5	15.85
Arsenic	18-067-0005	100%	5.92	1.04
	42-003-KOPA	100%	28	4.17
	42-003-KOPB	100%	6.45	3.14
	54-103-PWGC	100%	5.91	1.73
Beryllium	18-067-0005	97%	0.084	0.01
	42-003-KOPA	100%	0.097	0.02
	42-003-KOPB	100%	0.096	0.02
	54-103-PWGC	99%	0.018	0.01
Cadmium	18-067-0005	100%	237	11.88
	42-003-KOPA	100%	85.8	8.42
	42-003-KOPB	100%	67.8	15.16
	54-103-PWGC	100%	457	25.42
Chromium, total	18-067-0005	100%	42.9	5.14
	42-003-KOPA	100%	13	4.70
	42-003-KOPB	100%	8.72	4.46
	54-103-PWGC	100%	16.4	4.57
Chromium, hexavalent	18-067-0005	100%	0.883	0.20
	42-003-KOPA	100%	--	--
	42-003-KOPB	100%	--	--
	54-103-PWGC	100%	--	--
Cobalt	18-067-0005	100%	47.8	2.01
	42-003-KOPA	100%	0.607	0.16
	42-003-KOPB	100%	0.309	0.14
	54-103-PWGC	100%	7.8	1.33

Metal HAP[a]	Site	% Detected	Maximum Concentration (ng/m³)	95UCL[b] of the Mean (ng/m³)
Lead	18-067-0005	100%	11.6	2.73
	42-003-KOPA	100%	76	11.88
	42-003-KOPB	100%	76.6	17.35
	54-103-PWGC	100%	475	23.83
Manganese	18-067-0005	100%	60.1	11.38
	42-003-KOPA	100%	173	38.21
	42-003-KOPB	100%	88	34.22
	54-103-PWGC	100%	30.7	9.71
Mercury	18-067-0005	97%	0.058	0.01
	42-003-KOPA	100%	0.098	0.03
	42-003-KOPB	100%	0.041	0.03
	54-103-PWGC	100%	0.113	0.02
Nickel	18-067-0005	100%	65.8	3.09
	42-003-KOPA	100%	10	1.79
	42-003-KOPB	100%	23.3	3.43
	54-103-PWGC	100%	34.3	2.18
Selenium	18-067-0005	99%	464	20.62
	42-003-KOPA	100%	148	16.23
	42-003-KOPB	100%	175	30.55
	54-103-PWGC	100%	191	19.69

[a] HAP = hazardous air pollutant.
[b] 95UCL = 95th% upper confidence level.

APPENDIX F. CADMIUM CONCENTRATIONS FOR CALCULATION OF ACUTE HAZARD QUOTIENTS

Table F-1. Cadmium Concentrations for Calculation of Acute Hazard Quotients

Site Name	Site No.	Date	Maximum Daily Concentration (ng/m^3)	Average of 12-Day Concentrations (ng/m^3)	Average of 15-Day Concentrations (ng/m^3)
Kokomo	18-067-0005	7/26/2016	157	20.7	25.3
		8/10/2016	66.7	15.3	10.7
		1/16/2017	113	**31.6**	26.3
		2/06/2017	39.9	8.1	**35.9**
		2/21/2017	175	**48.4**	**40.3**
		4/25/17	237	**49.5**	**46.6**
Kopp A	42-003-KOPA	5/21/2017	85.8	12.0[a]	11.2
		6/18/2017	36.1	10.4	8.7
		10/07/2017	66.3	15.4	13.3
Kopp B	42-003-KOPB	8/08/2017	53.3	12.6	21.8
		8/23/2017	67.8	16.8	15.2
		9/10/2017	47.4	17.7	14.4
PWGC	54-103-PWGC	6/24/2017	45.2	13.4	11.4
		11/27/2017	457	**158.6**	**132.3**
		11/30/2017	334		

[a]This is a 13-day average concentration; data were available to support calculation of a 13-day average concentration.