A. Swissvale Toxic Metals Study Introduction

This report is the initial data report for the Swissvale Toxic Metals Study. This version contains data through ***January 28, 2021****. Revisions will be released quarterly while air sampling continues.*

A special study was initiated by the Allegheny County Health Department (Department) on June 14, 2020 in Swissvale, PA as a follow-up to a study conducted by the Environmental Protection Agency (EPA) in 2017 to evaluate levels of metal hazardous air pollutants (HAPs) at Kopp Glass and other art glass manufacturers in the country (https://alleghenycounty.us/Health-Department/Programs/Air-Quality/Kopp-Glass-Air-Monitoring-Study.aspx). This study is designed to collect air samples for one year. After one year of sampling, health risk assessments will be performed to determine relative risk levels to the community from the metals exposure. Presented in this document are a summary of data collected through January 28, 2021, preliminary risk estimates derived from these data, and a comparison of data between this study (2020 Swissvale) and the 2017 study (2017 Kopp).

B. Discussion of Air Monitoring Methods

Air sampling is being conducted on residential property using an EPA reference method PM_{10} sampler. This sampler is a high volume, filter-based method that is calibrated to draw ambient air at a flow rate of 40 cubic feet per minute. The sampler employs a size-selective inlet that allows only particles of an aerodynamic size of 10 microns or less (PM_{10}) to pass to the collection filter. Each sampling event is 24 hours in duration. Sampling during this study is conducted every six days following the EPA's 6-day schedule, with additional randomized sampling events scheduled at the Department's discretion.

After each sampling event, the sampling media (8x10" quartz fiber filter) is collected by a field technician and sent to a 3rd party certified laboratory for metals analysis via EPA Compendium Method IO-3.5. The seven metals species of interest in this study are antimony, arsenic, cadmium, chromium (total), lead, manganese and nickel. Measured concentrations are presented in nanograms per 1 cubic meter of air (ng/m^3), which is a standard method of presenting metals concentrations in ambient air.

C. Approach to Data

All monitoring data generated so far from this study are being used to calculate concentration averages, derive preliminary risk estimates, and compare against data from the 2017 study. Concentrations reported as below the method detection limit (MDL) from the lab are expressed as half of the MDL, which is considered an acceptable approach by the EPA (https://www.epa.gov/risk/regional-guidance-handling-chemical-concentration-data-near-detection-limit-risk-assessments). This occurred in 52%, 24% and 2% of the samples so far for nickel, cadmium and lead, respectively.

The Department used these data to calculate averages, (filter) blank-corrected averages, and the 95th percentile upper confidence level (95UCL) of the mean of the air concentration data for each metal HAP. 95UCL is a calculated value that equals or exceeds an exposure unit's actual arithmetic mean of the site concentrations 95% of the time. 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.

D. Approach to Chronic Inhalation Assessment

Chronic dose-response values come from a variety of sources and are used for screening risk assessments. ACHD references the National Ambient Air Quality Standards (NAAQS) for the criteria pollutants. For the metals measured during this study, only lead is a criteria pollutant. In most cases, for substances that are not included under the NAAQS, ACHD references the same chronic dose-response assessment values endorsed by the EPA. These values can be found at: https://www.epa.gov/fera/dose-response-assessment-assessing-health-risks-associated-exposure-hazardous-air-pollutants.

Table 1 displays cancer-based and noncancer-based risk levels associated with the metal HAP species measured in this study. The cancer-based comparison level represents an increased risk of 1-in-1 million from exposure to a metal HAP over a lifetime and is calculated from the inhalation unit risk estimate (URE) for each metal HAP. The noncancer-based comparison level is the chronic noncancer dose-response value and is used to derive individual hazard quotients (HQs) for each metal HAP. Target-organ-specific hazard indices (TOSHIs) are calculated by summing the chronic HQs for HAPs that affect the same target organ or organ system. The comparison levels conservatively presume continuous exposure over a lifetime.

Table 1: Cancer-Based and Chronic Noncancer-Based Comparison Levels for Metal HAPs

Cas No.	Metal HAP	Cancer-Based Comparison Level (ng/m3)[a]	Source of URE[b]	Noncancer-Based Comparison Level (ng/m^3)	Source of Noncancer Risk
7440-36-0	Antimony		--	200[c]	*EPA IRIS (RfC)*
7440-38-2	Arsenic	0.23	*EPA*	15	*CalEPA (REL)*
7440-43-9	Cadmium	0.56	*EPA*	10	*ATSDR (MRL)*
7440-47-3	Chromium (total)		--	--	*EPA IRIS (RfC)*
7439-92-1	Lead		--	150	*EPA (NAAQS)*
7439-96-5	Manganese		--	300	*ATSDR (MRL)*
7440-02-0	Nickel	2.1[d]	*EPA*	90	*ATSDR (MRL)*

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, IRIS = Integrated Risk Information System.
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

E: Data Summary and Preliminary Risk Estimates

To investigate whether the metal HAP levels measured are elevated compared to health risk-based criteria for chronic exposure, the Department compared the mean concentrations, (filter) blank-corrected mean concentrations and the 95UCL of the mean of the monitored metal HAP concentrations to the most stringent of the long-term health risk-related comparison levels. Summaries of the mean ambient concentrations, the 95UCL of the mean, and the maximum concentrations are presented in Table 2. Preliminary risk estimates presented in Table 3 and Table 4 are calculated by dividing the concentration data in Table 2 by the cancer-based and non-cancer risk comparison levels from Table 1. Individual concentrations for each 24-hour sampling event are presented in Appendix A at the end of this report.

Table 2: Data Summary

	Antimony (ng/m³)	Arsenic (ng/m³)	Cadmium (ng/m³)	Chromium (ng/m³)	Lead (ng/m³)	Manganese (ng/m³)	Nickel (ng/m³)
Mean (Average) Concentration	1.86	1.74	1.18	3.94	7.78	29.22	1.30
Filter Blank Average		*0.25*		*1.25*			
Blank-Corrected Average Concentration	1.86	1.48	1.18	2.69	7.78	29.22	1.30
95% Upper Confidence Level of the Mean	2.19	2.14	1.79	4.77	10.18	41.81	1.59
Maximum Daily Concentration	6.02	7.51	15.16	16.50	47.50	270.00	5.91

Table 3: Chronic Inhalation Cancer Risk

Cas No.	Metal HAP	Blank-Corrected Mean Cancer Risk Estimate (per 10^6)[a]	Mean Cancer Risk Estimate (per 10^6)[a]	95UCL of the Mean Cancer Risk Estimate (per 10^6)[a]
7440-36-0	Antimony			
7440-38-2	Arsenic	6.4	7.5	9.3
7440-43-9	Cadmium	2.1	2.1	3.2
7440-47-3	Chromium (total)			
7439-92-1	Lead			
7439-96-5	Manganese			
7440-02-0	Nickel	0.6	0.6	0.8
Total Cancer Risk Estimate[b]		**9-in-1 million**	**10-in-1 million**	**13-in-1 million**

Note: CAS = Chemical Abstracts Service, HAP = hazardous air pollutant, 95UCL = 95th % upper confidence level

a Cancer risks are calculated by dividing concentrations (Table 2) by the 1-in-1 million cancer-based comparison levels (Table 1)

b Total cancer risk estimate is the sum of the individual metal HAP cancer risks

Table 4: Chronic Inhalation Non-Cancer Risk

Cas No.	Metal HAP	Blank-Corrected Mean Hazard Quotient[a]	Mean Hazard Quotient[a]	95UCL of the Mean Hazard Quotient[a]
7440-36-0	Antimony	0.01	0.01	0.01
7440-38-2	Arsenic	0.10	0.12	0.14
7440-43-9	Cadmium	0.12	0.12	0.18
7440-47-3	Chromium (total)	-	-	-
7439-92-1	Lead	0.05	0.05	0.07
7439-96-5	Manganese	0.10	0.10	0.14
7440-02-0	Nickel	0.01	0.01	0.02
Maximum TOSHI[b]		**<1.0**	**<1.0**	**<1.0**

Note: CAS = Chemical Abstracts Service, HAP = hazardous air pollutant, 95UCL = 95th % upper confidence level, TOSHI = target organ-specific hazard index

a Hazard quotients are calculated by dividing concentrations (Table 2) by the non-cancer risk comparison levels (Table 1)

b Maximum TOSHI is the sum of the individual hazard quotients for each target organ or organ system

F: Comparison of 2020 and 2017 Studies

The 2020 Swissvale study is a follow-up to the 2017 Kopp study designed by the EPA. The 2017 Kopp study used two low-volume PM_{10} samplers located on the property of Kopp Glass. The 2020 Swissvale study utilizes one high-volume PM_{10} sampler on residential property approximately 15 meters from the Kopp Glass property and approximately 50 meters from where one of the samplers (KopA) was located in the 2017 Kopp study. Cancer risk estimates from the 2017 Kopp data were derived using the 95UCL of the mean, which the Department has provided for the 2020 Swissvale data as well.

Figure 1 shows average PM_{10} metals concentrations from the sampler in the current study (2020 Swissvale), and from the two samplers used the in 2017 Kopp study (KopA and KopB). Figure 2 shows the 95UCL of the mean concentrations from both studies. Figure 3 shows maximum daily concentrations from both studies.

In Figure 4 the preliminary cancer risk is compared between studies using the 95UCL of the mean. A cancer risk of 40-in-1 million means that, for every 1 million people exposed at the levels measured at the monitor, 40 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.

In Figure 5 the preliminary TOSHI is compared between studies using the 95UCL of the mean. Cadmium was the driver of the maximum TOSHI in the 2017 study with the kidney as the target organ. The maximum TOSHI for the 2020 study was comprised of metals (arsenic, lead and manganese) that affect the nervous system. A TOSHI equal to or less than 1 indicates that non-cancer effects are not likely to occur.

Figure 1: Average PM_{10} Metals Concentrations From 2020 and 2017 Studies

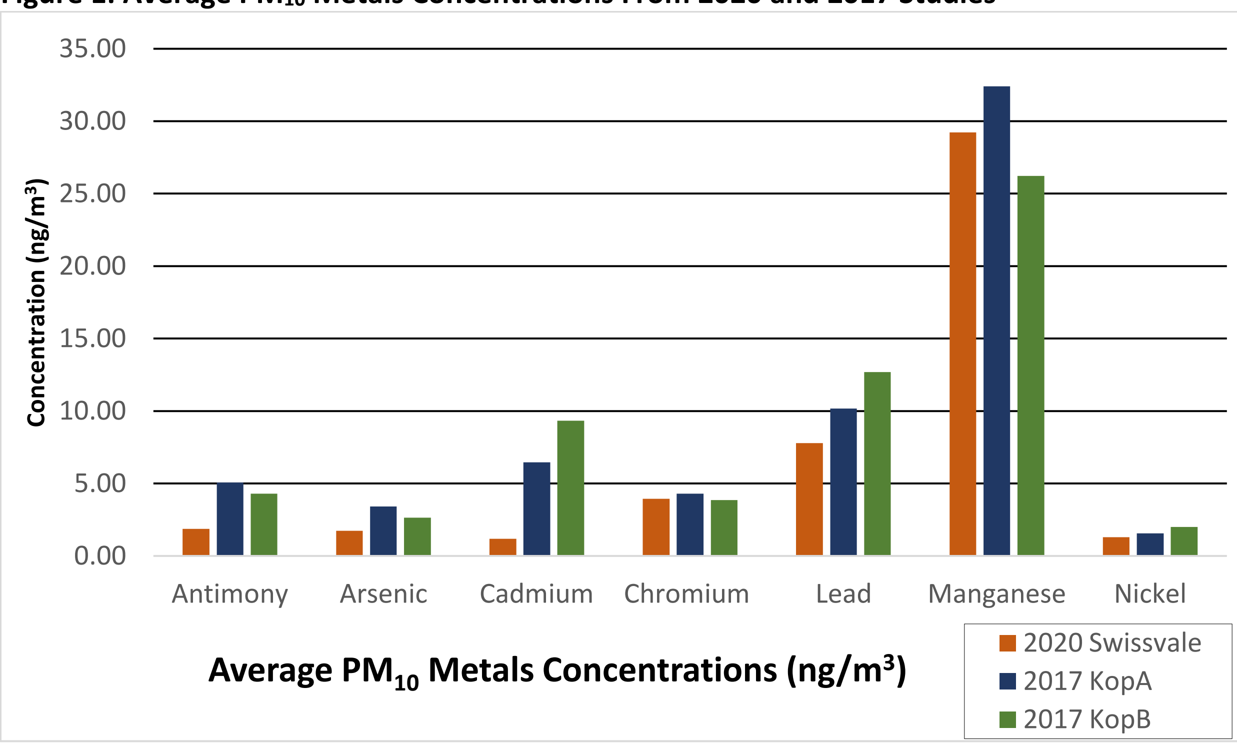


Figure 2: 95% Upper Confidence Level of the Mean Concentrations

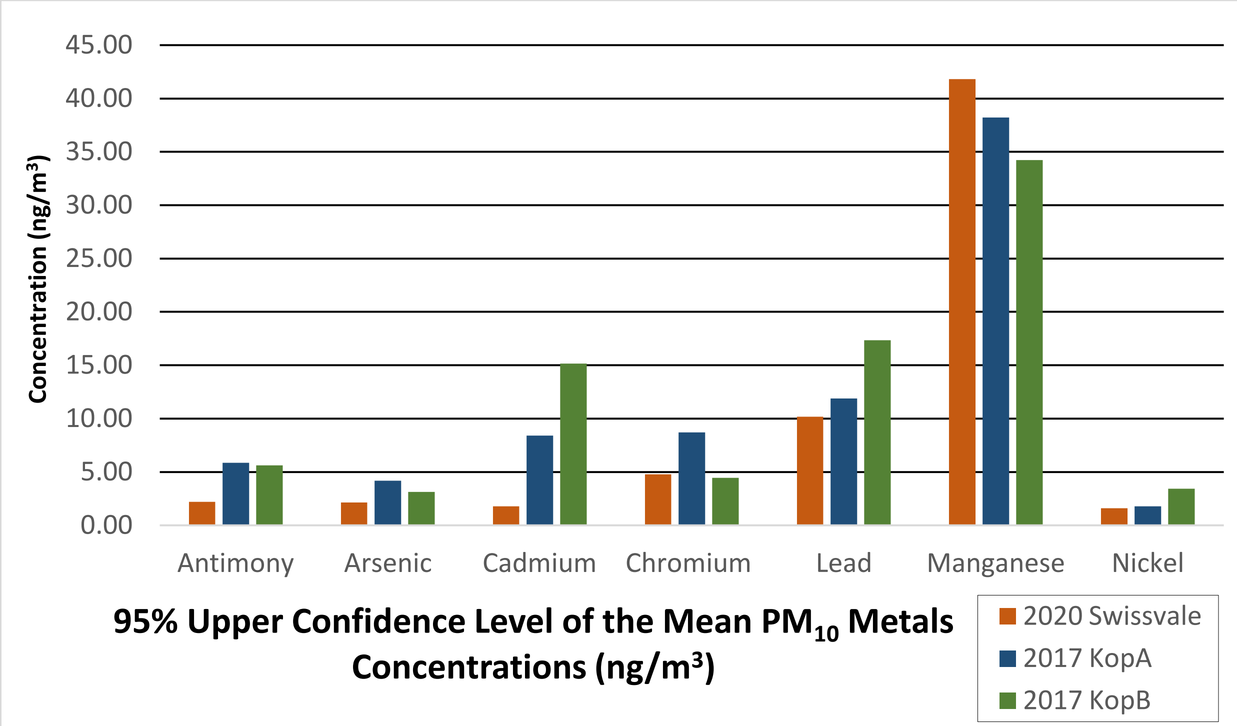


Figure 3: Maximum Daily Concentrations From 2020 and 2017 Studies

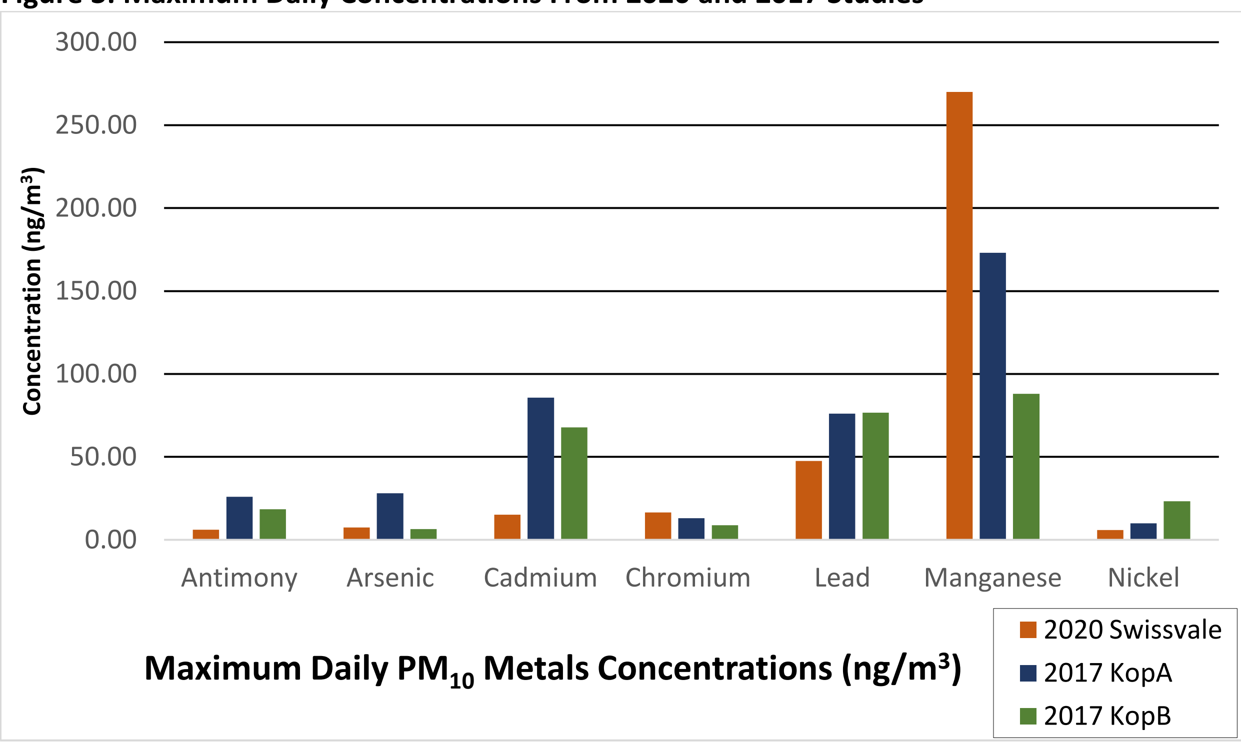


Figure 4: Cancer Risk From 2020 and 2017 Studies

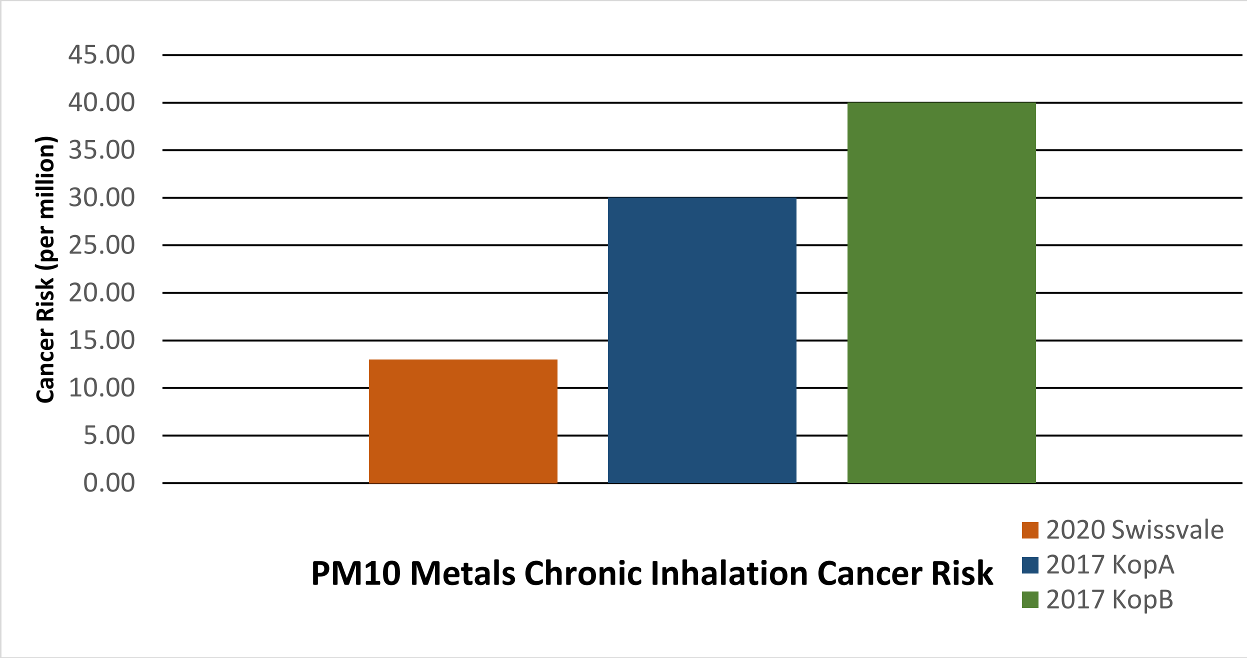
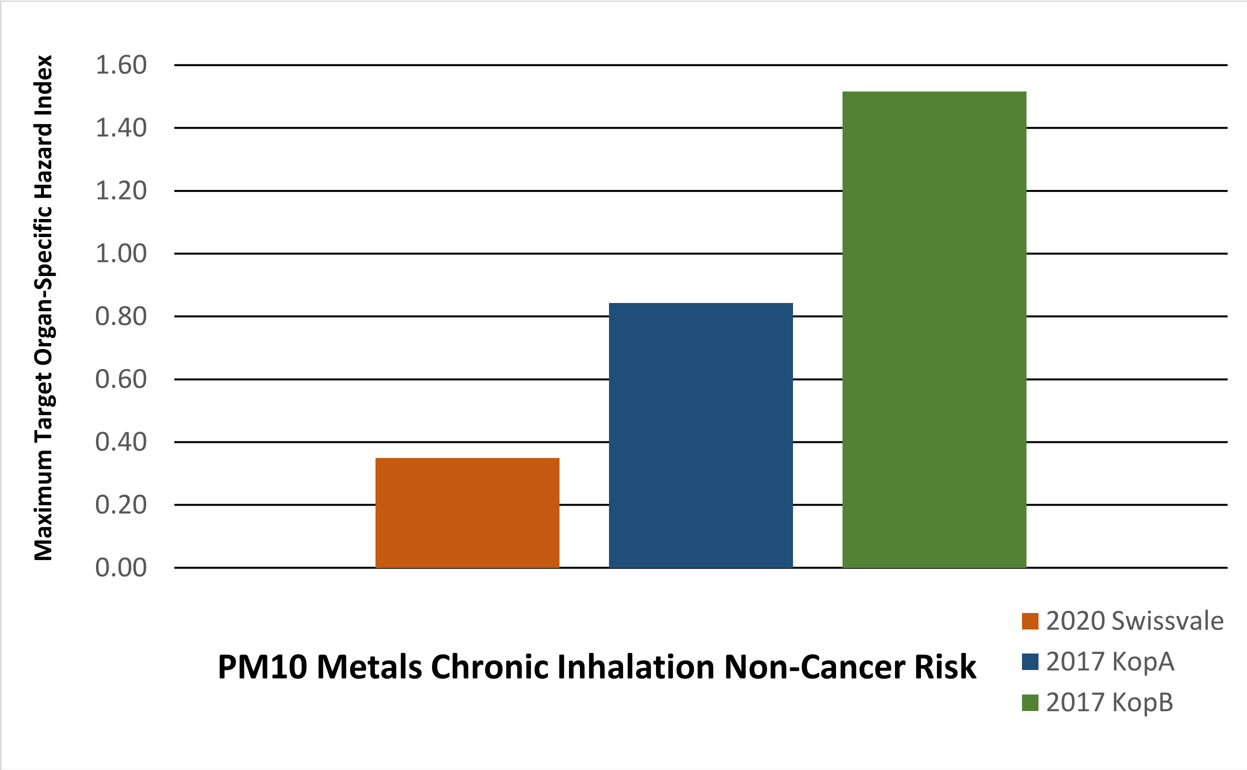


Figure 5: Non-Cancer Risk From 2020 and 2017 Studies



Appendix A: Individual Sampling Results

Sample Date	Antimony (ng/m^3)	Arsenic (ng/m^3)	Cadmium (ng/m^3)	Chromium (ng/m^3)	Lead (ng/m^3)	Manganese (ng/m^3)	Nickel (ng/m^3)
6/14/2020	1.79	1.72	2.98	1.63	3.63	4.92	0.56
6/20/2020	3.14	6.02	15.16	5.40	13.10	43.66	2.35
6/23/2020	1.95	1.57	1.59	4.11	3.93	16.01	1.26
6/26/2020	1.02	1.47	0.31	2.37	3.75	13.65	0.53
7/02/2020	1.26	1.28	0.11	2.32	2.64	9.07	0.55
7/08/2020	1.84	0.53	0.53	4.56	7.42	46.49	1.53
7/14/2020	2.27	1.24	0.29	3.03	6.06	21.70	1.15
7/20/2020	0.65	0.66	0.22	1.95	2.12	7.50	1.21
7/23/2020	0.86	1.41	0.06	2.74	2.16	4.91	0.56
7/26/2020	1.91	2.76	0.46	6.58	11.00	21.60	5.66
8/01/2020	1.43	1.49	2.88	1.90	4.35	9.71	0.55
8/04/2020	1.03	0.81	0.33	2.49	2.81	7.06	0.55
8/07/2020	1.45	0.92	0.17	2.88	3.14	9.85	1.24
8/13/2020	1.00	0.79	0.26	2.08	2.16	8.12	0.56
8/19/2020	0.61	0.45	0.06	1.68	1.34	4.02	0.55
8/25/2020	2.08	0.97	0.56	2.19	3.80	9.75	0.55
8/31/2020	4.51	1.03	0.81	2.67	5.00	20.60	0.56
9/06/2020	3.34	3.74	5.25	2.12	8.09	16.60	0.55
9/12/2020	2.75	1.54	1.91	12.00	18.40	11.60	0.56
9/15/2020	2.37	1.92	0.73	3.44	4.26	22.40	0.55
9/18/2020	1.05	0.94	0.06	1.68	2.89	6.53	0.55
9/24/2020	4.46	4.22	1.23	6.19	21.90	88.00	1.57
9/30/2020	1.13	1.07	0.39	2.34	2.97	7.58	0.54
10/06/2020	2.72	5.72	1.81	3.63	16.10	60.30	1.56
10/12/2020	0.55	0.95	0.06	1.60	1.19	2.90	2.38
10/18/2020	4.34	3.19	3.01	4.77	23.50	103.00	2.11
10/24/2020	0.92	0.90	0.06	1.50	1.80	2.28	1.94
10/27/2020	1.51	2.09	0.18	2.21	5.09	6.83	2.23
10/30/2020	0.77	0.82	0.06	1.48	2.22	2.01	5.91
11/05/2020	3.42	2.77	1.49	15.40	23.80	174.00	2.14

Sample Date	Antimony (ng/m^3)	Arsenic (ng/m^3)	Cadmium (ng/m^3)	Chromium (ng/m^3)	Lead (ng/m^3)	Manganese (ng/m^3)	Nickel (ng/m^3)
11/11/2020	3.36	1.22	1.47	7.57	11.10	36.60	1.31
11/17/2020	0.50	0.34	0.06	5.27	1.87	6.45	0.56
11/23/2020	0.43	0.34	0.14	4.47	2.30	1.82	0.55
11/29/2020	3.61	4.66	5.18	8.51	31.00	89.70	0.55
12/05/2020	1.21	0.78	0.17	1.81	2.26	3.27	1.52
12/08/2020	0.53	0.54	0.06	2.10	1.30	4.42	3.46
12/11/2020	6.02	7.51	2.11	16.50	47.50	270.00	1.80
12/17/2020	1.12	1.38	0.18	4.09	4.20	8.79	1.68
12/23/2020	2.72	2.61	0.85	5.82	26.30	114.00	1.31
12/29/2020	0.67	0.83	0.06	2.48	2.64	6.62	1.22
1/04/2021	1.18	0.59	0.06	1.97	1.66	2.52	0.55
1/10/2021	2.89	1.90	0.58	3.42	5.51	15.40	0.55
1/16/2021	0.94	1.02	0.20	2.11	3.92	9.66	0.56
1/19/2021	1.05	0.38	0.14	2.20	0.56	4.24	0.56
1/22/2021	0.58	0.37	0.06	2.06	3.95	4.43	0.55
1/28/2021	0.67	0.42	0.12	1.78	1.31	3.46	0.57

**Samples less than the Method Detection Limit are expressed as ½ MDL, color-coded red and are calculated based on the laboratory's minimum reporting limit (ng/filter) and air volume (cubic meters) submitted for each sample.*