# LETTER HEALTH CONSULTATION

**Analysis of Ambient Air Monitoring Data (1996-2016)**
**for Potential Health Effects near**
**Bath Borough, Northampton County, Pennsylvania**

July 30, 2018

Prepared by:


Pennsylvania Department of Health
Division of Environmental Health Epidemiology

## Health Consultation: A Disclaimer

This report was supported in part by funds provided through a cooperative agreement with the Agency for Toxic Substances and Disease Registry (ATSDR), U.S. Department of Health and Human Services (DHHS). The findings and conclusions in these reports are those of the author(s) and do not necessarily represent the views of the ATSDR or the DHHS. This document has not been revised or edited to conform to ATSDR standards.

The conclusions and recommendations presented in this health consultation document are based on an analysis of the environmental sampling data and information made available to the Pennsylvania Department of Health (PADOH) within a limited time frame. The availability of additional sampling data, new information and/or changes in site conditions could affect the conclusions and recommendations presented in this document. PADOH will consider reviewing additional future data related to the site, if made available and deemed appropriate.

pennsylvania
DEPARTMENT OF HEALTH

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Subject: Analysis of Ambient Air Monitoring Data for Potential Health Effects in Bath Borough, Northampton County, Pennsylvania (1996-2016).

July 30, 2018

Dear Ms. Bartholomew:

In February 2017, the Pennsylvania Department of Environmental Protection (PADEP) requested the Pennsylvania Department of Health (PADOH) to review and analyze data in PADEP's draft report entitled "*Analysis of Long-Term Particulate Matter Monitoring Data and Toxic Metals Health-Based Screening of Ambient Air in Bath Borough, Northampton County, PA, September 2016*", for potential public health implications. The purpose of this letter health consultation is to evaluate the data collected by PADEP in community near the Keystone Cement Company (KCC) and determine whether the contaminants detected in the air are impacting the health of the community near the KCC. PADEP conducted air monitoring near the KCC for possible exposure to total suspended particulate (TSP) matter, sulfate, iron and toxic metals. Monitoring was conducted in two phases. In the first phase (1996–2013), 24-hour air monitoring was conducted once every four days to screen for TSP matter, sulfates, iron and toxic metals such as, arsenic, zinc, cadmium, manganese, and lead. Since the detection limits for toxic metals in phase I monitoring were high and unsuitable for health effects evaluation, a second phase (2014–2016) monitoring was conducted. In the second phase, 24-hour monitoring was conducted once every six days to detect low levels of arsenic, cadmium, lead, manganese and zinc. PADOH reviewed the available data and concluded that the air quality in the community near the KCC is unlikely to harm people's health.

The remainder of this Letter Health Consultation (LHC) presents detailed information in support of PADOH's analysis and conclusion.

**Background**
The KCC facility is located adjacent to the Borough of Bath in Northampton County, Pennsylvania. Based on 2010 U.S. Census data, approximately 2,700 people live near this facility. KCC is owned and operated by Giant Cement Holding Inc. (a company of the Spanish firm Cementos Portland Valderrivas Group) producing Portland cement since 1928. Its emissions and releases are regulated under the Clean Air Act and the National Emissions Standards for Hazardous Air Pollutants for Major Sources: Industrial, Commercial, and Institutional Boilers and Process Heaters. Prior to 2009, the KCC used the "wet method" of cement production. In 2009, the company converted its facility process to the more energy efficient "dry method", to produce high quality cement products.

General information on the process of cement making and its associated emissions can be found in the Environmental Protection Agency's (EPA's) compendium of emissions factors [EPA 1995].

**Statement of Issue**
In December 1995, concerns were raised regarding the air pollution arising from the KCC facility and its impact on the local community of Bath Borough. In response to the concerns, PADEP placed ambient air monitors near the KCC facility on the campus of the George Wolf Elementary School located at 300 Allen Street in Bath Borough. The monitoring location was within the KCC facility's predominant downwind direction. Figure 1 shows the sampling location in relation to the KCC facility.

**Ambient Air Monitoring**
The monitors were configured to collect 24-hour samples over a four-day period for the Phase I monitoring period (1996–2013). Details on the particulate collection and filter analysis methods can be found in EPA's air monitoring methods [EPA 1999]. Ambient levels of TSP, sulfate, iron, and toxic metals, such as arsenic, cadmium, lead, manganese and zinc were monitored during this period. There were no health concerns expected at the detected levels of TSP, sulfate and iron contaminants. However, for toxic metals the detection limits were high and unsuitable for health effects evaluations. Therefore, Phase II monitoring was conducted from 2014–2016 to detect low levels of toxic metals using EPA Toxic Inorganic Compendium method IO 3.5. For Phase II monitoring, the monitors were configured to collect 24-hour samples once every six days.

Based on PADEP's draft report [PADEP 2016], Phase I monitoring measured air quality near the KCC facility and its relative changes over time from 1996 through 2013. Annual average concentrations of TSP, sulfate and iron were plotted in Figure 2 and Figure 3. Reduction in the average concentration of TSP and iron were almost consistent from the year 2001. The average concentration of iron peaked in 2010, followed by significant reduction from 2011 through 2013. Apparent reduction in the average concentration of sulfate started in 2005. Table 1 summarizes three-year average concentrations and percentage difference of TSP, sulfate and iron for the wet method (2006 - 2008) and the dry method (2009 - 2011). When the KCC changed its cement production from the wet to the dry method in 2009, the three-year average concentrations of TSP, sulfate and iron in ambient air dropped by 28, 26 and 11% respectively. However, for toxic metals

such as, arsenic, cadmium, lead, manganese, and zinc the detection limits were high and were not detected. Hence, these metals were subsequently monitored in Phase II.

Phase II monitoring measured TSP, sulfate, and iron along with arsenic, cadmium, lead, manganese, and zinc using the EPA Toxic Inorganic Compendium method IO 3.5 with lower detection limits. The TSP, sulfate, and iron concentrations detected were similar to concentrations detected during Phase I monitoring. All five toxic metals that were not detected in Phase I monitoring were detected in Phase II monitoring.

**Methods and Data Screening**

To evaluate the public health implication of the contaminants detected in community ambient air near the KCC, PADOH conducted an exposure pathway analysis to identify how people are likely exposed. PADOH evaluated the potential risks associated with exposures to contaminants in the air through inhalation and concludes that inhalation is a complete exposure pathway. Following exposure pathway analysis, PADOH screened the contaminants detected against health-based comparison values (CVs) such as Agency for Toxic Substances Disease Registry's (ATSDR's) Cancer Risk Evaluation Guide (CREG) CV to select contaminants for further evaluation for any potential health risk. When an ATSDR CV is not available, screening values are acquired from other environmental and health agencies such as the Texas Commission on Environmental Quality Air Monitoring CVs and the National Ambient Air Quality Standards [ATSDR 2005]. These CVs are conservative estimates, below which no health effects would be expected, which include uncertainty factors that account for the most sensitive population. For this LHC, PADOH used a conservative exposure point concentration (EPC) for the screening analysis. EPC was calculated based on frequency of detection (minimum of 15 percent of the time). EPC is believed to represent typical upper bound exposure averages. A conservative EPC is the 95% upper confidence limit (95UCL) of the arithmetic mean concentration. This calculated 95UCL is screened against the respective CVs. Screened contaminants concentrations above a CV will not necessarily be harmful. For a contaminant that exceed a CV, PADOH conducted a detailed public health evaluation using other standards and/or scientific studies to determine whether adverse health effects are likely. Based on our data screening process only one toxic metal (arsenic) was selected for further evaluation. The 95 UCL of cadmium, lead, manganese and zinc were less than their respective health CVs. As seen in Table 2, the 95 UCL of arsenic (0.0014 $\mu g/m^3$) exceeded the ATSDR's CREG CV of 0.00023 $\mu g/m^3$ (Table 2). Hence, arsenic was the only toxic metal selected for cancer risk evaluation (Table 3). To estimate excess lifetime (78 years) cancer risk from exposure to arsenic, the exposure concentration of 0.0014 $\mu g/m^3$ (95UCL) was multiplied by the EPA's inhalation unit risk of 0.0043 per $\mu g/m^3$ for arsenic. EPA's target cancer risk range is 1 in 1,000,000 to 1 in 10,000 (i.e., one in a million to one in ten thousand).

**Results**

Arsenic concentrations measured (0.00067–0.0040 $\mu g/m^3$) in the community near the KCC facility during 2014–2016 (Table 2) fall below the mean urban area ambient air concentration range (0.02–0.03 $\mu g/m^3$). However, the 95 UCL of arsenic (0.0014 $\mu g/m^3$) exceeded the ATSDR's CREG CV of 0.00023 $\mu g/m^3$.

***Possible Cancer Health Effects Evaluation from Exposure***

The estimated excess lifetime cancer risk in the community near the KCC facility was about six in a million of developing lung cancer over a person's lifetime. The estimated excess lifetime cancer risk calculated for the community near the KCC facility falls within EPA's target cancer risk range of 1 in 1,000,000 to 1 in 10,000 (i.e., one in a million to one in ten thousand). Therefore, based on our assessment, the estimated lifetime cancer risk from exposure to arsenic in the community near the KCC was low and not expected to cause harmful cancer health effects under current operating conditions.

**Discussion**

***Arsenic***

Arsenic is a metalloid which occurs naturally in the environment. Ambient air concentrations of arsenic range from less than 0.001 $\mu g/m^3$ to 2 $\mu g/m^3$, depending on location, weather conditions, and the level of industrial activity in the area. Urban areas generally have a mean arsenic level in air ranging from 0.02 $\mu g/m^3$ to 0.03 $\mu g/m^3$ [ATSDR 2007]. Inhalation of inorganic arsenic can increase the risk for lung cancer. The Department of Health and Human Services and EPA have determined that inorganic arsenic is a known human carcinogen. The International Agency for Research on Cancer has determined that inorganic arsenic is carcinogenic to humans [ATSDR 2007].

**Conclusion**

During Phase I monitoring, the three-year average concentrations of TSP, sulfate, and iron in ambient air dropped by 28%, 26%, and 11% respectively. There were no health concerns expected at the detected levels of TSP, sulfate and iron contaminants. Measured concentrations of toxic metals during Phase II monitoring in the community near the KCC facility are unlikely to harm people's health. However, this conclusion regarding toxic metals is based only on the two-year period screened in Phase II and not for the duration of Phase I sampling. In addition, the conclusion is based on assumptions that the screening concentrations remain the same throughout the lifetime of the exposed population. This assumption is not a prediction of future pollutant levels.

**Recommendation**

Based on evaluation of current information available there are no further recommendations for PADEP to follow up on the KCC facility.

Sincerely,

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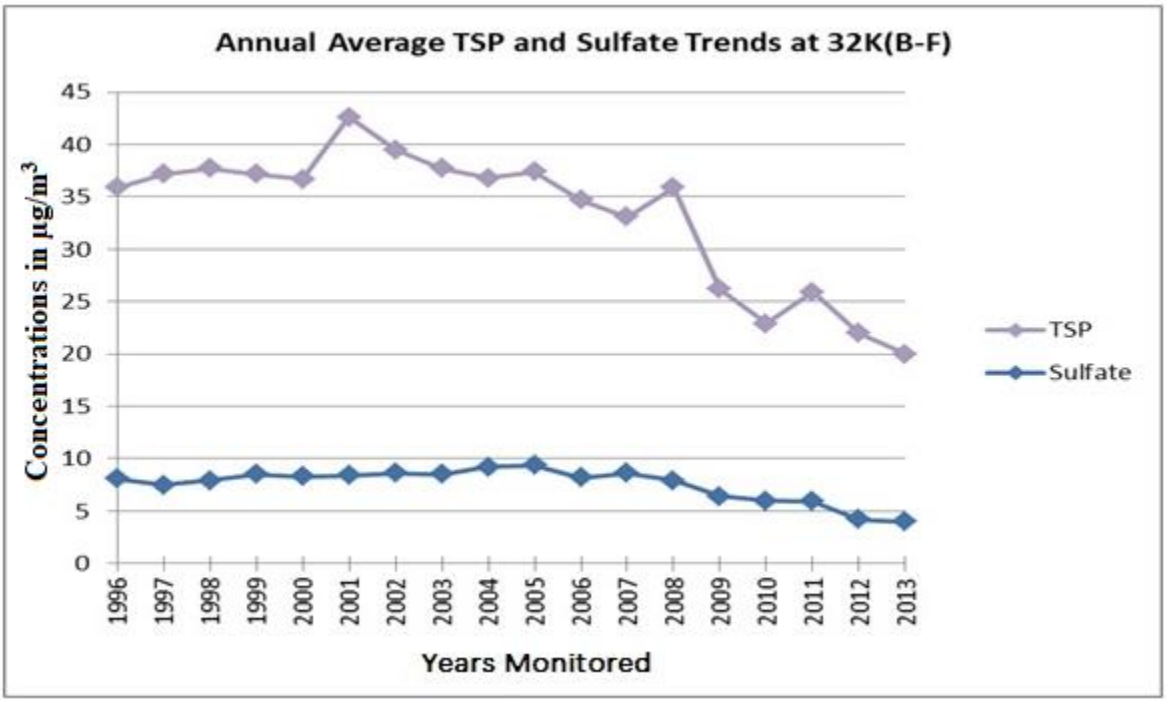
# Figures

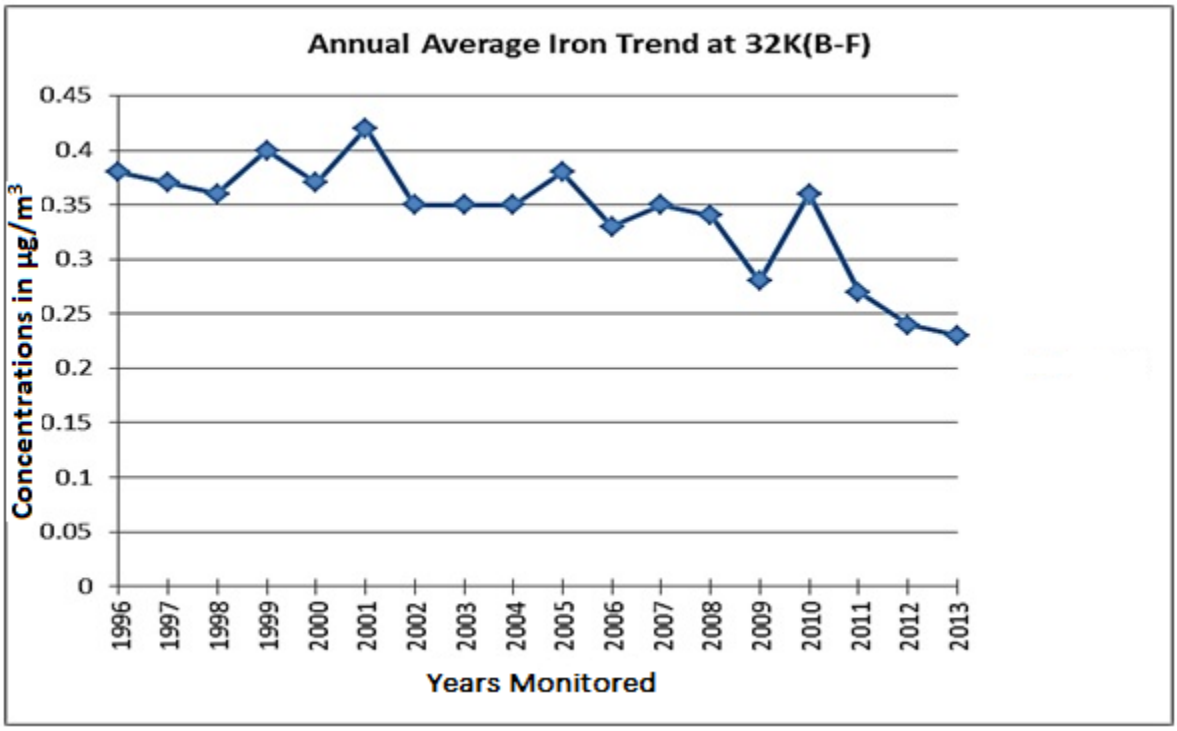
**Figure 1: Keystone Cement Company and the Sampling Location (1996 - 2016)**

**Figure 2: Annual Average TSP and Sulfate Trends from 1996-2013 (Phase I)**




TSP: Total Suspended Particulates

**Figure 3: Annual Average Iron Trend from 1996-2013 (Phase I)**



# Tables

**Table 1: Phase I - Three Year Average Concentrations and Percentage Difference of Total Suspended Particulates (TSP), Sulfate and Iron for Wet Method (2006 - 2008) and Dry Method (2009 - 2011)**

| Pollutants | 3 Year Average 2006 – 2008 (Wet Method) µg/m$^3$ | 3 Year Average 2009 – 2011 (Dry Method) µg/m$^3$ | Percentage Difference % |
|---|---|---|---|
| Total Suspended Particulates | 34.57 | 25.00 | -28% |
| Sulfate | 8.23 | 6.10 | -26% |
| Iron | 0.34 | 0.30 | -11% |

**Table 2: Phase II - Summary of Toxic Metals Detected (2014-2016) (µg/m$^3$)**

| Toxic Metals | Detects/Total Samples (%) | Range | 95UCL | CV | CV Source |
|---|---|---|---|---|---|
| Manganese | 92/92 (100%) | 0.0015 - 0.031 | 0.010 | 0.30 | ATSDR cMRL |
| Zinc | 92/92 (100%) | 0.0095 - 0.26 | 0.056 | 2.0 | TCEQ AMCV |
| **Arsenic** | 60/92 (65%) | 0.00067 - 0.0040 | **0.0014** | **0.00023** | **ATSDR CREG** |
| Lead | 40/92 (43%) | 0.0045 - 0.019 | 0.0060 | 0.15 | NAAQS |
| Cadmium | 31/92 (44%) | 0.00024 - 0.0017 | 0.00037 | 0.01/0.00056 | ATSDR cMRL/CREG |

µg/m$^3$ = micro gram per cubic meter; CV = Comparison Value; CREG = Cancer Risk Evaluation Guide; cMRL= chronic Minimum Risk Level; ATSDR = Agency for Toxic Substances Disease Registry; TCEQ AMCV = Texas Commission on Environmental Quality Air Monitoring Comparison Value; NAAQS = National Ambient Air Quality Standard
Arsenic was the only toxic metal selected for cancer risk evaluation; 95UCL = 95 Upper Confidence Limit

**Table 3: Phase II - Toxic Metal Detected above the Comparison Value (µg/m$^3$)**

| Toxic Metal | 95UCL | CV | CV Source | IUR | Estimated Excess Lifetime Cancer Risk (95UCL*IUR) |
|---|---|---|---|---|---|
| Arsenic | 0.0014 | 0.00023 | ATSDR CREG | 4.3E-03 | 6.02E-06 |

µg/m$^3$ = micro gram per cubic meter; CV = Comparison Value; 95UCL = 95 Upper Confidence Limit; CREG = Cancer Risk Evaluation Guide; IUR = Inhalation Unit Risk

## References

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