Letter Health Consultation

AMERICAN ZINC RECYCLING

PALMERTON, PENNSYLVANIA

JULY 31, 2018

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Agency for Toxic Substances and Disease Registry
Division of Community Health Investigations
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supplies; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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LETTER HEALTH CONSULTATION

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PALMERTON, PENNSYLVANIA

Prepared By:

U.S. Department of Health and Human Services
Agency for Toxic Substances and Disease Registry
Division of Community Health Investigations

DEPARTMENT OF HEALTH & HUMAN SERVICES

Public Health Service

Agency for Toxic Substances
and Disease Registry
Atlanta GA 30333

July 31, 2018

Zelma Maldonado
Associate Director
Office of Air Enforcement and
Compliance Assistance (3AP20)
1650 Arch Street
Philadelphia, PA 19103

Dear Ms. Maldonado,

On January 24, 2017, the United States Environmental Protection Agency (EPA) EPA Region 3, Office of Air Protection Division Office of Air Enforcement and Compliance (APD OAECA), requested that the Agency for Toxic Substances and Disease Registry (ATSDR) conduct a public health evaluation of the community's current exposures to lead in air near the operating American Zinc Recycling LLC (AZR), formerly Horsehead, facility in Palmerton, Carbon County, Pennsylvania, and summarize available childhood blood lead information for this community. To address this request, we evaluated available sources of information and identified a data gap in our understanding of the pattern and distribution of potential contaminants in air near this facility (i.e., in areas where people live, play, and/or frequent). ATSDR then began a collaboration with EPA to provide a public health review of EPA's air modeling results to address this data gap.

In summary, based on our preliminary spatial analysis of EPA's air modeling results and available state monitoring data, ATSDR concludes that a public health hazard is likely for young children and/or pregnant women living within 3 miles of the American Zinc Recycling facility. Young children and/or pregnant women could experience long-term health problems from exposure to lead in the outdoor air. The developing nervous system in children is among the most sensitive health endpoints associated with lead exposure. Pregnant women may have a higher risk for miscarriage. The unborn baby may have a higher risk for premature birth, low birth weight, learning and behavior problems, and damage to their developing brains. ATSDR notes that the rates of elevated blood lead levels in children living in Carbon County are similar to statewide rates. However, due to the small numbers of children involved, specific rates for Palmerton are not available to determine whether blood lead levels in children are unusually high in the immediate area near the American Zinc Recycling facility. Air modeling results suggest that higher concentrations of lead than those measured at the existing air monitoring station are possible in the Palmerton community.

Therefore, ATSDR recommends environmental agencies consider further actions to reduce offsite lead emissions from this facility, including evaluating existing permits and fugitive emissions; conducting further air modeling (including particle deposition modeling) and additional evaluations of air monitoring data; considering the current placement of air monitors; and characterizing surface soil that may be impacted by current air deposition. ATSDR recommends health agencies continue to evaluate and conduct further analyses of child and adult blood lead levels in Palmerton/Carbon County; further discuss available adult blood lead information; and continue discussions regarding the need to increase blood lead screening activities and health provider outreach in Palmerton, PA. ATSDR recommends

families in the community take steps to reduce the lead exposures of children and pregnant women; obtain blood lead testing for children and pregnant mothers; and talk to their health professional or call PADOH's Lead Information Line at 1-800-440-LEAD (5323) if they have concerns about exposure to lead or want additional information about steps they can take to reduce exposures.

There are important limitations to the air modeling and monitoring information reviewed. For example, the available air monitoring results are limited to lead results from a single fixed monitoring location and limited timeframe, the air modeling provides an estimate of air concentrations under a given set of conditions and time and may not represent actual air concentrations, and there is uncertainty as to whether modeled concentrations have occurred in the past or are occurring now. Further details on ATSDR's evaluation are provided below.

Background

The Centers for Disease Control and Prevention (CDC), ATSDR and the Pennsylvania Department of Health (PADOH) have a long history of public health work in Palmerton. Smelting operations began at this location in 1898. Environmental contamination related to smelting operations led to the listing of the American Zinc Recycling on the National Priorities List in 1983.[1] CDC, ATSDR and PADOH conducted a broad range of public health assessment and health study activities in this community over the years.[2]

EPA is currently working on a multi-faceted case involving the American Zinc Recycling electric arc furnace (EAF) dust recycling facility located in Palmerton, PA. Approximately 850 people live within one mile of the site, while the population of the entire town of Palmerton is approximately 5,000. The facility is owned by American Zinc Recycling and operates four horizontal kilns that heat EAF dust to high temperatures, volatilizing metals for recovery as co-products and products (only one kiln has a lead (Pb) and particulate matter (PM) limit under their Title V air permit). Due to the chemical composition of EAF dust and combustion reactions, each kiln emits criteria pollutants and heavy metals, including lead, zinc, nickel, cadmium and chromium. Agencies do not have current air monitoring or modeling data for metals other than lead. To monitor lead emissions from this facility, the Pennsylvania Department of Environmental Protection (PADEP) is operating a National Ambient Air Quality Standard (NAAQS) lead monitor near this facility. This monitor is located at 620 Little Gap Road in Palmerton, which is north and a little east of the facility in an area with limited development. PADEP and EPA have identified exceedances of the NAAQS for lead at this location. This document represents ATSDR's conclusions and recommendations regarding the NAAQS monitoring results for lead and collaborative efforts with EPA Region 3 to evaluate air dispersion modeling for the American Zinc Recycling Palmerton facility in Palmerton, PA, in addition to providing a summary of available childhood blood lead results for children residing in Carbon County.

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[1] US EPA, American Zinc Recycling Superfund Site, Fifth Five-Year Review, September 2017. Available at: https://cumulis.epa.gov/supercpad/SiteProfiles/index.cfm?fuseaction=second.scs&id=0300624&doc=Y&colid=30815&requestTimeout=480

[2] For example: Landrigan, PJ and Baker EL. Exposure to Children to Heavy Metals from Smelters: Epidemiology and Toxic Consequences, 1981. Env Res 25, 204-224; ATSDR, PADOH, Public Health Assessment, American Zinc Recycling, April 7, 1994; and ATSDR, Final Report, Technical Assistance to PADOH, Biologic Indicators of Exposures to Cadmium and Lead, Palmerton, PA, Part I, June 1994 and Part II, May 1995.

Environmental and Blood Lead Data

PADEP Air Monitoring

Ambient air quality monitoring is required to determine whether a geographical region or area is meeting the NAAQS for criteria pollutants. The NAAQS for lead is 0.15 µg/m^3 total suspended particles as a 3-month rolling average. In the NAAQS Final Rule for Lead, EPA estimates that at the NAAQS standard level of 0.15 µg/m^3, lead in air-related IQ losses are below 2 IQ points.[3] The NAAQS lead monitor in Palmerton was established as a source-oriented monitor for the American Zinc Recycling facility in Palmerton, PA, and started operating at its current location in May 2012. The levels detected at the Palmerton NAAQS monitor exceeded the 3-month rolling average of 0.15 µg/m^3 one time (in May 2015) over the 2013-2015 monitoring period.[4] This NAAQS monitoring information, in concert with the modeling information that suggests that this monitor may not be capturing maximum current air levels in the community, provides an indicator that public health exposures of concern may be occurring. Therefore, further evaluation of potential exposures in areas where community members live, play and/or frequent often (particularly children and pregnant women) is warranted. The Palmerton 2016 and 2017 PADEP NAAQS data have not yet been released and are undergoing data quality validation.

EPA Air Modeling

In consultation with ATSDR, EPA conducted air modeling using AERMOD Model 3 to better understand the pattern and concentration of potential off-site contaminants (see Attachments for the modeling inputs and results). ATSDR conducted a public health spatial analysis of these modeling results. The AERMOD modeling system is steady-state plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain. It is a steady-state dispersion model designed for short-range (up to 50 kilometers) dispersion of air pollutant emissions from stationary industrial sources. It also includes a terrain preprocessor (AERMAP) whose main purpose is to provide a physical relationship between terrain features and the behavior of air pollution plumes. It generates location and height data for each receptor location. It also provides information that allows the dispersion model to simulate the effects of air flowing over hills or splitting to flow around hills. AERMOD estimates air lead (Pb) concentrations from the American Zinc Recycling facility kilns to the surrounding area and receptor populations.

As described in the Attachment to this letter, the results from the AERMOD air modeling are:

- AERMOD highest estimated monthly average lead concentration: 0.268 µg/m^3,
- AERMOD highest estimated rolling 3-month average lead concentration: 0.244 µg/m^3,
- AERMOD highest estimated 24-hour average lead concentration: 1.598 µg/m^3,
- AERMOD estimated 95% 24-hour average lead concentration: 0.347 µg/m^3,
- AERMOD highest estimated average lead concentrations are located at locations primarily southeast, west, and northwest of the PADEP NAAQS monitor, and

[3] US EPA, 40 CFR Parts 50, 51, 53, and 58, National Ambient Air Quality Standards for Lead; Final Rule (73 FR 67005), November 12, 2008. Available at: https://www.gpo.gov/fdsys/pkg/FR-2008-11-12/pdf/E8-25654.pdf.

[4] Note, 2013 data for the Palmerton NAAQS monitor did not meet data completeness requirements. Commonwealth of Pennsylvania, Department of Environmental Protection, 2016 Annual Ambient Air Monitoring Network Plan, August 2016 (revised January 2017). Available at: https://www.epa.gov/amtic/pennsylvania-2016-annual-network-plan. http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-115998/Final%202016%20PA%20Annual%20Monitoring%20Network%20Plan.pdf

- AERMOD estimated lead concentrations above the NAAQS standard (0.15 µg/m^3) are located at locations within residential areas.

Note, consistent with the actual monitoring results from the Palmerton NAAQS monitor, the AERMOD modeling predicted exceedance of the lead NAAQS. AERMOD predicted the highest rolling 3-month average lead concentrations that exceeded the NAAQS 0.15 µg/m^3 3-month rolling average standard would occur to the northwest of the NAAQS monitor on a bluff near the Palmerton Junior/High School. The receptors that were predicted to have modeled exposures higher than the NAAQS were generally located west/northwest of the facility and along the ridge, with some receptors near the Palmerton Junior/High School.

Blood lead data

PADOH conducts lead exposure prevention and blood lead surveillance activities in the Commonwealth. PADOH's ninth childhood lead surveillance annual report[5] covers data for children tested in Pennsylvania during calendar year 2015, and represents the most recent information available. Data in this report were extracted from the Pennsylvania National Electronic Disease Surveillance System (PA-NEDSS), which is the Department's disease reporting system. The report is an overview of lead testing of children in Pennsylvania and provides information about testing for children under the age of 2, as well as under the age of 6 by race; confirmation status; method of testing; method of reporting; county of residence; and if they live in a rural county or an urban county. As summarized in PADOH's report, a total of 280 children were tested in Carbon County, out of a population of 1,144 children aged 0-23 months in the county (i.e., approximately 24.5% of the eligible population in the county). This is slightly less than the proportion of children tested statewide, which is approximately 27.8% of children aged 0-23 months in the Commonwealth. Table 1 provides a summary of the confirmed childhood blood lead data for Carbon County and Pennsylvania from this report.

Table 1. Comparison of Carbon County and Pennsylvania Statewide Confirmed Child Blood Lead Data, 2015

Population	Children <2 yrs BLL 5-9.9 µg/dL	Children <2 yrs BLL ≥10 µg/dL	Children <6 yrs BLL 5-9.9 µg/dL	Children <6 yrs BLL ≥10 µg/dL
Carbon County (#)	7	3	18	**6**
Carbon County % tested	**2.5%[a]**	**1.1%[a]**	**3.2%[b]**	**1.1%[b]**
State of Pennsylvania (#)	2,041	668	4,931	1,535
State of Pennsylvania % tested	2.6%[c]	0.8%[c]	3.5%[d]	1.1%[d]

[a]Total children <2 years tested in Carbon County = 280 children out of a total population of 1,144.
[b]Total children <6 years tested in Carbon County = 569 children out of a total population of 3,661.
[c]Total children <2 years tested in Pennsylvania = 79, 265 children out of a total population of 285,132.
[d]Total children <6 years tested in Pennsylvania = 140,147 children out of a total population of 859,311.

Overall, Carbon County had a similar number of children with elevated blood lead levels for children less than two and less than six years of age with blood leads between 5-10 µg/dL and at or greater than 10 µg/dL, compared to statewide rates. ATSDR consulted with PADOH about the availability of blood lead data information for children at the census tract or zip code level in Carbon County. However, PADOH

[5] Pennsylvania Department of Health, 2015 Childhood Lead Surveillance Annual Report, 2017. Available at: https://www.health.pa.gov/my%20health/infant%20and%20childrens%20health/lead%20poisoning%20prevention%20and%20control/documents/2015%20childhood%20lead%20surveillance%20annual%20report.pdf.

informed ATSDR that, due to the small numbers of children involved, specific rates at a lower geographic resolution are not available to determine whether blood lead levels are unusually high near the American Zinc Recycling facility.

At ATSDR's request, PADOH shared *adult* blood lead level data reported in the Pennsylvania National Electronic Disease Surveillance System (PA-NEDSS) for 2015, 2016, and 2017. This information included blood lead data reported for adults with residential addresses in zip code 18071 and affiliated companies in Carbon County, PA. The BLL data within PA-NEDSS may be incomplete and may not represent all employees enrolled in a specific company's (e.g., the American Zinc Recycling facility) occupational lead monitoring program and/or all blood lead reports from adult residents in this zip code and/or county who might have had blood lead testing. Another important limitation of this information is that we do not know the total number of adults who obtained blood lead testing. Therefore, it is not possible to generate surveillance rates from these results. Pennsylvania law requires reporting of adult blood lead results greater than or equal to 25 ug/dL, although some laboratories/medical providers voluntarily report all their adult blood lead testing results (non-detect and higher). Based on this preliminary information, all blood lead level reports for adults residing in this zip code or county are associated with an employer. Further, there were workers at the American Zinc Recycling facility in Palmerton who had elevated blood lead levels in recent years. OSHA records note that this location was cited for violations in 2014, 2015, and 2016.[6] ATSDR recommends further discussion of this finding with PADOH.

Limitations

There are some important limitations to ATSDR's evaluation:

- Modeling provides predictions of concentrations that may occur under specific conditions, but it does not determine whether exposure to these modeled concentrations occurred in the past or is occurring now.
- AERMOD emission parameters and results were based on 2014 stack test results for all kilns (results from a 2016 stack test was also used on Kiln 1). Operating conditions varying from those captured during these stack tests would alter these modeling results. Further, ATSDR and EPA did not have information necessary to conduct modeling and spatial analyses for emissions from other facility operations. For example, this modeling does not include contributions to air emissions related to fugitive emissions at this facility, particle deposition and contribution to dust and soil Pb levels, start-up/shut-down/emergency emissions, and/or total inorganic emissions (i.e., all metals) from the four kilns operating at this facility. Depending on operating specifics and meteorological conditions, these could result in over- or under-estimated exposures in the modeling.
- Arc furnace dust contains inorganic compounds at varying levels besides Pb (including Cd, Cr, Cu, Ni, and Zn) and we do not have monitoring or modeling data for any of the other compounds.
- Current residential soil and dust Pb levels have not been measured in this community, although there was significant soil and dust sampling results collected in the past. Lead from all environmental sources (e.g., air, water, dust, soil) contribute to a child's total lead exposure. Often, these exposures co-occur, making it difficult to identify and quantify the individual contribution of each lead source to a child's total lead burden.

[6] OSHA online inspection information, Horsehead Corporation. Available at: https://www.osha.gov/pls/imis/establishment.search?p_logger=1&establishment=horsehead&State=all&officetype=all&Office=all&p_case=all&p_violations_exist=all&startmonth=05&startday=10&startyear=2013&endmonth=05&endday=10&endyear=2018\)

- Data on blood lead testing is subject to several limitations, such as incomplete and inconsistent reporting. Pennsylvania does not have a universal childhood blood lead testing law, so there is no mandate for children not covered by Medicaid to be tested for lead. We are not able to specifically identify the potential at-risk population near this site. The childhood blood lead testing information summarized in this letter is at the county level, and may not represent areas nearby this site and/or from areas where modeling predicted higher levels of lead in air. Similarly, the adult blood lead data summarized may also be incomplete; Pennsylvania law requires reporting of adult blood lead results greater than or equal to 25 ug/dL.

Conclusions

Based on the available modeled and monitored data, ATSDR concludes that a public health hazard is likely for young children and/or pregnant women living within 3 miles (around 15,840 feet based on AERMOD modeling results) of the American Zinc Recycling facility in Palmerton from exposures to lead in outdoor air. Specifically, ATSDR concludes that:

- Children who come in repeated contact with lead are at risk for slower growth and development, hearing damage, and attention and learning problems. Pregnant women exposed to lead are at higher risk for miscarriage and put their unborn baby at risk for premature birth, low birth weight, learning and behavior problems, and damage to their developing brains, kidneys, and nervous system.[7] Adults who are exposed to lead over many years could develop kidney problems, high blood pressure, cardiovascular disease, and cognitive dysfunction.[8]
- Air modeling suggests that higher concentrations of lead than those measured at the existing air monitoring station are possible in the Palmerton community. This modeling information suggests that the current NAAQS monitor may be located outside the maximum deposition area. As such, available air monitoring results may not represent actual worst-case exposures in this community.

Recommendations

1. ATSDR recommends environmental agencies:
   - Conduct particle deposition modeling and compare to AERMOD modeling results.
   - Review PADEP particulate air monitoring (inorganic analysis) collected at location(s) by PADEP in response to complaints.
   - Consider placement of monitor(s) in the area(s) identified from the AERMOD and particle deposition modeling to have the highest ground level air concentrations.
   - Sample surface soil and/or conduct an XRF survey of area(s) identified from the AERMOD and particle deposition modeling with highest modeled ground level air concentrations.
   - Evaluate fugitive emissions from the facility boundary which could include monitoring and modeling.
   - Evaluate existing permits to ensure that all emission sources and potential offsite concentrations of site related chemicals do not pose a public health hazard. The outcome of this evaluation may result in a more comprehensive emissions inventory, permit limits and/or additional source control (e.g., reduced emissions).

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[7] Centers for Disease Control and Prevention, Lead, Prevention Tips, At Risk Populations, Pregnant Women. Last Updated December 8, 2015. Available at: https://www.cdc.gov/nceh/lead/tips/pregnant.htm

[8] Kosnett, et al. Recommendations for Medical Management of Adult Lead Exposure. Environ Health Perspect. 2007 Mar; 115(3): 463-471. Available at: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1849937/

2. ATSDR recommends health agencies:
   - Continue to evaluate and conduct further analyses of child and adult blood lead levels in Palmerton/Carbon County, and further discuss the adult blood lead information with PADOH.
   - Continue discussions with PADOH regarding the need to increase blood lead screening activities and health provider outreach in Palmerton, PA.

3. ATSDR recommends families in the community:
   - Take steps to reduce children's exposure to lead, including avoiding sources that contain lead such as lead-based paint; brass; lead-containing toys, candies, or tableware; traditional folk medicines; contaminated soil/dust; and lead from hobbies or jobs (e.g., stained glass, firearm ammunition, fishing weights, welding, and home renovation).
   - Test children's blood for lead, following guidance from the CDC and American Academy of Pediatrics, including an initial blood lead screening between 9 and 12 months; a second screening between 3 to 6 months later (between the ages of 12 and 18 months old) [9]; and a blood lead test annually until age 5 [10]. When a child has a BLL above the reference level, CDC recommends that health care providers work with families to determine the child's exposure history.
   - Talk to their health professional or call PADOH's Lead Information Line at 1-800-440-LEAD (5323) if they have concerns about exposure to lead and want more information on steps they can take to reduce exposures.

Thank you for allowing ATSDR this opportunity to provide EPA with this public health evaluation. We welcome opportunities to further discuss next steps to address the concerns about current lead exposures in this community. Please contact me at the contact information below if you would like to discuss this further.

Sincerely,

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Senior Toxicologist
ATSDR Region 3
1650 Arch Street
MS: 3HS00
Philadelphia, PA, 19103
215-814-3149
kvm4@cdc.gov

[9] American Academy of Pediatrics, Detection of Lead Poisoning, 2016. Available at: https://www.aap.org/en-us/advocacy-and-policy/aap-health-initiatives/lead-exposure/Pages/Detection-of-Lead-Poisoning.aspx.

[10] CDC, Recommended Actions Based on Blood Lead Level, 2018. Available at: https://www.cdc.gov/nceh/lead/acclpp/actions_blls.html.

Attachment

The Agency for Toxic Substances and Disease Registry (ATSDR) Division of Community Health Investigations, Science Support Branch, developed visualization for air dispersion modeling of lead emitted from American Zinc Recycling's zinc kilns (all 4 kilns) using the AMS/EPA Regulatory Model (AERMOD) that was performed by the Environmental Protection Agency Region III (EPA). EPA performed the modeling to assist ATSDR in interpreting results of existing air monitoring conducted by the Pennsylvania Department of Environmental Protection. While available monitoring data provides actual levels of exposure occurring at discrete monitoring sites near the American Zinc Recycling Palmerton site, air dispersion modeling can answer questions about where maximal impacts occur and how exposure decreases with distance from a source. Most air toxics risk assessment benefit from some combination of both modeling and monitoring to provide answers to exposure questions [EPA 2004A & B].

Model Details

Model Setting

Palmerton, PA is located in the Lehigh Valley, PA, at the confluence of the Aqushicola creek and the Lehigh River, north of Lehigh Gap (where the Lehigh River cuts through the Appalachian Mountains). The American Zinc Recycling Palmerton smelter is located to the east of downtown Palmerton. The model domain is set in a valley which runs roughly east - west, with mountainous terrain particularly to the south, with lesser slopes towards the north of the facility (see Figure 1).

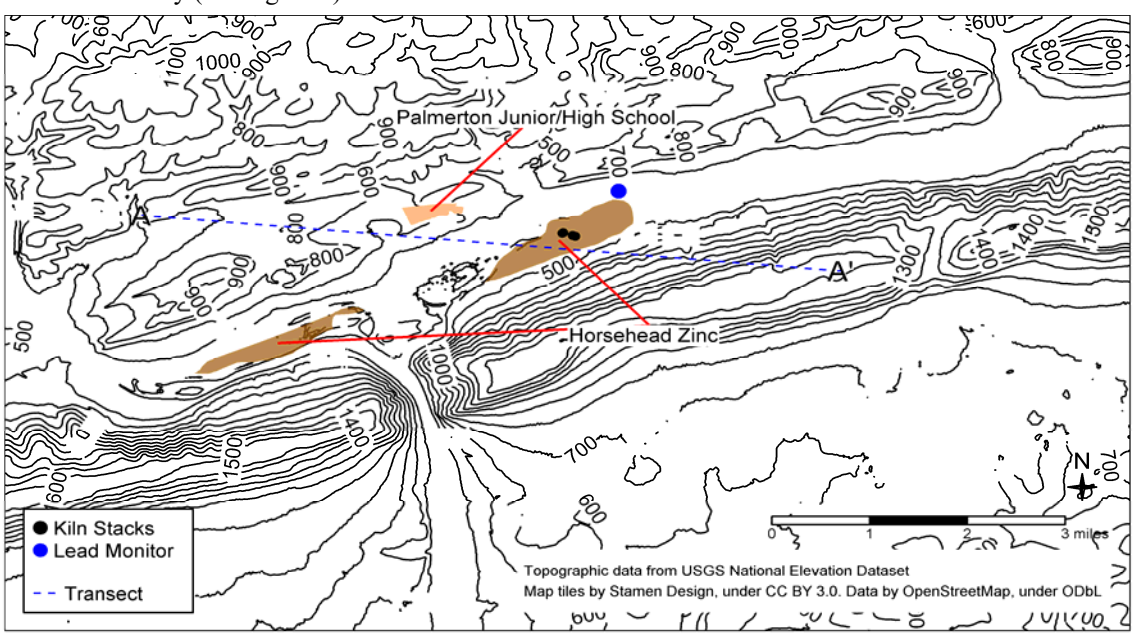

Figure 1: Palmerton, PA Terrain Map

Meteorological Data Processing

AERMINUTE

National Weather Service data from Lehigh Valley International Airport weather station (KABE) were used in this modeling project. AERMINUTE version 15272 was used to process 5-minute Automated Surface Observing System (ASOS) DSI-6401 data and 1-minute ASOS DSI- 6405 data from National Climatic Data Center for KABE. These wind speed and wind direction data are secondary to the onsite wind direction and wind speed, that is, they were substituted on the 14,392 hours of 78,888 hours when wind speed and direction were not available from the PADEP meteorological tower at Palmerton, PA (see Onsite Data, below). KABE is located 28.9 kilometers south-southeast of the site.

AERSURFACE

Surface characteristics around both KABE and the onsite meteorological stations were extracted using AERSURFACE version 13016 based on land use from the 1992 National Land Cover data. The options EPA selected for AERSURFACE are shown in Table 1.

Table 1: AERSURFACE Options

Option	Setting
Study Radius	1 kilometer (km)
Sectors	12 sectors in 30 degree increments
Continuous Snow	No
Monthly Season Assignment	1,2,12 - Winter without snow 3,4,5 – Spring 6,7,8 – Summer 9,10,11 – Autumn
Meteorological Site at Airport	KABE: Yes ONSITE: No
Arid Region	No
Surface Moisture	Average
NWS Station Location	40.650 North 75.433 West
Onsite Station Location	40.814204 North 75.580448 West

AERMET Processing

ATSDR used AERMET version 16216 to process the data from AERMINUTE, AERSURFACE, and measured onsite meteorological data into hourly parameters for dispersion modeling using AERMOD.

Onsite Data

Approximately 8 years of hourly wind speed, wind direction, insolation, temperature, and precipitation data from a 10-meter meteorological tower set up at Little Gap Road by PADEP. These data were pre-processed and imported into AERMET. For hourly wind direction and speed used in modeling, 82% came from the PADEP Little Gap Road air monitoring tower.

NWS Data

EPA used DSI- 3505 Hourly National weather service data from KABE for other surface meteorology parameters for modeling.

Upper Air Data

ATSDR processed upper air sounding data from Albany, New York (KALY).

AERMET Options

Options selected for AERMET processing are shown in Table 2. The data period processed was from January 2002 – December 2010. This period represents one year of onsite meteorology and is considered acceptable for modeling purposes [EPA 2005].

Table 2: AERMET Options

Option	Setting	Explanation
Onsite Wind Speed Threshold	0.2 meters per second	Wind Speeds less than 0.2 meters per second considered "calm"
Wind Dir	Random	Randomize NWS wind directions to account for truncation
Stable BL	Adjust u*	Adjust for low wind speed stable conditions
NWS Height	10 meters	Height of meteorological tower at KABE

Wind roses for the AERMET surface file are shown in Figures 2 and 3. As would be expected given the regional topography and wind patterns, the winds remain zonal (that is, a predominant east or westerly direction), with faster winds from the west, and faster winds during the day and winter/spring seasons.

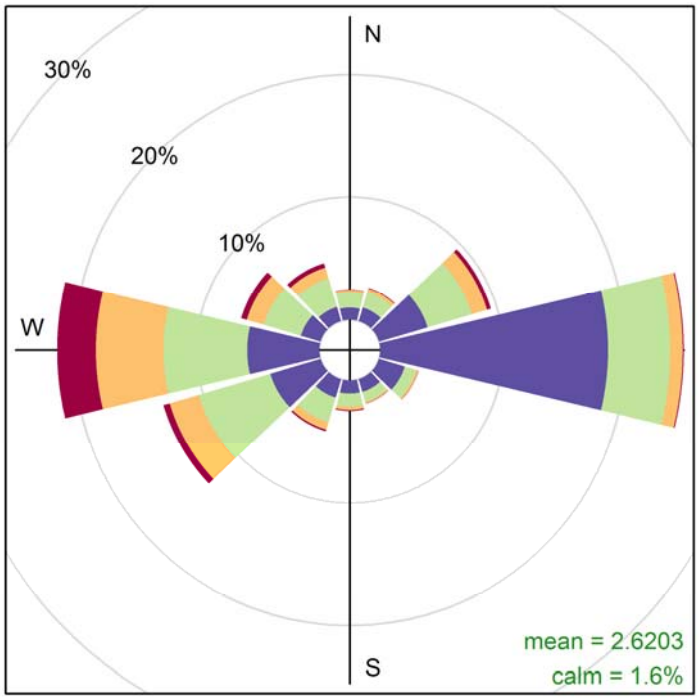

Figure 2: AERMET Surface File Wind Rose

Notes

- Model period based on 2002 - 2010 Onsite Meteorological Data using AERMOD Surface File
- ms^{-1}: Meters per Second

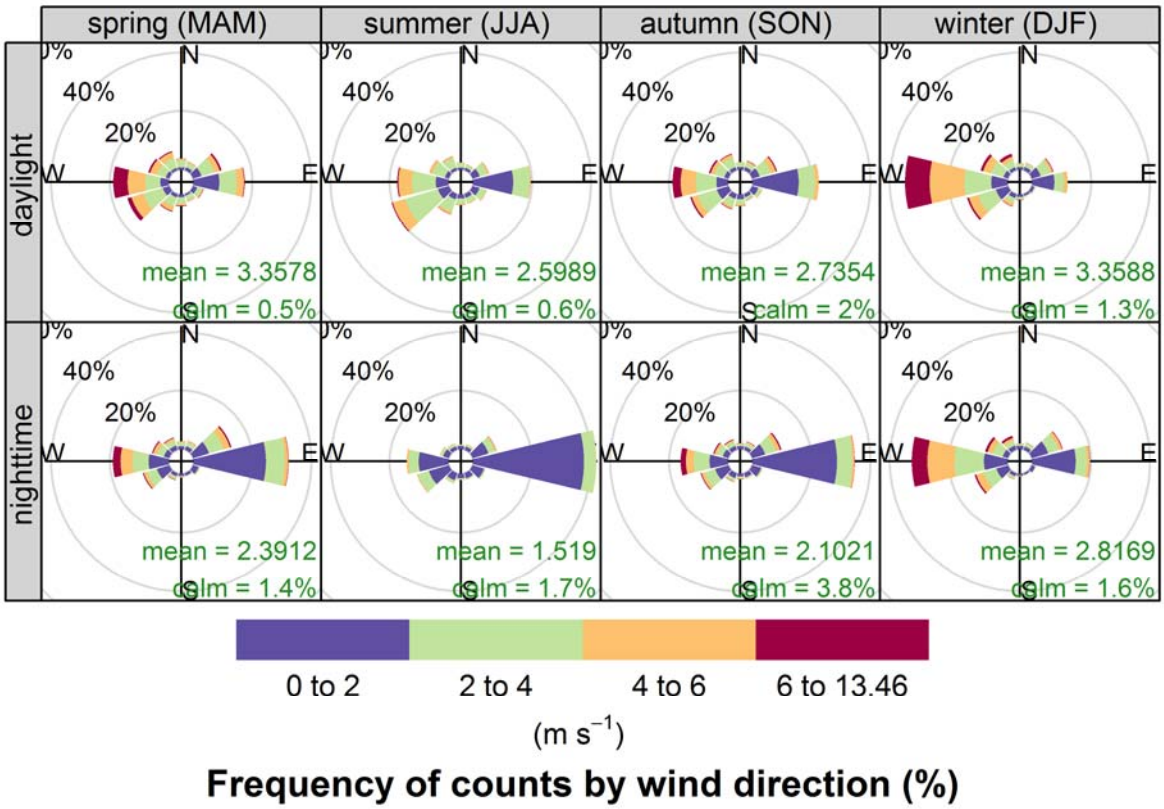

Figure 3: AERMET Surface File Diurnal/Seasonal Wind Roses

Notes

- Model period based on 2002 - 2010 Onsite Meteorological Data using AERMOD Surface File
- MAM: March, April, May
- JJA: June, July, August
- SSA: September, October, November
- DJF: December, January, February
- ms^{-1}: Meters per Second

Model Receptors

EPA used receptors provided by PADEP. Elevation and controlling hill height were based on land elevation analysis by AERMAP (version 11103) using National Elevation Dataset geotiff files. A map of the receptors is shown in Figure 4.

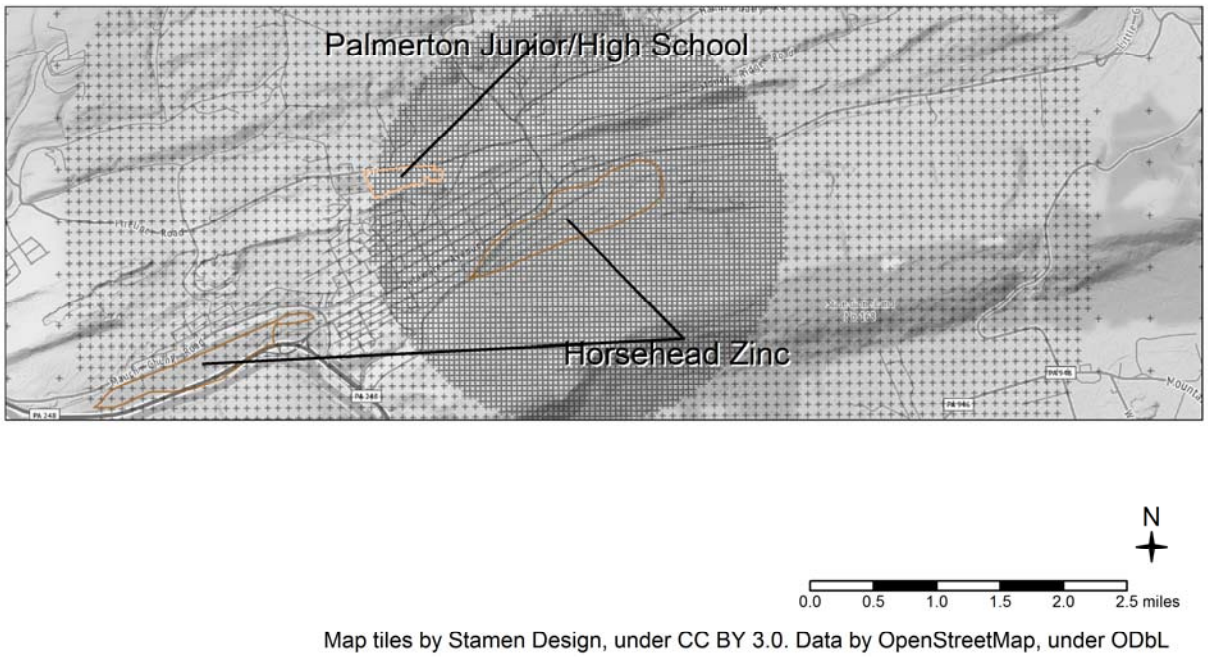

Figure 4: AERMOD Receptor Grid

AERMOD Processing

AERMOD version 16216r (EPA 2016a) was used to perform the dispersion modeling. Stack test results and other parameters were kiln specific for this modeling exercise. In addition, the optional u* adjustment was used for the model (EPA 2016b). Emission parameters for Kiln 1 were from a 3/22/2016 stack test completed by Pace Environmental. Emission parameters for the remaining kilns were obtained from a November 11, 2014 stack test completed by Weston. Monthly operating hours in each mode for Kiln 1 provided to EPA by facility (due to permitting restrictions). Annual operating hours for the remaining three kilns were obtained from PA DEP Air Information Management System (AIMS). Information regarding particle density or diameter was not available, so deposition and depletion were not included in the model (Schmidt 2017). This model only included parameters for stack emissions and did not include fugitive and non-point sources from the facility.

AERMOD was run to generate plotfiles showing model averages for:

- 95% highest and highest 24-hour period
- Highest Month
- Highest Year
- Period Average

Additionally, monthly averages were calculated at each receptor for processing using LEADPOST, which calculates rolling 3-month average times for comparison to the National Ambient Air Quality standard for lead.

Post Processing

Results of AERMOD plotfiles and LEADPOST were visualized first using POST View™ version 8.0.5 (Lakes 2012) and exported as shapefiles of contours of concentrations. Additionally, individual receptors were visualized to show concentrations exceeding NAAQS standards.

Model Results

Maximum annual average concentration was 0.1025 $\mu g/m^3$, with ridges of the valley predicted to have the higher concentrations (Figure 5). The air monitoring station on Little Gap Road is predicted to have an annual average between 0.01 – 0.05 $\mu g/m^3$.

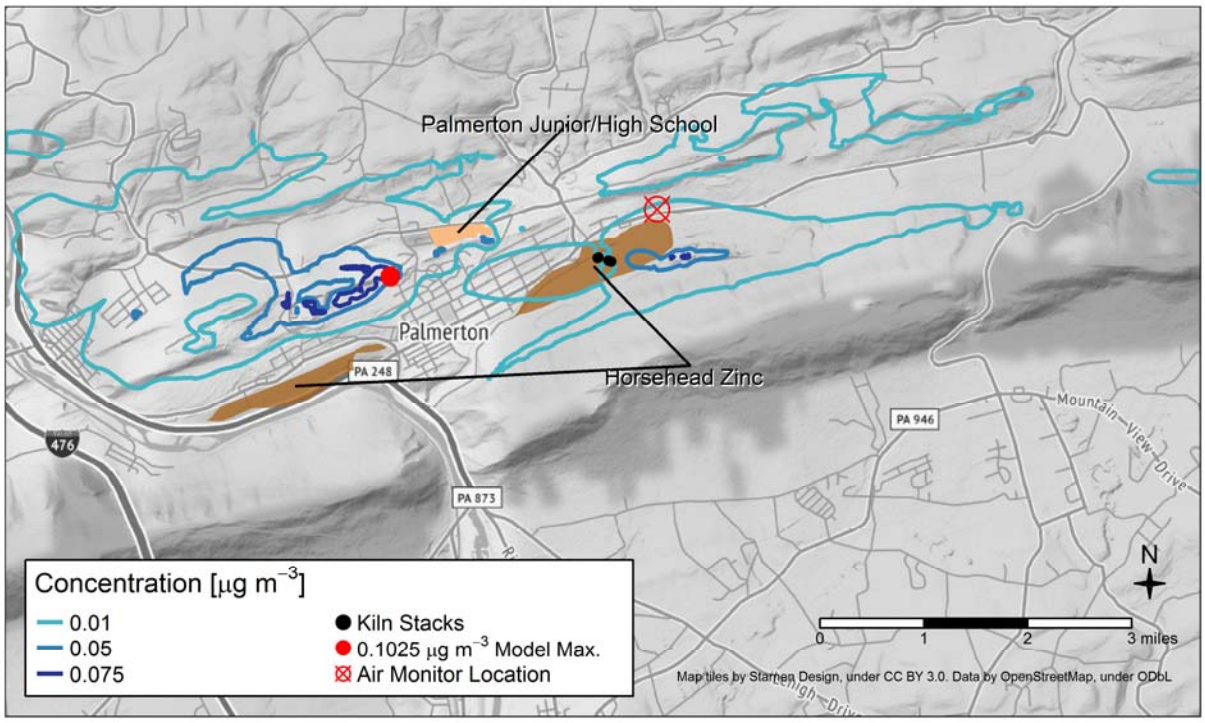

Figure 5: AERMOD Predicted Annual Lead Concentration

Notes

- Model period based on 2002 - 2010 Onsite Meteorological Data using AERMOD Version 16216.
- Contours of annual average plotfile.
- $\mu g/m^3$: Micrograms per cubic meter

The maximum monthly concentration was predicted to be 0.26779 $\mu g/m^3$, with the estimated Pb air concentration at the NAAQS air monitor location falling between 0.01 – 0.05 $\mu g/m^3$ (Figure 6). The highest rolling 3 – month average (which would be comparable to the NAAQS limit of 0.15 $\mu g/m^3$) was 0.24353 $\mu g/m^3$ (Figure 7). The maximum 3-month receptor air concentrations that were higher than the NAAQS were generally located west of the facility stacks and along the ridge, with some receptors near the Palmerton Junior/High School (Figure 8). The maximum 24 – hour concentration predicted by the model was 1.5976 $\mu g/m^3$, which was located on the south of the kilns (Figure 9). The model would predict the highest 24-hour measurement at the NAAQS monitoring site to be slightly higher than 0.1 $\mu g/m^3$ with a 95% highest measurement 0.05 $\mu g/m^3$ (Figures 9 and 10).

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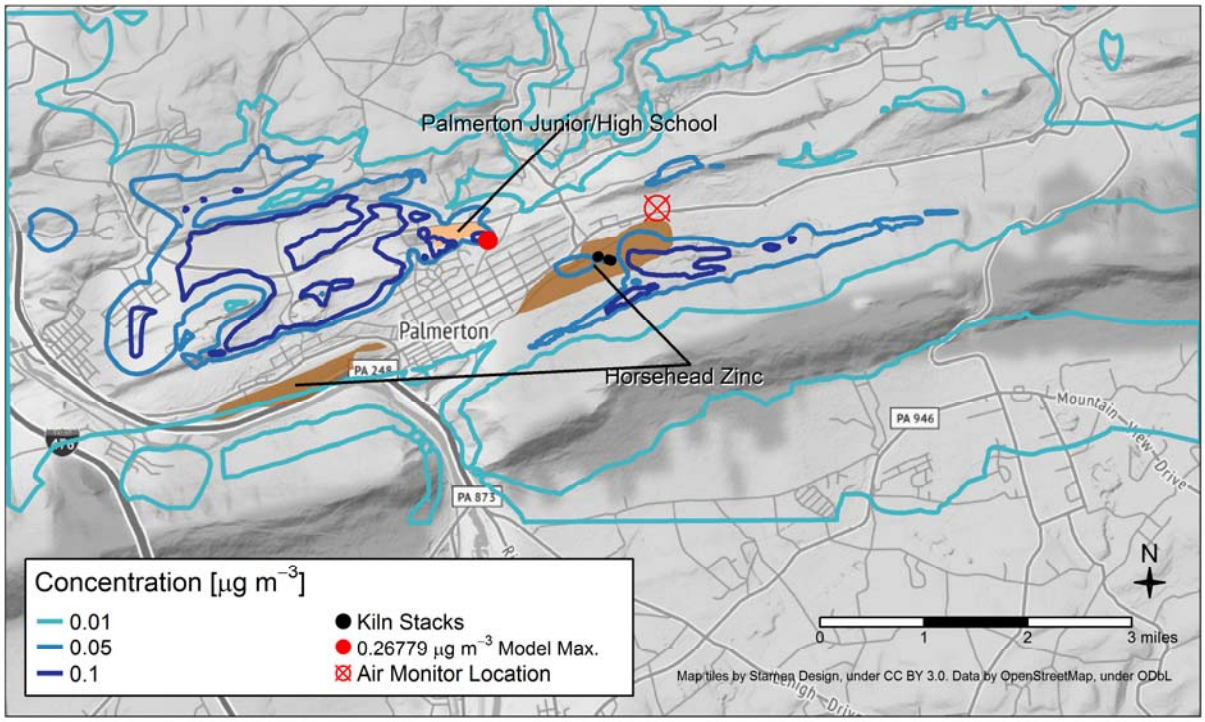

Figure 6: AERMOD Highest Monthly Average Lead Concentration

Notes

- Model period based on 2002 - 2010 Onsite Meteorological Data using AERMOD Version 16216.
- Contours of highest monthly average plotfile.
- $\mu g/m^3$: Micrograms per cubic meter

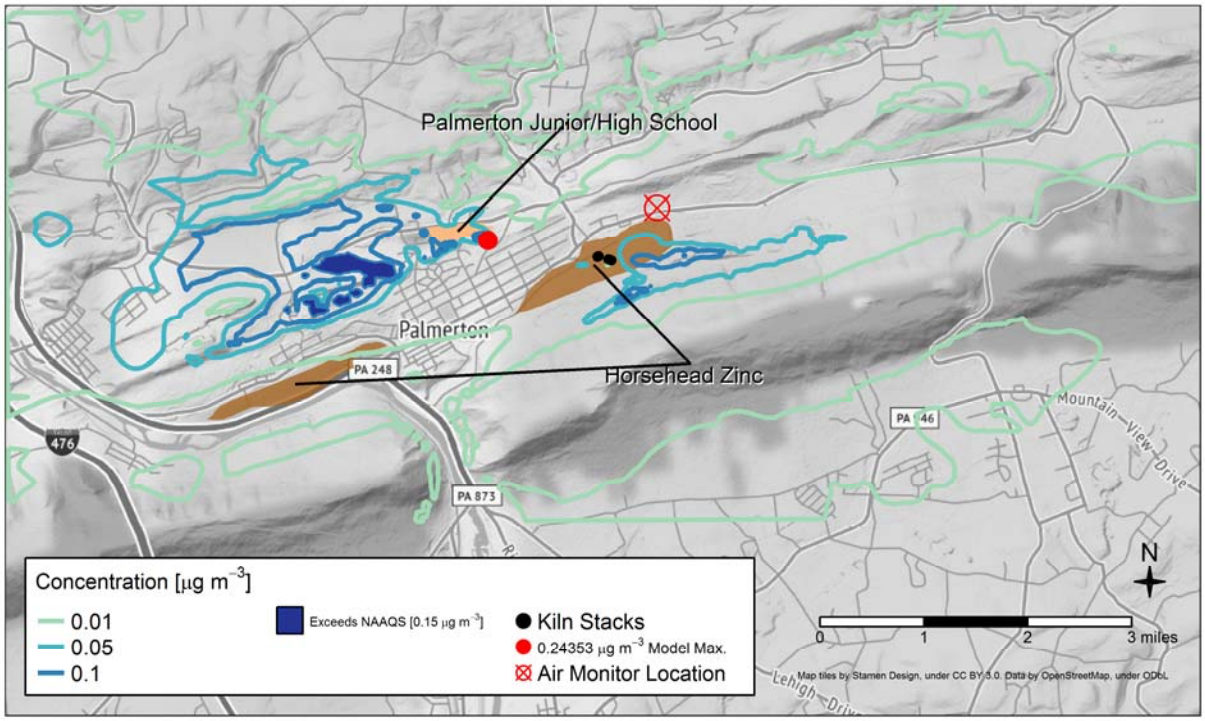

Figure 7: AERMOD Highest Rolling 3-Month Average Lead Concentration

Notes

- Model period based on 2002 - 2010 Onsite Meteorological Data using AERMOD Version 16216.
- Contours of highest rolling 3-month average design values processed by LEADPOST.
- Areas exceeding National Ambient Air Concentration (NAAQS) are highlighted in blue.
- $\mu g/m^3$: Micrograms per cubic meter

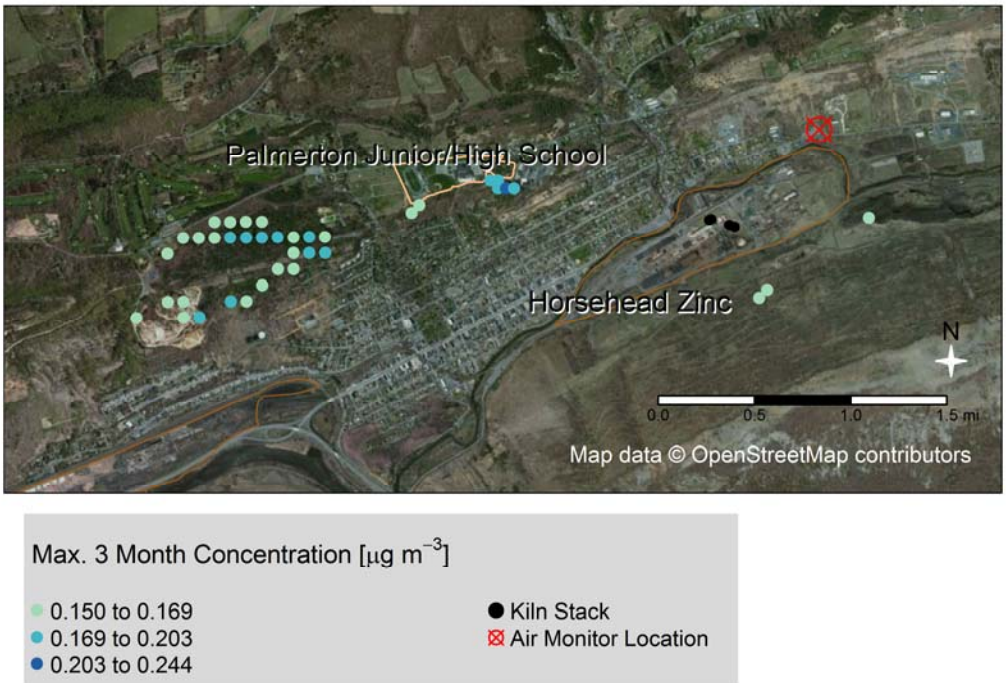

Figure 8: AERMOD Receptors Exceeding NAAQS

Notes

- Model period based on 2002 - 2010 Onsite Meteorological Data using AERMOD Version 16216.
- Contours of highest rolling 3-month average design values processed by LEADPOST..
- $\mu g/m^3$: Micrograms per cubic meter

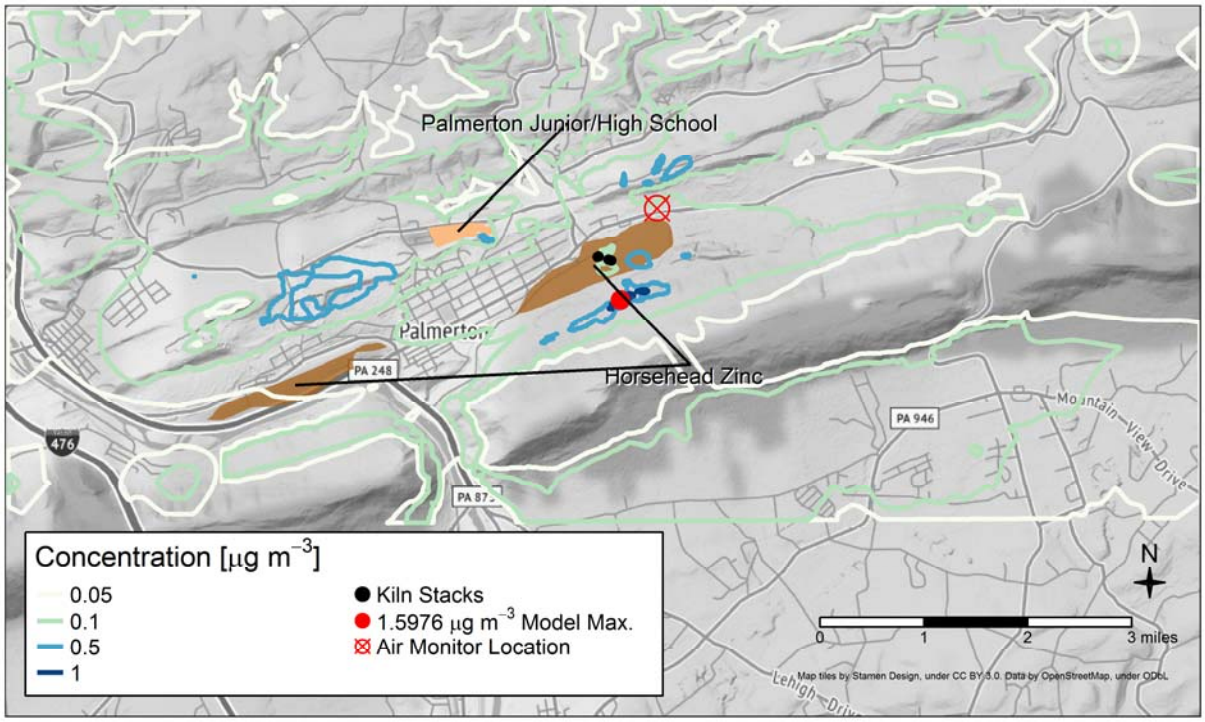

Figure 9: AERMOD Highest 24-Hour Average Lead Concentration

Notes

- Model period based on 2002 - 2010 Onsite Meteorological Data using AERMOD Version 16216.
- Contours of highest 24-hour average.
- $\mu g/m^3$: Micrograms per cubic meter

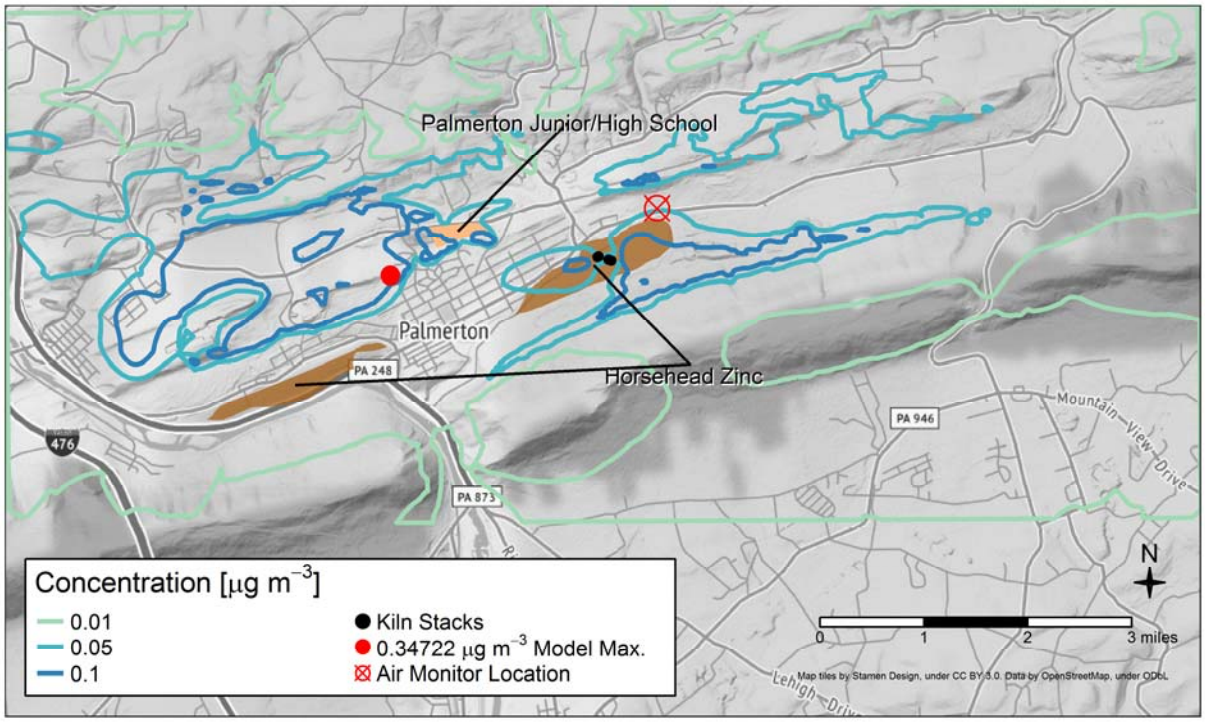

Figure 10: AERMOD 95% 24-Hour Average Lead Concentration

Notes

- Model period based on 2002 - 2010 Onsite Meteorological Data using AERMOD Version 16216.
- Contours Indicate the 95% of the 24-hour average.
- $\mu g/m^3$: Micrograms per cubic meter

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