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Date: February 21, 2022
To: Members of the House Environment & Transportation Committee
From: Holly Porter, Executive Director
Re: HB 798 – Community Healthy Air Act - **OPPOSE**

Delmarva Chicken Association (DCA) the 1,600-member trade association representing the meat-chicken growers, processing companies and allied business members on the Eastern Shore of Maryland, the Eastern Shore of Virginia, and Delaware opposes HB 798 and urges an unfavorable committee report.

HB 798 seeks to create a state funded Committee on Air Quality to develop an air quality sampling and monitoring protocol for the collection of air quality and public health data associated with animal farms throughout Maryland. Once the protocol is adopted, without approval by any state agency or the General Assembly, the Maryland Department of the Environment is to use it to measure air emissions from family farms, including cattle, dairy, hog, chicken, and possibly horse farms. And this is all to be completed within 15 months of passing this bill.

Proponents of this bill continue to press for legislation that is not needed. Three years ago when this bill was last introduced, the only groups willing to invest funds (nearly $400,000) and time into gathering data about the air quality within the communities surrounding chicken farms was the Delmarva Chicken Association, along with the Campbell Foundation for the Environment, University of Maryland Eastern Shore (UMES) and Maryland Department of Environment.

That data has been gathered since April 2020 through two air monitoring stations on the lower Eastern Shore of Maryland (Princess Anne and Pocomoke) and adding monitoring to two existing stations (Horn Point and Oldtown, Baltimore). The monitoring station at Pocomoke has 29 chicken houses within a one-mile radius, 70 chicken houses within a 2-mile radius and a significant number of additional houses beyond the two-mile radius.

Attached is the results of that publicly available data that can be found at https://mde.maryland.gov/programs/Air/AirQualityMonitoring/Pages/Lower-Eastern-Shore-Monitoring-Project.aspx. This data clearly shows that average and media hourly values are well below any standards or threshold of concern and even the maximum hourly value over the 20 months is below any levels of concern. As a matter of fact, fine particulate matter (PM 2.5) was higher on average at the Baltimore station than at either location on the lower Eastern Shore. There are no large-animal feeding operations near Baltimore city.

HB 798 creates a committee to study animal feeding operations yet does not include any experts from agriculture. The compressed timeframe for the study committee to be selected, to develop the protocol, to have it peer reviewed by an unidentified group of experts (again, not including agricultural experts), and to have the Maryland Department of the Environment use it to assess air pollutants and public health risks associated with all large animal-feeding operations is not a reasonable goal. In fact, MDE might not even have the expertise to assess public health risks. The committee is to identify all air

pollutants emitted from large animal-feeding operations and how to do that will vary from pollutant to pollutant, from animal species to species, and from season to season.

We have also attached information that we've shared with this committee before with studies that have showed that particulate matter levels in the air 100 feet away from chicken house ventilation fans is almost indistinguishable from ambient air. And this does not take into account the effectiveness of vegetative buffers around chicken farms.

The data has already been gathered; a committee is not needed to determine that there are no more public health risks to those living within our chicken community, including our own growers than those living in other parts of Maryland.

We urge an **unfavorable** vote on HB 798.

Should you have any additional questions, please feel free to contact me at porter@dcachicken.com or 302-222-4069 or Nick Manis, Manis Canning & Associates, 410-263-7882.

Lower Eastern Shore Air Monitoring Project – April 2020-January 2022 Summary

April 2020 – January 2022 Data Summary for NH_3 **MDE 1-hour screening level = 350 ppb**

Parameter	Site	Average hourly value (ppb)	Median hourly value (ppb)	Maximum hourly value (ppb)	Minimum hourly value (ppb)
NH_3	Baltimore Co. NR (Urban, no poultry operations)	4.9	4.6	18.8	-1.1
	Princess Anne (Low poultry operation density)	4.8	4	123.6	-1
	Pocomoke City (High poultry operation density)	10.4	7.8	218.7	-1

April 2020 – January 2022 Data Summary for $PM_{2.5}$ **NAAQS $PM_{2.5}$ 24-hour standard = 35 µg/m³**

Parameter	Site	Average 24-hr value (µg/m³)	Median 24-hr value (µg/m³)	Maximum 24-hr value (µg/m³)	Minimum 24-hr value (µg/m³)
$PM_{2.5}$	Lake Montebello* (Urban, no poultry operations)	10.4	10	18.2	4.5
	Princess Anne (Low poultry operation density)	7.5	6.8	36	1.5
	Pocomoke City (High poultry operation density)	7.2	6.6	33.7	1.9

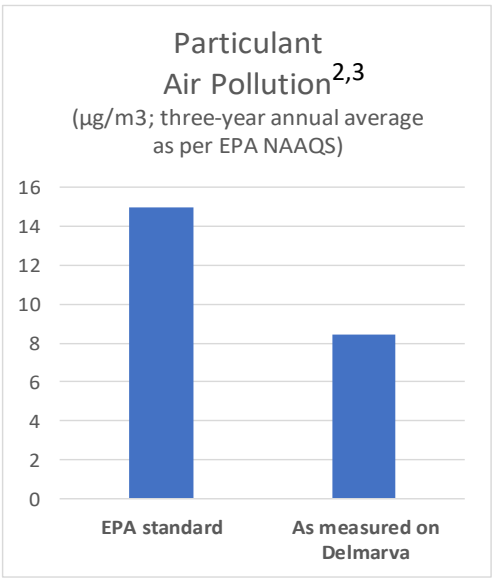
April 2020 – January 2022 Data Summary for PM_{10} **NAAQS PM_{10} 24-hour standard = 150 µg/m³**

Parameter	Site	Average 24-hr value (µg/m³)	Median 24-hr value (µg/m³)	Maximum 24-hr value (µg/m³)	Minimum 24-hr value (µg/m³)
PM_{10}	Princess Anne (Low poultry operation density)	13.9	13.1	46.8	3.2
	Pocomoke City (High poultry operation density)	14	13.2	46.2	4.2

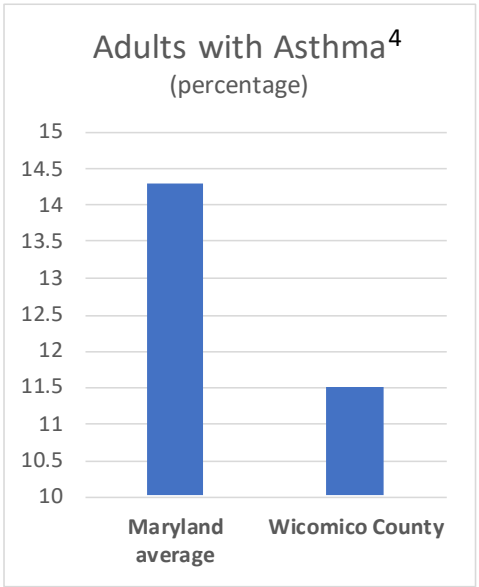
* During January 2022, PM2.5 was moved from Oldtown (closed) to Lake Montebello.
Please see 2021 data summary for further data.
NAAQS: National Ambient Air Quality Standards

A BREATH OF FRESH AIR

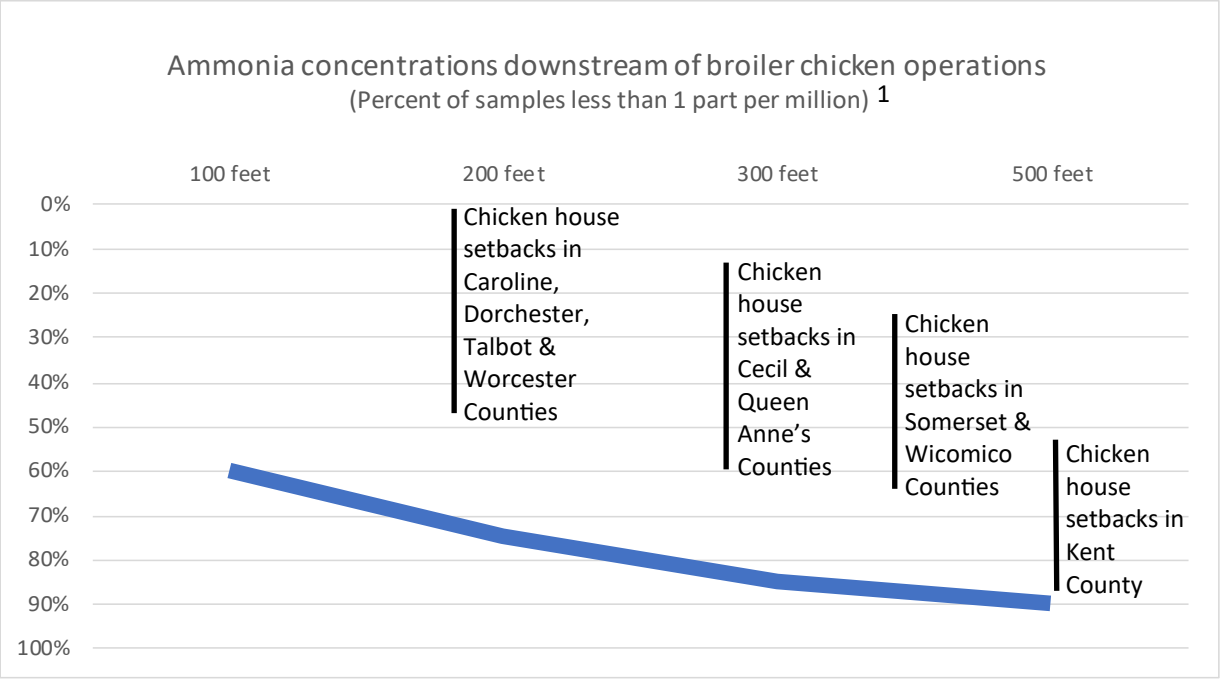
The bill requiring Maryland taxpayers to finance a study determining how to monitor air emissions from family farms won't actually improve public health, and it ignores all the evidence provided here that shows Eastern Shore air is clean and healthy.

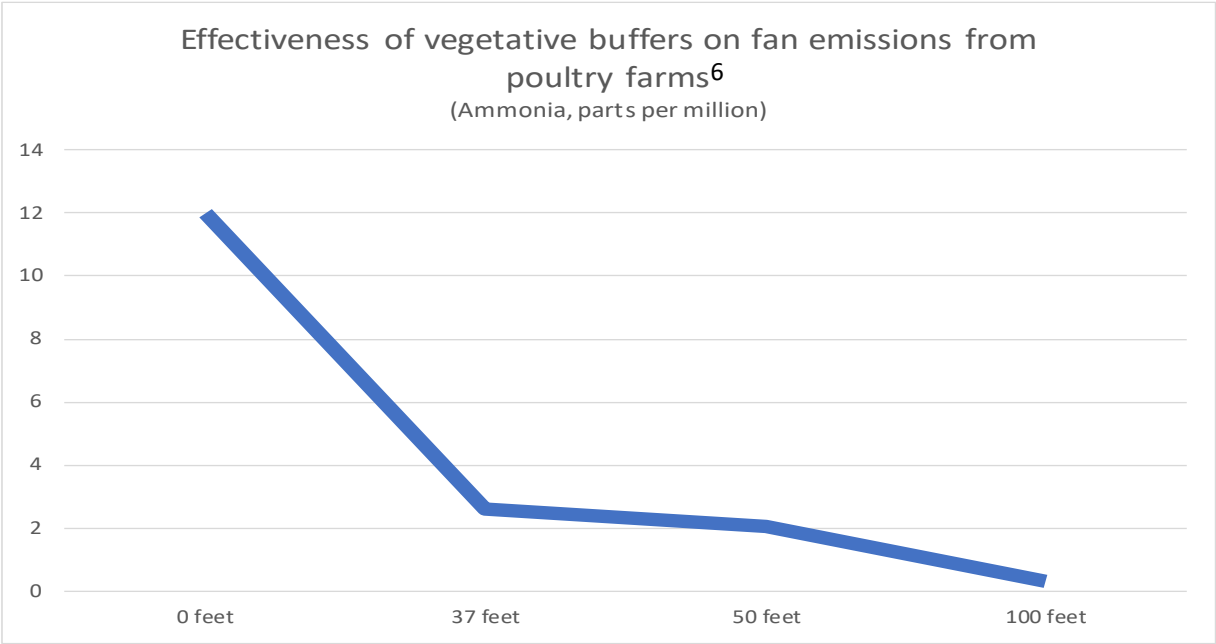


They say *no one's ever done air quality monitoring at chicken farms.*
We know that researchers <u>have</u> studied air quality on chicken farms. A University of Air Georgia study looked at particulate matter levels in the air 100 feet away chicken house ventilation fans. They found the levels were statistically indistinguishable from ambient air[2] — in fact, lower than typical particulate levels in urban areas.[2,3]
We know another study found ammonia levels at typical setbacks from chicken houses do not exceed OSHA and EPA odor detection thresholds.[1,3] Ammonia levels in air sampled 300 feet from the houses were less than 1 part per million 85 percent of the time; ammonia's odor is undetectable below 5 parts per million.[1]
And we know long-running air quality monitoring in the heart of Delmarva's chicken-producing region shows air here is cleaner, with lower particulate levels, than the EPA's standard for particulate matter, and cleaner than air in our region's urban areas.[3]



They say *counties with more chicken farms have higher asthma rates.*
We know that's just not true. In Wicomico County, where there are hundreds of family-owned chicken houses, the adult asthma rate is in fact lower than Maryland's average.[4]
The bill's supporters point to high asthma rates among Wicomico County middle schoolers, and they want you to think chicken farms are the reason.[5] **What they're not telling you**: Wicomico middle schoolers are twice as likely to smoke cigarettes as the average Maryland middle-schooler.[4] By trying to link chicken growers to asthma rates, agriculture's opponents are diverting attention and resources from real health issues and programs that could help.
And we know that poultry industry jobs increase the number of people with access to health insurance and wellness programs. Poultry companies offer their employees and their families on-site health care, above and beyond what most employers provide.





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Maryland
Department of the Environment

Lower Eastern Shore Air Quality Monitoring Project

April 2020 – March 2021

January 2022

Prepared by:

Ambient Air Monitoring Program

Air and Radiation Administration

Maryland Department of the Environment

Acknowledgements:

University of Maryland Eastern Shore

Keith Campbell Foundation for the Environment

Delmarva Chicken Association

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Executive Summary

Through the collective efforts of the Maryland Department of the Environment (Department or MDE), the Keith Campbell Foundation for the Environment, and the Delmarva Chicken Association, an air monitoring project was undertaken on Maryland's Lower Eastern Shore to collect data on ambient air quality to learn more about how air quality near poultry houses compares to other areas of Maryland. Ambient air quality monitoring equipment for ammonia (NH_3) and particulate matter was purchased and installed at two new monitoring sites – one near a higher-than-average density of poultry houses and one near a lower density of poultry houses. Additional NH_3 monitoring equipment was purchased and installed in two existing monitoring sites operated by the Department – one, an urban site at Oldtown in Baltimore City and the other, an isolated rural site at Horn Point in Dorchester County. These existing sites were in locations that allowed them to serve as background monitors for both NH_3 and particulate matter. Ambient air quality data collection for this project officially began on April 1, 2020.

According to U.S. Environmental Protection Agency's (EPA) environmental mapping and screening tool (EJ Screen), about one-third of the population within the portion of the study area that includes a higher-than-average density of poultry houses is considered low income and one-quarter of the population is above the age of 64. Both measures are higher than the statewide average. About 10% of the population has less than a high school education, which is equal to the statewide average. Thirty-four percent of the population are people of color, which is less than the statewide average of 49%.

After the completion of one full year of data collection, there were no measured violations of federal air quality standards for particulate matter and no exceedances of a conservative health benchmark for NH_3. Concentrations of all parameters remained quite low overall throughout the year. Summaries of monitoring results for April 2020-March 2021 are presented in Table 1 below.

To protect public health, MDE uses the National Ambient Air Quality Standards (NAAQS). As NH_3 does not have a health based national ambient standard, MDE scientists chose a conservative comparison metric. NAAQS exists for particulate matter less than 2.5 microns in diameter ($PM_{2.5}$, or fine particulate) and particulate matter less than 10 microns in diameter (PM_{10}). For the purposes of this project, the health benchmark selected for NH_3 comparison is the Department's one-hour air toxics screening level of 350 parts per billion (ppb).

Table 1. **Monitoring Results Summaries.**

April 2020 – March 2021 Data Summary for NH_3 MDE 1-hour screening level = 350 ppb

Parameter	Site	Average hourly value (ppb)	Median hourly value (ppb)	Maximum hourly value (ppb)	Minimum hourly value (ppb)
NH_3	Oldtown (Urban, no poultry operations)	6.5	6.4	26.9	-0.1
	Horn Point (Rural, no poultry operations)	2.2	2.1	9.4	0.3
	Princess Anne (Low poultry operation density)	6.3	5.5	123.6	0
	Pocomoke City (High poultry operation density)	11.3	8.1	218.7	0.2

April 2020 – March 2021 Data Summary for $PM_{2.5}$ NAAQS $PM_{2.5}$ 24-hour standard = 35 µg/m^3

Parameter	Site	Average 24-hr value (µg/m^3)	Median 24-hr value (µg/m^3)	Maximum 24-hr value (µg/m^3)	Minimum 24-hr value (µg/m^3)
$PM_{2.5}$	Oldtown (Urban, no poultry operations)	6.7	6	25.1	0.8
	Horn Point (Rural, no poultry operations)	4.9	4.6	16.7	-1
	Princess Anne (Low poultry operation density)	7.2	6.6	24.6	2
	Pocomoke City (High poultry operation density)	7	6.4	22.6	2

April 2020 – March 2021 Data Summary for PM_{10} NAAQS PM_{10} 24-hour standard = 150 µg/m^3

Parameter	Site	Average 24-hr value (µg/m^3)	Median 24-hr value (µg/m^3)	Maximum 24-hr value (µg/m^3)	Minimum 24-hr value (µg/m^3)
PM_{10}	Oldtown* (Urban, no poultry operations)	14.2	12.2	36.5	2.6
	Horn Point* (Rural, no poultry operations)	7.9	7	19.9	1.2
	Princess Anne (Low poultry operation density)	13.5	12.9	35.8	4
	Pocomoke City (High poultry operation density)	13.7	13.1	40.8	4.5

Concentrations of both $PM_{2.5}$ and PM_{10} for the two Lower Eastern Shore sites were comparable, on average, with those measured at the urban Oldtown site in Baltimore City, but the Oldtown site did show greater variability. The isolated rural Horn Point site was consistently much lower.

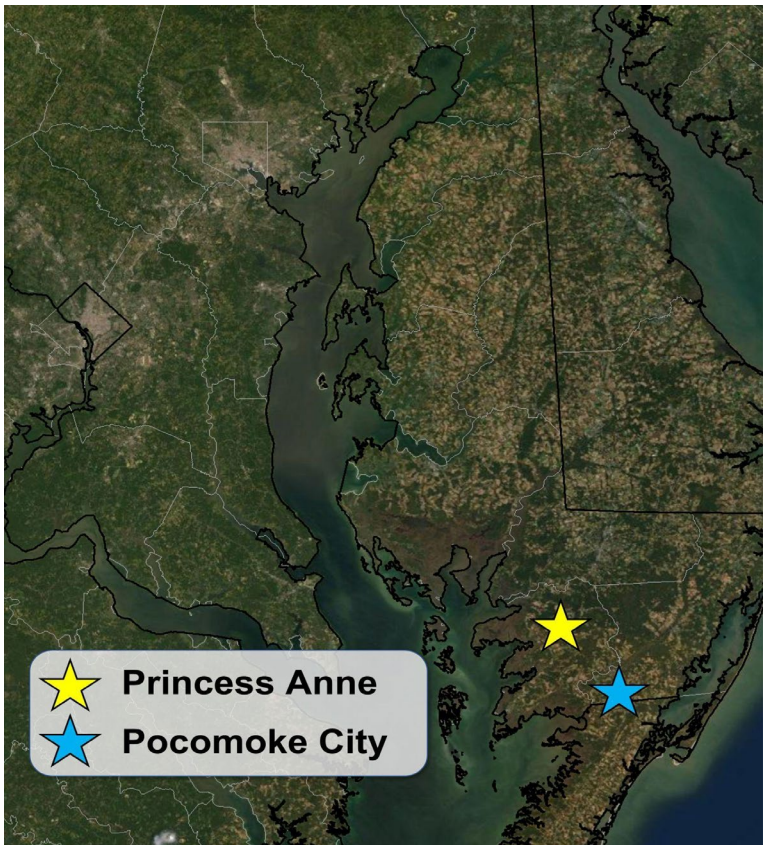
Transient hourly spikes in NH_3 concentrations were frequently observed at the Pocomoke City site, but these never approached the MDE 1-hour screening level, and the majority of the 24-hour NH_3 concentrations rarely exceeded 50 ppb. Average NH_3 concentrations were comparable for the Princess Anne (6.5 ppb) and Oldtown (6.3 ppb) sites while the Pocomoke City site average was almost twice as high (11.3 ppb), with the Horn Point site averaging much lower at 2.2 ppb.

The density of poultry operations within the 2-mile radius surrounding the Pocomoke City site is much greater than the majority of residents of the Eastern Shore would experience within 2 miles of their individual residences. Therefore, these results indicate that the majority of Lower Eastern Shore residents are not being exposed to harmful levels of NH_3, $PM_{2.5}$, or PM_{10} from poultry operations. We welcome additional information about exposure of residents who live even closer to poultry operations.

This project is a first step in determining the quality of the air breathed by the residents of the Lower Eastern Shore who live in the vicinity of a concentration of poultry houses. Monitoring remains ongoing at the two Lower Eastern Shore sites and an urban background site.

Section 1 – Background and Introduction

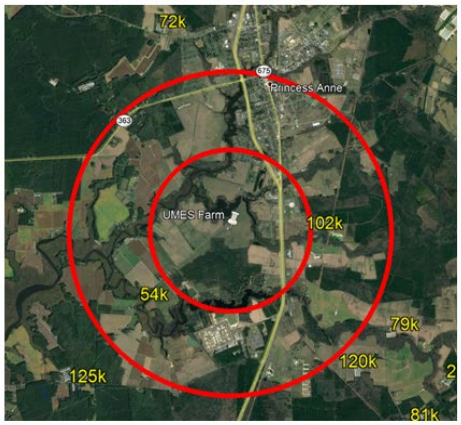
Through the collective efforts of MDE, the Keith Campbell Foundation, and the Delmarva Chicken Association, an air monitoring project was undertaken on Maryland's Lower Eastern Shore to collect data on ambient air quality to learn more about how air quality near poultry houses compares to other areas of Maryland. Ambient air quality monitoring equipment for NH_3 and particulate matter (both $PM_{2.5}$ and PM_{10}) was purchased and installed at two new monitoring sites (Fig. 2) – one near Pocomoke City and the other south of Princess Anne (on a farm owned by the University of Maryland Eastern Shore (UMES)). Additional NH_3 monitoring equipment was purchased and installed at two existing monitoring sites owned by the Department – one, an urban site at Oldtown in Baltimore City and the other, an isolated rural site at Horn Point in Dorchester County. These existing sites, which already contained fine particulate matter monitors, were in locations that allowed them to serve as background monitors for both NH_3 and particulate matter. Ambient air quality data collection for this project officially began on April 1, 2020.



Pocomoke City

- Almost 900,000 chickens within a 2 mile radius and about half that number within 1 mile.
- Impacted from multiple directions.
- Many more chicken houses outside of 2 mile radius.
- 29 broiler houses within a 1 mile radius and 70 houses within a 2 mile radius.

Princess Anne



- Much less impacted by poultry operations within a 2 mile radius.
- Approximately 14 miles to the NE of Pocomoke City site.
- No broiler houses within a 1 mile radius and 7 houses within a 2 mile radius.

Figure 1. Eastern Shore monitoring locations.

The Pocomoke City monitoring location was chosen due to its proximity to a higher-than-average density of poultry houses. Proximity to poultry houses was the location parameter that drove the decision on site placement. The Princess Anne monitoring location was chosen due to its similar general topography as the Pocomoke City station, but near a lower density of poultry houses. The maps in Figure 1 show the monitoring locations and the poultry houses within a 1- and a 2-mile radius of the monitoring locations. The number of birds within such houses is also shown on the maps. Detailed site descriptions are presented in Appendix C.

This report summarizes the ambient air quality monitoring data collected at the two Lower Eastern Shore sites and the two background sites for the period April 1, 2020 through March 31, 2021, and describes the monitoring methods utilized for the project. Monitoring is still ongoing at the Pocomoke City, Princess Anne, and an urban background site. Monitoring for NH_3 at Horn Point was discontinued on May 14, 2021 due to the measured concentrations continually being extremely low.

The data are available as near real-time on the Department's webpage at: mde.maryland.gov/programs/Air/AirQualityMonitoring/Pages/Lower-Eastern-Shore-Monitoring-Project.aspx. The historical data are also downloadable through links presented on the same webpage.

Section 2 - Monitoring Results Summaries

In evaluating the results of the first year of the Lower Eastern Shore Monitoring Project, $PM_{2.5}$ and PM_{10} concentrations will be compared to their respective NAAQS. For $PM_{2.5,}$ the applicable NAAQS are a 24-hour average of 35 micrograms/cubic meter ($\mu g/m^3$), and an annual average of 12 $\mu g/m^3$. For $PM_{10,}$ the applicable NAAQS is a 24-hour average of 150 $\mu g/m^3$. There is no annual NAAQS for PM_{10}.

No ambient NAAQS have been established for NH_3; however, risk-based residential and worker air concentration screening levels have been issued by various federal and state agencies. Among the available exposure levels that exist, the three that are shown in Table 2 below reflect those that best fit the objective of this project – to provide data on residential air quality in the vicinity of poultry operations. The first is EPA's residential lifetime exposure concentration, which assumes an exposure concentration reflective of a residential setting, where an individual would be exposed 24 hours a day, 350 days a year, and over a 30-year duration.

Table 2. NH_3 screening levels.

Source	NH_3 Concentration (ppbv)	Explanation
EPA (residential)	748	EPA residential lifetime exposure concentration assuming 24 hours a day, 350 days a year, and 30-year exposure duration. Concentrations are derived from the 2016 Integrated Risk Information System Toxicological Review for NH_3.
MDE 8-hour air toxics screening level	250	One one-hundredth of the Threshold Limit Values (TLVs) set by the American Conference of Governmental Industrial Hygienists for an 8-hour exposure period. TLVs refer to the airborne concentrations of a substance that represents conditions to which nearly all workers may be exposed without adverse health effects.
MDE 1-hour air toxics screening level	350	One one-hundredth of the TLVs set by the American Conference of Governmental Industrial Hygienists for a 1-hour exposure period.

The second and third values in the chart are MDE's air toxics screening levels. These screening levels are used during the permitting of pollution point sources to determine whether the emissions from an individual source would pose a threat to public health. The screening levels are conservative in nature, as they represent the worker protection exposure levels developed by the American Conference of Governmental Industrial Hygienists divided by a safety factor of 100.

There is no universally accepted level for when NH_3 can be detected through smelling. An odor threshold for NH_3 has been documented in different studies to be as low as 0.04 parts per million (40 ppb), and sensitivity to odors can vary among individuals. This threshold is below the levels shown above that are being used to determine impacts to public health, which means that an odor can be detected before the concentration reaches a level where public health is being impacted.

$PM_{2.5}$ Data Summaries

A summary of $PM_{2.5}$ data from April 1, 2020 through March 31, 2021 is presented below in Table 3. Throughout the course of the year, $PM_{2.5}$ concentrations remained relatively low and did not approach levels of either the 24-hour or annual NAAQS. Annual averages for the two Lower Eastern Shore sites and Oldtown were fairly comparable, with the Princess Anne and Pocomoke City sites registering slightly higher values than the Oldtown site in Baltimore City, (7.2 µg/m^3 and 7.0 µg/m^3 vs. 6.7 µg/m^3, respectively) and the rural Horn Point site demonstrating the lowest $PM_{2.5}$ annual average (4.9 µg/m^3).

Among the sites in this project, the maximum observed 24-hour $PM_{2.5}$ concentration throughout the year was 25.1 µg/m^3, which occurred at the Oldtown site on Dec. 11, 2020**.** On Feb. 10, 2021, Princess Anne and Pocomoke City experienced similar maximums at 24.6 µg/m^3 and 22.6 µg/m^3, respectively. The maximum at Horn Point, also on Feb. 10, 2021, was considerably lower at 16.7 µg/m^3, likely due to the isolated rural location. This is not definitive, but elevated concentrations over an area this large most likely indicate a regional air mass, not an event influenced by local sources. It could be due to an inversion over the Lower Eastern Shore. All sites exhibited excellent 24-hour data completeness, the lowest being 89% at the Oldtown site.

Table 3. $PM_{2.5}$ data summary, April 2020 – March 2021.

Parameter	Site	Average 24-hr value (µg/m^3)	Median 24-hr value (µg/m^3)	Maximum 24-hr value (µg/m^3)	Minimum 24-hr value (µg/m^3)	% Complete
$PM_{2.5}$	Oldtown (Urban, no poultry operations)	6.7	6	25.1	0.8	89
	Horn Point (Rural, no poultry operations)	4.9	4.6	16.7	-1	96
	Princess Anne (Low poultry operation density)	7.2	6.6	24.6	2	100
	Pocomoke City (High poultry operation density)	7	6.4	22.6	2	100

NAAQS 24-hr standard = 35 µg/m^3; Annual Average standard = 12 µg/m^3.

$PM_{2.5}$ Time Series Plots

Daily concentrations of $PM_{2.5}$ are color coded according to their corresponding Air Quality Index colors (Fig. 2), and never exceed the moderate range. The time series plots presented below in Figures 3 through 6 illustrate the daily 24-hour $PM_{2.5}$ concentration from April 1, 2020, through March 31,2021.

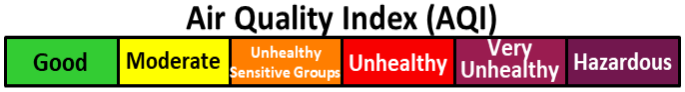


Figure 2. The Air Quality Index.

Concentrations tended to track well across all the sites on the Eastern Shore, rising and lowering on the same days. Although the magnitude was considerably lower at the more isolated and rural Horn Point site. This is indicative of $PM_{2.5}$ concentrations being primarily driven by a regional air mass. Concentrations at Oldtown did not track as well with the other sites and were more variable and generally higher due to local influences in the urban environment. Oldtown did experience an operational interruption from Aug. 24 to Sept. 17, 2020.

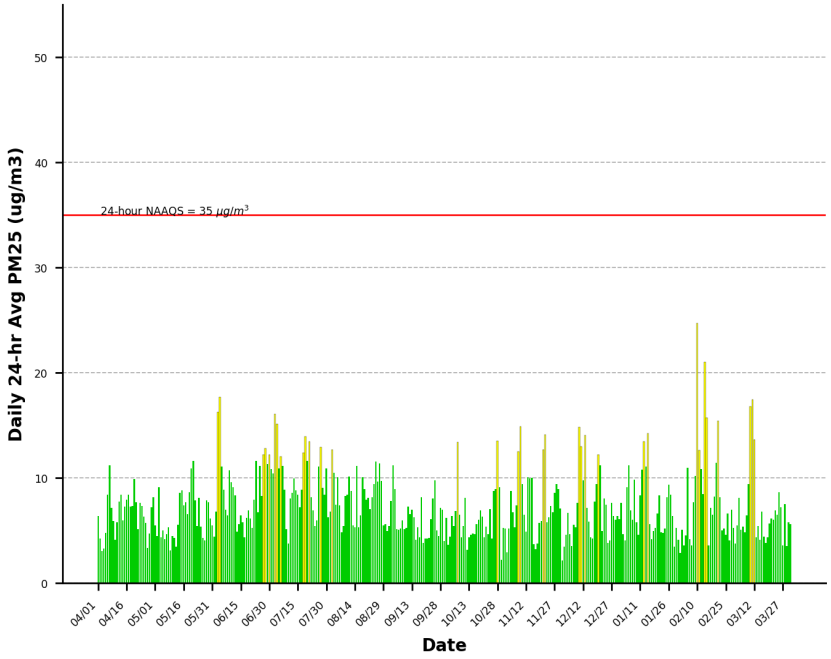


Figure 3. $PM_{2.5}$ at Princess Anne, April 2020 through March 2021.

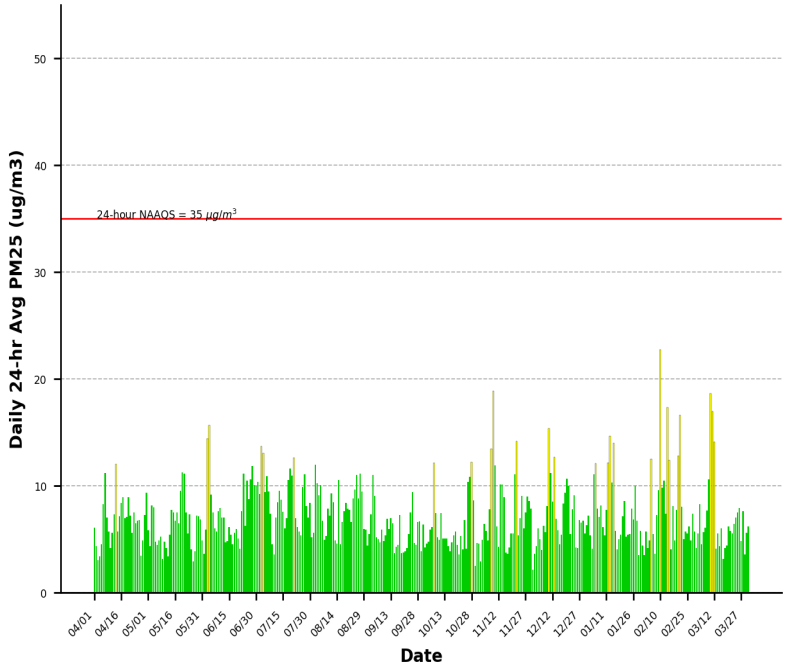


Figure 4. $PM_{2.5}$ at Pocomoke City, April 2020 through March 2021.

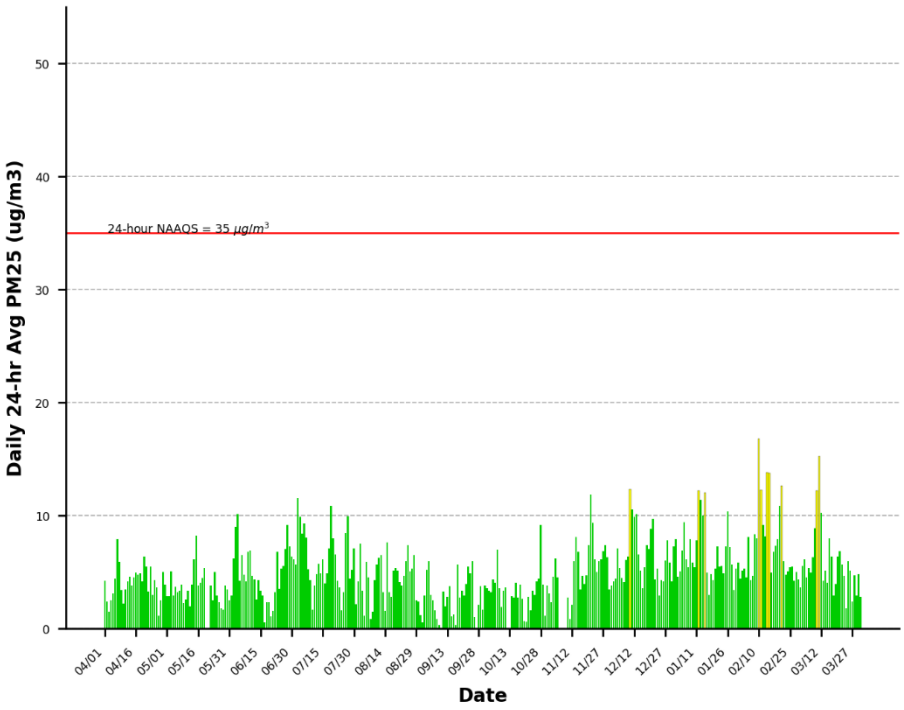


Figure 5. $PM_{2.5}$ at Horn Point, April 2020 through March 2021.

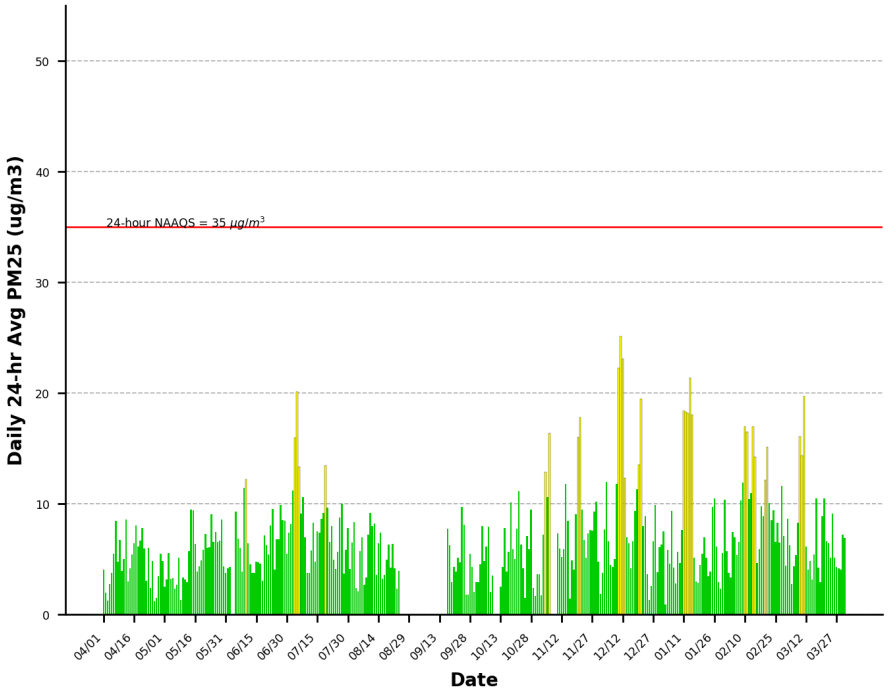


Figure 6. $PM_{2.5}$ at Oldtown, April 2020 through March 2021.

$PM_{2.5}$ Box and Whisker Plots

A box and whisker plot is a visual tool used to graphically display the center, range, distribution, and variance of values within a set of data. A typical representation of a 95/5 box and whisker plot is shown in Figure 7 below. In this example, the ends of the box represent the 75th and 25th percentiles, or the interquartile range, with 50% of the data points falling within the box. The interquartile range is a standard way of expressing variability as this is where most of the values lie. The median is represented by the orange horizontal line in the box with 50% of the data points falling above and below the line. The whiskers are the lines that extend above the box to the 95th percentile, and below to the 5th percentile with 90% of the data points bounded within this range.

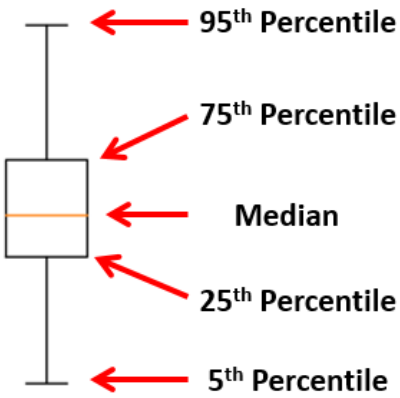


Figure 7. Typical 95/5 Box and Whisker Plot.

A 95/5 box and whisker plot for hourly concentrations of $PM_{2.5}$ from April 1, 2020, through March 31, 2021, is presented below in Figure 8. The Oldtown site exhibits the greatest overall and interquartile range, which is expected from an urban street corner environment compared to the more rural Eastern Shore sites. The Pocomoke City and Princess Anne sites are similar to one another with a slightly tighter overall and interquartile range versus Oldtown. The similarity in these two sites helps demonstrate that $PM_{2.5}$ concentrations are not unduly influenced by the proximity and density of chicken houses. The Horn Point site shows the tightest overall and interquartile range as expected due to its isolated rural location. For all sites, 95% of the 24-hour $PM_{2.5}$ concentrations were less than 16 µg/m^3. For the Eastern Shore sites, 95% were below 13.4 µg/m^3.

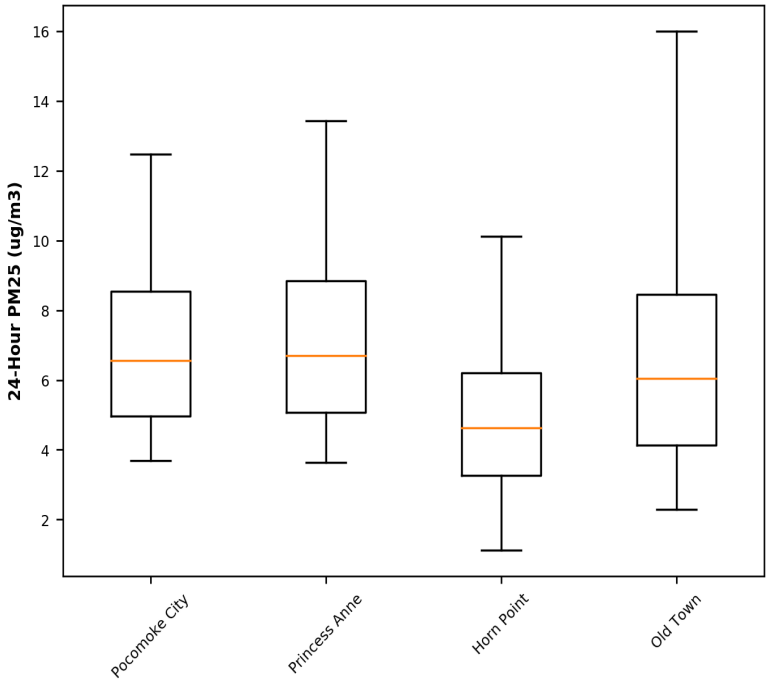


Figure 8. Box and whisker plots of 24-hour $PM_{2.5}$ data at all four study locations, April 2020 through March 2021.

It is also instructive to examine the range of hourly $PM_{2.5}$ concentrations across the sites. Wide disparities among the plots point to the likelihood of local sources impacting a site. A 95/5 box and whisker plot for hourly concentrations of $PM_{2.5}$ from April 1, 2020, through March 2021 is presented below in Figure 9. As with the 24-hour concentration plots, the Oldtown site exhibits the greatest overall and interquartile range (a standard way of expressing variability as this is where most of the values lie), which is expected from an urban street corner environment compared to the more rural Eastern Shore sites.

The Pocomoke City and Princess Anne sites again are similar; $PM_{2.5}$ concentrations seem not unduly influenced by the proximity of the Pocomoke City site to a higher than average density of chicken houses. The Horn Point site shows the lowest overall range as expected from the isolated rural location. For all sites, 95% of the hourly $PM_{2.5}$ concentrations measured throughout the year were below 17.0 µg/m^3. For the Eastern Shore sites, 95% were below 14.8 µg/m^3. The overall maximum hourly $PM_{2.5}$ concentration was 69.0 µg/m^3, which occurred at Oldtown on July 5, 2020. The maximums at the other sites are as follows: Pocomoke City was 49.4 µg/m^3 on May 4, 2020, Princess Anne was 37.7 on February 10, 2021, and Horn Point was 33.0 on April 8, 2020.

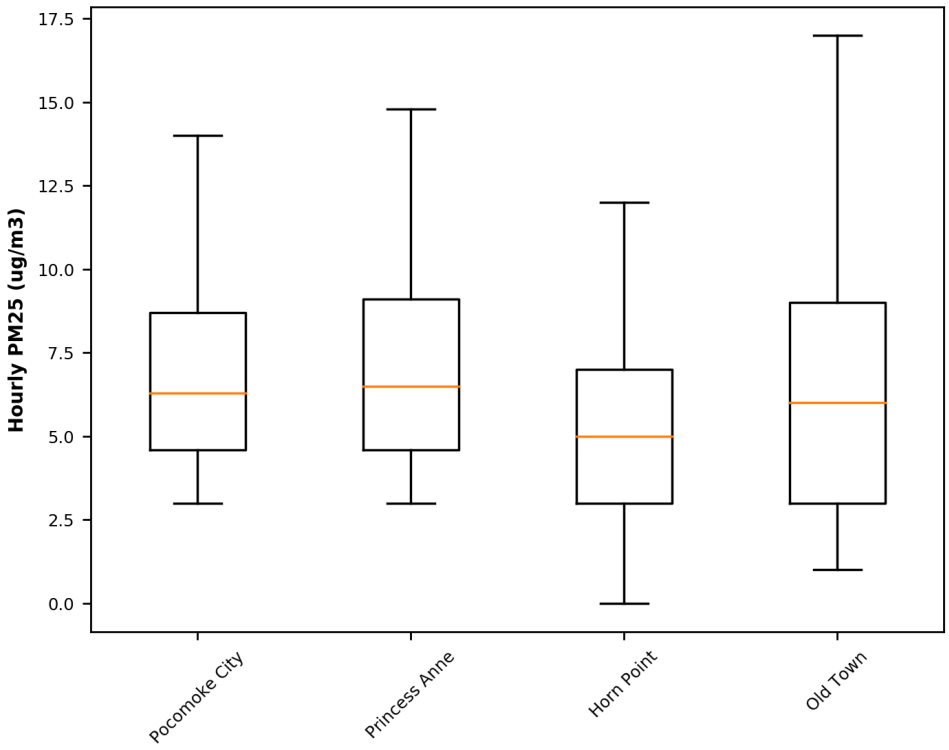


Figure 9. Box and Whisker plots of hourly $PM_{2.5}$ data at all four study locations, April 2021 through March 2021.

PM_{10} Data Summaries

Throughout the course of the year, PM_{10} concentrations remained extremely low and did not approach anywhere near the level of the 24-hour NAAQS. It is important to note that the Oldtown and Horn Point sites utilized different instrumentation. These sites used a manual filter-based Federal Reference Method (FRM) that gave a discreet 24-hour concentration and samples were collected on a once every 6-day frequency, while the Lower Eastern Shore sites had continuous monitors that measured hourly concentrations. A summary of PM_{10} data from April 1, 2020, through March 31, 2021, is presented below in Table 4.

Annual averages were comparable at Pocomoke City, Princess Anne, and Oldtown at 13.7 µg/m^3, 13.5 µg/m^3, and 13.5 µg/m^3, respectively. The more isolated and rural Horn Point was considerably lower at 8.0 µg/m^3. On average, a little over half of PM_{10} is composed of $PM_{2.5}$ at all of the sites.

The maximum observed 24-hour PM_{10} concentration throughout the year was 40.8 µg/m^3, and occurred at the Pocomoke City site on March 10, 2021. Oldtown experienced a similar maximum of 40.0 µg/m^3 March 11, 2021. The maximum at Princess Anne was 35.8 µg/m^3 (August 18, 2020). The maximum at Horn Point was considerably lower at 20.0 µg/m^3 March 11, 2021, likely due to the isolated rural location.

All sites exhibited excellent 24-hour data completeness at 100%.

Table 4. PM_{10} data summary, April 2020 – March 2021.

Parameter	Site	Average 24-hr value ($\mu g/m^3$)	Median 24-hr value ($\mu g/m^3$)	Maximum 24-hr value ($\mu g/m^3$)	Minimum 24-hr value ($\mu g/m^3$)	% Complete
PM_{10}	Oldtown* (Urban, no poultry operations)	13.5	12.1	40.0	2.6	100
	Horn Point* (Rural, no poultry operations)	8.0	7	20.0	1.2	100
	Princess Anne (Low poultry operation density)	13.5	12.9	35.8	4	100
	Pocomoke City (High poultry operation density)	13.7	13.1	40.8	4.5	100

*Oldtown and Horn Point stations measure PM_{10} with an FRM manual filter method. Values shown are through April 1, 2021. NAAQS 24-hr standard = 150 $\mu g/m^3$.

PM_{10} Time Series Plots

The time series plots presented below in Figures 10 through 13 illustrate the daily 24-hour PM_{10} concentration (every sixth day for Horn Point and Oldtown) from April 1, 2020, through March 31, 2021. These daily concentrations are color coded according to their corresponding Air Quality Index colors and never exceed the good range.

PM_{10} concentrations tended to track well across all the sites, rising and lowering on the same days. Although the magnitude was considerably lower at the more isolated and rural Horn Point site. The Lower Eastern Shore and Oldtown sites did exhibit spikes on different days occasionally, likely due to local influences like windblown road and agricultural dust due to nearby farming activities and possibly construction work at the Princess Anne site (PM_{10} is composed of larger particles that do not stay in the atmosphere as long).

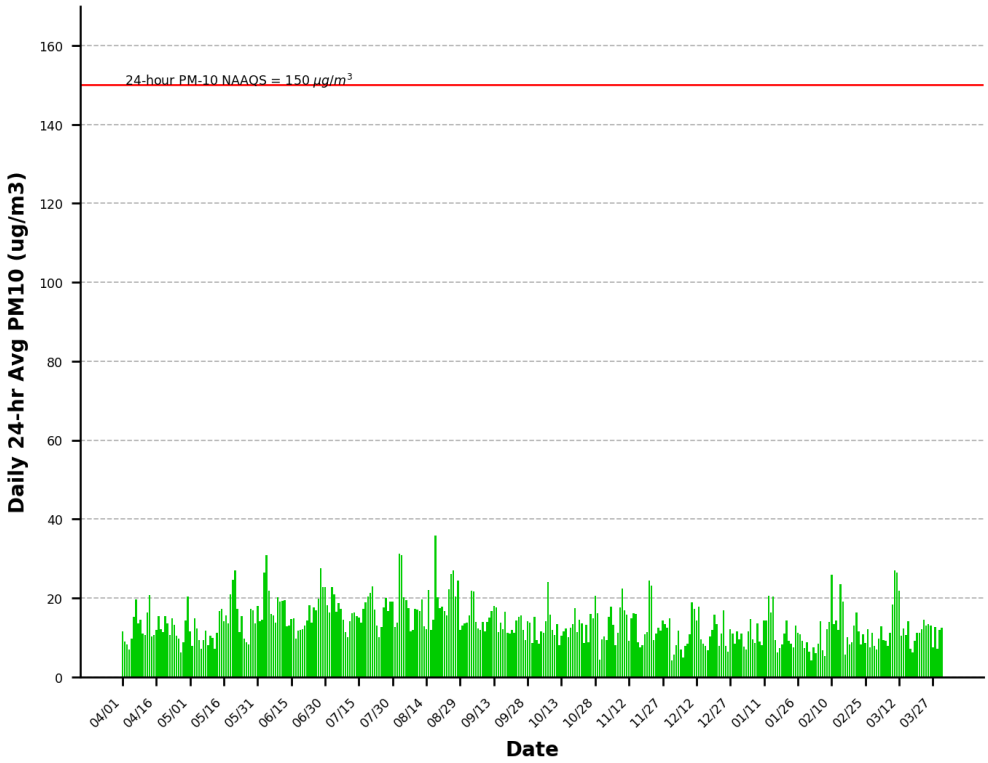


Figure 10. 24-hour PM_{10} data from Princess Anne, April 2020 through March 2021.

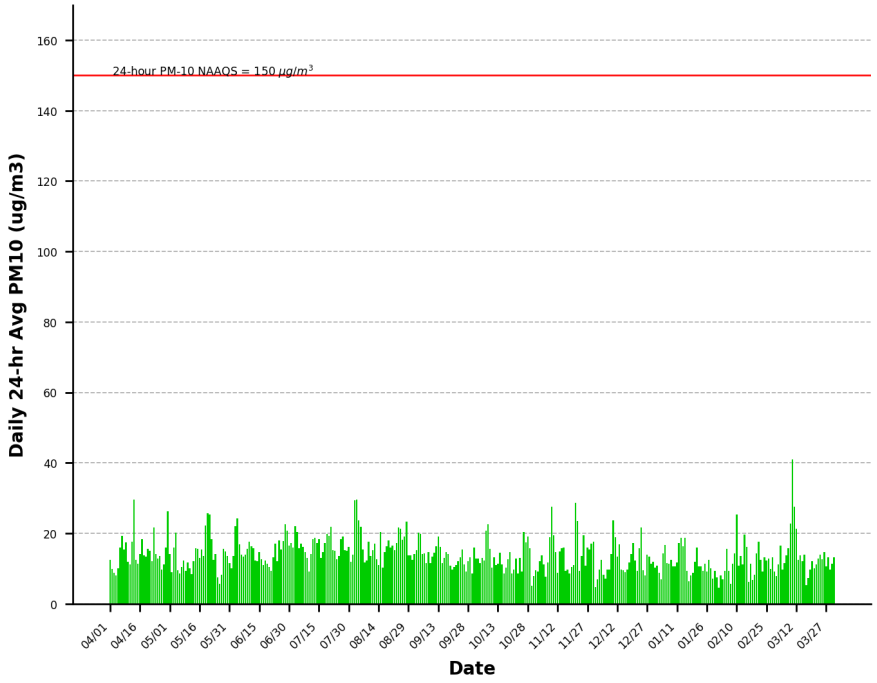


Figure 11. 24-hour PM_{10} data from Pocomoke City, April 2020 through March 2021.

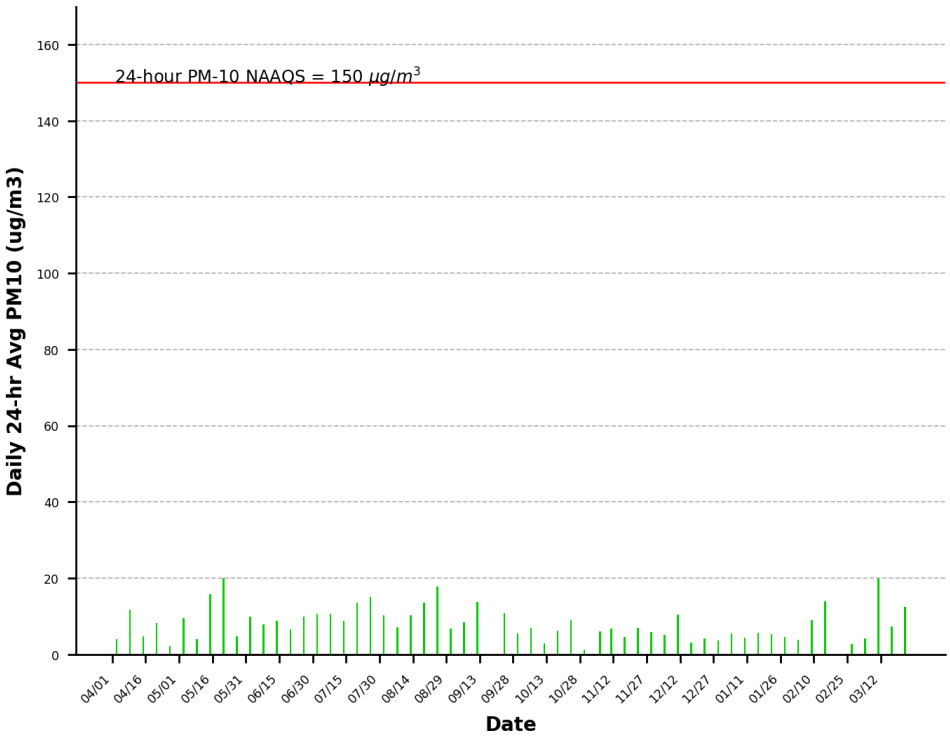


Figure 12. 24-hour PM_{10} data from Horn Point, April 2020 through March 2021.

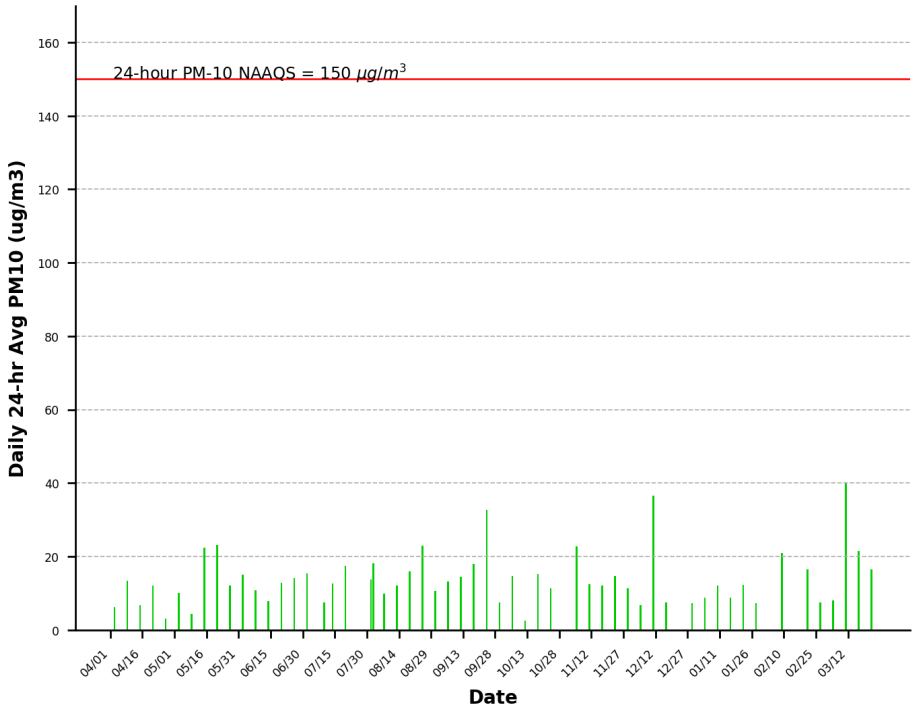


Figure 13. 24-hour PM_{10} data from Oldtown, April 2020 through March 2021.

PM_{10} Box and Whisker Plots

A 95/5 box and whisker plot for 24-hour concentrations of PM_{10} from April 1, 2020, through March 31, 2021, is presented below in Figure 14. The plots for Oldtown and the Lower Eastern Shore sites all exhibit similar overall and interquartile ranges, with Oldtown ranges being slightly larger than Pocomoke City, and Pocomoke City being slightly larger than Princess Anne. Horn Point again shows the lowest overall range consistent with its isolated location.

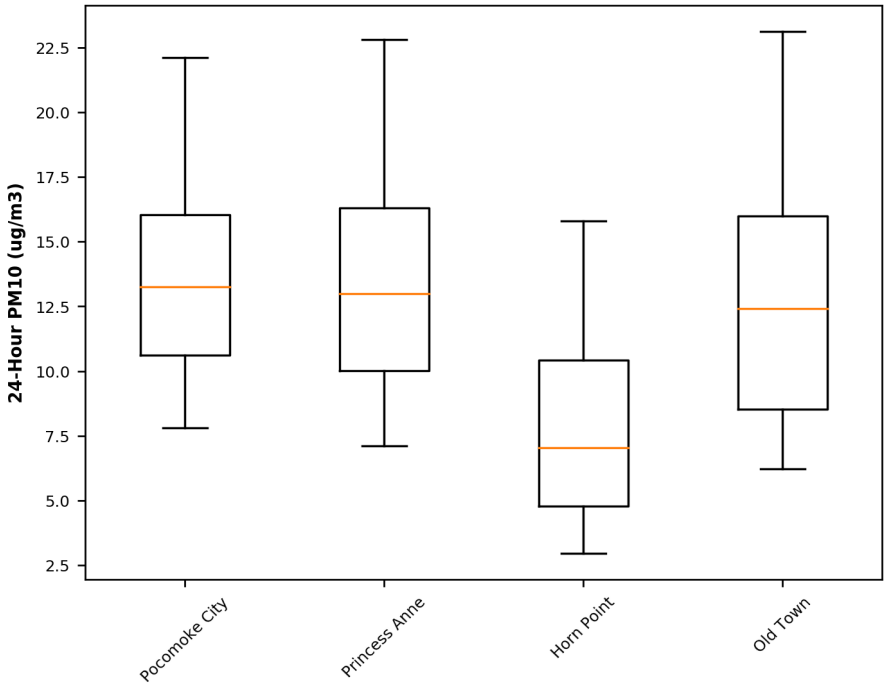


Figure 14. Box and whisker plots of 24-hour PM_{10} data at all four study sites, April 2020 through March 2021.

A 95/5 box and whisker plot for hourly concentrations of PM_{10} from April 1, 2020, through March 31, 2021, is presented below in Figure 15 (there were no hourly concentrations available for Oldtown or Horn Point because different instrumentation was used.) As with $PM_{2.5}$, the Pocomoke City and Princess Anne sites are nearly identical, indicating that PM_{10} concentrations are not unduly influenced by the proximity of the Pocomoke City site with a higher than average density of chicken houses. Overall, 95% of the hourly PM_{10} concentrations measured throughout the year at the Lower Eastern Shore sites were below 25.5 µg/m^3. The overall maximum hourly PM_{10} was 231.3 µg/m^3 and occurred at Princess Anne on August 18, 2020. The Pocomoke City maximum was 156.4 µg/m^3 on November 21, 2020. Construction activities at a building located less than 100 feet from the shelter at Princess Anne are believed to be responsible for the maximum value there. The construction crew was observed cutting concrete blocks for placement on the outside walls of the building, and a lot of visible dust was observed coming off of the saw itself. At Pocomoke City, the field operator observed, and later confirmed, that crop harvesting on fields adjacent to the shelter had occurred at the time of the maximum value at that site.

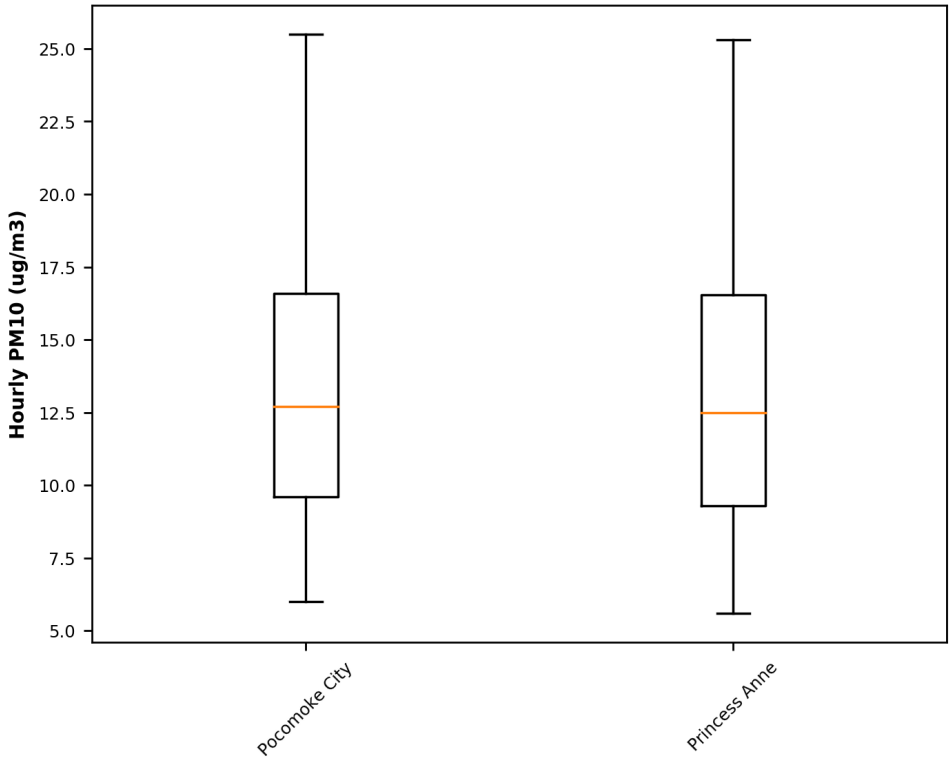


Figure 15. Box and whisker plots of hourly PM_{10} data at Pocomoke City and Princess Anne, April 2020 through March 2021.

NH_3 Data Summaries

Throughout the course of the year, hourly NH_3 concentrations remained very low and did not approach the level of the MDE 1-hour screening level of 350 ppb. The Pocomoke City site had the highest annual hourly average at 11.3 ppb. The Oldtown and Princess Anne sites were nearly identical at 6.5 ppb and 6.3 ppb, respectively. The more isolated and rural Horn Point site registered the lowest annual hourly average of 2.2 ppb. A summary of NH_3 data, from April 1, 2020, through March 31, 2021, is presented below in Table 5.

The wide variation in the magnitude of the maximums registered at each site can be attributed to the presence and type of potential NH_3 sources and meteorological influences near each location. The Pocomoke City site is located in an area with a higher than average density of poultry operations. Even in this area, other sources of NH_3 exist, including episodic application of manure or fertilizer along with vehicle emissions. Poultry operations will contribute NH_3 at different levels depending on the activities in the house and the weather during those operations. If the house does not actively house a flock, then emissions would be lower, unless cleanout is underway in which case both particle and NH_3 pollution may be episodically higher. Younger flocks will emit smaller amounts of NH_3 than older and larger birds. The Princess Anne site is in an area with a lower density of poultry operations but is located on the UMES Integrated Crop Farm where there are various agricultural activities occurring onsite and throughout the immediate surrounding area.

Urban sources of NH_3 likely to impact the Oldtown site include vehicle emissions, electric generating units equipped with Selective Catalytic Reduction systems, sewage, water treatment plants, incineration, and other industrial processes.

Table 5. NH_3 data summary, April 2020 – March 2021.

Parameter	Site	Average hourly value (ppb)	Median hourly value (ppb)	Maximum hourly value (ppb)	Minimum hourly value (ppb)	% Complete
NH_3	Oldtown (Urban, no poultry operations)	6.5	6.4	26.9	-0.1	91
	Horn Point (Rural, no poultry operations)	2.2	2.1	9.4	0.3	91
	Princess Anne (Low poultry operation density)	6.3	5.5	123.6	0	92
	Pocomoke City (High poultry operation density)	11.3	8.1	218.7	0.2	93

MDE 1-hour screening level = 350 ppb.

NH_3 Time Series Plots

The Princess Anne site only had one episode of elevated NH_3 concentrations while the Pocomoke City site exhibited frequent spikes in NH_3, thus we conclude that the Pocomoke City site is influenced by poultry operations. Unlike the time series plots for $PM_{2.5}$ and PM_{10}, NH_3 concentrations did not track as well across the sites and do show large differences in magnitude. The time series plot presented below in Figure 16 illustrates the hourly NH_3 concentrations from April 1, 2020 through March 31, 2021 for all four sites. Hourly concentrations at the Pocomoke City site clearly stand out as the most variable and exhibit more frequent spikes with greater magnitude than any of the other sites. The Princess Anne site did experience one multi-day episode of elevated hourly concentrations from July 2-5, 2020. This episode can most likely be attributed to the application of nitrogen liquid fertilizers on June 25, 26, and 27, 2020 to the front fields next to the monitoring station and subsequent volatilization over the following week (per communication from the UMES Farm Manager).

The primary differences in surrounding land use between the Pocomoke City and Princess Anne sites are the amount of agricultural area, forested area, and the density of poultry operations. Agricultural area is greater for the Princess Anne site while both forested area and density of poultry operations are greater for the Pocomoke City site.

The rural Horn Point site and the urban Oldtown site did not exhibit any significant spikes in NH_3 concentrations.

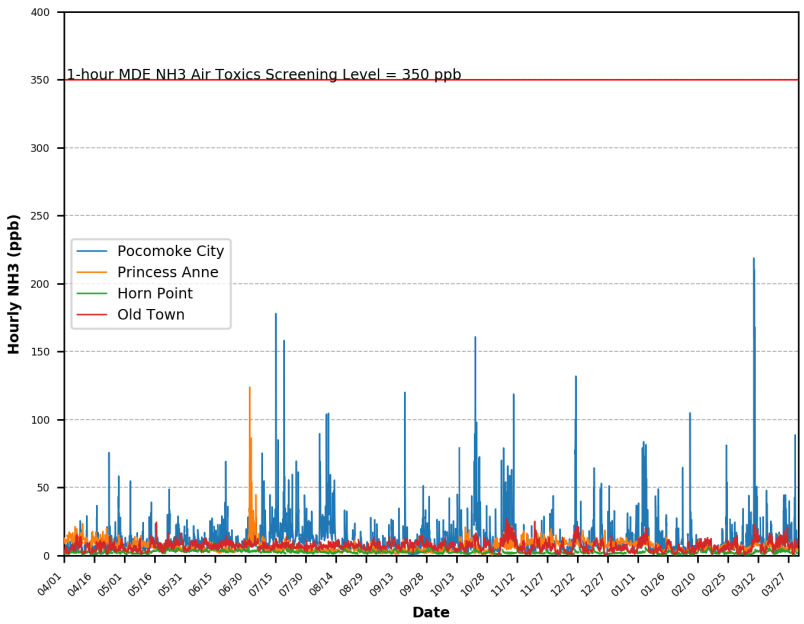


Figure 16. Hourly NH_3 concentrations, April 2020 through March 2021.

A time series plot of 24-hour NH_3 concentrations is presented below in Figure 17. In this figure, it is much easier to discern the difference in daily concentrations across the sites without focusing on the extreme one-hour excursions. The majority of the 24-hour concentrations fall well below 20 ppb with the higher values corresponding to the periods where hourly values spiked at the Pocomoke City and Princess Anne sites, as discussed above. Both the Oldtown and Princess Anne sites experience a bump in daily NH_3 concentrations during the winter months while the Pocomoke City site had a string of higher daily averages during July.

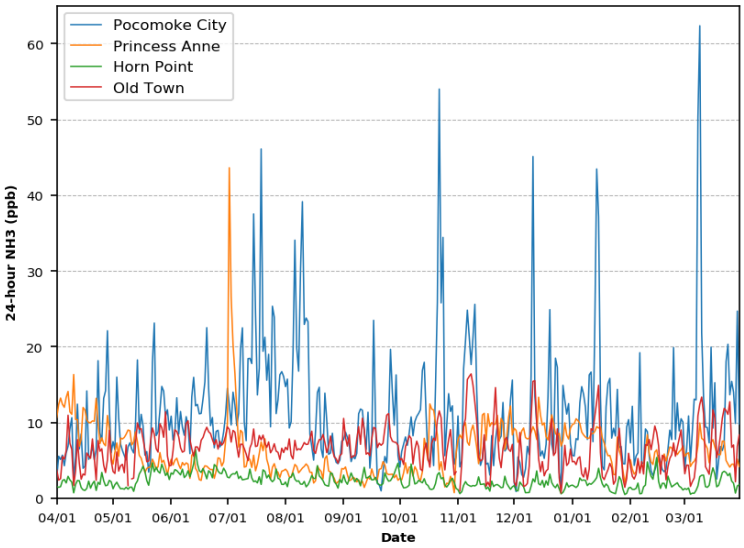


Figure 17. 24-hour NH_3 concentrations, April 2020 through March 2021.

NH_3 Box and Whisker Plots

A 95/5 box and whisker plot for hourly concentrations of NH_3 from April 1, 2020 through March 31, 2021, is presented below in Figure 18. Unlike the box and whisker plots for $PM_{2.5}$ and PM_{10}, the Pocomoke City site exhibits both a much greater overall and interquartile range. This is indicative of the influence of local sources of NH_3 and is consistent with the much greater density of poultry operations surrounding this location. The Princess Anne and Oldtown sites are again similar, with Oldtown having a somewhat higher median due the urban location. Once again, the Horn Point site shows the tightest and lowest range as expected given the isolated rural location. For all sites, 95% of the hourly NH_3 concentrations were below 29.6 ppb. Excluding the Pocomoke City site, 95% of the hourly NH_3 concentrations were below 12.5 ppb.

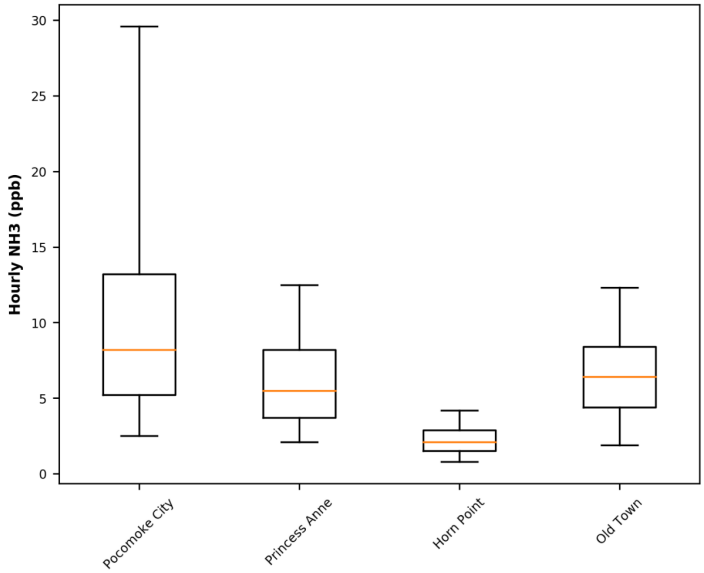


Figure 18. Box and whisker plots showing hourly NH_3 concentrations, April 2020 through March 2021.

Section 3 - Conclusions and Next Steps

The focus of this project was to characterize the air quality that the majority of residents of the Lower Eastern Shore experience and compare the data to the air quality at a more isolated rural location and an urban location in Baltimore City. Concentrations of both $PM_{2.5}$ and PM_{10} for the two Lower Eastern Shore sites were comparable, on average, with those measured at the urban Oldtown site in Baltimore City, but the Oldtown site did show greater variability. The isolated rural Horn Point site was consistently much lower.

Average NH_3 concentrations were comparable for the Princess Anne (6.5 ppb) and Oldtown (6.3 ppb) sites while the Pocomoke City site average was almost twice as high (11.3 ppb), with the Horn Point site averaging much lower at 2.2 ppb. Transient hourly spikes in NH_3 concentrations were frequently observed at the Pocomoke City site, but these never approached the MDE 1-hour screening level and the majority of the 24-hour NH_3 concentrations rarely exceeded 50 ppb.

After the completion of one full year of data collection, there were no measured violations of the $PM_{2.5}$ and PM_{10} NAAQS and no measured NH_3 concentrations approaching the MDE 1-hour air toxics screening level at any of the four monitoring locations. Concentrations of all parameters remained quite low overall throughout the year.

The density of poultry operations within the 2-mile radius surrounding the Pocomoke City site is much greater than the majority of residents of the Eastern Shore would experience within 2 miles of their individual residences. Therefore, it is reasonable to conclude that the majority of Lower Eastern Shore residents are not being exposed to harmful levels of NH_3, $PM_{2.5}$, or PM_{10} from poultry operations. Since fence line analysis of ammonia concentrations were not completed in this study, MDE encourages review and analysis by academic partners of existing research and/or further study, if needed.

Monitoring remains ongoing at the two Lower Eastern Shore sites and in the Baltimore area. Monitoring for NH_3 at Horn Point was discontinued on May 14, 2021 because measured concentrations were extremely low and there was limited value in continuing operating the site. The NH_3 monitor was moved from Oldtown to Baltimore County on Nov.19, 2021 as the Oldtown site was discontinued.

This project is a first step in determining the quality of the air of the Lower Eastern Shore who live in the vicinity of a concentration of poultry houses. This project will evolve to include additional monitoring sites aimed at furthering our understanding of the health impacts from poultry operations. MDE encourages the scientific community, academia, environmental advocate groups, and the general public to use the data to conduct independent evaluations of the public health impacts from poultry operations. This project was developed in response to public concerns about the health impacts in rural agricultural communities and continued engagement by the public will guide policies.

The following Appendices to this report are available online at the Department's web page at: mde.maryland.gov/programs/Air/AirQualityMonitoring/Pages/Lower-Eastern-Shore-Monitoring-Project.aspx.

- Appendix A - Quality Assurance and Data Validation Standard Operating Procedures
- Appendix B - Field Data Collection Methods
- Appendix C - Monitoring Site Descriptions and Maps