

## PM2.5 and PM10 Analyses for Barr School Monitoring Site Discontinuation

### *Probability Analysis for Barr School PM2.5 and PM10 Discontinued Monitors*

The following sites and monitors are affected by this discontinuation:

1. Barr School – 39-093-3002 – PM2.5 FRM
2. Barr School – 39-093-3002 – PM2.5 Continuous
3. Barr School – 39-093-3002 – PM10 FRM

The relevant NAAQS for the pollutants involved in this analysis according to 40 CFR Part 50 are:

- PM2.5: 12.0 ug/m<sup>3</sup> for an annual mean averaged over three years
- PM2.5: 35 ug/m<sup>3</sup>, 98<sup>th</sup> percentile 24-hour value averaged over three years
- PM10: 150 ug/m<sup>3</sup>, Not to be exceeded more than once per year on average over three years

Table 1 shows the design values for the 6-year calendar period of 2015-2020 based on data from the U.S. EPA Air Quality System (AQS) for the previously mentioned sites and pollutants. Note, however, that due to the form of the PM10 standard, as shown above, design value reports for PM10 only show the count of exceedances for each year and a design value of “3-Year Estimated Exceedances”. For each year from 2013 – 2020 and each three-year design value period from 2015 – 2020, these counts are all zero, which demonstrates the unlikelihood of an exceedance. Since these count values are not meaningful for this probability analysis, the highest 24-hour “1<sup>st</sup> Max Value” for each year is shown in Table 1, taken from an AMP450 Quick Look Report, which is a conservative value.

Also note, the 2020 design value for PM10 is not valid, as many sample runs were missed due to the COVID-19 pandemic. Many PM2.5 FRM samples runs were also missed, but the PM2.5 design value is still valid due to the continuous instrument at the site. Regardless, six years have been included rather than five because of this.

**Table 1 – Monitor Design Values**

Design Values for Pollutants and Sites to be Discontinued						
	2015	2016	2017	2018	2019	2020
Barr School PM2.5 – Annual (ug/m <sup>3</sup> )	8.7	8.1	7.6	7.5	7.5	7.2
Barr School PM2.5 – 24-hour (ug/m <sup>3</sup> )	22	20	18	17	19	18
Barr School PM10 – (ug/m <sup>3</sup> )	22	22	20	24	20	20

According to U.S. EPA’s Ambient Air Monitoring Network Assessment Guidance<sup>1</sup>, it can be shown that the probability that a monitor will exceed 80% of the applicable NAAQS during the next three years is less than 10% if the following equation is satisfied:

<sup>1</sup> <https://www3.epa.gov/ttnamti1/files/ambient/pm25/datamang/network-assessment-guidance.pdf>

$$\bar{X} + \frac{t * s}{\sqrt{n}} < 0.8 * NAAQS$$

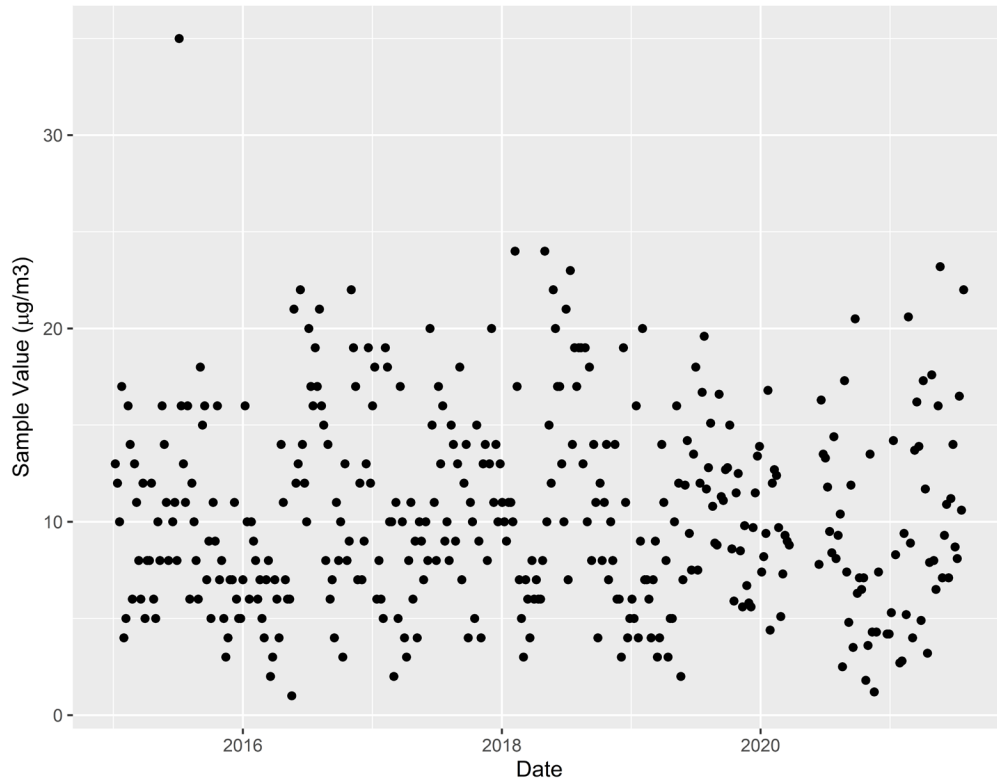
Where  $\bar{X}$  is the average design value for the last five years (or more),  $t$  is the  $t$  value for  $n-1$  degrees of freedom at the 90% confidence level,  $s$  is the standard deviation of the design values,  $n$  is the number of records (i.e., number of design values), and NAAQS is the standard of interest. Computing the included equation based on the design values from 2016 to 2020 results in the values shown in Table 2 as “comparison values”, along with 80% of the relevant standard and an indication of whether this satisfies the condition that the probability of exceeding 80% of the NAAQS over the next three years be less than 10% is satisfied. Additionally, using the equation above, the last column in table 2 represents the percentage of the standard for which probability of exceeding it over the next three years is less than 10%.

**Table 2 – 10 Percent Conditions**

<b>Comparison Values and satisfying the 10% Condition</b>				
	Comparison Values	80% of Standard	Satisfies 10% condition	% of standard <10% probability of exceeding
Barr School PM2.5 – Annual (ug/m3)	8.21	9.6	Yes	68.5
Barr School PM2.5 – 24-hour (ug/m3)	20.48	28	Yes	58.5
Barr School PM10 – (ug/m3)	28.33	120	Yes	18.89

Based on these results shown in Table 2, the Barr School PM2.5 and PM10 monitors satisfies the condition that the probability of exceeding 80% of the NAAQS over the next three years is less than 10%. This analysis is based on data from the monitor for the years 2015 - 2020, constituting six design values. Additionally, as discussed above, since PM10 design value reports do not provide values most suitable for probability analyses like these, included in Figure 1 is a time-series plot of all PM10 samples from 2015 – 2020 to demonstrate that this PM10 monitor’s values were well below the 150 ug/m3 NAAQS for this entire timeframe. The maximum 24-hour sample value during this time period was 35 ug/m3.

**Figure 1 – Barr School PM10**



*PM2.5 Comparison to Other Sites in the MSA*

Since at least 2016, other monitors in the area have had design values which are comparable to, or in most cases higher than, that of Barr School for PM2.5. Table 3 shows the annual and 24-hour design values for all operating PM2.5 monitor sites in the Cleveland-Elyria, OH MSA from 2016 to 2020. The highest value for each year for is highlighted. As the table shows, no annual or 24-hour design value at Barr school has been the highest in the Cleveland-Elyria, OH MSA for any of these years.

**Table 3 – PM2.5 MSA Design Values**

PM2.5 Design Values at All Sites in Cleveland-Elyria, OH MSA (ug/m3)					
	2016	2017	2018	2019	2020
Site	Annual Design Value				
39-093-3002 (Barr School)	8.10	7.60	7.46	7.51	7.21
39-035-0034	8.87	8.24	7.75	7.52	7.19
39-035-0038	11.38	10.59	9.82	9.47	9.08
39-035-0045	10.61	10.05	9.49	9.43	9.11
39-035-0060	11.16	10.45	9.75	9.94	9.32
39-035-0065	12.13	11.71	10.95	11.03	10.78
39-035-0073	NA	7.35	7.59	7.99	8.54
39-035-1002	8.86	8.32	7.85	7.71	6.98
39-103-0004	8.80	8.50	7.62	7.76	7.33
39-085-0007	7.88	7.38	7.01	6.91	6.58
	24-hour Design Value				
39-093-3002 (Barr School)	20	18	17	19	18
39-035-0034	20	19	18	18	17
39-035-0038	25	24	22	22	22
39-035-0045	23	21	20	22	20
39-035-0060	25	22	22	24	25
39-035-0065	25	25	23	24	24
39-035-0073	NA	14	17	19	20
39-035-1002	20	19	18	18	17
39-103-0004	20	20	18	19	18
39-085-0007	17	17	16	16	16

*\*Highlighted cells denote highest design value for the year.*