UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
SECTOR POLICIES AND PROGRAMS DIVISION
OFFICE OF AIR QUALITY PLANNING AND STANDARDS
OFFICE OF AIR AND RADIATION

DATE: June 14, 2016

SUBJECT: Review of the Continuous Opacity Monitoring System Data from the Pulp and Paper ICR Responses for Subpart MM Sources

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TO: EPA-HQ-OAR-2014-0741

The purpose of this memorandum is to present the results of the review of the Continuous Opacity Monitoring System (COMS) data provided by the pulp and paper industry in response to a 2011 section 114 Information Collection Request (ICR). This analysis is part of the U.S. Environmental Protection Agency's (EPA) effort to review the National Emission Standards for Hazardous Air Pollutants (NESHAP) for Chemical Recovery Combustion Sources at Kraft, Soda, Sulfite, and Stand-Alone Semichemical Pulp Mills (40 CFR part 63, subpart MM) in accordance with section 112(d)(6) of the Clean Air Act (CAA).

Section 112(d)(6) of the CAA mandates that the EPA review every 8 years and, if appropriate, revise the maximum achievable control technology (MACT) standards, taking into account developments in practices, processes, and control technologies. The subpart MM NESHAP was originally promulgated on January 12, 2001, and is due for a technology review under CAA section 112(d)(6).

Section I of this memorandum provides a summary of the tabulation and quality assurance/quality control (QA/QC) analysis of the COMS data provided by industry in response to the 2011 Pulp and Paper Sector ICR. Section II of this memorandum discusses the analysis of the QA/QC'd data.

I. Data Assembly and QA/QC

The COMS data were collected from the pulp and paper industry in 2011 in response to a CAA section 114 ICR. The three-part survey was distributed by the EPA in February 2011 and requested information needed to perform various regulatory reviews, including the subpart MM NESHAP technology review. This section of the memo discusses the QA/QC of the COMS data that were provided in response to the ICR. A similar analysis for this data was performed for the review of the Kraft Pulp Mill New Source Performance Standards (NSPS) in 2014. Those analyses can be found in the docket for the NSPS rulemaking, EPA-HQ-OAR-2012-0640.[1,2]

The general approach for processing the COMS data was to extract the data, as received, from individual ICR responses into a tabulation spreadsheet. Separate tabulation spreadsheets were developed for recovery furnace opacity and lime kiln opacity. These spreadsheets can be found in the docket for the subpart MM rulemaking, EPA-HQ-OAR-2014-0741. The opacity for a recovery furnace and a lime kiln located at a soda mill were tabulated in a separate spreadsheet, also included in docket EPA-HQ-OAR-2014-0741. Tabs within each tabulation spreadsheet were labeled in the format of RTI facility code followed by emission unit ID with a period as a separator for the two values. If data were provided for multiple stacks for a given unit, they were also extracted into separate worksheets with the same naming convention, followed by an indication of stack location in parentheses. For example, the unit R401 at RTI facility 243 has two stacks and was represented by data in two separate worksheets with tabs labeled as follows: 243.R401 (N) and 243.R401 (S). A summary worksheet was included in each tabulation spreadsheet to link and tabulate the data provided for each emission unit. Emission unit ID, RTI facility ID, and NEI site ID were provided to characterize the emission units; the "tab name" of each worksheet from which the data are linked was provided; and summary information such as 99th percentiles, averages, standard deviations, and maximum values were calculated. The count and percent of averaging periods exceeding existing limits and limits under consideration were also calculated on both a quarterly and a semiannual basis. The data from each summary worksheet were used for the data analyses discussed in Section II in this document.

Spreadsheet templates for COMS data were provided with part III of the ICR (P&P CEMS_PIII.xls). The ICR template requested 6-minute average opacity values for a period of one year (87,600 opacity averages). Alternative formats were also accepted. To some extent, the data extracted into the COMS tabulation spreadsheets varied in format and type, depending on the facility and the unit, likely due to other state reporting and compliance requirements. In some cases, respondents did not provide COMS data, or provided the data in an alternative format (*i.e.*, .pdf or .doc or .txt) that would have required extensive manipulation or re-entry of data. Given the abundance of data sets provided in spreadsheet form that were "analysis-ready," it was elected not to tabulate data provided in an alternative form. Mills that did not provide data in spreadsheet form were excluded from the quantitative analysis of the opacity limits, but the information these mills provided was reviewed qualitatively to confirm that it was comparable to the "analysis-ready" information provided by other mills.

All data provided were reviewed for erroneous COMS readings. The following types of data were removed:

- Negative opacity values were deemed suspect and were removed to prevent artificial lowering of a unit's performance.
- Measurements (including abnormally large values) corresponding with periods of zero (or negative) production values or periods labeled as "process downtime" were removed because emissions of opacity would not be expected when the process is down. These were removed to prevent the artificial increase in the emissions associated with the unit.
- Measurements recorded during monitoring system malfunctions, out-of-control periods or repairs, and monitor QA/QC checks, calibration checks, or zero or span adjustments to the extent that these time periods were labeled in the data sets were removed to be consistent with the proposed rule requirements that these data be excluded from compliance calculations.

The cells containing invalid values were highlighted to indicate removal of data. Large values reported during other periods were not deleted from the data sets. Facilities were asked to indicate in the ICR if any data were affected by periods of startup, shutdown, and malfunction (SSM). Opacity values occurring during periods of SSM were retained in the continuous monitoring data averages analyzed in order to evaluate whether the updated NESHAP should distinguish between periods of startup and shutdown and normal operation as revised emission limits were considered.[1]

Based on the part III survey responses, there were 151 recovery furnaces and 131 lime kilns at 98 kraft pulp mills in 2009. Of these, two recovery furnaces were indicated as non-operational during the year of the ICR, resulting in 149 operating recovery furnaces. These two units were the following: RF18 at Longview Fiber and Packaging (RTI 156, NEI42338) and EU445A at International Paper in Springfield (RTI 105, NEI45182). Updates to the inventory since the ICR indicate there are currently 148 recovery furnaces (including one located at a soda mill) and 130 lime kilns (including one located at a soda mill). Two kraft mills have closed since the NSPS data analysis (RTI 600 and RTI 157) and units at these mills were removed from this analysis. Data were not collected for upgrades or new units that occurred after the 2011 ICR.

A summary of the type of recovery furnace COMS data received and the comments from the QA/QC are listed in Appendix A. Similarly, a summary of the type of lime kiln COMS data and QA/QC comments are listed in Appendix B.

A. Recovery Furnace Opacity Data

Continuous opacity monitoring system data were provided for 137 of the 148 operating kraft recovery furnaces. Of the 137 units with data provided, 135 were extracted into a compiled recovery furnace COMS spreadsheet containing individual worksheets for each unit. There were 25 units with multiple-stack opacity data. The two units with data that were not extracted into the spreadsheet were not provided in Excel format. The data for 117.B21 were provided as .pdf and the data for 155.RECOVERY FURNACE were provided in Word format (.doc). Three units (600.G0803, 600.G0806, and 157.RB2) were removed from the dataset due to recent facility closures. Recovery furnace design (direct contact evaporator [DCE] or non-direct contact evaporator [NDCE]) and air pollution control device (APCD) type were added to the spreadsheet from the part III database. In all, adding in emission units with COMS on multiple stacks, 157 COMS data sets for kraft recovery furnaces were available for analysis. Data for one furnace located at a soda mill was also extracted to a separate spreadsheet. Thus, a total of 158 kraft/soda recovery furnace COMS data sets were analyzed for the subpart MM technology review.

The order of preference for opacity averaging period extracted into the opacity tabulation spreadsheet was 6-minute averages followed by 1-hour averages. Of the data provided, 5 units were extracted in the 1-hour format (1 unit with multiple stacks) and the remaining units were extracted in the 6-minute average format.

The recovery furnace COMS summary worksheet summarizes the data type as “6-minute averages,” “hourly averages,” “data not provided,” or indicates if data are provided in alternate format. For each COMS, the summary spreadsheet contains the maximum opacity, the average

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[1] Although malfunction data were not removed from the data sets, malfunction data were noted as invalid in analyses where these data would have been inappropriate for use

(including and excluding exceedances), the standard deviation, the 99th percentile, the median, and the number (and percentage) of opacity 6-minute average values over 20-percent and 35-percent. The number of averaging periods in which valid opacity data were provided is also indicated along with the percent of periods that exceeded the limits under consideration.

B. Lime Kiln Opacity Data

Lime kiln opacity data were compiled in order to review the limit for lime kilns with electrostatic precipitators (ESPs). Continuous opacity monitoring system data were provided for 28 lime kilns that utilize ESPs or ESP/scrubber combinations as pollution control devices. These were extracted into a compiled lime kiln COMs spreadsheet containing individual worksheets for each unit. There were 2 units with multiple stack opacity data. The order of preference for opacity averaging period extracted into the opacity tabulation spreadsheet was 6-minute averages and 1-hour average. There were 26 units extracted in the 6-minute average format and 2 extracted in the 1-hour format. Including kilns with dual stacks, 30 data sets were available for analysis.

The lime kiln COMS summary worksheet summarizes the data type as "6-minute averages" and "hourly averages." The maximum opacity, the average, the standard deviation, the 99th percentile, the median, and the number (and percentage) of opacity average values over 20-percent were calculated.

II. Data Analysis

The summary data from the recovery furnace and lime kiln COMS spreadsheets described in Section I were plotted and compared to the current subpart MM NESHAP limits in order to evaluate potential regulatory options for the technology review. The 99th percentile of the averaging periods were plotted for each emission unit and used to evaluate each opacity limit. The 99th percentile was used as an indicator of the emission limitation consistently met by each emission unit. The percent of averaging periods exceeding the opacity limit was calculated and plotted on both a quarterly basis and a semiannual basis to evaluate appropriate monitoring allowances to be coupled with each opacity limit.

Distinctions in furnace design and control systems, and current emissions allowances in the NESHAP were considered in the COMS analyses as described in more detail in the following sections. In addition, emission units were identified as either existing units (*i.e.*, units only subject to subpart MM), BB + existing units (*i.e.*, units subject to the subpart BB NSPS and considered existing units under subpart MM), BB + new units (*i.e.*, units subject to the NSPS and considered new units under subpart MM), BBa + new MM units (*i.e.*, units subject to the subpart BBa NSPS and considered new units under subpart MM), and new MM units (*i.e.*, soda units subject to the new source standards in subpart MM), when appropriate.

A. Recovery Furnace COMS Analysis

<u>Data analysis summary</u>. Table 1 summarizes the number of COMS data sets analyzed for recovery furnaces. A total of 158 data sets were analyzed for recovery furnaces, including 1 soda

(new MM), 81 BB + existing MM, 75 existing MM, and 1 BB + new MM data sets. With the exception of one unit, the COMs data sets met the current MM standard. A reduction in the monitoring allowance from 6-percent to 2-percent was investigated to provide an incentive to improve ESP performance. A total of 155 COMS data sets met the reduced monitoring allowance with a 35-percent opacity limit. The EPA further investigated reducing the opacity limit from 35-percent to 20-percent, since 20-percent opacity is the current corrective action level in subpart MM. A total of 131 COMS data sets met a 20-percent opacity limit with a 2-percent monitoring allowance on a quarterly reporting period. Finally, the EPA investigated reducing the reporting requirements from quarterly to semiannually and require that the reports be submitted electronically to improve data availability and to promote consistency between the NSPS subparts BB and BBa and the NESHAP. An additional 9 COMS data sets met the proposed standard when increasing the reporting period. There were no distinctions for the 16 units (18 data sets) that did not meet the proposed 20-percent opacity limit with a 2-percent monitoring allowance on a semiannual reporting basis. It is assumed that these units would need to increase ESP maintenance frequency or upgrade their ESPs to meet the proposed standards.

Table 1. Summary of Recovery Furnace COMS Data Sets Analyzed

COMS classification	**Data set count**	**Notes**
No. of COMS data sets	**158**	157 kraft data sets + 1 soda data set
BB + existing MM	81	These are units subject to the NSPS and considered existing units under subpart MM.
BBa + new MM	0	No data were available for units subject to NSPS subpart BBa and considered as new units under subpart MM, if such units exist.
BB + new MM	1	These are units subject to the NSPS and considered new units under subpart MM.
Existing MM	75	These are units not subject to the NSPS and considered existing units under subpart MM.
Soda (new MM)	1	
Option 1. No. of COMS meeting 35% opacity with a 6% allowance with quarterly reporting	**157**	A COMS data set was considered to meet the standard if all reporting periods for the year met the standard.
Option 2. No. of COMS meeting 35% opacity with a 2% allowance with semiannual reporting	**157**	
Option 3. No. of COMS meeting 20% opacity with a 6% allowance with quarterly reporting	**150**	
Option 4. No. of COMS meeting 20% opacity with a 2% allowance with semiannual reporting	**140**	
Option 5. No. of COMS meeting 20% opacity with a 2% allowance with quarterly reporting	**131**	
No. of COMS *not* meeting 20% opacity with a 2% allowance with semiannual reporting	**18**	Four sets of COMS data are from 2 units with 2 stacks, therefore 16 units do not meet the proposed revisions.
BB + existing MM	9	
Existing MM	9	

Opacity limit evaluation. The subpart MM NESHAP contains a 35-percent limit for opacity from existing recovery furnaces and a 20-percent limit from new recovery furnaces, and does not distinguish between recovery furnace design (DCE or NDCE). It also contains a corrective action threshold of 10 consecutive 6-minute averages above 20-percent. The standard requires opacity to be recorded as 6-minute averages, and allows 6-percent of the 6-minute averages per quarter recorded to be in exceedance of the 35-percent limit. Appendix C contains graphs of the recovery furnace opacity data. The horizontal axis represents each emission unit, but is not labeled with emission unit IDs because this would make the figures too difficult to read. A total of 158 COMS data sets were graphed (including multiple data sets for furnaces with separate COMS for dual stacks). The majority (152) of the COMS data sets graphed were 6-minute average data. Six data sets were based on hourly average. The hourly data sets were generally within the range of the 6-minute average data.

Apart from the monitoring allowance discussed below, compliance is based on each individual averaging period. Therefore, the 99th percentile and percent of averaging periods exceeding 35-percent were graphed in order to understand how opacity varies. Figure 1 in Appendix C presents the 99th percentile of the opacity readings for each recovery furnace COMS data set (158 data sets). Based on this figure, it does not appear that recovery furnace design affects opacity. Only one DCE recovery furnace had a 99th percentile opacity value that exceeded the existing subpart MM source limit of 35-percent. Figures 2 and 3 show the 99th percentile opacity by control type (within DCE and NDCE groupings in Figure 2). The primary control types are wet-bottom ESP (WBESP), dry-bottom ESP with a dry PM return system (DBESP), and dry-bottom ESP with a wet PM return system (DBESP-WPR). Figures 2 and 3 reveal no clear distinction between recovery furnace control system and opacity. Figure 4 shows the 99th percentile opacity based on the emission unit classification. The existing subpart MM units and the existing subpart MM units subject to the NSPS subpart BB performed similarly based on the 99th percentile. Data were available for analysis for one BB + new MM unit, as indicated by the purple “x” in the figure, and one new MM (soda) unit, as indicated by the green triangle. These units performed similarly to the existing units.

The subpart MM NESHAP contains a 20-percent opacity monitoring action level for new and existing recovery furnaces (40 CFR 63.864(k)(1)(i)). For new recovery furnaces equipped with an ESP, subpart MM considers opacity greater than 20-percent for more than 6-percent of quarterly operating time to be a violation of the subpart MM standards (40 CFR 63.864(k)(2)(i)). Figure 1 shows that most (136 of 160 data sets) recovery furnace COMS had 99th percentiles below the 20-percent level regardless of recovery furnace design. Figures 2 and 3 show that most control types are capable of meeting 20-percent opacity consistently, and that all control types are meeting 35-percent consistently. Two unique control systems (a parallel DBESP-WPR/DBESP/DBESP system and a two-sided dry and wet bottom ESP) had 99th percentiles around 25 and 27-percent, respectively.

Based on Figures 1 through 4 in Appendix C, 20-percent opacity is a proposed option for the technology review because: (1) 20-percent is already a benchmark under subpart MM and (2) the majority of recovery furnaces are consistently achieving 20-percent opacity. The EPA could have considered higher or lower options (e.g., 25-percent or 15-percent), but these do not have the benefit of relating to the existing subpart MM corrective action threshold. An opacity limit of 20-percent is considered adequately demonstrated for recovery furnaces.

Monitoring allowance evaluation. For existing recovery furnaces, subpart MM considers opacity greater than 35-percent for more than 6-percent of the quarterly operating time to be a violation of the MM standards (40 CFR 63.864(k)(2)(i)). For new recovery furnaces equipped with an ESP, subpart MM considers opacity greater than 20-percent for more than 6-percent of quarterly operating time to be a violation of the subpart MM standards (40 CFR 63.864(k)(2)(ii)). In this analysis of the COMS data, monitoring allowance calculations for opacity were conducted on a quarterly and a semiannual basis. The semiannual basis calculations were performed to investigate the option to reduce reporting frequency but require electronic reporting, and to make reporting consistent between the NSPS (which requires semiannual reporting) and the subpart MM NESHAP (which requires quarterly reporting), and are discussed in the following section.

Figures 5a and 5b in Appendix C show the percent of quarterly averaging periods that exceed the 35-percent opacity limit for DCEs and NDCEs. With the exception of one DCE, all emission units were significantly below the 6-percent monitoring allowance. Based on these figures, it does not appear that recovery furnace design affects opacity exceedances. Figures 6 and 7 break out the exceedances by control type (within design groupings in Figures 6a and 6b). Figures 6 and 7 show that all of the control types are capable of consistently meeting the 6-percent allowance. Figures 8a and 8b show the opacity exceedances based on the emission unit classification. The existing subpart MM units and the existing subpart MM units subject to the NSPS (BB + existing MM) performed similarly based on the percent of quarterly averaging periods exceeding 35-percent. Because the majority of units are preforming below 2-percent, reducing the 6-percent allowance to 2-percent is a feasible option.

Figures 9a and 9b in Appendix C show the percent of quarterly averaging periods that exceed a 20-percent opacity limit for DCEs and NDCEs. As to be expected, the percent of averaging periods that are exceedances increases when a more stringent opacity limit of 20-percent is considered. The majority of units are significantly below the 6-percent allowance even for a potential opacity limit of 20-percent. Figures 10 and 11 break out the exceedances by control type (within design groupings in Figures 10a and 10b). Figures 12a and 12b show the exceedances based on the emission unit classification. Based on these figures, the majority of units can meet a 6-percent monitoring allowance even with a 20-percent opacity limit.

Figure 9b in Appendix C shows in greater detail the percent of quarterly averaging periods that exceed a 20-percent opacity limit less than 6-percent of the time. Of the 632 quarterly averaging periods, 15 periods exceeded 6-percent, 21 periods exceeded 5-percent, 30 periods exceeded 4-percent, 41 periods exceeded 3-percent, 61 periods exceeded 2-percent, and 96 periods exceeded 1-percent. As part of the NSPS review, the EPA revised the monitoring allowance from 6-percent to 2-percent. Reducing the monitoring allowance for subpart MM to 2-percent may require 28 units to upgrade or perform maintenance on their ESP more frequently to meet the revised standard. Maintaining the 6-percent monitoring allowance would cover nearly all exceedances of the proposed 20-percent opacity limit but a 6-percent allowance would not provide much incentive for improvement compared to a 2-percent allowance. A 2-percent monitoring allowance more accurately represents the number of exceedances the best performing recovery furnaces were incurring on opacity limits ranging from 20-percent to 35-percent. Only 8 of 158 recovery furnaces COMS had zero exceedances of the 20-percent opacity limit which supports the need for having a monitoring allowance.

Reporting period evaluation. As part of EPA's transition to requiring all NSPSs to report electronically, the EPA is proposing to require electronic reporting for the subpart MM NESHAP. This proposal includes reducing the reporting frequency from quarterly to semiannually because the data will be more readily available for analysis than the currently reported paper reports. As discussed in the previous section, the NSPS and the subpart MM NESHAP have two different reporting period lengths. The subpart BB NSPS requires the monitoring allowance be calculated on a quarterly basis (with semiannual reporting), the subpart BBa NSPS requires the monitoring allowance to be calculated on a semiannual basis, and the NESHAP requires the monitoring allowance be calculated on a quarterly basis. To promote consistency, the EPA investigated changing the reporting period to a semiannual basis for the subpart MM NESHAP.

Figures 13 through 16 in Appendix C show the semiannual averaging periods exceeding a 20-percent opacity. Of the 315 semiannual averaging periods, 8 periods exceeded 6-percent, 9 periods exceeded 5-percent, 13 periods exceeded 4-percent, 19 periods exceeded 3-percent, 29 periods exceeded 2-percent, and 52 periods exceeded 1-percent. As part of the NSPS review, the EPA revised the monitoring allowance from 6-percent to 2-percent. Reducing the monitoring allowance for subpart MM to 2-percent and changing the reporting requirement to semiannual would require 16 units to improve maintenance or upgrade their ESP to meet the revised standard.

Recommendation. The figures in Appendix C support the proposed regulatory decision to reduce the subpart MM opacity limit from 35-percent to 20-percent for existing sources, to reduce the monitoring allowance from 6-percent to 2-percent for new and existing sources, and to reduce the reporting requirements from quarterly to semiannually. Overall, 140 of 158 total recovery furnace COMS data sets demonstrated that the 20-percent opacity limit with a 2-percent monitoring allowance proposed for subpart MM was achieved with a semiannual monitoring allowance calculation. Appendix E lists the recovery furnaces which may incur cost impacts associated with this recommendation and other options considered.

Startup and shutdown periods were included in the data sets used to evaluate the revised opacity limit. Therefore, a revised limit of 20-percent opacity with a 2-percent monitoring allowance accounts for startup and shutdown periods (as well as normal operation), supporting the conclusion that separate opacity limits for startup and shutdown are unnecessary. Continuous compliance with the subpart MM opacity limit can be demonstrated through monitoring of control device operating parameters (e.g., ESP secondary voltage and current or total secondary power) during times when the 2-percent monitoring allowance is invoked.

B. Lime Kiln COMS Analysis

Data analysis summary. Table 2 summarizes the number of COMS data sets analyzed for lime kilns. A total of 30 data sets were analyzed, including 1 soda, 24 BB + existing MM, 1 BB + new MM, and 4 existing MM. A reduction in the monitoring allowance from 6-percent to 1-percent was investigated to provide an incentive to improve ESP performance. Only two kilns did not meet the 1-percent monitoring allowance when reporting on a quarterly basis. Finally, the EPA investigated reducing the reporting frequency from quarterly to semiannually with electronic reporting to improve data availability and to promote consistency between the NSPS and the NESHAP. The same two kilns did not meet the 1-percent monitoring allowance when reporting on a semiannual basis. It is assumed that these units would need to perform maintenance on or upgrade their ESPs to meet the proposed standards.

Table 2. Summary of Lime Kiln COMS Data Sets Analyzed

COMS classification	Data set count	Notes
No. of COMS data sets	**30**	29 kraft + 1 soda
BB + existing MM	24	These are units subject to the NSPS and considered existing units under subpart MM.
BBa + new MM	0	No data were available for units subject to NSPS subpart BBa and considered as new units under subpart MM, if such units exist.
BB + new MM	1	These are units subject to the NSPS and considered new units under subpart MM.
Existing MM	4	These are units not subject to the NSPS and considered existing units under subpart MM.
Soda (new MM)	1	
No. of COMS meeting 20% opacity with a 6% allowance with quarterly reporting	**30**	
Option 2. No. of COMS meeting 20% opacity with a 1% allowance with semiannual reporting	**28**	
Option 3. No. of COMS meeting 20% opacity with a 1% allowance with quarterly reporting	**28**	
No. of COMS *not* meeting 20% opacity with a 1% allowance with semiannual reporting	**2**	Both units were BB + existing MM units, utilizing just an ESP as the control device.

Opacity limit evaluation. The EPA collected COMS data for lime kilns that had installed ESPs and are required to monitor opacity under subpart MM. Subpart MM requires continuous opacity monitoring for lime kilns and specifies 20-percent as the opacity limit for both new and existing kilns. Subpart MM also contains an opacity monitoring allowance where 6-percent of the 6-minute opacity averages per quarter may exceed the 20-percent limit without being considered a violation.

A total of 30 COMS data sets were graphed (including multiple data sets for two kilns with separate COMS for dual stacks), and the graphs are provided in Appendix D. The majority (28) of the COMS data sets graphed were 6-minute averages. Two data sets represented hourly averages. Figure 1 in Appendix D shows the 99th percentile of opacity based on APCD type. Lime kilns controlled with ESP and ESP/scrubber systems consistently achieved 20-percent opacity. The COMS for ESP/scrubber systems were usually placed between the ESP and scrubber. Two units had 99th percentiles which exceeded the 20-percent opacity, but further investigation shows they did not exceed 20-percent for more than the subpart MM 6-percent monitoring allowance.

Monitoring allowance evaluation. Subpart MM includes a 6-percent monitoring allowance per quarterly reporting period for lime kiln opacity. Figures 2 and 3 in Appendix D show the percent of quarterly averaging periods exceeding the 20-percent opacity limit based on APCD type (Figure 2) and the unit classification (Figure 3). Both figures show that no emission units exceed the current 6-percent allowance and only 2 units exceed the proposed 1-percent allowance. Both units exceeded the 2-percent allowance in one of the four quarterly reporting periods.

Reporting period evaluation. As discussed in the previous section, the EPA is proposing to reduce reporting from quarterly to semiannually and to require reports be submitted electronically. Also as previously discussed, the NSPS and the subpart MM NESHAP have two different reporting period lengths. The NSPS requires the monitoring allowance be calculated on a semiannual basis and the NESHAP requires the monitoring allowance be calculated on a quarterly basis. To promote consistency and to improve data availability, the EPA investigated changing the reporting period to a semiannual basis for the subpart MM NESHAP.

Figures 4 and 5 in Appendix D show the percent of lime kiln COMS that exceed the 20-percent opacity limit on a semiannual basis. No emission units exceeded the 6-percent monitoring allowance on a semiannual basis. Two units exceeded the proposed 1-percent allowance for one semiannual reporting period each.

Recommendation. In summary, a 20-percent opacity limit with a 1-percent monitoring allowance has been adequately demonstrated. Continuous compliance with the subpart MM PM standards can be demonstrated through monitoring of control device operating parameters (e.g., ESP secondary voltage and current or total secondary power) during times when the 1-percent monitoring allowance is invoked. Because the data analyzed in arriving at the recommendation included startup and shutdown periods, there is no need for a separate standard for startup and shutdown periods. Appendix E lists the lime kilns that may incur cost impacts associated with this recommendation and other options considered.

III. References

1. Spence, K., U.S. Environmental Protection Agency. Review of the Continuous Emission Monitoring and Continuous Opacity Monitoring Data from the Pulp and Paper Information

Collection Request Responses Pertaining to Subpart BB Sources. Memorandum to Docket ID No. EPA-HQ-OAR-2012-0640. April 5, 2013.

2. Spence, K., U.S. Environmental Protection Agency. Updated Review of the Continuous Emission Monitoring and Continuous Opacity Monitoring Data from the Pulp and Paper ICR Responses for NSPS Sources. Memorandum to Docket ID No. EPA-HQ-OAR-2012-0640. February 28, 2014.

APPENDIX A: Summary of Recovery Furnace Data Received

Summary of Recovery Furnace Data Received

RTI + Emission Unit ID	Opacity Data Type	Furnace Type	APCD	Unit Type	Comments on Data
100.037A	6-min averages	NDCE	DBESP	BB + existing MM	
102.RB10	6-min averages	NDCE	DBESP-WPR	Existing	
103.G-158	6-min averages	NDCE	DBESP	BB + existing MM	
104.EUG D6	data not provided				
105.EU445C	6-min averages	NDCE	DBESP-WPR	BB + existing MM	
105.EU445A	unit down				
107.08-P1	6-min averages	NDCE	DBESP	BB + existing MM	
108.RB3	6-min averages	NDCE	DBESP	BB + new MM	
109.RB4	6-min averages	NDCE	DBESP	BB + existing MM	
109.RB3	6-min averages	NDCE	DBESP	BB + existing MM	
111.G-44	6-min averages	NDCE	DBESP-WPR	BB + Existing MM	
112.AA-100	6-min averages	NDCE	DBESP	BB + Existing MM	
114.U500	6-min averages	NDCE	DBESP	BB + existing MM	
115.RE01	6-min averages	NDCE	DBESP	BB + existing MM	Unit has opacity data for 2 stacks
116.003	6-min averages	NDCE	WBESP	BB + existing MM	
117.B21	data in pdf form				Opacity data not tabulated
119.EQT010	6-min averages	NDCE	DBESP	BB + existing MM	
119.EQT008	data not provided				
120.F7	6-min averages	NDCE	DBESP	BB + existing MM	
121.000013	6-min averages	DCE	DBESP	Existing	
121.000014	6-min averages	DCE	DBESP	Existing	
124.001	6-min averages	DCE	DBESP	Existing	Unit has opacity data for 2 stacks
124.019	6-min averages	DCE	WBESP	Existing	Unit has opacity data for 2 stacks
126.RECOV	6-min averages	NDCE	WBESP	BB + existing MM	Unit has opacity data for 2 stacks

RTI + Emission Unit ID	Opacity Data Type	Furnace Type	APCD	Unit Type	Comments on Data
127.REC1	6-min averages	NDCE	WBESP	BB + existing MM	Unit has opacity data for 2 stacks.
130.1	6-min averages	DCE	WBESP	Existing	
130.2	6-min averages	DCE	WBESP	Existing	
130.3	6-min averages	NDCE	DBESP	Existing	
131.5	6-min averages	DCE	DBESP	Existing	
131.6	6-min averages	NDCE	DBESP	BB + existing MM	
132.4RB	hourly average	NDCE	DBESP-WPR	Existing	
132.5RB	hourly average	NDCE	DBESP-WPR	BB + existing MM	Unit has opacity data for 2 stacks
133.10	6-min averages	NDCE	DBESP	BB + existing MM	
135.003-1	6-min averages	NDCE	DBESP	BB + existing MM	
136.EU 005	6-min averages	NDCE	DBESP	BB + existing MM	
137.189	data not provided				
137.721	data not provided				
138.002	6-min averages	NDCE	DBESP-WPR	BB + existing MM	
139.02	6-min averages	NDCE	DBESP-WPR/DBESP/DBESP	Existing	
140.55	6-min averages	NDCE	DBESP	Existing	
142.CU7216	6-min averages	DCE	DBESP	Existing	
142.CU7214	6-min averages	NDCE	DBESP	Existing	
142.CU7215	6-min averages	DCE	WBESP	BB + existing MM	
143.7000	hourly average	DCE*	WBESP	Existing	
143.7010	hourly average	DCE*	WBESP	Existing	
143.7020	hourly average	DCE*	WBESP	Existing	
145.55	6-min averages	DCE	WBESP	Existing	
145.54	6-min averages	DCE	WBESP	Existing	
146.16	6-min averages	NDCE	DBESP-WPR	BB + existing MM	

RTI + Emission Unit ID	Opacity Data Type	Furnace Type	APCD	Unit Type	Comments on Data
146.8	data not provided				
147.14	6-min averages	NDCE	DBESP	BB + existing MM	Unit has opacity data for 2 stacks
147.5	6-min averages	NDCE	DBESP	BB + existing MM	
148.001	6-min averages	NDCE	DBESP	Existing	
148.007	6-min averages	NDCE	DBESP	BB + existing MM	
149.B011	6-min averages	NDCE	DBESP	BB + existing MM	
150.CREC-1	6-min averages	NDCE	DBESP	BB + existing MM	
151.REC004	6-min averages	NDCE	DBESP	BB + existing MM	
151.REC007	6-min averages	DCE	DBESP	Existing	
152.03	data not provided				
153.EQT 0065	not surveyed				Mill was closed during the development of the survey (reopened in 2010)
154.P36	6-min averages	DCE	WBESP	Existing	
154.P37	6-min averages	DCE	WBESP	BB + existing MM	P39 and P37 have own WBESP but vent to combined stack with single COMS
154.P39	6-min averages	DCE	WBESP	Existing	P39 and P37 have own WBESP but vent to combined stack with single COMS
155.RECOVERY FURNACE	provided as .doc				Not tabulated.
156.RF18	unit down				
156.RF19	6-min averages	DCE	WBESP	Existing	
156.RF22	6-min averages	NDCE	DBESP	BB + existing MM	
157.RB2	6-min averages	NDCE	WBESP	Existing	Removed – facility closed
159.F3	data not provided				Not tabulated.
162.381A	6-min averages	NDCE	DBESP	BB + existing MM	
162.382A	6-min averages	NDCE	DBESP	BB + existing MM	

RTI + Emission Unit ID	Opacity Data Type	Furnace Type	APCD	Unit Type	Comments on Data
163.RF2904	6-min averages	NDCE	WBESP	BB + existing MM	
163.RF1901	6-min averages	DCE	WBESP	Existing	
164.B08	6-min averages	NDCE	DBESP	Existing	Flue gases from B08 and B10 combine and then split into 2 ESPs
164.B10	6-min averages	NDCE	DBESP	Existing	Flue gases from B08 and B10 combine and then split into 2 ESPs
165.000013	6-min averages	NDCE	DBESP	BB + existing MM	Unit has opacity data for 2 stacks
165.000006	6-min averages	NDCE	DBESP	BB + existing MM	Unit has opacity data for 2 stacks
166.RB01	6-min averages	DCE	WBESP	Existing	Unit has opacity data for 2 stacks
166.RB02	data not provided				
167.005RB	6-min averages	DCE	WBESP	Existing	Unit has opacity data for 2 stacks
169.04	6-min averages	NDCE	WBESP	BB + existing MM	
169.05	6-min averages	NDCE	WBESP	BB + existing MM	
171.002	6-min averages	DCE	DBESP-WPR	Existing	
171.003	6-min averages	DCE	DBESP-WPR	Existing	
171.004	6-min averages	DCE	DBESP-WPR	Existing	Unit has opacity data for 2 stacks
172.RB01	6-min averages	NDCE	WBESP	Existing	
172.RB02	6-min averages	NDCE	WBESP	BB + existing MM	
173.RECOVB	6-min averages	NDCE	DBESP	Existing	Unit has opacity data for 2 stacks
174.G-32	6-min averages	NDCE	DBESP	BB + existing MM	
174.G-92	6-min averages	DCE	WBESP	Existing	Unit has opacity data for 2 stacks
175.RB3A	6-min averages	NDCE	DBESP	BB + existing MM	
175.RB2A	6-min averages	DCE	WBESP	Existing	

RTI + Emission Unit ID	Opacity Data Type	Furnace Type	APCD	Unit Type	Comments on Data
176.RB7	6-min averages	NDCE	DBESP	BB + existing MM	
177.EU0804	6-min averages	NDCE	DBESP	BB + existing MM	
178.08P012	6-min averages	NDCE	DBESP	Existing	
178.08P013	6-min averages	NDCE	DBESP	Existing	
179.RF3	6-min averages	NDCE	DBESP	BB + existing MM	
180.D001	6-min averages	NDCE	DBESP	BB + existing MM	
181.50	6-min averages	NDCE	DBESP	BB + existing MM	Unit has opacity data for 2 stacks
181.10	6-min averages	NDCE	WBESP	Existing	Unit has opacity data for 2 stacks
182.037	6-min averages	NDCE	DBESP	BB + existing MM	
183.002	6-min averages	NDCE	DBESP	Existing	
184.72	6-min averages	NDCE	DBESP-WPR	BB + existing MM	
184.73	6-min averages	NDCE	DBESP-WPR	BB + existing MM	
185.02	data not provided				
186.RB15	6-min averages	NDCE	DBESP	BB + existing MM	
188.014RB1	6-min averages	DCE	WBESP	Existing	
188.016RB2	6-min averages	DCE	WBESP	Existing	
189.SN26	6-min averages	NDCE	WBESP	BB + existing MM	
190.R400	6-min averages	NDCE	DBESP	BB + existing MM	R400 and R401 appear to each have a DBESP that vent through a common stack (opacity represents combined total)
190.R401	6-min averages	NDCE	DBESP	BB + existing MM	R400 and R401 appear to each have a DBESP that vent through a common stack (opacity represents combined total)
190.R402	6-min averages	NDCE	DBESP	Existing	Unit has opacity data for 2 stacks
195.003	6-min averages	NDCE	DBESP	BB + existing MM	
196.SN-06	6-min averages	NDCE	DBESP	BB + existing MM	

RTI + Emission Unit ID	Opacity Data Type	Furnace Type	APCD	Unit Type	Comments on Data
196.SN-14	6-min averages	NDCE	DBESP	BB + existing MM	
197.2	data not provided				
198.019	6-min averages	NDCE	DBESP	BB + existing MM	
199.002	6-min averages	NDCE	DBESP	Existing	
200.007RF2	6-min averages	NDCE	DBESP	Existing	Unit has opacity data for 2 stacks
200.007RF3	6-min averages	NDCE	DB-WBESP [2-sided dry and wet]	BB + Existing MM	Unit has opacity data for 2 stacks
201.SR0001	6-min averages	NDCE	DBESP	Existing	
202.Recovery Furnace EU320	6-min averages	NDCE	DBESP	BB + existing MM	
203.RF#2	6-min averages	NDCE	DBESP	BB + existing MM	
203.RF#3	6-min averages	NDCE	DBESP	BB + existing MM	
205.009	6-min averages	DCE	WBESP	Existing	Unit has opacity data for 2 stacks
206.G-32	6-min averages	DCE	WBESP	Existing	
206.G-31	6-min averages	DCE	WBESP	Existing	
207.038	6-min averages	NDCE	DBESP	BB + existing MM	Unit has opacity data for 2 stacks.
226.RECB2	6-min averages	NDCE	WBESP	BB + existing MM	
226.RECB1	6-min averages	NDCE	WBESP	Existing	Unit has opacity data for 2 stacks
240.RF04	6-min averages	NDCE	DBESP	BB + existing MM	
240.RF01	6-min averages	NDCE	DBESP	Existing	
242.AA-011	6-min averages	NDCE	DBESP	BB + existing MM	
243.R407	6-min averages	NDCE	DBESP	BB + existing MM	
243.R401	6-min averages	NDCE	DBESP	Existing	Unit has opacity data for 2 stacks
340.005	6-min averages	NDCE	DBESP	Existing	
525.EU18	6-min averages	NDCE	DBESP-WPR	Existing	
531.RF15	6-min averages	NDCE	DBESP	BB + existing MM	

RTI + Emission Unit ID	Opacity Data Type	Furnace Type	APCD	Unit Type	Comments on Data
600.G0803	6-min averages	DCE	WBESP	BB + existing MM	Removed – facility closed
600.G0806	6-min averages	NDCE	DBESP	BB + existing MM	Removed – facility closed
606.RB2	6-min averages	NDCE	DBESP	Existing	
606.RB3	6-min averages	DCE**	DBESP	Existing	
606.RB4	6-min averages	NDCE	DBESP	Existing	
610.4	6-min averages	NDCE	DBESP	Existing	Units 4 and 5 utilize a single stack with 1 COMS
610.5	6-min averages	NDCE	DBESP	Existing	Units 4 and 5 utilize a single stack with 1 COMS
613.001	6-min averages	DCE	DBESP	Existing	Unit has opacity data for 2 stacks
613.002	6-min averages	DCE	DBESP	Existing	Unit has opacity data for 2 stacks
615.24	6-min averages	NDCE	DBESP	BB + existing MM	Unit has opacity data for 2 stacks
617.B14	6-min averages	NDCE	DBESP	BB + existing MM	
208228535.001	6-min averages	NDCE	DBESP	BB + existing MM	
208228535.007	6-min averages	NDCE	DBESP	BB + existing MM	
106.RF	6-min averages	NDCE	WBESP	new MM	Soda recovery furnace

*The 3 DCEs at this mill were replaced with an NDCE in 2012.
**Process flow diagrams state that a RF conversion to NDCE was performed in 2011.

APPENDIX B: Summary of Lime Kiln Data Received

Summary of Lime Kiln Data Received

RTI + Emission Unit ID	Opacity Data Type	APCD	Unit Type	Comments On Data
100.115	6-min averages	ESP	BB + existing MM	
102.LK	6-min averages	ESP	BB + existing MM	Separate stacks. A portion of the ESP exhaust gas is withdrawn from each stack for use by SMI (a PCC plant). This lowers the stack gas flow and reduces pollutant mass emissions (though opacity remains the same).
103.G-165	NA			
104.EUG E7	not provided			
105.EU455	6-min averages	ESP	Existing	
107.11-P14	6-min averages	ESP	BB + existing MM	
108.LK1	NA			
109.LK1	6-min averages	ESP	BB + existing MM	
111.G-35	not provided			
112.AA-110	not provided			
114.U800	6-min averages	ESP	BB + new MM	
115.LK01	6-min averages	ESP	BB + existing MM	
116.001	NA			
117.P36	NA			
119.EQT006	NA			
120.M18	NA			
120.M19	NA			
121.000011	NA			
124.004-1	NA			
126.LK	not provided			
127.LK1	6-min averages	ESP	Existing	

RTI + Emission Unit ID	Opacity Data Type	APCD	Unit Type	Comments On Data
127.LK2	6-min averages	ESP	Existing	
130.4	NA			
130.5	NA			
131.18	NA			
131.16	NA			
132.21LK4	hourly average	ESP	BB + existing MM	
133.14	NA			
133.15	NA			
135.004-1	NA			
136.EU 033	6-min averages	ESP	BB + existing MM	
137.511	not provided			Did not tabulate
137.512	not provided			Did not tabulate
138.001	NA			
139.04	NA			
140.32	NA			
142.P6025	NA			
142.P6009	NA			
143.6063	hourly average	ESP	BB + existing MM	
145.001	NA			
146.6	NA			
146.30	6-min averages	ESP/SCBR	BB + existing MM	
147.3	NA			
147.55	not provided			
148.003	NA			
148.009	6-min averages	ESP	BB + existing MM	
149.P001	NA			

RTI + Emission Unit ID	Opacity Data Type	APCD	Unit Type	Comments On Data
150.CAU-12	NA			
151.CP002	NA			
151.CP001	NA			
152.08	NA			
153.EQT 0053	NA			Mill was not surveyed
154.P30	6-min averages	ESP/SCBR	BB + existing MM	
155.LIME KILN	NA			
156.143100	NA			Lime kiln 3
156.145000	NA			Lime kiln 4
156.LK5	6-min averages	ESP	BB + existing MM	Lime kiln 5; has 2 separate COMS (north and south stacks)
157.KILN	NA			
159.F4	NA			
162.371A	NA			
162.372A	6-min averages	ESP	BB + existing MM	
163.LK1501	NA			
163.LK2502	NA			
164.P12	NA			
165.000019	NA			
165.000002	NA			
166.LK01	NA			
166.LK02	NA			
167.004LK	NA			
169.03	NA			
171.010	NA			
171.009	NA			
172.LK03	NA			

RTI + Emission Unit ID	Opacity Data Type	APCD	Unit Type	Comments On Data
173.LK1	NA			
174.G-18	6-min averages	ESP/SCBR	BB + existing MM	
174.G-95	NA			
175.LK1A	NA			
175.LK2A	NA			
176.G-5	NA			
177.EU0905	NA			
178.09P037	6-min averages	ESP/SCBR	Existing	
179.LK3	6-min averages	ESP	BB + existing MM	
180.L001	NA			
180.L002	NA			
181.01	NA			
181.14	NA			
183.004	NA			
184.LK1	NA			
184.LK2	not provided			
185.07	NA			
186.LK	6-min averages	ESP/SCBR	BB + existing MM	
188.001LK1	NA			
188.002LK2	NA			
188.003LK3	NA			
189.SN25	NA			
190.L600	NA			
190.L601	NA			
195.002	NA			
196.SN-09	NA			

RTI + Emission Unit ID	Opacity Data Type	APCD	Unit Type	Comments On Data
196.SN-02	6-min averages	ESP	BB + existing MM	
197.1	NA			
198.004	NA			
199.011	NA			
200.007_10	6-min averages	ESP	BB + existing MM	
201.SR0003	NA			
202.Lime Kiln EU340	NA			
203.LKScr	NA			
205.008	NA			
206.G-37	NA			
206.G-38	NA			
207.103A	NA			
226.LK1	NA			
226.LK2	NA			
240.CA81	6-min averages	ESP	BB + existing MM	
242.AA-013	not provided			
243.LG07	not provided			
340.008	NA			
525.EU17	NA			
531.LK7	not provided			
600.G0903	NA			
600.G0905	NA			
600.G0908	NA			
606.LK4	6-min averages	ESP	BB + existing MM	
610.7	NA			
610.8	NA			

RTI + Emission Unit ID	Opacity Data Type	APCD	Unit Type	Comments On Data
613.009	NA			
615.21	NA			
617.P22	6-min averages	ESP	BB + existing MM	
208228535.003	NA			
208228535.009	6-min averages	ESP	BB + existing MM	
106.LK	6-min averages	ESP	New MM	Soda lime kiln

NA – Not applicable (for kilns with wet scrubbers)

APPENDIX C: Recovery Furnace Opacity Data

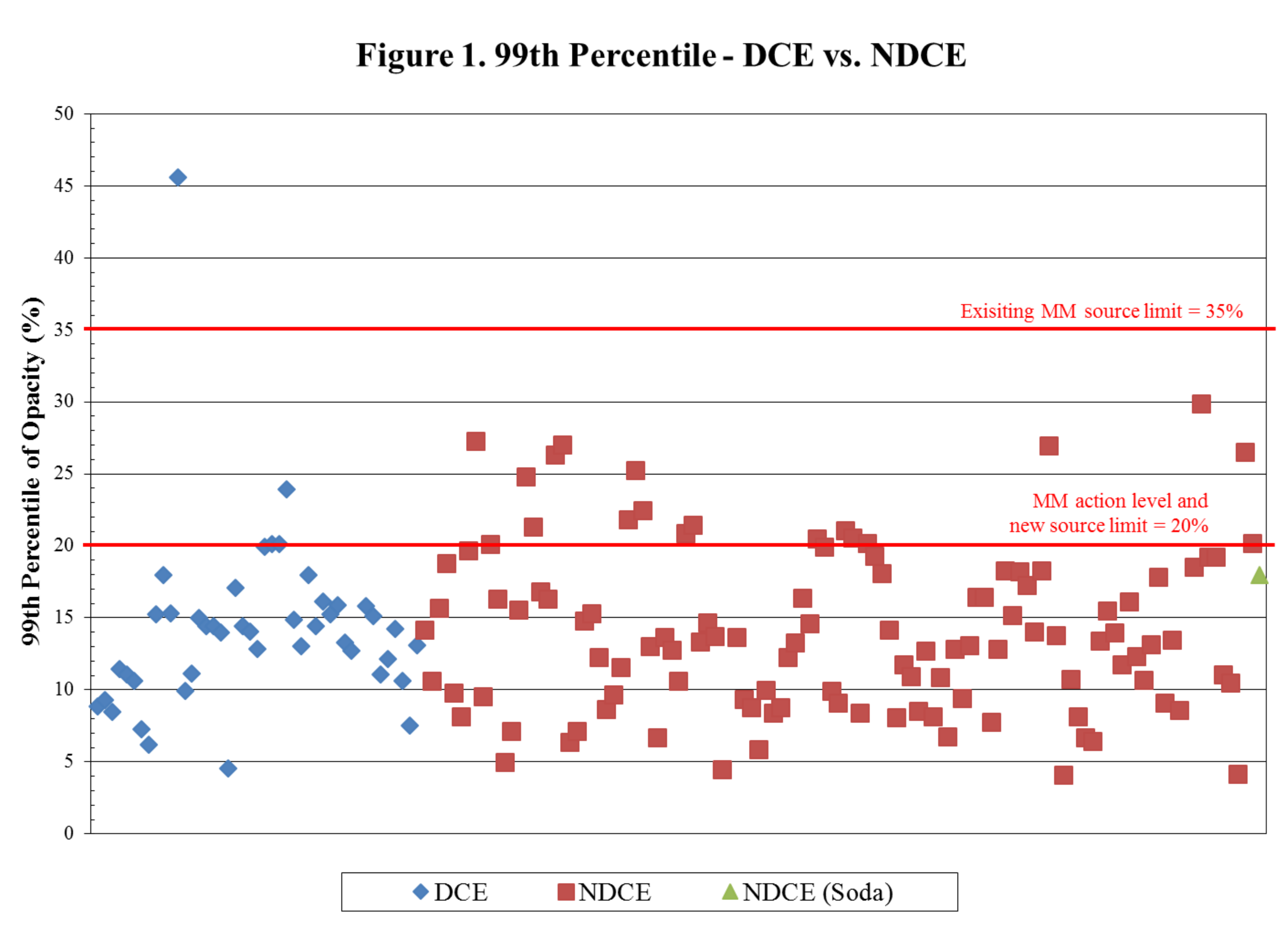
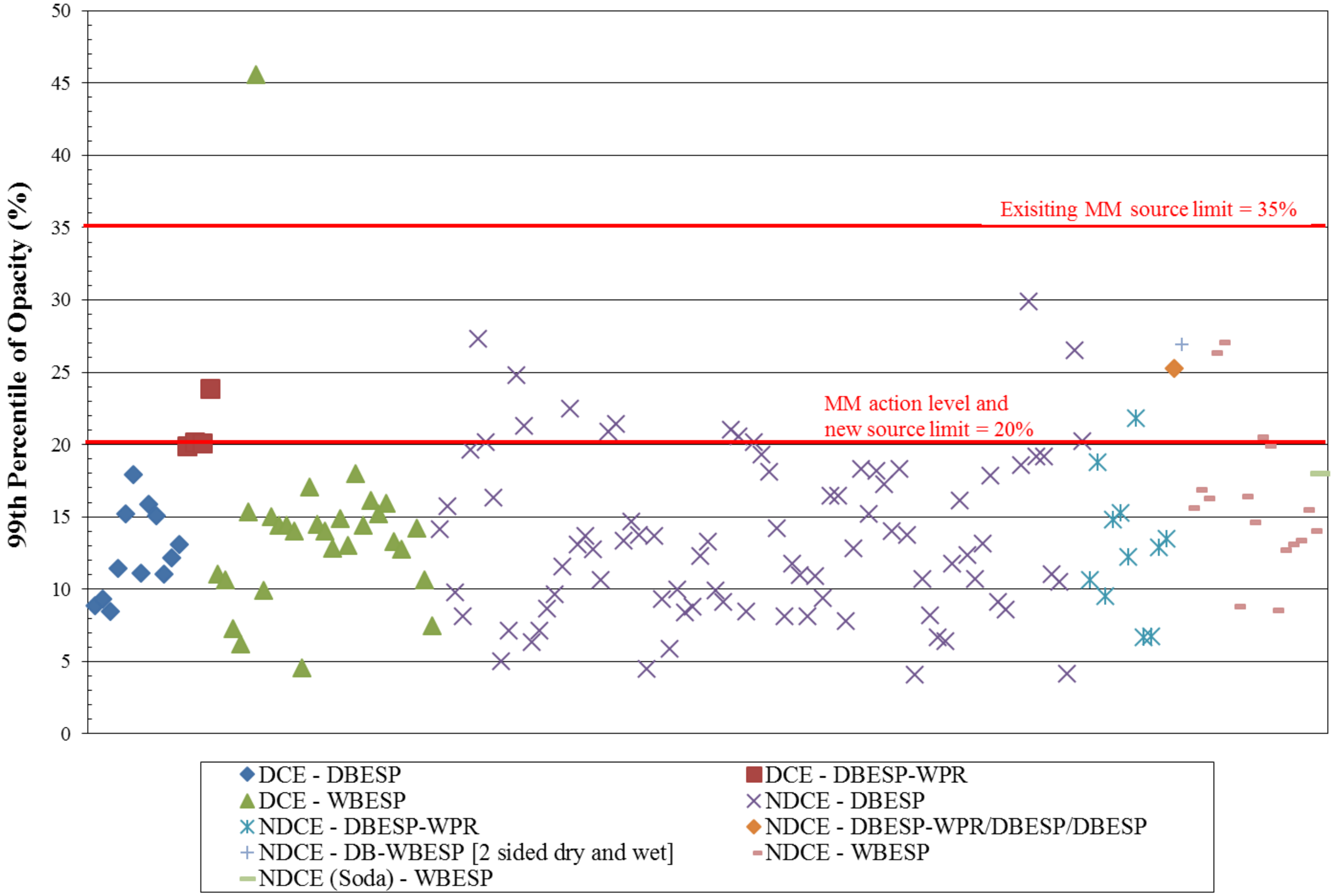


Figure 1. 99th Percentile - DCE vs. NDCE
99th Percentile of Opacity (%)
50
45
40
35
30
25
20
15
10
5
0
Exisiting MM source limit = 35%
MM action level and
new source limit = 20%
DCE
NDCE
NDCE (Soda)

Figure 2. 99th Percentile of Opacity - DCE vs. NDCE (Showing APCD)



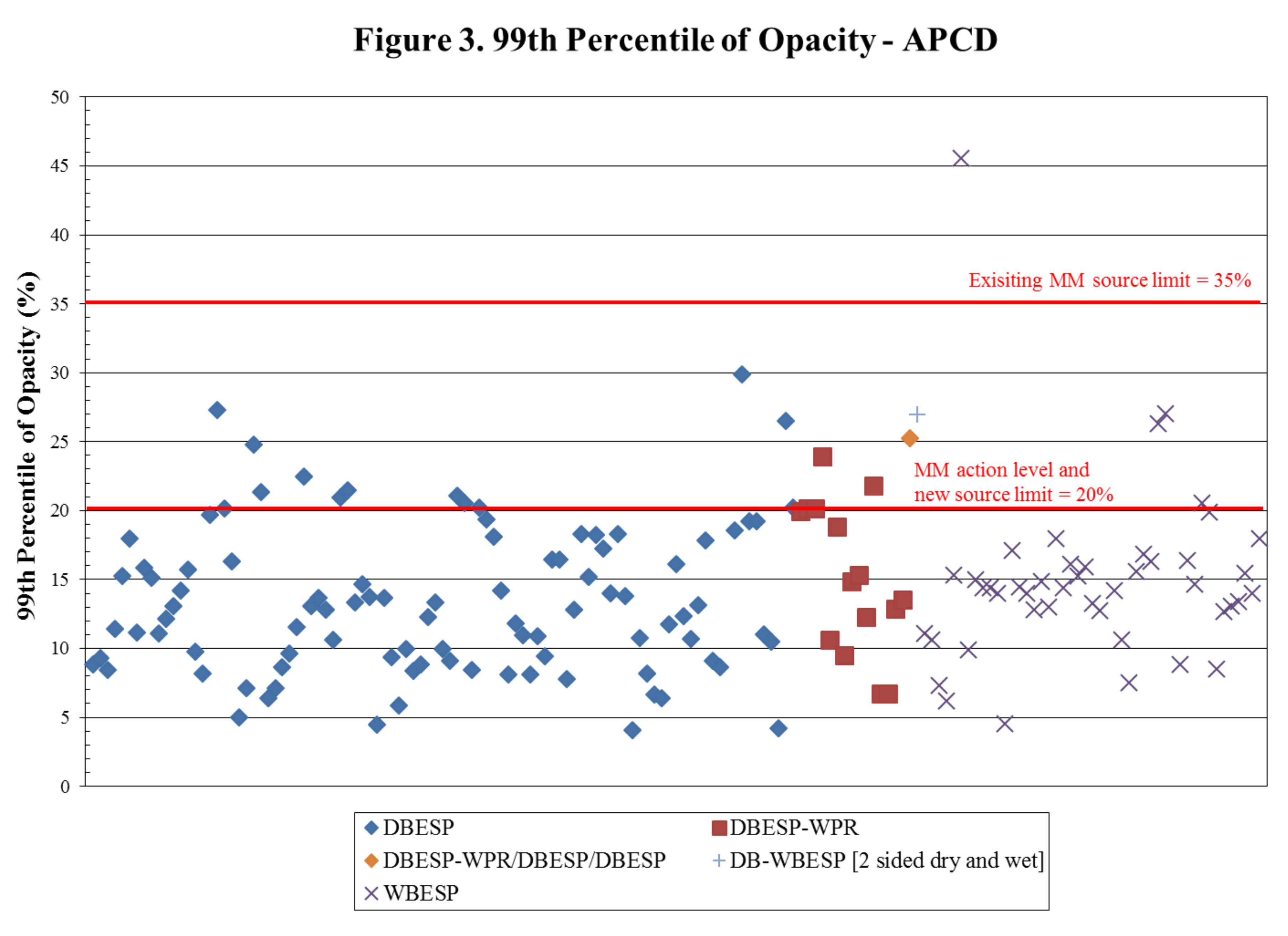


Figure 3. 99th Percentile of Opacity - APCD
99th Percentile of Opacity (%)
50
45
40
35
30
25
20
15
10
5
0
Exisiting MM source limit = 35%
MM action level and
new source limit = 20%
DBESP
DBESP-WPR
DBESP-WPR/DBESP/DBESP
DB-WBESP [2 sided dry and wet]
WBESP

Figure 4. 99th Percentile of Opacity - Emission Unit Classification

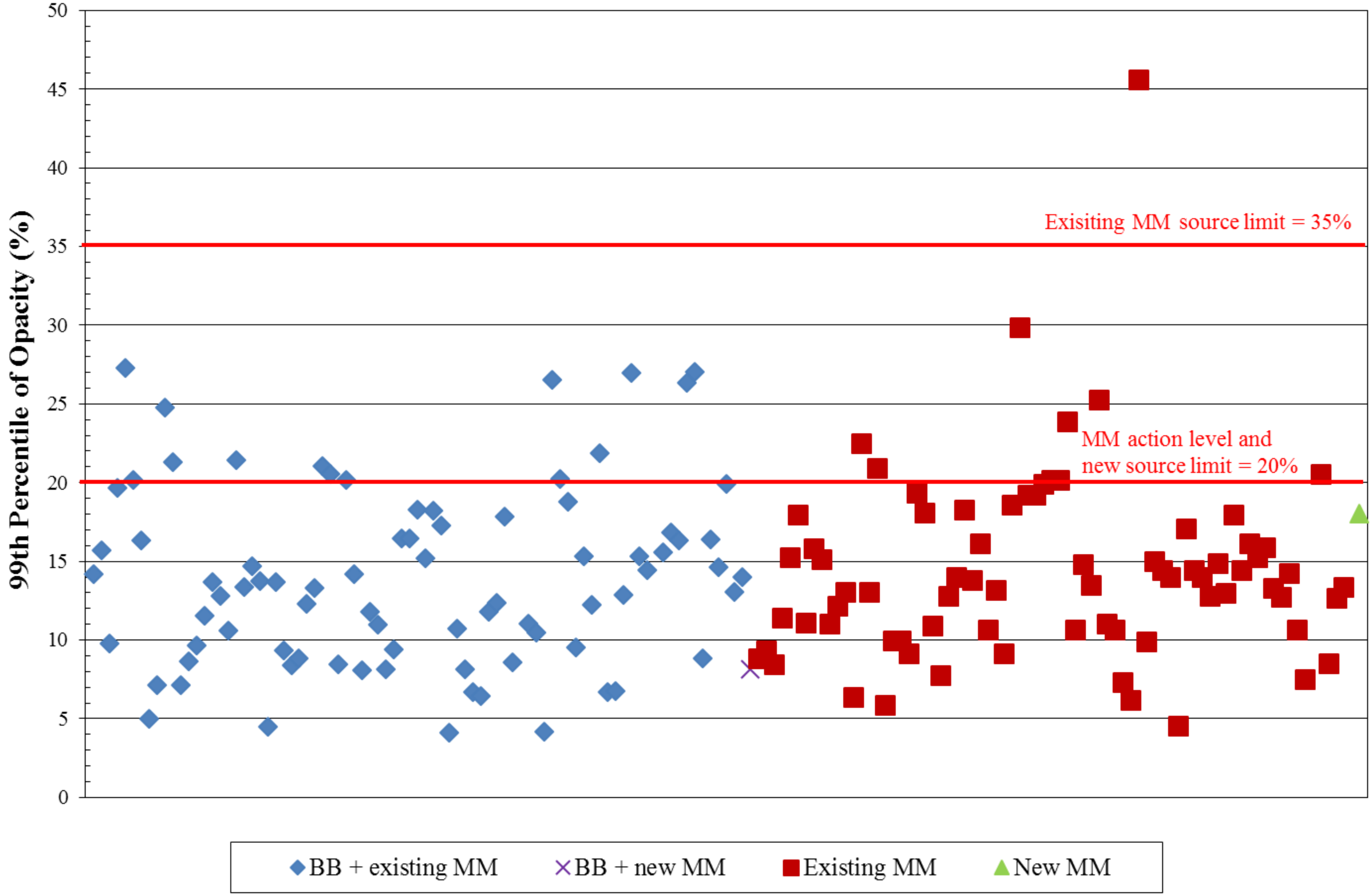
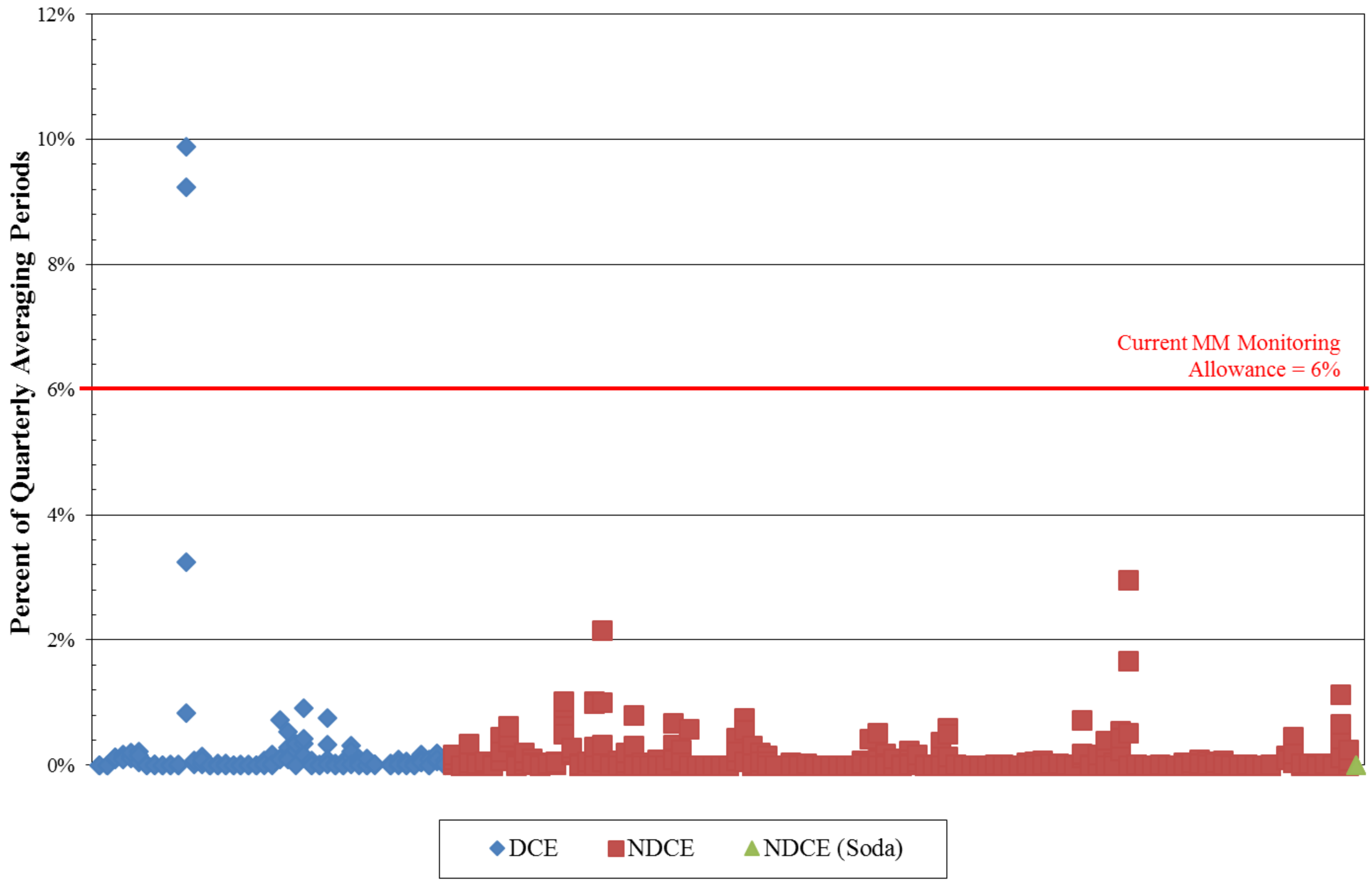


Figure 5a. Percent of Quarterly Averaging Periods Exceeding 35% - DCE vs. NDCE



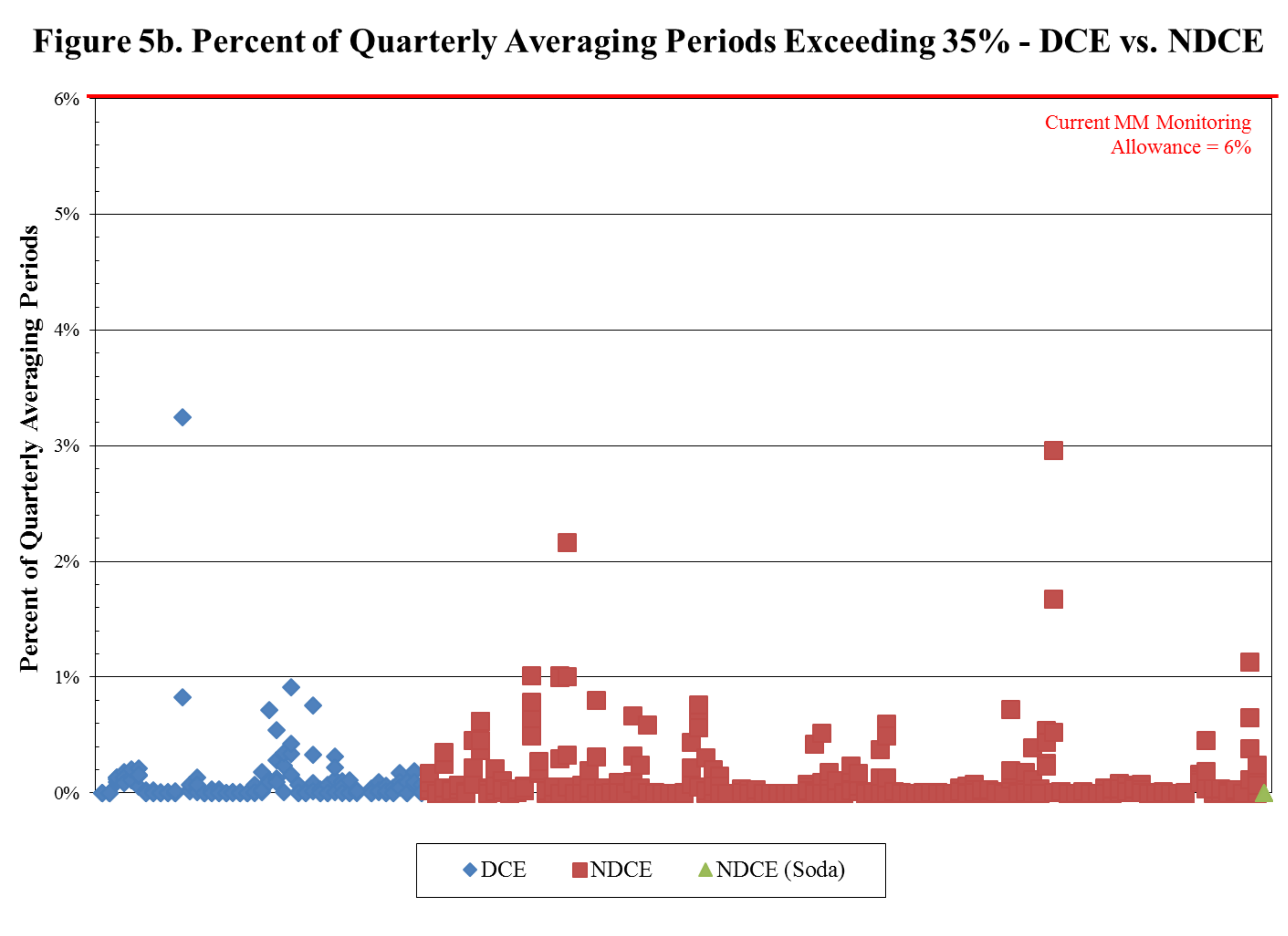
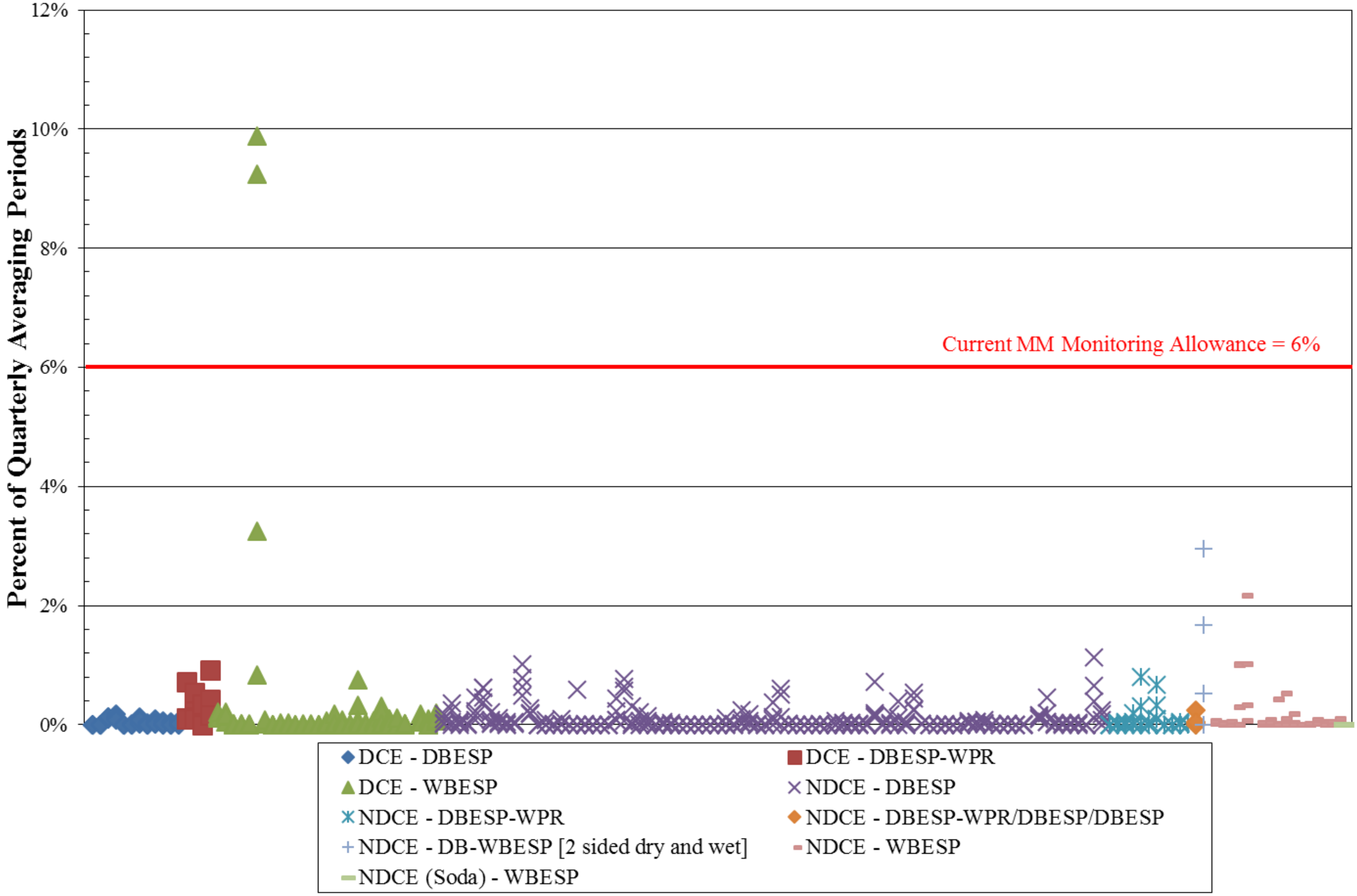


Figure 5b. Percent of Quarterly Averaging Periods Exceeding 35% - DCE vs. NDCE
Percent of Quarterly Averaging Periods
6%
5%
4%
3%
2%
1%
0%
Current MM Monitoring
Allowance = 6%
DCE
NDCE
NDCE (Soda)

Figure 6a. Percent of Quarterly Averaging Periods Exceeding 35% Opacity - DCE vs. NDCE (Showing APCD)



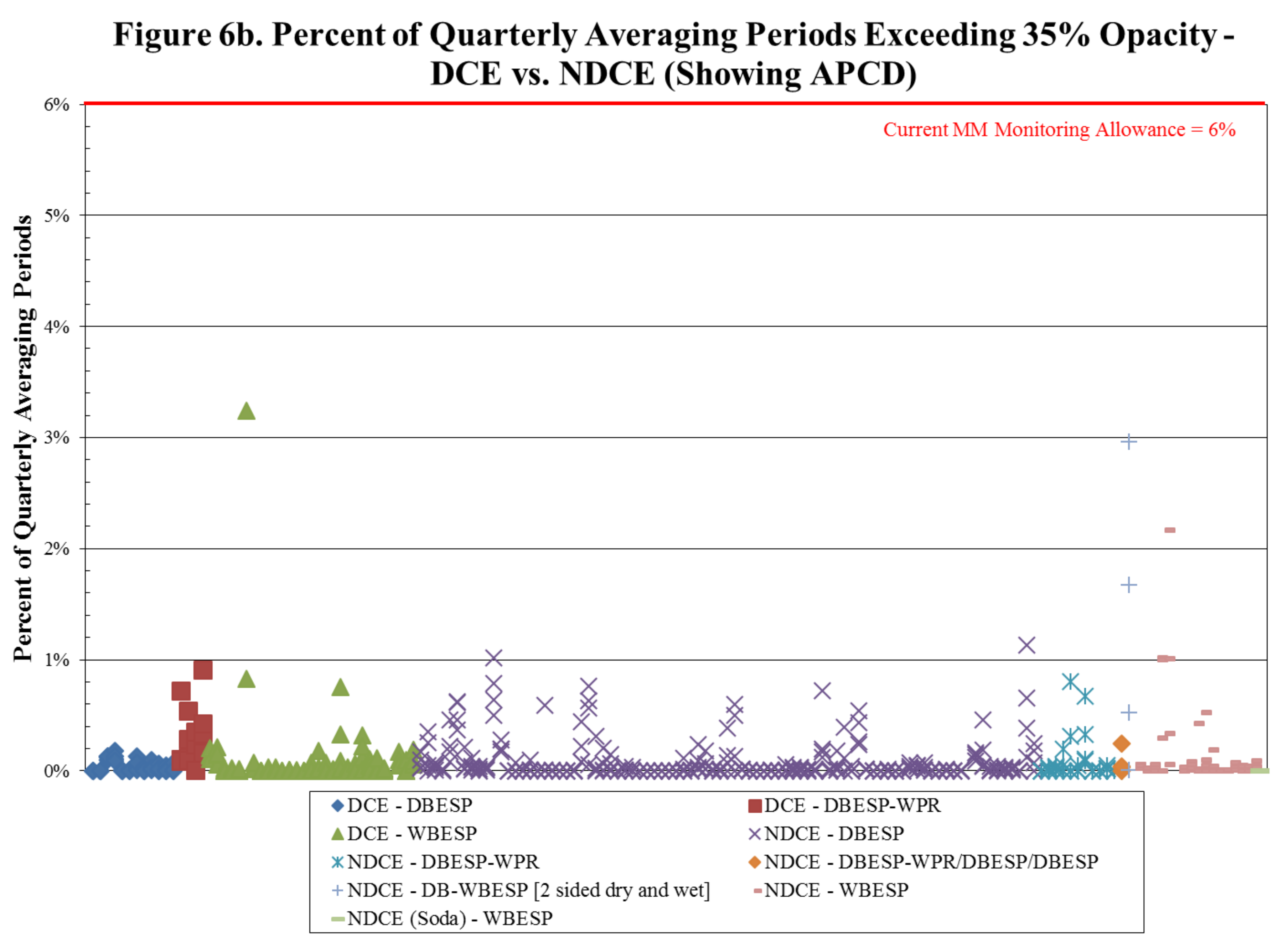


Figure 6b. Percent of Quarterly Averaging Periods Exceeding 35% Opacity - DCE vs. NDCE (Showing APCD)
Current MM Monitoring Allowance = 6%
Percent of Quarterly Averaging Periods
6%
5%
4%
3%
2%
1%
0%
DCE - DBESP
DCE - DBESP-WPR
DCE - WBESP
NDCE - DBESP
NDCE - DBESP-WPR
NDCE - DBESP-WPR/DBESP/DBESP
NDCE - DB-WBESP [2 sided dry and wet]
NDCE - WBESP
NDCE (Soda) - WBESP

Figure 7a. Percent of Quarterly Averaging Periods Exceeding 35% Opacity - APCD

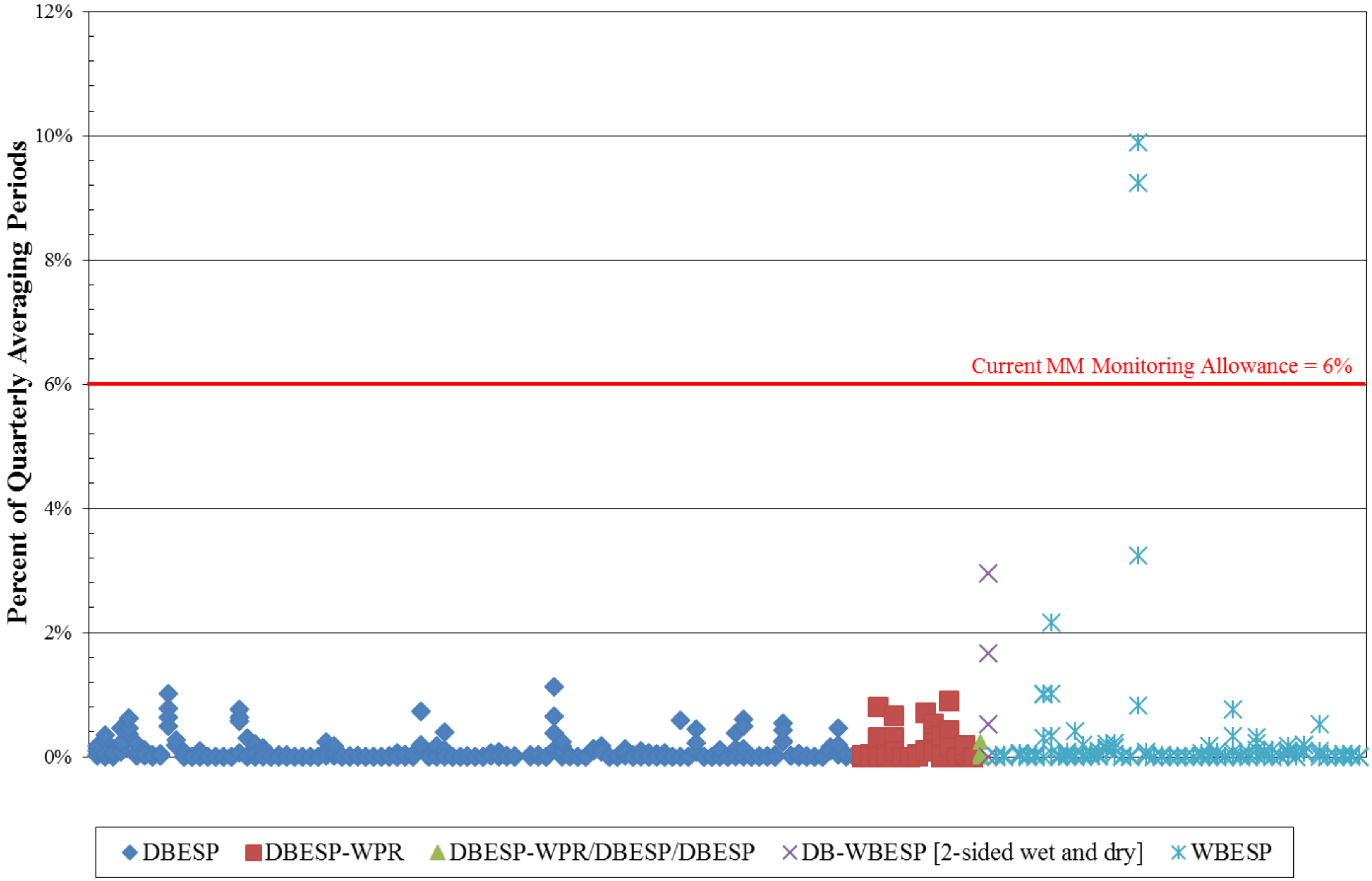
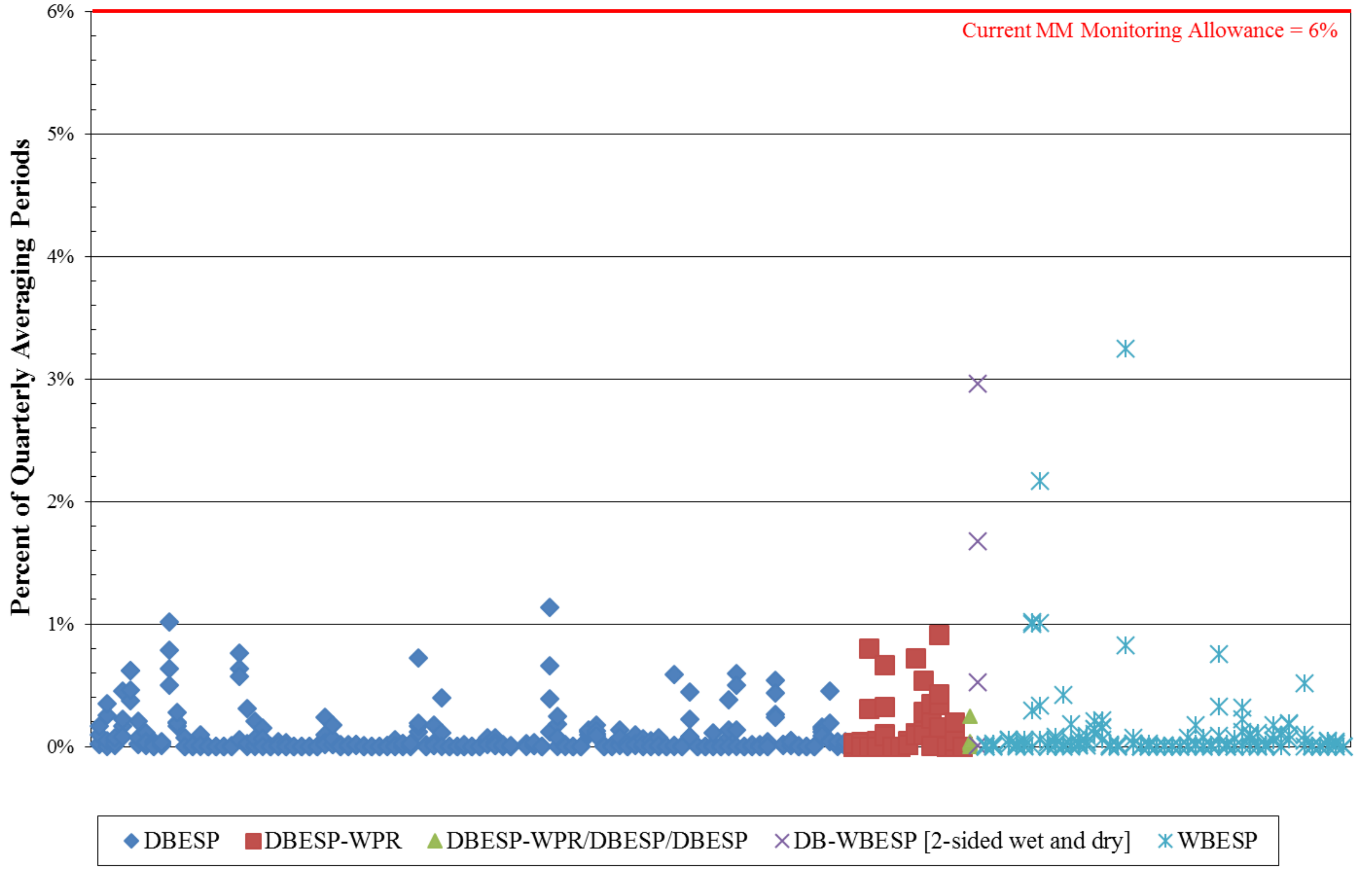


Figure 7b. Percent of Quarterly Averaging Periods Exceeding 35% Opacity - APCD



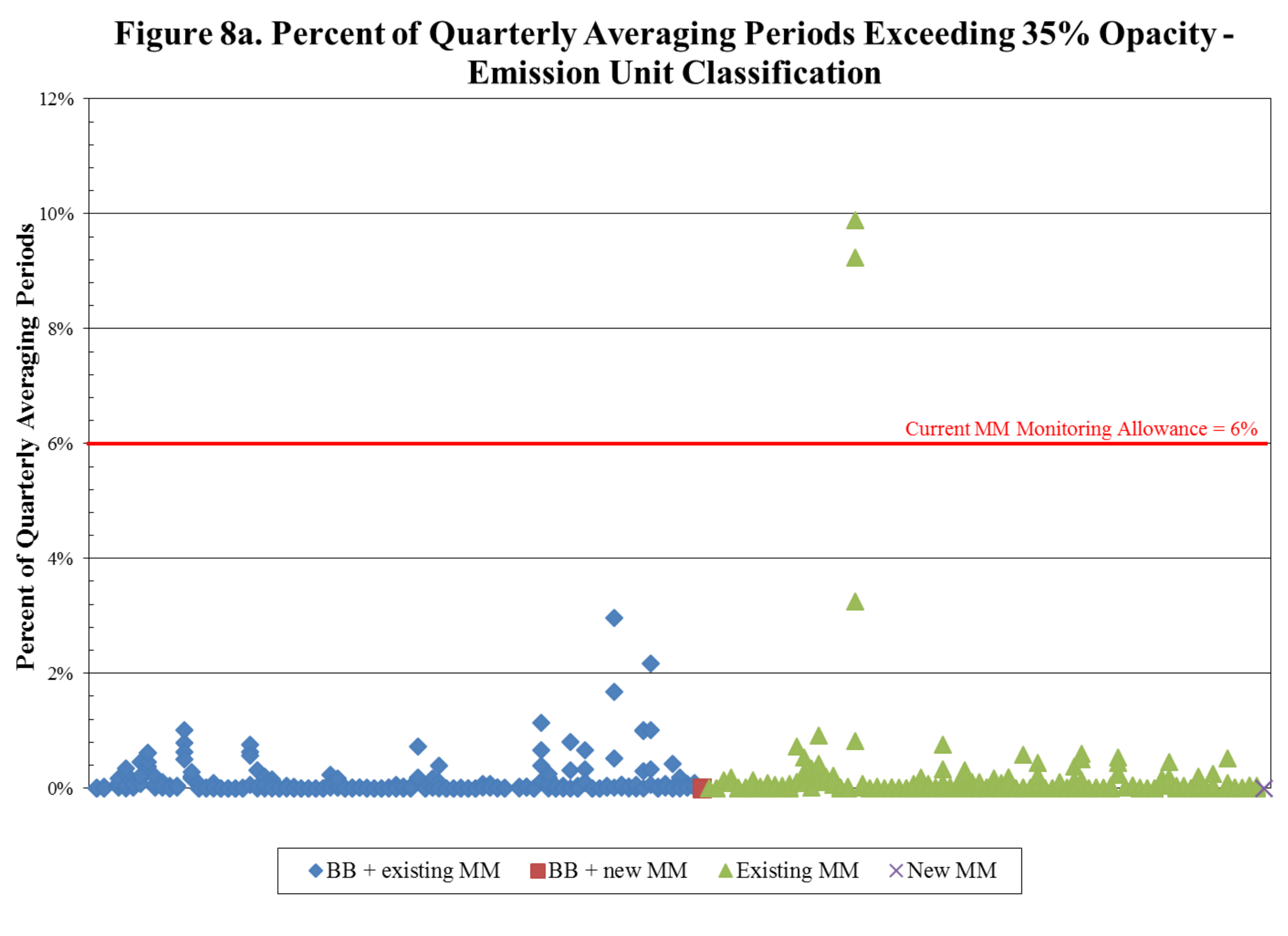


Figure 8a. Percent of Quarterly Averaging Periods Exceeding 35% Opacity - Emission Unit Classification
Percent of Quarterly Averaging Periods
12%
10%
8%
6%
4%
2%
0%
Current MM Monitoring Allowance = 6%
BB + existing MM
BB + new MM
Existing MM
New MM

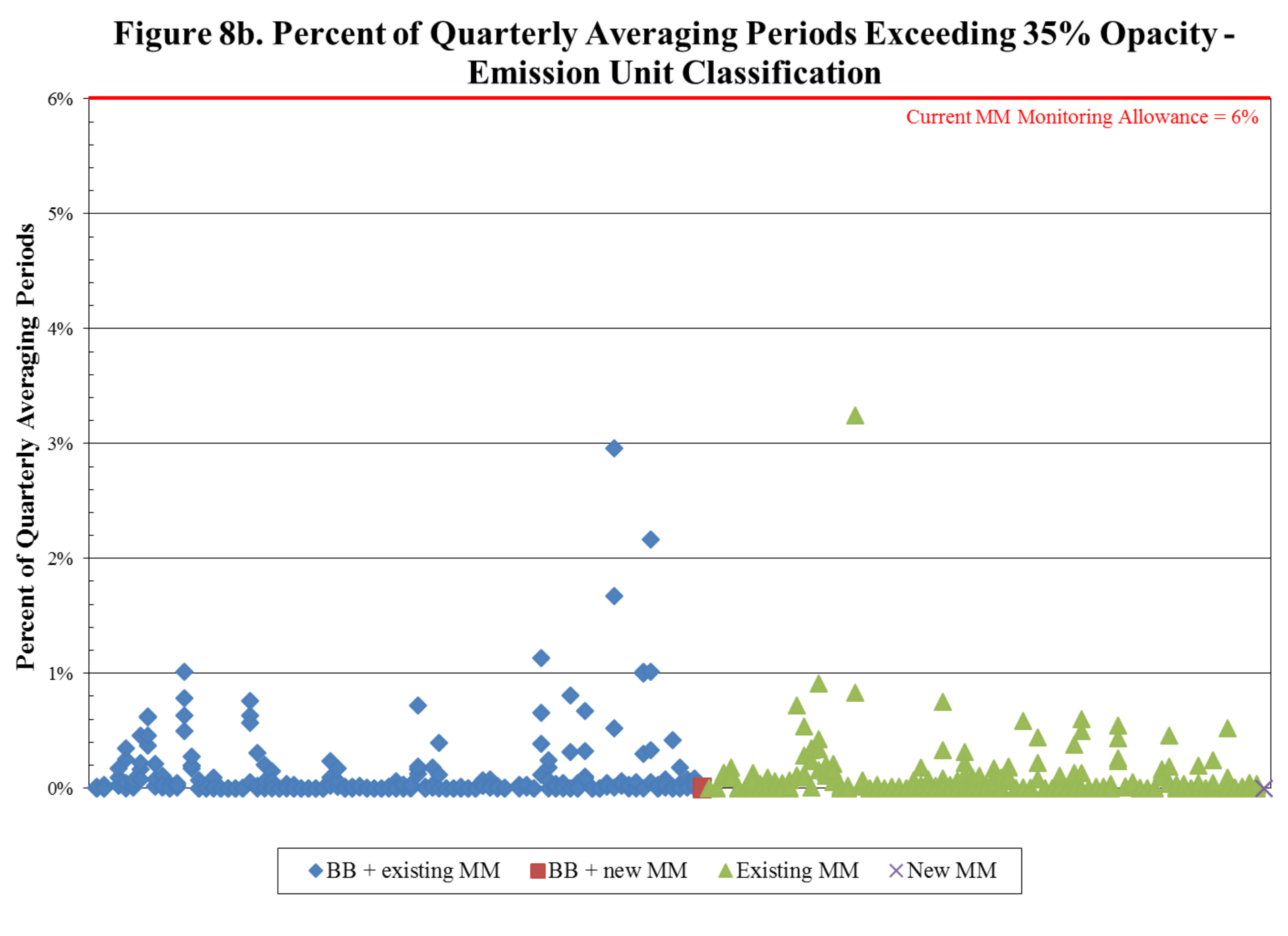


Figure 8b. Percent of Quarterly Averaging Periods Exceeding 35% Opacity - Emission Unit Classification
Percent of Quarterly Averaging Periods
6%
5%
4%
3%
2%
1%
0%
Current MM Monitoring Allowance = 6%
BB + existing MM
BB + new MM
Existing MM
New MM

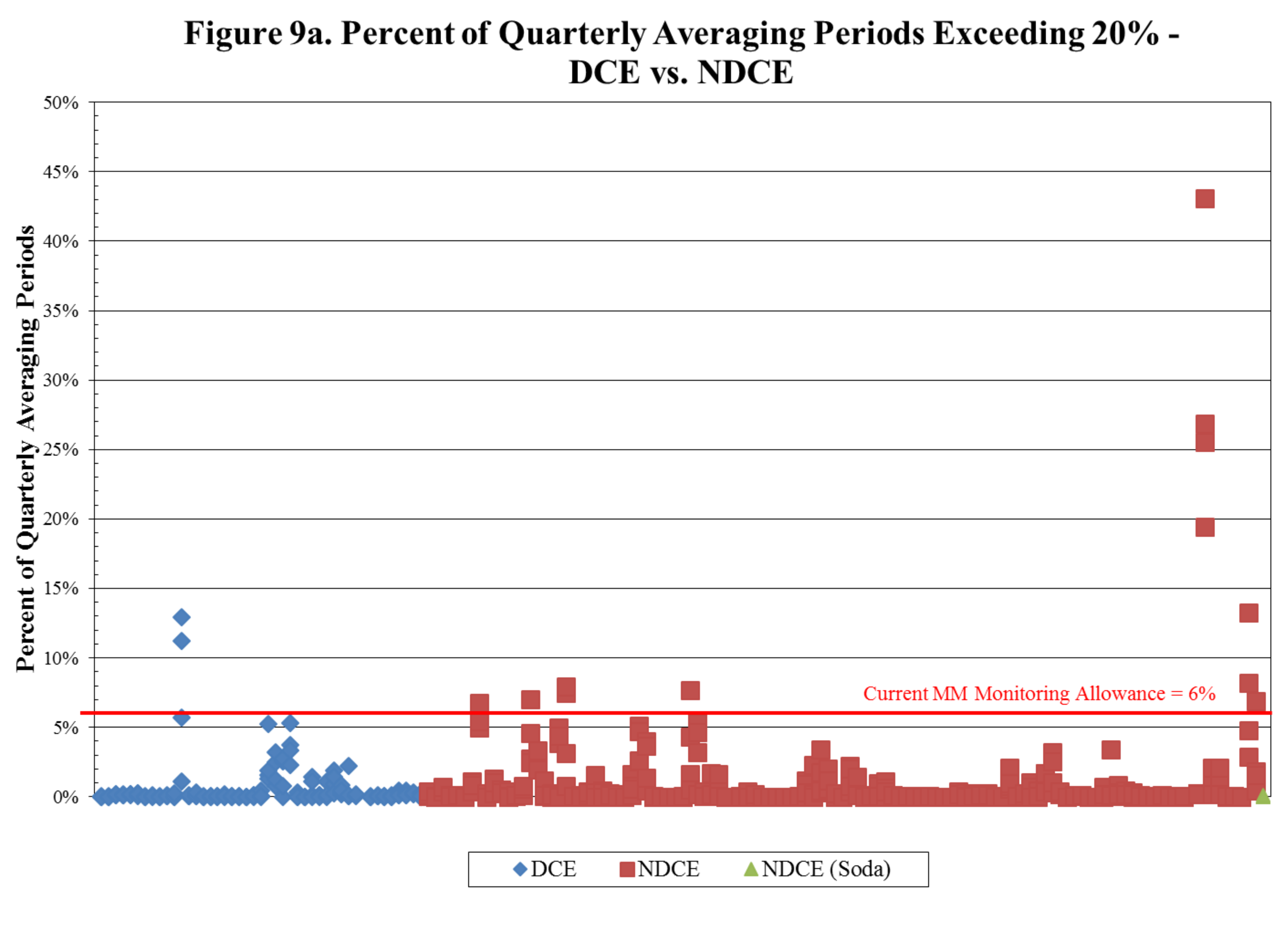


Figure 9a. Percent of Quarterly Averaging Periods Exceeding 20% - DCE vs. NDCE
Percent of Quarterly Averaging Periods
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
Current MM Monitoring Allowance = 6%
DCE
NDCE
NDCE (Soda)

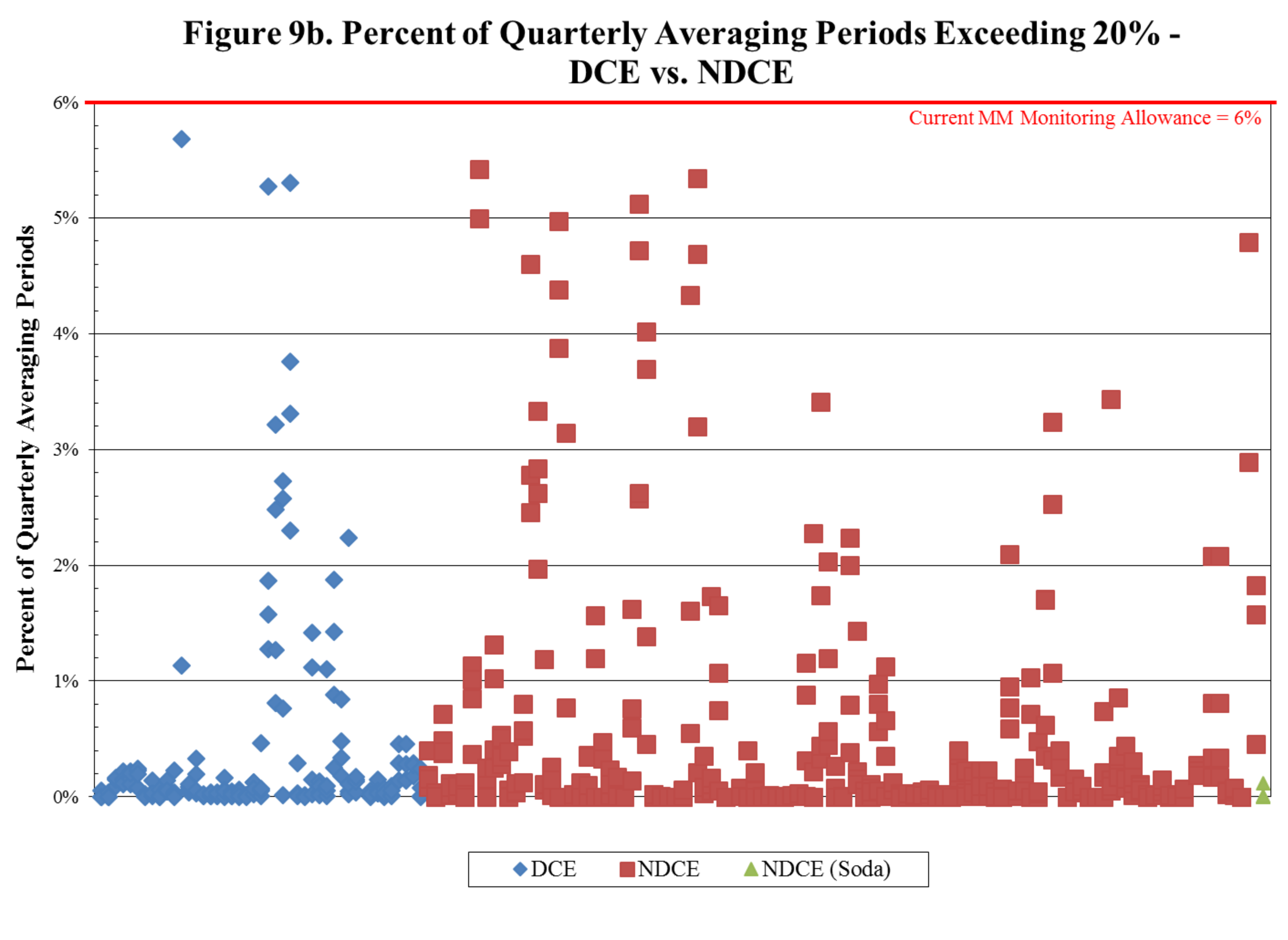


Figure 9b. Percent of Quarterly Averaging Periods Exceeding 20% -
DCE vs. NDCE
Current MM Monitoring Allowance = 6%
Percent of Quarterly Averaging Periods
6%
5%
4%
3%
2%
1%
0%
DCE
NDCE
NDCE (Soda)

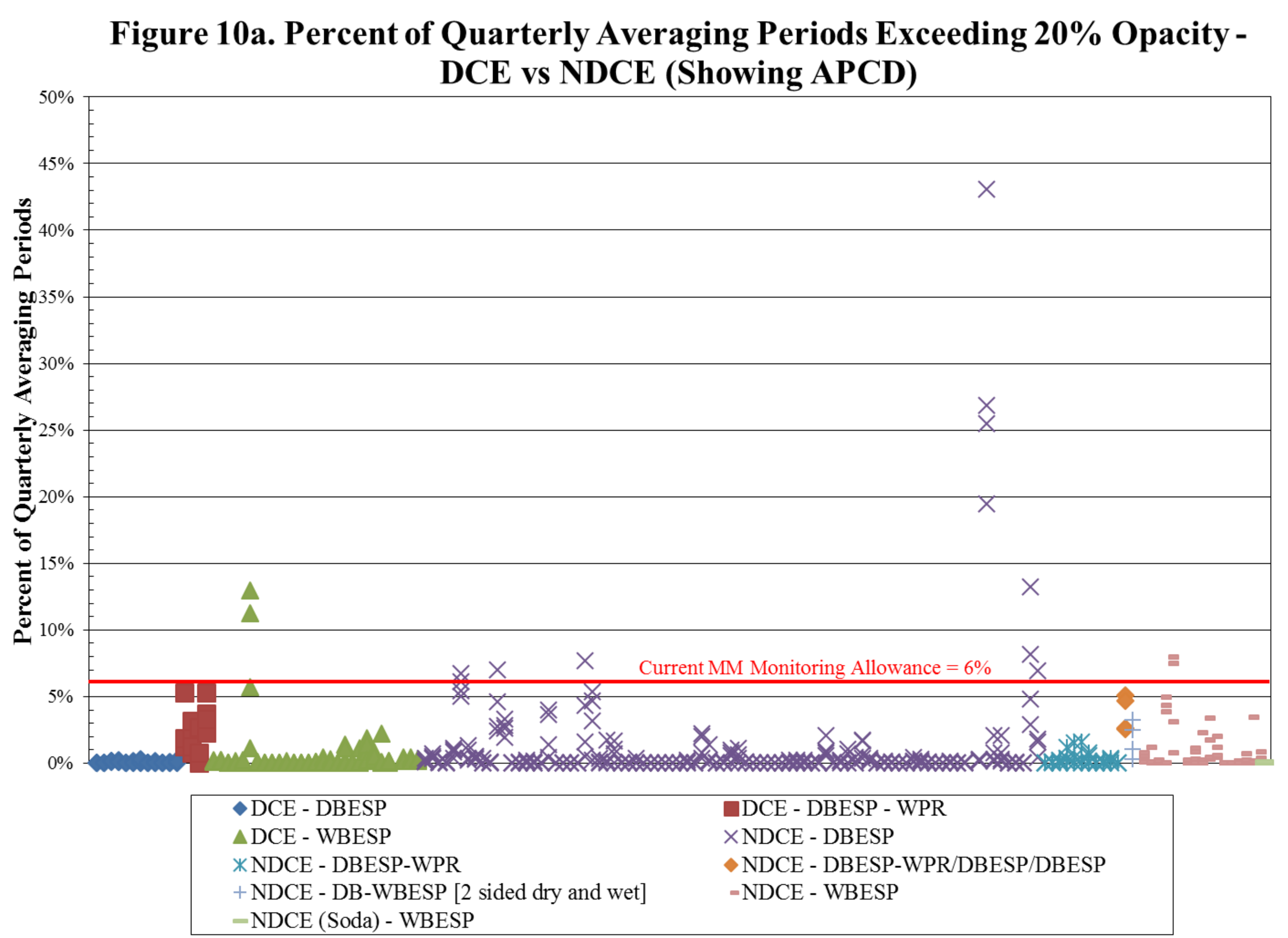


Figure 10a. Percent of Quarterly Averaging Periods Exceeding 20% Opacity - DCE vs NDCE (Showing APCD)
Percent of Quarterly Averaging Periods
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
Current MM Monitoring Allowance = 6%
DCE - DBESP
DCE - DBESP - WPR
DCE - WBESP
NDCE - DBESP
NDCE - DBESP-WPR
NDCE - DBESP-WPR/DBESP/DBESP
NDCE - DB-WBESP [2 sided dry and wet]
NDCE - WBESP
NDCE (Soda) - WBESP

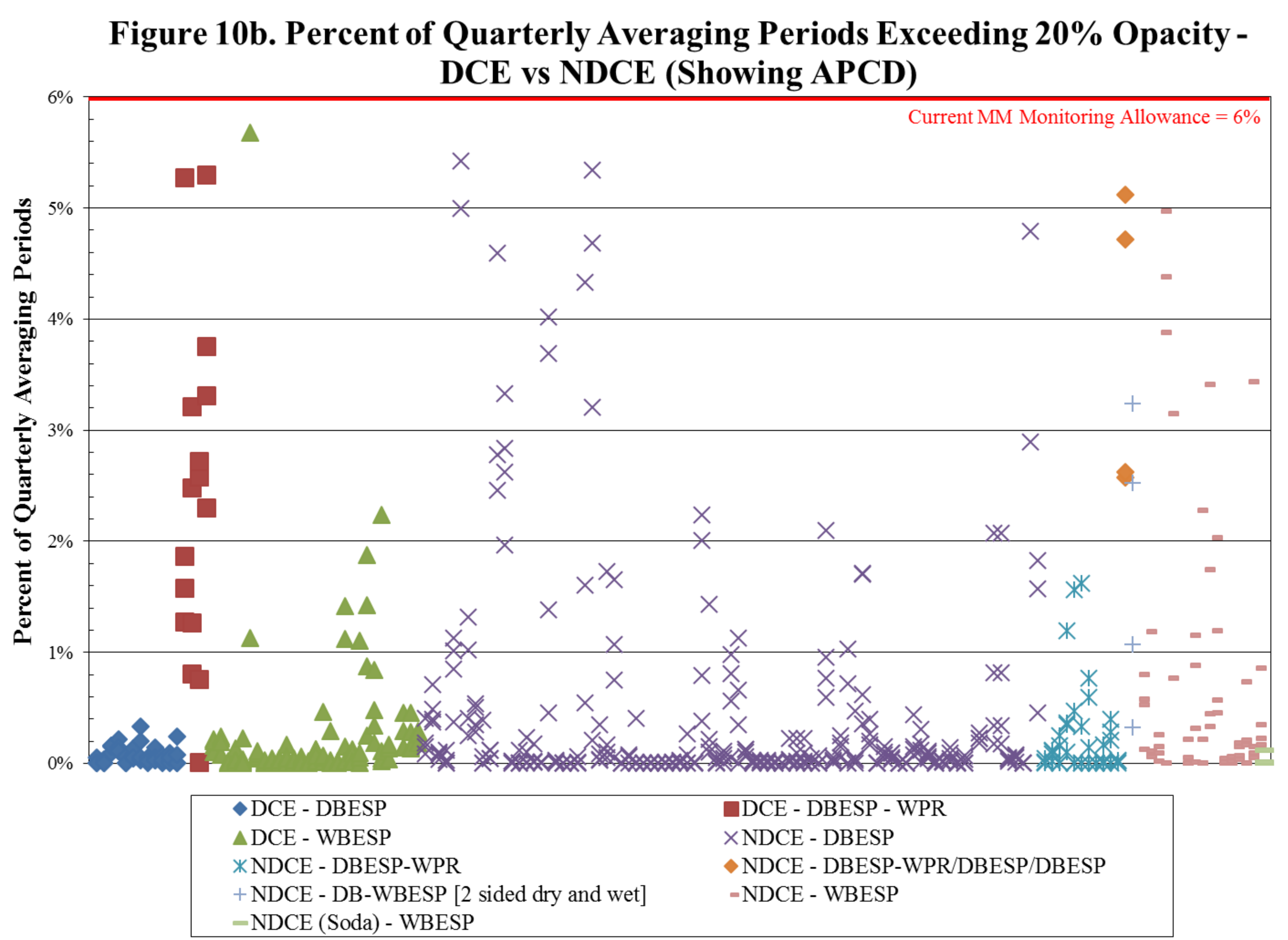


Figure 10b. Percent of Quarterly Averaging Periods Exceeding 20% Opacity - DCE vs NDCE (Showing APCD)
Current MM Monitoring Allowance = 6%
Percent of Quarterly Averaging Periods
6%
5%
4%
3%
2%
1%
0%
DCE - DBESP
DCE - DBESP - WPR
DCE - WBESP
NDCE - DBESP
NDCE - DBESP-WPR
NDCE - DBESP-WPR/DBESP/DBESP
NDCE - DB-WBESP [2 sided dry and wet]
NDCE - WBESP
NDCE (Soda) - WBESP

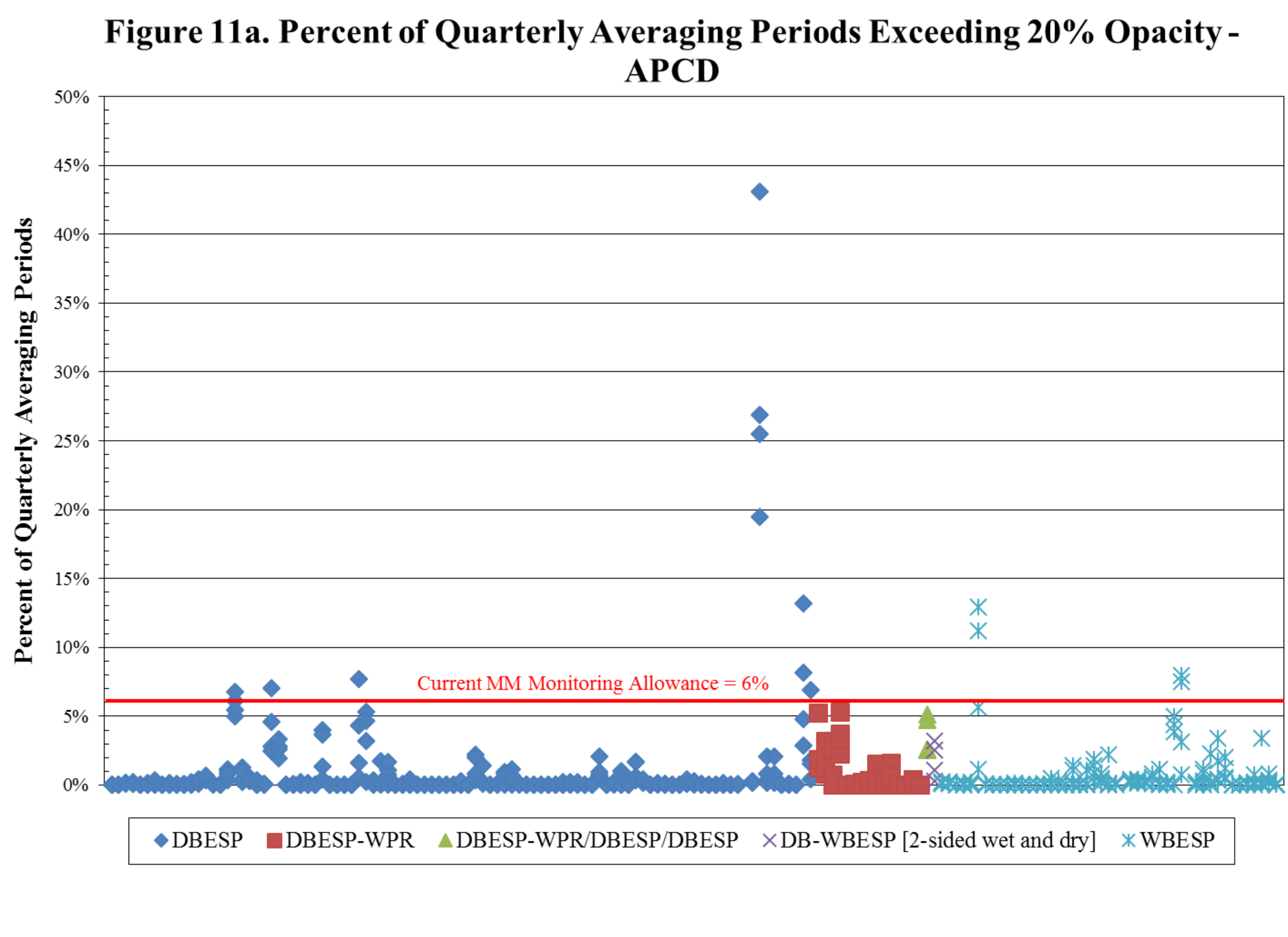
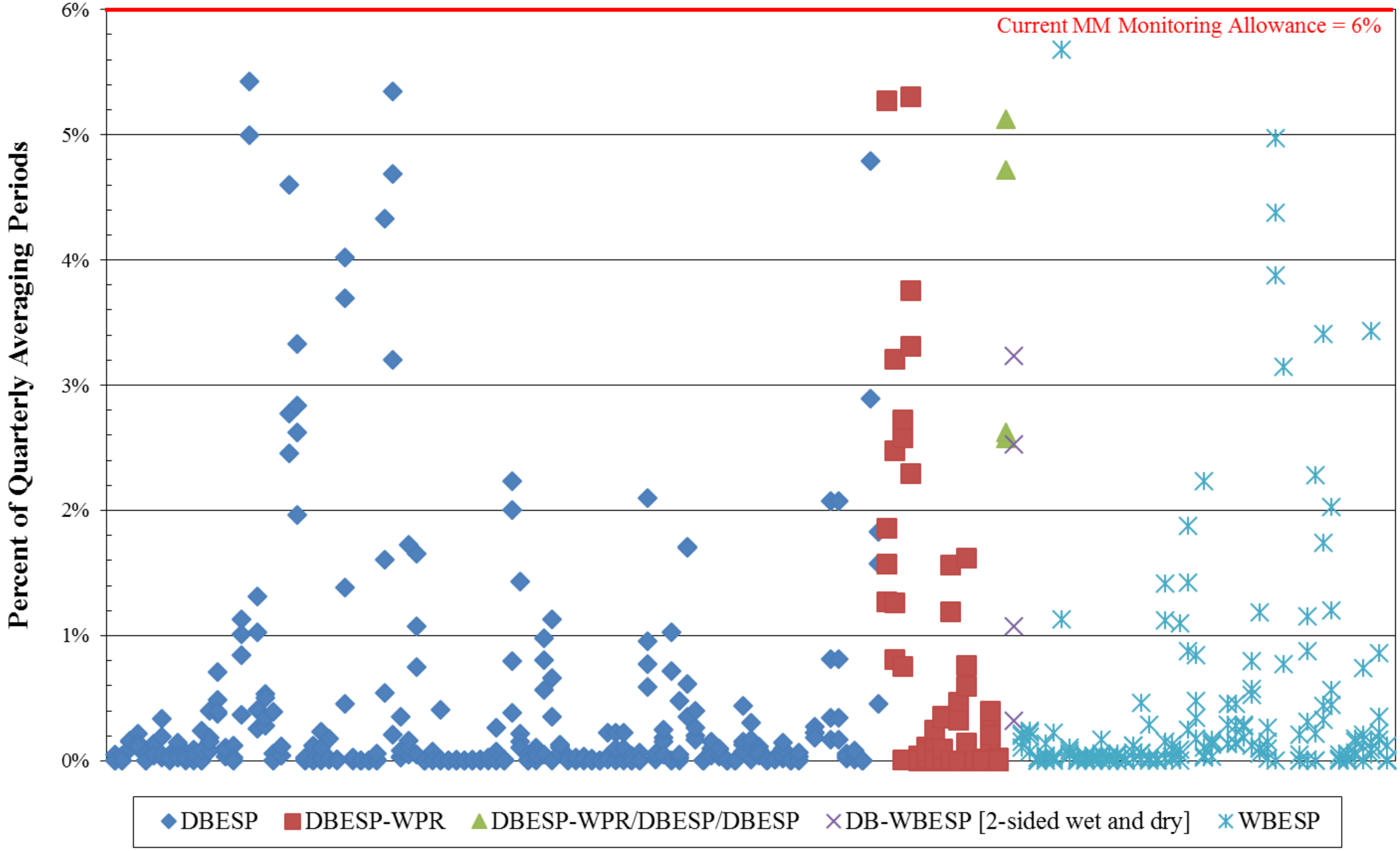


Figure 11a. Percent of Quarterly Averaging Periods Exceeding 20% Opacity - APCD
Percent of Quarterly Averaging Periods
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
Current MM Monitoring Allowance = 6%
DBESP
DBESP-WPR
DBESP-WPR/DBESP/DBESP
DB-WBESP [2-sided wet and dry]
WBESP

Figure 11b. Percent of Quarterly Averaging Periods Exceeding 20% Opacity - APCD



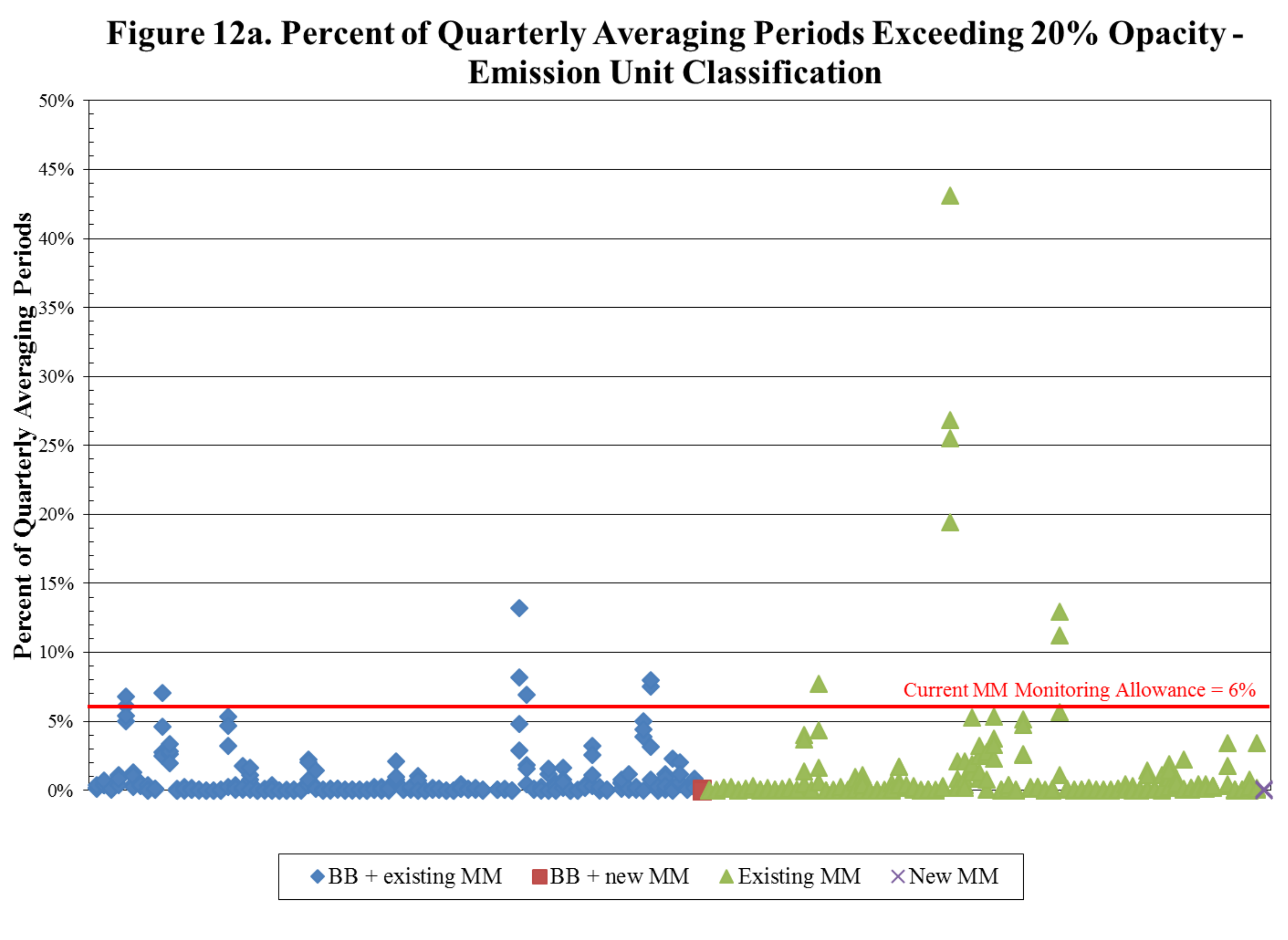
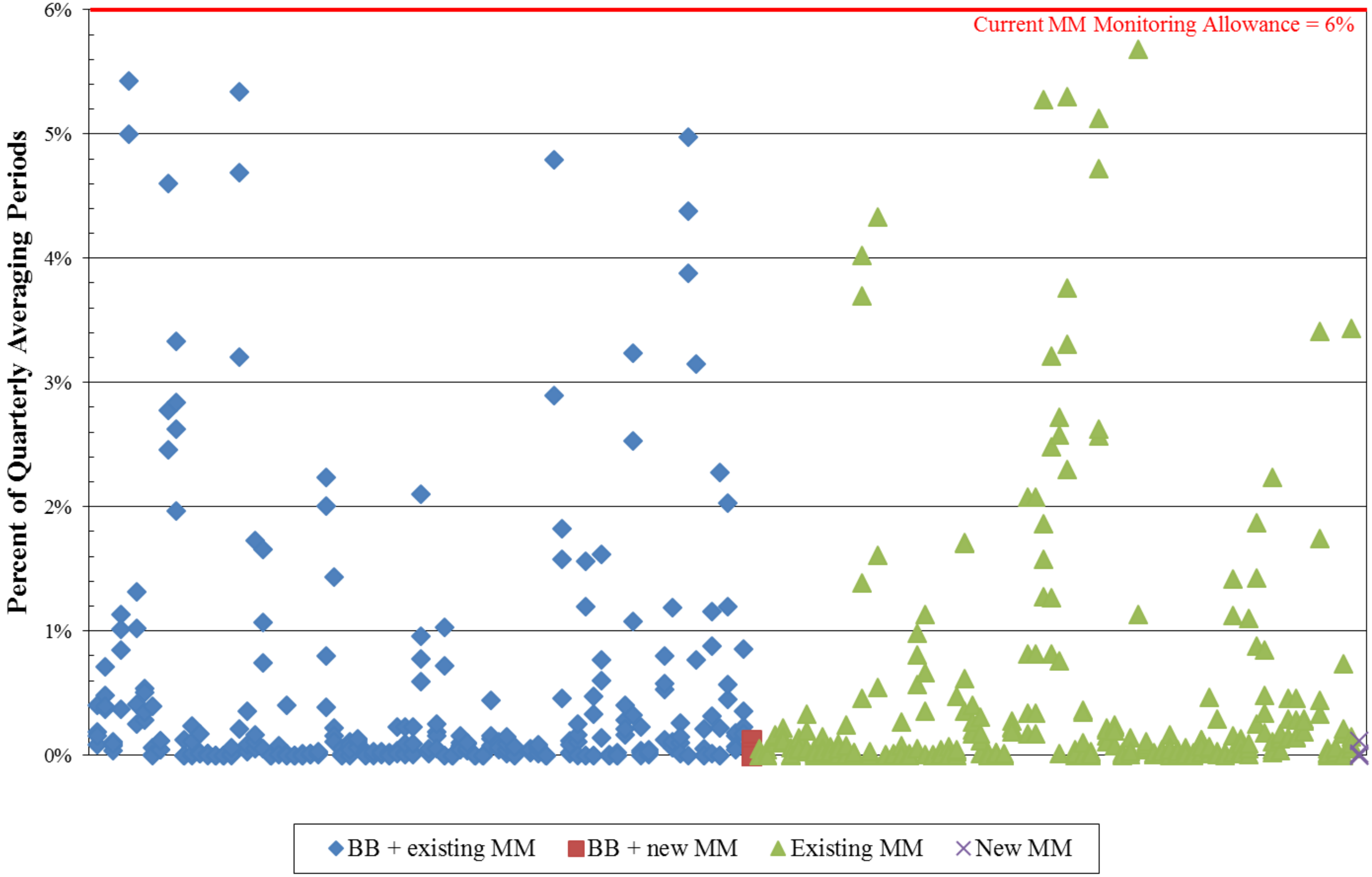


Figure 12a. Percent of Quarterly Averaging Periods Exceeding 20% Opacity - Emission Unit Classification
Percent of Quarterly Averaging Periods
50%
45%
40%
35%
30%
25%
20%
15%
10%
5%
0%
Current MM Monitoring Allowance = 6%
BB + existing MM
BB + new MM
Existing MM
New MM

Figure 12b. Percent of Quarterly Averaging Periods Exceeding 20% Opacity - Emission Unit Classification



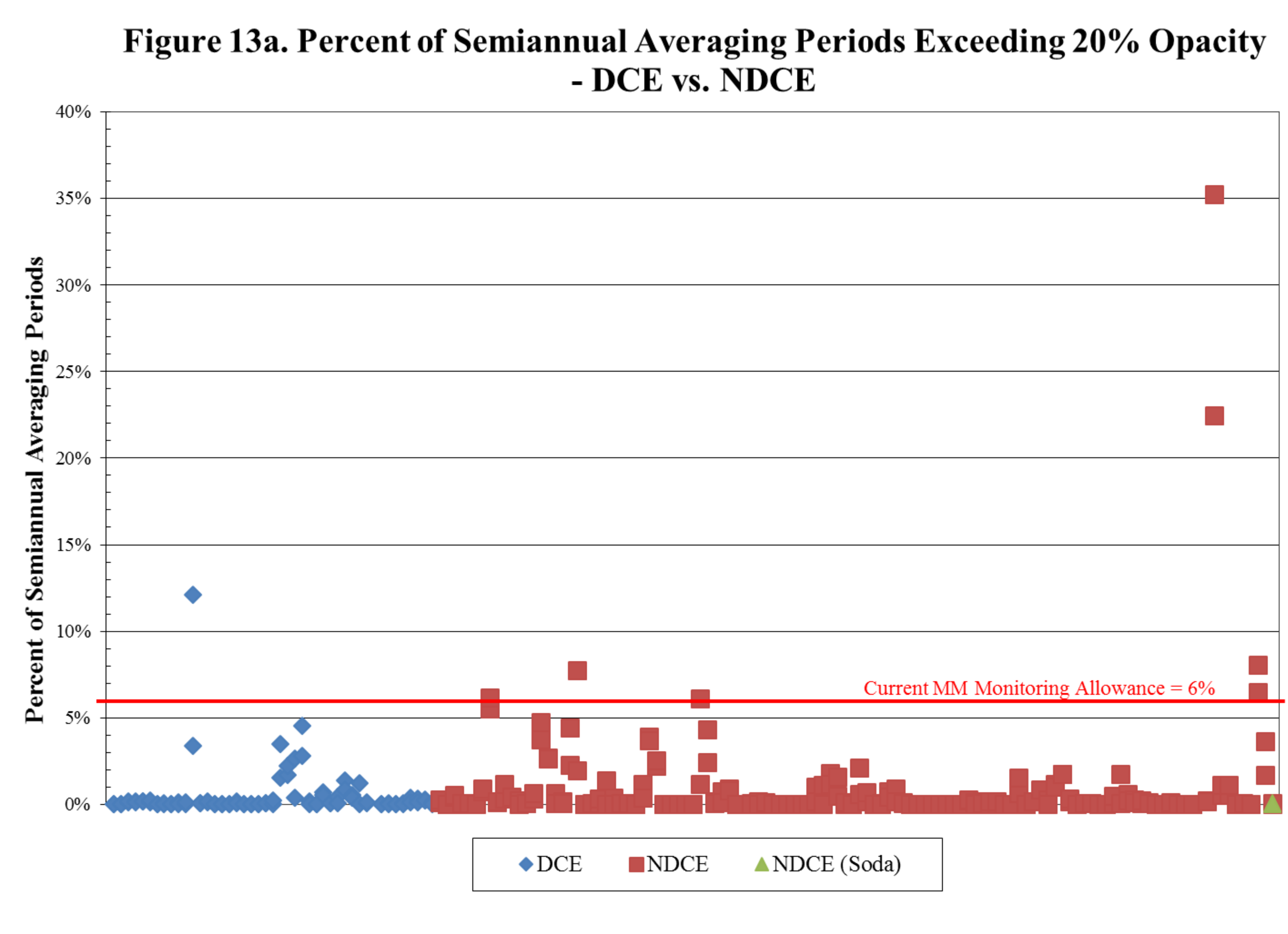


Figure 13a. Percent of Semiannual Averaging Periods Exceeding 20% Opacity - DCE vs. NDCE
Percent of Semiannual Averaging Periods
40%
35%
30%
25%
20%
15%
10%
5%
0%
Current MM Monitoring Allowance = 6%
DCE
NDCE
NDCE (Soda)

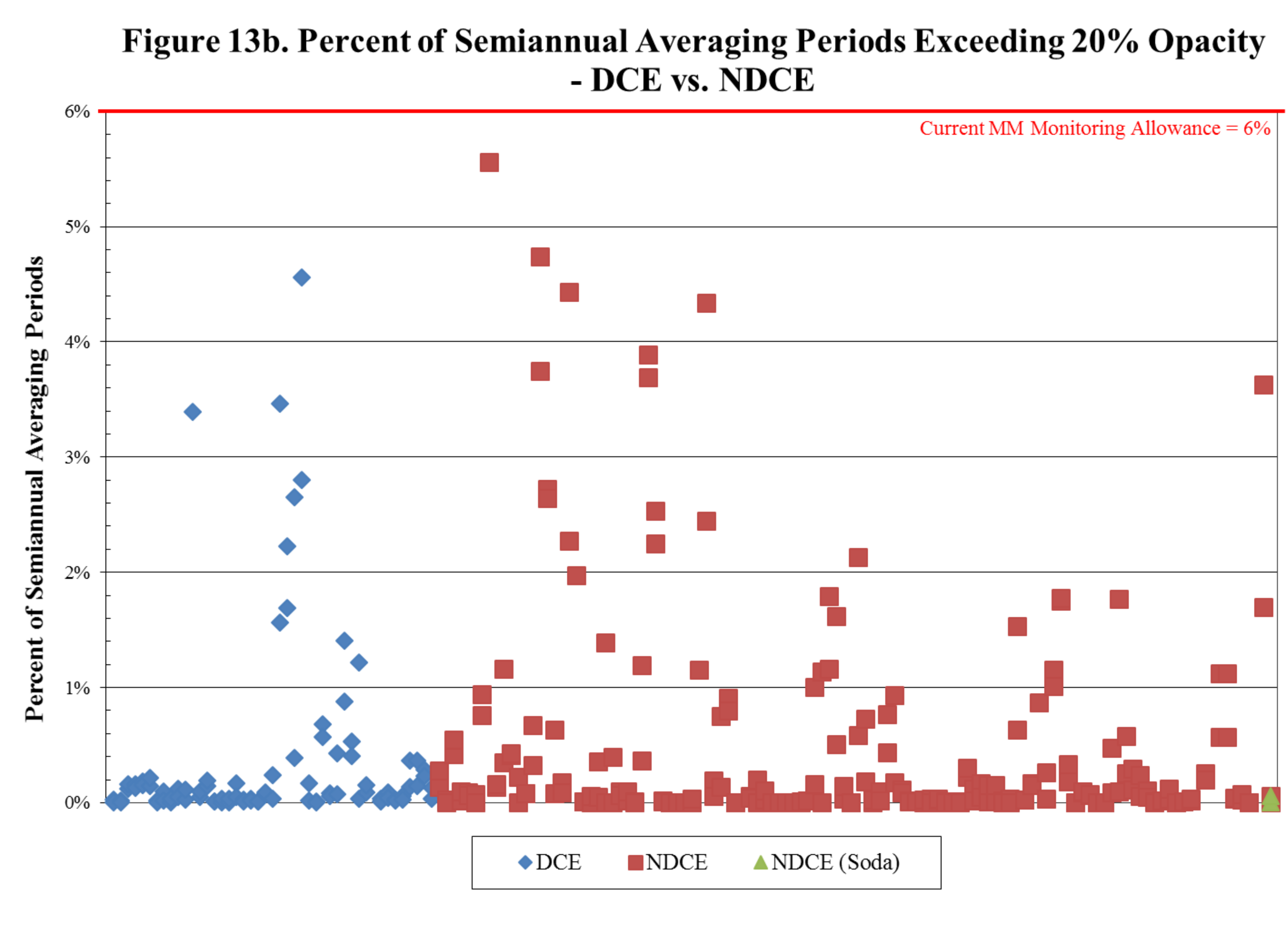


Figure 13b. Percent of Semiannual Averaging Periods Exceeding 20% Opacity - DCE vs. NDCE
Current MM Monitoring Allowance = 6%
Percent of Semiannual Averaging Periods
6%
5%
4%
3%
2%
1%
0%
DCE
NDCE
NDCE (Soda)

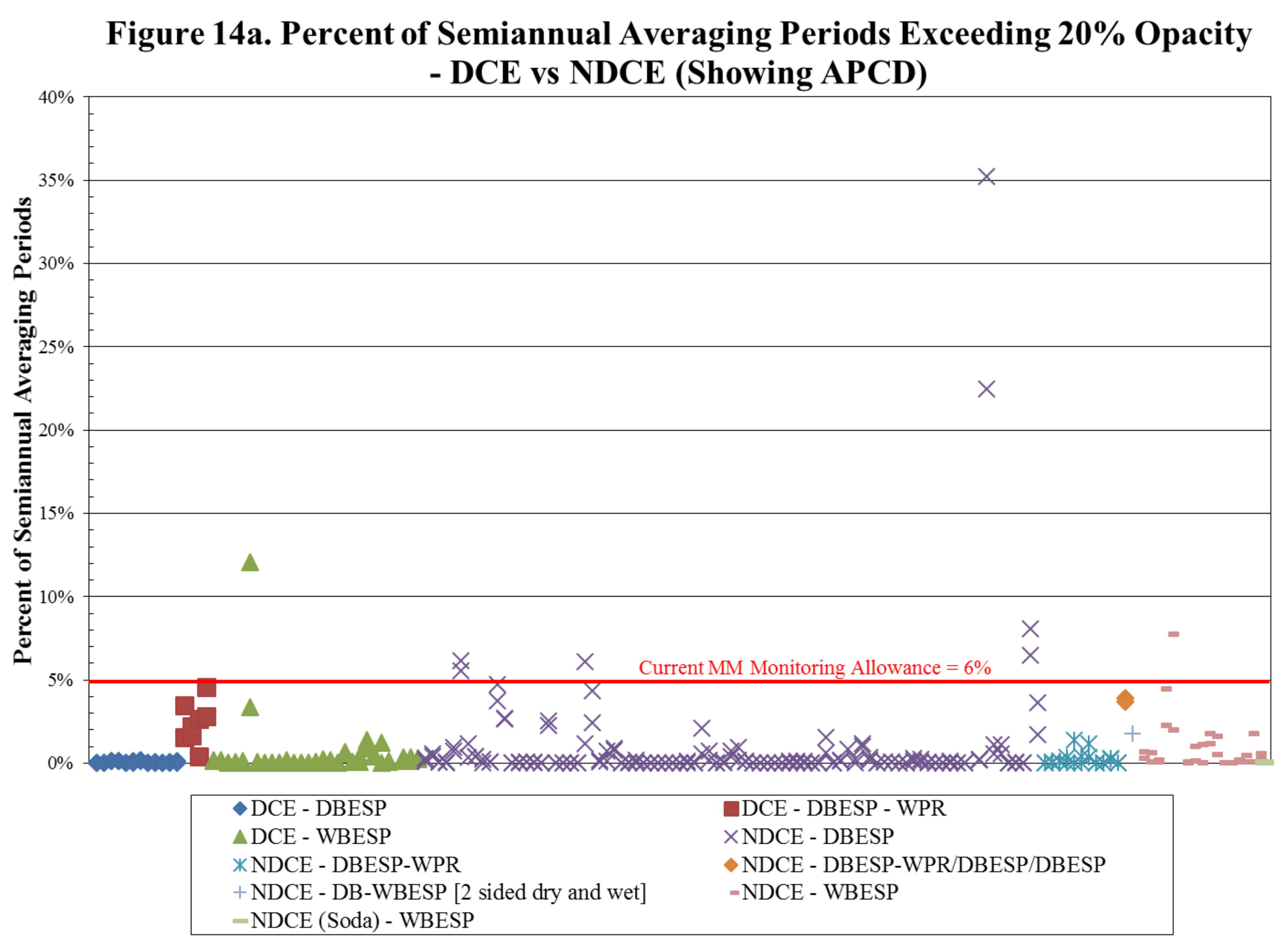


Figure 14a. Percent of Semiannual Averaging Periods Exceeding 20% Opacity - DCE vs NDCE (Showing APCD)
Percent of Semiannual Averaging Periods
40%
35%
30%
25%
20%
15%
10%
5%
0%
Current MM Monitoring Allowance = 6%
DCE - DBESP
DCE - DBESP - WPR
DCE - WBESP
NDCE - DBESP
NDCE - DBESP-WPR
NDCE - DBESP-WPR/DBESP/DBESP
NDCE - DB-WBESP [2 sided dry and wet]
NDCE - WBESP
NDCE (Soda) - WBESP

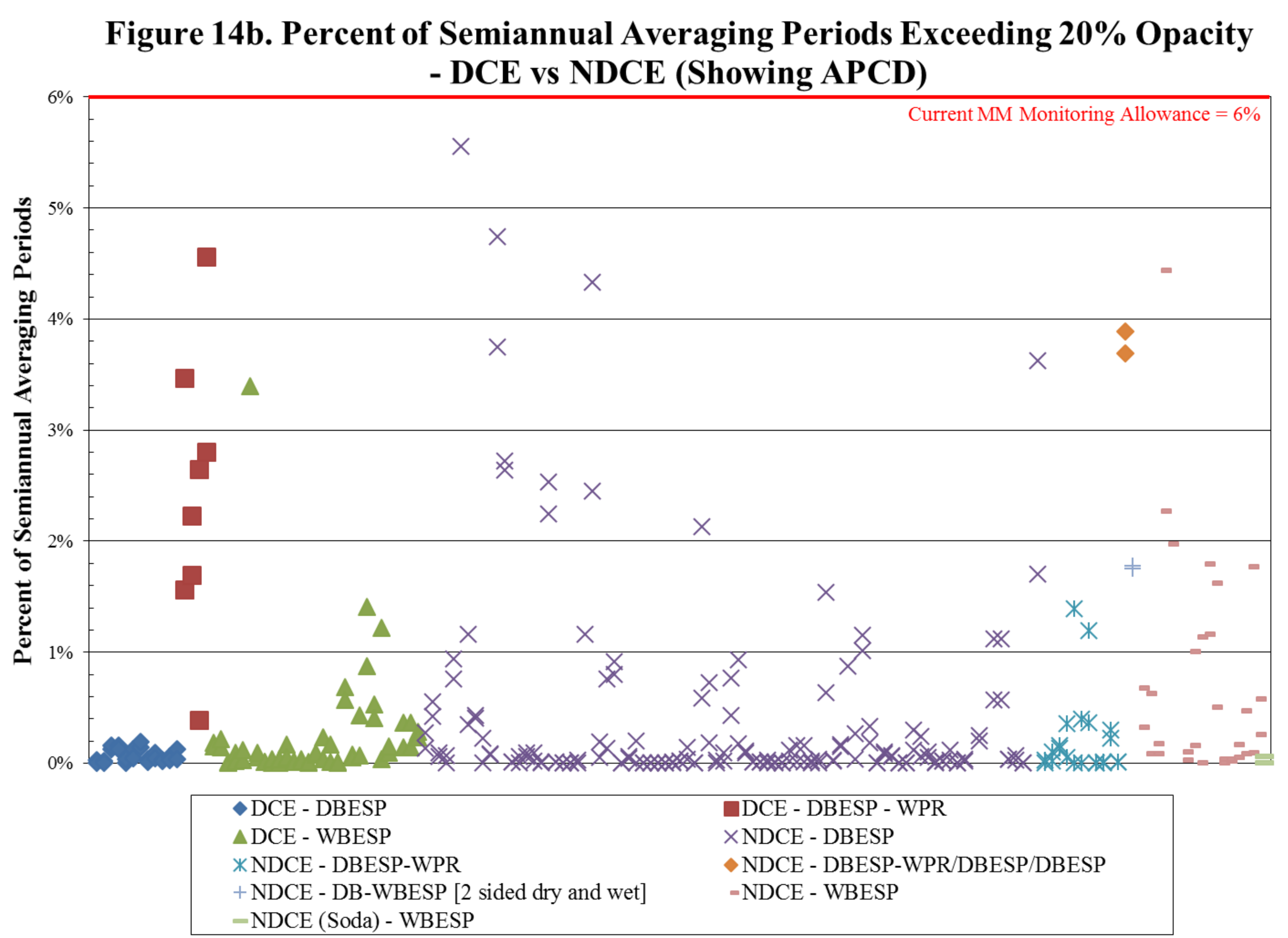


Figure 14b. Percent of Semiannual Averaging Periods Exceeding 20% Opacity - DCE vs NDCE (Showing APCD)
Percent of Semiannual Averaging Periods
6%
5%
4%
3%
2%
1%
0%
Current MM Monitoring Allowance = 6%
DCE - DBESP
DCE - DBESP - WPR
DCE - WBESP
NDCE - DBESP
NDCE - DBESP-WPR
NDCE - DBESP-WPR/DBESP/DBESP
NDCE - DB-WBESP [2 sided dry and wet]
NDCE - WBESP
NDCE (Soda) - WBESP

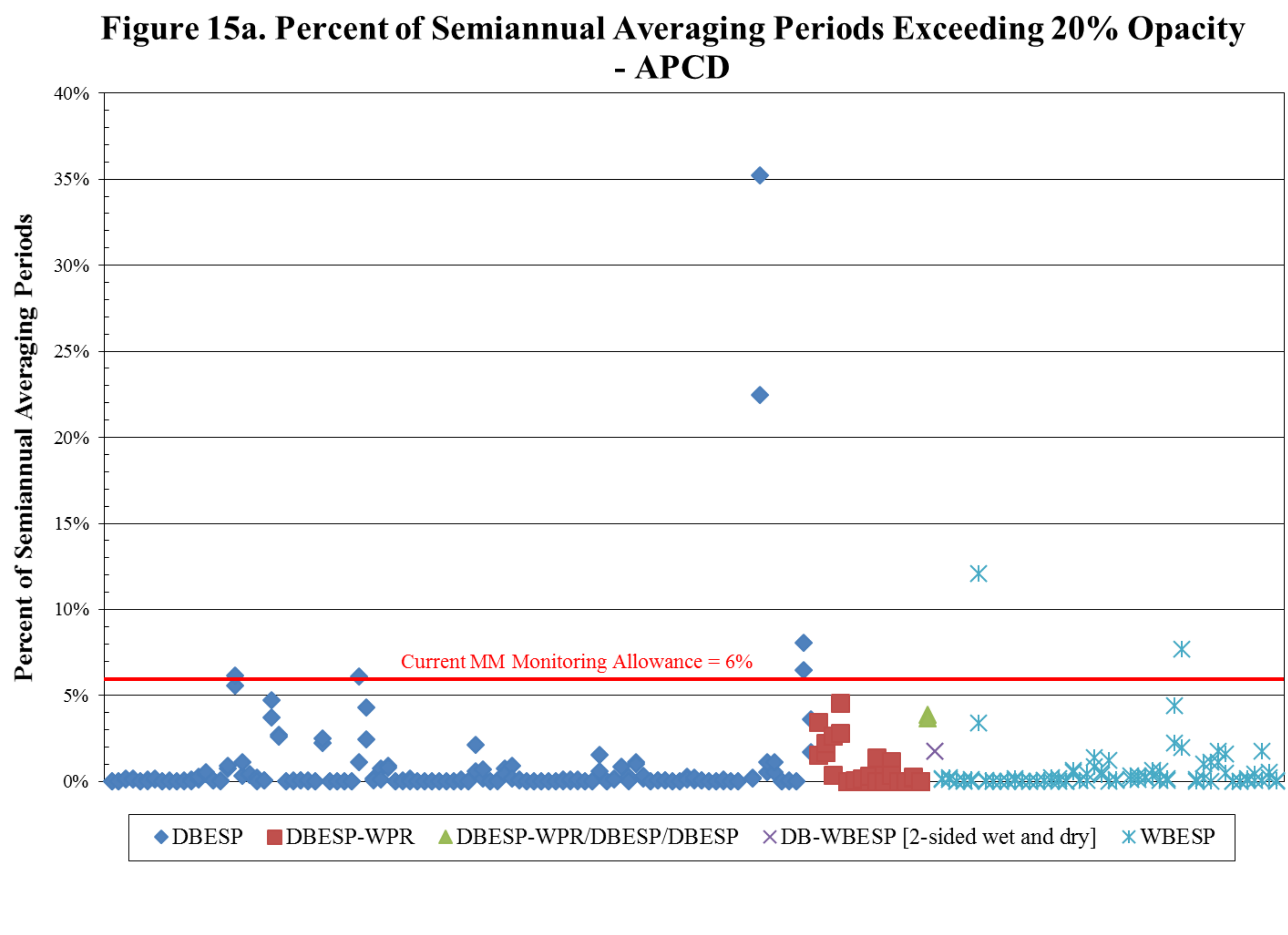


Figure 15a. Percent of Semiannual Averaging Periods Exceeding 20% Opacity - APCD
Percent of Semiannual Averaging Periods
40%
35%
30%
25%
20%
15%
10%
5%
0%
Current MM Monitoring Allowance = 6%
DBESP
DBESP-WPR
DBESP-WPR/DBESP/DBESP
DB-WBESP [2-sided wet and dry]
WBESP

Figure 15b. Percent of Semiannual Averaging Periods Exceeding 20% Opacity - APCD

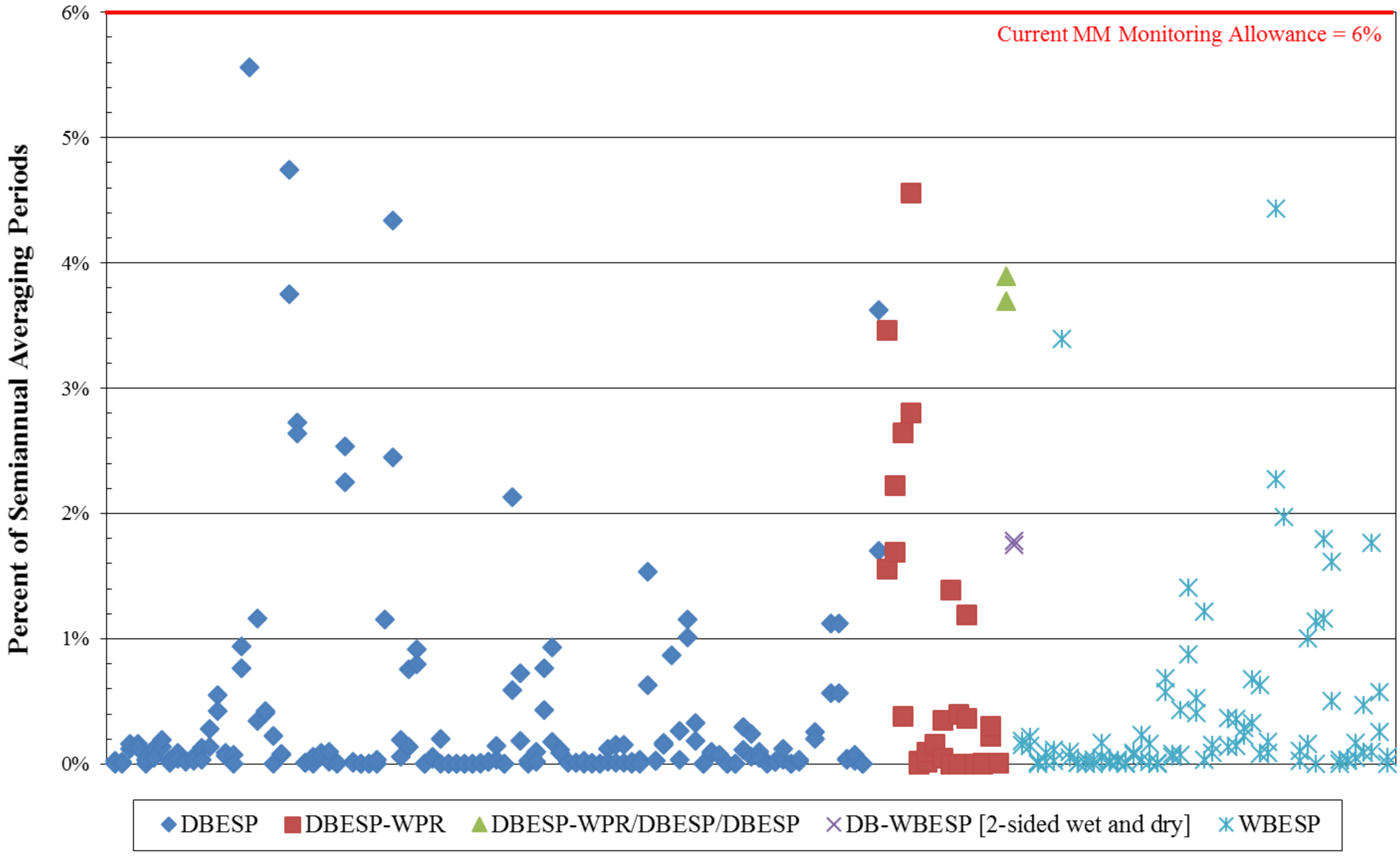


Figure 16a. Percent of Semiannual Averaging Periods Exceeding 20% Opacity - Emission Unit Classification

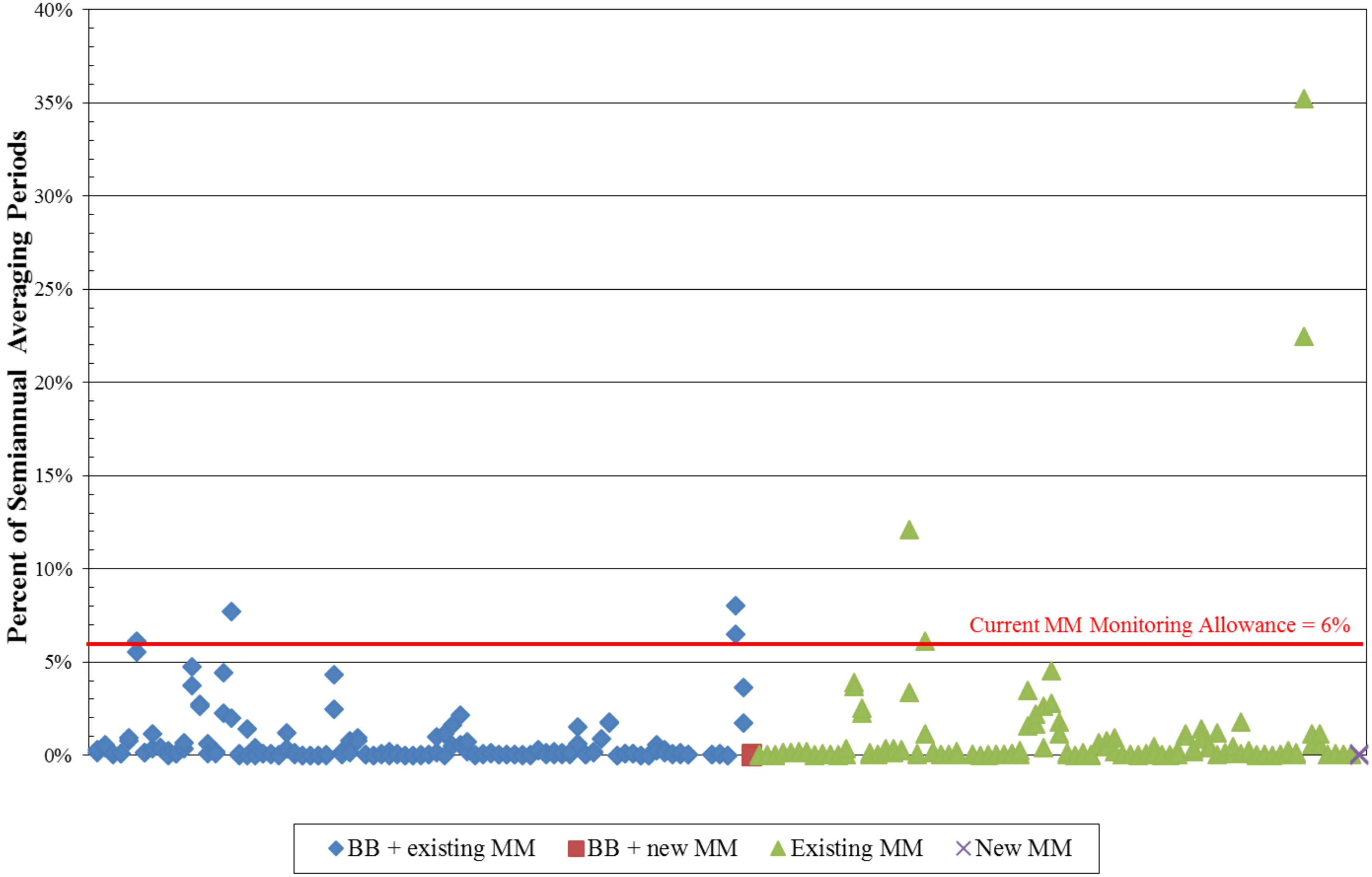
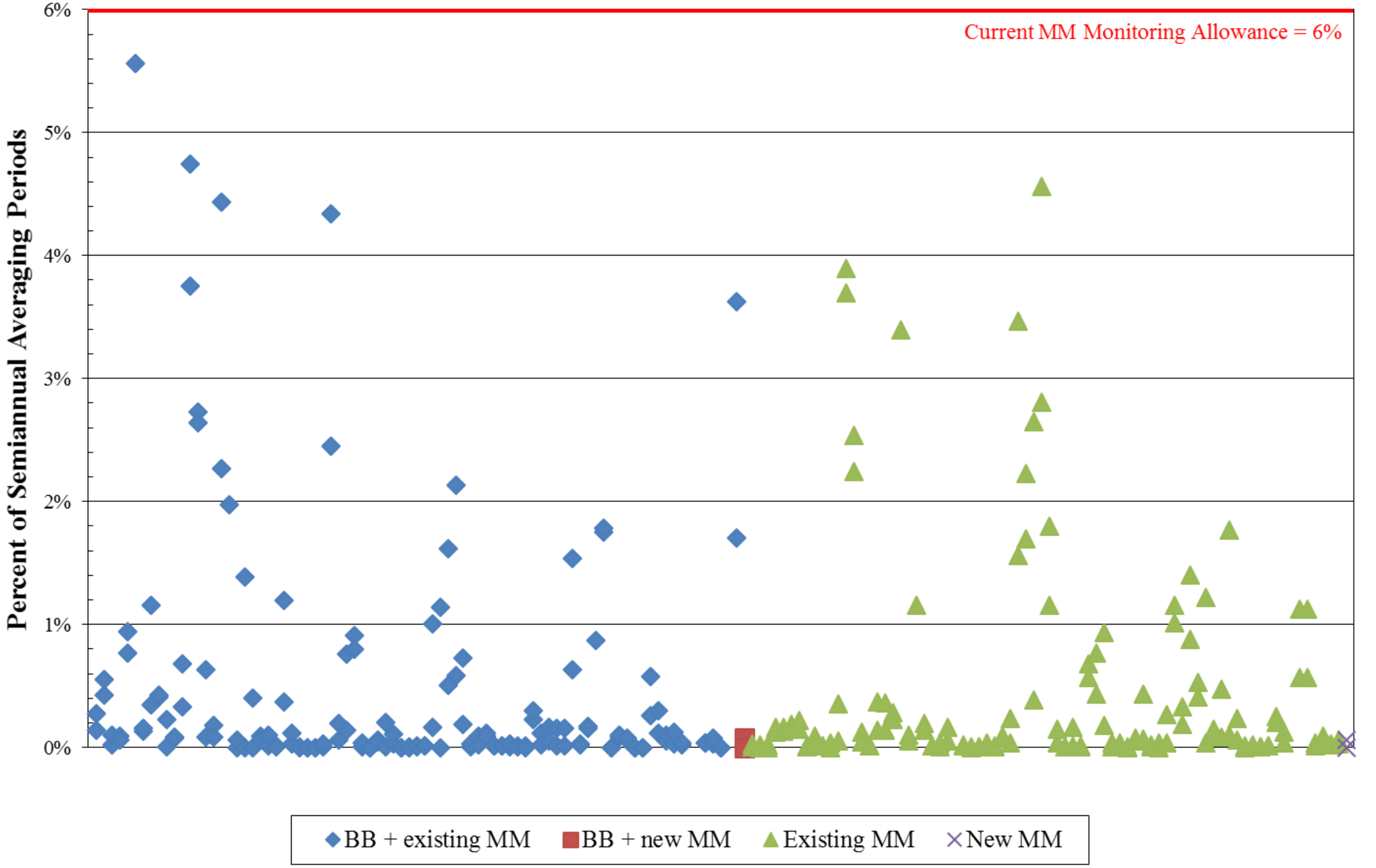


Figure 16b. Percent of Semiannual Averaging Periods Exceeding 20% Opacity - Emission Unit Classification



APPENDIX D: Lime Kiln Opacity Data

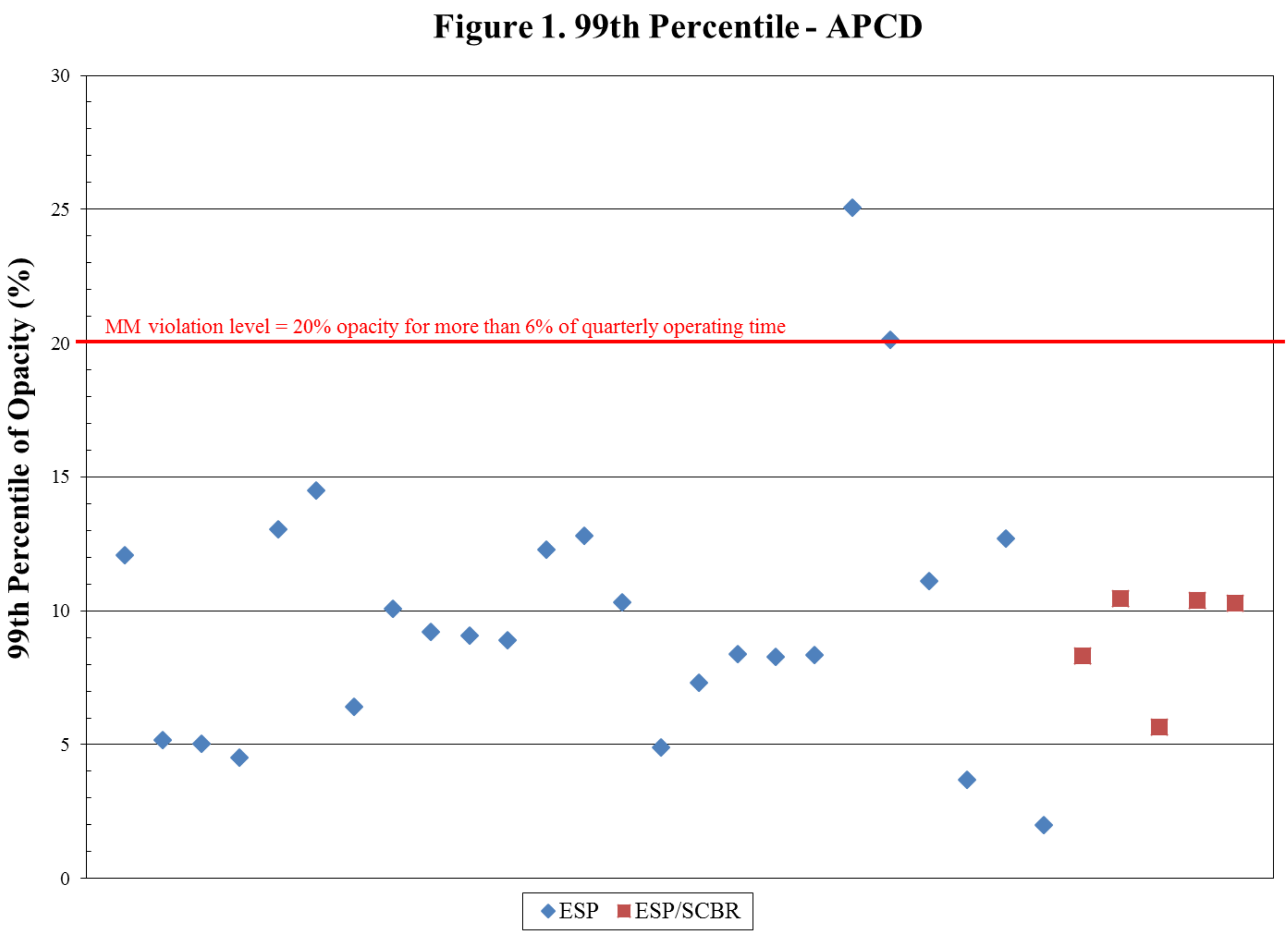


Figure 1. 99th Percentile - APCD
99th Percentile of Opacity (%)
30
25
20
15
10
5
0
MM violation level = 20% opacity for more than 6% of quarterly operating time
ESP
ESP/SCBR

Figure 2. Percent of Quarterly Averaging Periods Exceeding 20% Opacity

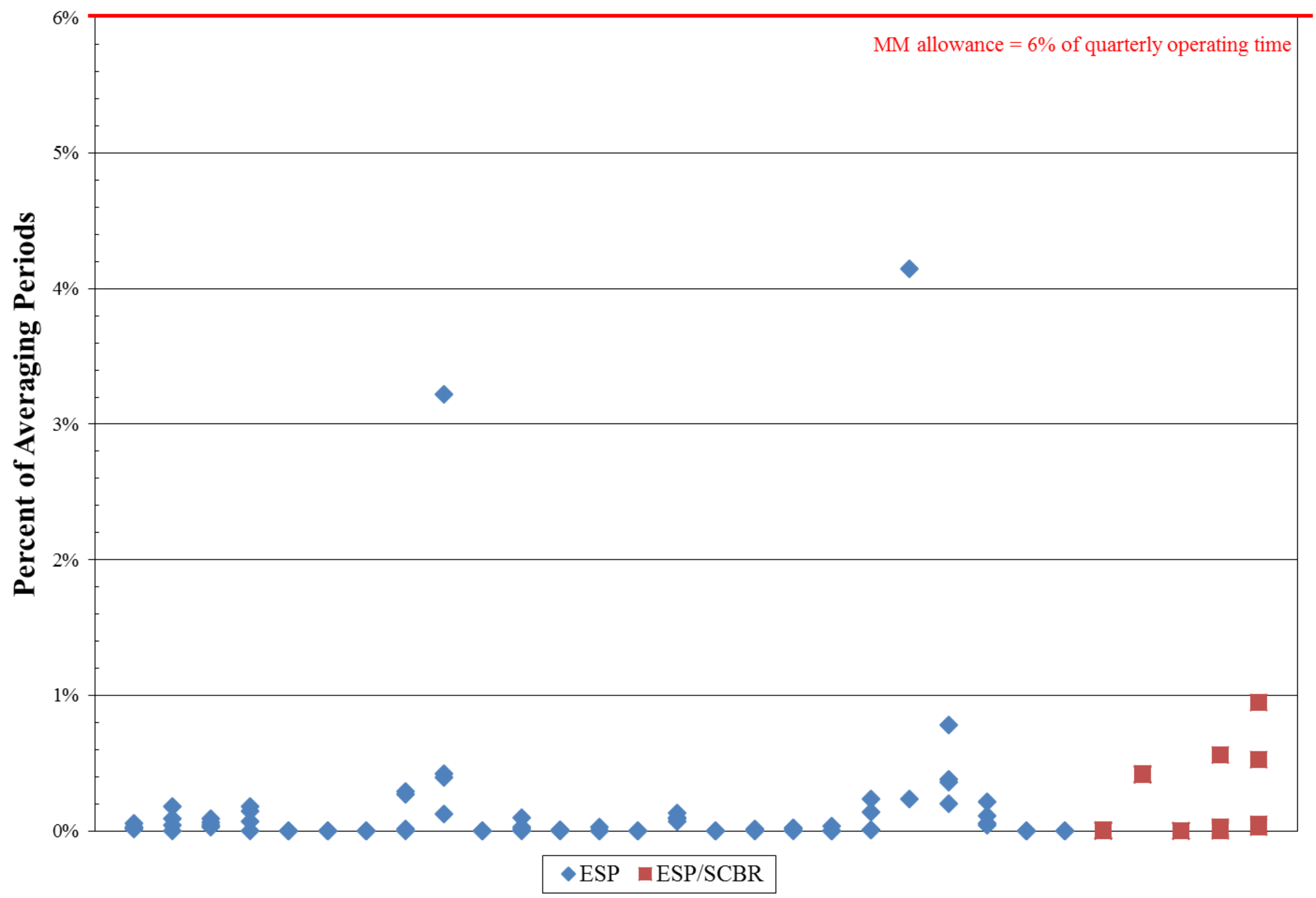


Figure 3. Percent of Quarterly Averaging Periods Exceeding 20% Opacity - Emission Unit Classification

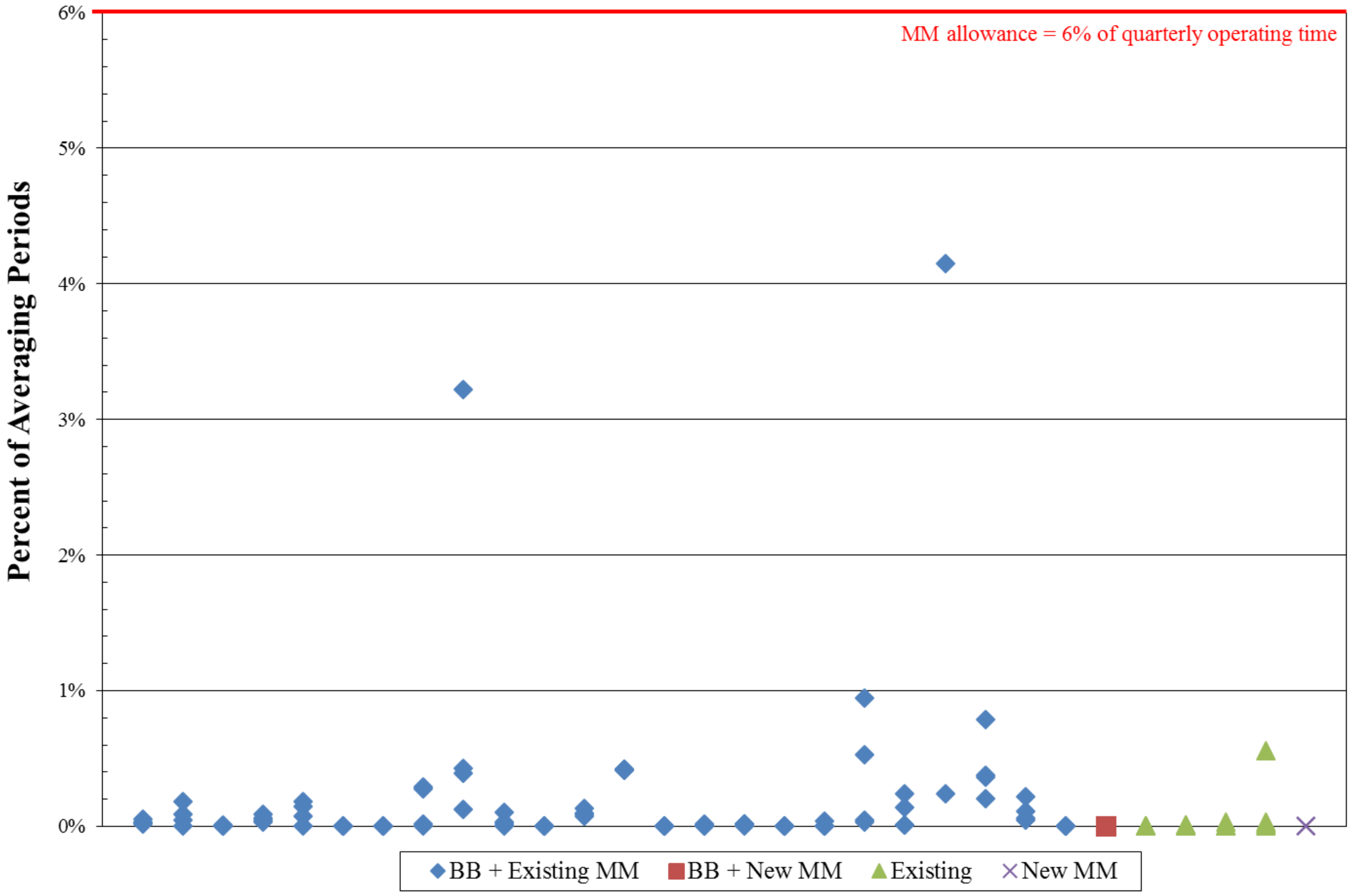


Figure 4. Percent of Semiannual Averaging Periods Exceeding 20% Opacity

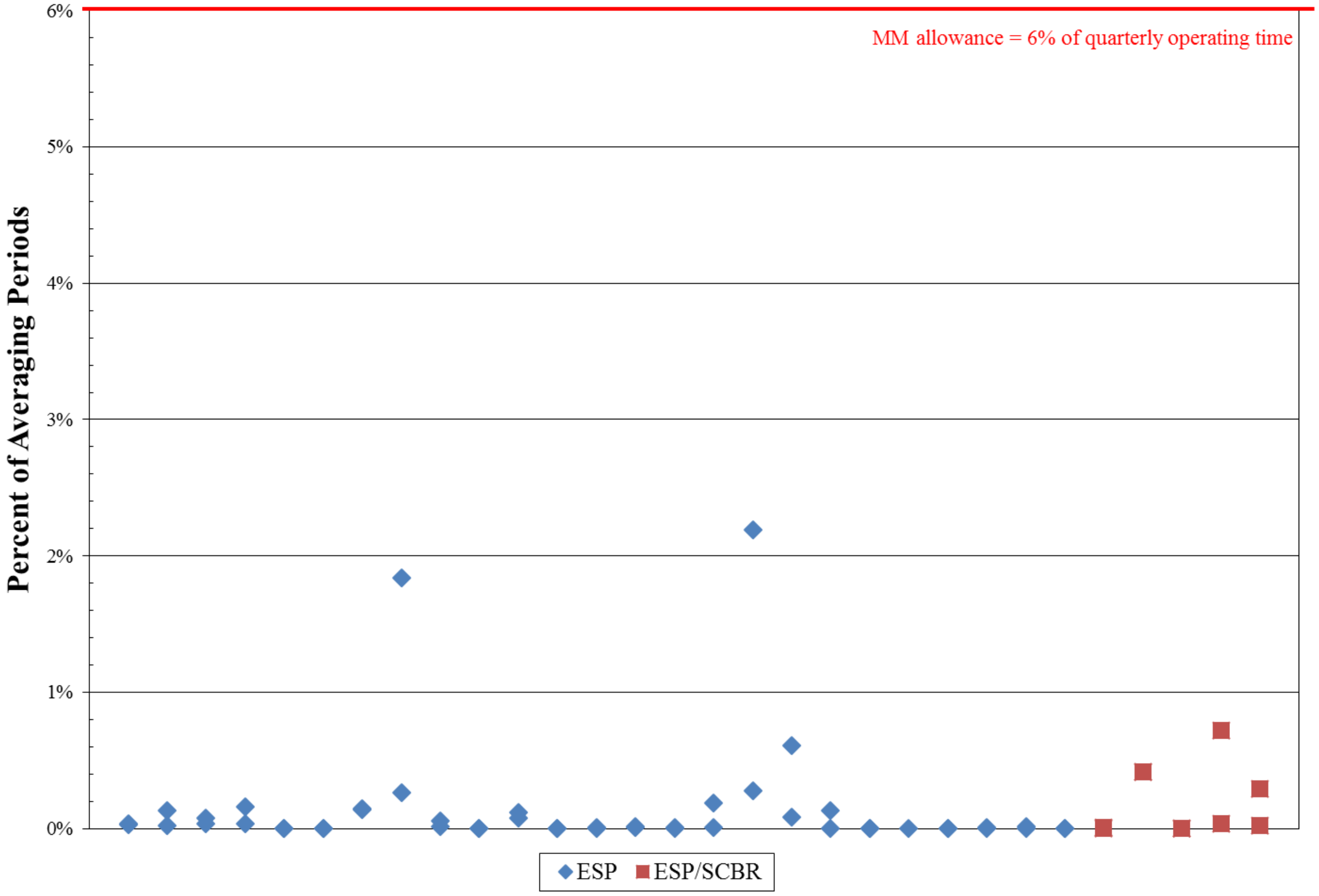
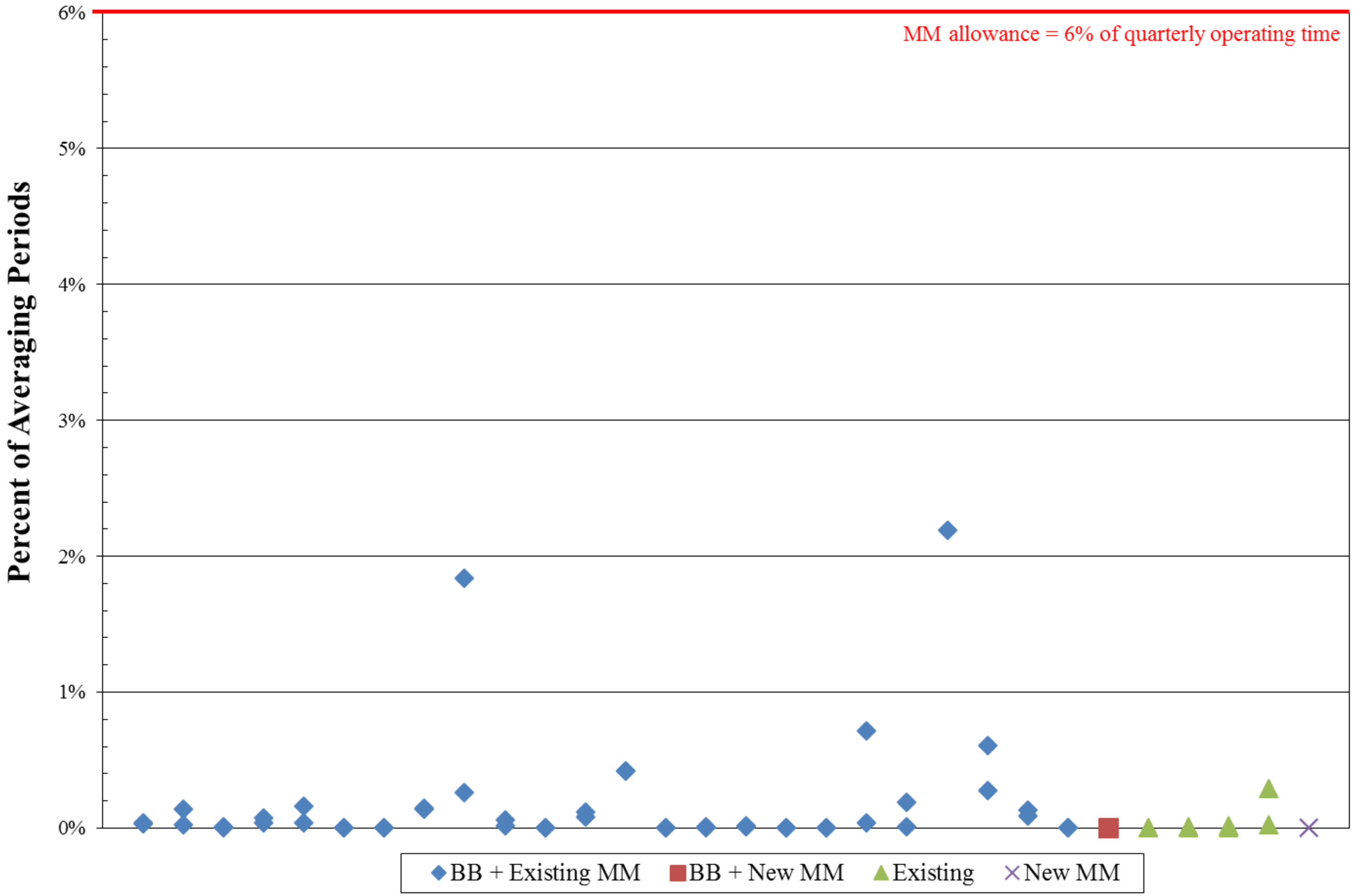


Figure 5. Percent of Semiannual Averaging Periods Exceeding 20% Opacity - Emission Unit Classification



APPENDIX E: Emission Units to be Included in Impacts Analysis

Recovery Furnaces Potentially Impacted by Opacity Monitoring Limit Options

Option 1: No change. 35% opacity, 20% corrective action level (CAL), 6% monitoring allowance (MA), quarterly reporting

- No emission units affected because this option represents the baseline (though it is noted that one emission unit did not meet the baseline).

Option 2: 35% opacity, 20% CAL, 2% MA, semiannual reporting (1 unit affected)

RTI Code + Emission Unit ID	Stack Configuration Notes	Emission Process Group	APCD	Percent exceeds 35% semiannual period 1	Percent exceeds 35% semiannual period 2	PM performance level less than 0.015 gr/dscf?[1]	Expected impact on ESP
145.55		DCE	WBESP	2.0%	9.6%	Yes	maintenance

1. PM performance of less than 0.015 gr/dscf at 8% O_2 is associated with and upgraded lime kiln ESP. Units meeting this performance level are assumed to require ESP maintenance (as opposed to an ESP upgrade) to consistently meet an opacity level of 20%.

Option 3: 20% opacity, 6% MA, quarterly reporting (8 units affected)

RTI Code + Emission Unit ID	Stack Configuration Notes	Emission Process Group	APCD	Percent of Averaging Periods Exceeding 20%				PM performance level less than 0.015 gr/dscf?[1]	Expected impact on ESP
				Period 1	Period 2	Period 3	Period 4		
109.RB3		NDCE	DBESP	5.0%	6.1%	6.8%	5.4%	Yes	upgrade
119.EQT010		NDCE	DBESP	2.8%	4.6%	2.5%	7.0%	Yes	upgrade
127.REC1	2 stacks with separate COMS	NDCE	WBESP	3.9%	5.0%	4.4%	0.0%	Yes	maintenance
127.REC1	2 stacks with separate COMS	NDCE	WBESP	0.8%	3.1%	7.5%	8.0%	Yes	maintenance
145.55		DCE	WBESP	5.7%	1.1%	12.9%	11.2%	Yes	maintenance
148.001		NDCE	DBESP	4.3%	7.7%	1.6%	0.5%	Yes	maintenance
606.RB4		NDCE	DBESP	25.5%	19.5%	26.9%	43.1%		upgrade
208228535.001		NDCE	DBESP	13.2%	2.9%	4.8%	8.2%	Yes	upgrade
208228535.007		NDCE	DBESP	0.5%	6.9%	1.8%	1.6%	Yes	maintenance

Option 4: 20% opacity, 2% MA, semiannual reporting (16 units affected)

RTI Code + Emission Unit ID	Stack Configuration Notes	Emission Process Group	APCD	Percent exceeds 20% semiannual period 1	Percent exceeds 20% semiannual period 2	PM performance level less than 0.015 gr/dscf?[1]	Expected impact on ESP
109.RB3		NDCE	DBESP	5.6%	6.1%		upgrade
119.EQT010		NDCE	DBESP	3.7%	4.7%		upgrade
120.F7		NDCE	DBESP	2.7%	2.6%	Yes	maintenance
127.REC1	2 stacks with separate COMS	NDCE	WBESP	4.4%	2.3%	Yes	maintenance
127.REC1	2 stacks with separate COMS	NDCE	WBESP	2.0%	7.7%	Yes	maintenance
139.02		NDCE	DBESP-WPR/DBESP/DBESP	3.9%	3.7%		upgrade
140.55		NDCE	DBESP	2.2%	2.5%	Yes	maintenance
145.55		DCE	WBESP	3.4%	12.1%	Yes	maintenance
148.001		NDCE	DBESP	6.1%	1.2%	Yes	maintenance
148.007		NDCE	DBESP	4.3%	2.4%	Yes	maintenance
171.002		DCE	DBESP-WPR	3.5%	1.6%		upgrade
171.003		DCE	DBESP-WPR	1.7%	2.2%		upgrade
171.004	2 stacks with separate COMS	DCE	DBESP-WPR	2.6%	0.4%		upgrade
171.004	2 stacks with separate COMS	DCE	DBESP-WPR	4.6%	2.8%		upgrade
174.G-32		NDCE	DBESP	2.1%	0.6%	Yes	maintenance
606.RB4		NDCE	DBESP	22.5%	35.2%		upgrade
208228535.001		NDCE	DBESP	8.0%	6.5%		upgrade
208228535.007		NDCE	DBESP	3.6%	1.7%	Yes	maintenance

Option 5: 20% opacity, 2% MA, quarterly reporting (25 units affected)

RTI Code + Emission Unit ID	Stack Configuration Notes	Emission Process Group	APCD	Percent of Averaging Periods Exceeding 20%				PM performance level less than 0.015 gr/dscf?[1]	Expected impact on ESP
				Period 1	Period 2	Period 3	Period 4		
109.RB3		NDCE	DBESP	5.0%	6.1%	6.8%	5.4%		upgrade
119.EQT010		NDCE	DBESP	2.8%	4.6%	2.5%	7.0%		upgrade
120.F7		NDCE	DBESP	2.6%	2.8%	2.0%	3.3%	Yes	maintenance
127.REC1	2 stacks with separate COMS	NDCE	WBESP	3.9%	5.0%	4.4%	0.0%	Yes	maintenance
127.REC1	2 stacks with separate COMS	NDCE	WBESP	0.8%	3.1%	7.5%	8.0%	Yes	maintenance
139.02		NDCE	DBESP-WPR/DBESP/DBESP	2.6%	5.1%	4.7%	2.6%		upgrade
140.55		NDCE	DBESP	0.5%	4.0%	1.4%	3.7%	Yes	maintenance
145.55		DCE	WBESP	5.7%	1.1%	12.9%	11.2%	Yes	maintenance
148.001		NDCE	DBESP	4.3%	7.7%	1.6%	0.5%	Yes	maintenance
148.007		NDCE	DBESP	3.2%	5.3%	4.7%	0.2%	Yes	maintenance
169.05		NDCE	WBESP	2.3%	0.2%	0.0%	0.0%		maintenance
171.002		DCE	DBESP-WPR	5.3%	1.6%	1.3%	1.9%		upgrade
171.003		DCE	DBESP-WPR	2.5%	0.8%	3.2%	1.3%		upgrade
171.004	2 stacks with separate COMS	DCE	DBESP-WPR	2.6%	2.7%	0.0%	0.8%		upgrade
171.004	2 stacks with separate COMS	DCE	DBESP-WPR	5.3%	3.8%	2.3%	3.3%		upgrade
172.RB01		NDCE	WBESP	0.3%	3.4%	1.7%	0.4%		upgrade
172.RB02		NDCE	WBESP	0.5%	0.6%	2.0%	1.2%		upgrade
174.G-32		NDCE	DBESP	2.2%	2.0%	0.4%	0.8%	Yes	maintenance
195.003		NDCE	DBESP	0.6%	0.8%	2.1%	1.0%		upgrade
200.007RF3	2 stacks with separate COMS	NDCE	DB-WBESP [2-sided	3.2%	0.3%	1.1%	2.5%		upgrade

RTI Code + Emission Unit ID	Stack Configuration Notes	Emission Process Group	APCD	Percent of Averaging Periods Exceeding 20%				PM performance level less than 0.015 gr/dscf?[1]	Expected impact on ESP
				Period 1	Period 2	Period 3	Period 4		
			dry and wet]						
206.G-32		DCE	WBESP	0.0%	0.0%	0.1%	2.2%		maintenance
226.RECB1	2 stacks with separate COMS	NDCE	WBESP	0.1%	0.1%	0.1%	3.4%		maintenance
606.RB4		NDCE	DBESP	25.5%	19.5%	26.9%	43.1%		upgrade
610.4	Combined stack with single COMS for 610.4 and 610.5. Opacity is total for 2 RFs. [However, each RF as separate TRS CEMS.]	NDCE	DBESP	0.3%	0.8%	0.2%	2.1%		maintenance
610.5		NDCE	DBESP	0.3%	0.8%	0.2%	2.1%		upgrade
208228535.001		NDCE	DBESP	13.2%	2.9%	4.8%	8.2%		upgrade
208228535.007		NDCE	DBESP	0.5%	6.9%	1.8%	1.6%	Yes	maintenance

Lime Kilns Potentially Impacted by Opacity Monitoring Limit Options

Option 1: No change. 20% opacity, 6% MA, quarterly reporting:

- No emission units affected

Option 2: 20% opacity, 1% MA, semiannual reporting

RTI Code + Emission Unit ID	Stack Configuration Notes	APCD	Percent of Averaging Periods Exceeding 20%, period 1	Percent of Averaging Periods Exceeding 20%, period 2	PM performance level less than 0.01 gr/dscf?[1]	Expected impact on ESP
109.LK1		ESP	1.84%	0.27%	Yes	maintenance
200.007_10		ESP	2.19%		Yes	maintenance

1. PM performance of less than 0.01 gr/dscf at 10% O_2 is associated with and upgraded lime kiln ESP. Units meeting this performance level are assumed to require ESP maintenance (as opposed to an ESP upgrade) to consistently meet an opacity level of 20%.

Option 3: 20% opacity, 1% MA, quarterly reporting

RTI Code + Emission Unit ID	Stack Configuration Notes	APCD	Percent of Averaging Periods Exceeding 20%, period 1	Percent of Averaging Periods Exceeding 20%, period 2	Percent of Averaging Periods Exceeding 20%, period 3	Percent of Averaging Periods Exceeding 20%, period 4	PM performance level less than 0.01 gr/dscf?[1]	Expected impact on ESP
109.LK1		ESP	3.22%	0.39%	0.13%	0.43%	Yes	maintenance
200.007_10		ESP	4.15%	0.24%			Yes	maintenance