State of Ohio Environmental Protection Agency
Division of Air Pollution Control

Ohio's Lead Attainment Demonstration Analysis for Cuyahoga County Partial Nonattainment Area under the 2008 Lead Standard

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Division of Air Pollution Control

June 2012
Revised February 26

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Section One

Background

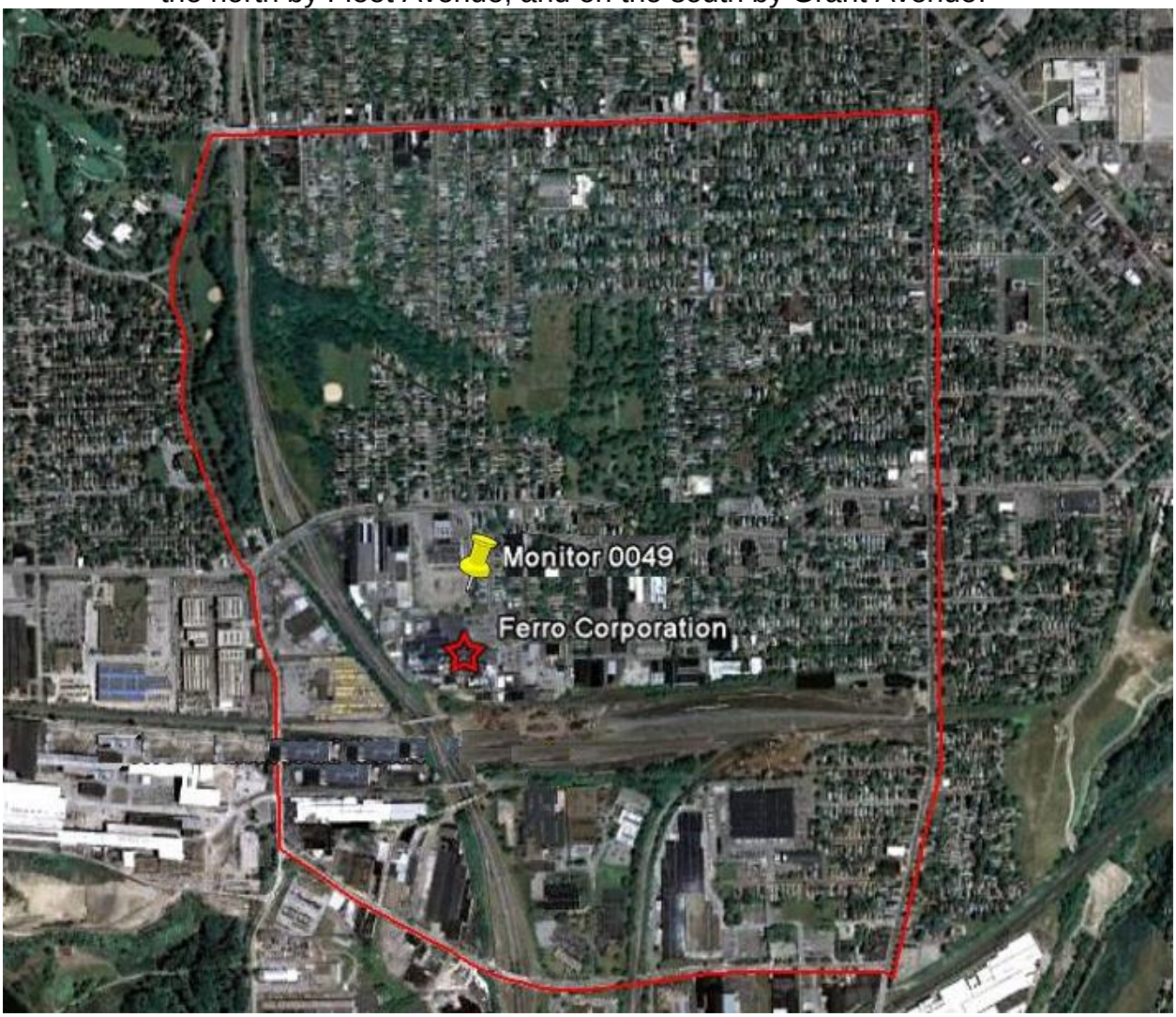
The United States Environmental Protection Agency (U.S. EPA) revised the National Ambient Air Quality Standard (NAAQS) for lead on November 12, 2008 (73 FR 66964) with an effective January 12, 2009. It replaced the existing lead standard of 1.5 ug/m^3 with a lower standard of 0.15 ug/m^3 as a rolling three-month average.

On November 22, 2010 (75 FR 71033), effective December 31, 2010, U.S. EPA promulgated the initial lead nonattainment areas for the revised lead standard across the country. The CAA Amendments requires states with lead nonattainment areas to submit a plan within eighteen months of the effective date of the designations (June 30, 2012) detailing how the lead standard will be attained by December 31, 2015. Ohio EPA submitted its attainment demonstration on June 25, 2012 and a subsequent revision on July 17, 2014. However, based on 2012 to 2014 air quality data, Ohio attained the standard before the deadline and submitted a clean data request on February 20, 2015. On May 26, 2015 (80 FR 29964) U.S. EPA approved Ohio EPA's clean data request with an effective date of July 27, 2015. As a result of attaining the standard, Ohio EPA withdrew the attainment demonstration on July 27, 2015 as U.S. EPA had not taken any formal action and the need for U.S. EPA to approve Ohio's attainment demonstrations is no longer necessary.

This document details Ohio's Lead State Implementation Plan (SIP) analysis that was submitted on June 25, 2012 for the partial Cuyahoga County nonattainment area in the State of Ohio. This document does not contain the entire SIP analysis submitted to U.S. EPA on June 25, 2012, but rather, only those portions that are relevant to supporting the redesignation request and maintenance plan of which this document is now an appendix.

This partial nonattainment area encompasses emissions from the Ferro Corporation Cleveland Frit Plant (herein referred to as "Ferro"). Ferro (Ohio EPA facility identification # 1318170235) is located at 4150 East 56th Street, Cleveland, Ohio, 44101. Figure 1 shows this lead nonattainment area's boundary, the facility location, and the monitoring network within.

Figure 1: Cuyahoga County Partial Lead Nonattainment Area and Monitoring Network: The area enclosed on the west by Washington Park Boulevard/Crete Avenue/East 49th Street, on the east by East 71st Street, on the north by Fleet Avenue, and on the south by Grant Avenue.



Section Two

Monitoring and Ambient Air Quality Data

Ohio EPA maintains a comprehensive network of lead air quality monitors throughout Ohio with the primary objective being to determine compliance with the lead NAAQS. Figure 1 shows Cuyahoga County's partial nonattainment area and the location of the designated lead monitor.

In accordance with the CAA Amendments, three complete years of monitoring data are required to demonstrate attainment at a monitoring site. 40 CFR Part 50, Appendix R provides the computation methods for the lead standard. This regulation requires individual samples be analyzed and a monthly mean computed. Compliance with the lead standard is determined over a three-calendar year period. Any one exceedance of a three-month average during this period indicates an exceedance of the lead standard. When this occurs, the area is said to be in attainment.

Table 1 provides a summary of the annual average lead monitoring data for 2006 through 2011 for this area's lead monitoring site. The nonattainment areas' air quality has remained stable and under the standard as can be seen by Figure 2; however, in 2010, air quality declined. These data were retrieved from the U.S. EPA Air Quality System (AQS) database (Appendix A). The AQS contains ambient air pollution data collected by U.S. EPA, state, local and tribal air pollution control agencies from thousands of monitoring stations. Data from the AQS is used to assess air quality, assist in attainment/nonattainment designations, evaluate state implementation plans for nonattainment areas, perform modeling for permit review analysis, and manage other air quality management functions.

The AQS database is updated monthly by states and local environmental agencies that operate the monitoring stations. States provide the monitoring data to U.S. EPA as required by the CAA Amendments.

Table 1. Three-Month Rolling Average Lead Data (2006 – 2011) in the Cuyahoga County Partial Nonattainment Area.

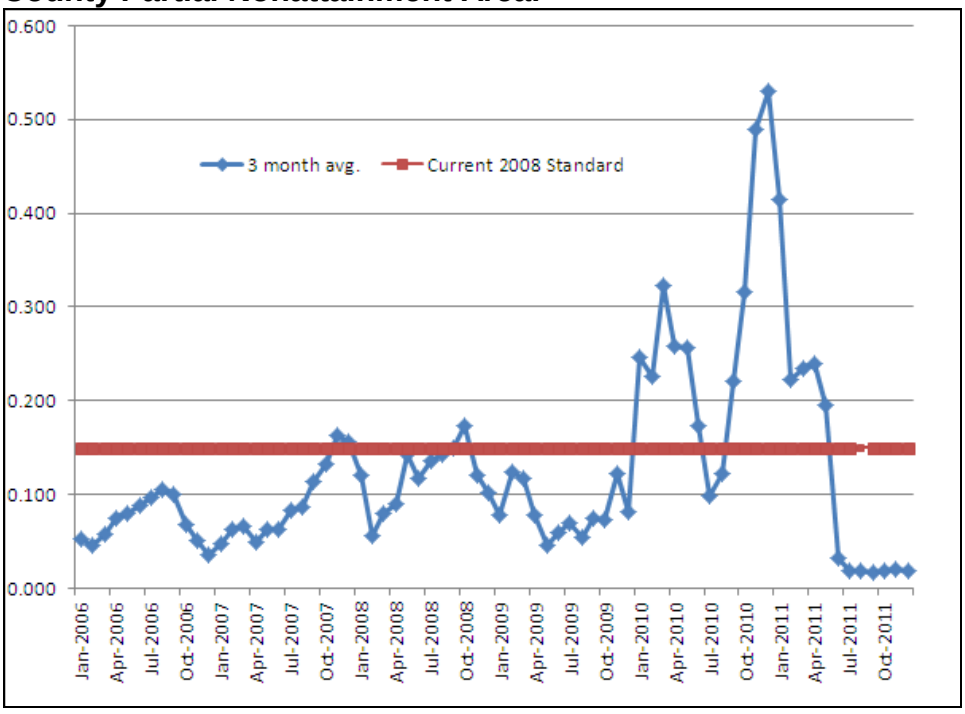
= Exceeds standard

Site Location City	3-month period	Three-month rolling average (ug/m^3)					
		2006	2007	2008	2009	2010	2011
39-035-0049 E. 56th St. Cleveland	Nov -Jan	0.053	0.047	0.120	0.078	0.247	0.414
	Dec -Feb	0.046	0.063	0.057	0.125	0.226	0.223
	Jan -Mar	0.058	0.067	0.080	0.117	0.323	0.235
	Feb-Apr	0.075	0.050	0.090	0.079	0.258	0.239
	Mar-May	0.079	0.063	0.143	0.047	0.256	0.196
	Apr-Jun	0.088	0.063	0.117	0.060	0.173	0.0323
	May-July	0.098	0.083	0.137	0.069	0.098	0.0183
	Jun-Aug	0.105	0.087	0.143	0.055	0.122	0.0188
	July-Sept	0.100	0.113	0.150	0.075	0.220	0.0172
	Aug-Oct	0.068	0.133	0.173	0.073	0.317	0.0191
	Sept-Nov	0.051	0.163	0.120	0.123	0.489	0.0203
	Oct-Dec	0.036	0.157	0.102	0.082	0.531	0.0187

Sites with one or months of a composite analysis missing in any three-month period.

Data source: U.S. EPA Air Quality System (AQS). http://www.epa.gov/ttn/airs/airsaqs/index.htm

Figure 2. Three-Month Rolling Average Lead Data (2006 – 2011) in the Cuyahoga County Partial Nonattainment Area.



Section Three

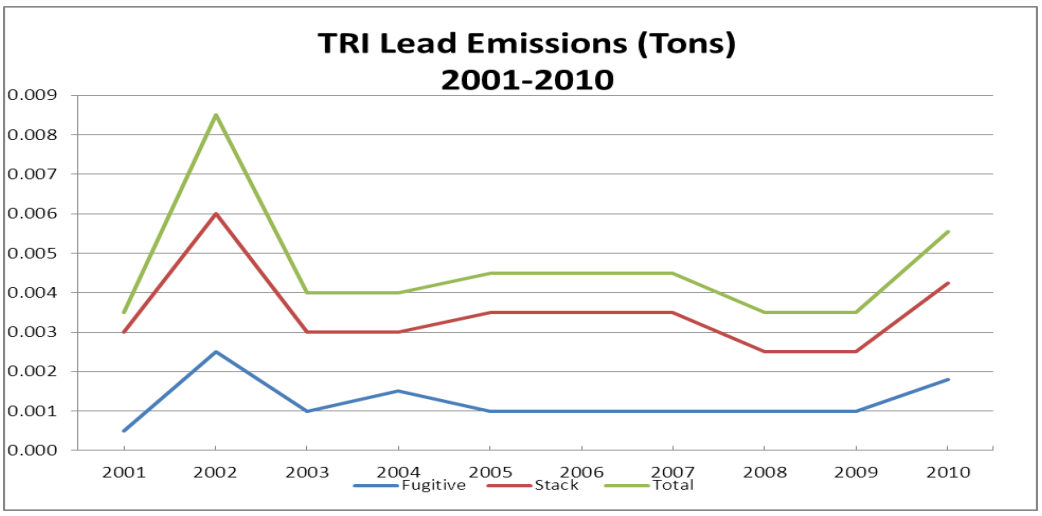
Emissions Analysis

Ferro is below NEI reporting thresholds and reports lead emission data through the Toxics Release Inventory (TRI). The following table summarizes historical lead emissions for Ferro reported under the TRI program. There are no other sources of lead emissions in the nonattainment area.

Table 2. Ferro TRI Data (2001 – 2010).

	LEAD COMPOUNDS (TPY)		
	Fugitive	**Stack**	**Total**
2001	0.001	0.003	0.0035
2002	0.003	0.006	0.0085
2003	0.001	0.003	0.004
2004	0.002	0.003	0.004
2005	0.001	0.0035	0.0045
2006	0.001	0.0035	0.0045
2007	0.001	0.0035	0.0045
2008	0.001	0.0025	0.0035
2009	0.001	0.0025	0.0035
2010	0.0018	0.00425	0.00605

Figure 3. Ferro TRI Data (2001 – 2010) Trends in Tons Per Year.



Section Four

Reasonably Available Control Measures

Section 172(c)(1) requires plan provisions provide for implementation of Reasonably Available Control Measures (RACM) as expeditiously as practicable (including such reductions in emissions from existing sources in the area as may be obtained through the adoption, at a minimum, of Reasonably Available Control Technology (RACT)) and provide for attainment of the national primary ambient air quality standards. In March 2012, U.S. EPA issued guidance entitled "Implementation of the 2008 Lead National Ambient Air Quality Standards: Guide to Developing Reasonably Available Control Measures (RACM) for Controlling Lead Emissions" (herein referred to as "RACM Guidance"). The RACM Guidance states that "most sources that will be required to implement RACM will be in the source categories focused on by this document – Secondary Lead Smelting, Lead Acid Battery Manufacturing, Iron and Steel Foundries, and Iron and Steel Mills. However, there might be some sources in other source categories that will be required to implement RACM for controlling lead emissions." The RACM Guidance provides basics steps that States can use in determining what constitutes RACM. Ohio EPA has performed a RACM analysis (Appendix B) for Ferro and has determined that existing controls and practices constitutes RACM, and that those existing controls and practices along with voluntary upgraded secondary controls and practices being implemented by Ferro to address the 2010 and early 2011 exceedances will ensure ongoing attainment of the 2008 lead standard. These measures are discussed in greater detail under the Control Measures, Means or Techniques heading of the Attainment Demonstration Strategy Analysis portion of this section.

Attainment Demonstration Strategy Analysis

Background

Ferro primarily produces frits which are vitreous compounds, not soluble in water, obtained by glass heating and then rapidly cooling carefully controlled blends of raw materials. The frit production process allows the use of soluble raw materials consisting of metal oxides and carbonates. The majority of production consists of end product powders. These are manufactured from intermediate cullet that that is melted and quenched. Production of "cullet" intermediates of non-lead bearing materials is also processed. The cullet is defined by the quench methodology. Frit by definition is a water quenched product yielding a material with a sand-like appearance. Flake is a water cooled roll quenched (splat quenched) material with, as the name implies, a flake or ribbon appearance. A variety of micron particle sized wend products are produced. The median particle sizes of these materials vary from 1 to 30 microns. Production methodology entails in all instances the utilization of ball or pebble mills. The use of dry or medium (water, alcohol) mills is governed by the desired particle size and permissible contaminants. Ferro manufactures glass cullet in two of these principle groups: pure vitreous glass and glass ceramics. Primary lead bearing production includes modified

Lead- Boro-Silicates or modified Lead- Alumino-Silicates. The lead raw material is 98% lead oxide.

As seen under Table 1 and Figure 2 above, monitored values remained stable between 2006 and 2009. In 2010, three-month rolling averages began to increase consistently through the first part of 2011. In 2010, Ohio EPA began working with Ferro staff to determine if Ferro was causing or contributing to exceedances of the new more stringent standard. Ohio EPA also analyzed data with respect to several other potential lead sources in the vicinity of, but excluded from, the nonattainment area. However, a combination of meteorological data, monitoring data and data obtained from Ferro indicate they were the likely source of the exceedances.

Two meteorological stations were used to analyze monitoring data trends: Cleveland Burke Lakefront Airport located north of Ferro and Cleveland Hopkins International Airport located to the southwest (Figure 4).

Figure 4. Meteorological Station Locations.

Daily monitor values were plotted against daily wind direction counts for both meteorological stations as depicted in Figures 5 through 8 below.

Figure 5. Burke Lakefront Airport Daily Wind Counts vs. the 2008 Standard.

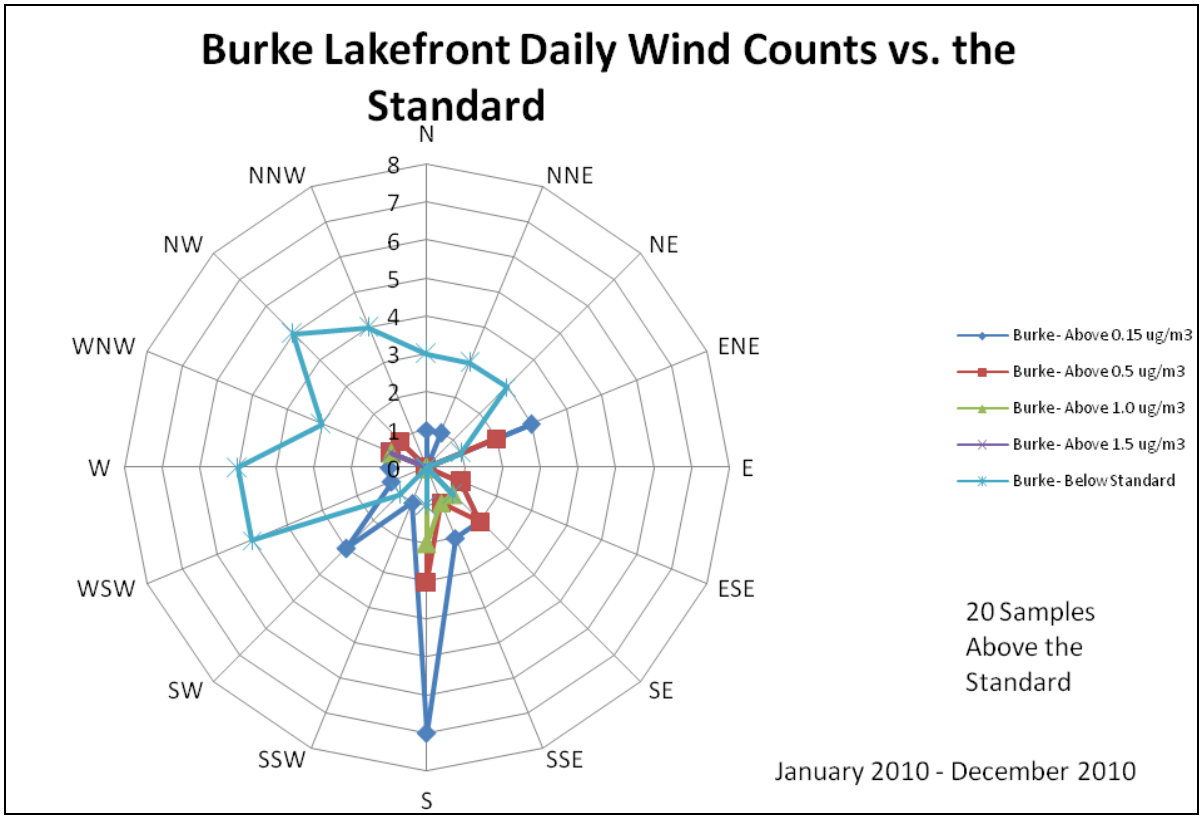


Figure 6. Burke Lakefront Airport Daily Wind Counts vs. the 2008 Standard – Overlaid on Monitor 0049.

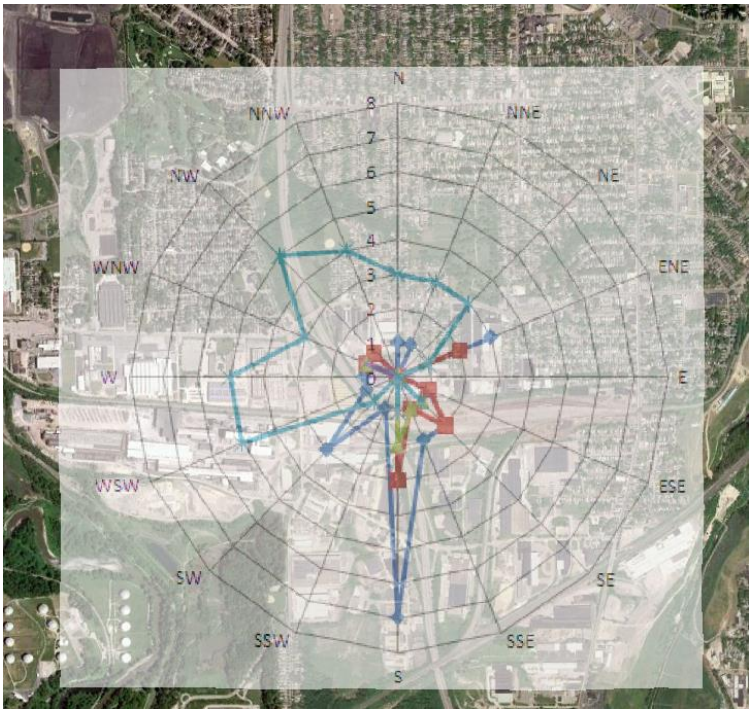


Figure 7. Cleveland Hopkins International Airport Daily Wind Counts vs. the 2008 Standard.

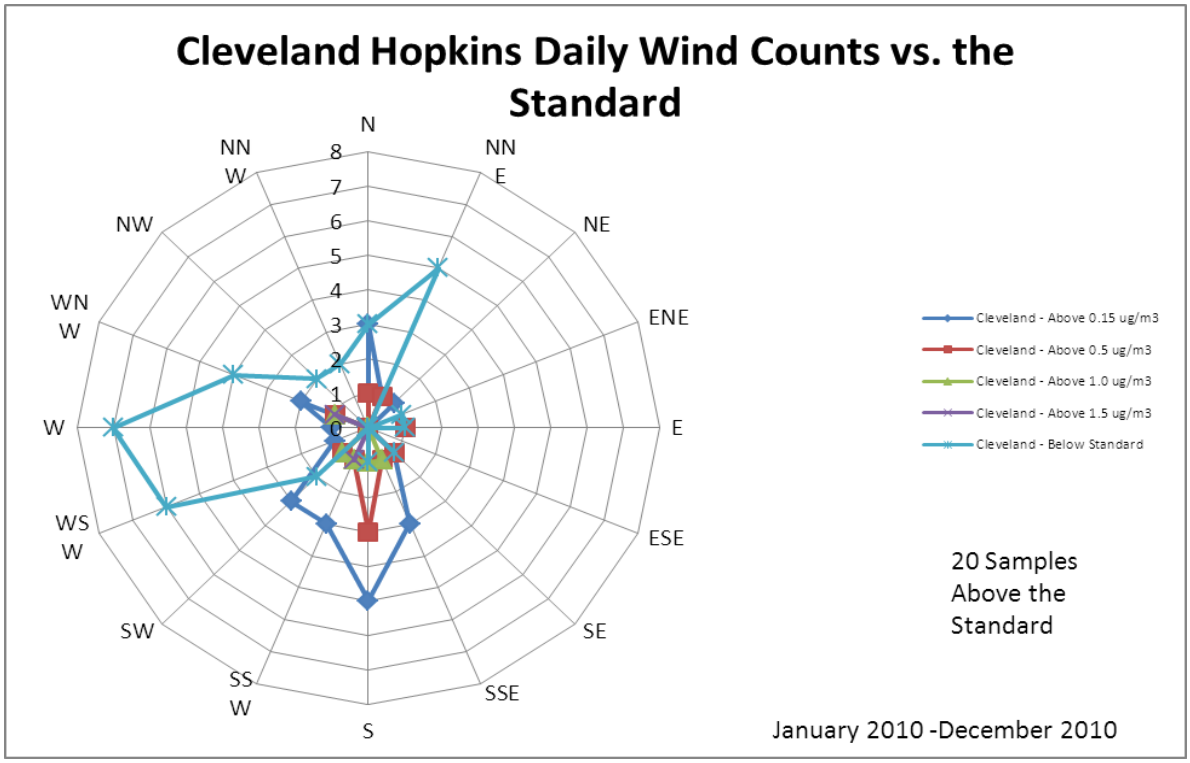
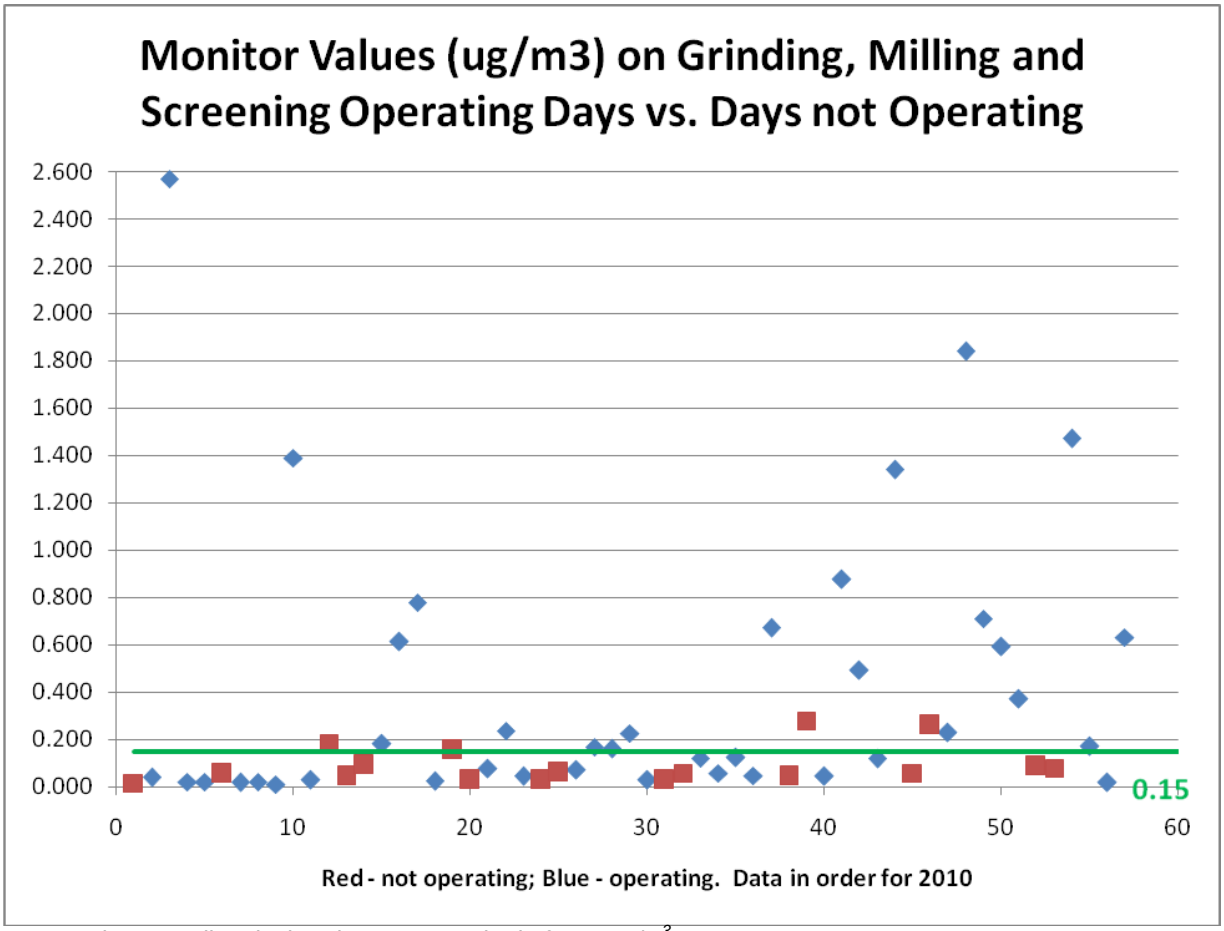


Figure 8. Cleveland Hopkins International Airport Daily Wind Counts vs. the 2008 Standard – Overlaid on Monitor 0049.

The monitor is located directly north of Ferro as seen in Figure 1. As depicted in Figures 5 through 8, higher monitored days are predominantly associated with winds coming out of the south where winds pass by Ferro before reaching the monitor.

Ferro production records were also compared to daily monitor values. Figure 9 depicts monitor values on days when grinding, milling and screening operations were occurring compared to days when these operations were not occurring. Higher monitor value days are associated with these operations running.

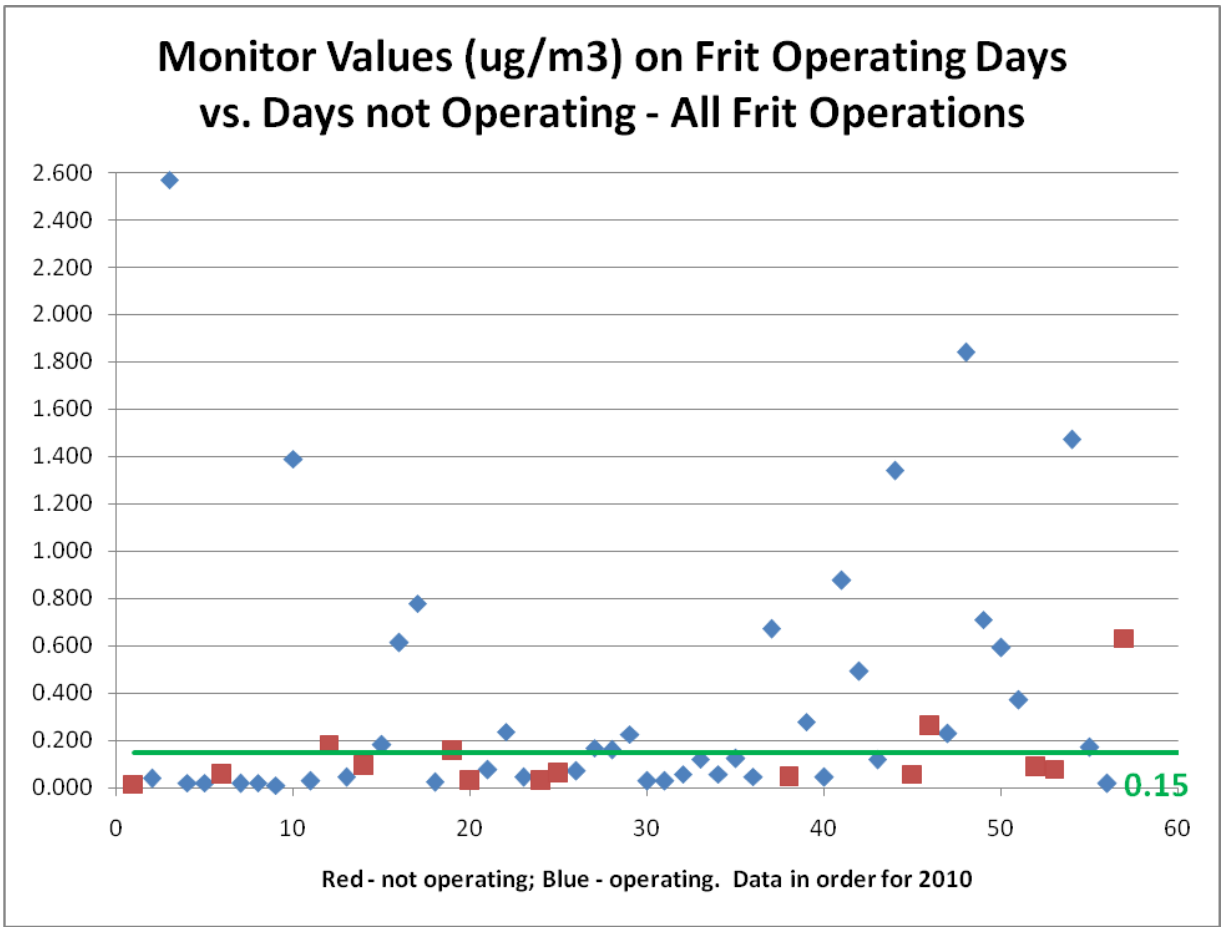
Figure 9. Monitor Values on Grinding, Milling, and Screening Operating Days vs. Days not Operating.



**the green line depicts the 2008 standard of 0.15 ug/m^3*

Figure 10 depicts monitor values on days when frit[1] operations were occurring compared to days when these operations were not occurring. Similarly, higher monitor value days are associated with these operations running.

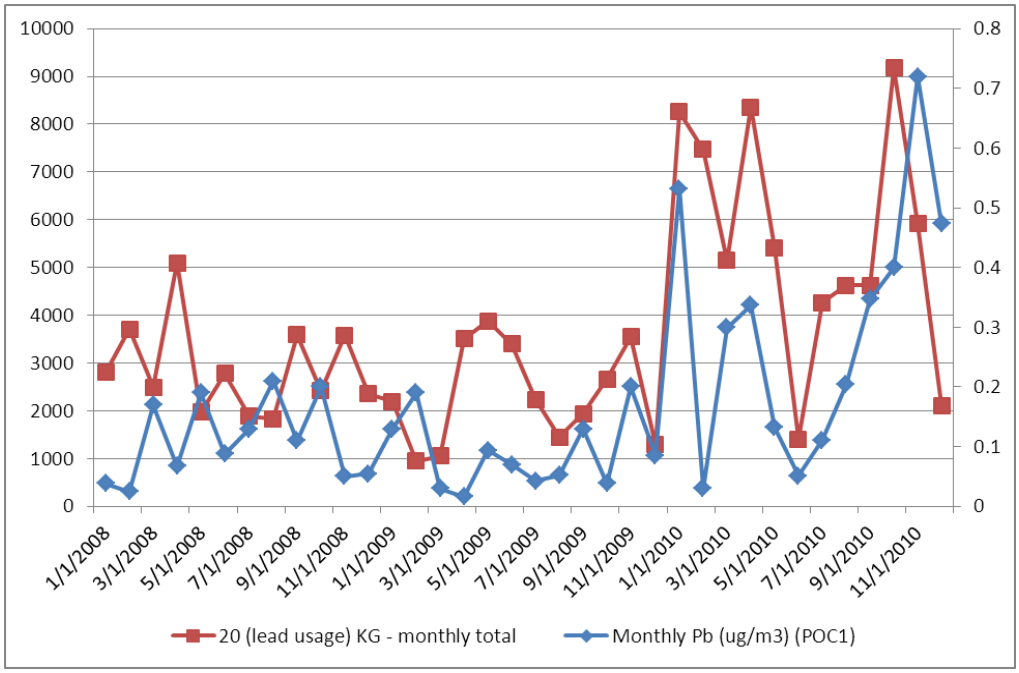
Figure 10. Monitor Values on Frit Operating Days vs. Days not Operating – All Frit Operations2.



1 This includes both lead bearing and non-lead bearing frit operations.
2 All Frit operations refers to the EGCM operations only.

Figure 11 depicts monthly monitor values compared to the lead raw material usage[3] for that month (in kilograms).

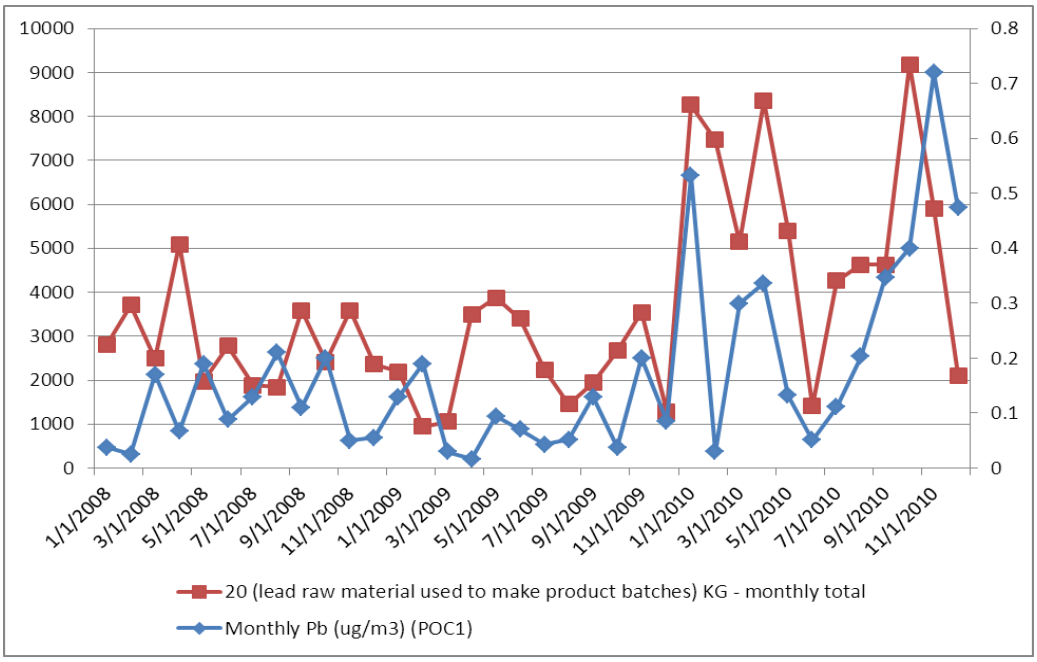
Figure 11. Monthly Lead Usage vs. Monthly Monitor Values.



3 This is when lead oxide is removed from inventory (the powder removed from the drum) prior to mixing. Generally mixing occurs within 24 hours.

Figure 12 depicts monthly monitor values compared to the production schedule[4] for lead for that month (in kilograms).

Figure 12. Monthly Lead-Based Glass Production Schedule vs. Monthly Monitor Values.



4 This is when batches are mixed but not necessarily when they are subjected to the melt process. Melting generally occurs within 24-48 hours of mix.

Figure 13 depicts monthly monitor values compared to total lead products produced in the same month (in kilograms).

Figure 13. Monthly Lead-Based Glass Produced vs. Monthly Monitor Values.

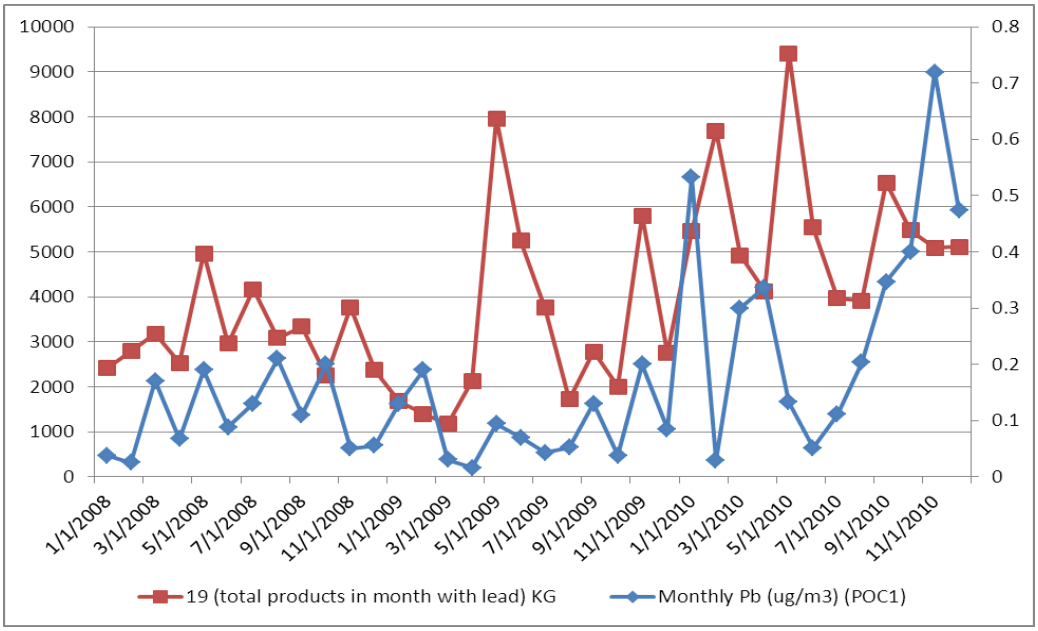
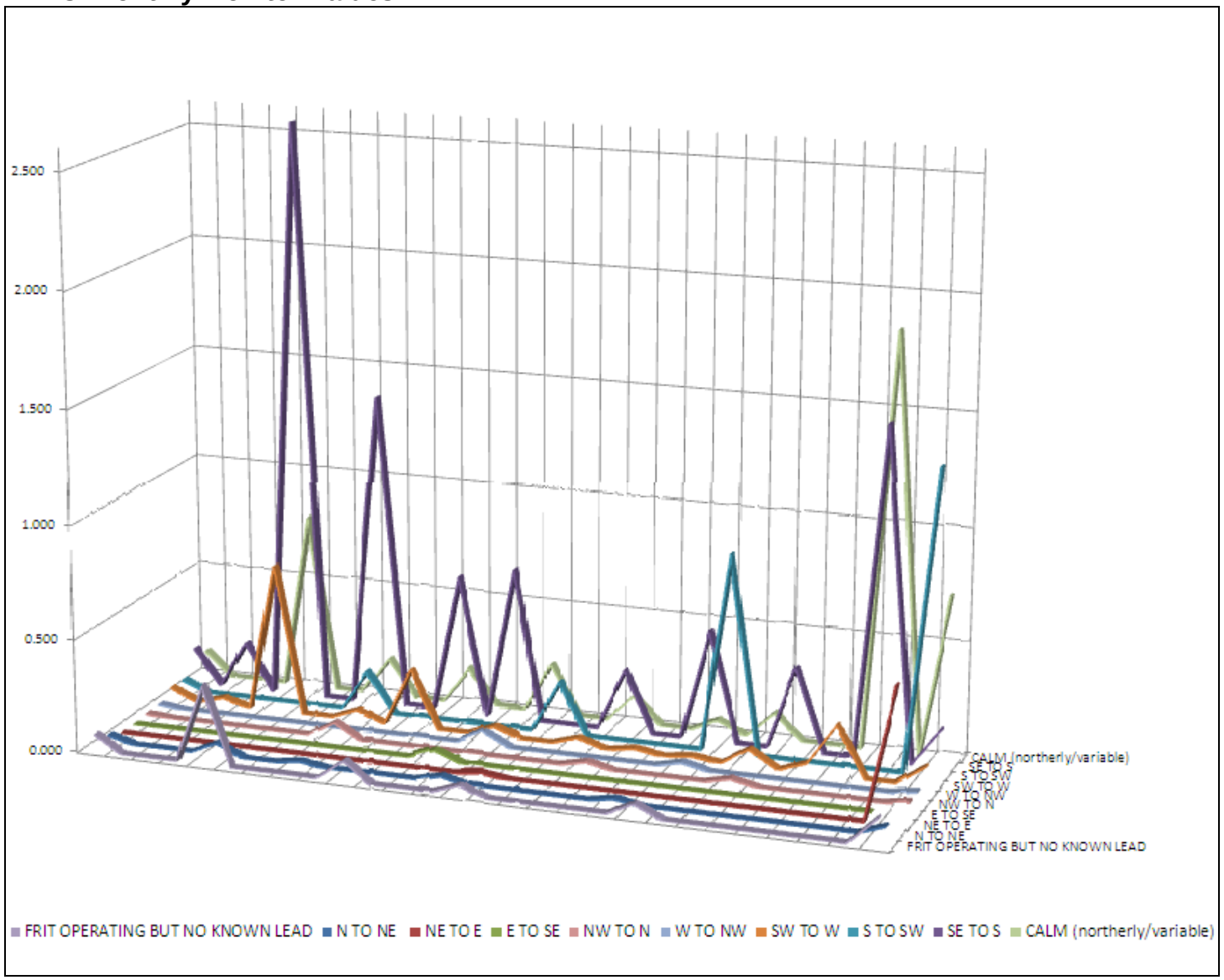


Figure 14 depicts daily monitor values categorized by wind direction for days when it was known that lead products were produced. The figure also depicts daily monitor values on days when frit was being produced but there was no lead in the production process that day (most forward line of image). The three furthest lines of the image show (in order from forward to back) daily monitor values when winds are predominantly from the south to southwest, south to southeast, or calm. This would be as winds pass over Ferro towards the monitor.

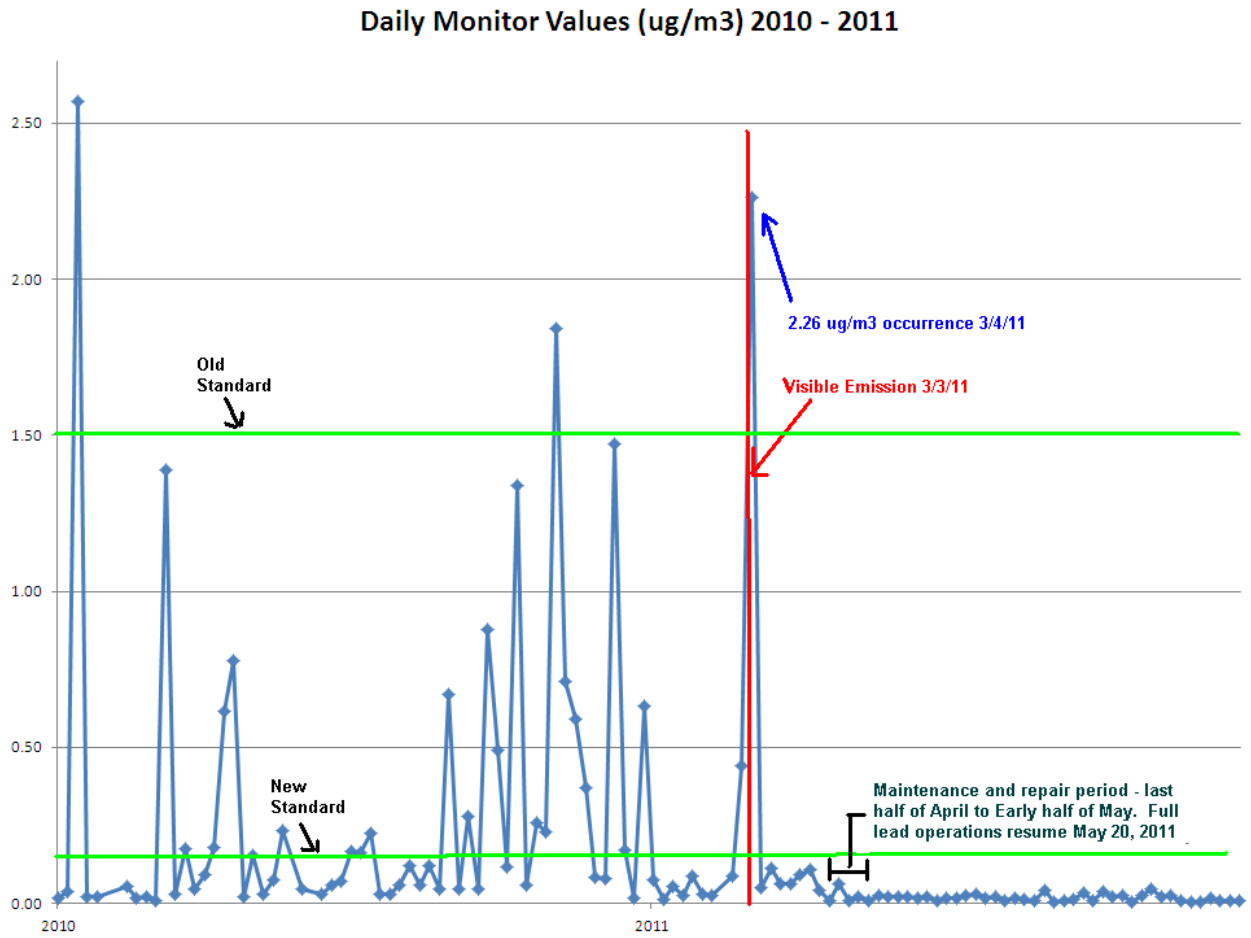
Figure 14. Lead-Based Glass Production Days by Wind Direction and Non-Lead-Based Glass Production Days vs. Monthly Monitor Values.



In 2011, exceedances periodically continued. Then on March 3, 2011 Ferro observed a visible emission from lead processing on one of their baghouses. Subsequently, on March 4, 2011, the monitor's 24-hour value was 2.26 ug/m^3. The source equipment and control units were shut down and the unit was inspected. The cause of visible emissions was determined to be a failed retaining clamp on a filter and a repair was immediately made and the unit was placed back into service on March 7, 2011. Ferro commenced a program to evaluate the condition of all baghouses. This occurred throughout the last half of April and early half of May 2011. Several small cracks in the canisters and damage to hopper dump slide gates on several baghouses were identified and operations were immediately shutdown until repairs were completed. Additionally, all air pulse jets, solenoids and timer boards were evaluated and replaced as necessary. During this time, Ferro also changed all filter cartridges and all pulse air supply regulators. Full production resumed on May 9, 2011 and full lead-based glass production resumed on May 20, 2011. In addition to these activities, Ferro identified four baghouses they deemed ready for replacement in the near future and is upgrading these and including new secondary control technologies. Additional discussion about new and replacement equipment is under the Control Measures, Means or Techniques section below. Appendix C contains a response letter from Ferro dated January 23, 2012. This document contains a more thorough discussion of these events.

It is Ohio EPA's belief that Ferro's equipment degradation and maintenance issues contributed to the periodic exceedances through 2010 and the early months of 2011. As can be seen in Table 1, nonattainment of the 2008 standard last occurred during the March-May 2011 period and 3-month rolling averages have sharply declined and been well below the standard since. This is consistent with when Ferro completed repairs and resumed full production of lead-based glass processes (May 20, 2011). Also, as can be seen in Figure15, daily monitor values have taken a sharp decline since the visible emission event and continued to decline and remain steady after the series of repairs were completed and operations were fully resumed.

Figure 15. Ferro Events and Daily Monitor Values (ug/m^3) from 2010 -2011.



Modeling

Per U.S. EPA's guidance (2008 Lead (Pb) National Ambient Air Quality Standards (NAAQS) Implementation Questions and Answers, July 8, 2011 (herein referred to as "Q&A Guidance"), "modeling for attainment demonstrations is used to show that a nonattainment area will be in attainment by the attainment date. The modeling is used to show the effectiveness of control measures on the sources. For attainment modeling, maximum allowable or federally enforceable permit limits should be the basis of the model input emissions, as described in Section 8.1 and Table 8-1 of Appendix W and the Guideline for Air Quality Models."

Two dispersion modeling analyses were performed for this analysis. One was an analysis relevant to the 2010 and early 2011 period, prior to equipment repairs (base case). Ohio EPA's analysis demonstrates the level of lead emissions that had to have occurred during a representative period when the equipment was not functioning properly. The second analysis demonstrates when the equipment is functioning properly and maintained properly, Ferro's federally enforceable permit limits will provide for attainment of the standard (future case).

The base case analysis evaluated a reasonable estimate of maximum actual emissions to determine the sources identified at Ferro with control equipment degradation that may have contributed most to the highest monitored concentrations. For this analysis, Ohio EPA selected the 3-month period of October to December 2010, when the highest three-month rolling average of 0.531 ug/m^3 occurred.

The future case analysis evaluated the existing and planned controls which are considered within Ferro's federally enforceable permit limits. Dispersion modeling was used to validate that the control strategies and permit limits will provide for attainment of the standard. Several conservative assumptions were made as a part of the modeling analysis and a weight-of-evidence approach was used to demonstrate attainment of the standard. In addition, as can be seen from Table 1 above, monitoring shows that since the violations occurred and the degraded equipment that caused excess emissions was repaired, 3-month rolling averages are well below the standard. This trend has also continued to date.

This dispersion modeling analysis was performed using the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) modeling system.

Appendix D contains the full modeling analyses and documentation.

Enforceable Emission Limitations

Ferro was issued a renewal Title V permit effective October 6, 2014 (Appendix E). Table 3 identifies lead sources (emissions units), corresponding control devices and federal enforceable permit limits for lead. The applicable requirements for lead in this Title V permit are based upon limitation incorporated into federally enforceable permits-to-install (Ohio EPA permit # P0116702 issued July 2, 2014 and Ohio EPA permit # P0116701 issued May 20, 2014). .

Control Measures, Means or Techniques

All lead processes (melting and milling) at Ferro are contained operations that are controlled by a series of dust collectors (bag houses) with design efficiencies of 99.97%. Because of equipment degradation and maintenance issues, Ferro made several repairs (as discussed above). Table 3 below provides a summary of the control device upgrades while Appendix C contains a detailed summary of the repairs and voluntary upgrades. In addition, Ferro implemented a comprehensive Preventative Maintenance Plan (Appendix F) to ensure adequate operation of all dust collectors.

Ohio EPA also performed a RACM analysis (Appendix B) for Ferro and has determined that existing controls and practices constitutes RACM. In addition, Ferro is voluntarily implementing additional controls and monitoring to ensure the 2010 and early 2011

exceedances are addressed. These include secondary HEPA filtration and bag leak detection devices on all control devices emitting lead.

Table 3. Ferro Sources of Lead, Base Case Control Devices, Control Device Upgrades and Federally Enforceable Permit Limits.

Emission Unit	Description of Source Emissions	Base Case Control Device	Voluntary Control Device Upgrade	Permit Limits	
				pound/ hour	ton/year
P065	220 lbs product/cycle electric, glass melter (large melter K or MELTER 2)	FEM 8	Replace existing dust collector with new 304 stainless steel dust collector and 316 stainless steel blower. New HEPA filter and broken bag detection device.	n/a[5]	0.30 combined limit
P064	220 lbs product/cycle electric, glass melter (large melter J or MELTER 1)				
P066	220 lbs product/cycle electric, glass melter (large melter G or MELTER 3)	FEM 9	New carbon steel blower, secondary HEPA filter and broken bag detection device		
P067	220 lbs product/cycle electric, glass melter (large melter L or MELTER 5)				
P068	220 lbs product/cycle electric, glass melter (small melter C or MELTER 9)	FEM 10	New carbon steel blower, secondary HEPA filter and broken bag detection device		
P069	220 lbs product/cycle electric, glass melter (small melter D or MELTER 10)				

[5] Compliance with Ferro's 0.01 pounds per hour particulate emissions limitation for each of these emissions units ensures compliance with the combined ton per year lead limitation and ensures attainment of the standard.

Emission Unit	Description of Source Emissions	Base Case Control Device	Voluntary Control Device Upgrade	Permit Limits	
				pound/ hour	ton/year
P071	Eleven (11) Mills (ten wet mills and one dry mill) and seven (7) Friction Dryers for drying methyl and isopropyl alcohol from fine particle specialty glass equipped with a packed bed scrubber for control of VOC emissions and a baghouse for control of particulate emissions.	FEM 12, Scrubber	New carbon steel blower, secondary HEPA filter and broken bag detection device	0.002	0.009
P915	EMS gas/O2 continuous melter, 1 electric batch melter with a maximum process weight rate of 220 lbs/hr	CERC 4		0	0
P101	22 lb/cycle melters (drop bottom melters 1, 2, 3, 4, 5 & 6)	FEM 10 (#4), FEM 11 (#1,5), and FEM 14 (#2,3,6)	FEM 14: New carbon steel blower, secondary HEPA filter and broken bag detection device	de mimimus	
P001	8 Ball Mills, 2 Screeners, 1 Cone Blender, 2 Scales	FEM1	New carbon steel blower, secondary HEPA filter and broken bag detection device	de mimimus	
P100	Packaging for Shipment (per process flow)	FEM 5	New carbon steel blower, secondary HEPA filter and broken bag detection device	de mimimus	

**FEM's are all dust collectors with HEPA filters*

In accordance with U.S. EPA's Q&A Guidance, all upgrades were scheduled and completed by November 1, 2012. U.S. EPA's Q&A Guidance states:

> *Control measures for the 2008 NAAQS need to be in place as expeditiously as practicable. In order for control measures to result in three years of monitored clean data by the attainment date, areas designated in the first round of designations (effective December 31, 2010, and requiring attainment*

demonstrations that show that the area will attain the standard as expeditiously as practicable, but no later than December 31, 2015) would need to have all necessary controls in place no later than November 1, 2012…..