Minnesota Pollution Control Agency
520 Lafayette Road North | St. Paul, Minnesota 55155-4194 | 651-296-6300
800-657-3864 | 651-282-5332 TTY | www.pca.state.mn.us | Equal Opportunity Employer

May 8, 2012

Ms. Susan Hedman
Regional Administrator (AR-19J)
U.S. Environmental Protection Agency, Region V
77 West Jackson Boulevard
Chicago, Illinois 60604

RE: Supplemental State Implementation Plan for Regional Haze

Dear Ms. Hedman:

The Minnesota Pollution Control Agency (MPCA) hereby submits to the U.S. Environmental Protection Agency (EPA) a revision to Minnesota's State Implementation Plan (SIP), pursuant to the federal Regional Haze Rule (40 CFR 51.300 – 51.309).

This revision supplements the Regional Haze SIP sent to you in December 2009. It includes changes to Minnesota's plan for reducing regional haze in the Boundary Waters Canoe Area Wilderness and Voyageurs National Park, as well as in Class I areas outside of Minnesota where visibility is impacted by emissions from Minnesota.

This Supplemental SIP revision covers three areas: Best Available Retrofit Technology (BART) for electric generating units (EGUs), BART for taconite facilities, and the long-term strategy as applied to the existing taconite facilities. The MPCA is requesting that the Cross State Air Pollution Rule, also known as the Transport Rule, substitute for source-specific BART at the subject-to-BART EGUs in Minnesota. The exception is Units 1 and 2 at Xcel's Sherburne County Generating Station (Sherco); the SIP includes an Administrative Order implementing source-specific limits for Sherco as an enhancement to BART.

The Supplemental SIP also includes Administrative Orders implementing BART limits at the six existing taconite facilities. These limits correspond to the BART determination, submitted in 2009, of good combustion practices and scrubber optimization at the taconite indurating furnaces. Finally, the Administrative Orders issued to the taconite facilities also include a requirement for the facilities to demonstrate compliance with the new one-hour National Ambient Air Quality Standards for nitrogen dioxide and sulfur dioxide. The SIP now relies on this requirement as the long-term strategy for the existing taconite facilities, replacing the prior plan to require pilot testing of emission control technologies.

The MPCA requests that EPA approve the attached Administrative Orders, for Sherco and the six existing taconite facilities, into Minnesota's SIP.

Along with this submittal is a CD containing an exact copy of the SIP submittal. Please contact Catherine Neuschler, of our staff, at 651-757-2607, if you have any questions regarding this SIP revision.

Sincerely,

Paul W. Aasen
Commissioner

PWA/CN:sth

Enclosures

cc: Kathleen D'Agostino, EPA Region V (w/enclosures)

Regional Haze

State Implementation Plan Supplement

April 2012

Minnesota Pollution Control Agency

Introduction

The state of Minnesota is home to two federal Class I areas, the Boundary Waters Canoe Area Wilderness (BWCAW) and Voyageurs National Park. In compliance with the Regional Haze Rule promulgated in 1999, the Minnesota Pollution Control Agency (MPCA) submitted to the U.S. Environmental Protection Agency (EPA) a State Implementation Plan (SIP) to reduce haze in the Class I areas in December 2009.

The December 2009 submittal contained Best Available Retrofit Technology (BART) determinations for several electric generating units (EGUs) and taconite facilities, in accordance with 40 CFR 51.308(e). However, these BART determinations did not all have associated emission limits, due to a lack of available data. In addition, they were not yet enforceable. On December 20, 2010, the MPCA received a letter from EPA Region 5 indicating that, pursuant to the requirements of Section 110 of the Clean Air Act, BART limits must be established in an enforceable form before EPA can approve Minnesota's Regional Haze SIP.

This submittal contains additional BART information and enforceable documents in fulfillment of the requirements of Section 110 of the Clean Air Act. In addition, this submittal contains a change in Minnesota's strategy for the Northeast Minnesota Plan, part of the long term strategy to improve visibility under 40 CFR 51.308(d)(3).

BART for Electric Generating Units

The MPCA's December 2009 Regional Haze SIP submittal included BART determinations and associated emission limits for five power plants. These plants are shown in the table below:

Facility Name	Subject-to-BART Unit(s)
Minnesota Power – Taconite Harbor	EU 003
Minnesota Power – Boswell Energy Center	EU 003
Northshore Mining Company – Silver Bay Power	EU 002
Rochester Public Utilities – Silver Lake	EU 003, EU 004
Xcel Energy – Sherco	EU 001, EU 002

However, the emission limits were not included in enforceable documents, and therefore have not yet been acted on by EPA. This supplemental SIP makes changes to the BART determinations for power plants in Minnesota.

The MPCA's initial intent was to determine that the Clean Air Interstate Rule (CAIR) was equivalent to BART for the power plants in Minnesota. EPA had determined that emissions reductions from CAIR would result in greater reasonable progress towards visibility goals than site-specific application of BART. Therefore, states could essentially "substitute" the participation of the state's power plants in CAIR for individual BART determinations. The initial draft Minnesota SIP, which was placed on notice in February 2008, included this CAIR=BART determination. One of the reasons that the MPCA felt comfortable making this determination is that many emission reductions were already occurring in preparation for CAIR.

After the completion of the public notice period, the DC Circuit Court of Appeals remanded the CAIR program to EPA. Part of that action questioned whether Minnesota was appropriately included in CAIR, and EPA subsequently removed Minnesota from the CAIR program.

Because of the removal of Minnesota from CAIR, the MPCA made individual BART determinations for the subject facilities. These BART determinations were described in the initial SIP submittal, but the emission limits were not included in enforceable documents at that time. In general, these BART determinations simply expressed emission limits from control projects that were being undertaken in planning for CAIR.

Minnesota is now included in the Cross-State Air Pollution Rule (CSAPR), also known as the Transport Rule (TR), as described in 40 CFR 52.1240 and 40 CFR 52.1241. On December 30, 2011, EPA published in the Federal Register a proposal that CSAPR would result in greater visibility improvement in all Class I areas than implementation of source-specific BART at individual power plants. (76 FR 82219). Therefore, the MPCA is determining that Transport Rule=BART for Minnesota. Rather than complying with the specific BART determinations made in the initial SIP submittal, Minnesota's subject-to-BART power plants simply need to comply with their obligations under the Transport Rule in order to meet the BART obligations.

The MPCA believes that this determination will not have an adverse impact on the emission reductions or air quality expected due to the application of BART. The majority of the MPCA's BART determinations for EGUs were based on the technology that facilities were planning to install in order to comply with the Clean Air Interstate Rule and will continue to run to comply with the Transport Rule.

The MPCA believes that many of the subject-to-BART facilities are already operating (and will continue to operate) emission controls. Although not officially included in Minnesota's SIP, limits requiring the operation of many of these emission controls are already federally enforceable. Minnesota Power Boswell Unit 3 already limits equivalent to the BART emission limits (NO_X limit of 0.07 lbs/MMBtu and SO_2 limit of 0.09 lbs/MMBtu, both on a 30-day rolling average basis) contained in the current facility permit (Air Emission Permit 06100004-006,issued on June 21, 2011). RPU Silver Lake also has a total facility permit containing limits equivalent to the BART limits (Air Emission Permit 10900011-004, issued September 7, 2007). Two remaining subject-to-BART units, Minnesota Power Taconite Harbor Unit 3 and Northshore Mining Silver Bay Power, Unit 2, are slated to receive emission allocations under CSAPR that are lower than their 2010 actual facility emissions and lower than the MPCA's source-specific BART determination. The need to meet these emission budgets or purchase emission allowances will likely drive reductions at these facilities.

BART for Sherco

Xcel Energy's Sherburne County Generating Station (Sherco) does not already have enforceable limits implementing BART-level emission reductions, and is slated to receive emission allocations under the Transport Rule that are much closer to its actual 2010 emissions. In addition, Sherco is projected by EPA's IPM modeling to emit at much higher levels in 2014 than it did in 2010.

For these reasons, the MPCA is choosing to include in the SIP an enforceable document implementing a source-specific BART determination for Sherco.

Under 40 CFR 51.308(e)(2)(v) and 40 CFR 51.308(e)(4), states that choose to implement a BART alternative also may choose to "include a geographic enhancement to the program to address the requirement under 40 CFR 51.302(c) related to BART for reasonably attributable impairment". In the preamble to the CSAPR=BART proposal, EPA indicates that "States may also include in their SIPs provisions applicable to a specific sources even if no federal land management agency has made such a reasonable attribution." (76 FR 82224).

The BART determination for Sherco Units 1 and 2 and the associated Administrative Order are being submitted to fulfill Minnesota's requirements under the Regional Haze portion of the visibility rules (40 CFR 51.308). Sherco is the subject of a RAVI determination under 40 CFR 51.302. Minnesota is under a FIP for the RAVI rules. Although the MPCA believes that a single BART determination could fulfill both purposes, EPA has indicated that they will make a future determination of BART for Sherco under RAVI.

The MPCA believes it is appropriate to submit source-specific limits for Sherco, and an Administrative Order for Sherco is included in Appendix 2.

BART for Taconite Facilities

In the submittal of December 2009, the MPCA determined that, generally, BART for the taconite facilities consisted of operation of existing scrubbers to control sulfur dioxide (SO_2) emissions, good combustion practices to control nitrogen oxides (NO_X) emissions, and continued implementation of the taconite Maximum Achievable Control Technology (MACT) standard for control of particulate matter (PM) emissions.

However, due to a lack of good data on emissions at the taconite facilities, the MPCA was unable to develop emission limits to correspond with the BART determinations for NO_X in all cases and for SO_2 in the case of facilities that burn higher sulfur fuels. The MPCA entered into Administrative Orders with the facilities, which required the facilities to do increased monitoring of their emissions and report emissions to the MPCA.

The MPCA felt that at least one year of data on emissions or operating parameters was needed from each facility in order to determine the appropriate BART limits. After receiving enough emissions data from the facilities, the MPCA analyzed the emissions to determine the BART limits.

The general approach to setting the BART limits was to focus on a recent set of at least 150 hours of data. A predictive interval was then constructed, and the BART limit was set at the 95% upper prediction limit. Table 1 lists the subject-to-BART unit(s) at each facility, the BART determination for SO_2 and NO_X, and the resulting emission limit.

Memos describing the process for setting the BART emission limits for each facility, including more detailed information on the statistical analysis, are included as Appendix 1. Administrative Orders making the BART limits for all three pollutants enforceable are included in Appendix 2.

The MPCA is requesting that EPA approve the attached Administrative Orders in Appendix 2, which contain BART emission limits and compliance methods, into Minnesota's SIP. The MPCA also requests that EPA not incorporate the Administrative Orders requiring additional emissions monitoring into the SIP, as those Orders represented an interim step towards BART implementation. The Orders in this supplemental SIP contain all necessary requirements for ongoing implementation of BART.

United Taconite

This supplemental SIP revision includes a slight change in approach for BART at United Taconite, due to a modification at the facility. In August 2010, the MPCA processed a permit amendment for United Taconite. The permit amendment allowed the concentrator and pellet plant at United Taconite to be modified in order to increase plant production from 5.3 million long tons of pellets annually to 6.0 million long tons. It also allowed for the use of solid fuels on Line 1, which had previously been fired only with natural gas. This authorization for solid fuels includes the testing of alternative fuels, such as a wood-based fuel.

The change in the facility made it difficult to determine appropriate BART limits. The MPCA determined that it was appropriate to make an initial finding of emission limits corresponding to the BART determination in the initial SIP submittal, based on the configuration of the facility at that time.

The permit amendment required that, within 120 days after receiving notification of the BART emission limits set by the MPCA, United Taconite undertake one of three options. The options are: 1) submit a permit application to MPCA to incorporate the BART limits; 2) submit a permit application that proposes emission limits for a BART alternative that provides greater controls of visibility impairing pollutants than the BART determination; or 3) submit an updated BART analysis for both Line 1 and Line 2 for the facility as changed by the permit amendment. The MPCA notified United Taconite of the BART limits on September 22, 2011.

On December 8, 2011, United Taconite proposed that the NO_X and SO_2 limits set as part of the above-mentioned permit amendment be incorporated as the BART limits for the facility. As described in the memo in Appendix 1, the MPCA found that these limits provided greater annual reductions of NO_X and SO_2 than would be provided by the MPCA's initial BART limits. Therefore, the MPCA is proposing generally to accept these as the BART limits for United Taconite. The NO_X limit includes the addition of a shorter averaging time for normal operations, a 30-day rolling average limit for total furnace operations. It also includes a 24-hour limit that the facility can opt to comply with on any day when they burn 100% natural gas in order to preserve fuel flexibility. The Order also includes a requirement to undertake a root cause analysis of the reasons for burning 100% natural gas if the facility opts in to this limit more than five days in any calendar quarter.

Facility	Unit		Stack Vent	NO_X BART	NO_X BART Limit (30-day rolling average)	SO_2 BART	SO_2 BART Limit (30-day rolling average)
Arcelor Mittal	Indurating Furnace	EU026	SV014, SV015, SV016, SV017	Good combustion practices, low NO_X burners in the pre-heat zone, furnace energy efficiency project (2007)	1018.7 lbs/hr	Existing wet scrubber	0.165 lbs/LT
Hibbing Taconite	Line 1 Pelletizing Furnace	EU020	SV021, SV022, SV023, SV024	Good combustion practices, furnace energy efficiency projects (2005, 2006)	449.7 lbs/hr	Existing wet scrubber	0.207 lbs/LT
	Line 2 Pelletizing Furnace	EU021	SV025, SV026, SV027, SV028	Good combustion practices, furnace energy efficiency projects (2005, 2006)	894.2 and 608.9 lbs/hr	Existing wet scrubber	0.207 lbs/LT
	Line 3 Pelletizing Furnace	EU022	SV029, SV030, SV031, SV032	Good combustion practices, furnace energy efficiency projects (2005, 2006)	347.5 lbs/hr	Existing wet scrubber	0.207 lbs/LT
Northshore Mining	Indurating Furnace 11	EU100E U104	SV101, SV102, SV103; SV104, SV105	Good combustion practices	122.4 lbs/hr	Existing wet scrubber	0.0651 lbs/LT
	Indurating Furnace 12	EU110E U114	SV111, SV112, SV113; SV114, SV115	Good combustion practices	122.4 lbs/hr	Existing wet scrubber	0.0651 lbs/LT
	Process Boiler #1	EU003	SV003	Existing controls	0.17 lbs/ MMBtu	N/A	N/A
	Process Boiler #2	EU004	SV003	Existing controls	0.17 lbs/ MMBtu	N/A	N/A
United Taconite	Line 1 Pellet Induration	EU040	SV046	Good combustion practices, past heat recuperation project	21.1 tons per day; 2641.0 lbs/hour option on a 24-hour basis when burning 100% natural gas	Existing wet scrubber	106.3 tons, 30-day rolling sum
	Line 2 Pellet Induration	EU042	SV048, SV049	Good combustion practices		Existing wet scrubber, Fuel blending	197 tons, 30-day rolling sum
U.S. Steel - Keetac	Phase II Grate-Kiln Pelletizing Furnace	EU030	SV051	Existing combustion controls and fuel blending	12.35 tons per day	Existing wet scrubber	2.71 tons per day
U.S. Steel – Minntac	All Indurating Furnaces	EU225 EU261 EU282 EU315 EU334	SV103 SV118 SV127 SV144 SV151	Good combustion practices, fuel blending	33.89 tons per day	Existing controls	6.35 tons per day

Long Term Strategy: Northeast Minnesota Plan

The December 2009 SIP submittal includes, as part of the long term strategy, the Northeast Minnesota Plan to reduce emissions of SO_2 and NO_X from large sources in the six county (St. Louis, Lake, Cook, Carlton, Itasca, and Koochiching) northeast Minnesota area.

The Northeast Minnesota Plan has two main components. The first is a goal of a 30% reduction in combined SO_2 and NO_X emissions from larger sources, those that emit over 100 tons per year of either pollutant, by 2018 as compared to a baseline year of 2002. There is an interim goal of a 20% reduction by 2012. As of 2009, the most recent year for which emission inventory data is available, emissions were down by 39%. Based on projections at the beginning of 2011, it appears Minnesota will meet both the 20% by 2012 and 30% by 2018 goals.

The second part of the Northeast Minnesota Plan laid out a strategy for pilot testing emission controls on the taconite plants. Based on the BART analyses provided by the taconite facilities, the MPCA determined that the six taconite facilities were likely to be undercontrolled. Very few emission control technologies have been demonstrated on the indurating furnaces, the main source of emissions at the taconite facilities. Therefore, the Northeast Minnesota Plan envisioned that the taconite facilities would investigate control measures and pollution prevention practices through pilot testing, and report to MPCA on the feasibility and cost effectiveness of the controls. Any reasonable controls would then be installed. This was intended to evolve the controls available for these facilities, as no other driver for reductions appeared to be likely.

The basic timeline envisioned for the pilot testing was that the taconite facilities would conduct the pilot testing during the end of 2011 and through 2012. They would then report to the MPCA on the results in early 2013, and the MPCA would review those reports. Any control measures that were determined to be reasonable using the five factors set forth in the Regional Haze rule would be required, and the MPCA would develop enforceable documents for those reductions from mid-2013 to mid-2014, with controls being installed in 2015 and onward.

However, since the original SIP submittal, EPA has issued two new National Ambient Air Quality Standards (NAAQS), for SO_2 and NO_2, which appear able to drive more stringent controls and on a faster timeline than envisioned by the pilot testing. Therefore, the MPCA is reconsidering the future progress of emission reductions from the taconite industry. We believe efforts to demonstrate compliance with new federal standards will result in appropriate evolution of control technologies and other practices that reduce emissions and meet the overall objective of the Northeast Minnesota Plan.

Assuming additional emission controls are implemented in order to meet new ambient air standards and other requirements, pilot testing of additional controls should not be necessary. Therefore, the MPCA is working with the taconite facilities to ensure each facility will be able to demonstrate compliance with the NAAQS for NO_2, and SO_2 in a time frame based on EPA's attainment date for the new one-hour standards.

The Administrative Orders in Appendix 2 contain, in addition to the BART emission limits, requirements for modeling. Each facility must provide to MPCA a modeling protocol describing how modeling will be

conducted for NO_X and SO_2 emissions.[1] The Order then goes on to require that each facility provide, by the end of 2012, the following information:

- Modeling that demonstrates compliance with the one-hour standards;
- Proposed emission limits that result in modeled compliance;
- A description of the work practices or controls that must be implemented to meet the emission limits; and
- A schedule for implementation which ensures that they will be in place and the emission limits achieved by June 30, 2017.

The MPCA is substituting this NAAQS based strategy for the pilot testing strategy laid out in the original SIP submittal. The requirements to demonstrate attainment with the NAAQS for NO_X and SO_2 standards sets a bright line goal for emission reductions. Ultimately, the MPCA believes that this NAAQS strategy will result in the demonstration of emission control technologies that work well at taconite facilities, and will result in greater emission reductions more quickly than envisioned under the pilot testing strategy.

[1] In some cases, MPCA already has a modeling protocol or completed modeling in house and therefore the Order does not require an additional protocol or modeling.

Appendix 1: BART Determination Memos

DEPARTMENT: POLLUTION CONTROL AGENCY

STATE OF MINNESOTA
Office Memorandum

DATE: March 2, 2012

TO: AQD File No. 257
(Delta ID No. 13700062)

FROM: Hongming Jiang
Air Quality Permits Section
Industrial Division

Catherine Neuschler
Air Assessment and Environmental Data Management Section
Environmental Analysis and Outcomes Division

PHONE: 651-757-2467

651-757-2607

SUBJECT: Nitrogen Oxides BART Limits for ArcelorMittal Steel Company

This memo was prepared to provide the documentation of the MPCA's NO_X BART limit determination based on the technical review performed by MPCA staff. EPA's approval of the Regional Haze State Implementation Plan (SIP) for Minnesota is needed for the MPCA's BART determination to become effective.

1. General Information

1.1 Applicant and Stationary Source Location:

Applicant/Mailing Address	Stationary Source (SIC: **1011**)/Address
ArcelorMittal Steel USA 1 South Dearborn Street Chicago, IL 60603	ArcelorMittal Minorca Mine Inc. 5950 Old Highway 53 North Virginia, MN, St. Louis County
Contact: Ms. Jaime Baggenstoss, Phone: (218) 749-5910 x283	

1.2 Description of the Facility

ArcelorMittal Minorca Mine Inc. (Arcelor) owns and operates a taconite pellet production plant. There are three main areas where emissions are created: the mine, tailings basin and pellet plant. Arcelor makes fully fluxed pellets using one straight grate furnace.

The major steps in taconite pellet production include taconite ore mining, crushing, grinding, concentrating, agglomerating, and indurating. The larger sources of air emissions at Arcelor are from the indurating furnace operations and from mining activities, with lesser amounts from other processing operations and fugitive dust sources, including haul roads and the tailings basin.

Arcelor's pellet plant has one Dravo indurating furnace. It burns a maximum of 370 MMBtu/hr of natural gas and is capable of handling 400 tons of pellets per hour.

2. Regulatory and/or Statutory Basis

2.1 Overview of Visibility, Regional Haze, and Best Available Retrofit Technology Program

The U.S. EPA's 1999 Regional Haze Rule singles out certain older emission sources that have not been regulated under other provisions of the Clean Air Act for additional controls. The MPCA is required to determine Best Available Retrofit Technology (BART) for these older sources that contribute to visibility impairment in Class I Areas to install Best Available Retrofit Technology (BART). On July 6, 2005, U.S. EPA published a revised final rule, including 40 CFR 51, Appendix Y "Guidelines for BART Determinations Under the Regional Haze Rule" which provides direction for determining which older sources may need to install BART and for determining BART.

The MPCA is required to determine BART for each source subject to BART based on an analysis of the best system of continuous emission control technology available and associated emission reductions achievable. The analysis must take into consideration the technology available, the costs of compliance, the energy and non-air quality environmental impacts, any pollution control equipment in use at the source, the remaining useful life of the source, and the degree of improvement in visibility which may reasonably be anticipated to result from use of the technology.

Further discussion of the regulatory basis for this determination can be found in the MPCA's December 2009 Regional Haze State Implementation Plan submittal, in Appendix 9.3.

2.2 Affected Units

The unit for which the MPCA must determine BART and establish a NO_X BART limit consistent with that determination is:

Emission Unit Name	EU Number[1]	Control Equipment & Stack Numbers[2]
Indurating Furnace	EU026	SV014, SV015, SV016, SV017

2.3 The BART Determination

The MPCA's NO_X BART determination for this unit, as documented in Appendix 9.3 of the December 2009 Regional Haze SIP submittal, is good combustion practices, past installation of Low NO_X Burners in the preheat zone and implementation of furnace energy efficiency projects in early 2008. However, due to the lack of sufficient emissions data representing the range of operating conditions that influence emissions, the MPCA did not set an emission limit at the time of making the BART determination.

Instead, the MPCA and Arcelor entered into an Administrative Order, under which Arcelor provided additional NO_X emission information to the MPCA.

2.4 MPCA Determination of the BART Limit

The MPCA reviewed the NO_X emission information provided by Arcelor. The MPCA focused analysis on a set of 157 hourly NO_X emission data points collected in March 2008. Under the previously mentioned Administrative Order, Arcelor was required to collect "a minimum of 150 one-hour data points under the range of [furnace] operating parameters that influence NO_X emissions. The range of each operating parameter during testing should be representative of furnace's operating range for the parameters in the 12 months previous to testing." This requirement was to ensure that the emissions data collected was appropriately representative of the range of operating conditions for the furnace.
The data was collected through simultaneous testing of each of the four furnace stacks, and continuously measured data was used to calculate four 15-minute averages for each hour. Then, an hourly average level was calculated for each hour.

The process of calculating the BART limit for Arcelor's indurating furnace began by constructing a predictive interval and taking the upper prediction level.

[1] The MPCA organizes conditions and illustrates associations in its permits using the Emission Unit (EU), Control Equipment (CE), and Stack/Vent (SV) numbers.
[2] The indurating furnace has no control equipment for NO_X emissions.

The example calculation below shows the 99% upper prediction level:

$$\text{Mean of 30 data points} = \bar{X} + [1.604 \times \sigma \times \sqrt{(\frac{1}{30} + \frac{1}{157})}]$$

- Where $\bar{X}$ and σ are, respectively, the mean and standard deviation of the sample of 157 hourly-averaged NO_X data points in the 2008 testing;
- The value 2.604 is the 2-tail percentage point of the t-distribution with a level of significance of 0.01 and 156 degrees of freedom;
- $\sqrt{(\frac{1}{30} + \frac{1}{157})}$ is used to relate the sample sizes for the intended compliance test and the 2008 data set.

The table below shows the descriptive statistics for the sample data, taken during March 2008.

Arcelor Mittal NO_X Stack Test Values (in lbs/hour)	
# Data Points	157
Mean	994.1
St Dev	31.2
Max Value	1060.5
Min Value	909.4
99% Interval UPL	1010.3

The MPCA conducted additional analysis in order to help alleviate concerns that any one stack test, even an extended stack test, cannot capture all anticipated furnace operating conditions. This was done through the use of bootstrapping, a resampling technique designed to replicate the taking of multiple samples of the same size from a population. This technique uses the 157 data points as a representative population, from which multiple samples of 30 data points are drawn. A random number generator was used to select the hourly data points used in constructing each 30 data point sample. A total of 2000 sets of 30 hourly data points were generated. The mean of each 30 point data set was then used to make a new, larger, sample of 2000 data points to represent the overall "population" of potential emission levels. This was repeated several times, both in Excel and using the R statistical package.

Each of the surrogate populations thus created had a different standard error. Standard error is the standard deviation of a summary statistic, or a measure of the precision of the estimate. So, in essence, the variability of the standard error for each of these surrogate populations gives a sense of how much the sample mean may differ from the "true" or population mean. In the bootstrapping technique, the standard error of a 30 point data set built from the new surrogate population (built from the mean of each of 2000 randomly selected 30 data point sample sets) ranged from 5.670 to 9.269.

The MPCA then looked at this highest standard error, and used that standard error (*se*) and the mean of the original 157 data point sample to develop an additional 99% UPL. Because of the large number of data points, this was calculated with a z-statistic, rather than the t-statistic used above. The z-statistic at α = 0.01 is 2.576.

This calculation is: $\bar{X} + [2.576 \times se]$, which results in a value of 1018.0, which was proposed as the BART limit.

The MPCA also looked at emissions information from three-hour compliance stack tests conducted from 2000 through 2009. These data further support the BART limit, as all would have demonstrated compliance with the limit above.

Stack Test Date	Furnace Average Emission Rate (lbs/hr)
June 2000	853
February 2001	537
January 2002	821
June 2003	726
June 2005	756
June 2007	762
March/April 2009	812

These limits were placed on public comment, which raised two key issues. First was the use of the 99% UPL rather than a 95% interval . The second was the existence of autocorrelation in the data, which (if not taken into account) tends to result in an underestimation of variance and narrower confidence and predictive intervals; thus, inappropriately lower limits. We decided to take into account both comments, by moving to a 95% UPL and correcting the data for the autocorrelation.

It was assumed, for simplicity, that the autocorrelation exhibited was first order autocorrelation – that is, that each data point is related only to the data point immediately ahead of it. The following equation, developed by Box and Jenkins and taken from Gilbert, R. O. (1987) *Statistical Methods for Environmental Pollution Monitoring*, was used to estimate the magnitude of the autocorrelation coefficient:

$$\hat{\rho} = \sum_{t=1}^{n-1}(X_t - \bar{X})(X_{t+1} - \bar{X}) / \sum_{t=1}^{n}(X_t - \bar{X})^2$$

The equation $n_{eff} = \frac{n(1-\rho)}{(1+\rho)}$ was then used to calculate the "Effective n" [3] or the effective sample size based on the number of samples arising from the 150 hour stack test.

Using the equation above, the MPCA found the following autocorrelation coefficients for the Arcelor furnace to be 0.60. The autocorrelation coefficient was used to adjust the effective sample size for both the sample data and the proposed compliance test, as suggested by the commenter. Ultimately, this does result in higher UPLs. When coupled with the move to the 95% interval, the resulting emission limit does change dramatically.

After reviewing stack test data provided by ArcelorMittal, and conducting the analyses described above, the MPCA has determined that an appropriate BART NO_X limit is 1018.7 lbs/hour. This limit is for all four stacks from the indurating furnace combined, and is a 30-day rolling average.

Compliance is to be determined through NO_X performance testing, simultaneously measured for 30 hourly data points. The MPCA is requiring this longer stack testing in order to ensure that the sample is sufficiently representative and long enough to capture periods of both higher and lower emissions, in order to ensure compliance.

[3] http://www.climatescience.gov/Library/sap/sap1-1/third-draft/sap1-1-draft3-appA.pdf

Arcelor Mittal Mining - Data for NO_x BART Limit on Indurating Furnaces				
	Original Data	Correction		
Average	994.1	994.1		
St Dev	31.2	31.2		
Max	1060.5	1060.4		
Min	909.4	909.4		
Count	157	39		
$t_{0.05, c-1}$	1.98	2.02		
UPL 95%	1006.405	1018.654		
$t_{0.01, c-1}$	2.61	2.71		
UPL 99%	1010.341	1026.986		
Auto Correlation	0.6			
"Effective N"	39.3			
"Effective M"	7.5			

ID	Timestamp	NOx lbs/hour (Arcelor)	Sample Mean	Xt - Mean	Xt+1 - Mean	(Xt - Mean)(Xt+1-Mean)	(Xt - Mean)^2
1	3/12/08 0:30	1037.5	994.1	43.4	19.3	835.83	1884.97
2	3/12/08 1:30	1013.4	994.1	19.3	19.8	380.43	370.62
3	3/12/08 2:30	1013.9	994.1	19.8	32.5	642.47	390.50
4	3/12/08 3:30	1026.6	994.1	32.5	49.0	1592.60	1057.05
5	3/12/08 4:30	1043.1	994.1	49.0	54.7	2681.57	2399.49
6	3/12/08 5:30	1048.8	994.1	54.7	39.0	2134.53	2996.80
7	3/12/08 6:30	1033.1	994.1	39.0	12.4	484.01	1520.36
8	3/12/08 7:30	1006.5	994.1	12.4	-17.4	-215.74	154.09
9	3/12/08 8:30	976.7	994.1	-17.4	-20.2	350.59	302.05
10	3/12/08 9:30	973.9	994.1	-20.2	48.9	-987.24	406.93
11	3/12/08 10:30	1043.0	994.1	48.9	33.0	1612.77	2395.12
12	3/12/08 11:30	1027.1	994.1	33.0	7.2	236.65	1085.96
13	3/12/08 12:30	1001.3	994.1	7.2	7.0	50.41	51.57
14	3/12/08 13:30	1001.1	994.1	7.0	-10.4	-73.19	49.28
15	3/12/08 14:30	983.7	994.1	-10.4	-35.1	366.33	108.70
16	3/12/08 15:30	959.0	994.1	-35.1	-41.1	1445.01	1234.58
17	3/12/08 16:30	953.0	994.1	-41.1	-37.3	1533.45	1691.30
18	3/12/08 17:30	956.8	994.1	-37.3	-2.7	102.36	1390.34
19	3/13/08 0:30	991.4	994.1	-2.7	25.3	-69.48	7.54
20	3/13/08 1:30	1019.4	994.1	25.3	27.5	694.89	640.61
21	3/13/08 2:30	1021.6	994.1	27.5	12.7	349.55	753.77
22	3/13/08 3:30	1006.8	994.1	12.7	-7.4	-94.42	162.10
23	3/13/08 4:30	986.7	994.1	-7.4	-17.0	125.77	55.00
24	3/13/08 5:30	977.1	994.1	-17.0	-67.9	1150.85	287.59
25	3/13/08 6:30	926.2	994.1	-67.9	-10.6	719.14	4605.37
26	3/13/08 7:30	983.5	994.1	-10.6	4.6	-48.83	112.30
27	3/13/08 8:30	998.7	994.1	4.6	-0.8	-3.67	21.23
28	3/13/08 9:30	993.3	994.1	-0.8	-29.5	23.51	0.63
29	3/13/08 10:30	964.6	994.1	-29.5	-17.8	524.59	870.92
30	3/13/08 11:30	976.3	994.1	-17.8	1.1	-19.14	315.98
31	3/13/08 12:30	995.2	994.1	1.1	-17.7	-19.11	1.16
32	3/13/08 13:30	976.4	994.1	-17.7	-4.1	73.01	314.85
33	3/13/08 14:30	990.0	994.1	-4.1	-32.3	132.70	16.93
34	3/13/08 15:30	961.8	994.1	-32.3	-18.6	600.79	1040.16
35	3/13/08 16:30	975.5	994.1	-18.6	38.4	-716.23	347.01
36	3/13/08 17:30	1032.5	994.1	38.4	46.1	1774.23	1478.27
37	3/13/08 18:30	1040.2	994.1	46.1	46.1	2128.86	2129.44
38	3/13/08 19:30	1040.2	994.1	46.1	21.8	1005.89	2128.27
39	3/13/08 20:30	1015.9	994.1	21.8	13.3	289.69	475.42
40	3/13/08 21:30	1007.4	994.1	13.3	28.6	379.48	176.51
41	3/13/08 22:30	1022.7	994.1	28.6	66.4	1897.46	815.83
42	3/13/08 23:30	1060.5	994.1	66.4	27.2	1809.60	4413.15
43	3/14/08 0:30	1021.3	994.1	27.2	8.4	229.74	742.02
44	3/14/08 1:30	1002.5	994.1	8.4	10.1	85.05	71.13
45	3/14/08 2:30	1004.2	994.1	10.1	-0.4	-4.32	101.69
46	3/14/08 3:30	993.7	994.1	-0.4	-18.7	8.00	0.18
47	3/14/08 4:30	975.4	994.1	-18.7	-6.4	119.18	348.04
48	3/14/08 5:30	987.7	994.1	-6.4	17.1	-109.02	40.81
49	3/14/08 6:30	1011.2	994.1	17.1	41.6	710.50	291.21
50	3/14/08 7:30	1035.7	994.1	41.6	6.6	274.22	1733.53
51	3/14/08 8:30	1000.7	994.1	6.6	-5.4	-35.74	43.38

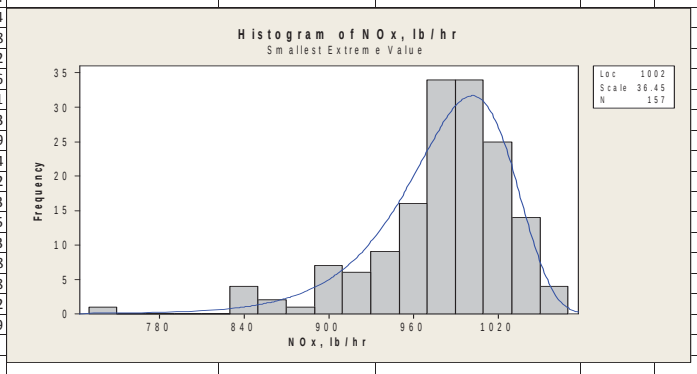
52	3/14/08 9:30	988.7	994.1	-5.4	-58.9	319.80	29.45
53	3/14/08 10:30	935.2	994.1	-58.9	-16.2	953.07	3472.63
54	3/14/08 11:30	977.9	994.1	-16.2	-36.0	581.73	261.57
55	3/14/08 18:45	958.1	994.1	-36.0	-17.8	639.60	1293.75
56	3/14/08 19:45	976.3	994.1	-17.8	-79.0	1404.74	316.21
57	3/17/08 14:45	915.1	994.1	-79.0	-18.9	1491.18	6240.54
58	3/17/08 15:45	975.2	994.1	-18.9	48.2	-909.45	356.32
59	3/17/08 16:45	1042.3	994.1	48.2	43.8	2109.85	2321.20
60	3/17/08 17:45	1037.9	994.1	43.8	41.3	1809.01	1917.75
61	3/17/08 18:45	1035.4	994.1	41.3	51.1	2112.48	1706.44
62	3/17/08 19:45	1045.2	994.1	51.1	-7.4	-380.74	2615.13
63	3/17/08 20:45	986.7	994.1	-7.4	15.3	-114.04	55.43
64	3/18/08 10:45	1009.4	994.1	15.3	49.0	750.61	234.61
65	3/18/08 11:45	1043.1	994.1	49.0	34.1	1671.82	2401.54
66	3/18/08 12:45	1028.2	994.1	34.1	59.9	2042.80	1163.83
67	3/18/08 13:45	1054.0	994.1	59.9	43.7	2616.37	3585.63
68	3/18/08 14:45	1037.8	994.1	43.7	7.0	304.25	1909.12
69	3/18/08 15:45	1001.1	994.1	7.0	10.8	74.87	48.49
70	3/18/08 16:45	1004.9	994.1	10.8	24.6	264.14	115.61
71	3/18/08 17:45	1018.7	994.1	24.6	-80.7	-1982.07	603.51
72	3/18/08 18:45	913.4	994.1	-80.7	-84.7	6834.35	6509.62
73	3/18/08 19:45	909.4	994.1	-84.7	-43.6	3689.12	7175.28
74	3/18/08 20:45	950.5	994.1	-43.6	-13.9	605.22	1896.73
75	3/18/08 21:45	980.2	994.1	-13.9	13.7	-190.62	193.11
76	3/18/08 22:45	1007.8	994.1	13.7	0.9	11.77	188.15
77	3/18/08 23:45	995.0	994.1	0.9	-8.7	-7.43	0.74
78	3/19/08 0:45	985.4	994.1	-8.7	16.4	-142.23	74.99
79	3/19/08 1:45	1010.5	994.1	16.4	57.1	938.05	269.77
80	3/19/08 2:45	1051.2	994.1	57.1	33.4	1906.03	3261.78
81	3/19/08 3:45	1027.5	994.1	33.4	46.5	1551.66	1113.80
82	3/19/08 4:45	1040.6	994.1	46.5	12.6	585.63	2161.64
83	3/19/08 5:45	1006.7	994.1	12.6	-2.1	-26.74	158.66
84	3/19/08 6:45	992.0	994.1	-2.1	24.9	-52.94	4.51
85	3/19/08 7:45	1019.0	994.1	24.9	4.1	101.67	621.95
86	3/19/08 8:45	998.2	994.1	4.1	-19.9	-81.09	16.62
87	3/19/08 9:45	974.2	994.1	-19.9	-13.7	273.08	395.61
88	3/19/08 10:45	980.4	994.1	-13.7	-24.3	333.86	188.50
89	3/19/08 11:45	969.8	994.1	-24.3	31.9	-774.69	591.34
90	3/19/08 12:45	1026.0	994.1	31.9	26.8	852.58	1014.88
91	3/19/08 13:45	1020.9	994.1	26.8	20.7	553.00	716.24
92	3/19/08 14:45	1014.8	994.1	20.7	6.0	123.54	426.97
93	3/19/08 15:45	1000.1	994.1	6.0	-12.2	-73.06	35.74
94	3/19/08 16:45	981.9	994.1	-12.2	-12.0	146.62	149.35
95	3/19/08 17:45	982.1	994.1	-12.0	-3.4	40.62	143.94
96	3/19/08 18:45	990.7	994.1	-3.4	7.8	-26.36	11.46
97	3/19/08 19:45	1001.9	994.1	7.8	1.0	7.89	60.61
98	3/19/08 20:45	995.1	994.1	1.0	-41.5	-42.06	1.03
99	3/19/08 21:45	952.6	994.1	-41.5	-60.3	2505.11	1724.39
100	3/19/08 22:45	933.8	994.1	-60.3	-61.9	3733.36	3639.30
101	3/19/08 23:45	932.2	994.1	-61.9	3.7	-227.14	3829.86
102	3/20/08 0:45	997.8	994.1	3.7	29.8	109.49	13.47
103	3/20/08 1:45	1023.9	994.1	29.8	22.1	657.81	889.90
104	3/20/08 2:45	1016.2	994.1	22.1	-6.7	-148.40	486.25
105	3/20/08 3:45	987.4	994.1	-6.7	-15.5	104.14	45.29

106	3/20/08 4:45	978.6	994.1	-15.5	-15.5	239.69	239.47
107	3/20/08 5:45	978.6	994.1	-15.5	27.5	-425.85	239.92
108	3/20/08 6:45	1021.6	994.1	27.5	22.9	629.57	755.88
109	3/20/08 7:45	1017.0	994.1	22.9	26.2	599.98	524.37
110	3/20/08 8:45	1020.3	994.1	26.2	34.5	905.20	686.51
111	3/20/08 9:45	1028.6	994.1	34.5	1.7	58.05	1193.55
112	3/20/08 10:45	995.8	994.1	1.7	-17.9	-30.15	2.82
113	3/20/08 11:45	976.2	994.1	-17.9	26.2	-469.97	322.10
114	3/20/08 12:45	1020.3	994.1	26.2	37.5	982.35	685.73
115	3/20/08 13:45	1031.6	994.1	37.5	-13.5	-507.01	1407.28
116	3/20/08 14:45	980.6	994.1	-13.5	-57.6	778.39	182.67
117	3/20/08 15:45	936.5	994.1	-57.6	-60.2	3467.54	3316.92
118	3/20/08 16:45	933.9	994.1	-60.2	-80.7	4861.18	3624.99
119	3/20/08 17:45	913.4	994.1	-80.7	-63.1	5093.55	6518.94
120	3/20/08 18:45	931.0	994.1	-63.1	-30.3	1909.74	3979.83
121	3/20/08 19:45	963.8	994.1	-30.3	-10.2	308.34	916.40
122	3/20/08 20:45	983.9	994.1	-10.2	-27.9	283.77	103.75
123	3/20/08 21:45	966.2	994.1	-27.9	-16.0	445.74	776.14
124	3/20/08 22:45	978.1	994.1	-16.0	-20.4	326.75	255.99
125	3/20/08 23:45	973.7	994.1	-20.4	-18.1	370.63	417.08
126	3/21/08 0:45	976.0	994.1	-18.1	0.2	-3.93	329.35
127	3/21/08 1:45	994.3	994.1	0.2	12.6	2.73	0.05
128	3/21/08 2:45	1006.7	994.1	12.6	-24.8	-311.21	158.01
129	3/21/08 3:45	969.3	994.1	-24.8	17.5	-432.44	612.94
130	3/21/08 4:45	1011.6	994.1	17.5	11.3	197.43	305.09
131	3/21/08 5:45	1005.4	994.1	11.3	-36.3	-410.54	127.76
132	3/21/08 6:45	957.8	994.1	-36.3	9.8	-357.30	1319.21
133	3/21/08 7:45	1003.9	994.1	9.8	-6.7	-65.69	96.77
134	3/21/08 8:45	987.4	994.1	-6.7	14.2	-94.71	44.60
135	3/21/08 9:45	1008.3	994.1	14.2	-3.1	-43.43	201.14
136	3/21/08 10:45	991.0	994.1	-3.1	-23.8	72.80	9.38
137	3/21/08 11:45	970.3	994.1	-23.8	-14.9	354.35	565.17
138	3/21/08 12:45	979.2	994.1	-14.9	-11.3	167.83	222.17
139	3/21/08 13:45	982.8	994.1	-11.3	-48.5	546.27	126.78
140	3/21/08 14:45	945.6	994.1	-48.5	-56.6	2745.54	2353.81
141	3/21/08 15:45	937.5	994.1	-56.6	-25.6	1446.99	3202.48
142	3/21/08 16:45	968.5	994.1	-25.6	16.8	-430.14	653.80
143	3/21/08 17:45	1010.9	994.1	16.8	10.2	172.39	282.99
144	3/21/08 18:45	1004.3	994.1	10.2	-21.3	-218.49	105.02
145	3/21/08 19:45	972.8	994.1	-21.3	-4.8	103.27	454.56
146	3/21/08 20:45	989.3	994.1	-4.8	12.3	-59.56	23.46
147	3/21/08 21:45	1006.4	994.1	12.3	15.9	195.83	151.19
148	3/21/08 22:45	1010.0	994.1	15.9	9.4	149.57	253.66
149	3/21/08 23:45	1003.5	994.1	9.4	6.2	58.56	88.19
150	3/22/08 0:45	1000.3	994.1	6.2	-9.8	-61.14	38.88
151	3/22/08 1:45	984.3	994.1	-9.8	-26.4	259.25	96.12
152	3/22/08 2:45	967.7	994.1	-26.4	-21.7	573.78	699.26
153	3/22/08 3:45	972.4	994.1	-21.7	7.9	-170.39	470.82
154	3/22/08 4:45	1002.0	994.1	7.9	-5.1	-40.34	61.67
155	3/22/08 5:45	989.0	994.1	-5.1	17.2	-88.33	26.39
156	3/22/08 6:45	1011.3	994.1	17.2	-3.4	-59.07	295.61
157	3/22/08 7:45	990.7	994.1	-3.4	0.0	0.00	11.80
	Average	994.1				90818.83	152230.41

					Autocorrelatic	0.60	
	MPCA "Multiplier"	0.1993	Effective N	39.6694			
	Effective N Multiplier	0.2420	Stack Test Size	7.58014			

Arcelor Mittal Mining - Data for NO_X BART Limit on Indurating Furnaces								
ID	Timestamp	NOx lbs/hour (Arcelor)	NOx lbs/hour (MPCA)					
1	3/12/08 0:30	1037.5	1037.4		**Descriptive Statistics**			
2	3/12/08 1:30	1013.4	1013.2		Arcelor Data			
3	3/12/08 2:30	1013.9	1013.7	**Average**	994.1			
4	3/12/08 3:30	1026.6	1026.5	**St Dev**	31.2			
5	3/12/08 4:30	1043.1	1042.9	**Max**	1060.5			
6	3/12/08 5:30	1048.8	1048.7	**Min**	909.4			
7	3/12/08 6:30	1033.1	1033.0	$t_{0.05,\ c\text{-}1}$	1.975			
8	3/12/08 7:30	1006.5	1006.4	**UPL 95%**	1006.405			
9	3/12/08 8:30	976.7	976.6	$t_{0.01,\ c\text{-}1}$	2.608			
10	3/12/08 9:30	973.9	973.8	**UPL 99%**	1010.340			
11	3/12/08 10:30	1043.0	1042.9					
12	3/12/08 11:30	1027.1	1026.9					
13	3/12/08 12:30	1001.3	912.5	**Supporting Data from Compliance Tests**				
14	3/12/08 13:30	1001.1	838.9	**Test Date and Time**	**Stack and Run**	**NO_X Emission Rate, lbs/hr**		
15	3/12/08 14:30	983.7	983.5	June 2000	Furnace Average	853.0		
16	3/12/08 15:30	959.0	958.8		Stack A			
17	3/12/08 16:30	953.0	952.8	06/27/01 0830-1015	Run 1	144.5		
18	3/12/08 17:30	956.8	894.0	06/27/01 1105-1213	Run 2	145.3		
19	3/13/08 0:30	991.4	991.2	06/27/01 1305-1412	Run 3	154.8		
20	3/13/08 1:30	1019.4	1019.3		Stack B			
21	3/13/08 2:30	1021.6	1021.4	06/27/01 0830-1015	Run 1	176.7		
22	3/13/08 3:30	1006.8	1006.7	06/27/01 1105-1213	Run 2	213.8		
23	3/13/08 4:30	986.7	986.6	06/27/01 1305-1412	Run 3	181.8		
24	3/13/08 5:30	977.1	977.0		Stack C			
25	3/13/08 6:30	926.2	926.1	06/27/01 0830-1015	Run 1	218.3		
26	3/13/08 7:30	983.5	983.4	06/27/01 1105-1213	Run 2	218.5		
27	3/13/08 8:30	998.7	998.6	06/27/01 1305-1412	Run 3	222.7		
28	3/13/08 9:30	993.3	993.2		Stack D			
29	3/13/08 10:30	964.6	964.5	06/27/01 0830-1015	Run 1	301.1		
30	3/13/08 11:30	976.3	732.1	06/27/01 1105-1213	Run 2	283.4		
31	3/13/08 12:30	995.2	995.0	06/27/01 1305-1412	Run 3	297.8		
32	3/13/08 13:30	976.4	976.2					
33	3/13/08 14:30	990.0	989.9	February 2001	Furnace Average	537.0		
34	3/13/08 15:30	961.8	961.7		Stack A			
35	3/13/08 16:30	975.5	975.3	02/15/01 0915-1015	Run 1	42.9		
36	3/13/08 17:30	1032.5	1032.4	02/15/01 1030-1130	Run 2	33.0		
37	3/13/08 18:30	1040.2	1036.8	02/15/01 1145-1245	Run 3	32.9		
38	3/13/08 19:30	1040.2	1002.2		Stack B			
39	3/13/08 20:30	1015.9	1012.4	02/15/01 0915-1015	Run 1	94.7		
40	3/13/08 21:30	1007.4	1007.3	02/15/01 1030-1130	Run 2	60.6		
41	3/13/08 22:30	1022.7	1022.5	02/15/01 1145-1245	Run 3	61.9		
42	3/13/08 23:30	1060.5	1060.4		Stack C			
43	3/14/08 0:30	1021.3	1021.2	02/15/01 0915-1015	Run 1	190.7		
44	3/14/08 1:30	1002.5	1002.4	02/15/01 1030-1130	Run 2	206.8		
45	3/14/08 2:30	1004.2	1004.1	02/15/01 1145-1245	Run 3	170.8		
46	3/14/08 3:30	993.7	993.5		Stack D			
47	3/14/08 4:30	975.4	975.3	02/15/01 0915-1015	Run 1	215.2		
48	3/14/08 5:30	987.7	987.6	02/15/01 1030-1130	Run 2	244.9		
49	3/14/08 6:30	1011.2	1011.0	02/15/01 1145-1245	Run 3	256.4		
50	3/14/08 7:30	1035.7	948.1					
51	3/14/08 8:30	1000.7	835.4	January 2002	Furnace Average	821		
52	3/14/08 9:30	988.7	899.5		Stack A			
53	3/14/08 10:30	935.2	935.0	1/23/2002 1040 - 1139	Run 1	109.1		
54	3/14/08 11:30	977.9	977.8	1/23/2002 1147 - 1246	Run 2	110.0		
55	3/14/08 18:45	958.1	958.0	1/23/2002 1255 - 1354	Run 3	116.2		
56	3/14/08 19:45	976.3	976.2		Stack B			
57	3/17/08 14:45	915.1	915.0	1/23/2002 0710 - 0809	Run 1	150.9		
58	3/17/08 15:45	975.2	975.1	1/23/2002 0819 - 1918	Run 2	148.4		
59	3/17/08 16:45	1042.3	1042.1	1/23/2002 0927 - 1026	Run 3	146.5		
60	3/17/08 17:45	1037.9	1037.8		Stack C			
61	3/17/08 18:45	1035.4	1035.3	1/22/2002 1320 - 1419	Run 1	224.9		
62	3/17/08 19:45	1045.2	1045.1	1/22/2002 1428 - 1527	Run 2	222.3		
63	3/17/08 20:45	986.7	960.4	1/22/2002 1534 - 1633	Run 3	233.1		
64	3/18/08 10:45	1009.4	1053.9		Stack D			
65	3/18/08 11:45	1043.1	1043.0	1/22/2002 0900 - 0959	Run 1	323.2		
66	3/18/08 12:45	1028.2	1023.5	1/22/2002 1017 - 1116	Run 2	330.6		
67	3/18/08 13:45	1054.0	1053.8	1/22/2002 1138 - 1237	Run 3	348.5		
68	3/18/08 14:45	1037.8	1037.7					
69	3/18/08 15:45	1001.1	1000.9	June 2003	Furnace Average	726		
70	3/18/08 16:45	1004.9	1004.7		Stack A			
71	3/18/08 17:45	1018.7	1018.5	6/24/2003 0810 - 0910	Run 1	110.2		
72	3/18/08 18:45	913.4	832.0	6/24/2003 1330 - 1430	Run 2	116.7		
73	3/18/08 19:45	909.4	909.3	6/24/2003 1450 - 1550	Run 3	112.1		
74	3/18/08 20:45	950.5	950.4		Stack B			
75	3/18/08 21:45	980.2	980.1	6/24/2003 0810 - 0910	Run 1	137.5		
76	3/18/08 22:45	1007.8	1007.7	6/24/2003 1330 - 1430	Run 2	127.1		
77	3/18/08 23:45	995.0	994.8	6/24/2003 1450 - 1550	Run 3	126.5		
78	3/19/08 0:45	985.4	985.3		Stack C			
79	3/19/08 1:45	1010.5	1010.4	6/24/2003 0810 - 0910	Run 1	189.8		
80	3/19/08 2:45	1051.2	1051.1	6/24/2003 1330 - 1430	Run 2	190.8		
81	3/19/08 3:45	1027.5	1027.3	6/24/2003 1450 - 1550	Run 3	199.1		
82	3/19/08 4:45	1040.6	1040.5		Stack D			
83	3/19/08 5:45	1006.7	1006.6	6/24/2003 0810 - 0910	Run 1	294.0		
84	3/19/08 6:45	992.0	991.8	6/24/2003 1330 - 1430	Run 2	284.2		

85	3/19/08 7:45	1019.0	863.8	6/24/2003 1450 - 1550	Run 3	289.6		
86	3/19/08 8:45	998.2	900.7					
87	3/19/08 9:45	974.2	942.1	June 2005	Furnace Average	756		
88	3/19/08 10:45	980.4	980.2		Stack A			
89	3/19/08 11:45	969.8	969.7	6/28/2005 0810 - 0910	Run 1	113.4		
90	3/19/08 12:45	1026.0	1025.8	6/28/2005 0935 - 1035	Run 2	104.2		
91	3/19/08 13:45	1020.9	1020.7	6/28/2008 1045 - 1145	Run 3	106.2		
92	3/19/08 14:45	1014.8	1014.6		Stack B			
93	3/19/08 15:45	1000.1	999.9	6/28/2005 1210 - 1310	Run 1	137.7		
94	3/19/08 16:45	981.9	978.7	6/28/2005 1325 - 1425	Run 2	140.2		
95	3/19/08 17:45	982.1	982.0	6/28/2005 1440 - 1540	Run 3	138.8		
96	3/19/08 18:45	990.7	990.6		Stack C			
97	3/19/08 19:45	1001.9	1001.8	6/29/2005 0750 - 0850	Run 1	221.5		
98	3/19/08 20:45	995.1	995.0	6/29/2005 0905 -1005	Run 2	215.8		
99	3/19/08 21:45	952.6	952.4	6/29/2005 1020 - 1120	Run 3	207.2		
100	3/19/08 22:45	933.8	933.6		Stack D			
101	3/19/08 23:45	932.2	898.5	6/29/2005 1140 - 1240	Run 1	293.6		
102	3/20/08 0:45	997.8	997.6	6/29/2005 1255 - 1355	Run 2	303.3		
103	3/20/08 1:45	1023.9	1023.8	6/29/2005 1410 - 1510	Run 3	301.1		
104	3/20/08 2:45	1016.2	1016.0					
105	3/20/08 3:45	987.4	987.2	June 2007	Furnace Average	762		
106	3/20/08 4:45	978.6	978.5		Stack A			
107	3/20/08 5:45	978.6	978.5	6/19/2007 0955 - 1104	Run 1	102.5		
108	3/20/08 6:45	1021.6	1021.5	6/19/2007 1140 - 1253	Run 2	100.1		
109	3/20/08 7:45	1017.0	861.4	6/19/2007 1322 - 1428	Run 3	100.7		
110	3/20/08 8:45	1020.3	921.4		Stack B			
111	3/20/08 9:45	1028.6	1028.5	6/19/2007 1504 - 1609	Run 1	127.5		
112	3/20/08 10:45	995.8	995.6	6/19/2007 1635 - 1739	Run 2	131.7		
113	3/20/08 11:45	976.2	976.0	6/19/2007 1800 - 1904	Run 3	130.8		
114	3/20/08 12:45	1020.3	1020.2		Stack C			
115	3/20/08 13:45	1031.6	1007.0	6/20/2007 0610 - 0715	Run 1	199.9		
116	3/20/08 14:45	980.6	912.9	6/20/2007 0740 - 0845	Run 2	210.4		
117	3/20/08 15:45	936.5	936.4	6/20/2007 0914 - 1014	Run 3	231.4		
118	3/20/08 16:45	933.9	933.8	6/20/2007 1051 - 1154	Run 4	201.5		
119	3/20/08 17:45	913.4	871.7		Stack D			
120	3/20/08 18:45	931.0	903.9	6/20/2007 1305 - 1412	Run 1	268.4		
121	3/20/08 19:45	963.8	936.5	6/20/2007 1444 - 1547	Run 2	270.4		
122	3/20/08 20:45	983.9	983.8	6/20/2007 1612 - 1717	Run 3	276.9		
123	3/20/08 21:45	966.2	966.1					
124	3/20/08 22:45	978.1	978.0	March/April 2009	Furnace Average	812		
125	3/20/08 23:45	973.7	973.5		Stack A			
126	3/21/08 0:45	976.0	975.8	3/31/2009 1015	Run 1	139.0		
127	3/21/08 1:45	994.3	994.2	3/31/2009 1249	Run 2	148.0		
128	3/21/08 2:45	1006.7	1006.5	4/1/2009 1248	Run 3	135.2		
129	3/21/08 3:45	969.3	969.2		Stack B			
130	3/21/08 4:45	1011.6	1011.4	4/1/2009 1435	Run 1	150.5		
131	3/21/08 5:45	1005.4	1005.3	4/1/2009 1600	Run 2	152.0		
132	3/21/08 6:45	957.8	957.7	4/1/2009 1704	Run 3	155.5		
133	3/21/08 7:45	1003.9	1003.8		Stack C			
134	3/21/08 8:45	987.4	839.8	4/2/2009 829	Run 1	235.0		
135	3/21/08 9:45	1008.3	907.8	4/2/2009 932	Run 2	231.6		
136	3/21/08 10:45	991.0	961.3	4/2/2009 1100	Run 3	236.1		
137	3/21/08 11:45	970.3	970.2		Stack D			
138	3/21/08 12:45	979.2	979.1	4/2/2009 1249	Run 1	283.8		
139	3/21/08 13:45	982.8	982.7	4/2/2009 1425	Run 2	281.0		
140	3/21/08 14:45	945.6	945.5	4/2/2009 1500	Run 3	288.4		
141	3/21/08 15:45	937.5	937.4					
142	3/21/08 16:45	968.5	968.4					
143	3/21/08 17:45	1010.9	1010.8					
144	3/21/08 18:45	1004.3	1004.2					
145	3/21/08 19:45	972.8	972.6					
146	3/21/08 20:45	989.3	989.1					
147	3/21/08 21:45	1006.4	1006.3					
148	3/21/08 22:45	1010.0	1009.9					
149	3/21/08 23:45	1003.5	1003.4					
150	3/22/08 0:45	1000.3	1000.2					
151	3/22/08 1:45	984.3	961.3					
152	3/22/08 2:45	967.7	967.5					
153	3/22/08 3:45	972.4	972.3					
154	3/22/08 4:45	1002.0	1001.8					
155	3/22/08 5:45	989.0	988.8					
156	3/22/08 6:45	1011.3	1011.2					
157	3/22/08 7:45	990.7	911.9					



Note: Arcelor determined some data was invalid. The MPCA re-included this data in some calculations, but chose to set the BART limit based on the data determined to be valid by Arcelor.

DEPARTMENT: POLLUTION CONTROL AGENCY

STATE OF MINNESOTA
Office Memorandum

DATE: April 4, 2012

TO: AQD File No. 541
(Delta ID No. 13700061)

FROM: Hongming Jiang
Air Quality Permits Section
Industrial Division

Catherine Neuschler
Air Assessment and Environmental Data Management Section
Environmental Analysis and Outcomes Division

PHONE: 651-757-2467

651-757-2607

SUBJECT: Nitrogen Oxides BART Limits for Hibbing Taconite Company (HTC)

This memo was prepared to provide the documentation of the MPCA's NO_X BART limit determination based on the technical review performed by MPCA staff. EPA's approval of the Regional Haze State Implementation Plan (SIP) for Minnesota is needed for the MPCA's BART determination to become effective.

1. General Information

1.1 Applicant and Stationary Source Location:

Applicant/Mailing Address	Stationary Source (SIC: **1011**)/Address
P.O. Box 589 Hibbing, MN 55746	Highway 5 North, Fire Number 4590 Hibbing, MN 55746, St. Louis County
Contact: Ms. Julie Lucas; Phone: (218) 262-6856	

1.2 Description of the Facility

Hibbing Taconite Company (HTC) is a taconite (magnetite) ore mining and beneficiation facility located in Hibbing, Minnesota. HTC is owned by ArcelorMittal, Cliffs Natural Resources, and US Steel; Cliffs Natural Resources is the managing agent.

The major steps in taconite pellet production include taconite ore mining, crushing, grinding, concentrating, agglomerating, and indurating. The larger sources of air emissions at HTC are from the mining activities and indurating furnace operations, with lesser amounts from other processing operations and fugitive dust sources, including haul roads and the tailings basin.

The facility was constructed in two phases. Phase I included two Dravo-Lurgi straight grate indurating furnaces. Construction of the phase began in 1974 and operation began in 1976. A third Dravo-Lurgi straight grate indurating furnace was added in Phase II. Construction of Phase II began in 1976, with operation beginning in 1979.

The three pellet indurating furnaces are functionally equivalent. The average production of the three furnaces is roughly equivalent. While the facility is capable of producing 9 million dry long tons annually, it reached its maximum in 1988 when it produced in excess of 8.6 million dry long tons. HTC's pelletizing furnaces are currently controlled by wet scrubbers primarily to remove particulate matter.

HTC started operation in 1976 with the flexibility to use natural gas or fuel oil (all grades). All three furnaces started operation with fuel oil No. 6 (Bunker C) as the primary fuel and were then switched over to natural gas as the primary fuel during 1981. (In the recent past, the facility evaluated other fuels including wood and oat hulls.)

2. Regulatory and/or Statutory Basis

2.1 Overview of Visibility, Regional Haze, and Best Available Retrofit Technology Program

The U.S. EPA's 1999 Regional Haze Rule singles out certain older emission sources that have not been regulated under other provisions of the Clean Air Act for additional controls. The MPCA is required to determine Best Available Retrofit Technology (BART) for these older sources that contribute to visibility impairment in Class I Areas to install Best Available Retrofit Technology (BART). On July 6, 2005, U.S. EPA published a revised final rule, including 40 CFR 51, Appendix Y "Guidelines for BART Determinations Under the Regional Haze Rule" which provides direction for determining which older sources may need to install BART and for determining BART.

The MPCA is required to determine BART for each source subject to BART based on an analysis of the best system of continuous emission control technology available and associated emission reductions achievable. The analysis must take into consideration the technology available, the costs of compliance, the energy and non-air quality environmental impacts, any pollution control equipment in use at the source, the remaining useful life of the source, and the degree of improvement in visibility which may reasonably be anticipated to result from use of the technology.

Further discussion of the regulatory basis for this determination can be found in the MPCA's December 2009 Regional Haze State Implementation Plan submittal, in Appendix 9.3.

2.2 Affected Units

The units for which the MPCA must determine BART and establish a NO_X BART limit consistent with that determination are:

Emission Unit Name	EU Number	Control Equipment and Stack Numbers
Line 1 Pelletizing Furnace	EU020	SV021, SV022, SV023, SV024
Line 2 Pelletizing Furnace	EU021	SV025, SV026, SV027, SV028
Line 3 Pelletizing Furnace	EU022	SV029, SV030, SV031, SV032

2.3 The BART Determination

The MPCA's NO_X BART determination for this unit, as documented in Appendix 9.3 of the December 2009 Regional Haze SIP submittal, is good combustion practices and implementation of furnace energy efficiency projects in 2005 and 2006. However, due to the lack of sufficient emissions data representing the range of operating conditions that influence emissions, the MPCA did not set an emission limit at the time of making the BART determination.

Instead, the MPCA and HTC entered into an Administrative Order, under which HTC provided additional NO_X emission information to the MPCA.

2.4 MPCA Determination of the BART Limit

The MPCA reviewed the NO_X emission information provided by HTC. Extensive stack tests were conducted using Method 7E. Initial stack tests were conducted in 2007 and 2008, and covered the entire range of the plant's operating conditions. Stack tests conducted in 2010 (July, October, November, December) were split to reflect the plant's two main operating conditions: producing standard pellets and producing high compression pellets.

Under the previously mentioned Administrative Order, HTC was required to collect "a minimum of 150 one-hour data points under the range of [furnace] operating parameters that influence NO_X emissions. The range of each operating parameter during testing should be representative of furnace's operating range for the parameters in the 12 months previous to testing." This requirement was to ensure that the emissions data collected was appropriately representative of the range of operating conditions for the furnace.

The data was collected through simultaneous testing of each of the four furnace stacks at each furnace, and continuously measured data was used to calculate four 15-minute averages for each hour. Then, an hourly average level was calculated for each hour. The process of calculating the BART limit for HTC's indurating furnaces began by constructing a 99% predictive interval and taking the upper prediction level.

The example calculation is below:

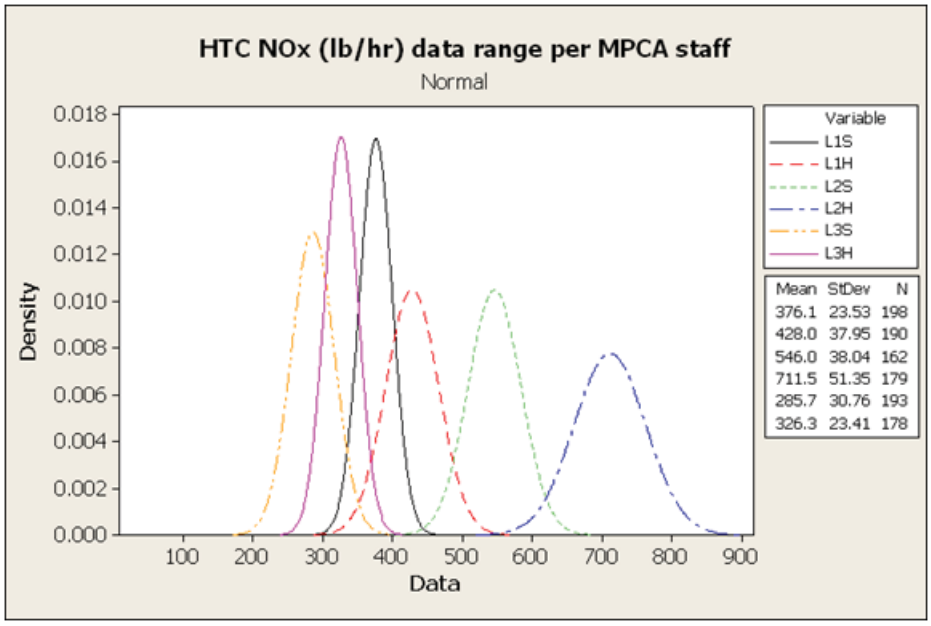
$$\text{Mean of 30 data points} = \bar{X} + [t - stat \times \sigma \times \sqrt{(\frac{1}{30} + \frac{1}{count})}]$$

- Where $\bar{X}$ and σ are, respectively, the mean and standard deviation of the sample of hourly-averaged NO_X data points;
- The t-stat is the 2-tail percentage point of the t-distribution with a level of significance of 0.01 and the appropriate degrees of freedom; and
- $\sqrt{(\frac{1}{30} + \frac{1}{count})}$ is used to relate the sample sizes for the intended compliance test and the sample data set.

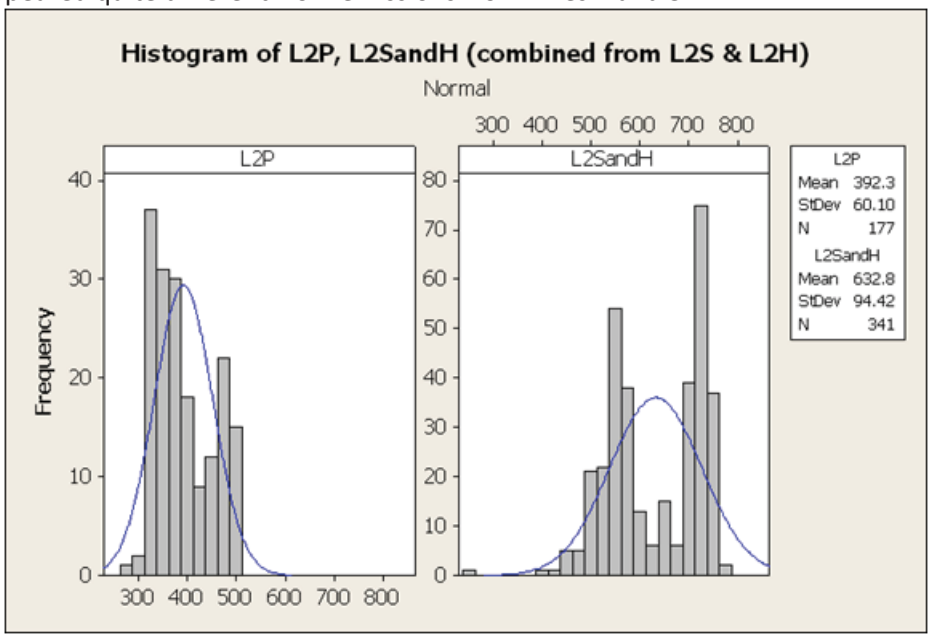
The table below shows the descriptive statistics for the sample data. The MPCA's review focused on the 2010 data. In addition, MPCA staff reviewed the earlier stack test data from 2007 and 2008, and looked at the difference in emissions between the furnaces, as the three furnaces are extremely similar.

Hibbing Taconite NO_X Stack Test Values (in lbs/hour)						
	Line 1		Line 2		Line 3	
	Standard	High Comp	Standard	High Comp	Standard	High Comp
2007/2008 Tests						
# Data Points	162		177		156	
Mean	406.4		392.3		315.5	
St Dev	39.00		60.10		39.54	
Max Value	479.3		510.5		366.4	
Min Value	321.9		268.2		113.1	
2010 Stack Tests						
# Data Points	198	190	162	179	193	178
Mean	376.1	428.0	546.0	711.5	285.7	326.3
St Dev	23.53	37.95	38.0	51.35	30.76	23.41
Max Value	423.2	470.8	630.7	765.2	310.6	355.8
Min Value	275.7	208.0	437.1	249.0	42.2	135.0
99% Interval UPL	**388.1**	**447.4**	**565.7**	**737.8**	**301.4**	**338.3**

A review of the data showed that the data from Line 1 and Line 3 were relatively consistent through the two different tests, and that the data from these furnaces were relatively similar to each other, as shown in the graph below.



However, as shown in the graph below, emissions from Line 2 were very different in the 2010 test from the previous 2007 test, and also appeared quite different from emissions from Lines 1 and 3.



Therefore, the MPCA took a much closer look at the data from Line 2. The combustion chambers on the furnaces at Hibbing Taconite have been modified to add a gas-fired burner at the lower part of the chamber (a vertically placed cylindrical body; two chambers per furnace line). Although the original top burner remains to facilitate oil-firing in case of natural gas curtailment, the MPCA believes that using the lower burner is the main operating scenario. The benefit of using the lower burner, when firing with natural gas, is a slight fuel saving with an apparent reduction in NO_X formation and emissions. Based on the data, it appears that the two sets of data from Line 2 may result from different burner management or operation.

Because of the discrepancy in the data, the MPCA believes that CEMS are necessary to monitor emissions on Line 2 in order to most accurately characterize the emissions. However, the MPCA needs to set a BART limit at this time. Because the initial Line 2 data appears to be closer to a standard operating condition for these units, the MPCA chose to set the

limit for Line 2 based on the 99% UPL of all data from Line 2 – both the 2007 and 2010 stack test data. Because Line 2 will eventually be using CEMs data for compliance, using the formula to relate the sample sizes for the intended compliance test and the sample data set includes a total of 720 data point for the intended compliance test – 30 days of 24 hourly data points. Also, because the sample size including all the data is large (over 300 data points) a z statistic was used rather than a t-statistic. The resulting equation is:

$$\text{Mean of 720 data points} = \bar{X} + [z - stat \times \sigma \times \sqrt{(\frac{1}{720} + \frac{1}{count})}]$$

For Line 1 and Line 3, the MPCA conducted additional analysis in order to help alleviate concerns that any one stack test, even an extended stack test, cannot capture all anticipated furnace operating conditions. This was done through the use of bootstrapping, a resampling technique designed to replicate the taking of multiple samples of the same size from a population.

This technique uses the sample data points as a representative population, from which multiple samples of 30 data points are drawn. A random number generator was used to select the hourly data points used in constructing each 30 data point sample. A total of 2000 sets of 30 hourly data points were generated. The mean of each 30 point data set was then used to make a new, larger, sample of 2000 data points to represent the overall "population" of potential emission levels. This was repeated several times. Each of the surrogate populations thus created had a different standard error. Standard error is the standard deviation of a summary statistic, or a measure of the precision of the estimate. So, in essence, the variability of the standard error for each of these surrogate populations gives a sense of how much the sample mean may differ from the "true" or population mean.

The MPCA then looked at this highest standard error, and used that standard error (*se*) and the mean of the original data point sample to develop an additional 99% UPL. The bootstrap analysis for each line resulted in very similar emission limits, so the MPCA chose to use the classic prediction method, which resulted in the following proposed limits, as a 30-day rolling average:

Unit	BART NO_X Limit (lbs/hr)
Line 1 Indurating Furnace	447.4
Line 2 Indurating Furnace	571.7
Line 3 Indurating Furnace	338.3

These limits were placed on public comment, which raised two key issues. First was the use of the 99% UPL rather than a 95% interval . The second was the existence of autocorrelation in the data, which (if not taken into account) tends to result in an underestimation of variance and narrower confidence and predictive intervals; thus, inappropriately lower limits. We decided to take into account both comments, by moving to a 95% UPL and correcting the data for the autocorrelation.

It was assumed, for simplicity, that the autocorrelation exhibited was first order autocorrelation – that is, that each data point is related only to the data point immediately ahead of it. The following equation, developed by Box and Jenkins and taken from Gilbert, R. O. (1987) *Statistical Methods for Environmental Pollution Monitoring*, was used to estimate the magnitude of the autocorrelation coefficient:

$$\hat{\rho} = \sum_{t=1}^{n-1}(X_t - \bar{X})(X_{t+1} - \bar{X}) / \sum_{t=1}^{n}(X_t - \bar{X})^2$$

The equation $n_{eff} = \frac{n(1-\rho)}{(1+\rho)}$ was then used to calculate the "Effective n" [1] or the effective sample size based on the number of samples arising from the 150 hour stack test.

[1] http://www.climatescience.gov/Library/sap/sap1-1/third-draft/sap1-1-draft3-appA.pdf

Using the equation above, the MPCA found the following autocorrelation coefficients for the lines at HTC: 0.35 for Line 1 (high compression), 0.69 for Line 3 (high compression), and 0.97 for Line 2 (all data). The autocorrelation coefficient was used to adjust the effective sample size for both the sample data and the proposed compliance test, as suggested by the commenter. Ultimately, this does result in higher UPLs. When coupled with the move to the 95% interval, the resulting emission limits for the most part do not change dramatically.

However, due to particular concern over Line 2 being able to meet the limit developed based on all data from Line 2, we also decided to set two limits on Line 2 – one to be met when producing high compression pellets and one to be met when producing standard pellets. In addition, six months after CEMS are installed and operating on Line 2, the limit steps down to the original limit proposed (571.7 lbs/hour), unless HTC provides a demonstration that that limit is inappropriate.

Therefore, the BART NO_X limits for HTC are as follows:

Unit	BART NO_X Limit (lbs/hr)
Line 1 Indurating Furnace	449.7
Line 2 Indurating Furnace	894.2 (HC); 608.9 (std)
Line 3 Indurating Furnace	347.5

This limit is for all four stacks from each indurating furnace combined. Compliance is to be determined through NO_X stack testing, simultaneously measured for 30 hourly data points. For Line 1 and Line 3, a failed stack test will result in a requirement to install CEMS. Until eight months after the CEMS are installed and certified, the limits will be: 514 lbs/hour on Line 1 and 384 lbs/hour on Line 3. These represent the 99% UPL for the furnace, as corrected for autocorrelation by Cliffs Natural Resources. After six months of data is collected from the CEMS, Cliffs is to submit the data to the MPCA and propose a new BART limit.

Once CEMS are installed on Line 2, those monitors will be used for compliance. CEMS are to be installed and certified on Line 2 within 14 months of the effective date of the Administrative Order implementing the BART limits on Line 2 and within 14 months of a failed stack test on Line 1 or Line 3.

Hibbing Taconite - Data for NOx BART Limit on Indurating Furnaces

Line 1

Timestamp	L1 NOx lb/hr - HC Pellets	Timestamp	L1 NOx lb/hr - Std Pellets
7/16/10 9:00	444.0	10/13/10 17:00	423.2
7/16/10 10:00	446.1	10/13/10 18:00	418.1
7/16/10 11:00	435.7	10/13/10 19:00	414.2
7/16/10 12:00	429.7	10/13/10 20:00	418.9
7/16/10 13:00	427.1	10/13/10 21:00	404.5
7/16/10 14:00	422.4	10/13/10 22:00	415.4
7/16/10 16:00	430.7	10/13/10 23:00	416.9
7/16/10 17:00	281.4	10/14/10 0:00	403.1
7/16/10 18:00	401.3	10/14/10 1:00	414.7
7/16/10 19:00	432.2	10/14/10 2:00	416.7
7/16/10 20:00	439.6	10/14/10 3:00	408.4
7/16/10 21:00	440.6	10/14/10 4:00	415.0
7/16/10 22:00	440.2	10/14/10 5:00	409.1
7/16/10 23:00	436.0	10/14/10 6:00	409.1
7/17/10 0:00	429.4	10/14/10 7:00	414.8
7/17/10 1:00	441.4	10/14/10 8:00	412.4
7/17/10 2:00	434.9	10/14/10 10:00	408.5
7/17/10 3:00	436.3	10/14/10 11:00	397.5
7/17/10 4:00	438.0	10/14/10 12:00	400.1
7/17/10 5:00	435.3	10/14/10 13:00	400.0
7/17/10 6:00	431.4	10/14/10 14:00	388.4
7/17/10 7:00	432.0	10/14/10 15:00	391.6
7/17/10 8:00	430.4	10/14/10 16:00	386.2
7/17/10 9:00	443.2	10/14/10 17:00	384.0
7/17/10 10:00	434.0	10/14/10 18:00	389.0
7/17/10 11:00	441.7	10/14/10 19:00	367.6
7/17/10 12:00	444.3	10/14/10 20:00	392.2
7/17/10 13:00	449.8	10/14/10 21:00	400.9
7/17/10 14:00	437.0	10/14/10 22:00	396.4
7/17/10 15:00	424.9	10/14/10 23:00	398.1
7/17/10 16:00	430.6	10/15/10 0:00	397.5
7/17/10 17:00	433.0	10/15/10 1:00	398.2
7/17/10 18:00	434.5	10/15/10 2:00	389.3
7/17/10 19:00	431.6	10/15/10 3:00	395.6
7/17/10 20:00	420.0	10/15/10 4:00	389.6
7/17/10 21:00	430.5	10/15/10 5:00	383.8
7/17/10 22:00	431.9	10/15/10 6:00	388.0
7/17/10 23:00	426.8	10/15/10 7:00	390.3
7/18/10 1:00	418.8	10/15/10 8:00	390.9
7/18/10 2:00	425.6	10/15/10 9:00	383.5
7/18/10 3:00	418.8	10/15/10 10:00	379.0
7/18/10 4:00	405.4	10/15/10 11:00	382.2
7/18/10 5:00	402.0	10/15/10 12:00	377.4
7/18/10 6:00	419.1	10/15/10 14:00	368.8
7/18/10 7:00	411.5	10/15/10 15:00	380.8
7/18/10 8:00	412.9	10/15/10 16:00	373.8
7/18/10 9:00	418.9	10/15/10 17:00	339.7
7/18/10 10:00	419.5	10/15/10 18:00	348.2
7/18/10 11:00	420.1	10/15/10 19:00	386.0
7/18/10 12:00	423.5	10/15/10 20:00	380.5
7/18/10 13:00	424.4	10/15/10 21:00	378.4
7/18/10 14:00	419.8	10/15/10 22:00	386.6
7/18/10 15:00	421.9	10/15/10 23:00	400.2
7/18/10 16:00	360.9	10/16/10 0:00	398.4
7/18/10 18:00	423.8	10/16/10 1:00	392.6
7/18/10 19:00	420.3	10/16/10 2:00	396.5
7/18/10 20:00	424.6	10/16/10 3:00	389.1
7/18/10 21:00	245.2	10/16/10 4:00	382.4
7/18/10 22:00	388.3	10/16/10 5:00	389.4
7/18/10 23:00	427.6	10/16/10 6:00	396.6
7/19/10 0:00	429.4	10/16/10 8:00	412.5
7/19/10 1:00	433.7	10/16/10 9:00	371.7
7/19/10 2:00	432.6	10/16/10 10:00	391.9
7/19/10 3:00	432.1	10/16/10 11:00	404.7
7/19/10 4:00	439.4	10/16/10 12:00	399.9
7/19/10 5:00	438.0	10/16/10 13:00	385.7
7/19/10 6:00	437.3	10/16/10 14:00	380.3

Line 2

Timestamp	L2 NOx lb/hr - All Pellets
10/24/07 19:34	384.5
10/25/07 12:10	355.0
10/25/07 13:10	356.3
10/25/07 14:10	355.5
10/25/07 14:47	352.5
10/25/07 15:47	349.9
10/25/07 16:47	348.4
10/25/07 17:47	340.2
10/25/07 18:47	335.4
10/25/07 19:47	337.2
10/25/07 20:47	350.4
10/25/07 21:47	343.3
10/25/07 22:47	337.0
10/25/07 23:47	333.2
10/26/07 0:47	335.3
10/26/07 1:47	334.0
10/26/07 2:47	337.6
10/26/07 3:47	329.4
10/26/07 4:47	339.7
10/26/07 5:47	336.9
10/26/07 6:47	336.9
10/26/07 7:47	347.2
10/26/07 8:47	365.3
10/26/07 9:14	359.7
10/26/07 11:54	350.5
10/26/07 12:54	351.9
10/26/07 13:54	347.9
10/26/07 14:54	349.4
10/26/07 15:54	349.3
10/26/07 16:54	364.3
10/26/07 17:54	363.5
10/26/07 18:54	367.7
10/26/07 19:54	364.6
10/26/07 20:54	371.0
10/26/07 21:54	367.0
10/26/07 22:54	368.0
10/26/07 23:54	367.9
10/27/07 0:54	371.3
10/27/07 1:54	369.4
10/27/07 2:54	372.5
10/27/07 3:54	376.3
10/27/07 4:54	384.2
10/27/07 5:54	378.0
10/27/07 6:54	378.1
10/27/07 7:54	462.1
10/27/07 8:54	483.1
10/27/07 11:04	453.5
10/27/07 12:04	485.9
10/27/07 13:04	481.5
10/27/07 14:04	476.3
10/27/07 15:04	478.2
10/27/07 16:04	476.1
10/27/07 17:04	495.5
10/27/07 18:04	493.9
10/27/07 19:04	504.7
10/27/07 20:04	502.6
10/27/07 21:04	499.4
10/27/07 22:04	503.5
10/27/07 23:04	503.7
10/28/07 0:04	506.9
10/28/07 0:42	499.8
10/28/07 21:27	364.0
10/28/07 22:27	357.8
10/28/07 23:27	346.2
10/29/07 0:27	345.7
10/29/07 1:27	339.1
10/29/07 2:27	345.9

7/19/10 7:00	425.3	10/16/10 15:00	379.6	10/29/07 3:27	349.2
7/19/10 8:00	443.8	10/16/10 16:00	387.4	10/29/07 4:27	348.8
7/19/10 10:00	441.5	10/16/10 17:00	376.4	10/29/07 5:27	343.5
7/19/10 11:00	437.6	10/16/10 18:00	379.8	10/29/07 6:27	347.7
7/19/10 12:00	428.9	10/16/10 19:00	383.0	10/29/07 7:59	320.3
7/19/10 13:00	414.3	10/16/10 20:00	383.6	10/29/07 9:59	333.9
7/19/10 14:00	425.8	10/16/10 21:00	386.4	10/29/07 10:59	329.1
7/19/10 15:00	431.1	10/16/10 22:00	373.9	10/29/07 11:59	326.2
7/19/10 16:00	427.6	10/16/10 23:00	313.5	10/29/07 12:59	331.1
7/19/10 17:00	424.3	10/17/10 0:00	372.6	10/29/07 13:59	327.4
7/19/10 18:00	423.6	10/17/10 1:00	382.1	10/29/07 14:59	327.3
7/19/10 19:00	419.5	10/17/10 2:00	407.6	10/29/07 15:59	321.6
7/19/10 20:00	429.4	10/17/10 3:00	410.4	10/29/07 16:59	268.2
7/19/10 21:00	208.0	10/17/10 4:00	396.5	10/29/07 17:59	337.1
7/19/10 22:00	272.7	10/17/10 5:00	275.7	10/29/07 18:59	323.1
7/19/10 23:00	456.4	10/17/10 6:00	359.9	10/29/07 19:59	327.7
7/20/10 0:00	451.1	10/17/10 7:00	390.1	10/29/07 20:59	325.8
7/20/10 1:00	456.0	10/17/10 8:00	389.0	10/29/07 21:59	332.3
7/20/10 2:00	456.4	10/17/10 9:00	383.1	10/29/07 22:59	333.1
7/20/10 3:00	465.2	10/17/10 10:00	393.1	10/29/07 23:59	327.8
7/20/10 4:00	460.7	10/17/10 11:00	391.1	10/30/07 0:59	330.4
7/20/10 5:00	455.1	10/17/10 12:00	390.6	10/30/07 1:59	335.1
7/20/10 6:00	454.2	10/17/10 13:00	391.7	10/30/07 2:59	327.5
7/20/10 7:00	456.0	10/17/10 14:00	387.9	10/30/07 3:59	318.0
7/20/10 8:00	246.6	10/17/10 15:00	389.2	10/30/07 4:59	310.5
7/20/10 10:00	411.9	10/17/10 17:00	396.2	10/30/07 5:29	304.3
7/20/10 11:00	441.3	10/17/10 18:00	389.6	10/30/07 10:40	452.0
7/20/10 12:00	445.2	10/17/10 19:00	387.4	10/30/07 11:40	437.1
7/20/10 13:00	380.2	10/17/10 20:00	387.4	10/30/07 12:40	432.7
7/20/10 14:00	444.7	10/17/10 21:00	388.5	10/30/07 13:40	419.0
7/20/10 15:00	450.2	10/17/10 22:00	386.1	10/30/07 14:40	424.1
7/20/10 16:00	449.9	10/17/10 23:00	378.5	10/30/07 15:40	382.5
7/20/10 17:00	445.4	10/18/10 0:00	375.6	10/30/07 16:40	390.4
7/20/10 18:00	442.4	10/18/10 1:00	383.6	10/30/07 17:40	380.1
7/20/10 19:00	447.6	10/18/10 2:00	384.0	10/30/07 18:40	386.7
7/20/10 20:00	446.6	10/18/10 3:00	387.8	10/30/07 19:40	388.1
7/20/10 21:00	445.9	10/18/10 4:00	382.8	10/30/07 20:40	391.1
7/20/10 22:00	443.4	10/18/10 5:00	383.0	10/30/07 21:40	393.3
7/20/10 23:00	448.4	10/18/10 6:00	381.5	10/30/07 22:40	392.2
7/21/10 0:00	449.7	10/18/10 7:00	381.2	10/30/07 23:40	370.8
7/21/10 1:00	445.3	10/18/10 8:00	383.2	10/31/07 0:40	376.6
7/21/10 2:00	442.2	10/18/10 9:00	383.4	10/31/07 7:49	400.4
7/21/10 3:00	449.1	10/18/10 11:00	385.6	10/31/07 9:30	398.7
7/21/10 4:00	447.5	10/18/10 12:00	387.5	10/31/07 11:30	411.5
7/21/10 5:00	454.7	10/18/10 13:00	386.2	10/31/07 12:30	400.2
7/21/10 6:00	451.4	10/18/10 14:00	380.9	10/31/07 13:30	398.5
7/21/10 7:00	451.3	10/18/10 15:00	370.0	10/31/07 14:30	409.9
7/21/10 8:00	446.1	10/18/10 16:00	364.6	10/31/07 14:45	401.1
7/21/10 9:00	449.8	10/18/10 17:00	371.0	10/31/07 15:45	401.1
7/21/10 10:00	447.7	10/18/10 18:00	366.3	10/31/07 16:35	406.3
7/21/10 11:00	455.8	10/18/10 19:00	360.5	10/31/07 20:11	442.8
7/21/10 12:00	467.1	10/18/10 20:00	364.9	10/31/07 21:11	467.6
7/21/10 13:00	462.0	10/18/10 21:00	360.9	10/31/07 22:11	472.7
7/21/10 14:00	456.3	10/18/10 22:00	368.5	10/31/07 23:11	493.4
7/21/10 15:00	457.3	10/18/10 23:00	360.1	11/1/07 0:11	488.4
7/21/10 16:00	464.4	10/19/10 0:00	346.4	11/1/07 1:11	486.7
7/21/10 17:00	461.1	10/19/10 1:00	344.7	11/1/07 2:11	482.6
7/21/10 18:00	467.7	10/19/10 2:00	334.8	11/1/07 3:11	491.3
7/21/10 19:00	470.8	10/19/10 3:00	330.5	11/1/07 4:11	489.9
7/21/10 20:00	467.5	10/19/10 4:00	334.3	11/1/07 5:11	490.9
7/21/10 21:00	467.1	10/19/10 5:00	331.9	11/1/07 6:11	481.9
7/21/10 22:00	460.5	10/19/10 6:00	323.4	11/1/07 6:30	510.5
7/21/10 23:00	463.8	10/19/10 7:00	325.9	11/1/07 7:30	411.5
7/22/10 0:00	463.9	10/19/10 8:00	326.9	11/1/07 8:30	365.6
7/22/10 1:00	464.2	10/19/10 9:00	320.1	11/1/07 10:14	370.3
7/22/10 2:00	458.9	10/19/10 10:00	285.0	11/1/07 11:14	360.4
7/22/10 3:00	458.9	10/19/10 13:00	320.1	11/1/07 12:14	364.4
7/22/10 4:00	460.1	10/19/10 14:00	348.2	11/1/07 13:14	354.9
7/22/10 5:00	450.7	10/19/10 15:00	345.1	11/1/07 14:14	357.8
7/22/10 6:00	446.0	10/19/10 16:00	351.0	11/1/07 15:14	364.5
7/22/10 7:00	455.1	10/19/10 17:00	354.9	11/1/07 16:14	359.0
7/22/10 8:00	456.7	10/19/10 18:00	355.4	11/1/07 17:14	362.8

7/22/10 9:00	450.3	10/19/10 19:00	359.7	11/1/07 18:14	364.5
7/22/10 10:00	447.1	10/19/10 20:00	361.0	11/1/07 19:14	381.7
7/22/10 11:00	445.3	10/19/10 21:00	353.4	11/1/07 20:14	406.0
7/22/10 12:00	448.0	10/19/10 22:00	368.1	11/1/07 21:14	434.4
7/22/10 13:00	446.2	10/19/10 23:00	359.8	11/1/07 22:14	444.7
7/22/10 14:00	446.5	10/20/10 0:00	357.3	11/1/07 23:14	436.8
7/22/10 15:00	444.0	10/20/10 1:00	361.4	11/2/07 0:14	441.6
7/22/10 16:00	444.1	10/20/10 2:00	360.6	11/2/07 1:14	446.1
7/22/10 17:00	443.6	10/20/10 3:00	359.3	11/2/07 2:14	412.5
7/22/10 18:00	449.5	10/20/10 4:00	352.5	11/2/07 3:14	407.2
7/22/10 19:00	446.6	10/20/10 5:00	349.3	11/2/07 4:14	441.3
7/22/10 20:00	435.2	10/20/10 6:00	350.6	11/2/07 5:14	430.8
7/22/10 21:00	373.0	10/20/10 7:00	353.2	11/2/07 6:14	433.2
7/22/10 22:00	439.6	10/20/10 8:00	365.3	11/2/07 7:14	413.0
7/22/10 23:00	436.1	10/20/10 10:00	375.6	11/2/07 7:29	314.3
7/23/10 0:00	431.5	10/20/10 11:00	376.5	11/2/07 8:00	318.5
7/23/10 1:00	432.6	10/20/10 12:00	378.1	11/2/07 9:35	319.2
7/23/10 2:00	440.4	10/20/10 13:00	382.3	11/2/07 10:35	314.6
7/23/10 3:00	439.4	10/20/10 14:00	364.3	11/2/07 11:35	320.7
7/23/10 4:00	424.4	10/20/10 15:00	366.3	11/2/07 12:35	320.0
7/23/10 5:00	235.8	10/20/10 16:00	373.9	11/2/07 13:35	328.3
7/23/10 6:00	422.5	10/20/10 17:00	376.0	11/2/07 14:35	322.9
7/23/10 7:00	440.6	10/20/10 18:00	377.9	11/2/07 14:59	329.6
7/23/10 8:00	438.4	10/20/10 19:00	373.6	11/2/07 15:59	458.6
7/23/10 9:00	435.0	10/20/10 20:00	381.5	11/2/07 16:29	476.4
7/23/10 10:00	422.3	10/20/10 21:00	370.2	11/2/07 17:29	464.1
7/23/10 11:00	410.5	10/20/10 22:00	364.9	11/2/07 18:29	477.6
7/23/10 12:00	418.3	10/20/10 23:00	368.2	11/2/07 19:29	474.3
7/23/10 13:00	417.8	10/21/10 0:00	367.5	11/2/07 20:29	462.0
7/23/10 14:00	414.2	10/21/10 1:00	365.0	11/2/07 21:29	472.0
7/23/10 15:00	407.7	10/21/10 2:00	368.3	11/2/07 22:29	472.0
7/23/10 16:00	392.3	10/21/10 3:00	361.4	11/2/07 23:29	454.0
7/23/10 17:00	400.5	10/21/10 4:00	382.9	11/3/07 0:29	469.9
7/23/10 18:00	408.0	10/21/10 5:00	388.2	11/3/07 1:29	473.1
7/23/10 19:00	407.3	10/21/10 6:00	388.8	11/3/07 2:29	465.3
7/23/10 20:00	421.2	10/21/10 7:00	384.7	11/3/07 3:29	468.0
7/23/10 21:00	413.0	10/21/10 8:00	385.4	11/3/07 4:29	458.0
7/23/10 22:00	416.6	10/21/10 9:00	376.9	11/3/07 5:29	473.5
7/23/10 23:00	412.5	10/21/10 10:00	369.8		
7/24/10 0:00	411.1	10/21/10 12:00	359.6		
7/24/10 1:00	403.0	10/21/10 13:00	359.3		
7/24/10 2:00	406.5	10/21/10 14:00	366.2		
7/24/10 3:00	410.8	10/21/10 15:00	362.4		
7/24/10 4:00	410.5	10/21/10 16:00	362.6		
7/24/10 5:00	404.0	10/21/10 17:00	370.0		
7/24/10 6:00	409.3	10/21/10 18:00	368.5		
7/24/10 7:00	402.1	10/21/10 19:00	364.6		
7/24/10 8:00	397.7	10/21/10 20:00	365.3		
7/24/10 9:00	402.1	10/21/10 21:00	364.5		
7/24/10 10:00	409.9	10/21/10 22:00	358.3		
7/24/10 11:00	408.3	10/21/10 23:00	362.3		
		10/22/10 0:00	351.7		
		10/22/10 1:00	357.6		
		10/22/10 2:00	346.9		
		10/22/10 3:00	351.6		
		10/22/10 4:00	347.6		
		10/22/10 5:00	349.8		
		10/22/10 6:00	352.7		
		10/22/10 7:00	351.7		

Count	190	**Count**	198	**Count**	177
Average	428.02	**Average**	376.10	**Average**	392.32
St Dev	37.95	**St Dev**	23.53	**St Dev**	60.10
Max	470.84	**Max**	423.20	**Max**	510.49
Min	207.96	**Min**	275.72	**Min**	268.19
$t_{0.05,\ c\text{-}1}$	1.973	$t_{0.05,\ c\text{-}1}$	1.972	$t_{0.05,\ c\text{-}1}$	1.974
UPL 95%	442.73	**UPL 95%**	385.19	**UPL 95%**	415.74
UCL 95%	433.45	**UCL 95%**	379.40	**UCL 95%**	401.24
$t_{0.01,\ c\text{-}1}$	2.602	$t_{0.01,\ c\text{-}1}$	2.601	$t_{0.01,\ c\text{-}1}$	2.604
UPL 99%	447.42	**UPL 99%**	388.09	**UPL 99%**	423.22
UCL 99%	435.18	**UCL 99%**	380.45	**UCL 99%**	404.09

Line 3

Timestamp	Line 2 NOx lb/hr - Std Pellets	Timestamp	L2 NOx lb/hr - HC Pellets	Timestamp	L3 NOx lb/hr - HC Pellets	Timestamp	L3 NOx lb/hr - Std Pellets
10/22/10 17:00	607.7	11/6/10 15:00	741.8	11/16/10 13:00	324.1	11/27/10 13:00	294.01
10/22/10 18:00	610.0	11/6/10 16:00	755.8	11/16/10 14:00	318.3	11/27/10 14:00	295.70
10/22/10 19:00	586.3	11/6/10 17:00	763.4	11/16/10 15:00	318.2	11/27/10 15:00	301.17
10/22/10 20:00	618.8	11/6/10 18:00	760.1	11/16/10 16:00	316.6	11/27/10 16:00	300.94
10/22/10 21:00	628.1	11/6/10 19:00	765.2	11/16/10 17:00	319.0	11/27/10 17:00	301.50
10/22/10 22:00	601.8	11/6/10 20:00	760.5	11/16/10 18:00	320.1	11/27/10 18:00	302.76
10/22/10 23:00	599.0	11/6/10 21:00	745.4	11/16/10 19:00	317.5	11/27/10 19:00	299.37
10/23/10 0:00	602.0	11/6/10 22:00	746.3	11/16/10 20:00	315.4	11/27/10 20:00	298.86
10/23/10 1:00	594.2	11/6/10 23:00	759.8	11/16/10 21:00	317.8	11/27/10 21:00	298.83
10/23/10 2:00	589.4	11/7/10 0:00	738.3	11/16/10 22:00	326.7	11/27/10 22:00	297.09
10/23/10 3:00	590.2	11/7/10 1:00	741.3	11/16/10 23:00	327.7	11/27/10 23:00	298.86
10/23/10 4:00	618.4	11/7/10 2:00	745.2	11/17/10 0:00	332.5	11/28/10 0:00	297.00
10/23/10 5:00	612.4	11/7/10 3:00	756.0	11/17/10 1:00	332.9	11/28/10 1:00	294.28
10/23/10 12:00	557.9	11/7/10 4:00	751.1	11/17/10 2:00	333.8	11/28/10 2:00	293.72
10/23/10 13:00	566.5	11/7/10 5:00	746.3	11/17/10 3:00	332.2	11/28/10 3:00	294.03
10/23/10 14:00	579.2	11/7/10 6:00	750.4	11/17/10 4:00	335.3	11/28/10 4:00	294.99
10/23/10 15:00	572.2	11/7/10 7:00	756.4	11/17/10 5:00	336.4	11/28/10 5:00	291.93
10/23/10 16:00	571.3	11/7/10 8:00	749.9	11/17/10 6:00	333.8	11/28/10 6:00	294.31
10/23/10 17:00	571.0	11/7/10 9:00	755.0	11/17/10 7:00	336.2	11/28/10 7:00	293.42
10/23/10 18:00	553.6	11/7/10 10:00	753.1	11/17/10 8:00	333.2	11/28/10 8:00	293.49
10/23/10 19:00	561.6	11/7/10 11:00	740.4	11/17/10 9:00	341.8	11/28/10 9:00	291.37
10/23/10 20:00	579.4	11/7/10 12:00	737.1	11/17/10 10:00	336.0	11/28/10 10:00	290.46
10/23/10 21:00	572.4	11/7/10 13:00	740.2	11/17/10 11:00	336.0	11/28/10 11:00	289.10
10/23/10 22:00	555.2	11/7/10 14:00	744.7	11/17/10 12:00	336.6	11/28/10 12:00	290.27
10/23/10 23:00	575.5	11/7/10 15:00	748.2	11/17/10 13:00	322.8	11/28/10 14:00	284.77
10/24/10 0:00	547.2	11/7/10 16:00	740.1	11/17/10 14:00	306.8	11/28/10 15:00	277.78
10/24/10 1:00	550.5	11/7/10 17:00	744.2	11/17/10 15:00	324.1	11/28/10 16:00	292.63
10/24/10 2:00	550.6	11/7/10 18:00	748.4	11/17/10 16:00	328.6	11/28/10 17:00	294.24
10/24/10 3:00	551.9	11/7/10 19:00	741.0	11/17/10 17:00	297.1	11/28/10 18:00	294.31
10/24/10 4:00	572.1	11/7/10 20:00	732.0	11/17/10 18:00	309.7	11/28/10 19:00	294.50
10/24/10 5:00	568.6	11/7/10 21:00	728.7	11/17/10 19:00	325.7	11/28/10 20:00	292.53
10/24/10 6:00	566.7	11/7/10 22:00	732.1	11/17/10 20:00	329.2	11/28/10 21:00	290.94
10/24/10 7:00	565.8	11/7/10 23:00	737.1	11/17/10 21:00	328.4	11/28/10 22:00	286.85
10/24/10 8:00	569.4	11/8/10 0:00	722.3	11/17/10 22:00	330.0	11/28/10 23:00	289.04
10/24/10 9:00	558.1	11/8/10 1:00	737.4	11/17/10 23:00	331.5	11/29/10 0:00	287.60
10/24/10 10:00	558.2	11/8/10 2:00	728.2	11/18/10 0:00	327.9	11/29/10 1:00	287.98
10/24/10 11:00	563.7	11/8/10 3:00	727.5	11/18/10 1:00	327.7	11/29/10 2:00	289.12
10/24/10 12:00	560.5	11/8/10 4:00	729.5	11/18/10 2:00	327.4	11/29/10 3:00	290.45
10/24/10 13:00	557.5	11/8/10 5:00	733.5	11/18/10 3:00	328.3	11/29/10 4:00	290.20
10/24/10 15:00	550.3	11/8/10 6:00	729.5	11/18/10 4:00	331.6	11/29/10 5:00	290.79
10/24/10 16:00	553.4	11/8/10 7:00	726.8	11/18/10 5:00	331.0	11/29/10 6:00	292.44
10/24/10 17:00	554.7	11/8/10 8:00	733.0	11/18/10 6:00	330.9	11/29/10 7:00	293.19
10/24/10 18:00	551.6	11/8/10 9:00	738.8	11/18/10 7:00	328.9	11/29/10 8:00	293.17
10/24/10 19:00	554.1	11/8/10 11:00	726.8	11/18/10 8:00	330.6	11/29/10 9:00	294.64
10/24/10 20:00	561.3	11/8/10 12:00	675.8	11/18/10 9:00	331.6	11/29/10 10:00	293.10
10/24/10 21:00	561.5	11/8/10 13:00	644.6	11/18/10 10:00	331.6	11/29/10 11:00	291.23
10/24/10 22:00	560.1	11/8/10 14:00	651.9	11/18/10 11:00	334.6	11/29/10 12:00	288.11
10/24/10 23:00	555.8	11/8/10 15:00	654.8	11/18/10 12:00	333.5	11/29/10 13:00	290.12
10/25/10 0:00	561.9	11/8/10 16:00	657.6	11/18/10 13:00	335.8	11/29/10 14:00	290.06
10/25/10 1:00	557.6	11/8/10 17:00	663.5	11/18/10 14:00	327.0	11/29/10 15:00	289.88
10/25/10 2:00	557.0	11/8/10 18:00	687.4	11/18/10 15:00	328.8	11/29/10 16:00	288.08
10/25/10 3:00	553.0	11/8/10 19:00	683.2	11/18/10 16:00	327.3	11/29/10 17:00	287.28
10/25/10 4:00	557.6	11/8/10 20:00	711.0	11/18/10 17:00	326.9	11/29/10 18:00	286.60
10/25/10 5:00	560.5	11/8/10 21:00	710.5	11/18/10 18:00	327.3	11/29/10 19:00	285.79
10/25/10 6:00	557.7	11/8/10 22:00	720.2	11/18/10 19:00	319.6	11/29/10 20:00	284.26
10/25/10 7:00	556.9	11/8/10 23:00	728.3	11/19/10 11:00	316.8	11/29/10 21:00	282.00
10/25/10 8:00	554.9	11/9/10 0:00	658.6	11/19/10 12:00	321.2	11/30/10 10:00	240.81
10/25/10 9:00	534.1	11/9/10 1:00	659.2	11/19/10 14:00	327.8	11/30/10 11:00	75.10
10/25/10 18:00	564.7	11/9/10 2:00	650.6	11/19/10 15:00	332.0	11/30/10 12:00	152.92
10/25/10 19:00	550.8	11/9/10 3:00	653.0	11/19/10 16:00	331.5	11/30/10 13:00	258.28
10/25/10 20:00	553.6	11/9/10 4:00	653.0	11/19/10 17:00	334.3	11/30/10 14:00	259.69
10/25/10 21:00	551.0	11/9/10 5:00	648.6	11/19/10 18:00	333.3	11/30/10 15:00	264.81
10/25/10 22:00	552.1	11/9/10 6:00	655.7	11/19/10 19:00	329.3	11/30/10 16:00	267.36
10/25/10 23:00	551.3	11/9/10 7:00	649.0	11/19/10 20:00	328.1	11/30/10 17:00	274.66
10/26/10 0:00	542.7	11/9/10 8:00	660.1	11/19/10 21:00	328.4	11/30/10 18:00	280.10
10/26/10 1:00	542.0	11/9/10 9:00	662.3	11/19/10 22:00	328.9	11/30/10 19:00	283.13
10/26/10 2:00	530.0	11/9/10 11:00	724.5	11/19/10 23:00	333.9	11/30/10 20:00	284.76

10/26/10 3:00	528.8	11/9/10 12:00	721.7	11/20/10 0:00	333.4	11/30/10 21:00	287.89
10/26/10 4:00	524.3	11/9/10 13:00	719.1	11/20/10 1:00	329.8	11/30/10 22:00	287.80
10/26/10 12:00	506.6	11/9/10 14:00	708.0	11/20/10 2:00	333.2	11/30/10 23:00	286.04
10/26/10 13:00	512.6	11/9/10 15:00	715.4	11/20/10 3:00	326.7	12/1/10 0:00	284.30
10/26/10 14:00	558.1	11/9/10 16:00	709.1	11/20/10 4:00	330.6	12/1/10 1:00	284.50
10/26/10 15:00	573.7	11/9/10 17:00	709.8	11/20/10 5:00	331.1	12/1/10 2:00	288.79
10/26/10 16:00	563.7	11/9/10 18:00	707.6	11/20/10 6:00	336.0	12/1/10 3:00	294.38
10/26/10 17:00	564.4	11/9/10 19:00	636.1	11/20/10 7:00	335.1	12/1/10 4:00	294.33
10/26/10 18:00	549.4	11/9/10 20:00	617.6	11/20/10 8:00	333.6	12/1/10 5:00	295.61
10/26/10 19:00	559.3	11/9/10 21:00	714.1	11/20/10 9:00	340.3	12/1/10 6:00	295.98
10/26/10 20:00	570.5	11/9/10 22:00	713.3	11/20/10 10:00	342.6	12/1/10 7:00	295.42
10/26/10 21:00	555.1	11/9/10 23:00	709.9	11/20/10 11:00	342.2	12/1/10 8:00	295.07
10/26/10 22:00	547.7	11/10/10 0:00	716.0	11/20/10 12:00	342.2	12/1/10 9:00	297.87
10/26/10 23:00	562.6	11/10/10 1:00	723.0	11/20/10 13:00	349.6	12/1/10 10:00	297.95
10/27/10 0:00	567.8	11/10/10 2:00	714.9	11/20/10 14:00	350.8	12/1/10 11:00	300.92
10/27/10 1:00	565.3	11/10/10 3:00	725.0	11/20/10 15:00	332.9	12/1/10 12:00	296.96
10/27/10 2:00	573.0	11/10/10 4:00	726.5	11/20/10 16:00	321.0	12/1/10 13:00	298.10
10/27/10 3:00	568.5	11/10/10 5:00	728.1	11/20/10 17:00	351.1	12/1/10 14:00	296.08
10/27/10 4:00	583.7	11/10/10 6:00	724.8	11/20/10 18:00	346.3	12/1/10 15:00	294.52
10/27/10 5:00	573.1	11/10/10 7:00	724.3	11/20/10 19:00	349.4	12/1/10 16:00	294.70
10/27/10 6:00	564.8	11/10/10 8:00	721.5	11/20/10 20:00	348.9	12/1/10 17:00	296.88
10/27/10 7:00	562.8	11/10/10 9:00	719.8	11/20/10 21:00	346.3	12/1/10 18:00	300.85
10/27/10 8:00	558.4	11/10/10 10:00	704.2	11/20/10 22:00	348.7	12/1/10 19:00	299.29
10/27/10 9:00	559.2	11/10/10 11:00	694.8	11/20/10 23:00	349.0	12/1/10 20:00	299.19
10/27/10 10:00	561.2	11/10/10 12:00	692.4	11/21/10 0:00	349.1	12/1/10 21:00	300.24
10/27/10 11:00	562.5	11/10/10 13:00	695.5	11/21/10 1:00	348.5	12/1/10 22:00	298.89
10/27/10 12:00	545.7	11/10/10 14:00	692.5	11/21/10 2:00	349.9	12/1/10 23:00	301.31
10/27/10 13:00	540.4	11/10/10 15:00	692.0	11/21/10 3:00	354.4	12/2/10 0:00	301.31
10/27/10 14:00	543.7	11/10/10 16:00	707.1	11/21/10 4:00	355.8	12/2/10 1:00	299.72
10/27/10 15:00	538.5	11/10/10 17:00	717.3	11/21/10 5:00	352.5	12/2/10 2:00	297.82
10/27/10 16:00	529.4	11/10/10 18:00	722.6	11/21/10 6:00	350.8	12/2/10 3:00	295.79
10/27/10 17:00	526.6	11/10/10 19:00	705.5	11/21/10 7:00	348.6	12/2/10 4:00	299.70
10/27/10 18:00	537.0	11/10/10 20:00	707.6	11/21/10 8:00	350.4	12/2/10 5:00	267.51
10/27/10 19:00	531.5	11/10/10 21:00	716.6	11/21/10 9:00	353.4	12/2/10 6:00	226.65
10/27/10 20:00	531.7	11/10/10 22:00	714.1	11/21/10 10:00	351.2	12/2/10 7:00	196.94
10/27/10 21:00	521.3	11/10/10 23:00	713.3	11/21/10 11:00	347.4	12/2/10 8:00	131.39
10/27/10 22:00	520.6	11/11/10 0:00	713.2	11/21/10 12:00	347.6	12/2/10 9:00	273.71
10/27/10 23:00	522.0	11/11/10 1:00	711.4	11/21/10 13:00	348.7	12/2/10 10:00	281.69
10/28/10 0:00	517.2	11/11/10 2:00	705.9	11/21/10 15:00	342.9	12/2/10 11:00	42.20
10/28/10 1:00	513.8	11/11/10 3:00	711.6	11/21/10 16:00	340.2	12/2/10 12:00	207.76
10/28/10 2:00	512.3	11/11/10 4:00	720.1	11/21/10 17:00	334.7	12/2/10 13:00	275.18
10/28/10 3:00	509.9	11/11/10 5:00	726.8	11/21/10 18:00	337.0	12/2/10 14:00	288.46
10/28/10 4:00	504.8	11/11/10 6:00	739.4	11/21/10 19:00	333.9	12/2/10 15:00	287.37
10/28/10 5:00	515.4	11/11/10 7:00	740.5	11/21/10 20:00	331.2	12/2/10 16:00	283.87
10/28/10 6:00	510.5	11/11/10 8:00	749.8	11/22/10 15:00	135.0	12/2/10 17:00	283.11
10/28/10 7:00	497.1	11/11/10 9:00	745.3	11/22/10 16:00	257.9	12/2/10 18:00	281.75
10/28/10 8:00	496.4	11/11/10 10:00	753.0	11/22/10 17:00	262.0	12/2/10 19:00	284.70
10/28/10 9:00	494.4	11/11/10 11:00	743.5	11/22/10 18:00	279.5	12/2/10 20:00	286.48
10/28/10 10:00	511.1	11/11/10 12:00	681.0	11/22/10 19:00	274.9	12/2/10 21:00	288.06
10/28/10 11:00	515.0	11/11/10 13:00	733.3	11/22/10 20:00	286.2	12/2/10 22:00	288.30
10/28/10 12:00	526.3	11/11/10 14:00	723.9	11/22/10 21:00	284.0	12/2/10 23:00	287.67
10/28/10 13:00	515.4	11/11/10 15:00	724.3	11/22/10 22:00	284.5	12/3/10 0:00	288.41
10/28/10 14:00	522.9	11/11/10 16:00	717.8	11/22/10 23:00	285.1	12/3/10 1:00	289.28
10/28/10 15:00	516.0	11/11/10 17:00	660.5	11/23/10 0:00	287.6	12/3/10 2:00	288.28
10/28/10 16:00	509.8	11/11/10 18:00	724.3	11/23/10 1:00	283.9	12/3/10 3:00	290.14
10/28/10 17:00	509.0	11/11/10 19:00	724.1	11/23/10 2:00	283.9	12/3/10 4:00	288.62
10/28/10 18:00	497.0	11/11/10 20:00	720.2	11/23/10 3:00	288.8	12/3/10 5:00	292.51
10/28/10 19:00	488.3	11/11/10 21:00	710.1	11/23/10 4:00	288.0	12/3/10 6:00	291.40
10/28/10 20:00	498.9	11/11/10 22:00	718.2	11/23/10 5:00	291.0	12/3/10 7:00	292.85
10/28/10 21:00	489.8	11/11/10 23:00	714.6	11/23/10 6:00	289.2	12/3/10 8:00	292.49
10/28/10 22:00	489.9	11/12/10 0:00	717.1	11/23/10 7:00	287.4	12/3/10 9:00	288.90
10/28/10 23:00	496.3	11/12/10 12:00	748.1	11/23/10 8:00	265.8	12/3/10 10:00	284.46
10/29/10 0:00	492.5	11/12/10 13:00	749.3	11/23/10 9:00	285.1	12/3/10 11:00	286.67
10/29/10 1:00	479.1	11/12/10 14:00	740.6	11/23/10 10:00	293.0	12/3/10 12:00	289.03
10/29/10 2:00	476.1	11/12/10 15:00	612.3	11/23/10 11:00	322.2	12/3/10 13:00	292.24
10/29/10 3:00	472.3	11/12/10 16:00	249.0	11/23/10 12:00	319.6	12/3/10 14:00	292.57
10/29/10 4:00	475.6	11/12/10 17:00	390.3	11/23/10 13:00	325.9	12/3/10 15:00	295.21
10/29/10 5:00	476.6	11/12/10 18:00	676.1	11/23/10 14:00	325.1	12/3/10 16:00	297.02
10/29/10 6:00	452.3	11/12/10 19:00	729.2	11/23/10 15:00	327.6	12/3/10 17:00	299.08
10/29/10 7:00	496.1	11/12/10 20:00	717.0	11/23/10 16:00	331.7	12/3/10 18:00	295.49
10/29/10 8:00	515.0	11/12/10 21:00	720.0	11/23/10 17:00	331.3	12/3/10 19:00	286.90
10/29/10 9:00	572.2	11/12/10 22:00	717.7	11/23/10 18:00	327.6	12/3/10 20:00	285.47

10/29/10 10:00	604.4	11/12/10 23:00	723.4	11/23/10 19:00	327.9	12/3/10 21:00	293.06
10/29/10 12:00	607.4	11/13/10 0:00	728.6	11/23/10 20:00	326.7	12/3/10 22:00	293.72
10/29/10 13:00	630.7	11/13/10 1:00	729.1	11/23/10 21:00	333.0	12/3/10 23:00	291.79
10/29/10 14:00	496.8	11/13/10 2:00	725.0	11/23/10 22:00	332.7	12/4/10 0:00	297.06
10/29/10 15:00	548.3	11/13/10 3:00	724.1	11/23/10 23:00	334.3	12/4/10 1:00	291.40
10/29/10 16:00	457.0	11/13/10 4:00	719.3	11/24/10 0:00	332.8	12/4/10 15:00	295.32
10/29/10 17:00	452.6	11/13/10 5:00	728.1	11/24/10 1:00	333.6	12/4/10 16:00	294.17
10/29/10 18:00	443.4	11/13/10 6:00	734.5	11/24/10 2:00	338.3	12/4/10 17:00	284.49
10/29/10 19:00	437.1	11/13/10 7:00	728.4	11/24/10 3:00	335.3	12/4/10 18:00	291.56
10/29/10 20:00	446.0	11/13/10 8:00	723.7	11/24/10 4:00	338.3	12/4/10 19:00	298.66
10/29/10 21:00	509.5	11/13/10 9:00	729.2	11/24/10 5:00	336.0	12/4/10 20:00	296.42
10/29/10 22:00	587.4	11/13/10 10:00	724.3	11/24/10 6:00	333.4	12/4/10 21:00	286.80
10/29/10 23:00	583.6	11/13/10 11:00	735.6	11/24/10 7:00	336.4	12/4/10 22:00	279.65
10/30/10 0:00	572.1	11/13/10 12:00	746.3	11/24/10 8:00	333.3	12/4/10 23:00	290.35
10/30/10 1:00	562.2	11/13/10 13:00	691.8	11/24/10 9:00	331.5	12/5/10 0:00	283.03
10/30/10 2:00	557.9	11/13/10 14:00	711.1	11/24/10 10:00	330.3	12/5/10 1:00	289.45
10/30/10 3:00	560.3	11/13/10 15:00	711.9	11/24/10 11:00	333.1	12/5/10 2:00	289.76
10/30/10 4:00	564.7	11/13/10 16:00	710.0	11/24/10 12:00	331.1	12/5/10 3:00	290.60
10/30/10 5:00	563.1	11/13/10 17:00	712.7	11/24/10 13:00	326.3	12/5/10 4:00	292.30
10/30/10 6:00	565.4	11/13/10 19:00	708.5	11/24/10 14:00	327.3	12/5/10 5:00	289.77
10/30/10 7:00	579.2	11/13/10 20:00	708.5	11/24/10 15:00	326.8	12/5/10 6:00	291.29
10/30/10 8:00	596.1	11/13/10 21:00	714.0	11/24/10 16:00	326.6	12/5/10 7:00	289.20
10/30/10 9:00	585.8	11/13/10 22:00	705.2	11/24/10 17:00	325.6	12/5/10 8:00	298.59
		11/13/10 23:00	710.1	11/24/10 18:00	322.9	12/5/10 9:00	298.98
		11/14/10 0:00	694.3	11/24/10 19:00	324.0	12/5/10 10:00	293.04
		11/14/10 1:00	709.1	11/24/10 20:00	328.0	12/5/10 11:00	288.44
		11/14/10 2:00	701.8	11/24/10 21:00	327.6	12/5/10 12:00	297.17
		11/14/10 3:00	714.4	11/24/10 22:00	329.0	12/5/10 13:00	297.72
		11/14/10 4:00	705.4	11/24/10 23:00	331.1	12/5/10 14:00	291.15
		11/14/10 5:00	709.8	11/25/10 0:00	331.0	12/5/10 15:00	292.23
		11/14/10 6:00	709.2	11/25/10 1:00	331.4	12/5/10 16:00	290.92
		11/14/10 7:00	707.5	11/25/10 2:00	331.6	12/5/10 17:00	292.91
		11/14/10 8:00	700.4	11/25/10 3:00	332.6	12/5/10 18:00	292.11
		11/14/10 9:00	707.5	11/25/10 4:00	332.6	12/5/10 19:00	290.62
		11/14/10 10:00	725.1	11/25/10 5:00	337.0	12/5/10 20:00	294.14
		11/14/10 11:00	704.7	11/25/10 6:00	339.2	12/5/10 21:00	294.32
		11/14/10 12:00	705.3	11/25/10 7:00	339.0	12/5/10 22:00	294.48
		11/14/10 13:00	719.5	11/25/10 8:00	342.4	12/5/10 23:00	293.22
		11/14/10 14:00	726.0	11/25/10 9:00	334.1	12/6/10 0:00	291.59
		11/14/10 15:00	716.2			12/6/10 1:00	292.75
						12/6/10 2:00	294.70
						12/6/10 3:00	288.93
						12/6/10 4:00	290.03
						12/6/10 5:00	279.35
						12/6/10 6:00	272.97
						12/6/10 7:00	282.02
						12/6/10 8:00	290.52
						12/6/10 9:00	306.58
						12/6/10 10:00	310.61
						12/6/10 11:00	276.40
						12/6/10 12:00	306.05
						12/6/10 13:00	307.32
						12/6/10 14:00	307.39
						12/6/10 15:00	309.64

Count	162	**Count**	179	**Count**	178	**Count**	193
Average	545.98	**Average**	711.46	**Average**	326.25	**Average**	285.69
St Dev	38.04	**St Dev**	51.35	**St Dev**	23.41	**St Dev**	30.76
Max	630.71	**Max**	765.15	**Max**	355.76	**Max**	310.61
Min	437.07	**Min**	249.01	**Min**	134.97	**Min**	42.20
$t_{0.05,\ c\text{-}1}$	1.975	$t_{0.05,\ c\text{-}1}$	1.973	$t_{0.05,\ c\text{-}1}$	1.973	$t_{0.05,\ c\text{-}1}$	1.972
UPL 95%	560.91	**UPL 95%**	731.46	**UPL 95%**	335.37	**UPL 95%**	297.59
UCL 95%	551.88	**UCL 95%**	719.04	UCL 95%	329.71	UCL 95%	290.05
$t_{0.01,\ c\text{-}1}$	2.607	$t_{0.01,\ c\text{-}1}$	2.604	$t_{0.01,\ c\text{-}1}$	2.604	$t_{0.01,\ c\text{-}1}$	2.603
UPL 99%	565.69	**UPL 99%**	737.84	**UPL 99%**	338.28	**UPL 99%**	301.40
UCL 99%	553.77	**UCL 99%**	721.46	**UCL 99%**	330.82	**UCL 99%**	291.45

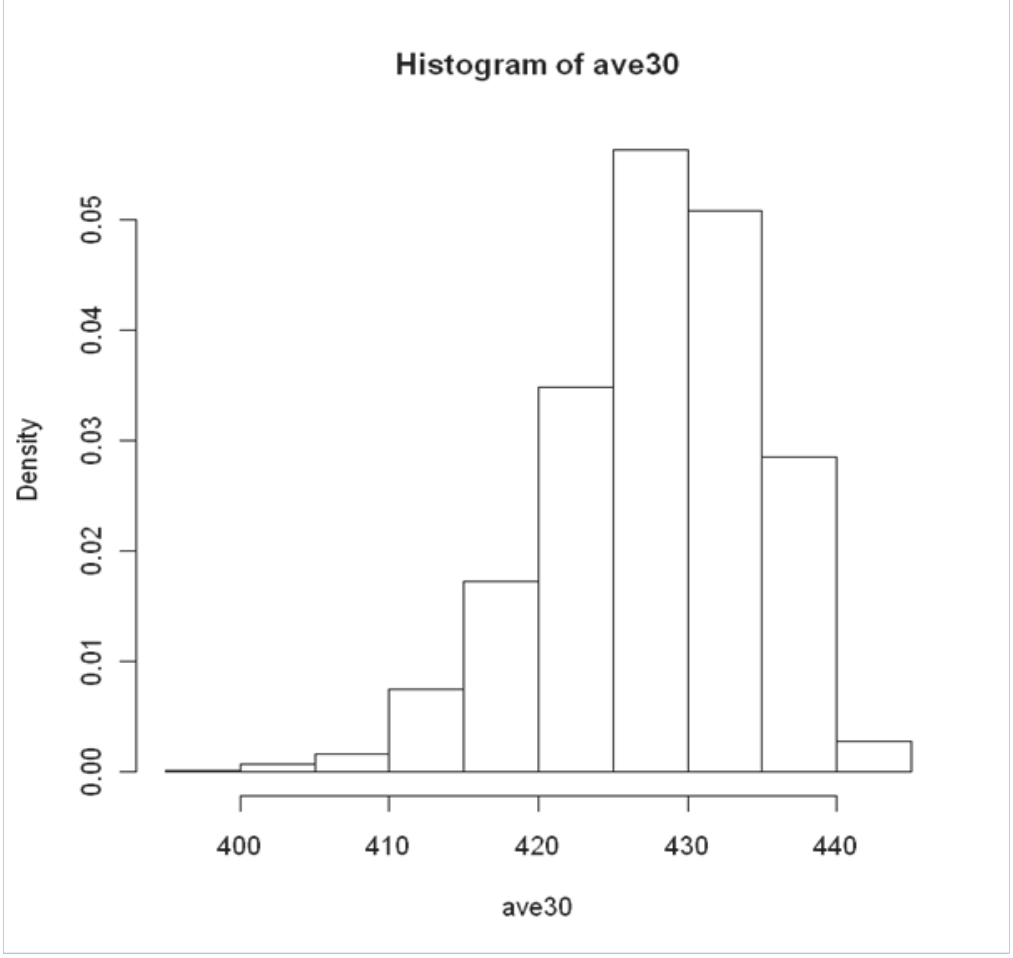
Line 1 Bootstrap Information

Classic prediction interval calculation for 30 new data points

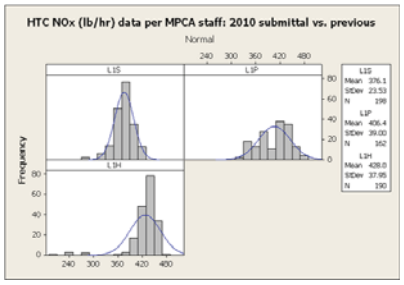
Mean	Stdev	Count	alpha	2-tail t	upper level
428.0	37.95	190	0.01	2.602	447.4
			0.05	1.973	442.7

Bootstrap results with 2000 replicates

Tool	Mean	SE(ave30)	alpha	2-tail z	upper level
Excel 2007	428.0	6.891	0.01	2.576	445.8
			0.05	1.960	441.5



Line 2 Information



BART Limit Options

1) Using L2S and L2H Data (2010)

Use of the 2-tail 99% confidence level for the fitted normal pattern

Mean	632.8	2-tail $z_{0.01}$	2.576	2-tail 99% UCL	646.0
Stdev	94.42	2-tail $z_{0.05}$	1.960	2-tail 95% UCL	642.9
Count	341				

2) Using the combined L2P, L2S, and L2H Data

Mean	550.7	2-tail 99% UCL	566.7
Stdev	141.9	2-tail 95% UCL	562.9
Count	518		

For predicting the next single data point

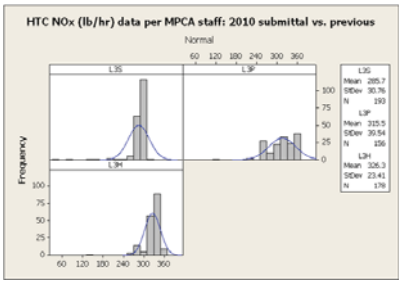
2-tail 99% UPL	916.5
2-tail 95% UPL	829.0

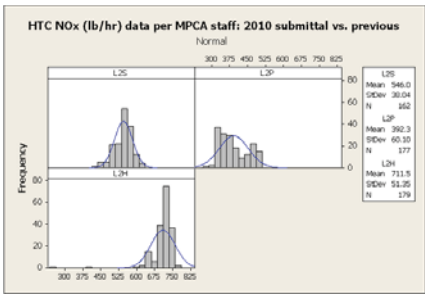
For predicting the next 30 data points - representing a 30 data point stack test

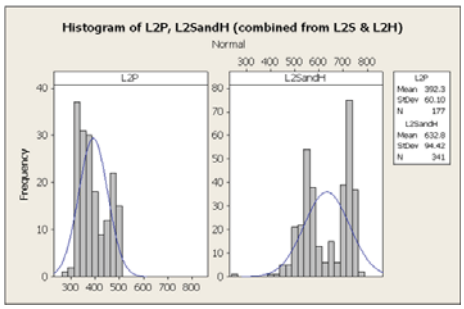
2-tail 99% UPL	619.3
2-tail 95% UPL	602.9

For predicting the next 720 data points - representing 30-day rolling average from daily hourly CEMS measurements.

2-tail 99% UPL	571.7
2-tail 95% UPL	566.7







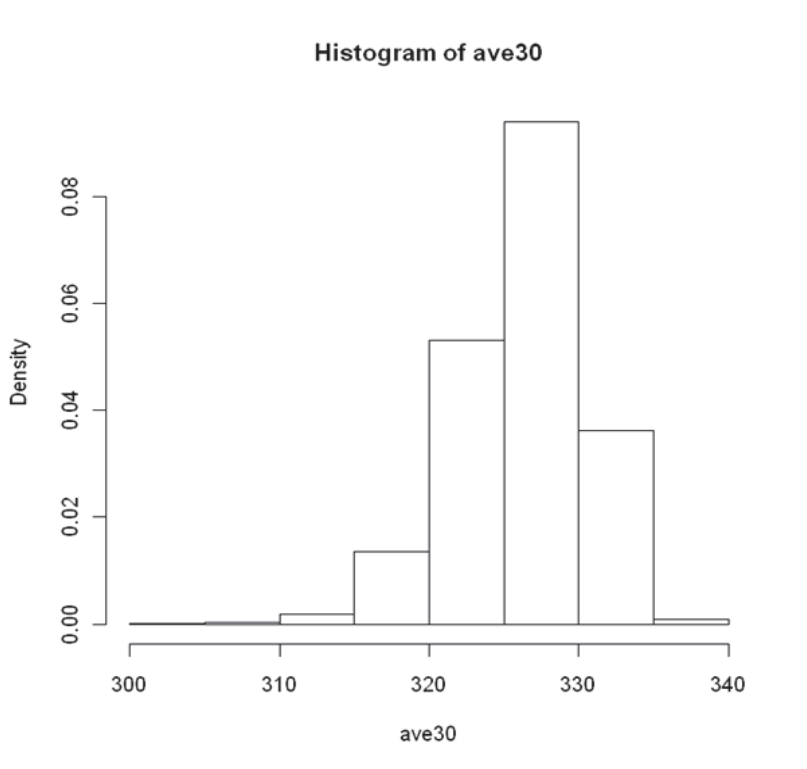
Line 3 Bootstrap Information

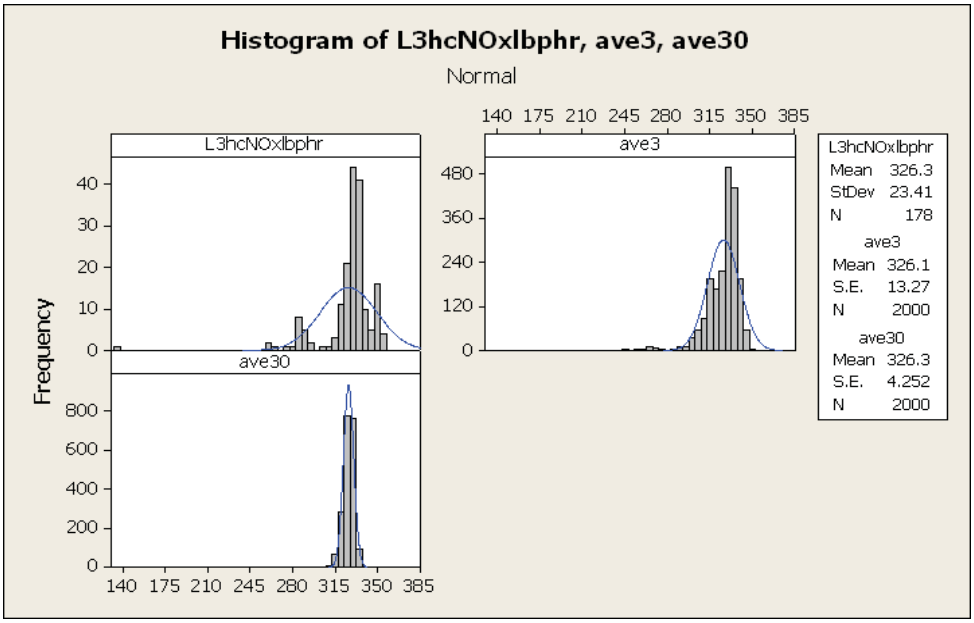
Classic prediction interval calculation for 30 new data points

Mean	Stdev	Count	alpha	2-tail t	upper level
326.3	23.41	178	0.01	2.604	338.3
			0.05	1.973	335.4

Bootstrap results with 2000 replicates

Tool	Mean	SE(ave30)	alpha	2-tail z	upper level
Excel 2007	326.3	4.252	0.01	2.576	337.2
			0.05	1.960	334.6





Hibbing Taconite - Data for NO_X BART Limit on Indurating Furnaces

Line 1 - High Compression		
	Original Data	Correction
Average	428.02	428.02
St Dev	37.95	37.95
Max	470.84	470.84
Min	207.96	207.96
Count	190	91
$t_{0.05, c-1}$	1.973	1.99
UPL 95%	442.73	449.66
$t_{0.01, c-1}$	2.602	2.63
UPL 99%	447.42	456.69
Autocorrelation		0.35
Effective "N"		91.48
Effective "M"		14.44

Line 2 - High Compression		
	Original Data	Correction
Average	711.46	711.46
St Dev	51.35	51.35
Max	765.20	765.20
Min	249.00	249.00
Count	179	4
$t_{0.05, c-1}$	1.973	3.18
UPL 95%	719.92	894.17
$t_{0.01, c-1}$	2.604	3.50
UPL 99%	722.63	912.37
Autocorrelation		0.96
Effective "N"		3.65
Effective "M"		0.61

Line 3 - High Compression		
	Original Data	Correction
Average	326.25	326.25
St Dev	23.41	23.41
Max	355.76	355.76
Min	134.97	134.97
Count	178	33
$t_{0.05, c-1}$	1.97	2.04
UPL 95%	335.37	347.46
$t_{0.01, c-1}$	2.60	2.63
UPL 99%	338.28	353.59
Autocorrelation		0.69
Effective "N"		32.65
Effective "M"		5.50

Line 1 - Standard		
	Original Data	Correction
Average	376.10	376.10
St Dev	23.53	23.53
Max	423.20	423.20
Min	275.72	275.72
Count	198	26
$t_{0.05, c-1}$	1.973	2.06
UPL 95%	385.19	402.18
$t_{0.01, c-1}$	2.602	2.80
UPL 99%	388.09	411.44
Autocorrelation		0.77
Effective "N"		25.73
Effective "M"		3.90

Line 2 - Standard		
	Original Data	Correction
Average	545.98	545.98
St Dev	38.04	38.04
Max	630.71	630.71
Min	437.07	437.07
Count	162	13
$t_{0.05, c-1}$	1.973	2.18
UPL 95%	719.92	608.93
$t_{0.01, c-1}$	2.604	3.05
UPL 99%	722.63	634.24
Autocorrelation		0.85
Effective "N"		13.14
Effective "M"		2.43

Line 3 - Standard		
	Original Data	Correction
Average	285.69	285.69
St Dev	30.76	30.76
Max	423.20	423.20
Min	275.72	275.72
Count	193	59
$t_{0.05, c-1}$	1.973	2.00
UPL 95%	297.60	307.72
$t_{0.01, c-1}$	2.604	2.66
UPL 99%	301.41	315.01
Autocorrelation		0.53
Effective "N"		59.29
Effective "M"		9.22

Line 2 - All Data		
	Original Data	Correction
Average	550.70	550.70
St Dev	141.90	141.90
Max	765.20	765.20
Min	249.00	249.00
Count	518	11
$t_{0.05, c-1}$	1.965	2.36
UPL 95%	566.76	906.59
$t_{0.01, c-1}$	2.604	3.50
UPL 99%	571.99	1077.40
Autocorrelation		0.97
Effective "N"		7.89
Effective "M"		0.61

L1H	NOx lb/hr	Sample Mean	Xt - Mean	Xt+1 - Mean	(Xt - Mean)(Xt+1-Mean)	(Xt - Mean)^2
7/16/10 9:00	444.0	428.0	16.0	18.1	289.22	256.43
7/16/10 10:00	446.1	428.0	18.1	7.7	139.27	326.20
7/16/10 11:00	435.7	428.0	7.7	1.7	13.37	59.46
7/16/10 12:00	429.7	428.0	1.7	-0.9	-1.48	3.01
7/16/10 13:00	427.1	428.0	-0.9	-5.6	4.79	0.73
7/16/10 14:00	422.4	428.0	-5.6	2.7	-15.36	31.29
7/16/10 16:00	430.7	428.0	2.7	-146.6	-402.42	7.54
7/16/10 17:00	281.4	428.0	-146.6	-26.7	3917.39	21481.68
7/16/10 18:00	401.3	428.0	-26.7	4.2	-111.14	714.37
7/16/10 19:00	432.2	428.0	4.2	11.6	48.39	17.29
7/16/10 20:00	439.6	428.0	11.6	12.6	147.01	135.44
7/16/10 21:00	440.6	428.0	12.6	12.2	154.48	159.57
7/16/10 22:00	440.2	428.0	12.2	8.0	97.99	149.54
7/16/10 23:00	436.0	428.0	8.0	1.4	11.29	64.21
7/17/10 0:00	429.4	428.0	1.4	13.4	18.88	1.99
7/17/10 1:00	441.4	428.0	13.4	6.9	93.05	179.51
7/17/10 2:00	434.9	428.0	6.9	8.3	57.57	48.23
7/17/10 3:00	436.3	428.0	8.3	10.0	83.13	68.70
7/17/10 4:00	438.0	428.0	10.0	7.3	73.68	100.59
7/17/10 5:00	435.3	428.0	7.3	3.4	24.63	53.98
7/17/10 6:00	431.4	428.0	3.4	4.0	13.26	11.24
7/17/10 7:00	432.0	428.0	4.0	2.4	9.53	15.66
7/17/10 8:00	430.4	428.0	2.4	15.2	36.54	5.80
7/17/10 9:00	443.2	428.0	15.2	6.0	91.06	230.07
7/17/10 10:00	434.0	428.0	6.0	13.7	82.24	36.04
7/17/10 11:00	441.7	428.0	13.7	16.3	223.32	187.68
7/17/10 12:00	444.3	428.0	16.3	21.8	355.53	265.74
7/17/10 13:00	449.8	428.0	21.8	9.0	196.41	475.65
7/17/10 14:00	437.0	428.0	9.0	-3.1	-28.07	81.10
7/17/10 15:00	424.9	428.0	-3.1	2.6	-8.19	9.71
7/17/10 16:00	430.6	428.0	2.6	5.0	13.10	6.91
7/17/10 17:00	433.0	428.0	5.0	6.5	32.52	24.81
7/17/10 18:00	434.5	428.0	6.5	3.6	23.51	42.61
7/17/10 19:00	431.6	428.0	3.6	-8.0	-28.92	12.98
7/17/10 20:00	420.0	428.0	-8.0	2.5	-19.89	64.45
7/17/10 21:00	430.5	428.0	2.5	3.9	9.61	6.14
7/17/10 22:00	431.9	428.0	3.9	-1.2	-4.51	15.05
7/17/10 23:00	426.8	428.0	-1.2	-9.2	10.73	1.35
7/18/10 1:00	418.8	428.0	-9.2	-2.4	22.06	85.11
7/18/10 2:00	425.6	428.0	-2.4	-9.2	21.95	5.72
7/18/10 3:00	418.8	428.0	-9.2	-22.6	207.48	84.20
7/18/10 4:00	405.4	428.0	-22.6	-26.0	588.29	511.23
7/18/10 5:00	402.0	428.0	-26.0	-8.9	232.41	676.96
7/18/10 6:00	419.1	428.0	-8.9	-16.5	147.08	79.79
7/18/10 7:00	411.5	428.0	-16.5	-15.1	248.16	271.14
7/18/10 8:00	412.9	428.0	-15.1	-9.1	137.80	227.13
7/18/10 9:00	418.9	428.0	-9.1	-8.5	77.62	83.61
7/18/10 10:00	419.5	428.0	-8.5	-7.9	66.89	72.07
7/18/10 11:00	420.1	428.0	-7.9	-4.5	35.74	62.08
7/18/10 12:00	423.5	428.0	-4.5	-3.6	16.50	20.58
7/18/10 13:00	424.4	428.0	-3.6	-8.2	30.01	13.23
7/18/10 14:00	419.8	428.0	-8.2	-6.1	50.69	68.05
7/18/10 15:00	421.9	428.0	-6.1	-67.1	412.39	37.76
7/18/10 16:00	360.9	428.0	-67.1	-4.2	283.17	4503.56

7/18/10 18:00	423.8	428.0	-4.2	-7.7	32.30	17.81
7/18/10 19:00	420.3	428.0	-7.7	-3.4	26.08	58.61
7/18/10 20:00	424.6	428.0	-3.4	-182.8	622.68	11.61
7/18/10 21:00	245.2	428.0	-182.8	-39.7	7259.75	33399.13
7/18/10 22:00	388.3	428.0	-39.7	-0.4	15.75	1578.00
7/18/10 23:00	427.6	428.0	-0.4	1.4	-0.57	0.16
7/19/10 0:00	429.4	428.0	1.4	5.7	8.20	2.06
7/19/10 1:00	433.7	428.0	5.7	4.6	26.48	32.71
7/19/10 2:00	432.6	428.0	4.6	4.1	19.15	21.43
7/19/10 3:00	432.1	428.0	4.1	11.4	47.16	17.11
7/19/10 4:00	439.4	428.0	11.4	10.0	114.58	130.00
7/19/10 5:00	438.0	428.0	10.0	9.3	93.19	100.99
7/19/10 6:00	437.3	428.0	9.3	-2.7	-25.01	86.00
7/19/10 7:00	425.3	428.0	-2.7	15.8	-42.58	7.28
7/19/10 8:00	443.8	428.0	15.8	13.5	212.75	249.25
7/19/10 10:00	441.5	428.0	13.5	9.6	129.17	181.60
7/19/10 11:00	437.6	428.0	9.6	0.9	8.68	91.88
7/19/10 12:00	428.9	428.0	0.9	-13.7	-12.39	0.82
7/19/10 13:00	414.3	428.0	-13.7	-2.2	30.13	187.34
7/19/10 14:00	425.8	428.0	-2.2	3.1	-6.85	4.85
7/19/10 15:00	431.1	428.0	3.1	-0.4	-1.19	9.68
7/19/10 16:00	427.6	428.0	-0.4	-3.7	1.43	0.15
7/19/10 17:00	424.3	428.0	-3.7	-4.4	16.31	14.01
7/19/10 18:00	423.6	428.0	-4.4	-8.5	37.14	18.98
7/19/10 19:00	419.5	428.0	-8.5	1.4	-11.88	72.67
7/19/10 20:00	429.4	428.0	1.4	-220.0	-306.67	1.94
7/19/10 21:00	208.0	428.0	-220.0	-155.3	34162.04	48418.52
7/19/10 22:00	272.7	428.0	-155.3	28.4	-4411.91	24103.27
7/19/10 23:00	456.4	428.0	28.4	23.1	657.74	807.57
7/20/10 0:00	451.1	428.0	23.1	28.0	647.52	535.72
7/20/10 1:00	456.0	428.0	28.0	28.4	794.20	782.67
7/20/10 2:00	456.4	428.0	28.4	37.2	1056.88	805.91
7/20/10 3:00	465.2	428.0	37.2	32.7	1219.19	1386.00
7/20/10 4:00	460.7	428.0	32.7	27.1	888.24	1072.46
7/20/10 5:00	455.1	428.0	27.1	26.2	710.58	735.66
7/20/10 6:00	454.2	428.0	26.2	28.0	732.64	686.34
7/20/10 7:00	456.0	428.0	28.0	-181.4	-5072.53	782.06
7/20/10 8:00	246.6	428.0	-181.4	-16.1	2929.34	32900.90
7/20/10 10:00	411.9	428.0	-16.1	13.3	-215.20	260.82
7/20/10 11:00	441.3	428.0	13.3	17.2	228.59	177.56
7/20/10 12:00	445.2	428.0	17.2	-47.8	-819.92	294.29
7/20/10 13:00	380.2	428.0	-47.8	16.7	-797.12	2284.32
7/20/10 14:00	444.7	428.0	16.7	22.2	370.10	278.16
7/20/10 15:00	450.2	428.0	22.2	21.9	485.42	492.43
7/20/10 16:00	449.9	428.0	21.9	17.4	379.93	478.52
7/20/10 17:00	445.4	428.0	17.4	14.4	249.87	301.65
7/20/10 18:00	442.4	428.0	14.4	19.6	282.57	206.98
7/20/10 19:00	447.6	428.0	19.6	18.6	365.92	385.75
7/20/10 20:00	446.6	428.0	18.6	17.9	332.80	347.11
7/20/10 21:00	445.9	428.0	17.9	15.4	274.67	319.07
7/20/10 22:00	443.4	428.0	15.4	20.4	313.44	236.44
7/20/10 23:00	448.4	428.0	20.4	21.7	441.70	415.51
7/21/10 0:00	449.7	428.0	21.7	17.3	374.62	469.55
7/21/10 1:00	445.3	428.0	17.3	14.2	245.11	298.89
7/21/10 2:00	442.2	428.0	14.2	21.1	298.58	201.01
7/21/10 3:00	449.1	428.0	21.1	19.5	409.63	443.52

7/21/10 4:00	447.5	428.0	19.5	26.7	518.61	378.33
7/21/10 5:00	454.7	428.0	26.7	23.4	623.09	710.90
7/21/10 6:00	451.4	428.0	23.4	23.3	543.64	546.12
7/21/10 7:00	451.3	428.0	23.3	18.1	420.27	541.16
7/21/10 8:00	446.1	428.0	18.1	21.8	393.25	326.38
7/21/10 9:00	449.8	428.0	21.8	19.7	428.11	473.81
7/21/10 10:00	447.7	428.0	19.7	27.8	546.71	386.82
7/21/10 11:00	455.8	428.0	27.8	39.1	1087.57	772.70
7/21/10 12:00	467.1	428.0	39.1	34.0	1328.86	1530.75
7/21/10 13:00	462.0	428.0	34.0	28.3	959.73	1153.59
7/21/10 14:00	456.3	428.0	28.3	29.3	829.22	798.46
7/21/10 15:00	457.3	428.0	29.3	36.4	1067.78	861.16
7/21/10 16:00	464.4	428.0	36.4	33.1	1203.94	1323.98
7/21/10 17:00	461.1	428.0	33.1	39.7	1313.85	1094.79
7/21/10 18:00	467.7	428.0	39.7	42.8	1701.01	1576.75
7/21/10 19:00	470.8	428.0	42.8	39.5	1692.08	1835.07
7/21/10 20:00	467.5	428.0	39.5	39.1	1543.70	1560.23
7/21/10 21:00	467.1	428.0	39.1	32.5	1269.99	1527.35
7/21/10 22:00	460.5	428.0	32.5	35.8	1161.98	1055.99
7/21/10 23:00	463.8	428.0	35.8	35.9	1282.40	1278.61
7/22/10 0:00	463.9	428.0	35.9	36.2	1299.81	1286.20
7/22/10 1:00	464.2	428.0	36.2	30.9	1121.51	1313.57
7/22/10 2:00	458.9	428.0	30.9	30.9	956.53	957.54
7/22/10 3:00	458.9	428.0	30.9	32.1	991.33	955.52
7/22/10 4:00	460.1	428.0	32.1	22.7	726.71	1028.48
7/22/10 5:00	450.7	428.0	22.7	18.0	408.51	513.48
7/22/10 6:00	446.0	428.0	18.0	27.1	488.91	324.99
7/22/10 7:00	455.1	428.0	27.1	28.7	777.00	735.51
7/22/10 8:00	456.7	428.0	28.7	22.3	638.08	820.83
7/22/10 9:00	450.3	428.0	22.3	19.1	426.29	496.02
7/22/10 10:00	447.1	428.0	19.1	17.3	332.01	366.36
7/22/10 11:00	445.3	428.0	17.3	20.0	346.76	300.88
7/22/10 12:00	448.0	428.0	20.0	18.2	364.49	399.63
7/22/10 13:00	446.2	428.0	18.2	18.5	337.17	332.45
7/22/10 14:00	446.5	428.0	18.5	16.0	295.10	341.96
7/22/10 15:00	444.0	428.0	16.0	16.1	256.90	254.66
7/22/10 16:00	444.1	428.0	16.1	15.6	251.93	259.15
7/22/10 17:00	443.6	428.0	15.6	21.5	337.00	244.91
7/22/10 18:00	449.5	428.0	21.5	18.6	401.19	463.73
7/22/10 19:00	446.6	428.0	18.6	7.2	133.45	347.09
7/22/10 20:00	435.2	428.0	7.2	-55.0	-394.32	51.31
7/22/10 21:00	373.0	428.0	-55.0	11.6	-641.07	3030.30
7/22/10 22:00	439.6	428.0	11.6	8.1	94.22	135.62
7/22/10 23:00	436.1	428.0	8.1	3.5	28.70	65.46
7/23/10 0:00	431.5	428.0	3.5	4.6	16.44	12.58
7/23/10 1:00	432.6	428.0	4.6	12.4	57.36	21.48
7/23/10 2:00	440.4	428.0	12.4	11.4	141.06	153.17
7/23/10 3:00	439.4	428.0	11.4	-3.6	-41.22	129.90
7/23/10 4:00	424.4	428.0	-3.6	-192.2	695.29	13.08
7/23/10 5:00	235.8	428.0	-192.2	-5.5	1062.19	36953.90
7/23/10 6:00	422.5	428.0	-5.5	12.6	-69.84	30.53
7/23/10 7:00	440.6	428.0	12.6	10.4	131.69	159.75
7/23/10 8:00	438.4	428.0	10.4	7.0	73.24	108.56
7/23/10 9:00	435.0	428.0	7.0	-5.7	-40.36	49.42
7/23/10 10:00	422.3	428.0	-5.7	-17.5	100.20	32.96
7/23/10 11:00	410.5	428.0	-17.5	-9.7	170.07	304.65

7/23/10 12:00	418.3	428.0	-9.7	-10.2	98.97	94.94
7/23/10 13:00	417.8	428.0	-10.2	-13.8	139.96	103.17
7/23/10 14:00	414.2	428.0	-13.8	-20.3	280.23	189.88
7/23/10 15:00	407.7	428.0	-20.3	-35.7	725.29	413.57
7/23/10 16:00	392.3	428.0	-35.7	-27.5	980.48	1271.96
7/23/10 17:00	400.5	428.0	-27.5	-20.0	550.79	755.79
7/23/10 18:00	408.0	428.0	-20.0	-20.7	414.50	401.39
7/23/10 19:00	407.3	428.0	-20.7	-6.8	140.58	428.04
7/23/10 20:00	421.2	428.0	-6.8	-15.0	101.60	46.17
7/23/10 21:00	413.0	428.0	-15.0	-11.4	169.72	223.58
7/23/10 22:00	416.6	428.0	-11.4	-15.5	175.45	128.83
7/23/10 23:00	412.5	428.0	-15.5	-16.9	261.65	238.95
7/24/10 0:00	411.1	428.0	-16.9	-25.0	423.23	286.51
7/24/10 1:00	403.0	428.0	-25.0	-21.5	537.99	625.21
7/24/10 2:00	406.5	428.0	-21.5	-17.2	370.58	462.93
7/24/10 3:00	410.8	428.0	-17.2	-17.5	301.41	296.66
7/24/10 4:00	410.5	428.0	-17.5	-24.0	420.04	306.25
7/24/10 5:00	404.0	428.0	-24.0	-18.7	448.68	576.11
7/24/10 6:00	409.3	428.0	-18.7	-25.9	484.73	349.44
7/24/10 7:00	402.1	428.0	-25.9	-30.3	786.18	672.41
7/24/10 8:00	397.7	428.0	-30.3	-25.9	784.78	919.21
7/24/10 9:00	402.1	428.0	-25.9	-18.1	469.34	670.00
7/24/10 10:00	409.9	428.0	-18.1	-19.7	356.61	328.78
7/24/10 11:00	408.3	428.0	-19.7	0.0		386.79
					95671.13	271878.00

Mean	428.0
Stdev	37.95
Count	190

$t_{0.01,\ 189}$=	2.602
$t_{0.05,\ 189}$=	1.973

Autocorrelation	0.35		
MPCA "Multiplier"	0.1965	Effective N	91.08797
Effective N Multiplier	0.2105	Compliance Test	14.38231

L1S	NOx lb/hr	Sample Mean	Xt - Mean	Xt+1 - Mean	(Xt - Mean)(Xt+1-Mean)	(Xt - Mean)^2
10/13/10 17:00	423.2	376.1	47.1	42.0	1978.00	2218.81
10/13/10 18:00	418.1	376.1	42.0	38.1	1598.65	1763.32
10/13/10 19:00	414.2	376.1	38.1	42.8	1629.52	1449.35
10/13/10 20:00	418.9	376.1	42.8	28.4	1217.06	1832.09
10/13/10 21:00	404.5	376.1	28.4	39.3	1117.61	808.50
10/13/10 22:00	415.4	376.1	39.3	40.8	1603.68	1544.91
10/13/10 23:00	416.9	376.1	40.8	27.0	1102.36	1664.70
10/14/10 0:00	403.1	376.1	27.0	38.6	1042.84	729.98
10/14/10 1:00	414.7	376.1	38.6	40.6	1567.45	1489.78
10/14/10 2:00	416.7	376.1	40.6	32.3	1312.13	1649.17
10/14/10 3:00	408.4	376.1	32.3	38.9	1256.98	1043.97
10/14/10 4:00	415.0	376.1	38.9	33.0	1284.52	1513.47
10/14/10 5:00	409.1	376.1	33.0	33.0	1090.51	1090.21
10/14/10 6:00	409.1	376.1	33.0	38.7	1278.51	1090.81
10/14/10 7:00	414.8	376.1	38.7	36.3	1404.38	1498.50
10/14/10 8:00	412.4	376.1	36.3	32.4	1176.32	1316.17
10/14/10 10:00	408.5	376.1	32.4	21.4	693.69	1051.33
10/14/10 11:00	397.5	376.1	21.4	24.0	513.02	457.71
10/14/10 12:00	400.1	376.1	24.0	23.9	573.76	575.00
10/14/10 13:00	400.0	376.1	23.9	12.3	294.93	572.53
10/14/10 14:00	388.4	376.1	12.3	15.5	191.38	151.93
10/14/10 15:00	391.6	376.1	15.5	10.1	157.08	241.08
10/14/10 16:00	386.2	376.1	10.1	7.9	79.99	102.34
10/14/10 17:00	384.0	376.1	7.9	12.9	102.18	62.52
10/14/10 18:00	389.0	376.1	12.9	-8.5	-109.55	166.98
10/14/10 19:00	367.6	376.1	-8.5	16.1	-136.38	71.87
10/14/10 20:00	392.2	376.1	16.1	24.8	399.38	258.81
10/14/10 21:00	400.9	376.1	24.8	20.3	503.90	616.31
10/14/10 22:00	396.4	376.1	20.3	22.0	446.23	411.99
10/14/10 23:00	398.1	376.1	22.0	21.4	471.14	483.31
10/15/10 0:00	397.5	376.1	21.4	22.1	474.57	459.27
10/15/10 1:00	398.2	376.1	22.1	13.2	292.04	490.37
10/15/10 2:00	389.3	376.1	13.2	19.5	257.75	173.93
10/15/10 3:00	395.6	376.1	19.5	13.5	264.52	381.98
10/15/10 4:00	389.6	376.1	13.5	7.7	104.33	183.18
10/15/10 5:00	383.8	376.1	7.7	11.9	91.63	59.42
10/15/10 6:00	388.0	376.1	11.9	14.2	168.68	141.30
10/15/10 7:00	390.3	376.1	14.2	14.8	209.46	201.37
10/15/10 8:00	390.9	376.1	14.8	7.4	108.58	217.88
10/15/10 9:00	383.5	376.1	7.4	2.9	21.10	54.11
10/15/10 10:00	379.0	376.1	2.9	6.1	17.60	8.23
10/15/10 11:00	382.2	376.1	6.1	1.3	8.07	37.66
10/15/10 12:00	377.4	376.1	1.3	-7.3	-9.60	1.73
10/15/10 14:00	368.8	376.1	-7.3	4.7	-34.22	53.30
10/15/10 15:00	380.8	376.1	4.7	-2.3	-10.57	21.98
10/15/10 16:00	373.8	376.1	-2.3	-36.4	82.12	5.08
10/15/10 17:00	339.7	376.1	-36.4	-27.9	1016.34	1327.05
10/15/10 18:00	348.2	376.1	-27.9	9.9	-276.75	778.38
10/15/10 19:00	386.0	376.1	9.9	4.4	43.37	98.40
10/15/10 20:00	380.5	376.1	4.4	2.3	9.98	19.12
10/15/10 21:00	378.4	376.1	2.3	10.5	24.04	5.21
10/15/10 22:00	386.6	376.1	10.5	24.1	253.89	110.82
10/15/10 23:00	400.2	376.1	24.1	22.3	538.82	581.67
10/16/10 0:00	398.4	376.1	22.3	16.5	369.74	499.11

10/16/10 1:00	392.6	376.1	16.5	20.4	337.52	273.90
10/16/10 2:00	396.5	376.1	20.4	13.0	264.32	415.92
10/16/10 3:00	389.1	376.1	13.0	6.3	81.25	167.98
10/16/10 4:00	382.4	376.1	6.3	13.3	83.34	39.30
10/16/10 5:00	389.4	376.1	13.3	20.5	272.73	176.69
10/16/10 6:00	396.6	376.1	20.5	36.4	746.88	420.97
10/16/10 8:00	412.5	376.1	36.4	-4.4	-159.71	1325.10
10/16/10 9:00	371.7	376.1	-4.4	15.8	-69.32	19.25
10/16/10 10:00	391.9	376.1	15.8	28.6	451.90	249.65
10/16/10 11:00	404.7	376.1	28.6	23.8	681.17	817.99
10/16/10 12:00	399.9	376.1	23.8	9.6	227.60	567.23
10/16/10 13:00	385.7	376.1	9.6	4.2	40.14	91.33
10/16/10 14:00	380.3	376.1	4.2	3.5	14.55	17.65
10/16/10 15:00	379.6	376.1	3.5	11.3	39.29	11.99
10/16/10 16:00	387.4	376.1	11.3	0.3	3.78	128.73
10/16/10 17:00	376.4	376.1	0.3	3.7	1.22	0.11
10/16/10 18:00	379.8	376.1	3.7	6.9	25.42	13.51
10/16/10 19:00	383.0	376.1	6.9	7.5	51.60	47.83
10/16/10 20:00	383.6	376.1	7.5	10.3	76.73	55.67
10/16/10 21:00	386.4	376.1	10.3	-2.2	-22.54	105.75
10/16/10 22:00	373.9	376.1	-2.2	-62.6	137.26	4.80
10/16/10 23:00	313.5	376.1	-62.6	-3.5	220.16	3921.79
10/17/10 0:00	372.6	376.1	-3.5	6.0	-21.14	12.36
10/17/10 1:00	382.1	376.1	6.0	31.5	189.44	36.15
10/17/10 2:00	407.6	376.1	31.5	34.3	1081.00	992.83
10/17/10 3:00	410.4	376.1	34.3	20.4	699.12	1177.01
10/17/10 4:00	396.5	376.1	20.4	-100.4	-2045.62	415.26
10/17/10 5:00	275.7	376.1	-100.4	-16.2	1621.31	10076.93
10/17/10 6:00	359.9	376.1	-16.2	14.0	-225.98	260.86
10/17/10 7:00	390.1	376.1	14.0	12.9	179.95	195.77
10/17/10 8:00	389.0	376.1	12.9	7.0	89.75	165.42
10/17/10 9:00	383.1	376.1	7.0	17.0	118.32	48.70
10/17/10 10:00	393.1	376.1	17.0	15.0	254.26	287.45
10/17/10 11:00	391.1	376.1	15.0	14.5	217.96	224.90
10/17/10 12:00	390.6	376.1	14.5	15.6	227.23	211.23
10/17/10 13:00	391.7	376.1	15.6	11.8	183.91	244.44
10/17/10 14:00	387.9	376.1	11.8	13.1	154.47	138.37
10/17/10 15:00	389.2	376.1	13.1	20.1	263.92	172.45
10/17/10 17:00	396.2	376.1	20.1	13.5	271.54	403.92
10/17/10 18:00	389.6	376.1	13.5	11.3	152.94	182.54
10/17/10 19:00	387.4	376.1	11.3	11.3	127.42	128.15
10/17/10 20:00	387.4	376.1	11.3	12.4	139.15	126.70
10/17/10 21:00	388.5	376.1	12.4	10.0	123.84	152.81
10/17/10 22:00	386.1	376.1	10.0	2.4	23.80	100.36
10/17/10 23:00	378.5	376.1	2.4	-0.5	-1.29	5.64
10/18/10 0:00	375.6	376.1	-0.5	7.5	-4.06	0.30
10/18/10 1:00	383.6	376.1	7.5	7.9	58.76	55.74
10/18/10 2:00	384.0	376.1	7.9	11.7	92.01	61.95
10/18/10 3:00	387.8	376.1	11.7	6.7	78.43	136.66
10/18/10 4:00	382.8	376.1	6.7	6.9	46.27	45.01
10/18/10 5:00	383.0	376.1	6.9	5.4	37.54	47.56
10/18/10 6:00	381.5	376.1	5.4	5.1	27.91	29.63
10/18/10 7:00	381.2	376.1	5.1	7.1	36.54	26.30
10/18/10 8:00	383.2	376.1	7.1	7.3	51.66	50.77
10/18/10 9:00	383.4	376.1	7.3	9.5	69.16	52.57
10/18/10 11:00	385.6	376.1	9.5	11.4	108.44	90.98

10/18/10 12:00	387.5	376.1	11.4	10.1	114.79	129.26
10/18/10 13:00	386.2	376.1	10.1	4.8	48.29	101.95
10/18/10 14:00	380.9	376.1	4.8	-6.1	-29.10	22.87
10/18/10 15:00	370.0	376.1	-6.1	-11.5	69.89	37.02
10/18/10 16:00	364.6	376.1	-11.5	-5.1	58.49	131.94
10/18/10 17:00	371.0	376.1	-5.1	-9.8	50.16	25.93
10/18/10 18:00	366.3	376.1	-9.8	-15.6	153.88	97.01
10/18/10 19:00	360.5	376.1	-15.6	-11.2	175.37	244.09
10/18/10 20:00	364.9	376.1	-11.2	-15.2	170.90	126.00
10/18/10 21:00	360.9	376.1	-15.2	-7.6	115.67	231.81
10/18/10 22:00	368.5	376.1	-7.6	-16.0	121.61	57.71
10/18/10 23:00	360.1	376.1	-16.0	-29.7	475.35	256.23
10/19/10 0:00	346.4	376.1	-29.7	-31.4	932.05	881.87
10/19/10 1:00	344.7	376.1	-31.4	-41.3	1296.37	985.09
10/19/10 2:00	334.8	376.1	-41.3	-45.6	1885.30	1706.00
10/19/10 3:00	330.5	376.1	-45.6	-41.8	1910.20	2083.45
10/19/10 4:00	334.3	376.1	-41.8	-44.2	1850.42	1751.36
10/19/10 5:00	331.9	376.1	-44.2	-52.7	2330.24	1955.08
10/19/10 6:00	323.4	376.1	-52.7	-50.2	2644.82	2777.39
10/19/10 7:00	325.9	376.1	-50.2	-49.2	2467.07	2518.58
10/19/10 8:00	326.9	376.1	-49.2	-56.0	2752.10	2416.63
10/19/10 9:00	320.1	376.1	-56.0	-91.1	5101.04	3134.15
10/19/10 10:00	285.0	376.1	-91.1	-56.0	5103.78	8302.29
10/19/10 13:00	320.1	376.1	-56.0	-27.9	1564.88	3137.51
10/19/10 14:00	348.2	376.1	-27.9	-31.0	867.17	780.51
10/19/10 15:00	345.1	376.1	-31.0	-25.1	777.85	963.47
10/19/10 16:00	351.0	376.1	-25.1	-21.2	530.09	628.00
10/19/10 17:00	354.9	376.1	-21.2	-20.7	437.90	447.45
10/19/10 18:00	355.4	376.1	-20.7	-16.4	340.20	428.55
10/19/10 19:00	359.7	376.1	-16.4	-15.1	247.79	270.07
10/19/10 20:00	361.0	376.1	-15.1	-22.7	342.57	227.35
10/19/10 21:00	353.4	376.1	-22.7	-8.0	180.98	516.18
10/19/10 22:00	368.1	376.1	-8.0	-16.3	130.03	63.46
10/19/10 23:00	359.8	376.1	-16.3	-18.8	306.67	266.46
10/20/10 0:00	357.3	376.1	-18.8	-14.7	276.12	352.95
10/20/10 1:00	361.4	376.1	-14.7	-15.5	227.37	216.02
10/20/10 2:00	360.6	376.1	-15.5	-16.8	259.61	239.31
10/20/10 3:00	359.3	376.1	-16.8	-23.6	396.33	281.64
10/20/10 4:00	352.5	376.1	-23.6	-26.8	633.25	557.72
10/20/10 5:00	349.3	376.1	-26.8	-25.5	683.84	719.00
10/20/10 6:00	350.6	376.1	-25.5	-22.9	584.96	650.39
10/20/10 7:00	353.2	376.1	-22.9	-10.8	248.17	526.10
10/20/10 8:00	365.3	376.1	-10.8	-0.5	5.23	117.06
10/20/10 10:00	375.6	376.1	-0.5	0.4	-0.19	0.23
10/20/10 11:00	376.5	376.1	0.4	2.0	0.80	0.16
10/20/10 12:00	378.1	376.1	2.0	6.2	12.37	4.02
10/20/10 13:00	382.3	376.1	6.2	-11.8	-73.03	38.04
10/20/10 14:00	364.3	376.1	-11.8	-9.8	115.74	140.20
10/20/10 15:00	366.3	376.1	-9.8	-2.2	21.37	95.54
10/20/10 16:00	373.9	376.1	-2.2	-0.1	0.27	4.78
10/20/10 17:00	376.0	376.1	-0.1	1.8	-0.22	0.02
10/20/10 18:00	377.9	376.1	1.8	-2.5	-4.46	3.10
10/20/10 19:00	373.6	376.1	-2.5	5.4	-13.72	6.43
10/20/10 20:00	381.5	376.1	5.4	-5.9	-31.83	29.27
10/20/10 21:00	370.2	376.1	-5.9	-11.2	65.63	34.61
10/20/10 22:00	364.9	376.1	-11.2	-7.9	87.90	124.46

10/20/10 23:00	368.2	376.1	-7.9	-8.6	67.51	62.07
10/21/10 0:00	367.5	376.1	-8.6	-11.1	94.98	73.43
10/21/10 1:00	365.0	376.1	-11.1	-7.8	86.79	122.85
10/21/10 2:00	368.3	376.1	-7.8	-14.7	114.75	61.31
10/21/10 3:00	361.4	376.1	-14.7	6.8	-98.93	214.75
10/21/10 4:00	382.9	376.1	6.8	12.1	81.45	45.57
10/21/10 5:00	388.2	376.1	12.1	12.7	153.32	145.56
10/21/10 6:00	388.8	376.1	12.7	8.6	109.32	161.50
10/21/10 7:00	384.7	376.1	8.6	9.3	80.20	74.00
10/21/10 8:00	385.4	376.1	9.3	0.8	7.66	86.92
10/21/10 9:00	376.9	376.1	0.8	-6.3	-5.16	0.68
10/21/10 10:00	369.8	376.1	-6.3	-16.5	103.86	39.39
10/21/10 12:00	359.6	376.1	-16.5	-16.8	277.96	273.83
10/21/10 13:00	359.3	376.1	-16.8	-9.9	166.77	282.15
10/21/10 14:00	366.2	376.1	-9.9	-13.7	135.79	98.57
10/21/10 15:00	362.4	376.1	-13.7	-13.5	184.40	187.07
10/21/10 16:00	362.6	376.1	-13.5	-6.1	81.81	181.76
10/21/10 17:00	370.0	376.1	-6.1	-7.6	45.84	36.82
10/21/10 18:00	368.5	376.1	-7.6	-11.5	86.99	57.06
10/21/10 19:00	364.6	376.1	-11.5	-10.8	124.22	132.61
10/21/10 20:00	365.3	376.1	-10.8	-11.6	124.84	116.36
10/21/10 21:00	364.5	376.1	-11.6	-17.8	205.42	133.92
10/21/10 22:00	358.3	376.1	-17.8	-13.8	245.81	315.10
10/21/10 23:00	362.3	376.1	-13.8	-24.4	337.37	191.76
10/22/10 0:00	351.7	376.1	-24.4	-18.5	450.39	593.57
10/22/10 1:00	357.6	376.1	-18.5	-29.2	539.51	341.74
10/22/10 2:00	346.9	376.1	-29.2	-24.5	714.86	851.72
10/22/10 3:00	351.6	376.1	-24.5	-28.5	699.28	599.99
10/22/10 4:00	347.6	376.1	-28.5	-26.3	750.57	815.00
10/22/10 5:00	349.8	376.1	-26.3	-23.4	616.30	691.23
10/22/10 6:00	352.7	376.1	-23.4	-24.4	572.71	549.48
10/22/10 7:00	351.7	376.1	-24.4			596.92
					83976.95	109047.33
				Autocorrelatic	0.77	

L2 All Data	NOx, lb/hr	Sample Mean	Xt - Mean	Xt+1 - Mean	(Xt - Mean)(Xt+1-Mean)	(Xt - Mean)^2
10/24/07 19:34	384.5	550.7	-166.2	-195.7	32531.94	27629.47
10/25/07 12:10	355.0	550.7	-195.7	-194.4	38044.76	38304.30
10/25/07 13:10	356.3	550.7	-194.4	-195.2	37950.18	37786.98
10/25/07 14:10	355.5	550.7	-195.2	-198.2	38688.58	38114.10
10/25/07 14:47	352.5	550.7	-198.2	-200.8	39796.04	39271.73
10/25/07 15:47	349.9	550.7	-200.8	-202.3	40621.16	40327.36
10/25/07 16:47	348.4	550.7	-202.3	-210.5	42575.50	40917.10
10/25/07 17:47	340.2	550.7	-210.5	-215.3	45318.62	44301.11
10/25/07 18:47	335.4	550.7	-215.3	-213.5	45959.74	46359.51
10/25/07 19:47	337.2	550.7	-213.5	-200.3	42759.62	45563.43
10/25/07 20:47	350.4	550.7	-200.3	-207.4	41537.66	40128.35
10/25/07 21:47	343.3	550.7	-207.4	-213.7	44309.40	42996.47
10/25/07 22:47	337.0	550.7	-213.7	-217.5	46471.14	45662.43
10/25/07 23:47	333.2	550.7	-217.5	-215.4	46850.07	47294.17
10/26/07 0:47	335.3	550.7	-215.4	-216.7	46681.77	46410.14
10/26/07 1:47	334.0	550.7	-216.7	-213.1	46176.69	46954.98
10/26/07 2:47	337.6	550.7	-213.1	-221.3	47149.20	45411.30
10/26/07 3:47	329.4	550.7	-221.3	-211.0	46686.77	48953.60
10/26/07 4:47	339.7	550.7	-211.0	-213.8	45111.48	44524.91
10/26/07 5:47	336.9	550.7	-213.8	-213.8	45715.92	45705.77
10/26/07 6:47	336.9	550.7	-213.8	-203.5	43523.49	45726.07
10/26/07 7:47	347.2	550.7	-203.5	-185.4	37733.08	41427.00
10/26/07 8:47	365.3	550.7	-185.4	-191.0	35400.83	34368.54
10/26/07 9:14	359.7	550.7	-191.0	-200.2	38226.01	36464.13
10/26/07 11:54	350.5	550.7	-200.2	-198.8	39800.05	40073.02
10/26/07 12:54	351.9	550.7	-198.8	-202.8	40313.41	39528.94
10/26/07 13:54	347.9	550.7	-202.8	-201.3	40807.79	41113.45
10/26/07 14:54	349.4	550.7	-201.3	-201.4	40537.19	40504.41
10/26/07 15:54	349.3	550.7	-201.4	-186.4	37537.35	40570.00
10/26/07 16:54	364.3	550.7	-186.4	-187.2	34878.55	34731.39
10/26/07 17:54	363.5	550.7	-187.2	-183.0	34249.68	35026.32
10/26/07 18:54	367.7	550.7	-183.0	-186.1	34059.52	33490.25
10/26/07 19:54	364.6	550.7	-186.1	-179.7	33439.15	34638.46
10/26/07 20:54	371.0	550.7	-179.7	-183.7	32999.00	32281.36
10/26/07 21:54	367.0	550.7	-183.7	-182.7	33556.59	33732.60
10/26/07 22:54	368.0	550.7	-182.7	-182.8	33391.71	33381.51
10/26/07 23:54	367.9	550.7	-182.8	-179.4	32778.40	33401.92
10/27/07 0:54	371.3	550.7	-179.4	-181.3	32516.92	32166.52
10/27/07 1:54	369.4	550.7	-181.3	-178.2	32299.46	32871.15
10/27/07 2:54	372.5	550.7	-178.2	-174.4	31063.06	31737.70
10/27/07 3:54	376.3	550.7	-174.4	-166.5	29036.88	30402.76
10/27/07 4:54	384.2	550.7	-166.5	-172.7	28755.28	27732.36
10/27/07 5:54	378.0	550.7	-172.7	-172.6	29802.40	29815.93
10/27/07 6:54	378.1	550.7	-172.6	-88.6	15293.68	29788.87
10/27/07 7:54	462.1	550.7	-88.6	-67.6	5993.46	7851.82
10/27/07 8:54	483.1	550.7	-67.6	-97.2	6576.35	4574.93
10/27/07 11:04	453.5	550.7	-97.2	-64.8	6299.23	9453.34
10/27/07 12:04	485.9	550.7	-64.8	-69.2	4481.18	4197.49
10/27/07 13:04	481.5	550.7	-69.2	-74.4	5148.51	4784.05
10/27/07 14:04	476.3	550.7	-74.4	-72.5	5398.96	5540.73
10/27/07 15:04	478.2	550.7	-72.5	-74.6	5412.00	5260.82
10/27/07 16:04	476.1	550.7	-74.6	-55.2	4120.53	5567.52
10/27/07 17:04	495.5	550.7	-55.2	-56.8	3134.07	3049.62
10/27/07 18:04	493.9	550.7	-56.8	-46.0	2609.05	3220.86
10/27/07 19:04	504.7	550.7	-46.0	-48.1	2210.39	2113.46
10/27/07 20:04	502.6	550.7	-48.1	-51.3	2466.32	2311.77
10/27/07 21:04	499.4	550.7	-51.3	-47.2	2420.19	2631.19
10/27/07 22:04	503.5	550.7	-47.2	-47.0	2217.69	2226.11
10/27/07 23:04	503.7	550.7	-47.0	-43.8	2056.76	2209.30
10/28/07 0:04	506.9	550.7	-43.8	-50.9	2227.41	1914.75
10/28/07 0:42	499.8	550.7	-50.9	-186.7	9505.73	2591.12
10/28/07 21:27	364.0	550.7	-186.7	-192.9	36017.95	34872.58
10/28/07 22:27	357.8	550.7	-192.9	-204.5	39444.03	37200.93
10/28/07 23:27	346.2	550.7	-204.5	-205.0	41917.44	41822.38
10/29/07 0:27	345.7	550.7	-205.0	-211.6	43375.42	42012.72
10/29/07 1:27	339.1	550.7	-211.6	-204.8	43339.78	44782.33
10/29/07 2:27	345.9	550.7	-204.8	-201.5	41260.30	41943.71
10/29/07 3:27	349.2	550.7	-201.5	-201.9	40667.06	40588.02
10/29/07 4:27	348.8	550.7	-201.9	-207.2	41822.58	40746.25
10/29/07 5:27	343.5	550.7	-207.2	-203.0	42051.06	42927.35
10/29/07 6:27	347.7	550.7	-203.0	-230.4	46770.53	41192.66

10/29/07 7:59	320.3	550.7	-230.4	-216.8	49961.35	53103.71
10/29/07 9:59	333.9	550.7	-216.8	-221.6	48038.54	47004.95
10/29/07 10:59	329.1	550.7	-221.6	-224.5	49752.77	49094.87
10/29/07 11:59	326.2	550.7	-224.5	-219.6	49314.60	50419.48
10/29/07 12:59	331.1	550.7	-219.6	-223.3	49049.10	48233.93
10/29/07 13:59	327.4	550.7	-223.3	-223.4	49890.78	49878.04
10/29/07 14:59	327.3	550.7	-223.4	-229.1	51182.79	49903.53
10/29/07 15:59	321.6	550.7	-229.1	-282.5	64727.72	52494.83
10/29/07 16:59	268.2	550.7	-282.5	-213.6	60354.50	79811.24
10/29/07 17:59	337.1	550.7	-213.6	-227.6	48618.13	45641.02
10/29/07 18:59	323.1	550.7	-227.6	-223.0	50746.49	51789.44
10/29/07 19:59	327.7	550.7	-223.0	-224.9	50145.95	49724.54
10/29/07 20:59	325.8	550.7	-224.9	-218.4	49123.28	50570.93
10/29/07 21:59	332.3	550.7	-218.4	-217.6	47526.76	47717.06
10/29/07 22:59	333.1	550.7	-217.6	-222.9	48486.18	47337.22
10/29/07 23:59	327.8	550.7	-222.9	-220.3	49088.91	49663.03
10/30/07 0:59	330.4	550.7	-220.3	-215.6	47484.78	48521.43
10/30/07 1:59	335.1	550.7	-215.6	-223.2	48113.43	46470.28
10/30/07 2:59	327.5	550.7	-223.2	-232.7	51943.22	49814.68
10/30/07 3:59	318.0	550.7	-232.7	-240.2	55902.99	54162.71
10/30/07 4:59	310.5	550.7	-240.2	-246.4	59178.22	57699.19
10/30/07 5:29	304.3	550.7	-246.4	-98.7	24307.16	60695.17
10/30/07 10:40	452.0	550.7	-98.7	-113.6	11209.25	9734.52
10/30/07 11:40	437.1	550.7	-113.6	-118.0	13402.33	12907.40
10/30/07 12:40	432.7	550.7	-118.0	-131.7	15532.44	13916.24
10/30/07 13:40	419.0	550.7	-131.7	-126.6	16672.39	17336.33
10/30/07 14:40	424.1	550.7	-126.6	-168.2	21293.13	16033.87
10/30/07 15:40	382.5	550.7	-168.2	-160.3	26957.27	28277.49
10/30/07 16:40	390.4	550.7	-160.3	-170.6	27346.08	25698.68
10/30/07 17:40	380.1	550.7	-170.6	-164.0	27974.12	29099.08
10/30/07 18:40	386.7	550.7	-164.0	-162.6	26668.04	26892.65
10/30/07 19:40	388.1	550.7	-162.6	-159.6	25957.08	26445.30
10/30/07 20:40	391.1	550.7	-159.6	-157.4	25129.61	25477.88
10/30/07 21:40	393.3	550.7	-157.4	-158.5	24961.01	24786.11
10/30/07 22:40	392.2	550.7	-158.5	-179.9	28518.97	25137.15
10/30/07 23:40	370.8	550.7	-179.9	-174.1	31314.65	32355.76
10/31/07 0:40	376.6	550.7	-174.1	-150.3	26161.53	30307.03

10/31/07 7:49	400.4	550.7	-150.3	-152.0	22840.45	22583.06
10/31/07 9:30	398.7	550.7	-152.0	-139.2	21158.37	23100.78
10/31/07 11:30	411.5	550.7	-139.2	-150.5	20950.37	19379.28
10/31/07 12:30	400.2	550.7	-150.5	-152.2	22900.33	22648.83
10/31/07 13:30	398.5	550.7	-152.2	-140.8	21430.73	23154.63
10/31/07 14:30	409.9	550.7	-140.8	-149.6	21066.94	19835.18
10/31/07 14:45	401.1	550.7	-149.6	-149.6	22375.21	22375.21
10/31/07 15:45	401.1	550.7	-149.6	-144.4	21603.73	22375.21
10/31/07 16:35	406.3	550.7	-144.4	-107.9	15586.25	20858.85
10/31/07 20:11	442.8	550.7	-107.9	-83.1	8968.41	11646.44
10/31/07 21:11	467.6	550.7	-83.1	-78.0	6479.19	6906.17
10/31/07 22:11	472.7	550.7	-78.0	-57.3	4469.91	6078.61
10/31/07 23:11	493.4	550.7	-57.3	-62.3	3569.78	3286.94
11/1/07 0:11	488.4	550.7	-62.3	-64.0	3983.78	3876.96
11/1/07 1:11	486.7	550.7	-64.0	-68.1	4359.96	4093.55
11/1/07 2:11	482.6	550.7	-68.1	-59.4	4049.57	4643.72
11/1/07 3:11	491.3	550.7	-59.4	-60.8	3613.67	3531.44
11/1/07 4:11	489.9	550.7	-60.8	-59.8	3633.71	3697.81
11/1/07 5:11	490.9	550.7	-59.8	-68.8	4110.14	3570.72
11/1/07 6:11	481.9	550.7	-68.8	-40.2	2765.47	4731.05
11/1/07 6:30	510.5	550.7	-40.2	-139.2	5596.26	1616.52
11/1/07 7:30	411.5	550.7	-139.2	-185.1	25764.23	19373.84
11/1/07 8:30	365.6	550.7	-185.1	-180.4	33384.58	34262.48
11/1/07 10:14	370.3	550.7	-180.4	-190.3	34316.90	32529.18
11/1/07 11:14	360.4	550.7	-190.3	-186.3	35455.66	36202.87
11/1/07 12:14	364.4	550.7	-186.3	-195.8	36491.79	34723.87
11/1/07 13:14	354.9	550.7	-195.8	-192.9	37783.32	38349.72
11/1/07 14:14	357.8	550.7	-192.9	-186.2	35918.52	37225.28
11/1/07 15:14	364.5	550.7	-186.2	-191.7	35695.71	34657.63
11/1/07 16:14	359.0	550.7	-191.7	-187.9	36034.71	36764.89
11/1/07 17:14	362.8	550.7	-187.9	-186.2	34994.93	35319.03
11/1/07 18:14	364.5	550.7	-186.2	-169.0	31471.45	34673.81
11/1/07 19:14	381.7	550.7	-169.0	-144.7	24459.58	28564.85
11/1/07 20:14	406.0	550.7	-144.7	-116.3	16826.88	20944.30
11/1/07 21:14	434.4	550.7	-116.3	-106.0	12320.90	13518.89
11/1/07 22:14	444.7	550.7	-106.0	-113.9	12070.40	11229.07
11/1/07 23:14	436.8	550.7	-113.9	-109.1	12425.21	12974.75
11/2/07 0:14	441.6	550.7	-109.1	-104.6	11411.76	11898.94
11/2/07 1:14	446.1	550.7	-104.6	-138.2	14462.22	10944.52
11/2/07 2:14	412.5	550.7	-138.2	-143.5	19833.91	19110.57
11/2/07 3:14	407.2	550.7	-143.5	-109.4	15692.77	20584.63
11/2/07 4:14	441.3	550.7	-109.4	-119.9	13119.47	11963.45
11/2/07 5:14	430.8	550.7	-119.9	-117.5	14096.63	14387.20
11/2/07 6:14	433.2	550.7	-117.5	-137.7	16188.38	13811.93
11/2/07 7:14	413.0	550.7	-137.7	-236.4	32562.36	18973.71
11/2/07 7:29	314.3	550.7	-236.4	-232.2	54898.31	55882.99
11/2/07 8:00	318.5	550.7	-232.2	-231.5	53753.79	53930.99
11/2/07 9:35	319.2	550.7	-231.5	-236.1	54655.80	53577.17
11/2/07 10:35	314.6	550.7	-236.1	-230.0	54316.64	55756.15
11/2/07 11:35	320.7	550.7	-230.0	-230.7	53073.42	52914.31
11/2/07 12:35	320.0	550.7	-230.7	-222.4	51320.93	53233.02
11/2/07 13:35	328.3	550.7	-222.4	-227.8	50666.06	49477.53
11/2/07 14:35	322.9	550.7	-227.8	-221.1	50367.82	51883.15
11/2/07 14:59	329.6	550.7	-221.1	-92.1	20373.59	48896.74
11/2/07 15:59	458.6	550.7	-92.1	-74.3	6844.50	8488.97
11/2/07 16:29	476.4	550.7	-74.3	-86.6	6434.99	5518.59

11/2/07 17:29	464.1	550.7	-86.6	-73.1	6335.68	7503.57
11/2/07 18:29	477.6	550.7	-73.1	-76.4	5587.19	5349.57
11/2/07 19:29	474.3	550.7	-76.4	-88.7	6779.47	5835.37
11/2/07 20:29	462.0	550.7	-88.7	-78.7	6988.14	7876.31
11/2/07 21:29	472.0	550.7	-78.7	-78.7	6194.86	6200.12
11/2/07 22:29	472.0	550.7	-78.7	-96.7	7604.26	6189.61
11/2/07 23:29	454.0	550.7	-96.7	-80.8	7807.54	9342.23
11/3/07 0:29	469.9	550.7	-80.8	-77.6	6269.78	6524.96
11/3/07 1:29	473.1	550.7	-77.6	-85.4	6625.76	6024.59
11/3/07 2:29	465.3	550.7	-85.4	-82.7	7057.94	7286.92
11/3/07 3:29	468.0	550.7	-82.7	-92.7	7662.00	6836.16
11/3/07 4:29	458.0	550.7	-92.7	-77.2	7155.79	8587.60
11/3/07 5:29	473.5	550.7	-77.2	57.0	-4402.58	5962.71
10/22/10 17:00	607.7	550.7	57.0	59.3	3380.49	3250.66
10/22/10 18:00	610.0	550.7	59.3	35.6	2113.29	3515.51
10/22/10 19:00	586.3	550.7	35.6	68.1	2426.10	1270.37
10/22/10 20:00	618.8	550.7	68.1	77.4	5270.81	4633.29
10/22/10 21:00	628.1	550.7	77.4	51.1	3953.23	5996.06
10/22/10 22:00	601.8	550.7	51.1	48.3	2465.38	2606.39
10/22/10 23:00	599.0	550.7	48.3	51.3	2474.91	2332.01
10/23/10 0:00	602.0	550.7	51.3	43.5	2228.47	2626.57
10/23/10 1:00	594.2	550.7	43.5	38.7	1681.55	1890.71
10/23/10 2:00	589.4	550.7	38.7	39.5	1528.02	1495.53
10/23/10 3:00	590.2	550.7	39.5	67.7	2675.48	1561.21
10/23/10 4:00	618.4	550.7	67.7	61.7	4179.89	4585.01
10/23/10 5:00	612.4	550.7	61.7	7.2	442.18	3810.56
10/23/10 12:00	557.9	550.7	7.2	15.8	113.27	51.31
10/23/10 13:00	566.5	550.7	15.8	28.5	451.24	250.03
10/23/10 14:00	579.2	550.7	28.5	21.5	613.01	814.38
10/23/10 15:00	572.2	550.7	21.5	20.6	441.62	461.43
10/23/10 16:00	571.3	550.7	20.6	20.3	417.72	422.67
10/23/10 17:00	571.0	550.7	20.3	2.9	58.44	412.84
10/23/10 18:00	553.6	550.7	2.9	10.9	31.49	8.27
10/23/10 19:00	561.6	550.7	10.9	28.7	314.10	119.84
10/23/10 20:00	579.4	550.7	28.7	21.7	621.77	823.22
10/23/10 21:00	572.4	550.7	21.7	4.5	97.48	469.62
10/23/10 22:00	555.2	550.7	4.5	24.8	111.44	20.24
10/23/10 23:00	575.5	550.7	24.8	-3.5	-85.77	613.69
10/24/10 0:00	547.2	550.7	-3.5	-0.2	0.53	11.99
10/24/10 1:00	550.5	550.7	-0.2	-0.1	0.02	0.02
10/24/10 2:00	550.6	550.7	-0.1	1.2	-0.13	0.01
10/24/10 3:00	551.9	550.7	1.2	21.4	25.34	1.41
10/24/10 4:00	572.1	550.7	21.4	17.9	382.52	456.46
10/24/10 5:00	568.6	550.7	17.9	16.0	286.59	320.55
10/24/10 6:00	566.7	550.7	16.0	15.1	241.67	256.23
10/24/10 7:00	565.8	550.7	15.1	18.7	282.87	227.93
10/24/10 8:00	569.4	550.7	18.7	7.4	138.09	351.06
10/24/10 9:00	558.1	550.7	7.4	7.5	55.56	54.32
10/24/10 10:00	558.2	550.7	7.5	13.0	98.17	56.82
10/24/10 11:00	563.7	550.7	13.0	9.8	127.44	169.59
10/24/10 12:00	560.5	550.7	9.8	6.8	66.48	95.77
10/24/10 13:00	557.5	550.7	6.8	-0.4	-2.47	46.15
10/24/10 15:00	550.3	550.7	-0.4	2.7	-0.98	0.13
10/24/10 16:00	553.4	550.7	2.7	4.0	10.68	7.23
10/24/10 17:00	554.7	550.7	4.0	0.9	3.62	15.78
10/24/10 18:00	551.6	550.7	0.9	3.4	3.11	0.83
10/24/10 19:00	554.1	550.7	3.4	10.6	36.36	11.66
10/24/10 20:00	561.3	550.7	10.6	10.8	114.80	113.35
10/24/10 21:00	561.5	550.7	10.8	9.4	100.83	116.28
10/24/10 22:00	560.1	550.7	9.4	5.1	47.40	87.44
10/24/10 23:00	555.8	550.7	5.1	11.2	56.70	25.70
10/25/10 0:00	561.9	550.7	11.2	6.9	77.53	125.12
10/25/10 1:00	557.6	550.7	6.9	6.3	43.93	48.05
10/25/10 2:00	557.0	550.7	6.3	2.3	14.51	40.17
10/25/10 3:00	553.0	550.7	2.3	6.9	15.73	5.24
10/25/10 4:00	557.6	550.7	6.9	9.8	67.68	47.25
10/25/10 5:00	560.5	550.7	9.8	7.0	69.22	96.93
10/25/10 6:00	557.7	550.7	7.0	6.2	43.29	49.43
10/25/10 7:00	556.9	550.7	6.2	4.2	25.99	37.92
10/25/10 8:00	554.9	550.7	4.2	-16.6	-70.00	17.81
10/25/10 9:00	534.1	550.7	-16.6	14.0	-232.46	275.13
10/25/10 18:00	564.7	550.7	14.0	0.1	1.13	196.42
10/25/10 19:00	550.8	550.7	0.1	2.9	0.23	0.01

10/25/10 20:00	553.6	550.7	2.9	0.3	0.73	8.42
10/25/10 21:00	551.0	550.7	0.3	1.4	0.34	0.06
10/25/10 22:00	552.1	550.7	1.4	0.6	0.88	1.86
10/25/10 23:00	551.3	550.7	0.6	-8.0	-5.13	0.41
10/26/10 0:00	542.7	550.7	-8.0	-8.7	69.76	63.87
10/26/10 1:00	542.0	550.7	-8.7	-20.7	180.32	76.20
10/26/10 2:00	530.0	550.7	-20.7	-21.9	452.06	426.74
10/26/10 3:00	528.8	550.7	-21.9	-26.4	577.50	478.90
10/26/10 4:00	524.3	550.7	-26.4	-44.1	1163.18	696.42
10/26/10 12:00	506.6	550.7	-44.1	-38.1	1680.56	1942.79
10/26/10 13:00	512.6	550.7	-38.1	7.4	-281.25	1453.73
10/26/10 14:00	558.1	550.7	7.4	23.0	169.86	54.41
10/26/10 15:00	573.7	550.7	23.0	13.0	300.12	530.26
10/26/10 16:00	563.7	550.7	13.0	13.7	178.44	169.86
10/26/10 17:00	564.4	550.7	13.7	-1.3	-18.03	187.46
10/26/10 18:00	549.4	550.7	-1.3	8.6	-11.33	1.73
10/26/10 19:00	559.3	550.7	8.6	19.8	170.20	74.09
10/26/10 20:00	570.5	550.7	19.8	4.4	86.07	390.99
10/26/10 21:00	555.1	550.7	4.4	-3.0	-12.99	18.95
10/26/10 22:00	547.7	550.7	-3.0	11.9	-35.53	8.91
10/26/10 23:00	562.6	550.7	11.9	17.1	203.11	141.65
10/27/10 0:00	567.8	550.7	17.1	14.6	249.93	291.25
10/27/10 1:00	565.3	550.7	14.6	22.3	326.28	214.48
10/27/10 2:00	573.0	550.7	22.3	17.8	395.56	496.38
10/27/10 3:00	568.5	550.7	17.8	33.0	586.38	315.22
10/27/10 4:00	583.7	550.7	33.0	22.4	738.74	1090.80
10/27/10 5:00	573.1	550.7	22.4	14.1	314.39	500.32
10/27/10 6:00	564.8	550.7	14.1	12.1	169.67	197.56
10/27/10 7:00	562.8	550.7	12.1	7.7	92.62	145.72
10/27/10 8:00	558.4	550.7	7.7	8.5	65.07	58.87
10/27/10 9:00	559.2	550.7	8.5	10.5	88.74	71.93
10/27/10 10:00	561.2	550.7	10.5	11.8	123.08	109.48
10/27/10 11:00	562.5	550.7	11.8	-5.0	-58.90	138.37
10/27/10 12:00	545.7	550.7	-5.0	-10.3	51.65	25.07
10/27/10 13:00	540.4	550.7	-10.3	-7.0	72.65	106.39
10/27/10 14:00	543.7	550.7	-7.0	-12.2	85.76	49.62
10/27/10 15:00	538.5	550.7	-12.2	-21.3	259.33	148.22
10/27/10 16:00	529.4	550.7	-21.3	-24.1	514.34	453.72
10/27/10 17:00	526.6	550.7	-24.1	-13.7	330.70	583.06
10/27/10 18:00	537.0	550.7	-13.7	-19.2	262.44	187.57
10/27/10 19:00	531.5	550.7	-19.2	-19.0	364.34	367.21
10/27/10 20:00	531.7	550.7	-19.0	-29.4	558.20	361.50
10/27/10 21:00	521.3	550.7	-29.4	-30.1	883.03	861.93
10/27/10 22:00	520.6	550.7	-30.1	-28.7	863.30	904.66
10/27/10 23:00	522.0	550.7	-28.7	-33.5	962.09	823.84
10/28/10 0:00	517.2	550.7	-33.5	-36.9	1237.70	1123.53
10/28/10 1:00	513.8	550.7	-36.9	-38.4	1419.76	1363.47
10/28/10 2:00	512.3	550.7	-38.4	-40.8	1569.81	1478.36
10/28/10 3:00	509.9	550.7	-40.8	-45.9	1872.20	1666.90
10/28/10 4:00	504.8	550.7	-45.9	-35.3	1618.22	2102.79
10/28/10 5:00	515.4	550.7	-35.3	-40.2	1419.37	1245.32
10/28/10 6:00	510.5	550.7	-40.2	-53.6	2155.98	1617.76
10/28/10 7:00	497.1	550.7	-53.6	-54.3	2912.41	2873.28
10/28/10 8:00	496.4	550.7	-54.3	-56.3	3060.30	2952.07
10/28/10 9:00	494.4	550.7	-56.3	-39.6	2230.54	3172.49
10/28/10 10:00	511.1	550.7	-39.6	-35.7	1412.31	1568.27
10/28/10 11:00	515.0	550.7	-35.7	-24.4	869.89	1271.86
10/28/10 12:00	526.3	550.7	-24.4	-35.3	861.27	594.96
10/28/10 13:00	515.4	550.7	-35.3	-27.8	982.86	1246.76
10/28/10 14:00	522.9	550.7	-27.8	-34.7	966.11	774.82
10/28/10 15:00	516.0	550.7	-34.7	-40.9	1419.68	1204.62
10/28/10 16:00	509.8	550.7	-40.9	-41.7	1704.66	1673.13
10/28/10 17:00	509.0	550.7	-41.7	-53.7	2236.23	1736.78
10/28/10 18:00	497.0	550.7	-53.7	-62.4	3350.39	2879.31
10/28/10 19:00	488.3	550.7	-62.4	-51.8	3235.10	3898.53
10/28/10 20:00	498.9	550.7	-51.8	-60.9	3156.36	2684.57
10/28/10 21:00	489.8	550.7	-60.9	-60.8	3704.47	3711.07
10/28/10 22:00	489.9	550.7	-60.8	-54.4	3305.94	3697.88
10/28/10 23:00	496.3	550.7	-54.4	-58.2	3165.90	2955.54
10/29/10 0:00	492.5	550.7	-58.2	-71.6	4170.34	3391.22
10/29/10 1:00	479.1	550.7	-71.6	-74.6	5343.55	5128.46
10/29/10 2:00	476.1	550.7	-74.6	-78.4	5847.51	5567.65
10/29/10 3:00	472.3	550.7	-78.4	-75.1	5886.14	6141.44

10/29/10 4:00	475.6	550.7	-75.1	-74.1	5567.46	5641.46
10/29/10 5:00	476.6	550.7	-74.1	-98.4	7297.55	5494.43
10/29/10 6:00	452.3	550.7	-98.4	-54.6	5375.99	9692.39
10/29/10 7:00	496.1	550.7	-54.6	-35.7	1950.64	2981.86
10/29/10 8:00	515.0	550.7	-35.7	21.5	-767.46	1276.05
10/29/10 9:00	572.2	550.7	21.5	53.7	1154.07	461.58
10/29/10 10:00	604.4	550.7	53.7	56.7	3048.09	2885.46
10/29/10 12:00	607.4	550.7	56.7	80.0	4540.08	3219.88
10/29/10 13:00	630.7	550.7	80.0	-53.9	-4309.98	6401.58
10/29/10 14:00	496.8	550.7	-53.9	-2.4	128.23	2901.78
10/29/10 15:00	548.3	550.7	-2.4	-93.7	223.04	5.67
10/29/10 16:00	457.0	550.7	-93.7	-98.1	9188.21	8779.58
10/29/10 17:00	452.6	550.7	-98.1	-107.3	10525.12	9615.87
10/29/10 18:00	443.4	550.7	-107.3	-113.6	12195.83	11520.34
10/29/10 19:00	437.1	550.7	-113.6	-104.7	11891.06	12910.92
10/29/10 20:00	446.0	550.7	-104.7	-41.2	4310.67	10951.76
10/29/10 21:00	509.5	550.7	-41.2	36.7	-1509.93	1696.70
10/29/10 22:00	587.4	550.7	36.7	32.9	1205.06	1343.72
10/29/10 23:00	583.6	550.7	32.9	21.4	705.05	1080.71
10/30/10 0:00	572.1	550.7	21.4	11.5	247.51	459.97
10/30/10 1:00	562.2	550.7	11.5	7.2	82.88	133.19
10/30/10 2:00	557.9	550.7	7.2	9.6	68.69	51.58
10/30/10 3:00	560.3	550.7	9.6	14.0	133.81	91.49
10/30/10 4:00	564.7	550.7	14.0	12.4	174.07	195.70
10/30/10 5:00	563.1	550.7	12.4	14.7	182.54	154.82
10/30/10 6:00	565.4	550.7	14.7	28.5	418.16	215.23
10/30/10 7:00	579.2	550.7	28.5	45.4	1294.07	812.42
10/30/10 8:00	596.1	550.7	45.4	35.1	1595.82	2061.24
10/30/10 9:00	585.8	550.7	35.1	191.1	6718.10	1235.48
11/6/10 15:00	741.8	550.7	191.1	205.1	39207.96	36530.54
11/6/10 16:00	755.8	550.7	205.1	212.7	43639.94	42081.62
11/6/10 17:00	763.4	550.7	212.7	209.4	44546.93	45255.97
11/6/10 18:00	760.1	550.7	209.4	214.5	44906.98	43849.00
11/6/10 19:00	765.2	550.7	214.5	209.8	44989.10	45990.49
11/6/10 20:00	760.5	550.7	209.8	194.7	40851.17	44009.51
11/6/10 21:00	745.4	550.7	194.7	195.6	38094.97	37919.49
11/6/10 22:00	746.3	550.7	195.6	209.1	40908.84	38271.26
11/6/10 23:00	759.8	550.7	209.1	187.6	39224.90	43728.21
11/7/10 0:00	738.3	550.7	187.6	190.6	35747.45	35185.35
11/7/10 1:00	741.3	550.7	190.6	194.5	37073.50	36318.52
11/7/10 2:00	745.2	550.7	194.5	205.3	39942.51	37844.18
11/7/10 3:00	756.0	550.7	205.3	200.4	41149.35	42157.18
11/7/10 4:00	751.1	550.7	200.4	195.6	39194.30	40165.60
11/7/10 5:00	746.3	550.7	195.6	199.7	39050.14	38246.50
11/7/10 6:00	750.4	550.7	199.7	205.7	41065.37	39870.66
11/7/10 7:00	756.4	550.7	205.7	199.2	40973.33	42295.88
11/7/10 8:00	749.9	550.7	199.2	204.3	40707.48	39692.13
11/7/10 9:00	755.0	550.7	204.3	202.4	41346.13	41748.81
11/7/10 10:00	753.1	550.7	202.4	189.7	38393.53	40947.33
11/7/10 11:00	740.4	550.7	189.7	186.4	35361.23	35999.01
11/7/10 12:00	737.1	550.7	186.4	189.5	35322.28	34734.75
11/7/10 13:00	740.2	550.7	189.5	194.0	36763.51	35919.74
11/7/10 14:00	744.7	550.7	194.0	197.5	38310.06	37627.11
11/7/10 15:00	748.2	550.7	197.5	189.4	37398.13	39005.41
11/7/10 16:00	740.1	550.7	189.4	193.5	36640.24	35857.08
11/7/10 17:00	744.2	550.7	193.5	197.7	38244.87	37440.52
11/7/10 18:00	748.4	550.7	197.7	190.3	37606.72	39066.50
11/7/10 19:00	741.0	550.7	190.3	181.3	34489.65	36201.48
11/7/10 20:00	732.0	550.7	181.3	178.0	32268.38	32858.76
11/7/10 21:00	728.7	550.7	178.0	181.4	32287.97	31688.61
11/7/10 22:00	732.1	550.7	181.4	186.4	33813.36	32898.66
11/7/10 23:00	737.1	550.7	186.4	171.6	31985.74	34753.49
11/8/10 0:00	722.3	550.7	171.6	186.7	32028.55	29438.40
11/8/10 1:00	737.4	550.7	186.7	177.5	33136.79	34846.59
11/8/10 2:00	728.2	550.7	177.5	176.8	31390.24	31510.88
11/8/10 3:00	727.5	550.7	176.8	178.8	31609.68	31270.06
11/8/10 4:00	729.5	550.7	178.8	182.8	32672.79	31952.98
11/8/10 5:00	733.5	550.7	182.8	178.8	32684.18	33408.81
11/8/10 6:00	729.5	550.7	178.8	176.1	31490.13	31975.26
11/8/10 7:00	726.8	550.7	176.1	182.3	32111.83	31012.36
11/8/10 8:00	733.0	550.7	182.3	188.1	34294.17	33250.29
11/8/10 9:00	738.8	550.7	188.1	176.1	33110.55	35370.82
11/8/10 11:00	726.8	550.7	176.1	125.1	22028.94	30994.71

11/8/10 12:00	675.8	550.7	125.1	93.9	11748.94	15656.68
11/8/10 13:00	644.6	550.7	93.9	101.2	9506.97	8816.54
11/8/10 14:00	651.9	550.7	101.2	104.1	10537.44	10251.47
11/8/10 15:00	654.8	550.7	104.1	106.9	11127.02	10831.39
11/8/10 16:00	657.6	550.7	106.9	112.8	12057.14	11430.73
11/8/10 17:00	663.5	550.7	112.8	136.7	15413.92	12717.89
11/8/10 18:00	687.4	550.7	136.7	132.5	18113.73	18681.47
11/8/10 19:00	683.2	550.7	132.5	160.3	21249.24	17563.23
11/8/10 20:00	711.0	550.7	160.3	159.8	25624.67	25708.84
11/8/10 21:00	710.5	550.7	159.8	169.5	27092.92	25540.78
11/8/10 22:00	720.2	550.7	169.5	177.6	30102.60	28739.38
11/8/10 23:00	728.3	550.7	177.6	107.9	19167.19	31530.49
11/9/10 0:00	658.6	550.7	107.9	108.5	11709.94	11651.61
11/9/10 1:00	659.2	550.7	108.5	99.9	10834.83	11768.56
11/9/10 2:00	650.6	550.7	99.9	102.3	10216.63	9975.18
11/9/10 3:00	653.0	550.7	102.3	102.3	10462.34	10463.92
11/9/10 4:00	653.0	550.7	102.3	97.9	10011.89	10460.76
11/9/10 5:00	648.6	550.7	97.9	105.0	10281.53	9582.28
11/9/10 6:00	655.7	550.7	105.0	98.3	10325.54	11031.80
11/9/10 7:00	649.0	550.7	98.3	109.4	10752.63	9664.50
11/9/10 8:00	660.1	550.7	109.4	111.6	12201.23	11963.27
11/9/10 9:00	662.3	550.7	111.6	173.8	19384.85	12443.93
11/9/10 11:00	724.5	550.7	173.8	171.0	29723.66	30197.27
11/9/10 12:00	721.7	550.7	171.0	168.4	28797.43	29257.47
11/9/10 13:00	719.1	550.7	168.4	157.3	26479.94	28344.61
11/9/10 14:00	708.0	550.7	157.3	164.7	25907.96	24737.94
11/9/10 15:00	715.4	550.7	164.7	158.4	26095.97	27133.32
11/9/10 16:00	709.1	550.7	158.4	159.1	25201.62	25098.28
11/9/10 17:00	709.8	550.7	159.1	156.9	24958.82	25305.38
11/9/10 18:00	707.6	550.7	156.9	85.4	13392.09	24617.00
11/9/10 19:00	636.1	550.7	85.4	66.9	5710.93	7285.54
11/9/10 20:00	617.6	550.7	66.9	163.4	10930.39	4476.64
11/9/10 21:00	714.1	550.7	163.4	162.6	26560.95	26688.18
11/9/10 22:00	713.3	550.7	162.6	159.2	25887.99	26434.33
11/9/10 23:00	709.9	550.7	159.2	165.3	26321.56	25352.94
11/10/10 0:00	716.0	550.7	165.3	172.3	28478.07	27327.18
11/10/10 1:00	723.0	550.7	172.3	164.2	28283.96	29677.42
11/10/10 2:00	714.9	550.7	164.2	174.3	28621.17	26955.93
11/10/10 3:00	725.0	550.7	174.3	175.8	30640.48	30389.29
11/10/10 4:00	726.5	550.7	175.8	177.4	31186.51	30893.74
11/10/10 5:00	728.1	550.7	177.4	174.1	30894.91	31482.05
11/10/10 6:00	724.8	550.7	174.1	173.6	30220.48	30318.73
11/10/10 7:00	724.3	550.7	173.6	170.8	29638.57	30122.55
11/10/10 8:00	721.5	550.7	170.8	169.1	28883.00	29162.37
11/10/10 9:00	719.8	550.7	169.1	153.5	25954.78	28606.31
11/10/10 10:00	704.2	550.7	153.5	144.1	22119.20	23549.02
11/10/10 11:00	694.8	550.7	144.1	141.7	20427.57	20776.19
11/10/10 12:00	692.4	550.7	141.7	144.8	20524.32	20084.79
11/10/10 13:00	695.5	550.7	144.8	141.8	20537.94	20973.46
11/10/10 14:00	692.5	550.7	141.8	141.3	20033.02	20111.47
11/10/10 15:00	692.0	550.7	141.3	156.4	22089.89	19954.88
11/10/10 16:00	707.1	550.7	156.4	166.6	26047.68	24453.34
11/10/10 17:00	717.3	550.7	166.6	171.9	28640.76	27745.97
11/10/10 18:00	722.6	550.7	171.9	154.8	26621.07	29564.41
11/10/10 19:00	705.5	550.7	154.8	156.9	24292.25	23970.75
11/10/10 20:00	707.6	550.7	156.9	165.9	26027.49	24618.06
11/10/10 21:00	716.6	550.7	165.9	163.4	27108.08	27517.62
11/10/10 22:00	714.1	550.7	163.4	162.6	26576.12	26704.64
11/10/10 23:00	713.3	550.7	162.6	162.5	26419.17	26448.22
11/11/10 0:00	713.2	550.7	162.5	160.7	26110.59	26390.15
11/11/10 1:00	711.4	550.7	160.7	155.2	24938.59	25834.00
11/11/10 2:00	705.9	550.7	155.2	160.9	24957.39	24074.22
11/11/10 3:00	711.6	550.7	160.9	169.4	27251.58	25872.96
11/11/10 4:00	720.1	550.7	169.4	176.1	29831.90	28703.66
11/11/10 5:00	726.8	550.7	176.1	188.7	33224.34	31004.48
11/11/10 6:00	739.4	550.7	188.7	189.8	35816.86	35603.14
11/11/10 7:00	740.5	550.7	189.8	199.1	37796.31	36031.85
11/11/10 8:00	749.8	550.7	199.1	194.6	38738.55	39647.18
11/11/10 9:00	745.3	550.7	194.6	202.3	39361.63	37850.76
11/11/10 10:00	753.0	550.7	202.3	192.8	38999.25	40932.82
11/11/10 11:00	743.5	550.7	192.8	130.3	25124.08	37157.01
11/11/10 12:00	681.0	550.7	130.3	182.6	23803.95	16987.90
11/11/10 13:00	733.3	550.7	182.6	173.2	31628.20	33354.81

11/11/10 14:00	723.9	550.7	173.2	173.6	30070.79	29990.96
11/11/10 15:00	724.3	550.7	173.6	167.1	29021.72	30150.84
11/11/10 16:00	717.8	550.7	167.1	109.8	18353.13	27934.89
11/11/10 17:00	660.5	550.7	109.8	173.6	19058.73	12057.95
11/11/10 18:00	724.3	550.7	173.6	173.4	30091.14	30124.11
11/11/10 19:00	724.1	550.7	173.4	169.5	29385.50	30058.20
11/11/10 20:00	720.2	550.7	169.5	159.4	27020.29	28727.85
11/11/10 21:00	710.1	550.7	159.4	167.5	26707.80	25414.24
11/11/10 22:00	718.2	550.7	167.5	163.9	27451.38	28067.19
11/11/10 23:00	714.6	550.7	163.9	166.4	27271.62	26849.07
11/12/10 0:00	717.1	550.7	166.4	197.4	32854.50	27700.81
11/12/10 12:00	748.1	550.7	197.4	198.6	39204.06	38967.03
11/12/10 13:00	749.3	550.7	198.6	189.9	37722.90	39442.54
11/12/10 14:00	740.6	550.7	189.9	61.6	11696.82	36078.23
11/12/10 15:00	612.3	550.7	61.6	-301.7	-18578.60	3792.20
11/12/10 16:00	249.0	550.7	-301.7	-160.4	48379.27	91019.68
11/12/10 17:00	390.3	550.7	-160.4	125.4	-20110.30	25714.80
11/12/10 18:00	676.1	550.7	125.4	178.5	22382.75	15727.29
11/12/10 19:00	729.2	550.7	178.5	166.3	29684.74	31854.65
11/12/10 20:00	717.0	550.7	166.3	169.3	28164.02	27662.64
11/12/10 21:00	720.0	550.7	169.3	167.0	28276.23	28674.50
11/12/10 22:00	717.7	550.7	167.0	172.7	28836.35	27883.50
11/12/10 23:00	723.4	550.7	172.7	177.9	30725.69	29821.76
11/13/10 0:00	728.6	550.7	177.9	178.4	31735.48	31657.03
11/13/10 1:00	729.1	550.7	178.4	174.3	31081.07	31814.14
11/13/10 2:00	725.0	550.7	174.3	173.4	30209.27	30364.90
11/13/10 3:00	724.1	550.7	173.4	168.6	29236.05	30054.43
11/13/10 4:00	719.3	550.7	168.6	177.4	29914.07	28439.95
11/13/10 5:00	728.1	550.7	177.4	183.8	32602.47	31464.59
11/13/10 6:00	734.5	550.7	183.8	177.7	32662.55	33781.50
11/13/10 7:00	728.4	550.7	177.7	173.0	30741.39	31580.67
11/13/10 8:00	723.7	550.7	173.0	178.5	30883.17	29924.42
11/13/10 9:00	729.2	550.7	178.5	173.6	30999.97	31872.63
11/13/10 10:00	724.3	550.7	173.6	184.9	32102.58	30151.20
11/13/10 11:00	735.6	550.7	184.9	195.6	36161.64	34180.24
11/13/10 12:00	746.3	550.7	195.6	141.1	27598.75	38257.89
11/13/10 13:00	691.8	550.7	141.1	160.4	22636.32	19909.39
11/13/10 14:00	711.1	550.7	160.4	161.2	25854.58	25736.75
11/13/10 15:00	711.9	550.7	161.2	159.3	25676.28	25972.94
11/13/10 16:00	710.0	550.7	159.3	162.0	25806.51	25383.00
11/13/10 17:00	712.7	550.7	162.0	157.8	25556.39	26237.08
11/13/10 19:00	708.5	550.7	157.8	157.8	24889.42	24893.36
11/13/10 20:00	708.5	550.7	157.8	163.3	25754.38	24885.48
11/13/10 21:00	714.0	550.7	163.3	154.5	25226.78	26653.60
11/13/10 22:00	705.2	550.7	154.5	159.4	24638.11	23876.34
11/13/10 23:00	710.1	550.7	159.4	143.6	22895.91	25424.20
11/14/10 0:00	694.3	550.7	143.6	158.4	22749.31	20619.05
11/14/10 1:00	709.1	550.7	158.4	151.1	23938.66	25099.66
11/14/10 2:00	701.8	550.7	151.1	163.7	24736.50	22831.36
11/14/10 3:00	714.4	550.7	163.7	154.7	25323.31	26800.62
11/14/10 4:00	705.4	550.7	154.7	159.1	24615.23	23927.43
11/14/10 5:00	709.8	550.7	159.1	158.5	25229.94	25322.81
11/14/10 6:00	709.2	550.7	158.5	156.8	24868.04	25137.42
11/14/10 7:00	707.5	550.7	156.8	149.7	23473.18	24601.55
11/14/10 8:00	700.4	550.7	149.7	156.8	23460.82	22396.57
11/14/10 9:00	707.5	550.7	156.8	174.4	27338.97	24575.64
11/14/10 10:00	725.1	550.7	174.4	154.0	26849.98	30413.03
11/14/10 11:00	704.7	550.7	154.0	154.6	23802.32	23704.37
11/14/10 12:00	705.3	550.7	154.6	168.8	26100.32	23900.67
11/14/10 13:00	719.5	550.7	168.8	175.3	29596.39	28502.40
11/14/10 14:00	726.0	550.7	175.3	165.5	29013.64	30732.36
11/14/10 15:00	716.2	550.7	165.5			27391.04
					10114073.18	10407664.35
Average		550.7				
				Autocorrelation	0.971790869	

MPCA "Multiplier"	0.0576	Effective N	7.41069
Effective N Multiplier	0.3692	Effective M	0.429191

L2S	NOx, lb/hr	Sample Mean	Xt - Mean	Xt+1 - Mean	(Xt - Mean) (Xt+1-Mean)	(Xt - Mean)^2
10/22/10 17:00	607.7	550.7	57.0	59.3	3380.49	3250.66
10/22/10 18:00	610.0	550.7	59.3	35.6	2113.29	3515.51
10/22/10 19:00	586.3	550.7	35.6	68.1	2426.10	1270.37
10/22/10 20:00	618.8	550.7	68.1	77.4	5270.81	4633.29
10/22/10 21:00	628.1	550.7	77.4	51.1	3953.23	5996.06
10/22/10 22:00	601.8	550.7	51.1	48.3	2465.38	2606.39
10/22/10 23:00	599.0	550.7	48.3	51.3	2474.91	2332.01
10/23/10 0:00	602.0	550.7	51.3	43.5	2228.47	2626.57
10/23/10 1:00	594.2	550.7	43.5	38.7	1681.55	1890.71
10/23/10 2:00	589.4	550.7	38.7	39.5	1528.02	1495.53
10/23/10 3:00	590.2	550.7	39.5	67.7	2675.48	1561.21
10/23/10 4:00	618.4	550.7	67.7	61.7	4179.89	4585.01
10/23/10 5:00	612.4	550.7	61.7	7.2	442.18	3810.56
10/23/10 12:00	557.9	550.7	7.2	15.8	113.27	51.31
10/23/10 13:00	566.5	550.7	15.8	28.5	451.24	250.03
10/23/10 14:00	579.2	550.7	28.5	21.5	613.01	814.38
10/23/10 15:00	572.2	550.7	21.5	20.6	441.62	461.43
10/23/10 16:00	571.3	550.7	20.6	20.3	417.72	422.67
10/23/10 17:00	571.0	550.7	20.3	2.9	58.44	412.84
10/23/10 18:00	553.6	550.7	2.9	10.9	31.49	8.27
10/23/10 19:00	561.6	550.7	10.9	28.7	314.10	119.84
10/23/10 20:00	579.4	550.7	28.7	21.7	621.77	823.22
10/23/10 21:00	572.4	550.7	21.7	4.5	97.48	469.62
10/23/10 22:00	555.2	550.7	4.5	24.8	111.44	20.24
10/23/10 23:00	575.5	550.7	24.8	-3.5	-85.77	613.69
10/24/10 0:00	547.2	550.7	-3.5	-0.2	0.53	11.99
10/24/10 1:00	550.5	550.7	-0.2	-0.1	0.02	0.02
10/24/10 2:00	550.6	550.7	-0.1	1.2	-0.13	0.01
10/24/10 3:00	551.9	550.7	1.2	21.4	25.34	1.41
10/24/10 4:00	572.1	550.7	21.4	17.9	382.52	456.46
10/24/10 5:00	568.6	550.7	17.9	16.0	286.59	320.55
10/24/10 6:00	566.7	550.7	16.0	15.1	241.67	256.23
10/24/10 7:00	565.8	550.7	15.1	18.7	282.87	227.93
10/24/10 8:00	569.4	550.7	18.7	7.4	138.09	351.06
10/24/10 9:00	558.1	550.7	7.4	7.5	55.56	54.32
10/24/10 10:00	558.2	550.7	7.5	13.0	98.17	56.82
10/24/10 11:00	563.7	550.7	13.0	9.8	127.44	169.59
10/24/10 12:00	560.5	550.7	9.8	6.8	66.48	95.77
10/24/10 13:00	557.5	550.7	6.8	-0.4	-2.47	46.15
10/24/10 15:00	550.3	550.7	-0.4	2.7	-0.98	0.13
10/24/10 16:00	553.4	550.7	2.7	4.0	10.68	7.23
10/24/10 17:00	554.7	550.7	4.0	0.9	3.62	15.78
10/24/10 18:00	551.6	550.7	0.9	3.4	3.11	0.83
10/24/10 19:00	554.1	550.7	3.4	10.6	36.36	11.66
10/24/10 20:00	561.3	550.7	10.6	10.8	114.80	113.35
10/24/10 21:00	561.5	550.7	10.8	9.4	100.83	116.28
10/24/10 22:00	560.1	550.7	9.4	5.1	47.40	87.44
10/24/10 23:00	555.8	550.7	5.1	11.2	56.70	25.70
10/25/10 0:00	561.9	550.7	11.2	6.9	77.53	125.12
10/25/10 1:00	557.6	550.7	6.9	6.3	43.93	48.05
10/25/10 2:00	557.0	550.7	6.3	2.3	14.51	40.17
10/25/10 3:00	553.0	550.7	2.3	6.9	15.73	5.24
10/25/10 4:00	557.6	550.7	6.9	9.8	67.68	47.25
10/25/10 5:00	560.5	550.7	9.8	7.0	69.22	96.93
10/25/10 6:00	557.7	550.7	7.0	6.2	43.29	49.43
10/25/10 7:00	556.9	550.7	6.2	4.2	25.99	37.92
10/25/10 8:00	554.9	550.7	4.2	-16.6	-70.00	17.81
10/25/10 9:00	534.1	550.7	-16.6	14.0	-232.46	275.13
10/25/10 18:00	564.7	550.7	14.0	0.1	1.13	196.42
10/25/10 19:00	550.8	550.7	0.1	2.9	0.23	0.01
10/25/10 20:00	553.6	550.7	2.9	0.3	0.73	8.42
10/25/10 21:00	551.0	550.7	0.3	1.4	0.34	0.06
10/25/10 22:00	552.1	550.7	1.4	0.6	0.88	1.86
10/25/10 23:00	551.3	550.7	0.6	-8.0	-5.13	0.41
10/26/10 0:00	542.7	550.7	-8.0	-8.7	69.76	63.87
10/26/10 1:00	542.0	550.7	-8.7	-20.7	180.32	76.20
10/26/10 2:00	530.0	550.7	-20.7	-21.9	452.06	426.74
10/26/10 3:00	528.8	550.7	-21.9	-26.4	577.50	478.90
10/26/10 4:00	524.3	550.7	-26.4	-44.1	1163.18	696.42
10/26/10 12:00	506.6	550.7	-44.1	-38.1	1680.56	1942.79
10/26/10 13:00	512.6	550.7	-38.1	7.4	-281.25	1453.73

10/26/10 14:00	558.1	550.7	7.4	23.0	169.86	54.41
10/26/10 15:00	573.7	550.7	23.0	13.0	300.12	530.26
10/26/10 16:00	563.7	550.7	13.0	13.7	178.44	169.86
10/26/10 17:00	564.4	550.7	13.7	-1.3	-18.03	187.46
10/26/10 18:00	549.4	550.7	-1.3	8.6	-11.33	1.73
10/26/10 19:00	559.3	550.7	8.6	19.8	170.20	74.09
10/26/10 20:00	570.5	550.7	19.8	4.4	86.07	390.99
10/26/10 21:00	555.1	550.7	4.4	-3.0	-12.99	18.95
10/26/10 22:00	547.7	550.7	-3.0	11.9	-35.53	8.91
10/26/10 23:00	562.6	550.7	11.9	17.1	203.11	141.65
10/27/10 0:00	567.8	550.7	17.1	14.6	249.93	291.25
10/27/10 1:00	565.3	550.7	14.6	22.3	326.28	214.48
10/27/10 2:00	573.0	550.7	22.3	17.8	395.56	496.38
10/27/10 3:00	568.5	550.7	17.8	33.0	586.38	315.22
10/27/10 4:00	583.7	550.7	33.0	22.4	738.74	1090.80
10/27/10 5:00	573.1	550.7	22.4	14.1	314.39	500.32
10/27/10 6:00	564.8	550.7	14.1	12.1	169.67	197.56
10/27/10 7:00	562.8	550.7	12.1	7.7	92.62	145.72
10/27/10 8:00	558.4	550.7	7.7	8.5	65.07	58.87
10/27/10 9:00	559.2	550.7	8.5	10.5	88.74	71.93
10/27/10 10:00	561.2	550.7	10.5	11.8	123.08	109.48
10/27/10 11:00	562.5	550.7	11.8	-5.0	-58.90	138.37
10/27/10 12:00	545.7	550.7	-5.0	-10.3	51.65	25.07
10/27/10 13:00	540.4	550.7	-10.3	-7.0	72.65	106.39
10/27/10 14:00	543.7	550.7	-7.0	-12.2	85.76	49.62
10/27/10 15:00	538.5	550.7	-12.2	-21.3	259.33	148.22
10/27/10 16:00	529.4	550.7	-21.3	-24.1	514.34	453.72
10/27/10 17:00	526.6	550.7	-24.1	-13.7	330.70	583.06
10/27/10 18:00	537.0	550.7	-13.7	-19.2	262.44	187.57
10/27/10 19:00	531.5	550.7	-19.2	-19.0	364.34	367.21
10/27/10 20:00	531.7	550.7	-19.0	-29.4	558.20	361.50
10/27/10 21:00	521.3	550.7	-29.4	-30.1	883.03	861.93
10/27/10 22:00	520.6	550.7	-30.1	-28.7	863.30	904.66
10/27/10 23:00	522.0	550.7	-28.7	-33.5	962.09	823.84
10/28/10 0:00	517.2	550.7	-33.5	-36.9	1237.70	1123.53
10/28/10 1:00	513.8	550.7	-36.9	-38.4	1419.76	1363.47
10/28/10 2:00	512.3	550.7	-38.4	-40.8	1569.81	1478.36

10/28/10 3:00	509.9	550.7	-40.8	-45.9	1872.20	1666.90
10/28/10 4:00	504.8	550.7	-45.9	-35.3	1618.22	2102.79
10/28/10 5:00	515.4	550.7	-35.3	-40.2	1419.37	1245.32
10/28/10 6:00	510.5	550.7	-40.2	-53.6	2155.98	1617.76
10/28/10 7:00	497.1	550.7	-53.6	-54.3	2912.41	2873.28
10/28/10 8:00	496.4	550.7	-54.3	-56.3	3060.30	2952.07
10/28/10 9:00	494.4	550.7	-56.3	-39.6	2230.54	3172.49
10/28/10 10:00	511.1	550.7	-39.6	-35.7	1412.31	1568.27
10/28/10 11:00	515.0	550.7	-35.7	-24.4	869.89	1271.86
10/28/10 12:00	526.3	550.7	-24.4	-35.3	861.27	594.96
10/28/10 13:00	515.4	550.7	-35.3	-27.8	982.86	1246.76
10/28/10 14:00	522.9	550.7	-27.8	-34.7	966.11	774.82
10/28/10 15:00	516.0	550.7	-34.7	-40.9	1419.68	1204.62
10/28/10 16:00	509.8	550.7	-40.9	-41.7	1704.66	1673.13
10/28/10 17:00	509.0	550.7	-41.7	-53.7	2236.23	1736.78
10/28/10 18:00	497.0	550.7	-53.7	-62.4	3350.39	2879.31
10/28/10 19:00	488.3	550.7	-62.4	-51.8	3235.10	3898.53
10/28/10 20:00	498.9	550.7	-51.8	-60.9	3156.36	2684.57
10/28/10 21:00	489.8	550.7	-60.9	-60.8	3704.47	3711.07
10/28/10 22:00	489.9	550.7	-60.8	-54.4	3305.94	3697.88
10/28/10 23:00	496.3	550.7	-54.4	-58.2	3165.90	2955.54
10/29/10 0:00	492.5	550.7	-58.2	-71.6	4170.34	3391.22
10/29/10 1:00	479.1	550.7	-71.6	-74.6	5343.55	5128.46
10/29/10 2:00	476.1	550.7	-74.6	-78.4	5847.51	5567.65
10/29/10 3:00	472.3	550.7	-78.4	-75.1	5886.14	6141.44
10/29/10 4:00	475.6	550.7	-75.1	-74.1	5567.46	5641.46
10/29/10 5:00	476.6	550.7	-74.1	-98.4	7297.55	5494.43
10/29/10 6:00	452.3	550.7	-98.4	-54.6	5375.99	9692.39
10/29/10 7:00	496.1	550.7	-54.6	-35.7	1950.64	2981.86
10/29/10 8:00	515.0	550.7	-35.7	21.5	-767.46	1276.05
10/29/10 9:00	572.2	550.7	21.5	53.7	1154.07	461.58
10/29/10 10:00	604.4	550.7	53.7	56.7	3048.09	2885.46
10/29/10 12:00	607.4	550.7	56.7	80.0	4540.08	3219.88
10/29/10 13:00	630.7	550.7	80.0	-53.9	-4309.98	6401.58
10/29/10 14:00	496.8	550.7	-53.9	-2.4	128.23	2901.78
10/29/10 15:00	548.3	550.7	-2.4	-93.7	223.04	5.67
10/29/10 16:00	457.0	550.7	-93.7	-98.1	9188.21	8779.58
10/29/10 17:00	452.6	550.7	-98.1	-107.3	10525.12	9615.87
10/29/10 18:00	443.4	550.7	-107.3	-113.6	12195.83	11520.34
10/29/10 19:00	437.1	550.7	-113.6	-104.7	11891.06	12910.92
10/29/10 20:00	446.0	550.7	-104.7	-41.2	4310.67	10951.76
10/29/10 21:00	509.5	550.7	-41.2	36.7	-1509.93	1696.70
10/29/10 22:00	587.4	550.7	36.7	32.9	1205.06	1343.72
10/29/10 23:00	583.6	550.7	32.9	21.4	705.05	1080.71
10/30/10 0:00	572.1	550.7	21.4	11.5	247.51	459.97
10/30/10 1:00	562.2	550.7	11.5	7.2	82.88	133.19
10/30/10 2:00	557.9	550.7	7.2	9.6	68.69	51.58
10/30/10 3:00	560.3	550.7	9.6	14.0	133.81	91.49
10/30/10 4:00	564.7	550.7	14.0	12.4	174.07	195.70
10/30/10 5:00	563.1	550.7	12.4	14.7	182.54	154.82
10/30/10 6:00	565.4	550.7	14.7	28.5	418.16	215.23
10/30/10 7:00	579.2	550.7	28.5	45.4	1294.07	812.42
10/30/10 8:00	596.1	550.7	45.4	35.1	1595.82	2061.24
10/30/10 9:00	585.8	550.7	35.1			1235.48
					201337.26	236634.18
				Autocorrelation		0.85083761

L2H	NOx, lb/hr	Sample Mean	Xt - Mean	Xt+1 - Mean	(Xt - Mean) (Xt+1-Mean)	(Xt - Mean)^2
11/6/10 15:00	741.8	550.7	191.1	205.1	39207.96	36530.54
11/6/10 16:00	755.8	550.7	205.1	212.7	43639.94	42081.62
11/6/10 17:00	763.4	550.7	212.7	209.4	44546.93	45255.97
11/6/10 18:00	760.1	550.7	209.4	214.5	44906.98	43849.00
11/6/10 19:00	765.2	550.7	214.5	209.8	44989.10	45990.49
11/6/10 20:00	760.5	550.7	209.8	194.7	40851.17	44009.51
11/6/10 21:00	745.4	550.7	194.7	195.6	38094.97	37919.49
11/6/10 22:00	746.3	550.7	195.6	209.1	40908.84	38271.26
11/6/10 23:00	759.8	550.7	209.1	187.6	39224.90	43728.21
11/7/10 0:00	738.3	550.7	187.6	190.6	35747.45	35185.35
11/7/10 1:00	741.3	550.7	190.6	194.5	37073.50	36318.52
11/7/10 2:00	745.2	550.7	194.5	205.3	39942.51	37844.18
11/7/10 3:00	756.0	550.7	205.3	200.4	41149.35	42157.18
11/7/10 4:00	751.1	550.7	200.4	195.6	39194.30	40165.60
11/7/10 5:00	746.3	550.7	195.6	199.7	39050.14	38246.50
11/7/10 6:00	750.4	550.7	199.7	205.7	41065.37	39870.66
11/7/10 7:00	756.4	550.7	205.7	199.2	40973.33	42295.88
11/7/10 8:00	749.9	550.7	199.2	204.3	40707.48	39692.13
11/7/10 9:00	755.0	550.7	204.3	202.4	41346.13	41748.81
11/7/10 10:00	753.1	550.7	202.4	189.7	38393.53	40947.33
11/7/10 11:00	740.4	550.7	189.7	186.4	35361.23	35999.01
11/7/10 12:00	737.1	550.7	186.4	189.5	35322.28	34734.75
11/7/10 13:00	740.2	550.7	189.5	194.0	36763.51	35919.74
11/7/10 14:00	744.7	550.7	194.0	197.5	38310.06	37627.11
11/7/10 15:00	748.2	550.7	197.5	189.4	37398.13	39005.41
11/7/10 16:00	740.1	550.7	189.4	193.5	36640.24	35857.08
11/7/10 17:00	744.2	550.7	193.5	197.7	38244.87	37440.52
11/7/10 18:00	748.4	550.7	197.7	190.3	37606.72	39066.50
11/7/10 19:00	741.0	550.7	190.3	181.3	34489.65	36201.48
11/7/10 20:00	732.0	550.7	181.3	178.0	32268.38	32858.76
11/7/10 21:00	728.7	550.7	178.0	181.4	32287.97	31688.61
11/7/10 22:00	732.1	550.7	181.4	186.4	33813.36	32898.66
11/7/10 23:00	737.1	550.7	186.4	171.6	31985.74	34753.49
11/8/10 0:00	722.3	550.7	171.6	186.7	32028.55	29438.40
11/8/10 1:00	737.4	550.7	186.7	177.5	33136.79	34846.59
11/8/10 2:00	728.2	550.7	177.5	176.8	31390.24	31510.88
11/8/10 3:00	727.5	550.7	176.8	178.8	31609.68	31270.06
11/8/10 4:00	729.5	550.7	178.8	182.8	32672.79	31952.98
11/8/10 5:00	733.5	550.7	182.8	178.8	32684.18	33408.81
11/8/10 6:00	729.5	550.7	178.8	176.1	31490.13	31975.26
11/8/10 7:00	726.8	550.7	176.1	182.3	32111.83	31012.36
11/8/10 8:00	733.0	550.7	182.3	188.1	34294.17	33250.29
11/8/10 9:00	738.8	550.7	188.1	176.1	33110.55	35370.82
11/8/10 11:00	726.8	550.7	176.1	125.1	22028.94	30994.71
11/8/10 12:00	675.8	550.7	125.1	93.9	11748.94	15656.68
11/8/10 13:00	644.6	550.7	93.9	101.2	9506.97	8816.54
11/8/10 14:00	651.9	550.7	101.2	104.1	10537.44	10251.47
11/8/10 15:00	654.8	550.7	104.1	106.9	11127.02	10831.39
11/8/10 16:00	657.6	550.7	106.9	112.8	12057.14	11430.73
11/8/10 17:00	663.5	550.7	112.8	136.7	15413.92	12717.89
11/8/10 18:00	687.4	550.7	136.7	132.5	18113.73	18681.47
11/8/10 19:00	683.2	550.7	132.5	160.3	21249.24	17563.23
11/8/10 20:00	711.0	550.7	160.3	159.8	25624.67	25708.84
11/8/10 21:00	710.5	550.7	159.8	169.5	27092.92	25540.78
11/8/10 22:00	720.2	550.7	169.5	177.6	30102.60	28739.38
11/8/10 23:00	728.3	550.7	177.6	107.9	19167.19	31530.49
11/9/10 0:00	658.6	550.7	107.9	108.5	11709.94	11651.61
11/9/10 1:00	659.2	550.7	108.5	99.9	10834.83	11768.56
11/9/10 2:00	650.6	550.7	99.9	102.3	10216.63	9975.18
11/9/10 3:00	653.0	550.7	102.3	102.3	10462.34	10463.92
11/9/10 4:00	653.0	550.7	102.3	97.9	10011.89	10460.76
11/9/10 5:00	648.6	550.7	97.9	105.0	10281.53	9582.28
11/9/10 6:00	655.7	550.7	105.0	98.3	10325.54	11031.80
11/9/10 7:00	649.0	550.7	98.3	109.4	10752.63	9664.50
11/9/10 8:00	660.1	550.7	109.4	111.6	12201.23	11963.27
11/9/10 9:00	662.3	550.7	111.6	173.8	19384.85	12443.93
11/9/10 11:00	724.5	550.7	173.8	171.0	29723.66	30197.27
11/9/10 12:00	721.7	550.7	171.0	168.4	28797.43	29257.47
11/9/10 13:00	719.1	550.7	168.4	157.3	26479.94	28344.61
11/9/10 14:00	708.0	550.7	157.3	164.7	25907.96	24737.94
11/9/10 15:00	715.4	550.7	164.7	158.4	26095.97	27133.32

11/9/10 16:00	709.1	550.7	158.4	159.1	25201.62	25098.28
11/9/10 17:00	709.8	550.7	159.1	156.9	24958.82	25305.38
11/9/10 18:00	707.6	550.7	156.9	85.4	13392.09	24617.00
11/9/10 19:00	636.1	550.7	85.4	66.9	5710.93	7285.54
11/9/10 20:00	617.6	550.7	66.9	163.4	10930.39	4476.64
11/9/10 21:00	714.1	550.7	163.4	162.6	26560.95	26688.18
11/9/10 22:00	713.3	550.7	162.6	159.2	25887.99	26434.33
11/9/10 23:00	709.9	550.7	159.2	165.3	26321.56	25352.94
11/10/10 0:00	716.0	550.7	165.3	172.3	28478.07	27327.18
11/10/10 1:00	723.0	550.7	172.3	164.2	28283.96	29677.42
11/10/10 2:00	714.9	550.7	164.2	174.3	28621.17	26955.93
11/10/10 3:00	725.0	550.7	174.3	175.8	30640.48	30389.29
11/10/10 4:00	726.5	550.7	175.8	177.4	31186.51	30893.74
11/10/10 5:00	728.1	550.7	177.4	174.1	30894.91	31482.05
11/10/10 6:00	724.8	550.7	174.1	173.6	30220.48	30318.73
11/10/10 7:00	724.3	550.7	173.6	170.8	29638.57	30122.55
11/10/10 8:00	721.5	550.7	170.8	169.1	28883.00	29162.37
11/10/10 9:00	719.8	550.7	169.1	153.5	25954.78	28606.31
11/10/10 10:00	704.2	550.7	153.5	144.1	22119.20	23549.02
11/10/10 11:00	694.8	550.7	144.1	141.7	20427.57	20776.19
11/10/10 12:00	692.4	550.7	141.7	144.8	20524.32	20084.79
11/10/10 13:00	695.5	550.7	144.8	141.8	20537.94	20973.46
11/10/10 14:00	692.5	550.7	141.8	141.3	20033.02	20111.47
11/10/10 15:00	692.0	550.7	141.3	156.4	22089.89	19954.88
11/10/10 16:00	707.1	550.7	156.4	166.6	26047.68	24453.34
11/10/10 17:00	717.3	550.7	166.6	171.9	28640.76	27745.97
11/10/10 18:00	722.6	550.7	171.9	154.8	26621.07	29564.41
11/10/10 19:00	705.5	550.7	154.8	156.9	24292.25	23970.75
11/10/10 20:00	707.6	550.7	156.9	165.9	26027.49	24618.06
11/10/10 21:00	716.6	550.7	165.9	163.4	27108.08	27517.62
11/10/10 22:00	714.1	550.7	163.4	162.6	26576.12	26704.64
11/10/10 23:00	713.3	550.7	162.6	162.5	26419.17	26448.22
11/11/10 0:00	713.2	550.7	162.5	160.7	26110.59	26390.15
11/11/10 1:00	711.4	550.7	160.7	155.2	24938.59	25834.00
11/11/10 2:00	705.9	550.7	155.2	160.9	24957.39	24074.22
11/11/10 3:00	711.6	550.7	160.9	169.4	27251.58	25872.96
11/11/10 4:00	720.1	550.7	169.4	176.1	29831.90	28703.66

11/11/10 5:00	726.8	550.7	176.1	188.7	33224.34	31004.48
11/11/10 6:00	739.4	550.7	188.7	189.8	35816.86	35603.14
11/11/10 7:00	740.5	550.7	189.8	199.1	37796.31	36031.85
11/11/10 8:00	749.8	550.7	199.1	194.6	38738.55	39647.18
11/11/10 9:00	745.3	550.7	194.6	202.3	39361.63	37850.76
11/11/10 10:00	753.0	550.7	202.3	192.8	38999.25	40932.82
11/11/10 11:00	743.5	550.7	192.8	130.3	25124.08	37157.01
11/11/10 12:00	681.0	550.7	130.3	182.6	23803.95	16987.90
11/11/10 13:00	733.3	550.7	182.6	173.2	31628.20	33354.81
11/11/10 14:00	723.9	550.7	173.2	173.6	30070.79	29990.96
11/11/10 15:00	724.3	550.7	173.6	167.1	29021.72	30150.84
11/11/10 16:00	717.8	550.7	167.1	109.8	18353.13	27934.89
11/11/10 17:00	660.5	550.7	109.8	173.6	19058.73	12057.95
11/11/10 18:00	724.3	550.7	173.6	173.4	30091.14	30124.11
11/11/10 19:00	724.1	550.7	173.4	169.5	29385.50	30058.20
11/11/10 20:00	720.2	550.7	169.5	159.4	27020.29	28727.85
11/11/10 21:00	710.1	550.7	159.4	167.5	26707.80	25414.24
11/11/10 22:00	718.2	550.7	167.5	163.9	27451.38	28067.19
11/11/10 23:00	714.6	550.7	163.9	166.4	27271.62	26849.07
11/12/10 0:00	717.1	550.7	166.4	197.4	32854.50	27700.81
11/12/10 12:00	748.1	550.7	197.4	198.6	39204.06	38967.03
11/12/10 13:00	749.3	550.7	198.6	189.9	37722.90	39442.54
11/12/10 14:00	740.6	550.7	189.9	61.6	11696.82	36078.23
11/12/10 15:00	612.3	550.7	61.6	-301.7	-18578.60	3792.20
11/12/10 16:00	249.0	550.7	-301.7	-160.4	48379.27	91019.68
11/12/10 17:00	390.3	550.7	-160.4	125.4	-20110.30	25714.80
11/12/10 18:00	676.1	550.7	125.4	178.5	22382.75	15727.29
11/12/10 19:00	729.2	550.7	178.5	166.3	29684.74	31854.65
11/12/10 20:00	717.0	550.7	166.3	169.3	28164.02	27662.64
11/12/10 21:00	720.0	550.7	169.3	167.0	28276.23	28674.50
11/12/10 22:00	717.7	550.7	167.0	172.7	28836.35	27883.50
11/12/10 23:00	723.4	550.7	172.7	177.9	30725.69	29821.76
11/13/10 0:00	728.6	550.7	177.9	178.4	31735.48	31657.03
11/13/10 1:00	729.1	550.7	178.4	174.3	31081.07	31814.14
11/13/10 2:00	725.0	550.7	174.3	173.4	30209.27	30364.90
11/13/10 3:00	724.1	550.7	173.4	168.6	29236.05	30054.43
11/13/10 4:00	719.3	550.7	168.6	177.4	29914.07	28439.95
11/13/10 5:00	728.1	550.7	177.4	183.8	32602.47	31464.59
11/13/10 6:00	734.5	550.7	183.8	177.7	32662.55	33781.50
11/13/10 7:00	728.4	550.7	177.7	173.0	30741.39	31580.67
11/13/10 8:00	723.7	550.7	173.0	178.5	30883.17	29924.42
11/13/10 9:00	729.2	550.7	178.5	173.6	30999.97	31872.63
11/13/10 10:00	724.3	550.7	173.6	184.9	32102.58	30151.20
11/13/10 11:00	735.6	550.7	184.9	195.6	36161.64	34180.24
11/13/10 12:00	746.3	550.7	195.6	141.1	27598.75	38257.89
11/13/10 13:00	691.8	550.7	141.1	160.4	22636.32	19909.39
11/13/10 14:00	711.1	550.7	160.4	161.2	25854.58	25736.75
11/13/10 15:00	711.9	550.7	161.2	159.3	25676.28	25972.94
11/13/10 16:00	710.0	550.7	159.3	162.0	25806.51	25383.00
11/13/10 17:00	712.7	550.7	162.0	157.8	25556.39	26237.08
11/13/10 19:00	708.5	550.7	157.8	157.8	24889.42	24893.36
11/13/10 20:00	708.5	550.7	157.8	163.3	25754.38	24885.48
11/13/10 21:00	714.0	550.7	163.3	154.5	25226.78	26653.60
11/13/10 22:00	705.2	550.7	154.5	159.4	24638.11	23876.34
11/13/10 23:00	710.1	550.7	159.4	143.6	22895.91	25424.20
11/14/10 0:00	694.3	550.7	143.6	158.4	22749.31	20619.05

11/14/10 1:00	709.1	550.7	158.4	151.1	23938.66	25099.66
11/14/10 2:00	701.8	550.7	151.1	163.7	24736.50	22831.36
11/14/10 3:00	714.4	550.7	163.7	154.7	25323.31	26800.62
11/14/10 4:00	705.4	550.7	154.7	159.1	24615.23	23927.43
11/14/10 5:00	709.8	550.7	159.1	158.5	25229.94	25322.81
11/14/10 6:00	709.2	550.7	158.5	156.8	24868.04	25137.42
11/14/10 7:00	707.5	550.7	156.8	149.7	23473.18	24601.55
11/14/10 8:00	700.4	550.7	149.7	156.8	23460.82	22396.57
11/14/10 9:00	707.5	550.7	156.8	174.4	27338.97	24575.64
11/14/10 10:00	725.1	550.7	174.4	154.0	26849.98	30413.03
11/14/10 11:00	704.7	550.7	154.0	154.6	23802.32	23704.37
11/14/10 12:00	705.3	550.7	154.6	168.8	26100.32	23900.67
11/14/10 13:00	719.5	550.7	168.8	175.3	29596.39	28502.40
11/14/10 14:00	726.0	550.7	175.3	165.5	29013.64	30732.36
11/14/10 15:00	716.2	550.7	165.5			27391.04
					4218869.59	4405914.09
				Autocorrelation		0.957546948

L3H	NOxlbphr	Sample Mean	Xt - Mean	Xt+1 - Mean	(Xt - Mean) (Xt+1-Mean)	(Xt - Mean)^2
11/16/10 13:00	324.1	326.3	-2.2	-8.0	17.39	4.73
11/16/10 14:00	318.3	326.3	-8.0	-8.1	64.34	63.84
11/16/10 15:00	318.2	326.3	-8.1	-9.7	78.00	64.84
11/16/10 16:00	316.6	326.3	-9.7	-7.3	70.56	93.83
11/16/10 17:00	319.0	326.3	-7.3	-6.2	45.46	53.06
11/16/10 18:00	320.1	326.3	-6.2	-8.8	54.82	38.95
11/16/10 19:00	317.5	326.3	-8.8	-10.9	96.12	77.15
11/16/10 20:00	315.4	326.3	-10.9	-8.5	93.07	119.75
11/16/10 21:00	317.8	326.3	-8.5	0.4	-3.18	72.33
11/16/10 22:00	326.7	326.3	0.4	1.4	0.53	0.14
11/16/10 23:00	327.7	326.3	1.4	6.2	8.86	2.04
11/17/10 0:00	332.5	326.3	6.2	6.6	40.89	38.58
11/17/10 1:00	332.9	326.3	6.6	7.5	49.36	43.33
11/17/10 2:00	333.8	326.3	7.5	5.9	44.60	56.23
11/17/10 3:00	332.2	326.3	5.9	9.0	53.69	35.38
11/17/10 4:00	335.3	326.3	9.0	10.1	91.18	81.47
11/17/10 5:00	336.4	326.3	10.1	7.5	76.03	102.05
11/17/10 6:00	333.8	326.3	7.5	9.9	74.80	56.65
11/17/10 7:00	336.2	326.3	9.9	6.9	68.85	98.77
11/17/10 8:00	333.2	326.3	6.9	15.5	107.47	48.00
11/17/10 9:00	341.8	326.3	15.5	9.7	150.22	240.62
11/17/10 10:00	336.0	326.3	9.7	9.7	93.51	93.78
11/17/10 11:00	336.0	326.3	9.7	10.3	99.57	93.25
11/17/10 12:00	336.6	326.3	10.3	-3.5	-36.35	106.32
11/17/10 13:00	322.8	326.3	-3.5	-19.5	68.68	12.43
11/17/10 14:00	306.8	326.3	-19.5	-2.2	43.00	379.52
11/17/10 15:00	324.1	326.3	-2.2	2.3	-5.13	4.87
11/17/10 16:00	328.6	326.3	2.3	-29.2	-67.94	5.40
11/17/10 17:00	297.1	326.3	-29.2	-16.6	484.62	854.39
11/17/10 18:00	309.7	326.3	-16.6	-0.6	9.22	274.88
11/17/10 19:00	325.7	326.3	-0.6	2.9	-1.60	0.31
11/17/10 20:00	329.2	326.3	2.9	2.1	6.08	8.25
11/17/10 21:00	328.4	326.3	2.1	3.7	7.73	4.48
11/17/10 22:00	330.0	326.3	3.7	5.2	18.90	13.32
11/17/10 23:00	331.5	326.3	5.2	1.6	8.15	26.81
11/18/10 0:00	327.9	326.3	1.6	1.4	2.18	2.48
11/18/10 1:00	327.7	326.3	1.4	1.1	1.57	1.92
11/18/10 2:00	327.4	326.3	1.1	2.0	2.31	1.28
11/18/10 3:00	328.3	326.3	2.0	5.3	10.84	4.18
11/18/10 4:00	331.6	326.3	5.3	4.7	25.06	28.11
11/18/10 5:00	331.0	326.3	4.7	4.6	21.62	22.33
11/18/10 6:00	330.9	326.3	4.6	2.6	11.93	20.93
11/18/10 7:00	328.9	326.3	2.6	4.3	11.10	6.81
11/18/10 8:00	330.6	326.3	4.3	5.3	22.71	18.10
11/18/10 9:00	331.6	326.3	5.3	5.3	28.43	28.48
11/18/10 10:00	331.6	326.3	5.3	8.3	44.37	28.37
11/18/10 11:00	334.6	326.3	8.3	7.2	60.25	69.40
11/18/10 12:00	333.5	326.3	7.2	9.5	68.45	52.32

11/18/10 13:00	335.8	326.3	9.5	0.7	7.10	89.57
11/18/10 14:00	327.0	326.3	0.7	2.5	1.86	0.56
11/18/10 15:00	328.8	326.3	2.5	1.0	2.46	6.17
11/18/10 16:00	327.3	326.3	1.0	0.6	0.58	0.98
11/18/10 17:00	326.9	326.3	0.6	1.0	0.61	0.35
11/18/10 18:00	327.3	326.3	1.0	-6.7	-6.93	1.07
11/18/10 19:00	319.6	326.3	-6.7	-9.5	63.62	44.82
11/19/10 11:00	316.8	326.3	-9.5	-5.1	48.66	90.31
11/19/10 12:00	321.2	326.3	-5.1	1.5	-7.73	26.21
11/19/10 14:00	327.8	326.3	1.5	5.7	8.67	2.28
11/19/10 15:00	332.0	326.3	5.7	5.2	29.68	32.90
11/19/10 16:00	331.5	326.3	5.2	8.0	41.22	26.77
11/19/10 17:00	334.3	326.3	8.0	7.0	56.00	63.48
11/19/10 18:00	333.3	326.3	7.0	3.0	20.81	49.40
11/19/10 19:00	329.3	326.3	3.0	1.8	5.41	8.77
11/19/10 20:00	328.1	326.3	1.8	2.1	3.88	3.34
11/19/10 21:00	328.4	326.3	2.1	2.6	5.48	4.51
11/19/10 22:00	328.9	326.3	2.6	7.6	19.66	6.66
11/19/10 23:00	333.9	326.3	7.6	7.1	54.41	58.03
11/20/10 0:00	333.4	326.3	7.1	3.5	25.03	51.02
11/20/10 1:00	329.8	326.3	3.5	6.9	24.21	12.28
11/20/10 2:00	333.2	326.3	6.9	0.4	2.52	47.72
11/20/10 3:00	326.7	326.3	0.4	4.3	1.57	0.13
11/20/10 4:00	330.6	326.3	4.3	4.8	20.68	18.60
11/20/10 5:00	331.1	326.3	4.8	9.7	46.55	23.00
11/20/10 6:00	336.0	326.3	9.7	8.8	85.25	94.22
11/20/10 7:00	335.1	326.3	8.8	7.3	64.52	77.13
11/20/10 8:00	333.6	326.3	7.3	14.0	102.64	53.98
11/20/10 9:00	340.3	326.3	14.0	16.3	228.10	195.19
11/20/10 10:00	342.6	326.3	16.3	15.9	260.15	266.57
11/20/10 11:00	342.2	326.3	15.9	15.9	253.29	253.88
11/20/10 12:00	342.2	326.3	15.9	23.3	370.84	252.71
11/20/10 13:00	349.6	326.3	23.3	24.5	570.73	544.18
11/20/10 14:00	350.8	326.3	24.5	6.6	162.12	598.58
11/20/10 15:00	332.9	326.3	6.6	-5.3	-35.37	43.91
11/20/10 16:00	321.0	326.3	-5.3	24.8	-132.39	28.50
11/20/10 17:00	351.1	326.3	24.8	20.0	496.86	615.04
11/20/10 18:00	346.3	326.3	20.0	23.1	463.28	401.39
11/20/10 19:00	349.4	326.3	23.1	22.6	522.43	534.71
11/20/10 20:00	348.9	326.3	22.6	20.0	451.92	510.43
11/20/10 21:00	346.3	326.3	20.0	22.4	448.85	400.11
11/20/10 22:00	348.7	326.3	22.4	22.7	509.05	503.53
11/20/10 23:00	349.0	326.3	22.7	22.8	517.25	514.63
11/21/10 0:00	349.1	326.3	22.8	22.2	505.21	519.88
11/21/10 1:00	348.5	326.3	22.2	23.6	522.59	490.95
11/21/10 2:00	349.9	326.3	23.6	28.1	662.26	556.27
11/21/10 3:00	354.4	326.3	28.1	29.5	827.18	788.44
11/21/10 4:00	355.8	326.3	29.5	26.2	772.89	867.83
11/21/10 5:00	352.5	326.3	26.2	24.5	642.98	688.34
11/21/10 6:00	350.8	326.3	24.5	22.3	545.81	600.61

11/21/10 7:00	348.6	326.3	22.3	24.1	536.17	496.00
11/21/10 8:00	350.4	326.3	24.1	27.1	652.92	579.58
11/21/10 9:00	353.4	326.3	27.1	24.9	674.09	735.54
11/21/10 10:00	351.2	326.3	24.9	21.1	524.33	617.78
11/21/10 11:00	347.4	326.3	21.1	21.3	450.38	445.02
11/21/10 12:00	347.6	326.3	21.3	22.4	478.15	455.81
11/21/10 13:00	348.7	326.3	22.4	16.6	370.97	501.59
11/21/10 15:00	342.9	326.3	16.6	13.9	230.26	274.36
11/21/10 16:00	340.2	326.3	13.9	8.4	116.28	193.24
11/21/10 17:00	334.7	326.3	8.4	10.7	89.25	69.97
11/21/10 18:00	337.0	326.3	10.7	7.6	81.25	113.85
11/21/10 19:00	333.9	326.3	7.6	4.9	37.03	57.98
11/21/10 20:00	331.2	326.3	4.9	-191.3	-930.50	23.65
11/22/10 15:00	135.0	326.3	-191.3	-68.4	13077.96	36608.33
11/22/10 16:00	257.9	326.3	-68.4	-64.3	4393.75	4671.97
11/22/10 17:00	262.0	326.3	-64.3	-46.8	3006.64	4132.11
11/22/10 18:00	279.5	326.3	-46.8	-51.4	2405.66	2187.72
11/22/10 19:00	274.9	326.3	-51.4	-40.1	2062.06	2645.30
11/22/10 20:00	286.2	326.3	-40.1	-42.3	1694.63	1607.41
11/22/10 21:00	284.0	326.3	-42.3	-41.8	1766.64	1786.59
11/22/10 22:00	284.5	326.3	-41.8	-41.2	1722.12	1746.92
11/22/10 23:00	285.1	326.3	-41.2	-38.7	1596.24	1697.67
11/23/10 0:00	287.6	326.3	-38.7	-42.4	1642.07	1500.86
11/23/10 1:00	283.9	326.3	-42.4	-42.4	1798.26	1796.57
11/23/10 2:00	283.9	326.3	-42.4	-37.5	1591.73	1799.94
11/23/10 3:00	288.8	326.3	-37.5	-38.3	1437.78	1407.60
11/23/10 4:00	288.0	326.3	-38.3	-35.3	1353.90	1468.60
11/23/10 5:00	291.0	326.3	-35.3	-37.1	1310.67	1248.15
11/23/10 6:00	289.2	326.3	-37.1	-38.9	1443.71	1376.32
11/23/10 7:00	287.4	326.3	-38.9	-60.5	2354.08	1514.41
11/23/10 8:00	265.8	326.3	-60.5	-41.2	2491.08	3659.30
11/23/10 9:00	285.1	326.3	-41.2	-33.3	1373.10	1695.81
11/23/10 10:00	293.0	326.3	-33.3	-4.1	137.09	1111.80
11/23/10 11:00	322.2	326.3	-4.1	-6.7	27.63	16.90
11/23/10 12:00	319.6	326.3	-6.7	-0.4	2.62	45.16
11/23/10 13:00	325.9	326.3	-0.4	-1.2	0.47	0.15
11/23/10 14:00	325.1	326.3	-1.2	1.3	-1.50	1.44
11/23/10 15:00	327.6	326.3	1.3	5.4	6.70	1.56
11/23/10 16:00	331.7	326.3	5.4	5.0	27.00	28.69
11/23/10 17:00	331.3	326.3	5.0	1.3	6.44	25.40
11/23/10 18:00	327.6	326.3	1.3	1.6	2.07	1.63
11/23/10 19:00	327.9	326.3	1.6	0.4	0.62	2.62
11/23/10 20:00	326.7	326.3	0.4	6.7	2.56	0.14
11/23/10 21:00	333.0	326.3	6.7	6.4	43.14	45.35
11/23/10 22:00	332.7	326.3	6.4	8.0	50.93	41.05
11/23/10 23:00	334.3	326.3	8.0	6.5	51.81	63.20
11/24/10 0:00	332.8	326.3	6.5	7.3	47.27	42.47
11/24/10 1:00	333.6	326.3	7.3	12.0	86.91	52.62
11/24/10 2:00	338.3	326.3	12.0	9.0	108.16	143.54
11/24/10 3:00	335.3	326.3	9.0	12.0	108.31	81.50

11/24/10 4:00	338.3	326.3	12.0	9.7	116.08	143.94
11/24/10 5:00	336.0	326.3	9.7	7.1	68.37	93.62
11/24/10 6:00	333.4	326.3	7.1	10.1	71.56	49.93
11/24/10 7:00	336.4	326.3	10.1	7.0	70.75	102.56
11/24/10 8:00	333.3	326.3	7.0	5.2	36.18	48.81
11/24/10 9:00	331.5	326.3	5.2	4.0	20.53	26.83
11/24/10 10:00	330.3	326.3	4.0	6.8	26.79	15.71
11/24/10 11:00	333.1	326.3	6.8	4.8	32.58	45.67
11/24/10 12:00	331.1	326.3	4.8	0.0	-0.05	23.24
11/24/10 13:00	326.3	326.3	0.0	1.0	-0.01	0.00
11/24/10 14:00	327.3	326.3	1.0	0.5	0.56	1.05
11/24/10 15:00	326.8	326.3	0.5	0.3	0.17	0.30
11/24/10 16:00	326.6	326.3	0.3	-0.7	-0.21	0.10
11/24/10 17:00	325.6	326.3	-0.7	-3.4	2.32	0.46
11/24/10 18:00	322.9	326.3	-3.4	-2.3	7.68	11.63
11/24/10 19:00	324.0	326.3	-2.3	1.7	-3.79	5.07
11/24/10 20:00	328.0	326.3	1.7	1.3	2.15	2.83
11/24/10 21:00	327.6	326.3	1.3	2.7	3.44	1.64
11/24/10 22:00	329.0	326.3	2.7	4.8	12.86	7.22
11/24/10 23:00	331.1	326.3	4.8	4.7	22.63	22.90
11/25/10 0:00	331.0	326.3	4.7	5.1	24.17	22.36
11/25/10 1:00	331.4	326.3	5.1	5.3	26.94	26.14
11/25/10 2:00	331.6	326.3	5.3	6.3	33.06	27.77
11/25/10 3:00	332.6	326.3	6.3	6.3	39.80	39.35
11/25/10 4:00	332.6	326.3	6.3	10.7	67.95	40.26
11/25/10 5:00	337.0	326.3	10.7	12.9	138.44	114.68
11/25/10 6:00	339.2	326.3	12.9	12.7	164.25	167.12
11/25/10 7:00	339.0	326.3	12.7	16.1	204.49	161.43
11/25/10 8:00	342.4	326.3	16.1	7.8	125.05	259.04
11/25/10 9:00	334.1	326.3	7.8	0.0	0.00	60.37
Mean		326.3			66472.36	96967.57
				Autocorrel	0.69	
0.1974	Effective N	33.21188				
0.2519						

L3S	NOxlbphr	Sample Mean	Xt - Mean	Xt+1 - Mean	(Xt - Mean) (Xt+1-Mean)	(Xt - Mean)^2
11/27/10 13:00	294.01	285.7	8.3	10.0	83.06	69.03
11/27/10 14:00	295.70	285.7	10.0	15.5	154.62	99.95
11/27/10 15:00	301.17	285.7	15.5	15.2	235.66	239.19
11/27/10 16:00	300.94	285.7	15.2	15.8	240.82	232.18
11/27/10 17:00	301.50	285.7	15.8	17.1	269.68	249.78
11/27/10 18:00	302.76	285.7	17.1	13.7	233.34	291.16
11/27/10 19:00	299.37	285.7	13.7	13.2	179.94	187.00
11/27/10 20:00	298.86	285.7	13.2	13.1	172.82	173.15
11/27/10 21:00	298.83	285.7	13.1	11.4	149.65	172.48
11/27/10 22:00	297.09	285.7	11.4	13.2	149.97	129.83
11/27/10 23:00	298.86	285.7	13.2	11.3	148.72	173.24
11/28/10 0:00	297.00	285.7	11.3	8.6	96.94	127.68
11/28/10 1:00	294.28	285.7	8.6	8.0	68.80	73.60
11/28/10 2:00	293.72	285.7	8.0	8.3	66.79	64.32
11/28/10 3:00	294.03	285.7	8.3	9.3	77.39	69.36
11/28/10 4:00	294.99	285.7	9.3	6.2	57.92	86.36
11/28/10 5:00	291.93	285.7	6.2	8.6	53.65	38.85
11/28/10 6:00	294.31	285.7	8.6	7.7	66.49	74.08
11/28/10 7:00	293.42	285.7	7.7	7.8	60.19	59.67
11/28/10 8:00	293.49	285.7	7.8	5.7	44.20	60.71
11/28/10 9:00	291.37	285.7	5.7	4.8	26.97	32.18
11/28/10 10:00	290.46	285.7	4.8	3.4	16.17	22.61
11/28/10 11:00	289.10	285.7	3.4	4.6	15.54	11.56
11/28/10 12:00	290.27	285.7	4.6	-0.9	-4.25	20.88
11/28/10 14:00	284.77	285.7	-0.9	-7.9	7.37	0.87
11/28/10 15:00	277.78	285.7	-7.9	6.9	-54.87	62.75
11/28/10 16:00	292.63	285.7	6.9	8.5	59.18	47.97
11/28/10 17:00	294.24	285.7	8.5	8.6	73.53	73.00
11/28/10 18:00	294.31	285.7	8.6	8.8	75.78	74.07
11/28/10 19:00	294.50	285.7	8.8	6.8	60.15	77.52
11/28/10 20:00	292.53	285.7	6.8	5.2	35.80	46.68
11/28/10 21:00	290.94	285.7	5.2	1.1	6.02	27.45
11/28/10 22:00	286.85	285.7	1.1	3.3	3.84	1.32
11/28/10 23:00	289.04	285.7	3.3	1.9	6.35	11.19
11/29/10 0:00	287.60	285.7	1.9	2.3	4.33	3.60
11/29/10 1:00	287.98	285.7	2.3	3.4	7.81	5.21
11/29/10 2:00	289.12	285.7	3.4	4.7	16.24	11.70
11/29/10 3:00	290.45	285.7	4.7	4.5	21.38	22.55
11/29/10 4:00	290.20	285.7	4.5	5.1	22.92	20.26
11/29/10 5:00	290.79	285.7	5.1	6.7	34.33	25.93
11/29/10 6:00	292.44	285.7	6.7	7.5	50.47	45.45
11/29/10 7:00	293.19	285.7	7.5	7.5	55.92	56.04
11/29/10 8:00	293.17	285.7	7.5	8.9	66.81	55.81
11/29/10 9:00	294.64	285.7	8.9	7.4	66.18	79.99
11/29/10 10:00	293.10	285.7	7.4	5.5	40.89	54.76
11/29/10 11:00	291.23	285.7	5.5	2.4	13.34	30.53
11/29/10 12:00	288.11	285.7	2.4	4.4	10.68	5.83
11/29/10 13:00	290.12	285.7	4.4	4.4	19.27	19.55

11/29/10 14:00	290.06	285.7	4.4	4.2	18.21	19.00
11/29/10 15:00	289.88	285.7	4.2	2.4	9.95	17.45
11/29/10 16:00	288.08	285.7	2.4	1.6	3.75	5.68
11/29/10 17:00	287.28	285.7	1.6	0.9	1.41	2.48
11/29/10 18:00	286.60	285.7	0.9	0.1	0.08	0.80
11/29/10 19:00	285.79	285.7	0.1	-1.4	-0.13	0.01
11/29/10 20:00	284.26	285.7	-1.4	-3.7	5.31	2.06
11/29/10 21:00	282.00	285.7	-3.7	-44.9	166.04	13.68
11/30/10 10:00	240.81	285.7	-44.9	-210.6	9453.61	2015.08
11/30/10 11:00	75.10	285.7	-210.6	-132.8	27962.11	44350.98
11/30/10 12:00	152.92	285.7	-132.8	-27.4	3640.07	17629.37
11/30/10 13:00	258.28	285.7	-27.4	-26.0	713.05	751.59
11/30/10 14:00	259.69	285.7	-26.0	-20.9	543.31	676.48
11/30/10 15:00	264.81	285.7	-20.9	-18.3	383.12	436.35
11/30/10 16:00	267.36	285.7	-18.3	-11.0	202.45	336.39
11/30/10 17:00	274.66	285.7	-11.0	-5.6	61.84	121.84
11/30/10 18:00	280.10	285.7	-5.6	-2.6	14.38	31.39
11/30/10 19:00	283.13	285.7	-2.6	-0.9	2.41	6.59
11/30/10 20:00	284.76	285.7	-0.9	2.2	-2.05	0.88
11/30/10 21:00	287.89	285.7	2.2	2.1	4.60	4.78
11/30/10 22:00	287.80	285.7	2.1	0.3	0.72	4.42
11/30/10 23:00	286.04	285.7	0.3	-1.4	-0.48	0.12
12/1/10 0:00	284.30	285.7	-1.4	-1.2	1.68	1.96
12/1/10 1:00	284.50	285.7	-1.2	3.1	-3.69	1.43
12/1/10 2:00	288.79	285.7	3.1	8.7	26.80	9.52
12/1/10 3:00	294.38	285.7	8.7	8.6	74.91	75.42
12/1/10 4:00	294.33	285.7	8.6	9.9	85.48	74.40
12/1/10 5:00	295.61	285.7	9.9	10.3	101.87	98.21
12/1/10 6:00	295.98	285.7	10.3	9.7	99.89	105.68
12/1/10 7:00	295.42	285.7	9.7	9.4	91.04	94.42
12/1/10 8:00	295.07	285.7	9.4	12.2	114.00	87.78
12/1/10 9:00	297.87	285.7	12.2	12.2	149.01	148.05
12/1/10 10:00	297.95	285.7	12.2	15.2	186.38	149.97
12/1/10 11:00	300.92	285.7	15.2	11.3	171.35	231.62
12/1/10 12:00	296.96	285.7	11.3	12.4	139.66	126.77
12/1/10 13:00	298.10	285.7	12.4	10.4	128.71	153.85
12/1/10 14:00	296.08	285.7	10.4	8.8	91.57	107.68
12/1/10 15:00	294.52	285.7	8.8	9.0	79.44	77.87
12/1/10 16:00	294.70	285.7	9.0	11.2	100.62	81.03
12/1/10 17:00	296.88	285.7	11.2	15.1	169.35	124.96
12/1/10 18:00	300.85	285.7	15.1	13.6	205.87	229.50
12/1/10 19:00	299.29	285.7	13.6	13.5	183.30	184.67
12/1/10 20:00	299.19	285.7	13.5	14.5	196.13	181.93
12/1/10 21:00	300.24	285.7	14.5	13.2	191.82	211.44
12/1/10 22:00	298.89	285.7	13.2	15.6	205.94	174.02
12/1/10 23:00	301.31	285.7	15.6	15.6	243.73	243.71
12/2/10 0:00	301.31	285.7	15.6	14.0	218.93	243.75
12/2/10 1:00	299.72	285.7	14.0	12.1	169.97	196.64
12/2/10 2:00	297.82	285.7	12.1	10.1	122.29	146.91
12/2/10 3:00	295.79	285.7	10.1	14.0	141.20	101.79

12/2/10 4:00	299.70	285.7	14.0	-18.2	-254.59	195.87
12/2/10 5:00	267.51	285.7	-18.2	-59.0	1074.08	330.90
12/2/10 6:00	226.65	285.7	-59.0	-88.8	5240.79	3486.35
12/2/10 7:00	196.94	285.7	-88.8	-154.3	13696.52	7878.12
12/2/10 8:00	131.39	285.7	-154.3	-12.0	1850.45	23812.13
12/2/10 9:00	273.71	285.7	-12.0	-4.0	48.07	143.80
12/2/10 10:00	281.69	285.7	-4.0	-243.5	976.14	16.07
12/2/10 11:00	42.20	285.7	-243.5	-77.9	18977.78	59292.84
12/2/10 12:00	207.76	285.7	-77.9	-10.5	819.98	6074.19
12/2/10 13:00	275.18	285.7	-10.5	2.8	-29.05	110.69
12/2/10 14:00	288.46	285.7	2.8	1.7	4.62	7.62
12/2/10 15:00	287.37	285.7	1.7	-1.8	-3.07	2.80
12/2/10 16:00	283.87	285.7	-1.8	-2.6	4.75	3.36
12/2/10 17:00	283.11	285.7	-2.6	-3.9	10.22	6.71
12/2/10 18:00	281.75	285.7	-3.9	-1.0	3.94	15.57
12/2/10 19:00	284.70	285.7	-1.0	0.8	-0.78	1.00
12/2/10 20:00	286.48	285.7	0.8	2.4	1.84	0.61
12/2/10 21:00	288.06	285.7	2.4	2.6	6.14	5.57
12/2/10 22:00	288.30	285.7	2.6	2.0	5.12	6.75
12/2/10 23:00	287.67	285.7	2.0	2.7	5.34	3.88
12/3/10 0:00	288.41	285.7	2.7	3.6	9.70	7.35
12/3/10 1:00	289.28	285.7	3.6	2.6	9.24	12.80
12/3/10 2:00	288.28	285.7	2.6	4.4	11.48	6.67
12/3/10 3:00	290.14	285.7	4.4	2.9	12.98	19.76
12/3/10 4:00	288.62	285.7	2.9	6.8	19.90	8.53
12/3/10 5:00	292.51	285.7	6.8	5.7	38.81	46.43
12/3/10 6:00	291.40	285.7	5.7	7.2	40.75	32.44
12/3/10 7:00	292.85	285.7	7.2	6.8	48.59	51.19
12/3/10 8:00	292.49	285.7	6.8	3.2	21.72	46.12
12/3/10 9:00	288.90	285.7	3.2	-1.2	-3.97	10.23
12/3/10 10:00	284.46	285.7	-1.2	1.0	-1.21	1.54
12/3/10 11:00	286.67	285.7	1.0	3.3	3.24	0.95
12/3/10 12:00	289.03	285.7	3.3	6.5	21.77	11.09
12/3/10 13:00	292.24	285.7	6.5	6.9	44.91	42.75
12/3/10 14:00	292.57	285.7	6.9	9.5	65.29	47.17
12/3/10 15:00	295.21	285.7	9.5	11.3	107.65	90.38
12/3/10 16:00	297.02	285.7	11.3	13.4	151.47	128.23
12/3/10 17:00	299.08	285.7	13.4	9.8	130.91	178.94
12/3/10 18:00	295.49	285.7	9.8	1.2	11.75	95.77
12/3/10 19:00	286.90	285.7	1.2	-0.2	-0.27	1.44
12/3/10 20:00	285.47	285.7	-0.2	7.4	-1.67	0.05
12/3/10 21:00	293.06	285.7	7.4	8.0	59.05	54.15
12/3/10 22:00	293.72	285.7	8.0	6.1	48.84	64.39
12/3/10 23:00	291.79	285.7	6.1	11.4	69.15	37.05
12/4/10 0:00	297.06	285.7	11.4	5.7	64.75	129.05
12/4/10 1:00	291.40	285.7	5.7	9.6	54.81	32.48
12/4/10 15:00	295.32	285.7	9.6	8.5	81.41	92.48
12/4/10 16:00	294.17	285.7	8.5	-1.2	-10.24	71.66
12/4/10 17:00	284.49	285.7	-1.2	5.9	-7.09	1.46
12/4/10 18:00	291.56	285.7	5.9	13.0	75.97	34.36

12/4/10 19:00	298.66	285.7	13.0	10.7	138.92	167.95
12/4/10 20:00	296.42	285.7	10.7	1.1	11.76	114.91
12/4/10 21:00	286.80	285.7	1.1	-6.1	-6.64	1.20
12/4/10 22:00	279.65	285.7	-6.1	4.6	-28.13	36.63
12/4/10 23:00	290.35	285.7	4.6	-2.7	-12.40	21.60
12/5/10 0:00	283.03	285.7	-2.7	3.8	-10.01	7.12
12/5/10 1:00	289.45	285.7	3.8	4.1	15.24	14.07
12/5/10 2:00	289.76	285.7	4.1	4.9	19.91	16.51
12/5/10 3:00	290.60	285.7	4.9	6.6	32.34	24.00
12/5/10 4:00	292.30	285.7	6.6	4.1	26.90	43.57
12/5/10 5:00	289.77	285.7	4.1	5.6	22.77	16.61
12/5/10 6:00	291.29	285.7	5.6	3.5	19.58	31.22
12/5/10 7:00	289.20	285.7	3.5	12.9	45.16	12.28
12/5/10 8:00	298.59	285.7	12.9	13.3	171.12	166.12
12/5/10 9:00	298.98	285.7	13.3	7.3	97.43	176.27
12/5/10 10:00	293.04	285.7	7.3	2.7	20.12	53.85
12/5/10 11:00	288.44	285.7	2.7	11.5	31.45	7.52
12/5/10 12:00	297.17	285.7	11.5	12.0	137.89	131.59
12/5/10 13:00	297.72	285.7	12.0	5.4	65.45	144.48
12/5/10 14:00	291.15	285.7	5.4	6.5	35.56	29.65
12/5/10 15:00	292.23	285.7	6.5	5.2	34.07	42.63
12/5/10 16:00	290.92	285.7	5.2	7.2	37.63	27.22
12/5/10 17:00	292.91	285.7	7.2	6.4	46.24	52.02
12/5/10 18:00	292.11	285.7	6.4	4.9	31.57	41.09
12/5/10 19:00	290.62	285.7	4.9	8.4	41.58	24.25
12/5/10 20:00	294.14	285.7	8.4	8.6	72.74	71.28
12/5/10 21:00	294.32	285.7	8.6	8.8	75.64	74.24
12/5/10 22:00	294.48	285.7	8.8	7.5	66.02	77.06
12/5/10 23:00	293.22	285.7	7.5	5.9	44.29	56.57
12/6/10 0:00	291.59	285.7	5.9	7.0	41.52	34.68
12/6/10 1:00	292.75	285.7	7.0	9.0	63.47	49.70
12/6/10 2:00	294.70	285.7	9.0	3.2	29.05	81.05
12/6/10 3:00	288.93	285.7	3.2	4.3	13.96	10.41
12/6/10 4:00	290.03	285.7	4.3	-6.3	-27.47	18.72
12/6/10 5:00	279.35	285.7	-6.3	-12.7	80.85	40.32
12/6/10 6:00	272.97	285.7	-12.7	-3.7	46.80	162.13
12/6/10 7:00	282.02	285.7	-3.7	4.8	-17.73	13.51
12/6/10 8:00	290.52	285.7	4.8	20.9	100.74	23.28
12/6/10 9:00	306.58	285.7	20.9	24.9	520.03	435.94
12/6/10 10:00	310.61	285.7	24.9	-9.3	-231.66	620.33
12/6/10 11:00	276.40	285.7	-9.3	20.4	-189.32	86.51
12/6/10 12:00	306.05	285.7	20.4	21.6	440.05	414.31
12/6/10 13:00	307.32	285.7	21.6	21.7	468.96	467.39
12/6/10 14:00	307.39	285.7	21.7	23.9	519.31	470.54
12/6/10 15:00	309.64	285.7	23.9			573.15
					94672.33	179296.59
				Autocorrelat	0.53	

DEPARTMENT: POLLUTION CONTROL AGENCY

STATE OF MINNESOTA
Office Memorandum

DATE: March 2, 2012

TO: AQD File No. 27A
(Delta ID No. 07500003)

FROM: Hongming Jiang
Air Quality Permits Section
Industrial Division

Catherine Neuschler
Air Assessment and Environmental Data Management Section
Environmental Analysis and Outcomes Division

PHONE: 651-757-2467

651-757-2607

SUBJECT: Nitrogen Oxides BART Limits for Northshore Mining Company (NSM)

This memo was prepared to provide the documentation of the MPCA's NO_X BART limit determination based on the technical review performed by MPCA staff. EPA's approval of the Regional Haze State Implementation Plan (SIP) for Minnesota is needed for the MPCA's BART determination to become effective.

1. General Information

1.1 Applicant and Stationary Source Location:

Applicant/Mailing Address	Stationary Source (SIC: **1011**)/Address
Northshore Mining Company 10 Outer Drive Silver Bay, MN 55614	Northshore Mining Company 10 Outer Drive Silver Bay, MN 55614, Lake County
Contact: Mr. Scott Gischia; Phone: (218) 226-6076	

1.2 Description of the Facility

Northshore Mining Company's (NSM) Silver Bay facility is located on the north shore of Lake Superior. It was the first taconite operation in Minnesota, originally built in the mid-1950s by Reserve Mining Company. Cleveland Cliffs, Incorporated purchased the facility from Cyprus Minerals in 1994; Cleveland Cliffs now owns and operates the facility.

NSM has four indurating furnaces. Furnaces 11 and 12 began operating in 1963, a few years after Furnaces 5 and 6 started operation. However, Furnace 5 was shut down for several years; in 2006, NSM received a Prevention of Significant Deterioration permit authorizing the restarting of Furnace 5. Furnaces 11 and 12 were manufactured by Arthur G. McKee and are NSM's largest indurating furnaces. They each burn a maximum of 150 MMBtu/hr of natural gas and are capable of processing 300 tons of pellets per hour.

NSM also operates two process boilers that are subject to BART. Both process boilers were installed in 1965 and are rated at 79 MMBtu/hr. The boilers are capable of burning fuel oil and natural gas.

2. Regulatory and/or Statutory Basis

2.1 Overview of Visibility, Regional Haze, and Best Available Retrofit Technology Program

The U.S. EPA's 1999 Regional Haze Rule singles out certain older emission sources that have not been regulated under other provisions of the Clean Air Act for additional controls. The MPCA is required to determine Best Available Retrofit Technology (BART) for these older sources that contribute to visibility impairment in Class I Areas to install Best Available Retrofit Technology (BART). On July 6, 2005, U.S. EPA published a revised final rule, including 40 CFR 51, Appendix Y "Guidelines for BART Determinations Under the Regional Haze Rule" which provides direction for determining which older sources may need to install BART and for determining BART.

The MPCA is required to determine BART for each source subject to BART based on an analysis of the best system of continuous emission control technology available and associated emission reductions achievable. The analysis must take into consideration the technology available, the costs of compliance, the energy and non-air quality environmental impacts, any pollution control equipment in use at the source, the remaining useful life of the source, and the degree of improvement in visibility which may reasonably be anticipated to result from use of the technology.

Further discussion of the regulatory basis for this determination can be found in the MPCA's December 2009 Regional Haze State Implementation Plan submittal, in Appendix 9.3.

2.2 Affected Units

The units for which the MPCA must determine BART and establish a NO_X BART limit consistent with that determination is:

Emission Unit Name	EU Number	Control Equipment and Stack Numbers
Indurating Furnace #11 – Hood Exhaust	EU100	SV101, SV102, SV103
Indurating Furnace #11 – Waste Gas	EU104	SV104, SV105
Indurating Furnace #12 – Hood Exhaust	EU110	SV111, SV112, SV113
Indurating Furnace #12 – Waste Gas	EU114	SV114, SV115
Process Boiler #1	EU003	SV003
Process Boiler #2	EU004	SV003

2.3 The BART Determination

The MPCA's NO_X BART determinations for these units are documented in Appendix 9.3 of the December 2009 Regional Haze SIP submittal. The BART NO_X determination for the process boilers is existing design and permitted fuels. The BART NO_X determination for the indurating furnaces is good combustion practices.

However, due to the lack of sufficient emissions data representing the range of operating conditions that influence emissions, the MPCA did not set an emission limit at the time of making the BART determination for the indurating furnaces. Instead, the MPCA and NSM entered into an Administrative Order, under which NSM provided additional NO_X emission information to the MPCA.

2.4 MPCA Determination of the BART Limit

The BART limit for the process boilers was previously determined and is 0.17 lbs NO_X/MMBtu heat input; no SO_2 limit was set as the process boilers burn only natural gas and low sulfur distillate fuel oil. The SO_2 BART limit for the furnaces was previously determined and is 0.0651 lb SO2 per long ton of pellets fired (finished) that applies only when the company is burning natural gas.

The MPCA reviewed the NO_X emission information from the indurating furnaces provided by NSM. Under the previously mentioned Administrative Order, NSM was required to collect "a minimum of 150 one-hour data points under the range of [furnace] operating parameters that influence NO_X emissions. The range of each operating parameter during testing should be representative of furnace's operating range for the parameters in the 12 months previous to testing." This requirement was to ensure that the emissions data collected was appropriately representative of the range of operating conditions for the furnace. Method 7E stack tests were conducted in April and May 2008 and July 2009. The 2008 tests collected over 150 data points for each furnace, while the 2009 tests were shorter (30 data points).

The BART limit, in the form of a mass emission rate of NO_X in lbs/hour for each furnace, was developed based on the 2008 data, with the 2009 data used to check and further support the limit.

The data was analyzed to determine different limits that would be appropriate based on different compliance test durations. The MPCA believes the most appropriate compliance test would involve obtaining at least 30 hourly-averaged data points, as obtained by NSM in the 2009 stack testing. Using 30 data points also tends to reduce data fluctuations.

The process of calculating the BART limit for Furnace 11 began by constructing a 99% confidence interval and taking the upper prediction level. The MPCA believes the use of a 99% upper predictive level for setting the limit is appropriate, due to the need for limits to be met during all operating conditions, including during times of startup, shutdown, and malfunction.

The sample calculation below is for the 99% confidence interval:

$$\text{Mean of 30 data points} = \bar{X} + [2.604 \times \bar{\sigma} \times \sqrt{(\frac{1}{30} + \frac{1}{176})}]$$

- Where $\bar{X}$ and $\bar{\sigma}$ are, respectively, the mean and standard deviation of the sample of 176 hourly-averaged NO_X data points of 2008 for Furnace 11;
- The value 2.604 is the 2-tail percentage point of the t-distribution with a level of significance of 0.01 and 175 degrees of freedom;
- $\sqrt{(\frac{1}{30} + \frac{1}{176})}$ is used to relate the sample sizes for the intended compliance test and the 2008 Furnace 11 data set; and
- The resultant value is the recommended limit as the mean of 30 hourly-averaged data points.

Northshore Mining NO_X Stack Test Values (in lbs/hour)		
	Furnace 11	Furnace 12
May 2008 Stack Test		
# Data Points	176	158
Mean	111.0	98.9
St Dev	8.7	10.3
Max Value	130.4	130.0
Min Value	73.5	87.5
99% Interval UPL	115.9	115.8
July 2009 Stack Tests		
# Data Points	35	32
Mean	94.0	90.1
St Dev	3.8	2.5
Max Value	102.0	95.5
Min Value	87.8	85.4
99% Interval UPL	93.85	87.6

The MPCA conducted additional analysis in order to help alleviate concerns that any one stack test, even an extended stack test, cannot capture all of the anticipated furnace operating conditions. This was done through the use of bootstrapping, a resampling technique designed to replicate the taking of multiple samples of the same size from a population.

This technique uses the data points from the 150 hour (or greater) stack test as a representative population, from what multiple samples of 30 data points are drawn. A random number generator was used to select the hourly data points used in constructing each 30 data point sample. A total of 2000 sets of 30 hourly data points were generated. The mean of each 30 point data set was then used to make a new, larger, sample of 2000 data points to represent the overall "population" of potential emission levels. This was repeated several times, both in Excel and using the R statistical package.

Each of the surrogate populations thus created had a different standard error. Standard error is the standard deviation of a summary statistic, or a measure of the precision of the estimate. So, in essence, the variability of the standard error for each of these surrogate populations gives a sense of how much the sample mean may differ from the "true" or population mean. In the bootstrapping technique, the standard error of datasets of 30 points drawn the new surrogate population (built from the mean of each of 2000 randomly selected 30 data point sample sets) ranged from 1.563 to 1.616 for Furnace 11 and from 1.883 to 1.896 for Furnace 12 .

The MPCA then looked at the analyses with varying standard error, and used that standard error (*se*) and the mean of the original data point sample to develop additional 99% UPLs. Because of the large number of data points, this was calculated with a z-statistic, rather than the t-statistic used above. The z-statistic at $\alpha = 0.01$ is 2.576. This calculation is: $\overline{X} + [2.576 \times se]$. For the data from Nortshore, this is: $110.0 + [2.576 \times 9.269]$.

Using the different standard errors, the 99% UPLs for Line 11 are all around 115 lbs/hour. The 99% UPLs for Northshore are all around 103 to 104 lbs/hour. Based on the MPCA's experience in analyzing data from these units, the recommended limit for Furnace 12 is the same as that for Furnace 11, although completing the calculation shown above would result in a slightly lower value for Furnace 12.

These limits were placed on public comment, which raised two key issues. First was the use of the 99% UPL rather than a 95% interval . The second was the existence of autocorrelation in the data, which (if not taken into account) tends to

result in an underestimation of variance and narrower confidence and predictive intervals; thus, inappropriately lower limits. We decided to take into account both comments, by moving to a 95% UPL and correcting the data for the autocorrelation.

It was assumed, for simplicity, that the autocorrelation exhibited was first order autocorrelation – that is, that each data point is related only to the data point immediately ahead of it. The following equation, developed by Box and Jenkins and taken from Gilbert, R. O. (1987) *Statistical Methods for Environmental Pollution Monitoring*, was used to estimate the magnitude of the autocorrelation coefficient:

$$\hat{\rho} = \sum_{t=1}^{n-1}(X_t - \bar{X})(X_{t+1} - \bar{X}) / \sum_{t=1}^{n}(X_t - \bar{X})^2$$

The equation $n_{eff} = \frac{n(1-\rho)}{(1+\rho)}$ was then used to calculate the "Effective n" [1] or the effective sample size based on the number of samples arising from the 150 hour stack test.

Using the equation above, the MPCA found the following autocorrelation coefficients for the furnaces at NSM: 0.80 for Furnace 11 and 0.82 for Furnace 12. The autocorrelation coefficient was used to adjust the effective sample size for both the sample data and the proposed compliance test, as suggested by the commenter. Ultimately, this does result in higher UPLs. When coupled with the move to the 95% interval, the resulting emission limits for the most part do not change dramatically.

After reviewing stack test data provided by NSM and conducting the analyses described above, the MPCA has determined that an appropriate BART NO_X limit is122.4 lbs/hour per furnace; this limit is a 30-day rolling average.

Compliance is to be determined through NO_X performance testing, simultaneously measured from all furnace stacks at each of the two furnaces for 30 hourly data points.

[1] http://www.climatescience.gov/Library/sap/sap1-1/third-draft/sap1-1-draft3-appA.pdf

Northshore Mining Company - Data for NOX BART Limit on Indurating Furnaces

Line 11 Furnace - Combined Stacks

2008 Stack Testing		2009 Stack Testing	
Date and Time	Total Emission Rate, lb/hr	Date/Time	Total Emission Rate, lb/hr
5/15/08 0:00	104.2	07/27/09 19:00	91.8
5/15/08 1:00	103.1	07/27/09 20:00	87.8
5/15/08 2:00	100.2	07/27/09 21:00	95.2
5/15/08 3:00	110.0	07/27/09 22:00	95.9
5/15/08 4:00	111.0	07/27/09 23:00	97.0
5/15/08 5:00	110.2	07/28/09 00:00	100.0
5/15/08 6:00	113.5	07/28/09 01:00	99.6
5/15/08 7:00	113.5	07/28/09 02:00	94.6
5/15/08 8:00	113.1	07/28/09 04:00	
5/15/08 9:00	100.6	07/28/09 05:00	90.8
5/15/08 10:00	116.4	07/28/09 06:00	92.2
5/15/08 11:00	117.2	07/28/09 07:00	90.4
5/15/08 12:00	113.2	07/28/09 08:00	95.2
5/15/08 13:00	108.9	07/28/09 09:00	91.6
5/15/08 14:00	107.1	07/28/09 10:00	93.3
5/15/08 15:00	106.5	07/28/09 11:00	99.4
5/15/08 16:00	109.0	07/28/09 12:00	95.1
5/15/08 17:00	108.0	07/28/09 13:00	92.0
5/15/08 18:00	104.6	07/28/09 14:00	89.7
5/15/08 19:00	105.5	07/28/09 15:00	93.1
5/15/08 20:00	108.8	07/28/09 16:00	90.0
5/15/08 21:00	106.9	07/28/09 17:00	89.8
5/15/08 22:00	110.6	07/28/09 18:00	88.1
5/15/08 23:00	103.0	07/28/09 19:00	91.3
5/16/08 0:00	94.8	07/28/09 20:00	93.2
5/16/08 1:00	96.4	07/28/09 21:00	89.3
5/16/08 2:00	97.2	07/28/09 22:00	90.5
5/16/08 3:00	98.3	07/28/09 23:00	91.7
5/16/08 4:00	108.8	07/29/09 00:00	93.6
5/16/08 5:00	109.9	07/29/09 01:00	94.0
5/16/08 6:00	113.2	07/29/09 02:00	98.6
5/16/08 7:00	101.6	07/29/09 03:00	102.0
5/16/08 8:00	98.7	07/29/09 04:00	97.3
5/16/08 9:00	101.3	07/29/09 05:00	98.6
5/16/08 10:00	103.2	07/29/09 06:00	101.4
5/16/08 11:00	99.2		95.5
5/16/08 12:00	99.6		
5/16/08 13:00	106.7		
5/16/08 14:00	106.9		
5/16/08 15:00	109.5		
5/16/08 16:00	110.3		
5/16/08 17:00	111.2		
5/16/08 18:00	115.5		
5/16/08 19:00	113.4		
5/16/08 20:00	118.1		
5/16/08 21:00	124.2		
5/16/08 22:00	118.0		
5/16/08 23:00	125.2		
5/17/08 0:00	129.5		
5/17/08 1:00	130.4		
5/17/08 2:00	129.7		
5/17/08 3:00	129.2		
5/17/08 4:00	123.4		
5/17/08 5:00	119.9		
5/17/08 6:00	116.6		

Line 12 Furnace - Combined Stacks

2008 Stack Testing		2009 Stack Testing	
Date and Time	Total Emission Rate, lb/hr	Date/Time	Total Emission Rate, lb/hr
4/22/08 20:00	118.2	07/29/09 10:00	94.4
4/22/08 21:00	125.1	07/29/09 11:00	91.4
4/22/08 22:00	125.8	07/29/09 12:00	91.8
4/22/08 23:00	126.7	07/29/09 13:00	92.1
4/23/08 0:00	127.1	07/29/09 14:00	95.5
4/23/08 1:00	128.0	07/29/09 15:00	89.9
4/23/08 2:00	128.1	07/29/09 16:00	92.0
4/23/08 3:00	127.2	07/29/09 17:00	92.8
4/23/08 4:00	126.9	07/29/09 18:00	90.5
4/23/08 5:00	128.3	07/29/09 19:00	90.3
4/23/08 6:00	130.1	07/29/09 20:00	94.0
4/23/08 7:00	129.4	07/29/09 21:00	89.5
4/23/08 8:00	119.4	07/29/09 22:00	91.0
4/23/08 9:00	118.0	07/29/09 23:00	94.3
4/23/08 10:00	117.2	07/30/09 00:00	89.2
4/23/08 11:00	117.0	07/30/09 01:00	88.8
4/23/08 12:00	117.0	07/30/09 02:00	89.1
4/23/08 13:00	105.7	07/30/09 03:00	89.4
4/23/08 14:00	102.2	07/30/09 04:00	90.0
4/23/08 15:00	98.1	07/30/09 05:00	90.2
4/23/08 16:00	96.3	07/30/09 06:00	88.9
4/23/08 17:00	92.8	07/30/09 07:00	86.3
4/23/08 18:00	91.9	07/30/09 08:00	90.0
4/23/08 19:00	95.0	07/30/09 09:00	91.0
4/23/08 20:00	98.1	07/30/09 10:00	89.3
4/23/08 21:00	96.8	07/30/09 11:00	87.8
4/23/08 22:00	93.8	07/30/09 12:00	85.7
4/23/08 23:00	96.4	07/30/09 13:00	89.7
4/24/08 0:00	94.6	07/30/09 14:00	88.4
4/24/08 1:00	93.4	07/30/09 15:00	85.8
4/24/08 2:00	92.8	07/30/09 16:00	87.3
4/24/08 3:00	92.3	07/30/09 17:00	85.4
4/24/08 4:00	92.3		
4/24/08 5:00	92.9		
4/24/08 6:00	91.3		
4/24/08 7:00	87.6		
4/24/08 8:00	91.7		
4/24/08 9:00	90.2		
4/24/08 10:00	89.6		
4/24/08 11:00	89.8		
4/24/08 12:00	88.1		
4/24/08 13:00	93.0		
4/24/08 14:00	90.6		
4/24/08 15:00	89.9		
4/24/08 16:00	93.6		
4/24/08 17:00	93.7		
4/24/08 18:00	92.9		
4/24/08 19:00	88.7		
4/24/08 20:00	88.4		
4/24/08 21:00	89.5		
4/24/08 22:00	88.5		
4/24/08 23:00	91.2		
4/25/08 0:00	91.2		
4/25/08 1:00	92.9		
4/25/08 2:00	95.3		

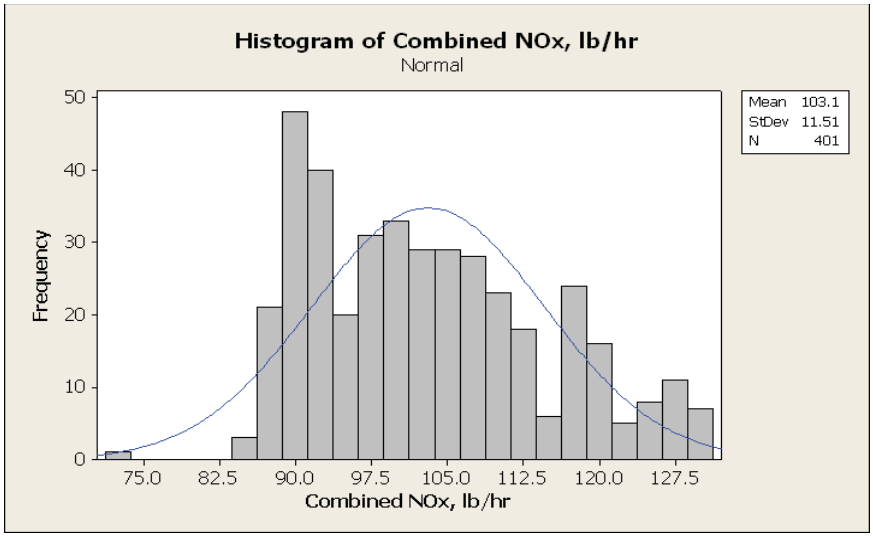
5/17/08 7:00	112.0
5/17/08 8:00	112.0
5/17/08 9:00	110.2
5/17/08 10:00	108.7
5/17/08 11:00	108.6
5/17/08 12:00	110.9
5/17/08 13:00	108.7
5/17/08 14:00	104.5
5/17/08 15:00	104.1
5/17/08 16:00	100.1
5/17/08 17:00	101.1
5/17/08 18:00	103.0
5/17/08 19:00	106.0
5/17/08 20:00	106.5
5/17/08 21:00	105.7
5/17/08 22:00	107.4
5/17/08 23:00	103.6
5/18/08 0:00	103.3
5/18/08 1:00	103.5
5/18/08 2:00	103.8
5/18/08 3:00	103.3
5/18/08 4:00	105.9
5/18/08 5:00	114.3
5/18/08 6:00	112.6
5/18/08 7:00	97.5
5/18/08 8:00	98.2
5/18/08 9:00	108.0
5/18/08 10:00	107.1
5/18/08 11:00	106.8
5/18/08 12:00	107.7
5/18/08 13:00	110.8
5/18/08 14:00	110.2
5/18/08 15:00	106.3
5/18/08 16:00	110.3
5/18/08 17:00	113.1
5/18/08 18:00	117.9
5/18/08 19:00	118.3
5/18/08 20:00	120.5
5/18/08 21:00	120.2
5/18/08 22:00	111.6
5/18/08 23:00	107.9
5/19/08 0:00	107.2
5/19/08 1:00	106.1
5/19/08 2:00	111.9
5/19/08 3:00	109.4
5/19/08 4:00	112.2
5/19/08 5:00	116.9
5/19/08 6:00	107.6
5/19/08 7:00	102.1
5/19/08 8:00	104.2
5/19/08 9:00	106.5
5/19/08 10:00	110.0
5/19/08 11:00	110.7
5/19/08 12:00	112.3
5/19/08 13:00	115.3
5/19/08 14:00	126.2
5/19/08 15:00	126.7
5/19/08 16:00	126.4
5/19/08 17:00	125.7
5/19/08 18:00	125.5
5/19/08 19:00	126.7
4/25/08 3:00	93.2
4/25/08 4:00	91.3
4/25/08 5:00	88.3
4/25/08 6:00	93.7
4/25/08 7:00	92.4
4/25/08 8:00	93.2
4/25/08 9:00	94.1
4/25/08 10:00	90.0
4/25/08 11:00	87.8
4/25/08 12:00	88.7
4/25/08 13:00	89.9
4/25/08 14:00	88.5
4/25/08 15:00	88.1
4/25/08 16:00	89.7
4/25/08 17:00	88.5
4/25/08 18:00	89.7
4/25/08 19:00	89.6
4/25/08 20:00	89.3
4/25/08 21:00	89.2
4/25/08 22:00	87.6
4/25/08 23:00	87.8
4/26/08 0:00	88.2
4/26/08 1:00	91.9
4/26/08 2:00	89.9
4/26/08 3:00	90.3
4/26/08 4:00	92.7
4/26/08 5:00	92.4
4/26/08 6:00	90.6
4/26/08 7:00	89.9
4/26/08 8:00	91.7
4/26/08 9:00	93.8
4/26/08 10:00	94.5
4/26/08 11:00	92.5
4/26/08 12:00	91.0
4/26/08 13:00	91.2
4/26/08 14:00	97.9
4/26/08 15:00	98.9
4/26/08 16:00	98.7
4/26/08 17:00	99.7
4/26/08 18:00	99.8
4/26/08 19:00	100.8
4/26/08 20:00	100.5
4/26/08 21:00	101.9
4/26/08 22:00	103.5
4/26/08 23:00	105.4
4/27/08 0:00	104.3
4/27/08 1:00	104.3
4/27/08 2:00	105.0
4/27/08 3:00	104.7
4/27/08 4:00	102.5
4/27/08 5:00	103.2
4/27/08 6:00	102.3
4/27/08 7:00	98.0
4/27/08 8:00	98.2
4/27/08 9:00	97.3
4/27/08 10:00	98.3
4/27/08 11:00	96.6
4/27/08 12:00	97.4
4/27/08 13:00	99.6
4/27/08 14:00	98.9
4/27/08 15:00	99.4

5/19/08 20:00	129.3
5/19/08 21:00	128.0
5/19/08 22:00	117.6
5/19/08 23:00	120.5
5/20/08 0:00	121.6
5/20/08 1:00	120.0
5/20/08 2:00	118.7
5/20/08 3:00	119.8
5/20/08 4:00	118.0
5/20/08 5:00	120.8
5/20/08 6:00	114.5
5/20/08 7:00	73.6
5/20/08 8:00	96.1
5/20/08 9:00	94.7
5/20/08 10:00	90.6
5/20/08 11:00	102.7
5/20/08 12:00	102.1
5/20/08 13:00	103.9
5/20/08 14:00	104.4
5/20/08 15:00	104.8
5/20/08 16:00	105.6
5/20/08 17:00	105.5
5/20/08 18:00	107.9
5/20/08 19:00	105.9
5/20/08 20:00	104.9
5/20/08 21:00	107.2
5/20/08 22:00	107.0
5/20/08 23:00	109.6
5/21/08 0:00	113.0
5/21/08 1:00	120.6
5/21/08 2:00	120.6
5/21/08 3:00	122.5
5/21/08 4:00	118.4
5/21/08 5:00	117.8
5/21/08 6:00	121.2
5/21/08 7:00	123.9
5/21/08 8:00	116.4
5/21/08 9:00	119.0
5/21/08 10:00	119.9
5/21/08 11:00	117.7
5/21/08 12:00	119.9
5/21/08 13:00	118.8
5/21/08 14:00	118.5
5/21/08 15:00	120.7
5/21/08 16:00	123.5
5/21/08 17:00	121.4
5/21/08 18:00	112.5
5/21/08 19:00	115.0
5/21/08 20:00	112.6
5/21/08 21:00	109.2
5/21/08 22:00	104.5
5/21/08 23:00	99.1
5/22/08 0:00	102.7
5/22/08 1:00	105.6
5/22/08 2:00	109.1
5/22/08 3:00	113.5
5/22/08 4:00	118.4
5/22/08 5:00	117.6
5/22/08 6:00	116.7
5/22/08 7:00	114.2
4/27/08 16:00	99.3
4/27/08 17:00	98.6
4/27/08 18:00	98.6
4/27/08 19:00	99.1
4/27/08 20:00	100.0
4/27/08 21:00	102.2
4/27/08 22:00	106.1
4/27/08 23:00	105.4
4/28/08 0:00	107.0
4/28/08 1:00	106.7
4/28/08 2:00	106.8
4/28/08 3:00	106.3
4/28/08 4:00	106.7
4/28/08 5:00	104.1
4/28/08 6:00	103.7
4/28/08 7:00	103.2
4/28/08 8:00	100.8
4/28/08 9:00	100.8
4/28/08 10:00	101.5
4/28/08 11:00	99.4
4/28/08 12:00	100.1
4/28/08 13:00	103.0
4/28/08 14:00	101.7
4/28/08 15:00	102.1
4/28/08 16:00	100.2
4/28/08 17:00	101.0
4/28/08 18:00	99.2
4/28/08 19:00	99.1
4/28/08 20:00	99.3
4/28/08 21:00	98.8
4/28/08 22:00	98.0
4/28/08 23:00	100.4
4/29/08 0:00	71.8
4/29/08 1:00	3.1
4/29/08 2:00	45.6
4/29/08 3:00	85.9
4/29/08 4:00	97.8
4/29/08 5:00	97.0
4/29/08 6:00	96.6
4/29/08 7:00	98.9
4/29/08 8:00	96.5
4/29/08 9:00	96.3
4/29/08 10:00	93.2
4/29/08 11:00	90.9
4/29/08 12:00	88.5
4/29/08 13:00	89.2
	97.78

Descriptive Statistics

Furnace 11	**2008**	**2009**
Average Emissions, lbs/hour	111.1	94.0
Stdev	8.7	3.8
Count	176	35
Maximum lbs/hour	130.4	102.0
Minimum lbs/hour	73.5	87.8
$t_{0.05,\ C\text{-}1}$	1.974	2.032
95% UPL	114.46	95.92
$t_{0.01,\ c\text{-}1}$	2.604	2.728
99% UPL	115.54	104.24

Furnace 12	**2008**	**2009**
Average Emissions, lbs/hour	97.8	90.1
Stdev	10.3	2.5
Count	158	32
Maximum lbs/hour	130.0	95.5
Minimum lbs/hour	87.5	85.4
$t_{0.05,\ C\text{-}1}$	1.975	2.040
95% UPL	101.85	91.12
$t_{0.01,\ c\text{-}1}$	2.608	2.744
99% UPL	103.15	91.84



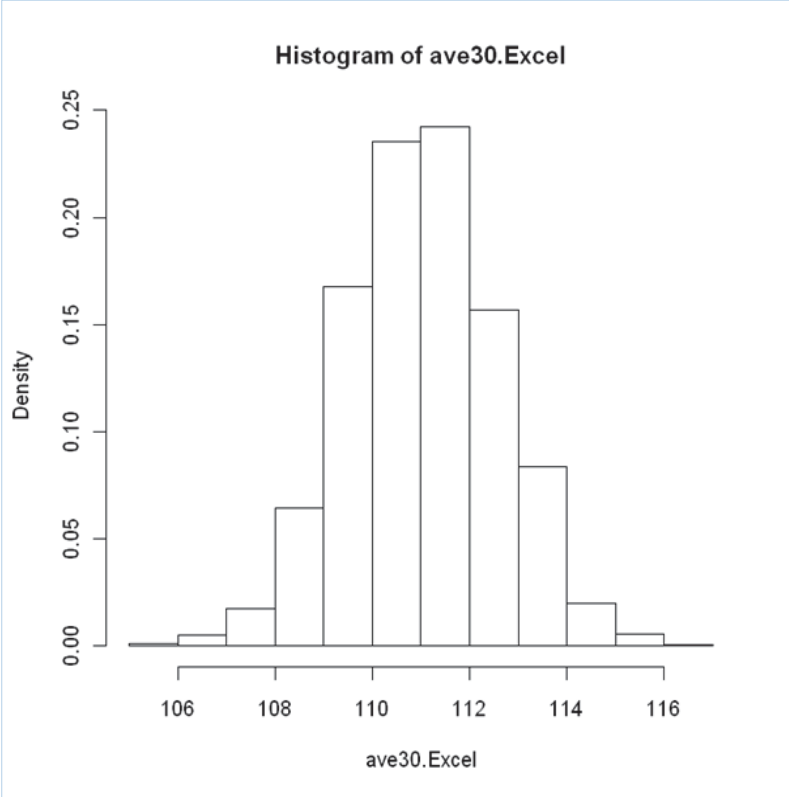
Furnace 11: Classic Predictive Interval Calculations for 30 data Points

Mean	Stdev	Count	alpha	2-tail t	upper level
111.04896	8.747557	176.0	0.01	2.604	115.5
			0.05	1.974	114.5

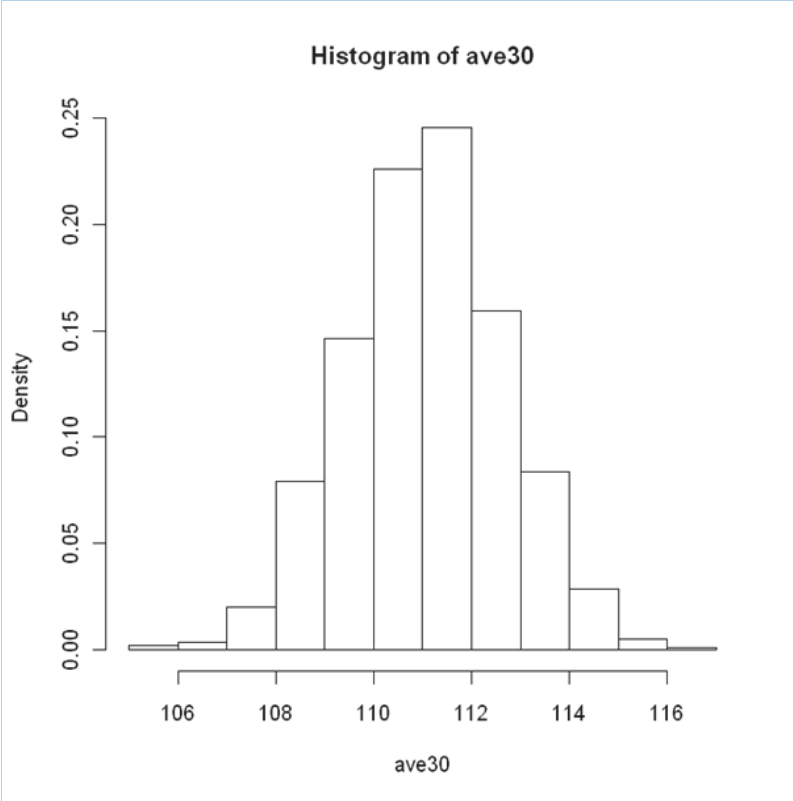
Furnace 11: Bootstrap Results: 2000 replicates based on NOx lbs/hour Data

Tool	Mean	SE(ave30)	alpha	2-tail z	upper level
Excel 2007	111.0	1.563	0.01	2.576	115.1
			0.05	1.960	114.1
R	111.0	1.612	0.01	2.576	115.2
			0.05	1.960	114.2
R	111.0	1.616	0.01	2.576	115.2
			0.05	1.960	114.2
R	111.0	1.604	0.01	2.576	115.2
			0.05	1.960	114.2
R	111.0	1.581	0.01	2.576	115.1
			0.05	1.960	114.1
R	111.0	1.605	0.01	2.576	115.2
			0.05	1.960	114.2
R	111.0	1.616	0.01	2.576	115.2
			0.05	1.960	114.2
R	111.0	1.590	0.01	2.576	115.1
			0.05	1.960	114.2
R	111.0	1.566	0.01	2.576	115.1
			0.05	1.960	114.1
R	111.0	1.570	0.01	2.576	115.1
			0.05	1.960	114.1

Histogram of Bootstrap Distribution (Excel, se = 1.563)



Histogram of Bootstrap Distribution (R, se = 1.612)



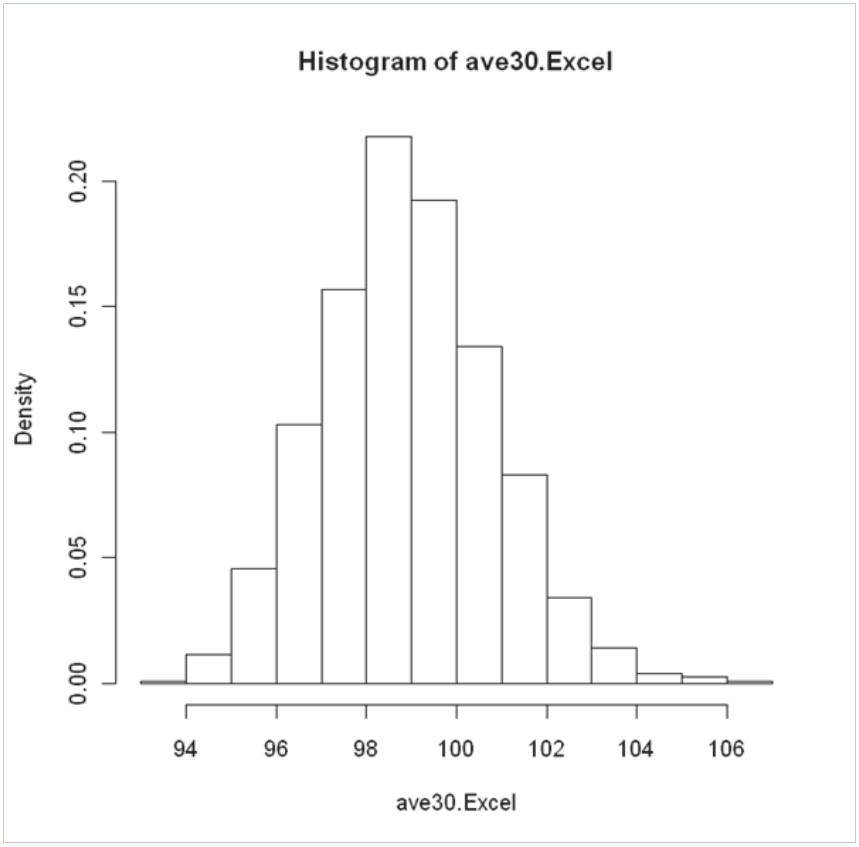
Furnace 12: Classic Predictive Interval Calculations for 30 data Points

Mean	Stdev	Count	alpha	2-tail t	upper level
98.9	10.318	158	0.01	2.608	104.3
			0.05	1.975	103.0

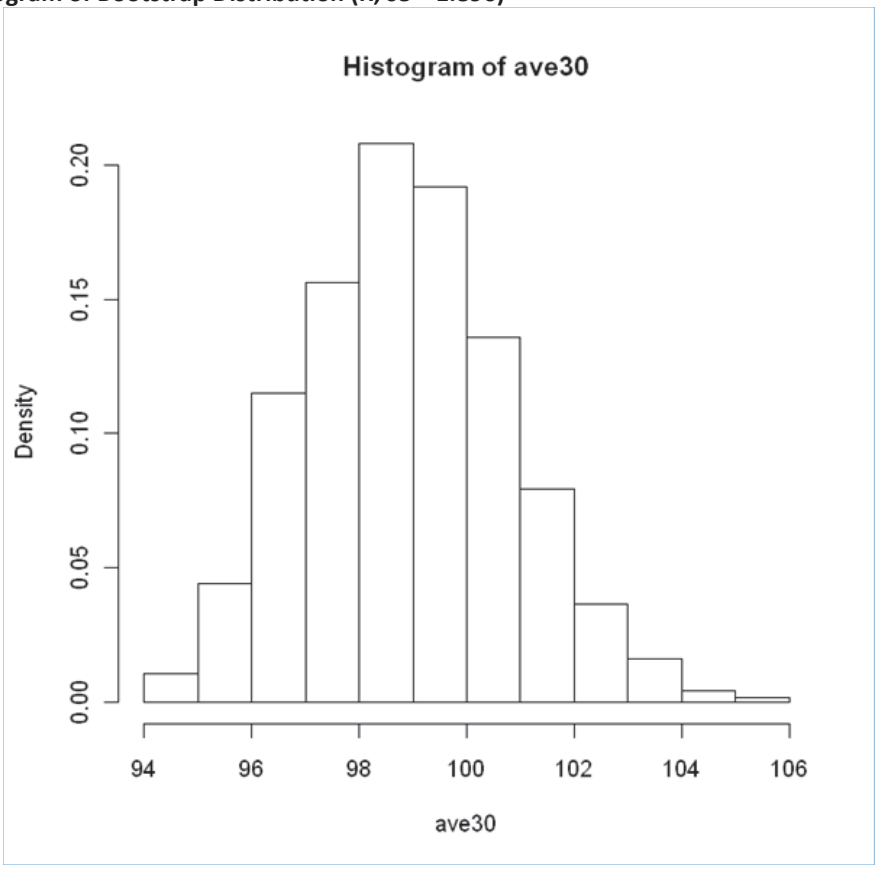
Furnace 12: Bootstrap Results: 2000 replicates based on NOx lbs/hour Data

Tool	Mean	SE(ave30)	alpha	2-tail z	upper level
Excel 2007	98.9	1.883	0.01	2.576	103.8
			0.05	1.960	102.6
R	98.9	1.896	0.01	2.576	103.8
			0.05	1.960	102.7
R	98.9	1.894	0.01	2.576	103.8
			0.05	1.960	102.7
R	98.9	1.883	0.01	2.576	103.8
			0.05	1.960	102.6

Histogram of Bootstrap Distribution (Excel, se = 1.883)



Histogram of Bootstrap Distribution (R, se = 1.896)



Northshore Mining - Data for NO_X BART Limit on Indurating Furnaces						
		Furnace 11			Furnace 12	
		Original Data	Correction		Original Data	Correction
	Average	111.1	111.1		97.8	97.8
	St Dev	8.7	8.7		10.3	10.3
	Max	130.4	130.4		130	130
	Min	73.5	73.5		87.5	87.5
	Count	176	20		158	16
	$t_{0.05, c-1}$	1.97	2.09		1.98	2.13
	UPL 95%	114.492	122.374		101.852	111.612
	$t_{0.01, c-1}$	2.60	2.86		2.61	2.95
	UPL 99%	115.575	126.510		103.149	116.896
	Auto Correlation	0.8			0.82	
	"Effective N"	19.6			15.6	
	"Effective M"	3.3			3.0	

Northshore Furnace 11 Box Jenkins						
Date and Time	Total Emission Rate, lb/hr	Sample Mean	Xt - Mean	Xt+1 - Mean	(Xt - Mean)(Xt+1-Mean)	(Xt - Mean)^2
5/15/08 0:00	104.2	111.1	-6.9	-8.0	54.98	47.60
5/15/08 1:00	103.1	111.1	-8.0	-10.9	86.49	63.51
5/15/08 2:00	100.2	111.1	-10.9	-1.1	11.64	117.78
5/15/08 3:00	110.0	111.1	-1.1	-0.1	0.11	1.15
5/15/08 4:00	111.0	111.1	-0.1	-0.9	0.09	0.01
5/15/08 5:00	110.2	111.1	-0.9	2.4	-2.15	0.81
5/15/08 6:00	113.5	111.1	2.4	2.4	5.79	5.70
5/15/08 7:00	113.5	111.1	2.4	2.0	4.95	5.89
5/15/08 8:00	113.1	111.1	2.0	-10.5	-21.45	4.16
5/15/08 9:00	100.6	111.1	-10.5	5.3	-56.19	110.62
5/15/08 10:00	116.4	111.1	5.3	6.1	32.51	28.54
5/15/08 11:00	117.2	111.1	6.1	2.1	12.86	37.02
5/15/08 12:00	113.2	111.1	2.1	-2.2	-4.67	4.46
5/15/08 13:00	108.9	111.1	-2.2	-4.0	8.76	4.89
5/15/08 14:00	107.1	111.1	-4.0	-4.6	18.13	15.71
5/15/08 15:00	106.5	111.1	-4.6	-2.1	9.41	20.93
5/15/08 16:00	109.0	111.1	-2.1	-3.1	6.42	4.23
5/15/08 17:00	108.0	111.1	-3.1	-6.5	20.19	9.74
5/15/08 18:00	104.6	111.1	-6.5	-5.6	36.19	41.87
5/15/08 19:00	105.5	111.1	-5.6	-2.3	12.66	31.28
5/15/08 20:00	108.8	111.1	-2.3	-4.2	9.53	5.13
5/15/08 21:00	106.9	111.1	-4.2	-0.5	2.03	17.72
5/15/08 22:00	110.6	111.1	-0.5	-8.1	3.89	0.23
5/15/08 23:00	103.0	111.1	-8.1	-16.3	131.65	65.09
5/16/08 0:00	94.8	111.1	-16.3	-14.7	240.43	266.30
5/16/08 1:00	96.4	111.1	-14.7	-13.9	204.23	217.08
5/16/08 2:00	97.2	111.1	-13.9	-12.8	177.67	192.15
5/16/08 3:00	98.3	111.1	-12.8	-2.3	29.48	164.27
5/16/08 4:00	108.8	111.1	-2.3	-1.2	2.84	5.29
5/16/08 5:00	109.9	111.1	-1.2	2.1	-2.54	1.53
5/16/08 6:00	113.2	111.1	2.1	-9.5	-19.50	4.24
5/16/08 7:00	101.6	111.1	-9.5	-12.4	117.12	89.73
5/16/08 8:00	98.7	111.1	-12.4	-9.8	120.75	152.86
5/16/08 9:00	101.3	111.1	-9.8	-7.9	77.37	95.38
5/16/08 10:00	103.2	111.1	-7.9	-11.9	94.19	62.76
5/16/08 11:00	99.2	111.1	-11.9	-11.5	136.70	141.36
5/16/08 12:00	99.6	111.1	-11.5	-4.4	50.64	132.19
5/16/08 13:00	106.7	111.1	-4.4	-4.2	18.54	19.40
5/16/08 14:00	106.9	111.1	-4.2	-1.6	6.65	17.72
5/16/08 15:00	109.5	111.1	-1.6	-0.8	1.25	2.49
5/16/08 16:00	110.3	111.1	-0.8	0.1	-0.11	0.63
5/16/08 17:00	111.2	111.1	0.1	4.4	0.62	0.02
5/16/08 18:00	115.5	111.1	4.4	2.3	10.11	19.36
5/16/08 19:00	113.4	111.1	2.3	7.0	16.19	5.28
5/16/08 20:00	118.1	111.1	7.0	13.1	92.03	49.61
5/16/08 21:00	124.2	111.1	13.1	6.9	90.77	170.74
5/16/08 22:00	118.0	111.1	6.9	14.1	98.12	48.26
5/16/08 23:00	125.2	111.1	14.1	18.4	259.29	199.48
5/17/08 0:00	129.5	111.1	18.4	19.3	354.19	337.03
5/17/08 1:00	130.4	111.1	19.3	18.6	359.12	372.23

5/17/08 2:00	129.7	111.1	18.6	18.1	336.36	346.48
5/17/08 3:00	129.2	111.1	18.1	12.3	223.15	326.54
5/17/08 4:00	123.4	111.1	12.3	8.8	108.38	152.49
5/17/08 5:00	119.9	111.1	8.8	5.5	47.97	77.02
5/17/08 6:00	116.6	111.1	5.5	0.9	4.96	29.87
5/17/08 7:00	112.0	111.1	0.9	0.9	0.84	0.82
5/17/08 8:00	112.0	111.1	0.9	-0.9	-0.80	0.87
5/17/08 9:00	110.2	111.1	-0.9	-2.4	2.02	0.73
5/17/08 10:00	108.7	111.1	-2.4	-2.5	5.90	5.59
5/17/08 11:00	108.6	111.1	-2.5	-0.2	0.38	6.23
5/17/08 12:00	110.9	111.1	-0.2	-2.4	0.36	0.02
5/17/08 13:00	108.7	111.1	-2.4	-6.6	15.81	5.72
5/17/08 14:00	104.5	111.1	-6.6	-7.0	46.06	43.73
5/17/08 15:00	104.1	111.1	-7.0	-11.0	76.61	48.52
5/17/08 16:00	100.1	111.1	-11.0	-10.0	109.45	120.94
5/17/08 17:00	101.1	111.1	-10.0	-8.1	80.16	99.04
5/17/08 18:00	103.0	111.1	-8.1	-5.1	41.38	64.87
5/17/08 19:00	106.0	111.1	-5.1	-4.6	23.71	26.40
5/17/08 20:00	106.5	111.1	-4.6	-5.4	24.75	21.30
5/17/08 21:00	105.7	111.1	-5.4	-3.7	19.74	28.77
5/17/08 22:00	107.4	111.1	-3.7	-7.5	27.54	13.55
5/17/08 23:00	103.6	111.1	-7.5	-7.8	58.03	56.01
5/18/08 0:00	103.3	111.1	-7.8	-7.6	58.71	60.11
5/18/08 1:00	103.5	111.1	-7.6	-7.3	55.23	57.33
5/18/08 2:00	103.8	111.1	-7.3	-7.8	56.99	53.21
5/18/08 3:00	103.3	111.1	-7.8	-5.2	40.81	61.04
5/18/08 4:00	105.9	111.1	-5.2	3.2	-16.61	27.28
5/18/08 5:00	114.3	111.1	3.2	1.5	4.89	10.11
5/18/08 6:00	112.6	111.1	1.5	-13.6	-20.87	2.37
5/18/08 7:00	97.5	111.1	-13.6	-12.9	175.47	183.95
5/18/08 8:00	98.2	111.1	-12.9	-3.1	39.75	167.37
5/18/08 9:00	108.0	111.1	-3.1	-4.0	12.27	9.44
5/18/08 10:00	107.1	111.1	-4.0	-4.3	17.00	15.95
5/18/08 11:00	106.8	111.1	-4.3	-3.4	14.60	18.12
5/18/08 12:00	107.7	111.1	-3.4	-0.3	1.13	11.77
5/18/08 13:00	110.8	111.1	-0.3	-0.9	0.29	0.11
5/18/08 14:00	110.2	111.1	-0.9	-4.8	4.15	0.75
5/18/08 15:00	106.3	111.1	-4.8	-0.8	3.78	22.85
5/18/08 16:00	110.3	111.1	-0.8	2.0	-1.62	0.62
5/18/08 17:00	113.1	111.1	2.0	6.8	13.90	4.19
5/18/08 18:00	117.9	111.1	6.8	7.2	48.74	46.07
5/18/08 19:00	118.3	111.1	7.2	9.4	67.70	51.57
5/18/08 20:00	120.5	111.1	9.4	9.1	85.93	88.87
5/18/08 21:00	120.2	111.1	9.1	0.5	4.56	83.08
5/18/08 22:00	111.6	111.1	0.5	-3.2	-1.61	0.25
5/18/08 23:00	107.9	111.1	-3.2	-3.9	12.71	10.41
5/19/08 0:00	107.2	111.1	-3.9	-5.0	19.62	15.52
5/19/08 1:00	106.1	111.1	-5.0	0.8	-3.82	24.80
5/19/08 2:00	111.9	111.1	0.8	-1.7	-1.29	0.59
5/19/08 3:00	109.4	111.1	-1.7	1.1	-1.83	2.84
5/19/08 4:00	112.2	111.1	1.1	5.8	6.31	1.18
5/19/08 5:00	116.9	111.1	5.8	-3.5	-20.42	33.68
5/19/08 6:00	107.6	111.1	-3.5	-9.0	31.78	12.38

5/19/08 7:00	102.1	111.1	-9.0	-6.9	62.67	81.62
5/19/08 8:00	104.2	111.1	-6.9	-4.6	31.74	48.12
5/19/08 9:00	106.5	111.1	-4.6	-1.1	4.84	20.94
5/19/08 10:00	110.0	111.1	-1.1	-0.4	0.43	1.12
5/19/08 11:00	110.7	111.1	-0.4	1.2	-0.49	0.17
5/19/08 12:00	112.3	111.1	1.2	4.2	5.13	1.46
5/19/08 13:00	115.3	111.1	4.2	15.1	64.12	18.03
5/19/08 14:00	126.2	111.1	15.1	15.6	235.96	228.05
5/19/08 15:00	126.7	111.1	15.6	15.3	238.87	244.15
5/19/08 16:00	126.4	111.1	15.3	14.6	222.48	233.70
5/19/08 17:00	125.7	111.1	14.6	14.4	209.33	211.79
5/19/08 18:00	125.5	111.1	14.4	15.6	223.96	206.89
5/19/08 19:00	126.7	111.1	15.6	18.2	283.05	242.44
5/19/08 20:00	129.3	111.1	18.2	16.9	306.32	330.46
5/19/08 21:00	128.0	111.1	16.9	6.5	109.06	283.96
5/19/08 22:00	117.6	111.1	6.5	9.4	61.06	41.89
5/19/08 23:00	120.5	111.1	9.4	10.5	98.82	89.01
5/20/08 0:00	121.6	111.1	10.5	8.9	93.17	109.71
5/20/08 1:00	120.0	111.1	8.9	7.6	67.82	79.12
5/20/08 2:00	118.7	111.1	7.6	8.7	66.27	58.13
5/20/08 3:00	119.8	111.1	8.7	6.9	59.98	75.54
5/20/08 4:00	118.0	111.1	6.9	9.7	66.63	47.62
5/20/08 5:00	120.8	111.1	9.7	3.4	32.98	93.24
5/20/08 6:00	114.5	111.1	3.4	-37.5	-128.23	11.66
5/20/08 7:00	73.6	111.1	-37.5	-15.0	563.51	1409.83
5/20/08 8:00	96.1	111.1	-15.0	-16.4	246.71	225.24
5/20/08 9:00	94.7	111.1	-16.4	-20.5	336.17	270.22
5/20/08 10:00	90.6	111.1	-20.5	-8.4	171.76	418.21
5/20/08 11:00	102.7	111.1	-8.4	-9.0	75.48	70.54
5/20/08 12:00	102.1	111.1	-9.0	-7.2	64.36	80.75
5/20/08 13:00	103.9	111.1	-7.2	-6.7	48.05	51.30
5/20/08 14:00	104.4	111.1	-6.7	-6.3	42.51	45.02
5/20/08 15:00	104.8	111.1	-6.3	-5.5	34.85	40.14
5/20/08 16:00	105.6	111.1	-5.5	-5.6	30.95	30.26
5/20/08 17:00	105.5	111.1	-5.6	-3.2	18.24	31.66
5/20/08 18:00	107.9	111.1	-3.2	-5.2	16.93	10.51
5/20/08 19:00	105.9	111.1	-5.2	-6.2	32.27	27.26
5/20/08 20:00	104.9	111.1	-6.2	-3.9	23.96	38.20
5/20/08 21:00	107.2	111.1	-3.9	-4.1	15.73	15.03
5/20/08 22:00	107.0	111.1	-4.1	-1.5	6.24	16.46
5/20/08 23:00	109.6	111.1	-1.5	1.9	-2.99	2.37
5/21/08 0:00	113.0	111.1	1.9	9.5	18.47	3.78
5/21/08 1:00	120.6	111.1	9.5	9.5	90.44	90.29
5/21/08 2:00	120.6	111.1	9.5	11.4	108.88	90.59
5/21/08 3:00	122.5	111.1	11.4	7.3	83.31	130.87
5/21/08 4:00	118.4	111.1	7.3	6.7	48.53	53.03
5/21/08 5:00	117.8	111.1	6.7	10.1	67.56	44.41
5/21/08 6:00	121.2	111.1	10.1	12.8	129.49	102.78
5/21/08 7:00	123.9	111.1	12.8	5.3	67.12	163.14
5/21/08 8:00	116.4	111.1	5.3	7.9	41.34	27.61
5/21/08 9:00	119.0	111.1	7.9	8.8	68.97	61.89
5/21/08 10:00	119.9	111.1	8.8	6.6	57.94	76.86
5/21/08 11:00	117.7	111.1	6.6	8.8	58.30	43.68

5/21/08 12:00	119.9	111.1	8.8	7.7	67.90	77.80
5/21/08 13:00	118.8	111.1	7.7	7.4	56.85	59.27
5/21/08 14:00	118.5	111.1	7.4	9.6	70.61	54.53
5/21/08 15:00	120.7	111.1	9.6	12.4	118.96	91.44
5/21/08 16:00	123.5	111.1	12.4	10.3	127.58	154.76
5/21/08 17:00	121.4	111.1	10.3	1.4	14.37	105.17
5/21/08 18:00	112.5	111.1	1.4	3.9	5.49	1.96
5/21/08 19:00	115.0	111.1	3.9	1.5	5.80	15.35
5/21/08 20:00	112.6	111.1	1.5	-1.9	-2.77	2.19
5/21/08 21:00	109.2	111.1	-1.9	-6.6	12.30	3.50
5/21/08 22:00	104.5	111.1	-6.6	-12.0	78.95	43.18
5/21/08 23:00	99.1	111.1	-12.0	-8.4	100.40	144.35
5/22/08 0:00	102.7	111.1	-8.4	-5.5	45.79	69.83
5/22/08 1:00	105.6	111.1	-5.5	-2.0	10.70	30.02
5/22/08 2:00	109.1	111.1	-2.0	2.4	-4.60	3.82
5/22/08 3:00	113.5	111.1	2.4	7.3	17.23	5.54
5/22/08 4:00	118.4	111.1	7.3	6.5	47.27	53.61
5/22/08 5:00	117.6	111.1	6.5	5.6	36.32	41.67
5/22/08 6:00	116.7	111.1	5.6	3.1	17.41	31.66
5/22/08 7:00	114.2	111.1	3.1			9.57
					10688.55	13394.76
				Autocorrelation	0.797965234	
				Effective N	19.78	
"Multiplier"	0.198			Effective M	3.37	
With "Effective N	0.290					

Line 12 Furnace Box Jenkins						
Date and Time	Total Emission Rate, lb/hr	Sample Mean	Xt - Mean	Xt+1 - Mean	(Xt - Mean)(Xt+1-Mean)	(Xt - Mean)^2
4/22/08 20:00	118.2	97.8	20.4	27.3	557.72	417.28
4/22/08 21:00	125.1	97.8	27.3	28.0	764.28	745.43
4/22/08 22:00	125.8	97.8	28.0	28.9	809.94	783.61
4/22/08 23:00	126.7	97.8	28.9	29.3	848.79	837.15
4/23/08 0:00	127.1	97.8	29.3	30.2	886.09	860.59
4/23/08 1:00	128.0	97.8	30.2	30.3	915.48	912.35
4/23/08 2:00	128.1	97.8	30.3	29.4	889.89	918.63
4/23/08 3:00	127.2	97.8	29.4	29.1	854.18	862.06
4/23/08 4:00	126.9	97.8	29.1	30.5	885.89	846.37
4/23/08 5:00	128.3	97.8	30.5	32.3	982.51	927.25
4/23/08 6:00	130.1	97.8	32.3	31.6	1018.05	1041.07
4/23/08 7:00	129.4	97.8	31.6	21.6	681.93	995.55
4/23/08 8:00	119.4	97.8	21.6	20.2	436.79	467.10
4/23/08 9:00	118.0	97.8	20.2	19.4	392.09	408.45
4/23/08 10:00	117.2	97.8	19.4	19.2	372.55	376.39
4/23/08 11:00	117.0	97.8	19.2	19.2	368.06	368.75
4/23/08 12:00	117.0	97.8	19.2	7.9	151.26	367.37
4/23/08 13:00	105.7	97.8	7.9	4.4	34.81	62.28
4/23/08 14:00	102.2	97.8	4.4	0.3	1.44	19.46
4/23/08 15:00	98.1	97.8	0.3	-1.5	-0.48	0.11
4/23/08 16:00	96.3	97.8	-1.5	-5.0	7.34	2.16
4/23/08 17:00	92.8	97.8	-5.0	-5.9	29.59	24.92
4/23/08 18:00	91.9	97.8	-5.9	-2.8	16.35	35.14
4/23/08 19:00	95.0	97.8	-2.8	0.3	-0.90	7.60
4/23/08 20:00	98.1	97.8	0.3	-1.0	-0.34	0.11
4/23/08 21:00	96.8	97.8	-1.0	-4.0	4.20	1.09
4/23/08 22:00	93.8	97.8	-4.0	-1.4	5.67	16.23
4/23/08 23:00	96.4	97.8	-1.4	-3.2	4.56	1.98
4/24/08 0:00	94.6	97.8	-3.2	-4.4	14.41	10.51
4/24/08 1:00	93.4	97.8	-4.4	-5.0	22.14	19.74
4/24/08 2:00	92.8	97.8	-5.0	-5.5	27.59	24.82
4/24/08 3:00	92.3	97.8	-5.5	-5.5	30.46	30.66
4/24/08 4:00	92.3	97.8	-5.5	-4.9	27.09	30.27
4/24/08 5:00	92.9	97.8	-4.9	-6.5	32.20	24.24
4/24/08 6:00	91.3	97.8	-6.5	-10.2	67.03	42.78
4/24/08 7:00	87.6	97.8	-10.2	-6.1	62.09	105.04
4/24/08 8:00	91.7	97.8	-6.1	-7.6	46.34	36.70
4/24/08 9:00	90.2	97.8	-7.6	-8.2	62.64	58.51
4/24/08 10:00	89.6	97.8	-8.2	-8.0	65.67	67.06
4/24/08 11:00	89.8	97.8	-8.0	-9.7	77.65	64.31
4/24/08 12:00	88.1	97.8	-9.7	-4.8	46.31	93.76
4/24/08 13:00	93.0	97.8	-4.8	-7.2	34.55	22.87
4/24/08 14:00	90.6	97.8	-7.2	-7.9	57.05	52.20
4/24/08 15:00	89.9	97.8	-7.9	-4.2	33.16	62.35
4/24/08 16:00	93.6	97.8	-4.2	-4.1	17.29	17.63
4/24/08 17:00	93.7	97.8	-4.1	-4.9	20.36	16.95
4/24/08 18:00	92.9	97.8	-4.9	-9.1	45.16	24.47
4/24/08 19:00	88.7	97.8	-9.1	-9.4	86.21	83.36
4/24/08 20:00	88.4	97.8	-9.4	-8.3	78.23	89.15
4/24/08 21:00	89.5	97.8	-8.3	-9.3	76.67	68.66
4/24/08 22:00	88.5	97.8	-9.3	-6.6	60.74	85.61
4/24/08 23:00	91.2	97.8	-6.6	-6.6	43.27	43.09
4/25/08 0:00	91.2	97.8	-6.6	-4.9	32.15	43.45
4/25/08 1:00	92.9	97.8	-4.9	-2.5	12.31	23.78
4/25/08 2:00	95.3	97.8	-2.5	-4.6	11.59	6.37
4/25/08 3:00	93.2	97.8	-4.6	-6.5	29.74	21.09
4/25/08 4:00	91.3	97.8	-6.5	-9.5	61.68	41.94
4/25/08 5:00	88.3	97.8	-9.5	-4.1	39.32	90.72

4/25/08 6:00	93.7	97.8	-4.1	-5.4	22.46	17.04
4/25/08 7:00	92.4	97.8	-5.4	-4.6	25.18	29.60
4/25/08 8:00	93.2	97.8	-4.6	-3.7	17.15	21.42
4/25/08 9:00	94.1	97.8	-3.7	-7.8	28.99	13.73
4/25/08 10:00	90.0	97.8	-7.8	-10.0	78.41	61.23
4/25/08 11:00	87.8	97.8	-10.0	-9.1	90.87	100.40
4/25/08 12:00	88.7	97.8	-9.1	-7.9	71.32	82.23
4/25/08 13:00	89.9	97.8	-7.9	-9.3	72.88	61.85
4/25/08 14:00	88.5	97.8	-9.3	-9.7	89.77	85.87
4/25/08 15:00	88.1	97.8	-9.7	-8.1	78.82	93.85
4/25/08 16:00	89.7	97.8	-8.1	-9.3	75.56	66.20
4/25/08 17:00	88.5	97.8	-9.3	-8.1	75.24	86.24
4/25/08 18:00	89.7	97.8	-8.1	-8.2	66.09	65.64
4/25/08 19:00	89.6	97.8	-8.2	-8.5	69.08	66.53
4/25/08 20:00	89.3	97.8	-8.5	-8.6	72.72	71.72
4/25/08 21:00	89.2	97.8	-8.6	-10.2	87.58	73.73
4/25/08 22:00	87.6	97.8	-10.2	-10.0	102.20	104.04
4/25/08 23:00	87.8	97.8	-10.0	-9.6	96.05	100.40
4/26/08 0:00	88.2	97.8	-9.6	-5.9	56.86	91.89
4/26/08 1:00	91.9	97.8	-5.9	-7.9	46.69	35.18
4/26/08 2:00	89.9	97.8	-7.9	-7.5	58.85	61.97
4/26/08 3:00	90.3	97.8	-7.5	-5.1	37.98	55.90
4/26/08 4:00	92.7	97.8	-5.1	-5.4	27.56	25.81
4/26/08 5:00	92.4	97.8	-5.4	-7.2	38.90	29.43
4/26/08 6:00	90.6	97.8	-7.2	-7.9	56.63	51.40
4/26/08 7:00	89.9	97.8	-7.9	-6.1	48.52	62.38
4/26/08 8:00	91.7	97.8	-6.1	-4.0	24.88	37.74
4/26/08 9:00	93.8	97.8	-4.0	-3.3	13.18	16.40
4/26/08 10:00	94.5	97.8	-3.3	-5.3	17.30	10.60
4/26/08 11:00	92.5	97.8	-5.3	-6.8	36.34	28.25
4/26/08 12:00	91.0	97.8	-6.8	-6.6	45.21	46.75
4/26/08 13:00	91.2	97.8	-6.6	0.1	-0.39	43.72
4/26/08 14:00	97.9	97.8	0.1	1.1	0.06	0.00
4/26/08 15:00	98.9	97.8	1.1	0.9	0.91	1.13
4/26/08 16:00	98.7	97.8	0.9	1.9	1.68	0.74
4/26/08 17:00	99.7	97.8	1.9	2.0	3.92	3.80
4/26/08 18:00	99.8	97.8	2.0	3.0	5.99	4.04
4/26/08 19:00	100.8	97.8	3.0	2.7	8.15	8.88
4/26/08 20:00	100.5	97.8	2.7	4.1	11.08	7.47
4/26/08 21:00	101.9	97.8	4.1	5.7	23.26	16.44
4/26/08 22:00	103.5	97.8	5.7	7.6	43.62	32.89
4/26/08 23:00	105.4	97.8	7.6	6.5	49.49	57.85
4/27/08 0:00	104.3	97.8	6.5	6.5	42.41	42.35
4/27/08 1:00	104.3	97.8	6.5	7.2	47.22	42.47
4/27/08 2:00	105.0	97.8	7.2	6.9	49.80	52.51
4/27/08 3:00	104.7	97.8	6.9	4.7	32.31	47.23
4/27/08 4:00	102.5	97.8	4.7	5.4	25.40	22.11
4/27/08 5:00	103.2	97.8	5.4	4.5	24.57	29.19
4/27/08 6:00	102.3	97.8	4.5	0.2	1.09	20.68
4/27/08 7:00	98.0	97.8	0.2	0.4	0.09	0.06
4/27/08 8:00	98.2	97.8	0.4	-0.5	-0.18	0.13
4/27/08 9:00	97.3	97.8	-0.5	0.5	-0.23	0.25
4/27/08 10:00	98.3	97.8	0.5	-1.2	-0.55	0.21
4/27/08 11:00	96.6	97.8	-1.2	-0.4	0.45	1.44
4/27/08 12:00	97.4	97.8	-0.4	1.8	-0.67	0.14
4/27/08 13:00	99.6	97.8	1.8	1.1	2.02	3.23
4/27/08 14:00	98.9	97.8	1.1	1.6	1.85	1.27
4/27/08 15:00	99.4	97.8	1.6	1.5	2.42	2.71
4/27/08 16:00	99.3	97.8	1.5	0.8	1.22	2.17
4/27/08 17:00	98.6	97.8	0.8	0.8	0.67	0.69
4/27/08 18:00	98.6	97.8	0.8	1.3	1.03	0.65

4/27/08 19:00	99.1	97.8	1.3	2.2	2.86	1.64
4/27/08 20:00	100.0	97.8	2.2	4.4	9.83	4.98
4/27/08 21:00	102.2	97.8	4.4	8.3	36.53	19.42
4/27/08 22:00	106.1	97.8	8.3	7.6	62.71	68.71
4/27/08 23:00	105.4	97.8	7.6	9.2	69.84	57.22
4/28/08 0:00	107.0	97.8	9.2	8.9	81.91	85.23
4/28/08 1:00	106.7	97.8	8.9	9.0	79.50	78.72
4/28/08 2:00	106.8	97.8	9.0	8.5	76.03	80.28
4/28/08 3:00	106.3	97.8	8.5	8.9	75.42	72.00
4/28/08 4:00	106.7	97.8	8.9	6.3	56.40	79.01
4/28/08 5:00	104.1	97.8	6.3	5.9	37.38	40.26
4/28/08 6:00	103.7	97.8	5.9	5.4	31.95	34.71
4/28/08 7:00	103.2	97.8	5.4	3.0	16.08	29.41
4/28/08 8:00	100.8	97.8	3.0	3.0	8.86	8.79
4/28/08 9:00	100.8	97.8	3.0	3.7	11.06	8.92
4/28/08 10:00	101.5	97.8	3.7	1.6	5.82	13.71
4/28/08 11:00	99.4	97.8	1.6	2.3	3.69	2.47
4/28/08 12:00	100.1	97.8	2.3	5.2	12.26	5.51
4/28/08 13:00	103.0	97.8	5.2	3.9	20.14	27.28
4/28/08 14:00	101.7	97.8	3.9	4.3	16.61	14.87
4/28/08 15:00	102.1	97.8	4.3	2.4	10.52	18.55
4/28/08 16:00	100.2	97.8	2.4	3.2	7.87	5.97
4/28/08 17:00	101.0	97.8	3.2	1.4	4.45	10.39
4/28/08 18:00	99.2	97.8	1.4	1.3	1.75	1.90
4/28/08 19:00	99.1	97.8	1.3	1.5	1.88	1.60
4/28/08 20:00	99.3	97.8	1.5	1.0	1.52	2.21
4/28/08 21:00	98.8	97.8	1.0	0.2	0.22	1.04
4/28/08 22:00	98.0	97.8	0.2	2.6	0.56	0.05
4/28/08 23:00	100.4	97.8	2.6	-26.0	-66.75	6.58
4/29/08 0:00	71.8	97.8	-26.0	-94.7	2465.06	676.93
4/29/08 1:00	3.1	97.8	-94.7	-52.2	4947.52	8976.63
4/29/08 2:00	45.6	97.8	-52.2	-11.9	620.94	2726.86
4/29/08 3:00	85.9	97.8	-11.9	0.0	-0.34	141.40
4/29/08 4:00	97.8	97.8	0.0	-0.8	-0.02	0.00
4/29/08 5:00	97.0	97.8	-0.8	-1.2	0.94	0.61
4/29/08 6:00	96.6	97.8	-1.2	1.1	-1.38	1.45
4/29/08 7:00	98.9	97.8	1.1	-1.3	-1.50	1.31
4/29/08 8:00	96.5	97.8	-1.3	-1.5	1.94	1.73
4/29/08 9:00	96.3	97.8	-1.5	-4.6	6.86	2.18
4/29/08 10:00	93.2	97.8	-4.6	-6.9	31.89	21.53
4/29/08 11:00	90.9	97.8	-6.9	-9.3	63.67	47.22
4/29/08 12:00	88.5	97.8	-9.3	-8.6	79.80	85.85
4/29/08 13:00	89.2	97.8	-8.6			74.18
	97.78				24239.07	29449.76
				Autocorrelation	0.823064995	
MPCA "Multiplier"	0.1988	Effective N	15.72268175			
Effective N Multiplier	0.3113					

DEPARTMENT: POLLUTION CONTROL AGENCY

STATE OF MINNESOTA
Office Memorandum

DATE: April 9, 2012

TO: AQD File No. 869A
(Delta ID No. 13700113)

FROM: Hongming Jiang
Air Quality Permits Section
Industrial Division

Catherine Neuschler
Air Assessment and Environmental Data Management Section
Environmental Analysis and Outcomes Division

PHONE: 651-757-2467

651-757-2607

SUBJECT: BART Limits for United Taconite (UTac)

This memo was prepared to provide the documentation of the MPCA's NO_X BART limit determination based on the technical review performed by MPCA staff. EPA's approval of the Regional Haze State Implementation Plan (SIP) for Minnesota is needed for the MPCA's BART determination to become effective.

1. General Information

1.1 Applicant and Stationary Source Location:

Applicant/Mailing Address	Stationary Source (SIC: **1011**)/Address
United Taconite LLC – Fairlane Plant P.O. Box 180 Eveleth, Minnesota 55734-0180	Highway 16 Forbes, Minnesota 55738 St. Louis County
Contact: Ms. Candice Maxwell; Phone: (218) 744-7849	

1.2 Description of the Facility

The United Taconite, LLC (UTac) facility processes crude taconite ore into a pellet product with ore supplied from a rail-linked facility, UTac's Thunderbird Mine. Fine crushing and grinding of crude ore and magnetic separation processes produce a taconite concentrate, which is used to make pellets. Taconite pellets are thermally hardened in a grate-kiln indurating furnace. The finished product (fired pellets) is transferred by conveyors to storage bins for holding and loading into railcars.

This facility has two indurating Allis-Chalmers furnaces. Line 1 is the smaller of the two, with a rated throughput of 280 tons of pellets per hour and a heat input of 190 MMBtu per hour of natural gas. The newer line, Line 2, is rated at 672 tons per hour with a heat input from natural gas, coal, petroleum coke, and other fuels of 400 MMBtu per hour.

2. Regulatory and/or Statutory Basis

2.1 Overview of Visibility, Regional Haze, and Best Available Retrofit Technology Program

The U.S. EPA's 1999 Regional Haze Rule singles out certain older emission sources that have not been regulated under other provisions of the Clean Air Act for additional controls. The MPCA is required to determine Best Available Retrofit Technology (BART) for these older sources that contribute to visibility impairment in Class I Areas to install Best Available Retrofit Technology (BART). On July 6, 2005, U.S. EPA published a revised final rule, including 40 CFR 51, Appendix Y "Guidelines for BART Determinations Under the Regional Haze Rule" which provides direction for determining which older sources may need to install BART and for determining BART.

The MPCA is required to determine BART for each source subject to BART based on an analysis of the best system of continuous emission control technology available and associated emission reductions achievable. The analysis must take into consideration the technology available, the costs of compliance, the energy and non-air quality environmental impacts, any pollution control equipment in use at the source, the remaining useful life of the source, and the degree of improvement in visibility which may reasonably be anticipated to result from use of the technology.

Further discussion of the regulatory basis for this determination can be found in the MPCA's December 2009 Regional Haze State Implementation Plan submittal, in Appendix 9.3.

2.2 Affected Units

The units for which the MPCA must determine BART and establish a NO_X BART limit consistent with that determination are:

Emission Unit Name	EU Number	Stack Numbers
Line 1 Pellet Induration	EU040	SV046
Line 2 Pellet Induration	EU042	SV048, SV049

2.3 The BART Determination

When the MPCA submitted the original Regional Haze SIP (December 2009), the Line 1 indurating furnace was able to burn both natural gas and fuel oil, but natural gas was the primary fuel. Since natural gas is low in sulfur, the primary source of sulfur at the Line 1 furnace was the iron ore used to form the green balls. Some additional sulfur may be present in additives also used in the green balls. Based on this operating scenario, the MPCA's SO_2 BART determination for Line 1 was current operation of the wet scrubbers, with a corresponding emission limit of 0.121 lbs SO_2/long ton of pellets produced.

The Line 2 indurating furnace is permitted to burn pulverized coal, a coal/pet coke blend, distillate oil, and natural gas. It is primarily operated using a blend of coal and pet coke. Therefore, the primary source of sulfur at this furnace is the fuel, though the iron ore also contributes some sulfur to the waste gas. The MPCA's SO_2 BART determination for Line 2 was for fuel blending to reduce SO_2 emissions, with a corresponding emission limit of 1.7 lbs/MMBtu.

The MPCA's BART determinations for the pellet induration furnaces are documented in Appendix 9.3 of the December 2009 Regional Haze SIP submittal.

The MPCA's NO_X BART determination for Line 1 is good combustion practices and implementation of a past heat recuperation project. The MPCA's NO_X BART determination for Line 2 is good combustion practices. However, due to the lack of sufficient emissions data representing the range of operating conditions that influence emissions, the MPCA did not set an emission limit at the time of making the BART determination.

Instead, the MPCA and UTac entered into an Administrative Order, under which UTac provided additional NO_X emission information to the MPCA. Subsequently, UTac was required a Stipulation Agreement to install Continuous Emission Monitoring Systems (CEMS) on both lines. UTac certified the CEMS in late 2010, and began reporting information to the MPCA in 2011.

2.4 MPCA Determination of the "Baseline" BART Limit

Setting the BART limits for United Taconite is a two-step process, because of a planned change in facility operations. The MPCA was unable to find guidance on how to evaluate appropriate BART limits for a modifying facility, particularly in this case where the BART determinations were made but data was not available to set matching emission limits.

The first step was to determine a "baseline BART" – BART for the unmodified facility. The MPCA reviewed the NO_X emission information provided by UTac. Although some data was received for November and December 2010, the MPCA focused on emission data from January through June 2011.

The 30-day rolling average of NO_X emissions from the two lines at UTac does not fit any standard statistical probably curve. Therefore, the calculation to set the emission limit was done based on a normal curve. For Line 1, a 95% predictive interval was constructed, and the upper prediction level was used to the set the BART limit. For Line 2, a 99% predictive interval was constructed, and again the upper prediction level was used to develop the BART limit. (A 99% interval was used for Line 2 in order to ensure that the upper prediction level is above the maximum demonstrated emissions level.)

UTac NO_X Emissions Descriptive Statistics (30 day rolling average, lbs/hour)			
	Line 1 NO_X	Line 2 NO_X (Stack A)	Line 2 NO_X (Stack B)
# Data Points	111	142	181
Minimum	552.27	98.41	82.84
Mean	743.04	215.20	196.41
Standard Deviation	138.27	70.11	58.18
Maximum	952.33	364.14	345.01

After reviewing the CEMS data provided by UTac, the MPCA has determined that appropriate baseline BART NO_X limits are: 1018.3 lbs/hour for Line 1, and 753.8 lbs/hour for Line 2. Along with the emission limits set in the original SIP submittal, the baseline BART emission limits for the facility are as follows:

UTac Baseline BART Emissions Limits (30 day rolling average)		
	Line 1	Line 2
SO_2 BART Limit	0.121 lbs/LT pellet	1.7 lbs/MMBtu
NO_X BART Limit	1018.3 lbs/hour	753.8 lbs/hour

2.5 Facility Changes and the BART Limit

In August 2010, after the MPCA determined the BART work practices and controls for UTac, the facility received a permit amendment that allows for the use of solid fuels on Line 1 and a facility-wide production increase.

Because of this change, certain requirements were placed in the amended permit. Within 120 days of receiving a memo documenting the baseline BART limits set in part 2.4 from the MPCA, UTac must submit to the MPCA a permit application to incorporate into its air emission permit either 1) NO_X and SO_2 BART emission limits as described in this memo or 2) a BART alternative as described in the December 2009 Regional Haze SIP submittal. Alternatively, UTac may submit within 120 days an updated BART analysis based on the modified Lines 1 and 2 for the facility with an

appropriate permit amendment application to incorporate the BART limits proposed in that update analysis. The MPCA sent documentation of the initial BART limits on September 22, 2011.

On December 8, 2011, UTac provided MPCA with a proposal requesting that the permit limits from the permit issued in August 2010 be used as the BART limits for the facility.

UTac Proposed BART Emission Limits		
	Line 1 (EU040)	Line 2 (EU042)
SO_2 Limit	106.3 tons as a 30-day rolling sum	197 tons as a 30-day rolling sum
NO_X Limit	816 tons as a 180-day rolling sum	1820 tons as a 180-day rolling sum

UTac had calculated, and the MPCA also then analyzed and conducted additional calculations of, the emission reductions that would result from this proposal, compared to the MPCA's original BART proposal. The following table shows the MPCA's calculation of annual emissions from the facility prior to BART, using baseline actual emissions (Past Emissions), the MPCA's baseline BART proposal, and UTac's BART proposal. These were calculated using the maximum pellet production and heat input for each furnace.

Annual Emissions from UTac (tons per year) Full Furnace Capacity[1]						
	Line 1		Line 2		Total	
	NO_X	SO_2	NO_X	SO_2	NO_X	SO_2
Past Emissions[2]	4371	38	1968	7008	6338	7046
MPCA Baseline BART	4460	148	3302	2978	7762	3127
UTac BART Proposal	1655	1293	3692	2394	5347	3687

This demonstrates that the MPCA's baseline BART proposal is essentially unconstraining, except for the SO_2 emissions limit for Line 2. Compared to past actual emissions, the MPCA's baseline BART proposal results in about a 2500 tons per year decrease in overall emissions of NO_X and SO_2. The proposal by UTac results in a 4350 tons per year decrease in overall emissions as compared to the past emission scenario, and 1855 tons per year as compared to MPCA's BART determination. Although this scenario raises the SO_2 limit on Line 1 to account for the addition of solid fuels, it results in lower NO_X limits on both lines and lower SO_2 limits on Line 2 than the MPCA's baseline BART proposal. Therefore, the MPCA will accept this proposal as a BART alternative.

However, because visibility is looked at in terms of best and worst days, a shorter-term limit is needed. The generally accepted averaging time for BART limits is a 30-day rolling average. The SO_2 limits proposed by UTac are a 30-day rolling sum and therefore sufficiently short-term. A 30-day NO_X limit was developed using the using the 95% UPL of NO_X CEMS data from February 2011 through February 2012. UTac requested that the limit be an aggregate limit for the two indurating furnaces. Therefore, the 30-day rolling average for each line was summed and then the 95% UPL developed from the summed data. This resulted in a NO_X emission limit of 21.1 tpd.

[1] Estimates of emissions for the past emissions and MPCA proposals were done using the maximum furnace throughput and assuming 8760 hours of operation annually.

[2] Because the facility does not have NO_X emission limits, the past emissions for NO_X were estimated using baseline actuals from the August 2010 permitting action. Line 1 SO_2 unlimited emissions were estimated the same way, while Line 2 SO_2 unlimited emissions were estimated using the statewide 4.0 lbs/MMBtu emission limit, which is higher than the baseline actuals of 3652 tpy.

The following limits are BART for United Taconite.

Unit	**BART NO_X Limit** (tons per day, 30-day rolling average)	**BART SO_2 limit** (tons, 30-day rolling sum)
Line 1 (EU040)	21.1	106.3
Line 2 (EU042)		197

However, the facility provided comments that the shorter averaging period for the NO_X limit does not allow necessary flexibility to operate on 100% natural gas, which may be needed during periods of startup, shutdown, and malfunction. Since 100% natural gas operation results in worst-case NO_X emissions, it was determined that a limit should be developed for those periods, but with requirements that would help understand the causes of malfunctions or other reasons to operate using only natural gas and to limit the periods of operation.

The limits shown above (30-day limits) will be retained as the BART limits, but with the addition of limits that the facility can choose to comply with during periods of operation on 100% natural gas.

The 100% natural gas limits were derived by analyzing the CEMS data received for operations during 2011. Periods of operation on 100% natural gas where production was over 255 tons per hour on Line 1 and 400 tons per hour on Line 2 were included. A series of 24-hour rolling averages were derived from this hourly data. The 95% UPL was then used to predict the next 24-hour average. The resulting limits are 1256.0 lbs/hour on a 24-hour basis for Line 1 and 1385.7 lbs/hour on a 24-hour basis for Line 2, which are aggregated to a 2641.0 lbs/hour limit.

United may choose to comply with these limits for any calendar day during which a line operates on 100% natural gas for at least one hour. These days must be recorded, and will then be removed from determining compliance with the 30-day rolling average limit. If United chooses to opt-in to these limits more than 5 days in a calendar quarter, then United must conduct a root cause analysis in order to identify the causes of incidents that required the facility to operate burning 100% natural gas and measures to minimize the duration of operation on 100% natural gas.

The limit for Line 2 applies to emissions from both stacks. Compliance will be determined through the use of CEMS.

Line 1											
Furnace Capacity	280	tons pellets/hour	190	MMBtu/hr	2,452,800	tons pellets/year					
Proposed Operations (From 8/10 Permit)	250	tons pellets/hour	0.61	MMBtu/LT pellets	1,950,000	tons pellets/year	1,189,500	MMBtu/year			
Past Emissions Estimate - L1 on Natural Gas - Full Furnace Capacity			lbs/hour	lbs/day	tons per day	tons per year					
NOX	3.5639	lbs/long tons pellet	997.892	23949.41	11.97	4371	Estimated using baseline Actuals from 8/10 permit				
SO2	0.0308	lbs/long tons pellet	8.624	206.98	0.10	38	Estimated using baseline Actuals from 8/10 permit				
Past Emissions Estimate - L1 on Natural Gas - Proposed Operations											
NOX	3.5639	lbs/long tons pellet	890.975	21383.40	10.69	3475					
SO2	0.0308	lbs/long tons pellet	7.7	184.80	0.09	30					
Potential Emissions Estimate - L1 on Solid Fuels - Full Furnace Capacity											
NOX	0.6685	lbs/long tons pellet	187.18	4492.32	2.25	820	Baseline Actual emission factor from Line 2				
SO2	4.0	lbs/MMBtu	760	18240.00	9.12	3329	Using statewide 4.0 emission factor				
Potential Emissions Estimate - L1 on Solid Fuels - Proposed Operations											
NOX	0.6685	lbs/long tons pellet	167.125	4011.00	2.01	652	Baseline Actuals emission factor for Line 2				
SO2	4.0	lbs/MMBtu	610	14640.00	7.32	2379	Using statewide 4.0 emission factor				
MPCA Limit - L1 on Natural Gas - Full Furnace Capacity											
NOX	1018.3	lbs/hour	1018.3	24439.2	12.22	4460					
SO2	0.121	lbs/long tons pellet	33.88	813.12	0.41	148					
MPCA Limit - Proposed Operations											
NOX	1018.3	lbs/hour				3971	7800	hours of operation annually			
SO2	0.121	lbs/long tons pellet				118					
Utac Proposed Limit - Full Furnace Capacity											
NOX	816	tons/180 days			4.53	1655					
SO2	106.3	tons/30 days			3.54	1293					
	1.7	lbs/MMBtu	323	7752	3.88	1415	Sample calculation, based on baseline SO2 BART for Line 2				
Line 2											
Furnace Capacity	672	tons pellets/hour	400	MMBtu/hr							
Proposed Operations	4,050,000	tons pellets/year	0.52	MMBtu/LT	2,106,000	MMBtu/year					
Past Emissions Estimate - Full Furnace Capacity			lbs/hour	lbs/day	tons per day	tons per year					
NOX	0.6685	lbs/long tons pellets	449.232	10781.568	5.39	1968	Estimated using baseline Actuals from Last Permit				
SO2	4.0	lbs/MMBtu	1600	38400	19.20	7008	Using 4.0 emission factor; baseline actuals were 3652				
Past Emissions Estimate - Proposed Operations											
NOX	0.6685	lbs/long tons pellets				1354	Estimated using baseline Actuals from Last Permit				
SO2	4.0	lbs/MMBtu				4212	Using 4.0 emission factor; baseline actuals were 3652				
MPCA Limit - Full Furnace Capacity											
NOX	753.8	lbs/hour	753.8	18091.2	9.05	3302					
SO2	1.7	lbs/MMBtu	680.0	16320	8.16	2978					
MPCA Limit - Proposed Operations											
NOX	753.8	lbs/hour				2271	6027	hours of operation annually			
SO2	1.7	lbs/MMBtu				1790					

Utac Proposed Limit					tons per day	tons per year					
NOX	1820	tons/180 days			10.11	3692					
SO2	197	tons/30 day			6.57	2394					
Reported Actual Emissions from UTac	**2007**	**2008**	**2009**	**2010**							
NOX	4263	3540	1968	4057							
SO2	3654	3726	2936	2493							
Total Emissions - Full Furnace Capacity	**NOX**	**SO2**									
Past and Unmodified	6338	7046									
MPCA BART	7762	3127									
MPCA - Past	1423	-3919	-2496								
Utac BART	5347	3687									
Utac BART - Past	-991	-3359	-4350								
Utac BART - MPCA	-2415	560	-1855								
Total Emissions - Proposed Operations	**NOX**	**SO2**									
Past and Unmodified	4829	4242		Using baseline actuals and proposed future annual throughput.							
MPCA BART	6243	1908		Using proposed annual throughput.							
MPCA - Past	1414	-2334	-920								
Utac BART	5347	3687									
Utac BART - Past	518	-555	-37								
Utac BART - MPCA	-896	1779	883								

Daily NOx Data - 30-day Rolling Averages

Date	L1 NOx, tpd	Date	L2 NOx, tpd	Date	L1 + L2
2/11/2011	5.1	2/11/2011	15.6	2/11/2011	20.8
2/12/2011	7.0	2/12/2011	14.8	2/12/2011	21.8
2/13/2011	6.5	2/13/2011	13.2	2/13/2011	19.8
2/14/2011	6.2	2/14/2011	12.9	2/14/2011	19.1
2/15/2011	5.7	2/15/2011	8.0	2/15/2011	13.7
2/16/2011	3.6	2/16/2011	2.9	2/16/2011	6.5
2/17/2011	5.3	2/17/2011	3.3	2/17/2011	8.6
2/18/2011	6.3	2/18/2011	4.3	2/18/2011	10.5
2/19/2011	7.1	2/19/2011	4.0	2/19/2011	11.1
2/20/2011	8.6	2/20/2011	4.0	2/20/2011	12.6
2/21/2011	6.3	2/21/2011	3.9	2/21/2011	10.2
2/22/2011	7.7	2/22/2011	4.2	2/22/2011	11.9
2/23/2011	7.3	2/23/2011	4.1	2/23/2011	11.4
2/24/2011	6.8	2/24/2011	4.2	2/24/2011	11.1
2/25/2011	8.5	2/25/2011	4.0	2/25/2011	12.5
2/26/2011	7.6	2/26/2011	3.0	2/26/2011	10.6
2/27/2011	9.6	2/27/2011	4.6	2/27/2011	14.2
2/28/2011	9.9	2/28/2011	4.5	2/28/2011	14.4
3/1/2011	10.2	3/1/2011	4.7	3/1/2011	14.9
3/2/2011	10.5	3/2/2011	4.7	3/2/2011	15.2
3/3/2011	9.0	3/3/2011	4.7	3/3/2011	13.6
3/4/2011	10.0	3/4/2011	5.1	3/4/2011	15.2
3/5/2011	10.3	3/5/2011	4.9	3/5/2011	15.2
3/6/2011	9.8	3/6/2011	4.3	3/6/2011	14.1
3/7/2011	9.2	3/7/2011	4.1	3/7/2011	13.3
3/8/2011	9.5	3/8/2011	4.0	3/8/2011	13.5
3/9/2011	9.4	3/9/2011	3.7	3/9/2011	13.2
3/10/2011	8.8	3/10/2011	3.8	3/10/2011	12.6
3/11/2011	9.8	3/11/2011	3.8	3/11/2011	13.6
3/12/2011	10.3	3/12/2011	3.9	3/12/2011	14.2
3/13/2011	0.0	3/13/2011	0.0	3/13/2011	0.0
3/14/2011	11.8	3/14/2011	0.0	3/14/2011	11.8
3/15/2011	10.5	3/15/2011	0.0	3/15/2011	10.5
3/16/2011	10.9	3/16/2011	0.0	3/16/2011	10.9
3/17/2011	9.7	3/17/2011	0.0	3/17/2011	9.7
3/18/2011	10.1	3/18/2011	0.0	3/18/2011	10.1
3/19/2011	11.7	3/19/2011	0.0	3/19/2011	11.7
3/20/2011	3.1	3/20/2011	0.0	3/20/2011	3.1
3/21/2011	0.0	3/21/2011	0.0	3/21/2011	0.0
3/22/2011	0.0	3/22/2011	0.0	3/22/2011	0.0
3/23/2011	0.0	3/23/2011	0.0	3/23/2011	0.0
3/24/2011	0.0	3/24/2011	0.0	3/24/2011	0.0
3/25/2011	0.0	3/25/2011	0.0	3/25/2011	0.0
3/26/2011	0.0	3/26/2011	0.0	3/26/2011	0.0

Date	L1 NOx, tpd	Date	L2 NOx, tpd	Date	L1 + L2
3/27/2011	0.0	3/27/2011	0.1	3/27/2011	0.0
3/28/2011	0.0	3/28/2011	4.3	3/28/2011	4.3
3/29/2011	5.6	3/29/2011	11.9	3/29/2011	17.5
3/30/2011	7.4	3/30/2011	11.8	3/30/2011	19.2
3/31/2011	5.3	3/31/2011	10.2	3/31/2011	15.4
4/1/2011	8.0	4/1/2011	10.4	4/1/2011	18.5
4/2/2011	8.8	4/2/2011	12.9	4/2/2011	21.6
4/3/2011	9.1	4/3/2011	12.9	4/3/2011	22.0
4/4/2011	9.8	4/4/2011	14.2	4/4/2011	24.0
4/5/2011	10.0	4/5/2011	12.3	4/5/2011	22.3
4/6/2011	12.7	4/6/2011	13.0	4/6/2011	25.6
4/7/2011	10.3	4/7/2011	15.3	4/7/2011	25.6
4/8/2011	11.0	4/8/2011	15.2	4/8/2011	26.2
4/9/2011	12.1	4/9/2011	12.6	4/9/2011	24.7
4/10/2011	12.6	4/10/2011	13.2	4/10/2011	25.7
4/11/2011	11.7	4/11/2011	13.8	4/11/2011	25.5
4/12/2011	11.6	4/12/2011	13.5	4/12/2011	25.1
4/13/2011	11.8	4/13/2011	6.0	4/13/2011	17.8
4/14/2011	10.2	4/14/2011	3.8	4/14/2011	14.0
4/15/2011	12.2	4/15/2011	3.8	4/15/2011	16.1
4/16/2011	11.0	4/16/2011	3.7	4/16/2011	14.7
4/17/2011	12.5	4/17/2011	4.1	4/17/2011	16.6
4/18/2011	14.8	4/18/2011	4.3	4/18/2011	19.1
4/19/2011	19.4	4/19/2011	4.2	4/19/2011	23.6
4/20/2011	12.0	4/20/2011	4.0	4/20/2011	16.1
4/21/2011	6.6	4/21/2011	3.7	4/21/2011	10.3
4/22/2011	10.4	4/22/2011	4.0	4/22/2011	14.4
4/23/2011	9.1	4/23/2011	3.7	4/23/2011	12.8
4/24/2011	13.3	4/24/2011	4.1	4/24/2011	17.4
4/25/2011	12.8	4/25/2011	4.1	4/25/2011	16.8
4/26/2011	11.1	4/26/2011	4.0	4/26/2011	15.1
4/27/2011	10.0	4/27/2011	3.9	4/27/2011	13.9
4/28/2011	10.2	4/28/2011	3.7	4/28/2011	13.9
4/29/2011	10.7	4/29/2011	3.7	4/29/2011	14.4
4/30/2011	9.3	4/30/2011	3.7	4/30/2011	13.1
5/1/2011	12.8	5/1/2011	3.8	5/1/2011	16.6
5/2/2011	9.8	5/2/2011	4.4	5/2/2011	14.2
5/3/2011	9.3	5/3/2011	3.7	5/3/2011	13.0
5/4/2011	10.6	5/4/2011	3.9	5/4/2011	14.6
5/5/2011	10.9	5/5/2011	4.2	5/5/2011	15.1
5/6/2011	11.1	5/6/2011	3.5	5/6/2011	14.6
5/7/2011	10.6	5/7/2011	3.9	5/7/2011	14.4
5/8/2011	12.2	5/8/2011	3.8	5/8/2011	16.0
5/9/2011	12.1	5/9/2011	3.9	5/9/2011	15.9
5/10/2011	10.6	5/10/2011	3.8	5/10/2011	14.4

Date	L1 NOx, tpd	Date	L2 NOx, tpd	Date	L1 + L2
5/11/2011	10.7	5/11/2011	3.6	5/11/2011	14.3
5/12/2011	9.1	5/12/2011	4.1	5/12/2011	13.2
5/13/2011	9.7	5/13/2011	4.2	5/13/2011	13.9
5/14/2011	11.4	5/14/2011	4.2	5/14/2011	15.6
5/15/2011	12.2	5/15/2011	4.5	5/15/2011	16.6
5/16/2011	11.7	5/16/2011	4.2	5/16/2011	15.9
5/17/2011	12.5	5/17/2011	3.2	5/17/2011	15.7
5/18/2011	13.1	5/18/2011	0.2	5/18/2011	13.3
5/19/2011	12.9	5/19/2011	4.4	5/19/2011	17.3
5/20/2011	9.2	5/20/2011	3.8	5/20/2011	13.0
5/21/2011	5.1	5/21/2011	4.1	5/21/2011	9.2
5/22/2011	10.2	5/22/2011	3.9	5/22/2011	14.2
5/23/2011	9.7	5/23/2011	4.1	5/23/2011	13.8
5/24/2011	9.6	5/24/2011	4.3	5/24/2011	13.9
5/25/2011	9.9	5/25/2011	4.0	5/25/2011	13.9
5/26/2011	8.7	5/26/2011	3.9	5/26/2011	12.6
5/27/2011	11.2	5/27/2011	4.3	5/27/2011	15.5
5/28/2011	7.3	5/28/2011	4.0	5/28/2011	11.4
5/29/2011	8.1	5/29/2011	4.0	5/29/2011	12.1
5/30/2011	10.5	5/30/2011	4.1	5/30/2011	14.6
5/31/2011	9.1	5/31/2011	4.0	5/31/2011	13.1
6/1/2011	9.6	6/1/2011	4.1	6/1/2011	13.8
6/2/2011	0.1	6/2/2011	3.4	6/2/2011	3.5
6/3/2011	0.0	6/3/2011	3.9	6/3/2011	3.9
6/4/2011	0.1	6/4/2011	3.7	6/4/2011	3.7
6/5/2011	6.5	6/5/2011	3.8	6/5/2011	10.3
6/6/2011	6.4	6/6/2011	3.7	6/6/2011	10.0
6/7/2011	3.7	6/7/2011	2.8	6/7/2011	6.5
6/8/2011	7.1	6/8/2011	3.9	6/8/2011	11.0
6/9/2011	7.2	6/9/2011	3.7	6/9/2011	10.9
6/10/2011	8.3	6/10/2011	4.0	6/10/2011	12.3
6/11/2011	9.8	6/11/2011	4.1	6/11/2011	13.9
6/12/2011	9.5	6/12/2011	4.0	6/12/2011	13.5
6/13/2011	10.1	6/13/2011	2.0	6/13/2011	12.1
6/14/2011	9.5	6/14/2011	0.6	6/14/2011	10.1
6/15/2011	7.2	6/15/2011	4.7	6/15/2011	11.9
6/16/2011	5.5	6/16/2011	3.8	6/16/2011	9.3
6/17/2011	8.3	6/17/2011	4.0	6/17/2011	12.3
6/18/2011	6.4	6/18/2011	4.1	6/18/2011	10.5
6/19/2011	8.7	6/19/2011	4.2	6/19/2011	12.9
6/20/2011	9.3	6/20/2011	4.2	6/20/2011	13.5
6/21/2011	8.0	6/21/2011	4.0	6/21/2011	11.9
6/22/2011	5.4	6/22/2011	3.5	6/22/2011	8.9
6/23/2011	6.7	6/23/2011	2.8	6/23/2011	9.5
6/24/2011	10.7	6/24/2011	0.2	6/24/2011	10.9

Date	L1 NOx, tpd	Date	L2 NOx, tpd	Date	L1 + L2
6/25/2011	8.3	6/25/2011	0.0	6/25/2011	8.3
6/26/2011	8.1	6/26/2011	2.2	6/26/2011	10.3
6/27/2011	7.2	6/27/2011	3.6	6/27/2011	10.8
6/28/2011	8.2	6/28/2011	3.7	6/28/2011	11.9
6/29/2011	9.9	6/29/2011	3.9	6/29/2011	13.8
6/30/2011	9.0	6/30/2011	3.8	6/30/2011	12.9
7/1/2011	9.4	7/1/2011	3.6	7/1/2011	13.0
7/2/2011	11.5	7/2/2011	3.8	7/2/2011	15.3
7/3/2011	13.5	7/3/2011	3.8	7/3/2011	17.3
7/4/2011	12.5	7/4/2011	3.8	7/4/2011	16.3
7/5/2011	11.4	7/5/2011	3.8	7/5/2011	15.2
7/6/2011	9.2	7/6/2011	4.2	7/6/2011	13.3
7/7/2011	7.5	7/7/2011	3.5	7/7/2011	11.0
7/8/2011	10.7	7/8/2011	3.9	7/8/2011	14.6
7/9/2011	11.2	7/9/2011	3.0	7/9/2011	14.3
7/10/2011	8.9	7/10/2011	4.4	7/10/2011	13.4
7/11/2011	6.6	7/11/2011	3.8	7/11/2011	10.4
7/12/2011	10.3	7/12/2011	3.9	7/12/2011	14.2
7/13/2011	11.2	7/13/2011	10.6	7/13/2011	21.9
7/14/2011	14.0	7/14/2011	13.2	7/14/2011	27.2
7/15/2011	12.2	7/15/2011	6.3	7/15/2011	18.4
7/16/2011	9.5	7/16/2011	5.8	7/16/2011	15.3
7/17/2011	7.9	7/17/2011	5.1	7/17/2011	13.0
7/18/2011	8.5	7/18/2011	4.7	7/18/2011	13.2
7/19/2011	10.6	7/19/2011	4.2	7/19/2011	14.8
7/20/2011	7.7	7/20/2011	3.9	7/20/2011	11.6
7/21/2011	6.1	7/21/2011	3.5	7/21/2011	9.7
7/22/2011	7.8	7/22/2011	3.7	7/22/2011	11.4
7/23/2011	8.2	7/23/2011	3.7	7/23/2011	11.9
7/24/2011	8.8	7/24/2011	3.8	7/24/2011	12.7
7/25/2011	8.3	7/25/2011	4.0	7/25/2011	12.2
7/26/2011	10.2	7/26/2011	3.9	7/26/2011	14.0
7/27/2011	9.1	7/27/2011	3.7	7/27/2011	12.8
7/28/2011	9.8	7/28/2011	3.7	7/28/2011	13.5
7/29/2011	10.0	7/29/2011	3.9	7/29/2011	13.8
7/30/2011	3.0	7/30/2011	1.2	7/30/2011	4.2
7/31/2011	0.0	7/31/2011	0.6	7/31/2011	0.6
8/1/2011	0.0	8/1/2011	4.3	8/1/2011	4.3
8/2/2011	0.0	8/2/2011	3.8	8/2/2011	3.8
8/3/2011	0.0	8/3/2011	5.1	8/3/2011	5.1
8/4/2011	0.0	8/4/2011	4.4	8/4/2011	4.4
8/5/2011	0.0	8/5/2011	4.0	8/5/2011	4.0
8/6/2011	0.0	8/6/2011	4.7	8/6/2011	4.6
8/7/2011	0.0	8/7/2011	4.8	8/7/2011	4.8
8/8/2011	0.0	8/8/2011	7.2	8/8/2011	7.2

Date	L1 NOx, tpd	Date	L2 NOx, tpd	Date	L1 + L2
8/9/2011	0.0	8/9/2011	8.3	8/9/2011	8.3
8/10/2011	0.0	8/10/2011	9.3	8/10/2011	9.3
8/11/2011	0.0	8/11/2011	9.3	8/11/2011	9.3
8/12/2011	0.0	8/12/2011	9.7	8/12/2011	9.7
8/13/2011	0.0	8/13/2011	10.7	8/13/2011	10.7
8/14/2011	0.0	8/14/2011	10.7	8/14/2011	10.7
8/15/2011	0.0	8/15/2011	9.5	8/15/2011	9.5
8/16/2011	0.0	8/16/2011	9.8	8/16/2011	9.8
8/17/2011	0.0	8/17/2011	10.3	8/17/2011	10.3
8/18/2011	0.0	8/18/2011	9.9	8/18/2011	9.9
8/19/2011	0.0	8/19/2011	10.0	8/19/2011	10.0
8/20/2011	0.0	8/20/2011	10.0	8/20/2011	10.0
8/21/2011	0.0	8/21/2011	10.6	8/21/2011	10.6
8/22/2011	0.0	8/22/2011	9.8	8/22/2011	9.8
8/23/2011	0.0	8/23/2011	9.1	8/23/2011	9.1
8/24/2011	0.0	8/24/2011	7.7	8/24/2011	7.7
8/25/2011	0.0	8/25/2011	7.3	8/25/2011	7.3
8/26/2011	2.1	8/26/2011	5.9	8/26/2011	8.0
8/27/2011	3.6	8/27/2011	5.1	8/27/2011	8.8
8/28/2011	4.6	8/28/2011	7.8	8/28/2011	12.4
8/29/2011	5.5	8/29/2011	5.3	8/29/2011	10.8
8/30/2011	0.9	8/30/2011	5.4	8/30/2011	6.3
8/31/2011	11.3	8/31/2011	4.6	8/31/2011	15.9
9/1/2011	1.2	9/1/2011	4.4	9/1/2011	5.6
9/2/2011	4.0	9/2/2011	4.4	9/2/2011	8.3
9/3/2011	7.2	9/3/2011	4.6	9/3/2011	11.8
9/4/2011	4.3	9/4/2011	4.9	9/4/2011	9.2
9/5/2011	3.2	9/5/2011	3.8	9/5/2011	7.0
9/6/2011	3.0	9/6/2011	4.0	9/6/2011	7.0
9/7/2011	3.3	9/7/2011	1.5	9/7/2011	4.8
9/8/2011	3.2	9/8/2011	0.0	9/8/2011	3.3
9/9/2011	3.4	9/9/2011	0.0	9/9/2011	3.4
9/10/2011	2.6	9/10/2011	0.0	9/10/2011	2.6
9/11/2011	2.7	9/11/2011	0.0	9/11/2011	2.7
9/12/2011	2.9	9/12/2011	0.0	9/12/2011	3.0
9/13/2011	3.2	9/13/2011	0.1	9/13/2011	3.3
9/14/2011	3.2	9/14/2011	0.0	9/14/2011	3.2
9/15/2011	3.3	9/15/2011	0.5	9/15/2011	3.8
9/16/2011	2.5	9/16/2011	3.0	9/16/2011	5.5
9/17/2011	0.9	9/17/2011	5.0	9/17/2011	5.9
9/18/2011	0.0	9/18/2011	6.1	9/18/2011	6.1
9/19/2011	0.0	9/19/2011	4.8	9/19/2011	4.8
9/20/2011	1.8	9/20/2011	4.2	9/20/2011	5.9
9/21/2011	2.7	9/21/2011	3.7	9/21/2011	6.4
9/22/2011	2.9	9/22/2011	3.4	9/22/2011	6.3

Date	L1 NOx, tpd	Date	L2 NOx, tpd	Date	L1 + L2
9/23/2011	4.3	9/23/2011	3.6	9/23/2011	7.8
9/24/2011	3.2	9/24/2011	3.7	9/24/2011	6.9
9/25/2011	2.6	9/25/2011	3.8	9/25/2011	6.4
9/26/2011	2.7	9/26/2011	4.3	9/26/2011	7.0
9/27/2011	3.0	9/27/2011	4.8	9/27/2011	7.8
9/28/2011	3.0	9/28/2011	5.4	9/28/2011	8.3
9/29/2011	3.4	9/29/2011	4.6	9/29/2011	8.0
9/30/2011	2.9	9/30/2011	3.9	9/30/2011	6.8
10/1/2011	3.6	10/1/2011	4.1	10/1/2011	7.7
10/2/2011	3.3	10/2/2011	4.8	10/2/2011	8.1
10/3/2011	2.9	10/3/2011	9.1	10/3/2011	12.0
10/4/2011	0.1	10/4/2011	4.9	10/4/2011	5.0
10/5/2011	1.5	10/5/2011	6.8	10/5/2011	8.2
10/6/2011	3.4	10/6/2011	4.8	10/6/2011	8.3
10/7/2011	2.7	10/7/2011	4.6	10/7/2011	7.3
10/8/2011	2.4	10/8/2011	4.1	10/8/2011	6.5
10/9/2011	2.5	10/9/2011	3.4	10/9/2011	5.9
10/10/2011	3.0	10/10/2011	4.0	10/10/2011	6.9
10/11/2011	2.9	10/11/2011	3.8	10/11/2011	6.7
10/12/2011	2.9	10/12/2011	4.3	10/12/2011	7.2
10/13/2011	4.0	10/13/2011	3.3	10/13/2011	7.3
10/14/2011	0.4	10/14/2011	4.2	10/14/2011	4.6
10/15/2011	7.3	10/15/2011	4.6	10/15/2011	11.9
10/16/2011	9.3	10/16/2011	4.9	10/16/2011	14.2
10/17/2011	6.8	10/17/2011	4.0	10/17/2011	10.9
10/18/2011	8.8	10/18/2011	4.2	10/18/2011	13.0
10/19/2011	11.3	10/19/2011	4.4	10/19/2011	15.7
10/20/2011	9.0	10/20/2011	3.0	10/20/2011	12.0
10/21/2011	6.4	10/21/2011	0.0	10/21/2011	6.4
10/22/2011	5.4	10/22/2011	2.4	10/22/2011	7.7
10/23/2011	8.0	10/23/2011	14.1	10/23/2011	22.1
10/24/2011	7.8	10/24/2011	13.8	10/24/2011	21.6
10/25/2011	7.3	10/25/2011	7.0	10/25/2011	14.3
10/26/2011	9.8	10/26/2011	4.3	10/26/2011	14.1
10/27/2011	4.5	10/27/2011	3.7	10/27/2011	8.2
10/28/2011	4.9	10/28/2011	4.0	10/28/2011	8.9
10/29/2011	5.7	10/29/2011	4.5	10/29/2011	10.3
10/30/2011	6.1	10/30/2011	4.7	10/30/2011	10.8
10/31/2011	6.4	10/31/2011	4.8	10/31/2011	11.2
11/1/2011	6.4	11/1/2011	4.1	11/1/2011	10.5
11/2/2011	6.7	11/2/2011	4.4	11/2/2011	11.1
11/3/2011	6.7	11/3/2011	5.3	11/3/2011	11.9
11/4/2011	4.5	11/4/2011	4.5	11/4/2011	9.1
11/5/2011	13.5	11/5/2011	4.7	11/5/2011	18.2
11/6/2011	11.9	11/6/2011	0.4	11/6/2011	12.3

Date	L1 NOx, tpd	Date	L2 NOx, tpd	Date	L1 + L2
11/7/2011	14.4	11/7/2011	0.0	11/7/2011	14.4
11/8/2011	14.3	11/8/2011	0.0	11/8/2011	14.3
11/9/2011	15.7	11/9/2011	0.0	11/9/2011	15.7
11/10/2011	10.5	11/10/2011	0.0	11/10/2011	10.5
11/11/2011	9.7	11/11/2011	0.0	11/11/2011	9.7
11/12/2011	11.4	11/12/2011	0.2	11/12/2011	11.6
11/13/2011	9.2	11/13/2011	5.1	11/13/2011	14.3
11/14/2011	9.5	11/14/2011	4.6	11/14/2011	14.1
11/15/2011	9.5	11/15/2011	4.8	11/15/2011	14.3
11/16/2011	10.3	11/16/2011	4.0	11/16/2011	14.3
11/17/2011	8.8	11/17/2011	4.3	11/17/2011	13.1
11/18/2011	6.3	11/18/2011	4.3	11/18/2011	10.5
11/19/2011	9.0	11/19/2011	3.9	11/19/2011	12.9
11/20/2011	9.4	11/20/2011	4.0	11/20/2011	13.4
11/21/2011	9.5	11/21/2011	4.1	11/21/2011	13.6
11/22/2011	4.9	11/22/2011	4.2	11/22/2011	9.1
11/23/2011	3.7	11/23/2011	3.8	11/23/2011	7.5
11/24/2011	5.6	11/24/2011	3.7	11/24/2011	9.3
11/25/2011	9.0	11/25/2011	4.2	11/25/2011	13.2
11/26/2011	8.9	11/26/2011	3.9	11/26/2011	12.8
11/27/2011	10.2	11/27/2011	4.2	11/27/2011	14.4
11/28/2011	12.3	11/28/2011	7.4	11/28/2011	19.7
11/29/2011	9.2	11/29/2011	7.0	11/29/2011	16.2
11/30/2011	7.3	11/30/2011	3.8	11/30/2011	11.1
12/1/2011	8.0	12/1/2011	4.2	12/1/2011	12.2
12/2/2011	6.4	12/2/2011	4.0	12/2/2011	10.4
12/3/2011	6.7	12/3/2011	3.5	12/3/2011	10.1
12/4/2011	10.0	12/4/2011	3.7	12/4/2011	13.7
12/5/2011	0.1	12/5/2011	4.1	12/5/2011	4.2
12/6/2011	0.0	12/6/2011	5.0	12/6/2011	5.0
12/7/2011	0.0	12/7/2011	2.6	12/7/2011	2.6
12/8/2011	1.0	12/8/2011	3.8	12/8/2011	4.8
12/9/2011	4.8	12/9/2011	3.5	12/9/2011	8.3
12/10/2011	6.3	12/10/2011	4.5	12/10/2011	10.9
12/11/2011	6.9	12/11/2011	4.4	12/11/2011	11.4
12/12/2011	4.7	12/12/2011	4.3	12/12/2011	9.0
12/13/2011	2.5	12/13/2011	1.2	12/13/2011	3.7
12/14/2011	5.8	12/14/2011	0.0	12/14/2011	5.8
12/15/2011	10.3	12/15/2011	0.1	12/15/2011	10.4
12/16/2011	8.2	12/16/2011	2.1	12/16/2011	10.3
12/17/2011	7.6	12/17/2011	4.6	12/17/2011	12.2
12/18/2011	7.8	12/18/2011	4.2	12/18/2011	12.0
12/19/2011	8.2	12/19/2011	4.4	12/19/2011	12.6
12/20/2011	5.4	12/20/2011	3.9	12/20/2011	9.3
12/21/2011	8.0	12/21/2011	4.0	12/21/2011	11.9

Date	L1 NOx, tpd	Date	L2 NOx, tpd	Date	L1 + L2
12/22/2011	8.8	12/22/2011	4.3	12/22/2011	13.0
12/23/2011	9.3	12/23/2011	3.8	12/23/2011	13.0
12/24/2011	11.0	12/24/2011	4.3	12/24/2011	15.3
12/25/2011	8.9	12/25/2011	4.0	12/25/2011	12.9
12/26/2011	9.5	12/26/2011	3.9	12/26/2011	13.5
12/27/2011	10.9	12/27/2011	4.1	12/27/2011	15.0
12/28/2011	11.3	12/28/2011	4.4	12/28/2011	15.8
12/29/2011	9.2	12/29/2011	2.4	12/29/2011	11.6
12/30/2011	11.1	12/30/2011	4.4	12/30/2011	15.4
12/31/2011	8.9	12/31/2011	4.4	12/31/2011	13.3
1/1/2012	11.2	1/1/2012	4.6	1/1/2012	15.7
1/2/2012	11.4	1/2/2012	4.4	1/2/2012	15.8
1/3/2012	2.2	1/3/2012	5.8	1/3/2012	8.0
1/4/2012	0.1	1/4/2012	4.7	1/4/2012	4.8
1/5/2012	0.0	1/5/2012	5.2	1/5/2012	5.2
1/6/2012	0.0	1/6/2012	4.2	1/6/2012	4.2
1/7/2012	0.0	1/7/2012	4.1	1/7/2012	4.1
1/8/2012	0.0	1/8/2012	4.6	1/8/2012	4.6
1/9/2012	0.0	1/9/2012	5.4	1/9/2012	5.4
1/10/2012	0.0	1/10/2012	5.5	1/10/2012	5.5
1/11/2012	0.0	1/11/2012	5.0	1/11/2012	5.1
1/12/2012	0.0	1/12/2012	4.3	1/12/2012	4.3
1/13/2012	0.0	1/13/2012	4.4	1/13/2012	4.4
1/14/2012	0.0	1/14/2012	1.1	1/14/2012	1.1
1/15/2012	0.0	1/15/2012	2.3	1/15/2012	2.3
1/16/2012	0.0	1/16/2012	4.8	1/16/2012	4.8
1/17/2012	0.0	1/17/2012	4.6	1/17/2012	4.6
1/18/2012	0.0	1/18/2012	5.2	1/18/2012	5.2
1/19/2012	0.0	1/19/2012	4.9	1/19/2012	4.9
1/20/2012	0.0	1/20/2012	5.0	1/20/2012	5.0
1/21/2012	0.0	1/21/2012	5.0	1/21/2012	5.0
1/22/2012	0.0	1/22/2012	5.0	1/22/2012	5.0
1/23/2012	0.0	1/23/2012	4.7	1/23/2012	4.7
1/24/2012	0.0	1/24/2012	4.5	1/24/2012	4.5
1/25/2012	0.7	1/25/2012	4.5	1/25/2012	5.2
1/26/2012	8.2	1/26/2012	4.4	1/26/2012	12.5
1/27/2012	6.2	1/27/2012	2.1	1/27/2012	8.2
1/28/2012	5.1	1/28/2012	4.1	1/28/2012	9.3
1/29/2012	4.8	1/29/2012	4.1	1/29/2012	9.0
1/30/2012	4.9	1/30/2012	4.1	1/30/2012	9.0
1/31/2012	3.9	1/31/2012	4.1	1/31/2012	8.0
2/1/2012	3.5	2/1/2012	4.3	2/1/2012	7.8
2/2/2012	4.2	2/2/2012	4.3	2/2/2012	8.6
2/3/2012	4.5	2/3/2012	4.2	2/3/2012	8.7
2/4/2012	6.0	2/4/2012	4.6	2/4/2012	10.7

Date	L1 NOx, tpd
2/5/2012	2.8
2/6/2012	2.9
2/7/2012	4.7
2/8/2012	2.8
2/9/2012	2.7
2/10/2012	4.0
2/11/2012	8.3
2/12/2012	8.9

Count	367
Average	6.46
St Dev	4.24
Max	19.36
Min	0.00
$t_{0.05, c-1}$	1.966
UPL 95%	14.81
$t_{0.01, c-1}$	2.589
UPL 99%	17.45

Date	L2 NOx, tpd
2/5/2012	5.3
2/6/2012	5.3
2/7/2012	6.4
2/8/2012	7.2
2/9/2012	5.6
2/10/2012	4.9
2/11/2012	5.3
2/12/2012	4.9

Count	367
Average	4.61
St Dev	2.97
Max	15.65
Min	0.00
$t_{0.05, c-1}$	1.966
UPL 95%	10.45
$t_{0.01, c-1}$	2.589
UPL 99%	12.30

Date	L1 + L2
2/5/2012	8.1
2/6/2012	8.2
2/7/2012	11.1
2/8/2012	10.0
2/9/2012	8.3
2/10/2012	8.8
2/11/2012	13.5
2/12/2012	13.8

Count	367
Average	11.07
St Dev	5.10
Max	27.24
Min	0.00
$t_{0.05, c-1}$	1.966
UPL 95%	21.10
$t_{0.01, c-1}$	2.589
UPL 99%	24.28

Line 1		
	MPCA DATA	UTAC DATA
	100+	255+gas
	24-hr AVG	Daily Avg
Count	5513	87.0
Average	773.28	916.6
St Dev	189.46	169.7
Max	1651.77	1613.0
Min	283.52	392.4
$t_{0.05, c-1}$	1.960	2.0
UPL 95%	1144.72	1256.0
$t_{0.01, c-1}$	2.577	2.6
UPL 99%	1261.50	1366.3

Line 2		
	MPCA DATA	UTAC DATA
		400+gas
	24-hr AVG	DAILY
Count	655.0	22.0
Average	1064.2	1113.2
St Dev	154.0	128.2
Max	1358.6	1341.2
Min	548.3	846.0
$t_{0.05, c-1}$	2.0	2.1
UPL 95%	1366.8	1385.7
$t_{0.01, c-1}$	2.6	2.8
UPL 99%	1462.3	1484.3

FACILITY	2850.6	lb/hr Daily Avg.

Date	Daily NOx avg lb/hr	NOx tons/day	Production LTPH
4/1/2011	670.6	8.0	268.8
4/2/2011	730.5	8.8	287.8
4/3/2011	758.5	9.1	283.3
4/4/2011	820.7	9.8	280.3
4/6/2011	1057.4	12.7	289.9
4/7/2011	858.8	10.3	261.1
4/8/2011	914.0	11.0	276.3
4/9/2011	1008.0	12.1	284.0
4/10/2011	1047.9	12.6	288.6
4/11/2011	973.9	11.7	269.6
4/12/2011	966.8	11.6	284.6
4/13/2011	983.6	11.8	270.9
4/15/2011	1020.5	12.2	283.0
4/16/2011	919.4	11.0	267.5
4/17/2011	1040.3	12.5	277.3
4/18/2011	1231.5	14.8	290.0
4/19/2011	1613.0	19.4	290.0
4/20/2011	1004.2	12.0	266.1
4/22/2011	869.3	10.4	265.5
4/24/2011	1111.2	13.3	296.8
4/25/2011	1062.7	12.8	284.6
4/26/2011	925.7	11.1	277.2
4/28/2011	849.8	10.2	258.1
4/29/2011	895.7	10.7	260.6
5/1/2011	1067.9	12.8	268.1
5/2/2011	819.9	9.8	257.5
5/4/2011	887.4	10.6	260.9
5/5/2011	905.0	10.9	267.2
5/7/2011	880.1	10.6	255.6
5/8/2011	1017.5	12.2	274.1
5/9/2011	1005.6	12.1	269.5
5/10/2011	880.5	10.6	261.7
5/11/2011	894.0	10.7	258.5
5/15/2011	1013.0	12.2	272.1
5/16/2011	971.4	11.7	267.1
5/17/2011	1039.8	12.5	269.9
5/18/2011	1092.9	13.1	274.3
5/19/2011	1072.5	12.9	288.2
5/23/2011	805.2	9.7	257.3
5/27/2011	936.1	11.2	256.6
5/30/2011	874.4	10.5	262.1
5/31/2011	754.5	9.1	258.3
6/11/2011	815.9	9.8	267.6
6/12/2011	795.1	9.5	261.0
6/13/2011	840.6	10.1	259.0
6/14/2011	792.2	9.5	259.5
6/20/2011	774.5	9.3	256.8
6/29/2011	827.5	9.9	270.3
7/2/2011	957.9	11.5	273.7
7/3/2011	1122.1	13.5	277.2

Date	Daily NOx avg lb/hr	NOx tons/day	Production LTPH
7/8/2011	893.3	10.7	256.1
7/9/2011	936.5	11.2	277.2
7/13/2011	934.5	11.2	266.5
7/14/2011	1167.2	14.0	280.0
7/15/2011	1012.9	12.2	268.6
7/18/2011	711.6	8.5	255.2
7/19/2011	881.6	10.6	273.2
7/26/2011	846.0	10.2	265.8
7/28/2011	813.1	9.8	267.2
7/29/2011	831.5	10.0	263.5
10/16/2011	775.2	9.3	265.8
10/19/2011	939.7	11.3	274.3
11/5/2011	1124.1	13.5	264.5
11/6/2011	992.2	11.9	259.6
11/7/2011	1201.7	14.4	266.4
11/8/2011	1192.3	14.3	272.3
11/9/2011	1310.0	15.7	286.2
11/12/2011	947.2	11.4	258.2
11/21/2011	790.2	9.5	255.1
11/27/2011	847.5	10.2	258.0
11/28/2011	1029.2	12.3	277.2
12/12/2011	392.4	4.7	257.3
12/15/2011	857.5	10.3	263.6
12/20/2011	446.2	5.4	263.4
12/21/2011	664.0	8.0	263.6
12/22/2011	729.7	8.8	257.1
12/23/2011	771.5	9.3	268.7
12/24/2011	920.7	11.0	289.9
12/25/2011	744.8	8.9	264.9
12/26/2011	794.2	9.5	280.0
12/27/2011	904.3	10.9	280.8
12/28/2011	943.9	11.3	272.0
12/30/2011	922.1	11.1	278.3
1/1/2012	930.5	11.2	275.9
1/2/2012	948.8	11.4	273.7
1/26/2012	680.7	8.2	258.7
2/12/2012	738.2	8.9	255.7

Count 87
Average 916.60
St Dev 169.75
Max 1613.05
Min 392.41
$\mathbf{t}_{0.05,\ c\text{-}1}$ 1.988
UPL 95% 1255.98
$\mathbf{t}_{0.01,\ c\text{-}1}$ 2.634
UPL 99% 1366.32

date	Line 2 NOx daily avg lb/hr	Line 2 NOx tons/day	Line 2 Pellet Prod Avg LTPH
2/11/2011	1303.9	15.6	503.9
2/12/2011	1233.2	14.8	523.2
2/13/2011	1103.8	13.2	526.7
2/14/2011	1073.6	12.9	511.7
3/29/2011	993.0	11.9	513.4
3/30/2011	987.4	11.8	508.5
3/31/2011	846.0	10.2	437.6
4/1/2011	867.2	10.4	471.6
4/2/2011	1073.4	12.9	598.4
4/3/2011	1078.4	12.9	598.5
4/4/2011	1181.2	14.2	605.0
4/5/2011	1025.5	12.3	543.4
4/6/2011	1079.6	13.0	566.8
4/7/2011	1278.1	15.3	597.6
4/8/2011	1270.0	15.2	610.5
4/9/2011	1053.9	12.6	606.7
4/10/2011	1097.0	13.2	625.0
4/11/2011	1151.1	13.8	615.8
4/12/2011	1129.0	13.5	592.6
10/23/2011	1173.8	14.1	461.8
10/24/2011	1149.5	13.8	434.9
3/21/2012	1341.2	16.1	609.1

Count	22
Average	1113.18
St Dev	128.19
Max	1341.17
Min	845.96
$\mathbf{t}_{0.05,\ c\text{-}1}$	2.080
UPL 95%	1385.74
$\mathbf{t}_{0.01,\ c\text{-}1}$	2.831
UPL 99%	1484.27

DEPARTMENT: POLLUTION CONTROL AGENCY

STATE OF MINNESOTA
Office Memorandum

DATE: October 7, 2011

TO: AQD File No. 62B
(Delta ID No. 13700063)

FROM: Hongming Jiang
Air Quality Permits Section
Industrial Division

Catherine Neuschler
Air Assessment and Environmental Data Management Section
Environmental Analysis and Outcomes Division

PHONE: 651-757-2467

651-757-2607

SUBJECT: Nitrogen Oxides BART Limits for U.S. Steel – Keewatin Taconite (Keetac)

This memo was prepared to provide the documentation of the MPCA's NO_X and SO_2 BART limit determination based on the technical review performed by MPCA staff. EPA's approval of the Regional Haze State Implementation Plan (SIP) for Minnesota is needed for the MPCA's BART determination to become effective.

1. General Information

1.1 Applicant and Stationary Source Location:

Applicant/Mailing Address	Stationary Source (SIC: **1011**)/Address
U.S. Steel – Keetac P.O. Box 217 Keewatin, MN 55753-0217	1 Mine Road Keewatin, Minnesota 55753 St. Louis County
Contact: Mr. Ryan Siats; Phone (218) 778-8684	

1.2 Description of the Facility

U.S. Steel owns and operates a taconite mine and processing facility in Keewatin, Minnesota, known as Keetac. At Keetac, U.S. Steel operates one grate-kiln furnace (the "Phase II furnace;" EU030) constructed in 1976. The furnace is capable of processing 415 tons of pellets per hour with a heat input of 178.5 MMBtu/hr.

The permit for the Keetac facility allows the combustion of natural gas, distillate fuel oils, coal, and petroleum coke in the pelletizing furnace. Coal and natural gas are the primary fuels; coal is a significant source of sulfur. Another source of sulfur emissions from this furnace is the iron ore used to form the green balls, although this represents a smaller contribution than the sulfur in the solid fuels burned. Sulfur dioxide emissions are currently controlled by wet scrubbers.

2. Regulatory and/or Statutory Basis

2.1 Overview of Visibility, Regional Haze, and Best Available Retrofit Technology Program

The U.S. EPA's 1999 Regional Haze Rule singles out certain older emission sources that have not been regulated under other provisions of the Clean Air Act for additional controls. The MPCA is required to determine Best Available Retrofit Technology (BART) for these older sources that contribute to visibility impairment in Class I Areas to install Best Available Retrofit Technology (BART). On July 6, 2005, U.S. EPA published a revised final rule, including 40 CFR 51, Appendix Y "Guidelines for BART Determinations Under the Regional Haze Rule" which provides direction for determining which older sources may need to install BART and for determining BART.

The MPCA is required to determine BART for each source subject to BART based on an analysis of the best system of continuous emission control technology available and associated achievable emission limits. The analysis must take into

consideration the technology available, the costs of compliance, the energy and non-air quality environmental impacts, any pollution control equipment in use at the source, the remaining useful life of the source, and the degree of improvement in visibility which may reasonably be anticipated to result from use of the technology.

Further discussion of the regulatory basis for this determination can be found in the MPCA's December 2009 Regional Haze State Implementation Plan submittal, in Appendix 9.3.

2.2 Affected Units

The units for which the MPCA must determine BART and establish emission limits consistent with that determination are:

Emission Unit Name	EU Number[1]	Control Equipment and Stack Numbers
Phase II Grate-Kiln Pelletizing Furnace	EU030	CE110, CE111/SV051

2.3 The BART Determination

The MPCA's BART determinations for this unit is documented in Appendix 9.3 of the December 2009 Regional Haze SIP submittal.

The NO_X BART determination for the Phase II furnace is existing combustion controls and fuel blending, along with good combustion practices.

However, due to the lack of sufficient emissions data representing the range of operating conditions that influence emissions, the MPCA did not set an emission limit at the time of making the BART determination for the indurating furnaces. Instead, the MPCA and Keetac entered into an Administrative Order, under which Keetac agreed to install and maintain Continuous Emissions Monitoring Systems (CEMS) and provide NO_X emission information to the MPCA.

The SO_2 BART determination is operation of the existing wet scrubber. However, as with NO_X, additional emission information was needed prior to setting an SO_2 limit from this primarily coal-fired furnace. Keetac agreed in an Administrative Order to install and maintain SO_2 CEMS and provide emission information to the MPCA.

2.4 MPCA Determination of the BART Limit

The MPCA reviewed the NO_X and SO_2 emission information provided by Keetac.

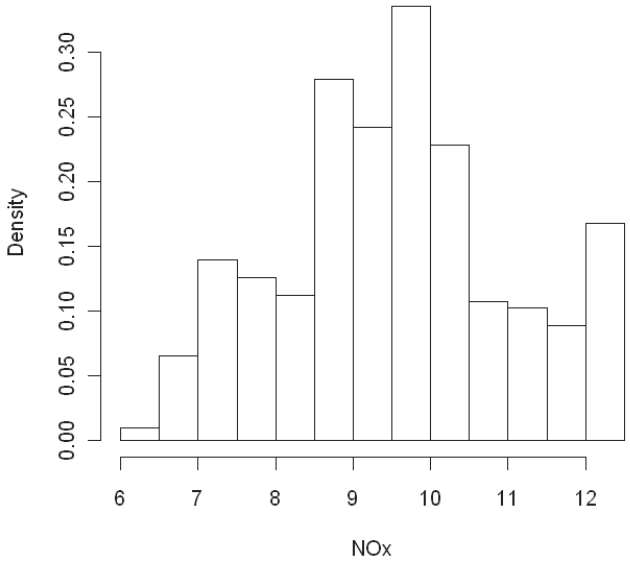
NO_X emission data was received going back to November 2008, but the Keetac facility was shut down for a year from early December 2008 through late December 2009. (Only a few days of operating data were received for December 2009.) Therefore, the MPCA's review focused on the most recent data after Keetac's return to operations in December 2009. Data from late January 2010 through the end of March 2011 was analyzed to develop the BART limits.

The following graphs show the variation in emissions over the analyzed time frame, along with the frequency of measurements of each emission level.

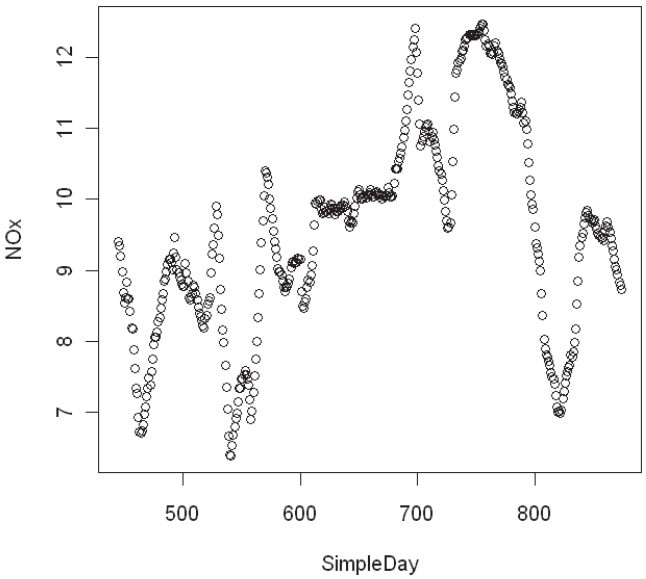
---

[1] The MPCA organizes conditions and illustrates associations in its permits using the Emission Unit (EU), Control Equipment (CE), and Stack/Vent (SV) numbers.

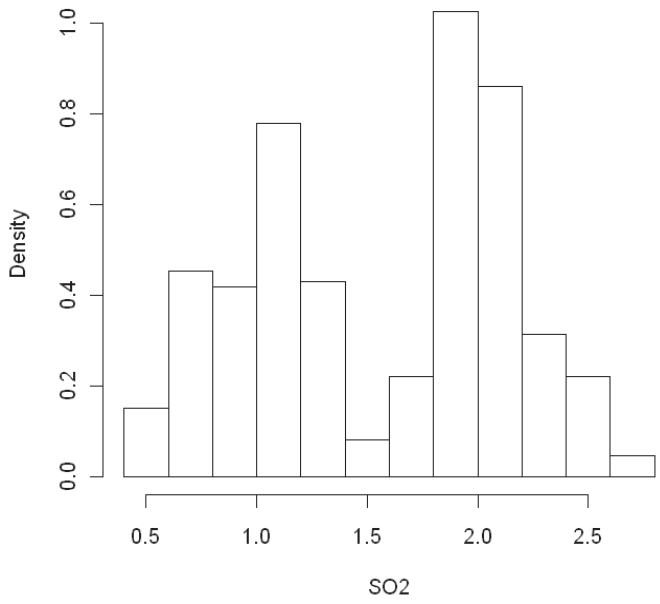
Frequency of NO_X Emissions (tpd)



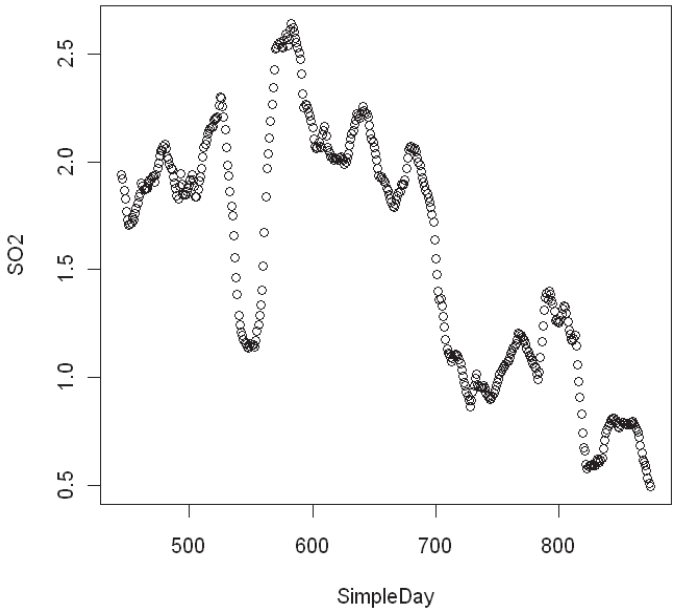
NO_X Emissions Over Time (tpd)



Frequency of SO_2 Emissions (tpd)



SO_2 Emissions Over Time (tpd)



The following table shows descriptive statistics of the NO_X and SO_2 emissions from the furnace, in tons per day.

Keetac Emissions Descriptive Statistics (30 day rolling average, tons per day)		
	Furnace NO_X	Furnace SO_2
# Data Points	429	429
Minimum	6.390	0.4953
Mean	9.535	1.569
Median	9.587	1.789
Maximum	12.476	2.639

The most recent data was plotted to the most appropriate statistical probability distribution, and a 98% confidence interval was constructed. The limit was based on the upper confidence level.

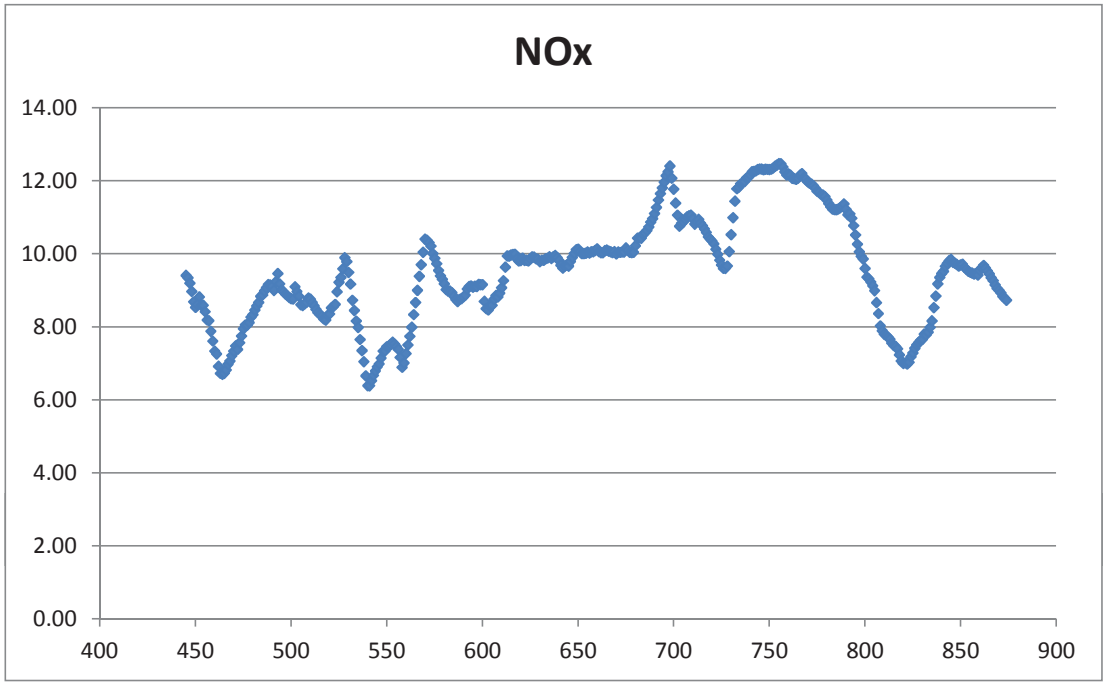
A reviewing the CEMS data provided by Keetac, the MPCA has determined that the appropriate BART limits are those shown in the following table.

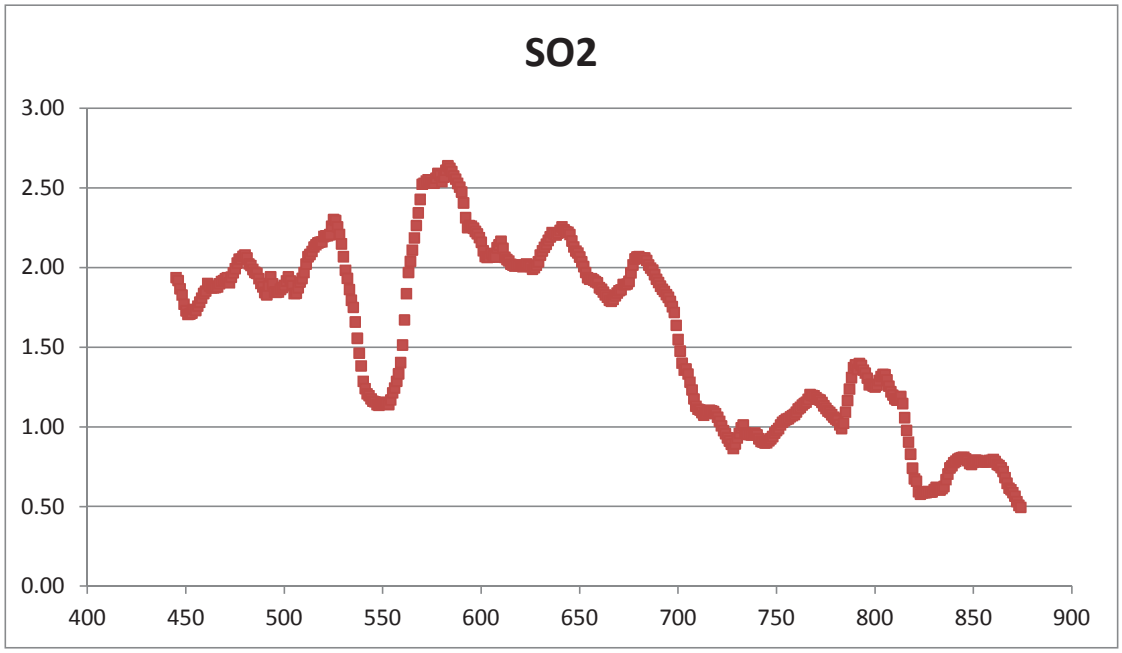
Keetac BART Limits (30 day rolling average, tons per day)		
	Furnace NO_X	Furnace SO_2
BART Limit	12.35	2.71

These limits are 30-day rolling averages. Compliance is to be determined through the continued use of CEMS.

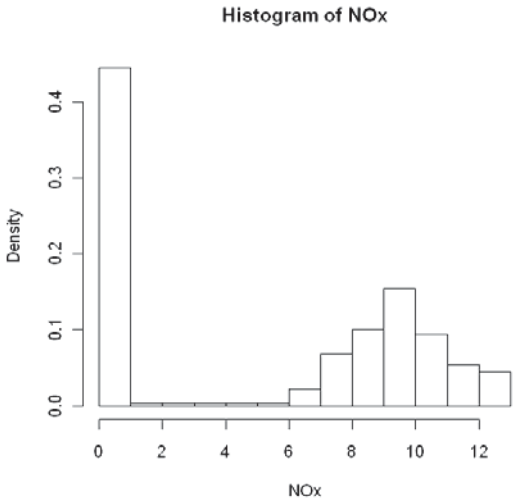
Proposed Keetac BART Limits (ton/day) calculated as a 30-day rolling average

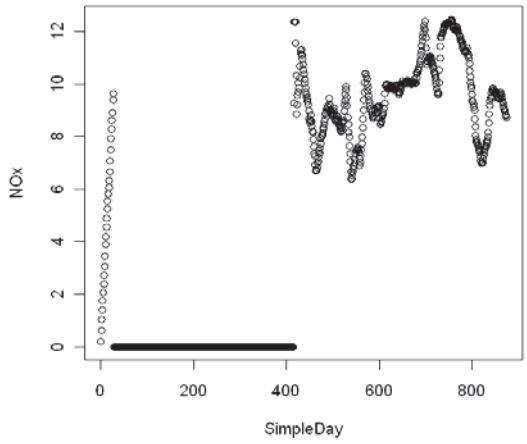
Phase 2 pelletizer	NOx	SO2	
Proposed limit	12.35	2.71	ton/day
Pattern; %-tile	Weibull; 98	Weibull; 98	based on the data of recent rows (1/26/2010-3/31/2011)
c.f. Max	12.48	2.64	based on the data of recent rows
	1040	220	uniform emission rate, lb/hr
Limit/Max	99%	103%	
	1029	225.8	uniform limit, lb/hr
	1032	240	gap filling value permittee used in submittal



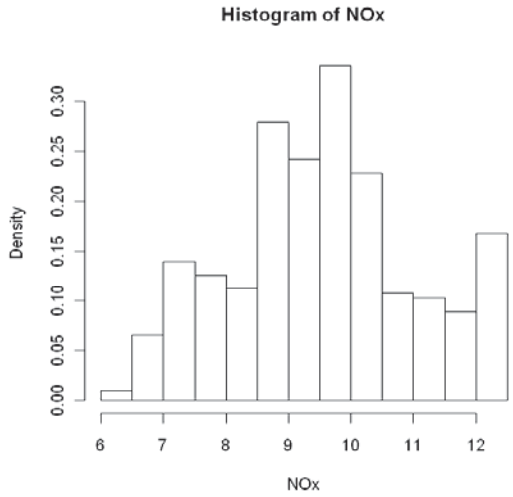


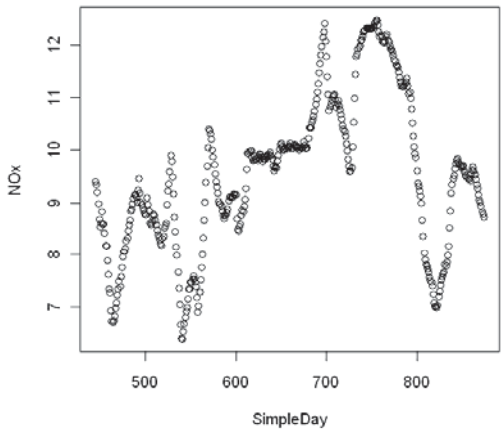
All rows of data:



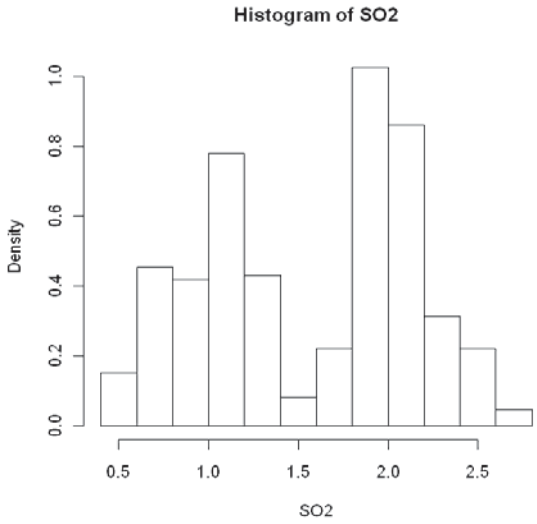


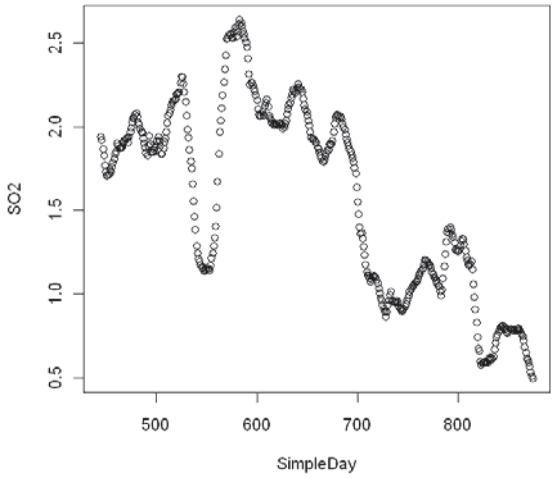
Recent rows (1/26/2010-3/31/2011)





Recent rows (1/26/2010-3/31/2011)





Commands entered at R Console (7/29/2011) **R 2.1.3.0** R for Windows GUI front-end

```
> dataframe<-read.csv("C:\\Documents and Settings\\hjiang\\Desktop\\Data_R.csv",header=T)
> names(dataframe)
[1] "SimpleDay" "NOx"
> attach(dataframe)
> summary(dataframe)
   SimpleDay           NOx
 Min.   :   0     Min.   : 0.000
 1st Qu.: 218.5   1st Qu.: 0.000
 Median :437.0    Median : 7.257
 Mean   : 437.0   Mean   : 5.192
 3rd Qu.: 655.5   3rd Qu.: 9.699
 Max.   :  874    Max.   :12.476
> hist(NOx,prob=T)
```

```
   SimpleDay          NOx              SO2
 Min.   :  445   Min.   :  6.390   Min.   : 0.4953
 1st Qu.: 552.2  1st Qu.:  8.595   1st Qu.: 1.0800
 Median :659.5   Median :  9.587   Median :1.7890
 Mean   : 659.5  Mean   :  9.535   Mean   : 1.5694
 3rd Qu.: 766.8  3rd Qu.: 10.341   3rd Qu.: 2.0234
 Max.   :  874   Max.   : 12.476   Max.   : 2.6393
> hist(NOx,prob=T)
> hist(SO2,prob=T)
> plot(SimpleDay,NOx)
```

Keetac Phase II NOx 30-day rolling average, ton/day, as submitted

Date	SimpleDay	NOx	SO2	
11/7/08	0	0.20	0.031	
11/8/08	1	0.61	0.077	
11/9/08	2	1.02	0.113	
11/10/08	3	1.41	0.157	
11/11/08	4	1.76	0.202	
11/12/08	5	2.06	0.265	
11/13/08	6	2.40	0.330	
11/14/08	7	2.72	0.394	
11/15/08	8	3.07	0.446	
11/16/08	9	3.44	0.499	
11/17/08	10	3.88	0.553	
11/18/08	11	4.21	0.597	
11/19/08	12	4.55	0.625	
11/20/08	13	4.87	0.665	
11/21/08	14	5.25	0.708	
11/22/08	15	5.54	0.751	
11/23/08	16	5.83	0.793	
11/24/08	17	6.05	0.833	
11/25/08	18	6.33	0.872	
11/26/08	19	6.66	0.892	
11/27/08	20	7.08	0.940	
11/28/08	21	7.50	1.007	
11/29/08	22	7.91	1.059	
11/30/08	23	8.28	1.078	
12/1/08	24	8.62	1.114	
12/2/08	25	8.90	1.149	
12/3/08	26	9.40	1.171	
12/4/08	27	9.62	1.177	
12/5/08	28	0.00	0.000	
No data until 12/27/09				Blank was submitted.
12/28/09	416	9.29	0.000	Not calc'd in the submittal
12/29/09	417	12.38	0.000	
12/30/09	418	12.38	0.000	
12/31/09	419	12.38	0.000	
1/1/10	420	11.56	2.71	
1/2/10	421	10.32	2.70	
1/3/10	422	8.85	2.66	
1/4/10	423	9.57	2.58	
1/5/10	424	9.20	2.51	
1/6/10	425	9.70	2.49	
1/7/10	426	10.05	2.37	
1/8/10	427	9.84	2.34	
1/9/10	428	10.25	2.30	
1/10/10	429	10.70	2.23	
1/11/10	430	11.16	2.18	
1/12/10	431	11.29	2.10	
1/13/10	432	11.32	2.03	
1/14/10	433	11.12	1.95	
1/15/10	434	11.12	1.93	
1/16/10	435	10.95	1.94	
1/17/10	436	10.74	1.96	
1/18/10	437	10.53	1.96	
1/19/10	438	10.38	1.96	
1/20/10	439	10.18	1.97	
1/21/10	440	10.02	1.96	
1/22/10	441	9.85	1.94	
1/23/10	442	9.71	1.93	
1/24/10	443	9.60	1.93	
1/25/10	444	9.51	1.93	
1/26/10	445	9.41	1.94	
1/27/10	446	9.34	1.92	
1/28/10	447	9.20	1.87	
1/29/10	448	8.97	1.83	
1/30/10	449	8.69	1.77	
1/31/10	450	8.54	1.73	
2/1/10	451	8.61	1.71	
2/2/10	452	8.83	1.71	

2/3/10	453	8.59	1.72
2/4/10	454	8.59	1.74
2/5/10	455	8.42	1.73
2/6/10	456	8.19	1.76
2/7/10	457	8.17	1.78
2/8/10	458	7.88	1.81
2/9/10	459	7.61	1.84
2/10/10	460	7.34	1.85
2/11/10	461	7.26	1.90
2/12/10	462	6.92	1.89
2/13/10	463	6.73	1.87
2/14/10	464	6.70	1.87
2/15/10	465	6.73	1.88
2/16/10	466	6.82	1.88
2/17/10	467	6.98	1.90
2/18/10	468	7.06	1.91
2/19/10	469	7.21	1.92
2/20/10	470	7.34	1.93
2/21/10	471	7.48	1.94
2/22/10	472	7.39	1.90
2/23/10	473	7.57	1.94
2/24/10	474	7.75	1.97
2/25/10	475	7.95	1.99
2/26/10	476	8.06	2.03
2/27/10	477	8.05	2.05
2/28/10	478	8.12	2.05
3/1/10	479	8.27	2.07
3/2/10	480	8.34	2.08
3/3/10	481	8.46	2.06
3/4/10	482	8.58	2.02
3/5/10	483	8.68	2.01
3/6/10	484	8.84	1.99
3/7/10	485	8.87	1.97
3/8/10	486	8.98	1.96
3/9/10	487	9.08	1.93
3/10/10	488	9.16	1.90
3/11/10	489	9.16	1.88
3/12/10	490	9.11	1.84
3/13/10	491	9.00	1.83
3/14/10	492	9.24	1.88
3/15/10	493	9.46	1.94
3/16/10	494	9.18	1.90
3/17/10	495	9.01	1.85
3/18/10	496	8.96	1.85
3/19/10	497	8.90	1.85
3/20/10	498	8.86	1.86
3/21/10	499	8.81	1.88
3/22/10	500	8.78	1.89
3/23/10	501	8.77	1.92
3/24/10	502	9.10	1.94
3/25/10	503	8.97	1.92
3/26/10	504	8.84	1.89
3/27/10	505	8.61	1.84
3/28/10	506	8.59	1.84
3/29/10	507	8.63	1.87
3/30/10	508	8.68	1.91
3/31/10	509	8.79	1.93
4/1/10	510	8.76	1.97
4/2/10	511	8.67	2.02
4/3/10	512	8.58	2.07
4/4/10	513	8.48	2.08
4/5/10	514	8.39	2.10
4/6/10	515	8.34	2.13
4/7/10	516	8.30	2.14
4/8/10	517	8.22	2.16
4/9/10	518	8.19	2.16
4/10/10	519	8.32	2.16
4/11/10	520	8.36	2.20
4/12/10	521	8.52	2.20
4/13/10	522	8.56	2.20
4/14/10	523	8.62	2.21

4/15/10	524	8.96	2.26
4/16/10	525	9.22	2.30
4/17/10	526	9.36	2.30
4/18/10	527	9.59	2.26
4/19/10	528	9.90	2.21
4/20/10	529	9.79	2.15
4/21/10	530	9.49	2.07
4/22/10	531	9.17	1.98
4/23/10	532	8.73	1.93
4/24/10	533	8.45	1.86
4/25/10	534	8.16	1.80
4/26/10	535	7.99	1.75
4/27/10	536	7.66	1.66
4/28/10	537	7.35	1.56
4/29/10	538	7.05	1.46
4/30/10	539	6.66	1.38
5/1/10	540	6.39	1.29
5/2/10	541	6.39	1.24
5/3/10	542	6.53	1.21
5/4/10	543	6.67	1.20
5/5/10	544	6.79	1.18
5/6/10	545	6.91	1.16
5/7/10	546	6.99	1.16
5/8/10	547	7.15	1.14
5/9/10	548	7.34	1.14
5/10/10	549	7.34	1.15
5/11/10	550	7.46	1.16
5/12/10	551	7.46	1.15
5/13/10	552	7.52	1.15
5/14/10	553	7.59	1.14
5/15/10	554	7.53	1.17
5/16/10	555	7.46	1.21
5/17/10	556	7.39	1.24
5/18/10	557	7.17	1.29
5/19/10	558	6.90	1.33
5/20/10	559	7.01	1.40
5/21/10	560	7.27	1.51
5/22/10	561	7.51	1.67
5/23/10	562	7.74	1.84
5/24/10	563	7.99	1.97
5/25/10	564	8.34	2.04
5/26/10	565	8.67	2.11
5/27/10	566	9.00	2.19
5/28/10	567	9.39	2.26
5/29/10	568	9.70	2.34
5/30/10	569	10.04	2.43
5/31/10	570	10.40	2.52
6/1/10	571	10.37	2.53
6/2/10	572	10.31	2.54
6/3/10	573	10.21	2.55
6/4/10	574	10.01	2.55
6/5/10	575	9.88	2.53
6/6/10	576	9.73	2.53
6/7/10	577	9.55	2.56
6/8/10	578	9.40	2.59
6/9/10	579	9.30	2.58
6/10/10	580	9.18	2.54
6/11/10	581	9.03	2.57
6/12/10	582	8.98	2.61
6/13/10	583	8.98	2.64
6/14/10	584	8.94	2.62
6/15/10	585	8.84	2.60
6/16/10	586	8.75	2.58
6/17/10	587	8.70	2.56
6/18/10	588	8.76	2.53
6/19/10	589	8.78	2.51
6/20/10	590	8.82	2.47
6/21/10	591	8.87	2.41
6/22/10	592	9.04	2.31
6/23/10	593	9.11	2.25
6/24/10	594	9.13	2.26

6/25/10	595	9.09	2.26
6/26/10	596	9.12	2.25
6/27/10	597	9.10	2.23
6/28/10	598	9.16	2.21
6/29/10	599	9.16	2.19
6/30/10	600	9.16	2.16
7/1/10	601	8.70	2.11
7/2/10	602	8.50	2.07
7/3/10	603	8.46	2.06
7/4/10	604	8.56	2.07
7/5/10	605	8.60	2.09
7/6/10	606	8.76	2.07
7/7/10	607	8.86	2.07
7/8/10	608	8.82	2.13
7/9/10	609	8.93	2.14
7/10/10	610	9.07	2.17
7/11/10	611	9.27	2.12
7/12/10	612	9.64	2.07
7/13/10	613	9.95	2.05
7/14/10	614	9.94	2.04
7/15/10	615	9.97	2.02
7/16/10	616	9.99	2.02
7/17/10	617	9.99	2.01
7/18/10	618	9.86	2.02
7/19/10	619	9.80	2.01
7/20/10	620	9.82	2.01
7/21/10	621	9.88	2.01
7/22/10	622	9.82	2.02
7/23/10	623	9.82	2.02
7/24/10	624	9.80	2.01
7/25/10	625	9.87	2.01
7/26/10	626	9.93	1.99
7/27/10	627	9.91	2.00
7/28/10	628	9.87	2.02
7/29/10	629	9.85	2.04
7/30/10	630	9.79	2.08
7/31/10	631	9.83	2.11
8/1/10	632	9.82	2.13
8/2/10	633	9.87	2.15
8/3/10	634	9.88	2.17
8/4/10	635	9.92	2.19
8/5/10	636	9.88	2.22
8/6/10	637	9.92	2.21
8/7/10	638	9.96	2.20
8/8/10	639	9.90	2.22
8/9/10	640	9.82	2.23
8/10/10	641	9.69	2.26
8/11/10	642	9.61	2.24
8/12/10	643	9.66	2.23
8/13/10	644	9.70	2.22
8/14/10	645	9.67	2.21
8/15/10	646	9.80	2.17
8/16/10	647	9.91	2.13
8/17/10	648	10.01	2.10
8/18/10	649	10.11	2.09
8/19/10	650	10.13	2.07
8/20/10	651	10.06	2.04
8/21/10	652	10.01	2.01
8/22/10	653	10.01	1.97
8/23/10	654	10.02	1.94
8/24/10	655	10.05	1.93
8/25/10	656	10.02	1.93
8/26/10	657	10.06	1.92
8/27/10	658	10.06	1.91
8/28/10	659	10.10	1.91
8/29/10	660	10.14	1.87
8/30/10	661	10.06	1.86
8/31/10	662	10.03	1.85
9/1/10	663	10.03	1.83
9/2/10	664	10.09	1.81
9/3/10	665	10.10	1.80

9/4/10	666	10.08	1.79
9/5/10	667	10.06	1.80
9/6/10	668	10.03	1.82
9/7/10	669	10.06	1.84
9/8/10	670	10.00	1.86
9/9/10	671	10.05	1.86
9/10/10	672	10.04	1.89
9/11/10	673	10.05	1.89
9/12/10	674	10.05	1.90
9/13/10	675	10.17	1.91
9/14/10	676	10.10	1.97
9/15/10	677	10.04	2.02
9/16/10	678	10.03	2.05
9/17/10	679	10.05	2.07
9/18/10	680	10.23	2.07
9/19/10	681	10.43	2.06
9/20/10	682	10.44	2.06
9/21/10	683	10.43	2.06
9/22/10	684	10.54	2.05
9/23/10	685	10.58	2.02
9/24/10	686	10.64	2.00
9/25/10	687	10.74	1.98
9/26/10	688	10.88	1.96
9/27/10	689	10.97	1.93
9/28/10	690	11.10	1.91
9/29/10	691	11.27	1.88
9/30/10	692	11.48	1.86
10/1/10	693	11.65	1.85
10/2/10	694	11.81	1.83
10/3/10	695	11.96	1.81
10/4/10	696	12.14	1.79
10/5/10	697	12.25	1.76
10/6/10	698	12.41	1.72
10/7/10	699	12.08	1.64
10/8/10	700	11.77	1.55
10/9/10	701	11.39	1.48
10/10/10	702	11.06	1.40
10/11/10	703	10.76	1.36
10/12/10	704	10.83	1.36
10/13/10	705	10.88	1.33
10/14/10	706	10.95	1.28
10/15/10	707	11.02	1.23
10/16/10	708	11.04	1.18
10/17/10	709	11.07	1.13
10/18/10	710	10.96	1.11
10/19/10	711	10.82	1.11
10/20/10	712	10.88	1.09
10/21/10	713	10.94	1.07
10/22/10	714	10.84	1.09
10/23/10	715	10.77	1.10
10/24/10	716	10.69	1.11
10/25/10	717	10.59	1.10
10/26/10	718	10.47	1.10
10/27/10	719	10.41	1.08
10/28/10	720	10.35	1.06
10/29/10	721	10.27	1.04
10/30/10	722	10.13	1.01
10/31/10	723	9.99	0.98
11/1/10	724	9.83	0.96
11/2/10	725	9.70	0.93
11/3/10	726	9.60	0.91
11/4/10	727	9.61	0.89
11/5/10	728	9.67	0.86
11/6/10	729	10.06	0.89
11/7/10	730	10.53	0.93
11/8/10	731	10.99	0.96
11/9/10	732	11.44	0.99
11/10/10	733	11.78	1.01
11/11/10	734	11.83	0.96
11/12/10	735	11.92	0.95
11/13/10	736	11.95	0.95

11/14/10	737	11.98	0.95
11/15/10	738	12.08	0.95
11/16/10	739	12.10	0.96
11/17/10	740	12.17	0.95
11/18/10	741	12.25	0.93
11/19/10	742	12.26	0.91
11/20/10	743	12.27	0.90
11/21/10	744	12.32	0.90
11/22/10	745	12.33	0.90
11/23/10	746	12.32	0.91
11/24/10	747	12.31	0.93
11/25/10	748	12.32	0.94
11/26/10	749	12.32	0.96
11/27/10	750	12.31	0.98
11/28/10	751	12.32	0.99
11/29/10	752	12.35	1.01
11/30/10	753	12.40	1.03
12/1/10	754	12.44	1.04
12/2/10	755	12.48	1.05
12/3/10	756	12.47	1.05
12/4/10	757	12.38	1.06
12/5/10	758	12.25	1.07
12/6/10	759	12.16	1.08
12/7/10	760	12.19	1.09
12/8/10	761	12.16	1.11
12/9/10	762	12.06	1.12
12/10/10	763	12.06	1.14
12/11/10	764	12.04	1.15
12/12/10	765	12.07	1.16
12/13/10	766	12.16	1.17
12/14/10	767	12.20	1.20
12/15/10	768	12.09	1.20
12/16/10	769	12.05	1.20
12/17/10	770	11.98	1.18
12/18/10	771	11.93	1.17
12/19/10	772	11.91	1.17
12/20/10	773	11.87	1.15
12/21/10	774	11.80	1.13
12/22/10	775	11.72	1.12
12/23/10	776	11.69	1.10
12/24/10	777	11.63	1.09
12/25/10	778	11.61	1.08
12/26/10	779	11.57	1.06
12/27/10	780	11.48	1.05
12/28/10	781	11.38	1.04
12/29/10	782	11.29	1.01
12/30/10	783	11.22	0.99
12/31/10	784	11.21	1.02
1/1/11	785	11.21	1.09
1/2/11	786	11.23	1.17
1/3/11	787	11.26	1.24
1/4/11	788	11.30	1.31
1/5/11	789	11.37	1.37
1/6/11	790	11.22	1.39
1/7/11	791	11.07	1.36
1/8/11	792	11.10	1.40
1/9/11	793	10.98	1.39
1/10/11	794	10.78	1.36
1/11/11	795	10.52	1.34
1/12/11	796	10.27	1.31
1/13/11	797	10.06	1.26
1/14/11	798	9.94	1.27
1/15/11	799	9.86	1.26
1/16/11	800	9.61	1.25
1/17/11	801	9.37	1.26
1/18/11	802	9.32	1.29
1/19/11	803	9.23	1.32
1/20/11	804	9.13	1.33
1/21/11	805	8.99	1.33
1/22/11	806	8.67	1.30
1/23/11	807	8.37	1.26

1/24/11	808	8.03	1.22
1/25/11	809	7.90	1.20
1/26/11	810	7.80	1.18
1/27/11	811	7.77	1.17
1/28/11	812	7.72	1.18
1/29/11	813	7.67	1.19
1/30/11	814	7.56	1.15
1/31/11	815	7.50	1.06
2/1/11	816	7.46	0.98
2/2/11	817	7.40	0.91
2/3/11	818	7.24	0.83
2/4/11	819	7.07	0.74
2/5/11	820	7.00	0.67
2/6/11	821	7.02	0.66
2/7/11	822	6.99	0.59
2/8/11	823	7.03	0.58
2/9/11	824	7.18	0.59
2/10/11	825	7.29	0.59
2/11/11	826	7.41	0.59
2/12/11	827	7.51	0.60
2/13/11	828	7.57	0.59
2/14/11	829	7.63	0.59
2/15/11	830	7.66	0.61
2/16/11	831	7.81	0.62
2/17/11	832	7.78	0.61
2/18/11	833	7.86	0.60
2/19/11	834	7.99	0.61
2/20/11	835	8.17	0.63
2/21/11	836	8.53	0.67
2/22/11	837	8.84	0.71
2/23/11	838	9.18	0.74
2/24/11	839	9.35	0.76
2/25/11	840	9.46	0.78
2/26/11	841	9.52	0.79
2/27/11	842	9.66	0.80
2/28/11	843	9.74	0.80
3/1/11	844	9.81	0.81
3/2/11	845	9.85	0.81
3/3/11	846	9.77	0.80
3/4/11	847	9.75	0.79
3/5/11	848	9.71	0.77
3/6/11	849	9.66	0.77
3/7/11	850	9.70	0.78
3/8/11	851	9.72	0.79
3/9/11	852	9.63	0.79
3/10/11	853	9.58	0.78
3/11/11	854	9.52	0.78
3/12/11	855	9.50	0.78
3/13/11	856	9.47	0.78
3/14/11	857	9.45	0.78
3/15/11	858	9.47	0.79
3/16/11	859	9.42	0.79
3/17/11	860	9.55	0.80
3/18/11	861	9.62	0.78
3/19/11	862	9.69	0.77
3/20/11	863	9.61	0.76
3/21/11	864	9.53	0.74
3/22/11	865	9.45	0.72
3/23/11	866	9.35	0.68
3/24/11	867	9.27	0.65
3/25/11	868	9.15	0.62
3/26/11	869	9.06	0.61
3/27/11	870	9.00	0.59
3/28/11	871	8.93	0.57
3/29/11	872	8.84	0.53
3/30/11	873	8.79	0.51
3/31/11	874	8.73	0.50

DEPARTMENT: POLLUTION CONTROL AGENCY

STATE OF MINNESOTA
Office Memorandum

DATE: April 9, 2012

TO: AQD File No. 26A
(Delta ID No. 13700005)

FROM: Hongming Jiang
Air Quality Permits Section
Industrial Division

Catherine Neuschler
Air Assessment and Environmental Data Management Section
Environmental Analysis and Outcomes Division

PHONE: 651-757-2467

651-757-2607

SUBJECT: Nitrogen Oxides BART Limits for U.S. Steel – Minnesota Ore Operations (Minntac)

This memo was prepared to provide the documentation of the MPCA's NO_X and SO_2 BART limit determination based on the technical review performed by MPCA staff. EPA's approval of the Regional Haze State Implementation Plan (SIP) for Minnesota is needed for the MPCA's BART determination to become effective.

1. General Information

1.1 Applicant and Stationary Source Location:

Applicant/Mailing Address	Stationary Source (SIC: **1011**)/Address
U.S. Steel Corp. Minnesota Ore Operations P.O. Box 417 Mountain Iron, MN 55768	Minntac County Highway 102 Mountain Iron; St. Louis County
Contact: Ms. Chrissy Bartovich; Phone (218) 749-7364	

1.2 Description of the Facility

U.S. Steel – Minnesota Ore Operations (Minntac) owns and operates a taconite mine and processing facility at County Highway 102, on the Mesabi Range north of the City of Mountain Iron, St. Louis County, Minnesota.

Minntac operates five indurating furnaces (Lines 3, 4, 5, 6, and 7). Line 3 (Step I) began operation in 1967; Lines 4 and 5 (Step II) began operation in 1972; and Lines 6 and 7 (Step III) began operation in 1978. This memorandum describes the MPCA's determination of the NO_X BART limit for these five lines, along with the SO_2 BART limit for Lines 6 and 7.

2. Regulatory and/or Statutory Basis

2.1 Overview of Visibility, Regional Haze, and Best Available Retrofit Technology Program

The U.S. EPA's 1999 Regional Haze Rule singles out certain older emission sources that have not been regulated under other provisions of the Clean Air Act for additional controls. The MPCA is required to determine Best Available Retrofit Technology (BART) for these older sources that contribute to visibility impairment in Class I Areas to install Best Available Retrofit Technology (BART). On July 6, 2005, U.S. EPA published a revised final rule, including 40 CFR 51, Appendix Y "Guidelines for BART Determinations Under the Regional Haze Rule" which provides direction for determining which older sources may need to install BART and for determining BART.

The MPCA is required to determine BART for each source subject to BART based on an analysis of the best system of continuous emission control technology available and associated emission reductions achievable. The analysis must take into consideration the technology available, the costs of compliance, the energy and non-air quality environmental

impacts, any pollution control equipment in use at the source, the remaining useful life of the source, and the degree of improvement in visibility which may reasonably be anticipated to result from use of the technology.

Further discussion of the regulatory basis for this determination can be found in the MPCA's December 2009 Regional Haze State Implementation Plan submittal, in Appendix 9.3.

2.2 Affected Units

The units for which the MPCA must determine BART and establish emission limits consistent with that determination are:

Emission Unit Name	EU Number[1]	Control Equipment and Stack Numbers
Line 3 Indurating Furnace	EU225	CE146/SV103
Line 4 Indurating Furnace	EU261	CE103/SV118
Line 5 Indurating Furnace	EU282	CE113/SV127
Line 6 Indurating Furnace	EU315	CE126/SV144
Line 7 Indurating Furnace	EU334	CE136/SV151

2.3 The BART Determination

The MPCA's BART determinations for these units are documented in Appendix 9.3 of the December 2009 Regional Haze SIP submittal.

The NO_X BART determination for the five indurating furnaces is generally good combustion practices. This is coupled with low-NO_X burners in the pre-heat zone and fuel blending for Lines 4, 5, 6, and 7. Low NO_X burners were installed on Line 6 in 2006, Line 7 in 2008, and Lines 4 and 5 in 2009. Fuel blending on Line 3 is also part of the BART determination for that unit.

However, due to the lack of sufficient emissions data representing the range of operating conditions that influence emissions, the MPCA did not set a NO_X emission limit at the time of making the BART determination for the indurating furnaces. Instead, the MPCA and Minntac entered into an Administrative Order, under which Minntac agreed to install and maintain Continuous Emissions Monitoring Systems (CEMS) on all five lines and provide NO_X emission information to the MPCA.

The SO_2 BART determination for the indurating furnaces is operation of existing controls. In the initial Regional Haze SIP, the MPCA set a corresponding SO_2 emission limit for Lines 3, 4, and 5, as these lines are natural gas and biomass fired and the SO_2 emissions come primarily from the ore. However, as with NO_X, additional emission information was needed prior to setting an SO_2 limit from the coal-fired Lines 6 and 7. Minntac agreed in an Administrative Order to install and maintain SO_2 CEMS on these lines and provide emission information to the MPCA. In addition, Minntac has installed SO_2 CEMS on Lines 3, 4, and 5. After reviewing all the data, at the request of Minntac, the MPCA determined to reevaluate the limits for SO_2 on Line 3, 4, and 5.

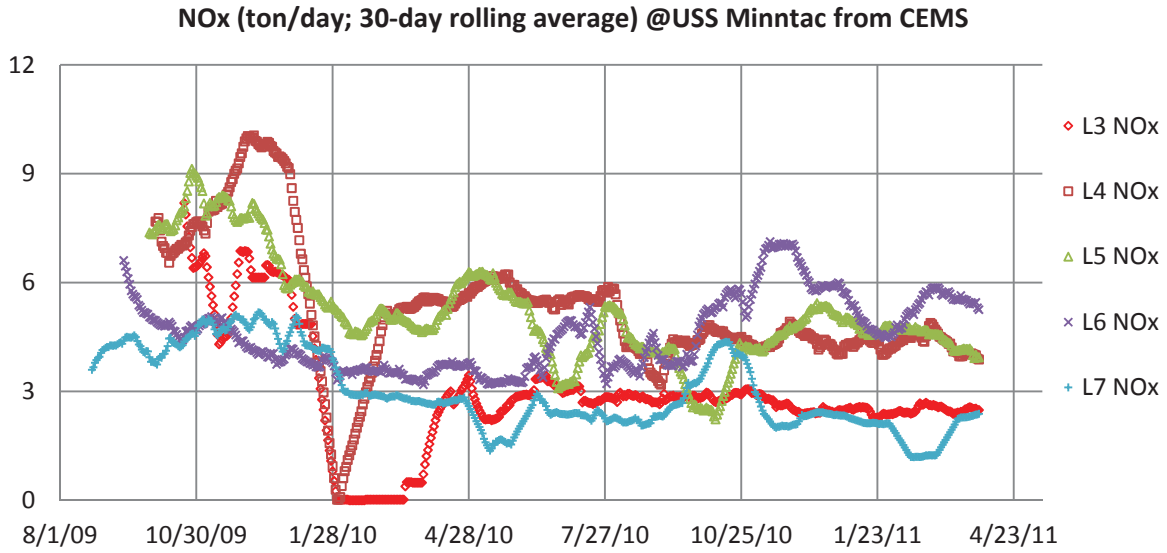
[1] The MPCA organizes conditions and illustrates associations in its permits using the Emission Unit (EU), Control Equipment (CE), and Stack/Vent (SV) numbers.

2.4 MPCA Determination of the BART Limit

The MPCA reviewed the NO_X and SO_2 emission information from all five indurating furnaces provided by Minntac.

NO_X emission data was received beginning in October 2007 and SO_2 emission data beginning in July 2008. The MPCA's review focused on the most recent data, from the end of August 2009 through the end of March 2011. Each line had a slightly different start date for the data that was analyzed. This difference is due to the high number of zero or very low values for NO_X emissions recorded through the spring and summer months of 2009. The data to analyze was determined by picking a start date that would allow the calculation of a 30-day rolling average that did not include these large areas of zero values. SO_2 emissions were then looked at over the same time frame.

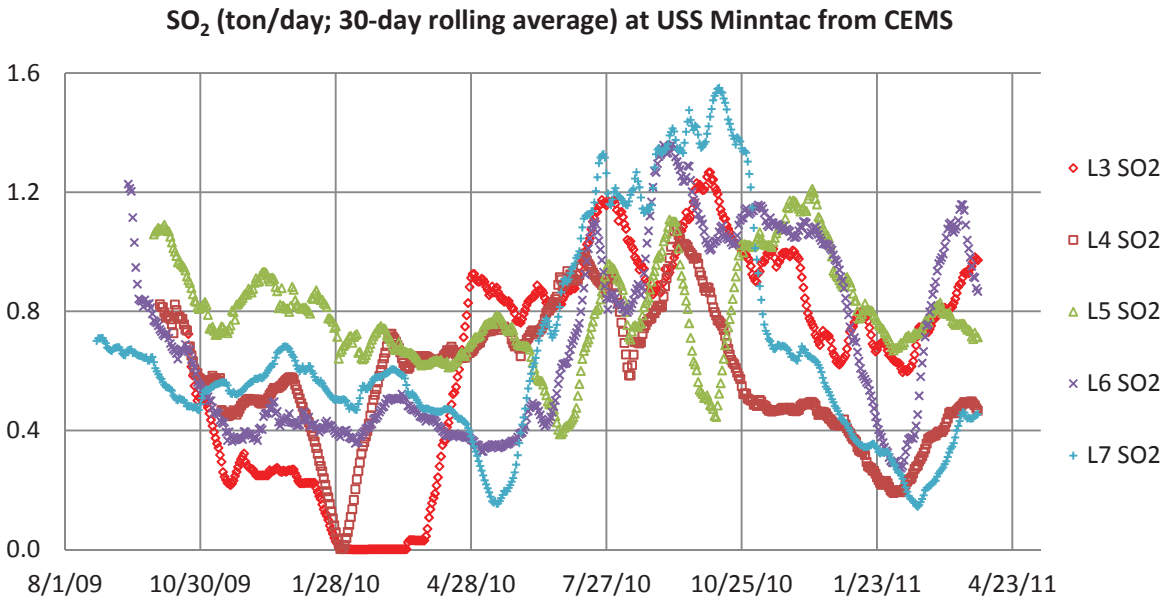
The following graph shows the variation in NO_X emissions over the analyzed time frame.



The following table shows descriptive statistics of the NO_X emissions for each line, in tons per day.

Minntac NO_X Emissions Descriptive Statistics (30 day rolling average, tons per day)					
	Line 3 NO_X	Line 4 NO_X	Line 5 NO_X	Line 6 NO_X	Line 7 NO_X
# Data Points	526	545	549	566	587
Minimum	0.000	0.02	2.23	3.18	1.19
Mean	2.92	5.27	5.20	4.57	3.01
Std Deviation	1.62	1.82	1.43	1.00	1.08
Median	2.74	4.78	4.874	4.51	2.70
Maximum	8.19	10.06	9.136	7.13	5.18

The following graphs show the variation in SO_2 emissions for all lines over the analyzed time frame.



The following table shows descriptive statistics of the SO_2 emissions for Lines 6 and 7, in tons per day

Minntac SO_2 Emissions Descriptive Statistics (30 day rolling average, tons per day)					
	Line 3	Line 4	Line 5	Line 6	Line 7
# Data Points	526	545	549	565	587
Minimum	0.00	0.00	0.29	0.27	0.14
Mean	0.66	0.58	0.80	0.70	0.67
Std Deviation	0.37	0.22	0.17	0.31	0.35
Median	0.77	0.58	0.77	0.60	0.58
Maximum	1.27	1.09	1.21	1.36	1.55

The most recent data for each line and each pollutant was plotted to the most appropriate statistical probability distribution, and a 99% prediction interval was constructed. The 99% upper prediction levels for each individual furnace are showing below:

Line	NO_X 99% UPL (Tons/Day)	SO_2 99% UPL (Tons/Day)
3	7.85	1.28
4	9.85	1.10
5	9.46	1.19
6	7.14	1.47
7	5.51	1.61

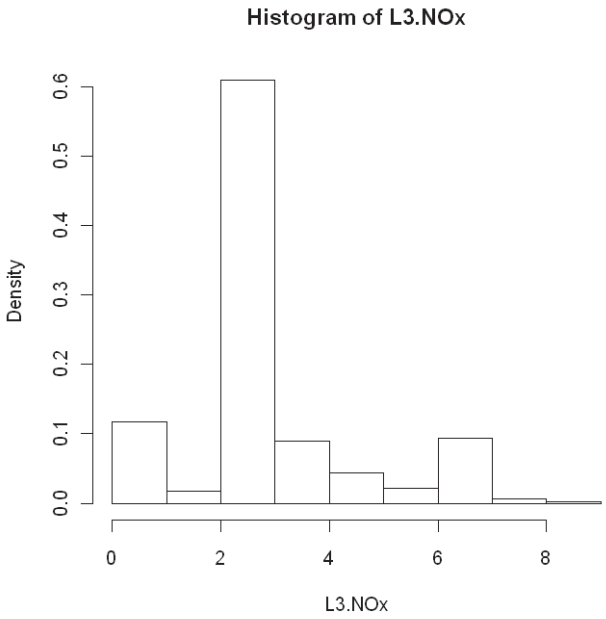
During the public comment period, Minntac requested that the limits be set as combined limits for all lines. Rather than simply summing the proposed limits, the MPCA develop a total facility using data available from the period when all five lines were operating together. This was October 22, 2009 – March 31, 2011 for NO_X data and October 29, 2009 – March 31, 2011 for SO_2 data, with a break from the beginning of January 2010 through the end of March 2010 when Lines 3 and Line 4 experienced downtime. The following table shows the descriptive statistics for the data when it is summed across all indurating lines.

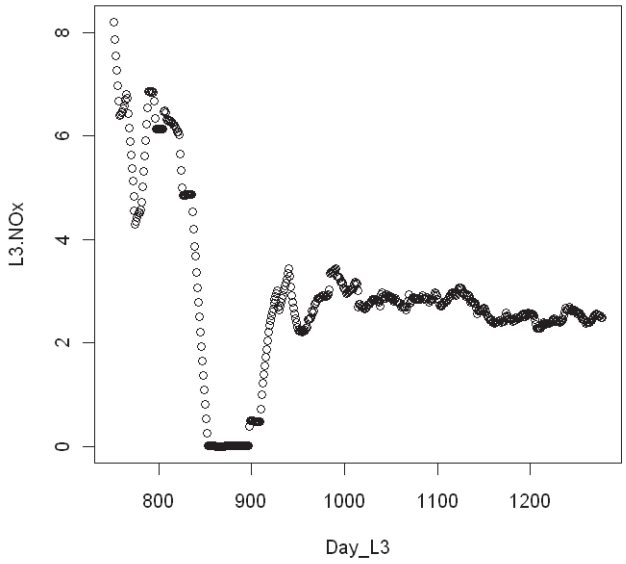
Minntac Emissions Data: All Lines		
	NO_X 30-Day Rolling Averages	SO_2 30-Day Rolling Averages
Count	436	429
Average	21.26	3.64
St Dev	4.87	1.04
Maximum	33.74	5.90
Minimum	16.08	1.99

A 99% UPL was then constructed based on this data. This results in the following BART limits: 33.89 tons per day NO_X and 6.35 tons per day SO_2. This limit is on a 30-day rolling average basis. Compliance is to be determined through continued operation of the CEMS.

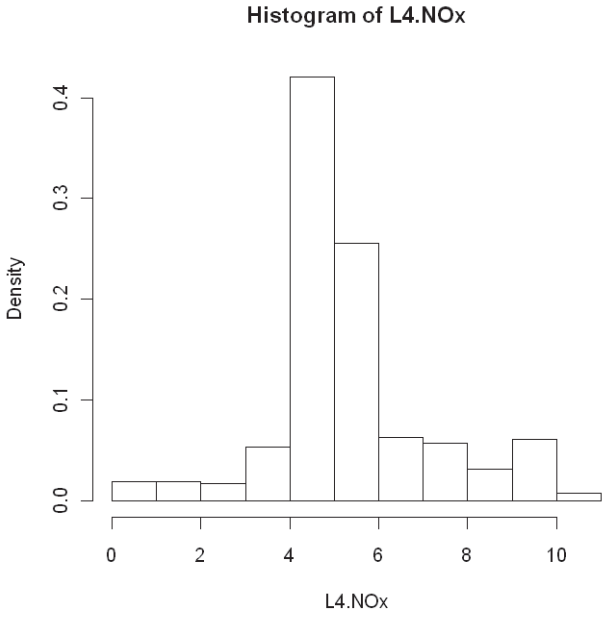
Supporting Plots

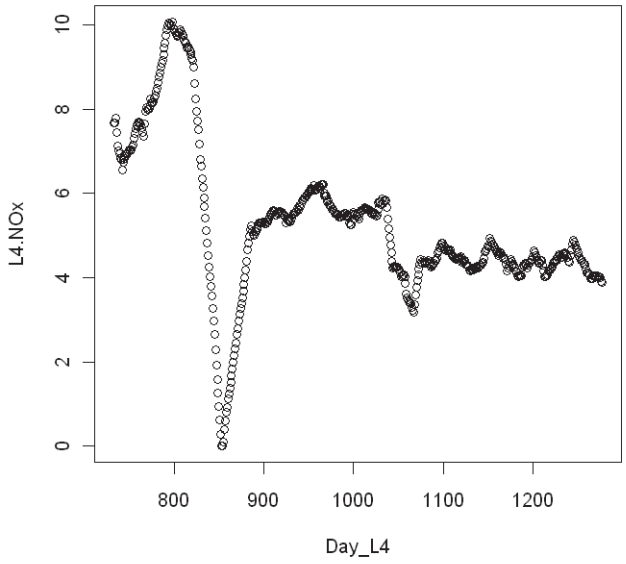
NO_X Recent Data - L3: 10/22/2009-3/31/2011



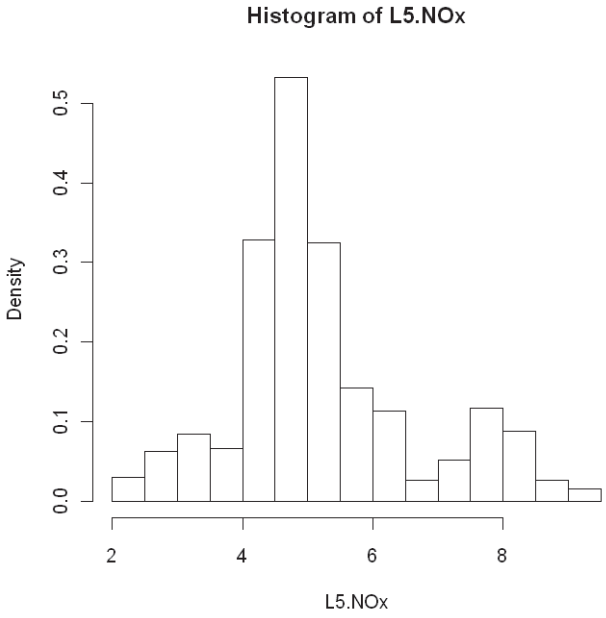


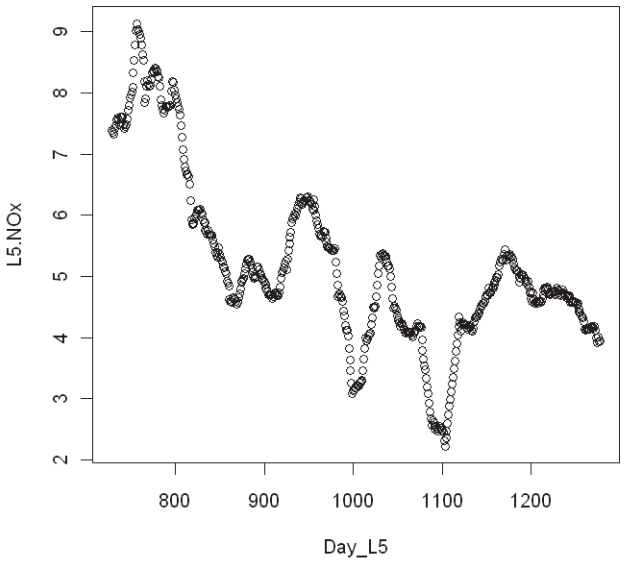
NO_X Recent Data - L4: 10/3/2009-3/31/2011



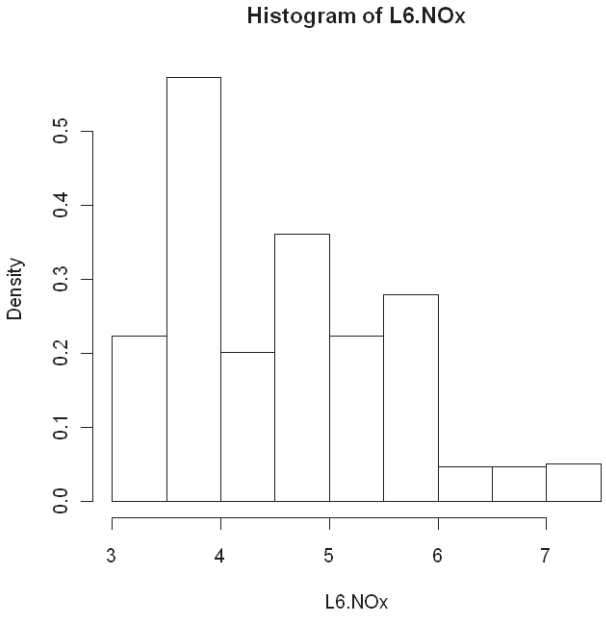


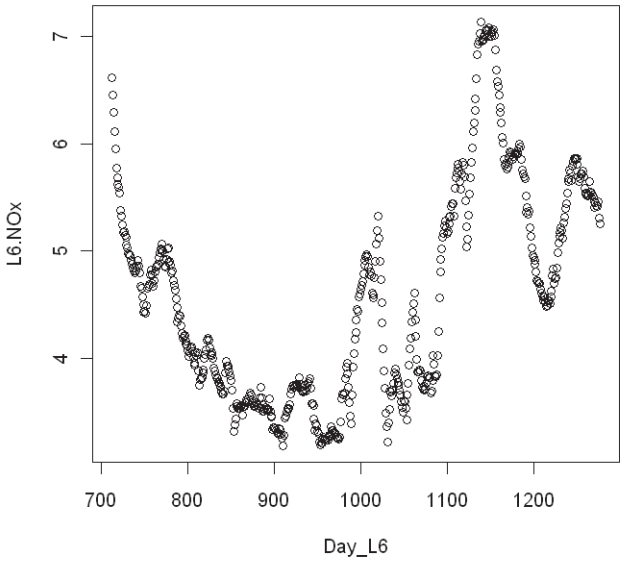
NO_X Recent Data - L5: 9/29/2009-3/31/2011



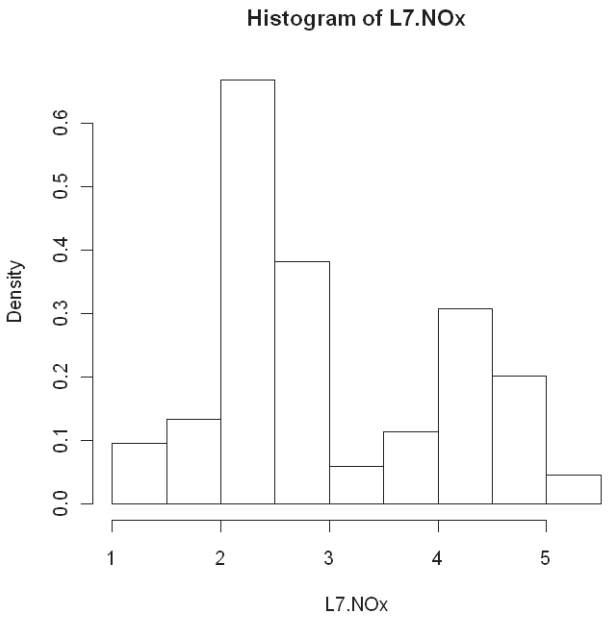


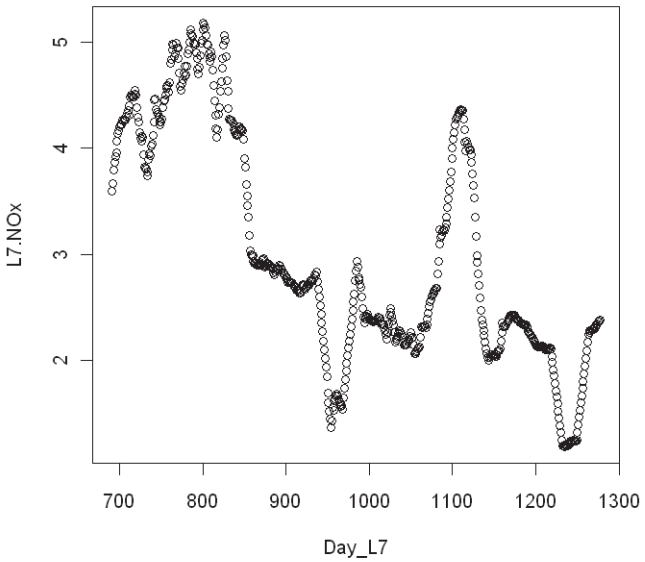
NO_X Recent Data - L6: 9/12/2009-3/31/2011



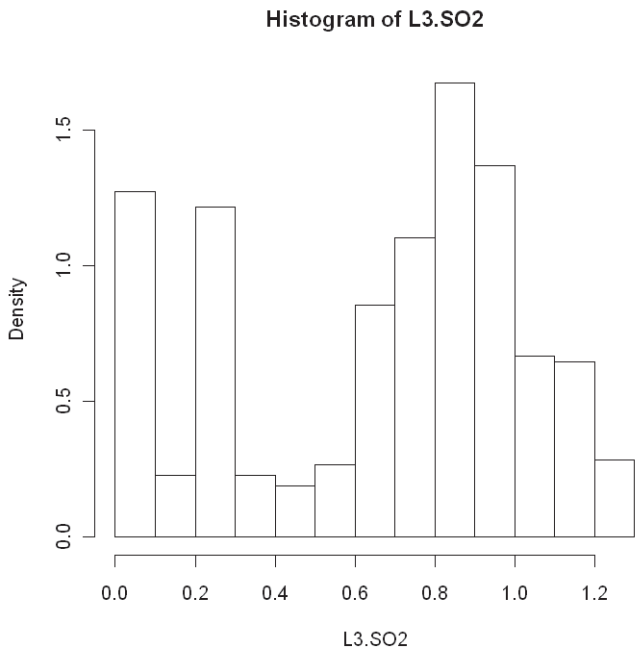


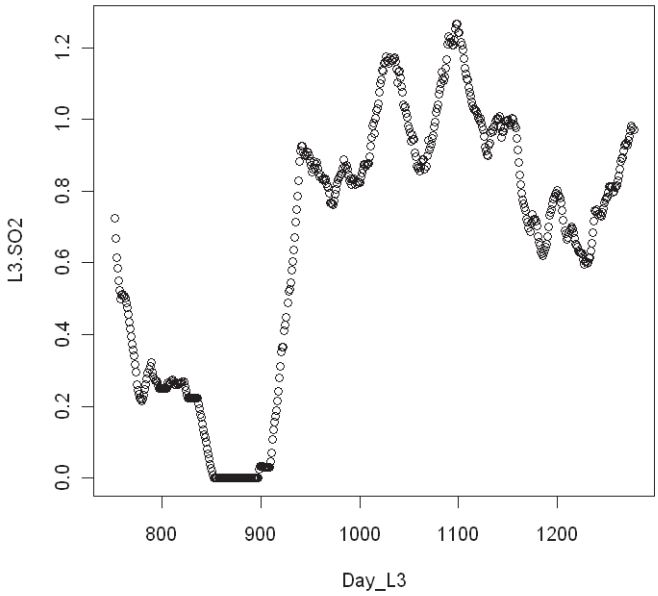
NO_X Recent Data - L7: 8/22/2009-3/31/2011





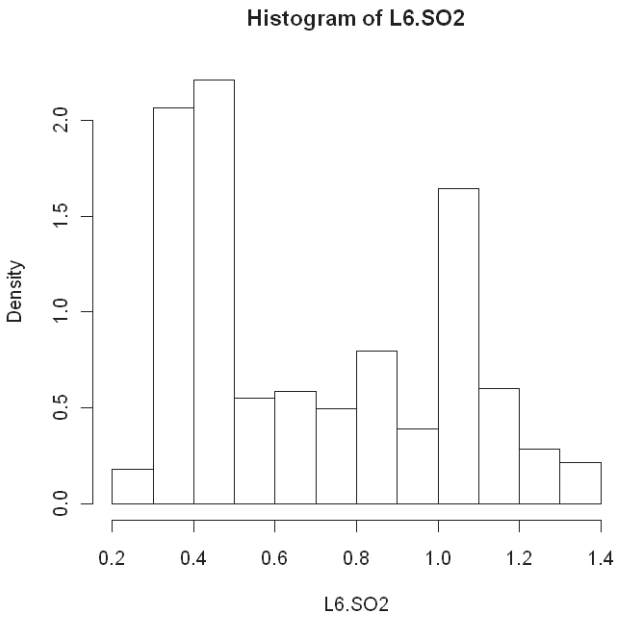
SO_2 Recent Data – L3

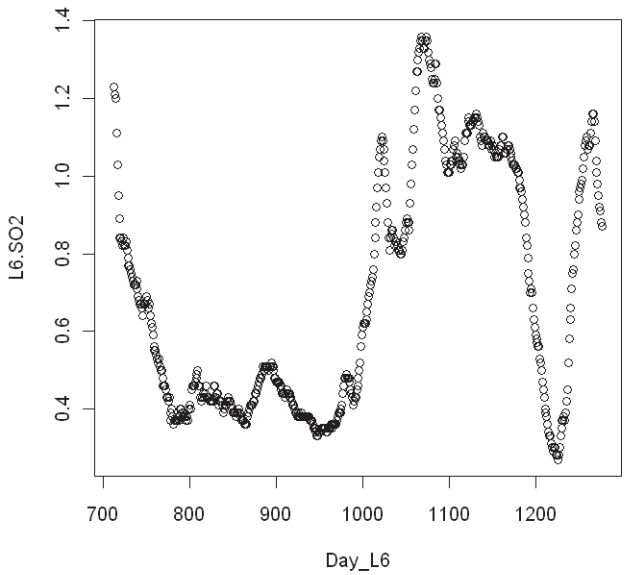




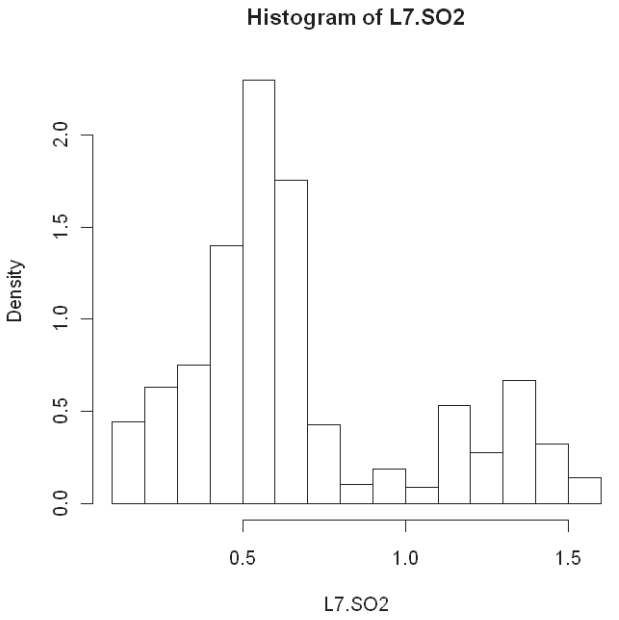
-

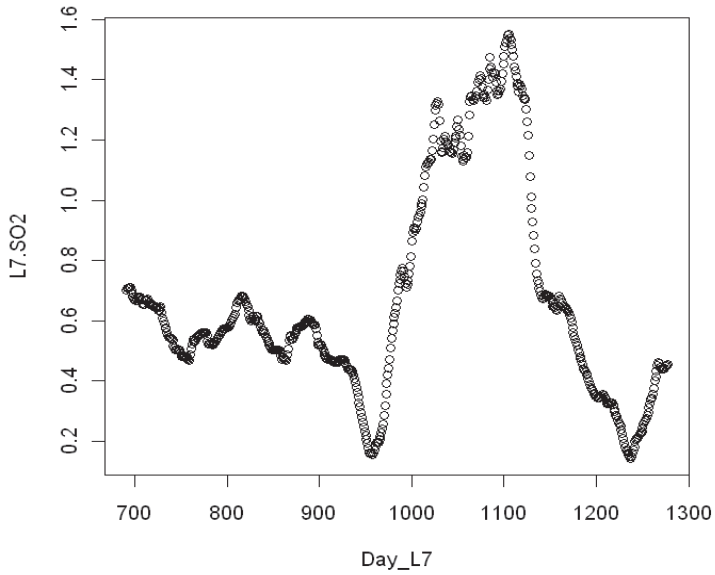
SO_2 Recent Data – L6





SO_2 Recent Data – L7





Minntac 30-day rolling average, ton/day, as submitted

Date	SimpleDay	L3 NOx	L4 NOx	L5 NOx	L6 NOx	L7 NOx	Sum L3 - L7 NOX	L3 SO2	L4 SO2	L5 SO2	L6 SO2	L7 SO2	Sum SO2
10/22/09	752	8.1939	7.0439	8.0954	4.4914	4.3807	32.2053						
10/23/09	753	7.8767	7.1063	8.3277	4.6517	4.4495	32.4119						
10/24/09	754	7.551	7.1429	8.5313	4.665	4.4551	32.3453						
10/25/09	755	7.271	7.299	8.7884	4.6896	4.5057	32.5537						
10/26/09	756	6.9715	7.4311	9.0248	4.7808	4.5644	32.7726						
10/27/09	757	6.6813	7.5344	9.1365	4.8223	4.5881	32.7626						
10/28/09	758	6.4043	7.612	9.0355	4.7755	4.5954	32.4227						
10/29/09	759	6.4201	7.6227	9.0044	4.7	4.5295	32.2767	0.5107	0.5767	0.8076	0.5543	0.4685	2.9178
10/30/09	760	6.4436	7.6675	8.9487	4.6691	4.6209	32.3498	0.513	0.572	0.8122	0.5482	0.4883	2.9337
10/31/09	761	6.479	7.6882	8.8905	4.7235	4.7998	32.581	0.5077	0.5661	0.816	0.5391	0.5083	2.9372
11/1/09	762	6.5231	7.6803	8.7885	4.8051	4.8384	32.6354	0.5065	0.564	0.8239	0.5302	0.5229	2.9475
11/2/09	763	6.5887	7.6179	8.6305	4.8502	4.9249	32.6122	0.5016	0.5687	0.8312	0.5234	0.5322	2.9571
11/3/09	764	6.7029	7.5493	8.527	4.8573	4.9833	32.6198	0.4895	0.5674	0.821	0.5251	0.5375	2.9405
11/4/09	765	6.8114	7.441	8.1818	4.8761	4.9735	32.2838	0.4764	0.5542	0.7881	0.5131	0.5334	2.8652
11/5/09	766	6.7307	7.3503	7.8438	4.9356	4.864	31.7244	0.4572	0.5528	0.7419	0.5	0.537	2.7889
11/6/09	767	6.4273	7.6428	7.9107	4.9806	4.8905	31.8519	0.4349	0.5679	0.7412	0.4996	0.5437	2.7873
11/7/09	768	6.1455	7.9543	8.1083	5.0145	4.9891	32.2117	0.4153	0.5836	0.7482	0.476	0.5476	2.7707
11/8/09	769	5.8873	8.0394	8.1997	5.0164	4.9503	32.0931	0.3946	0.5758	0.7349	0.4571	0.5504	2.7128
11/9/09	770	5.6299	7.9856	8.1428	5.0634	4.9461	31.7678	0.3744	0.5723	0.7206	0.4649	0.5545	2.6867
11/10/09	771	5.3808	7.9981	8.1051	4.9976	4.8439	31.3255	0.3559	0.5684	0.7207	0.4599	0.5555	2.6604
11/11/09	772	5.1334	8.0176	8.1268	4.925	4.7114	30.9142	0.3412	0.5671	0.7274	0.4547	0.5568	2.6472
11/12/09	773	4.8326	8.2553	8.2187	4.8604	4.585	30.752	0.3176	0.5758	0.7374	0.4337	0.5595	2.624
11/13/09	774	4.5598	8.0856	8.3204	4.8531	4.5497	30.3686	0.2945	0.4682	0.7496	0.4276	0.5618	2.5017
11/14/09	775	4.3016	8.1472	8.3617	4.9189	4.6071	30.3365	0.2601	0.4635	0.7463	0.4233	0.5621	2.4553
11/15/09	776	4.3498	8.155	8.3377	5.016	4.6439	30.5024	0.244	0.4601	0.7351	0.4277	0.5602	2.4271
11/16/09	777	4.4253	8.1788	8.4015	5.0305	4.7092	30.7453	0.2338	0.4533	0.7329	0.3949	0.5596	2.3745
11/17/09	778	4.4755	8.2785	8.3914	4.8918	4.7734	30.8106	0.2235	0.4478	0.7264	0.3657	0.5512	2.3146
11/18/09	779	4.5134	8.3137	8.3627	4.9067	4.6835	30.78	0.221	0.4492	0.7398	0.3952	0.5333	2.3385
11/19/09	780	4.5246	8.4321	8.3464	4.8668	4.6942	30.8641	0.2161	0.4565	0.7525	0.3799	0.5243	2.3293
11/20/09	781	4.572	8.5056	8.2714	4.7963	4.7738	30.9191	0.2217	0.457	0.8026	0.3627	0.5225	2.3665
11/21/09	782	4.7124	8.6271	8.2556	4.813	4.8895	31.2976	0.2319	0.4676	0.7976	0.3682	0.5288	2.3941
11/22/09	783	5.019	8.7745	8.1008	4.7211	4.9305	31.5459	0.247	0.4615	0.7717	0.3684	0.5228	2.3714
11/23/09	784	5.3214	8.8513	7.8928	4.68	5.0038	31.7493	0.2608	0.4532	0.8225	0.3695	0.5214	2.4274
11/24/09	785	5.6221	9.0031	7.7992	4.6335	5.0812	32.1391	0.2771	0.4624	0.824	0.373	0.524	2.4605
11/25/09	786	5.9211	9.0884	7.7251	4.5558	5.1157	32.4061	0.2917	0.4721	0.8314	0.3764	0.5267	2.4983
11/26/09	787	6.2358	9.1473	7.6728	4.4751	5.0615	32.5925	0.3034	0.4832	0.8381	0.3769	0.5295	2.5311
11/27/09	788	6.5527	9.2882	7.7157	4.341	5.0548	32.9524	0.3128	0.4905	0.8447	0.3696	0.5323	2.5499
11/28/09	789	6.8708	9.4631	7.7783	4.37	4.9946	33.4768	0.3224	0.4933	0.8546	0.3964	0.54	2.6067
11/29/09	790	6.8585	9.5662	7.7798	4.3965	4.981	33.582	0.2949	0.4985	0.8596	0.3951	0.5464	2.5945
11/30/09	791	6.8396	9.7439	7.7659	4.3909	4.9814	33.7217	0.2821	0.5035	0.8564	0.3888	0.5499	2.5807
12/1/09	792	6.8707	9.8934	7.7757	4.3008	4.9008	33.7414	0.2776	0.5062	0.8761	0.3831	0.556	2.599
12/2/09	793	6.8589	9.9784	7.786	4.2304	4.8467	33.7004	0.2716	0.5049	0.8707	0.3881	0.56	2.5953
12/3/09	794	6.85	10.042	7.7978	4.1837	4.7473	33.6208	0.2713	0.5003	0.8631	0.3831	0.5628	2.5806
12/4/09	795	6.6705	10.0246	7.7878	4.1985	4.7018	33.3832	0.2681	0.5014	0.8754	0.3729	0.566	2.5838
12/5/09	796	6.3457	9.9758	8.0374	4.2146	4.7695	33.343	0.257	0.5038	0.8961	0.3761	0.5728	2.6058
12/6/09	797	6.1403	10.004	8.1945	4.1561	4.872	33.3669	0.2489	0.5013	0.9112	0.3746	0.5732	2.6092
12/7/09	798	6.1403	10.0601	8.1707	4.1289	4.9891	33.4891	0.2489	0.504	0.8991	0.3657	0.5726	2.5903
12/8/09	799	6.1403	9.909	8.0417	4.1171	5.0184	33.2265	0.2489	0.4932	0.9009	0.4039	0.5764	2.6233
12/9/09	800	6.1403	9.8875	7.9746	4.0676	5.1179	33.1879	0.2489	0.4909	0.9208	0.4082	0.5783	2.6471
12/10/09	801	6.1403	9.8194	7.9056	4.0174	5.1785	33.0612	0.2489	0.4903	0.9297	0.4025	0.5757	2.6471
12/11/09	802	6.1403	9.7837	7.8385	4.0535	5.165	32.981	0.2489	0.4934	0.9321	0.4462	0.5786	2.6992
12/12/09	803	6.1403	9.73	7.7785	4.0938	5.1413	32.8839	0.2489	0.4967	0.9318	0.4552	0.5844	2.717
12/13/09	804	6.1403	9.7537	7.7357	4.1011	5.0669	32.7977	0.2489	0.5031	0.9267	0.4584	0.5936	2.7307
12/14/09	805	6.1403	9.8276	7.6413	4.0606	4.9824	32.6522	0.2489	0.5094	0.9093	0.4579	0.6015	2.727
12/15/09	806	6.4755	9.818	7.4673	4.0078	4.974	32.7426	0.2663	0.5194	0.9006	0.4728	0.6101	2.7692
12/16/09	807	6.4865	9.8827	7.4572	3.9496	4.8972	32.6732	0.2615	0.526	0.9124	0.4766	0.6157	2.7922
12/17/09	808	6.4615	9.8523	7.2707	3.9376	4.8556	32.3777	0.2638	0.5359	0.9126	0.4926	0.6227	2.8276
12/18/09	809	6.324	9.7724	7.0758	4.0511	4.8176	32.0409	0.2657	0.5428	0.908	0.4963	0.6233	2.8361
12/19/09	810	6.3024	9.7466	6.9145	4.0254	4.9109	31.8998	0.2714	0.5418	0.8821	0.4574	0.6443	2.797
12/20/09	811	6.2909	9.6293	6.7962	4.0499	4.8655	31.6318	0.2744	0.5424	0.8675	0.464	0.6614	2.8097
12/21/09	812	6.3053	9.5888	6.7321	3.8791	4.7367	31.242	0.2685	0.544	0.8103	0.4282	0.6675	2.7185
12/22/09	813	6.2847	9.5592	6.6602	3.7437	4.5925	30.8403	0.2618	0.5484	0.8218	0.4152	0.6693	2.7165
12/23/09	814	6.2722	9.4642	6.6586	3.8001	4.4486	30.6437	0.2605	0.5515	0.8778	0.4277	0.6741	2.7916
12/24/09	815	6.2455	9.4808	6.6357	3.8038	4.3095	30.4753	0.2653	0.5586	0.8188	0.435	0.6804	2.7581
12/25/09	816	6.2186	9.4537	6.5048	3.8198	4.1886	30.1855	0.263	0.5649	0.8119	0.4321	0.6819	2.7538
12/26/09	817	6.2019	9.4113	6.2352	3.8593	4.0993	29.807	0.2613	0.5694	0.8087	0.4378	0.6813	2.7585
12/27/09	818	6.1751	9.3545	5.933	3.8901	4.1786	29.5313	0.2646	0.574	0.8089	0.4431	0.6797	2.7703
12/28/09	819	6.1382	9.2902	5.8616	4.0002	4.3197	29.6099	0.2667	0.578	0.7982	0.4566	0.6741	2.7736
12/29/09	820	6.0886	9.1937	5.8404	4.0362	4.3887	29.5476	0.2649	0.578	0.8181	0.4279	0.6638	2.7527
12/30/09	821	6.0815	9.1578	5.865	4.0764	4.5357	29.7164	0.2687	0.5771	0.8822	0.4262	0.6535	2.8077
12/31/09	822	6.022	8.9904	5.9463	4.1659	4.6324	29.757	0.2685	0.5716	0.8723	0.4263	0.6464	2.7851
Break - Line 3 Down 1/1/10 - 3/29/10 and Line 4 down 1/1/10 - 2/1/10													
4/1/10	913	1.3859	5.4761	4.7237	3.459	2.6572	17.7019	0.135	0.639	0.6292	0.441	0.4667	2.3109
4/2/10	914	1.5493	5.4924	4.6921	3.4907	2.6632	17.8877	0.1556	0.6372	0.6303	0.44	0.4672	2.3303
4/3/10	915	1.7181	5.5173	4.7022	3.5207	2.6472	18.1055	0.1729	0.6381	0.6343	0.4367	0.4653	2.3473
4/4/10	916	1.8762	5.5404	4.6934	3.5329	2.633	18.2759	0.188	0.634	0.6341	0.4324	0.4633	2.3518
4/5/10	917	2.0318	5.5808	4.7383	3.5277	2.6332	18.5118	0.215	0.6339	0.6364	0.4264	0.4625	2.3742
4/6/10	918	2.2057	5.5681	4.8342	3.57	2.6458	18.8238	0.2428	0.6326	0.6318	0.4152	0.4635	2.3859
4/7/10	919	2.3446	5.553	4.9706	3.6604	2.7049	19.2335	0.2794	0.6343	0.6338	0.4101	0.4622	2.4198
4/8/10	920	2.4324	5.5456	5.0596	3.7127	2.7172	19.4675	0.3125	0.6392	0.6374	0.4067	0.4633	2.4591
4/9/10	921	2.5206	5.496	5.0934	3.74	2.7057	19.5557	0.3506	0.6432	0.6279	0.3977	0.4659	2.4853
4/10/10	922	2.594	5.4815	5.1396	3.7471	2.7065	19.6687	0.3664	0.6515	0.6258	0.3936	0.4709	2.5082
4/11/10	923	2.6599	5.4849	5.2113	3.7304	2.671	19.7575	0.3664	0.6574	0.6232	0.3866	0.4713	2.5049
4/12/10	924	2.7596	5.469	5.2524	3.7409	2.6846	19.9065	0.4111	0.6692	0.631	0.3834	0.4719	2.5666
4/13/10	925	2.8357	5.3059	5.109	3.7561	2.6926	19.6993	0.4256	0.6631	0.6116	0.3806	0.4706	2.5515
4/14/10	926	2.9022	5.3879	5.2757	3.7501	2.7014	20.0173	0.4493	0.6713	0.6127	0.3862	0.4713	2.5908
4/15/10	927	2.9571	5.3632	5.4264	3.7537	2.7069	20.2073	0.4873	0.681	0.6194	0.3834	0.4673	2.6384
4/16/10	928	3.0044	5.3425	5.5399	3.7299	2.7253	20.342	0.522	0.6708	0.6194	0.378	0.4617	2.6519
4/17/10	929	2.6905	5.3292	5.6374	3.8179	2.7411	20.2161	0.5273	0.6632	0.6278	0.3896	0.456	2.6639

4/18/10	930	2.642	5.3528	5.7299	3.7496	2.7516	20.2259	0.5457	0.6551	0.6303	0.3826	0.4483	2.662
4/19/10	931	2.7075	5.4207	5.8738	3.7301	2.7563	20.4884	0.5793	0.6481	0.6383	0.3846	0.4395	2.6898
4/20/10	932	2.7835	5.4834	5.9493	3.6908	2.7556	20.6626	0.6049	0.645	0.6525	0.383	0.4394	2.7248
4/21/10	933	2.856	5.5267	5.981	3.6853	2.7706	20.8196	0.6367	0.6431	0.658	0.3829	0.4391	2.7598
4/22/10	934	2.9112	5.5204	6.0231	3.6902	2.8018	20.9467	0.6706	0.6432	0.6624	0.3816	0.4365	2.7943
4/23/10	935	3.0254	5.5499	5.9846	3.7079	2.7944	21.0622	0.7127	0.6455	0.6523	0.3802	0.4317	2.8224
4/24/10	936	3.0947	5.5725	6.0492	3.7425	2.7969	21.2558	0.749	0.6442	0.6493	0.3764	0.4264	2.8453
4/25/10	937	3.1505	5.6317	6.1084	3.6931	2.8337	21.4174	0.7866	0.6508	0.662	0.3759	0.4211	2.8964
4/26/10	938	3.2388	5.6407	6.1642	3.7236	2.7443	21.5116	0.8278	0.6606	0.6791	0.3772	0.4073	2.952
4/27/10	939	3.338	5.6072	6.2141	3.7668	2.6696	21.5957	0.8817	0.66	0.6857	0.3749	0.3952	2.9975
4/28/10	940	3.4425	5.7135	6.2927	3.7826	2.5975	21.8288	0.9121	0.6641	0.6934	0.369	0.3795	3.0181
4/29/10	941	3.2801	5.6926	6.2653	3.806	2.5123	21.5563	0.9249	0.667	0.6984	0.3668	0.3623	3.0194
4/30/10	942	3.0829	5.7586	6.1909	3.7194	2.4325	21.1843	0.9255	0.6753	0.7091	0.3622	0.3455	3.0176
5/1/10	943	2.9129	5.815	6.1821	3.5784	2.3489	20.8373	0.91	0.6848	0.7141	0.3524	0.329	2.9903
5/2/10	944	2.7853	5.8579	6.2041	3.5722	2.2675	20.687	0.9021	0.689	0.7112	0.3518	0.3144	2.9685
5/3/10	945	2.6659	5.8865	6.2338	3.5589	2.1775	20.5226	0.8994	0.6932	0.7146	0.35	0.2968	2.954
5/4/10	946	2.5629	5.8838	6.2422	3.4319	2.099	20.2198	0.9004	0.6957	0.719	0.3394	0.2805	2.935
5/5/10	947	2.469	5.9324	6.2937	3.3192	2.0189	20.0332	0.9094	0.71	0.7343	0.3291	0.265	2.9478
5/6/10	948	2.3926	5.9618	6.2901	3.3873	1.9353	19.9671	0.9061	0.7178	0.7417	0.3294	0.2489	2.9439
5/7/10	949	2.3043	6.0018	6.3013	3.3646	1.8417	19.8137	0.8988	0.7287	0.7532	0.339	0.2324	2.9521
5/8/10	950	2.2398	6.0244	6.2326	3.3151	1.6923	19.5042	0.8826	0.7332	0.7563	0.3414	0.2188	2.9323
5/9/10	951	2.2271	6.0438	6.2219	3.3	1.5962	19.389	0.8726	0.7323	0.7585	0.3431	0.2056	2.9121
5/10/10	952	2.2334	6.0798	6.2104	3.2172	1.5142	19.255	0.8542	0.7349	0.7624	0.3458	0.192	2.8893
5/11/10	953	2.2392	6.1181	6.1711	3.193	1.4415	19.1629	0.8616	0.7329	0.7625	0.3486	0.1773	2.8829
5/12/10	954	2.239	6.0919	6.105	3.205	1.3664	19.0073	0.8834	0.7384	0.7646	0.3526	0.1617	2.9007
5/13/10	955	2.2026	6.0794	6.0781	3.2105	1.4256	18.9962	0.863	0.7365	0.7571	0.3514	0.1577	2.8657
5/14/10	956	2.2221	6.1803	6.2606	3.2442	1.5567	19.4639	0.8747	0.7515	0.7813	0.3527	0.1627	2.9229
5/15/10	957	2.2295	6.0745	6.1465	3.2612	1.529	19.2407	0.8797	0.7469	0.7853	0.3453	0.1538	2.911
5/16/10	958	2.2501	6.0791	5.9994	3.24	1.6135	19.1821	0.8638	0.7377	0.7801	0.3407	0.1548	2.8771
5/17/10	959	2.2722	6.0971	5.9132	3.2413	1.6346	19.1584	0.8502	0.7459	0.7821	0.3437	0.1629	2.8848
5/18/10	960	2.296	6.1419	5.8404	3.2342	1.6601	19.1726	0.8404	0.7496	0.7748	0.3454	0.1724	2.8826
5/19/10	961	2.4463	6.1598	5.791	3.2517	1.677	19.3258	0.8452	0.7484	0.7659	0.3487	0.1833	2.8915
5/20/10	962	2.4497	6.1685	5.6926	3.2333	1.6637	19.2078	0.8319	0.7482	0.7573	0.3538	0.1969	2.8881
5/21/10	963	2.4667	6.1118	5.6595	3.2787	1.6291	19.1458	0.8347	0.7425	0.7445	0.3567	0.1961	2.8745
5/22/10	964	2.4953	6.2236	5.6704	3.2764	1.607	19.2727	0.8309	0.7379	0.7366	0.3528	0.1956	2.8538
5/23/10	965	2.6104	6.2066	5.6431	3.2736	1.5646	19.2983	0.8343	0.7348	0.7325	0.355	0.2069	2.8635
5/24/10	966	2.5855	6.2228	5.7319	3.3567	1.5791	19.476	0.8207	0.7296	0.7438	0.3595	0.216	2.8696
5/25/10	967	2.6228	6.0032	5.7213	3.3252	1.5729	19.2454	0.8118	0.7056	0.7487	0.3645	0.2278	2.8584
5/26/10	968	2.7517	5.9329	5.7279	3.3231	1.5378	19.2734	0.8095	0.6925	0.7365	0.3638	0.2402	2.8425
5/27/10	969	2.774	5.9394	5.6321	3.3062	1.641	19.2927	0.793	0.6823	0.7169	0.3646	0.2591	2.8159
5/28/10	970	2.7971	5.9372	5.5594	3.2948	1.7323	19.3208	0.7681	0.6862	0.7016	0.3688	0.285	2.8097
5/29/10	971	2.85	5.8087	5.4907	3.2912	1.8137	19.2543	0.7669	0.6885	0.69	0.3774	0.3168	2.8396
5/30/10	972	2.857	5.819	5.4668	3.2648	1.894	19.3016	0.7648	0.6746	0.6851	0.387	0.3573	2.8688
5/31/10	973	2.8654	5.7295	5.4695	3.2489	1.9705	19.2838	0.7618	0.6493	0.6843	0.3902	0.3923	2.8779
6/1/10	974	2.8801	5.7176	5.4693	3.2454	2.0407	19.3531	0.774	0.681	0.6845	0.3933	0.4193	2.9521
6/2/10	975	2.8874	5.6898	5.4468	3.2385	2.112	19.3745	0.7914	0.6808	0.6844	0.4023	0.4436	3.0025
6/3/10	976	2.9063	5.6203	5.4281	3.263	2.1785	19.3962	0.8051	0.6905	0.6828	0.4144	0.4732	3.066
6/4/10	977	2.9082	5.625	5.4292	3.4068	2.2461	19.6153	0.8206	0.7048	0.6829	0.4416	0.5085	3.1584
6/5/10	978	2.9158	5.5651	5.4277	3.6236	2.3183	19.8505	0.8325	0.7109	0.68	0.4645	0.5406	3.2285
6/6/10	979	2.902	5.5195	5.4627	3.6598	2.3902	19.9342	0.8384	0.7203	0.6719	0.4756	0.566	3.2722
6/7/10	980	2.8917	5.5105	5.2284	3.6594	2.4664	19.7564	0.8431	0.7313	0.6466	0.483	0.5903	3.2943
6/8/10	981	2.9119	5.5075	5.0496	3.6766	2.5503	19.6959	0.8481	0.7361	0.6273	0.4913	0.6129	3.3157
6/9/10	982	2.9287	5.4977	4.8546	3.8038	2.6244	19.7092	0.8488	0.7317	0.607	0.4837	0.6253	3.2965
6/10/10	983	3.0332	5.4824	4.671	3.9193	2.7533	19.8592	0.8635	0.7232	0.5848	0.4829	0.6435	3.2979
6/11/10	984	3.3378	5.4428	4.7094	3.9555	2.8408	20.2863	0.887	0.7309	0.5741	0.4793	0.6678	3.3391
6/12/10	985	3.3421	5.4385	4.7143	3.8543	2.9322	20.2814	0.8703	0.7311	0.5686	0.465	0.7014	3.3364
6/13/10	986	3.3649	5.4432	4.6702	3.7302	2.8742	20.0827	0.8649	0.7384	0.5657	0.4521	0.725	3.3461
6/14/10	987	3.3717	5.4756	4.6547	3.5845	2.7619	19.8484	0.8709	0.7432	0.5657	0.4375	0.7368	3.3541
6/15/10	988	3.3841	5.4806	4.5889	3.4613	2.7826	19.6975	0.8619	0.7551	0.5543	0.4253	0.7541	3.3507
6/16/10	989	3.3989	5.5073	4.44	3.3859	2.7175	19.4496	0.845	0.7745	0.5338	0.414	0.7649	3.3322
6/17/10	990	3.4134	5.5189	4.3608	3.6546	2.6843	19.632	0.8287	0.7945	0.5182	0.4194	0.7756	3.3364
6/18/10	991	3.4372	5.531	4.2	3.9163	2.5952	19.6797	0.8341	0.8023	0.4973	0.4276	0.7667	3.328
6/19/10	992	3.2813	5.4772	4.124	4.0394	2.4894	19.4113	0.8195	0.803	0.4879	0.4349	0.7469	3.2922
6/20/10	993	3.2824	5.4428	4.1134	4.1726	2.4071	19.4183	0.8317	0.8117	0.4868	0.4455	0.7248	3.3005
6/21/10	994	3.2715	5.4633	4.0311	4.2341	2.3551	19.3551	0.8329	0.8235	0.4888	0.4607	0.7122	3.3181
6/22/10	995	3.2492	5.3083	3.8243	4.3589	2.3843	19.125	0.8333	0.8307	0.4705	0.4795	0.7214	3.3354
6/23/10	996	3.1782	5.2638	3.6275	4.4568	2.4034	18.9297	0.8175	0.8409	0.4483	0.5006	0.7346	3.3419
6/24/10	997	3.1756	5.2637	3.4578	4.4361	2.4151	18.7483	0.8207	0.8491	0.4266	0.5241	0.7547	3.3752
6/25/10	998	3.1655	5.466	3.2633	4.5726	2.4298	18.8972	0.826	0.8889	0.4022	0.5562	0.7815	3.4548
6/26/10	999	3.0668	5.5059	3.0874	4.5954	2.4061	18.6616	0.8244	0.9142	0.387	0.5853	0.8147	3.5256
6/27/10	1000	3.044	5.5417	3.1356	4.6448	2.385	18.7511	0.8242	0.9067	0.3874	0.6105	0.8638	3.5926
6/28/10	1001	3.0106	5.3843	3.1546	4.6815	2.3793	18.6103	0.8409	0.8827	0.3951	0.6226	0.8927	3.634
6/29/10	1002	2.9558	5.5149	3.1863	4.7176	2.3754	18.75	0.8511	0.8905	0.4087	0.6248	0.9081	3.6832
6/30/10	1003	2.97	5.4535	3.1869	4.7867	2.375	18.7721	0.86	0.8973	0.4139	0.6244	0.905	3.7006
7/1/10	1004	2.9978	5.4777	3.2187	4.8707	2.3657	18.9306	0.8752	0.9351	0.4159	0.6289	0.8994	3.7545
7/2/10	1005	3.0024	5.4363	3.2111	4.9133	2.3618	18.9249	0.8735	0.9117	0.4204	0.6487	0.9071	3.7614
7/3/10	1006	3.0193	5.3965	3.2079	4.9443	2.367	18.935	0.8694	0.9239	0.4272	0.6714	0.9278	3.8197
7/4/10	1007	3.036	5.5393	3.2618	4.9615	2.3744	19.173	0.8744	0.9195	0.4352	0.6911	0.9431	3.8633
7/5/10	1008	3.0416	5.5894	3.2774	4.9485	2.3806	19.2375	0.8775	0.9105	0.4441	0.702	0.9502	3.8843
7/6/10	1009	3.0435	5.6052	3.3064	4.8452	2.3904	19.1907	0.8767	0.9055	0.4564	0.7174	0.9603	3.9163
7/7/10	1010	3.1296	5.6137	3.2848	4.778	2.4045	19.2106	0.8954	0.9032	0.4755	0.7285	0.9797	3.9823
7/8/10	1011	3.1727	5.6119	3.4686	4.8048	2.4061	19.4641	0.9244	0.906	0.5165	0.7429	0.988	4.0778
7/9/10	1012	3.1495	5.6438	3.644	4.7713	2.3972	19.6058	0.9497	0.921	0.556	0.7599	1.0015	4.1881
7/10/10	1013	3.1374	5.657	3.822	4.6068	2.4006	19.6238	0.9821	0.9508	0.5998	0.7987	1.0446	4.376
7/11/10	1014	3.0086	5.6435	3.9928	4.5654	2.3468	19.5571	0.99	0.9786	0.6402	0.8374	1.0819	4.5281
7/12/10	1015	2.6945	5.6207	3.9447	4.592	2.3423	19.1942	0.9613	0.9936	0.6668	0.8776	1.1112	4.6105
7/13/10	1016	2.7389	5.6266	3.9854	4.7507	2.3391	19.4407	1.0021	0.9888	0.6796	0.9234	1.1196	4.7135
7/14/10	1017	2.7438	5.6246	4.034	4.9021	2.3346	19.6391	1.0242	0.9707	0.6953	0.9688	1.1239	4.7829
7/15/10	1018	2.7139	5.6015	4.0605	5.064	2.3051	19.745	1.0299	0.9589	0.7056	1.0103	1.1249	4.8296
7/16/10	1019	2.6907	5.5462	4.0687	5.1915	2.282	19.7791	1.0449	0.9515	0.7231	1.0453	1.1263	4.8911
7/17/10	1020	2.682	5.5211	4.2192	5.3216	2.2415	19.9854	1.0756	0.9408	0.7478	1.0719	1.136	4.9721

7/18/10	1021	2.6758	5.5153	4.3316	5.1214	2.1956	19.8397	1.1011	0.9305	0.7659	1.0912	1.1366	5.0253
7/19/10	1022	2.6503	5.5448	4.5011	4.9008	2.2573	19.8543	1.1115	0.9219	0.7911	1.1016	1.1655	5.0916
7/20/10	1023	2.681	5.5263	4.5031	4.7307	2.3428	19.7839	1.1374	0.9147	0.8035	1.0924	1.2035	5.1515
7/21/10	1024	2.6823	5.5094	4.4794	4.5161	2.4216	19.6088	1.1342	0.9062	0.8053	1.0659	1.2502	5.1618
7/22/10	1025	2.7348	5.4704	4.5072	4.3264	2.4889	19.5277	1.155	0.9012	0.8138	1.0366	1.2975	5.2041
7/23/10	1026	2.751	5.4729	4.6783	4.0866	2.4546	19.4434	1.159	0.896	0.8402	1.0074	1.3161	5.2187
7/24/10	1027	2.7378	5.627	4.8588	3.8818	2.4112	19.5166	1.1741	0.8893	0.8663	0.9719	1.3233	5.2249
7/25/10	1028	2.7758	5.7745	5.0426	3.7159	2.3678	19.6766	1.1634	0.8881	0.891	0.9318	1.3282	5.2025
7/26/10	1029	2.8027	5.7976	5.18	3.4849	2.3355	19.6007	1.1611	0.8763	0.9166	0.8845	1.3165	5.155
7/27/10	1030	2.8405	5.7919	5.3485	3.3591	2.2568	19.5968	1.1557	0.8621	0.9422	0.8439	1.2637	5.0676
7/28/10	1031	2.845	5.7258	5.3201	3.2115	2.1745	19.2769	1.1714	0.8872	0.9567	0.806	1.1957	5.017
7/29/10	1032	2.8436	5.8786	5.3579	3.3935	2.1847	19.6583	1.1656	0.9199	0.9587	0.8409	1.1605	5.0456
7/30/10	1033	2.8354	5.7607	5.3719	3.5224	2.2091	19.6995	1.1648	0.9109	0.9506	0.8491	1.1571	5.0325
7/31/10	1034	2.8262	5.8203	5.3461	3.6876	2.2246	19.9048	1.1703	0.9256	0.9476	0.855	1.1758	5.0743
8/1/10	1035	2.8101	5.8373	5.3335	3.6838	2.2487	19.9134	1.1719	0.907	0.9425	0.8612	1.2015	5.0841
8/2/10	1036	2.8001	5.8272	5.327	3.6459	2.2788	19.879	1.1608	0.8875	0.929	0.8444	1.2137	5.0354
8/3/10	1037	2.7874	5.6756	5.2775	3.7008	2.2719	19.7132	1.1403	0.8552	0.9088	0.8222	1.195	4.9215
8/4/10	1038	2.7078	5.3833	5.231	3.7589	2.2562	19.3372	1.1036	0.8285	0.9092	0.825	1.1869	4.8532
8/5/10	1039	2.9334	5.1531	5.1676	3.8642	2.2303	19.3486	1.1309	0.798	0.8996	0.8277	1.1829	4.8391
8/6/10	1040	2.9687	4.958	5.1718	3.8954	2.2142	19.2081	1.1339	0.762	0.8859	0.8196	1.1777	4.7791
8/7/10	1041	2.9	4.7768	5.1296	3.8482	2.1733	18.8279	1.1168	0.7312	0.8715	0.808	1.1628	4.6903
8/8/10	1042	2.8626	4.5932	4.9979	3.8081	2.1431	18.4049	1.0925	0.6938	0.8371	0.8075	1.1632	4.5941
8/9/10	1043	2.8967	4.3917	4.8224	3.7762	2.1475	18.0345	1.0767	0.6551	0.7975	0.7995	1.1581	4.4869
8/10/10	1044	2.8646	4.2208	4.6444	3.747	2.1438	17.6206	1.0402	0.6119	0.7538	0.7963	1.1556	4.3578
8/11/10	1045	2.9334	4.2573	4.4842	3.6998	2.1544	17.5291	1.0323	0.5847	0.7135	0.8028	1.1689	4.3022
8/12/10	1046	2.9359	4.2683	4.5194	3.6573	2.1789	17.5598	1.0354	0.585	0.705	0.8128	1.1911	4.3293
8/13/10	1047	2.8999	4.2387	4.4898	3.5908	2.1902	17.4094	1.0162	0.6191	0.7318	0.825	1.2049	4.397
8/14/10	1048	2.8799	4.2549	4.4532	3.5413	2.2021	17.3314	1.0073	0.6542	0.7493	0.8381	1.2115	4.4604
8/15/10	1049	2.8751	4.2395	4.3626	3.4918	2.2228	17.1918	0.9824	0.6964	0.7529	0.8617	1.2456	4.539
8/16/10	1050	2.9006	4.2019	4.3043	3.6038	2.2628	17.2734	0.9742	0.6979	0.7496	0.8764	1.2671	4.5652
8/17/10	1051	2.8796	4.1773	4.2841	3.5899	2.2072	17.1381	0.9621	0.6943	0.7466	0.8905	1.2364	4.5299
8/18/10	1052	2.8335	4.1091	4.2456	3.5254	2.2181	16.9317	0.9395	0.6924	0.7563	0.8844	1.2163	4.4889
8/19/10	1053	2.8069	4.0323	4.1826	3.4198	2.1415	16.5831	0.9566	0.696	0.7589	0.8553	1.1822	4.449
8/20/10	1054	2.8425	4.0467	4.2321	3.6589	2.0619	16.8421	0.9451	0.7242	0.7861	0.8814	1.1447	4.4815
8/21/10	1055	2.8652	4.0576	4.2311	3.7666	2.064	16.9845	0.9432	0.7432	0.8141	0.9279	1.1307	4.5591
8/22/10	1056	2.8083	4.0578	4.1806	3.9356	2.0794	17.0617	0.9078	0.7536	0.8274	0.9762	1.1351	4.6001
8/23/10	1057	2.7835	4.0269	4.1309	4.0832	2.091	17.1155	0.8971	0.765	0.8366	1.0287	1.148	4.6754
8/24/10	1058	2.7921	3.8584	4.0939	4.1882	2.1082	17.0408	0.868	0.7727	0.8462	1.0703	1.1417	4.6989
8/25/10	1059	2.773	3.6179	4.0747	4.337	2.1137	16.9163	0.8644	0.7745	0.8736	1.1202	1.1413	4.774
8/26/10	1060	2.7641	3.5201	4.1053	4.4267	2.1259	16.9421	0.8664	0.7777	0.8994	1.1672	1.1571	4.8678
8/27/10	1061	2.6923	3.4627	4.0924	4.5104	2.2158	16.9736	0.8566	0.7942	0.9204	1.2167	1.214	5.0019
8/28/10	1062	2.7018	3.4265	4.0879	4.6057	2.3122	17.1341	0.8676	0.7936	0.9347	1.2715	1.283	5.1504
8/29/10	1063	2.7012	3.4137	4.0894	4.3535	2.3123	16.8701	0.8798	0.8043	0.9563	1.2662	1.3275	5.2341
8/30/10	1064	2.6962	3.3734	4.071	4.2025	2.3049	16.648	0.8881	0.8181	0.9787	1.2955	1.3433	5.3237
8/31/10	1065	2.6983	3.2871	4.0878	3.9911	2.3154	16.3797	0.8876	0.8187	0.9884	1.3199	1.3483	5.3629
9/1/10	1066	2.6437	3.2248	4.0422	3.8729	2.3281	16.1117	0.8626	0.8138	0.9839	1.326	1.3344	5.3207
9/2/10	1067	2.6882	3.1857	4.0119	3.8704	2.3208	16.077	0.8706	0.8179	1.0017	1.3457	1.3306	5.3665
9/3/10	1068	2.8081	3.367	4.0838	3.8888	2.3067	16.4544	0.8977	0.8496	1.035	1.358	1.34	5.4803
9/4/10	1069	2.939	3.5834	4.0839	3.8781	2.3345	16.8189	0.9413	0.8842	1.0488	1.3454	1.3455	5.5652
9/5/10	1070	2.7595	3.7634	4.1193	3.7905	2.3868	16.8195	0.9156	0.9115	1.0601	1.33	1.3459	5.5631
9/6/10	1071	2.7919	3.9246	4.1884	3.7274	2.4383	17.0706	0.923	0.9428	1.0833	1.3317	1.3617	5.6425
9/7/10	1072	2.8217	4.0656	4.2325	3.7135	2.5054	17.3387	0.9305	0.9791	1.1079	1.3531	1.3907	5.7613
9/8/10	1073	2.8699	4.2056	4.1805	3.7321	2.5549	17.543	0.9474	1.017	1.1012	1.3578	1.4018	5.8252
9/9/10	1074	2.863	4.3164	4.1805	3.6964	2.5729	17.6292	0.9564	1.0423	1.1012	1.3607	1.4139	5.8745
9/10/10	1075	2.8833	4.4385	4.1805	3.7129	2.6098	17.825	0.98	1.0718	1.1012	1.3458	1.404	5.9028
9/11/10	1076	2.8316	4.3577	4.1699	3.7599	2.6262	17.7453	0.9937	1.0869	1.1011	1.3185	1.3752	5.8754
9/12/10	1077	2.848	4.3518	3.9717	3.8225	2.6328	17.6268	1.0185	1.0746	1.0703	1.3028	1.3461	5.8123
9/13/10	1078	2.8449	4.412	3.7983	3.8356	2.6479	17.5387	1.0294	1.0553	1.0108	1.2887	1.342	5.7262
9/14/10	1079	2.847	4.3677	3.647	3.8213	2.6591	17.3421	1.0401	1.0427	0.9572	1.2757	1.3486	5.6643
9/15/10	1080	2.8511	4.3388	3.544	3.8139	2.6813	17.2291	1.0707	1.0171	0.9193	1.2532	1.3395	5.5998
9/16/10	1081	2.8308	4.3833	3.4747	3.6708	2.6797	17.0393	1.0847	1.0223	0.8925	1.2372	1.3319	5.5686
9/17/10	1082	2.8368	4.3644	3.3435	3.6942	2.8134	17.0523	1.1007	1.0268	0.8707	1.2361	1.3659	5.6002
9/18/10	1083	2.8782	4.4014	3.1983	3.7884	2.9351	17.2014	1.1317	1.0222	0.8355	1.2502	1.403	5.6426
9/19/10	1084	2.9071	4.3429	3.0918	4.0266	3.097	17.4654	1.1136	1.017	0.8076	1.2888	1.4369	5.6639
9/20/10	1085	2.8585	4.3098	2.9281	3.9412	3.2365	17.2741	1.1082	1.003	0.7598	1.2866	1.4755	5.6331
9/21/10	1086	2.8386	4.2548	2.7911	3.8335	3.1555	16.8735	1.1176	0.9959	0.7108	1.2401	1.4428	5.5072
9/22/10	1087	2.8505	4.2785	2.6815	3.8238	3.1815	16.8158	1.144	0.9894	0.6675	1.2018	1.4232	5.4259
9/23/10	1088	2.8855	4.2875	2.5601	3.8426	3.2103	16.786	1.168	0.9764	0.6318	1.1742	1.4089	5.3593
9/24/10	1089	2.8825	4.3177	2.6439	4.0196	3.2335	17.0972	1.2093	0.9801	0.6219	1.1655	1.4236	5.4004
9/25/10	1090	2.8471	4.3418	2.6154	4.2475	3.2267	17.2785	1.2307	0.9787	0.6018	1.1517	1.4189	5.3818
9/26/10	1091	2.7932	4.414	2.5513	4.5608	3.254	17.5733	1.2151	0.9598	0.5625	1.126	1.3934	5.2568
9/27/10	1092	2.8305	4.42	2.512	4.8038	3.2834	17.8497	1.2254	0.9314	0.5362	1.1056	1.3635	5.1621
9/28/10	1093	2.8173	4.4554	2.5504	4.9223	3.3517	18.0971	1.2146	0.9204	0.5293	1.1091	1.3495	5.1229
9/29/10	1094	2.8386	4.5857	2.5258	5.0188	3.4386	18.4075	1.2069	0.9014	0.5219	1.0939	1.3536	5.0777
9/30/10	1095	2.8577	4.6389	2.4722	5.1236	3.5269	18.6193	1.2083	0.8795	0.5091	1.0677	1.3621	5.0267
10/1/10	1096	2.911	4.7005	2.51	5.1666	3.6037	18.8918	1.2203	0.8684	0.5108	1.0394	1.3691	5.008
10/2/10	1097	2.9676	4.7754	2.5547	5.236	3.6823	19.216	1.2519	0.8804	0.5177	1.029	1.3962	5.0752
10/3/10	1098	2.9552	4.8284	2.5209	5.2773	3.776	19.3578	1.2664	0.8785	0.5029	1.0126	1.4212	5.0816
10/4/10	1099	2.9054	4.828	2.4915	5.2133	3.9031	19.3413	1.2667	0.8634	0.4855	1.0052	1.4536	5.0744
10/5/10	1100	2.8361	4.7465	2.4934	5.165	3.9998	19.2408	1.2414	0.84	0.4812	1.0099	1.4794	5.0519
10/6/10	1101	2.79	4.7324	2.4515	5.1778	4.0823	19.234	1.2425	0.8127	0.4718	1.027	1.5087	5.0627
10/7/10	1102	2.7277	4.7043	2.3089	5.2487	4.1478	19.1374	1.2162	0.7971	0.4489	1.0347	1.524	5.0209
10/8/10	1103	2.7088	4.6603	2.2297	5.3119	4.2183	19.129	1.2068	0.7856	0.4453	1.036	1.5334	5.0071
10/9/10	1104	2.7132	4.6367	2.357	5.325	4.2789	19.3108	1.1937	0.7707	0.4837	1.0428	1.5473	5.0382
10/10/10	1105	2.7348	4.6529	2.477	5.4103	4.297	19.572	1.1688	0.7667	0.5233	1.0668	1.5502	5.0758
10/11/10	1106	2.7499	4.6705	2.5912	5.445	4.3021	19.7587	1.1423	0.7595	0.5585	1.0818	1.538	5.0801
10/12/10	1107	2.767	4.6274	2.7353	5.438	4.3186	19.8863	1.1264	0.7516	0.6016	1.0867	1.5344	5.1007
10/13/10	1108	2.7746	4.6568	2.8749	5.3262	4.338	19.9705	1.1124	0.7372	0.6407	1.0494	1.5148	5.0545
10/14/10	1109	2.7992	4.5668	2.9878	5.587	4.357	20.2978	1.1105	0.717	0.6856	1.0579	1.5003	5.0713
10/15/10	1110	2.8059	4.5285	3.1224	5.6796	4.3701	20.5065	1.0896	0.6935	0.7162	1.0472	1.4779	5.0244
10/16/10	1111	2.8273	4.5024	3.2407	5.7318	4.3555	20.6577	1.0765	0.6738	0.7459	1.0414	1.4441	4.9817

10/17/10	1112	2.859	4.4754	3.3523	5.7751	4.3566	20.8184	1.0656	0.6548	0.7741	1.0442	1.4295	4.9682
10/18/10	1113	2.8953	4.4583	3.4859	5.8056	4.2723	20.9174	1.0496	0.6369	0.804	1.0314	1.4103	4.9322
10/19/10	1114	2.9051	4.4341	3.6187	5.7499	4.172	20.8798	1.039	0.6279	0.8415	1.0226	1.3902	4.9212
10/20/10	1115	2.9516	4.447	3.7689	5.6445	4.0606	20.8726	1.0309	0.6224	0.8807	1.0287	1.3789	4.9416
10/21/10	1116	2.9623	4.4543	3.8988	5.5786	3.9782	20.8722	1.0285	0.6096	0.9171	1.0274	1.3599	4.9425
10/22/10	1117	2.9624	4.487	4.0432	5.7224	4.0645	21.2795	1.0244	0.594	0.9516	1.0543	1.3843	5.0086
10/23/10	1118	2.9549	4.462	4.1869	5.827	4.0436	21.4744	1.0227	0.5819	0.987	1.0899	1.3801	5.0616
10/24/10	1119	2.9282	4.4675	4.3344	5.7985	4.0101	21.5387	1.0149	0.5725	1.0217	1.1057	1.3704	5.0852
10/25/10	1120	2.9135	4.5027	4.2471	5.693	3.9883	21.3446	1.0026	0.5491	1.0298	1.1133	1.3472	5.042
10/26/10	1121	2.9712	4.3621	4.1111	5.4644	3.9863	20.8951	0.9993	0.5218	0.9977	1.1134	1.3367	4.9689
10/27/10	1122	3.0307	4.3935	4.2144	5.2227	3.9391	20.8004	1.0023	0.5247	1.0253	1.1393	1.3384	5.03
10/28/10	1123	3.0584	4.4191	4.2464	5.0386	3.8631	20.6256	0.9895	0.523	1.0228	1.1454	1.3325	5.0132
10/29/10	1124	3.0606	4.406	4.22	5.108	3.7599	20.5545	0.979	0.507	1.0219	1.1301	1.3028	4.9408
10/30/10	1125	3.0618	4.309	4.2217	5.3343	3.6487	20.5755	0.9724	0.5038	1.0232	1.1262	1.2613	4.8869
10/31/10	1126	3.0409	4.2867	4.2155	5.5329	3.533	20.609	0.952	0.5006	1.0196	1.1312	1.2163	4.8197
11/1/10	1127	2.9557	4.2896	4.1655	5.6826	3.3503	20.4437	0.9239	0.5002	1.0157	1.1376	1.1482	4.7256
11/2/10	1128	2.9713	4.2578	4.1377	5.8255	3.1675	20.3598	0.9126	0.4864	1.0197	1.1376	1.0801	4.6364
11/3/10	1129	2.947	4.1823	4.1795	5.9623	2.9848	20.2559	0.9025	0.487	1.0293	1.1474	1.012	4.5782
11/4/10	1130	2.8971	4.1521	4.1857	6.116	2.9265	20.2774	0.8982	0.4821	1.0409	1.1505	0.9735	4.5452
11/5/10	1131	2.9198	4.2142	4.1759	6.1984	2.8186	20.3269	0.9274	0.4889	1.0494	1.1571	0.9278	4.5506
11/6/10	1132	2.9315	4.1761	4.2036	6.3149	2.705	20.3311	0.9343	0.5022	1.0652	1.1517	0.8845	4.5379
11/7/10	1133	2.9224	4.1731	4.1234	6.4193	2.5844	20.2226	0.9623	0.4975	1.043	1.1532	0.8384	4.4944
11/8/10	1134	2.9032	4.1888	4.1002	6.61	2.4713	20.2735	0.9699	0.4862	1.0257	1.1449	0.7905	4.4172
11/9/10	1135	2.8372	4.2231	4.1468	6.8275	2.3759	20.4105	0.9659	0.4836	1.0247	1.13	0.7554	4.3596
11/10/10	1136	2.7843	4.2422	4.255	6.9275	2.3315	20.5405	0.9786	0.4809	1.0214	1.1031	0.7345	4.3185
11/11/10	1137	2.7945	4.2218	4.3197	6.957	2.2822	20.5752	0.9947	0.4722	1.022	1.0887	0.7239	4.3015
11/12/10	1138	2.8014	4.2732	4.3413	7.0325	2.2326	20.681	1.0003	0.4662	1.0228	1.0838	0.7065	4.2796
11/13/10	1139	2.7796	4.2233	4.3428	7.1325	2.1703	20.6485	1.0028	0.4672	1.0191	1.114	0.7	4.3031
11/14/10	1140	2.7566	4.276	4.3948	6.9554	2.1101	20.4929	1.0001	0.4633	1.0158	1.0983	0.6851	4.2626
11/15/10	1141	2.7588	4.2871	4.4115	6.9659	2.0634	20.4867	1.0097	0.4677	1.0319	1.0966	0.6747	4.2806
11/16/10	1142	2.6654	4.3057	4.4648	6.9787	2.0218	20.4364	0.9792	0.4663	1.0463	1.0879	0.6734	4.2531
11/17/10	1143	2.5653	4.3364	4.5189	7.0015	1.9977	20.4198	0.9494	0.4676	1.0619	1.091	0.6781	4.248
11/18/10	1144	2.6087	4.3623	4.5327	7.0085	2.027	20.5392	0.9648	0.4687	1.0734	1.0929	0.6878	4.2876
11/19/10	1145	2.6268	4.4574	4.5532	7.0586	2.0261	20.7221	0.9657	0.4676	1.0802	1.0868	0.6859	4.2862
11/20/10	1146	2.6131	4.6081	4.5533	7.0675	2.0375	20.8795	0.9778	0.4721	1.0812	1.0756	0.6806	4.2873
11/21/10	1147	2.6164	4.6242	4.5626	7.0535	2.0557	20.9124	0.9947	0.476	1.0783	1.0773	0.684	4.3103
11/22/10	1148	2.6309	4.6374	4.5959	7.0838	2.0416	20.9896	0.9959	0.4729	1.0879	1.0858	0.6823	4.3248
11/23/10	1149	2.646	4.6799	4.6671	6.9989	2.0423	21.0342	0.9974	0.4714	1.112	1.0726	0.6814	4.3348
11/24/10	1150	2.6685	4.7461	4.7093	7.0315	2.0474	21.2028	0.9973	0.4742	1.1503	1.076	0.6764	4.3742
11/25/10	1151	2.6576	4.7299	4.6938	7.002	2.0318	21.1151	0.9899	0.4702	1.1464	1.0719	0.6697	4.3481
11/26/10	1152	2.5958	4.9238	4.8044	7.0397	2.0371	21.4008	0.984	0.4766	1.1719	1.0673	0.6586	4.3584
11/27/10	1153	2.5434	4.8725	4.7392	7.0461	2.0549	21.2561	0.9903	0.471	1.1607	1.0519	0.6471	4.321
11/28/10	1154	2.5007	4.8345	4.7382	7.0654	2.0808	21.2196	1.0044	0.4655	1.1719	1.0554	0.6464	4.3436
11/29/10	1155	2.485	4.796	4.7821	7.0108	2.0885	21.1624	1.0003	0.4655	1.1706	1.0476	0.6436	4.3276
11/30/10	1156	2.4577	4.7438	4.8118	6.8765	2.0887	20.9785	0.9886	0.4642	1.166	1.0485	0.638	4.3053
12/1/10	1157	2.4353	4.737	4.8184	6.6919	2.103	20.7856	0.9825	0.4676	1.1527	1.0547	0.6345	4.292
12/2/10	1158	2.4405	4.664	4.854	6.5809	2.1789	20.7183	0.9761	0.4697	1.1446	1.0708	0.6497	4.3109
12/3/10	1159	2.3951	4.614	4.901	6.5314	2.258	20.6995	0.9461	0.4812	1.1351	1.0837	0.6624	4.3085
12/4/10	1160	2.3849	4.6232	4.9366	6.4535	2.3499	20.7481	0.9144	0.4856	1.1442	1.0843	0.6815	4.31
12/5/10	1161	2.3733	4.5798	4.9908	6.3399	2.3137	20.5975	0.8798	0.4904	1.1475	1.102	0.6735	4.2932
12/6/10	1162	2.3942	4.5288	4.991	6.2928	2.321	20.5278	0.8441	0.4883	1.1374	1.0997	0.6704	4.2399
12/7/10	1163	2.4017	4.6136	5.0358	6.1974	2.3193	20.5678	0.8195	0.4868	1.1367	1.0957	0.6591	4.1978
12/8/10	1164	2.409	4.5832	5.1717	6.0602	2.3375	20.5616	0.7941	0.4901	1.1781	1.0592	0.6507	4.1722
12/9/10	1165	2.4058	4.5659	5.2288	6.0091	2.3505	20.5601	0.7763	0.4943	1.1885	1.0559	0.6484	4.1634
12/10/10	1166	2.4206	4.522	5.2824	5.8514	2.3689	20.4453	0.7658	0.496	1.2038	1.0644	0.6453	4.1753
12/11/10	1167	2.4227	4.4613	5.2661	5.7978	2.3819	20.3298	0.7549	0.4941	1.2108	1.0732	0.6407	4.1737
12/12/10	1168	2.4301	4.4681	5.2666	5.8152	2.3958	20.3758	0.7453	0.4907	1.1991	1.081	0.6388	4.1549
12/13/10	1169	2.3922	4.4324	5.3604	5.7678	2.4148	20.3676	0.7214	0.4841	1.1776	1.0842	0.635	4.1023
12/14/10	1170	2.4062	4.3076	5.4345	5.7808	2.4209	20.35	0.7131	0.466	1.1589	1.0723	0.6293	4.0396
12/15/10	1171	2.4178	4.1544	5.2696	5.8285	2.4288	20.0991	0.6983	0.4522	1.1173	1.059	0.6198	3.9466
12/16/10	1172	2.4124	4.2195	5.3416	5.8713	2.4191	20.2639	0.6866	0.458	1.1106	1.0468	0.6104	3.9124
12/17/10	1173	2.4965	4.2833	5.3404	5.9229	2.4219	20.465	0.7121	0.4632	1.0938	1.0372	0.5956	3.9019
12/18/10	1174	2.5715	4.373	5.3305	5.9131	2.4221	20.6102	0.7343	0.4619	1.0807	1.0267	0.5765	3.8801
12/19/10	1175	2.5169	4.4312	5.3466	5.896	2.4064	20.5971	0.7197	0.4609	1.07	1.0269	0.5598	3.8373
12/20/10	1176	2.4997	4.3935	5.3613	5.8565	2.3981	20.5091	0.7208	0.4574	1.0601	1.0252	0.5466	3.8101
12/21/10	1177	2.4751	4.2955	5.3333	5.8824	2.3896	20.3759	0.7213	0.4474	1.0558	1.0239	0.5391	3.7875
12/22/10	1178	2.469	4.315	5.3216	5.9106	2.3815	20.3977	0.7164	0.4402	1.0451	1.0194	0.5286	3.7497
12/23/10	1179	2.4495	4.3004	5.2813	5.9052	2.3801	20.3165	0.7023	0.437	1.0202	1.0116	0.5175	3.6886
12/24/10	1180	2.4449	4.2439	5.1991	5.9015	2.3656	20.155	0.6735	0.4301	0.984	1.0057	0.5046	3.5979
12/25/10	1181	2.4177	4.1593	5.1355	5.9071	2.3487	19.9683	0.6574	0.4229	0.9356	0.9894	0.4947	3.5
12/26/10	1182	2.421	4.126	5.1134	5.9275	2.3483	19.9362	0.6493	0.418	0.9285	0.9739	0.4814	3.4511
12/27/10	1183	2.4388	4.0438	5.0976	5.9565	2.3551	19.8918	0.631	0.4186	0.9195	0.9691	0.4743	3.4125
12/28/10	1184	2.4788	4.0155	5.0869	5.9972	2.3417	19.9201	0.6246	0.4167	0.914	0.9589	0.4654	3.3796
12/29/10	1185	2.4877	4.053	5.0652	5.9742	2.3382	19.9183	0.6208	0.4162	0.9041	0.939	0.4541	3.3342
12/30/10	1186	2.4765	4.0374	4.9806	5.8541	2.3328	19.6814	0.6281	0.4191	0.8928	0.9159	0.4397	3.2956
12/31/10	1187	2.4731	4.0389	4.9108	5.7532	2.3358	19.5118	0.6365	0.4169	0.8842	0.9022	0.4358	3.2756
1/1/11	1188	2.4844	4.2412	4.9737	5.7227	2.3338	19.7558	0.643	0.4365	0.8977	0.8775	0.4305	3.2852
1/2/11	1189	2.5113	4.2848	5.0375	5.6946	2.3171	19.8453	0.6518	0.42	0.9039	0.8438	0.4227	3.2422
1/3/11	1190	2.5168	4.2831	5.0319	5.675	2.3059	19.8127	0.674	0.4069	0.9152	0.8161	0.4219	3.2341
1/4/11	1191	2.5417	4.3194	5.0223	5.5126	2.2721	19.6681	0.7017	0.3973	0.9049	0.7881	0.408	3.2
1/5/11	1192	2.5536	4.3317	4.9793	5.3632	2.2611	19.4889	0.7316	0.3904	0.897	0.7479	0.3992	3.1661
1/6/11	1193	2.5097	4.3091	4.956	5.4082	2.2462	19.4292	0.7416	0.3796	0.8836	0.7254	0.3891	3.1193
1/7/11	1194	2.4973	4.229	4.9079	5.3461	2.2333	19.2136	0.7492	0.3716	0.859	0.7004	0.3785	3.0587
1/8/11	1195	2.5225	4.2875	4.8742	5.3686	2.2185	19.2713	0.7634	0.369	0.8361	0.7119	0.3722	3.0526
1/9/11	1196	2.5492	4.3479	4.9158	5.2204	2.2044	19.2377	0.7777	0.3624	0.8355	0.6963	0.3665	3.0384
1/10/11	1197	2.5542	4.353	4.8305	5.1356	2.1915	19.0648	0.7827	0.3431	0.8012	0.6633	0.3604	2.9507
1/11/11	1198	2.5742	4.4137	4.7271	5.0281	2.1771	18.9202	0.7903	0.3328	0.7753	0.6327	0.3547	2.8858
1/12/11	1199	2.5525	4.4425	4.7454	4.9578	2.1662	18.8644	0.7938	0.3302	0.7805	0.6082	0.3507	2.8634
1/13/11	1200	2.5678	4.5062	4.6367	4.9389	2.1469	18.7965	0.8024	0.3267	0.7901	0.589	0.3501	2.8583
1/14/11	1201	2.5623	4.6463	4.5969	4.9135	2.1334	18.8524	0.7894	0.335	0.8045	0.5814	0.3447	2.855
1/15/11	1202	2.5544	4.5823	4.7376	4.88	2.1253	18.8796	0.7872	0.3171	0.8259	0.5722	0.3444	2.8468

1/16/11	1203	2.5486	4.5301	4.6225	4.8015	2.1244	18.6271	0.7813	0.2945	0.8056	0.5618	0.3437	2.7869
1/17/11	1204	2.5248	4.4735	4.5561	4.7213	2.1215	18.3972	0.767	0.2801	0.8026	0.5551	0.3458	2.7506
1/18/11	1205	2.4498	4.4018	4.5837	4.7178	2.1249	18.278	0.7448	0.2762	0.8039	0.534	0.3482	2.7071
1/19/11	1206	2.3581	4.3549	4.5906	4.6932	2.129	18.1258	0.7203	0.2738	0.8027	0.5164	0.3511	2.6643
1/20/11	1207	2.2747	4.3368	4.5643	4.6919	2.1356	18.0033	0.6901	0.2653	0.7995	0.4967	0.3553	2.6069
1/21/11	1208	2.2834	4.3406	4.5973	4.6465	2.1337	18.0015	0.6814	0.2639	0.787	0.4739	0.3544	2.5606
1/22/11	1209	2.2727	4.4128	4.5909	4.6022	2.1261	18.0047	0.6648	0.2546	0.7784	0.4457	0.3461	2.4896
1/23/11	1210	2.2842	4.4007	4.575	4.5776	2.1192	17.9567	0.6707	0.2425	0.7699	0.4253	0.3404	2.4488
1/24/11	1211	2.2777	4.293	4.5865	4.5326	2.1024	17.7922	0.6856	0.2329	0.7559	0.4021	0.3275	2.404
1/25/11	1212	2.3173	4.1548	4.6334	4.5717	2.108	17.7852	0.689	0.2238	0.7503	0.3883	0.323	2.3744
1/26/11	1213	2.364	4.0131	4.6956	4.5705	2.105	17.7482	0.6946	0.2173	0.745	0.3776	0.326	2.3605
1/27/11	1214	2.3874	4.0135	4.7818	4.523	2.098	17.8037	0.7007	0.2227	0.7403	0.3592	0.3255	2.3484
1/28/11	1215	2.3713	4.0384	4.8109	4.479	2.1087	17.8083	0.695	0.227	0.7294	0.3435	0.3266	2.3215
1/29/11	1216	2.3569	4.0705	4.7987	4.4903	2.1162	17.8326	0.6845	0.2303	0.7233	0.3316	0.3275	2.2972
1/30/11	1217	2.3678	4.1473	4.8056	4.5344	2.1193	17.9744	0.6683	0.2226	0.7145	0.3262	0.3289	2.2605
1/31/11	1218	2.368	4.1845	4.8222	4.533	2.1098	18.0175	0.6532	0.2099	0.7039	0.3088	0.3201	2.1959
2/1/11	1219	2.3826	4.1795	4.7917	4.5049	2.0389	17.8976	0.6507	0.199	0.694	0.2979	0.3064	2.148
2/2/11	1220	2.3719	4.2208	4.7117	4.5669	1.9798	17.8511	0.6435	0.194	0.6794	0.2928	0.299	2.1087
2/3/11	1221	2.3937	4.2513	4.7051	4.6225	1.9118	17.8844	0.6346	0.19	0.6686	0.2902	0.287	2.0704
2/4/11	1222	2.4015	4.2695	4.7242	4.7677	1.8537	18.0166	0.6313	0.1949	0.6765	0.2971	0.2818	2.0816
2/5/11	1223	2.4242	4.3506	4.7378	4.8342	1.7765	18.1233	0.629	0.1965	0.6766	0.2951	0.269	2.0662
2/6/11	1224	2.4549	4.3566	4.7502	4.7004	1.7093	17.9714	0.6272	0.198	0.6782	0.2798	0.2598	2.043
2/7/11	1225	2.464	4.3853	4.7573	4.7416	1.6548	18.003	0.6247	0.199	0.6866	0.2766	0.2568	2.0437
2/8/11	1226	2.439	4.4382	4.7608	4.7464	1.5893	17.9737	0.6083	0.1978	0.6941	0.2734	0.2495	2.0231
2/9/11	1227	2.4152	4.4126	4.6982	4.8417	1.5209	17.8886	0.5957	0.1926	0.6862	0.2803	0.2374	1.9922
2/10/11	1228	2.4114	4.5003	4.7178	4.9823	1.453	18.0648	0.6035	0.2027	0.6956	0.2994	0.2235	2.0247
2/11/11	1229	2.4202	4.5437	4.8194	5.0774	1.3831	18.2438	0.6029	0.2185	0.7118	0.3282	0.2087	2.0701
2/12/11	1230	2.4232	4.5222	4.7823	5.1321	1.3138	18.1736	0.5984	0.2278	0.7153	0.353	0.1943	2.0888
2/13/11	1231	2.4103	4.4842	4.7677	5.1697	1.245	18.0769	0.6015	0.2353	0.7184	0.3698	0.1797	2.1047
2/14/11	1232	2.3871	4.4739	4.7033	5.2141	1.1913	17.9697	0.6134	0.2363	0.7097	0.3743	0.1715	2.1052
2/15/11	1233	2.4047	4.5648	4.685	5.1896	1.1923	18.0364	0.6154	0.2417	0.7127	0.376	0.1679	2.1137
2/16/11	1234	2.421	4.5664	4.7158	5.1147	1.186	18.0039	0.6325	0.2562	0.7205	0.3731	0.163	2.1453
2/17/11	1235	2.4411	4.5909	4.7771	5.2587	1.1986	18.2664	0.6545	0.2705	0.7273	0.3856	0.1561	2.194
2/18/11	1236	2.516	4.5794	4.7317	5.3182	1.1968	18.3421	0.6855	0.2782	0.7252	0.4151	0.1476	2.2516
2/19/11	1237	2.6011	4.5608	4.711	5.3966	1.1949	18.4644	0.7158	0.2821	0.7231	0.4532	0.1435	2.3177
2/20/11	1238	2.6738	4.5352	4.6955	5.4371	1.1936	18.5352	0.7468	0.2965	0.7284	0.5161	0.1492	2.437
2/21/11	1239	2.6391	4.4835	4.6505	5.5367	1.1965	18.5063	0.7443	0.3044	0.7314	0.5803	0.1596	2.52
2/22/11	1240	2.6307	4.3894	4.6683	5.6511	1.2073	18.5468	0.7487	0.3134	0.7419	0.6262	0.1695	2.5997
2/23/11	1241	2.6569	4.3694	4.6935	5.6775	1.2167	18.614	0.7354	0.3254	0.755	0.6649	0.1821	2.6628
2/24/11	1242	2.6885	4.5256	4.6903	5.7519	1.2346	18.8909	0.7366	0.3381	0.768	0.7139	0.1996	2.7562
2/25/11	1243	2.6612	4.6695	4.6786	5.7241	1.2305	18.9639	0.7332	0.3557	0.7716	0.7515	0.207	2.819
2/26/11	1244	2.6218	4.8028	4.5737	5.6563	1.2386	18.8932	0.7298	0.3719	0.7608	0.7568	0.2096	2.8289
2/27/11	1245	2.6233	4.8869	4.5864	5.7925	1.2428	19.1319	0.7397	0.3756	0.781	0.7981	0.2134	2.9078
2/28/11	1246	2.6092	4.8538	4.5837	5.839	1.2365	19.1222	0.7513	0.3787	0.7948	0.8195	0.2176	2.9619
3/1/11	1247	2.6299	4.784	4.573	5.86	1.24	19.0869	0.768	0.3808	0.8018	0.8562	0.2257	3.0325
3/2/11	1248	2.6079	4.7051	4.5854	5.8596	1.235	18.993	0.7744	0.3832	0.8093	0.8772	0.2289	3.073
3/3/11	1249	2.5917	4.6554	4.5755	5.8545	1.2475	18.9246	0.7808	0.3835	0.8139	0.8995	0.231	3.1087
3/4/11	1250	2.5632	4.594	4.5786	5.8635	1.3163	18.9156	0.7832	0.3916	0.8199	0.9351	0.2451	3.1749
3/5/11	1251	2.5774	4.5091	4.5513	5.8133	1.3883	18.8394	0.7969	0.3963	0.8222	0.9605	0.2559	3.2318
3/6/11	1252	2.5825	4.4919	4.5609	5.6904	1.4604	18.7861	0.8129	0.3951	0.8293	0.9712	0.2627	3.2712
3/7/11	1253	2.5568	4.4517	4.4701	5.6445	1.5263	18.6494	0.8126	0.3944	0.804	0.9805	0.2691	3.2606
3/8/11	1254	2.527	4.4149	4.4251	5.6776	1.5953	18.6399	0.8107	0.4016	0.7939	0.9927	0.2757	3.2746
3/9/11	1255	2.501	4.4038	4.4094	5.7236	1.6623	18.7001	0.812	0.4108	0.7954	1.018	0.2866	3.3228
3/10/11	1256	2.4639	4.3687	4.3713	5.7201	1.7329	18.6569	0.7963	0.4267	0.7919	1.0469	0.296	3.3578
3/11/11	1257	2.4519	4.3133	4.3414	5.7496	1.8029	18.6591	0.7999	0.44	0.7915	1.0767	0.3108	3.4189
3/12/11	1258	2.4479	4.3186	4.3298	5.691	1.8731	18.6604	0.8111	0.4582	0.7958	1.0925	0.3258	3.4834
3/13/11	1259	2.4249	4.2132	4.262	5.5868	1.9419	18.4288	0.8122	0.4628	0.7849	1.0976	0.3388	3.4963
3/14/11	1260	2.3798	4.1042	4.1402	5.5298	2.0132	18.1672	0.8145	0.4594	0.7675	1.0744	0.3454	3.4612
3/15/11	1261	2.3926	4.1095	4.1162	5.5423	2.0848	18.2454	0.828	0.4575	0.7604	1.0655	0.3574	3.4688
3/16/11	1262	2.3982	4.0958	4.1312	5.5226	2.1674	18.3152	0.8421	0.4585	0.7546	1.0753	0.3765	3.507
3/17/11	1263	2.4197	4.07	4.1308	5.5148	2.2435	18.3788	0.8611	0.4666	0.7583	1.0842	0.3995	3.5697
3/18/11	1264	2.3984	3.9702	4.1439	5.5244	2.2605	18.2974	0.8817	0.4725	0.7555	1.1052	0.4149	3.6298
3/19/11	1265	2.4386	3.9684	4.1406	5.6473	2.2824	18.4773	0.8915	0.4782	0.7576	1.142	0.4316	3.7009
3/20/11	1266	2.4356	3.9713	4.1631	5.5487	2.2818	18.4005	0.8945	0.4824	0.7581	1.1587	0.4505	3.7442
3/21/11	1267	2.4708	4.0332	4.183	5.5408	2.2873	18.5151	0.9135	0.4886	0.7584	1.1578	0.4608	3.7791
3/22/11	1268	2.5074	4.0331	4.1608	5.5182	2.2845	18.504	0.9286	0.4951	0.757	1.1389	0.4597	3.7793
3/23/11	1269	2.5159	4.0179	4.1752	5.5077	2.2887	18.5054	0.9316	0.4929	0.7463	1.0899	0.4471	3.7078
3/24/11	1270	2.5485	4.0449	4.1597	5.4577	2.2992	18.51	0.9325	0.4915	0.7385	1.0392	0.4401	3.6418
3/25/11	1271	2.565	4.0288	4.1819	5.407	2.3069	18.4896	0.9276	0.495	0.739	1.0103	0.4422	3.6141
3/26/11	1272	2.5512	4.0485	4.125	5.4519	2.3218	18.4984	0.9427	0.4969	0.7334	0.9815	0.4397	3.5942
3/27/11	1273	2.5213	4.0275	3.9992	5.419	2.3315	18.2985	0.9515	0.4967	0.7155	0.9509	0.4401	3.5547
3/28/11	1274	2.5186	4.0121	3.9184	5.4177	2.3467	18.2135	0.9672	0.4901	0.7066	0.9157	0.4419	3.5215
3/29/11	1275	2.5283	3.9952	4.0119	5.456	2.3602	18.3516	0.9819	0.4843	0.7285	0.9126	0.4493	3.5566
3/30/11	1276	2.4788	3.9045	3.9393	5.3067	2.3666	17.9959	0.9754	0.4742	0.7147	0.8773	0.4514	3.493
3/31/11	1277	2.488	3.8805	3.9437	5.2513	2.3826	17.9461	0.9719	0.4667	0.7127	0.8663	0.4552	3.4728
					Average		21.26				Average		3.64
					Stdev		4.87				Stdev		1.04
					Maximum		33.74				Maximum		5.90
					Minimum		16.08				Minimum		1.99
					Count		436				Count		429
					$t_{0.01,\ 197}$		2.59				$t_{0.01,\ 197}$		2.59
					$t_{0.05,\ 197}$		1.97				$t_{0.05,\ 197}$		1.97
					UPL_99		33.89				UPL_99		6.35
					UPL_95		30.85				UPL_95		5.69
					LPL_95		11.68				LPL_95		1.58
					LPL_99		8.64				LPL_99		0.93

Appendix 2: BART Administrative Orders

STATE OF MINNESOTA
Minnesota Pollution Control Agency

In the Matter of: **ADMINISTRATIVE ORDER BY CONSENT**
Xcel Energy – Northern States Power Company
Sherburne County Generating Station

The Commissioner of the Minnesota Pollution Control Agency (MPCA) and Xcel Energy – Northern States Power Company (Xcel) enter into this Administrative Order by Consent for the Sherburne County Generating Station (Sherco), Becker, Sherburne County, Minnesota, pursuant to Minn. Stat. § 116.07, subd. 9 (2010).

FINDINGS OF FACT

BACKGROUND

1. On July 6, 2005, the U.S. Environmental Protection Agency (EPA) published regulations to address visibility impairment in our nation's largest national parks and wilderness ("Class I") areas (70 FR 39103). This rule is commonly known as the "Regional Haze Rule". 40 CFR §§ 51.300-51.309.

2. The Regional Haze Rule (Rule) requires that Minnesota establish and achieve visibility goals for each of its Class I areas by 2018. The Rule regulates the emission of pollutants that contribute to regional haze. The MPCA has determined that the key contributing pollutants are particulate matter (PM, measured as PM_{10}), sulfur dioxide (SO_2), and nitrogen oxides (NO_X).

3. The Rule regulates certain older stationary sources that could contribute to visibility impairment in Class I areas and requires Best Available Retrofit Technology (BART) emission limits on contributing pollutants for these sources.

4. The Rule requires that Minnesota submit a Regional Haze State Implementation Plan (SIP) to U.S. EPA that identifies the older sources that cause or contribute to visibility impairment in its Class I areas. The Regional Haze SIP submittal must also include a schedule for implementation of BART limits and other control measures.

5. The Rule includes 40 CFR Part 51, Appendix Y *"Guidelines for BART Determinations Under the Regional Haze Rule"* which provides direction for determining which sources may need to install BART and for determining BART.

6. To satisfy the Rule, the MPCA determined what constitutes BART for each BART-eligible unit and established emission limits consistent with its determination of BART. BART limits take into consideration the technology available, the costs of compliance, the energy and the non-air quality environmental impacts of compliance, any pollution control equipment in use or in existence at the source, the remaining useful life of the source, and the degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology.

7. To identify the BART-eligible emission units, MPCA used the following criteria:

a. One, or more, emission(s) units at the facility fit within one of the twenty-six (26) categories listed in the 40 CFR Part 51, Appendix Y *Guidelines*;

b. The emission unit(s) were in existence on August 7, 1977 and began operation at some point on or after August 7, 1962; and

c. The sum of the potential emissions from all emission unit(s) identified in the previous two bullets was greater than 250 tons per year of the visibility-impairing pollutants: sulfur dioxide (SO_2), nitrogen oxide (NO_x), and PM_{10}.

8. The MPCA requested BART analyses from BART-eligible electric generating facilities that were found through modeling to be subject-to-BART, unless the facility was scheduled for future emissions reductions and all of the following criteria were met:

    a. The MPCA had sufficient information about planned emission reductions at the time facilities were notified that they were subject to BART;

    b. Public Utility Commission (PUC) approvals for the reductions were in place; and

    c. The MPCA determined that planned emission reductions likely represented presumptive BART emissions levels as described in the *Guidelines*.

9. In July 2005, EPA determined that the Clean Air Interstate Rule (CAIR) provided more emission reductions of NO_X and SO_2 than would be required under BART, and thus states could choose in their Regional Haze SIPs to let participation in CAIR substitute for BART for electric generating facilities for these pollutants. The MPCA originally pursued this option.

10. In May 2009, EPA published a proposed rule to stay application of CAIR in Minnesota. *See* Stay of Clean Air Interstate Rule for Minnesota; Stay of Federal Implementation Plan To Reduce Interstate Transport of Fine Particulate Matter and Ozone for Minnesota (74 FR 22147). In November 2009, EPA finalized the stay of CAIR in Minnesota. *See* Administrative Stay of Clean Air Interstate Rule for Minnesota; Administrative Stay of Federal Implementation Plan To Reduce Interstate Transport of Fine Particulate Matter and Ozone for Minnesota (74 FR 56721). Thus, the MPCA decided it could no longer determine that CAIR would substitute for BART for electric generating facilities.

11. The MPCA submitted a Regional Haze SIP to U.S. EPA on December 30, 2009, which identified the BART-eligible and subject-to-BART sources and gave the MPCA's determination of what constitutes BART and associated emission limits.

12. On August 8, 2011, EPA promulgated the Cross State Air Pollution Rule (CSAPR), also known as the Transport Rule. This trading program rule replaced CAIR, and Minnesota was covered by the rule. *See* Federal Implementation Plans: Interstate Transport of Fine Particulate Matter and Ozone and Correction of SIP Approvals (76 FR 48208).

13. On December 19, 2011, the MPCA placed on public notice a Supplemental Regional Haze SIP that proposed to determine that participation in CSAPR would substitute for source-specific BART determinations for power plants.

14. On December 30, 2011, EPA proposed that CSAPR provided more emission reductions of NO_X and SO_2 than would be required under BART, and thus states could choose in their Regional Haze SIPs to let participation in CSAPR substitute for BART for electric generating facilities for these pollutants. *See* Regional Haze: Revisions to Provisions Governing Alternatives to Source-Specific Best Available Retrofit Technology (BART) Determinations, Limited SIP Disapprovals, and Federal Implementation Plans (76 FR 82219).

15. Under 40 CFR 51.308(e)(4), a state that opts to participate in the trading program in lieu of source-specific BART may also adopt provisions for a geographic enhancement to the program, to address the requirement under 40 CFR 51.302(c) related to BART for reasonably attributable visibility impairment. In addition, EPA has said that states may also include in their SIPs provisions applicable to a specific source even if there is no such reasonable attribution for that source (76 FR 82224).

16. MPCA is choosing to include in the SIP a source-specific BART requirement applicable only to Sherco.

17. As is required for all SIP conditions, the MPCA must make BART emission limits enforceable. The MPCA is making the BART emission limits applicable to the Sherco facility enforceable through this Administrative Order.

THE FACILITY

18. Xcel Energy – Northern States Power Company owns and operates Sherco. Sherco has two emission units, Unit 1 and Unit 2, which are BART-eligible. Unit 1 (690 MW net, operational beginning in 1976) and Unit 2 (683 MW net, operational beginning in 1977) are tangentially fired and discharge emissions to the atmosphere through a common 650 foot stack, identified as SV001.

19. The MPCA determined that Sherco Units 1 and 2 are subject to BART. *See* RESULTS of Best Available Retrofit Technology (BART) Modeling to Determine Sources Subject-to-BART in the State of Minnesota at http://proteus.pca.state.mn.us/publications/aq-sip2-07.pdf.

BEST AVAILABLE RETROFIT TECHNOLOGY (BART)

20. The MPCA requested a BART analysis from Xcel for Sherco. Xcel submitted the analysis in October 2006. *See* Best Available Retrofit Technology (BART) Analysis For Sherburne County Generating Plant Units 1 and 2 http://www.pca.state.mn.us/index.php/view-document.html?gid=2231

21. After the Administrative Stay of the Clean Air Interstate Rule, the MPCA requested updated BART information from the facility. This was received in November 2008. http://www.pca.state.mn.us/index.php/view-document.html?gid=2234

22. After considering the five statutory factors as documented in the MPCA's BART determination memorandum dated October 26, 2009, the MPCA determined that BART for Units 1 and 2 is represented by the emission limitations set forth in this Order. These limitations are based on:

    a. Installation of sparger tubes and lime injection in the existing scrubber to control SO_2 emissions;

    b. Low NO_X burners and overfire air on Unit 1 and additional computerized combustion controls on Unit 2 to control NO_X emissions; and

    c. Existing wet electrostatic precipitators to control PM emissions.

ORDER

NOW, THEREFORE, IT IS ORDERED AND AGREED:

Xcel Energy will install and operate control equipment in order to meet the following requirements, which the parties agree represent BART for Sherco.

I. BART Emission Limitations and Compliance

A. BART for Nitrogen Oxides (NO_X)

1. Emission Limitations

a) NO_X emissions from SV001 shall not exceed 0.15 lb/MMBtu on a 30-day rolling average basis.

2. Compliance with the NO_X emission limits above will be determined through use of a continuous emission monitor in accordance with 40 CFR 75.10 and Minnesota Rules 7017.1002 through 7017.1180, as applicable.

a) The 30-day rolling average shall be calculated from the daily averages, with each daily average calculated from the valid hourly averages in each day. Biased data shall be used, following Appendix A to 40 CFR 75, but not substituted data.

B. BART for Sulfur Dioxide (SO_2)

1. Emission Limitations

a) SO_2 emissions from SV001 shall not exceed 0.12 lb/MMBtu on a 30-day rolling average basis.

2. Compliance with the SO_2 emission limits above will be determined through use of a continuous emission monitor in accordance with 40 CFR 75.10 and Minnesota Rules 7017.1002 through 7017.1180, as applicable.

a) The 30-day rolling average shall be calculated from the daily averages, with each daily average calculated from the valid hourly averages in each day.

Biased data shall be used, following Appendix A to 40 CFR 75, but not substituted data.

C. BART for Particulate Matter (PM)

1. Emission Limitations

a) PM_{10} emissions, including filterable plus organic and inorganic condensables, from SV001 shall not exceed 0.09 lb/MMBtu, based on an averaging period consistent with the particulate matter test reference methods stated below.

2. Compliance with the PM emission limit above will be determined through:

a) Operation of a continuous opacity monitor in accordance with Minnesota Rules Parts 7017.1190 to 7017.1220, as applicable;

b) Maintaining opacity for SV001 at less than or equal to 20 percent using a 3-hour average.

c) Performance testing at a frequency consistent with that required under EPA's Mercury and Air Toxics Standards Rule (40 CFR Part 63, Subpart UUUUU), or at least every 3 years. Particulate matter testing shall be conducted according to Minn. R. 7017.2001 to 7017.2060, using US EPA Method 201A or Method 5, and Method 202.

D. Compliance Deadline for BART

1. Initial compliance with these limits shall be demonstrated no later January 1, 2015.

II. Recordkeeping and Reporting Requirements

A. Recordkeeping Requirements

1. CEMS and COMS data shall be recorded and retained at the facility available for review by the MPCA or EPA inspectors

2. Retain onsite at the stationary source an operation and maintenance plan for all air pollution control equipment, keeping copies of the O & M Plan available for use by staff and MPCA or EPA staff.

3. Retain all records at the facility for a period of five (5) years from the date of monitoring, sample, measurement or report. Records which must be kept at this location include all calibration and maintenance records and all electronic recordings for continuous monitoring instrumentation.

B. Reporting Requirements

1. Excess Emission Reports

a) Excess emissions/downtime reports shall be submitted 30 days after end of each calendar quarter. The Excess Emissions Report (EER) shall indicate all periods of monitor downtime, monitor bypass and all periods of exceedances of the limit. The EER must be submitted even if there were no excess emissions, downtime or bypasses during the quarter.

2. Compliance Certification

a) A compliance certification report is due 30 days after end of each calendar year (for the previous calendar year). It is to be submitted on a form approved by the Commissioner. This report covers all deviations from the BART NO_X, SO_2, and PM limits experienced during the calendar year.

General Conditions

23. Nothing in this Order shall relieve Xcel of its obligation to meet permitting requirements for any physical or operational change at Sherco.

24. This Order by Consent is not transferable or assignable to any person without the express written approval of the MPCA.

25. This Order by Consent is effective upon the date that it is signed by the MPCA Commissioner or his designee.

26. The terms of this Order by Consent may be amended by the written agreement of the parties.

27. By their signatures below, the signatories to this Order represent that they have authority to enter into and bind their respective parties.

RESERVATION OF AUTHORITY

Nothing in this Order shall prevent the MPCA from taking action to enforce the requirements of this Order, or from requiring additional action by the Regulated Party if necessary to ensure compliance with the Regional Haze rule and other MPCA rules and statutes.

IT IS SO ORDERED AND AGREED.

Xcel Energy – Northern States Power Company

Judy M. Poferl

President and CEO

Minnesota Pollution Control Agency

Paul W. Aasen 5/2/12

Paul W. Aasen

Commissioner

STATE OF MINNESOTA

Minnesota Pollution Control Agency

In the Matter of: **ADMINISTRATIVE ORDER**

ArcelorMittal – Minorca Mine Inc.

This Administrative Order (Order) is issued by the Minnesota Pollution Control Agency (MPCA) to ArcelorMittal Minorca Mine, Inc (Arcelor) pursuant to Minn. Stat. 116.07, subd. 9 (2011).

FINDINGS OF FACT

BACKGROUND

1. On July 6, 2005, the U.S. Environmental Protection Agency (U.S. EPA) published regulations to address visibility impairment in our nation's largest national parks and wilderness ("Class I") areas ((70 Fed. Reg. 39103). This rule is commonly known as the "Regional Haze Rule" ((40 CFR 51.300-51.309). The Regional Haze Rule (Rule) requires that Minnesota establish and achieve visibility goals for each of its mandatory Class I areas by 2018.

2. The Rule regulates the emission of pollutants that contribute to regional haze. The MPCA has determined that the key pollutants contributing to regional haze are particulate matter (PM), sulfur dioxide (SO_2), and nitrogen oxides (NO_X).

3. The Rule requires that Minnesota submit a Regional Haze State Implementation Plan (SIP) to U.S. EPA for its approval. The SIP must include:

    a. Reasonable Progress Goals – Minnesota must establish, for each Class I area within the state, "goals (expressed in deciviews) that provide for reasonable progress towards achieving natural visibility conditions." (40 CFR 51.308(d)(1)).

    b. Long-Term Strategy – Minnesota must submit a long-term strategy that addresses regional haze visibility impairment, and includes "measures as necessary to achieve the reasonable progress goals established by States having mandatory Class I Federal areas." (40 CFR 51.308(d)(3)).

    c. Best Available Retrofit Technology – The Rule regulates certain stationary sources that could contribute to visibility impairment in Class I areas. States, including Minnesota, must determine what constitutes the best available retrofit technology (BART) to control for PM, SO_2, and NO_X and to establish emissions limits that are consistent with BART for these sources. The limits must be included in the SIP for U.S. EPA approval.

4. The MPCA submitted a Regional Haze SIP to U.S. EPA on December 30, 2009, which included the required Reasonable Progress Goals and Long-Term Strategy and identified the BART-eligible and subject-to-BART sources, listed the MPCA's BART determinations, and included associated BART emission limits where MPCA had sufficient emissions data to set such limits. On April 1, 2010, U.S. EPA notified the MPCA that the submittal was complete.

5. Subsequently, MPCA prepared a supplemental SIP submittal that revised the long-term strategy and included BART emission limits where additional data had been collected. The supplemental SIP submittal also included this Order and supporting documents.

6. On December 19, 2011, the MPCA put its proposed supplemental SIP submittal on public notice for 45 days. (36 SR 684). The public comment period provided Arcelor and members of the general public an opportunity to comment on this Order and the other elements of the proposed supplemental SIP, including the BART emission limits, prior to U.S. EPA's final decision on the SIP.

THE FACILITY

7. ArcelorMittal Minorca Mine Inc. (Arcelor) owns and operates a mine and taconite pellet production plant at its facility ("Facility") located near Virginia, Minnesota. Arcelor makes fully fluxed pellets using one straight grate indurating furnace. The furnace burns a maximum of 370 MMBtu/hr of natural gas and is capable of handling 400 tons of pellets per hour. The Facility has three main areas where emissions are created: the mine, the tailings basin, and the pellet plant. The larger sources of regulated air emissions at Arcelor are the indurating furnace operations and the mining activities, with lesser amounts from other processing operations and fugitive dust sources, including haul roads and the tailings basin.

BEST AVAILABLE RETROFIT TECHNOLOGY (BART)

8. The Rule includes 40 CFR Part 51, Appendix Y "*Guidelines for BART Determinations Under the Regional Haze Rule*" which provides direction for determining which sources may need to install BART and for determining BART.

9. To satisfy the Rule, the MPCA determined what constitutes BART for each BART-eligible unit and established emission limits consistent with its determination of BART. As required, the MPCA took into consideration the technology available, the costs of compliance, the energy and the non-air quality environmental impacts of compliance, any pollution control equipment in use or in existence at the source, the remaining useful life of the source, and the degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology. (40 CFR 51.308(e)(ii)).

10. To identify the BART-eligible emission units, MPCA used the following criteria:

    a. One, or more, emission(s) units at the facility fit within one of the twenty-six (26) categories listed in the 40 CFR 51, Appendix Y *Guidelines*;

    b. The emission unit(s) were in existence on August 7, 1977 and began operation at some point on or after August 7, 1962; and

    c. The sum of the potential emissions from all emission unit(s) identified in the previous two bullets was greater than 250 tons per year of the visibility-impairing pollutants: SO_2, NO_X, and PM.

11. The Facility includes units that are subject to BART. *See* RESULTS of Best Available Retrofit Technology (BART) Modeling to Determine Sources Subject-to-BART in the State of Minnesota at http://proteus.pca.state.mn.us/publications/aq-sip2-07.pdf.

12. Arcelor has one unit, the indurating furnace identified as Emission Unit 026 in Air Emissions Permit No. 13700062-003, that is subject-to-BART and for which Arcelor performed a BART analysis. This

unit has four stack vents. The stack vents associated with the unit are SV014, SV015, SV016, and SV017.

13. MPCA determined and Arcelor agreed that its indurating furnace (EU026) is subject-to-BART.

14. The MPCA determined that BART for this unit consists of:

    a. Operation of the existing wet scrubber to control SO_2 emissions; and

    b. Good combustion practices and operation of low NO_X burners in the pre-heat zone to control NO_X emissions; and

    c. Implementation of the taconite Maximum Achievable Control Technology (MACT) standard to control PM emissions. (40 CFR 63, Subp. RRRRR).

15. The MPCA must place BART emission limits in an enforceable document. (40 CFR 51.308(e)(1)(iv)). The MPCA has chosen to issue this Administrative Order as the enforceable document by which to establish the BART emission limit for Arcelor.

LONG-TERM STRATEGY

16. In the SIP, the MPCA established, as part of the long-term strategy, a target or goal of a reduction in combined SO_2 and NO_X emissions from large point sources located in St. Louis, Lake, Cook, Carlton, Itasca and Koochiching counties that emitted over 100 tons per year of either SO_2 or NO_X in 2002.

17. The MPCA also determined that the six taconite facilities in Minnesota may be undercontrolled, and that very few emission control technologies are known to be effective for the industrial processes involved in taconite production. The MPCA therefore also established a requirement for these facilities to investigate control technologies and pollution prevention practices for their indurating furnaces as part of the long-term strategy.

18. The MPCA has determined that an appropriate mechanism for implementing the long-term strategy for the taconite facilities, including Arcelor, is their demonstration that their facilities are in attainment with the one-hour National Ambient Air Quality Standards (NAAQS) for SO_2 (40 CFR 50.17) and nitrogen dioxide (NO_2) (40 CFR 50.11). As a result, Arcelor must model compliance with the one-hour and SO_2 and NO_2 NAAQS. This Order establishes the tasks and schedules by which the modeling for Arcelor will be completed.

ORDER

NOW, THEREFORE, ARCELOR IS ORDERED:

19. To install and operate any necessary control equipment or undertake any necessary work practices to meet the following requirements, which represent BART for Arcelor.

I. BART Emission Limitations and Compliance Methods

   a. BART for NO_X

i. Emission Limitations

1. NO_X emissions from EU026 shall not exceed 1018.7 lbs/hour at all times that EU026 is operating, measured on a 30-day rolling average.

2. Hours during which EU026 does not operate are not included in the calculation of the rolling average. Periods of startup, shutdown and malfunction are included in the calculation of the rolling average.

3. The NO_X emission limit is effective on and after the date six months after the effective date of U.S. EPA's approval of this BART determination.

ii. Arcelor must demonstrate compliance with the NO_X emission limit above as follows:

1. NO_X stack testing, with simultaneous measurement of emissions from all four stacks for 30 hourly data points, conducted in compliance with Minn. R. 7017.2001 through Minn. R. 7017.2060.

a. Initial BART NO_X performance test. Within 12 months of the date that the emissions limit becomes effective, Arcelor shall conduct a performance test to demonstrate compliance with the BART limit for NO_X emissions.

b. Annual BART NO_X performance tests. Each calendar year after the initial test, Arcelor shall conduct a performance test to demonstrate compliance with the BART limit for NO_x emissions. Performance testing shall include a minimum of six months and a maximum of 18 months between tests.

c. The owner or operator may receive an extension to the schedule in item 1b in the case of seasonal or temporary shutdown of the affected emissions units. Any request for an extension of the time schedule shall be submitted to the commissioner in writing by the owner or operator prior to the date by which the test is required. The request shall specify an alternative test schedule. If the commissioner grants an extension, the owner or operator shall implement the alternative test schedule.

d. Performance tests shall be conducted using methodology and under such conditions as the Commissioner specifies in the Commissioner's test plan approval.

2. As an alternative to the stack testing required in part 1, Arcelor may install and operate continuous emission monitoring systems (CEMS) to demonstrate compliance on a continuous basis. CEMS shall be operated in accordance with Minn. R. 7017.1002 through Minn. R. 7017.1220. Once CEMS are installed and certified, compliance must be determined through use of CEMS.

b. BART for SO_2

i. Emission Limitations

1. SO_2 emissions from EU026 shall not exceed 0.165 lbs per long ton of pellets produced at all times that EU026 is operating, measured on a 30-day rolling average basis.

2. Hours during which EU026 does not operate are not included in the calculation of the rolling average. Periods of startup, shutdown and malfunction are included in the calculation of the rolling average.

3. The limit applies only when the company is burning natural gas.

4. The SO_2 emission limit is effective on and after the date six months after the effective date of EPA's approval of this BART determination.

ii. Arcelor must demonstrate compliance with the SO_2 emission limit above as follows:

1. SO_2 stack testing, with simultaneous measurement of emissions from all four stacks for 30 hourly data points, conducted in compliance with Minn. R. 7017.2001 through Minn. R. 7017.2060.

a. Initial BART SO_2 performance test. Within 12 months of the date that the emissions limit becomes effective, Arcelor shall conduct a performance test to demonstrate compliance with the BART limit for SO_2 emissions.

b. Annual BART SO_2 performance tests. Each calendar year after the initial test, Arcelor shall conduct a performance test to demonstrate compliance with the BART limit for SO_2 emissions. Performance testing shall include a minimum of six months and a maximum of 18 months between tests.

c. The owner or operator may receive an extension to the schedule in item 1B in the case of seasonal or temporary shutdown of the affected emissions units. Any request for an extension of the time schedule shall be submitted to the commissioner in writing by the owner or operator prior to the date by which the test is required. The request shall specify an alternative test schedule. If the commissioner grants an extension, the owner or operator shall implement the alternative test schedule.

d. Performance tests shall be conducted using methodology and under such conditions as the Commissioner specifies in the Commissioner's test plan approval.

2. Operate and maintain a continuous parametric monitoring system (CPMS) to measure and record the daily average scrubber pressure drop and the daily average scrubber water flow rate, to demonstrate that the levels remain at or above the minimum levels established pursuant to the Taconite MACT for this emission control system.

    i. Arcelor shall not use data recorded during monitor malfunctions, associated repairs, and required quality assurance or control activities in data averages and calculations used to report emission or operating levels, or to fulfill a minimum data availability requirement. Arcelor shall use all the data collected during all other periods in assessing compliance. A monitoring malfunction is any sudden, infrequent, not reasonably preventable failure of the monitoring system to provide valid data. Monitoring failures that are caused in whole or in part by poor maintenance or careless operation are not considered malfunctions.

3. As an alternative to the stack testing required in part 1, Arcelor may install and operate continuous emission monitoring systems (CEMS) to demonstrate compliance on a continuous basis. CEMS shall be operated in accordance with Minn. R. 7017.1002 through Minn. R. 7017.1220.Once CEMS are installed and certified, compliance must be determined through the use of CEMS.

c. BART for Particulate Matter (PM)

    i. Emission Limitations

        1. Filterable (front-half) PM emissions from EU026 shall not exceed 0.01 gr/dscf at all times that EU026 is operating.

    ii. Arcelor must demonstrate compliance with the PM emission limits above using the compliance methods in 40 CFR 63 Subpart RRRRR, the taconite MACT, based on the flow weighted mean concentration of all four stacks associated with EU026.

    iii. Compliance with the PM emission limit must be demonstrated by the deadlines laid out in 40 CFR 63, Subpart RRRRR.

II. Recordkeeping and Reporting

a. Recordkeeping. Arcelor shall maintain electronic files of all information required by this Order in a form suitable for determination of Arcelor's compliance with this Order by EPA or MPCA staff and readily available for EPA or MPCA inspection and review.

i. Arcelor shall maintain monitoring, testing, startup, shutdown, bypass, breakdowns, and excess emissions records from EU026 pertaining to the emission limits established by this Order in the manner required in the total Facility requirements of Arcelor's air emissions permit, pursuant to Minn. R. 7007.0800.

ii. Arcelor shall maintain records of both the Firing Chamber Gas Flow Rate (A+B) and the Preheat Gas Flow Rate in mmcf/hour.

iii. Arcelor shall retain the records for a minimum of five years following the date on which the record was generated. The most recent two years of information must be kept on site**.**

b. Reporting. Arcelor shall, in the Semiannual Deviations Report required under Minn. R. 7007.0800, Subp. 6(A)(2), report each instance in which an emission limit was not met. This includes periods of startup, shutdown, and malfunction.

20. To conduct the following modeling analyses and submit the following information in order to ensure expeditious attainment of the one-hour SO_2 and NO_2 NAAQS as part of the long-term strategy

I. Modeling Protocol

a. By June 1, 2012, submit to the MPCA a modeling protocol for the Arcelor facility for NO_2 emissions. The protocol must be submitted using MPCA's most recent model protocol forms, AQDMP-01 and AQDMPS-01.

II. Modeling and Emission Limits Demonstrating Compliance

a. By December 31, 2012, submit to the MPCA:

i. A modeling demonstration that shows modeled compliance with the one-hour SO_2 NAAQS (40 CFR 50.17) and one-hour NO_2 NAAQS (40 CFR 50.11);

ii. A table of proposed emission limits from the facility, by emission unit and stack vent, that result in modeled compliance with the one-hour SO_2 and NO_2 NAAQS;

iii. A description of the work practices or controls to be implemented in order to meet the proposed emission limits; and

iv. A detailed schedule for implementation of the necessary work practices or controls which ensures that they will be in place and the emission limits achieved by June 30, 2017.

General.

21. Nothing in this Order shall relieve Arcelor of its obligation to meet permitting requirements for any physical or operational change at its facility.

22. This Order is not transferable or assignable to any person without the express written approval of the MPCA.

23. This Order is effective upon the date that it is signed by the MPCA Commissioner or his designee.

RESERVATION OF AUTHORITY

Nothing in this Order shall prevent the MPCA from taking action to enforce the requirements of this Order, or from requiring additional action by the Regulated Party if necessary to ensure compliance with the Regional Haze rule and other MPCA rules and statutes.

IT IS SO ORDERED.

Minnesota Pollution Control Agency

Paul W. Aasen

Commissioner

Dated: 5/2/12

STATE OF MINNESOTA

Minnesota Pollution Control Agency

In the Matter of: **ADMINISTRATIVE ORDER**

Hibbing Taconite Company

This Administrative Order (Order) is issued by the Minnesota Pollution Control Agency (MPCA) to Hibbing Taconite Company (HTC) pursuant to Minn. Stat. 116.07, subd. 9 (2011).

FINDINGS OF FACT

BACKGROUND

1. On July 6, 2005, the U.S. Environmental Protection Agency (U.S. EPA) published regulations to address visibility impairment in our nation's largest national parks and wilderness ("Class I") areas (70 Fed. Reg. 39103). This rule is commonly known as the "Regional Haze Rule" (40 CFR 51.300-51.309). The Regional Haze Rule (Rule) requires that Minnesota establish and achieve visibility goals for each of its Class I areas by 2018.
2. The Rule regulates the emission of pollutants that contribute to regional haze. The MPCA has determined that the key pollutants are particulate matter (PM), sulfur dioxide (SO_2), and nitrogen oxides (NO_X).
3. The Rule requires that Minnesota submit a Regional Haze State Implementation Plan (SIP) to U.S. EPA for its approval. The SIP must include:
    a. Reasonable Progress Goals – Minnesota must establish, for each Class I area within the state, "goals (expressed in deciviews) that provide for reasonable progress towards achieving natural visibility conditions." (40 CFR 51.308(d)(1)).
    b. Long-Term Strategy – Minnesota must submit a long-term strategy that addresses regional haze visibility impairment, and includes "measures as necessary to achieve the reasonable progress goals established by States having mandatory Class I Federal areas." (40 CFR 51.308(d)(3)).
    c. Best Available Retrofit Technology – The Rule regulates certain stationary sources that could contribute to visibility impairment in Class I areas. States, including Minnesota, must determine what constitutes the best available retrofit technology (BART) to control for PM, SO_2, and NO_X and to establish emissions limits that are consistent with BART for these sources. The limits must be included in the SIP for U.S. EPA approval.
4. The MPCA submitted a Regional Haze SIP to U.S. EPA on December 30, 2009, which included the required Reasonable Progress Goals and Long-Term Strategy and identified the BART-eligible and subject-to-BART sources, listed the MPCA's BART determinations, and included associated BART emission limits where MPCA had sufficient emissions data to set such limits. On April 1, 2010, U.S. EPA notified the MPCA that the submittal was complete.
5. Subsequently, MPCA prepared a supplemental SIP submittal that revised the long-term strategy and included BART emission limits where additional data had been collected. The supplemental SIP submittal also included this Order and supporting documents.
6. On December 19, 2011, the MPCA put its proposed supplemental SIP submittal on public notice for 45 days. (36 SR 684). The public comment period provided HTC and members of the general public

an opportunity to comment on this Order and the other elements of the proposed supplemental SIP, including the BART emission limits, prior to U.S. EPA's final decision on the SIP.

THE FACILITY

7. Hibbing Taconite Company (HTC) is a taconite (magnetite) ore mining and beneficiation facility ("Facility) located in Hibbing, Minnesota. HTC is owned by ArcelorMittal, Cliffs Natural Resources, and US Steel; Cliffs Natural Resources is the managing agent. HTC operates three functionally equivalent straight grate indurating furnaces, which are capable of producing a combined 9 million dry tons of pellets annually. The larger sources of air emissions at HTC are from the mining activities and indurating furnace operations, with lesser amounts from other processing operations and fugitive dust sources, including haul roads and the tailings basin.

BEST AVAILABLE RETROFIT TECHNOLOGY (BART)

8. The Rule includes 40 CFR Part 51, Appendix Y "*Guidelines for BART Determinations Under the Regional Haze Rule*" which provides direction for determining which sources may need to install BART and for determining BART.

9. To satisfy the Rule, the MPCA determined what constitutes BART for each BART-eligible unit and established emission limits consistent with its determination of BART. As required, the MPCA took into consideration the technology available, the costs of compliance, the energy and the non-air quality environmental impacts of compliance, any pollution control equipment in use or in existence at the source, the remaining useful life of the source, and the degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology. (40 CFR 51.308(e)(ii)).

10. To identify the BART-eligible emission units, MPCA used the following criteria:

    a. One, or more, emission(s) units at the facility fit within one of the twenty-six (26) categories listed in the 40 CFR 51, Appendix Y *Guidelines*;

    b. The emission unit(s) were in existence on August 7, 1977 and began operation at some point on or after August 7, 1962; and

    c. The sum of the potential emissions from all emission unit(s) identified in the previous two bullets was greater than 250 tons per year of the visibility-impairing pollutants: SO_2, NO_X, and PM.

11. The Facility includes units that are subject to BART. *See* RESULTS of Best Available Retrofit Technology (BART) Modeling to Determine Sources Subject-to-BART in the State of Minnesota at http://proteus.pca.state.mn.us/publications/aq-sip2-07.pdf.

12. HTC has three units, the pelletizing furnaces identified as Emission Units 020, 021 and 022 in Air Emissions Permit No. 13700061-004, that are subject-to-BART and for which HTC performed a BART analysis. Each unit has four stack vents. The stack vents associated with EU020, the Line 1 pelletizing furnace, are SV021, SV022, SV023 and SV024. The stack vents associated with EU021, the Line 2 pelletizing furnace, are SV025, SV026, SV027, and SV028. The stack vents associated with EU022, the Line 3 pelletizing furnace, are SV029, SV030, SV031, and SV032.

13. MPCA and HTC agreed that its three pelletizing furnaces (EU020, EU021, and EU022) are subject-to-BART.

14. The MPCA determined that BART for these units consists of

    a. Operation of the existing wet scrubber to control SO_2 emissions; and

    b. Good combustion practices to control NO_X emissions; and

    c. Implementation of the taconite Maximum Achievable Control Technology (MACT) standard to control PM emissions. (40 CFR 63, Subp. RRRRR).

15. The MPCA must place BART emission limits in an enforceable document. (40 CFR 51.308(e)(1)(iv)). The MPCA has chosen to issue this Administrative Order as the enforceable document by which to establish the BART emission limit for HTC.

LONG-TERM STRATEGY

16. In the SIP, the MPCA established, as part of the long-term strategy, a target or goal of a reduction in combined SO_2 and NO_X emissions from large point sources located in St. Louis, Lake, Cook, Carlton, Itasca and Koochiching counties that emitted over 100 tons per year of either SO_2 or NO_X in 2002.

17. The MPCA also determined that the six taconite facilities in Minnesota may be undercontrolled, and that very few emission control technologies are known to be effective for the industrial processes involved in taconite production. The MPCA therefore also established a requirement for these facilities to investigate control technologies and pollution prevention practices for their indurating furnaces as part of the long-term strategy.

18. The MPCA has determined that an appropriate mechanism for implementing the long-term strategy for the taconite facilities, including HTC, is their demonstration that their facilities are in attainment with the one-hour National Ambient Air Quality Standards (NAAQS) for SO_2 (40 CFR 50.17) and nitrogen dioxide (NO_2) (40 CFR 50.11). As a result, HTC must model compliance with the one-hour and SO_2 and NO_2 NAAQS. This Order establishes the tasks and schedules by which the modeling for HTC will be completed.

ORDER

NOW, THEREFORE, HTC IS ORDERED:

19. To install and operate any necessary control equipment or implement any necessary work practices in order to meet the following requirements, which represent BART for HTC.

I. BART Emission Limitations and Compliance Methods

   a. BART for Nitrogen Oxides (NO_X)

      i. Emission Limitations

         1. NO_X emissions from Line 1, EU020 shall not exceed 449.7 lbs/hour at all times that EU020 is operating, measured on a 30-day rolling average.

         2. NO_X emissions from Line 2, EU021:

a. Shall not exceed the following levels, measured on a 30-day rolling average, for the period from the effective date of this Order until six months after the date on which the CEMS required under Part II are certified following installation:

    i. 894.2 lbs/hour at all times that EU021 is operating and making high compression pellets; and

    ii. 608.9 lbs/hour at all times that EU021 is operating and making standard pellets.

b. Shall not exceed 572 lbs/hour, measured on a 30-day rolling average, for the period beginning six months after the date on which the CEMS required under Part II are certified following installation.

    i. If, within the six months after the date on which the CEMS are certified period, it is determined that is not feasible for HTC to comply with the limit specified in part b, the owner/operator shall submit a notification to the Commissioner that it is not feasible for the facility to meet the limits and a request for an adjustment of the limits. The information shall be submitted prior to the effective date of this lower limit and shall, at a minimum, contain the following information:

        1. All validated CEMS data for NO_X emissions from EU021. The CEMS data shall be recorded and reported in the units of ppm and lb/hr on an hourly basis; and

        2. Operating parameter data required under Part III.a.ii, for the period of time corresponding to the validated CEMS data; and

        3. An analysis of operating parameters, conditions, or other factors that contributed to periods of emissions higher than 572 lb/hour; and

        4. Proposed NO_X emission limits to replace the 572 lbs/hour limit, measured on a 30-day rolling average.

        5. If a notification containing this information is submitted within six months following CEMS certification, the emissions limits from 2.a shall continue to apply until this Order is amended or the MPCA notifies HTC that this Order will not be amended.

3. NO_X emissions from Line 3, EU022:

    a. Shall not exceed 347.5 lbs/hour, at all times that EU022 is operating, measured on a 30-day rolling average.

4. These NO_X emission limits are effective on and after the date six months after the effective date of U.S. EPA's approval of this BART determination.

ii. HTC must demonstrate compliance with the NO_X emission limits above as follows:

1. NO_X stack testing with simultaneous measurement of emissions from all four stacks for 30 hourly data points, conducted in compliance with Minn. R. 7017.2001 through Minn. R. 7017.2060.

a. Initial BART NO_X performance test. Within 12 months of the date that the limit becomes effective, HTC shall conduct a performance test to demonstrate compliance with the BART limit for NO_X emissions.

b. Annual BART NO_X performance tests. Each calendar year after the initial test, HTC shall conduct a performance test to demonstrate compliance with the BART limit for NO_x emissions. The performance test shall be conducted between 10 months and 14 months after the previous BART NO_x performance test.

c. Performance tests shall be conducted using test methodology and under such conditions as the Commissioner specifies in the Commissioner's test plan approval.

2. As an alternative to the stack testing required in part 1, HTC may install and operate continuous emission monitoring systems (CEMS) to demonstrate compliance on a continuous basis. CEMS shall be operated in accordance with Minn. R. 7017.1002 through Minn. R. 7017.1220. Once any CEMS, whether installed under Part II of this Order or installed voluntarily, are installed and certified, compliance must be determined through the use of CEMS.

b. BART for Sulfur Dioxide (SO_2)

i. Emission Limitations

1. SO_2 emissions from Line 1, EU020, shall not exceed 0.207 lbs SO_2/long ton of pellets fired (finished) at all times that EU020 is operating, measured on a 30-day rolling average;

2. SO_2 emissions from Line 2, EU021, shall not exceed 0.207 lbs SO_2/long ton of pellets fired (finished) at all times that EU021 is operating, measured on a 30-day rolling average;

3. SO_2 emissions from Line 3, EU022, shall not exceed 0.207 lbs SO_2/long ton of pellets fired (finished) at all times that EU022 is operating, measured on a 30-day rolling average.

4. Each limit applies only when HTC is burning natural gas.

5. Hours during which the subject emission unit does not operate are not included in the calculation of the rolling average. Periods of startup, shutdown and malfunction are included in the calculation of the rolling average.

6. These SO_2 emission limits are effective on and after the date six months after the effective date of U.S. EPA's approval of this BART determination.

ii. HTC must demonstrate compliance with the SO_2 emission limits as follows:

1. SO_2 stack testing, with simultaneous measurement of emissions from all four stacks for 30 hourly data points, conducted in compliance with Minn. R. 7017.2001 through Minn. R. 7017.2060.

a. Initial BART SO_2 performance test. Within 12 months of the date that the emissions limit becomes effective, HTC shall conduct a performance test to demonstrate compliance with the BART limit for SO_2 emissions.

b. Annual BART SO_2 performance tests. Each calendar year after the initial test, HTC shall conduct a performance test to demonstrate compliance with the BART limit for SO_2 emissions. Performance testing shall include a minimum of six months and a maximum of 18 months between tests.

c. The owner or operator may receive an extension to the schedule in item 1B in the case of seasonal or temporary shutdown of the affected emissions units. A request for an extension of the time schedule shall be submitted to the commissioner in writing by the owner or operator prior to the date by which the test is required. The request shall specify an alternative test schedule. If the commissioner grants an extension, the owner or operator shall implement the alternative test schedule.

d. Performance tests shall be conducted using test methodology and under such conditions as the Commissioner specifies in the Commissioner's test plan approval.

2. Operate and maintain a continuous parametric monitoring system (CPMS) to measure the daily average scrubber pressure drop and the daily average scrubber water flow rate, to demonstrate that the levels remain at or above the minimum levels established during the initial and subsequent performance tests.

i. HTC shall not use data recorded during monitoring malfunctions, associated repairs, and required quality assurance or control activities in data averages and calculations used to report emission or operating levels, or to fulfill a minimum data availability requirement. HTC shall use all the data collected during all other periods in assessing compliance. A monitoring malfunction is any sudden, infrequent, not reasonably preventable failure of the monitoring system to provide valid data. Monitoring failures that are caused in part by poor maintenance or careless operation are not considered malfunctions.

iii. Compliance with these limits must be demonstrated by six months after the effective date of EPA's approval of this BART determination.

c. BART for Particulate Matter (PM)

i. Emission Limitations

1. Filterable (front-half) PM emissions from Line 1, EU020, shall not exceed 0.01 gr/dscf at all times EU020 is operating; and

2. Filterable (front-half) PM emissions from Line 2, EU021, shall not exceed 0.01 gr/dscf at all times EU021 is operating; and

3. Filterable (front-half) PM emissions from Line 3, EU022, shall not exceed 0.01 gr/dscf at all times EU022 is operating.

ii. Compliance with the PM emission limits above will be determined using the compliance methods laid out 40 CFR 63 Subpart RRRRR, the taconite MACT, and determined based on the flow weighted mean concentration of all stacks associated with the subject emission unit.

iii. Compliance with the PM emission limit must be demonstrated by the deadlines laid out in the taconite MACT.

II. Installation of Continuous Emission Monitoring Systems (CEMS)

a. Line-Specific CEMS Requirements

i. Line 2, EU021

1. Within 60 days of the effective date of this Order, HTC shall submit to the MPCA a Plan with a schedule for the installation and certification of NO_X CEMS on the pelletizing furnace, measuring emissions from each stack on EU021.

2. The Plan shall provide that the CEMS are installed and certification test results that report certification are submitted to the MPCA no later than one year after the due date of the Plan.

ii. Line 1, EU020, and Line 3, EU022

1. In the event that an annual stack test conducted under Part I.a.ii of this Order shows noncompliance with the applicable NO_X emission limit, HTC will, within 60 days of the submittal of the Performance Test report showing noncompliance, submit to the MPCA a Plan which provides a schedule for the installation of NO_X CEMS on the pelletizing furnaces , measuring emissions from each stack on the subject Line.

a. The Plan shall provide that the CEMS are installed and certification test results that report certification are submitted to the MPCA no later than one year after the due date of the Plan.

2. In the period between the end of the annual stack test and ten months after the CEMS required under Part II.a.ii.1 are certified, the following NO_X limits will apply:

a. NO_X emissions from Line 1, EU020, shall not exceed 514 lbs/hr at all times EU020 is operating, measured on a 30-day rolling average.

b. NO_X emissions from Line 3, EU022, shall not exceed 384 lbs/hr at all times EU022 is operating, measured on a 30-day rolling average.

3. Six months after the CEMS required under Part II.a.ii.1 are certified, HTC shall submit to the MPCA a request for a revised NO_X emission limit. The request shall, at a minimum, contain the following information:

a. All validated CEMS data for NO_X emissions from the subject unit. The CEMS data shall be recorded and reported in the units of ppm and lb/hr on an hourly basis; and

b. Operating parameter data required under Part III.a.ii, for the period of time corresponding to the validated CEMS data; and

c. An analysis of operating parameters, conditions, or other factors that contributed to periods of emissions higher than the limits specified in Part I.a.i;

d. Proposed NO_X emission limit(s) to replace the limits in Part II.a.ii.2, measured on a 30-day rolling average.

e. If this Order is not amended prior to the deadline established in Part II.a.ii.2, the emission limits for EU020 and EU022 will revert to those established in Part I.a.i of this Order.

b. HTC shall conform to the CEMS requirements specified in Minn. R. chs. 7017.1002, 7017.1030, 7017.1035, 7017.1040, 7017.1050, 7017.1060, 7017.1070, 7017.1080, 7017.1090, 7017.1100, 7017.1110, 7017.1120, subps. 2, 3, and 4, 7017.1130, 7017.1140, 7017.1150, 7017.1160, 7017.1170 and 7017.1180.

c. Once installed, HTC shall continuously operate the CEMS under this Order at all times when the associated process equipment is operating.

d. Once installed and certified, the CEMS shall be used to determine compliance with the NO_X emissions limits in this Order.

III. Recordkeeping and Reporting

a. Recordkeeping. HTC shall maintain electronic files of all information required by this Order immediately upon such time as each requirement is effective and in a form suitable for determination of HTC's compliance with this Order by U.S. EPA or MPCA staff and readily available for U.S. EPA or MPCA inspection and review.

i. HTC shall maintain monitoring, testing, and excess emissions records pertaining to the requirements of this Order in the manner required in the total Facility requirements of HTC's air emissions permit, pursuant to Minn. R. 7007.0800.

ii. HTC shall retain records of operational parameters related to emissions, including ferrous iron content of the feed materials, pellet type, production rate, heat input, stack gas flow rate, and combustion zone temperature.

iii. HTC shall retain the records for a minimum of five years following the date on which the record was generated. The most recent two years of information must be kept on site.

b. Reporting. HTC shall provide a quarterly report of each instance in which a NO_X emission limit was not met. This includes periods of startup, shutdown, and malfunction. The report shall be submitted using the Excess Emissions Report (DRF-1). HTC shall, in the Semiannual Deviations Report required under Minn. R. 7007.0800, Subp. 6(A)(2), report each instance in which an emission limit was not met. This includes periods of startup, shutdown, and malfunction.

20. To conduct the following modeling analyses and submit the following information in order to ensure expeditious attainment of the one-hour SO_2 and NO_2 NAAQS as part of the long-term strategy

I. Modeling Protocol

a. By June 1, 2012, submit to the MPCA a modeling protocol for the HTC for NO_2 emissions. The protocol must be submitted using MPCA's most recent model protocol forms, AQDMP-01 and AQDMPS-01.

II. Modeling and Emission Limits Demonstrating Compliance

a. By December 31, 2012, submit to the MPCA:

i. A modeling demonstration that shows modeled compliance with the one-hour SO_2 and NO_2 NAAQS;

ii. A table of proposed emission limits from the facility, by emission unit and stack vent, that result in modeled compliance with the one-hour SO_2 and NO_2 NAAQS;

iii. A description of the work practices or controls to be implemented in order to meet the proposed emission limits; and

iv. A detailed schedule for implementation of the necessary work practices or controls which ensures that they will be in place and the emission limits achieved by June 30, 2017.

General.

21. Nothing in this Order shall relieve HTC of its obligation to meet permitting requirements for any physical or operational change at its facility.

22. This Order is not transferable or assignable to any person without the express written approval of the MPCA.

23. This Order is effective upon the date that it is signed by the MPCA Commissioner or his designee.

RESERVATION OF AUTHORITY

Nothing in this Order shall prevent the MPCA from taking action to enforce the requirements of this Order, or from requiring additional action by the Regulated Party if necessary to ensure compliance with the Regional Haze rule and other MPCA rules and statutes.

IT IS SO ORDERED.

Minnesota Pollution Control Agency

Paul W. Aasen

Commissioner

Dated: 5/2/12

STATE OF MINNESOTA

Minnesota Pollution Control Agency

In the Matter of: **ADMINISTRATIVE ORDER**

Northshore Mining Company – Silver Bay

This Administrative Order (Order) is issued by the Minnesota Pollution Control Agency (MPCA) to Northshore Mining Company – Silver Bay (NSM) pursuant to Minn. Stat. 116.07, subd. 9 (2011).

FINDINGS OF FACT

BACKGROUND

1. On July 6, 2005, the U.S. Environmental Protection Agency (U.S. EPA) published regulations to address visibility impairment in our nation's largest national parks and wilderness ("Class I") areas (70 Fed. Reg. 39103). This rule is commonly known as the "Regional Haze Rule" (40 CFR 51.300-51.309). The Regional Haze Rule (Rule) requires that Minnesota establish and achieve visibility goals for each of its mandatory Class I areas by 2018.

2. The Rule regulates the emission of pollutants that contribute to regional haze. The MPCA has determined that the key pollutants contributing to regional haze are particulate matter (PM), sulfur dioxide (SO_2), and nitrogen oxides (NO_X).
3. The Rule requires that Minnesota submit a Regional Haze State Implementation Plan (SIP) to U.S. EPA for its approval. The SIP must include:

    a. Reasonable Progress Goals – Minnesota must establish, for each Class I area within the state, "goals (expressed in deciviews) that provide for reasonable progress towards achieving natural visibility conditions." (40 CFR 51.308(d)(1)).

    b. Long-Term Strategy – Minnesota must submit a long-term strategy that addresses regional haze visibility impairment, and includes "measures as necessary to achieve the reasonable progress goals established by States having mandatory Class I Federal areas." (40 CFR 51.308(d)(3)).

    c. Best Available Retrofit Technology – The Rule regulates certain stationary sources that could contribute to visibility impairment in Class I areas. States, including Minnesota, must determine what constitutes the best available retrofit technology (BART) to control for PM, SO_2, and NO_X and to establish emissions limits that are consistent with BART for these sources. The limits must be included in the SIP for U.S. EPA approval.

4. The MPCA submitted a Regional Haze SIP to U.S. EPA on December 30, 2009, which included the required Reasonable Progress Goals and Long-Term Strategy and identified the BART-eligible and subject-to-BART sources, listed the MPCA's BART determinations, and included associated BART emission limits where MPCA had sufficient emissions data to set such limits. On April 1, 2010, U.S. EPA notified the MPCA that the submittal was complete.

5. Subsequently, MPCA prepared a supplemental SIP submittal that revised the long-term strategy and included BART emission limits where additional data had been collected. The supplemental SIP submittal also included this Order and supporting documents.

6. On December 19, 2011, the MPCA put its proposed supplemental SIP submittal on public notice for 45 days. (36 SR 684). The public comment period provided NSM and members of the general public an opportunity to comment on this Order and the other elements of the proposed supplemental SIP, including the BART emission limits, prior to U.S. EPA's final decision on the SIP.

THE FACILITY

7. Northshore Mining Company – Silver Bay (NSM) is located on the north shore of Lake Superior. It was the first taconite operation in Minnesota, originally built in the mid-1950s by Reserve Mining Company. Cleveland Cliffs, Incorporated purchased the facility from Cyprus Minerals in 1994; Cliffs Natural Resources now owns and operates the facility.

8. NSM has four indurating furnaces. Furnaces 11 and 12 began operating in 1963. Furnaces 11 and 12 were manufactured by Arthur G. McKee and are NSM's largest indurating furnaces. They each burn a maximum of 150 MMBtu/hr of natural gas and are capable of processing 300 tons of pellets per hour. The other two furnaces, Furance 5 and Furnace 6, began operation prior to 1962. Furnace 5 was shut down for several years; in 2006, NSM received a Prevention of Significant Deterioration permit authorizing the restarting of Furnace 5.

9. NSM also operates two process boilers. Both process boilers were installed in 1965 and are rated at 79 MMBtu/hr. The boilers are capable of burning fuel oil and natural gas.

BEST AVAILABLE RETROFIT TECHNOLOGY (BART)

10. The Rule includes 40 CFR Part 51, Appendix Y "*Guidelines for BART Determinations Under the Regional Haze Rule*" which provides direction for determining which sources may need to install BART and for determining BART.

11. To satisfy the Rule, the MPCA determined what constitutes BART for each BART-eligible unit and established emission limits consistent with its determination of BART. As required, the MPCA took into consideration the technology available, the costs of compliance, the energy and the non-air quality environmental impacts of compliance, any pollution control equipment in use or in existence at the source, the remaining useful life of the source, and the degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology. (40 CFR 51.308(e)(ii).)

12. To identify the BART-eligible emission units, MPCA used the following criteria:

    a. One, or more, emission(s) units at the facility fit within one of the twenty-six (26) categories listed in the 40 CFR Part 51, Appendix Y *Guidelines*;

    b. The emission unit(s) were in existence on August 7, 1977 and began operation at some point on or after August 7, 1962; and

    c. The sum of the potential emissions from all emission unit(s) identified in the previous two bullets was greater than 250 tons per year of the visibility-impairing pollutants: SO_2, NO_X, and PM.

13. The facility includes units that are subject to BART. *See* RESULTS of Best Available Retrofit Technology (BART) Modeling to Determine Sources Subject-to-BART in the State of Minnesota at http://proteus.pca.state.mn.us/publications/aq-sip2-07.pdf.

14. NSM has four units, the indurating furnaces identified as Emission Units 100/104, and 110/113 and the process boilers identified as Emission Units 003 and 004 in Air Emissions Permit No. 07500003-007, that are subject-to-BART and for which NSM performed a BART analysis. The stack vents associated with Furnace 11, EU100/EU104, are SV101, SV102, SV103, SV104, and SV105. The stack vents associated with Furnace 12, EU110/EU114, are SV111, SV112, SV113, SV114, and SV115. The stack vent associated with process boiler #1, EU003, is SV003. The stack vent associated with process boiler #2, EU004, is SV003.

15. MPCA determined and NSM agreed that two of NSM's indurating furnaces (Furnace 11 and Furnace 12) and two of NSM's process boilers (boiler #1 and boiler #2) are subject-to-BART.

16. The MPCA determined that BART for the indurating furnaces consists of

    a. Operation of the existing wet scrubber to control SO_2 emissions;

    b. Good combustion practices to control NO_X emissions; and

    c. Implementation of the taconite Maximum Achievable Control Technology (MACT) standard to control PM emissions. (40 CFR 63, Subp. RRRRR).

17. The MPCA determined that BART for the process boilers consists of existing design and permitted fuels.

18. The MPCA must place BART emission limits in an enforceable document. (40 CFR 51.308(e)(1)(iv)). The MPCA has chosen to issue this Administrative Order as the enforceable document by which to establish the BART emission limit for NSM.

LONG-TERM STRATEGY

19. In the SIP, the MPCA established, as part of the long-term strategy, a target or goal of a reduction in combined SO_2 and NO_X emissions from large point sources located in St. Louis, Lake, Cook, Carlton, Itasca and Koochiching counties that emitted over 100 tons per year of either SO_2 or NO_X in 2002.

20. The MPCA also determined that the six taconite facilities in Minnesota may be undercontrolled, and that very few emission control technologies are known to be effective for the industrial processes involved in taconite production. The MPCA therefore also established a requirement for these facilities to investigate control technologies and pollution prevention practices for their indurating furnaces as part of the long-term strategy.

21. The MPCA has determined that an appropriate mechanism for implementing the long-term strategy for the taconite facilities, including NSM, is their demonstration that their facilities are in attainment with the one-hour National Ambient Air Quality Standards (NAAQS) for SO_2 (40 CFR 51.17) and nitrogen dioxide (NO_2) (40 CFR 51.11). As a result, NSM must model compliance with the one-hour and SO_2 and NO_2 NAAQS. This Order establishes the tasks and schedules by which the modeling for NSM will be completed.

ORDER

NOW, THEREFORE, NSM IS ORDERED:

22. To install and operate any necessary control equipment or undertake any necessary work practices in order to meet the following requirements, which represent BART for NSM.

I. Process Boiler BART Emission Limitations and Compliance Methods

a. BART for NO_X

i. Emission Limitations

1. NO_X emissions from Process Boiler #1 (EU003) shall not exceed 0.17 lbs/hour at all times when EU003 is operating, measured on a 30-day rolling average.

2. NO_X emissions from Process Boiler #2 (EU004) shall not exceed 0.17 lbs/hour at all times when EU004 is operating, measured on a 30-day rolling average.

3. Hours during which the unit does not operate are not included in the calculation of the rolling average. Periods of startup, shutdown and malfunction are included in the calculation of the rolling average.

4. The NO_X emission limit is effective on and after the date six months after the effective date of U.S. EPA's approval of this BART determination.

ii. NSM must demonstrate compliance with the NO_X emission limits above will as follows:

1. NO_X stack testing, conducted in compliance with Minn. R. 7017.2001 through Minn. R. 7017.2060.

a. Initial BART NO_X performance test. Within 12 months of the date that the emissions limit becomes effective, NSM shall conduct a performance test to demonstrate compliance with the BART limit for NO_X emissions.

b. BART NO_X performance tests. NSM shall conduct a performance test to demonstrate compliance with the BART limit for NO_x emissions once every five years.

c. Performance tests shall be conducted using methodology and under such conditions as the Commissioner specifies in the Commissioner's test plan approval.

II. Furnace BART Emission Limitations and Compliance Methods

a. BART for NO_X

i. Emission Limitations

1. NO_X emissions from Furnace 11 shall not exceed 122.4 lbs/hour as all times when Furnace 11 is operating, measured on a 30-day rolling average;

2. NO_X emissions from Furnace 12 shall not exceed 122.4 lbs/hour at all times when Furnace 12 is operating, measured on a 30-day rolling average.

3. Hours during which the emission unit does not operate are not included in the calculation of the rolling average. Periods of startup, shutdown and malfunction are included in the calculation of the rolling average.

4. The NO_X emission limit is effective on and after the date six months after the effective date of U.S. EPA's approval of this BART determination.

ii. NSM must demonstrate compliance with the NO_X emission limits above as follows:

1. NO_X stack testing, with simultaneous measurement of emissions from all four stacks for 30 hourly data points, conducted in compliance with Minn. R. 7017.2001 through Minn. R. 7017.2060.

a. Initial BART NO_X performance test. Within 12 months of the date that the limit becomes effective, NSM shall conduct a performance test to demonstrate compliance with the BART limit for NO_X emissions.

b. Annual BART NO_X performance tests. Each calendar year after the initial test, NSM shall conduct a performance test to demonstrate compliance with the BART limit for NO_x emissions. Performance testing shall include a minimum of six months and a maximum of 18 months between tests.

c. The owner or operator may receive an extension to the schedule in item 1b in the case of seasonal or temporary shutdown of the affected emissions units. Any request for an extension of the time schedule shall be submitted to the commissioner in writing by the owner or operator prior to the date by which the test is required. The request shall specify an alternative test schedule. If the commissioner grants an extension, the owner or operator shall implement the alternative test schedule.

d. Performance tests shall be conducted using methodology and under such conditions as the Commissioner specifies in the Commissioner's test plan approval.

a. As an alternative to the stack testing laid out in part 1, NSM may install and operate continuous emission monitoring systems (CEMS) to demonstrate compliance on a continuous basis. CEMS shall be operated in accordance with Minn. R. 7017.1002 through Minn. R. 7017.1220. Once CEMS are installed and certified, compliance must be determined through the use of CEMS.

b. BART for Sulfur Dioxide (SO_2)

i. Emission Limitations

1. SO_2 emissions from Furnace 11 shall not exceed 0.0651 lbs SO_2/long ton of pellets fired (finished), measured on a 30-day rolling average;

2. SO_2 emissions from Furnace 12 shall not exceed 0.0651 lbs SO_2/long ton of pellets fired (finished), measured on a 30-day rolling average.

3. This limit applies only when the subject emission unit is burning natural gas.

4. Hours during which the subject emission unit does not operate are not included in the calculation of the rolling average. Periods of startup, shutdown and malfunction are included in the calculation of the rolling average.

5. The SO_2 emissions limits are effective on and after the date six months after the effective date of U.S. EPA's approval of this BART determination.

ii. Compliance with the SO_2 emission limits above will be determined as follows:

1. Annual SO_2 stack testing, with simultaneous measurement of emissions from all four stacks for 30 hourly data points, conducted in compliance with Minn. R. 7017.2001 through Minn. R. 7017.2060.

a. Initial BART SO_2 performance test. Within 12 months of the date that the limit becomes effective, NSM shall conduct a performance test to demonstrate compliance with the BART limit for SO_2 emissions.

b. Annual BART SO_2 performance tests. Each calendar year after the initial test, NSM shall conduct a performance test to demonstrate compliance with the BART limit for SO_2 emissions.

c. Performance testing shall include a minimum of six months and a maximum of 18 months between tests.

d. The owner or operator may receive an extension to the schedule in item 1b in the case of seasonal or temporary shutdown of the affected emissions units. Any request for an extension of the time schedule shall be submitted to the commissioner in writing by the owner or operator prior to the date by which the test is required. The request shall specify an alternative test schedule. If the commissioner grants an extension, the owner or operator shall implement the alternative test schedule.

e. Performance tests shall be conducted using methodology and under such conditions as the Commissioner specifies in the Commissioner's test plan approval.

2. Operate and maintain a continuous parametric monitoring system (CPMS) to measure the daily average scrubber pressure drop and the daily average scrubber water flow rate, to demonstrate that the levels remain at or above the minimum levels established during the initial and subsequent performance tests.

    i. NSM shall not use data recorded during monitoring malfunctions, associated repairs, and required quality assurance or control activities in data averages and calculations used to report emission or operating levels, or to fulfill a minimum data availability requirement. NSM shall use all the data collected during all other periods in assessing compliance. A monitoring malfunction is any sudden, infrequent, not reasonably preventable failure of the monitoring system to provide valid data. Monitoring failures that are caused in part by poor maintenance or careless operation are not considered malfunctions.

3. As an alternative to the stack testing laid out in part 1, NSM may install and operate continuous emission monitoring systems (CEMS) to demonstrate compliance on a continuous basis. CEMS shall be operated in accordance with Minn. R. 7017.1002 through Minn. R. 7017.1220. Once CEMS are installed and certified, compliance must be determined through the use of CEMS.

c. BART for Particulate Matter (PM)

i. Emission Limitations

1. Filterable (front-half) PM emissions from EU100 shall not exceed 0.01 gr/dscf at all times when EU100 is operating;

2. Filterable (front-half) PM emissions from EU104 shall not exceed 0.01 gr/dscf at all times when EU104 is operating;

3. Filterable (front-half) PM emissions from EU110 shall not exceed 0.01 gr/dscf at all times when EU110 is operating; and

4. Filterable (front-half) PM emissions from EU114 shall not exceed 0.01 gr/dscf at all times when EU1114 is operating.

ii. Compliance with the PM emission limits above will be determined using the compliance methods laid out in 40 CFR 63 Subpart RRRRR, the taconite MACT, and determined based on the flow weighted mean concentration of all stacks for the furnace.

iii. Compliance with the PM emission limit must be demonstrated by the deadlines laid out in the taconite MACT.

III. Recordkeeping and Reporting

a. Recordkeeping. NSM shall maintain electronic files of all information required by this Order in a form suitable for determination of NSM's compliance with this Order by U.S. EPA or MPCA staff and readily available for U.S. EPA or MPCA inspection and review.

i. NSM shall maintain monitoring, testing, and excess emissions records pertaining to the requirements of this Order in the manner required in the total Facility requirements of NSM's air emissions permit, pursuant to Minn. R. 7007.0800.

ii. NSM shall retain records of operational parameters related to emissions, including ferrous iron content of the feed materials, pellet type, production rate, heat input, stack gas flow rate, and combustion zone temperature.

iii. NSM shall retain the records for a minimum of five years following the date on which the record was generated. The most recent two years of information must be kept on site**.**

b. Reporting. NSM shall, in the Semiannual Deviations Report required under Minn. R. 7007.0800, Subp. 6(A)(2), report each instance in which an emission limit was not met. This includes periods of startup, shutdown, and malfunction.

23. To conduct the following modeling analyses and submit the following information in order to ensure expeditious attainment of the one-hour SO_2 and NO_2 NAAQS as part of the long-term strategy

I. Modeling Protocol

a. By June 1, 2012, submit to the MPCA a modeling protocol for the NSM facility for NO_2 emissions. The protocol must be submitted using MPCA's most recent model protocol forms, AQDMP-01 and AQDMPS-01.

II. Modeling and Emission Limits Demonstrating Compliance

a. By December 31, 2012, submit to the MPCA:

i. A modeling demonstration that shows modeled compliance with the one-hour SO_2 and NO_2 NAAQS;

ii. A table of proposed emission limits from the facility, by emission unit and stack vent, that result in modeled compliance with the one-hour SO_2 and NO_2 NAAQS;

iii. A description of the work practices or controls to be implemented in order to meet the proposed emission limits; and

iv. A detailed schedule for implementation of the necessary work practices or controls which ensures that they will be in place and the emission limits achieved by June 30, 2017.

General.

24. Nothing in this Order shall relieve NSM of its obligation to meet permitting requirements for any physical or operational change at its facility.

25. This Order is not transferable or assignable to any person without the express written approval of the MPCA.

26. This Order is effective upon the date that it is signed by the MPCA Commissioner or his designee.

RESERVATION OF AUTHORITY

Nothing in this Order shall prevent the MPCA from taking action to enforce the requirements of this Order, or from requiring additional action by the Regulated Party if necessary to ensure compliance with the Regional Haze rule and other MPCA rules and statutes.

IT IS SO ORDERED.

Minnesota Pollution Control Agency

Paul W. Aasen

Commissioner

Dated: 5/2/12

STATE OF MINNESOTA
Minnesota Pollution Control Agency

In the Matter of: **ADMINISTRATIVE ORDER**
United Taconite, LLC

This Administrative Order (Order) is issued by the Minnesota Pollution Control Agency (MPCA) to United Taconite, LLC (United) pursuant to Minn. Stat. 116.07, subd. 9 (2011).

FINDINGS OF FACT

BACKGROUND

1. On July 6, 2005, the U.S. Environmental Protection Agency (U.S. EPA) published regulations to address visibility impairment in our nation's largest national parks and wilderness ("Class I") areas (70 Fed. Reg. 39103). This rule is commonly known as the "Regional Haze Rule" (40 CFR 51.300-51.309). The Regional Haze Rule (Rule) requires that Minnesota establish and achieve visibility goals for each of its mandatory Class I areas by 2018.

2. The Rule regulates the emission of pollutants that contribute to regional haze. The MPCA has determined that the key pollutants contributing to regional haze are particulate matter (PM), sulfur dioxide (SO_2), and nitrogen oxides (NO_X).
3. The Rule requires that Minnesota submit a Regional Haze State Implementation Plan (SIP) to U.S. EPA for its approval. The SIP must include:

    a. Reasonable Progress Goals – Minnesota must establish, for each Class I area within the state, "goals (expressed in deciviews) that provide for reasonable progress towards achieving natural visibility conditions." (40 CFR 51.308(d)(1)).

    b. Long-Term Strategy – Minnesota must submit a long-term strategy that addresses regional haze visibility impairment, and includes "measures as necessary to achieve the reasonable progress goals established by States having mandatory Class I Federal areas." (40 CFR 51.308(d)(3)).

    c. Best Available Retrofit Technology – The Rule regulates certain stationary sources that could contribute to visibility impairment in Class I areas. States, including Minnesota, must determine what constitutes the best available retrofit technology (BART) to control for PM, SO_2, and NO_X and to establish emissions limits that are consistent with BART for these sources. The limits must be included in the SIP for U.S. EPA approval.

4. The MPCA submitted a Regional Haze SIP to U.S. EPA on December 30, 2009, which included the required Reasonable Progress Goals and Long-Term Strategy and identified the BART-eligible and subject-to-BART sources, listed the MPCA's BART determinations, and included associated BART emission limits where MPCA had sufficient emissions data to set such limits. On April 1, 2010, U.S. EPA notified the MPCA that the submittal was complete.

5. Subsequently, MPCA prepared a supplemental SIP submittal that revised the long-term strategy and included BART emission limits where additional data had been collected. The supplemental SIP submittal also included this Order and supporting documents.

6. On December 19, 2011, the MPCA put its proposed supplemental SIP submittal on public notice for 45 days. (36 SR 684). The public comment period provided United and members of the general

public an opportunity to comment on this Order and the other elements of the proposed supplemental SIP, including the BART emission limits, prior to U.S. EPA's final decision on the SIP.

THE FACILITY

7. United produces taconite pellets at its facility (herein referred to as "Facility") located near Forbes, Minnesota. This facility has two indurating Allis-Chalmers furnaces. Line 1 is the smaller of the two, with a rated throughput of 280 tons of pellets per hour and a heat input of 190 MMBtu per hour of natural gas. The newer line, Line 2, is rated at 672 tons per hour with a heat input from natural gas, coal, petroleum coke, and other fuels of 400 MMBtu per hour.

BEST AVAILABLE RETROFIT TECHNOLOGY (BART)

8. The Rule includes 40 CFR Part 51, Appendix Y "*Guidelines for BART Determinations Under the Regional Haze Rule*" which provides direction for determining which sources may need to install BART and for determining BART.

9. To satisfy the Rule, the MPCA determined what constitutes BART for each BART-eligible unit and established emission limits consistent with its determination of BART. As required, the MPCA took into consideration the technology available, the costs of compliance, the energy and the non-air quality environmental impacts of compliance, any pollution control equipment in use or in existence at the source, the remaining useful life of the source, and the degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology. (40 CFR 51.308(e)(ii)).

10. To identify the BART-eligible emission units, MPCA used the following criteria:

    a. One, or more, emission(s) units at the facility fit within one of the twenty-six (26) categories listed in the 40 CFR Part 51, Appendix Y *Guidelines*;

    b. The emission unit(s) were in existence on August 7, 1977 and began operation at some point on or after August 7, 1962; and

    c. The sum of the potential emissions from all emission unit(s) identified in the previous two bullets was greater than 250 tons per year of the visibility-impairing pollutants: SO_2, NO_X, and PM.

11. The United facility includes two units (EU040 and EU042) that are subject to BART. *See* RESULTS of Best Available Retrofit Technology (BART) Modeling to Determine Sources Subject-to-BART in the State of Minnesota at http://proteus.pca.state.mn.us/publications/aq-sip2-07.pdf.

12. United's two pellet furnaces, Line 1 (EU040 with SV046) and Line 2 (EU042 with SV048 and SV049), were determined to be subject-to-BART and United performed a BART analysis for the furnaces.

13. MPCA determined and United agreed that the pellet furnaces (EU040 and EU042) are subject-to-BART.

14. The MPCA determined that BART for this unit consists of:

a. Operation of the existing wet scrubber and use of appropriate fuel blends to control SO_2 emissions;

b. Good combustion practices, along with existing combustion controls to control NO_X emissions; and

c. Implementation of the taconite Maximum Achievable Control Technology (MACT) standard to control PM emissions. (40 CFR 63, Subp. RRRRR).

15. The MPCA must place BART emission limits in an enforceable document. (40 CFR 51.308(e)(1)(iv)). The MPCA has chosen to issue this Administrative Order as the enforceable document by which to establish the BART emission limit for United.

LONG-TERM STRATEGY

16. In the SIP, the MPCA established, as part of the long-term strategy, a target or goal of a reduction in combined SO_2 and NO_X emissions from large point sources located in St. Louis, Lake, Cook, Carlton, Itasca and Koochiching counties that emitted over 100 tons per year of either SO_2 or NO_X in 2002.

17. The MPCA also determined that the six taconite facilities in Minnesota may be undercontrolled, and that very few emission control technologies are known to be effective for the industrial processes involved in taconite production. The MPCA therefore also established a requirement for these facilities to investigate control technologies and pollution prevention practices for their indurating furnaces as part of the long-term strategy.

18. The MPCA has determined that an appropriate mechanism for implementing the long-term strategy for the taconite facilities, including United, is their demonstration that their facilities are in attainment with the one-hour National Ambient Air Quality Standards (NAAQS) for SO_2 (40 CFR 50.17) and nitrogen dioxide (NO_2) (40 CFR 50.11). As a result, United must model compliance with the one-hour and SO_2 and NO_2 NAAQS. This Order establishes the tasks and schedules by which the modeling for United will be completed.

ORDER

NOW, THEREFORE, IT IS ORDERED:

19. United shall install and operate any necessary control equipment or implement any necessary work practices to meet the following requirements which represent BART for United.

I. BART Emission Limitations and Compliance Methods

a. BART for Nitrogen Oxides (NO_X)

i. Annual Emission Limitations

1. NO_X emissions from EU040 shall not exceed 1655 tons per year; and
2. NO_X emissions from EU042 shall not exceed 3692 tons per year.

ii. Emission Limitations

1. Total NO_X emissions from the indurating furnaces (EU040 and EU042) shall not exceed 21.1 tons per day, measured on a 30-day rolling average, excluding any periods designated under Part iii; and

2. NO_X emissions from an individual indurating furnace (EU040 or EU042) shall not exceed 14.8 tons per day when only one furnace is operating, measured on a 30-day rolling average, excluding any periods designated under Part iii.

iii. Emission Limitations During Operation on 100% Natural Gas

1. United may choose to comply with the following emission limit for any calendar day during which either subject emission unit burns 100% natural gas for one or more operating hours.

a. Total NO_X emissions from the indurating furnaces (EU040 and EU042) shall not exceed 2641.0 lbs/hour, measured on a 24-hour rolling average basis; and

b. NO_X emissions from an individual indurating furnace (EU040 or EU042) shall not exceed 1500.0 lbs/hour when only one furnace is operating, measured on a 24-hour rolling average basis.

iv. The NO_X emission limits are effective on and after the date six months after the effective date of U.S. EPA's approval of United's BART determination.

v. Compliance with the NO_X emission limits will be demonstrated through the use of continuous emission monitoring systems (CEMS) in accordance with Minn. R. 7017.1002 through Minn. R. 7017.1220.

b. BART for Sulfur Dioxide (SO_2)

i. Annual Emission Limitations

1. SO_2 emissions from EU 040 shall not exceed 1293 tons per year; and

2. SO_2 emissions from EU 042 shall not exceed 2394 tons per year.

ii. Emission Limitations

1. SO_2 emissions from EU040 shall not exceed 106.3 tons over 30 days, measured as a 30-day rolling sum, at all times when EU040 is operating; and

2. SO_2 emissions from EU042 shall not exceed 197 tons over 30 days, measured as a 30-day rolling sum, at all times when EU 042 is operating.

3. The SO_2 emission limit is effective on and after the date six months after the effective date of U.S. EPA's approval of United's BART determination.

iii. Compliance with the SO_2 emission limit above will be determined through the use of continuous emission monitoring systems (CEMS) in accordance with Minn. R. 7017.1002 through Minn. R. 7017.1220.

c. BART for Particulate Matter (PM)

i. Emission Limitations

1. Filterable (front-half) PM emissions from each line shall not exceed 0.01 gr/dscf.

ii. Compliance with the PM emission limits above will be determined using the compliance methods laid out in 40 CFR 63 Subpart RRRRR, the taconite MACT, and determined based on the flow weighted mean concentration of all stacks for the furnace.

iii. Compliance with the PM emission limit must be demonstrated based on the timelines laid out in the taconite MACT.

II. Recordkeeping and Reporting

a. Recordkeeping. United shall maintain electronic files of all information required by this Order, immediately upon such time as each requirement is effective, in a form suitable for determination of United's compliance with this Order by U.S. EPA or MPCA staff and readily available for U.S. EPA or MPCA inspection and review.

i. United shall maintain monitoring records, including all calibration and maintenance records and all original strip-chart recordings for continuous monitoring instrumentation on EU 040 and 042.

ii. United shall maintain records of testing, startup, shutdown, bypass, breakdowns and excess emissions from EU 040 and EU 042 pertaining to the emission limits established by this Order in the manner required in the total Facility requirements of United's air emissions permit, pursuant to Minn. R. 7007.0800.

iii. United shall retain records of all calendar days during which the facility is complying with the emission limits in Part I.a.iii of this Order.

iv. United shall retain the records for a minimum of five years following the date on which the record was generated. The most recent two years of information must be kept on site.

b. Reporting.

i. United shall provide a quarterly report of each instance in which an emission limit was not met. This includes periods of startup, shutdown, and malfunction. The report shall be submitted using the Excess Emissions Report (DRF-1) as required by United's Air Emission Permit.

ii. United shall provide, with the quarterly report, a listing of each instance in which the facility chose to comply with the Emission Limitations During Operation on 100% Natural Gas listed in Part I.a.iii of this Order.

c. Root Cause Analysis

i. If United chooses to comply with the emission limit in Part I.a.iii for five or more calendar days in any calendar quarter United must undertake a root cause analysis to determine the cause of the need to operate using 100% natural gas and identify measures to eliminate or reduce the frequency of the root cause.

1. Root cause is defined as a condition that, if corrected, would prevent recurrence of or similar occurrences to an undesirable event. The root cause may or may not apply to this occurrence only, but has generic implications to a broad group of possible occurrences, and it is the most fundamental aspect of the cause that can logically be identified and corrected. There may be a series of causes that can be identified, one leading to another. This series should be pursued until each fundamental, correctable cause has been identified.

2. A root cause analysis report shall be submitted within 60 days of the end of the calendar quarter. If an event was ongoing at the end of the calendar quarter, it should be noted and the root cause analysis provided after the following calendar quarter.

3. The root cause analysis shall identify and address the event, other than start up after a furnace outage, causing the greatest use of natural gas during the quarter, or during consecutive quarters for events that extend across quarters.

a. The root cause analysis shall include, but is not limited to: a review of any equipment failures and the conditions that led to such failures, a review of relevant maintenance schedules and practices, an assessment of equipment inventories and spare parts, a review of furnace operational practices, and a review of relevant operator standard work.

b. The root cause analysis shall describe a plan and schedule to be implemented to reduce or eliminate occurrences of the event, including potential activities and investments to eliminate the event's cause(s) and the option selected by United to eliminate the cause(s).

20. To conduct the following modeling analyses and submit the following information in order to ensure expeditious attainment of the one-hour SO_2 and NO_2 NAAQS as part of the long-term strategy

I. Modeling Protocol

a. By June 1, 2012, submit to the MPCA a modeling protocol for the United facility for NO_2 emissions. The protocol must be submitted using MPCA's most recent modeling protocol forms, AQDMP-01 and AQDMPS-01.

II. Modeling and Emission Limits Demonstrating Compliance

a. By December 31, 2012, submit to the MPCA:

i. A modeling demonstration that shows modeled compliance with the one-hour SO_2 NAAQS and one-hour NO_2 NAAQS;

ii. A table of proposed emission limits from the facility, by emission unit and stack vent, that result in modeled compliance with the one-hour SO_2 and NO_2 NAAQS;

iii. A description of the work practices or controls to be examined for implementation in order to meet the proposed emission limits; and

iv. A detailed schedule for implementation of necessary work practices or controls which ensures that they will be in place and the emission limits achieved by June 30, 2017.

General.

21. Nothing in this Order shall relieve United of its obligation to meet permitting requirements for any physical or operational change at its facility.

22. This Order is not transferable or assignable to any person without the express written approval of the MPCA.

23. This Order is effective upon the date that it is signed by the MPCA Commissioner or his designee.

RESERVATION OF AUTHORITY

Nothing in this Order shall prevent the MPCA from taking action to enforce the requirements of this Order, or from requiring additional action by the Regulated Party if necessary to ensure compliance with the Regional Haze rule and other MPCA rules and statutes.

IT IS SO ORDERED.

Minnesota Pollution Control Agency

Paul W. Aasen

Commissioner

Dated: 5/2/12

STATE OF MINNESOTA

Minnesota Pollution Control Agency

In the Matter of: **ADMINISTRATIVE ORDER**

United States Steel Corporation – Keetac

This Administrative Order (Order) is issued by the Minnesota Pollution Control Agency (MPCA) to United States Steel Corporation, Keetac (Keetac) pursuant to Minn. Stat. 116.07, subd. 9 (2011).

FINDINGS OF FACT

BACKGROUND

1. On July 6, 2005, the U.S. Environmental Protection Agency (U.S. EPA) published regulations to address visibility impairment in our nation's largest national parks and wilderness ("Class I") areas (70 Fed. Reg. 39103). This rule is commonly known as the "Regional Haze Rule" (40 CFR 51.300-51.309). The Regional Haze Rule (Rule) requires that Minnesota establish and achieve visibility goals for each of its mandatory Class I areas by 2018.

2. The Rule regulates the emission of pollutants that contribute to regional haze. The MPCA has determined that the key pollutants contributing to regional haze are particulate matter (PM), sulfur dioxide (SO_2), and nitrogen oxides (NO_X).

3. The Rule requires that Minnesota submit a Regional Haze State Implementation Plan (SIP) to U.S. EPA for its approval. The SIP must include:

    a. Reasonable Progress Goals – Minnesota must establish, for each Class I area within the state, "goals (expressed in deciviews) that provide for reasonable progress towards achieving natural visibility conditions." (40 CFR 51.308(d)(1)).

    b. Long-Term Strategy – Minnesota must submit a long-term strategy that addresses regional haze visibility impairment, and includes "measures as necessary to achieve the reasonable progress goals established by States having mandatory Class I Federal areas." (40 CFR 51.308(d)(3)).

    c. Best Available Retrofit Technology – The Rule regulates certain stationary sources that could contribute to visibility impairment in Class I areas. States, including Minnesota, must determine what constitutes the best available retrofit technology (BART) to control for PM, SO_2, and NO_X and to establish emissions limits that are consistent with BART for these sources. The limits must be included in the SIP for U.S. EPA approval.

4. The MPCA submitted a Regional Haze SIP to U.S. EPA on December 30, 2009, which included the required Reasonable Progress Goals and Long-Term Strategy and identified the BART-eligible and subject-to-BART sources, listed the MPCA's BART determinations, and included associated BART emission limits where MPCA had sufficient emissions data to set such limits. On April 1, 2010, U.S. EPA notified the MPCA that the submittal was complete.

5. Subsequently, MPCA prepared a supplemental SIP submittal that revised the long-term strategy and included BART emission limits where additional data had been collected. The supplemental SIP submittal also included this Order and supporting documents.

6. On December 19, 2011, the MPCA put its proposed supplemental SIP submittal on public notice for 45 days. (36 SR 684). The public comment period provided Keetac and members of the general public an opportunity to comment on this Order and the other elements of the proposed supplemental SIP, including the BART emission limits, prior to U.S. EPA's final decision on the SIP.

THE FACILITY

7. United States Steel Corporation – Keetac (Keetac) owns and operates a taconite mine and processing facility ("Facility") in Keewatin, Minnesota. Keetac is authorized to operate two grate-kiln furnaces (EU030 and EU068/EU069/EU070). EU030 was constructed in 1976. The furnace is capable of processing 415 tons of pellets per hour with a heat input of 178.5 MMBtu/hr. Keetac was authorized to reconstruct and operate EU068/EU069/EU070 by a permit amendment that the MPCA issued on September 14, 2011. EU068/EU069/EU070 is not yet operational.

8. The permit allows Keetac to combust natural gas, distillate fuel oils, coal, and petroleum coke in the EU030 pelletizing furnace. Coal and natural gas are the primary fuels; coal is a significant source of sulfur. Another source of sulfur emissions from this furnace is the iron ore used to form the taconite green balls, although this represents a smaller contribution than the sulfur in the solid fuels burned. Sulfur dioxide emissions are currently controlled by wet scrubbers.

BEST AVAILABLE RETROFIT TECHNOLOGY (BART)

9. The Rule includes 40 CFR Part 51, Appendix Y "*Guidelines for BART Determinations Under the Regional Haze Rule*" which provides direction for determining which sources may need to install BART and for determining BART.

10. To satisfy the Rule, the MPCA determined what constitutes BART for each BART-eligible unit and established emission limits consistent with its determination of BART. As required, the MPCA took into consideration the technology available, the costs of compliance, the energy and the non-air quality environmental impacts of compliance, any pollution control equipment in use or in existence at the source, the remaining useful life of the source, and the degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology. (40 CFR 51.308(e)(ii)).

11. To identify the BART-eligible emission units, MPCA used the following criteria:

    a. One, or more, emission(s) units at the facility fit within one of the twenty-six (26) categories listed in the 40 CFR Part 51, Appendix Y *Guidelines*;

    b. The emission unit(s) were in existence on August 7, 1977 and began operation at some point on or after August 7, 1962; and

    c. The sum of the potential emissions from all emission unit(s) identified in the previous two bullets was greater than 250 tons per year of the visibility-impairing pollutants: SO_2, NO_X, and PM.

12. The Keetac facility includes one unit (EU030) that is subject to BART. *See* RESULTS of Best Available Retrofit Technology (BART) Modeling to Determine Sources Subject-to-BART in the State of Minnesota at http://proteus.pca.state.mn.us/publications/aq-sip2-07.pdf.

13. Keetac's EU030 Grate-Kiln pelletizing furnace was determined to be subject-to-BART, and US Steel performed a BART analysis for it. This unit has one associated stack vent, SV051.

14. MPCA determined and US Steel agreed that the Keetac Grate-Kiln pelletizing furnace (EU030) is subject-to-BART.

15. The MPCA determined that BART for this unit consists of

    a. Operation of the existing wet scrubber to control SO_2 emissions; and

    b. Good combustion practices, along with existing combustion controls and fuel blending to control NO_X emissions; and

    c. Implementation of the taconite Maximum Achievable Control Technology (MACT) standard to control PM emissions. (40 CFR 63, Subp. RRRRR).

16. The MPCA must place BART emission limits in an enforceable document. (40 CFR 51.308(e)(1)(iv)). The MPCA has chosen to issue this Administrative Order as the enforceable document by which to establish the BART emission limit for Keetac.

ORDER

NOW, THEREFORE, KEETAC IS ORDERED:

17. To install and operate any necessary control equipment or undertake any necessary work practices to meet the following requirements which represent BART for Keetac.

I. BART Emission Limitations and Compliance Methods

   a. BART for Nitrogen Oxides (NO_X)

      i. Emission Limitations

         1. NO_X emissions from EU030 shall not exceed 12.35 tons per day at all times when EU030 is operating, measured on a 30-day rolling average.

         2. Hours during which EU030 does not operate are not included in the calculation of the rolling average. Periods of startup, shutdown and malfunction are included in the calculation of the rolling average.

         3. The NO_X emission limit is effective on and after the date six months after the effective date of U.S. EPA's approval of Keetac's BART determination.

ii. Compliance with the NO_X emission limit above will be demonstrated through the use of continuous emission monitoring systems (CEMS) in accordance with Minn. R. 7017.1002 through Minn. R. 7017.1220.

b. BART for Sulfur Dioxide (SO_2)

i. Emission Limitations

1. SO_2 emissions from EU030 shall not exceed 2.71 tons per day at all times when EU030 is operating, measured on a 30-day rolling average basis.

2. Hours during which EU030 does not operate are not included in the calculation of the rolling average. Periods of startup, shutdown and malfunction are included in the calculation of the rolling average.

3. The SO_2 emission limit is effective on and after the date six months after the effective date of U.S. EPA's approval of Keetac's BART determination.

ii. Compliance with the SO_2 emission limit above will be determined through the use of continuous emission monitoring systems (CEMS) in accordance with Minn. R. 7017.1002 through Minn. R. 7017.1220.

c. BART for Particulate Matter (PM)

i. Emission Limitations

1. Filterable (front-half) PM emissions from EU030 shall not exceed 0.01 gr/dscf.

ii. Compliance with the PM emission limits above will be determined using the compliance methods laid out in 40 CFR 63 Subpart RRRRR, the taconite MACT.

iii. Compliance with the PM emission limit must be demonstrated based on the timelines laid out in the taconite MACT.

II. Recordkeeping and Reporting

a. Recordkeeping. Keetac shall maintain electronic files of all information required by this Order in a form suitable for determination of Keetac's compliance with this Order by U.S. EPA or MPCA staff and readily available for U.S. EPA or MPCA inspection and review.

i. Keetac shall maintain monitoring records, including all calibration and maintenance records and all original strip-chart recordings for continuous monitoring instrumentation on EU 030.

ii. Keetac shall maintain records of testing, startup, shutdown, bypass, breakdowns, and excess emissions from EU 030 pertaining to the emission limits established by this Order in the manner required in the total Facility requirements of Keetac's air emissions permit, pursuant to Minn. R. 7007.0800.

iii. Keetac shall retain the records for a minimum of five years following the date on which the record was generated. The most recent two years of information must be kept on site.

b. Reporting. Keetac shall provide a quarterly report of each instance in which an emission limit was not met. This includes periods of startup, shutdown, and malfunction. The report shall be submitted using the Excess Emissions Report (DRF-1) as required by Keetac's Air Emission Permit.

General.

18. Nothing in this Order shall relieve Keetac of its obligation to meet permitting requirements for any physical or operational change at its facility.

19. This Order is not transferable or assignable to any person without the express written approval of the MPCA.

20. This Order is effective upon the date that it is signed by the MPCA Commissioner or his designee.

RESERVATION OF AUTHORITY

Nothing in this Order shall prevent the MPCA from taking action to enforce the requirements of this Order, or from requiring additional action by the Regulated Party if necessary to ensure compliance with the Regional Haze rule and other MPCA rules and statutes.

IT IS SO ORDERED.

Minnesota Pollution Control Agency

Paul W. Aasen

Commissioner

Dated: 5/2/12

STATE OF MINNESOTA

Minnesota Pollution Control Agency

In the Matter of: **ADMINISTRATIVE ORDER**

United States Steel Corporation – Minntac

This Administrative Order (Order) is issued by the Minnesota Pollution Control Agency (MPCA) to United States Steel Corporation Minntac (Minntac) pursuant to Minn. Stat. 116.07, subd. 9 (2011).

FINDINGS OF FACT

BACKGROUND

1. On July 6, 2005, the U.S. Environmental Protection Agency (U.S. EPA) published regulations to address visibility impairment in our nation's largest national parks and wilderness ("Class I") areas (70 Fed. Reg. 39103). This rule is commonly known as the "Regional Haze Rule" (40 CFR 51.300-51.309). The Regional Haze Rule (Rule) requires that Minnesota establish and achieve visibility goals for each of its mandatory Class I areas by 2018.

2. The Rule regulates the emission of pollutants that contribute to regional haze. The MPCA has determined that the key pollutants contributing to regional haze are particulate matter (PM), sulfur dioxide (SO_2), and nitrogen oxides (NO_X).

3. The Rule requires that Minnesota submit a Regional Haze State Implementation Plan (SIP) to U.S. EPA for its approval. The SIP must include:

    a. Reasonable Progress Goals – Minnesota must establish, for each Class I area within the state, "goals (expressed in deciviews) that provide for reasonable progress towards achieving natural visibility conditions." (40 CFR 51.308(d)(1)).

    b. Long-Term Strategy – Minnesota must submit a long-term strategy that addresses regional haze visibility impairment, and includes "measures as necessary to achieve the reasonable progress goals established by States having mandatory Class I Federal areas." (40 CFR 51.308(d)(3)).

    c. Best Available Retrofit Technology – The Rule regulates certain stationary sources that could contribute to visibility impairment in Class I areas. States, including Minnesota, must determine what constitutes the best available retrofit technology (BART) to control for PM, SO_2, and NO_X and to establish emissions limits that are consistent with BART for these sources. The limits must be included in the SIP for U.S. EPA approval.

4. The MPCA submitted a Regional Haze SIP to U.S. EPA on December 30, 2009, which included the required Reasonable Progress Goals and Long-Term Strategy and identified the BART-eligible and subject-to-BART sources, listed the MPCA's BART determinations, and included associated BART emission limits where MPCA had sufficient emissions data to set such limits. On April 1, 2010, U.S. EPA notified the MPCA that the submittal was complete.

5. Subsequently, MPCA prepared a supplemental SIP submittal that revised the long-term strategy and included BART emission limits where additional data had been collected. The supplemental SIP submittal also included this Order and supporting documents.

6. On December 19, 2011, the MPCA put its proposed supplemental SIP submittal on public notice for 45 days. (36 SR 684). The public comment period provided Minntac and members of the general public an opportunity to comment on this Order and the other elements of the proposed supplemental SIP, including the BART emission limits, prior to U.S. EPA's final decision on the SIP.

THE FACILITY

7. United States Steel – Minntac (Minntac) owns and operates a taconite mine and processing facility ("Facility") at County Highway 102, on the Mesabi Range north of the City of Mountain Iron, St. Louis County, Minnesota.

8. Minntac operates five indurating furnaces (Lines 3, 4, 5, 6, and 7). Line 3 (Step I) began operation in 1967; Lines 4 and 5 (Step II) began operation in 1972; and Lines 6 and 7 (Step III) began operation in 1978.

BEST AVAILABLE RETROFIT TECHNOLOGY (BART)

9. The Rule includes 40 CFR Part 51, Appendix Y "*Guidelines for BART Determinations Under the Regional Haze Rule*" which provides direction for determining which sources may need to install BART and for determining BART.

10. To satisfy the Rule, the MPCA determined what constitutes BART for each BART-eligible unit and established emission limits consistent with its determination of BART. As required, the MPCA took into consideration the technology available, the costs of compliance, the energy and the non-air quality environmental impacts of compliance, any pollution control equipment in use or in existence at the source, the remaining useful life of the source, and the degree of improvement in visibility which may reasonably be anticipated to result from the use of such technology. (40 CFR 51.308(e)(ii)).

11. To identify the BART-eligible emission units, MPCA used the following criteria:

    a. One, or more, emission(s) units at the facility fit within one of the twenty-six (26) categories listed in the 40 CFR Part 51, Appendix Y *Guidelines*;

    b. The emission unit(s) were in existence on August 7, 1977 and began operation at some point on or after August 7, 1962; and

    c. The sum of the potential emissions from all emission unit(s) identified in the previous two bullets was greater than 250 tons per year of the visibility-impairing pollutants: SO_2, NO_X, and PM.

12. Minntac includes units that are subject to BART. *See* RESULTS of Best Available Retrofit Technology (BART) Modeling to Determine Sources Subject-to-BART in the State of Minnesota at http://proteus.pca.state.mn.us/publications/aq-sip2-07.pdf.

13. Minntac has five units, the indurating furnaces identified as Emission Units 225, 261, 282, 315, and 334 in Air Emissions Permit No. 13700005-005, that are subject-to-BART and for which a BART analysis was performed. The stack vent associated with EU225, the Line 3 indurating furnace, is SV103. The stack vent associated with EU261, the Line 4 indurating furnace, is SV118. The stack vent associated with EU282, the Line 5 indurating furnace, is SV127. The stack vent associated with EU315, the Line 6 indurating furnace, is SV144. The stack vent associated with EU334, the Line7 indurating furnace, is SV151.

14. MPCA determined and US Steel agreed that Minntac's five indurating furnaces (EU225, EU261, EU282, EU315, and EU334) are subject-to-BART

15. The MPCA determined that BART for these units consists of:

    a. Operation of the existing wet scrubber to control SO_2 emissions; and

    b. Good combustion practices and fuel blending to control NO_X emissions for Lines 3, 4, 5, 6, and 7, with the addition of low-NO_X burners in the pre-heat zone for Lines 4, 5, 6, and 7; and

    c. Implementation of the taconite Maximum Achievable Control Technology (MACT) standard to control PM emissions. 40 CFR 63, Subp. RRRRR.

16. The MPCA must place BART emission limits in an enforceable document. (40 CFR 51.308(e)(1)(iv)). The MPCA has chosen to issue this Administrative Order as the enforceable document by which to establish the BART emission limit for Minntac.

LONG-TERM STRATEGY

17. In the SIP, the MPCA established, as part of the long-term strategy, a target or goal of a reduction in combined SO_2 and NO_X emissions from large point sources located in St. Louis, Lake, Cook, Carlton, Itasca and Koochiching counties that emitted over 100 tons per year of either SO_2 or NO_X in 2002.

18. The MPCA also determined that the six taconite facilities in Minnesota may be undercontrolled, and that very few emission control technologies are known to be effective for the industrial processes involved in taconite production. The MPCA therefore also established a requirement for these facilities to investigate control technologies and pollution prevention practices for their indurating furnaces as part of the long-term strategy.

19. The MPCA has determined that an appropriate mechanism for implementing the long-term strategy for the taconite facilities, including Minntac, is their demonstration that their facilities are in attainment with the one-hour National Ambient Air Quality Standards (NAAQS) for SO_2 (40 CFR 50.17) and nitrogen dioxide (NO_2) (40 CFR 50.11). As a result, Minntac must model compliance with the one-hour and SO_2 and NO_2 NAAQS. This Order establishes the tasks and schedules by which the modeling for Minntac will be completed.

ORDER

NOW, THEREFORE, MINNTAC IS ORDERED:

20. To install and operate any necessary control equipment or undertake any necessary work practices to meet the following requirements, which represent BART for Minntac.

I. BART Emission Limitations and Compliance Methods

a. BART for Nitrogen Oxides (NO_X)

i. Emission Limitations

1. NO_X emissions from the indurating furnaces (EU225, EU261, EU282, EU315, and EU334) shall not exceed 33.89 tons per day, measured on a 30-day rolling average.

2. This NO_X emission limit is effective on and after the date six months after the effective date of U.S. EPA's approval of this BART determination.

ii. Compliance with the NO_X emission limit above will be demonstrated through the use of continuous emission monitoring systems (CEMS) in accordance with Minn. R. 7017.1002 through Minn. R. 7017.1220 and 40 CFR Part 75.

b. BART for Sulfur Dioxide (SO_2)

i. Emission Limitations

1. SO_2 emissions from the indurating furnaces (EU225, EU261, EU282, EU315, and EU334) shall not exceed 6.35 tons per day, measured on a 30-day rolling average.

2. This SO_2 emission limit is effective on and after the date six months after the effective date of U.S. EPA's approval of this BART determination.

ii. Compliance with the SO_2 emission limit above will be determined through the use of continuous emission monitoring systems (CEMS) in accordance with Minn. R. 7017.1002 through Minn. R. 7017.1220 and 40 CFR Part 75.

c. BART for Particulate Matter (PM)

i. Emission Limitations

1. Filterable (front-half) PM emissions from each line shall not exceed 0.01 gr/dscf

ii. Compliance with the PM emission limits above will be determined using the compliance methods laid out in 40 CFR 63 Subpart RRRRR, the taconite MACT.

iii. Compliance with the PM emission limit must be demonstrated based on the timelines laid out in the taconite MACT.

II. Recordkeeping and Reporting

a. Recordkeeping. Minntac shall maintain electronic files of all information required by this Order in a form suitable for determination of Minntac's compliance with this Order by U.S. EPA or MPCA staff and readily available for U.S. EPA or MPCA inspection and review.

i. Minntac shall maintain monitoring, testing, startup, shutdown, bypass, breakdowns, excess emissions and noncompliance with operational requirements records pertaining to the requirements of this Order in the manner required in the total Facility requirements of Minntac's air emissions permit, pursuant to Minn. R. 7007.0800 and. Minntac shall retain the records for a minimum of five years following the date on which the record was generated. The most recent two years of information must be kept on site**.**

b. Minntac shall provide a quarterly report of each instance in which an emission limit was not met. This includes periods of startup, shutdown, and malfunction. The report shall be submitted as part of the Excess Emissions Report (DRF-1).

21. To conduct the following modeling analyses and submit the following information in order to ensure expeditious attainment of the one-hour SO_2 and NO_2 NAAQS as part of the long-term strategy

I. Modeling and Emission Limits Demonstrating Compliance

a. By December 15, 2012, submit to the MPCA:

i. A modeling demonstration that shows modeled compliance with the one-hour SO_2 NAAQS and one-hour NO_2 NAAQS;

ii. A table of proposed emission limits from the facility, by emission unit and stack vent, that result in modeled compliance with the one-hour SO_2 and NO_2 NAAQS;

iii. A description of the work practices or controls to be implemented in order to meet the proposed emission limits; and

iv. A detailed schedule for implementation of the necessary work practices or controls which ensures that they will be in place and the emission limits achieved by June 30, 2017.

General.

22. Nothing in this Order shall relieve Minntac of its obligation to meet permitting requirements for any physical or operational change at its facility.

23. This Order is not transferable or assignable to any person without the express written approval of the MPCA.

24. This Order is effective upon the date that it is signed by the MPCA Commissioner or his designee.

RESERVATION OF AUTHORITY

Nothing in this Order shall prevent the MPCA from taking action to enforce the requirements of this Order, or from requiring additional action by the Regulated Party if necessary to ensure compliance with the Regional Haze rule and other MPCA rules and statutes.

IT IS SO ORDERED.

Minnesota Pollution Control Agency

Paul W. Aasen

Commissioner

Dated: 5/2/12