ANDREW M. CUOMO
GOVERNOR

JOE MARTENS
COMMISSIONER

STATE OF NEW YORK
DEPARTMENT OF ENVIRONMENTAL CONSERVATION
ALBANY, NEW YORK 12233-1010

DEC 1 8 2013

Ms. Judith A. Enck
Regional Administrator
U.S. Environmental Protection Agency, Region 2
290 Broadway 26th Floor
New York, New York 10007-1866

Dear Administrator Enck:

On July 12, 2013, EPA granted conditional approval to a revision of the New York State Implementation Plan regarding amendments to Title 6 of the New York Codes, Rules, and Regulations Part 220, "Portland Cement Plants and Glass Plants."[1] Final approval was contingent on DEC submitting Reasonably Available Control Technology (RACT) determinations for the applicable facilities as State Implementation Plan (SIP) revisions.

The regulatory revision to Part 220 updated the requirement for Portland cement plants and glass plants to perform facility-specific RACT analyses for oxides of nitrogen (NO_x) to determine which pollution control options are reasonable based on technological and economic feasibility. DEC staff reviewed facilities' analyses and determined a representative NO_x emission rate. This SIP submission provides RACT determinations from the following major stationary sources:

- Subpart 220-1, Portland Cement Plants:[2]
    - Lafarge Building Materials, Inc. (DEC ID 4-0124-00001)
    - Lehigh Northeast Cement Company (DEC ID 5-5205-00013)
- Subpart 220-2, Glass Plants:
    - Owens-Corning Insulating Systems – Feura Bush (DEC ID 4-0122-00004)
    - Owens-Brockway Glass Container Inc. (DEC ID 7-0552-00004)
    - Ardagh Glass Inc. (DEC ID 8-0704-00036)
    - Guardian Geneva Float Glass Facility (DEC ID 8-3205-00041)

Enclosed are the individual determination documents for each facility, as well as a table that summarizes the RACT determinations. Also enclosed is the public notice from the October 20, 2013 Environmental Notice Bulletin. The public comment period ended November 29, 2013; no comments were received.

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[1] 78 FR 41846, *Approval and Promulgation of Implementation Plans; New York State Ozone Implementation Plan Revision*; Final Rule

[2] Although EPA's Federal Register notice cited three existing cement plants, the Holcim Inc. Catskill Plant closed permanently and its permits were expired by DEC effective February 13, 2012

If you have any questions, please contact Mr. Scott Griffin of the Bureau of Air Quality Planning at (518) 402-8396.

Sincerely,

Joseph J. Martens

Enclosures

c: R. Ruvo, EPA
K. Wieber, EPA
J. Snyder

List of Enclosures

1. October 30, 2013 Public Notice from the New York Environmental Notice Bulletin

2. Facility Status summary table

3. Lafarge: April 3, 2013 RACT approval letter from DEC to Lafarge

4. Lafarge: April 1, 2013 RACT proposal letter from Lafarge to DEC

5. Lehigh: November 2010 RACT analysis

6. Lehigh: Title V permit conditions for Part 220

7. Owens-Corning: November 2010 RACT analysis

8. Owens-Corning: Title V permit conditions for Part 220

9. Owens-Brockway: June 14, 2012 RACT approval letter from DEC to Owens-Brockway

10. Owens-Brockway: March 30, 2012 RACT analysis addendum

11. Owens-Brockway: November 29, 2011 RACT analysis

12. Owens-Brockway: Title V permit conditions for Part 220 (proposed)

13. Ardagh: RACT analysis (undated)

14. Ardagh: Title V permit conditions for Part 220

15. Guardian: May 3, 2012 RACT approval letter from DEC to Guardian

16. Guardian: November 29, 2010 RACT analysis

17. Guardian: Title V permit conditions for Part 220

ENB - Statewide Notices 10/30/2013

Public Notice

Single-Source State Implementation Plan Revisions for Reasonably Available Control Technology for Oxides of Nitrogen from Portland Cement Plants and Glass Plants

Notice is hereby given that the New York State Department of Environmental Conservation (NYS DEC) plans to submit single-source State Implementation Plan (SIP) revisions for Reasonably Available Control Technology (RACT) for six facilities to the United States Environmental Protection Agency (US EPA) for approval.

NYS DEC recently revised Title 6 of the New York Codes, Rules, and Regulations (NYCRR) Part 220, "Portland Cement Plants and Glass Plants" as part of an ongoing effort to attain the 8-hour ozone National Ambient Air Quality Standards (NAAQS). This regulatory revision to Part 220 updated the requirement for subject facilities to perform facility-specific RACT analyses for oxides of nitrogen (NO_x) to determine which pollution control options are reasonable based on technological and economic feasibility. NYS DEC staff then reviewed facilities' analyses and determined representative NO_x emission rates. These approved NO_x RACT determinations, summarized in the table below, will now be submitted to EPA as SIP revisions pursuant to parts 220-1.6(b)(4) and 220-2.3(a)(4).

Approved NOx RACT Determinations	
Facility	**RACT Technology + Limit**
Lafarge Building Materials,Inc. DEC ID: 4-0124-00001 Ravena, Albany County	Operation of SNCR. NO_x limit on Kilns 1 + 2 of 5.2 lb per ton of clinker on 30-day rolling avg. Overall 3,750 tpy NO_x cap.
Lehigh Northeast Cement Company DEC ID: 5-5205-00013 Glens Falls, Warren County	Operation of SNCR. NO_x limit of 2.88 lb per ton of clinker on 30-day rolling avg.
Owens-Corning Insulating Systems DEC ID: 4-0122-00004 Delmar, Albany County	Oxy-fuel firing technology on DM-1 + DM-2 melting furnaces. NO_x limit on each furnace of 4.0 lb NOx per ton of glass pulled on block 24-hr basis. Limit to be refined following 12 months of CEMS recording.
Owens-Brockway Glass Container Inc. DEC ID: 7-0552-00004 Sennett, Cayuga County	Installation of air staging system on melting furnaces A + B. NO_x limit on each furnace of 4.0 lb per ton of glass produced on 30-day rolling avg. Idle mode limits of 50 lb/hr on furnace A and 40 lb/hr on furnace B on 3-hour rolling avg
Ardagh Glass Inc. DEC ID: 8-0704-00036 Elmira, Chemung County	(f.k.a. Anchor Glass Container Corp.) Air staging technology and optimized combustion controls on furnaces 1 + 2. NO_x limits of 4.49 and 5.00 lb per ton of glass produced for furnaces 1 + 2, respectively.
Guardian Geneva Float Glass Facility DEC ID: 8-3205-00041 Geneva, Ontario County	Current configuration with Low NO_x burners, oxy-firing, and/or Type 1 or 2 3R control. NO_x limit of 199 pounds per hour on 30-day rolling avg.

NYS DEC is providing a 30-day period to comment on the proposed submittal or request a hearing. **Written comments should be submitted by 5:00 p.m. on November 29, 2013 to:** Scott Griffin, NYS DEC - Division of Air Resources, 625 Broadway, 11th Floor, Albany, NY 12233-3251, or by e-mail to airsips@gw.dec.state.ny.us. Scott Griffin can be reached at (518) 402-8396 with any questions regarding these SIP revisions.

Contact: Scott Griffin, NYS DEC - Division of Air Resources, 625 Broadway, 11th Floor, Albany, NY 12233-3251, Phone: (518) 402-8396, E-mail: airsips@gw.dec.state.ny.us.

Facility	Applicable Regulation	RACT Technology + Limit
Lafarge Building Materials, Inc. DEC ID: 4-0124-00001 Ravena, Albany County	220-1	Operation of SNCR on Kilns 1 + 2. NOx limit on each Kiln of 5.2 lb per ton of clinker on 30-day rolling avg. Overall 3,750 tpy NOx cap.
Lehigh Northeast Cement Company DEC ID: 5-5205-00013 Glens Falls, Warren County	220-1	Operation of SNCR. NOx limit of 2.88 lb per ton of clinker on 30-day rolling avg. (Permit Condition 84).
Owens-Corning Insulating Systems DEC ID: 4-0122-00004 Delmar, Albany County	220-2	Oxy-fuel firing technology on DM-1 + DM-2 melting furnaces represents RACT. NOx limit on each furnace of 4.0 lb NOx per ton of glass pulled on block 24-hr basis. Limit to be refined following 12 months of CEMS recording (Permit Condition 4-14).
Owens-Brockway Glass Container Inc. DEC ID: 7-0552-00004 Sennett, Cayuga County	220-2	Installation of air staging system on melting furnaces A + B. NOx limit on each furnace of 4.0 lb per ton of glass produced on 30-day rolling avg. (Proposed Permit Conditions 39, 41). Idle mode limits of 50 lb/hr on furnace A and 40 lb/hr on furnace B on 3-hour rolling avg. (Proposed Permit Conditions 38, 40).
Ardagh Glass Inc. DEC ID: 8-0704-00036 Elmira, Chemung County	220-2	(f.k.a. Anchor Glass Container Corp.) Air staging technology and optimized combustion controls on furnaces 1 + 2. NOx limits of 4.49 and 5.00 lb per ton of glass produced for furnaces 1 + 2, respectively (Permit Condition 36, 37).
Guardian Geneva Float Glass Facility DEC ID: 8-3205-00041 Geneva, Ontario County	220-2	Current configuration with Low NOx burners, oxy-firing, and/or Type 1 or 2 3R control. NOx limit of 199 pounds per hour (6.8 pounds per ton) on 30-day rolling avg. (Permit Condition 74). RACT to be re-evaluated during cold tank repair (by 3/31/16).

New York State Department of Environmental Conservation
Office of Environmental Quality, Region 4
1130 North Westcott Road, Schenectady, New York 12306-2014
Phone: (518) 357-2045 • **Fax:** (518) 357-2398
Website: www.dec.ny.gov

Joe Martens
Commissioner

April 3, 2013

Mr. Mike Kralik
Plant Manager – Ravena Cement Plant
Lafarge Building Materials Inc.
P. O. Box 3
Ravena, NY 12143

Dear Mr. Kralik:

Thank you for your letter of April 1, 2013 concerning the nitrogen oxides emissions (NOx) from the kilns at your Ravena facility.

Congratulations on your recent appointment as Plant Manager for Ravena.

Lafarge had previously submitted several reports which concluded that installation of selective non catalytic reduction (SNCR) on the wet kilns at Ravena was neither technically feasible nor economically reasonable. The Department had disagreed with Lafarge's conclusions in each submittal.

In your April 1 letter, you proposed an emission rate of 5.2 pounds of NOx per ton of clinker from Kiln #2 as the reasonably available control technology (RACT) required by Subpart 220-1. An SNCR system has been in operation on Kiln #2 for the last year, and it has been effective in controlling NOx emissions to that level.

You proposed to install another SNCR system on Kiln #1 with the same 5.2 pound of NOx per ton of clinker emission rate. You are satisfied that the SNCR system on Kiln #2 is technically feasible and economically reasonable, and the installation of similar equipment on Kiln #1 would also be RACT. Installation of the SNCR ammonia injection equipment on Kiln #1 would occur this summer and be operational in the fall.

I approve of your 5.2 pound per ton emission rates as RACT for the Ravena kilns. We will propose two new conditions establishing these allowables in a modified Title V permit later this year. The effective date of the condition for Kiln #2 will be June 1, 2013, and the effective date of the condition for Kiln #1 will be November 1, 2013. Both conditions will require you to calculate compliance as 30 day rolling averages using your NOx continuous emissions monitor as required by Subpart 220-1.

For the period until you begin operation of the SNCR system on Kiln #1, you proposed to continue to preferentially operate Kiln #2 over Kiln #1 to minimize NOx emissions and comply with the existing 3750 ton NOx emissions cap in the Title V permit and the EPA Consent Decree.

Thanks again for your cooperation. If you need to contact me, I am available at 357-2350.

Sincerely,

Donald H. Spencer

Donald H. Spencer
Regional Air Pollution Control Engineer

ecc: Matt Stewart, Lafarge
Rich Ostrov
Ricky Leone
Gary McPherson
Blaze Constantakes

LAFARGE

April 1, 2013

Mr. Don Spencer
Regional Air Pollution Control Engineer
New York State Department of Environmental Conservation
1130 North Westcott Road
Schenectady, New York 12306-2014

RE: Lafarge Building Materials, Inc. Ravena Cement Plant
NOx Reasonably Available Control Technology Plan

Dear Mr. Spencer:

In June of 2012, Lafarge provided your office with a revised NOx RACT plan dated June 25, 2012.

Subsequent to receipt of this plan, on July 17, 2012 you provided a number of comments on this revised NOx RACT Plan.

A variety of process modifications and add-on NOx controls have been evaluated by Lafarge for technical feasibility and economic reasonableness. Each technology and control strategy has different implementation, performance, environmental, or economic issues. The existing NOx control practices at Ravena include: operation of SNCR technology on Kiln #2, dust insufflation, beneficial use of fly ash, good combustion for managing primary air, and use of the smart process combustion control system. Additionally, the Ravena Plant is subject to facility wide NO_x limit of 3750 tons per year, 12-month rolling average.

In order to meet the 3750 tons NO_x cap, Kiln #2 has been run selectively over Kiln #1. With Kiln #2 running at optimal utilization, Kiln #1 without additional control is restricted in its utilization in order to maintain compliance with the 12-month rolling NOx cap. However, Lafarge acknowledges that SNCR is technologically feasible and that at this utilization, SNCR is a cost-effective control technology and represents RACT for the unit.

Accordingly, Lafarge proposes a RACT strategy consisting of continuing operation of SNCR on Kiln #2, at an emission rate of 5.2 pounds/ton clinker expressed as a 30 day rolling average. Effective 180 days after approval of this approach, Kiln #1 shall be required to operate SNCR control technology when the kiln is in operation and be subject to an emission rate of 5.2 pounds/ton clinker expressed as a 30 day rolling

Mike Kralik
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average. These RACT limitations shall remain in effect until Kiln #1 and Kiln #2 are required to cease operation as the result of other state and federal applicable requirements. This approach affords the Ravena Plant with the necessary flexibility to operate Kiln #1 when market demand or the unavailability of Kiln #2 necessitates.

If you have any questions or require further information please contact me at 518-756-5006.

Sincerely,

Mike Kralik
Plant Manager - Ravena

NO_X RACT ANALYSIS ▪ LEHIGH NORTHEAST CEMENT COMPANY

GLENS FALLS, NEW YORK

Prepared by:

TRINITY CONSULTANTS
100 Davidson Ave
Suite 206
Somerset, New Jersey 08873
(732) 356-9121

November 2010

Project 103101.0030

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1. EXECUTIVE SUMMARY

This report documents the determination of Reasonably Available Control Technology (RACT) as proposed by Lehigh Northeast Cement Company (Lehigh) for the portland cement manufacturing plant located in Glens Falls, New York (Glens Falls plant). The kiln began operation in 1971 and is a short, dry preheater kiln rated at 160 tons per hour (tph). Particulate matter emissions from the kiln are controlled by an electrostatic precipitator (ESP).

Trinity Consultants (Trinity) is assisting Lehigh with this analysis and utilized the New York State Department of Environmental Conservation (NYSDEC) RACT Rule for cement plants to establish RACT for the kiln. NYSDEC Rule 220-1 requires the owner or operator of a portland cement kiln to submit a RACT analysis for the emissions of oxides of nitrogen (NO_X) from the kiln. The analysis must propose a RACT emission limit and identify the monitoring equipment and procedures that will be used to demonstrate compliance with the proposed emission limit. The RACT analysis includes:

1. Identification of available NO_X control technologies
2. Projected effectiveness of each control technology identified
3. Costs for installation and operation of each technology
4. Determination of the control technology and emission limit selected as RACT

Based on the NO_X RACT analysis for the kiln at the Glens Falls plant, Lehigh proposes to install and operate a selective non-catalytic reduction (SNCR) system to meet NO_X RACT. SNCR has been deemed to be the Best Demonstrated Technology for NO_X control in cement plants according to NSPS (40 CFR 60, Subpart F). The proposed NO_X emission limit for RACT is 2.9 lbs NO_X/ton clinker, based on a 30-day rolling average.

2. Introduction and Background

NYSDEC Part 220 imposes RACT requirements on emissions of NO_X from portland cement kilns. While these RACT requirements have been in place since 1995, the NYSDEC revised Part 220 in 2010 to include two subparts (220-1 and 220-2). Subpart 220-1 applies to cement plants and requires updated NO_X RACT plans to be submitted for cement kilns at NO_X major sources. The NYSDEC has determined that three (3) portland cement plants in New York will be subject to the revised NO_X RACT requirements in Subpart 220-1. Due to the specific equipment design and operating conditions at each cement plant, each cement plant is required to submit a facility specific RACT analysis and a permit modification application for any new control equipment and/or emission limit by December 1, 2010. If the existing NO_X control equipment and emission limit is determined to be RACT, a permit modification application is not required. Subpart 220-1 requires that RACT be implemented no later than July 1, 2012.

The RACT analysis must include a list of the technically feasible NO_X control technologies, an evaluation of the effectiveness of each of the technologies considered, an assessment of the costs for installation and operation of each of the technologies, and a selection of the technology and emission limit that has been selected as RACT, considering the costs for installation and operation of the technology. If new technology will be required to meet RACT, the RACT analysis must also include a schedule for installation of the control equipment.

Cement kilns subject to Subpart 220-1 are required to demonstrate compliance with the NO_X RACT emission limit by measuring NO_X emissions with a continuous emissions monitoring system (CEMS). The CEMS shall comply with the requirements of Subpart 220-1, subdivision (d), which requires:

(1) Installation, calibration, evaluation, operation, and maintenance of the CEMS in accordance with the provisions of 40 CFR Part 75
(2) Permit modification applications to include submission of a CEMS monitoring plan that complies with the provisions of 40 CFR Part 75, Subpart F for approval by the NYSDEC
(3) Submission of a CEMS certification protocol at least 60 days prior to CEMS certification testing for approval by the NYSDEC
(4) Compliance to be determined daily based on a 30-day rolling average basis, with the 30-day rolling average calculated by dividing 30-day total NO_X emissions by 30-day total clinker production, including only days when the kiln operates. Annual re-certifications, quarterly accuracy, and daily calibration drift tests shall be performed in accordance with 40 CFR Part 75, Subpart C. During periods of CEM downtime, 40 CFR Part 75, Subpart D, data substitution procedures shall be used.
(5) Recordkeeping and reporting requirements are to be in accordance with 40 CFR Part 75, Subparts F and G.

In portland cement kilns, the NO_X that is generated is primarily classified into one of two categories: thermal NO_X or fuel NO_X. Thermal NO_X occurs as a result of the high-temperature oxidation of molecular nitrogen present in the combustion air. Fuel NO_X is created by the oxidation of nitrogenous compounds present in the fuel. It is also possible for nitrogenous compounds to be present in the raw material feed and become oxidized to form additional NO_X referred to as feed NO_X.

Due to the high flame temperature in the burning zone of the rotary kiln (3400 ^oF), NO_X emissions from the kiln tend to be mainly comprised of thermal NO_X. Although NO_X emissions from cement kilns include both nitrogen oxide (NO) and nitrogen dioxide (NO_2), typically less than 10% of the total NO_X in the flue gas is NO_2.

Subpart 220-1 requires submittal of a RACT analysis to address NO_X from the cement kiln. The existing Lehigh Glens Falls Title V permit NO_X limit for the kiln and the actual NO_X emission rates recorded by the CEMS in 2007, 2008, and 2009 are summarized in Table 3-1.

TABLE 3-1 EXISTING NO_X EMISSION RATES

Year	Title V Permit NO_X Emission Limit (lbs/hr)	NO_X Actual Emissions (lb/hr)	NO_X Actual Emissions (lb/ton of Clinker)
2009	372.7	297.52[1]	4.66[2]
2008	372.7	311.4[3]	4.46[3]
2007	372.7	239.4[4]	3.24[4]

[1] The actual 2009 NO_X emissions as recorded by the CEMS were 1,334,080 lb/yr and the kiln operated for 4,484 hours in 2009.
[2] Total clinker produced in 2009 was 286,125 tons.
[3] The actual 2008 NO_X emissions recorded by the CEMS were 1,206 tons and clinker production was 541,183 tons, with 7,746 hours of operation.
[4] The actual 2007 NO_X emissions recorded by the CEMS were 948 tons and clinker production was 585,192 tons, with 7,921 hours of operation.

3.1 IDENTIFICATION OF AVAILABLE NO_X CONTROL TECHNOLOGIES

Step 1 of the RACT determination is the identification of all reasonably available NO_X control technologies. A list of control technologies was obtained by reviewing the EPA's Clean Air Technology Center, control equipment vendor information, publicly-available air permits, applications, and technical literature published by the EPA and RPOs.

The available NO_X control technologies are summarized in Table 3-2.

TABLE 3-2 POSSIBLE NO_X CONTROL TECHNOLOGIES

Kiln Control Technologies
Low NO_X Burner (LNB) Flue Gas Recirculation (FGR) CKD Insufflation Selective Non-Catalytic Reduction (SNCR) Selective Catalytic Reduction (SCR)

3.2 ELIMINATION OF TECHNICALLY INFEASIBLE NO_X CONTROL TECHNOLOGIES

Step 2 of the RACT determination is to eliminate technically infeasible NO_X control technologies that were identified in Step 1.

3.2.1 LOW NO_X BURNER IN THE ROTARY KILN

Low NO_X burners (LNBs) reduce the amount of NO_X formed at the flame. The principle of all LNBs is the same: stepwise or staged combustion and localized exhaust gas recirculation (i.e., at the flame). As applied to the rotary cement kiln, the low NO_X burner creates primary and secondary combustion zones at the end of the main burner pipe to reduce the amount of NO_X initially formed at the flame. In the high-temperature primary zone, combustion is initiated in a fuel-rich environment in the presence of a less than stoichiometric oxygen concentration. The oxygen-deficient condition at the primary combustion site minimizes thermal and fuel NO_X formation and produces free radicals that chemically reduce some of the NO_X that is being generated in the flame.

In the secondary zone, combustion is completed in an oxygen-rich environment. The temperature in the secondary combustion zone is much lower than in the first; therefore, lower NO_X formation is achieved as combustion is completed.

EPA has indicated that a 14% reduction in NO_X emissions may be anticipated in switching from a direct-fired standard burner to an indirect-fired LNB.[1] This is based on a study conducted on an indirect-fired LNB at the Dragon Product Company cement kiln at the plant located in Thomaston, Maine. The kiln was reconfigured from direct-fired to indirect fired at this plant for the study. However, the EPA has also determined that the [emission reduction] contribution of the LNB itself and of the firing system conversion [direct to indirect] cannot be isolated from the limited data available[2]. The terms direct and indirect firing have unique meaning in the context of kiln firing (unlike the more general meanings where direct firing implies that the products of combustion contact the process materials

[1] NO_X Control Technologies for the Cement Industry, EC/R Incorporated, Chapel Hill, NC, USA, U.S. EPA Contract NO. 68-D98-025, U.S. EPA RTP, September 19, 2000.

[2] USEPA, Office of Air Quality Planning and Standards. *Alternative Controls Technology Document - NO_X Emissions from Cement manufacturing.* EPA-453/R-94-004, Page 5-5 to 5-8.

whereas indirect firing involves a heat transfer medium). In kiln firing, direct and indirect firing describes the manner in which pulverized fuel is conveyed from the fuel grinding mill to the burner.

In the direct firing configuration, fuel is pneumatically conveyed directly from the coal mill to the burner. The quantity of air introduced to the primary combustion zone is dictated by the minimum air requirements of the coal mill and the conveyance system, rather than the optimum flame requirements. The Glens Falls plant kiln uses a direct firing system.

In the indirect firing configuration, the coal mill air is separated from the pulverized fuel which is stored in a tank before being fed to the kiln. The pulverized fuel is then conveyed to the burner with the quantity of air that is optimum for flame considerations. There have been no controlled studies conducted on cement kilns that verify that this method of burning solid fuel reduces the formation of NO_X.

Other designs include a direct fired LNB system that consists of a plugged annual burner pipe. In this design, the burner pipe has a central plug, which reduces the pressure at the core of the jet. As a result, the pressure of the primary air jet is relieved inward, reducing the rate of the expansion of the flame. This produces a non-divergent flame that minimizes surface area of the flame and maintains the fuel concentrated in the core of the flame. The annual burner pipe is shown in Figures 3-1 and 3-2.

FIGURE 3-1 ANNUAL BURNER PIPE WITH CONTRACTED FLAME

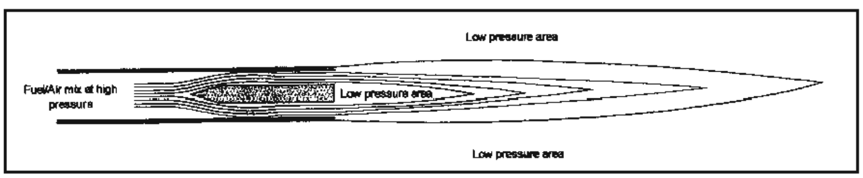
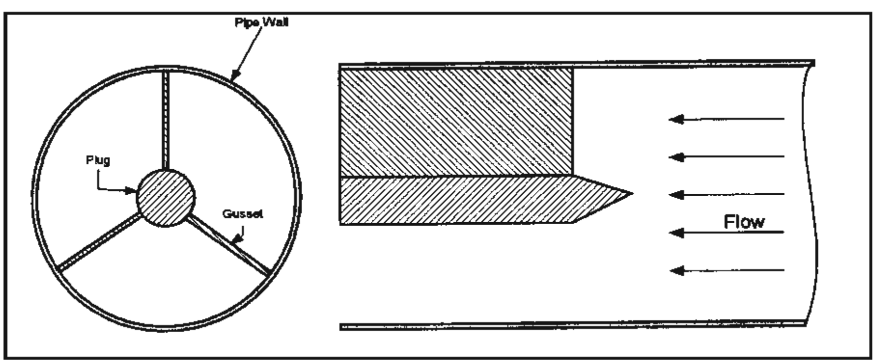


FIGURE 3-2 SCHEMATIC OF ANNUAL BURNER PIPE



When compared to simple free jet burners without the annual nozzle, plugged annual burners enhance NO_X control by reducing flame turbulence, delaying fuel/air mixing, and establishing a fuel rich core in the flame for initial combustion.

As such, low NO_X burners are a technically feasible option for NO_X control for the kiln at the Glens Falls plant.

3.2.2 Flue Gas Recirculation

Flue gas recirculation (FGR) involves the use of oxygen-deficient flue gas from some point in the process as a substitute for primary air in the main burner pipe in the rotary kiln. FGR lowers the peak flame temperature and develops localized reducing conditions in the burning zone through a significant reduction of the oxygen content of the primary combustion "air." The intended effect of the lower flame temperature and reducing conditions in the flame is to decrease both thermal and fuel NO_X formation in the rotary kiln.

While FGR is a practiced control technology in the electric utility industry, Lehigh is not aware of any attempt to apply FGR to a cement kiln because of the unique process requirements of the industry. Specifically, a hot flame is required to complete the chemical reactions that form clinker minerals from the raw materials. The process of producing clinker in a cement kiln requires the heating of raw materials to about 2700 °F for a brief but appropriate time to allow the desired chemical reactions that form the clinker minerals to occur. A short, high-temperature flame of about 3400 °F is necessary to meet this process requirement. The long/lazy flame that would be produced by FGR would result in the production of lower or unacceptable quality clinker because of the resulting undesirable mineralogy. Clinkering reactions must take place in an oxidizing atmosphere in the burning zone to generate clinker that can be used to produce acceptable cement. FGR would tend to produce localized or general reducing conditions that also could detrimentally affect clinker quality. Due to these important limitations on the application of FGR and the lack of a successful demonstration of this technology on a cement kiln, FGR is not a technically feasible control option for NO_X control on a kiln at this time.

3.2.3 Cement Kiln Dust Insufflation

Cement kiln dust (CKD) is a residual byproduct that can be produced by any of the four basic types of cement kiln systems. CKD is most often treated as a waste even though there are some beneficial uses. However, as a means of recycling usable CKD to the cement pyroprocess, CKD sometimes is injected or insufflated into the burning zone of the rotary kiln in or near the main flame. The presence of these cold solids within or in close proximity to the flame has the effect of cooling the flame and/or the burning zone thereby reducing the formation of thermal $NO_{X.}$ The insufflation process is somewhat counterintuitive because a basic requirement of a cement kiln is a very hot flame to heat the clinkering raw materials to about 2700° F in as short a time as possible. As mentioned earlier, the high temperature heating is critical to maintaining the quality of the clinker produced at desired levels. In addition, the injection of a high-sulfur material, i.e., CKD, in the vicinity of the flame may increase SO_2 generation [3] and emissions if localized reducing conditions are present.

[3] Per the publication titled, "Interactions Among Gaseous Pollutants from Cement Manufacture and their Control Technologies" by Walter L. Greer, Portland Cement Association, PCA R&D Serial No. 2728.

A RACT, BACT, LAER Clearinghouse (RBLC) search of the EPA database for control technologies for NO_X in portland cement plants shows that CKD insufflation technology has not been used in any cement plants in the United States to meet RACT, BACT, or LAER requirements. As such, CKD insufflation is not a technically feasible option for NO_X control on a kiln at this time.

3.2.4 SELECTIVE NON-CATALYTIC REDUCTION

In the relatively narrow temperature window of 1600 to 1995°F, ammonia (NH_3) reacts with NO_X without the need for a catalyst to form water and molecular nitrogen in accordance with the following simplified reactions.

$4NO + 4NH_3 + O_2 \rightarrow 4N_2 + 6H_2O$
$2NO_2 + 4NH_3 + O_2 \rightarrow 3N_2 + 6H_2O$

As applied to NO_X control from cement kilns and other combustion sources, this technology is called SNCR. Above this temperature range, the NH_3 is oxidized to NO_X thereby increasing NO_X emissions. Below this temperature range, the reaction rate is too slow for completion and unreacted NH_3 may be emitted from the system. This temperature window generally is available at some location within the rotary kiln. The NH_3 could be delivered to the kiln shell through the use of anhydrous NH_3 or an aqueous solution of NH_3 (ammonium hydroxide) or urea.

A concern about application of SNCR technology is the breakthrough of unreacted NH_3 as "ammonia slip" and its subsequent reaction in the atmosphere with SO_2, sulfur trioxide (SO_3), hydrogen chloride (HCl) and/or chlorine (Cl_2) to form a detached plume of particulate matter with an aerodynamic diameter less than 10 microns (PM_{10}).

However, SNCR is a technically feasible NO_X control technology option for the kiln at the Glens Falls plant.

3.2.5 SELECTIVE CATALYTIC REDUCTION

Selective Catalytic Reduction (SCR) is an add-on control technology for the control of NO_X emissions. SCR has been successfully employed in the electric power industry. The basic SCR system consists of a system of catalyst grids placed in series with each other within a vessel that is located in a part of the process where the normal flue gas temperature is in the required range. An ammonia-containing reagent is injected at a controlled rate upstream of the catalyst grids that are designed to ensure relatively even flue gas distribution within the grids, to provide good mixing of the reagent and flue gas, and to result in minimum NH_3 slip.[4] The NH_3 reacts with NO_X compounds (i.e., NO and NO_2) on the surface of the catalyst in equal molar amounts (i.e., one molecule of NH_3 reacts with one molecule of NO_X). Common reagents include aqueous NH_3, anhydrous

[4] Slip refers to the quantity of unreacted reagent that exits the SCR reactor.

NH_3 and urea [$(NH_2)_2CO$]. In the presence of the catalyst, the injected ammonia is converted by OH^- radicals to ammonia radicals (i.e., NH_2^-), which, in turn, react with NO_X to form N_2 and H_2O. The SCR catalyst enables the necessary reactions to occur at lower temperatures than those required for SNCR. While catalysts can be effective over a larger range of temperatures, the optimal temperature range for SCR is 570 - 750ºF.

The catalyst system used in SCR applications usually consists of (1) a porous honeycomb of a ceramic substrate onto which catalyst has been attached to the surface of the ceramic material, or (2) a flat or corrugated plate onto which catalytic material has been deposited on the surface. A porous metal oxide with a high surface area-to-volume ratio acts as a catalyst base. On this base, typically titanium dioxide (TiO_2), one or more metal oxide catalysts are deposited in various concentrations. In SCR applications, the active catalyst material typically consists of vanadium pentoxide (V_2O_5), tungsten trioxide (WO_3), and molybdenum trioxide (MoO_3) in various combinations. The composition, also known as the catalyst formulation, is tailored by the catalyst vendor to best suit a particular SCR application. Catalyst deactivation through poisoning, fouling, masking, sintering and erosion are common problems for SCR catalysts that, without careful process design and operation, could be exacerbated. If not fouled by SO_2, the catalysts used in SCR have a propensity to oxidize SO_2 in the flue gas to SO_3, a more undesirable pollutant.

Because the reaction rate of NH_3 and NO_X is temperature dependent, the temperature of the flue gas stream to be controlled is the most important consideration in applying SCR technology to any combustion source. The optimum temperature range for SCR application is about 300ºC (570ºF) to 450ºC (840ºF).

The SCR technology has been attempted at a handful of European plants [5], the noteworthy ones being the Solnhofen plant in Germany (2001) and the Cementeria de Moncelice plant (2006) & Cementeria di Sarche di Calavino (2007) in Italy. Except for one recent planned installation (January 2010 announcement by Lafarge and EPA for a planned installation at Lafarge's Joppa, IL plant), SCR has not been applied to a cement plant of any type in the United States, nor has SCR been demonstrated to be a viable technology for cement plants in the United States.

The EPA, in the preamble to the final rule [6] published on August 9, 2010, 40 CFR Part 60 Subpart F, Standards of Performance for Portland Cement Plants (NSPS Subpart F), states:

> *At proposal we did not believe that SCR was sufficiently demonstrated technology for this industry. We are aware that there have been three cement kilns in Europe that have successfully used SCR, and that SCR technology is a demonstrated control technology for NO_X control for other source categories, such as utility boilers. We*

[5] From report titled "The Costs and Benefits of Selective Catalytic Reduction on Cement Kilns for Multi-pollutant Control" by Dr. Al Armanderiz, Southern Methodist University, February 2008.

[6] 40 CFR Parts 60 and 63 [EPA-HQ-OAR-2007-0877] RIN 2060-AO42, [EPA-HQ-OAR-2002-0051] RIN 2060-AO15, National Emission Standards for Hazardous Air Pollutants From the Portland Cement Manufacturing Industry and Standards of Performance for Portland Cement Plants.

also are aware that one domestic cement company has agreed to install SCR technology on one kiln as part of a settlement agreement.

However, we continue to question if SCR technology would be effective at all locations where new kilns might be installed. The main concern is the potential for dust buildup on the catalyst, which can be influenced by site specific raw material characteristics present in the facility's proprietary quarry, such as trace contaminants that may produce a stickier particulate than is experienced at sites where the technology has been installed. This buildup could reduce the effectiveness of the SCR technology, and make cleaning of the catalyst difficult resulting in kiln downtime and significant costs. We were unable to estimate these costs and did not include these costs in our overall cost estimates for SCR. For these reasons, we have not selected SCR technology as the basis of BDT (Best Demonstrated Technology). We will continue to follow this technology as it is applied in the U.S., and will reconsider this decision in the next review of this standard.

The EPA further states that:

Although SCR has been demonstrated at a few cement plants in Europe and has been demonstrated on coal-fired power plants in the US, it is not satisfied that it has been sufficiently demonstrated as an off-the-shelf control technology that is readily applicable to cement kilns. The experience with SCR use on coal-fired power plants in the US is not directly transferrable to portland cement plants with the main difference being the lower dust loadings at power plants than would occur at cement plants. The experience at European kilns showed long periods of trial and error before the technology was operating properly. In particular, problems with the high-dust installations and the resulting fouling of the catalyst were problematic. This and other problems were eventually overcome, although at one of the early facilities to add SCR, the use of the SCR was discontinued in favor of a selective non-catalytic reduction (SNCR) system while the facility owners and operators gathered additional data to assess the advantages and disadvantages of the SCR system in comparison to the SNCR system.

NESCAUM's recent report titled, "Assessment of Control Technologies for RACT-Eligible Sources" prepared in partnership with the MANE-VU dated March 2005 mirrors similar drawbacks of SCR as a NO_X control technology for cement plants.

Therefore, SCR is not technically feasible and is eliminated from further consideration as RACT for NO_X control on the kiln at the Glens Falls plant.

3.3 RANK OF TECHNICALLY FEASIBLE NO_X CONTROL OPTIONS BY EFFECTIVENESS

The third step in the RACT analysis is to rank the technically feasible options according to effectiveness. As explained in the preceding sections, SNCR and low NO_X burners are the only two technically feasible control options for the Glens Falls plant. Table 3-3 presents potential NO_X technically feasible control technologies for the kiln and the associated NO_X emission levels.

TABLE 3-3 RANKING OF TECHNICALLY FEASIBLE KILN NO_X CONTROL TECHNOLOGIES BY EFFECTIVENESS

Control Technology	Effectiveness NO_X Emissions Level (% NO_X Reduction)
SNCR	50%[1]
LNB	~15-25 % control[2]

1 Data provided by Petro SNCR system, vendor guaranteed value for the proposed installation at the Glens Falls plant.

2 Typically achieved NO_X reduction values for low NO_X burners installed on kiln systems converted from direct to indirect fired configuration. Data provided by Mr. Max Vaccarro of Fives Pillard, Inc.

3.4 EVALUATION OF IMPACTS FOR FEASIBLE NO_X CONTROLS

Step four of the RACT analysis procedure is the impact analysis. The RACT determination guidelines list the four factors to be considered in the impact analysis:

- Cost of compliance for the potential technology
- Energy impacts
- Non-air quality impacts; and
- The remaining useful life of the source

3.4.1 SNCR

Cost of Compliance

Lehigh is proposing to select SNCR as RACT. SNCR achieves the highest NO_X emission reduction Because the most stringent control option is being proposed as RACT, a detailed cost analysis is not presented here. The capital expenditure to purchase and install a Petro SNCR system at the Glens Falls plant is estimated to be in the range of $1,800,000 to $2,100,000. Adding tax, freight, and installation to the capital expenditure cost results in a total capital cost of $2,562,000. The annual capital recovery cost, annual reagent cost, and the annual mechanical and electrical costs result in a total annual cost of $928,676. In addition to this cost, the lime system may need to operate more to alleviate the potential for a detached plume, resulting in additional operating cost. Assuming a conservative control effectiveness of 50% NO_X removal, 811.0 tons of NO_X may be removed annually, resulting in a cost of $1,145 per ton of NO_X removed (without including the costs of any additional lime system operation).

Energy Impacts and Non Air-Quality Impacts
SNCR systems require electricity to operate the blowers and pumps. The generation of the electricity will most likely involve fuel combustion, which will cause an increase in indirect emissions. However, these emissions should be small compared to the reduction in NO_X that would be gained by operating an SNCR system on the kiln.

Remaining Useful Life
The remaining useful life of the kiln does not impact the annualized costs of SNCR because the useful life is anticipated to be at least as long as the capital cost recovery period, which is 10 years.

Because Lehigh has proposed to install the control technology that achieves the highest NO_X reduction, SNCR, as RACT, other technically feasible control technologies (such as the low NO_X burner) have not been considered.

3.5 PROPOSED RACT FOR NO_X

As evaluated in the preceding sections, the only two technically feasible control options for NO_X for the kiln at the Glens Falls plant are SNCR and low NO_X burners. And as seen above, the percent NO_X reduction potential for SNCR is much higher (50%) than could be guaranteed for a low NO_X burner installation (~15-25%) at the plant. Hence, SNCR is the most stringent NO_X control technology that can be installed on the kiln at the Glens Falls plant.

SNCR has been deemed to be the Best Demonstrated Technology for NO_X control in cement plants. In the preamble to the recently promulgated NSPS for portland cement plants (40 CFR 60, Subpart F, promulgated on August 9, 2010), EPA states:

> *We determined SNCR to be BDT and applied a control efficiency for the SNCR to the baseline uncontrolled level to determine the appropriate NO_x level consistent with application of BDT. SNCR performance varies depending on various factors, but especially the normalized molar ratio (NMR), or the molar ratio of ammonia injected to NO_x- higher removal efficiencies are associated with a higher NMR. SNCR performance has been shown to range from 20 to 80 percent NO_x removal.*

Lehigh proposes to install and operate SNCR on the kiln, thus employing the control device with the highest NO_X removal efficiency. According to NYSDEC guidance, if the most effective control technology is chosen as RACT, the remaining, less effective controls do not have to be evaluated if no significant environmental impacts are expected from the most effective technology. Since Lehigh will be installing the most effective NO_X control technology on the kiln and there are no significant environmental impacts associated with SNCR, the RACT analysis is complete and no further evaluation is required for the other control technologies.

The current NO_X permit limit for the kiln is 372.7 lb/hr, which assuming a conservative estimate of 8,760 hours of operation per year, translates to 1632.43 tons/year of NO_X emissions. The proposed SNCR system is guaranteed to reduce NO_X emissions by 50%. Considering the control effectiveness, the new potential emissions from the kiln are 816.21 tons/year. Table 3-1 provides historic clinker production data for 2007, 2008, and 2009, which can be used to establish the pounds of NO_X per ton of clinker that would be considered RACT for the facility. Unusual market conditions in 2009 resulted in limited plant operations during the year, therefore the 2009 production data is not indicative of normal plant operations, and has not been included in the historic clinker production rate. Dividing the potential NO_X emissions (with SNCR installed), by the average production rate from the 2007 and 2008 operating years (563,000 tons of clinker), results in a NO_X emission limit of 2.9 lbs NO_X/ton of clinker produced. Lehigh proposes the 2.9 lb NO_X/ton clinker as RACT.

4. IMPLEMENTATION SCHEDULE

Lehigh has proposed to install SNCR on the kiln to satisfy NO_X RACT. Because of the scope of the NO_X RACT project implementation, Lehigh requests an extension of the NO_X RACT deadlines to allow sufficient time to coordinate equipment installation with plant operating schedules. The proposed schedule of implementation is provided below.

Stage	Activity	Date
SNCR Implementation	NO_X RACT Analysis Submittal to NYSDEC	December 1, 2010
	NYSDEC Approval of NOx RACT Analysis	January 2011
	Submittal of permit modification application	December 31, 2010.
	Project Kickoff	March 2011
	System design and engineering	December 2011
	Expected permit issuance	January 2013
	Site preparation and equipment installation	March 2013
	Equipment startup and shakedown	December 2013
	Compliance testing	May 2014
	Submittal of compliance data to NYSDEC	August 2014

APPENDIX A

TECHNICAL DESCRIPTION AND PRICE QUOTE OF A FULL AUTOMATICE PETRO SNCR

Reference Test Method: Method 9
Monitoring Frequency: WEEKLY
Averaging Method: 6-MINUTE AVERAGE (METHOD 9)
Reporting Requirements: AS REQUIRED - SEE MONITORING DESCRIPTION

Condition 80: Compliance Demonstration
Effective between the dates of 02/28/2012 and 02/27/2017

Applicable State Requirement:6 NYCRR 220-1.4 (c)

Item 80.1:
The Compliance Demonstration activity will be performed for the Facility.

Regulated Contaminant(s):
CAS No: 0NY075-00-0 PARTICULATES

Item 80.2:
Compliance Demonstration shall include the following monitoring:

Monitoring Type: WORK PRACTICE INVOLVING SPECIFIC OPERATIONS
Monitoring Description:
Any person who owns or operates an area, parking lot, clinker gallery, rail car loading shed, conveyor tunnel, access road, stockpile, building opening, or refuse disposal area at a portland cement plant that has the potential to emit visible emissions for one continuous hour or longer must apply corrective measures to eliminate such potential. This requirement shall be implementated thru daily inspections and appropriate action as described in GFLC's "Fugitive Dust Control Plan" which is an attachment to this permit.

Work Practice Type: PARAMETER OF PROCESS MATERIAL
Process Material: MATERIAL
Parameter Monitored: OPACITY
Upper Permit Limit: 0 percent
Monitoring Frequency: DAILY
Averaging Method: AVERAGING METHOD - SEE MONITORING DESCRIPTION
Reporting Requirements: SEMI-ANNUALLY (CALENDAR)
Reports due 30 days after the reporting period.
The initial report is due 7/30/2012.
Subsequent reports are due every 6 calendar month(s).

Condition 84: Compliance Demonstration
Effective between the dates of 07/01/2012 and 02/27/2017

Applicable State Requirement:6 NYCRR 220-1.6 (b)

Item 84.1:
The Compliance Demonstration activity will be performed for the facility:

The Compliance Demonstration applies to:

Emission Unit: 0-UKILN Emission Point: 01070

Regulated Contaminant(s):
CAS No: 0NY210-00-0 OXIDES OF NITROGEN

Item 84.2:
Compliance Demonstration shall include the following monitoring:

Monitoring Type: WORK PRACTICE INVOLVING SPECIFIC OPERATIONS
Monitoring Description:

Emissions of Oxides of Nitrogen (NOx) from the cement kiln are limited to no more than 2.88 pounds per ton of clinker produced. This is based upon the use of selective non-catalytic reduction (SNCR) with a manufacturers guarantee of 50% control, as proposed in Lehigh's NOx RACT plan, submitted electronically on November 30, 2010 and subsequently amended.

Compliance with this requirement demonstrates compliance with 6 NYCRR 220-1.6(b) as well as 6 NYCRR 249.3(a). The effective deadlines for each requirement are July 1, 2012 for Part 220-1.6(b) and January 1, 2014 for Part 249.3(a).

Work Practice Type: PARAMETER OF PROCESS MATERIAL
Process Material: CLINKER
Manufacturer Name/Model Number: ABB/Advance Optima Limas Model 11 NDUV Analyzer
Parameter Monitored: OXIDES OF NITROGEN
Upper Permit Limit: 2.88 pounds per ton
Reference Test Method: CFR 60/App A/Mt 4.7
Monitoring Frequency: DAILY
Averaging Method: 30 DAY ROLLING AVERAGE, ROLLED DAILY
Reporting Requirements: SEMI-ANNUALLY (CALENDAR)
Reports due 30 days after the reporting period.
The initial report is due 7/30/2012.
Subsequent reports are due every 6 calendar month(s).

Condition 85: Compliance Demonstration
Effective between the dates of 02/28/2012 and 07/01/2012

Applicable State Requirement:6 NYCRR 220-1.6 (b) (4)

Item 85.1:
The Compliance Demonstration activity will be performed for the facility:
The Compliance Demonstration applies to:

Emission Unit: 0-UKILN Emission Point: 01070

Regulated Contaminant(s):

CAS No: 0NY210-00-0 OXIDES OF NITROGEN

Item 85.2:
Compliance Demonstration shall include the following monitoring:

Monitoring Type: CONTINUOUS EMISSION MONITORING (CEM)
Monitoring Description:
The NOx RACT limit was established under the terms of the Consent Order file No. D5-0001-97-06.

Manufacturer Name/Model Number: ABB/Advance Optima Limas Model 11 NDUV Analyzer
Parameter Monitored: OXIDES OF NITROGEN
Upper Permit Limit: 372.7 pounds per hour
Reference Test Method: CFR 60/APP A/MT 4.7
Monitoring Frequency: CONTINUOUS
Averaging Method: 30-DAY ROLLING AVERAGE
Reporting Requirements: QUARTERLY (CALENDAR)
Reports due 30 days after the reporting period.
The initial report is due 4/30/2012.
Subsequent reports are due every 3 calendar month(s).

Condition 86: Compliance Demonstration
Effective between the dates of 02/28/2012 and 02/27/2017

Applicable State Requirement:6 NYCRR 220-1.7

Item 86.1:
The Compliance Demonstration activity will be performed for the facility:
The Compliance Demonstration applies to:

Emission Unit: 0-UKILN Emission Point: 01070

Emission Unit: 0-UKILN Emission Point: 01122

Item 86.2:
Compliance Demonstration shall include the following monitoring:

Monitoring Type: RECORD KEEPING/MAINTENANCE PROCEDURES
Monitoring Description:
(a) The owner or operator of a portland cement kiln or clinker cooler must maintain a file of daily clinker production rates, kiln feed rates, and any particulate emission measurements. The production and feed rates must be summarized monthly. The records and summary must be retained for at least five years following the date of such records and summaries and must be made available for inspection by the department during normal business hours.

(b) The owner or operator of a portland cement kiln at a dry process plant or clinker cooler at either a dry or wet process plant, subject to section 220-1.4 (a) or (b) of this Subpart, must install, maintain, calibrate daily, and operate a device, approved by the department, for continuously measuring and recording the opacity of emissions from such kiln or clinker cooler. If two or more kilns are vented through a single stack, an opacity monitor in the common stack would satisfy the requirements of this subdivision. Records of opacity must be retained for at least five years following the date on which they are made.

(c) The owner or operator of a portland cement kiln shall demonstrate compliance with the NOx RACT emission limit(s) established in section 220-1.6(b) of this Subpart by measuring NOx emissions with a continuous emissions monitoring system (CEMS). The CEMS shall comply with the requirements of subdivision (d) of this section or with equivalent requirements approved by the department. Any approved equivalent CEMS requirements will be submitted by the department to the United States Environmental Protection Agency for approval as separate State Implementation Plan revisions.

(d) CEMS requirements.

(1) The owner or operator of a portland cement kiln shall install, calibrate, evaluate, operate, and maintain a CEMS, in accordance with the provisions of 40 CFR part 75, for measuring NOx at locations approved in the CEMS certification protocol under paragraph (3) of this subdivision, and shall record the output of the system.

(2) As part of its application for a permit or permit modification, the owner or operator of a portland cement kiln shall submit for department approval a CEMS monitoring plan that complies with the provisions of 40 CFR part 75, subpart F.

(3) The owner or operator of a portland cement kiln shall submit for department approval a CEMS certification protocol at least 60 days prior to CEMS certification testing. The certification protocol shall include the location of and specifications for each instrument or device, as well as procedures for calibration, operation, data evaluation, and data reporting.

(4) The procedures in subparagraphs (i) through (v) of this paragraph shall be used for determining compliance with the NOx RACT emission limit established under section 220-1.6(b) of this Subpart.

(i) The owner or operator of a portland cement kiln shall determine compliance daily on a 30 day rolling average basis. The 30 day rolling averages shall be calculated by dividing 30 day total NOx emissions by 30 day total clinker production. Only days when the kiln operates shall be included in the 30 day rolling averages.

(ii) Along with any specific additional data requirements mandated by the department for a particular portland cement kiln, annual re-certifications, quarterly accuracy, and daily calibration drift tests shall be performed in accordance with 40 CFR part 75, subpart C.

(iii) When NOx emissions data are not obtained because of CEMS downtime, or for periods when no valid CEMS data is available, the owner or operator of a portland cement kiln shall use 40 CFR part 75, subpart D, data substitution procedures.

(5) In addition to the requirements of subparagraphs (i) through (iii) of this paragraph, the owner or operator of a portland cement kiln shall comply with the CEMS recordkeeping and reporting requirements of 40 CFR part 75, subparts F and G.

(i) The owner or operator of a portland cement kiln shall notify the department of the planned initial start-up date of any new CEMS.

(ii) Emissions, monitoring, and operating parameter records or measurements required by this Subpart and any additional parameters required by the department shall be maintained for at least five years and made available to the department upon request.

(iii) On a semi-annual basis, the owner or operator of a portland cement kiln shall tabulate and summarize applicable emissions, monitoring, and operating parameter measurements recorded during the preceding six months, and submit these records to the department. These records shall be submitted in a format acceptable to the department and shall include:

(a) the 30 day rolling average NOx emissions as specified under paragraph (4) of this subdivision;

(b) identification of the operating hours when NOx emissions data are not included in a calculation of the 30 day rolling average emissions and the reasons for not including that data;

(c) a comparison of the NOx emissions to the NOx RACT emissions limit(s);

(d) type and amount of fuel burned on a daily basis and the as burned heat content of the fuel;

(e) the total daily NOx emissions and total daily clinker production; and

(f) the results of CEMS accuracy assessments as required by 40 CFR part 75, appendix A and B and any additional data quality information required by the department.

(e) Protocols, reports, summaries, schedules, and any other information required to be submitted to the department under provisions of this Subpart must be sent (in either hardcopy or electronically) as follows:

(1) one copy to the Division of Air Resources, New York State Department of Environmental Conservation, 625 Broadway, Albany, New York 12233; and

(2) one copy to the regional air pollution control engineer at New York State Department of Environmental Conservation, 232 Golf Course Rd., Warrensburg, New York 12885.

Monitoring Frequency: AS REQUIRED - SEE PERMIT MONITORING DESCRIPTION
Reporting Requirements: AS REQUIRED - SEE MONITORING DESCRIPTION

NO_X RACT ANALYSIS AND MODIFICATION APPLICATION
OWENS CORNING INSULATING SYSTEMS, LLC
DELMAR PLANT

Prepared By:

INNOVATIONS FOR LIVING™

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Project 103101.0029

NOVEMBER 2010

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1. EXECUTIVE SUMMARY

Owens Corning Insulating Systems, LCC (OCIS) operates a wool fiberglass insulation products manufacturing plant (Delmar Plant) in Feura Bush, New York. The OCIS Delmar Plant currently operates under a Title V permit ID 4-0122-00004/00039 issued on November 5, 2010 by New York State Department of Environmental Conservation (NYSDEC).

The OCIS Delmar facility operates two glass melting furnaces[1] DM-1 (EU2) and DM-2(EU12). Both these units are subject to NO_x RACT requirements. The original NO_x RACT analysis for the glass melting furnaces was submitted to the NYSDEC in October 1994 and revised in May 1999 in accordance with 6 NYCRR 212.10(c)(3) regulations. NYSDEC RACT regulations (6 NYCRR 220-2) were updated on July 11, 2010. Under this most recent rule revision, NYSDEC requires glass manufacturing facilities categorized as major sources of NO_x emissions to submit a NO_x RACT analysis for the furnaces and permit modification application (requesting the installation of monitoring equipment) by December 1, 2010. Therefore, this permit modification application is being submitted by the OCIS Delmar facility in order to meet the regulatory requirements of the NO_x RACT rule.

This permit modification application requests the following:

1. NYSDEC agreement with the determination that the existing furnace oxy-firing control technology is NO_x RACT.
2. Incorporation of a NO_x RACT emission limit of 4.0 lb/ton glass pulled for both the furnaces DM-1 (EU2) and DM-2 (EU12) into the permit.
3. Approval and authorization to install the proposed Continuous Emissions Monitoring Systems (CEMs) for both the furnaces DM-1 (EU2) and DM-2 (EU12) per 6NYCRR 220-2.4.

1.1 APPLICATION CONTENTS

The permit application is organized as follows. Two copies of the permit application are enclosed.

- ▲ Section 1 includes the executive summary and application contents
- ▲ Section 2 provides the introduction and background related to the NO_x RACT regulations
- ▲ Section 3 provides the technical description of glass melting furnaces

[1] 6NYCRR Part 220-2.2(b)(1), Glass melting furnace. *A refractory vessel in which raw materials are charged, melted at high temperature, refined, and conditioned to produce molten glass. The furnace includes foundations, superstructure and retaining walls, raw material charger systems, heat exchangers, melter cooling system, exhaust system, refractory brick work, fuel supply and electrical boosting equipment, integral control systems and instrumentation, and appendages for conditioning and distributing molten glass to forming apparatuses. The forming apparatuses, including the float bath used in flat glass manufacturing and flow channels in wool fiberglass and textile fiberglass manufacturing, are not considered part of the glass melting furnace.*

- Section 4 details the control technology evaluation for NO_x reduction for the glass furnaces.
- Section 5 summarizes the NO_x RACT for the glass furnaces.
- Section 6 provides the installation schedule for NO_x CEMs for the glass furnaces.
- Appendix A includes a summary of EPA's RACT/BACT/LAER Clearinghouse (RBLC) Database Results
- Appendix B includes the cost analysis.
- Appendix C includes NYSDEC forms with P.E. Certification

2. INTRODUCTION AND BACKGROUND

New York State is a member of the Ozone Transport Commission (OTC) and is regulated as part of the Ozone Transport Region where ozone nonattainment is treated as a regional issue. Given the regional nature of ozone formation, OTC provides coordinating rulemaking leadership so that each member state can promulgate rules at the state level that achieve regional ozone attainment goals. In June 2006, the OTC set forth guidelines for emission reduction strategies for six industrial source sectors, including glass plants. OTC member states agreed to pursue rulemakings to achieve emission reductions consistent with the guidelines. The OTC emission guidelines for glass plants are as follows:

TABLE 2-1 OTC RECOMMENDED NO_x RACT LIMITS FOR GLASS PLANTS

Type of Glass	Emission Rate (lbs NO_x/ton of glass pulled) Block 24-hour average	Emission Rate (lbs NO_x/ton of glass pulled) Rolling 30-day average
Container Glass	4.0	N/A
Flat Glass	9.2	7.0
Pressed/Blown Glass	4.0	N/A
Fiberglass	4.0	N/A

The NYSDEC has recently revised Part 220 to address the guidelines developed by the OTC. To that end, the Compilation of the Rules and Regulations of the State of New York (NYCRR) Part 220 has been revised to require glass plants that are major sources of NO_x to meet NO_x RACT requirements. RACT is defined as the lowest emission limitation that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility. RACT for a source category may be established as presumptive RACT limits or RACT may be established on a case by case basis, considering the technological and economic circumstances of the individual source.

The NYSDEC has decided that for the glass plants in New York, RACT differs from facility to facility based on site-specific operation and design. As a result, the revised rule requires each glass plant to perform a facility specific analysis to determine RACT for emissions of NO_x from its glass furnace(s). The RACT analysis must include an assessment of the available NO_x control technologies, the projected effectiveness of each of the technologies considered, the costs for installation and operation for each of the technologies, and the technology and the appropriate emission limit that has been selected as RACT, considering the costs for installation and operation of the technology.

3. TECHNICAL DESCRIPTION OF GLASS MELTING FURNACES

The Owens Corning Delmar facility manufactures wool fiberglass used primarily as building insulation. The glass fiber manufacturing process is a high temperature conversion of various raw materials (predominantly borosilicates) into a homogeneous melt, followed by a fabrication of this melt into glass fibers. The manufacturing process can be segmented into four phases: raw materials handling, glass melting and refining, wool glass fiber forming and wool glass fiber curing.

The glass melting furnaces melt/dissolve the raw materials into molten glass. The raw materials are continuously introduced on top of the molten glass bath where they slowly mix and melt/dissolve. For glass furnaces that are fired with natural gas burners whose source of oxygen is ambient air, the furnace NO_x emissions are generated by the homogeneous gas-phase reaction of oxygen and nitrogen present in the combustion gas, at the high temperatures inherent to this process. The NO_x resulting from the high temperature oxidation is referred to as "thermal NO_x". NO_x is a mixture of NO and NO_2. In the case of the furnace, the thermal NO_x is essentially all in the form of NO with very little NO_2. Because natural gas is used as the fuel in almost all glass furnaces, there is little contribution of fuel bound nitrogen to NO_x emissions. However, some glass raw materials contain nitrates ("niter") which may emit NO_2 when heated. Uncontrolled NO_x emissions depend primarily on various process parameters including fuel firing rate, furnace geometry, fuels used, and raw materials. Therefore, NO_x emissions can vary significantly from site-to site, depending on the raw materials and from furnace to furnace, depending on the design and operation of the furnace.

In the case of Delmar facility, essentially nitrogen-free oxygen is used instead of ambient air for the furnaces' oxy-fuel gas burners so the mechanisms that are described above for NO_x generation are not applicable. Instead, NO_x is formed when nitrogen that is in ambient air that is inspirated through the annular space around the oxy-fuel burners' blocks reacts with free oxygen in the high temperature atmosphere in the freeboard area above the melt in the furnaces.

4. CONTROL TECHNOLOGY EVALUATION

This section outlines the methodology used for conducting the NO_x RACT evaluation and presents the results of the step-by-step analysis.

4.1 RACT METHODOLOGY

Per 6 NYCRR Part 220-2 regulations, OCIS is required to submit a revised/updated NO_x RACT analysis for the glass melting furnaces. The original NO_x RACT analysis was submitted to the NYSDEC in October 1994 and a revised analysis was submitted in May 1999.

The RACT analysis must identify the available NO_x control technologies (eliminating technically infeasible options), evaluate the projected effectiveness of the technologies considered, determine the costs for installation and operation for each of the technically feasible and beneficial technologies, and determine the appropriate emission limit selected as RACT considering the costs for installation and operation of the technology. For a glass melting furnace that was in operation prior to the effective date of the Subpart and for which the existing NO_x control equipment has been determined to not be RACT, the RACT analysis must also include a schedule for installation of control equipment.

When developing a RACT analysis, a source must consider viable controls, including controls that are required under specific regulations, and determine if they are reasonably available for the specific source or source category being evaluated. However, the fact that another similar source has such controls in place does not mean that such a control is reasonably available for all other similar sources across the country. Per the NYSDEC Air Guide 20 (AG-20), NYSDEC established the cost that defines the upper economic limit of implementing NO_x RACT, currently in the range of $5,000 to $5,500 per ton reduced[2].

The RACT analysis includes the following steps:

Step 1. Identify potential control technologies
Step 2. Eliminate technically infeasible options
Step 3. Evaluate and rank remaining control technologies by control effectiveness
Step 4. Evaluate economic feasibility and document results
Step 5. Select RACT, and determine RACT emission limit.

4.1.1 STEP 1 – IDENTIFICATION OF POTENTIAL CONTROL TECHNOLOGIES

OCIS conducted a detailed search to identify potential NO_x control technologies for the glass melting furnaces. The following information sources were reviewed:

[2] As provided in the Regulatory Impact Statement Summary 6NYCRR Part 220

- EPA's RACT/BACT/LAER Clearinghouse (RBLC) (SIC Code 3296 – October 2010)
- Alternative Control Techniques Document – NO_x Emissions From Glass Manufacturing Facilities (EPA – 453/R-94-037) (June 1994)
- State of the Art (SOTA) Manual for Glass Industry published by New Jersey Department of Environmental Protection (NJDEP) (July 1997)
- Glass Plants – EPA Region 6 Workshop (February 2008) and
- Internet Searches
- OCIS' own technical information based on the glass melting technologies that it has utilized at its various facilities

The potential NO_x control technologies identified in the search are categorized into the three types of control methods listed below:

1. Combustion Modification
    a. Low-NO_x Burners
    b. Oxy-firing
    c. Cold Top Electric (CTE) melter
    d. 100% Natural gas fired melter
    e. Natural gas fired with electric boost melter (Electric Boost)
    f. Hot Spot Electric (HSE) melter
2. Post Combustion Control Technology
    a. Selective Catalytic Reduction (SCR)
    b. Selective Non-Catalytic Reduction (SNCR)
    c. Reaction and Reduction in the Regenerator (3R)
    d. FENIX (Patent Process)
3. Process Modification
    a. Cullet Preheat

4.1.2 STEP 2 – EVALUATION OF TECHNICAL FEASIBILITY

Several factors must be considered when determining whether available control options can be feasibly applied. For purposes of establishing RACT, each control technology is evaluated on physical, chemical, and/or engineering design principles. Those that are deemed infeasible are eliminated from further consideration.

First, the NO_x RACT analysis submitted to NYSDEC in 1999 and data provided in the aforementioned[3] literature have established that cullet preheat, electric boost, selective catalytic reduction (SCR), and selective noncatalytic reduction (SNCR) are technically infeasible for the OCIS

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3 Alternative Control Techniques Document – NO_x Emissions From Glass Manufacturing Facilities (EPA – 453/R-94-037) (June 1994)
Glass Plants – EPA Region 6 Workshop (February 2008) and
Internet Searches

Delmar facility. SCR and SNCR control technologies have not been utilized to control emissions from glass melting furnaces in the wool fiberglass insulation industry and therefore they have been established as technically infeasible for the glass melting furnaces at OCIS Delmar. As such, SCR and SNCR are not considered further in this analysis. Cullet preheat has only been utilized in the container glass production industry[4]. In addition, cullet preheat has lower NO_x emission reduction than the currently installed Oxy-Fuel furnaces. Hence this option is not further evaluated in this NO_x RACT analysis.

In 100% natural gas-fired regenerative and recuperative glass furnaces, NO_x is primarily formed by thermal oxidation of nitrogen in the combustion air. Thermal NO_x depends upon the time-temperature history of the flame and increases as residence time and peak flame temperatures rise. Thermal NO_x also increases significantly with the increasing availability of oxygen in the high-temperature zone. To reduce NO_x formation during natural gas combustion, both peak temperatures within the flame and oxygen availability must be reduced. The easiest method of reducing oxygen availability for NO_x formation is to reduce the amount of excess air. At low excess air levels (below 5% excess O_2), the oxygen availability becomes dominant and NO_x decreases with decreasing excess air levels, even though the peak flame temperatures increase. Because glass melters typically operate in the range of 2-5% excess O_2, the NO_x would generally be reduced by reducing excess air levels. The NO_x emissions reduction is in the range of 40% to 60%.[5]

As the excess air is decreased and NO_x formation is reduced, an increase in carbon monoxide (CO) or unburned hydrocarbon (HC) concentrations in the exhaust gases may occur. Increasing CO or HC emissions in order to reduce NO_x emissions is not an acceptable means to achieve emission reductions. In addition, because of the design, regenerative and recuperative furnaces have lower energy efficiency than Oxy-Fuel furnaces. Hence this option is not further evaluated in this NO_x RACT analysis.

Electric boost is a supplement to the primary melting technique of 100% natural gas firing with ambient air serving as the burners' source of oxygen and involves submerged electrodes in the glass melt through which an electric current passes in order to resistively heat the batch materials. Furnaces which use electric boost are primarily gas-fired. The heat generated via the "boost' can supplement heat that would otherwise be generated by fuel combustion. NO_x reductions from electric boost are directly proportional to the percent of energy input, i.e., if 10 percent of the fuel to the furnace is replaced by electricity this would correspond to a 10 percent reduction in NO_x, all else being equal[6].

The NO_x control technologies of Electric Boost and 100% Natural Gas Firing have both been employed in the wool fiberglass manufacturing industry, but they each demand the use of a nitrate

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[4] Alternative Control Techniques Document – NOx Emissions from Glass Manufacturing Facilities (EPA 453/R-94-037)

[5]Industrial Glass Bandwidth Analysis, Gas Technology Institute, Energy Utilization Center, US DOE, Contract no. DE-FC36-03G013092, June 2006

[6] Alternative Control Techniques Document – NOx Emissions From Glass Manufacturing Facilities (EPA – 453/R-94-037)

oxidizer which generates an excessive level of NO_x which is greater than that of an Oxy-Fuel furnace. This is sufficient to eliminate these technologies from further consideration.

LOW NO_X BURNERS (LNBS)

Low NO_x burners (LNBs) reduce the amount of NO_x by combustion staging, which involves creating fuel-rich and air-rich combustion zones in a single burner, and limited excess air burners, which create turbulent mixing of fuel and air, thereby reducing the need for excess air. Many burners for glass furnaces include features to allow adjustment of air/fuel velocities, contact angle, flame shape and injection orifice. Each of these burners can reduce NO_x emissions, but the burners are not designed to be low NO_x burners.

Readily available LNBs are difficult to be retrofitted for use in glass furnaces where the glass furnace burner functions as a fuel injector, rather than a fuel/air mixer. Glass furnace burners that inject fuel into the flow of combustion air entering the furnace and the mixing of fuel and air takes place within the furnace area are unlike LNBs in which the fuel/air mixing occurs within the burner.

LNBs are designed to reduce peak flame temperature with slower mixing of fuel and air, minimum injection velocities, and higher emissivity flames. These types of burners are used and demonstrated technology in flat glass manufacturing facility[7] but not in wool fiberglass manufacturing. Therefore, LNBs are not technically feasible for use in the furnaces at OCIS Delmar. They are also likely to create more NO_x than the Delmar furnaces' oxy-fuel burners.

OXY-FIRING

Oxy-fuel combustion is the process of burning a fuel using pure oxygen instead of air as the primary oxidant. Since the nitrogen component of air is not heated, fuel consumption is reduced, and higher flame temperatures are possible. Historically, the primary use of oxy-fuel combustion has been in welding and cutting of metals, especially steel, since oxy-fuel allows for higher flame temperatures than can be achieved with an air-fuel flame. The glass industry has been employing oxy-fuel since the early 1990's because glass furnaces require a temperature of approximately 2800 degrees F, which is not economically attainable at adiabatic flame temperatures for air-fuel combustion unless heat is regenerated between the flue stream and the incoming air stream. Historically, glass furnace regenerators were large and expensive high temperature brick ducts filled with brick arranged in a checkerboard pattern to capture heat as flue gas exits the furnace. When the flue duct is thoroughly heated, air flow is reversed and the flue duct becomes the air inlet, releasing its heat into the incoming air, and allowing for higher furnace temperatures than can be attained with air-fuel only. Two sets of regenerative flue ducts allowed for the air flow to be reversed at regular intervals, and thus maintain a high temperature in the incoming air. By allowing new furnaces to be built without the expense of regenerators or flue gas recuperative heat exchangers, and especially with the added benefit of

[7] Interim White Paper Midwest RPO Candidate Control Measures dated 12/02/2005. http://www.ladco.org/reports/control/white_papers/glass_fiberglass_manufacturing_plants.pdf

nitrogen oxide reduction, which allows glass plants to meet emission restrictions, oxy-fuel is cost effective without the need to reduce CO_2 emissions. Oxy-fuel furnaces can achieve high NO_x emissions reduction ranging up to 80-85% compared to conventional furnace firing (natural gas and air).[8] Oxy-fuel combustion also reduces CO_2 release at the glass plant location, although this may be offset by CO_2 production due to electric power generation which is necessary to produce oxygen for the combustion process.

Oxy-fuel makes fuel-fired glass furnaces more energy efficient. Oxy-fuel can be used to increase glass melting capacity for a given melting area. Also, when regenerators or a recuperator deteriorate, oxy-fuel can be applied, in part or in total, to maintain the production level desired. NO_x emissions are reduced substantially with a complete oxy-fuel conversion. Oxy-fuel melting provides an improvement in fuel efficiency when compared with traditional air-fuel melting. Other energy savings are obtained with the elimination of the combustion air fan and reduction of hot fan energy requirements. The energy savings partially offsets the cost of oxygen. Oxy-fuel eliminates the regenerators or recuperator, which can be the overriding factor that determines life of an air-fuel furnace. With oxy-fuel, life is determined by the melter itself, usually resulting in a longer equipment useful life. With a properly designed oxy-fuel furnace, glass quality will be improved compared to air-fuel melting. An additional benefit is the steady state operation when compared to regenerative melters. With no regenerators or recuperator, the furnace operation and maintenance are simplified.

The current oxy-fuel furnaces DM-1 (EU2) and DM-2 (EU12) at the OCIS Delmar facility are designed by Owens Corning for the site-specific operation. Per the NJDEP SOTA Manual for Glass Industry, oxy-fuel firing is NO_x RACT for wool fiberglass insulation industry. The oxy-fuel conversion has also allowed the glass melt furnace to operate with less or no niter (sodium nitrate), which further reduces the NO_x emissions.

The "Industrial Glass Bandwidth analysis" study conducted to research and evaluate the different glass industry segments energy use and means by which energy use can be effectively reduced points out that Oxy-fuel firing is the single best available technology to reduce energy use in melting/refining[9].

COLD TOP ELECTRIC (CTE) MELTER

The CTE melt furnace operates on the joule principle and is an ideal glass melting process with lower energy usage and emissions. The melting takes place vertically. Efficiency is enhanced by the insulating "batch blanket" or "crust" which covers the molten glass. The temperature drops from roughly 1400^0C (2550^0F) at the batch/glass interface to 50^0C (122^0F) at the blanket surface. As a result, a CTE furnace operates in the 75% fuel efficiency range, about twice that of its fossil-fuel counterpart[10]. CTE melters are not as simple to operate as fossil fuel furnaces. Finding a balance between blanket thickness, batch chemistry, glass temperature, and glass quality require some counter

[8] Alternative Control Techniques Document – NOx Emissions From Glass Manufacturing Facilities (EPA – 453/R-94-037)

[9] Industrial Glass Bandwidth Analysis, Gas Technology Institute, Energy Utilization Center, US DOE, Contract no. DE-FC36-03G013092, June 2006

[10] TECO Electric Melt Technology, http://www.teco.com/News/Documents/Electric%20Melt%20Article.pdf

intuitive decisions, plus significant patience. In CTE melters, any change in pull, temperature, etc., must be done in slower, smaller steps than with a fossil-fuel melter. CTE melters do not allow for large variations in pull rate. As pull is reduced, glass temperature must also be reduced to maintain the batch blanket, and with lower temperature, at some point, glass quality (refining) could be a potential problem. The turndown on an electric melter is limited to approximately 50% of rated capacity before the melter turns "glow up".

There are other factors that limit the use of electric furnaces including limits to the size of electric furnaces (up to 270 tonnes/day[11]), electrical conductivity of some batches at high temperature and electricity costs. The production and delivery of electricity from fossil fuel is only about 30 percent efficient, making most of the electric furnaces generally not cost competitive.[12] The niter usage for CTE furnaces is usually in the range of 0.0 wt% to 0.7 wt% per batch. This results in maximum NO_x emissions generation from niter usage of about 6.83 pounds of NO_x per ton of molten glass[13]. This is in addition to the NO_x emissions generated during the electricity generation at nearby power plants.

HOT SPOT ELECTRIC MELTER

Hot spot electric (HSE) melters function like CTE melters with the exception that their electrodes are inserted through the top of the mixed glass batch that rests atop the glass melt. HSE melters are not as simple to operate as fossil fuel furnaces. Finding a balance between blanket thickness, batch chemistry, glass temperature, and glass quality require some counter-intuitive decisions, plus significant patience. In HSE melters, any change in pull, temperature, etc., must be done in slower, smaller steps than with a fossil-fuel melter. HSE melters do not allow for large variations in pull rate. As pull is reduced, glass temperature must also be reduced to maintain the batch blanket, and with lower temperature, at some point, glass quality (refining) could be a potential problem. The turndown on an electric melter is limited to approximately 50% of rated capacity before the melter turns "glow up".

There are other factors that limit the use of electric furnaces including limits to the size of electric furnaces (up to 270 tonnes/day[14]), electrical conductivity of some batches at high temperature and electricity costs. The production and delivery of electricity from fossil fuel is only about 30 percent efficient, making most of the electric furnaces generally not cost competitive.[15] HSE melters typically do not require the use of oxidizer melting aids such as niter, but they generate much more uncontrolled particulate matter than CTE furnaces.

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[11] http://www.teco.com/products/Documents/ElectMeltBroch.pdf

[12] Alternative Control Techniques Document – NOx Emissions From Glass Manufacturing Facilities (EPA – 453/R-94-037)

[13] OCIS Research

[14] http://www.teco.com/products/Documents/ElectMeltBroch.pdf

[15] Alternative Control Techniques Document – NOx Emissions From Glass Manufacturing Facilities (EPA – 453/R-94-037)

REACTION AND REDUCTION IN THE REGENERATOR (3R)

The 3R process developed by Pilkington Glass Limited in United Kingdom in 1993 is another control method for reducing NO_x emissions from glass furnaces. The 3R process uses various hydrocarbon fuels, injected into the furnace waste gas stream, as the agent to reduce NO_x to harmless nitrogen and water vapor. The 3R fuel does not burn but dissociates to form free radicals. The reactions are endothermic, i.e., they absorb energy. As a result there is no increase in regenerator temperatures or risk of burning down the checker work. Central to the 3R process is the technology to modify the operation of the furnace regenerators such that they become “reactors”, in addition to fulfilling their main roles in energy recovery and providing high levels of combustion air preheat essential for the productions of high quality glass. One of the key elements with the 3R process is that there is no change in the normal furnace temperature profile so there is no impact on furnace throughput or glass quality. The 3R process has been installed, and is operating, on two flat glass furnaces in Europe. These installations and trials have shown that the process is suitable for most regenerative furnaces, and involves no fundamental change to the glass making process.[16]

The 3R technology has not been demonstrated in the wool fiberglass insulation industry, and is not considered a technically viable control technology for the OCIS Delmar facility. Hence, this technology is not further evaluated in this NO_x RACT analysis.

FENIX

The FENIX process is based on the combination of a number of primary measures for the optimization of combustion and the reduction of energy consumption. The FENIX process also involves a complete modification of the combustion system and particularly the use of a new type of injectors. These modifications are the subject of a patent application. The technique also includes a review of the furnace control system and the installation of methods of monitoring certain furnace parameters. In particular, oxygen probes are installed at the top of the regenerator chambers to provide better control of excess air levels.

Temperature peaks are limited by the maintenance of the flame length while increasing the flame volume. The staging of combustion is achieved by control of the supply of fuel and oxidant to stagger the contact and/or increase the flame volume. A 100 % oxygen flame may be used at the hottest level of the furnace. The staggering of the contact is also partly achieved by the use of an inert “buffer” gas on at least one injector. The inert gas can be CO_2 or recycled flue gas and is injected between the main fuel and oxidant supplies. This pushes the development of the flame towards the centre of the furnace and promotes a wider more even flame of greater volume. The contact between the oxidant and fuel can also be retarded by a secondary fuel injector(s) positioned in or close to the air inlet opening above the injectors of the main fuel supply. The technique can also include the use of air injectors or oxygen lances at various locations to maintain an oxidizing atmosphere above the glass without overall excess air. These devices can also be used to help control the combustion. A very important aspect of the technique is the design of the burner, details of which are considered

[16] NJDEP SOTA Manual for Glass Industry published July 1997

confidential. The FENIX process is a relatively new technique and has only been fully developed on one furnace, the Saint-Gobain float glass line in Aniche, France. The results from this plant indicate about 63 % reduction in NO_x emissions.[17]

This Saint Gobain technology is proprietary and is still under review by U.S.EPA[18]. The technology has not been utilized in the wool fiberglass insulation industry and therefore, the technology has not been deemed technologically feasible for use at the OCIS Delmar plant. Thus, this FENIX is not evaluated further in this NO_x RACT analysis.

4.1.3 STEP 3 – RANK THE REMAINING CONTROL TECHNOLOGIES BY CONTROL EFFECTIVENESS

Table 4-1 summarizes the technologies considered technically feasible for glass melting furnaces for the wool fiberglass insulation industry with a ranking based on NO_x control effectiveness.

TABLE 4-1. NO_X CONTROL TECHNIQUES RANKED FROM HIGHEST TO LOWEST ESTIMATED REMOVAL EFFECTIVENESS

NO_x Control Technique (Combustion Modification)	**Estimated NO_X Emission Rate – lbs NO_X/ton glass**	**Reference**
CTE Melter	Minimum = 0	1 & OCIS knowledge
Oxy-Firing	NO_x RACT = 4.0 w/ % niter in the batch	2 & OCIS knowledge
HSE Melter	Minimum = 0	3 & OCIS knowledge

1 TECO Electric Melt Technology, http://www.teco.com/products/Documents/ElectMeltBroch.pdf

2 Alternative Control Techniques Document – NO_x Emissions from Glass Manufacturing Facilities (EPA – 453/R-94-037) and NJDEP SOTA Manual

3 TECO Electric Melt Technology, http://www.teco.com/products/Documents/ElectMeltBroch.pdf

4.1.4 STEP 4 – EVALUATE ECONOMIC FEASIBILITY AND DOCUMENT THE RESULTS

In order to determine RACT for the OCIS Delmar plant, an evaluation of the economic feasibility of the technically feasible control technology options must be completed. The EPA

[17] Integrated Pollution Prevention and Control (IPPC), Reference Document on Best Available Techniques in the Glass Manufacturing Industry, European Commission, December 2001

[18] Glass Plants – EPA Region 6 Workshop (February 2008)

Cost Manual[19] was used to develop the economic evaluations for the control technologies. The costs associated with the capital expenditure and the annual operating and maintenance costs were evaluated to determine a cost per ton of NO_x removed.

4.1.4.1 COLD TOP ELECTRIC (CTE) MELTER

The CTE melt furnace is an ideal glass melting process with lower energy usage and emissions. A CTE furnace operates in the 75% fuel efficiency range, about twice that of its fossil-fuel counterpart[20]. However, CTE melters are not as simple to operate as fossil fuel furnaces. In addition, there are other factors that limit the use of electric furnaces including limits to the size of electric furnaces (up to 270 tonnes/day[21]), electrical conductivity of some batches at high temperature and electricity costs. The production and delivery of electricity from fossil fuel is only about 30 percent efficient, making most of the electric furnaces generally not cost competitive.[22] The niter usage for CTE furnaces is usually in the range of 0.0 wt% to 0.7 wt% per batch. These result in a range of NO_x emissions generation from niter usage from 0 to 6.83 pounds of NO_x per ton of molten glass[23]. Note that these NO_x emissions are solely from the niter usage, and the CTE melter would also be using electricity, and the NO_x emissions from the electricity generation should also be considered in the assessment of emissions.

In the Delmar, NY region, the current electricity costs are about $0.079/kw-hr and about 0.65 MW of power is required to melt one ton of glass. The current oxy-fuel furnaces at the OCIS Delmar facility (DM-1 and DM-2) were converted in 1999-2000 from an electric operating mode to an oxy-fuel operating mode as an economic decision based on the longer useful life of oxy-fuel furnaces (longer time between rebuilds) and the relative cost of natural gas fuel vs. electric power and to also reduce NO_x emissions.

The estimated costs to initially install and then periodically rebuild a CTE melter were developed by OCIS from their extensive experience with these types of melters. These cost estimates are also provided in Appendix B.

The following table, Table 4-2 provides the cost analysis for installing the CTE melter furnace for both DM-1 and DM-2 in lieu of rebuilding the existing Oxy-fuel units. The cost analysis is based on the current PTE NO_x emissions for both DM-1 and DM-2 (using oxy-fuel) and assuming that the CTE would result in a 100% reduction of NO_x emissions from the current NO_x emission levels. The current oxy-fuel furnace operating scenario has reduced NO_x emissions by 85% from conventionally fired furnace operations. Converting

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[19] EPA Air Pollution Control Cost Manual, Cost Estimation: Concepts and Methodology", Chapter 2, U.S. EPA, 2002

[20] TECO Electric Melt Technology, http://www.teco.com/News/Documents/Electric%20Melt%20Article.pdf

[21] http://www.teco.com/products/Documents/ElectMeltBroch.pdf

[22] Alternative Control Techniques Document – NOx Emissions From Glass Manufacturing Facilities (EPA – 453/R-94-037)

[23] OCIS Research

the furnaces to CTE would reduce emissions by 100% compared to conventional firing, but in actuality, the CTE would only eliminate the 15% of emissions (from conventional firing) that were not already reduced by the conversion to oxy-fuel. Thus, the cost estimate is based on the reduction of NO_x emissions from the current oxy-fuel levels to zero NO_x emission levels. The annual operating costs takes into account the difference in operating costs due to the electricity costs for the CTE furnace and the natural gas and oxygen fuel costs for the Oxy-fuel furnace.

TABLE 4-2. CTE COST ESTIMATE

Description	Cost	Notes/Units
Capital Costs:		
DM-1 CTE Furnace Capital Cost	$11,000,000	Costs based on actual experience of OCIS in installing and rebuilding CTE furnaces
DM-2 CTE Furnace Capital Cost	$11,000,000	
Sales Tax @ 7%	$1,540,000	
Installation Cost	$4,300,000	
Total Capital Cost of installing two CTEs with a combined molten glass capacity of 330 tons/day	$27,840,000	Includes equipment and installation
Total Capital Cost of rebuilding the two existing OxyFuel furnaces	$10,000,000	Costs based on actual experience of OCIS in installing and rebuilding Oxy-Fuel furnaces
Net Capital Cost	$17,840,000	CTE installation minus Oxy-Fuel rebuild
Annual Costs:		
Others (Taxes Insurance, Administrative, Maintenance & Utilities)	$3,017,725	OCIS Estimates for the differential between operating CTE units vs. Oxy-Fuel units
Total Annual Cost Calculation:		
Capital Recovery Factor (CRF)[1]	0.205	10% Interest for 7 Years[2]
Capital Recovery Cost	$3,664,434	Applied only to the $17,840,000 capital cost of the CTE melters
Total Annual Cost	$6,682,159	Capital Recovery cost plus Annual Operating Differential

Description	Cost	Notes/Units
Cost per ton NO_x Reduced:		
Current NO_x Emission Rate (using oxy-fuel)	171.8	Tons/yr
Controlled NO_x Emission Rate	0.0	Tons/yr (100% Emissions Reduction)
Annual Reduction in NO_x Emissions	171.8	Tons/yr
Annual Cost per Ton of NO_x Reduction	$38,895	$/Ton

[1] CRF = $i(1+i)^n/[(1+i)^n - 1]$, where i=interest rate and n=number of useful years, Office of Air Quality Planning and Standards (OAQPS), EPA Air Pollution Control Cost Manual, Sixth Edition, Sec 3.2, Chpt 2, EPA/452/B-02-001 (http://www.epa.gov/ttn/catc/dir1/cs3-2ch2.pdf), Vatavuk, van der Vaart, and Spivey, September 2000.

[2] Used an Interest Rate of 10% and a period of 7 years which is the typical useful life of a CTE furnace.

The annual cost per ton of NO_x emissions reduction for the CTE melter furnace system is significantly higher than the NYSDEC's range of cost effectiveness for implementing RACT (currently $5,000 to $5,500 per ton NO_x reduced). Additionally, the cost analysis does not include any consideration of the fact that the increased electricity demand of the CTE melter furnace will result in increased NO_x emissions from fossil fuel electricity generation at nearby power plants. Based on the cost analysis, CTE is not economically feasible and cannot be determined to be RACT.

4.1.4.2 HOT SPOT ELECTRIC (HSE) MELTER

A HSE melter furnace operates in the 75% fuel efficiency range, about twice that of its fossil-fuel counterpart[24]. However, HSE melters are not as simple to operate as fossil fuel furnaces. In addition, there are other factors that limit the use of electric furnaces including limits to the size of electric furnaces (up to 270 tonnes/day[25]), electrical conductivity of some batches at high temperature and electricity costs. The production and delivery of electricity from fossil fuel is only about 30 percent efficient, making most of the electric furnaces generally not cost competitive.[26]

HSE melters typically do not require the use of oxidizer melting aids such as niter, but they generate much more uncontrolled particulate matter than CTE furnaces.

In the Delmar, NY region, the current electricity costs are about $0.079/kw-hr and about 0.85 MW of power is required to melt one ton of glass. The current oxy-fuel furnaces at the OCIS Delmar facility (DM-1 and DM-2) were converted in 1999-2000 from an electric operating

[24] TECO Electric Melt Technology, http://www.teco.com/News/Documents/Electric%20Melt%20Article.pdf

[25] http://www.teco.com/products/Documents/ElectMeltBroch.pdf

[26] Alternative Control Techniques Document – NOx Emissions From Glass Manufacturing Facilities (EPA – 453/R-94-037)

mode to an oxy-fuel operating mode as an economic decision based on the relative cost of natural gas fuel vs. electric power and to also reduce NO_x emissions.

OCIS consulted qualified vendors capable of providing a HSE melter for the Delmar facility. The cost estimate is provided in Appendix B.

The following table, Table 4-3 provides the cost analysis for installing the HSE melter furnace system for both DM-1 and DM-2 to replace the current oxy-fuel furnaces. The current oxy-fuel furnace operating scenario has reduced NO_x emissions by 85% from conventionally fired furnace operations. Converting the furnaces to HSE would reduce emissions by 100% compared to conventional firing, but in actuality, HSE would only eliminate the 15% of emissions (from conventional firing) that were not already reduced by the conversion to oxy-fuel. Thus, the cost estimate is based on the reduction of NO_x emissions from the current oxy-fuel levels to zero NO_x emission levels. The annual operating costs takes into account the difference in operating costs due to the electricity costs for the CTE furnace and the natural gas and oxygen fuel costs for the Oxy-fuel furnace.

TABLE 4-3. HSE COST ESTIMATE

Description	Cost	Notes/Units
Capital Costs:		
DM-1 HSE Furnace Capital Cost	$11,950,000	OCIS knowledge and experience in installing HSE furnaces & Vendor Quotes
DM-2 HSE Furnace Capital Cost	$11,950,000	
Sales Tax @ 7%	$1,673,000	
Installation Cost	$400,000	
Total Capital Cost of installing six HSEs with a combined molten glass capacity of 330 tons/day	$25,973,000	Includes equipment and installation
Total Capital Cost of rebuilding the two existing oxy-fuel furnaces	$10,000,000	Costs based on actual experience of OCIS in rebuilding oxy-fuel furnaces and installing HSE furnaces
Net Capital Cost	$15,973,000	HSE installation minus oxy-fuel rebuild
Annual Costs:		
Others (Taxes Insurance, Administrative, Maintenance & Utility)	$5,512,106	OCIS Estimates for the difference between operating and annually rebuilding the HSEs versus operating the oxy-fuels
Total Annual Cost Calculation:		

Description	Cost	Notes/Units
Capital Recovery Factor (CRF)[1]	0.205	10% Interest for 7 Years[2]
Capital Recovery Cost	$3,280,942	
Total Annual Cost	$8,793,048	
Cost per ton NO_x Reduced:		
Current NO_x Emission Rate	171.8	Tons/yr
Controlled NO_x Emission Rate	0.0	Tons/yr (100% Emissions Reduction)
Annual Reduction in NO_x Emissions	171.8	Tons/yr
Annual Cost per Ton of NO_x Reduction	$51,182	$/Ton

[1] CRF = $i(1+i)^n/[(1+i)^n -1]$, where i=interest rate and n=number of useful years, Office of Air Quality Planning and Standards (OAQPS), EPA Air Pollution Control Cost Manual, Sixth Edition, Sec 3.2, Chpt 2, EPA/452/B-02-001 (http://www.epa.gov/ttn/catc/dir1/cs3-2ch2.pdf), Vatavuk, van der Vaart, and Spivey, September 2000.

[2] Used an Interest Rate of 10% and a period of 7 years which is the typical useful life of a CTE furnace.

The annual cost per ton of NO_x emissions reduction for the HSE melter furnace is significantly higher than the NYSDEC's range of cost effectiveness for implementing RACT (currently $5,000 to $5,500 per ton NO_x reduced). Additionally, the cost analysis does not include any consideration of the fact that the increased electricity demand of the HSE furnace will result in increased NO_x emissions from fossil fuel electricity generation at nearby power plants. Based on the cost analysis, HSE is not economically feasible and cannot be determined to be RACT.

4.1.5 STEP 5 – SELECT RACT

The final step in the RACT analysis is to compare the technically and economically feasible control technologies and select RACT for the facility.

Based on this evaluation, oxy-firing can be determined to be RACT for the OCIS Delmar plant. The two technologies which could reduce NO_x emissions beyond the 80-85% reduction achieved with oxy-firing were evaluated for economic feasibility. Both CTE and HSE were deemed to not be economically feasible alternatives, because the cost per ton of NO_x removed was significantly higher than the NYSDEC RACT economic feasibility range. Additionally, both CTE and HSE have higher electricity usage than oxy-firing. This additional electricity would be generated by fossil fuel fired power plants, resulting in increased NO_x emissions, which should be considered in the overall NO_x emission evaluation.

The current oxy-fuel furnaces DM-1 (EU2) and DM-2 (EU12) at the OCIS Delmar facility are designed by OCIS for the site-specific operation, and oxy-firing technology was installed on DM-1 furnace in June 2000 and DM-2 furnace in April 1999. Therefore, the facility proposes to meet NO_x RACT without installation of additional control equipment.

4.1.5.1 COMPARISON OF NO_X EMISSION RATES

OCIS conducted a search of EPA's RACT/BACT/LAER database for wool fiberglass insulation industry, which is included in Appendix A. The search was carried out by SIC Code (3296), for the period from 1990 to 2010. The search resulted in only one RACT determination. The rest of the entries in database were for BACT-PSD determinations.

Table 4-3 provides a comparison of various RACT/SOTA recommended values for the wool fiberglass insulation industry glass melting furnaces.

TABLE 4-4. EPA RBLC AND OTHER SOURCES RECOMMENDED NO_X RACT LIMIT (LB OF NO_X/TON OF GLASS PULLED)

Plant/Location	Permitted/ Recommended Emission Rate (lb NO_x/ton glass pulled)	Reference	Date of Entry/ Permit	Comments
Owens Corning Fulton County, GA	13.5	RBLC RACT Entry	Nov 1994	Electric Furnace, Combustion control achieved by limiting sodium nitrate usage.
Wool Fiberglass Industry	4.0	NJDEP SOTA Manual	July 1997	Recommended combustion control - Oxy-firing technology
Wool fiberglass Industry	4.0	OTC Guidelines	June 2006	RACT

Based on the historical stack test results and performance of the currently installed Oxy-fuel firing furnaces, OCIS would like to propose the NO_x RACT limit of 4.0 lb/ton glass pulled for both the furnaces.

5. CONCLUSION

Based on this evaluation, OCIS has determined that the existing furnace oxy-firing control technology is NO_x RACT.

CTE and HSE were considered as technically feasible options because these technologies may provide further NO_x emissions reductions, but the economic analysis concluded that these technologies are not economically feasible for OCIS. As discussed in Section 4, the minimum cost effectiveness to install CTE furnaces on both the furnaces DM-1 (EU2) and DM-2 (EU12) is $38,895 per ton of NO_x removed. The minimum cost effectiveness to install HSE furnaces on both the furnaces DM-1 (EU2) and DM-2 (EU12) is $51,182 per ton of NO_x removed. This cost effectiveness is much greater than the typical cost effectiveness threshold (approximately $5,000-$5,500/ton) for NO_x RACT Plans in New York. Therefore, these technologies have been determined to be beyond RACT requirements.

In contrast, oxy-firing was evaluated and determined to be technically feasible and economically viable. Oxy-firing is currently installed and operational at the OCIS Delmar facility and therefore equipment modification or installation is not required. The current oxy-fuel furnaces DM-1 (EU2) and DM-2 (EU12) at the OCIS Delmar facility are designed by OCIS for the site-specific operation. Per the NJDEP SOTA Manual for Glass Industry, oxy-fuel firing is NO_x RACT for wool fiberglass insulation industry. The oxy-fuel conversion has also allowed the glass melt furnace to operate with less niter (sodium nitrate), which further reduces the NO_x emissions.

OCIS is proposing a NO_x RACT emission level that equates to approximately of 4.0 lb/ton glass pulled for both the furnaces DM-1 and DM-2. This level is representative of the most recent 5-year period of operation. [27] OCIS proposes to continue proper operation and good combustion practices to assure that NO_x emissions are minimized from the furnaces. At the proposed NO_x emission rates, the OCIS Delmar facility will continue to meet the NO_x annual limits (tons per year) in the Title V permit.

Although not part of the RACT evaluation or determination, the OCIS Delmar facility was issued the NYSDEC approval on November 5, 2010 to convert from using a binder system that is based on a formaldehyde/phenol resin to a starch-based binder system in both the manufacturing lines at the Delmar Plant (DM-1 and DM-2). The use of the starch-based binder system will result in NO_x emissions reduction from the binder usage. The binder related NO_x emissions will decrease since the new binder formulation eliminates the nitrogen-bearing compounds (ammonium sulfate and urea) that are currently used and replaces them with compounds that do not contain any nitrogen. Although outside the scope of this RACT determination, when implemented, the proposed binder change will result in further NO_x emission reductions at the facility.

[27] Based on stack test results for both the furnaces.

6. PROPOSED INSTALLATION OF CEMS

In accordance with 6NYCRR 220-2.4, OCIS proposes to install Continuous Emissions Monitoring System (CEMs) on both the glass furnaces DM-1 (EU2) and DM-2 (EU12) to demonstrate compliance with the NO_x RACT emission limit. OCIS is in the process of finalizing the CEMs, equipment details and plans to submit the CEMs plans by mid-next year to NYSDEC. In accordance with 6NYCRR 220 regulations, the CEMs will be operational by July 1, 2012.

APPENDIX A

EPA RBLC DATABASE RESULTS

RBLC ID	FACILITY NAME	FACILITY STATE	AGENCY NAME	PERMIT NO	SIC CODE	PERMIT NOTES	PROCESS NAME	PRIMARY FUEL	THROUGHPUT	PROCESS NOTES	POLLUTANT	CONTROL METHOD DESCRIPTION	EMISSION LIMIT 1	CASE BY CASE BASIS	OTHER APPLICABLE REQUIREMENTS
GA-0060	OWENS-CORNING	GA	GEORGIA DEPARTMENT OF NATURAL RESOURCES	3296-060-10079	3296	(RACT FOR Ozone/NOx) Electric glass furnaces account for 94% of the total NOx emissions. 54.1% of the sodium nitrate used in the furnace will form NO_2 on a mass basis. Therefore, sodium nitrate usage can be used for compliance determination.	WOOL FIBER GLASS FURNACE ELECTRIC			COMPLIANCE VERIFIED BY RECORDS OF STOICHIOMETRY OF SODIUM NITRATE.	Nitrogen Oxides (NOx)	LIMIT SODIUM NITRATE USAGE: LB(NOX) = LB(NANO3) * 0.541	13.5 lb/ton Glass Pulled	RACT	
GA-0125	OWENS CORNING CORDELE	GA	GEORGIA DEPARTMENT OF NATURAL RESOURCES	3296081-0063-P-01-0	3296	This BACT determination is specific to a wool fiberglass plant manufacturing FDM 4.2 and cannot be generalized in the fiberglass insulation manufacturing industry.	GLASS MELT FURNACE CG101			NATURAL GAS BACKUP	Nitrogen Oxides (NOx)	LIMITED BASED ON AMOUNT OF SODIUM NITRATE ADDED TO MIXED GLASS BATCH	13.5 lb/ton Glass Pulled	BACT-PSD	NSPS, MACT, SIP
KS-0018	CERTAINTEED CORPORATION	KS	KANSAS CITY/WYANDOTTE CO HEALTH DEPT, KS	2090001	3296	New 300 Ton/d glass melting furnace and new 300 Ton/d wool fiberglass manufacturing line were permitted at an existing facility.	GLASS MELTING FURNACE	OXYGEN/GLASS	300 Ton/day		Nitrogen Dioxide (NO_2)	FUEL SPEC: OXYGEN-FIRED. EFFICIENCY RANGES FROM 50 - 70 PERCENT.	1.21 lb/ton Glass Pulled	BACT-PSD	

RBLC ID	FACILITY NAME	FACILITY STATE	AGENCY NAME	PERMIT NO	SIC CODE	PERMIT NOTES	PROCESS NAME	PRIMARY FUEL	THROUGHPUT	PROCESS NOTES	POLLUTANT	CONTROL METHOD DESCRIPTION	EMISSION LIMIT 1	CASE BY CASE BASIS	OTHER APPLICABLE REQUIREMENTS
OH-0296	JOHNS MANVILLE PLANT 1	OH	OHIO ENVIRONMENTAL PROTECTION AGENCY	04-01345	3296	This is a modification to the electric boost system resulting in an increase in production. This permit was PSD for PM10 and Fluorides. This permit included many smaller sources which were not entered into a process, they included crusher/hammer mill w/fluid bed dryer to baghouse, 7 forming pre-bake curing ovens, 2 chop dryers, 2 tunnel prebake ovens, 4 direct chop ovens to baghouse, 4 direct chop classifiers to baghouse, gypsum line oven w/baghouse, and finishing department w/baghouse. Permit included combined 12-month rolling limits for both furnaces together, that were slightly lower than the sum of the individual tpy limits (lower by 1 to 2 T). These limits were not worth including for this minimal difference.	GLASS MELTING FURNACE 9211	NATURAL GAS	8 T glass/Hour	NATURAL GAS OXYFUEL FIRING AND ELECTRIC BOOST, CONTROLLED BY WET CAUSTIC SCRUBBER AND FABRIC FILTER. MAXIMUM CUMULATIVE PRODUCTION RATE NOT TO EXCEED 69,350 TONS OF GLASS PULLED PER ROLLING 12-MONTHS FOR GLASS FURNACE 9211.	Nitrogen Oxides (NOx)		1.71 lb/ton Glass Pulled	BACT-PSD	SIP

RBLC ID	FACILITY NAME	FACILITY STATE	AGENCY NAME	PERMIT NO	SIC CODE	PERMIT NOTES	PROCESS NAME	PRIMARY FUEL	THROUGHPUT	PROCESS NOTES	POLLUTANT	CONTROL METHOD DESCRIPTION	EMISSION LIMIT 1	CASE BY CASE BASIS	OTHER APPLICABLE REQUIREMENTS
OH-0296	JOHNS MANVILLE PLANT 1	OH	OHIO ENVIRONMENTAL PROTECTION AGENCY	04-01345	3296	This is a modification to the electric boost system resulting in an increase in production. This permit was PSD for PM10 and Fluorides. This permit included many smaller sources which were not entered into a process, they included crusher/hammer mill w/fluid bed dryer to baghouse, 7 forming pre-bake curing ovens, 2 chop dryers, 2 tunnel prebake ovens, 4 direct chop ovens to baghouse, 4 direct chop classifiers to baghouse, gypsum line oven w/baghouse, and finishing department w/baghouse. Permit included combined 12-month rolling limits for both furnaces together, that were slightly lower than the sum of the individual tpy limits (lower by 1 to 2 T). These limits were not worth including for this minimal difference.	GLASS MELTING FURNACE 9212	NATURAL GAS	8.4 T Glass/Hour	NATURAL GAS OXYFUEL FIRING AND ELECTRIC BOOST, CONTROLLED BY WET CAUSTIC SCRUBBER AND FABRIC FILTER. MAXIMUM CUMULATIVE PRODUCTION RATE NOT TO EXCEED 73,000 TONS OF GLASS PULLED PER ROLLING 12-MONTHS FOR GLASS FURNACE 9212.	Nitrogen Oxides (NOx)		1.71 lb/ton Glass Pulled	BACT-PSD	SIP
TX-0460	CLEBURNE PLANT	TX	TEXAS COMMISSION ON ENVIRONMENTAL QUALITY (TCEQ)	P1025	3296		GLASS FURNACES				Nitrogen Oxides (NOx)		14.35 lb/h	BACT-PSD	
WV-0017	INWOOD	WV	WEST VIRGINIA AIR POLLUTION CONTROL COMM	R14-0015	3296	Facility consists of two wool fiberglass production lines. 1st line produces 7,500 lb/hr of resinated fiberglass insulation; 2nd line produces 8,000 lb/hr of fiberglass insulation. Facility will be subject to 40 CFR 63 Subpart NNN upon start-up of the 2nd line.	MELTING AND REFINING OF 1ST PRODUCTION LINE	NATURAL GAS	7500 lb/Hour	7500 lb/hr electric arc melter	Nitrogen Oxides (NOx)	ELECTRIC ARC MELTER	0.023 lb/ton	BACT-PSD	

RBLC ID	FACILITY NAME	FACILITY STATE	AGENCY NAME	PERMIT NO	SIC CODE	PERMIT NOTES	PROCESS NAME	PRIMARY FUEL	THROUGHPUT	PROCESS NOTES	POLLUTANT	CONTROL METHOD DESCRIPTION	EMISSION LIMIT 1	CASE BY CASE BASIS	OTHER APPLICABLE REQUIREMENTS
WV-0017	INWOOD	WV	WEST VIRGINIA AIR POLLUTION CONTROL COMM	R14-0015	3296	Facility consists of two wool fiberglass production lines. 1st line produces 7,500 lb/hr of resinated fiberglass insulation; 2nd line produces 8,000 lb/hr of fiberglass insulation. Facility will be subject to 40 CFR 63 Subpart NNN upon start-up of the 2nd line.	MELTING AND REFINING OF 2ND PRODUCTION LINE	NATURAL GAS	8000 Lb/Hour	Throughput is lb of glass per hour.	Nitrogen Oxides (NOx)	ELECTRIC ARC MELTER/COMBUSTION CONTROLS	0.024 lb/ton	Other Case-by-Case	

APPENDIX B

COST ANALYSIS

DM-1 & DM-2 CTE Cost Estimate

<u>Current Limits</u>

PTE NOx for DM-1 & DM-2 171.80 tpy

Description	Price		Notes / Units
DM-1		$11,000,000.00	
DM-2		$11,000,000.00	
Sales Tax @ 7%		$1,540,000.00	Costs based on actual experience of OCIS in
Installation Cost		$4,300,000.00	installing and rebuilding CTE furnaces
Total Capital Cost of installing two CTEs with a combined molten glass capacity of 330 tons/day	$	27,840,000	Includes equipment and installation
Total Capital Cost of rebuilding the two existing Oxy-Fuel furnaces	$	10,000,000	Costs based on actual experience of OCIS in installing and rebuilding Oxy-fuel furnaces
Net Capital Cost	**$**	**17,840,000**	CTE installation minus Oxy-fuel rebuild
<u>Annual Costs</u>			
Others (Taxes Insurance, Administrative, Maintenance & Utilities)	$	3,017,725	OCIS Estimates for the differential between operating CTE units vs. Oxy-fuel units
Capital Recovery Factor (CRF) [1]		0.205	10 % Interest for 7 years [2]
Capital Recovery	$	3,664,434	Applied only to the $17,840,000 capital cost of the CTE melters
Total Annual Cost	**$**	**6,682,159**	Capital Recovery cost plus Annual Operating Differential
Current NOx Emission Rate		171.80	tons/yr
Controlled NOx Emission Rate		0.00	tons/yr (Assuming 100% emissions reduction)
Annual Reduction in NOx Emissions		171.80	tons/yr
Annual Cost per Ton of NOx Reduction	**$**	**38,895**	$/ton

1 - CRF = CRF = $i(1+i)^n / (1+i)^n - 1$; where i=interest rate and n = number of useful years, , Office of Air Quality Planning and Standards (OAQPS), EPA Air Pollution Control Cost Manual, Sixth Edition, Sec 3.2, Chpt 2, EPA/452/B-02-001 (http://www.epa.gov/ttn/catc/dir1/cs3-2ch2.pdf), Vatavuk, van der Vaart, and Spivey, September 2000.

2 - Used an Interest Rate of 10 % and a period of 7 years which is the typical useful life of a CTE furnace

DM-1 & DM-2 HSE Cost Estimate

Current Limits

PTE NOx for DM-1 & DM-2 171.80 tpy

Description	Price	Notes / Units
DM-1	$11,950,000.00	
DM-2	$11,950,000.00	
Sales Tax @ 7%	$1,673,000.00	OCIS knowledge and experience in installing
Installation Cost	$400,000.00	HSE furnaces and Vendor Quotes
Total Capital Cost of installing six HSEs with a combined molten glass capacity of 330 tons/day	$ 25,973,000	Includes equipment and installation
Total Capital Cost of rebuilding the two existing Oxyfuel furnaces	$ 10,000,000	Costs based on actual experience of OCIS in installing and rebuilding Oxy-fuel furnaces
Net Capital Cost	**$ 15,973,000**	HSE installation minus Oxyfuel rebuild
Annual Costs		
Others (Taxes Insurance, Administrative, Maintenance & Utility)	$ 5,512,106	OCIS Estimates for the difference in operating and annually rebuilding the HSEs and operating the Oxyfuels
Capital Recovery Factor (CRF) [1]	0.205	10 % Interest for 7 years [2]
Capital Recovery	$ 3,280,942	Applied only to the $15,973,000 capital cost of the HSE melters
Total Annual Cost	**$ 8,793,048**	Capital Recovery cost plus Annual Operating Differential
Current NOx Emission Rate	171.80	tons/yr
Controlled NOx Emission Rate	0.00	tons/yr (Assuming 100% emissions reduction)
Annual Reduction in NOx Emissions	171.80	tons/yr
Annual Cost per Ton of NOx Reduction	**$ 51,182**	$/ton

[1] - CRF = CRF = $i(1+i)^n / (1+i)^n - 1$; where i=interest rate and n = number of useful years, , Office of Air Quality Planning and Standards (OAQPS), EPA Air Pollution Control Cost Manual, Sixth Edition, Sec 3.2, Chpt 2, EPA/452/B-02-001 (http://www.epa.gov/ttn/catc/dir1/cs3-2ch2.pdf), Vatavuk, van der Vaart, and Spivey, September 2000.

[2] - Used an Interest Rate of 10 % and a period of 7 years which is the typical useful life of a CTE furnace

and duration of the maintenance and/or start-up/shutdown activities and the identification of air contaminants, and the estimated emission rates. If a facility owner and/or operator is subject to continuous stack monitoring and quarterly reporting requirements, he need not submit reports for equipment maintenance or start-up/shutdown for the facility to the commissioner's representative.

(b) In the event that emissions of air contaminants in excess of any emission standard in 6 NYCRR Chapter III Subchapter A occur due to a malfunction, the facility owner and/or operator shall report such malfunction by telephone to the commissioner's representative as soon as possible during normal working hours, but in any event not later than two working days after becoming aware that the malfunction occurred. Within 30 days thereafter, when requested in writing by the commissioner's representative, the facility owner and/or operator shall submit a written report to the commissioner's representative describing the malfunction, the corrective action taken, identification of air contaminants, and an estimate of the emission rates. These reporting requirements are superceded by conditions elsewhere in this permit which contain reporting and notification provisions for applicable requirements more stringent than those above.

(c) The Department may also require the owner and/or operator to include in reports described under (a) and (b) above an estimate of the maximum ground level concentration of each air contaminant emitted and the effect of such emissions depending on the deviation of the malfunction and the air contaminants emitted.

(d) In the event of maintenance, start-up/shutdown or malfunction conditions which result in emissions exceeding any applicable emission standard, the facility owner and/or operator shall take appropriate action to prevent emissions which will result in contravention of any applicable ambient air quality standard. Reasonably available control technology, as determined by the commissioner, shall be applied during any maintenance, start-up/shutdown or malfunction condition subject to this paragraph.

(e) In order to have a violation of a federal regulation (such as a new source performance standard or national emissions standard for hazardous air pollutants) excused, the specific federal regulation must provide for an affirmative defense during start-up, shutdowns, malfunctions or upsets.

Condition 4-13: Visible Emissions Limited
Effective between the dates of 05/18/2012 and 11/04/2015

Applicable State Requirement:6 NYCRR 211.2

Item 4-13.1:
Except as permitted by a specific part of this Subchapter and for open fires for which a restricted burning permit has been issued, no person shall cause or allow any air contamination source to emit any material having an opacity equal to or greater than 20 percent (six minute average) except for one continuous six-minute period per hour of not more than 57 percent opacity.

Condition 4-14: Compliance Demonstration
Effective between the dates of 05/18/2012 and 11/04/2015

Applicable State Requirement:6 NYCRR 220-2.3 (a)

Replaces Condition(s) 135

Item 4-14.1:
The Compliance Demonstration activity will be performed for the facility:
The Compliance Demonstration applies to:

Emission Unit: U-00002
Process: OX1

Emission Unit: U-00012
Process: OX2

Regulated Contaminant(s):
CAS No: 0NY210-00-0 OXIDES OF NITROGEN

Item 4-14.2:
Compliance Demonstration shall include the following monitoring:

Monitoring Type: WORK PRACTICE INVOLVING SPECIFIC OPERATIONS
Monitoring Description:
In accordance with the approved Reasonably Available Control Technology (RACT) analysis dated November 2010, the existing furnace oxy-fuel firing control technology is determined to be NOx RACT for the DM-1 and DM-2 glass melting furnaces (processes OX1 and OX2). Each furnace is required to achieve a maximum NOx emission limit of 4.0 pounds NOx per ton of glass pulled on a block 24-hour basis, which is the Ozone Transport Commission (OTC) guideline for fiberglass manufacturing plants. The facility owner or operator shall demonstrate compliance with this NOx RACT emission limit, which is to be implemented by July 1, 2012, by measuring NOx emissions with a continuous emissions monitoring system (CEMS) that complies with the requirements of 6 NYCRR Part 220-2.4(c). Such NOx emissions measurements in combination with the tracking of daily glass production rates, as required elsewhere in this permit, are to be use to calculate ongoing actual NOx emission rates in pounds NOx per ton of glass pulled.

Approval of the RACT analysis is conditioned upon the requirement that the facility owner or operator shall establish a more representative, facility-specific NOx emission limit (pounds NOx per ton glass pulled) on a 30-day rolling average basis for each furnace. This shall be based from the collection of twelve (12) consecutive months of NOx emissions CEMS data, beginning no later than 60 days after commencement of operation of the required CEMS, in combination with the tracking of daily glass production rates. Establishment of an approvable facility-specific NOx RACT emission limit for each furnace shall be completed and submitted to the department within 30 days following the 12-month CEMS data collection period. Once established and approved by the department, the permit will be modified to reflect the more representative, facility-specific NOx emission limit.

Work Practice Type: PARAMETER OF PROCESS MATERIAL
Process Material: GLASS
Parameter Monitored: OXIDES OF NITROGEN
Upper Permit Limit: 4.0 pounds per ton
Monitoring Frequency: CONTINUOUS
Averaging Method: 24 HOUR BLOCK AVERAGE
Reporting Requirements: SEMI-ANNUALLY (CALENDAR)
Reports due 30 days after the reporting period.
The initial report is due 10/30/2012.
Subsequent reports are due every 6 calendar month(s).

Condition 4-15: Compliance Demonstration
Effective between the dates of 05/18/2012 and 11/04/2015

Applicable State Requirement:6 NYCRR 220-2.4 (a)

Item 4-15.1:
The Compliance Demonstration activity will be performed for the facility:
The Compliance Demonstration applies to:

Emission Unit: U-00002
Process: OX1

Emission Unit: U-00012
Process: OX2

Regulated Contaminant(s):
CAS No: 0NY210-00-0 OXIDES OF NITROGEN

Item 4-15.2:
Compliance Demonstration shall include the following monitoring:

Monitoring Type: RECORD KEEPING/MAINTENANCE PROCEDURES
Monitoring Description:
The owner or operator of the facility must maintain a file of daily glass production rates. The production rates must be summarized monthly. Glass production records must be retained for at least five years following the date of such records and must be made available for inspection by the department during normal business hours.

Monitoring Frequency: MONTHLY
Averaging Method: Daily block average
Reporting Requirements: SEMI-ANNUALLY (CALENDAR)
Reports due 30 days after the reporting period.
The initial report is due 10/30/2012.
Subsequent reports are due every 6 calendar month(s).

Condition 4-16: Compliance Demonstration
Effective between the dates of 05/18/2012 and 11/04/2015

Applicable State Requirement:6 NYCRR 220-2.4 (c)

Item 4-16.1:
The Compliance Demonstration activity will be performed for the facility:
The Compliance Demonstration applies to:

Emission Unit: U-00002
Process: OX1

Emission Unit: U-00012
Process: OX2

Regulated Contaminant(s):
CAS No: 0NY210-00-0 OXIDES OF NITROGEN

Item 4-16.2:
Compliance Demonstration shall include the following monitoring:

Monitoring Type: RECORD KEEPING/MAINTENANCE PROCEDURES
Monitoring Description:

The owner or operator of a glass melting furnace shall install, calibrate, evaluate, operate, and maintain a continuous emissions monitoring system (CEMS), in accordance with the provisions of 40 CFR part 60, appendices A, B and F, for measuring NOx and shall record the output of the system.

As part of its application for a permit or permit modification, the owner or operator of a glass melting furnace shall submit for department approval a CEMS plan.

The owner or operator of a glass melting furnace shall submit for department approval a CEMS certification protocol at least 60 days prior to CEMS certification testing. The certification protocol shall include the location of and specifications for each instrument or device, as well as procedures for calibration, operation, data evaluation, and data reporting.

The procedures in subparagraphs (i) through (v) below shall be used for determining compliance with the NOx RACT emission limit established under section 6 NYCRR Part 220-2.3(a).

(i) The owner or operator of a glass melting furnace shall determine compliance daily on a 30 day rolling average basis. The 30 day rolling averages shall be calculated by dividing 30 day total NOx emissions by 30 day total glass production. Only days when the furnace operates shall be included in the 30 day rolling averages.

(ii) At a minimum, valid CEMS data shall be obtained for 90 percent of the operating hours in each calendar quarter that the subject facility is operating.

(iii) All valid CEMS data shall be used in calculating emission rates even if the minimum data requirements of subparagraph (ii) above are not met.

(iv) Along with any specific additional data requirements mandated by the department for a particular glass melting furnace, annual recertifications, quarterly accuracy, and daily calibration drift tests shall be performed in accordance with 40 CFR part 60, appendix F.

(v) When NOx emissions data are not obtained because of CEMS downtime, or for periods when no valid CEMS data is available, emission data shall be obtained by using the 90th percentile value of all CEMS NOx emission data collected over the last 180 days.

In addition to the requirements of subparagraphs (i) through (iii) below, the owner or operator of a glass melting furnace shall comply with the CEMS recordkeeping and reporting requirements of 40 CFR part 60, subpart A and appendix F.

(i) The owner or operator of a glass melting furnace shall notify the department of the planned initial start-up date of any new CEMS.

(ii) Emissions, monitoring, and operating parameter records or measurements required by this Subpart and any additional parameters required by the department shall be maintained for at least five years and made available to the department upon request.

(iii) On a semi-annual basis, the owner or operator of a glass melting furnace shall tabulate and summarize applicable emissions, monitoring, and operating parameter measurements recorded during the preceding six months, and submit these records to the department. These records shall be submitted in a format acceptable to the department and shall include:

(a) the 30 day rolling average NOx emissions as specified under paragraph (4) of this subdivision;

(b) identification of the operating hours when NOx emissions data are not included in a calculation of the 30 day rolling average emissions and the reasons for not including that data;

(c) a comparison of the NOx emissions to the NOx RACT emissions limit(s);

(d) type and amount of fuel burned on a daily basis and the as burned heat content of the fuel;

(e) the total daily NOx emissions and total daily glass production; and

(f) the results of CEMS accuracy assessments as required by 40 CFR part 60, appendix F and any additional data quality information required by the department.

Monitoring Frequency: CONTINUOUS
Reporting Requirements: SEMI-ANNUALLY (CALENDAR)
Reports due 30 days after the reporting period.
The initial report is due 10/30/2012.
Subsequent reports are due every 6 calendar month(s).

Condition 4-17: Compliance Demonstration
Effective between the dates of 05/18/2012 and 11/04/2015

Applicable State Requirement:6 NYCRR 220-2.4 (d)

Item 4-17.1:
The Compliance Demonstration activity will be performed for the facility:
The Compliance Demonstration applies to:

Emission Unit: U-00002
Process: OX1

Emission Unit: U-00012
Process: OX2

Regulated Contaminant(s):
CAS No: 0NY210-00-0 OXIDES OF NITROGEN

Item 4-17.2:
Compliance Demonstration shall include the following monitoring:

Monitoring Type: RECORD KEEPING/MAINTENANCE PROCEDURES
Monitoring Description:
Protocols, reports, summaries, schedules, and any other information required to be submitted to the department under provisions of this Subpart must be sent (in either

hardcopy or electronically) as follows:

(1) one copy to the Division of Air Resources, New York State Department of Environmental Conservation, 625 Broadway, Albany, New York 12233; and

(2) one copy to the Regional Air Pollution Control Engineer, New York State Department of Environmental Conservation - Region 4 Office, 1130 North Westcott Road, Schenectady, NY 12306.

Monitoring Frequency: AS REQUIRED - SEE PERMIT MONITORING DESCRIPTION
Reporting Requirements: SEMI-ANNUALLY (CALENDAR)
Reports due 30 days after the reporting period.
The initial report is due 10/30/2012.
Subsequent reports are due every 6 calendar month(s).

Condition 136: Compliance Demonstration
Effective between the dates of 11/05/2010 and 11/04/2015

Applicable State Requirement:6 NYCRR 231-11.2 (b)

Item 136.1:
The Compliance Demonstration activity will be performed for the facility:
The Compliance Demonstration applies to:

Emission Unit: U-00003
Process: BP1

Emission Unit: U-00003
Process: CO1

Emission Unit: U-00003
Process: CS1

Emission Unit: U-00003
Process: FZ1

Emission Unit: U-00003
Process: FZ2

Emission Unit: U-00003
Process: ME1

Emission Unit: U-00003
Process: SS1

Emission Unit: U-00006
Process: 212

Emission Unit: U-00006

New York State Department of Environmental Conservation
Division of Air Resources, Region 7
615 Erie Boulevard West, Syracuse, New York 13204-2400
Phone: (315) 426-7552 • **Fax:** (315) 426-7487
Website: www.dec.ny.gov

Joe Martens
Commissioner

June 14, 2012

Mr. Dennis Garbig
Owens-Brockway Glass Container Inc.
1 Michael Owens Way
Perrysburg, OH 43551-2999

Re: NOx RACT Plan – Plant #35 Auburn, NY

Dear Mr. Garbig:

The department has reviewed your NOx RACT analysis and addendum. We approve the NOx RACT Plan based on the addendum dated March 30, 2012. Under this plan, the facility will install an air staging system on glass melting furnaces A & B.

As part of NOx RACT, the facility will now be subject to a new emission limit on these furnaces of four pounds of NOx per ton of glass pulled (4.0 lb/ton) effective July 1, 2012. This limit is based on a 30 operating day rolling basis and applies during all periods of operation except hot idle periods. The facility is subject to an alternate limit of 50 lb/hr and 40 lb/hour NOx (3-hour rolling average) for furnaces A and B respectively when the furnaces are in a hot idle mode where production has dropped to a rate less than or equal to 75 tons of glass pulled per day. The facility will demonstrate compliance with these limits through the use of continuous emissions monitoring systems and report on a semiannual basis.

If you have any questions, please don't hesitate to contact me at (315) 426-7472, or by email at aclofaro@gw.dec.state.ny.us.

Sincerely,

Andrew C. LoFaro
Environmental Engineer I

Cc: Reginald Parker, DEC
David Weaver, DEC

Owens-Illinois, Inc.
One Michael Owens Way
Perrysburg, OH 43551-2999
+1 567 336 5000 tel
www.o-i.com

March 30, 2012

New York State Department of Environmental Conservation
Division of Air Resources, Region 7
615 Erie Boulevard West
Syracuse, NY 13204-2400

Attn: Mr. David A. Weaver

Re: RACT Analysis Report Addendum Revisions
Owens-Brockway Container Glass Inc. – Plant #35 Auburn, NY
7134 County House Road
Auburn, NY

Dear Mr. Weaver:

Pursuant to conversations between Owens-Brockway and the New York State Department of Environmental Conservation (NYSDEC), we respectfully submit revisions to our Addendum to the Reasonably Available Control Technology (RACT) Analysis report that was prepared per the requirements of 6NYCRR Subpart 220-2 and originally submitted to the NYSDEC on November 29, 2011. Additionally, please find included a copy of the vendor quotations used in the revisions to the addendum.

Owens-Brockway respectfully requests your expedited review of this report. If you have any questions regarding this addendum, please contact me at (567) 336-7894 or at Dennis.Garbig@o-i.com.

Sincerely,

Dennis Garbig
Environmental Affairs
Owens-Brockway Container Glass Inc.

Enclosures

Reasonably Available Control Technology (RACT) Analysis Addendum-Revised

For Reduction of Oxides of Nitrogen (NOx) Emissions from Container Glass Furnaces

Owens-Brockway Glass Container Inc. - Plant #35 Auburn, NY

Antea Group Project No. 5D1108607P
March 30, 2012

Prepared for:
Owens-Brockway Glass Container Inc.
One Michael Owens Way
Two O-I Plaza
Perrysburg, OH 43551-2999
+1 567 336 7894

Prepared by:
Antea™Group
8008 Corporate Center Drive, Suite 100
Charlotte, North Carolina 28226
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Technical Exhibits

Reasonably Available Control Technology (RACT) Analysis Addendum-Revised

For Reduction of Oxides of Nitrogen (NOx) Emissions from Container Glass Furnaces
Facility: Owens-Brockway Glass Container Inc. – Plant #35 Auburn, NY

1.0 EXECUTIVE SUMMARY

Owens-Brockway Glass Container Inc. (Owens-Brockway) operates a container glass manufacturing plant at 7134 County House Road in Auburn, New York (Plant #35). Air emissions from the plant's two glass furnaces are subject to regulation under various rules enforced by the New York State Department of Environmental Conservation (NYSDEC). In accordance with §6 NYCRR 220-2, Owens-Brockway has conducted an analysis of potential NO_X reduction measures to identify Reasonably Available Control Technology (RACT), as defined in §6 NYCRR 200.1(b-q) for Glass Plants. Owens-Brockway submitted the RACT Analysis Report on November 29, 2011.

Based on the NYSDEC's review and subsequent conversations between Owens-Brockway and the NYSDEC, this RACT Analysis Report Addendum has been prepared to determine the economic feasibility of air staging control technology based on actual vendor cost quotations. Using this information, Antea Group prepared a detailed cost-effectiveness analysis for air staging control technology.

In a conference call for the purpose of discussing NYSDEC's review of the addendum, comments regarding annualized labor costs, interest rate, and lower emissions fees were presented. Owens-Brockway and Antea Group revisited the estimated labor costs with the air staging vendor, researched current industrial capital procurement interest rates, and included the emissions fee reduction in the cost analysis. This submittal serves as a revision to the RACT Analysis Addendum.

Per the revised analysis, Antea Group has concluded that the Air Staging NO_X control option is justified on a cost effectiveness basis, and that the existing system with air staging control technology is representative of RACT for this application.

2.0 INTRODUCTION

In accordance with §6 NYCRR 220-2, Owens-Brockway conducted an analysis of potential NO_X reduction measures to identify Reasonably Available Control Technology (RACT) for the glass furnaces at its Auburn facility. The results of that analysis, conducted on behalf of Owens-Brockway by Antea™Group (Antea Group), were documented in a report dated November 29, 2011. The RACT report indicated that there were no add-on control technologies that met the technical and/or economic feasibility criteria specified by NYSDEC. Owens-Brockway concluded that the existing NO_X emission controls represented RACT, and recommended an operating limit of 5.0 lb NO_X/ton of glass produced.

Subsequent conversation between Owens-Brockway and the NYSDEC regarding the NYSDEC's review of the RACT analysis suggests that the NYSDEC is seeking a lower NO_X limit (i.e., 4.0 lbs/ton of glass produced on a rolling 30-day average basis) on the assumption that cost analyses using actual vendor data may result in lower actual costs.

Owens-Brockway presented their concerns regarding the implementation deadlines for compliance with the RACT regulations versus the time consuming nature of acquiring vendor cost quotations for all potentially feasible control technologies as presented in the RACT Analysis. In addition, Owens-Brockway presented a discussion regarding the impracticality of the various technically feasible control options presented in the RACT Analysis due to the Auburn plant's side port furnace design. Owens-Brockway has suggested that should they be required to install further control technology to achieve a NO_X RACT limit of 4.0 lbs/ton of glass produced on a rolling 30-day average basis, that Owens-Brockway would prefer Air Staging as this is a proven technology for them at other plant locations and does not present the same impracticalities as the alternative technically feasible control technologies.

Owens-Brockway suggested that they perform a feasibility analysis utilizing a readily available vendor cost quotation for air staging and present it as an addendum to the original RACT Analysis Report. The NYSDEC agreed to this approach.

Upon NYSDEC review of the addendum, comments were provided to Owens-Brockway regarding annualized labor expenses, capital interest rate, and lower emission fees. Owens-Brockway and Antea Group revisited the estimated labor costs with the air staging vendor, researched current industrial capital procurement interest rates, and included the emissions fee reduction in a revised cost analysis.

2.1 Method of RACT Determination and RACT Protocol

Antea Group developed a RACT analysis protocol for the review of air staging technology. Antea Group used the same basic methodology as provided in the original RACT Analysis report. Antea Group developed an analysis of direct and indirect capital costs based on actual vendor cost quotations provided by Owens-Brockway. Annual operating costs were developed per the actual vendor cost quotations for the purposes of calculating the total annual cost per ton of NO_X reduced (annual cost-effectiveness) of the air staging technology. Finally, a comparison of the annual cost-effectiveness for the air staging control technology was made against the target threshold value of reduction per ton of glass produced.

The maximum economic feasibility for NO_X control threshold was provided within the NYSDEC Regulatory Impact Statement: §6 NYCRR 220, Portland Cement Plants and Glass Plants; §6 NYCRR 200, General Provisions [4]. The maximum rate as discussed with the NYSDEC was presented as \$5,500 per ton of NO_X removed.

For this RACT analysis, should the air staging control technology have an annual cost-effectiveness lower (better) than $5,500 per ton, it will be considered economically feasible. Should the air staging technology have an annual cost-effectiveness greater (worse) than $5,500 per ton, it will not be considered economically feasible.

3.0 COST ANALYSIS OF AIR STAGING CONTROL TECHNOLOGY

The cost analysis was developed as an Excel spreadsheet for the selected technically feasible control technology for a combined system designed to control NO_X for both furnaces, FURNA and FURNB. The spreadsheet (**Exhibit 1**) summarizes results for the air staging technology based on vendor cost quotations (**Exhibits 2 and 3**).

In developing this spreadsheet, Antea Group used as a technical reference the COST-AIR Air Pollution Control Spreadsheets published by USEPA's Office of Air Quality Planning and Standards (OAQPS). The COST-AIR spreadsheets were designed to supplement the OAQPS Control Cost Manual, a standard guidance for cost analysis.

The format of the cost spreadsheet in the exhibits is in general accord with that presented in the OAQPS manual. This format was modified from that specified in COST-AIR to enable Owens-Brockway to develop the cost estimate utilizing an actual vendor cost quotation. Many of the costs were internalized by Owens-Brockway in an effort to reduce overall capital direct and indirect expenses. The costs presented are based on actual cost estimates for equipment installation and furnace refractory work at other Owens-Brockway facilities. Both equipment installation and furnace refractory work are components of air staging installation.

3.1 Air Staging

Exhibit 1 presents the cost analysis for air staging technology. Air staging or two-stage combustion is generally described as the introduction of overfire air into the furnace. Air staging technology requires the introduction of combustion air to be separated into primary and secondary flow sections to achieve complete burnout and to encourage the formation of N_2 rather than NO_X. The location of injection ports and mixing of overfire air are critical to maintain efficient combustion and presents a challenge when retrofitting glass furnaces with a side port design. The table below summarizes the results for this system and specific cost elements are discussed below.

Parameter	Auburn A+B
Total Capital Investment	$1,901,000
Total Annualized Cost	$673,196
Cost/ton Process NOx Reduced	$3,140
NOx Reduced, TPY	214.40

Direct Costs
Direct and indirect capital costs were derived from vendor cost quotations for the purchase and installation of air staging control technology. Many of the costs were internalized by Owens-Brockway in an effort to reduce overall capital direct and indirect expenses. The costs presented are based on actual cost estimates for equipment installation and furnace refractory work at other Owens-Brockway facilities. Both equipment installation and furnace refractory work are components of air staging installation.

Annual Operating Conditions
Operating hours, production, emissions, and furnace exhaust flow are taken from information provided by Owens-Brockway in the form of emissions calculations, annual reports, and reports for permit required NO_X tune up tests on each furnace.

Annual Costs
All unit costs reflect local rates, including property tax. The capital recovery factor for the main system is based on a 10-year economic life, consistent with OAQPS guidance for this technology.

As shown in the tabular summaries, revised cost effectiveness for this system is $3,140 per ton of NO_X removed, which is below the $5,500 / ton threshold. We conclude that this option is cost-effective.

4.0 CONCLUSION: SUMMARY OF RACT DETERMINATION

RACT is operationally determined as the most effective technically feasible control technology that is deemed cost-effective. Results of this study in that context are summarized below:

Furnace(s)	Control System	Control Efficiency (%)	Total Annualized Cost	TPY NOx Reduced	Annual CE, $/ton
A+B	Air Staging	30	$673,196	214.40	$3,140

Based on the vendor cost quotations and internalized costs as presented by Owens-Brockway, Antea Group concludes the air staging NO_X control technology reviewed for Owens-Brockway's furnaces, is below the annual cost effectiveness threshold of $5,500 per ton reduced. Consequently, it is our opinion that the existing system with IPC combined with air staging is representative of RACT for this application.

Reasonably Available Control Technology (RACT) Analysis

For Reduction of Oxides of Nitrogen (NOx) Emissions from Container Glass Furnaces

Owens-Brockway Glass Container Inc. - Plant #35 Auburn, NY

Antea Group Project No. 5D1108607P
November 29, 2011

Prepared for:
Owens-Brockway Glass Container Inc.
One Michael Owens Way
Two O-I Plaza
Perrysburg, OH 43551-2999
+1 567 336 7894

Prepared by:
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Reasonably Available Control Technology (RACT) Analysis

For Reduction of Oxides of Nitrogen (NOx) Emissions from Container Glass Furnaces
Facility: Owens-Brockway Glass Container Inc. – Plant #35 Auburn, NY

1.0 EXECUTIVE SUMMARY

Owens-Brockway Glass Container Inc. (Owens-Brockway) operates a container glass manufacturing plant at 7134 County House Road in Auburn, New York (Plant #35). Air emissions from the plant's two glass furnaces are subject to regulation under various rules enforced by the New York State Department of Environmental Conservation (NYSDEC). In accordance with §6 NYCRR 220-2, Owens-Brockway has conducted an analysis of potential NO_X reduction measures to identify Reasonably Available Control Technology (RACT), as defined in §6 NYCRR 200.1(b-q) for Glass Plants. This report documents the results of that analysis, conducted on behalf of Owens-Brockway by Antea™Group (Antea Group).

Based primarily upon furnace operating parameters and emission data provided by Owens-Brockway and reviews of control technology databases, Antea Group identified the NO_X control technologies that are potentially technically feasible at the Auburn plant. The following control technologies were reviewed for economic feasibility:

- Pilkington 3-R Technology
- Oxy-Fuel Firing
- Oxygen Enriched Air Staging
- Air Staging
- Flue Gas Recirculation (FGR)
- Cullet Preheat
- Combustion Optimization – Individual Port Control (IPC)
- Electric Boost

Using this information, Antea Group prepared detailed cost-effectiveness analyses for each system. Results and conclusions are summarized below:

- While Combustion Optimization through Individual Port Control (IPC) was not the most efficient (15% control) of the technically feasible technologies, it was the most cost effective at $1,876 per ton of NO_X removed.
- Owens-Brockway installed IPC technology on Furnace A in 1998/1999 and on Furnace B in 2010. The use of IPC technology represents RACT for this facility.
- All other technologies have cost effectiveness above $6,900 per ton and as such are not considered cost effective based on NYSDEC's RACT criteria.

Accordingly, Antea Group concludes that the IPC NO_X control option identified for both of the furnaces is justified on both a technical and cost effectiveness basis, and that the existing system without additional controls is representative of RACT for this application.

2.0 INTRODUCTION

Owens-Brockway Glass Container Inc. (Owens-Brockway) operates a container glass manufacturing plant (#35 Auburn, NY) located at 7134 County House Road in Auburn, New York (Plant #35). Air emissions from the plant's two glass melting furnaces (A and B) are subject to regulation under various rules enforced by the New York State Department of Environmental Conservation (NYSDEC). Owens-Brockway was required to conduct an analysis of potential NO_X reduction measures to identify Reasonably Available Control Technology (RACT), as defined in §6 NYCRR 200.1(b-q).

The Owens-Brockway facility's most recent Title V Operating Permit (7-0552-00004/0019) became effective April 1, 2008 and is scheduled to expire on March 31, 2013. This report documents the results of the RACT analysis, conducted on behalf of Owens- Brockway by Antea™Group (Antea Group).

2.1 Emission Source Description

The plant's Title V Permit application contains detailed information on the subject emission sources. Furnaces A and B are regenerative side port units that operate continuously. Burners for each furnace are fueled by natural gas. Each furnace has a refiner to precondition glass, and alcoves and forehearths to transport refined glass to the forming process downstream. The refiners and forehearths are also fueled by natural gas. The forehearths vent inside the furnace area. Each furnace has a single stack.

Owens-Brockway's permit, in accordance with 6NYCRR, Subpart 212 allows both Furnace A and Furnace B to be operated at a production rate plus 10% upon successful demonstration of compliance at a higher production rate. Owens-Brockway's most recent stack tests resulted in a 10% production increase. Potential NO_X emissions, taking into account the 10% production increase, total approximately 88.15 pounds per hour (lb/hr) or 386.1 tons per year (TPY) for Furnace A at maximum capacity running 8,760 hours per year (emissions at maximum capacity so defined are termed potential to emit or PTE). For Furnace B, PTE for NO_X is at 75.10 lb/hr or 328.9 TPY.

2.2 RACT Requirements

New York State rule §6 NYCRR 212.3(a) limits process emissions of air contaminants based upon a published environmental rating. NO_X emissions from existing glass manufacturers must be reduced by a level determined to represent Reasonably Available Control Technology (RACT) per §6 NYCRR 220-2 [3].

2.3 Method of RACT Determination and RACT Protocol

Antea Group developed a RACT analysis protocol for the review of demonstrated technologies including those already employed by Owens-Brockway and alternatives that are used by other glass container manufacturers as well as those employed by flat glass manufacturers. Antea Group used the standard "top-down" methodology described below to identify RACT for the Auburn plant based on technical feasibility as well as energy, environmental, and economic factors. The analysis protocol included but was not limited to the following:

- Assess control technology databases maintained by USEPA and various states to identify candidate RACT systems based on technical feasibility for NO_X reduction in container glass furnaces.
- Develop analyses of annualized capital costs and annual operating costs per guidelines published by USEPA's Office of Air Quality Planning and Standards (OAQPS), to calculate the total annual cost per ton of NO_X reduced (annual cost-effectiveness) of each technically feasible alternative on each furnace.

- Sort systems in order of decreasing reduction efficiency.
- Compare the annual cost-effectiveness for each system to the target threshold value, below which control can be deemed cost-effective. The system yielding the greatest emission reduction that is cost-effective represents RACT. If no system is cost-effective, RACT is determined to be no control.

The maximum economic feasibility for NO_X control threshold was provided within the NYSDEC Regulatory Impact Statement: §6 NYCRR 220, Portland Cement Plants and Glass Plants; §6 NYCRR 200, General Provisions [4]. The maximum rate was presented as a range from $5,000 to $5,500 per ton of NO_X removed.

For this RACT analysis, technologies with an annual cost-effectiveness lower (better) than $5,500 per ton have been considered economically feasible and technologies with annual cost-effectiveness greater (worse) than $5,500 per ton have been considered economically infeasible.

3.0 SELECTION OF FEASIBLE CONTROL ALTERNATIVES

Antea Group researched technically feasible NO_X control options available in the marketplace and or installed at potentially similar sources, as well as control systems presently employed at the Auburn facility. The control technology currently used by Owens-Brockway consists of combustion operation through Individual Port Control (IPC). IPC technology controls the flow of fuel delivery to the burners enabling a more uniform distribution of the fuel to each burner, which allows for more uniform combustion resulting in more even heating, increased fuel combustion efficiency and consequently lower NO_X emissions. The following section details the review and selection process.

3.1 Review of Control Technology Databases

The primary source of information used in all regulatory determinations of emission control feasibility is the USEPA's RACT/BACT/LAER Clearinghouse (RBLC)[1]. The RBLC serves as a master repository of data gathered by all state permitting agencies when determining emission control measures required to satisfy regulatory requirements. Antea Group accessed this database via the Internet to search for NO_X RACT determinations on glass melting furnaces, which is less specific than the similar source category for this facility – "container glass furnaces." Antea Group also accessed the California BACT Clearinghouse Database [2] online.

Antea Group's search results are presented in **Exhibits 1** and **2.** All glass manufacturing operations identified by the RBLC's comprehensive report were required to perform BACT analyses and none of the facilities are representative of container glass manufacturing.

3.2 Selection of Alternative Technologies for Cost Analysis

Antea Group's search results, presented in **Exhibits 1** and **2**, disclosed control technologies that have been used by glass manufacturers for the control of NO_X in BACT analyses. All of the glass manufacturing plants detailed in the RBLC database consisted of flat glass manufacturing operations. The RBLC comprehensive report details implemented controls ranging from Good Combustion Practices to Pilkington's 3-R technology.

In considering NO_X reduction technology options for the Owens-Brockway Auburn facility's RACT analysis, consideration of the furnace design was a significant factor. As previously discussed, the RBLC database presented strictly, flat glass manufacturing operations. Container glass as manufactured by Owens-Brockway's Auburn facility differs from flat glass manufacture in many ways. The following table presents some of the primary differences between flat glass and Auburn, NY container glass manufacture:

Category	Float Glass Manufacturing	Auburn, NY Container Glass Manufacturing
Furnace Design/Type	End Port or Side Port	Side Port
Glass Processing	Float Forming	Forehearths
Heat Required	Up to 2,300^{O} F	Between 1,500^{O} F and 2,000^{O} F
Furnace Length	>100 feet	40-45 feet
Furnace Capacity	Up to 800 tons/day	Up to 389 tons/day

All of the listed technologies were deemed qualified for technical feasibility study for the purposes of this analysis. Additionally, technologies not presented in the RBLC comprehensive report were reviewed and deemed qualified for technical feasibility study.

Of the technologies reviewed for potential NO_X control, Pilkington's float glass furnaces employing their patented 3-R Technology for the control of NO_X emissions was presented in the RBLC database. Since 1998, three float glass plants have acquired licenses from Pilkington for the use of Pilkington's patented 3-R Technology: Cardinal FG Company; AFG Industries; and Guardian Industries. While Pilkington's 3-R technology has not been demonstrated on container glass furnaces, Pilkington claims their 3-R system is a technically feasible option. Therefore, the Pilkington 3-R system was deemed qualified for technical feasibility study.

The following table presents NO_X control technologies that were reviewed for technical feasibility and found to be technically infeasible as a result of Antea Group's review:

[1]Control System	[2]Control Efficiency (%)	Basis for Technical Infeasibility
Selective Catalytic Reduction	70	Not effectively demonstrated in the U.S. Where demonstrated, catalyst became clogged by particulate nullifying NO_X reduction. Therefore, SCR is not technically feasible.
Low NO_X Burners	35	Not technically feasible due to container glass side port furnace design: air fuel mixing occurs within the furnace. Therefore, LNB is not technically feasible.
Selective Non-Catalytic Reduction	30	Demonstrated in one California float glass application since 1991. Due to the furnaces' side port design, there is no point within the furnace that provides the proper temperature range required for ammonia injection. Therefore, SNCR is not technically feasible.

[1]Combinations of control systems were limited due to infeasibility of one or more of the technologies involved.
[2]The technologies presented were ranked on the basis of potential control efficiency.

The following table presents NO_X control technologies that were reviewed and deemed technically feasible as a result of Antea Group's review:

Control System	[1]Control Efficiency (%)	Basis for Technical Feasibility
Pilkington 3-R	75	Though not demonstrated on container glass furnaces, proven on flat glass furnaces over many years. Pilkington claims feasibility on container glass furnaces.
Oxy-Fuel Firing	75	Demonstrated as NO_X reduction technology over many years.
Oxygen-Enriched Air Staging	35	Demonstrated as NO_X reduction technology over many years.
Air Staging	30	Demonstrated as NO_X reduction technology over many years.
Flue Gas Recirculation	25	Demonstrated as NO_X reduction technology over many years.
Cullet Preheat	25	Demonstrated as NO_X reduction technology over many years.
Individual Port Control	15	Demonstrated as NO_X reduction technology over many years.
Electric Boost	10	Demonstrated as NO_X reduction technology over many years.

[1]The technologies presented in the preceding table were ranked on the basis of potential control efficiency and were subjected to cost effectiveness evaluation as further described in Section 4.

4.0 COST ANALYSIS OF CONTROL ALTERNATIVES

Cost analyses were developed as Excel spreadsheets for each of the selected technically feasible control technologies for a combined system designed to control NO_X for both furnaces, FURNA and FURNB. For each system, one spreadsheet (**Exhibits 4-11**) details the analysis for each technology. A final spreadsheet (**Exhibit 12**) summarizes results for all technologies.

In developing these spreadsheets, Antea Group used as a technical reference the COST-AIR Air Pollution Control Spreadsheets published by USEPA's Office of Air Quality Planning and Standards (OAQPS) [12]. The COST-AIR spreadsheets were designed to supplement the OAQPS Control Cost Manual [10], a standard guidance for cost analysis. Lastly, R. Leon Leonard's book titled Air Quality Permitting, 1997, CRC Press, Inc. [7] was used as guidance in developing the costing methodology. In this study, both sources were used to check assumptions and to confirm calculation methods. All costs developed from prior studies were adjusted by inflation factors derived from appropriate inflation indices.

The format of each cost spreadsheet in the technical exhibits is in general accord with that presented in the OAQPS manual. This format simplifies the design-level detail specified in COST-AIR to enable a user to develop cost estimates without vendor assistance. Such detail has been deemed unnecessary for this RACT analysis. Cost analyses for each system are discussed below in “top-down” order.

4.1 Pilkington 3-R Technology

Exhibit 4 presents the cost analysis for the Pilkington 3-R Technology, summarized with the others in **Exhibit 12**. Pilkington's 3-R Technology is a proprietary control technology consisting of Reaction, Reduction, and (fuel) Re-burning. The table below summarizes the results for this system while specific cost elements are discussed below.

Parameter	Auburn A+B
Total Capital Investment	$16,131,750
Total Annualized Cost	$3,863,538
Cost/ton Process NOx Reduced	$7,208
NOx Reduced, TPY	536

Direct Costs
A variety of sources were utilized in estimating the total capital investment. These sources included: the internet; EPA's Air Pollution Control Cost Manual; EPA's Alternative Control Techniques Document: NO_X Emissions from Glass Manufacturing; and EPA Technical Bulletin: NO_X – How and Why Controlled. The published dates of the EPA references were between 1994 and 2002, which is between nine and seventeen years ago. The costs for each technology varied and in some cases, the variance was significant. Therefore, the direct costs as presented in the reference documents were averaged with an inflation factor applied to produce a current cost estimate.

Annual Operating Conditions
Operating hours, production, emissions, and furnace exhaust flow are taken from information provided by Owens-Brockway in the form of emissions calculations, annual reports, and reports for permit required NO_X tune-up tests on each furnace.

Annual Costs
All unit costs reflect local rates, including property tax. The capital recovery factor was averaged for the main system components resulting in a 10-year economic life, consistent with OAQPS guidance for this technology.

As shown in the tabular summaries, cost effectiveness for this system has been estimated at $7,208 per ton of NO_X removed, which is above the $5,500 / ton threshold. We conclude that this option is not cost-effective, therefore not representative of RACT for this application.

4.2 Oxy-Fuel Firing NO_X Reduction Technology

Exhibit 5 presents the cost analysis for Oxy-Fuel Firing system, summarized with the others in **Exhibit 12**. Oxy-fuel firing is a process of fuel combustion using pure oxygen instead of air as the primary oxidant. The result of oxy-fuel firing is that the nitrogen component of air is not heated. Additionally, fuel consumption is reduced thereby reducing the nitrogen component from fuel combustion. A primary adverse impact of oxy-fuel firing in a refractory furnace includes higher flame temperature resulting in an expected 50% decrease in furnace life. The table below summarizes the results for this system while specific costs are discussed below.

Parameter	Auburn A+B
Total Capital Investment	$20,697,577
Total Annualized Cost	$4,795,209
Cost/ton Process NOx Reduced	$8,946
NOx Reduced, TPY	536

Direct Costs
A variety of sources were utilized in estimating the total capital investment. These sources included: the internet; EPA's Air Pollution Control Cost Manual; EPA's Alternative Control Techniques Document: NO_X Emissions from Glass Manufacturing; and EPA Technical Bulletin: NO_X – How and Why Controlled. The published dates of the EPA references were between 1994 and 2002, which is between nine and seventeen years ago. The costs for each technology varied and in some cases, the variance was significant. Therefore, the direct costs as presented in the reference documents were averaged and an inflation factor applied to produce a current cost estimate.

Annual Operating Conditions
Operating hours, production, emissions, and furnace exhaust flow are taken from information provided by Owens-Brockway in the form of emissions calculations, annual reports, and reports for permit required NO_X tune-up tests on each furnace.

Annual Costs
All unit costs reflect local rates, including property tax. The capital recovery factor for the main system is based on a 10-year economic life, consistent with OAQPS guidance for this technology.

As shown in the tabular summaries, cost effectiveness for this system has been estimated at $8,946 per ton of NO_X removed, which is above the $5,500 / ton threshold. We conclude that this option is not cost-effective, therefore not representative of RACT for this application.

4.3 Oxygen Enriched Air Staging (OEAS)

Exhibit 6 presents the cost analysis for Oxygen-Enriched Air Staging (OEAS) technology, and is summarized with the others in **Exhibit 12**. OEAS is a retrofit staged combustion technique that primarily reduces the amount of primary air entering through the ports to decrease NO_X formation in the flame by injecting oxidant into the furnace near the exhaust ports to complete combustion in a second stage within the furnace. The table below summarizes the results for this system and specific cost elements are discussed below.

Parameter	Auburn A+B
Total Capital Investment	$3,741,782
Total Annualized Cost	$1,687,327
Cost/ton Process NOx Reduced	$9,444
NOx Reduced, TPY	250.13

Direct Costs
A variety of sources were utilized in estimating the total capital investment. These sources included: the internet; EPA's Air Pollution Control Cost Manual; EPA's Alternative Control Techniques Document: NO_X Emissions from Glass Manufacturing; and EPA Technical Bulletin: NO_X – How and Why Controlled. The published dates of the EPA references were between 1994 and 2002, which is between nine and seventeen years ago. The costs for each technology varied and in some cases, the variance was significant. Therefore, the direct costs as presented in the reference documents were averaged and an inflation factor applied to produce a current cost estimate.

Annual Operating Conditions
Operating hours, production, emissions, and furnace exhaust flow are taken from information provided by Owens-Brockway in the form of emissions calculations, annual reports, and reports for permit required NO_X tune-up tests on each furnace.

Annual Costs
All unit costs reflect local rates, including property tax. The capital recovery factor for the main system is based on a 10-year economic life, consistent with OAQPS guidance for this technology.

As shown in the tabular summaries, cost effectiveness for this system has been estimated at $9,444 per ton of NO_X removed, which is above the $5,500 / ton threshold. We conclude that this option is not cost-effective, therefore not representative of RACT for this application.

4.4 Air Staging

Exhibit 7 presents the cost analysis for air staging technology, and is summarized with the others in **Exhibit 12**. Air staging or two-stage combustion is generally described as the introduction of overfire air into the furnace. Air staging technology requires the introduction of combustion air to be separated into primary and secondary flow sections to achieve complete burnout and to encourage the formation of N_2 rather than NO_X. The location of injection ports and mixing of overfire air are critical to maintain efficient combustion and presents a challenge when retrofitting glass furnaces with a side port design. The table below summarizes the results for this system and specific cost elements are discussed below.

Parameter	Auburn A+B
Total Capital Investment	$3,602,436
Total Annualized Cost	$1,657,998
Cost/ton Process NOx Reduced	$9,280
NOx Reduced, TPY	214.40

Direct Costs
A variety of sources were utilized in estimating the total capital investment. These sources included: the internet; EPA's Air Pollution Control Cost Manual; EPA's Alternative Control Techniques Document: NO_X Emissions from Glass Manufacturing; and EPA Technical Bulletin: NO_X – How and Why Controlled. The published dates of the EPA references were between 1994 and 2002, which is between nine and seventeen years ago. The costs for each

technology varied and in some cases, the variance was significant. Therefore, the direct costs as presented in the reference documents were averaged and an inflation factor applied to produce a current cost estimate.

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Annual Operating Conditions

Operating hours, production, emissions, and furnace exhaust flow are taken from information provided by Owens-Brockway in the form of emissions calculations, annual reports, and reports for permit required NO_X tune up tests on each furnace.

Annual Costs

All unit costs reflect local rates, including property tax. The capital recovery factor for the main system is based on a 10-year economic life, consistent with OAQPS guidance for this technology.

As shown in the tabular summaries, cost effectiveness for this system has been estimated at $9,280 per ton of NO_X removed, which is above the $5,500 / ton threshold. We conclude that this option is not cost-effective.

4.5 Flue Gas Recirculation (FGR)

Exhibit 8 presents the cost analysis for the Flue Gas Recirculation (FGR) system, summarized with the others in **Exhibit 12**. FGR is a technology that employs the use of fans to pull flue gases out of the furnace stacks and blend them with fresh air prior to injecting the gases into factory-modified burners. Factory-modified burners make this relatively simple technology cost prohibitive since in refractory furnaces, the fuel air mixing occurs within the furnace. The table below summarizes the results for this system and specific cost elements are discussed below.

Parameter	Auburn A+B
Total Capital Investment	$3,764,485
Total Annualized Cost	$1,701,320
Cost/ton Process NOx Reduced	$9,522
NOx Reduced, TPY	178.67

Direct Costs

A variety of sources were utilized in estimating the total capital investment. These sources included: the internet; EPA's Air Pollution Control Cost Manual; EPA's Alternative Control Techniques Document: NO_X Emissions from Glass Manufacturing; and EPA Technical Bulletin: NO_X – How and Why Controlled. The published dates of the EPA references were between 1994 and 2002, which is between nine and seventeen years ago. The costs for each technology varied and in some cases, the variance was significant. Therefore, the direct costs as presented in the reference documents were averaged and an inflation factor applied to produce a current cost estimate.

Annual Operating Conditions

Operating hours, production, emissions, and furnace exhaust flow are taken from information provided by Owens-Brockway in the form of emissions calculations, annual reports, and reports for permit required NO_X tune-up tests on each furnace.

Annual Costs

All unit costs reflect local rates, including property tax. The capital recovery factor for the main system is based on a 10-year economic life, consistent with OAQPS guidance for this technology.

As shown in the tabular summaries, cost effectiveness for this system has been estimated at $9,522 per ton of NO_X removed, which is above the $5,500 / ton threshold. We conclude that this option is not cost-effective, therefore not representative of RACT for this application.

4.6 Cullet Preheat

Exhibit 9 presents the cost analysis for combustion optimization technology through a Cullet Preheat system, and is summarized with the others in **Exhibit 12**. Cullet preheating is a process in which cullet, or recycled glass, is preheated utilizing furnace exhaust gases. The table below summarizes the results for this system and specific cost elements are discussed below.

Parameter	Auburn A+B
Total Capital Investment	$3,291,878
Total Annualized Cost	$1,237,778
Cost/ton Process NOx Reduced	$6,928
NOx Reduced, TPY	178.67

Direct Costs
A variety of sources were utilized in estimating the total capital investment. These sources included: the internet; EPA's Air Pollution Control Cost Manual; EPA's Alternative Control Techniques Document: NO_X Emissions from Glass Manufacturing; and EPA Technical Bulletin: NO_X – How and Why Controlled. The published dates of the EPA references were between 1994 and 2002, which is between nine and seventeen years ago. The costs for each technology varied and in some cases, the variance was significant. Therefore, the direct costs as presented in the reference documents were averaged and an inflation factor applied to produce a current cost estimate.

Annual Operating Conditions
Operating hours, production, emissions, and furnace exhaust flow are taken from information provided by Owens-Brockway in the form of emissions calculations, annual reports, and reports for permit required NO_X tune-up tests on each furnace.

Annual Costs
All unit costs reflect local rates, including property tax. The capital recovery factor for the main system is based on a 10-year economic life, consistent with OAQPS guidance for this technology.

As shown in the tabular summaries, cost effectiveness for this system has been estimated at $6,928 per ton of NO_X removed, which is above the $5,500 / ton threshold. We conclude that this option is not cost-effective, therefore not representative of RACT for this application.

4.7 Combustion Optimization: Individual Port Control (IPC)

Exhibit 10 presents the cost analysis for combustion optimization technology through an Individual Port Control (IPC) system, and is summarized with the others in **Exhibit 12**. IPC technology utilizes a series of valves to distribute fuel evenly among the burners of a multiple burner system. The results of IPC include equal constant flame temperatures, fuel reduction, and less excess air, all of which contribute to less nitrogen combustion. The table below summarizes the results for this system and specific cost elements are discussed below.

Parameter	Auburn A+B
Total Capital Investment	$968,898
Total Annualized Cost	$201,068
Cost/ton Process NOx Reduced	$1,876
NOx Reduced, TPY	107.20

Direct Costs
Owens-Brockway is currently operating an IPC system on each of the furnaces. The direct costs are known based on the 2008 installation on FURNB and the 1998/1999 installation on FURNA. The 2008 actual equipment costs were escalated to yield 2011 dollars in order to provide a consistent basis for the cost comparisons.

Annual Operating Conditions
Operating hours, production, emissions, and furnace exhaust flow are taken from information provided by Owens-Brockway in the form of emissions calculations, annual reports, and reports for permit required NO_X tune up tests on each furnace.

Annual Costs
All unit costs reflect local rates, including property tax. The capital recovery factor for the main system is based on a 20-year economic life, consistent with OAQPS guidance for this technology.

As shown in the tabular summaries, cost effectiveness for this system has been estimated at $1,876 per ton of NO_X removed, which is below the $5,500 / ton threshold. We conclude that this option is cost-effective.

4.8 Electric Boost

Exhibit 11 presents the cost analysis for an electric boost system, and is summarized with the others in **Exhibit 12**. Electric boost is a technology that employs the use of electrically generated heat that is injected by electrodes into the furnace from the bottom or sides. The molten glass then acts as a heating element conducting electricity between the inserted electrodes. The result of electric boost is reduced fuel combustion thereby reducing the amount of available nitrogen entering the combustion chamber. The table below summarizes the results for this system and specific cost elements are discussed below.

Parameter	Auburn A+B
Total Capital Investment	$4,222,382
Total Annualized Cost	$980,577
Cost/ton Process NOx Reduced	$13,721
NOx Reduced, TPY	71.47

Direct Costs
A variety of sources were utilized in estimating the total capital investment. These sources included: the internet; EPA's Air Pollution Control Cost Manual; EPA's Alternative Control Techniques Document: NO_X Emissions from Glass Manufacturing; and EPA Technical Bulletin: NO_X – How and Why Controlled. The published dates of the EPA references were between 1994 and 2002, which is between nine and seventeen years ago. The costs for each technology varied and in some cases, the variance was significant. Therefore, the direct costs as presented in the reference documents were averaged and an inflation factor applied to produce a current cost estimate.

Annual Operating Conditions
Operating hours, production, emissions, and furnace exhaust flow are taken from information provided by Owens-Brockway in the form of emissions calculations, annual reports, and reports for permit required NO_X tune-up tests on each furnace.

Annual Costs
All unit costs reflect local rates, including property tax. The capital recovery factor for the main system is based on a 10-year economic life, consistent with OAQPS guidance for this technology.

As shown in the tabular summaries, cost effectiveness for this system has been estimated at $13,721 per ton of NO_X removed, which is above the $5,500 / ton threshold. We conclude that this option is not cost-effective, therefore not representative of RACT for this application.

5.0 CONCLUSION: SUMMARY OF RACT DETERMINATION

As noted in the Introduction, RACT is operationally determined as the most effective technically feasible control technology that is deemed cost-effective. Results of this study in that context are summarized below:

Furnace(s)	Control System	Control Efficiency (%)	Total Annualized Cost	TPY NOx Reduced	Annual CE, $/ton
A+B	3-R	75	$16,131,750	536.00	$7,208
	Oxy-Fuel Firing	75	$20,697,577	536.00	$8,946
	OEAS	35	$3,741,782	250.13	$9,444
	Air Staging	30	$3,602,436	214.40	$9,280
	FGR	25	$3,764,485	178.67	$9,522
	Cullet Preheat	25	$3,291,878	178.67	$6,928
	IPC	15	$968,898	107.20	$1,876
	Electric Boost	10	$4,222,382	71.47	$13,721

For each furnace, control systems are listed in order of decreasing reduction efficiency from the Pilkington 3-R System down (a typical "top down" RACT analysis approach). Based on NYSDEC's RACT criteria of $5,500 per ton reduced as the threshold below which controls are clearly cost effective, only IPC has been deemed to be cost effective.

Based on the information provided, and taking technical feasibility, cost effectiveness, and environmental factors into account, Antea Group concludes that of the NO_X control options reviewed for Owens-Brockway's furnaces, IPC is below the annual cost effectiveness threshold of $5,500 per ton reduced. Owens-Brockway currently has this technology employed on both furnaces. Consequently, it is our opinion that the existing system with IPC represents RACT for this application at this time.

5.1 Requested NO_X Emission Limit

Currently, Owens-Brockway's Title V permit includes a NO_X emission limit for each of the facility's two furnaces on a pound per ton of glass melted basis per 6NYCRR, Subpart 212. This limit is 5.5 lb/ton of glass based on a 24-hour average basis, which calculates to a combined PTE of 715 tons per year based on the furnaces' maximum throughput of 712 tons of glass per day and an operating schedule of 8,760 hours per year. IPC control technology is reported to potentially offer up to a 15% NO_X emission reduction.

Official and unofficial test results derived from the required annual NO_X tune up were reviewed to evaluate the impact of IPC implementation on NOx emission performance. The tests suggest that NO_X emissions equivocal to a 10% reduction from the current 5.5 lb/ton limit are being achieved through implementation of IPC.

Stack testing, as well as anecdotal information, also suggests that the furnaces' life cycles have an effect on NO_X emission rate. Antea Group's review resulted in evidence that there is an increase in NOx emission rate over time, as a function of the furnace life cycle. The review also confirmed that an overall 10% reduction in NO_X emissions is feasible.

Due to the control variables inherent with the current technology employed (IPC) and the impact resulting from furnace lifecycles, Owens-Brockway could reasonably assert that a NO_X permit limit of 5.0 lb/ton of glass on a monthly-averaging basis is feasible utilizing RACT as demonstrated in this report.

6.0 CONTINUOUS EMISSIONS MONITORING SYSTEM (CEMS)

Per §6 NYCRR 220-2.4(a)-(b) owners or operators of glass melting furnaces that are subject to RACT requirements must maintain daily glass production rates and summarize them monthly. Additionally, compliance with the NO_X RACT emission limit(s) is required to be measured with a CEMS.

As a part of this RACT analysis, Owens is providing a tentative schedule for the purchase, installation, and testing of a CEMS. In accordance with §6 NYCRR 220-2.4(c), Owens will be required to submit a CEMS Plan for department approval. Upon approval, Owens-Brockway will then be required to notify the department at least 60 days prior to CEMS certification testing. The notification is required to include the following:

- Certification Protocol
  - Location and specifications for each instrument or device
  - Calibration procedures
  - Operation procedures
  - Data evaluation procedures
  - Data reporting procedures

The schedule is presented below and is tentative due to the custom nature of the CEMS. Primary among the contingencies will be: department approval of the RACT analysis; department approval of the CEMS Plan; and the potential for CEMS vendor backlog. The CEMS design and fabrication will be required to be specific to the equipment present at the facility.

Major Milestone Description	Tentative Date
RACT Analysis Submittal to NYSDEC Deadline	12/1/2011
NYSDEC Approval of RACT Analysis	1/1/2011
Vendor Equipment Review Process	12/1/2011 to 2/1/2012
Preparation and Submittal of CEMS Plan for Approval	1/1/2011
NYSDEC Approval of CEMS Plan	2/1/2011
Order Equipment	2/1/2012
Vendor Design and Fabrication	2/1/2012 to 5/18/2012
Submit Notification of CEMS Certification Testing (60 days before 6/11/2012)	4/1/2012
Equipment Installation	6/4/2012 to 6/8/2012
Certification Testing (7-Day Drift Test and RATA)	6/11/2012 to 6/22/2012

7.0 REFERENCES

1. RACT/RACT/LAER Clearinghouse, at http://209.42.208.109/rblc/htm/bl02.htm

2. California BACT Clearinghouse Database, at www.arbis.ca.gov/RACT/db/search.htm

3. §6 NYCRR 220-2

4. Regulatory Impact Statement: §6 NYCRR 220, Portland Cement Plants and Glass Plants; §6 NYCRR 200, General Provisions

5. AP-42 (Compilation of Air Pollution Emission Factors),Fifth Edition, at www.epa.gov/ttn/chief/ap42

6. Air Pollution Control Engineering Manual, AWMA

7. Air Quality Permitting, R. Leon Leonard, 1997, CRC Press, Inc.

8. Demonstration of Oxygen-Enriched Air Staging at Owens-Brockway Glass Containers. Final Technical Report for the period April 1, 1995 to February 28, 1997. Institute of Gas Technology: D. Rue, H. Abbasi. October 1997.

9. EPA Technical Bulletin, Nitrogen Oxides (NO_X), Why and How They Are Controlled, November 1999

10. EPA Alternative Control Techniques for NO_X from Glass Manufacturing (EPA-453/R-94-037), June 1994

11. OAQPS Control Cost Manual, Sixth Edition (EPA/453/B-02-001), January 2002

12. COST-AIR Air Pollution Control Spreadsheets, www.epa.gov/ttn/catc/products.html#cccinfo

13. Chemical Engineering, 2008

tests shall be performed in accordance with 40 CFR part 60, appendix F.

(v) When NOx emissions data are not obtained because of CEMS downtime, or for periods when no valid CEMS data is available, emission data shall be obtained by using the 90th percentile value of all CEMS NOx emission data collected over the last 180 days.

In addition to the requirements of subparagraphs (i) through (iii) below, the owner or operator of a glass melting furnace shall comply with the CEMS recordkeeping and reporting requirements of 40 CFR part 60, subpart A and appendix F.

(i) The owner or operator of a glass melting furnace shall notify the department of the planned initial start-up date of any new CEMS.

(ii) Emissions, monitoring, and operating parameter records or measurements required by this Subpart and any additional parameters required by the department shall be maintained for at least five years and made available to the department upon request.

(iii) On a semi-annual basis, the owner or operator of a glass melting furnace shall tabulate and summarize applicable emissions, monitoring, and operating parameter measurements recorded during the preceding six months, and submit these records to the department. These records shall be submitted in a format acceptable to the department.

Monitoring Frequency: CONTINUOUS
Reporting Requirements: SEMI-ANNUALLY (CALENDAR)
Reports due 30 days after the reporting period.
Subsequent reports are due every 6 calendar month(s).

Condition 38: Compliance Demonstration
Effective for entire length of Permit

Applicable State Requirement:6 NYCRR 220-2.4 (b)

Item 38.1:
The Compliance Demonstration activity will be performed for:

Emission Unit: A-FURNC
Process: FRN Emission Source: FURNA

Regulated Contaminant(s):
CAS No: 0NY210-00-0 OXIDES OF NITROGEN

Item 38.2:
Compliance Demonstration shall include the following monitoring:

Monitoring Type: CONTINUOUS EMISSION MONITORING (CEM)
Monitoring Description:

NOX emissions shall not exceed 50 lb/hr for this furnace. This limit is only in effect during periods when the furnace is in an idle mode where production has dropped to a rate less than or equal to 75 tons of glass pulled per day.

Manufacturer Name/Model Number: Thermo Environmental, Inc. 42i NOX; EMRC DP-60/75 Mark 2 Flow
Upper Permit Limit: 50 pounds per hour
Reference Test Method: 40 CFR 60 App B
Monitoring Frequency: CONTINUOUS
Averaging Method: 3-HOUR ROLLING AVERAGE
Reporting Requirements: SEMI-ANNUALLY (CALENDAR)
Reports due 30 days after the reporting period.
Subsequent reports are due every 6 calendar month(s).

Condition 39: Compliance Demonstration
Effective for entire length of Permit

Applicable State Requirement:6 NYCRR 220-2.4 (b)

Item 39.1:
The Compliance Demonstration activity will be performed for:

Emission Unit: A-FURNC
Process: FRN Emission Source: FURNA

Regulated Contaminant(s):
CAS No: 0NY210-00-0 OXIDES OF NITROGEN

Item 39.2:
Compliance Demonstration shall include the following monitoring:

Monitoring Type: CONTINUOUS EMISSION MONITORING (CEM)
Monitoring Description:

NOX emissions shall not exceed 4.0 lb/ton on a 30-day rolling average basis for this furnace. Furnace emissions shall be calculated by summing total NOx emissions for 30 days in pounds and dividing by the 30 day total glass production weight in tons.

For purposes of determining compliance with this limit, only periods when the furnace is in operation should be included in the calculation. Any periods when the furnace is in an idle mode where production falls to a rate less than or equal to 75 tons of glass pulled per day should be excluded from this calculation.

Manufacturer Name/Model Number: Thermo Environmental, Inc. 42i NOX; EMRC DP-60/75 Mark 2 Flow
Upper Permit Limit: 4.0 pounds per ton
Reference Test Method: 40 CFR 60 App B
Monitoring Frequency: CONTINUOUS
Averaging Method: 30 DAY ROLLING AVERAGE, ROLLED DAILY
Reporting Requirements: SEMI-ANNUALLY (CALENDAR)

Reports due 30 days after the reporting period.
Subsequent reports are due every 6 calendar month(s).

Condition 40: Compliance Demonstration
Effective for entire length of Permit

Applicable State Requirement:6 NYCRR 220-2.4 (b)

Item 40.1:
The Compliance Demonstration activity will be performed for:

Emission Unit: A-FURNC
Process: FRN Emission Source: FURNB

Regulated Contaminant(s):
CAS No: 0NY210-00-0 OXIDES OF NITROGEN

Item 40.2:
Compliance Demonstration shall include the following monitoring:

Monitoring Type: CONTINUOUS EMISSION MONITORING (CEM)
Monitoring Description:
NOX emissions shall not exceed 40 lb/hr for this furnace. This limit is only in effect during periods when the furnace is in an idle mode where production has dropped to a rate less than or equal to 75 tons of glass pulled per day.

Manufacturer Name/Model Number: Thermo Environmental, Inc. 42i NOX; EMRC DP-60/75 Mark 2 Flow
Upper Permit Limit: 40 pounds per hour
Reference Test Method: 40 CFR 60 App B
Monitoring Frequency: CONTINUOUS
Averaging Method: 3-HOUR ROLLING AVERAGE
Reporting Requirements: SEMI-ANNUALLY (CALENDAR)
Reports due 30 days after the reporting period.
Subsequent reports are due every 6 calendar month(s).

Condition 41: Compliance Demonstration
Effective for entire length of Permit

Applicable State Requirement:6 NYCRR 220-2.4 (b)

Item 41.1:
The Compliance Demonstration activity will be performed for:

Emission Unit: A-FURNC
Process: FRN Emission Source: FURNB

Regulated Contaminant(s):
CAS No: 0NY210-00-0 OXIDES OF NITROGEN

Item 41.2:
Compliance Demonstration shall include the following monitoring:

Monitoring Type: CONTINUOUS EMISSION MONITORING (CEM)
Monitoring Description:

NOX emissions shall not exceed 4.0 lb/ton on a 30-day rolling average basis for this furnace. Furnace emissions shall be calculated by summing total NOx emissions for 30 days in pounds and dividing by the 30 day total glass production weight in tons.

For purposes of determining compliance with this limit, only periods when the furnace is in operation should be included in the calculation. Any periods when the furnace is in an idle mode where production falls to a rate less than or equal to 75 tons of glass pulled per day should be excluded from this calculation.

Manufacturer Name/Model Number: Thermo Environmental, Inc. 42i NOX; EMRC DP-60/75 Mark 2 Flow
Upper Permit Limit: 4.0 pounds per ton
Reference Test Method: 40 CFR 60 APP B
Monitoring Frequency: CONTINUOUS
Averaging Method: 30 DAY ROLLING AVERAGE, ROLLED DAILY
Reporting Requirements: SEMI-ANNUALLY (CALENDAR)
Reports due 30 days after the reporting period.
Subsequent reports are due every 6 calendar month(s).

Anchor
Glass Container

151 East McCanns Blvd
Elmira Heights, NY 14903

RACT Analysis
Furnace NO_x Emissions
Anchor Glass Container
Elmira, New York
Facility DEC ID: 8070400036

CURRENT COMBUSTION SYSTEM

The Anchor Glass Container (Anchor Glass) Elmira, New York plant operates two glass furnaces (Furnace #1 and Furnace #2) to produce container glass. Both are side port regenerative furnaces that use natural gas as fuel. The combustion of natural gas generates various emissions including NO_x. The plant operates under Title V Air Permit # 8-0704-00036/00041, which regulates NO_x emissions from the furnaces.

Furnace # 1 has four (4) side ports and Furnace # 2 has five (5) side ports. Each port has two (2) natural gas burners. Natural gas is introduced through the ports on one side of the furnace and staged air is introduced from the opposite side. This is periodically reversed to maximize pre-heating of the main air and enable the furnace to achieve the temperature necessary to melt glass.

Anchor Glass maintains compliance with furnace NO_x emission Reasonably Available Control Technology (RACT) requirements in its air permit through the use this air staging technology and optimized combustion controls. During 1997 improvements were made to the Tank #1 system to reduce NO_x emissions from Furnace #1 and comply with RACT requirements. An air staging system was added to Furnace #1. The air staging system reduced the melter combustion air on the main flame and substituted it with staged air. This reduces the amount of excess air in the furnace during combustion which results in lower NO_x emissions. In 2000 a similar air staging system was added to Furnace #2. These improvements reduced NO_x emissions from each furnace from about 13.5 lbs NO_x/ton of glass to approximately 5.0 lbs NO_x/ton of glass.

The air staging system on each furnace allows the plant to tightly control the air to gas ratio and reduce NO_x emissions. The plant measures the amount of excess oxygen (O_2) in the exhaust from each furnace and controls combustion in each to those measurement. Furnace #1 must maintain excess O_2 from 0.5 % to 1.0%. Furnace #2 must maintain excess O_2 between 2.0 % to 2.5%. At these excess O_2 levels each furnace is emitting NO_x at or below its permitted limit.

Furnace #1 is equipped with Combustion Tec #0300V In-Line Burners Model #02. There are a total of 8 burners (2 at each port). NO_x emissions are limited to 4.49 lbs NO_x /ton of glass produced. A stack test is conducted once per Title V permit term to verify compliance with this limit.

Furnace #2 is equipped with Combustion Tec #0308MSZ "MS" style special length gas only Brightfire burners. The Brightfire burner is an adjustable low NO_x air-fuel burner. There are a total of 10 burners (2 at each port).

Anchor
Glass Container

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NO_x emissions from Furnace #2 are limited to 5.0 lbs NO_x /ton of glass produced. A stack test is conducted once per Title V permit term to verify compliance with this limit.

OPTIONS TO REDUCE NO_x

Low NO_x Burners

The installation of low NO_x burners is a common approach to lowering NO_x emissions from natural gas combustions. Anchor Glass has installed low NO_x burners on Furnace #2. Through Anchor Glass's experience with burner systems they have determined that air staging technology and combustion controls have a much greater impact on the production of NO_x from a furnace than the actual burner design. This is demonstrated by the fact that the NO_x emissions rate from both furnace is the about the same, with Furnace #1 being lower. The cost of replacing the existing burners in Furnace #1 with low NO_x burners would be approximately $80,000. The installation of these burners would result in basically no NO_x reduction from the furnace. This is therefore not considered a reasonable available control technology based on excessive cost for no reduced NO_x.

Raw Material Substitution

Certain raw materials used in glass production can contain nitrogen and are known to contribute to the NO_x emissions from a glass furnace. Nitrogen is liberated from these materials as they melt. This nitrogen will then exit the furnace as NO_x.

The primary raw materials used at the Elmira plant are:

Cullet (recycled glass)	Zinc Selenite
Limestone	Cupric Oxide
Sand	Dolomite
Soda Ash	Anthracite

Anchor Glass has reviewed these raw materials for nitrogen content and determined that the nitrogen content of each is low or nonexistent. The melting of these produces is not known to contribute significant amounts of NO_x to the furnace emissions. Product substitution to reduce NO_x emissions is therefore not considered reasonably available control technology for this plan.

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Glass Container

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Selective Catalytic Reduction (SCR)

Add-on controls are available that could, in theory, reduce the amount of NO_x being emitted from each furnace. Selective catalytic reduction (SCR) is the reaction of ammonia (NH_3) with NO_x to produce nitrogen (N_2) and water vapor (H2O). The two principal reactions are:

$4NH_3 + 4NO + O_2$ 6 $4N_2 + 6H_2O$ (1)
$4NH_3 + 2NO_2 + O_2$ 6 $3N_2 + 6H_2O$. (2)

Reaction (1) is the reduction of NO, Reaction (2) the reduction of NO_2. Reaction (1) is the most important since 90 to 95 percent of the NO_x in the flue gas is NO. To achieve reaction rates of practical interest, a catalyst is used to promote the reaction at temperatures.

The flue gas is treated in three consecutive steps:

1. Adsorption of acidic compounds by hydrated lime injection,
2. Particulate removal, including reacted lime, and
3. SCR. catalyst

This process has been demonstrated to reduce NO_x emissions from boilers by up 80% in pilot operations. Its use in the U.S. container glass industry has been minimal, if at all. Therefore it is difficult to determine the cost associated with the installation and annual operation and maintenance costs. Based on the limited industry experience and use with this emissions control system, it is not considered a reason available control technology.
reasonably

Selective Noncatalytic Reduction (SNCR)

A second add-on control is Selective Noncatalytic Reduction (SNCR). SNCR is the reaction of ammonia or urea with NO, via the same type of reactions as shown above for SCR, without the use of a catalyst. These processes do not reduce NO_2. Any of a number of nitrogen compounds can be used to reduce NO to N_2 and H_2O by similar reactions. Based on cost, safety, simplicity, and byproduct formation, ammonia and urea have the most widespread application.

This technology was basically developed for use on boiler systems. It has not been widely, if at all, used by the glass production industry, especially container glass. It is therefore difficult to estimate its effectiveness or costs, both construction and maintenance, if added to the furnaces at the Anchor Glass Elmira plant. Since there is so little experience with or availability of this technology in the glass industry, Anchor Glass does not consider this a reasonably available control technology for the Elmira plant.

Anchor
Glass Container

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CONCLUSION

During the late 1990's the Anchor Glass Elmira plant made significant upgrades to it two container glass furnaces. These upgrades included significant improvements to its air stage technology and combustion controls. This work greatly reduced the emissions of NO_x from each furnace and represented reasonably available control technology for each furnace.

The Elmira plant has evaluated various additional NO_x control strategies to determine if any system is reasonable based on availability, effectiveness and cost. The table below summarizes the results of this evaluation:

RACT Analysis Summary
Furnace NO_x Emissions
Anchor Glass Container
Elmira, New York
Facility DEC ID: 8070400036

Control Technology	Reasonably Available?	NO_x Reduction	Cost to Implement	RACT
Low NO_x Burners	Yes	None	$80,000 to install	No
Raw Material Substitution	No	N/A	N/A	No
Selective Catalytic Reduction (SCR)	No	N/A	N/A	No
Selective Noncatalytic Reduction (SNCR)	No	N/A	N/A	No

Based on this RACT analysis Anchor Glass concludes that the current operation reduces NO_x emissions and achieves RACT.

limits calculated from Part 212.9 Table 4 equation using the process weight at the time of testing.

All stack tests shall be performed in accordance with the USEPA reference method for particulate matter as set forth in 40 CFR 60 and 6 NYCRR Part 202.

Reference Test Method: METHOD 5
Monitoring Frequency: ONCE DURING THE TERM OF THE PERMIT
Averaging Method: AVERAGING METHOD AS PER REFERENCE TEST METHOD INDICATED
Reporting Requirements: SEMI-ANNUALLY (CALENDAR)
Reports due 30 days after the reporting period.
The initial report is due 1/30/2013.
Subsequent reports are due every 6 calendar month(s).

Condition 36: Compliance Certification
Effective between the dates of 10/02/2012 and 10/01/2017

Applicable Federal Requirement:6 NYCRR 212.10 (a) (2)

To be moved to Part 220 with next permit modification

Item 36.1:
The Compliance Certification activity will be performed for:

Emission Unit: 0-00001
Process: O1A Emission Source: 10000

Regulated Contaminant(s):
CAS No: 0NY210-00-0 OXIDES OF NITROGEN

Item 36.2:
Compliance Certification shall include the following monitoring:

Monitoring Type: INTERMITTENT EMISSION TESTING
Monitoring Description:
In order to maintain compliance with NOx RACT requirements, anchor shall use air staging NOx reduction technology and optimize combustion controls during the operation of furnace #1. NOx emissions from furnace #1 (ep 00001) are limited to 4.49 lbs NOx/ton of glass produced. Stack tests shall be conducted once per permit term to verify compliance with this limit.

All stack tests shall be performed in accordance with the USEPA reference method for NOx as set forth in 40 CFR 60 and 6 NYCRR Part 202. Each stack test shall measure emissions of NOx and O2 in the exhaust stacks. This compliance certification will not be applicable when the facility installs a CEMS as required by 6NYCRR 220-2.

Upper Permit Limit: 4.49 pounds per ton
Reference Test Method: METHOD 7E

Monitoring Frequency: ONCE DURING THE TERM OF THE PERMIT
Averaging Method: AVERAGING METHOD AS PER REFERENCE TEST METHOD INDICATED
Reporting Requirements: SEMI-ANNUALLY (CALENDAR)
Reports due 30 days after the reporting period.
The initial report is due 1/30/2013.
Subsequent reports are due every 6 calendar month(s).

Condition 37: Compliance Certification
Effective between the dates of 10/02/2012 and 10/01/2017

Applicable Federal Requirement:6 NYCRR 212.10 (a) (2)

Item 37.1:
The Compliance Certification activity will be performed for:

Emission Unit: 0-00001
Process: O1A Emission Source: 20000

Regulated Contaminant(s):
CAS No: 0NY210-00-0 OXIDES OF NITROGEN

Item 37.2:
Compliance Certification shall include the following monitoring:

Monitoring Type: INTERMITTENT EMISSION TESTING
Monitoring Description:
In order to maintain compliance with NOx RACT requirements, anchor shall use air staging NOx reduction technology and optimize combustion controls during the operation of furnace #2. NOx emissions from furnace #2 (EP 00002) are limited to 5.00 lbs NOx/ton of glass produced. Stack tests shall be conducted once per permit term to verify compliance with this limit.

All stack tests shall be performed in accordance with the USEPA reference method for NOx as set forth in 40 CFR 60 and 6 NYCRR Part 202. Each stack test shall measure emissions of NOx and O2 in the exhaust stacks.
This compliance certification will not be applicable when the facility installs a CEMS as required by 6NYCRR 220-2.

Upper Permit Limit: 5.00 pounds per ton
Reference Test Method: METHOD 7E
Monitoring Frequency: ONCE DURING THE TERM OF THE PERMIT
Averaging Method: AVERAGING METHOD AS PER REFERENCE TEST METHOD INDICATED
Reporting Requirements: SEMI-ANNUALLY (CALENDAR)
Reports due 30 days after the reporting period.
The initial report is due 1/30/2013.
Subsequent reports are due every 6 calendar month(s).

New York State Department of Environmental Conservation
Division of Air Resources, Region 8
6274 East Avon-Lima Road, Avon, New York 14414-9516
Phone: (585) 226-2466 • **Fax:** (585) 226-2909
Website: www.dec.ny.gov

Joe Martens
Commissioner

May 3, 2012

Mr. Jonathon K. Rioch
Guardian Industries Corp.
50 Forge Avenue
Geneva, NY 14456

Re: 6 NYCRR Part 220-2 Nitrogen Oxides (NOx) RACT Analysis for Guardian Geneva

Dear Mr. Rioch:

This letter is in response to your November 29, 2010 submission of the Reasonably Available Control Technology (RACT) analysis for Guardian's Geneva float glass furnace. The Department has reviewed the analysis and agrees with the conclusion that the current configuration of technologies which may include some or all of the following: low NOx burners, oxy-firing, and/or type 1 or type 2 3R® controls in order to maintain NOx emissions at or below 199 lb/hr, satisfies RACT.

RACT determinations are generally re-evaluated every five years or sooner if there is a substantial change to the contributing factors. Some of the NOx control options included in Guardian's evaluation are more likely to be feasible if implemented during the cold tank repair (CTR). Therefore, the Department requests that Guardian re-evaluate NOx RACT during the CTR planning process. Please submit this next NOx RACT evaluation by March 31, 2016.

Please feel free to contact Bernette Schilling at (585) 226-5315 if you have and questions or concerns.

Sincerely,

Thomas L. Marriott, P.E.
Regional Air Pollution Control Engineer

cc: Michael Jennings, Div of Air Resources, Bureau of Stationary Sources

Hand Delivered

GUARDIAN

Glass • Automotive • Building Products

NOV 29 2010

November 29, 2010

Thomas L. Marriott
Regional Air Pollution Control Engineer
NYSDEC - Region 8
6274 E Avon-Lima Road
Avon, NY 14414

RE: Guardian Geneva RACT Analysis (DEC Permit #8-3205-00041-00001)

Dear Mr. Marriott:

As required by 6 NYCRR220-2, the RACT analysis for the Guardian Industries Corp. Geneva, NY float glass furnace is enclosed.

RACT has been determined to be a combination of any and/or all of the following control technologies: best operating practices, low NOx burners, supplemental/zero-port oxygen burners, and/or 3R® NOx technology to achieve the current NOx emission limit of 199 lbs/hr (6.8 lbs/ton).

Please contact me at (315) 787-7047 if you have any questions, comments, or require any additional information.

Sincerely,

Jonathan K. Rioch

Jonathan K. Rioch
Environmental Engineer

Enclosures

cc: Division of Air Resources
New York State Department of Environmental Conservation
625 Broadway
Albany, New York 12233

GUARDIAN INDUSTRIES CORP.
GENEVA, NEW YORK
RACT ANALYSIS
NOVEMBER 2010

I. Regulatory Applicability

The Guardian Industries Corp. Geneva, New York facility (Guardian Geneva) is subject to the requirements of 6 NYCRR 220-2 and submits this timely Reasonably Available Control Technology (RACT) analysis for the glass melting furnace by December 1, 2010 to fulfill that requirement.

II. RACT Definition

6 NYCRR 220-1.1 defines RACT as "lowest emission limit that a particular source is capable of meeting by application of control technology that is reasonably available, considering technological and economic feasibility."

In the hierarchy of control technology analyses, RACT is less stringent than Best Available Control Technology (BACT) and Lowest Achievable Emission Rate (LAER) levels of control.

III. Guardian Geneva NOx Technology and Emission Limits

In order to avoid costly and lengthy litigation over pre-construction NOx technology and emission limits when the facility was originally permitted, Guardian Geneva agreed to be the first flat glass manufacturer to license and utilize the experimental and unproven Pilkington 3R® NOx reduction technology. The initial emission limit was 190 lbs/hr. This equated to 6.5 lbs of NOx per ton of glass produced (lb/ton), though the 6.5 lbs/ton was not set forth in the permit as an enforceable limit. Within one year of commencing operation, Guardian Geneva discovered that the 3R® NOx technology resulted in unanticipated side effects such as increased carbon monoxide, sulfuric acid, and PM10 emissions. It also caused excessive reducing conditions in the glass furnace regenerators (i.e., heat exchangers). These reducing conditions caused premature and comprehensive damage to the regenerator refractory which obligated Guardian to spend in excess of $1,500,000 in 2003/04 to replace the damaged and collapsed refractories. Guardian is in the planning stages of conducting this same repair and replacement of damaged refractories a second time due to reducing conditions in the regenerators. It is anticipated that this project will be implemented in early 2011

In order to minimize the negative effects of the 3R® NOx technology, Guardian Geneva has installed and is implementing the following technologies: 1) low NOx burners and 2) supplemental oxygen burners in the 'port zero' area of the furnace, in addition to process and combustion optimizations.

Even with these additional NOx control technologies, Guardian Geneva still needed to seek an increase in NOx limits from 190 to 199 lbs/hr (equivalent to 6.8 lbs/ton, non-enforceable). This increase was memorialized in a June 2004 consent agreement and subsequent permit application.

In summary, Guardian Geneva's current NOx emission limit is 199 lbs/hr (equivalent to 6.8 lbs/ton) utilizing a combination of best operating practices, low NOx burners, supplemental/zero-port oxygen burners, and/or 3R® NOx technology. Guardian believes that this limit also satisfies New York's RACT requirement as discussed below. First, it is lower than all of the BACT determinations in EPA's RACT/BACT/LAER Clearinghouse as discussed in Section IV. Second, it is consistent with the pollution control technologies defined and discussed in the European Union's most recent best available techniques guidance (IPPC-BREF) as discussed in Section V.

IV. U.S. EPA RACT-BACT-LAER Clearinghouse Data

Attachment 1 contains a table of the U.S. EPA RACT-BACT-LAER Clearinghouse emissions data for NOx on float glass manufacturing furnaces. Guardian's limits of 199 lbs/hr and 6.8 lbs/ton are lower than all of the BACT determinations in the Clearinghouse. Accordingly, Guardian's current limits meet New York's RACT requirements. In addition to the U.S. EPA Clearinghouse data, Guardian is aware of two other NOx control technologies currently being utilized on glass melting furnaces: 1) Selective Catalytic Reduction (SCR) and 2) 100% oxy-fired combustion.

Comparing Guardian Geneva's technology and emission limits (199 lbs/hr and 6.8 lbs/ton) to the three most recent entries (220 lbs/hr and 7.0 lbs/ton) reveals that Guardian's emissions are still lower than a BACT level of stringency.

V. Technological Feasibility and Cost Evaluations

As further evidence that Guardian's current permit meets the RACT requirements, we analyzed the most recent and adopted version of pollution control methodologies in the glass industry published by the European Union: *Integrated Pollution Prevention and Control Reference Document on Best Available Techniques in the Glass Manufacturing Industry* (IPPC-BREF) [web link: ftp://ftp.jrc.es/pub/eippcb/doc/gls_bref_1201.pdf December 2001]. This comprehensive document presents and discusses all applicable

NOx control techniques. These techniques can be categorized into seven main areas: 1) combustion modifications, 2) batch formulization, 3) special furnace designs, 4) 100% oxy-fuel melting, 5) chemical reduction by fuel, 6) SCR, and 7) SNCR. Each of these categories and its feasibility to Guardian Geneva's operations are discussed below.

1. Combustion Modifications

Combustion modifications listed in the BREF include: reduced air/fuel ratio, reduced combustion air temperature, staged combustion, flue gas recirculation, low NOx burners, fuel choice, and the FENIX® process.

Guardian Geneva currently utilizes varying combinations of these combustion modifications such as optimizing air/fuel ratio, limiting combustion temperature, and using low NOx burners that utilize staged/pulsed combustion features.

Other technologies are technologically infeasible and/or incompatible with Guardian Geneva's existing NOx control strategy. For example, the BREF document describes flue gas recirculation thusly: "Difficulties have been encountered with applying this technique in the Glass Industry at full-scale, and it is no longer thought to be in use. At the time of writing, this technique is not considered to be technically proven in this application". [Page 145] Fuel switching from natural gas to fuel oil is not feasible due to the trade-off between lower NOx emissions, but higher SOx and PM emissions from the combustion of fuel oil. Fuel oil is also not compatible with 3R® NOx technology. According to the BREF Document, FENIX® is a patented process which utilizes the following combustion modifications: "the reduction of excess air", "suppression of hot spots and the homogenization of flame temperatures", and "controlled mixing of the fuel and combustion air" [Page 150]. These methods are already in use by Guardian Geneva through other non-patented means.

Applicability – Guardian Geneva utilizes combustion modifications.

2. Batch Formulization

Best practices are not to use nitrate, nitrite, and/or other nitrogen containing raw materials. Guardian does not use these materials.

Applicability – Guardian Geneva utilizes best practices for batch formulization.

3. Special Furnace Designs

Special furnace design is not applicable to Guardian Geneva's float glass furnace. According to the BREF Document "These furnaces are only really viable when high levels of cullet are used i.e. greater than 70 %. Therefore, at the time of writing this implies the technique is only applicable to the Container Glass Sector and to those furnaces with >70 % cullet." [Page 149]

Applicability – Special furnace designs are not technologically feasible for Guardian Geneva.

4. Oxy-Fuel Melting

Guardian Geneva currently utilizes oxy-fuel burners at the zero port area of the furnace to assist in NOx reduction.

It is technologically infeasible to utilize 100% oxy fuel firing at Guardian Geneva because the furnace was not designed and refractories selected for adopting this technology mid-campaign. 100% oxy fuel firing can only be instituted with a cold tank repair (CTR) because of the special furnace design required and very exacting selection and installation of refractories. This is best exemplified by two float glass facilities (Pilkington in Rossford Ohio and PPG in Fresno California) that switched to 100% oxy-fuel fired float glass manufacturing furnaces at the end of their furnace's natural campaign life.

Applicability – Guardian Geneva utilizes zero port oxy-fuel burners. It is technologically infeasible to employ 100% oxy-fuel melting during the middle of a campaign.

5. Chemical Reduction by Fuel

The BREF Document lists chemical reductions by fuel as 3R® NOx technology.

Applicability – Guardian Geneva utilizes 3R® NOx technology.

6. SCR

In 2009 during Guardian Industries Corp. Kingsburg California's CTR, a SCR system was installed at a cost of $10,848,820. The SCR system included a scrubber, electrostatic precipitator, and SCR catalyst bed. This SCR system has the lowest NOx emission rates of any float glass facility in North America – 3.7 lbs of NOx per ton of glass produced. Based upon actual system parameters, the estimated annual operating costs (electricity, ammonia, reagent, disposal, etc.) for Guardian Geneva would be $2,600,000. These very high capital and operating costs are excessive for RACT and are more indicative of LAER, as was the case in California. * Current NOx LAER

Applicability – SCR represents LAER technology which is well above a RACT determination. SCR technology is technically feasible to install during a CTR. SCR is not economically feasible due to the high capital and operating costs.

7. SNCR

According to the BREF document, SNCR "...reactions take place at higher temperature without the need for a catalyst. The operating temperature is within the range 800 - 1100°C, but most is effective around 950°C." [Page 169] This temperature band is not compatible with Guardian Geneva's post-3R® exhaust. Over the last 12 years of operation, Guardian Geneva's average exhaust temperature has been 875°F/470°C, well below the required temperature.

Applicability – SNCR is not technologically feasible for Guardian Geneva.

VI. Selected RACT

Guardian Geneva concludes that RACT is a combination of any and/or all of the following control technologies: best operating practices, low NOx burners, supplemental/zero-port oxygen burners, and/or 3R® NOx technology to achieve the current NOx emission limit of 199 lbs/hr (6.8 lbs/ton).

RACT -- BACT -- LAER CLEARINGHOUSE DATA

Company	Location	Date	Level	Technology	Limits
Pilkington	Rossford, Ohio	10/27/2008	BACT	3R	220 lbs/hr
Cardinal	Winlock, Washington	2/14/2008	BACT	3R	7 lbs/ton
Cardinal	Durant, Oklahoma	6/16/2004	BACT	3R	7 lbs/ton
Cardinal	Portage,Wisconsin	12/23/1999	BACT	low NO_x burners	400 lbs/hour
Cardinal	Mooreseville, North Carolina	10/29/1998	BACT	3R	7 lbs/ton
Guardian	Geneva, New York	8/11/1997	LAER	3R	6.5 lbs/ton
PPG	Fresno, California	2/15/1996	other	supplemental burner system	240 lbs/hr
Guardian	DeWitt, Iowa	3/28/1995	BACT	SNCR (process controls)	325 lbs/hr
Cardinal	Menominee, Wisconsin	11/23/1994	BACT	furnace design	400 lbs/hr

The owner or operator of a glass melting furnace located at a glass plant that is a major facility of oxides of nitrogen (NOx) must maintain a file of daily glass production rates. The production rates must be summarized monthly. Glass production records must be retained for at least five years following the date of such records and must be made available for inspection by the department during normal business hours.

Monitoring Frequency: MONTHLY
Averaging Method: Daily block average
Reporting Requirements: SEMI-ANNUALLY (CALENDAR)
Reports due 30 days after the reporting period.
The initial report is due 1/30/2014.
Subsequent reports are due every 6 calendar month(s).

Condition 74: Compliance Demonstration
Effective between the dates of 07/18/2013 and 07/17/2018

Applicable State Requirement:6 NYCRR 220-2.4 (b)

Item 74.1:
The Compliance Demonstration activity will be performed for:

Emission Unit: U-FURNC

Regulated Contaminant(s):
CAS No: 0NY210-00-0 OXIDES OF NITROGEN

Item 74.2:
Compliance Demonstration shall include the following monitoring:

Monitoring Type: CONTINUOUS EMISSION MONITORING (CEM)
Monitoring Description:
In accordance with the approved Reasonably Available Control Technology (RACT) analysis, dated November 29, 2010, the existing NOx reduction technologies which may include some or all of the following: low NOx burners, oxy-firing, and/or type 1 or type 2 3R control in order to maintain NOx emissions at or below 199 lb/hr on a rolling 30 day average basis, is determined to be RACT for the glass melting furnace (ES F0001).

Guardian shall demonstrate compliance with the NOx RACT emission limit by measuring NOx emissions with a CEMS. The CEMS shall comply with the requirements of 6 NCYRR Part 220-2.4(c).

Manufacturer Name/Model Number: THERMO-ENVIRONMENTAL INSTRUMENTS MODEL 42C or equivalent
Upper Permit Limit: 199 pounds per hour
Reference Test Method: METHOD 7E

Monitoring Frequency: CONTINUOUS
Averaging Method: 30-DAY ROLLING AVERAGE
Reporting Requirements: SEMI-ANNUALLY (CALENDAR)
Reports due 30 days after the reporting period.
The initial report is due 1/30/2014.
Subsequent reports are due every 6 calendar month(s).

Condition 75: Compliance Demonstration
Effective between the dates of 07/18/2013 and 07/17/2018

Applicable State Requirement:6 NYCRR 220-2.4 (c)

Item 75.1:
The Compliance Demonstration activity will be performed for:

Emission Unit: U-FURNC

Regulated Contaminant(s):
CAS No: 0NY210-00-0 OXIDES OF NITROGEN

Item 75.2:
Compliance Demonstration shall include the following monitoring:

Monitoring Type: CONTINUOUS EMISSION MONITORING (CEM)
Monitoring Description:

The owner or operator of a glass melting furnace shall install, calibrate, evaluate, operate, and maintain a CEMS, in accordance with the provisions of 40 CFR part 60, appendices A, B and F, for measuring NOx and shall record the output of the system.

As part of its application for a permit or permit modification, the owner or operator of a glass melting furnace shall submit for department approval a CEMS plan.

The owner or operator of a glass melting furnace shall submit for department approval a CEMS certification protocol at least 60 days prior to CEMS certification testing. The certification protocol shall include the location of and specifications for each instrument or device, as well as procedures for calibration, operation, data evaluation, and data reporting.

The procedures in subparagraphs (i) through (v) below shall be used for determining compliance with the NOx RACT emission limit established under section 6 NYCRR Part 220-2.3(a).

(i) The owner or operator of a glass melting furnace shall determine compliance daily on a 30 day rolling average basis. The 30 day rolling averages shall be calculated by dividing 30 day total NOx emissions by 30 day total glass production. Only days when the furnace operates shall be included in the 30 day rolling averages.

(ii) At a minimum, valid CEMS data shall be obtained for 90 percent of the operating hours in each calendar quarter that the subject facility is operating.

(iii) All valid CEMS data shall be used in calculating emission rates even if the minimum data requirements of subparagraph (ii) above are not met.

(iv) Along with any specific additional data requirements mandated by the department for a particular glass melting furnace, annual recertifications, quarterly accuracy, and daily calibration drift tests shall be performed in accordance with 40 CFR part 60, appendix F.

(v) When NOx emissions data are not obtained because of CEMS downtime, or for periods when no valid CEMS data is available, emission data shall be obtained by using the 90th percentile value of all CEMS NOx emission data collected over the last 180 days.

In addition to the requirements of subparagraphs (i) through (iii) below, the owner or operator of a glass melting furnace shall comply with the CEMS recordkeeping and reporting requirements of 40 CFR part 60, subpart A and appendix F.

(i) The owner or operator of a glass melting furnace shall notify the department of the planned initial start-up date of any new CEMS.

(ii) Emissions, monitoring, and operating parameter records or measurements required by this Subpart and any additional parameters required by the department shall be maintained for at least five years and made available to the department upon request.

(iii) On a semi-annual basis, the owner or operator of a glass melting furnace shall tabulate and summarize applicable emissions, monitoring, and operating parameter measurements recorded during the preceding six months, and submit these records to the department. These records shall be submitted in a format acceptable to the department and shall include:

(a) the 30 day rolling average NOx emissions as specified under paragraph (4) of this subdivision;

(b) identification of the operating hours when NOx emissions data are not included in a calculation of the 30 day rolling average emissions and the reasons for not including that data;

(c) a comparison of the NOx emissions to the NOx RACT emissions limit(s);

(d) type and amount of fuel burned on a daily basis and the as burned heat content of the fuel;

(e) the total daily NOx emissions and total daily glass production; and

(f) the results of CEMS accuracy assessments as required by 40 CFR part 60, appendix F and any additional data quality information required by the department.

Manufacturer Name/Model Number: THERMO-ENVIRONMENTAL INSTRUMENTS MODEL 42C or equivalent
Upper Permit Limit: 199 pounds per hour
Reference Test Method: METHOD 7E
Monitoring Frequency: CONTINUOUS
Averaging Method: 30-DAY ROLLING AVERAGE
Reporting Requirements: SEMI-ANNUALLY (CALENDAR)
Reports due 30 days after the reporting period.
The initial report is due 1/30/2014.
Subsequent reports are due every 6 calendar month(s).

Condition 76: Compliance Demonstration
Effective between the dates of 07/18/2013 and 07/17/2018

Applicable State Requirement:6 NYCRR 220-2.4 (d)

Item 76.1:
The Compliance Demonstration activity will be performed for:

Emission Unit: U-FURNC

Regulated Contaminant(s):
CAS No: 0NY210-00-0 OXIDES OF NITROGEN

Item 76.2:
Compliance Demonstration shall include the following monitoring:

Monitoring Type: RECORD KEEPING/MAINTENANCE PROCEDURES
Monitoring Description:
Protocols, reports, summaries, schedules, and any other information required to be submitted to the department under provisions of this Subpart must be sent (in either

hardcopy or electronically) as follows:

(1) one copy to the Division of Air Resources, New York State Department of Environmental Conservation, 625 Broadway, Albany, New York 12233; and

(2) one copy to Thomas L. Marriott, Regional Air Pollution Control Engineer, New York State Department of Environmental Conservation - Region 8 Office, 6274 East Avon-Lima Road, Avon, NY 14414-9519.

Monitoring Frequency: AS REQUIRED - SEE PERMIT MONITORING DESCRIPTION
Reporting Requirements: ANNUALLY (CALENDAR)
Reports due 30 days after the reporting period.
The initial report is due 1/30/2014.
Subsequent reports are due every 12 calendar month(s).

Condition 77: Sources meeting Federal requirements, satisfy Part 212 compliance for regulated contaminant
Effective between the dates of 07/18/2013 and 07/17/2018

Applicable State Requirement:6 NYCRR 212.5 (e)

Item 77.1:
This Condition applies to Emission Unit: U-FURNC
Process: FUR

Item 77.2:
A process emission source, subject to the Federal new source performance standards in 40 CFR Part 60, the national emission standards for hazardous air pollutants in 40 CFR Part 61, or to the polychlorinated biphenyl disposal criteria in 40 CFR part 761 satisfies the requirements of this Part for the contaminant regulated by the Federal standard if the source owner can demonstrate that the source is in compliance with the respective Federal regulation.