• EST. 1919 •
NEWMAN
& COMPANY, INC

September 26, 2023

Rahel Gebrekidan
City Of Philadelphia
Air Management Services
321 S University Ave.
Philadelphia, PA 19104

Re: Supplemental Information for RACT III Alternative RACT Compliance Analysis [25 Pa. Code §129.114(i)]
Title V Operating Permit No. V15-003
Newman & Company, Inc. – Philadelphia, PA

Dear Ms. Gebrekidan:

At the request of Philadelphia Air Management Services (AMS), Newman & Company (Newman) is providing supplemental information to support the Reasonably Available Control Technology for Major Sources of Nitrogen Oxides and Volatile Organic Compounds (RACT) III plan approval submittal in December 2022. Newman's original RACT III submittal constituted an alternative RACT proposal or RACT emission limitation pursuant to 25 Pa. Code §129.114(d) for the Union Cogeneration Boiler operated at the facility, which is subject to RACT III on the basis of NOx emissions. Because Newman commenced operation of the Union Cogeneration Boiler prior to October 24, 2016 and has not modified the boiler since that time, Newman may make the demonstrations contemplated in 25 Pa. Code §129.114(i) to confirm that the alternative RACT determination made under RACT II (25 Pa. Code §129.99(e) will satisfy the requirements of RACT III.

Newman's RACT II submittal, made in October 2016, addressed several possible control options for the Union Cogeneration Boiler, ultimately identifying Selective Catalytic Reduction (SCR), Low NO_X Burners (LNB), Flue Gas Recirculation (FGR), and LNB+FGR in combination as technically feasible options for consideration. At the time of the RACT II submittal, Newman's operating engineer presented concerns relating to the potential safety, reliability and capacity effects of LNB, FGR and LNB+FGR on the Union Cogeneration Boiler. However, Newman proceeded to an economic feasibility analysis for these controls as a conservative measure and demonstrated these controls to be economically infeasible. AMS agreed with Newman's analysis and Newman's proposed good operating practices and proposed emission limits were approved as RACT II via Plan Approval 16-000223 effective March 31, 2020.

Consistent with recent discussions with AMS, this submittal seeks to address two items: 1) a demonstration that the cost effectiveness of LNB+FGR continues to exceed $7,500 per ton of NO_X removed, consistent with 25 Pa. Code §129.114(i)(1)(i); and 2) a top-down evaluation of RACT for the Union Cogeneration Boiler in order to demonstrate that LNB, FGR and LNB+FGR are technically infeasible options for the unit. Newman understands and acknowledges that the economic infeasibility demonstration will be sufficient to demonstrate that the alternative RACT II approval will likewise satisfy RACT III. Newman is nonetheless submitting technical infeasibility information for these add-on controls in order to provide clarity with respect to the current status of its evaluations of these controls under RACT II and RACT III, and in the event that a future evaluation of technical feasibility is needed.

The economic feasibility demonstration contemplated in 25 Pa. Code §129.114(i)(1)(i) is set forth at Attachment A of this submittal. The top-down RACT analysis for the Union Cogeneration Boiler, which includes a conclusion that LNB, FGR and LNB+FGR are technically infeasible controls, is set forth at Attachment B of this submittal. Together, these analyses demonstrate that the good operating practices and emission limitations set forth in Newman's RACT III submittal are appropriate and meet the RACT III criteria for approval.

Please contact Brent Shick at (610) 422-1142 or via email at bshick@all4inc.com if you have any questions related to this submittal.

Sincerely,
Newman & Company, Inc.

Michael Ferman
Chief Executive Officer

cc: Brent Shick (ALL4 LLC)
Bob Kuklentz (ALL4 LLC)

Attachment A – Control Cost Analyses Updated from RACT II for RACT III
Attachment B – Case-by-Case Top-Down Analysis for the Union Cogen Boiler

ATTACHMENT A -
CONTROL COST ANALYSES UPDATED FROM RACT II FOR RACT III

Table A-1

Capital and Annualized Costs for Operation of Low NO_X Burner (LNB) + Flue Gas Recirculation (FGR) [(a)]

Boiler 1 (Source ID 001) Firing Natural Gas

Newman and Company, Inc. - Philadelphia, PA

CAPITAL COSTS

COST ITEM	FACTOR		COST ($)
Direct Capital Costs [(b)]			
Purchased Equipment Costs			
LNB System with FGR [(c)]		A	$1,691,868
Instrumentation [(d)]			$277,428
Freight	0.05 A		$84,593
Total Purchased Equipment Cost		**B**	**$2,053,890**
Direct Installation Costs			
Mechanical Installation [(d)]			$33,672
Electrical Installation [(d)]			$80,032
Ductwork [(d)]			$30,500
Total Direct Installation Cost			**$144,204**
Total Direct Capital Cost		***DC***	**$2,198,094**
Indirect Capital Costs [(e)]			
Engineering and office fees	0.10 B		$205,389
Contingencies	0.20 B		$410,778
General facilities	0.05 B		$102,694
Startup & Testing [(d)]			$124,440
Total Indirect Installation Cost		**IC**	**$843,301**
Total Capital Investment (TCI)			***$3,041,395***

ANNUALIZED COSTS

COST ITEM	FACTOR		UNIT COST	ANNUAL COST ($)
Direct Annual Costs [(b)]				
Operation and Maintenance				
Maintenance costs [(f)]	2.75%	of TCI		$83,638
Renting and Operating Temporary Boiler [(g)]				$16,348
Operator [(h)]	0.00	total shift hr/day	$30.00 /hr	$0
Supervisor [(h)]	15.00%	of Operator Costs		$0
Lost Electric Generation [(i)]				$52,448
Utilities				
Electricity [(d)]				$70,532
Total Direct Annual Costs			***DAC***	***$222,966***
Indirect Annual Costs [(b)]				
Overhead	60%	of sum of operating, supervisor, and maintenance labor and maintenance materials		$50,183
Administrative charges	2%	of TCI		$60,828
Property taxes	1%	of TCI		$30,414
Insurance	1%	of TCI		$30,414
Capital recovery	0.15	CRF x TCI		$443,088
Expected lifetime of equipment:	*10*	*years*		
at	*7.5%*	*interest* [(i)]		
Total Indirect Annual Costs			***IDAC***	***$614,927***
Total Annualized Costs				***$837,893***
Cost Effectiveness ($/ton)				
Control Efficiency [(j)]:	73%			
Uncontrolled Emissions Rate [(k)]:	121.00	tons NO_X/yr @ 0.37 lb/MMBtu	***Annual Cost/Ton NO_X Removed:***	***$9,489***
Potential Controlled Emissions:	88.30	tons NO_X/yr @ 0.10 lb/MMBtu		

Table A-1

Capital and Annualized Costs for Operation of Low NO_X Burner (LNB) + Flue Gas Recirculation (FGR) [(a)]

Boiler 1 (Source ID 001) Firing Natural Gas

Newman and Company, Inc. - Philadelphia, PA

[(a)] During the initial RACT II submittal, the standalone costs for the LNB and FGR costs were higher than LNB+FGR due to a lower control efficiency with similar capital costs, thus resulting in a higher cost effectiveness value. PADEP has issued a list of cost effectiveness requirements to be included as part of the RACT analysis under 25 Pa. Code §129.114(i)(1)(i)(A)-(D):

(A) A statement that explains how the owner or operator determined that there is no new pollutant specific air cleaning device, air pollution control technology or technique available.

Please refer to Section 2.1 of the BAT analysis in Attachment B.

(B) A list of the technically feasible air cleaning devices, air pollution control technologies or techniques previously identified and evaluated under § 129.92(b) (1)-(3) included in the written RACT proposal submitted under § 129.99(d) and approved by the Department or appropriate approved local air pollution control agency under § 129.99(e).

Please refer to Section 2.2 of the BAT analysis in Attachment B.

(C) A summary of the economic feasibility analysis performed for each technically feasible air cleaning device, air pollution control technology or technique listed in clause (B) and the cost effectiveness of each technically feasible air cleaning device, air pollution control technology or technique as submitted previously under § 129.99(d) or as calculated consistent with the "EPA Air Pollution Control Cost Manual" (6th Edition), EPA/452/B-02-001, January 2002, as amended.

Please refer to Sections 2.2-2.4 of the BAT analysis in Attachment B.

(D) A statement that an evaluation of each economic feasibility analysis summarized in clause (C) demonstrates that the cost effectiveness remains equal to or greater than $7,500 per ton of NO_X emissions reduced or $12,000 per ton of VOC emissions reduced.

As shown above, the cost effectiveness is greater than $7,500 per ton of NO_X emissions removed. Further, the control vendor indicated that equipment costs are higher than those assessed during RACT II.

[(b)] Capital and annualized costs were estimated based on the U.S. EPA Office of Air Quality Planning and Standards (OAQPS) Control Cost Manual, Sixth Edition (January 2002). The costs were converted from 2016 to 2022 dollars.

[(c)] Purchase equipment includes LNB with FGR System, Windbox Upgrade and associated piping, and Control System as quoted during RACT II in 2016 by Powerhouse Operations, Inc. The LNB quoted has a NOX guarantee of 15 ppm. By definition, the quoted burner meets the definition of an ultra-low NOX burner (ULNB).

[(d)] Instrumentation, mechanical, electrical and ductwork installation, startup and testing, and electricity cost as quoted during RACT II in 2016 by Powerhouse Operations, Inc.

[(e)] Indirect capital cost factors (i.e., engineering and office fees, contingencies, and general facilities) based on guidance from "Methods for Evaluating the Costs of Utility NO_X Control Technologies," Loan K. Tran and H. Christopher Frey, June 1996.

[(f)] Maintenance costs were estimated based on the U.S. EPA OAQPS Alternative Control Techniques Document - NO_X Emissions from Process Heaters (Revised), Document No. EPA-453/R-93-034 (September 1993).

[(g)] The cost to rent and operate a temporary boiler for 3 months, as well as the lost electric generation during this time, has been estimated by Powerhouse Operations, Inc. during RACT II in 2016 to be approximately $563,900 and scaled to 2022 dollars. This cost has been accounted for over the expected lifetime of LNG with FGR.

[(h)] Newman has conservatively assumed that no labor and/or maintenance will be required annually on the LNB + FGR. Wage information for operator rates is specific to Newman.

[(i)] The historical prime rate as of December 15, 2022 (during the RACT III submittal period) was 7.5% as reported by JP Morgan Chase & Co., Bank of America, and Commercial Bank.

[(j)] Control efficiency conservatively based upon the reduction of NO_X emissions from the permitted limit of 0.37 lb/MMBtu to the presumptive RACT III emissions limit of 0.10 lb/MMBtu when firing natural gas under 25 Pa. Code §129.112(g)(1)(i).

[(k)] Uncontrolled potential NO_X emissions rate based on Condition No. 4 of Section D of Newman's current TVOP No. V15-003.

Table A-2

Capital and Annualized Costs for Operation of Low NO_X Burner (LNB) + Flue Gas Recirculation (FGR) [a]

Boiler 1 (Source ID 001) Firing Ultra-low Sulfur Diesel

Newman and Company, Inc. - Philadelphia, PA

CAPITAL COSTS

COST ITEM	FACTOR		COST ($)
Direct Capital Costs [b]			
Purchased Equipment Costs			
LNB System with FGR [c]		A	$1,691,868
Instrumentation [d]			$277,428
Freight	0.05 A		$84,593
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Operator [h]	0.00	total shift hr/day	$30.00 /hr		$0
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Overhead	60%	of sum of operating, supervisor, and maintenance labor and maintenance materials			$50,183
Administrative charges	2%	of TCI			$60,828
Property taxes	1%	of TCI			$30,414
Insurance	1%	of TCI			$30,414
Capital recovery	0.15	CRF x TCI			$443,088
Expected lifetime of equipment:	*10*	*years*			
at	*7.5%*	*interest* [i]			
Total Indirect Annual Costs				***IDAC***	***$614,927***
Total Annualized Costs					***$837,893***

Cost Effectiveness ($/ton)

Control Efficiency [j]:	33%			
Uncontrolled Emissions Rate [k]:	93.03	tons NO_X/yr	***Annual Cost/Ton NO_X Removed:***	***$27,020***
Potential Controlled Emissions:	31.01	tons NO_X/yr		

Table A-2

Capital and Annualized Costs for Operation of Low NO_X Burner (LNB) + Flue Gas Recirculation (FGR) [a]

Boiler 1 (Source ID 001) Firing Ultra-low Sulfur Diesel

Newman and Company, Inc. - Philadelphia, PA

[a] During the initial RACT II submittal, the standalone costs for the LNB and FGR costs were higher than LNB+FGR due to a lower control efficiency with similar capital costs, thus resulting in a higher cost effectiveness value. PADEP has issued a list of cost effectiveness requirements to be included as part of the RACT analysis under 25 Pa. Code §129.114(i)(1)(i)(A)-(D):

(A) A statement that explains how the owner or operator determined that there is no new pollutant specific air cleaning device, air pollution control technology or technique available.

Please refer to Section 2.1 of the BAT analysis in Attachment B.

(B) A list of the technically feasible air cleaning devices, air pollution control technologies or techniques previously identified and evaluated under § 129.92(b) (1)-(3) included in the written RACT proposal submitted under § 129.99(d) and approved by the Department or appropriate approved local air pollution control agency under § 129.99(e).

Please refer to Section 2.2 of the BAT analysis in Attachment B.

(C) A summary of the economic feasibility analysis performed for each technically feasible air cleaning device, air pollution control technology or technique listed in clause (B) and the cost effectiveness of each technically feasible air cleaning device, air pollution control technology or technique as submitted previously under § 129.99(d) or as calculated consistent with the "EPA Air Pollution Control Cost Manual" (6th Edition), EPA/452/B-02-001, January 2002, as amended.

Please refer to Sections 2.2-2.4 of the BAT analysis in Attachment B.

(D) A statement that an evaluation of each economic feasibility analysis summarized in clause (C) demonstrates that the cost effectiveness remains equal to or greater than $7,500 per ton of NO_X emissions reduced or $12,000 per ton of VOC emissions reduced.

As shown above, the cost effectiveness is greater than $7,500 per ton of NO_X emissions removed. Further, the control vendor indicated that equipment costs are higher than those assessed during RACT II.

[b] Capital and annualized costs were estimated based on the U.S. EPA Office of Air Quality Planning and Standards (OAQPS) Control Cost Manual, Sixth Edition (January 2002). The costs were converted from 2016 to 2022 dollars.

[c] Purchase equipment includes LNB with FGR System, Windbox Upgrade and associated piping, and Control System as quoted during RACT II in 2016 by Powerhouse Operations, Inc. The LNB quoted has a NO_X guarantee of 15 ppm. By definition, the quoted burner meets the definition of an ultra-low NO_X burner (ULNB).

[d] Instrumentation, mechanical, electrical and ductwork installation, startup and testing, and electricity cost as quoted during RACT II in 2016 by Powerhouse Operations, Inc.

[e] Indirect capital cost factors (i.e., engineering and office fees, contingencies, and general facilities) based on guidance from "Methods for Evaluating the Costs of Utility NO_X Control Technologies," Loan K. Tran and H. Christopher Frey, June 1996.

[f] Maintenance costs were estimated based on the U.S. EPA OAQPS Alternative Control Techniques Document - NO_X Emissions from Process Heaters (Revised), Document No. EPA-453/R-93-034 (September 1993).

[g] The cost to rent and operate a temporary boiler for 3 months, as well as the lost electric generation during this time, has been estimated by Powerhouse Operations, Inc. during RACT II in 2016 to be approximately $563,900. This cost has been accounted for over the expected lifetime of LNG with FGR.

[h] Newman has conservatively assumed that no labor and/or maintenance will be required annually on the LNB + FGR. Wage information for operator rates is specific to Newman.

[i] The historical prime rate as of December 15, 2022 (during the RACT III submittal period) was 7.5% as reported by JP Morgan Chase & Co., Bank of America, and Commercial Bank.

[j] Control efficiency conservatively based upon the reduction of NO_X emissions from the proposed permit limit of 0.18 lb/MMBtu to the presumptive RACT III emissions limit of 0.12 lb/MMBtu when firing ULSD under 25 Pa. Code §129.112(g)(1)(ii).

[k] Uncontrolled potential NO_X emissions rate based on the pre-control 0.18 lb/MMBtu emission factor PTE for 8,760 hours of operation with the existing heat input of 118 MMBtu/hr.

ATTACHMENT B -
CASE-BY-CASE TOP-DOWN ANALYSIS FOR THE UNION COGEN BOILER

1. TOP-DOWN EVALUATION OF REASONABLY AVAILABLE CONTROL TECHNOLOGY

RACT determinations are case-by-case analyses that involve an assessment of the applicable control technologies capable of reducing emissions of a pollutant and are conducted using a "top-down" approach taking into account technical feasibility, as well as, economic, environmental, and energy impacts. RACT is defined in 25 Pa. Code §121.1 as follows:

> *Reasonably Available Control Technology — the lowest emission limit for VOCs or* NO_X *that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility.*

The RACT analyses presented in this notification follow 25 Pa. Code §129.115 RACT proposal requirements and, more generally, the U.S. EPA guidance outlined in Chapter B of the U.S. EPA Draft *"New Source Review Workshop Manual."*[1] For purposes of this discussion, a "top-down" RACT analysis includes the following five basic steps:

- Step 1: Identify Available Control Technologies
- Step 2: Eliminate Technically Infeasible Options
- Step 3: Rank Remaining Control Technologies by Control Effectiveness
- Step 4: Evaluate Economic, Environmental, and Energy Impacts of Technically Feasible Control Technologies
- Step 5: Identify RACT

The five-step approach taken to perform "top-down" RACT analyses used to evaluate appropriate emissions sources at the facility is described further in the following sections.

Step 1 – Identify Available Control Technologies

The first step in the "top-down" RACT process is to identify "available" control options. Available control options are those air pollution control technologies or techniques (including lower-emitting processes and practices) that have the potential for practical application to the emissions source and pollutant under

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[1] U.S. EPA, Draft New Source Review Workshop Manual, Prevention of Significant Deterioration and Nonattainment Area Permitting, October 1990 (1990 Workshop Manual).

evaluation, with a focus on technologies that have been demonstrated to achieve the highest levels of control for the pollutant in question, regardless of the source type in which the demonstration has occurred.

Potential control options were determined based on a review of the RBLC database for entries within the last 10 years.[2] The control options identified from the RBLC database were supplemented with other permitted facilities not currently listed in the RBLC. Entries that were not representative of the emissions source, or fuel being fired were excluded from further consideration.

Step 2 – Eliminate Technically Infeasible Options

In the second step of the RACT analysis, an available control technique identified in Step 1 may be eliminated from further consideration if it is not technically feasible for the specific source under review. A demonstration of technical infeasibility must be documented and show, based on physical, chemical, or engineering principles, that technical issues would preclude the successful use of the control option on the emissions source under review. U.S. EPA generally considers a technology to be technically feasible if it has been demonstrated and operated successfully on the same type of emissions source under review or is available and applicable to the emissions source type under review. If a technology has been operated on the same type of emissions source, it is presumed to be technically feasible. However, an available technology from Step 1 cannot be eliminated as infeasible simply because it has not been used on the same type of unit that is under review. If the technology has not been operated successfully on the type of unit under review, then questions regarding “availability” and “applicability” to the particular unit type under review were considered for the technology to be eliminated as technically infeasible.

Step 3 – Rank Remaining Control Technologies by Control Effectiveness

In the third step of a top-down RACT analysis, the remaining control technologies were listed in order of its overall control effectiveness for the pollutant being assessed. The most effective control alternative (i.e., the option with the highest control efficiency that achieves the lowest emissions level) was ranked at the top of the list. The remaining technologies were then ranked in descending order of control effectiveness with the least effective control alterative at the bottom. The ranking of control options in Step 3 determines where to start the “top-down” selection process in Step 4. In determining and ranking technologies based on control effectiveness, facilities may include information on each technology’s

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[2] RACT/BACT/LAER Clearinghouse (RBLC). http://cfpub.epa.gov/rblc/

control efficiency (e.g., percent pollutant removed, emissions per unit product), expected emissions rate [e.g., tpy, pounds per hour (lb/hr), pounds per unit of product, pounds per unit of input, parts per million volume, dry (ppmvd)], and expected emissions reduction (e.g., tpy) was considered. The metrics chosen for ranking best represent the array of control technology alternatives under consideration for the pollutant included in the evaluation. If the top ranked control was selected prior to Step 4, then Step 4 may not be necessary.

Step 4 – Evaluate Economic, Environmental, and Energy Impacts of Technically Feasible Control Technologies

In the fourth step of a RACT analysis, the economic, environmental, and energy impacts arising from each remaining option under consideration are evaluated. The "top" control option was established as RACT unless the applicant can eliminate it from consideration based on its economic, environmental, or energy impacts. If the most stringent technology is eliminated in this fashion, then the next most stringent alternative is considered, and so on. Both direct and indirect impacts of the emissions control option or strategy being evaluated were considered.

Step 5 – Identify Reasonably Available Control Technology

During the fifth and final step of a RACT analysis, the most effective control option not eliminated in Step 4 was selected as RACT for the specific pollutant and emissions source under review.

2. RACT ANALYSIS FOR THE UNION COGENERATION BOILER

Source ID 001, Union Cogeneration Boiler, is a source of NO_X emissions. The boiler has a rated capacity of 118 million British thermal units per hour (MMBtu/hr). The boiler is the point of air emissions and is subject to the presumptive RACT requirements found in 25 Pa. Code §129.112. Specifically, when firing natural gas, the presumptive NO_X emissions rate for a boiler of this size is 0.10 pound per million British thermal units (lb/MMBtu), found in §129.112(g)(1)(i). When firing ULSD, the presumptive NO_X emissions rate for a boiler of this size is 0.12 lb/MMBtu, found in §129.112(g)(1)(ii). The boiler is unable to meet either of these applicable emissions limits without adding on controls. Therefore, the control of NO_X emissions is evaluated in the following sections.

2.1 STEP 1 – IDENTIFY AVAILABLE CONTROL TECHNOLOGIES

Newman conducted searches of the RBLC database, for entries of similar sized boilers that were installed, modified, or controlled within the last 10 years, to identify available technologies for controlling NO_X emissions from the boiler. Tables A-1 and A-2 of Appendix A of this attachment summarize the RBLC search results for natural gas- and fuel oil-fired boilers, respectively. Through the RBLC searches and additional research, Newman has identified the following potential NO_X control technologies that may be compatible with the boiler. A more detailed description of each control technology is provided in Section 3 of this attachment.

- Good Operating Practices
- Selective Catalytic Reduction (SCR)
- Selective Non-Catalytic Reduction (SNCR)
- Economizer
- Low NO_X Burners (LNB)
- Ultra Low NOX Burners (ULNB)
- Flue Gas Recirculation (FGR)
- LNB with FGR
- LNB with SCR

2.2 STEP 2 – ELIMINATE TECHNICALLY INFEASIBLE OPTIONS

Two control technology options were considered to be technically feasible, as indicated below:

- Good Operating Practices
- Selective Catalytic Reduction

- ~~Selective Non-Catalytic Reduction~~
- ~~Economizer~~
- ~~Low NO_X Burners~~
- ~~Ultra Low NO_X Burners~~
- ~~Flue Gas Recirculation~~
- ~~LNB with FGR~~
- ~~LNB with SCR~~

Selective Non-Catalytic Reduction

There are technical issues associated with the application of SNCR to Source ID 001, specifically, the required temperature necessary to support NO_X reduction reaction without the presence of a catalyst. The boiler exhaust temperature is below 600°F and SNCR requires a minimum temperature of 1,600°F. For the boiler to meet the minimum temperature requirement for the SNCR process to be effective, the system would need to be equipped with a supplementary fuel-fired pre-heater/heat exchanger to raise the exhaust gas temperature, which adds to the complexity and costs associated with the overall system and will result in additional fuel use and product of combustion emissions. On larger, base-load boilers, SNCR systems are most often installed in an ideal temperature zone within the boiler heat exchange system. Because Source ID 001 is not base-loaded and is generally small for SNCR systems, it does not have the space within the boiler itself where an optimal temperature zone is available. If the minimum temperature range is not satisfied, the SNCR reaction kinetics decrease, and ammonia slip issues may arise. In addition, adequate wall space within the boiler will be required for the installation of injectors. Adequate space adjacent to the boiler must also be available for distribution system equipment and for performing maintenance. Based on the significant increase in exhaust gas temperature required to initiate and sustain the NO_X reduction reaction, the size and space limitations, and the lack of demonstrated implementation of SNCR for similar sized boilers, Newman has determined that SNCR technology is not a technically feasible NO_X control option for Source ID 001. This is supported by the RBLC search returning no boilers of this size using an SNCR as a control technology.

Economizer

An economizer operates by recirculating the exhaust air from a boiler to be used as pre-heat for the air as it enters the boiler, requiring less fuel to be burned and therefore less thermal NO_X to be generated. Source ID 001 is operated in order to generate steam to be used within other processes at the Facility. An engineering study determined that, by recirculating the exhaust air, the boiler would no longer be able to achieve the high-level temperatures needed to generate steam. Removing the capability of the boiler to generate steam renders the unit useless to the Facility. Newman has therefore determined that the use of an economizer is not a technically feasible NO_X control option for Source ID 001. This is supported by the RBLC search returning no boilers of this size using an economizer as a control technology.

LNB, ULNB, and FGR

Newman investigated potential front-end control options for reducing NO_X emissions from Source ID 001. Newman determined that no technically feasible front-end control technology exists primarily because there are physical limitations to the boiler that prevent the use of LNB, ULNB, and FGR for the firing of ULSD for Source ID 001.

For LNB and ULNB specifically, the physical design of the Facility building would require moving the burner back three feet into the operating floor. This alteration would require the addition of a tunnel which poses structural challenges regarding supporting a roof in a high temperature zone. The tunnel would also concentrate the initial heat release, defeating the purpose of the LNB or ULNB as the projected emissions reduction does not account for the effects of the unusual tunnel alteration. LNB or ULNB staged combustion would also reduce flame stability and therefore increase the likelihood of flame failure trips which would result in needing to shut down and restart Source ID 001.

The addition of an FGR unit would pose similar technical problems as a result of lowering the flame stability. The FGR unit would also increase convective heat transfer to the super heater, and the increased temperatures may exceed the metal ratings of the super heater, requiring extensive alterations. These alterations would further complicate operations and may increase the likelihood of interruption to Facility operations. Additional engineering justification related to the infeasibility of LNB, ULNB, and FGR is supplied by Powerhouse Operations Inc. as letters from RACT II and RACT III, which are included in Appendix B of this attachment. The conclusion of the engineer is that the expected NO_X reduction will not be realized, and the safety, reliability and capacity of the boiler will be adversely affected. Newman has therefore determined that the use of LNB, ULNB, or FGR are not technically feasible NO_X control options for Source ID 001. Because these individual control options are not technically feasible, any combinations of control technology which include them are also considered technically infeasible NO_X control options for Source ID 001 (i.e., LNB with FGR and LNB with SCR).

2.3 STEP 3 – RANK REMAINING CONTROL TECHNOLOGIES BY CONTROL EFFECTIVENESS

The technically feasible control technology options identified under Step 2 have been ranked by control effectiveness as follows:

Table 2-1
Ranking of Feasible NO_X Control Technologies

Control Technology Option	Control Efficiency	Ranking
Selective Catalytic Reduction	70-90%[3]	1
Good Operating Practices	Variable	2

2.4 STEP 4 – EVALUATE ECONOMIC, ENVIRONMENTAL, AND ENERGY IMPACTS OF TECHNICALLY INFEASIBLE OPTIONS

SCR

A control cost analysis was conducted for operation of an SCR system for Source ID 001 to control NO_X emissions in accordance with the U.S. EPA Office of Air Quality Planning and Standards (OAQPS) Control Cost Manual, Sixth Edition. The capital and annual costs of an SCR system are based on a report completed for a similar SCR installation on a comparable boiler. Firing fuel oil would decrease the ability of a SCR to control NO_X emissions, therefore decreasing the amount of NO_X reduction achieved and increasing the associated cost per ton. The results of the control cost analysis demonstrate that the annual cost for an SCR is approximately \$30,000 per ton of NO_X reduced. While the use of an SCR is technically feasible, this cost control analysis has demonstrated that it is not economically feasible for the boiler. The control cost analysis is included in Table C-1 of Appendix C of this attachment.

Good Operating Practices

A control cost analysis was not conducted for the use of good operating practices. Newman does not anticipate any additional economic, environmental, and energy impacts associated with this control technique.

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[3] U.S. EPA Air Pollution Control Technology Fact Sheet, Selective Catalytic Reduction, Document No. EPA-452/F-03-032.

2.5 STEP 5 – IDENTIFY RACT

Based on the technical and economic feasibility of the control technologies evaluated, Newman proposes NO_X RACT to be the use of good operating practices (i.e., maintaining optimum combustion efficiency, implementing appropriate maintenance procedures, optimizing the air-fuel ratio, etc.) and compliance with a NO_X emissions limit of 0.18 lb/MMBtu when firing ULSD that was proposed in Newman's RACT III Plan Approval Application submitted in December 2022.

3. DESCRIPTIONS OF APPLICABLE CONTROL TECHNOLOGIES

Good Operating Practices

Good operating practices are a method of controlling NO_X emissions. Good operating practices include maintaining optimum combustion efficiency, implementing appropriate maintenance procedures, optimizing the air-fuel ratio, and may include other techniques. Low excess air during combustion is known to reduce NO_X formation as well.

SCR

SCR is a control technology used to convert NO_X into diatomic nitrogen (N_2) and water (H_2O) using a catalyst. The reduction reactions used by SCR require oxygen (O_2), so it is most effective at O_2 levels above 2-3%. Base metals such as vanadium or titanium are often used for the catalyst due to their effectiveness as a control technology for NO_X and for their cost-effectiveness for use with natural gas combustion. In addition, a gaseous reductant such as anhydrous ammonia or aqueous ammonia [$NH_{3(aq)}$] is added to the flue gas and absorbed onto the catalyst.[1] Typical NO_X reduction efficiency ranges from 70% to 90%[1].

SNCR

SNCR is a post-combustion control technology for NO_X emissions that uses a reduction-oxidation reaction to convert NO_X into N_2, H_2O, and carbon dioxide (CO_2). Like SCR, SNCR involves injecting ammonia (or urea) into the flue gas stream, which must be between approximately 1,400°F and 2,000°F for the chemical reaction to occur.

SNCR is typically more economically desirable than SCR since a catalyst is not required and, in theory, SNCR can control NO_X emissions similar to that of SCR (i.e., with an efficiency of up to 90%). However, operating constraints on temperature, reaction time, and mixing often lead to less effective results when using SNCR in practice. Typical NO_X reduction efficiency ranges from 30% to 50%[1].

LNB

LNB is a “front end” control technology for limiting NO_X emissions. LNB delay combustion by staging the air or fuel in multiple zones and thus limiting peak flame temperatures. This results in uniform temperatures below the peak NO_X formation temperature range, thereby lowering NO_X emissions.

ULNB

Like LNB, the use of ULNB is a front-end control technology for limiting NO_X emissions. While LNB limits peak flame temperature by separating combustion into multiple stages, an ULNB uses more advanced techniques, such as internal FGR and lean premixing of the air and fuel, to reduce NO_X emissions.

FGR

FGR can be a highly effective technique for lowering NO_X emissions from burners and is relatively inexpensive to apply. FGR lowers NO_X in two ways:

1) The cooled, relatively inert, recirculated flue gases act as a heat sink, absorbing heat from the flame and lowering peak flame temperatures.
2) When mixed with the combustion air, recirculated flue gases lower the average oxygen content of the air, starving the NO_X-forming reaction of a key ingredient needed.

Economizer

An economizer is an add-on control that primarily functions as heat recovery equipment, capturing heat from the boiler exhaust gas and using it to pre-heat the boiler feed water. This reduces the need for fuel and therefore decreases the amount of thermal NO_X emissions produced.

APPENDIX A -
RBLC SEARCH SUMMARY

Table A-1

RBLC (RACT/BACT/LAER Clearinghouse) Search Inquiry Results for Natural Gas-fired Boilers 50-250 MMBtu/Hr

Newman and Company- Philadelphia, PA

Facility Name	Process Name	Primary Fuel	Throughput	Throughput Unit	Pollutant	Control Method Description	Emissions Limit	Emissions Limit Unit	Pollutant Compliance Notes
Kenai Nitrogen Operations	Three (3) Package Boilers	Natural Gas	243	MMBTU/Hr	Nitrogen Oxides (NOx)	Ultra Low NOx Burners	0.01	LB/MMBtu	
Kenai Nitrogen Operations	Three (3) Package Boilers	Natural Gas	243	MMBTU/Hr	Nitrogen Oxides (NOx)	Selective Catalytic Reduction	0.01	LB/MMBtu	
Big River Steel LLC	Boiler, Pickle Line	Natural Gas	67	MMBTU/Hr	Nitrogen Oxides (NOx)	Low nox burners Combustion of clean fuel Good combustion practices	0.035	LB/MMBtu	
Big River Steel LLC	Pickle Line Boiler	Natural Gas	53.7	MMBTU/Hr	Nitrogen Oxides (NOx)	Low NOx burners Combustion of clean fuel Good Combustion Practices	0.035	LB/MMBtu	
Big River Steel LLC	Galvanizing Line Boilers #1 And #2	Natural Gas	53.7	MMBTU/Hr	Nitrogen Oxides (NOx)	Low NOx burners Combustion of clean fuel Good Combustion Practices	0.035	LB/MMBtu	
Big River Steel LLC	Pickle Galvanizing Line Boiler	Natural Gas	53.7	MMBTU/Hr	Nitrogen Oxides (NOx)	Low NOx burners Combustion of clean fuel Good Combustion Practices	0.035	LB/MMBtu	
Plaquemine Ethylene Plant 1	Bp Steam Boiler Packages (Eu-2/Eu-2, Eqt0266/Eqt0267)	Natural Gas	180.13	MMBTU/Hr	Nitrogen Oxides (NOx)	LNB + SCR and good combustion practices	0.021	LB/MMBtu	
Indeck Niles, LLC	Euauxboiler (Auxiliary Boiler)	Natural Gas	182	MMBTU/Hr	Nitrogen Oxides (NOx)	Low NOx burners/Flue gas recirculation and good combustion practices.	0.04	LB/MMBtu	Selective catalytic reduction (SCR) is greater than $10,000/ton for NOx.
Filer City Station	Euauxboiler (Auxiliary Boiler)	Natural Gas	182	MMBTU/Hr	Nitrogen Oxides (NOx)	LNB that incorporate internal (within the burner) FGR and good combustion practices.	0.04	LB/MMBtu	The emission limit as required in 40 CFR 60.44b(l)(1) is 0.20 lb/MMBTU (expressed as NO2) at a high heat release rate. The emission limit above subsumes the NSPS emission limit. Selective catalytic reduction (SCR) is greater than $44,000/ton for NOx.
Indeck Niles, LLC	Euauxboiler	Natural Gas	182	MMBTU/Hr	Nitrogen Oxides (NOx)	Low NOx burners/flue gas recirculation and good combustion practices.	0.04	LB/MMBtu	Selective Catalytic Reduction (SCR) is greater than $10,000/ton for NOx
Kraton Polymers U.S. LLC	Two 249 Mmbtu/H Boilers	Natural Gas	249	MMBTU/Hr	Nitrogen Oxides (NOx)	Low-NOx burners	0.12	LB/MMBtu	0.40 LB NOx/MMBtu/H when burning Belpre Naphtha. Subject to NSPS Subparts A and Db. Netted out for NOx by replacing old coal/oil-fired boilers.
La Paloma Energy Center	Boiler	Natural Gas	150	MMBTU/Hr	Nitrogen Oxides (NOx)	low-NOx burners, limited use	0.02	LB/MMBtu	
Greensville Power Station	Auxiliary Boiler (1) And Fuel Gas Heaters (6)	Natural Gas	185	MMBTU/Hr	Nitrogen Oxides (NOx)	ultra low-NOx burners	0.011	LB/MMBtu	

Table A-2

RBLC (RACT/BACT/LAER Clearinghouse) Search Inquiry Results for Ultra-low Sulfur Diesel-fired Boilers 50-250 MMBtu/Hr

Newman and Company- Philadelphia, PA

Facility Name	Process Name	Primary Fuel	Throughput	Throughput Unit	Pollutant	Control Method Description	Emissions Limit	Emissions Limit Unit	Pollutant Compliance Notes
Point Thomson Production Facility	Combustion of Diesel	ULSD	7520	kW	Nitrogen Oxides (NOx)	Dry Low NOx and SoLoNOx. DLN and SoLoNOx combustors utilize multistage premix combustors where the air and fuel is mixed at a lean fuel to air ratio. The excess air in the lean mixture acts as a heat sink, which lowers peak combustion temperatures and also ensures a more homogeneous mixture, both resulting in greatly reduced NOX formation rates.	96	PPMV	This is the base technology now

APPENDIX B -
TECHNICAL INFEASIBILITY LETTERS

poi controls

Powerhouse Operations Inc.
168 Kings Gate Drive
Lititz, PA 17543
Phone (717) 519-0687
Email: tom@poicontrols.com

October 19, 2022

Mr. Michael Ferman
Newman & Company, Inc.
6101 Tacony Street
Philadelphia, PA 19135

RACT II / III Analysis
Newman & Company, Inc.

Dear Mr. Ferman:

POWERHOUSE has reviewed the RACT II Analysis for the 001 Union Boiler at the Newman & Company, Inc., facility located at 6101 Tacony Street, Philadelphia, PA 19135. An Alternative RACT Compliance Proposal was submitted to Philadelphia Air Management Services on October 20, 2016. Additional comments and responses were provided following requests for additional information in 2019.

The Alternative Compliance Proposal reviewed several NOx reduction practices commonly employed to reduce NOx in Water Tube boilers. The Analysis of NOx reduction technologies as performed for the RACT II Analysis of the 001 Union Boiler are the same valid technologies that would be reviewed in the RACT III analysis of the boiler.

NOx Reduction Analysis for Natural Gas combustion

The 2016 RACT II Analysis reviewed the following technologies which are currently employed in Water Tube boilers to reduce NOx emissions for natural gas combustion:

1. Install new Low NOx Burners
2. Install Flue Gas Recirculation
3. Install new Low NOx Burners and Flue Gas Recirculation

Additional technologies were reviewed in the 2014 RACT Analysis report and included replacing the Air Preheater with a Feedwater Economizer which was found to be technically infeasible with the current boiler configuration and superheated steam use.

The technical questions and concerns with the implementation of these technologies on this field erected boiler continue to be concerns with these technologies. The furnace box, which was originally designed for a coal stocker boiler, continues to be too short Low NOx burner technologies. The short furnace plus a lack of water tubes in the furnace box would require significant modifications to the boiler front and considerable downtime to conduct these modifications. Additional modifications including changes to the Forced Draft Fan and Induced Draft Fan systems would also require upgrades to handle changes to the boiler configuration. All of these concerns are outlined in the RACT II Analysis already presented.

POWERHOUSE has reviewed the above options as presented in the 2014 RACT Analysis and the 2015 RACT II Analysis and confirms that there is no change in the assessment in the implementation of these industry recognized NOx reduction technologies. The economic feasibility of these technologies would reflect inflationary trends in the economic climate conditions.

Please feel free to contact me if you have any questions.

Sincerely,

Thompson McConnell, CAP, CEM

poi controls

Powerhouse Operations Inc.
168 Kings Gate Drive
Lititz, PA 17543
Phone (717) 669-5365
FAX (866) 406-7988
Email: tom@poicontrols.com

October 20, 2016

Newman & Company
6101 Tacony St.
Philadelphia, PA 19135
Attn: Michael Ferman

RACT 2 Low NOX Burners
Concerns for Operations

Dear Michael:

I would like to express my serious reservations about the proposed installation of Low NOX Burners (LNB) and Flue Gas Recirculation (FGR) on the Union Boiler. Powerhouse Operations Inc. has diligently participated in preparing cost estimates to install the burner equipment as proposed by Coen Burner / John Zink but, all along I have doubted the projected outcome and more importantly, I fear for the integrity of the boiler if these changes are made.

The following outlines the reasons for this concern based on knowledge of the furnace design and more than 35 years of dealing with *these* Burners and Combustion Controls. My initial involvement was the installation of Natural Gas in the late 1970's. I have been inside the Furnace numerous times to see crumbling brickwork resulting from impingement and combustion zone high temperatures.

Furnace Design

Most of the problems described in the following points are the result of the initial design requirement that the Boiler be capable of adding a *future* Coal Stoker. The objective of providing for changing fuel economics is admirable but, the result was a compromised furnace configuration that has limited the Combustion in several ways:

- The design for a chain grate for Coal Firing resulted in a short furnace length which requires multiple burners with short flame patterns.
- The area provided for the future stoker is all brick without waterwall cooling. The furnace floor is all brick, the side and rear walls are brick up to a height of about 3 feet and the burner front is also uncooled brickwork. The result is that more than half of the combustion zone is brick with resulting in Combustion Zone high temperatures.

Low NOX Burner and FGR Concerns

Low NOX Burners are designed to reduce flame temperatures by staging combustion over a longer path. The FGR also slows the combustion which further tends to lengthen the flame. The Union Boiler all ready struggles to make load without flame impingement on the rear wall, a longer flame path is not possible without adding length. The Coen Burner offering requires moving the burner front back into the operating floor by 3 Ft.

- The new design does not address the high Combustion Zone Temperature and in fact, adds more uncooled brick work and higher temperatures. For this reason alone I seriously doubt Coen Burner's projection of emission reduction. Note that Coen will not guarantee *any* result.
- Moving the Burner Front back 3 ft requires the fabrication of a *Tunnel* in the furnace. This sounds easier said than done. The *Tunnel* will require multiple courses of brick for insulation. My main concern for this addition is: How do you support the roof in this high temperature zone? Even with the best design and materials this could be a frequent problem requiring extended shutdown periods for repairs.
- The extension *Tunnel* will actually concentrate the initial heat release defeating some of the benefits of staged combustion. Coen Burner's projections of NOX reduction are based on results with more conventional furnace configurations and do not account for the effects of this very unusual modification. This is a further reason that I seriously doubt the projected NOX reduction.
- The Boiler is rated for 90,000 PPH steam flow but it can not safely generate more than 82,000 PPH even for the few hours required for stack testing. In my professional judgment the new burners will further limit capacity due to flame impingement on the rear wall.
- Both the LNB staged combustion and FGR mixing will reduce flame stability particularly as firing rate is reduced. This instability will increase the likelihood of flame failure trips shutting down the boiler and requiring a restart. These interruptions will result in loss of electric power to the Mill forcing a paper break and lengthy re-feed of the sheet onto the dryer. As you well know, each interruption cost about $15,000 in wasted board and lost production. If these interruptions become frequent the entire business is threatened. These costs and there continuing effect on the business are not included in the estimates.
- The purpose for this style field erected boiler is to provide high pressure *superheated* steam for a topping cycle turbine generator. The effect of the FGR on the superheater section is unknown. The FGR will increase convective heat transfer to the superheater. The increased temperatures may exceed the metal ratings of the superheater requiring modification that are not in the estimated cost. These modifications will further complicate operations and may increase the likelihood of interruption to Mill operations.

Summary

To summarize my concerns is very simple: I don't think it will achieve results in NOX reduction and Newman & Company's operations will be seriously jeopardized.

This opinion is based on professional engineering experience with *this* boiler. The Cogeneration design of the Powerhouse has been a model of efficiency for small industrial operations like the Newman Mill. This Powerhouse design can not be economically duplicated but the entire operation will be put at risk if the suggested LNB/FGR project is implemented.

Sincerely yours,

Thomas McConnell

Thomas McConnell
Consulting Engineer

APPENDIX C -
SCR CONTROL COST ANALYSIS

Table C-1

Capital and Annualized Costs for Operation of Selective Catalytic Reduction

Boiler 1 (Source ID 001) Firing Ultra-low Sulfur Diesel

Newman and Company, Inc. - Philadelphia, PA

CAPITAL COSTS

COST ITEM	FACTOR		COST ($)
Direct Capital Costs [a]			
Purchased Equipment Costs			
SCR System, including catalyst [b]		A	$595,000
Instrumentation	0.10 A		$59,500
Freight	0.05 A		$29,750
Total Purchased Equipment Cost		**B**	**$684,250**
Direct Installation Costs [c]			
Foundations and Supports	0.12 B		$82,110
Handling and Erection	0.40 B		$273,700
Electrical	0.01 B		$6,843
Piping	0.05 B		$34,213
Insulation for Ductwork	0.07 B		$47,898
Painting	0.02 B		$13,685
Total Direct Installation Cost			**$458,448**
Total Direct Capital Cost		***DC***	***$1,142,698***
Indirect Capital Costs [a]			
Indirect Installation Costs			
General Facilities	0.05 DC		$57,135
Engineering and Home Office Fees	0.10 DC		$114,270
Process Contingency	0.05 DC		$57,135
Total Indirect Installation Cost		**IC**	**$228,540**
Project Contingency	0.15 (DC+IC)		$205,686
Total Plant Cost	DC+IC+ Proj. Cont.		$1,576,923
Preproduction Cost	0.02 (Total Plant Cost)		$31,538
Inventory Capital [d]	$Vol_{reagent} * Cost_{reagent}$		$50
Total Capital Investment (TCI)			***$1,608,511***

ANNUALIZED COSTS

COST ITEM	FACTOR		UNIT COST		ANNUAL COST ($)
Direct Annual Costs [a]					
Operating Materials					
Aqueous Ammonia Reagent [e]	16,391	gallons/yr	$0.08 per gallon		$1,311
Catalyst Replacement [f, g]					$33,729
Reheat Exhaust [h]					$693,391
Renting and Operating Temporary Boiler [i]					$6,700
Lost Electric Generation [i]					$21,495
Maintenance					
Maintenance Labor and Materials	1.5%	of TCI			$24,128
Utilities					
Electricity [j, k]	27	kilowatts	$0.069 per kWh		$16,387
Total Direct Annual Costs				***DAC***	***$797,141***
Indirect Annual Costs [a]					
Capital Recovery	0.0944	CRF x TCI			$151,832
Expected Lifetime of Equipment:	*20*	*years*			
at	*7%*	*interest*			
Total Indirect Annual Costs				***IDAC***	***$151,832***
Total Annualized Costs					***$948,973***

Cost Effectiveness ($/ton)

Control Efficiency [l]:	33%			
Uncontrolled Emissions Rate [m]:	93.03	tons NO_x/yr @ 0.18 lb/MMBtu	***Annual Cost/Ton NO_X Removed:***	***$30,602***
Potential Controlled Emissions:	31.01	tons NO_x/yr @ 0.12 lb/MMBtu		

Table C-1

Capital and Annualized Costs for Operation of Selective Catalytic Reduction

Boiler 1 (Source ID 001) Firing Ultra-low Sulfur Diesel

Newman and Company, Inc. - Philadelphia, PA

(a) Direct and indirect capital and annualized costs were estimated based on the U.S. EPA Office of Air Quality Planning and Standards (OAQPS) Control Cost Manual, Sixth Edition (January 2002), Section 1, Chapter 2 and Section 4.2, Chapter 2.

(b) Cost information is representative of SCR equipment and associated aqueous ammonia storage tank and tank components (piping, valves, etc.). Cost information for SCR was obtained from Cleaver-Brooks on May 27, 2016, and cost information for the tank was obtained from Airgas on October 4, 2016. The estimated cost of SCR is $395,000 and the estimated cost of the tank is $200,000.

(c) Direct installation costs calculated using installation factors evaluated for similar control methods, as presented in the U.S. EPA OAQPS Air Pollution Control Manual, 6th Edition, January 2002.

(d) Inventory capital is based on the reagent storage tank capacity, calculated based on equations 2.32 through 2.35 in Section 4.2, Chapter 2, Section 2.3 of the U.S. EPA OAQPS Control Cost Manual, Sixth Edition, and the vendor-specific reagent price for a 19% aqueous ammonia solution. 19% aqueous ammonia was chosen as the reagent to avoid the applicable requirements of a Risk Management Plan.

Reagent Storage Tank Capacity	629 gallons
Price of Ammonia Reagent	$0.08 per gallon

(e) Annual reagent consumption based on the expected 19% aqueous ammonia solution consumption rate, calculated based on equations 2.32 through 2.34 in Section 4.2, Chapter 2, Section 2.3 of the U.S. EPA OAQPS Control Cost Manual, Sixth Edition.

Expected Reagent Consumption	1.87 gallons/hr
Operating Schedule	8,760 hrs/yr

(f) Catalyst replacement cost calculated based on equations 2.50 through 2.53 in Section 4.2, Chapter 2, Section 2.4.1 of the U.S. EPA OAQPS Control Cost Manual, Sixth Addition. The catalyst volume was sized using guidance from Section 4.2, Chapter 2, Section 2.3 of the U.S. EPA OAQPS Control Cost Manual, Sixth Addition. The following factors were used in the calculation:

Catalyst Volume	265 ft^3
No. of SCR Reactors	1
Catalyst Lifetime	24,000 hours
Interest Rate	7%

(g) Catalyst cost is from the U.S. EPA Air Pollution Control Technology Fact Sheet for Selective Catalytic Reduction, Document No. EPA-452/F-03-032, July 2003. Cost has been adjusted to reflect estimated cost in 2016.

Catalyst Cost	$370 per ft^3

(h) To achieve stack conditions such that the SCR will be capable of operating, the stack exhaust flow must be reheated. The cost associated with this reheat is based upon engineering judgement.

(i) The cost to rent and operate a temporary boiler for 3 months, as well as the lost electric generation during this time, has been estimated by Powerhouse Operations, Inc. to be approximately $563,900. This cost has been accounted for over the expected lifetime of the SCR.

(j) Electrical requirement was calculated based on equation 2.48 in Section 4.2, Chapter 2, Section 2.4.1 of the U.S. EPA OAQPS Control Cost Manual. The calculation is based on the boiler heat input and uncontrolled NO_X emissions rate, as listed in Newman's current TVOP No. V15-003. for Source ID 001. The number of catalyst layers was determined using guidance from Section 4.2, Chapter 2, Section 2.3 of the U.S. EPA OAQPS Control Cost Manual. The following factors were used in the calculation:

Boiler Heat Input	118.0 MMBtu/hr
Uncontrolled NO_X Emissions Rate	0.18 lb/MMBtu
Ductwork Pressure Drop	2 in. H_2O
No. of Catalyst Layers	3
Catalyst Pressure Drop	1 in. H_2O per layer

(k) Price of electricity (industrial) is April 2016 data for Pennsylvania: https://www.eia.gov/electricity/monthly/epm_table_grapher.cfm?t=epmt_5_6_a

(l) Control efficiency based on vendor estimation that the SCR system will achieve an emissions rate of 18 ppmv when firing ULSD.

(m) Uncontrolled potential NO_X emissions rate based on Condition No. 4 of Section D of Newman's current TVOP No. V15-003.