Table of Contents for Pittsburgh Allegheny County Thermal, Ltd. SIP Package
RACT 2 Case-by-Case Evaluation
Installation Permit No. 0044-I001

Pennsylvania Department of Environmental Protection
Bureau of Air Quality

RACT SIP COMPLETENESS CHECKLIST

TO BE FILLED IN BY REGIONAL STAFF AND SUBMITTED TO CENTRAL OFFICE

Facility Name: **Pittsburgh Allegheny Co. Thermal, LTD**

RACT Plan Approval/Permit Number: **Installation Permit No. 0044-I001**

Plan Approval/Permit Issuance Date: **March 25, 2020**

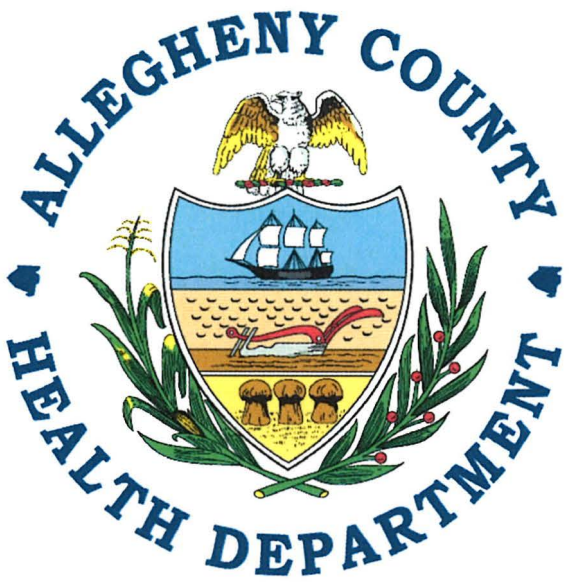
TECHNICAL MATERIALS

Included	Not Included	Not Applicable	
☒	☐	☐	**Identification of all regulated (NOx and VOC) pollutants affected by the RACT plan (Review memo and RACT Permit)**
☒	☐	☐	**Quantification of the changes in plan allowable emissions from the affected sources as a result of RACT implementation. (Review Memo)**
☐	☐	☒	**Rationale as to why applicable CTG or ACT regulation is not RACT for the facility. (Review Memo)**
☐	☐	☒	**Demonstration that the NAAQS, PSD increment, reasonable further progress demonstration, and visibility, as applicable, are protected if the plan is approved and implemented. (Review Memo)**
☐	☐	☒	**In the event of actual emission increase as a result of RACT SIP revision: Modeling information to support the proposed revision, including input data, output data, model used, ambient monitoring data used, meteorological data used, justification for use of offsite data (where used), modes of models used, assumptions, and other information relevant to the determination of adequacy of the modeling analysis. (Review Memo)**
☐	☐	☒	**Include evidence, where necessary that emission limitations are based on continuous emission reduction technology. (Review Memo)**
☒	☐	☐	**State in RACT PA/OP that expiration date shown in PA or OP is for state purposes. Either use the statement below or redact the expiration date on the permit.** **(Sample: The expiration date shown in this permit is for state purposes. For federal enforcement purposes the conditions of this operating permit which pertain to the implementation of RACT regulations shall remain in effect as part of the State Implementation Plan (SIP) until replaced pursuant to 40 CFR 51 and approved by the U.S. Environmental Protection Agency (EPA). The operating permit shall become enforceable by the U.S. EPA upon its approval of the above as a revision to the SIP.) (RACT Permit)**
☐	☐	☒	**Include evidence that the State has the necessary legal authority under State law to adopt and implement the RACT plan. (Reference of PA's Air Pollution Control Act (January 8, 1960, P.L. 2119, as amended and 25 PA Code Chapter 127 (NSR), and 25 PA Code Chapter 129 §§129.91 – 95 in RACT PA/OP). (Review memo or more likely operating permit)**

☒	☐	☐	**State that independent technical and economic justification for RACT determination by the Department was performed. As long as you reviewed the companies proposal you may agree with it but that must be stated. (Review memo)**
☐	☐	☒	**Confidential Business Information excluded, highlighted or marked. Please also redact all checks from the application. (Review Memo, RACT Permit, RACT Plan by the company)**
☒	☐	☐	**Adequate compliance demonstration, monitoring, recordkeeping, work practice standards, and reporting requirements. (Review memo and RACT Permit)**

ADMINISTRATIVE DOCUMENTS

Attached	Not Attached	Not Applicable	
☒	☐	☐	**Signed copy of final RACT Plan Approval/Operating Permit.**
☒	☐	☐	**Redacted copy of the RACT Plan Approval/Operating Permit. Reviewer should be able to read the redacted text. (We can do electronically if the PA/OP is uploaded in AIMS or available in pdf format). Make sure that the expiration date of the operating permit is redacted. SIPs do not expire.**
☒	☐	☐	**Signed Technical Support Document or Review Memorandum. The review memo should contain a discussion about previous case by case RACT determinations so that requirements can be compared**
☒	☐	☐	**Public Notice evidence: Include a copy of the actual published notice of the public hearing as it appeared in the local newspaper(s). The newspaper page must be included to show the date of publication. The notice must specifically identify by title and number each RACT regulation adopted or amended. A signed affidavit showing the dates of publication and the newspaper clipping is best. Next best is a copy of the newspaper clippings from all days the article was published. An email showing that the newspaper article was purchased is acceptable unless the EPA receives comments during their comment period stating that there is no proof of publication. The newspaper notice must say that the case by case requirements will be submitted to the EPA as an amendment to the SIP**
☒	☐	☐	**A separate formal certification duly signed indicating that public hearings were held. If no public hearings were held the review memo should state that.**
☒	☐	☐	**Public hearing minutes: This document must include certification that the hearing was held in accordance with the information in the public notice. It must also list the RACT regulations that were adopted, the date and place of the public hearing, and name and affiliation of each commenter. If there were no comments made during the notice period or at the hearing, please indicate that in the review memo.**
☒	☐	☐	**Comment and Response Document: A compilation of EPA, company, and public comments and Department's responses to these comments.**
☒	☐	☐	**Copy of RACT proposal, amendments, and other written correspondence between the Department and the facility.**



AIR QUALITY PROGRAM
301 39th Street, Bldg. #7
Pittsburgh, PA 15201-1811

Minor Source/Minor Modification INSTALLATION PERMIT

Issued To: **Pittsburgh Allegheny Co. Thermal, LTD**

ACHD Permit#: 0044-I001

Date of Issuance: March 25, 2020

~~Expiration Date: (See Section III.12)~~

Issued By:

JoAnn Truchan, P.E.
Section Chief, Engineering

Prepared By:

David D. Good
Air Quality Engineer

V. EMISSION UNIT LEVEL TERMS AND CONDITIONS

Pages 2 through 16 have been redacted.

A. Boilers No. 1 through No. 4

Process Description: Four identical M21 Keystone O-type, package boilers with a common stack
Facility ID: B001, B002, B003 & B004
Maximum Design Rate: 150 MMBtu/hr each
Fuel(s): Natural gas and no. 2 fuel oil as an emergency fuel
Control Device(s): None

1. Restrictions:

a. ~~The permittee shall continue to meet the conditions of Operating Permit No. 0044, in addition to the revisions in this permit. [§2102.04.b.5]~~

b. At no time shall the permittee allow emissions of nitrogen oxides from each boiler to exceed 0.22 pounds per MMBtus and 72.3 tons during any 12 consecutive month period (RACT Order #265, Condition 1.1; §2105.06, 25 Pa. Code §129.99).

c. At no time shall the permittee operate boilers no. 1 through no. 4 unless all process equipment and O_2 trim equipment are properly operated and maintained according to condition V.A.3.a below (RACT Order #265, Condition 1.2; §2105.06, 25 Pa. Code §129.99).

d. Natural gas usage in each boiler shall not exceed the maximum potential usage of 147,060 scf in any one-hour period and 644.12 MMscf (50% of annual capacity) in any consecutive twelve-month period. (§2103.12.h.1, §2103.12.a.2.C, 25 Pa. Code §129.99)

e. At no time shall the permittee operate the subject boilers using any fuel other than natural gas with the exception of no.2 fuel oil, which may be combusted only during combustion tuning, emergency conditions and/or natural gas curtailment (RACT Order #265, Condition 1.3; §2105.06, 25 Pa. Code §129.99).

f. Emissions from each boiler shall not exceed the following limitations in Table V-A-1 at any time: (§2101.02.c.4, §2103.12.a.2.B, §2104.03.a.2; §2104.03.b, 25 Pa. Code §129.99)

TABLE V-A-1: Emission Limitations for B001, B002, B003 & B004 (each)

POLLUTANT	Natural Gas (lb/hr)	No. 2 Fuel Oil (lb/hr)	ANNUAL EMISSION LIMIT (tons/year)[1]
Nitrogen Oxides	33.0	25.95	72.3

1) A year is defined as any consecutive 12-month period.

g. At no time No. 2 fuel oil combustion in each boiler shall not exceed 1,080 gallons each in any one-hour period and 540,035 gallons in any consecutive twelve-month period. (§2103.12.h.1, 25 Pa. Code §129.99).

2. Testing Requirements:

a. The permittee shall perform NO_X emission testing on boilers no.1 through no. 4, in accordance with Site Level Condition IV.14 above, once every two years in order to demonstrate compliance with the natural gas NO_x emission limitations in conditions V.A.1.b and V.A.1.f above (§2103.12.i, §2108.02, 25 Pa. Code §129.100)

b. The permittee shall perform NO_X emission testing on boilers no.1 through no. 4 within 60 days of firing fuel oil, in order to demonstrate compliance with the fuel oil NO_X, emission limitations in condition V.A.1.f above (RACT Order #265, Condition 1.4; §2103.12.i; §2108.02, 25 Pa. Code §129.100)

~~c. The Department reserves the right to require additional emissions testing sufficient to assure compliance with the terms and conditions of this permit. Such testing shall be performed in accordance with Article XXI §2108.02. (§2103.12.h.1)~~

3. Monitoring Requirements:

a. The permittee shall continuously monitor the oxygen content of the flue gas of each boiler to within 3% of the measured value and record the oxygen content to the nearest 0.1%, to ensure the subject boilers are being operated and maintained properly and are operating under the conditions demonstrated during the most recent compliance test. (§2103.12.i and §2108.03, 25 Pa. Code §129.100)

4. Record Keeping Requirements:

a. The permittee shall keep and maintain the following data for boilers no. 1 through no. 4: (§2103.12.j; §2103.12.h.1 and RACT Order #265, Condition 1.5; §2105.06, 25 Pa. Code §129.100):
1) Fuel consumption (daily, monthly, and 12-month), type of fuel consumed and suppliers' certification of sulfur content, and heating value for each boiler;
2) Steam load, (Mlbs/day, monthly average);
3) Flue gas oxygen (hourly high, low and average, monthly average)
4) Total operating hours, (hours/day, monthly and 12-month); and
5) Records of operation, maintenance, inspection, calibration and/or replacement of combustion equipment; and
6) Stack test protocols and reports.

b. The permittee shall record all instances of non-compliance with the conditions of this permit upon occurrence along with corrective action taken to restore compliance. (§2103.12.h.1, 25 Pa. Code §129.100)

c. All records required under this section shall be maintained by the permittee for a period of five years following the date of such record. [§2103.12.j.2, 25 Pa. Code §129.100]

5. Reporting Requirements:

a. The permittee shall report the following information to the Department within thirty days of the end of each calendar half. The reports shall contain all required information for the time period of the report: (§2103.12.k.1, 25 Pa. Code §129.100)

1) Monthly and 12-month data required to be recorded by condition V.A.4.a above; and
2) Non-compliance information required to be recorded by V.A.4.b above.

~~b.~~ ~~Reporting instances of non-compliance does not relieve the permittee of the requirement to report breakdowns in accordance with Site Level Condition IV.8, if appropriate. [§2103.12.k]~~

6. Work Practice Standard:

The permittee shall at all times properly operate and maintain all process and emission control equipment at the facility according to good engineering practice. (25 Pa. Code §129.99)

Pages 20 through 21 have been redacted.

ALLEGHENY COUNTY HEALTH DEPARTMENT
AIR QUALITY PROGRAM

March 25, 2020

SUBJECT: **Reasonable Available Control Technology (RACT II) Determination**
Pittsburgh Allegheny County Thermal, Ltd.
120 Cecil Way
Pittsburgh, PA 15222
Allegheny County

Title V Installation Permit No. 0044-I001

TO: JoAnn Truchan, P.E.
Section Chief, Engineering

FROM: David D. Good
Air Quality Engineer

I. Executive Summary

The Pittsburgh Allegheny County Thermal, Ltd. (PACT) facility is defined as a major source of NO_X emissions and was subjected to a Reasonable Available Control Technology II (RACT II) review by the Allegheny County Health Department (ACHD) required for the 1997 and 2008 Ozone National Ambient Air Quality Standard (NAAQS). The findings of the review established that technically and financially feasible RACT would result in the following emissions changes, summarized below.

Table 1 Technically and Financially Feasible Control Options Summary for NO_X

The Permittee has elected to take operational and fuel restrictions that reduce the potential NO_X emissions from Boiler Nos. 1, 2, 3 and 4. Additional control options are not economically feasible.

II. Regulatory Basis

ACHD requested all major sources of NO_X (potential emissions of 100 tons per year or greater) and all major sources of VOC (potential emissions of 50 tons per year or greater) to reevaluate NO_X and/or VOC RACT for incorporation into Allegheny County's portion of the PA SIP. The non-exempt sources at PACT are subject to presumptive RACT requirements. The facility has requested a case-by-case evaluation Boiler Nos. 1, 2, 3 and 4, as each boiler currently does not meet the presumptive NO_X emissions limits as per 25 Pa Code, §129.97. This document is the result of ACHD's determination of RACT for these four emission sources at PACT based on the materials submitted by the subject source and other relevant information.

III. Facility Description, Existing RACT I and Sources of NO_X

The Pittsburgh Allegheny County Thermal, LTD, Stanwix Street facility is an industrial steam generation plant located at 120 Cecil Way in the downtown section of Pittsburgh, PA, which supplies steam for heating and refrigeration to commercial and institutional sites in that area. The plant is composed of four (4) boilers, with a

common stack, which fire natural gas as their primary fuel and have the capacity to fire no. 2 fuel oil, in lieu of natural gas at times of emergency or natural gas curtailment. PACT is a major source of NO_X emissions.

On November 9th, 1998 the facility entered into a consent decree with the Department to meet RACT I obligations under RACT Order No. 265. RACT Order 265 was approved as RACT by EPA in 2001 (66 FR 52044). The RACT I requirements are listed in Table 2 below:

Table 2 RACT I Summary

Source	RACT Order 265 Condition No.	RACT I Requirement
Boiler Nos. 1, 2, 3 and 4	I.1.1	Boiler 1 NO_X: 0.22 lb/MMBtu, 126.5 TPY Boiler 2 NO_X: 0.22 lb/MMBtu, 126.5 TPY Boiler 3 NO_X: 0.22 lb/MMBtu, 126.5 TPY Boiler 4 NO_X: 0.22 lb/MMBtu, 126.5 TPY
Boiler Nos. 1, 2, 3 and 4	I.1.2	At no time shall the permittee operate boilers 1, 2, 3 and 4 unless all process equipment and O_2 trim equipment are properly operated and maintained according to good engineering practice.
Boiler Nos. 1, 2, 3 and 4	I.1.3	At no time shall the permittee operate boilers 1, 2, 3 and 4 using any fuel other than natural gas or No. 2 fuel oil.
Boiler Nos. 1, 2, 3 and 4	I.1.4	The permittee shall conduct NO_X emission tests on Boilers 1 through 4 every 2 years.
Boiler Nos. 1, 2, 3 and 4	I.1.5	The permittee shall maintain all records including, but not limited to: A. Production data on a daily basis for each boiler: 1. Total fuel consumption and type consumed; 2. Amount of fuel usage; 3. Steam load; and 4. Total operating hours.
Boiler Nos. 1, 2, 3 and 4	I.1.6	The permittee shall maintain all appropriate records to demonstrate compliance with the requirements of both Section 2105.06 of Article XXI and this Order.

Table 3 Facility Sources Subject to Case-by-Case RACT II and Their Existing RACT I Limits

Source ID	Description	Rating	NO_X Presumptive Limit (RACT II)	NO_X Limit (RACT I) – Consent Order No. 265	Proposed Case-by-Case RACT II
B001	M21 Keystone O-type, package boiler.	150 MM Btu/hr	0.10 lb/MMBtu	0.22 lb/MMBtu; 126.5 tpy	0.22 lb/MMBtu; 72.3 tpy; 644.12 MMscf/yr
B002	M21 Keystone O-type, package boiler.	150 MM Btu/hr	0.10 lb/MMBtu	0.22 lb/MMBtu; 126.5 tpy	0.22 lb/MMBtu; 72.3 tpy; 644.12 MMscf/yr
B003	M21 Keystone O-type, package boiler.	150 MM Btu/hr	0.10 lb/MMBtu	0.22 lb/MMBtu; 126.5 tpy	0.22 lb/MMBtu; 72.3 tpy; 644.12 MMscf/yr
B004	M21 Keystone O-type, package boiler.	150 MM Btu/hr	0.10 lb/MMBtu	0.22 lb/MMBtu; 126.5 tpy	0.22 lb/MMBtu; 72.3 tpy; 644.12 MMscf/yr

IV. RACT Determination

Boilers 1, 2, 3 and 4 are not able to meet the Presumptive NO_X Requirements per 25 PA Code, §129.97 of 0.10 lb/MMBtu. A case-by-case evaluation was performed for the four boilers. The NO_X emission rates from the most

recent stack test (February 2019) were 0.19, 0.19, 0.22, and 0.19 lb/MMBtu for Boilers 1, 2, 3 and 4, respectively. Since the boilers historically have not operated near full load, the permittee has elected to take operational and fuel limit restrictions that reduce the annual potential NO_X emissions from each boiler. The fuel limit restrictions accepted by the permittee include restricting natural gas consumed in Boilers 1 through 4 by 50% of the maximum boiler capacity. The hourly natural gas usage limit for each boiler remains unchanged from Title V Operating Permit no. 0044 (issued March 24, 2015) at 147,060 SCF in any one-hour period. The annual (12-month) natural gas usage limit for each boiler has been reduced by 50% from 1,288 MMSCF to 644 MMSCF. The new baseline NO_X PTE is 72.3 tpy for each boiler and is based on each boiler operating at 50% of maximum annual capacity at their RACT limit of 0.22 lb/MMBtu.

The Department evaluated further emission controls for NO_X emissions. Some control options were found to be not technically feasible such as SCR (flue gas temperatures well below the effective range of control), SNCR (fluctuations in temperatures) and low excess air (boilers already use oxygen trim systems). A summary of those controls that were found to be technically feasible [Low NO_X Burner (LNB) and Flue Gas Recirculation (FGR)] are in the table below:

Table 4 RACT Analysis Summary

Source ID	Baseline NO_X Emissions (tpy)	LNB (NO_X lb/MMBtu; $/ton of NOx removed)	FGR + LNB (NO_X lb/MMBtu; $/ton of NOx removed)
B001	72.3	0.10; $10,026	0.05; $7,851
B002	72.3	0.10; $10,026	0.05; $7,851
B003	72.3	0.10; $10,026	0.05; $7,851
B004	72.3	0.10; $10,026	0.05; $7,851

The new fuel limitations and annual NO_X emissions restrictions make any further control options not economically feasible. RACT II shall be the retention of the RACT I allowable emission rate of 0.22 lb/MMBTU for each boiler with the natural gas fuel restriction (50% of capacity) and annual emission limitations (72.3 tpy) proposed in Table 3 above. The permittee is already restricted to 540,035 gallons (equivalent to 500 hours at maximum capacity) of fuel oil for each boiler. The permittee shall at all times properly operate and maintain all process and emission control equipment at the facility according to good engineering practice

V. RACT Emissions Summary

The conditions listed in the table in Section VI of this document below supersede the relevant conditions of Plan Approval Order and Agreement No. 265, issued November 9th, 1998. The RACT II conditions are at least as stringent as those from RACT I. Other RACT I conditions not affected by RACT II remain in effect. Based on the findings in this RACT analysis, the facility emissions can be summarized as follows:

Table 5 RACT II NO_X Emissions Reduction Summary

NO_X Potential Emissions (tpy)		
PTE Prior to RACT II	RACT Reduction	Revised PTE
506	213.2	292.8

As shown in Table 5, the RACT II restrictions reduced 213.2 tons of potential NO_X emissions from the facility.

VI. RACT II Permit Conditions

Source ID	Description	Permit Condition 0022-I003	RACT II Regulations
Boilers 1-4	Four identical M21 Keystone O-type package boilers. 150 MMBtu/hr (each)	Condition V.A.1.b	25 PA Code §129.99
		Condition V.A.1.c	25 PA Code §129.99
		Condition V.A.1.d	25 PA Code §129.99
		Condition V.A.1.e	25 PA Code §129.99
		Condition V.A.1.f	25 PA Code §129.99
		Condition V.A.1.g	25 PA Code §129.99
		Condition V.A.2.a	25 PA Code §129.100
		Condition V.A.2.b	25 PA Code §129.100
		Condition V.A.3.a	25 PA Code §129.100
		Condition V.A.4.a	25 PA Code §129.100
		Condition V.A.4.b	25 PA Code §129.100
		Condition V.A.4.c	25 PA Code §129.100
		Condition V.A.5.a	25 PA Code §129.100
		Condition V.A.6	25 PA Code §129.99

Appendix A
(Case-by-Case Economic Evaluation for Boilers 1, 2, 3 and 4)

Table 1

ACHD 3/24/2020

OAQPS Cost Control Calculations
PACT Boilers

Boiler Type:	Packaged Watertube
Boiler Capacity (MMBtu/hr):	150
Fuel Type:	Natural Gas
Control Method:	**LNB with FGR (50% Fuel Restriction)**

	Direct Capital Costs (DCC)		
	a. Equipment Cost (EC) for LNB, FGR Duct and new 300 HP Fan/Motor =	$515,000	PER BOILER
	b. Instrumentation = 10% of EC =	$51,500	
	c. Sales Tax = 3% of EC =		
	d. Freight = 5% of EC =	$25,750	
	e. Purchased Equipment Costs (PEC) =	$592,250	
	e. Direct Installation Cost = 75% of PEC =	$444,188	
	f. Site Preparation Cost =	$0	
	g. Buildings =	$0	
	DCC = PEC + Installation + Site Prep + Buildings	$1,036,438	
	Indirect Capital Costs (ICC)		
	a. Engineering = 10% of PEC =	$59,225	
	b. Construction and Field Expenses = 10% of PEC =	$59,225	
	c. Construction Fee = 10% of PEC =	$59,225	
	d. Startup = 2% of PEC =	$11,845	
	e. Performance Test = 1% of PEC =	$5,923	
	Total ICC =	$195,443	
	Contingency		
3	Contingency = 20% of (ICC + DCC)	$246,376	
	Total Capital Investment (TCI)		
4	TCI = DCC + ICC + Contingency =	$1,478,256	
	Direct Annual (O&M) Costs (DAC) =		
	a. Maintenance Labor (semi-annual inspection) =	$2,000	
	b. Electricity @ $0.085/kW-hr (300 hp vs 125 hp fan motor)	$97,168	
	c. Fuel @ $10.00 / MMBtu (1% efficiency penalty for FGR-LNB Combo)	$131,400	
	d. Other	$0	
	Total DAC =	$230,568	
	Indirect Annual (O&M) Costs (IAC) =		
	a. Overhead = 60% of total labor and maint. materials=	$1,200	
	b. Administrative = 2% of TCI =	$29,565	
	c. Property Tax = 1% of TCI =		
	d. Insurance = 1% of TCI =	$14,783	
	Total IAC =	$45,548	
	Total Direct and Indirect Annual O&M Costs = DAC + IAC = (O&M) =	$276,116	
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	Capital Recovery Annual Costs		
	a. Capital Recovery Period (years) =	15	
	b. Annual Interest Rate =	7%	
	c. Capital Recovery Factor = (CRF) =	0.1098	
	Annualized Capital Investment Cost (ACIC) = CRF * TCI =	$162,305	
	Total Annualized Cost (TAC) = ACIC + O&M =	$438,421	
9			
	NOx Removal		
	a. Baseline NOx Emission Rate (lb/MMBtu) =	0.22	
	b. Controlled NOx Emission Rate (lb/MMBtu) =	0.05	
	c. Control Efficiency =	77%	
	d. Maximum Fuel Firing Rate per Boiler (MMBtu/hr) =	150	
	e. Baseline NOx Emissions @ 50% (ton/yr) =	72.3	
	f. Controlled NOx Emissions @ 50% (ton/yr) =	16.4	
	e. NOx Removed per boiler per year (ton/yr) = (Operating at Max. Firing Rate for 4,380 hrs/yr)	55.85	POTENTIAL-BASED
	Cost Effectiveness ($/ton NOx Removed) = TAC / NOx Removal =	**$7,851**	POTENTIAL-BASED
11			

Table 2

ACHD 3/24/2020

OAQPS Cost Control Calculations

PACT Boilers

Boiler Type:	Packaged Watertube
Boiler Capacity (MMBtu/hr):	150
Fuel Type:	Natural Gas
Control Method:	**LNB (50% Fuel Restriction)**

1	**Direct Capital Costs (DCC)**		
	a. Equipment Cost (EC) for 1 LNB and a new 300 HP Fan and Motor =	$463,000	PER BOILER
	b. Instrumentation = 10% of EC =	$46,300	
	c. Freight = 5% of EC =	$23,150	
	d. Purchased Equipment Costs (PEC) =	$532,450	
	e. Direct Installation Cost = 50% of PEC =	$266,225	
	f. Site Preparation Cost =	$0	
	g. Buildings =	$0	
	DCC = PEC + Installation + Site Prep + Buildings	$798,675	
2	**Indirect Capital Costs (ICC)**		
	a. Engineering = 10% of PEC =	$53,245	
	b. Construction and Field Expenses = 10% of PEC =	$53,245	
	c. Construction Fee = 10% of PEC =	$53,245	
	d. Startup = 2% of PEC =	$10,649	
	e. Performance Test = 1% of PEC =	$5,325	
	Total ICC =	$175,709	
3	**Contingency**		
	Contingency = 20% of (ICC + DCC)	$194,877	
4	**Total Capital Investment (TCI)**		
	TCI = DCC + ICC + Contingency =	$1,169,260	
5	**Direct Annual (O&M) Costs (DAC) =**		
	a. Maintenance Labor (semi-annual inspection) =	$2,000	
	b. Electricity @ $0.085/kW-hr (300 hp vs 125 hp fan motor)	$97,168	
	c. Fuel @ $10.00 / MMBtu (1% efficiency penalty for FGR-LNB Combo)	$131,400	
	d. Other	$0	
	Total DAC =	$230,568	
6	**Indirect Annual (O&M) Costs (IAC) =**		
	a. Overhead = 60% of total labor and maint. materials=	$1,200	
	b. Administrative = 2% of TCI =	$23,385	
	c. Property Tax = 1% of TCI =		
	d. Insurance = 1% of TCI =	$11,693	
	Total IAC =	$36,278	
7	**Total Direct and Indirect Annual O&M Costs = DAC + IAC = (O&M) =**	$266,846	
8	**Capital Recovery Annual Costs**		
	a. Capital Recovery Period (years) =	15	
	b. Annual Interest Rate =	7%	
	c. Capital Recovery Factor = (CRF) =	0.1098	
	Annualized Capital Investment Cost (ACIC) = CRF * TCI =	$128,378	
9	**Total Annualized Cost (TAC) = ACIC + O&M =**	$395,225	
10	**NOx Removal**		
	a. Baseline NOx Emission Rate (lb/MMBtu) =	0.22	
	b. Controlled NOx Emission Rate (lb/MMBtu) =	0.10	
	c. Control Efficiency =	55%	
	d. Maximum Fuel Firing Rate per Boiler (MMBtu/hr) =	150	
	e. Baseline NOx Emissions @ 50% (ton/yr) =	72.3	
	f. Controlled NOx Emissions @ 50% (ton/yr) =	32.9	
	g. NOx Removed per boiler per year (ton/yr) = (Operating at Max. Firing Rate for 4,380 hrs/yr)	39.42	POTENTIAL-BASED
11	**Cost Effectiveness ($/ton NOx Removed) = TAC / NOx Removal =**	$10,026	POTENTIAL-BASED

ALLEGHENY COUNTY HEALTH DEPARTMENT
Air Quality Program

SUMMARY OF PUBLIC COMMENTS AND DEPARTMENT RESPONSES ON THE PROPOSED ISSUANCE OF PITTSBURGH ALLEGHENY COUNTY THERMAL, LTD INSTALLATION PERMIT NO. 0044-I001

[Notice of the opportunity for public comment appeared in the legal section of the Pittsburgh Post-Gazette on February 6, 2020. The public comment period ended on March 20, 2020.]

1. **COMMENT:** The commenter noted that a comparison of the RACT II vs RACT I requirements must be made to ensure that there is no backsliding, as per the Clean Air Act §110(l).

   RESPONSE: The Department agrees with the commenter. In Table 2 of the technical support document all of the existing RACT I conditions (Order No. 265) are listed. As noted in Section V of the technical support document: "The RACT II conditions are at least as stringent as those from RACT I. Other RACT I conditions not affected by RACT II remain in effect."

2. **COMMENT:** The commenter noted that the RACT I provision to test Boilers 1 through 4 for NO_X emissions every two years was not included in the draft permit.

   RESPONSE: The Department has amended condition V.A.2.a to include NO_X emissions testing every two years.

3. **COMMENT:** The commenter noted that the no. 2 fuel oil restriction was not included in the draft permit should be included as a RACT II condition.

   RESPONSE: The Department agrees with the commenter. Condition no. V.A.1.e from the Title V Operation Permit no. 0044 was incorporated by reference, but not as a RACT 2 condition. The Department has added condition V.A.1.g to address hourly and annual fuel oil restrictions.

4. **COMMENT:** The commenter requested additional clarification of the 50% capacity restriction on natural gas usage in the review memo and for it to be clearly reflected in the permit.

   RESPONSE: The Department added more detail in the technical support document under Section IV regarding the 50% capacity. Additionally, the Department noted that the annual fuel limit for each boiler of 644.12 MMscf is 50% of the unit's annual capacity.

5. **COMMENT:** The commenter requested that a boiler derating of 1% (fuel efficiency penalty) for the retrofitting and combined usage of low NOx burners and flue gas recirculation (LNB+FGR) to be included in the RACT analysis, as per the boiler supplier.

   RESPONSE: The Department agrees with the commenter and modified the direct annual O&M costs and economic feasibility analysis to reflect the 1% efficiency penalty. The addition of the 1% efficiency penalty however does not change the conclusion reached by the Department. The full economic feasibility analysis has been attached to the review memo as Appendix A.

6. **COMMENT:** The commenter requested further clarification on hourly fuel use restrictions. The commenter also inquired about NO_X emissions averaging as per 25 Pa Code 129.98 as an alternative means of compliance.

RESPONSE: See response to Comment no. 4. The 50% restriction on fuel is applied to each boiler on an annual (12-month) basis. The 50% restriction on fuel is not applied on an hourly basis to any individual boiler or combination of boilers. Additionally, NO_X emissions averaging would not be permissible at this facility since no individual boiler or combination of boilers can meet the presumptive emission limits of 129.97.

7. **COMMENT:** The commenter requested better substantiation in support of the RACT II determination, including calculations and a determination of economic feasibility.

RESPONSE: See response to comment no. 4 and no. 5. Appendix A has been added to the technical support document and now provides a detailed analysis on the cost-effectiveness for each technically feasible control option. The cost effectiveness of each control option has been updated in both Appendix A and Table 4 of the review memo. The determination of cost-effectiveness of control for VOC (cited in comment) is evaluated differently from NO_X. This can be seen in question 41 of the PADEP "Responses to Frequently Asked Questions" regarding the final rulemaking for RACT II: http://files.dep.state.pa.us/Air/AirQuality/AQPortalFiles/Permits/RACT/RACT%20Final%20FAQ%206-21-2016.docx. The Department does not consider the lowest cost option (LNB+FGR) of $7,851/ton of NO_X removed to be a cost-effective control option for any of the boilers at PACT. The facility has accepted fuel restrictions and new baseline emission limits that reduce potential emissions of NO_X by 213 tons/year at the facility.

David D. Good, Air Quality Engineer

List of Commenters

Name	Affiliation
Cynthia H. Stahl, PhD. Air Protection Division (Comments 1-4)	U.S. Environmental Protection Agency Region III
Jerome Griger (Comments 5-6)	PACT
Joseph Otis Minott, Esq. Christopher Ahlers, Esq. (Comment 7)	Clean Air Council

AIR QUALITY PROGRAM
301 39th Street, Bldg. #7
Pittsburgh, PA 15201-1811

Minor Source/Minor Modification
INSTALLATION PERMIT

Issued To: **Pittsburgh Allegheny Co. Thermal, LTD**

ACHD Permit#: 0044-I001

Date of Issuance: ---

Expiration Date: (See Section III.12)

Issued By: _____
JoAnn Truchan, P.E.
Section Chief, Engineering

Prepared By: _____
David D. Good
Air Quality Engineer

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AMENDMENTS:

DATE SECTION(S)

I. CONTACT INFORMATION

Facility Location:
Pittsburgh Allegheny Co. Thermal, LTD
120 Cecil Way
Pittsburgh, PA 15222

Permittee/Owner:
Pittsburgh Allegheny Co. Thermal, LTD
120 Cecil Way
Pittsburgh, PA 15222

Responsible Official: **Jerome E. Griger**
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ACHD Contact:
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Allegheny County Health Department
Air Quality Program
301 39th Street, Building #7
Pittsburgh, PA 15201-1891

EPA Contact:
Enforcement Programs Section (3AP12)
USEPA Region III
1650 Arch Street
Philadelphia, PA 19103-2029

II. FACILITY DESCRIPTION

FACILITY DESCRIPTION

The Pittsburgh Allegheny County Thermal, LTD, Stanwix Street facility is an industrial steam generation plant located at 120 Cecil Way in the downtown section of Pittsburgh, PA, which supplies steam for heating and refrigeration to commercial and institutional sites in that area. The plant is composed of four boilers, with a common stack, which fire natural gas as their primary fuel and have the capacity to fire no. 2 fuel oil, in lieu of natural gas at times of emergency or natural gas curtailment. The facility is a major source of nitrogen oxides (NO_X) and carbon monoxide emissions (CO), a minor source of particulate matter (PM), particulate matter < 10 microns in diameter (PM-10), sulfur dioxide (SO_2), volatile organic compounds (VOCs) and hazardous air pollutants (HAPs) as defined in section 2101.20 of Article XXI.

INSTALLATION DESCRIPTION

This installation permit is for inclusion of physical and operational conditions for subject facilities pursuant to Reasonable Available Control Technology (RACT) in section 2105.06 of Article XXI. There are no new units being added to the facility as part of this permitting action.

The emission units regulated by this permit are summarized in Table II-1:

TABLE II-1: Emission Unit Identification

I.D.	SOURCE DESCRIPTION	CONTROL DEVICE(S)	MAXIMUM CAPACITY	FUEL/RAW MATERIAL
B001	M21 Keystone O-type, package boiler	None	150 MMBtu/hr	Natural gas, fuel oil
B002	M21 Keystone O-type, package boiler	None	150 MMBtu/hr	Natural gas, fuel oil
B003	M21 Keystone O-type, package boiler	None	150 MMBtu/hr	Natural gas, fuel oil
B004	M21 Keystone O-type, package boiler	None	150 MMBtu/hr	Natural gas, fuel oil

DECLARATION OF POLICY

Pollution prevention is recognized as the preferred strategy (over pollution control) for reducing risk to air resources. Accordingly, pollution prevention measures should be integrated into air pollution control programs wherever possible, and the adoption by sources of cost-effective compliance strategies, incorporating pollution prevention, is encouraged. The Department will give expedited consideration to any permit modification request based on pollution prevention principles.

The permittee is subject to the terms and conditions set forth below. These terms and conditions constitute provisions of *Allegheny County Health Department Rules and Regulations, Article XXI Air Pollution Control*. The subject equipment has been conditionally approved for operation. The equipment shall be operated in conformity with the plans, specifications, conditions, and instructions which are part of your application, and may be periodically inspected for compliance by the Department. In the event that the terms and conditions of this permit or the applicable provisions of Article XXI conflict with the application for this permit, these terms and conditions and the applicable provisions of Article XXI shall prevail. Additionally, nothing in this permit relieves the permittee from the obligation to comply with all applicable Federal, State and Local laws and regulations.

III. GENERAL CONDITIONS

1. Prohibition of Air Pollution (§2101.11)

It shall be a violation of this permit to fail to comply with, or to cause or assist in the violation of, any requirement of this permit, or any order or permit issued pursuant to authority granted by Article XXI. The permittee shall not willfully, negligently, or through the failure to provide and operate necessary control equipment or to take necessary precautions, operate any source of air contaminants in such manner that emissions from such source:

a. Exceed the amounts permitted by this permit or by any order or permit issued pursuant to Article XXI;
b. Cause an exceedance of the ambient air quality standards established by Article XXI §2101.10; or
c. May reasonably be anticipated to endanger the public health, safety, or welfare.

2. Nuisances (§2101.13)

Any violation of any requirement of this Permit shall constitute a nuisance.

3. Definitions (§2101.20)

a. Except as specifically provided in this permit, terms used retain the meaning accorded them under the applicable provisions and requirements of Article XXI or the applicable federal or state regulation. Whenever used in this permit, or in any action taken pursuant to this permit, the words and phrases shall have the meanings stated, unless the context clearly indicates otherwise.

b. Unless specified otherwise in this permit or in the applicable regulation, the term "*year*" shall mean any twelve (12) consecutive months.

4. Certification (§2102.01)

Any report or compliance certification submitted under this permit shall contain written certification by a responsible official as to truth, accuracy, and completeness. This certification and any other certification required under this permit shall be signed by a responsible official of the source, and shall state that, based on information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate, and complete.

5. Operation and Maintenance (§2105.03)

All air pollution control equipment required by this permit or Article XXI, and all equivalent compliance techniques that have been approved by the Department, shall be properly installed, maintained, and operated consistent with good air pollution control practice.

6. Conditions (§2102.03.c)

It shall be a violation of this permit giving rise to the remedies provided by Article XXI §2109.02, for any person to fail to comply with any terms or conditions set forth in this permit.

7. Transfers (§2102.03.e)

This permit shall not be transferable from one person to another, except in accordance with Article XXI §2102.03.e and in cases of change-in-ownership which are documented to the satisfaction of the Department, and shall be valid only for the specific sources and equipment for which this permit was issued. The transfer of permits in the case of change-in-ownership may be made consistent with the administrative permit amendment procedure of Article XXI §2103.14.b.

8. Effect (§2102.03.g)

Issuance of this permit shall not in any manner relieve any person of the duty to fully comply with the requirements of Article XXI or any other provision of law, nor shall it in any manner preclude or affect the right of the Department to initiate any enforcement action whatsoever for violations of Article XXI or this Permit, whether occurring before or after the issuance of such permit. Further, the issuance of this permit shall not be a defense to any nuisance action, nor shall such permit be construed as a certificate of compliance with the requirements of Article XXI or this Permit.

9. General Requirements (§2102.04.a)

It shall be a violation of this Permit giving rise to the remedies set forth in Article XXI §2109 for any person to install, modify, replace, reconstruct, or reactivate any source or air pollution control equipment to which this Permit applies unless either:

a. The Department has first issued an Installation Permit for such source or equipment; or

b. Such action is solely a reactivation of a source with a current Operating Permit, which is approved under §2103.13 of Article XXI.

10. Conditions (§2102.04.e)

Further, the initiation of installation, modification, replacement, reconstruction, or reactivation under this

Installation Permit and any reactivation plan shall be deemed acceptance by the source of all terms and conditions specified by the Department in this permit and plan.

11. Revocation (§2102.04.f)

a. The Department may, at any time, revoke this Installation Permit if it finds that:
   1) Any statement made in the permit application is not true, or that material information has not been disclosed in the application;
   2) The source is not being installed, modified, replaced, reconstructed, or reactivated in the manner indicated by this permit or applicable reactivation plan;
   3) Air contaminants will not be controlled to the degree indicated by this permit;
   4) Any term or condition of this permit has not been complied with;
   5) The Department has been denied lawful access to the premises or records, charts, instruments and the like as authorized by this Permit; or

b. Prior to the date on which construction of the proposed source has commenced the Department may, revoke this Installation Permit if a significantly better air pollution control technology has become available for such source, a more stringent regulation applicable to such source has been adopted, or any other change has occurred which requires a more stringent degree of control of air contaminants.

12. Term (§2102.04.g)

This Installation Permit shall expire in 18 months if construction has not commenced within such period or shall expire 18 months after such construction has been suspended, if construction is not resumed within such period. In any event, this Installation Permit shall expire upon completion of construction, except that this Installation Permit shall authorize temporary operation to facilitate shakedown of sources and air cleaning devices, to permit operations pending issuance of a related subsequent Operating Permit, or to permit the evaluation of the air contamination aspects of the source. Such temporary operation period shall be valid for a limited time, not to exceed 180 days, but may be extended for additional limited periods, each not to exceed 120 days, except that no temporary operation shall be authorized or extended which may circumvent the requirements of this Permit.

13. Annual Installation Permit Administrative Fee (§2102.10.c & e)

No later than 30 days after the date of issuance of this Installation Permit and on or before the last day of the month in which this permit was issued in each year thereafter, during the term of this permit until a subsequent corresponding Operating Permit or amended Operating Permit is properly applied for, the owner or operator of such source shall pay to the Department, in addition to all other applicable emission and administration fees, an Annual Installation Permit Administration Fee in an amount of $750.

14. Severability Requirement (§2103.12.l)

The provisions of this permit are severable, and if any provision of this permit is determined to by a court of competent jurisdiction to be invalid or unenforceable, such a determination will not affect the remaining provisions of this permit.

15. Reporting Requirements (§2103.12.k)

a. The permittee shall submit reports of any required monitoring at least every six (6) months. All

instances of deviations from permit requirements must be clearly identified in such reports. All required reports must be certified by the Responsible Official.

b. Prompt reporting of deviations from permit requirements is required, including those attributable to upset conditions as defined in this permit and Article XXI §2108.01.c, the probable cause of such deviations, and any corrective actions or preventive measures taken.

c. All reports submitted to the Department shall comply with the certification requirements of General Condition III.4 above.

d. Semiannual reports required by this permit shall be submitted to the Department within 30 days of the end of the calendar half.

e. Quarterly reports required by this permit shall be submitted to the Department within 30 days of the end of the calendar quarter.

f. Reports may be emailed to the Department at aqreports@achd.net in lieu of mailing a hard copy.

16. Minor Installation Permit Modifications (§2102.10.d)

Modifications to this Installation Permit may be applied for but only upon submission of an application with a fee in the amount of $300 and where:

a. No reassessment of any control technology determination is required; and
b. No reassessment of any ambient air quality impact is required.

17. Violations (§2104.06)

The violation of any emission standard established by this Permit shall be a violation of this Permit giving rise to the remedies provided by Article §2109.02.

18. Other Requirements Not Affected (§2105.02)

Compliance with the requirements of this permit shall not in any manner relieve any person from the duty to fully comply with any other applicable federal, state, or county statute, rule, regulation, or the like, including, but not limited to, any applicable NSPSs, NESHAPs, MACTs, or Generally Achievable Control Technology standards now or hereafter established by the EPA, and any applicable requirement of BACT or LAER as provided by Article XXI, any condition contained in this Installation Permit and/or any additional or more stringent requirements contained in an order issued to such person pursuant to Part I of Article XXI.

19. Other Rights and Remedies Preserved (§2109.02.b)

Nothing in this permit shall be construed as impairing any right or remedy now existing or hereafter created in equity, common law or statutory law with respect to air pollution, nor shall any court be deprived of such jurisdiction for the reason that such air pollution constitutes a violation of this permit

20. Penalties, Fines, and Interest (§2109.07.a)

A source that fails to pay any fee required under this Permit or article XXI when due shall pay a civil penalty

of 50% of the fee amount, plus interest on the fee amount computed in accordance with of Article XXI §2109.06.a.4 from the date the fee was required to be paid. In addition, the source may have its permit revoked.

21. Appeals (§2109.10)

In accordance with State Law and County regulations and ordinances, any person aggrieved by an order or other final action of the Department issued pursuant to Article XXI shall have the right to appeal the action to the Director in accordance with the applicable County regulations and ordinances.

IV. SITE LEVEL TERMS AND CONDITIONS

1. Reporting of Upset Conditions (§2103.12.k.2)

The permittee shall promptly report all deviations from permit requirements, including those attributable to upset conditions as defined in Article XXI §2108.01.c, the probable cause of such deviations, and any corrective actions or preventive measures taken.

2. Visible Emissions (§2104.01.a)

Except as provided for by Article XXI §2108.01.d pertaining to a cold start, no person shall operate, or allow to be operated, any source in such manner that the opacity of visible emissions from a flue or process fugitive emissions from such source, excluding uncombined water:

a. Equal or exceed an opacity of 20% for a period or periods aggregating more than three (3) minutes in any sixty (60) minute period; or,
b. Equal or exceed an opacity of 60% at any time.

3. Odor Emissions (§2104.04) (County-only enforceable)

No person shall operate, or allow to be operated, any source in such manner that emissions of malodorous matter from such source are perceptible beyond the property line.

4. Materials Handling (§2104.05)

The permittee shall not conduct, or allow to be conducted, any materials handling operation in such manner that emissions from such operation are visible at or beyond the property line.

5. Operation and Maintenance (§2105.03)

All air pollution control equipment required by this permit or any order under Article XXI, and all equivalent compliance techniques approved by the Department, shall be properly installed, maintained, and operated consistently with good air pollution control practice.

6. Open Burning (§2105.50)

No person shall conduct, or allow to be conducted, the open burning of any material, except where the Department has issued an Open Burning Permit to such person in accordance with Article XXI §2105.50 or where the open burning is conducted solely for the purpose of non-commercial preparation of food for human consumption, recreation, light, ornament, or provision of warmth for outside workers, and in a manner which contributes a negligible amount of air contaminants.

7. Shutdown of Control Equipment (§2108.01.b)

a. In the event any air pollution control equipment is shut down for reasons other than a breakdown, the person responsible for such equipment shall report, in writing, to the Department the intent to shut down such equipment at least 24 hours prior to the planned shutdown. Notwithstanding the submission of such report, the equipment shall not be shut down until the approval of the Department is obtained; provided, however, that no such report shall be required if the source(s) served by such air pollution control equipment is also shut down at all times that such equipment

is shut down.

b. The Department shall act on all requested shutdowns as promptly as possible. If the Department does not take action on such requests within ten (10) calendar days of receipt of the notice, the request shall be deemed denied, and upon request, the owner or operator of the affected source shall have a right to appeal in accordance with the provisions of Article XI.

c. The prior report required by Site Level Condition IV.7.a above shall include:

1) Identification of the specific equipment to be shut down, its location and permit number (if permitted), together with an identification of the source(s) affected;
2) The reasons for the shutdown;
3) The expected length of time that the equipment will be out of service;
4) Identification of the nature and quantity of emissions likely to occur during the shutdown;
5) Measures, including extra labor and equipment, which will be taken to minimize the length of the shutdown, the amount of air contaminants emitted, or the ambient effects of the emissions;
6) Measures which will be taken to shut down or curtail the affected source(s) or the reasons why it is impossible or impracticable to shut down or curtail the affected source(s) during the shutdown; and
7) Such other information as may be required by the Department.

8. Breakdowns (§2108.01.c)

a. In the event that any air pollution control equipment, process equipment, or other source of air contaminants breaks down in such manner as to have a substantial likelihood of causing the emission of air contaminants in violation of this permit, or of causing the emission into the open air of potentially toxic or hazardous materials, the person responsible for such equipment or source shall immediately, but in no event later than sixty (60) minutes after the commencement of the breakdown, notify the Department of such breakdown and shall, as expeditiously as possible but in no event later than seven (7) days after the original notification, provide written notice to the Department.

b. To the maximum extent possible, all oral and written notices required shall include all pertinent facts, including:

1) Identification of the specific equipment which has broken down, its location and permit number (if permitted), together with an identification of all related devices, equipment, and other sources which will be affected.
2) The nature and probable cause of the breakdown.
3) The expected length of time that the equipment will be inoperable or that the emissions will continue.
4) Identification of the specific material(s) which are being, or are likely to be emitted, together with a statement concerning its toxic qualities, including its qualities as an irritant, and its potential for causing illness, disability, or mortality.
5) The estimated quantity of each material being or likely to be emitted.
6) Measures, including extra labor and equipment, taken or to be taken to minimize the length of the breakdown, the amount of air contaminants emitted, or the ambient effects of the emissions, together with an implementation schedule.
7) Measures being taken to shut down or curtail the affected source(s) or the reasons why it is impossible or impractical to shut down the source(s), or any part thereof, during the breakdown.

c. Notices required shall be updated, in writing, as needed to advise the Department of changes in the information contained therein. In addition, any changes concerning potentially toxic or hazardous emissions shall be reported immediately. All additional information requested by the Department shall be submitted as expeditiously as practicable.

d. Unless otherwise directed by the Department, the Department shall be notified whenever the condition causing the breakdown is corrected or the equipment or other source is placed back in operation by no later than 9:00 AM on the next County business day. Within seven (7) days thereafter, written notice shall be submitted pursuant to Paragraphs a and b above.

e. Breakdown reporting shall not apply to breakdowns of air pollution control equipment which occur during the initial startup of said equipment, provided that emissions resulting from the breakdown are of the same nature and quantity as the emissions occurring prior to startup of the air pollution control equipment.

f. In no case shall the reporting of a breakdown prevent prosecution for any violation of this permit or Article XXI.

9. Cold Start (§2108.01.d)

In the event of a cold start on any fuel-burning or combustion equipment, except stationary internal combustion engines and combustion turbines used by utilities to meet peak load demands, the person responsible for such equipment shall report in writing to the Department the intent to perform such cold start at least 24 hours prior to the planned cold start. Such report shall identify the equipment and fuel(s) involved and shall include the expected time and duration of the startup. Upon written application from the person responsible for fuel-burning or combustion equipment which is routinely used to meet peak load demands and which is shown by experience not to be excessively emissive during a cold start, the Department may waive these requirements and may instead require periodic reports listing all cold starts which occurred during the report period. The Department shall make such waiver in writing, specifying such terms and conditions as are appropriate to achieve the purposes of Article XXI. Such waiver may be terminated by the Department at any time by written notice to the applicant.

10. Monitoring of Malodorous Matter Beyond Facility Boundaries (§2104.04)

The permittee shall take all reasonable action as may be necessary to prevent malodorous matter from becoming perceptible beyond facility boundaries. Further, the permittee shall perform such observations as may be deemed necessary along facility boundaries to insure that malodorous matter beyond the facility boundary in accordance with Article XXI §2107.13 is not perceptible and record all findings and corrective action measures taken.

11. Emissions Inventory Statements (§2108.01.e & g)

a. Emissions inventory statements in accordance with §2108.01.e shall be submitted to the Department by March 15 of each year for the preceding calendar year. The Department may require more frequent submittals if the Department determines that more frequent submissions are required by the EPA or that analysis of the data on a more frequent basis is necessary to implement the requirements of Article XXI or the Clean Air Act.

b. The failure to submit any report or update within the time specified, the knowing submission of

false information, or the willful failure to submit a complete report shall be a violation of this permit giving rise to the remedies provided by Article XXI §2109.02.

12. Orders (§2108.01.f)

In addition to meeting the requirements Site Level Conditions IV.7 through IV.11, inclusive, the person responsible for any source shall, upon order by the Department, report to the Department such information as the Department may require in order to assess the actual and potential contribution of the source to air quality. The order shall specify a reasonable time in which to make such a report.

13. Violations (§2108.01.g)

The failure to submit any report or update thereof required by Site Level Conditions IV.7 through IV.12 above, inclusive, within the time specified, the knowing submission of false information, or the willful failure to submit a complete report shall be a violation of this permit giving rise to the remedies provided by Article XXI §2109.02.

14. Emissions Testing (§2108.02)

a. **Orders:** No later than 60 days after achieving full production or 120 days after startup, whichever is earlier, the permittee shall conduct, or cause to be conducted, such emissions tests as are specified by the Department to demonstrate compliance with the applicable requirements of this permit and shall submit the results of such tests to the Department in writing. Upon written application setting forth all information necessary to evaluate the application, the Department may, for good cause shown, extend the time for conducting such tests beyond 120 days after startup but shall not extend the time beyond 60 days after achieving full production. Emissions testing shall comply with all applicable requirements of Article XXI, §2108.02.e.

b. **Tests by the Department:** Notwithstanding any tests conducted pursuant to this permit, the Department or another entity designated by the Department may conduct emissions testing on any source or air pollution control equipment. At the request of the Department, the permittee shall provide adequate sampling ports, safe sampling platforms and adequate utilities for the performance of such tests.

c. **Testing Requirements:** No later than 45 days prior to conducting any tests required by this permit, the person responsible for the affected source shall submit for the Department's approval a written test protocol explaining the intended testing plan, including any deviations from standard testing procedures, the proposed operating conditions of the source during the test, calibration data for specific test equipment and a demonstration that the tests will be conducted under the direct supervision of persons qualified by training and experience satisfactory to the Department to conduct such tests. In addition, at least 30 days prior to conducting such tests, the person responsible shall notify the Department in writing of the time(s) and date(s) on which the tests will be conducted and shall allow Department personnel to observe such tests, record data, provide pre-weighed filters, analyze samples in a County laboratory and to take samples for independent analysis. Test results shall be comprehensively and accurately reported in the units of measurement specified by the applicable emission limitations of this permit.

d. Test methods and procedures shall conform to the applicable reference method set forth in this permit or Article XXI Part G, or where those methods are not applicable, to an alternative sampling and testing procedure approved by the Department consistent with Article XXI §2108.02.e.2.

e. **Violations:** The failure to perform tests as required by this permit or an order of the Department, the failure to submit test results within the time specified, the knowing submission of false information, the willful failure to submit complete results, or the refusal to allow the Department, upon presentation of a search warrant, to conduct tests, shall be a violation of this permit giving rise to the remedies provided by Article XXI §2109.02.

15. Abrasive Blasting (§2105.51)

a. Except where such blasting is a part of a process requiring an operating permit , no person shall conduct or allow to be conducted, abrasive blasting or power tool cleaning of any surface, structure, or part thereof, which has a total area greater than 1,000 square feet unless such abrasive blasting complies with all applicable requirements of Article XXI §2105.51.

b. In addition to complying with all applicable provisions of §2105.51, no person shall conduct, or allow to be conducted, abrasive blasting of any surface unless such abrasive blasting also complies with all other applicable requirements of Article XXI unless such requirements are specifically addressed by §2105.51.

16. Asbestos Abatement (§2105.62, §2105.63)

In the event of removal, encasement, or encapsulation of Asbestos-Containing Material (ACM) at a facility or in the event of the demolition of any facility, the permittee shall comply with all applicable provisions of Article XXI §2105.62 and §2105.63.

17. Volatile Organic Compound Storage Tanks (§2105.12.a)

No person shall place or store, or allow to be placed or stored, a volatile organic compound having a vapor pressure of 1.5 psia or greater under actual storage conditions in any aboveground stationary storage tank having a capacity equal to or greater than 2,000 gallons but less than or equal to 40,000 gallons, unless there is in operation on such tank pressure relief valves which are set to release at the higher of 0.7 psig of pressure or 0.3 psig of vacuum or at the highest possible pressure and vacuum in accordance with State or local fire codes, National Fire Prevention Association guidelines, or other national consensus standard approved in writing by the Department. Petroleum liquid storage vessels that are used to store produced crude oil and condensate prior to lease custody transfer are exempt from these requirements.

18. Fugitive Emissions (§2105.49)

The person responsible for a source of fugitive emissions, in addition to complying with all other applicable provisions of this permit shall take all reasonable actions to prevent fugitive air contaminants from becoming airborne. Such actions may include, but are not limited to:

a. The use of asphalt, oil, water, or suitable chemicals for dust control;
b. The paving and maintenance of roadways, parking lots and the like;
c. The prompt removal of earth or other material which has been deposited by leaks from transport, erosion or other means;
d. The adoption of work or other practices to minimize emissions;
e. Enclosure of the source; and
f. The proper hooding, venting, and collection of fugitive emissions.

19. Episode Plans (§2106.02)

The permittee shall upon written request of the Department, submit a source curtailment plan, consistent with good industrial practice and safe operating procedures, designed to reduce emissions of air contaminants during air pollution episodes. Such plans shall meet the requirements of Article XXI §2106.02.

20. New Source Performance Standards (§2105.05)

a. It shall be a violation of this permit giving rise to the remedies provided by §2109.02 of Article XXI for any person to operate, or allow to be operated, any source in a manner that does not comply with all requirements of any applicable NSPS now or hereafter established by the EPA, except if such person has obtained from EPA a waiver pursuant to Section 111 or Section 129 of the Clean Air Act or is otherwise lawfully temporarily relieved of the duty to comply with such requirements.

b. Any person who operates, or allows to be operated, any source subject to any NSPS shall conduct, or cause to be conducted, such tests, measurements, monitoring and the like as is required by such standard. All notices, reports, test results and the like as are required by such standard shall be submitted to the Department in the manner and time specified by such standard. All information, data and the like which is required to be maintained by such standard shall be made available to the Department upon request for inspection and copying.

21. National Emission Standards for Hazardous Air Pollutants (§2104.08)

a. The permittee shall comply with each applicable emission limitation, work practice standard, and operation and maintenance requirement of 40 CFR Part 63, Subpart DDDDD – *National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers and Process Heaters*, CFR Part 63, Subpart UUUUU – *National Emission Standards for Hazardous Air Pollutants for Coal- and Oil-Fired electric Utility Steam Generating Units, and* CFR Part 63, Subpart ZZZZ – *National Emission Standards for Stationary Reciprocating Internal Combustion Engines.*

V. EMISSION UNIT LEVEL TERMS AND CONDITIONS

A. Boilers No. 1 through No. 4

Process Description: Four identical M21 Keystone O-type, package boilers with a common stack
Facility ID: B001, B002, B003 & B004
Maximum Design Rate: 150 MMBtu/hr each
Fuel(s): Natural gas and no. 2 fuel oil as an emergency fuel
Control Device(s): None

1. Restrictions:

a. The permittee shall continue to meet the conditions of Operating Permit No. 0044, in addition to the revisions in this permit. [§2102.04.b.5]

b. At no time shall the permittee allow emissions of nitrogen oxides from each boiler to exceed 0.22 pounds per MMBtus and 72.3 tons during any 12 consecutive month period (RACT Order #265, Condition 1.1; §2105.06, 25 Pa. Code §129.99).

c. At no time shall the permittee operate boilers no. 1 through no. 4 unless all process equipment and O_2 trim equipment are properly operated and maintained according to condition V.A.3.a below (RACT Order #265, Condition 1.2; §2105.06, 25 Pa. Code §129.99).

d. Natural gas usage in each boiler shall not exceed the maximum potential usage of 147,060 scf in any one-hour period and 644.12 MMscf in any consecutive twelve-month period. (§2103.12.h.1, §2103.12.a.2.C, 25 Pa. Code §129.99)

e. At no time shall the permittee operate the subject boilers using any fuel other than natural gas with the exception of no.2 fuel oil, which may be combusted only during combustion tuning, emergency conditions and/or natural gas curtailment (RACT Order #265, Condition 1.3; §2105.06, 25 Pa. Code §129.99).

f. Emissions from each boiler shall not exceed the following limitations in Table V-A-1 at any time: (§2101.02.c.4, §2103.12.a.2.B, §2104.03.a.2; §2104.03.b, 25 Pa. Code §129.99)

TABLE V-A-1: Emission Limitations for B001, B002, B003 & B004 (each)

POLLUTANT	Natural Gas (lb/hr)	No. 2 Fuel Oil (lb/hr)	ANNUAL EMISSION LIMIT (tons/year)[1]
Nitrogen Oxides	33.0	25.95	72.3

1) A year is defined as any consecutive 12-month period.

2. Testing Requirements:

a. The permittee shall perform NO_X emission testing on boilers no.1 through no. 4, in accordance with Site Level Condition IV.14 above, in order to demonstrate compliance with the natural gas NO_x emission limitations in conditions V.A.1.b through V.A.1.f above (§2103.12.i, §2108.02, 25 Pa. Code §129.100)

b. The permittee shall perform NO_X emission testing on boilers no.1 through no. 4 within 60 days of firing fuel oil, in order to demonstrate compliance with the fuel oil NO_X, emission limitations in condition V.A.1.f above (RACT Order #265, Condition 1.4; §2103.12.i; §2108.02, 25 Pa. Code §129.100)

c. The Department reserves the right to require additional emissions testing sufficient to assure compliance with the terms and conditions of this permit. Such testing shall be performed in accordance with Article XXI §2108.02. (§2103.12.h.1)

3. Monitoring Requirements:

a. The permittee shall continuously monitor the oxygen content of the flue gas of each boiler to within 3% of the measured value and record the oxygen content to the nearest 0.1%, to ensure the subject boilers are being operated and maintained properly and are operating under the conditions demonstrated during the most recent compliance test. (§2103.12.i and §2108.03, 25 Pa. Code §129.100)

4. Record Keeping Requirements:

a. The permittee shall keep and maintain the following data for boilers no. 1 through no. 4: (§2103.12.j; §2103.12.h.1 and RACT Order #265, Condition 1.5; §2105.06, 25 Pa. Code §129.100):

1) Fuel consumption (daily, monthly, and 12-month), type of fuel consumed and suppliers' certification of sulfur content, and heating value for each boiler;
2) Steam load, (Mlbs/day, monthly average);
3) Flue gas oxygen (hourly high, low and average, monthly average)
4) Total operating hours, (hours/day, monthly and 12-month); and
5) Records of operation, maintenance, inspection, calibration and/or replacement of combustion equipment; and
6) Stack test protocols and reports.

b. The permittee shall record all instances of non-compliance with the conditions of this permit upon occurrence along with corrective action taken to restore compliance. (§2103.12.h.1, 25 Pa. Code §129.100)

c. All records required under this section shall be maintained by the permittee for a period of five years following the date of such record. [§2103.12.j.2, 25 Pa. Code §129.100]

5. Reporting Requirements:

a. The permittee shall report the following information to the Department within thirty days of the end of each calendar half. The reports shall contain all required information for the time period of the report: (§2103.12.k.1, 25 Pa. Code §129.100)

1) Monthly and 12-month data required to be recorded by condition V.A.4.a above; and
2) Non-compliance information required to be recorded by V.A.4.b above.

b. Reporting instances of non-compliance does not relieve the permittee of the requirement to report breakdowns in accordance with Site Level Condition IV.8, if appropriate. [§2103.12.k]

6. Work Practice Standard:

The permittee shall at all times properly operate and maintain all process and emission control equipment at the facility according to good engineering practice. (25 Pa. Code §129.99)

VI. ALTERNATIVE OPERATING SCENARIOS

No alternative operating scenarios exist for this operation.

VII. EMISSIONS LIMITATIONS SUMMARY

The following table summarizes the estimated annual maximum potential emissions (which may not include fugitive) from Boilers 1, 2, 3 and 4 at Pittsburgh Allegheny County Thermal, LTD. These annual (consecutive 12 month) potential emission estimates assume that all three boilers operate continuously according to to their permit conditions.

TABLE VII-1: Boiler 1, 2, 3 and 4 Emission Limitations Summary

POLLUTANT	ANNUAL EMISSION LIMIT (tons/year)*
Nitrogen Oxides (NO_X)	**292.8**

*** A year is defined as any consecutive 12-month period.**

ALLEGHENY COUNTY HEALTH DEPARTMENT
AIR QUALITY PROGRAM

February 5, 2020

SUBJECT: **Reasonable Available Control Technology (RACT II) Determination**
Pittsburgh Allegheny County Thermal, Ltd.
120 Cecil Way
Pittsburgh, PA 15222
Allegheny County

Title V Installation Permit No. 0044-I001

TO: JoAnn Truchan, P.E.
Section Chief, Engineering

FROM: David D. Good
Air Quality Engineer

I. Executive Summary

The Pittsburgh Allegheny County Thermal, Ltd. (PACT) facility is defined as a major source of NO_X emissions and was subjected to a Reasonable Available Control Technology II (RACT II) review by the Allegheny County Health Department (ACHD) required for the 1997 and 2008 Ozone National Ambient Air Quality Standard (NAAQS). The findings of the review established that technically and financially feasible RACT would result in the following emissions changes, summarized below.

Table 1 Technically and Financially Feasible Control Options Summary for NO_X

The Permittee has elected to take operational and fuel restrictions that reduce the potential NO_X emissions from Boiler Nos. 1, 2, 3 and 4. Additional control options are not economically feasible.

II. Regulatory Basis

ACHD requested all major sources of NO_X (potential emissions of 100 tons per year or greater) and all major sources of VOC (potential emissions of 50 tons per year or greater) to reevaluate NO_X and/or VOC RACT for incorporation into Allegheny County's portion of the PA SIP. The non-exempt sources at PACT are subject to presumptive RACT requirements. The facility has requested a case-by-case evaluation Boiler Nos. 1, 2 and 3, as each boiler currently does not meet the presumptive NO_X emissions limits as per 25 Pa Code, §129.97. This document is the result of ACHD's determination of RACT for these four emission sources at PACT based on the materials submitted by the subject source and other relevant information.

III. Facility Description, Existing RACT I and Sources of NO_X

The Pittsburgh Allegheny County Thermal, LTD, Stanwix Street facility is an industrial steam generation plant located at 120 Cecil Way in the downtown section of Pittsburgh, PA, which supplies steam for heating and refrigeration to commercial and institutional sites in that area. The plant is composed of four (4) boilers, with a

common stack, which fire natural gas as their primary fuel and have the capacity to fire no. 2 fuel oil, in lieu of natural gas at times of emergency or natural gas curtailment. PACT is a major source of NO_X emissions.

On November 9th, 1998 the facility entered into a consent decree with the Department to meet RACT I obligations under RACT Order No. 265. RACT Order 265 was approved as RACT by EPA in 2001 (66 FR 52044). The RACT I requirements are listed in Table 2 below:

Table 2 RACT I Summary

Source	RACT Order 265 Condition No.	RACT I Requirement
Boiler Nos. 1, 2, 3 and 4	I.1.1	Boiler 1 NO_X: 0.22 lb/MMBtu, 126.5 TPY Boiler 2 NO_X: 0.22 lb/MMBtu, 126.5 TPY Boiler 3 NO_X: 0.22 lb/MMBtu, 126.5 TPY Boiler 4 NO_X: 0.22 lb/MMBtu, 126.5 TPY
Boiler Nos. 1, 2, 3 and 4	I.1.2	At no time shall the permittee operate boilers 1, 2, 3 and 4 unless all process equipment and O_2 trim equipment are properly operated and maintained according to good engineering practice.
Boiler Nos. 1, 2, 3 and 4	I.1.3	At no time shall the permittee operate boilers 1, 2, 3 and using any fuel other than natural gas or No. 2 fuel oil.
Boiler Nos. 1, 2, 3 and 4	I.1.4	The permittee shall conduct NO_X emission tests on Boilers 1 through 4 every 2 years.
Boiler Nos. 1, 2, 3 and 4	I.1.5	The permittee shall maintain all records including, but not limited to: A. Production data on a daily basis for each boiler: 1. Total fuel consumption and type consumed; 2. Amount of fuel usage; 3. Steam load; and 4. Total operating hours.
Boiler Nos. 1, 2, 3 and 4	I.1.6	The permittee shall maintain all appropriate records to demonstrate compliance with the requirements of both Section 2105.06 of Article XXI and this Order.

Table 3 Facility Sources Subject to Case-by-Case RACT II and Their Existing RACT I Limits

Source ID	Description	Rating	NO_X Presumptive Limit (RACT II)	NO_X Limit (RACT I) – Consent Order No. 265	Proposed Case-by-Case RACT II
B001	M21 Keystone O-type, package boiler.	150 MM Btu/hr	0.10 lb/MMBtu	0.22 lb/MMBtu; 126.5 tpy	0.22 lb/MMBtu; 72.3 tpy; 644.12 MMscf/yr
B002	M21 Keystone O-type, package boiler.	150 MM Btu/hr	0.10 lb/MMBtu	0.22 lb/MMBtu; 126.5 tpy	0.22 lb/MMBtu; 72.3 tpy; 644.12 MMscf/yr
B003	M21 Keystone O-type, package boiler.	150 MM Btu/hr	0.10 lb/MMBtu	0.22 lb/MMBtu; 126.5 tpy	0.22 lb/MMBtu; 72.3 tpy; 644.12 MMscf/yr
B004	M21 Keystone O-type, package boiler.	150 MM Btu/hr	0.10 lb/MMBtu	0.22 lb/MMBtu; 126.5 tpy	0.22 lb/MMBtu; 72.3 tpy; 644.12 MMscf/yr

IV. RACT Determination

Boilers 1, 2, 3 and 4 are not able to meet the Presumptive NO_X Requirements per 25 PA Code, §129.97 of 0.10 lb/MMBtu. A case-by-case evaluation was performed for the four boilers. The NO_X emission rates from the most recent stack test (February 2019) were 0.19, 0.19, 0.22, and 0.19 lb/MMBtu for Boilers 1, 2, 3 and 4, respectively. Since the boilers historically have not operated near full load, the permittee has elected to take operational and fuel limit restrictions that reduce the annual potential NO_X emissions from each boiler. The fuel limit restrictions accepted by the permittee include restricting natural gas consumed in Boilers 1 through 4 by 50% of the maximum boiler capacity. The new baseline NO_X PTE is 72.3 tpy for each boiler.

The Department evaluated further emission controls for NO_X emissions. Some control options were found to be not technically feasible such as SCR (flue gas temperatures well below the effective range of control), SNCR (fluctuations in temperatures) and low excess air (boilers already use oxygen trim systems). A summary of those controls that were found to be technically feasible [Low NO_X Burner (LNB) and Flue Gas Recirculation (FGR)] are in the table below:

Table 4 RACT Analysis Summary

Source ID	Baseline NO_X Emissions (tpy)	LNB (NO_X lb/MMBtu; $/ton of NOx removed)	FGR + LNB (NO_X lb/MMBtu; $/ton of NOx removed)
B001	72.3	0.10; $6,967	0.05; $5,691
B002	72.3	0.10; $6,967	0.05; $5,691
B003	72.3	0.10; $6,967	0.05; $5,691
B004	72.3	0.10; $6,967	0.05; $5,691

The new fuel limitations and annual NO_X emissions restrictions make any further control options not economically feasible. RACT II shall be the retention of the RACT I allowable emission rate of 0.22 lb/MMBTU for each boiler with the natural gas fuel restriction (50% of capacity) and annual emission limitations (72.3 tpy) proposed in Table 3 above. The permittee is already restricted to 540,035 gallons (equivalent to 500 hours at maximum capacity) of fuel oil for each boiler. The permittee shall at all times properly operate and maintain all process and emission control equipment at the facility according to good engineering practice

V. RACT Emissions Summary

The conditions listed in the table in Section VI of this document below supersede the relevant conditions of Plan Approval Order and Agreement No. 265, issued November 9th, 1998. The RACT II conditions are at least as stringent as those from RACT I. Other RACT I conditions not affected by RACT II remain in effect. Based on the findings in this RACT analysis, the facility emissions can be summarized as follows:

Table 5 RACT II NO_X Emissions Reduction Summary

NO_X Potential Emissions (tpy)		
PTE Prior to RACT II	RACT Reduction	Revised PTE
506	213.2	292.8

As shown in Table 5, the RACT II restrictions reduced 213.2 tons of potential NO_X emissions from the facility.

VI. RACT II Permit Conditions

Source ID	Description	Permit Condition 0022-I003	RACT II Regulations
Boilers 1-4	Four identical M21 Keystone O-type package boilers. 150 MMBtu/hr (each)	Condition V.A.1.b	25 PA Code §129.99
		Condition V.A.1.c	25 PA Code §129.99
		Condition V.A.1.d	25 PA Code §129.99
		Condition V.A.1.e	25 PA Code §129.99
		Condition V.A.1.f	25 PA Code §129.99
		Condition V.A.2.a	25 PA Code §129.100
		Condition V.A.2.b	25 PA Code §129.100
		Condition V.A.3.a	25 PA Code §129.100
		Condition V.A.4.a	25 PA Code §129.100
		Condition V.A.4.b	25 PA Code §129.100
		Condition V.A.4.c	25 PA Code §129.100
		Condition V.A.5.a	25 PA Code §129.100
		Condition V.A.6	25 PA Code §129.99

Allegheny County Health Department

Technical Support Document (TSD)
REASONABLY AVAILABLE CONTROL TECHNOLOGY (RACT) DETERMINATION

Source Information

Source Name:	Pittsburgh Allegheny County Thermal (PACT) – Stanwix Street facility
Source Location:	120 Cecil Way, Pittsburgh, PA 15222
Mailing Address:	120 Cecil Way, Pittsburgh, PA 15222
County:	Allegheny
NAICS Code:	22133 (Steam and Air-Conditioning Supply)
Part 70 Permit No.:	0044
Major Source:	NO_x
Permit Reviewer:	Melissa Jativa

The Allegheny County Health Department (ACHD) has performed the following Reasonably Available Control Technology (RACT) analyses for a major source of NO_x relating to steam services, located in Pittsburgh, Pennsylvania.

Background

Allegheny County was designated marginal nonattainment for the 2008 8-hour ozone on April 30, 2012 (published in 77 FR 30160, May 21, 2012). In order to implement the 2008 NAAQS for ozone, EPA issued a proposed rulemaking in June 2013 to provide steps and standards for states to develop and submit certain materials, dependent on each state's attainment status. Although Allegheny County is designated marginal nonattainment, Pennsylvania is also a part of the Ozone Transport Region (OTR), which must meet more stringent requirements, including submitting a RACT SIP for EPA approval. As such, Allegheny County must reevaluate the NO_x and VOC RACT in the existing RACT SIP for the eight-hour ozone NAAQS.

ACHD requested all major sources of NO_x (potential emissions of 100 tons per year or greater) and all major sources of VOC (potential emissions of 50 tons per year or greater) to reevaluate NO_x and/or VOC RACT for incorporation into Allegheny County's portion of the Pennsylvania State Implementation Plan (SIP). This document is the result of ACHD's review of the RACT re-evaluations submitted by the subject source and supplemented with additional information as needed by ACHD.

RACT Summary

Pittsburgh Allegheny County Thermal, LTD, Stanwix Street facility ("PACT") is a major source of NOx. The NO_x emitting emission units at the facility are four (4) boilers and RACT evaluations were conducted for these units. The following tables show the result of those evaluations.

- Table S1 shows the RACT findings and net emission reductions;
- Table S2 compares the PA proposed presumptive RACT with RACT findings; and
- Table S3 below shows conditions considered by ACHD to be RACT.

The RACT determinations are summarized in the **Table S1** below.

Table S1. NOx RACT Findings for PACT.

Unit Description	Fuel	RACT[a]	Total NOx PTE before RACT (tpy)	Total NOx PTE after RACT (tpy)
Boilers B001, B002, B003, B004 (each 150 MMBtu/hr)	Natural Gas	Annual tune-up;[b] Install LNB + FGR	126.5[c] (each)	17.3[d] (each)
	No.2 Fuel Oil			
Total:			**506 tpy**	**69 tpy[d]**
Emission Reductions				437

Where PTE=potential to emit; tpy=tons per year; LNB+FGR= Low NOx Burner and Flue Gas Recirculation.

(a) Detailed RACT requirements are provided in Table S3.
(b) Tune-ups are currently required by existing regulatory requirements i.e., Boiler Area Source Rule, 40 CFR 63, Subpart JJJJJJ. However, annual tune-ups were found to be cost-effective and are therefore included as RACT.
(c) Operating Permit Condition V.A.1.b limits NOx emissions for each boiler to 126.5 tons/yr.
(d) The technical literature shows that tune-ups reduce fuel consumption and a decrease in emissions will also be achieved, but it is difficult to predict the overall reduction in emissions that tune-ups can achieve because the pre-tune-up status is unknown.

Table S2. Comparison of PA proposed presumptive RACT and ACHD RACT findings.

Unit Description	Fuel	PA proposed presumptive RACT (lb/MMBtu)	ACHD [a] RACT (lb/MMBtu)
Boilers B001, B002, B003, and B004 (each 150 MMBtu/hr)	Natural Gas	0.10	0.030 [b]
	No.2 Fuel Oil	0.12	

(a) Detailed RACT requirements are provided in Table S3.
(b) ACHD considers meeting an emission rate of 0.030 lb/MMBtu of NOx to be considered RACT for Boilers B001, B002, B003, and B004 independent of fuel type. Achievable with the installation of LNB + FGR; detailed analysis below shows these technologies to be cost-effective.

Table S3. Conditions Considered to be RACT.

Unit Description	Current **and New** Permit Conditions
Boilers B001, B002, B003, and B004 (each 150 MMBtu/hr)	• Operate oxygen trim equipment. • Fuel oil usage limited to 1,080 gallons/hr or 540,035 gallons/yr. • Combust no. 2 fuel oil only during combustion tuning, emergency conditions, and/or natural gas curtailment. • Natural gas usage limited to 147,060 scf in any one hour period and 1,288.235 MMscf in any consecutive twelve month period. • **NEW: Install and operate LNB + FGR, NOx emissions for each boiler is limited to 0.030 lb/MMBtu and 17.3 tpy** • **NEW: Conduct tune-ups annually.**

(a) Tune-ups are currently required by existing regulatory requirements i.e., Boiler Area Source Rule, 40 CFR 63, Subpart JJJJJJ. However, annual tune-ups were found to be cost-effective and are therefore included as RACT.

RACT Evaluations

RACT is "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." (44 FR 53761, 9/17/1979)

ACHD provided the following guidance to the major sources of NO_x and VOC in Allegheny County for performing the RACT analyses:

1. The analysis shall address all reasonably possible controls of VOCs and NO_x including changes in operation and work practices.

2. All control technology that is found to be technically infeasible must be accompanied by detailed and documented reason(s) as to why the technology is not feasible. General statements about the non-applicability of control technology to your industry will not be sufficient.

3. All changes in operation and work practices that are found not to be feasible require the same documentation as the controls in step #2 above.

4. All feasible control technology, changes in operation, work practices, etc. that are found to be cost prohibitive require a cost analysis demonstrating the cost per ton of pollutant controlled.

5. The analysis shall be done according to the procedures in EPA's OAQPS Cost Manual, EPA's cost spreadsheets are recommended where applicable. The manual and spreadsheets may be found on the CATC/RBLC web page on EPA's Technology Transfer Network (TTN) at http://www.epa.gov/ttn/catc/.

6. All data used in cost estimates, such as exhaust flow rates or the amount of ductwork used need proper documentation. If vendor quotes are used in the analysis for equipment costs, they are required to be supplied. Old analyses increased for inflation will not be acceptable. VATAVUK Air Pollution Control Cost Indexes shall be used with the aforementioned cost spreadsheets.

Each RACT analysis section is organized by the following 4 steps, which incorporate the guidance elements provided by Allegheny:

Step 1 – Identify Control Options (guidance element 1)
Step 2 – Eliminate Technically Infeasible Control Options (guidance elements 2 and 3)
Step 3 – Evaluate Control Options, including costs and emission reductions (guidance elements 4, 5, and 6)
Step 4 – Select RACT (guidance element 1)

Source/Process Description

The PACT Stanwix Street facility is an industrial steam generation plant located at 120 Cecil Way in the downtown section of Pittsburgh, PA, which supplies steam for heating and refrigeration to commercial and institutional sites in that area. Emissions from the source are primarily the result of fuel combustion in four natural gas fired boilers and ancillary operations.

The NO_x emitting emission units at the plant are four (4) boilers each with a capacity of 150 MMBtu/hr. Each boiler has dual fuel capabilities and can fire either natural gas or No. 2 fuel oil. The boilers exhaust to a common stack S001.

RACT Analyses in this Document

This source is a major source of NO_x but is not a major source of VOC; therefore, only NO_x RACT analyses have been conducted and are provided in this document.

The four boilers at the source are identical in terms of design and operation; therefore, one NOx RACT analysis has been conducted for all the boilers.

ACHD has determined that it is not necessary to conduct a RACT evaluation for the fuel oil storage tanks. This decision was made based on the relatively low potential emissions from these units. These units are subject to Article XXI section 2105.12.e for existing petroleum liquid storage tanks. In 2015, ACHD determined it unlikely that additional controls would be technically and economically feasible for these units.

Therefore, this document has RACT evaluations for boilers B001, B002, B003, and B004.

RACT for NO_x – Boilers B001, B002, B003, and B004

Four (4) water-tube boilers each with a capacity of 150 MMBtu/hr has dual fuel capabilities and can fire either natural gas or No. 2 fuel oil. The boilers exhaust to a common stack S001. The units are O-type package boilers manufactured by Indeck Keystone Energy and each has a single burner.

Each boiler uses a Foxboro Oxygen Trim system. The system automatically controls fuel and air feed rates to minimize excess oxygen which reduces thermal NOx formation. Oxygen trim is considered baseline operation at PACT LTD.

Pursuant to operating permit 0044, issued March 24, 2015, condition V.A.1.b, NO_x emissions from each boiler are limited to 0.22 lb/MMBtu and 126.5 tons per year. Condition V.A.1.h, further restricts each boiler when fuel oil is burned to 0.1728 lb/MMBtu.

Fuel oil usage is restricted according to two (2) permit conditions:

- Condition V.A.1.e, usage for each boiler is limited to 1,080 gallons per hour and 540,035 gallons per year; and
- Condition V.A.1.f, at no time shall the permittee operate the subject boilers using any fuel other than natural gas with the exception of no.2 fuel oil, which may be combusted only during combustion tuning, emergency conditions and/or natural gas curtailment.

These conditions effectively restrict each boiler to 500 hours of burning fuel oil annually, assuming operation at full capacity.

Step 1 – Identify Control Options

ACHD reviewed PACT's RACT submittal for these boilers and consulted several references to ensure that all possible control options were identified. ACHD reviewed EPA's Alternative Control Techniques (ACT) document for Industrial/Commercial/Institutional (ICI) Boilers[1] and investigated additional resources to determine if any other ICI boiler controls have been demonstrated since 1994 when the ACT was published.

Information provided by PACT was valuable in determining technology feasibility and control efficiency.

Table 1 below presents the identified controls from the ACT and/or the source's RACT submittal. No additional control measure was identified for ICI boilers, except for combinations of controls listed below. These control measures have been organized into 6 groups: combustion optimization, staged combustion, additions to combustion air or fuel, low-NO_x burners, post combustion controls, and fuel switching.

Table 1. Boilers B001, B002, B003, and B004 – All NO_x Control Options

Category	Control Option	Reference (a)
Combustion Optimization	Reduced air preheat (RAP)	ACT
	Tune-up	NC State
	Low Excess Air (LEA)	ACT+PACT
Staged Combustion	Air Staging	ACT
	Fuel Staging	ACT
	Fuel Reburning	ACT
Additions To Combustion, Air or Fuel	Flue Gas Recirculation (FGR)	ACT+PACT
	Water / Steam Injection (WSI)	ACT
	Fuel Induced Recirculation (FIR)	ACT
Low-NO_x Burning	Low-NOx Burner (LNB)	ACT+PACT
Post Combustion Control	Selective Catalytic Reduction (SCR)	ACT+PACT
	Selective Non-Catalytic Reduction (SNCR)	ACT+PACT
Fuel Switching	Fuel Switching	ACT

(a) – PACT is the Pittsburgh Allegheny County Thermal RACT submittals dated February 4, 2014 and December 24, 2014; NC STATE is a Report Summarizing the Findings and Recommendations of an Evaluation of Boilers in State Operated Facilities prepared for the NC State Energy Office in 2004; and ACT is EPA's Alternative Control Techniques document for Industrial/Commercial/Institutional Boilers published in 1994.

There are additional control techniques that could potentially be used by boilers, but these are either uncommon or not commercially demonstrated for ICI. These techniques include using

[1] Alternative Control Techniques (ACT) Document – NO_x Emissions from Industrial/ Commercial/ Institutional (ICI) Boilers (EPA-453/R-94-022). http://www.epa.gov/ttncatc1/dir1/icboiler.pdf, accessed January 23, 2015.

oxygen instead of air, catalytic combustion, injection of an oxidant, non-thermal plasma, and adsorption/absorption.

Combustion Optimization

Boiler operation can be optimized to reduce NO_x emissions by modifying boiler control settings. Sources can conduct a tune-up to determine the optimal settings for operating the boiler to address NO_x emissions, as well as other factors. Alternatively, sources can specifically reduce the air preheat and/or the level of excess air to reduce NO_x.

(a) Reduced Air Preheat

Air preheat is used to increase furnace thermal efficiency. Coal-fired stoker boilers with heat input capacities greater than 100 MMBtu/hr tend to have air preheaters. Air preheat has an adverse effect on NOx emissions. The level of combustion air preheat has a direct effect on the temperatures in the combustion zone, which in turn, has a direct impact on the amount of thermal NOx formed.

Available emissions data for RAP is limited, but the data shows a reduction of preheated combustion air temperature reduced NOx by 32%.[2]

(b) Tune-ups

The operation of combustion sources can be improved through tuning the device periodically. Tune-ups are used to improve efficiency and save money, reduce combustion emissions, and to ensure safe operations. A tune-up generally involves: conducting an evaluation of existing equipment such as oxygen probes and other instrumentation, burners, dampers, tilt mechanisms, heat transfer surfaces, and actuators ; determining if equipment needs to be cleaned, repaired, or replaced; investigating levels of excess air and emissions of NOx and CO; evaluating temperatures and pressures; and inspecting for leakage and condensate. The data is analyzed and adjustments are made to determine the combination of settings that result in optimal combustion with respect to NO_x and CO emissions, opacity, efficiency, and sustainable operation of the boiler (i.e., elimination of combustion operations that excessively deteriorate the boiler).

In a study by the North Carolina State University on the effect of tune-ups on state operated boilers,[3] it was found that 1 to 5% fuel savings could be achieved. Although the effect on emissions was not reported, an emission decrease of 1 to 5% would have occurred based on the use of less fuel. However, additional NOx and CO emission reductions would be expected above those associated with efficiency improvements. It is difficult to predict the overall reduction in emissions that tune-ups can achieve because the pre-tune-up status is unknown. For these calculations, a reduction of 2% is assumed.

(c) Low Excess Air (LEA)

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[2] Alternative Control Techniques (ACT) Document – NO_x Emissions from Industrial/ Commercial/ Institutional (ICI) Boilers (EPA-453/R-94-022). http://www.epa.gov/ttncatc1/dir1/icboiler.pdf, accessed January 12, 2015.

[3] Eckerlin, Dr. Herbert M. and Eric W. Soderberg, USI Boiler Efficiency Program: A Report Summarizing the Findings and Recommendations of an Evaluation of Boilers in State Operated Facilities. Prepared for the State Energy Office, NC Department of Administration. Revised 2/25/04.

LEA, also referred to as oxygen trim, is a burner optimization strategy in which the furnace is operated at the lowest excess air level that provides efficient, reliable, safe, and complete combustion. The reduction in excess air typically reduces NO_x emissions by 10% (in natural gas-fired units), reduces the total flue gas flow, and improves heat transfer.[4] One notable advantage of this strategy is that no significant capital expenses for new or modified hardware are required.

With LEA, incomplete combustion may occur resulting in an increase in carbon content of boiler ash, a decrease in energy efficiency, a decrease in steam temperature, and a significant increase in CO emissions when the O_2 content is less than 1%. Without a strict control system, these characteristics can also lead to slagging and corrosion, opacity concerns, and fires in air preheaters and ash hoppers.

An oxygen trim system is designed to maintain LEA and continuously monitor the flue gases and adjust the burner oxygen. For example, colder air is denser and contains more oxygen than warm air. The oxygen trim system can continuously adjust to ambient and atmospheric conditions that affect oxygen/air supply.

Staged Combustion

Staged combustion relies on the reduction of the peak flame zone oxygen level to reduce formation of fuel NO_x and is achieved by delaying or staging the addition of combustion air.

(e) Air Staging

Air staging can be carried out using overfire air (OFA) or two-stage combustion. With air staged combustion, the combustion air is controlled and distributed to the combustion process to create different zones. By distributing the air and staging the combustion, the flame temperature is reduced, which reduces the NO_x created. In the first zone, the air is sparingly distributed to create an initial sub-stoichiometric, fuel rich zone. In the second zone above the first, the air is generously introduced to complete the combustion in a high excess air, low temperature zone, reducing thermal NO_x formation.

(f) Fuel Staging

Staged fuel combustion can be accomplished using burners out of service (BOOS), biasing the fuel flow to burners (a.k.a., biased firing), and fuel re-burning. These methods create different zones of fuel burning, such as fuel rich and fuel lean zones, within the furnace by shutting off fuel flow, diverting fuel from specific burners, or by controlling air and fuel injection zones. Separating the combustion zones reduces the flame temperature, thereby reducing NO_x. BOOS and biasing the fuel flow to burners cannot be conducted on boilers with only one burner because these are techniques that use multi-burners. Staged fuel combustion can achieve up to 50% NO_x reduction.

(g) Fuel Re-burn

Fuel re-burning is a staged fuel combustion technique where fuel is introduced downstream of the primary combustion chamber in a boiler to create a secondary combustion zone. However, with fuel re-burning, the NO_x formed in the primary

[4] Cleaver Brooks. Boiler Emission Guide - Reference Guide, 3rd Edition. Thomasville, GA: 2010. http://www.cleaverbrooks.com/uploadedFiles/Internet_Content/Reference_Center/Insights/Boiler%20Emissions%20Guide.pdf, accessed January 23, 2015.

combustion area is destroyed in the re-burn area. The fuel added can be any type of fuel but most experience is with natural gas. Emission reductions of 35 to 60% are possible.[5]

Additions to Combustion Air or Fuel

Boiler operation can be optimized to reduce NO_x emissions by injecting flue gases, water, steam, oxygen, or other materials into the combustion zone or the fuel. This controls the formation of NO_x by controlling the stoichiometric ratio of the chemicals that react to form NO_x. The addition of flue gas, water, or steam dilutes the combustion zone and reduces the combustion temperature, which in turn reduces the formation of thermal NO_x. The addition of oxygen (in place of air) in the combustion chamber essentially displaces the nitrogen available for NO_x formation.

(h) Flue Gas Recirculation (FGR)

FGR consists of recycling a portion of the flue gas back to the primary combustion zone. Injecting the inert flue gas in the primary combustion zone lowers the peak flame temperatures in the primary combustion zone and thereby lowers thermal NO_x formation. In addition, the flue gas lowers the oxygen concentration in the primary combustion zone and thereby lowers thermal NO_x.

Coal-fired boilers often use FGR to control the steam temperature. Flue gas is added to the boiler through the furnace hopper or above the windbox in coal boilers. This is not an effective NO_x control. The flue gas must be introduced into the windbox to affect the thermal NO_x emissions. FGR through the windbox can only affect the thermal NO_x emissions. Because coal has a significant amount of nitrogen in the fuel, much of the NO_x emissions from coal-fired boilers are from fuel NO_x; therefore, FGR is not considered an effective NO_x reduction technique for coal-fired boilers since it does not reduce fuel NO_x.

FGR reduces emissions of NO_x in a natural gas boiler by about 53 to 74%.[6]

(i) Water / Steam Injection (WSI)

While somewhat effective in oil-fired and coal-fired boilers, WSI has been utilized more effectively in natural gas fired boilers and combustion turbines.

With this technique, water or steam is injected into the primary combustion zone to reduce the formation of thermal NO_x, but not fuel NO_x, by decreasing the peak combustion temperature. More specifically, water injection decreases the peak flame temperature by diluting the combustion gas stream and acting as a heat sink by absorbing heat necessary to vaporize the water (latent heat of vaporization) and raise the vaporized water temperature to the combustion temperature. WSI reduces NO_x emissions by as much as 80% (in natural gas-fired units).[7]

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[5] Northeast States For Coordinated Air Use Management (NESCAUM), and Praveen Amar. Applicability and Feasibility of NO_x, SO_2, and PM Emissions Control Technologies for Industrial Commercial, and Institutional Boilers. November, 2008 (Revised January 2009). http://www.nescaum.org/documents/ici-boilers-20081118-final.pdf, accessed January 23, 2015.
[6] Alternative Control Techniques (ACT) Document – NO_x Emissions from Industrial/ Commercial/ Institutional (ICI) Boilers (EPA-453/R-94-022). http://www.epa.gov/ttncatc1/dir1/icboiler.pdf, accessed January 12, 2015.
[7] Cleaver Brooks. Boiler Emission Guide - Reference Guide, 3rd Edition. Thomasville, GA: 2010. http://www.cleaverbrooks.com/uploadedFiles/Internet_Content/Reference_Center/Insights/Boiler%20Emissions%20Guide.pdf, accessed January 23, 2015.

(j) Fuel Induced Recirculation (FIR)

FIR is a combustion control used in natural gas boilers. With FIR, flue gas is recirculated and mixed with the fuel. This technique cools the temperature similarly to how FGR reduces the temperature, and thermal NO_x is reduced. However, FIR also reduces prompt NO_x. Prompt NO_x is from the oxidation of compounds formed from reactions between atmospheric nitrogen and radicals formed in the combustion of fuel. For example, nitrogen monohydride, hydrogen cyanide, and other compounds can form during combustion and then be oxidized to nitric oxide.

Low-NO_x Burning

Low-NO_x burners emit less NO_x than conventional burners. They are usually designed to incorporate one of the combustion control techniques within the burner, such as staged combustion, flue gas recirculation, fuel induced recirculation, low excess air, or a combination of these techniques. In all cases, the NO_x emissions are controlled by lowering combustion zone temperatures to reduce the production of NO_x.

(k) Low-NO_x Burner (LNB)

LNB is a relative term that refers to a burner design in which the supplied fuel and air are staged across the burner. It is relative in the sense that a LNB in a furnace that is several decades old may have a NO_x emission rate of approximately 50 ppm, while a LNB on a new boiler may have a NO_x emission rate of less than 30 ppm.[8]

The staging results in fuel-lean and fuel-rich combustion zones in the furnace at the burner. In the fuel-lean zones, the combustion temperature is lowered, reducing the production of NO_x emissions. Both the temperature and oxygen concentrations are lowered in the fuel-rich zones. LNB technology is available from many manufacturers and applicable to all fuels. Retrofitting older boilers with newer LNB can be technically feasible but comes at a high capital cost. Low-NO_x burners achieve 32 to 71% reduction.[9]

Post Combustion Control

Post combustion control includes the addition of technologies that reduce NO_x emissions (as opposed to preventing NO_x generation). Generally, these technologies include the addition of a catalyst or reactant into the exhaust stream which chemically reduces the NO_x, allowing for removal from the gas stream.

(l) Selective Catalytic Reduction (SCR)

SCR controls NO_x emissions by promoting the conversion of NO_x into molecular nitrogen and water vapor using a catalyst. NH_3, usually diluted with air or steam, is injected into the exhaust upstream of a catalyst bed. On the catalyst surface, NH_3 reacts with NO_x to form molecular nitrogen and water with the following basic reaction pathways:

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[8] *Id. See 7.*

[9] Alternative Control Techniques (ACT) Document – NO_x Emissions from Industrial/ Commercial/ Institutional (ICI) Boilers (EPA-453/R-94-022). http://www.epa.gov/ttncatc1/dir1/icboiler.pdf, accessed January 12, 2015.

$$4NH3 + 4NO + O2 \rightarrow 4N2 + 6H2O$$
$$8NH3 + 6NO2 \rightarrow 7N2 + 12H2O$$

Depending on system design, NO_x removal of 70-90% can be achieved under optimum conditions.[10]

The catalyst serves to lower the activation energy of these reactions, which allows the NO_x conversions to take place at a lower temperature than the exhaust gas. The optimum temperatures can range from 350°F to 1,100°F, but NOx conversions typically are designed to occur between 600°F and 750°F, depending on the catalyst.[11] Typical SCR catalysts include metal oxides (titanium oxide and vanadium), noble metals (combinations of platinum and rhodium), zeolite (alumino-silicates), and ceramics. Water vapor and elemental nitrogen are released to the atmosphere as part of the exhaust stream.

Factors affecting SCR performance include space velocity (volume per hour of flue gas divided by the volume of the catalyst bed), ammonia/NO_x molar ratio, and catalyst bed temperature. Space velocity is a function of catalyst bed depth. Decreasing the space velocity (increasing catalyst bed depth) will improve NO_x removal efficiency by increasing residence time but will also cause an increase in catalyst bed pressure drop.

Reaction temperature is critical for proper SCR operation. Below the minimum temperature, reduction reactions will not proceed. At temperatures exceeding the optimal range, oxidation of ammonia will take place resulting in an increase in NO_x emissions.

SCR catalysts can be subject to deactivation by a number of mechanisms. Loss of catalyst activity can occur from thermal degradation, if the catalyst is exposed to excessive temperatures over a prolonged period of time. Catalyst deactivation can also occur due to chemical poisoning. Principal poisons include arsenic, sulfur, potassium, sodium, and calcium.

(m) Selective Non-Catalytic Reduction (SNCR)

Like SCR, SNCR operates by promoting the conversion of NO_x into molecular nitrogen and water vapor using urea or ammonia. However, unlike SCR, SNCR does not utilize a catalyst and therefore requires an exhaust of 1700-2000°F.[12]

Units with the above furnace exit temperatures, residence times less than 1-sec, and high levels of uncontrolled NO_x are good candidates for SNCR control. Depending on system design, NO_x removal of 30-50%.[13]

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[10] The Babcock & Wilcox Company. Steam Its Generation and Use, 40th Edition. Ed. S C Stultz and J B Kitto. Barberton, Ohio: 1992

[11] California Environmental Protection Agency - Air Resources Board, and Stephanie Kato. Report to the Legislature: Gas-Fired Power Plant NO_x Emission Controls and Related Environmental Impacts. May: 2004.

[12] Northeast States For Coordinated Air Use Management (NESCAUM), and Praveen Amar. Applicability and Feasibility of NO_x, SO_2, and PM Emissions Control Technologies for Industrial Commercial, and Institutional Boilers. November, 2008 (Revised January 2009). http://www.nescaum.org/documents/ici-boilers-20081118-final.pdf, accessed January 23, 2015.

[13] U.S. EPA. Air Pollution Control Technology Fact Sheet; Selective Non-Catalytic Reduction (EPA-452/F-03-031). 2003. http://www.epa.gov/ttncatc1/dir1/fsncr.pdf, accessed January 23, 2015.

Fuel Switching

Fuel switching reduces NO_x formation by reducing fuel NO_x. By replacing high-nitrogen fuels with low-nitrogen fuels, the overall nitrogen available for oxidation is reduced, lowering NO_x emissions.

(n) Fuel Switching

Nitrogen concentrations in fuel have a large impact on total NO_x emissions from fuel combustion in boilers. Replacing high-nitrogen fuels with low-nitrogen fuels, such as distillate oil or natural gas, can be an effective means in reducing NO_x. Low-nitrogen fuels can be used to displace a fraction of the boiler combustion fuel, or replace it entirely. Either means of reducing the use of high-nitrogen fuels can result in significant NO_x emissions.

Step 2 – Eliminate Technically Infeasible Control Options

Each control option listed in Step 1 was evaluated to determine if it was a feasible control for boilers B001, B002, B003, and B004. It was determined that tune-ups, LNB, FGR, and both LNB and FGR in combination are technically feasible for controlling NO_x emissions. These controls are economically evaluated in the next section.

A number of the control options identified are not technically feasible for controlling NO_x boilers B001, B002, B003, and B004. This section presents the rationale explaining why each control option is not, technically feasible.

(a) Reduced Air Preheat

RAP is limited to stokers equipped with combustion air preheaters.[14] Boilers B001, B002, B003, and B004 use ambient (not preheated) combustion air. Therefore, RAP is removed from further consideration.

(b) Tune-ups

Boilers B001, B002, B003, and B004 are already being tuned every 5 years pursuant to 40 CFR Part 63 Subpart JJJJJJ (National Emission Standards for Hazardous Air Pollutants for Area Sources: Industrial, Commercial, and Institutional Boilers). However, an economic analysis was conducted for annual tune-ups since this was a technically feasible control option.

(c) LEA

Boilers B001, B002, B003, and B004 are operated in low excess air. Therefore, LEA is removed from further consideration.

(c) Air Staging / Fuel Staging

The ICI ACT states that staged burner flame lengths tend to be longer than those of conventional burners. There is the possibility that flame impingement can occur on the furnace walls, resulting in tube failure and corrosion. Additionally,

[14] Alternative Control Techniques (ACT) Document – NO_x Emissions from Industrial/ Commercial/ Institutional (ICI) Boilers (EPA-453/R-94-022). http://www.epa.gov/ttncatc1/dir1/icboiler.pdf, accessed January 23, 2015.

staged burners are often wider and longer than conventional burners, requiring significant modifications to existing water-walls and windboxes.[15]

Boilers B001, B002, B003, and B004 are packaged units with small combustion zones. Therefore, air staging and fuel staging are considered technically infeasible for controlling NO_x emissions.

(d) Fuel Re-burn

Reburning has been chiefly developed and applied in coal-fired boilers. Typically natural gas is introduced downstream of the primary combustion chamber to create a secondary combustion zone. Natural gas is an attractive re-burn fuel because it is nitrogen-free.

Boilers B001, B002, B003, and B004 are primarily natural gas fired. Therefore fuel re-burn is considered technically infeasible for controlling NO_x emissions.

(e) WSI

WSI can control NO_x, but it has severe operational drawbacks, namely: reduced thermal efficiency, reduced steam production, and increased equipment corrosion. For these reasons, WSI has been primarily used on gas turbines where the reduction in thermal efficiency is much less than on a steam boiler. Therefore, WSI is considered technically infeasible for controlling NO_x emissions.

(f) FIR

EPA's RBLC (RACT-BACT-LAER Clearinghouse) shows only a single industrial sized natural gas fired boiler equipped with an FIR for NO_x control over the last 10 years. [16] Therefore, FIR is removed from further consideration.

(g) SNCR

The success of SNCR at reducing NOx is dependent upon maintaining a constant temperature zone within the boiler where a reducing agent can be injected and a sufficient residence time is allowed for reaction (residence times on the order of 1 to 2 seconds are typically considered sufficient). The appropriate SNCR temperature window is approximately 1600 to 2000°F.

The PACT boilers are small water-tube units in which the heat from the fuel combustion is quickly removed from the combustion by-products. Quick temperature reduction not only requires the precise placement of the reagent injection nozzles, but it does not leave enough residence time for the reduction reaction, resulting in significant ammonia slip.

Residence times on the order of 1 to 2 seconds are required for effective SNCR, while residence times in the PACT boilers are an order of magnitude below these. Additionally, SNCR has been effectively applied mainly in constant load boilers where the location and residence time of the appropriate temperature window is fixed. The PACT boilers are highly variable systems in which the load is constantly changing to meet steam demand. This variability combined with its

[15] *Id. See 14.*

[16] The following RBLC Codes were included in the search: 12.310 (Fuel Combustion; Industrial-Size Boilers/Furnaces size 100-250 MMBtu/hr; Natural Gas) and 13.310 (Fuel Combustion; Industrial-Size Boilers/Furnaces <100 and MMBtu/hr; Natural Gas.

inadequate residence time at the appropriate temperature renders this NOx control approach technologically infeasible. Therefore, SNCR is considered technically infeasible for controlling NO_x emissions.

(h) SCR

PACT indicates that it has insufficient floor space in the building and no space available outside for the SCR catalyst bed; the bed must be located in an accessible area for periodic catalyst change-out. General arrangement drawings and photos of the boiler plant were reviewed by ACHD. Therefore, SCR is considered technically infeasible for controlling NO_x emissions.

(i) Fuel Switching

If Boilers B001, B002, B003, and B004 burned coal or residual oil, there would be an opportunity to reduce fuel-bound nitrogen. No. 2 fuel oil and natural gas are low-nitrogen fuels.[17] Therefore, fuel switching is removed from further consideration.

Step 3 - Evaluate Control Options

Emissions and Emission Reductions

Boilers B001, B002, B003, and B004 each have a potential to emit (PTE) 126.5 tons/yr NO_x and are limited to 0.22 lb/MMBtu.[18] Compliance test data, collected in February of 2013 showed that emissions when natural gas was fired were on average 0.189 lb/MMBtu.

The technically feasible control options with their estimated control efficiency are outlined in **Table 2** below.

Table 2. Boilers B001, B002, B003, and B004 – NO_x Technically Feasible Control Options

Control Type	Estimated NO_x [(a)] Control Efficiency	NO_x Emission Reductions (tons/yr)	Controlled NO_x Emissions (lb/MMBtu)
Tune-up[(b)]	2.0%	2.9	0.220
FGR	60%	75.9	0.088
LNB	77%	97.8	0.050
LNB + FGR	86%	109	0.030

(a) Percent reductions are calculated from the technical literature.
(b) Annual tune-ups for Boilers B001, B002, B003, and B004. Percent reduction are for fuel usage; therefore, the emissions on a lb/MMBtu basis do not change.

Control efficiencies were derived from RBLC emissions limits for gas fired ICI boilers and are consistent with the control efficiency ranges in the references cited in Step 1.

[17] Alternative Control Techniques (ACT) Document – NO_x Emissions from Industrial/ Commercial/ Institutional (ICI) Boilers (EPA-453/R-94-022). http://www.epa.gov/ttncatc1/dir1/icboiler.pdf, accessed January 23, 2015.
[18] Pursuant to operating permit 0044, issued March 24, 2015, condition V.A.1.b, NOx emissions from each boiler is limited to 0.22 lb/MMBtu and 126.5 tons per year.

Economic Analysis

Using information provided by PACT and collected by ACHD, a thorough economic analysis of the technically feasible control options for Boilers B001, B002, B003, and B004 was conducted - see Appendix A for more information. The analysis estimates the total costs associated with the NO_x control equipment, including the total capital investment of the various components intrinsic to the complete system, the estimated annual operating costs, and the indirect annual costs. All costs, except for direct installation costs, were calculated using the methodology described in Section 6, Chapter 1 of the "EPA Air Pollution Control Cost Manual, Sixth Edition" (document # EPA 452-02-001). Direct capital cost is based on a vendor quote. Annualized costs are based on an interest rate of 7%, an equipment life of 15 years.

The basis of cost-effectiveness, used to evaluate the control option, is the ratio of the annualized cost to the amount of NO_x (tons) removed per year. A summary of the cost determined in the analysis is provided in **Table 3** below.

Table 3. Boilers B001, B002, B003, and B004 – Economic Analysis of NO_x Technically Feasible Control Options

Option	Total Capital Investment ($)	Total Annualized Cost ($/yr)	Potential NO_x Removal from Add-on Control (ton/yr)	Cost Effectiveness ($/ton NO_x removed)
Tune-up[(a)]	6,500	2,000	2.9	700
FGR	463,000	319,000	75.9	4,200
LNB	1,000,000	245,000	97.8	2,500
LNB + FGR	1,265,000	493,000	109.3	4,000

(a) Tune-up costs are $6,500 in initial set-up costs per turbine, annualized over fifteen years and an ongoing annual tune-up cost of $1,300 per year.

Step 4 – Select RACT

Based on the costs shown in **Table 3**, all control options are cost-effective.

The NOx RACT was determined to be: 1) installation of LNB + FGR, 2) compliance with a new NO_x limit emission of 0.030 lb/MMBtu that is achievable with LNB + FGR, and 3) an annual tune-up pursuant to the provisions of §2105.06.d.2, which requires that the tune-up include, at a minimum:

- Inspection, adjustment, cleaning, or replacement of fuel-burning equipment, including the burners and moving parts necessary for proper operation as specified by the manufacturer;
- Inspection of the flame pattern or characteristics and adjustments necessary to minimize total emissions of NOx, and to the extent practicable minimize emissions of CO; and
- Inspection of the air-to-fuel ratio control system and adjustments necessary to ensure proper calibration and operation as specified by the manufacturer.

Additionally, the following records must be maintained for each adjustment conducted in the annual tune-up:

- The date of the adjustment procedure;
- The name of the service company and technicians;
- The operating rate or load after adjustment;
- The CO and NOx emission rates before and after adjustment;
- The excess oxygen rate after adjustment; and
- Other information required by the applicable operating permit.

The source may petition ACHD to reduce the frequency of the tune-ups to biennially, if there is not a significant change in the NOx and CO emission rate between subsequent years following a tune-up.

ACHD reviewed the EPA's RBLC determinations for oil fired boilers. **Table 4** provides the RBLC findings, which show that the RACT emission limits are consistent with limits in the RBLC for the same control technologies. Specifically ACHD reviewed the most recent 5-years of boilers listed under the following RBLC Codes:

- 11.220 Utility and Large Industrial Size Boilers/Furnaces >250 MMBtu/hr; Distillate Oil,
- 11.310 Utility and Large Industrial Size Boilers/Furnaces >250 MMBtu/hr; Natural Gas,
- 12.220 Industrial Size Boilers/Furnaces between 100-250 MMBtu/hr; Distillate Oil,
- 12.310 Industrial Size Boilers/Furnaces between 100-250 MMBtu/hr; Natural Gas,
- 13.220 Commercial/Institutional Size Boiler/Furnaces <100 MMBtu/hr; Distillate Oil, and
- 13.310 Commercial/Institutional Size Boiler/Furnaces <100 MMBtu/hr; Natural Gas.

Table 4. EPA's RBLC Findings

Source	RBLC ID	Date of Permit Issuance	NO_x Limit (lb/MMBtu)	NO_x Control
12.310 – Gas Kraton Polymers US LLC [249 MMBtu/hr]	OH-0354	1/15/13	**0.120 [Oil]** 0.100 [Gas]	LNB
13.220 – Oil US DOE – Hanford [191 MMBtu/hr]	WA-0349	4/4/13	**0.090 [Oil]**	LNB
13.220 – Oil Wolverine Power [72.4 MMBtu/hr]	MI-0400	6/29/11	**0.023 [Oil]**	LNB
12.310 – Gas International Station Power Plant **(Primary Fuel: Diesel)** [12.5 MMBtu/hr]	AK-0073	12/20/10	0.032 [Gas]	LNB+FGR
13.31 – Gas Carty Plant [91 MMBtu/hr]	OR-0048	12/29/2010	0.0495	LNB
13.31 – Gas Woodbridge Energy Center [91.6 MMBtu/hr]	NJ-0079	7/25/2012	0.0100	LNB
12.31 – Gas Cronus Chemicals, LLC [104 MMBtu/hr]	IL-0114	9/5/2014	0.0800	LNB
12.31 – Gas Pinecrest Energy Center [150 MMBtu/hr]	TX-0641	11/12/2013	0.0190 (3% O_2)	LNB
12.31 – Gas Lake Charles Chemical Complex - Lab Unit [170 MMBtu/hr]	LA-0244	11/29/2010	0.1158 (hrly max.)	LNB
12.31 – Gas Karn Weadock Generating Complex [220 MMBtu/hr]	MI-0389	12/29/2009	0.0180 (30-Day Rolling)	LNB
12.31 – Gas Kraton Polymers U.S. LLC [249 MMBtu/hr]	OH-0354	1/15/2013	0.1200 0.12 burn dist)	LNB
13.31 – Gas Suwannee Mill [46 MMBtu/hr]	FL-0335	9/5/2012	0.0360	LNB+FGR
11.31 – Gas Georgia Pacific Breton, LLC [425 MMBtu/hr]	AL-0271	6/11/2014	0.0200	LNB+FGR
13.31 – Gas St.Joseph Energy Center,LLC [80 MMBtu/hr]	IN-0158	12/3/2012	0.0320 (3 hours)	LNB+FGR
11.31 – Gas Iowa Fertilizer Company [472.4 MMBtu/hr]	IA-0105	10/26/2012	0.0125 (30 day rolling avg.)	LNB+FGR
11.31 – Gas Green River Soda Ash Plant [254 MMBtu/hr]	WY-0074	11/18/2013	0.0110 (30 day rolling)	LNB+FGR
13.31 – Gas Thetford Generating Station [100 MMBtu/hr]	MI-0410	7/25/2013	0.0500	LNB+FGR
13.31 – Gas Oregon Clean Energy Center	OH-0352	6/18/2013	0.0200	LNB+FGR

Source	RBLC ID	Date of Permit Issuance	NO_x Limit (lb/MMBtu)	NO_x Control
[99 MMBtu/hr]				
13.31 – Gas Hess Newark Energy Center [589 MMBtu/hr]	NJ-0080	11/1/2012	0.0500	LNB+FGR
13.31 – Gas Holland Board Of Public Works - East 5Th Street [95 MMBtu/hr]	MI-0412	12/4/2013	0.0500	LNB+FGR+ GCP
12.31 – Gas Ammonia Production Facility [217.5 MMBtu/hr]	LA-0272	3/27/2013	0.0500 (annual avg.)	LNB+FGR+ GCP
13.31 – Gas Holland Board Of Public Works - East 5Th Street [55 MMBtu/hr]	MI-0412	12/4/2013	0.0500	LNB+GCP
Current Operating Permit Limit	-	2009	**0.1728 [Oil]** 0.220 [Gas]	-
Stack Test – February 2013	-	2013	0.189 [Gas]	-

Where GCP=Good Combustion Practices; LNB=Low NOx Burner; and FGR=Flue Gas Recirculation.

February 4, 2014

Allegheny County Health Department
Air Quality Program
301 39th Street, Building #7
Pittsburgh, PA 15201-1811

Attn: Carl Dettlinger, Document Manager

Subject: Pittsburgh Allegheny County Thermal (PACT)
Reasonably Available Control Technology Evaluation

Dear Mr. Dettlinger,

The December 6, 2013 letter from the ACHD requested our preparation and submittal of a Reasonably Available Control Technology (RACT) Evaluation for PACT.

For the preparation of this RACT Evaluation, we followed the outline described in your letter. We trust that the enclosed RACT Evaluation fully satisfies your request. Please advise if any further information is required.

Sincerely,

Ray Lion
Plant Manager

Attachment

cc: Project File 41028-0000

Reasonably Available Control Technology (RACT) Plan

Pittsburgh Allegheny County Thermal, Ltd. (PACT)
Stanwix Plant

Prepared for:

Allegheny County Health Department
Air Quality Program

February 1, 2014

SLAI Project 41028-0000

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Table 3: FGR

1.0 INTRODUCTION

Pittsburgh Allegheny County Thermal, Ltd. (PACT), with support from the Pittsburgh Operations office of SNC-Lavalin America, Inc. (SLAI), has prepared this Reasonably Available Control Technology (RACT) Plan to comply with the requirements of a letter dated December 6, 2013 from Sandra Etzel (ACHD) to PACT. The letter requires PACT to re-evaluate the previously-submitted (2006) RACT Plan within 60 days from December 6, 2013.

1.1 Applicant Information

Pittsburgh Allegheny County Thermal, Ltd. (PACT) is the designated applicant for RACT plan approval. The employee to whom all questions and correspondence concerning this proposal should be addressed is:

Mr. Ray Lion
Plant Manager
PACT Stanwix Plant
Law and Finance Building, Suite 806
429 Fourth Avenue
Pittsburgh, PA 15219

1.2 Organization of the RACT Proposal

This RACT proposal contains the following sections:

- Section 2.0 summarizes the ACHD requirements for a RACT Plan which reference procedures from the United States Environmental Protection Agency (USEPA) for performing RACT cost evaluations.
- Section 3.0 describes the emission sources and presents the annual potential and actual pollutant emissions at the PACT facility.
- Section 4.0 contains a background discussion of NOx formation mechanisms.
- Section 5.0 introduces available NOx control technologies, and a technological feasibility analysis is performed to determine if any of the technologies may be eliminated from further consideration.
- Section 6.0 presents an economic feasibility analysis on the remaining control technologies using a "top-down" format. That is, the remaining technology with the highest overall control efficiency is evaluated first, and only if that technology is eliminated, is the next lower technology considered.
- In Section 7.0, the RACT Plan for the PACT Stanwix Plant is presented.

2.0 ACHD RACT REQUIREMENTS

The preparation of this RACT Plan is to satisfy requirements outlined in a December 6, 2013 letter from the ACHD to PACT.

In specific, the ACHD letter requires that the RACT Plan meet these requirements (listed verbatim from the ACHD letter):

1. The analysis shall address all reasonably possible controls of NOx including changes in operation and work practices.

2. All control technology that is found to be technically infeasible must be accompanied by detailed documented reason(s) as to why the technology is not feasible. General statements about the non-applicability of control technology to your industry will not be sufficient.

3. All changes in operation and work practices that are found not feasible require the same documentation as the controls in step #2 above.

4. All feasible control technology, changes in operation, work practices, etc that are found to be cost prohibitive require a cost analysis demonstrating the cost per ton of pollutant controlled.

5. The analysis shall be done according to the procedures in EPA's OAQPS Cost Manual. EPA's cost spreadsheets are recommended where applicable. [Note: EPA's website advises that the Vatavuk Air Pollution Control Cost Indices and the COST-AIR Air Pollution Control Cost Spreadsheets are no longer supported by EPA.]

6. All data used in cost estimates, such as exhaust flow rates or the amount of ductwork used need proper documentation. If vendor quotes are used in the analysis for equipment costs, they are required to be supplied. Old analyses increased for inflation will not be acceptable. VATAVUK Air Pollution Control Cost Indexes shall be used with the aforementioned cost spreadsheets. [Please see note under Item 5 above.]

2.1 RACT Evaluation Procedures

General procedures for performing a RACT evaluation can be found in several USEPA guidance documents. Two key criteria that must be satisfied in the determination of RACT are: (1) technological feasibility and (2) economic feasibility. The following approach, which follows the general USEPA guidance, was used to evaluate RACT for PACT's Stanwix Plant.

2.1.1 Technological Feasibility

The following procedure was used to determine technological feasibility:

- Determine baseline NOx emission rate for each source. The baseline emissions rates were determined prior to consideration of process or operating changes or equipment purchase. Baseline actual emission rates for this analysis were assumed to be the average actual annual NOx emissions for the previous two full years (2011 and 2012).

- Identify available NOx emission reduction and control options. The available NOx control measures may include operational improvements and/or add-on pollution control devices. Information from trade literature, regulatory guidance, and equipment vendors was used to establish the range of available NOx controls.

- Review performance data for the available control measures. Available performance data may be examined to identify potentially achievable NOx control efficiencies.

- Eliminate technologically infeasible control measures. Only those control measures deemed technologically feasible were further evaluated for economic feasibility. The technologically feasible control measures were ranked in a top-down fashion (i.e., in order of overall control effectiveness for NOx emissions).

2.1.2 Economic Feasibility

The following procedure was used for determining economic feasibility:

- Develop capital and annualized costs. Capital and annualized costs were estimated for each technologically feasible control measure. USEPA cost estimating procedures were used as required by ACHD. Total and net annualized costs are total annualized costs net of the value of any fuel savings (or additional fuel costs) resulting from more (or less) efficient combustion.

- Compare cost impacts. The economic impact analysis compares the capital and annualized costs and the relative cost effectiveness to compute the cost per ton of NOx emission reduction of implementing (i.e., purchasing, installing, and operating) any available and technologically feasible control measures.

The emission reduction is calculated as the current NOx RACT emissions rate minus any revised NOx RACT emissions rate.

3.0 PACT EMISSION SOURCES AND BASELINE EMISSIONS

A summary of the emission of NOx at the PACT facility is presented in this section. VOC emissions at PACT are minimal and therefore are not addressed in this RACT re-evaluation.

3.1 Emission Sources

The PACT Stanwix Plant consists of four (4) Zurn Keystone 21-M boilers each rated at 150 MMBtu/hr fuel input, 125,000 lb/hr steam output, and capable of firing either natural gas or No. 2 Fuel Oil. Due to the higher radiant heat release rate of oil combustion, the 125,000 lb/hr can be supplied at an oil firing rate of 144 MMBtu/hr. The boilers are single-burner, package, water-tube O-type boilers which use ambient (not preheated) combustion air. Energy recovery from the flue gas is accomplished through an economizer (boiler water pre-heater).

These boilers are used to supply steam to public and private buildings in Pittsburgh's downtown area, and are operated with one unit always being fired on stand-by status, so that steam demands can be met if one unit goes down. This operating strategy typically translates to only two boilers operating during the summer months, and 3 or 4 units operating during the winter months. Due to the seasonal nature of the steam demand, the annual capacity factor of all four boilers as a single unit is rather low, typically less than 20%.

3.2 Baseline NOx Emissions

For this report, quantification of emissions is based on using the maximum permitted limit for the boilers, 0.22 lb/MM Btu. This limit is consistent with the USEPA document entitled "Alternative Control Techniques Document – NOx emissions from Industrial / Commercial / Institutional (ICI) Boilers" (EPA-453 R-94-022). This document details NOx emission rates from boilers of various designs firing different types of fuels, including natural gas, oil, coal, wood, and municipal solid waste. The ACT document addresses the impact of boiler type (water tube vs. fire tube and packaged vs. field erected) and use of air preheat on NOx emission rate. This additional detail allows the average emission factors presented in the ACT document to more closely reflect actual emissions.

Table 3.1 – Potential and Baseline (Actual) NOx Emissions from the PACT Boilers

	Potential NOx Emissions		Baseline (Actual) NOx		
	Oil Firing	Gas Firing	2011	2012	Average
Rated Heat Input (MMBtu/hr)	144	150	144/150	144/150	---
NOx Emission Factor (lb/MM Btu)	0.22	0.22	---	---	---
Boiler Emissions (lb/boiler/hr)	32	33	---	---	---
Boiler Emissions (ton/boiler/yr)	139	145	---	---	---
Facility Emissions (ton/yr)	556	580	88.6	81.4	85.0

4.0 NOx FORMATION MECHANISMS

Nitrogen oxides (NOx) are formed as a result of combustion processes. Predominantly, nitric oxide (NO) is formed, with lesser amounts of nitrogen dioxide (NO_2). However, once emitted into the atmosphere, NO eventually converts to NO_2; thus NO and NO_2 are collectively known as NOx. Three formation mechanisms are responsible for production of NOx emissions, namely "thermal", "fuel", and "prompt".

4.1 Thermal NOx

Thermal NOx is produced by the oxidation of nitrogen contained in the combustion air supply. Ambient air contains 70% nitrogen by volume. The chemistry associated with production of thermal NOx is relatively well-understood, at least under fuel-lean conditions. The controlling chemical reactions are referred to as the Zeldovich mechanisms and include the following reactions:

$$O_2 + M \rightarrow O + O + M \quad (1)$$

$$N_2 + O \rightarrow NO + N \quad (2)$$

$$N + O_2 \rightarrow NO + O \quad (3)$$

Reaction (1) is the dissociation of oxygen into two oxygen atoms. Oxygen atoms are a necessary reactant for the second reaction step. Reaction (2) is the rate-controlling step, whereby an oxygen atom reacts with molecular nitrogen to form a nitric oxide molecule and another nitrogen atom. The remaining nitrogen atom from step (2) is free to react with other oxidizers (e.g. O_2) to from another nitric oxide molecule as shown in reaction (3) above. Most of the NOx formed from combustion of natural gas and high grade fuel oil (e.g., distillate oil and naphtha) is attributable to thermal NOx. Because of the exponential dependence of reaction rate on temperature, the control of thermal NOx is best achieved by reducing peak combustion temperature.

4.2 Fuel NOx

The second source of NOx emissions, called fuel NOx, exists when the fuel being burned contains nitrogen within its molecular structure, or as a contaminant. Fuel NOx is typically controlled by switching to a lower nitrogen content fuel, or by post-NOx production flue gas treatment techniques. Clean fuels such as natural gas or distillate oil typically contain negligible amounts of chemically-bound nitrogen and thus the contribution of fuel NOx to overall NOx emissions is minimal.

4.3 Prompt NOx

Prompt NOx is so termed because of its early formation in the flame zone where the fuel and air first react, at temperatures too low to produce thermal NOx. C_2 and CH radicals present in hydrocarbon flames are believed to be the primary sources of prompt NOx because they react with atmospheric nitrogen to form precursors such as HCN and NH_3, which are rapidly oxidized to NO. Prompt NOx is generally minor compared to the overall quantity of NOx generated from combustion, and therefore, the control of prompt NOx is not typically targeted because of prompt NOx's minor contribution to total NOx.

5.0 NOx CONTROL TECHNOLOGIES

NOx control technologies being implemented by industry are typically broken down into two categories, combustion modifications and flue gas treatment technologies. Table 6.3 in the ICI Boiler ACT document assigns a default control efficiency to each of the discussed NOx control techniques. These control efficiencies will be used as the basis of ranking the control techniques in order of control effectiveness.

5.1 Combustion Modification

The control of NOx from natural gas and distillate oil combustion focuses primarily on thermal NOx due to the low nitrogen content of these fuels. In order to achieve NOx suppression, control methods utilize combustion staging or reduction of peak flame temperature. Combustion modification control techniques theoretically applicable to the PACT boilers are: Oxygen Trim (OT); use of Low NOx burners (LNBs); Flue Gas Recirculation (FGR); and combinations of these techniques.

5.1.1 Oxygen Trim (OT)

Typically, the simplest boiler operational adjustments rely on the reduction of excess oxygen used in combustion. Thermal NOx can be reduced to some extent by minimizing this excess oxygen, often referred to as burner tuning / oxygen trim. Test results show that NOx emissions can be reduced when the stack excess oxygen concentration is lowered to 2 to 3 percent, measured in the flue gas on a dry basis. The actual amount of NOx reduced by decreasing excess air varies significantly based on fuel and burner conditions. These reductions are due mainly to lower oxygen concentration in the flame, where NOx formation is highest. The effect of lower oxygen concentration on NOx is partially offset by some increase in thermal NOx because of higher peak temperature with lower gas volume.

5.1.2 Low NOx Burners (LNB)

The most common type of LNBs achieve lower NOx emissions by staging the injection of either air or fuel in the near burner region. Thus this type of LNB is classified as either a staged air burner or a staged fuel burner. As the name implies, the staged air burner gradually introduces the combustion air to the fuel at various points along the flame front. These regions are typically referred to as the primary, secondary, and tertiary (staged) air zones. The division of combustion air reduces the oxygen concentration in the primary burner combustion zone, lowering the amount of NO formed and increasing the amount of NO reducing agents formed in an oxygen deficient combustion zone. Secondary and tertiary air complete the combustion downstream of the primary zone, lowering the peak temperature and reducing thermal NOx formation. Besides the basic staged air burner described, there are variations on staged air burners which incorporate internal recirculation of combustion products to aid in NOx reduction.

The retrofit of LNBs usually involves removing the original burner and bolting the LNB in. Most boiler LNBs are designed as self-contained units to allow easy bolt-on retrofit without boiler tube wall modifications. However, due to the staging effect of staged air burners, flame lengths tend to be longer than those of conventional burners. This is of particular concern for packaged units (like those at PACT) because there is the possibility that flame impingement will occur on the furnace walls, resulting in tube failure and corrosion. Additionally, staged air burners are often wider and longer than conventional burners, requiring significant modifications to existing windboxes, and the higher pressure drop of most LNBs require the installation of a higher horsepower combustion air fan. Burner size may also be an important factor when assessing the feasibility of retrofitting boilers located in restricted spaces. The effectiveness of LNB at reducing the formation of thermal NOx has been established by the ACT document to be 50% control.

5.1.3 Flue Gas Recirculation (FGR)

FGR involves recycling a portion of the combustion gases from the stack to the boiler windbox. These low oxygen combustion products, when mixed with combustion air, lower the overall excess oxygen concentration and act as a heat sink to lower the peak flame temperature and the residence time at peak flame temperature. These effects result in reduced thermal NOx formation. However, there is little effect on fuel NOx emissions. The amount of NOx reduction achievable depends primarily on the fuel nitrogen content and amount of FGR used.

When compared to the number of Low NOx burners (LNB), the number of watertube boilers equipped only with FGR is relatively small. In general, for retrofit cases to existing packaged watertube boilers, FGR is rarely applied without the installation of new LNB's as well. This is because the performance of many older burner systems tend to be adversely affected when an inert such as flue gas is injected into the combustion zone. In order to retrofit a boiler with FGR, the major additional equipment needed are a gas recirculation fan and ducting. Table 6.3 of the ACT document assigns a 40% NOx reduction efficiency to FGR alone.

5.2 Flue Gas Treatment Technologies

Unlike combustion modifications, flue gas treatment technologies are not concerned with the prevention of NOx emissions by preventing their initial formation. Instead, these technologies are focused on the elimination of NOx after it is formed in the combustion process. This is accomplished by chemically reducing NOx to harmless nitrogen gas in a gas phase reaction via Selective Non-Catalytic Reduction (SNCR) or catalytically via Selective Catalytic Reduction (SCR).

5.2.1 Selective Non-Catalytic Reduction (SNCR)

SNCR involves the injection of ammonia (NH_3) or urea (NH_2CONH_2) in a temperature window of the boiler where NOx removal occurs by the selective reduction of NO by NH_2 radicals to form water and nitrogen. The reaction for the SNCR process must occur at elevated temperatures, typically between 1,600 and 2,000°F because the reduction proceeds in the gas phase, without the aid of a catalyst. SNCR is particularly effective when the mixing of injected reagent and flue gas is maximized and the residence time of the gas within the reaction temperature is also maximized. These favorable conditions are often encountered in retrofit applications of SNCR on fluid bed combustor (FBC) boilers, but rarely apply to conventional boilers.

Generally, similar NOx reduction efficiencies were obtained whether ammonia or urea was used. For ammonia injection, NOx reduction ranged from 50 to 80 percent, depending on fuel type. For urea-based systems, most reported NOx reduction efficiencies also fell within this range, although some were as low as 25 percent and as high as 88 percent. Experience with SNCR on smaller capacity boilers is minimal. Low-load operation and frequent load changes on such boilers pose additional complexities on the retrofit of SNCR for these boilers.

Achievable NOx reductions for an individual boiler depend on the flue gas temperature, the residence time at that temperature, the initial NOx concentration, the NH_3/NOx ratio, the excess oxygen level, and the degree of ammonia/flue gas mixing. Also, stratification of both temperature and NOx in the flue gas can affect the performance of the SNCR control. The optimum placement of SNCR injectors requires a detailed mapping of the temperature profile in the convective passes of the boiler, because of the narrow temperature window.

The feasibility of retrofitting an existing boiler with SNCR often hinges on the ability to accommodate injection nozzles at a location where flue gas temperatures and residence time are optimum for the reaction to take place. Smaller units, especially packaged watertube and firetube boilers, have limited space and access for the injection nozzles.

The newer SNCR technology for flue gas treatment NOx control utilizes urea as a reagent rather than ammonia. One urea-based SNCR process, known by the trade name of NOxOUT®, is offered by Nalco Fuel Tech, Inc., and its licensees. In the NOxOUT process, an aqueous solution containing urea and chemical enhancers is injected into the furnace or boiler at one or more locations, depending on the boiler type and size. The urea reacts with NOx in the flue gas to produce nitrogen, carbon dioxide, and water. The main advantage of urea injection over ammonia injection is that urea is a nontoxic liquid that can be safely stored and handled. Table 6.3 of the ACT document applies an average NOx reduction efficiency of 55% of the SNCR.

The application of SNCR to the PACT boilers will be eliminated from further consideration based on a number of technological factors. The success of SNCR at reducing NOx is highly dependent upon maintaining a constant temperature zone within the boiler where a reducing agent can be injected, and a sufficient residence time is allowed for reaction (residence times on the order of 1 to 2 seconds are typically considered sufficient).

The PACT boilers are smaller watertube units in which the heat from the fuel combustion is quickly removed from the combustion by-products. The radiant and convective tubes within the boiler housing are very effective at reducing the temperature of the off-gas. The boiler design sheets list the temperature of the gases exiting the furnace of the boiler at between 2100 and 2500°F, and the temperature of the gases leaving the boiler at 400 to 500°F (recall that SNCR is only effective between 2000 and 1600°F). This quick temperature reduction not only would require the precise placement of the reagent injection nozzles, but would also not leave enough residence time for the reduction reaction, resulting in significant ammonia slip. Residence times on the order of 1 to 2 seconds are required for effective SNCR, while residence times in the PACT boilers are approximately an order of magnitude below these. Additionally, SNCR has been effectively applied mainly in constant load boilers where the location and residence time of the appropriate temperature window is fixed. The PACT boilers are highly variable systems in which the load is constantly changing to meet the steam demand. This variability combined with its inadequate residence time at the appropriate temperature renders this NOx control approach technologically infeasible.

5.2.2 Selective Catalytic Reduction (SCR)

The SCR process uses the same chemistry to remove NOx as SNCR, but takes advantage of the lower temperature required for reaction in the presence of a catalytic surface. Catalysts come in various shapes and sizes, according to the particular application. Gaseous ammonia is injected with a carrier gas, typically steam or compressed air, into the flue gas upstream of the catalyst. The ammonia/flue gas mixture enters the catalyst, where it is distributed through the catalytic bed. The flue gas then leaves the catalytic reactor and continues to the exit stack or air preheater. SCR technology is capable of achieving similar NOx reductions as Thermal DeNOx SNCR using a much smaller amount of ammonia, due to the positive effects of the lower reaction temperature and the selective catalyst. Because of this, ammonia slip tends to be less with SCR than SNCR.

SCR operates most efficiently at temperatures between 575 and 800°F and when the flue gas is relatively free of particulate matter, which tends to contaminate or "poison" the catalytic surfaces. In some cases reheating of the flue gas is needed to meet temperature requirements, impacting the cost of the system. To avoid reheat requirements,

some manufacturers are currently developing or have already developed special low-temperature catalysts which can be used at temperatures as low as 400°F, although with lower efficiency than at higher temperatures. Catalysts lose their effectiveness over time due to contamination or clogging of catalyst pores; they must be replaced periodically. On large boilers, it has been reported that catalyst replacement may be necessary every 1 to 5 years, depending on the application and the level of contaminants in the fuel.

The retrofit of SCR to an existing boiler requires far more extensive modifications than does SNCR, as the SCR reactor must be placed in the existing flue gas path where the temperature is sufficiently high for efficient NOx control. This is in addition to the required installation of reagent injectors and storage and control equipment. It is for these reasons that SCR will be eliminated from further consideration as a technologically available control for the PACT boilers. The PACT Stanwix plant has essentially no free floor space in the building and no space available outside for the catalyst bed. Since the bed must be located in an accessible area for periodic catalyst change-out, SCR cannot be accommodated at the existing facility.

5.3 Control Effectiveness Summary

Table 5.1 lists the technologies which have been found to be technologically feasible in order of control effectiveness. The control effectiveness listed in Table 5.1 is that which is expected for combustion of oil, the fuel which produces the highest NOx potential emissions at PACT, as measured on a lb/MMBtu basis.

Table 5.1 – Ranking of Control Technology Effectiveness

Technology	Control Effectiveness
LNB & FGR	55%
LNB	50%
FGR	40%
Oxygen Trim	Baseline

6.0 ECONOMIC FEASIBILITY ANALYSIS

The remaining NOx control technologies were analyzed for economic feasibility in a "top-down" fashion. That is, the most effective control technology was evaluated first. The next most effective approach was only considered if the more effective control option had been eliminated from consideration. This analysis continued until a control approach cannot be eliminated, or no control options remained.

The costing methodology used in this study is based primarily on the U.S. EPA's OAQPS Control Cost Manual. Costs of retrofit NOx controls can be divided into two major cost categories, capital investment costs and annual operations and maintenance (O&M) costs. Capital costs are the total investment necessary to purchase, construct, and make operational a control system. O&M costs are the total annual costs necessary to operate and maintain the control system, above what was required to operate the pre-retrofit boiler without additional NOx control. The detailed calculations of the cost-effectiveness determinations cited in this section are presented in the attached Tables 1, 2 and 3.

Because of the wide disparity between maximum potential NOx emissions and total annual actual NOx emissions, the costs for NOx control retrofits were also calculated on the basis of estimated actual NOx reductions. For these analyses, the 2011/2012 actual NOx emissions were used as the baseline. NOx control effectiveness percentages were assumed to be the same as used for the potential reduction calculations: FGR/LNB combination 55%; LNB alone 50%; FGR alone 40%. Capital and operating costs were kept constant.

6.1 Low NOx Burner and Flue Gas Recirculation

The boiler manufacturer (Alborg-Keystone; now, Indeck) was contacted to prepare a budgetary cost estimate to supply a low NOx burner in conjunction with an induced flue gas recirculation system for each boiler. The retrofit of a LNB and/or an FGR system to an existing boiler is not a simple operation. Possible problems of concern to PACT are the loss of boiler steam output (boiler derating), flame impingement on the furnace walls, automation of the oil gun, and adequate power and developed pressure of the combustion air fans.

The estimate from Indeck gives an equipment cost of over $500,000 (per boiler) for a LNB-FGR control system. A significant part of this cost is for new 300 hp FD fans. These fans are required for both the recirculation of the flue gas and to drive the combustion air and flue gas through the new LNB's. Standard burner designs typically force air through a windbox and out of air registers which surround the burner. LNBs of the staged air variety, which are the most common, incorporate two or three air registers. These multiple registers create a fuel-rich zone near the burner and sequentially add more air to this zone to complete combustion. This multiple register approach greatly increases the pressure drop across the windbox and burner which the fan must overcome. Additionally, more developed pressure is required for the fan to recirculate up to 20% of the flue gas into the combustion air and force this flue gas through the burner. Currently, the PACT boilers have 125 hp fan motors. Indeck has determined that these fans and motors are undersized for the quoted LNB-FGR control equipment, and have determined that a new 300 hp fan would be required for each boiler.

In addition to the standard QAQPS calculations for total capital expenditure, annual operating costs when utilizing this control technology include the cost of electricity to run the 300 hp vs. the current 125 hp fan motors, and the 10-20% fuel penalty incurred when LNB-FGR controls are used due to boiler inefficiencies and consequent derating of the boilers.

The calculated cost effectiveness, which is presented in Table 1, is based on the ACT document control efficiency of 55%. The cost-effectiveness for the LNB-FGR combination is well in excess of a "reasonable" cost of $2,400/ton, therefore LNB/FGR will be eliminated from further consideration. The $2,400/ton cost threshold is based on escalating the $1,500/ton threshold established in the "original" round of RACT analyses in the mid-1990's by the increase in the Consumer Price Index over the period of 1994-2013, (approximately 60%). Cost effectiveness based on actual emissions from PACT would be substantially higher than the potential-based calculation.

6.2. Low NOx Burner

The use of Low-NOx burners alone (without FGR) suffers from some of the same high capital and annual costs associated with the LNB-FGR combination discussed in Section 6.1 (see Table 2). The increased annual costs of operating the 300 hp fans and derating the boilers were again included. This resulted in a calculated cost effectiveness based on a control efficiency of 50%. As this cost is also well in excess of the $2,400/ton "reasonable" cost, low-NOx burners will be eliminated from further consideration as an economically available technology. Again, the actual-based amount is considerably higher than the potential-based figure.

6.3 Flue Gas Recirculation

A cost effectiveness calculation was also prepared for the use of FGR alone in the PACT boilers. Based on Indeck's analysis and confirmed by another firm that also concluded the need for adding a new fan, the existing FD fans are undersized for an acceptable FGR rate. The annualized capital equipment costs for the new fans and FGR ductwork were added to the increased annual operating costs of the new fans and the annual cost of the fuel penalty associated with FGR to obtain the potential-based cost effectiveness for FGR (Table 3). This calculated cost effectiveness was again in excess of the calculated "reasonable" cost of $2,400/ton, and again, the actual-based calculation is even higher.

6.4 Burner Tuning / Oxygen Trim

PACT has installed an upgraded control system for the boilerhouse. This control system, manufactured by Foxboro, automatically controls fuel and air feed rates, to establish a stack oxygen concentration of 2 to 3%. This control system controls NOx by reducing the amount of excess oxygen in the flue gas stream. Proper tuning and maintenance of the burners and the reduction of excess air is now considered baseline operation at PACT.

7.0 RACT PLAN

PACT proposes that continued operation of the Foxboro Oxygen Trim system is RACT for each of its 4 boilers. This control technology not only reduces NOx emissions, but also results in a reduction in the production of other pollutants due to increased boiler efficiency. The following current permit conditions apply to the PACT boilers and are hereby proposed as RACT for PACT:

1) The boilers are not operated without employing good combustion control, including oxygen trim.

2) NOx emissions from all boilers will not exceed 0.22 lb/MMBtu.

3) Source testing will be performed every 2 years in accordance with the provisions of ♣ 2108.02 of Article XXI of the Allegheny County Health Department Rules and Regulations

Table 1

1/29/2014

OAQPS Cost Control Calculations
PACT Boilers

Boiler Type:	Packaged Watertube
Boiler Capacity (MMBtu/hr):	144
Fuel Type:	No. 2 Fuel Oil
Control Method:	**LNB with FGR**

1	**Direct Capital Costs (DCC)**		
	a. Equipment Cost (EC) for LNB, FGR Duct and new 300 HP Fan/Motor =	$515,000	PER BOILER
	b. Instrumentation = 10% of EC =	$51,500	
	c. Sales Tax = 3% of EC =	$15,450	
	d. Freight = 5% of EC =	$25,750	
	e. Purchased Equipment Costs (PEC) =	$607,700	
	f. Direct Installation Cost = 75% of PEC =	$455,775	
	g. Site Preparation Cost =	$0	
	h. Buildings =	$0	
	DCC = PEC + Installation + Site Prep + Buildings	$1,063,475	
2	**Indirect Capital Costs (ICC)**		
	a. Engineering = 10% of PEC =	$60,770	
	b. Construction and Field Expenses = 10% of PEC =	$60,770	
	c. Construction Fee = 10% of PEC =	$60,770	
	d. Startup = 2% of PEC =	$12,154	
	e. Performance Test = 1% of PEC =	$6,077	
	Total ICC =	$200,541	
3	**Contingency**		
	Contingency = 20% of (ICC + DCC)	$252,803	
4	**Total Capital Investment (TCI)**		
	TCI = DCC + ICC + Contingency =	$1,516,819	
5	**Direct Annual (O&M) Costs (DAC) =**		
	a. Maintenance Labor (semi-annual inspection) =	$2,000	
	b. Electricity @ $0.085/kW-hr (300 hp vs 125 hp fan motor)	$107,965	
	c. Fuel @ $10 / MMBtu (10% efficiency penalty for FGR-LNB Combo)	$1,261,440	
	d. Other	$0	
	Total DAC =	$1,371,405	
6	**Indirect Annual (O&M) Costs (IAC) =**		
	a. Overhead = 60% of total labor and maint. materials=	$1,200	
	b. Administrative = 2% of TCI =	$30,336	
	c. Property Tax = 1% of TCI =	$15,168	
	d. Insurance = 1% of TCI =	$15,168	
	Total IAC =	$61,873	
7	**Total Direct and Indirect Annual O&M Costs = DAC + IAC = (O&M) =**	$1,433,278	
8	**Capital Recovery Annual Costs**		
	a. Capital Recovery Period (years) =	10	
	b. Annual Interest Rate =	7%	
	c. Capital Recovery Factor = (CRF) =	0.1424	
	Annualized Capital Investment Cost (ACIC) = CRF * TCI =	$215,961	
9	**Total Annualized Cost (TAC) = ACIC + O&M =**	$1,649,239	
10	**NOx Removal**		
	a. Baseline NOx Emission Rate (lb/MMBtu) =	0.22	
	b. Controlled NOx Emission Rate (lb/MMBtu) =	0.10	
	c. Control Efficiency =	55%	
	d. Maximum Fuel Firing Rate per Boiler (MMBtu/hr) =	144	
	e. NOx Removed per boiler per year (ton/yr) = (Operating at Max. Firing Rate for 8,760 hrs/yr)	75.69	POTENTIAL-BASED
	f. Actual annual ave NOx emissions per boiler (TPY, 2011-2012)=	21.30	
	g. NOx Removed per boiler per year (ton/yr) based on actuals=	11.62	ACTUAL-BASED
11	**Cost Effectiveness ($/ton NOx Removed) = TAC / NOx Removal =**	$21,790	POTENTIAL-BASED
		$141,953	ACTUAL-BASED

Table 2

1/29/2014

OAQPS Cost Control Calculations
PACT Boilers

Boiler Type:	Packaged Watertube
Boiler Capacity (MMBtu/hr):	144
Fuel Type:	No. 2 Fuel Oil
Control Method:	**LNB**

1	**Direct Capital Costs (DCC)**		
a.	Equipment Cost (EC) for 1 LNB and a new 300 HP Fan and Motor =	$463,000	PER BOILER
b.	Instrumentation = 10% of EC =	$46,300	
c.	Sales Tax = 3% of EC =	$13,890	
d.	Freight = 5% of EC =	$23,150	
e.	Purchased Equipment Costs (PEC) =	$546,340	
f.	Direct Installation Cost = 50% of PEC =	$273,170	
g.	Site Preparation Cost =	$0	
h	Buildings =	$0	
	DCC = PEC + Installation + Site Prep + Buildings	$819,510	
2	**Indirect Capital Costs (ICC)**		
a.	Engineering = 10% of PEC =	$54,634	
b.	Construction and Field Expenses = 10% of PEC =	$54,634	
c.	Construction Fee = 10% of PEC =	$54,634	
d.	Startup = 2% of PEC =	$10,927	
e.	Performance Test = 1% of PEC =	$5,463	
	Total ICC =	$180,292	
3	**Contingency**		
	Contingency = 20% of (ICC + DCC)	$199,960	
4	**Total Capital Investment (TCI)**		
	TCI = DCC + ICC + Contingency =	$1,199,763	
5	**Direct Annual (O&M) Costs (DAC) =**		
a.	Maintenance Labor (semi-annual inspection) =	$2,000	
b.	Electricity @ $0.085/kW-hr (300 hp vs 125 hp fan motor)	$107,965	
c.	Fuel @ $10.00 / MMBtu (5% derate)	$630,720	
d.	Other	$0	
	Total DAC =	$740,685	
6	**Indirect Annual (O&M) Costs (IAC) =**		
a.	Overhead = 60% of total labor and maint. materials=	$1,200	
b.	Administrative = 2% of TCI =	$23,995	
c.	Property Tax = 1% of TCI =	$11,998	
d.	Insurance = 1% of TCI =	$11,998	
	Total IAC =	$49,191	
7	**Total Direct and Indirect Annual O&M Costs = DAC + IAC = (O&M) =**	$789,875	
8	**Capital Recovery Annual Costs**		
a.	Capital Recovery Period (years) =	10	
b.	Annual Interest Rate =	7%	
c.	Capital Recovery Factor = (CRF) =	0.1424	
	Annualized Capital Investment Cost (ACIC) = CRF * TCI =	$170,819	
9	**Total Annualized Cost (TAC) = ACIC + O&M =**	$960,695	
10	**NOx Removal**		
a.	Baseline NOx Emission Rate (lb/MMBtu) =	0.22	
b.	Controlled NOx Emission Rate (lb/MMBtu) =	0.11	
c.	Control Efficiency =	50%	
d.	Maximum Fuel Firing Rate per Boiler (MMBtu/hr) =	144	
e.	NOx Removed per boiler per year (ton/yr) = (Operating at Max. Firing Rate for 8,760 hrs/yr)	69.38	POTENTIAL-BASED
f.	Actual annual ave NOx emissions per boiler (TPY, 2011-2012)=	21.30	
g.	NOx Removed per boiler per year (ton/yr) based on actuals=	10.65	ACTUAL-BASED
11	**Cost Effectiveness ($/ton NOx Removed) = TAC / NOx Removal =**	$13,847	POTENTIAL-BASED
		$90,206	ACTUAL-BASED

Table 3

OAQPS Cost Control Calculations 1/29/2014
PACT Boilers

Boiler Type:	Packaged Watertube
Boiler Capacity (MMBtu/hr):	144
Fuel Type:	No. 2 Fuel Oil
Control Method:	**FGR**

1	**Direct Capital Costs (DCC)**		
	a. Equipment Cost (EC) for FGR Duct and new 300 HP Fan and Motor =	$189,000	PER BOILER
	b. Instrumentation = 10% of EC =	$18,900	
	c. Sales Tax = 3% of EC =	$5,670	
	d. Freight = 5% of EC =	$9,450	
	e. Purchased Equipment Costs (PEC) =	$223,020	
	f. Direct Installation Cost = 75% of PEC =	$167,265	
	g. Site Preparation Cost =	$0	
	h. Buildings =	$0	
	DCC = PEC + Installation + Site Prep + Buildings	$390,285	
2	**Indirect Capital Costs (ICC)**		
	a. Engineering = 10% of PEC =	$22,302	
	b. Construction and Field Expenses = 10% of PEC =	$22,302	
	c. Construction Fee = 10% of PEC =	$22,302	
	d. Startup = 2% of PEC =	$4,460	
	e. Performance Test = 1% of PEC =	$2,230	
	Total ICC =	$73,597	
3	**Contingency**		
	Contingency = 20% of (ICC + DCC)	$92,776	
4	**Total Capital Investment (TCI)**		
	TCI = DCC + ICC + Contingency =	$556,658	
5	**Direct Annual (O&M) Costs (DAC) =**		
	a. Maintenance Labor (semi-annual inspection) =	$2,000	
	b. Electricity @ $0.085/kW-hr (300 hp vs 125 hp fan motor)	$107,965	
	c. Fuel @ $10.00 / MMBtu (5% Efficiency Penalty for FGR)	$1,261,440	
	d. Other	$0	
	Total DAC =	$1,371,405	
6	**Indirect Annual (O&M) Costs (IAC) =**		
	a. Overhead = 60% of total labor and maint. materials=	$1,200	
	b. Administrative = 2% of TCI =	$11,133	
	c. Property Tax = 1% of TCI =	$5,567	
	d. Insurance = 1% of TCI =	$5,567	
	Total IAC =	$23,466	
7	**Total Direct and Indirect Annual O&M Costs = DAC + IAC = (O&M) =**	$1,394,871	
8	**Capital Recovery Annual Costs**		
	a. Capital Recovery Period (years) =	10	
	b. Annual Interest Rate =	7%	
	c. Capital Recovery Factor = (CRF) =	0.1424	
	Annualized Capital Investment Cost (ACIC) = CRF * TCI =	$79,256	
9	**Total Annualized Cost (TAC) = ACIC + O&M =**	$1,474,127	
10	**NOx Removal**		
	a. Baseline NOx Emission Rate (lb/MMBtu) =	0.22	
	b. Controlled NOx Emission Rate (lb/MMBtu) =	0.13	
	c. Control Efficiency =	40%	
	d. Maximum Fuel Firing Rate per Boiler (MMBtu/hr) =	144	
	e. NOx Removed per boiler per year (ton/yr) = (Operating at Max. Firing Rate for 8,760 hrs/yr)	55.50	POTENTIAL-BASED
	f. Actual annual ave NOx emissions per boiler (TPY, 2011-2012)=	21.30	
	g. NOx Removed per boiler per year (ton/yr) based on actuals=	8.52	ACTUAL-BASED
11	**Cost Effectiveness ($/ton NOx Removed) = TAC / NOx Removal =**	$26,559	POTENTIAL-BASED
		$173,020	ACTUAL-BASED

ALLEGHENY COUNTY HEALTH DEPARTMENT

IN RE:	Pittsburgh Allegheny County Thermal, Ltd. Law and Finance Building Suite 806, 429 Fourth Avenue Pittsburgh, PA 15219	)**PLAN APPROVAL ORDER**) **AND AGREEMENT NO. 265**) **UPON CONSENT**

AND NOW, this 9th day of November 1998,

WHEREAS, the Allegheny County Health Department, (hereafter referred to as "Department"), has determined that the Pittsburgh Allegheny County Thermal, Ltd., (hereafter referred to as "PACT"), Law and Finance Building, Suite 806, 429 Fourth Avenue, Pittsburgh, Allegheny County, PA 15219, as the operator and the owner of its steam generation facility, Stanwix Street Plant, Pittsburgh, Allegheny County, PA 15219, (hereafter referred to as "the facility"), is a major stationary source of "oxides of nitrogen" emissions (hereafter referred to as "NO_x") as defined of Section 2101.20 of Article XXI, Rules and Regulations of the Allegheny County Health Department, Air Pollution Control, (hereafter referred to as "Article XXI"), and

WHEREAS, the Department has determined that Section 2105.06.a. of Article XXI, entitled "Major Source of NO_x" is applicable to PACT'S operations; and

WHEREAS, PACT promptly submitted to the Department all documents required of Section 2105.06.b of Article XXI (hereafter referred to as "the proposal"); and

WHEREAS, after a review of the submitted proposal, the Department has determined it to be complete; and

WHEREAS, the Department has further determined, after review of the submitted proposal, that it constitutes Reasonably Available Control Technology (hereafter referred to as "RACT") for control of NO_x emissions from PACT; and

WHEREAS, the parties have agreed that the most appropriate vehicle for both memorializing the submitted proposal and approving the submitted proposal by the Department for the purpose of submission of the same to the U.S. Environmental Protection Agency (hereafter referred to as "US EPA") as a revision to the Commonwealth of Pennsylvania State Implementation Plan, (hereafter referred to as, "SIP") is a Plan Approval Order and Agreement Upon Consent; and

WHEREAS, the Department and PACT desire to memorialize the details of the submitted proposal by entry of an Plan Approval Order and Agreement Upon Consent; and

WHEREAS, pursuant to Section 2109.03 of Article XXI, the Director of the Allegheny County Health Department or his designated representative may take action in order to aid in the enforcement of the provisions this Article; and

NOW, THEREFORE, this first day above written, the Department, pursuant of Section 2109.03 of Article XXI, and upon agreement of the parties as hereinafter set forth, hereby issues this Plan Approval Order and Agreement upon Consent:

I. ORDER

1.1. At no time shall PACT allow emissions from the facility to exceed the following limitations:

Boiler No.	NO_x lbs/mmBTU	TPY
1	0.22	126.5
2	0.22	126.5
3	0.22	126.5
4	0.22	126.5

A year shall be defined as any twelve consecutive months.

1.2. At no time shall PACT operate boilers no.1, no. 2, no. 3 and no. 4 unless all process equipment and O_2 trim equipment are properly operated and maintained according to good engineering practice.

1.3. At no time shall PACT operate boilers no. 1, no. 2, no. 3 and no. 4 using any fuel other than natural gas or No. 2 fuel oil.

1.4. The facility shall perform NO_x emission testing on boilers no. 1 through no. 4, every 2 years in order to demonstrate compliance with the emission limitations referenced in paragraph 1.1 above. Such testing shall be conducted in accordance with all applicable US EPA approved test methods and Section 2108.02 of Article XXI. Initial NO_x emission testing shall be conducted prior to March 1, 1999.

1.5. PACT shall maintain all appropriate records to demonstrate compliance with both the requirements of Section 2105.06 of Article XXI and this Order. Such records shall provide sufficient data and calculations to demonstrate that all requirements of Section 2105.06 of Article XXI and this Order are being met. Such records shall include, but not be limited to, the following:

A. production data on a daily basis for each boiler:

1. total fuel consumption and type consumed;
2. amount of fuel usage, (mmBTU/day and/or gallon(s)/day);
3. steam load, (mlbs/day); and
4. total operating hours, (hours/day) and hours/year).

1.6. PACT shall retain all records required by both Section 2105.06 of Article XXI and this Order for the facility for at least two (2) years and shall make the same available to the Department upon request.

II. AGREEMENT

The foregoing Order shall be enforced in accordance with and is subject to the following agreement of the parties, to wit:

2.1. The contents of this Order shall be submitted to The US EPA as a revision to the Commonwealth of Pennsylvania's SIP.

2.2. Failure to comply with any portion of this Order or Agreement is a violation of Article XXI that may subject PACT to criminal and civil proceedings, including injunctive relief, by the Department.

2.3. This Order does not, in any way, preclude, limit or otherwise affect any other remedies available to the Department for violations of this Order or of Article XXI, including, but not limited to, actions to require the installation of additional pollution control equipment and the implementation of additional corrective operating practices.

2.4. PACT hereby consents to the foregoing Order and hereby knowingly waives all rights to appeal said Order, and the undersigned represents that he is authorized to consent to the Order and to enter into this Agreement on behalf of PACT.

2.5. PACT acknowledges and understands that the purpose of this Agreement is to establish RACT for the control of emissions of NO_x from this facility. PACT further acknowledges and understands the possibility that the US EPA may decide to not accept the Agreement portion of this Order and Agreement by Consent as a revision to the Commonwealth of Pennsylvania's SIP.

IN WITNESS WHEREOF, and intending to be legally bound, the parties hereby consent to all of the terms and conditions of the foregoing Order and Agreement as of the date of the above written.

PITTSBURGH ALLEGHENY COUNTY THERMAL, LTD.

By: Robert S. Wilson

(signature)

Print or type Name: ROBERT S. WILSON

Title: PRESIDENT

Date: 10/29/98

ALLEGHENY COUNTY HEALTH DEPARTMENT

By: Bruce W Dixon 4/9/98

Bruce W. Dixon, M.D., Director
Allegheny County Health Department

and By: _____

Sandra L. Etzel, Chief Engineer Air Quality
Allegheny County Health Department

ALLEGHENY COUNTY HEALTH DEPARTMENT

AIR QUALITY PROGRAM
301 39th Street, Bldg. #7
Pittsburgh, PA 15201-1811

Minor Source/Minor Modification INSTALLATION PERMIT

Issued To: **Pittsburgh Allegheny Co. Thermal, LTD**

ACHD Permit#: 0044-I001

Date of Issuance: March 25, 2020

Expiration Date: (See Section III.12)

Issued By:
JoAnn Truchan, P.E.
Section Chief, Engineering

Prepared By:
David D. Good
Air Quality Engineer

TABLE OF CONTENTS

AMENDMENTS:

DATE SECTION(S)

I. CONTACT INFORMATION

Facility Location:
Pittsburgh Allegheny Co. Thermal, LTD
120 Cecil Way
Pittsburgh, PA 15222

Permittee/Owner:
Pittsburgh Allegheny Co. Thermal, LTD
120 Cecil Way
Pittsburgh, PA 15222

Responsible Official: **Jerome E. Griger**
Title: Plant/System Manager
Company: Pittsburgh Allegheny Co. Thermal, LTD
Address: 120 Cecil Way
Pittsburgh, PA 15222
Telephone Number: 412-642-2796
Fax Number: 412-642-4204
E-mail Address: **Jerome.griger@pacthermal.com**

Facility Contact: **Jerome E. Griger**
Title: Plant/System Manager
Telephone Number: 412-642-2796
Fax Number: 412-642-4204
E-mail Address: **Jerome.griger@pacthermal.com**

AGENCY ADDRESSES:

ACHD Engineer: **Hafeez Ajenifuja**
Title: Air Quality Engineer
Telephone Number: 412-578-8132
Fax Number: 412-578-8144
E-mail Address: Hafeez.Ajenifuja@alleghenycounty.us

ACHD Contact:
Chief Engineer
Allegheny County Health Department
Air Quality Program
301 39th Street, Building #7
Pittsburgh, PA 15201-1891

EPA Contact:
Enforcement Programs Section (3AP12)
USEPA Region III
1650 Arch Street
Philadelphia, PA 19103-2029

II. FACILITY DESCRIPTION

FACILITY DESCRIPTION

The Pittsburgh Allegheny County Thermal, LTD, Stanwix Street facility is an industrial steam generation plant located at 120 Cecil Way in the downtown section of Pittsburgh, PA, which supplies steam for heating and refrigeration to commercial and institutional sites in that area. The plant is composed of four boilers, with a common stack, which fire natural gas as their primary fuel and have the capacity to fire no. 2 fuel oil, in lieu of natural gas at times of emergency or natural gas curtailment. The facility is a major source of nitrogen oxides (NO_X) and carbon monoxide emissions (CO), a minor source of particulate matter (PM), particulate matter < 10 microns in diameter (PM-10), sulfur dioxide (SO_2), volatile organic compounds (VOCs) and hazardous air pollutants (HAPs) as defined in section 2101.20 of Article XXI.

INSTALLATION DESCRIPTION

This installation permit is for inclusion of physical and operational conditions for subject facilities pursuant to Reasonable Available Control Technology (RACT) in section 2105.06 of Article XXI. There are no new units being added to the facility as part of this permitting action.

The emission units regulated by this permit are summarized in Table II-1:

TABLE II-1: Emission Unit Identification

I.D.	SOURCE DESCRIPTION	CONTROL DEVICE(S)	MAXIMUM CAPACITY	FUEL/RAW MATERIAL
B001	M21 Keystone O-type, package boiler	None	150 MMBtu/hr	Natural gas, fuel oil
B002	M21 Keystone O-type, package boiler	None	150 MMBtu/hr	Natural gas, fuel oil
B003	M21 Keystone O-type, package boiler	None	150 MMBtu/hr	Natural gas, fuel oil
B004	M21 Keystone O-type, package boiler	None	150 MMBtu/hr	Natural gas, fuel oil

DECLARATION OF POLICY

Pollution prevention is recognized as the preferred strategy (over pollution control) for reducing risk to air resources. Accordingly, pollution prevention measures should be integrated into air pollution control programs wherever possible, and the adoption by sources of cost-effective compliance strategies, incorporating pollution prevention, is encouraged. The Department will give expedited consideration to any permit modification request based on pollution prevention principles.

The permittee is subject to the terms and conditions set forth below. These terms and conditions constitute provisions of *Allegheny County Health Department Rules and Regulations, Article XXI Air Pollution Control*. The subject equipment has been conditionally approved for operation. The equipment shall be operated in conformity with the plans, specifications, conditions, and instructions which are part of your application, and may be periodically inspected for compliance by the Department. In the event that the terms and conditions of this permit or the applicable provisions of Article XXI conflict with the application for this permit, these terms and conditions and the applicable provisions of Article XXI shall prevail. Additionally, nothing in this permit relieves the permittee from the obligation to comply with all applicable Federal, State and Local laws and regulations.

III. GENERAL CONDITIONS

1. Prohibition of Air Pollution (§2101.11)

It shall be a violation of this permit to fail to comply with, or to cause or assist in the violation of, any requirement of this permit, or any order or permit issued pursuant to authority granted by Article XXI. The permittee shall not willfully, negligently, or through the failure to provide and operate necessary control equipment or to take necessary precautions, operate any source of air contaminants in such manner that emissions from such source:

a. Exceed the amounts permitted by this permit or by any order or permit issued pursuant to Article XXI;
b. Cause an exceedance of the ambient air quality standards established by Article XXI §2101.10; or
c. May reasonably be anticipated to endanger the public health, safety, or welfare.

2. Nuisances (§2101.13)

Any violation of any requirement of this Permit shall constitute a nuisance.

3. Definitions (§2101.20)

a. Except as specifically provided in this permit, terms used retain the meaning accorded them under the applicable provisions and requirements of Article XXI or the applicable federal or state regulation. Whenever used in this permit, or in any action taken pursuant to this permit, the words and phrases shall have the meanings stated, unless the context clearly indicates otherwise.

b. Unless specified otherwise in this permit or in the applicable regulation, the term "*year*" shall mean any twelve (12) consecutive months.

4. Certification (§2102.01)

Any report or compliance certification submitted under this permit shall contain written certification by a responsible official as to truth, accuracy, and completeness. This certification and any other certification required under this permit shall be signed by a responsible official of the source, and shall state that, based on information and belief formed after reasonable inquiry, the statements and information in the document are true, accurate, and complete.

5. Operation and Maintenance (§2105.03)

All air pollution control equipment required by this permit or Article XXI, and all equivalent compliance techniques that have been approved by the Department, shall be properly installed, maintained, and operated consistent with good air pollution control practice.

6. Conditions (§2102.03.c)

It shall be a violation of this permit giving rise to the remedies provided by Article XXI §2109.02, for any person to fail to comply with any terms or conditions set forth in this permit.

7. Transfers (§2102.03.e)

This permit shall not be transferable from one person to another, except in accordance with Article XXI §2102.03.e and in cases of change-in-ownership which are documented to the satisfaction of the Department, and shall be valid only for the specific sources and equipment for which this permit was issued. The transfer of permits in the case of change-in-ownership may be made consistent with the administrative permit amendment procedure of Article XXI §2103.14.b.

8. Effect (§2102.03.g)

Issuance of this permit shall not in any manner relieve any person of the duty to fully comply with the requirements of Article XXI or any other provision of law, nor shall it in any manner preclude or affect the right of the Department to initiate any enforcement action whatsoever for violations of Article XXI or this Permit, whether occurring before or after the issuance of such permit. Further, the issuance of this permit shall not be a defense to any nuisance action, nor shall such permit be construed as a certificate of compliance with the requirements of Article XXI or this Permit.

9. General Requirements (§2102.04.a)

It shall be a violation of this Permit giving rise to the remedies set forth in Article XXI §2109 for any person to install, modify, replace, reconstruct, or reactivate any source or air pollution control equipment to which this Permit applies unless either:

a. The Department has first issued an Installation Permit for such source or equipment; or

b. Such action is solely a reactivation of a source with a current Operating Permit, which is approved under §2103.13 of Article XXI.

10. Conditions (§2102.04.e)

Further, the initiation of installation, modification, replacement, reconstruction, or reactivation under this

Installation Permit and any reactivation plan shall be deemed acceptance by the source of all terms and conditions specified by the Department in this permit and plan.

11. Revocation (§2102.04.f)

a. The Department may, at any time, revoke this Installation Permit if it finds that:
   1) Any statement made in the permit application is not true, or that material information has not been disclosed in the application;
   2) The source is not being installed, modified, replaced, reconstructed, or reactivated in the manner indicated by this permit or applicable reactivation plan;
   3) Air contaminants will not be controlled to the degree indicated by this permit;
   4) Any term or condition of this permit has not been complied with;
   5) The Department has been denied lawful access to the premises or records, charts, instruments and the like as authorized by this Permit; or

b. Prior to the date on which construction of the proposed source has commenced the Department may, revoke this Installation Permit if a significantly better air pollution control technology has become available for such source, a more stringent regulation applicable to such source has been adopted, or any other change has occurred which requires a more stringent degree of control of air contaminants.

12. Term (§2102.04.g)

This Installation Permit shall expire in 18 months if construction has not commenced within such period or shall expire 18 months after such construction has been suspended, if construction is not resumed within such period. In any event, this Installation Permit shall expire upon completion of construction, except that this Installation Permit shall authorize temporary operation to facilitate shakedown of sources and air cleaning devices, to permit operations pending issuance of a related subsequent Operating Permit, or to permit the evaluation of the air contamination aspects of the source. Such temporary operation period shall be valid for a limited time, not to exceed 180 days, but may be extended for additional limited periods, each not to exceed 120 days, except that no temporary operation shall be authorized or extended which may circumvent the requirements of this Permit.

13. Annual Installation Permit Administrative Fee (§2102.10.c & e)

No later than 30 days after the date of issuance of this Installation Permit and on or before the last day of the month in which this permit was issued in each year thereafter, during the term of this permit until a subsequent corresponding Operating Permit or amended Operating Permit is properly applied for, the owner or operator of such source shall pay to the Department, in addition to all other applicable emission and administration fees, an Annual Installation Permit Administration Fee in an amount of $750.

14. Severability Requirement (§2103.12.l)

The provisions of this permit are severable, and if any provision of this permit is determined to by a court of competent jurisdiction to be invalid or unenforceable, such a determination will not affect the remaining provisions of this permit.

15. Reporting Requirements (§2103.12.k)

a. The permittee shall submit reports of any required monitoring at least every six (6) months. All

instances of deviations from permit requirements must be clearly identified in such reports. All required reports must be certified by the Responsible Official.

b. Prompt reporting of deviations from permit requirements is required, including those attributable to upset conditions as defined in this permit and Article XXI §2108.01.c, the probable cause of such deviations, and any corrective actions or preventive measures taken.

c. All reports submitted to the Department shall comply with the certification requirements of General Condition III.4 above.

d. Semiannual reports required by this permit shall be submitted to the Department within 30 days of the end of the calendar half.

e. Quarterly reports required by this permit shall be submitted to the Department within 30 days of the end of the calendar quarter.

f. Reports may be emailed to the Department at aqreports@achd.net in lieu of mailing a hard copy.

16. Minor Installation Permit Modifications (§2102.10.d)

Modifications to this Installation Permit may be applied for but only upon submission of an application with a fee in the amount of $300 and where:

a. No reassessment of any control technology determination is required; and
b. No reassessment of any ambient air quality impact is required.

17. Violations (§2104.06)

The violation of any emission standard established by this Permit shall be a violation of this Permit giving rise to the remedies provided by Article §2109.02.

18. Other Requirements Not Affected (§2105.02)

Compliance with the requirements of this permit shall not in any manner relieve any person from the duty to fully comply with any other applicable federal, state, or county statute, rule, regulation, or the like, including, but not limited to, any applicable NSPSs, NESHAPs, MACTs, or Generally Achievable Control Technology standards now or hereafter established by the EPA, and any applicable requirement of BACT or LAER as provided by Article XXI, any condition contained in this Installation Permit and/or any additional or more stringent requirements contained in an order issued to such person pursuant to Part I of Article XXI.

19. Other Rights and Remedies Preserved (§2109.02.b)

Nothing in this permit shall be construed as impairing any right or remedy now existing or hereafter created in equity, common law or statutory law with respect to air pollution, nor shall any court be deprived of such jurisdiction for the reason that such air pollution constitutes a violation of this permit

20. Penalties, Fines, and Interest (§2109.07.a)

A source that fails to pay any fee required under this Permit or article XXI when due shall pay a civil penalty

of 50% of the fee amount, plus interest on the fee amount computed in accordance with of Article XXI §2109.06.a.4 from the date the fee was required to be paid. In addition, the source may have its permit revoked.

21. Appeals (§2109.10)

In accordance with State Law and County regulations and ordinances, any person aggrieved by an order or other final action of the Department issued pursuant to Article XXI shall have the right to appeal the action to the Director in accordance with the applicable County regulations and ordinances.

IV. SITE LEVEL TERMS AND CONDITIONS

1. Reporting of Upset Conditions (§2103.12.k.2)

The permittee shall promptly report all deviations from permit requirements, including those attributable to upset conditions as defined in Article XXI §2108.01.c, the probable cause of such deviations, and any corrective actions or preventive measures taken.

2. Visible Emissions (§2104.01.a)

Except as provided for by Article XXI §2108.01.d pertaining to a cold start, no person shall operate, or allow to be operated, any source in such manner that the opacity of visible emissions from a flue or process fugitive emissions from such source, excluding uncombined water:

a. Equal or exceed an opacity of 20% for a period or periods aggregating more than three (3) minutes in any sixty (60) minute period; or,
b. Equal or exceed an opacity of 60% at any time.

3. Odor Emissions (§2104.04) (County-only enforceable)

No person shall operate, or allow to be operated, any source in such manner that emissions of malodorous matter from such source are perceptible beyond the property line.

4. Materials Handling (§2104.05)

The permittee shall not conduct, or allow to be conducted, any materials handling operation in such manner that emissions from such operation are visible at or beyond the property line.

5. Operation and Maintenance (§2105.03)

All air pollution control equipment required by this permit or any order under Article XXI, and all equivalent compliance techniques approved by the Department, shall be properly installed, maintained, and operated consistently with good air pollution control practice.

6. Open Burning (§2105.50)

No person shall conduct, or allow to be conducted, the open burning of any material, except where the Department has issued an Open Burning Permit to such person in accordance with Article XXI §2105.50 or where the open burning is conducted solely for the purpose of non-commercial preparation of food for human consumption, recreation, light, ornament, or provision of warmth for outside workers, and in a manner which contributes a negligible amount of air contaminants.

7. Shutdown of Control Equipment (§2108.01.b)

a. In the event any air pollution control equipment is shut down for reasons other than a breakdown, the person responsible for such equipment shall report, in writing, to the Department the intent to shut down such equipment at least 24 hours prior to the planned shutdown. Notwithstanding the submission of such report, the equipment shall not be shut down until the approval of the Department is obtained; provided, however, that no such report shall be required if the source(s) served by such air pollution control equipment is also shut down at all times that such equipment

is shut down.

b. The Department shall act on all requested shutdowns as promptly as possible. If the Department does not take action on such requests within ten (10) calendar days of receipt of the notice, the request shall be deemed denied, and upon request, the owner or operator of the affected source shall have a right to appeal in accordance with the provisions of Article XI.

c. The prior report required by Site Level Condition IV.7.a above shall include:

1) Identification of the specific equipment to be shut down, its location and permit number (if permitted), together with an identification of the source(s) affected;
2) The reasons for the shutdown;
3) The expected length of time that the equipment will be out of service;
4) Identification of the nature and quantity of emissions likely to occur during the shutdown;
5) Measures, including extra labor and equipment, which will be taken to minimize the length of the shutdown, the amount of air contaminants emitted, or the ambient effects of the emissions;
6) Measures which will be taken to shut down or curtail the affected source(s) or the reasons why it is impossible or impracticable to shut down or curtail the affected source(s) during the shutdown; and
7) Such other information as may be required by the Department.

8. Breakdowns (§2108.01.c)

a. In the event that any air pollution control equipment, process equipment, or other source of air contaminants breaks down in such manner as to have a substantial likelihood of causing the emission of air contaminants in violation of this permit, or of causing the emission into the open air of potentially toxic or hazardous materials, the person responsible for such equipment or source shall immediately, but in no event later than sixty (60) minutes after the commencement of the breakdown, notify the Department of such breakdown and shall, as expeditiously as possible but in no event later than seven (7) days after the original notification, provide written notice to the Department.

b. To the maximum extent possible, all oral and written notices required shall include all pertinent facts, including:

1) Identification of the specific equipment which has broken down, its location and permit number (if permitted), together with an identification of all related devices, equipment, and other sources which will be affected.
2) The nature and probable cause of the breakdown.
3) The expected length of time that the equipment will be inoperable or that the emissions will continue.
4) Identification of the specific material(s) which are being, or are likely to be emitted, together with a statement concerning its toxic qualities, including its qualities as an irritant, and its potential for causing illness, disability, or mortality.
5) The estimated quantity of each material being or likely to be emitted.
6) Measures, including extra labor and equipment, taken or to be taken to minimize the length of the breakdown, the amount of air contaminants emitted, or the ambient effects of the emissions, together with an implementation schedule.
7) Measures being taken to shut down or curtail the affected source(s) or the reasons why it is impossible or impractical to shut down the source(s), or any part thereof, during the breakdown.

c. Notices required shall be updated, in writing, as needed to advise the Department of changes in the information contained therein. In addition, any changes concerning potentially toxic or hazardous emissions shall be reported immediately. All additional information requested by the Department shall be submitted as expeditiously as practicable.

d. Unless otherwise directed by the Department, the Department shall be notified whenever the condition causing the breakdown is corrected or the equipment or other source is placed back in operation by no later than 9:00 AM on the next County business day. Within seven (7) days thereafter, written notice shall be submitted pursuant to Paragraphs a and b above.

e. Breakdown reporting shall not apply to breakdowns of air pollution control equipment which occur during the initial startup of said equipment, provided that emissions resulting from the breakdown are of the same nature and quantity as the emissions occurring prior to startup of the air pollution control equipment.

f. In no case shall the reporting of a breakdown prevent prosecution for any violation of this permit or Article XXI.

9. Cold Start (§2108.01.d)

In the event of a cold start on any fuel-burning or combustion equipment, except stationary internal combustion engines and combustion turbines used by utilities to meet peak load demands, the person responsible for such equipment shall report in writing to the Department the intent to perform such cold start at least 24 hours prior to the planned cold start. Such report shall identify the equipment and fuel(s) involved and shall include the expected time and duration of the startup. Upon written application from the person responsible for fuel-burning or combustion equipment which is routinely used to meet peak load demands and which is shown by experience not to be excessively emissive during a cold start, the Department may waive these requirements and may instead require periodic reports listing all cold starts which occurred during the report period. The Department shall make such waiver in writing, specifying such terms and conditions as are appropriate to achieve the purposes of Article XXI. Such waiver may be terminated by the Department at any time by written notice to the applicant.

10. Monitoring of Malodorous Matter Beyond Facility Boundaries (§2104.04)

The permittee shall take all reasonable action as may be necessary to prevent malodorous matter from becoming perceptible beyond facility boundaries. Further, the permittee shall perform such observations as may be deemed necessary along facility boundaries to insure that malodorous matter beyond the facility boundary in accordance with Article XXI §2107.13 is not perceptible and record all findings and corrective action measures taken.

11. Emissions Inventory Statements (§2108.01.e & g)

a. Emissions inventory statements in accordance with §2108.01.e shall be submitted to the Department by March 15 of each year for the preceding calendar year. The Department may require more frequent submittals if the Department determines that more frequent submissions are required by the EPA or that analysis of the data on a more frequent basis is necessary to implement the requirements of Article XXI or the Clean Air Act.

b. The failure to submit any report or update within the time specified, the knowing submission of

false information, or the willful failure to submit a complete report shall be a violation of this permit giving rise to the remedies provided by Article XXI §2109.02.

12. Orders (§2108.01.f)

In addition to meeting the requirements Site Level Conditions IV.7 through IV.11, inclusive, the person responsible for any source shall, upon order by the Department, report to the Department such information as the Department may require in order to assess the actual and potential contribution of the source to air quality. The order shall specify a reasonable time in which to make such a report.

13. Violations (§2108.01.g)

The failure to submit any report or update thereof required by Site Level Conditions IV.7 through IV.12 above, inclusive, within the time specified, the knowing submission of false information, or the willful failure to submit a complete report shall be a violation of this permit giving rise to the remedies provided by Article XXI §2109.02.

14. Emissions Testing (§2108.02)

a. **Orders:** No later than 60 days after achieving full production or 120 days after startup, whichever is earlier, the permittee shall conduct, or cause to be conducted, such emissions tests as are specified by the Department to demonstrate compliance with the applicable requirements of this permit and shall submit the results of such tests to the Department in writing. Upon written application setting forth all information necessary to evaluate the application, the Department may, for good cause shown, extend the time for conducting such tests beyond 120 days after startup but shall not extend the time beyond 60 days after achieving full production. Emissions testing shall comply with all applicable requirements of Article XXI, §2108.02.e.

b. **Tests by the Department:** Notwithstanding any tests conducted pursuant to this permit, the Department or another entity designated by the Department may conduct emissions testing on any source or air pollution control equipment. At the request of the Department, the permittee shall provide adequate sampling ports, safe sampling platforms and adequate utilities for the performance of such tests.

c. **Testing Requirements:** No later than 45 days prior to conducting any tests required by this permit, the person responsible for the affected source shall submit for the Department's approval a written test protocol explaining the intended testing plan, including any deviations from standard testing procedures, the proposed operating conditions of the source during the test, calibration data for specific test equipment and a demonstration that the tests will be conducted under the direct supervision of persons qualified by training and experience satisfactory to the Department to conduct such tests. In addition, at least 30 days prior to conducting such tests, the person responsible shall notify the Department in writing of the time(s) and date(s) on which the tests will be conducted and shall allow Department personnel to observe such tests, record data, provide pre-weighed filters, analyze samples in a County laboratory and to take samples for independent analysis. Test results shall be comprehensively and accurately reported in the units of measurement specified by the applicable emission limitations of this permit.

d. Test methods and procedures shall conform to the applicable reference method set forth in this permit or Article XXI Part G, or where those methods are not applicable, to an alternative sampling and testing procedure approved by the Department consistent with Article XXI §2108.02.e.2.

e. **Violations:** The failure to perform tests as required by this permit or an order of the Department, the failure to submit test results within the time specified, the knowing submission of false information, the willful failure to submit complete results, or the refusal to allow the Department, upon presentation of a search warrant, to conduct tests, shall be a violation of this permit giving rise to the remedies provided by Article XXI §2109.02.

15. Abrasive Blasting (§2105.51)

a. Except where such blasting is a part of a process requiring an operating permit , no person shall conduct or allow to be conducted, abrasive blasting or power tool cleaning of any surface, structure, or part thereof, which has a total area greater than 1,000 square feet unless such abrasive blasting complies with all applicable requirements of Article XXI §2105.51.

b. In addition to complying with all applicable provisions of §2105.51, no person shall conduct, or allow to be conducted, abrasive blasting of any surface unless such abrasive blasting also complies with all other applicable requirements of Article XXI unless such requirements are specifically addressed by §2105.51.

16. Asbestos Abatement (§2105.62, §2105.63)

In the event of removal, encasement, or encapsulation of Asbestos-Containing Material (ACM) at a facility or in the event of the demolition of any facility, the permittee shall comply with all applicable provisions of Article XXI §2105.62 and §2105.63.

17. Volatile Organic Compound Storage Tanks (§2105.12.a)

No person shall place or store, or allow to be placed or stored, a volatile organic compound having a vapor pressure of 1.5 psia or greater under actual storage conditions in any aboveground stationary storage tank having a capacity equal to or greater than 2,000 gallons but less than or equal to 40,000 gallons, unless there is in operation on such tank pressure relief valves which are set to release at the higher of 0.7 psig of pressure or 0.3 psig of vacuum or at the highest possible pressure and vacuum in accordance with State or local fire codes, National Fire Prevention Association guidelines, or other national consensus standard approved in writing by the Department. Petroleum liquid storage vessels that are used to store produced crude oil and condensate prior to lease custody transfer are exempt from these requirements.

18. Fugitive Emissions (§2105.49)

The person responsible for a source of fugitive emissions, in addition to complying with all other applicable provisions of this permit shall take all reasonable actions to prevent fugitive air contaminants from becoming airborne. Such actions may include, but are not limited to:

a. The use of asphalt, oil, water, or suitable chemicals for dust control;
b. The paving and maintenance of roadways, parking lots and the like;
c. The prompt removal of earth or other material which has been deposited by leaks from transport, erosion or other means;
d. The adoption of work or other practices to minimize emissions;
e. Enclosure of the source; and
f. The proper hooding, venting, and collection of fugitive emissions.

19. Episode Plans (§2106.02)

The permittee shall upon written request of the Department, submit a source curtailment plan, consistent with good industrial practice and safe operating procedures, designed to reduce emissions of air contaminants during air pollution episodes. Such plans shall meet the requirements of Article XXI §2106.02.

20. New Source Performance Standards (§2105.05)

a. It shall be a violation of this permit giving rise to the remedies provided by §2109.02 of Article XXI for any person to operate, or allow to be operated, any source in a manner that does not comply with all requirements of any applicable NSPS now or hereafter established by the EPA, except if such person has obtained from EPA a waiver pursuant to Section 111 or Section 129 of the Clean Air Act or is otherwise lawfully temporarily relieved of the duty to comply with such requirements.

b. Any person who operates, or allows to be operated, any source subject to any NSPS shall conduct, or cause to be conducted, such tests, measurements, monitoring and the like as is required by such standard. All notices, reports, test results and the like as are required by such standard shall be submitted to the Department in the manner and time specified by such standard. All information, data and the like which is required to be maintained by such standard shall be made available to the Department upon request for inspection and copying.

21. National Emission Standards for Hazardous Air Pollutants (§2104.08)

a. The permittee shall comply with each applicable emission limitation, work practice standard, and operation and maintenance requirement of 40 CFR Part 63, Subpart DDDDD – *National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers and Process Heaters*, CFR Part 63, Subpart UUUUU – *National Emission Standards for Hazardous Air Pollutants for Coal- and Oil-Fired electric Utility Steam Generating Units, and* CFR Part 63, Subpart ZZZZ – *National Emission Standards for Stationary Reciprocating Internal Combustion Engines.*

V. EMISSION UNIT LEVEL TERMS AND CONDITIONS

A. Boilers No. 1 through No. 4

Process Description: Four identical M21 Keystone O-type, package boilers with a common stack
Facility ID: B001, B002, B003 & B004
Maximum Design Rate: 150 MMBtu/hr each
Fuel(s): Natural gas and no. 2 fuel oil as an emergency fuel
Control Device(s): None

1. Restrictions:

a. The permittee shall continue to meet the conditions of Operating Permit No. 0044, in addition to the revisions in this permit. [§2102.04.b.5]

b. At no time shall the permittee allow emissions of nitrogen oxides from each boiler to exceed 0.22 pounds per MMBtus and 72.3 tons during any 12 consecutive month period (RACT Order #265, Condition 1.1; §2105.06, 25 Pa. Code §129.99).

c. At no time shall the permittee operate boilers no. 1 through no. 4 unless all process equipment and O_2 trim equipment are properly operated and maintained according to condition V.A.3.a below (RACT Order #265, Condition 1.2; §2105.06, 25 Pa. Code §129.99).

d. Natural gas usage in each boiler shall not exceed the maximum potential usage of 147,060 scf in any one-hour period and 644.12 MMscf (50% of annual capacity) in any consecutive twelve-month period. (§2103.12.h.1, §2103.12.a.2.C, 25 Pa. Code §129.99)

e. At no time shall the permittee operate the subject boilers using any fuel other than natural gas with the exception of no.2 fuel oil, which may be combusted only during combustion tuning, emergency conditions and/or natural gas curtailment (RACT Order #265, Condition 1.3; §2105.06, 25 Pa. Code §129.99).

f. Emissions from each boiler shall not exceed the following limitations in Table V-A-1 at any time: (§2101.02.c.4, §2103.12.a.2.B, §2104.03.a.2; §2104.03.b, 25 Pa. Code §129.99)

TABLE V-A-1: Emission Limitations for B001, B002, B003 & B004 (each)

POLLUTANT	Natural Gas (lb/hr)	No. 2 Fuel Oil (lb/hr)	ANNUAL EMISSION LIMIT (tons/year)[1]
Nitrogen Oxides	33.0	25.95	72.3

1) A year is defined as any consecutive 12-month period.

g. At no time No. 2 fuel oil combustion in each boiler shall not exceed 1,080 gallons each in any one-hour period and 540,035 gallons in any consecutive twelve-month period. (§2103.12.h.1, 25 Pa. Code §129.99).

2. Testing Requirements:

a. The permittee shall perform NO_X emission testing on boilers no.1 through no. 4, in accordance with Site Level Condition IV.14 above, once every two years in order to demonstrate compliance with the natural gas NO_x emission limitations in conditions V.A.1.b and V.A.1.f above (§2103.12.i, §2108.02, 25 Pa. Code §129.100)

b. The permittee shall perform NO_X emission testing on boilers no.1 through no. 4 within 60 days of firing fuel oil, in order to demonstrate compliance with the fuel oil NO_X, emission limitations in condition V.A.1.f above (RACT Order #265, Condition 1.4; §2103.12.i; §2108.02, 25 Pa. Code §129.100)

c. The Department reserves the right to require additional emissions testing sufficient to assure compliance with the terms and conditions of this permit. Such testing shall be performed in accordance with Article XXI §2108.02. (§2103.12.h.1)

3. Monitoring Requirements:

a. The permittee shall continuously monitor the oxygen content of the flue gas of each boiler to within 3% of the measured value and record the oxygen content to the nearest 0.1%, to ensure the subject boilers are being operated and maintained properly and are operating under the conditions demonstrated during the most recent compliance test. (§2103.12.i and §2108.03, 25 Pa. Code §129.100)

4. Record Keeping Requirements:

a. The permittee shall keep and maintain the following data for boilers no. 1 through no. 4: (§2103.12.j; §2103.12.h.1 and RACT Order #265, Condition 1.5; §2105.06, 25 Pa. Code §129.100):
   1) Fuel consumption (daily, monthly, and 12-month), type of fuel consumed and suppliers' certification of sulfur content, and heating value for each boiler;
   2) Steam load, (Mlbs/day, monthly average);
   3) Flue gas oxygen (hourly high, low and average, monthly average)
   4) Total operating hours, (hours/day, monthly and 12-month); and
   5) Records of operation, maintenance, inspection, calibration and/or replacement of combustion equipment; and
   6) Stack test protocols and reports.

b. The permittee shall record all instances of non-compliance with the conditions of this permit upon occurrence along with corrective action taken to restore compliance. (§2103.12.h.1, 25 Pa. Code §129.100)

c. All records required under this section shall be maintained by the permittee for a period of five years following the date of such record. [§2103.12.j.2, 25 Pa. Code §129.100]

5. Reporting Requirements:

a. The permittee shall report the following information to the Department within thirty days of the end of each calendar half. The reports shall contain all required information for the time period of the report: (§2103.12.k.1, 25 Pa. Code §129.100)

1) Monthly and 12-month data required to be recorded by condition V.A.4.a above; and
2) Non-compliance information required to be recorded by V.A.4.b above.

b. Reporting instances of non-compliance does not relieve the permittee of the requirement to report breakdowns in accordance with Site Level Condition IV.8, if appropriate. [§2103.12.k]

6. Work Practice Standard:

The permittee shall at all times properly operate and maintain all process and emission control equipment at the facility according to good engineering practice. (25 Pa. Code §129.99)

VI. ALTERNATIVE OPERATING SCENARIOS

No alternative operating scenarios exist for this operation.

VII. EMISSIONS LIMITATIONS SUMMARY

The following table summarizes the estimated annual maximum potential emissions (which may not include fugitive) from Boilers 1, 2, 3 and 4 at Pittsburgh Allegheny County Thermal, LTD. These annual (consecutive 12 month) potential emission estimates assume that all three boilers operate continuously according to to their permit conditions.

TABLE VII-1: Boiler 1, 2, 3 and 4 Emission Limitations Summary

POLLUTANT	ANNUAL EMISSION LIMIT (tons/year)*
Nitrogen Oxides (NO_X)	**292.8**

*** A year is defined as any consecutive 12-month period.**