Alternative Reasonably Available Control Technology (RACT) for Oxides of Nitrogen (NOx) Determination for the 2015 8-Hour Ozone National Ambient Air Quality Standards (NAAQS)

State Implementation Plan (SIP) Revision

June 13, 2023

DEPARTMENT OF ENERGY & ENVIRONMENT
GOVERNMENT OF THE DISTRICT OF COLUMBIA

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1.0 Background

The District of Columbia Department of Energy and Environment (DOEE or the Department) is proposing a revision to the District of Columbia's State Implementation Plan (SIP) under the federal Clean Air Act (CAA), as amended in 1990. This SIP revision addresses three submissions under the District's Alternative RACT (Reasonable Available Control Technology) program allowed for under 20 DCMR § 805.2. The Alternative RACT plans describe alternatives to the presumptive NOx RACT emissions limits promulgated under 20 DCMR § 805 that each submitter believes represents RACT for their specific circumstances. The presumptive emission limits were designed to meet the federal requirements for ozone and nitrogen oxide (NOx) for areas located in the Ozone Transport Region (OTR) and for moderate nonattainment areas for the 2015 8-hour ozone national ambient air quality standards (NAAQS).[1]

The CAA, which was last amended in 1990, requires the U.S. Environmental Protection Agency (EPA) to set NAAQS (40 C.F.R. part 50) for pollutants considered harmful to public health and the environment. On October 26, 2015, the EPA promulgated revised 8-hour primary and secondary ozone NAAQS. 80 Fed. Reg. 65292 (October 26, 2015).

States with areas designated as nonattainment for the revised 2015 ozone NAAQS and states located in the OTR are required to revise their relevant SIPs to ensure that the SIP complies with updated statutory and regulatory requirements. These SIP Revisions must be submitted to EPA for review and approval. 42 U.S.C. § 7502(b).

The District was classified as marginal attainment for the 2015 ozone NAAQS. Because of this designation and because the District is located within the OTR, the District must submit a revised SIP for EPA approval. 83 Fed. Reg. 25776, 25795 (June 4, 2018). In revising the SIP, the District must review its regulations and determine if the District has implemented all Reasonably Available Control Technology (RACT) requirements on all major stationary sources of precursor pollutants of ozone—volatile organic compounds (VOCs) and oxides of nitrogen (NOx) (40 C.F.R. Part 51, Subpart X) for NAAQS. The District has submitted both requirements to EPA. However, the final NOx RACT rule allowed for sources to apply for an alternative emissions limit and DOEE has received three applications under this program.

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1 History of the District's Previous SIP Revisions based on revised NAAQS: Under the CAA amendments of 1990, the District was classified as a serious nonattainment area for the 1979 1-hour ozone NAAQS; the District submitted to the EPA certification of RACT provisions under the 1979 1-hour ozone NAAQS and this certification was adopted into the District's SIP effective December 26, 2000 (65 Fed. Reg. 81369).

The District was classified as a moderate nonattainment area for the 1997 8-hour ozone NAAQS; the District submitted its certification of RACT provisions under the 1997 8-hour ozone NAAQS and this certification was adopted into the District's SIP effective July 16, 2009 (74 Fed. Reg. 28447, June 16, 2009)

The District was classified as a marginal nonattainment area for the 2008 8-hour ozone NAAQS. The District submitted its certification of RACT provisions under the 2008 8-hour ozone NAAQS and this certification was adopted into the District's SIP effective November 12, 2019 (85 Fed. Reg. 10295, February 24, 2020).

EPA has defined RACT as "the lowest emission limitation that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility… In evaluating economic feasibility for RACT determinations, the EPA gives significant weight to economic efficiency and relative cost effectiveness." 83 Fed. Reg. 62998, 63007, FN 16 (December 6, 2018).

DOEE has reviewed the three applications and proposes to approve the plans submitted by Georgetown University and the U.S. General Services Administration (GSA) because they will meet the requirements of Alternative RACT following their adoption of all necessary proposed requirements into the District's SIP. DOEE does not believe that the plan submitted by Architect of the Capitol (AOC) for the U.S. Capitol Power Plant (CPP) meets the requirements of Alternative RACT.

1.1 RACT Requirements

To help determine RACT, EPA developed control techniques guidelines (CTGs) and alternative control techniques (ACT) documents. While CTGs from the 1970s through the 1990s are still used to presumptively limit RACT for VOC sources, there are no CTG-like presumptive RACT limits for NOx sources. ACTs were developed for VOCs and NOx in the late 1980s and 1990s and describe available control technologies and their respective cost-effectiveness. ACTs provide historical background on controls but do not identify RACT. Additionally, since RACT can change over time as technology develops, states must consider newly available information to supplement ACT documents and when establishing NOx RACT requirements.

In addition to the evaluation of economic feasibility for RACT determinations, DOEE also considers current ozone levels in its evaluation of RACT. The District was required under its marginal ozone classification to achieve levels at or below 0.070 parts per million (ppm) by August 3, 2021. Since the District itself, and the Washington, DC-MD-VA area as a whole, were continuing to monitor ozone levels above the NAAQS, decisions concerning presumptive RACT standards must be made in light of this. Furthermore, the Washington, DC-MD-VA region has since been reclassified to moderate nonattainment for the 2015 Ozone NAAQS. 87 Fed. Reg. 60897 (October 7, 2022)

States implementing the 2015 8-hour ozone standard must assure the state also meets the RACT determination through developing a new a RACT regulation, or a certification (with supporting information) that previously required RACT controls represent RACT for 8-hour implementation purposes.[2]

In the 2008 Ozone NAAQS Implementation Rule, EPA states that, "in some cases, a new RACT determination under the 2008 standard would result in the same or similar control technology as the initial RACT determination under the 1-hour or 1997 standard because the fundamental control techniques, as described in the CTGs and ACTs, are still applicable. In cases where controls were

[2] In the case of VOCs, states may also certify their RACT determination with a negative declaration that there are no sources in the nonattainment area covered by a specific CTG category that would require RACT.

applied due to the 1-hour or 1997 NAAQS ozone RACT requirement, we expect that any incremental emissions reductions from application of a second round of controls would be small and, therefore, the cost for advancing that small additional increment of reduction would not be reasonable" (80 Fed. Reg. 12279). In the 2015 ozone NAAQS Implementation Rule, EPA states that it is "retaining existing general RACT requirements for purposes of the 2015 ozone NAAQS," which implies that the previous statement still holds (83 Fed. Reg. 63007).

The District was designated as a marginal nonattainment area for the 2015 ozone NAAQS. According to CAA Section 182(a)(2)(A), states in marginal nonattainment of a NAAQS must submit a "RACT fix-up," which is "a revision that includes such provisions to correct requirements in (or add requirements to) the plan concerning [RACT] as were required [prior to November 15, 1990]."

Additionally, the District is a member of the OTR[3], therefore CAA Section 184 is applicable; it requires states in the OTR to implement more stringent moderate area RACT at a minimum for major sources of NOx.[4]

1.2 Major Source Thresholds

The District was classified as marginal nonattainment for 2015 ozone NAAQS RACT. The OTR requires major source thresholds of 50 tpy for VOCs and 100 tpy for NOx.[5] The District had been severe-15 nonattainment under the one-hour ozone NAAQS, for which a 25 tpy for NOx major source threshold is required.

Therefore, all facilities that have, or had, the potential to emit 25 tpy NOx must be regulated under the District's NOx RACT Rule either by meeting presumptive RACT or by having an accepted Alternative RACT analysis.

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[3] States in the OTR include Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and the Consolidated Metropolitan Statistical Area that includes the District of Columbia.

[4] CAA Section 184 requires states in the OTR to implement more stringent RACT on any stationary source that has the potential to emit (PTE) at least fifty tons per year (tpy) of VOC, which shall be considered a major stationary source and subject to the requirements applicable to major stationary sources in Moderate nonattainment areas (CAA § 184(b)(2)). (*The requirements for major stationary sources of VOCs also apply to major sources of NOx (CAA § 182(f)), where a "major stationary source" directly emits or has the potential to emit one hundred tons per year or more of any pollutant.*)

[5] **Per Appendix I guidance:** "For purposes of meeting the 8-hour RACT requirement, the State's RACT analysis only needs to include an evaluation of RACT for CTG sources and for non-CTG major sources based on the area's 8-hour classification. We note, however, that under the anti-backsliding requirements, the State may not remove RACT requirements for sources that were subject to RACT for the 1-hour standard (but that would not be subject to RACT based on the area's 8-hour classification). Similarly, if the State has never met the RACT requirement for one or more sources for the 1-hour standard, the anti-backsliding requirements require the State to meet that obligation. The anti-backsliding provisions can be found at 40 C.F.R. § 51.905 and apply to all former 1-hour non-attainment areas."

1.3 Existing NOx RACT in the District

In January 1994, the District submitted its first "Reasonably Available Control Technology for Major Stationary Sources of the Oxides of Nitrogen" (NOx RACT) rulemaking (20 DCMR § 805) to EPA as a SIP revision for the 1-hour ozone NAAQS. Since the District was designated as a serious nonattainment area at the time, RACT was applicable for sources that emitted or had a PTE of 50 tpy or more of NOx. Therefore, in 1994, Section 805 contained presumptive emissions limits for certain source categories: stationary combustion turbines (§ 805.4), fossil fuel-fired steam generating units (§ 805.5), and asphalt concrete plants (§ 805.6). Through "generic RACT" provisions, major sources not otherwise covered by presumptive limits were required to identify source-specific RACT-level controls by a specified date that would later go through the SIP process. The District received no source specific RACT determinations from EPA. In December 1998, the District submitted a "negative declaration" to EPA, stating that all major sources of NOx were covered by presumptive limits in §§ 805.4, 805.5, and 805.6. The District submitted minor revisions to the NOx RACT rule to EPA in 2000, and the regulation was first approved as a SIP revision on December 26, 2000 (65 Fed. Reg. 81369).

The District failed to meet the attainment date of November 15, 1999, so the District was reclassified from serious to severe nonattainment for the 1-hour ozone NAAQS. The major source thresholds dropped to a PTE of 25 tpy for both VOC and NOx from 50 tpy. In 2004, the District submitted SIP revisions to meet the more stringent major source definitions and new source offset ratio requirements for severe areas. EPA approved the revision on December 28, 2004 (69 Fed. Reg. 77647).

Later the District submitted to EPA, and EPA approved, a SIP amendment with revisions to the District's NOx RACT rule in response to requirements under the 2008 ozone NAAQS (85 Fed. Reg. 10295). In addition to the updates in Table 1, this SIP amendment included source specific RACT for certain equipment at the Blue Plains Advanced Wastewater Treatment Plant (40 CFR 52.470(d)).

Most recently on November 26, 2021, the District finalized regulations updating presumptive RACT in response to the 2015 Ozone NAAQS (68 DCR 12420) with minor technical corrections being finalized later on September 16, 2022 (69 DCR 11277). This rulemaking process also updated the Alternative RACT provision. These rules were submitted to EPA for approval into the District's SIP but are not yet approved. The presumptive RACT standards are in Table 1.

Table 1: Presumptive NOx RACT Regulations Addressing the 2015 Ozone NAAQS in the District

Source Category		**20 DCMR Section***	**Previous EPA Approval(s)**
Fuel-burning equipment with input capacity… **	Equal to or greater than 5, but less than 20, MMBtu/hr	805.5	n/a
	Equal to or greater than 20, but less than 50, MMBtu/hr	805.5	12/28/2004 (69 Fed. Reg. 77645 & 69 Fed. Reg. 77647)
	Equal to or greater than 50, but less than 100, MMBtu/hr	805.5, specifically (e)	
	100 MMBtu/hr or greater	805.5, specifically (d)	
Asphaltic concrete plants with a PTE of 25 tpy or greater		805.6	
Other fuel burning equipment with a PTE of 25 tpy or greater		805.8	
Combustion turbine with an input capacity of greater than 50 MMBtu/hr		805.4	2/24/2020 (85 Fed. Reg. 10295)
Stationary Engines (non-emergency)		805.7	n/a

* All listed categories are also covered for specific requirements (e.g., reporting) under §§ 805.1, 805.3, and 805.9 through 805.11
** The term used in § 805.5 is being updated from fossil-fuel steam generating units to fuel burning equipment so as to encompass more units, in particular water heaters

Of the source categories with presumptive RACT emissions limits, the Alternative RACT applications DOEE received in response to the November 26, 2021, regulations updates solely focused on alternatives for fuel burning equipment. For fuel burning equipment, the currently adopted RACT and updated RACT emissions limits for the District are in Table 2Table 2. It should be noted that other fuel burning equipment, such as water heaters, had no presumptive RACT but are now included under the new terms used in the update for the 2015 Ozone NAAQS.

Table 2: Presumptive RACT emissions limits (lb/MMBTU) for fuel burning equipment in the District of Columbia for the 2008 and 2015 ozone NAAQS

SIZE	COAL		NATURAL GAS		DISTILLATE		
	2008*	2015	2008*	2015	2008*	2015	2015 (during curtailment)
>=100 MMBTU/HR	0.43	0.12	0.25	0.05	0.2	0.12	0.12
>=50 & <100 MMBTU/HR	0.3	0.12	0.3	0.05	0.3	0.09	0.12
>=25 & <50 MMBTU/HR	Tune-up	0.12	Tune-up	0.05	Tune-up	0.09	0.12
>=20 & <25 MMBTU/HR	Tune-up	Tune-up	Tune-up	Tune-up	Tune-up	Tune-up	Tune-up
>=5 & <20 MMBTU/HR	None	Tune-up	None	Tune-up	None	Tune-up	Tune-up

*2008 presumptive RACT only is applicable to fossil-fuel steam generating units, and not all fossil fuel equipment

1.4 Ozone Transport Commission (OTC) RACT Analysis

OTC conducted a RACT analysis that DOEE will use as a comparative, though not definitive, point, in determining the reasonableness of control. OTC states however do not calculate cost thresholds identically; some rely on Potential To Emit (PTE), which in this case is considered to be a unit operating 8,760 hours per year regardless of any permit condition limits, while others rely on Allowable Emissions (AE), which reduces the PTE calculations to the maximum amount allowable in the permit, and one OTC state relies on actual emissions. One would expect higher cost thresholds for states using actual emissions, lower thresholds for PTE, and AE to fall in the middle, but the opposite seems to be true, and thus DOEE is relying on these comparative points as a guide and not a definitive answer to what is cost effective.

Table 3: Cost effectiveness for NOx emissions from Industrial, Commercial, and Institutional (ICI) boilers ($/ton of NOx removed)

NEW JERSEY	DELAWARE	NEW YORK	CONNECTICUT	PENNSYLVANIA	HIGH	LOW	AVG.
6,363*	6,000	6,000	13,635	3,750	13,636	3,750	7,150
Allowable	Allowable	PTE	PTE	Actual			

*The annual cost-effectiveness varies from $600.00 per ton to $18,000 per ton, In general for most scenarios, $5000 per ton. (Please see Page 78 of August 4, 2008 New Jersey RACT rule proposal, available at *https://www.nj.gov/dep/rules/proposals/080408a.pdf and* Response to comment 97, page 64 of New Jersey adoption document available at https://www.nj.gov/dep/rules/adoptions/adopt_090420.pdf)

2.0 Analysis of Alternative NOx RACT Applications

2.1 Georgetown University

Georgetown University has four units subject to 20 DCMR § 805.5, specifically, Boilers 1, 2, 3, and 4. All of these boilers are fired primarily with natural gas and have fuel oil as a backup source. Every boiler utilizes Good Combustion Practices (GCP) and Flue Gas Recirculation (FGR). Boilers 2 and 4 both have installed Low NOx Burners (LNB), also termed Low Emission Burners (LEB). In its application Georgetown states that they "plan to retrofit Boiler 3 with LEB." As a result of these controls Georgetown states "an alternative RACT is not necessary for Boilers 2, 3 and 4." Georgetown will not be in compliance with presumptive RACT standards for Boiler 3 until this work is completed, but this statement in its Alternative RACT plan now precludes Georgetown from using the Alternative RACT provision for these units. This leaves solely Boiler 1 that requires scrutiny under Alternative RACT.

Boiler 1 typically has emissions that vary from 0.06 to 0.09 lb/MMBtu on a daily average, which is above the District's presumptive RACT limit of 0.05 lb/MMBtu. Georgetown found that this unit warrants Alternative RACT limits and conducted a four-step analysis to demonstrate the need for an Alternative RACT limit.

2.1.1 Step 1 – Identify All Potentially Available Control Options

Georgetown's submittal includes an examination of the following control options:

1. Good Combustion Practices (GCP)
2. Air Staged Combustion (ASG)
3. Low NOx Burners (LNB)
4. Flue Gas Recirculation (FGR)
5. Selective Catalytic Reduction (SCR)
6. Selective Non-Catalytic Reduction (SNCR)
7. EMx Catalytic Absorption/Oxidation
8. Operational Limitations (OL) – Included in Georgetown's baseline

DOEE finds this to be a reasonable list of potential control options.

2.1.2 Step 2 – Eliminate Technically Infeasible Control Options

Boiler 1 already utilizes GCP and FGR, so those options are already reducing emissions. Boiler 1 was found to be too old to rely on ASG, exhibits too low an exhaust temperature to accommodate SNCR, and is too large to rely on EMx, so each of these options were removed from consideration. This left LNB, SCR, and though Georgetown did not explicitly analyze it because it was considered in their baseline, OL.

Georgetown also noted that they have recently had cost overruns when upgrading Boiler 2 to LNB, which is similar in design to Boiler 1. DOEE will also note that the Boiler 2 upgrade came with an unexpected increase in CO emissions. Georgetown noted, concerning SCR, that there may be space

limitations impacting installation. Georgetown also noted that OL was calculated as based on limiting the unit to a 15% capacity factor for the boiler.

DOEE finds Georgetown's approach to eliminating technically infeasible control options to be reasonable.

2.1.3 Step 3 – Rank Remaining Control Options by Effectiveness

In this step Georgetown submitted rankings of three control options with least effective listed first and emission rates in parentheses:

1. Current controls + OL (~ 0.09 lb/MMBtu or ~ 8.0 ton/yr)
2. Current controls + OL + LNB (~ 0.0145 lb/MMBtu or ~ 1.29 ton/yr)
3. Current controls + OL + SCR (~ 0.014 lb/MMBtu or ~ 1.2 ton/yr)

Options 2 and 3 would be compliant with presumptive RACT, leaving only Option 1 as requiring an Alternative RACT approval.

DOEE finds this ranking to be reasonable.

2.1.4 Step 4 – Evaluation of the Most Effective Control Options

Georgetown based annualized costs on assumptions of a 15-year operating lifetime and a 4% interest rate. Georgetown submitted calculations of the cost effectiveness for each of the control options as follows in Table 1Table 4.

Table 4: Incremental Cost of control as calculated and submitted by Georgetown University

CONTROL OPTION	CONTROL CONFIG.	TOTAL CAPITAL	TOTAL ANNUALIZED COSTS ($/YR)	TONS/YR NOX REMOVED COMPARED TO NO ACTION	TONS/YR REMOVED COMPARED TO OPTION A	COST EFFECTIVENESS ($/TON NOX REMOVED)
NO ACTION	GCP + FGR	$0	$0	N/A	N/A	N/A
A	GCP + FGR + OL	$0	$0	~42.1*	N/A	N/A
B	GCP + FGR + OL + LNB	$2,479,000	$222,900	~48.8	~6.7	~ $33,100
C	GCP + FGR + OL + SCR	$2,305,000	$207,300	~48.9	~6.8	~ $30,400

* Although this value was not specifically calculated, it was implied through the calculations Georgetown included and is necessary for evaluation for inclusion.

Given that Georgetown included OL in its baseline (Option A), DOEE further calculated the cost effectiveness for B and C as follows without inclusion of OL on Boiler 1 as shown in Table 5.

Table 5: Additional cost of control calculations completed by DOEE (excluding OL)

CONTROL OPTION	CONTROL CONFIG.	TOTAL CAPITAL	TOTAL ANNUALIZED COSTS ($/YR)	TONS/YR NOX REMOVED	COST EFFECTIVENESS ($/TON NOX REMOVED)
B	GCP + FGR + LNB	$2,479,000	$222,900	~42	~ $5,300
C	GCP + FGR + SCR	$2,305,000	$207,300	~43	~ $4,900

DOEE finds the cost analysis conducted by Georgetown to be reasonable. While a lack of an operating limit (OL) would have resulted in LNB or SCR being considered reasonable, and would have met presumptive RACT, limiting operations as proposed creates a situation where the cost of additional controls is no longer reasonable due to the high cost/ton value.

2.1.5 Step 5 – Select RACT

Georgetown selected the following to be Alternative RACT as described in the addendum to their plan that was submitted on November 25 ,2022:

- Good combustion practices.
- Flue gas recirculation.
- Restricted operation, more specifically defined as:
    - Operation only during periods when no other boiler is available to meet required steam demand.
    - Total fuel consumption shall not exceed 166,878 MMBtu (higher heating value) per rolling twelve-consecutive-month period.
    - Fuel oil consumption shall not exceed 80,616 gallons per rolling twelve consecutive month period.
    - Periods for appropriate maintenance and testing.
- Unrestricted operation during an "Operational Incident." An Operational Incident means a situation in which the steam demand of the Georgetown University Hospital cannot be satisfied by Boilers 2, 3 and 4 because of on-site disaster, local equipment failure, or an emergency defined in 20 DCMR § 399.1. When Georgetown determines that an Operational Incident is likely to occur for more than 72 consecutive hours, Georgetown will promptly send a written notification to air.quality@dc.gov that:
    - Identifies the start of the Operational Incident and what is believed to have caused it.
    - Describes what actions are being taken to address the Operational Incident.
    - Provides a timeline for the expected resolution of the Operational Incident.
- Root Cause Analysis (RCA) implementation: Within ninety (90) days of submitting the incident notification, Georgetown University will complete an RCA and submit the corresponding RCA report to DOEE. The objectives of the RCA are to determine the primary cause(s) of the Operational Incident and identify what, if any, measures should be taken to prevent future occurrences.

While DOEE finds that under current operating conditions compliance with RACT for Boiler 1 would require the installation of controls, EPA guidance states "Where a source has a federally enforceable limit on emissions or a federally enforceable restriction on the hours of operation, then the analysis of whether the source is subject to RACT would be based on emissions considering those restrictions."[6]

To achieve the "federally enforceable restriction on the hours of operation," the operating limits requested by Georgetown will be proposed as part of Georgetown's operating permit and the relevant portions will be included in the District's SIP and upon finalization become federally enforceable. DOEE

[6] Harnett, William. "RACT Qs & As – Reasonably Available Control Technology (RACT): Questions and Answers." May 2016,

also finds that the allowances for operations during an "operational incident" and the subsequent root cause analysis to be reasonable as well.

DOEE thus proposes to accept Georgetown University's Alternative RACT plan and will update Georgetown University's operating permit to reflect the annual limit on natural gas use, the additional requirements on unrestricted operations, and the root cause analysis, and following that, will propose to incorporate the specific permit requirements outlined above into the District's SIP.

2.2 U.S. General Services Administration (GSA)

GSA has eight units at its Central Heating Plant (CHP) subject to 20 DCMR § 805 including three 250 MMBTU/hr boilers, two 500 MMBTU/hr boilers, one 210 MMBTU/hr heat recovery steam generator (HRSG)/duct burner system, and two 64 MMBTU/hr combustion turbines (all on a high heating value (HHV) basis). GSA finds that the HSRG/duct burner system and combustion turbines can comply with the presumptive RACT. GSA is also proposing controls to be installed on boilers 1, 2, and 3 that would be compliant with presumptive RACT. GSA will not be in compliance with presumptive RACT standards for boilers 1, 2, and 3 until this work is completed, but stating as such in its alternative RACT plan now precludes GSA from using the Alternative RACT provision for these units. This leaves boilers 4 (500 MMBTU/hr) and 6 (250 MMBTU/hr) that require further scrutiny for Alternative RACT.

2.2.1 Step 1 – Identify All Potentially Available Control Options

GSA submitted that they examined the following control options:

1. Low NOx Burners (LNB)
2. Overfire Air (OFA)
3. Flue Gas Recirculation (FGR)
4. Burners Out of Service (BOOS)
5. Selective Non-Catalytic Reduction (SNCR)
6. Selective Catalytic Reduction (SCR)

DOEE finds this to be a reasonable list of potential control options.

2.2.2 Step 2 – Eliminate Technically Infeasible Control Options

GSA stated that all of the boilers have too low of an exhaust temperature to accommodate either SNCR or SCR. GSA also stated that OFA was infeasible because it "would require derating the boilers in order to modify the superheater tube bank to minimize changes in the heat absorption profile of the boilers" and "the physical configuration and age of the boilers make achieving adequate separation and mixing between the top row of burners and the OFA ports impossible." BOOS was considered technically infeasible due to the age of the units.

Replacement of current LNB systems with upgraded LNB solely or with upgraded LNB and installation of FGR were considered by GSA to be technically feasible.

DOEE finds GSA's approach to eliminating technically infeasible control options to be reasonable.

2.2.3 Step 3 – Rank Remaining Control Options by Effectiveness

In this step GSA submitted rankings of three control options (including SCR and SCNR which were asserted to be technically infeasible) with least effective listed first and emission rates in parentheses:

1. SCR (0.007 to 0.017 lb/MMBtu)
2. LNB + FGR (0.05 lb/MMBtu)
3. SCNR (0.036 to 0.09 lb/MMBtu)

DOEE finds this ranking to be reasonable but finds that a best technically feasible emission rate should be used for LNB+FGR rather than just using the presumptive RACT emission limits in 20 DCMR § 805. AOC relied on 0.03 lb/MMBTU for LNB+FGR, which would be more reasonable. DOEE will not consider SCR or SCNR since they are technically infeasible.

2.2.4 Step 4 – Evaluation of the Most Effective Control Options

Annualized costs were based on assumptions of a 20-year operating lifetime and a 5.5% interest rate. GSA submitted calculations of the cost effectiveness for each of the control options as follows. DOEE also recalculated the emissions benefit and cost effectiveness based Allowable Emissions (AE) rather than 2020 operating behavior.

AEs were calculated based on several assumptions from GSA's operating permits and the information provided for other units at the facility:

- Emission rates for boilers 1, 2, and 3 were assumed to be 0.05 lb/MMBTU, which is the presumptive NOX RACT emissions limit for this type of unit.
- The emission rate for the CHP unit and its duct burner system was assumed to be 0.092 lb/MMBTU when operating without the duct burner on natural gas, 0.163 lb/MMBTU when operating without the duct burner on fuel oil, and 0.2 lb/MMBTU when operating with the duct burner, which is the presumptive NOX RACT emissions limit for this type of unit. The unit was assumed to use the duct burner during non-ozone season only and operate solely on natural gas during ozone season.
- In order to meet the 25 ton per ozone season emissions limit for units 3, 4, and 5, the oil limit of 4,435,035 gallons per year for units 3 through 6, and the 268 ton per year facility emission levels:
    - Units 3 and 4 were assumed to operate only 326 hours during ozone season, the remaining units were assumed to operate 3,672 hours each during ozone season. This acted to limit the ozone season emissions in the base case to 25 tons for units 3 through 5 of NOX (see 20 DCMR § 1001.1).
    - Oil usage was distributed equally between units 3 through 6, only used during non-ozone season, and 7.2 gallons/MMBTU were assumed.
    - All units were assumed to operate 5,912 hours per year, with an estimate of 2,328 during non-ozone season. This acted to limit the total emissions in the base case to 268 tons of NOx.
    - LNB+FGR was expected to operate at 0.03 lb/MMBtu when natural gas was burned (as justified as achievable by AOC) and at 0.12 lb/MMBTU when oil was burned, which is the presumptive NOX RACT emissions limit for this type of unit and since no better technical estimate was made available by any sources.

Table 6: GSA and DOEE cost calculations for the Central Heating Plant

BOILER	CONTROL CONFIG.	TOTAL CAPITAL	TOTAL ANNUALIZED COSTS ($/YR)	TONS/YR NOX REMOVED		COST EFFECTIVENESS ($/TON NOX REMOVED)	
				GSA	AE	GSA	AE
BOILER 4	LNB + FGR	$1,500,000	$1,100,586	14.5	81.0	$76,150	$13,586
BOILER 6	LNB + FGR	$1,500,000	$613,052	7.3	27.5	$4,432*	$22,262

*DOEE is unable to calculate this value and believes it to be an error and should in fact be $83,980/ton.

DOEE finds that its calculations of emissions reductions and cost effectiveness are more appropriate for using in determining RACT for this facility. DOEE is expressly taking comments on its interpretation of AE in light of the various operating conditions in the permits for this facility.

2.2.5 Step 5 – Select RACT

GSA found that no change in control would be technologically or economically reasonable for Boiler 4 and Boiler 6. Evaluation of cost effectiveness based on 2020 data would find that would be reasonable for Boiler 4, but Boiler 6 has a cost effectiveness of $4,432, which is below all states analyzed by the OTC except Pennsylvania. However, DOEE believes the submitted value of $4,432 to be an error and $83,980/ton to be the appropriate value, following GSA's methodology. This corrected value is an unreasonable cost of control. However, since AE should be used in the calculations, the costs of control for units 4 and 6 should be evaluated in light of those estimates. Using DOEE's methodology for both units 4 and 6, DOEE finds that the cost of controls would still be unreasonable to require as RACT.

As discussed earlier, GSA is also proposing to install LNB that meets presumptive RACT on Boilers 1, 2, and 3 and DOEE finds this to be reasonable.

In order for DOEE to accept the plan, the following permit conditions that led to a lower PTE must be in the SIP:

- The 25 ton per ozone season emissions limit for units 3, 4, and 5
- The oil limit of 4,435,035 gallons per year for units 3 through 6, and
- The 268 ton per year facility emission levels.

The first of these requirements stems from a NOx SIP Call regulation 20 DCMR § 1001 that was approved into the District SIP on February 22, 2016 (81 Fed. Reg. 8656) and the second of these requirements is already in GSA source-specific requirements as approved on September 30, 1999 (64 Fed. Reg. 52654). This leaves only the facility-wide emissions limit, which must be federally enforceable. The requirement is already included in an extended Title V permit, No. 32.

DOEE thus proposes to accept GSA's Alternative RACT plan and will incorporate the facility-wide emissions limit of 268 tons per year of NOx into a new permit. After issuing the new permit, DOEE will propose to submit the specific permit requirement into the District's SIP.

2.3 U.S. Capitol Power Plant

The U.S. Capitol Power Plant (CPP), operated by the Architect of the Capitol (AOC), has ten units subject to 20 DCMR § 805.5, specifically a combustion turbine (CT-1) and heat recovery steam generator (HRSG-1), two dry bottom coal fired boilers ≥100 MMBtu/hr that are also capable of burning natural gas (CU-1 and CU-2), one natural gas fired boiler with oil back up sized ≥100 MMBtu/hr (CU-3) and four boilers (CU-4 to CU-7) and one temporary boiler that burn natural gas with oil back up and are sized >25 and <100 MMBtu/hr. AOC states that CPP will comply with presumptive RACT limits for CU-1, CU-2, CT-1, HRSG-1, and the temporary boiler. This leaves boilers CU-3 through CU-7 that warrant further scrutiny. Separate alternative RACT analyses were conducted for CU-3 and the remainder of the boilers.

2.3.1 Step 1 – Identify All Potentially Available Control Options

AOC examined the following control options for CPP emission units:

1. Low NOx Burners (LNB)
2. Overfire Air (OFA)
3. Flue Gas Recirculation (FGR)
4. Burners Out of Service (BOOS)
5. Selective Non-Catalytic Reduction (SNCR)
6. Selective Catalytic Reduction (SCR)

DOEE finds this to be a reasonable list of potential control options.

2.3.2 Step 2 – Eliminate Technically Infeasible Control Options

The flue gas temperature for CU-3 through CU-7 is typically too low to accommodate SNCR or SCR at normal operating rates, though under some operating situations a sufficient temperature to operate SCR may be reached[7]. Since the units spend much of their operating time operating outside of the temperature range of effectiveness of SCR, and never operate within the temperature range of effectiveness of SNCR, AOC found these control options not technically feasible.

BOOS was considered technically feasible for CU-3 but would provide no NOx benefit. BOOS was not technically feasible for CU-4 through CU-7 due to their configuration. Therefore, AOC did not further evaluate BOOS.

Replacement of current LNB systems with upgraded LNB solely or with both upgraded LNB and installation of FGR were considered by AOC to be technically feasible.

[7] CPP's alternate RACT analysis indicates that SNCR operates optimally between 1,600 °F and 2,100 °F, while SCR operates optimally between 480 °F and 800 °F. Their analysis indicates that CU-3 typically operates with an exhaust temperature less than 300 °F, while CU-4 through CU-7 typically operate with exhaust temperatures range from 300 °F to 800 °F. While there is some overlap between the SCR temperature ranges and the outlet temperatures for CU-4 through CU-7, most of the normal operating range is below the SCR temperature range. As corroboration, DOEE reviewed 2022 stack testing for CU-3, CU-6, and CU-7. These tests were performed while the equipment operated at or above 90% load or at the maximum load that did not create unsafe conditions, so one would expect the flue gas temperatures to be significantly higher than average. During the testing, CU-3 averaged 326 °F while firing natural gas and 332.4 °F while firing fuel oil. CU-6 averaged 575 °F while firing natural gas and 563.1 °F while firing oil. CU-7 averaged 410.9 °F while firing natural gas and 426.5 °F while firing oil.

DOEE finds AOC's approach to eliminating technically infeasible control options to be reasonable.

2.3.3 Step 3 – Rank Remaining Control Options by Effectiveness

In this step AOC submitted rankings of two control options with least effective listed first and emission rates in parentheses:

1. LNB (~ 0.05 lb/MMBtu)
2. LNB + FGR (~ 0.03 lb/MMBtu)

DOEE finds this ranking to be reasonable. DOEE is not considering SCR or SCNR since they are technically infeasible.

2.3.4 Step 4 – Evaluation of the Most Effective Control Options

Annualized costs were based on assumptions of a 20-year operating lifetime and a 3.75% interest rate. AOC submitted calculations of the cost effectiveness for each of the control options based on the 2020-2021 operating behavior. DOEE also recalculated the emissions benefit and cost effectiveness based on Allowable Emission (AE) for CU-3 through CU-7 rather than 2020-2021 operating behavior. To calculate AE, we assumed the Capital Power Plant was compliant with the facility's existing Plantwide Applicability Limit (PAL) and that units not included in this analysis were operating in accordance with their 2020 operating behavior as shown in Table 7. This was necessary since these units contribute to the total emissions emitted by the facility and are therefore included in any assessment of whether the PAL is breached. This realistically represents what is *allowable* under the PAL for the units AOC analyzed.

Table 7: 2020 operating emissions for units at Capitol Power not analyzed in the RACT analysis

UNIT	FUEL	2020 NOX EMISSIONS (TONS)
CU-1	Gas	0.2
CU-2		Temporarily Shut Down
Combustion Turbine	Gas	14.93
	Oil	0.17
HRSG	Gas	0.23
	Oil	0.01
Emergency Gen.	Diesel	0.79
Fire Pump	Diesel	0.009
Coal Car Burners		0.00691
Total 2020 NOx Emissions (tons):		16.35
PAL Limit for CPP (tons NOx):		196.7

DOEE calculated the maximum number of hours that CU-3 through CU-7 were allowed to operate while remaining in compliance with the PAL limit of 196.7 tons/year, which equaled 7,657 hours per

year for each boiler. DOEE then calculated a control case using this operating hour assumption. The results of AOC's calculations and the additional calculations conducted by DOEE are in Table 8.

Table 8: AOC and DOEE cost calculations for Capitol Power Plant

BOILER	CONTROL CONFIG.	TOTAL CAPITAL	TOTAL ANNUALIZED COSTS ($/YR)	TONS/YR NOX REMOVED		COST EFFECTIVENESS ($/TON NOX REMOVED)	
				AOC	AE	AOC	AE
CU-3	LNB	$2,725,448	$196,129	7.2	45.4	$27,219	$4,322
	LNB + FGR	$3,452,234	$248,430	9.7	60.9	$25,719	$4,078
CU-4	LNB	$666,221	$67,556	3.1	12.5	$15,447	$3,835
CU-5	LNB	$666,221	$67,556	1.6	13.2	$29,569	$3,639
CU-6	LNB	$666,221	$67,556	2.3	11.7	$20,898	$4,114
CU-7	LNB	$666,221	$67,556	1.9	12.8	$24,893	$3,739
CU-4	LNB + FGR	$938,765	$67,556	4.3	17.1	$15,885	$3,952
CU-5	LNB + FGR	$938,765	$67,556	2.2	17.8	$30,723	$3,802
CU-6	LNB + FGR	$938,765	$67,556	4.3	16.2	$15,885	$4,158
CU-7	LNB + FGR	$938,765	$67,556	2.6	17.4	$25,733	$3,879

Since AOC did not include an operational limit in the request, DOEE must presume that the units could operate the estimated 7,657 hours per year. As a result, DOEE does not find AOC's calculations to be appropriate to determine RACT. DOEE will rely on our calculations to determine the cost effectiveness of RACT controls.

2.3.5 Step 5 – Select RACT

AOC asserts that "all possible control technologies are not technically or economically effective" for boilers CU-3 through CU-7, and therefore proposes that RACT for these five boilers should be a single limit for the combined stack of 0.20 lb/MMBtu on a daily average.

Based on DOEE's cost-effectiveness calculations, installation of LNB, or installation of LNB + FGR, is lower than or comparable to the RACT cost effectiveness of controls in all five of the OTC states with ICI cost data shown in Table 3.
Installation of LNB or installation of LNB and FGR will achieve the presumptive NOx RACT emissions limit found in 20 DCMR § 805.5, therefore Alternative RACT is not appropriate under current operating limits since controls are necessary and reasonable to install and once installed will meet presumptive RACT.

3.0 Public Comment

This version is being provided for public comment and synopsis of the comments and a response will be included in the final document.

4.0 NOx RACT Certification

DOEE, on behalf of the District of Columbia, proposes that the plans submitted by Georgetown and GSA meet the requirements of Alternative RACT and that AOC's plan for CPP does not meet the requirements of Alternative RACT. If finalized as proposed, DOEE will subsequently adopt the cited requirements into the operating permits for the Georgetown and GSA facilities and submit the relevant portions of those permits as SIP amendments.