Technical Support Document

Docket: EPA-R02-OAR-2023-0237

Facility: Sylvamo Ticonderoga Mill

Location: 568 Shore Airport Rd Ticonderoga, NY 12883 (Essex County)

March 29, 2024

Title V Operating Permit: 5-1548-00008/00081 (NYSDEC Region 5)
Condition 52, Emission Unit P-OWERH, Power boiler
Condition 78, Emission Unit R-CAUST, Lime kiln
Condition 85, Emission Unit R-ECOVB, Recovery furnace

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Figure 1: Sylvamo Ticonderoga Mill, Google Earth View 2023

I. Introduction

This technical support document (TSD) outlines the Environmental Protection Agency (EPA)'s analysis of the New York Department of Environmental Conservation (NYSDEC) Source-specific State Implementation Plan (SSSIP) revision for Sylvamo Ticonderoga Mill (Facility), formerly known as International Paper, and is included in the docket as part of the EPA's SSSIP rulemaking. The purpose of this TSD is to support the EPA's findings for the Reasonably Available Control Technology (RACT) analysis and RACT determination under consideration for the Facility's SSSIP revision. The Facility's original RACT plan is dated September 2016. An updated version of this RACT plan is included in the SSSIP submission and is dated August 2021. This TSD also provides background on Clean Air Act (CAA) for informational purposes.

The Facility is a fully integrated bleached kraft pulp and paper mill (the kraft process is a manufacturing process by which wood chips are transformed into pulp) that manufactures printing papers in Essex County, New York. The mill's process operations are supplied with steam and electricity from an 855 MMBtu/hr power boiler that is permitted to burn No. 2 fuel oil, No. 6 fuel oil, waste fuel type "A," wood/bark, rejected digester wood knots, primary clarifier fiber, dried secondary biomass, and natural gas delivered to the mill by truck. Firing of natural gas in the power boiler began in June 2015 using compressed natural gas (CNG). The mill processes hardwood and softwood logs and chips using the kraft pulping process and produces approximately 900 tons per day of uncoated free sheet paper for commercial printing. The chemical recovery for the pulping process is typical for a kraft pulp mill and includes a recovery furnace and a lime kiln.

II. Ozone

For helpful information about ozone, see the EPA website, Ground-level Ozone Basics, https://www.epa.gov/ground-level-ozone-pollution/ground-level-ozone-basics.

a. Ozone formation

Ground level ozone is created by chemical reactions between nitrogen oxides (NOx) and volatile organic compounds (VOCs) when pollutants emitted by sources chemically react in the presence of sunlight. Nonattainment for ground level ozone is defined as an area that is not meeting (or that contributes to ambient air quality in a nearby area that does not meet) the primary or secondary national ambient air quality standards (NAAQS) for 8-hour ozone. Nonattainment areas for the ozone standard are classified as either Marginal, Moderate, Serious, Severe, or Extreme.

Ground-level ozone causes a variety of negative effects on human health, vegetation, and ecosystems. In humans, acute and chronic exposure to ozone is associated with premature mortality and several morbidity effects, such as asthma exacerbation. In ecosystems, ozone exposure may cause visible foliar injury, decrease plant growth, and affect ecological community composition. The potential for ground-level ozone formation tends to be highest during months with warmer temperatures and stagnant air masses; therefore, ozone levels are generally higher during the summer months (referred to as the “ozone season”).

The ozone season is the time of year when ground level ozone reaches its highest concentrations because ozone forms when nitrogen oxides mix with volatile organic compounds in intense sunlight and sunlight is strongest in the summer months. The ozone season in New York is generally considered to be April 15 through October 15 and the non-ozone season from October 16 through April 14.

b. NAAQS for ozone

The EPA has regulated ozone pollution and the precursor emissions that contribute to ozone (i.e., NOx and VOC) for the last five decades as outlined in the bullets below:

- Primary and secondary NAAQS were first established for photochemical oxidants in 1971. 36 FR 8186 (April 30, 1971).
- In 1979, the EPA revised the NAAQS to change the indicator from photochemical oxidants to O_3 and to revise the primary and secondary standards. 44 FR 8202, (February 8, 1979).
- In 1997, the EPA once again revised the primary and secondary standards for ozone NAAQS. 62 FR 38856 (July 18, 1997).
- In 2015, the 1997 ozone NAAQS were revoked. 80 FR 12264 (March 6, 2015).
- There are two NAAQS for ozone relevant to this action:
  - On March 12, 2008, the EPA promulgated a revision to the ozone NAAQS, lowering both the primary and secondary standards to 0.075 parts per million (ppm) averaged over an 8-hour time frame (2008 8-hour Ozone Standard). See, 73 FR 16436 (March 27, 2008); and
  - On October 1, 2015, the EPA lowered the primary and secondary standards to 0.070 ppm averaged over an 8-hour time frame (2015 8-hour Ozone Standard). See, 80 FR 65292 (October 26, 2015).

c. Ozone transport and OTC

Precursor emissions (i.e., NOx and VOC) can be transported downwind directly or, after transformation in the atmosphere, as ozone or secondary ozone precursors. Studies have established that ozone formation, atmospheric residence, and transport can occur on a regional scale (i.e., hundreds of miles) over much of the eastern U.S., with elevated concentrations occurring in rural as well as metropolitan areas. Additionally, observational studies have demonstrated the presence of ozone and ozone precursor transport and documented the impact that upwind emissions have on high concentrations of ozone pollution. As a result of ozone transport, ozone pollution levels in each location are impacted by a combination of local emissions and emissions from upwind sources. The transport of ozone across state borders compounds the difficulty for downwind states to be in attainment with the ozone NAAQS. While substantial progress has been made in reducing ozone in many urban areas, regional-scale ozone transport is still a major component of peak ozone concentrations during the summer ozone season.

The CAA section 184(a)[1], Control of Interstate Ozone Air Pollution, Ozone Transport Regions, addresses requirements for nonattainment areas located in the Ozone Transport Region (OTR), and the CAA section 176A[2], Interstate Transport Commissions, sets forth the responsibilities of the Ozone Transport Commission (OTC), which include establishing control measures for major sources of NOx located in the OTR. The OTC is governed by a commission and consists of a group of northeast states.[3] States in the OTR are required to submit a State Implementation Plan (SIP) submission demonstrating a certain level of controls for pollutants that form ozone, even if the applicable sources are not located in an area that is designated as nonattainment for the ozone standard.[4]

Section 184(b) of the CAA establishes specific control requirements that each state in the OTR is required to implement within the state, including certain controls on sources of NO_X and VOCs. These control requirements are required to be implemented statewide in any state included within the OTR, regardless of ozone attainment status.

Under CAA section 184(b)(2), major stationary sources of VOCs in OTR states are subject to the same requirements that apply to major sources in designated ozone nonattainment areas classified as Moderate. Thus, the state must adopt rules to apply nonattainment new source review (NNSR) and reasonably available control technology (RACT) (pursuant to CAA section 182(b)(2)) provisions for major VOC sources statewide.

Under section 182(f) of the CAA, states must apply the same requirements to major stationary sources of NO_X as are applied to major stationary sources of VOCs. Thus, the same

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[1] More information can be found at §184, https://www.gpo.gov/fdsys/pkg/USCODE-2013-title42/html/USCODE-2013-title42-chap85-subchapI-partD-subpart2-sec7511c.htm
[2] More information can be found at §176A, https://www.gpo.gov/fdsys/pkg/USCODE-2013-title42/html/USCODE-2013-title42-chap85-subchapI-partD-subpart1-sec7506a.htm
[3] More information about the OTC can be found at https://otcair.org/.
[4] More information on non-attainment and OTC SIP requirements can be found at https://www.epa.gov/ozone-pollution/nonattainment-and-ozone-transport-region-otr-sip-requirements.

NNSR and RACT requirements that apply to major stationary sources of VOCs in the OTR also apply to major stationary sources of NO_X. See, 57 FR 55622 (November 25, 1992).

The State of New York is located within the OTR, which triggers statewide RACT requirements. Although the Facility is not located in one of New York's two ozone nonattainment areas, it is subject to RACT requirements because it is located in the OTR. New York has two ozone nonattainment areas: 1) Jamestown; and 2) New York Metro Area[5] (Bronx County, Kings County, Nassau County, New York County, Queens County, Richmond County, Rockland County, Suffolk County, Westchester County).

III. Federal RACT Requirements

Reasonably Available Control Technology (RACT) is defined as the lowest emission limit that a particular source is capable of meeting by the application of control technology that is reasonably available considering technological and economic feasibility.[6]

The Clean Air Act (CAA) section 182, Plan Submissions and Requirements, requires states with ozone nonattainment areas to include in their SIPs, among other things, provisions to require the implementation of reasonably available control technology (RACT).[7] As described above, states within the OTR like New York are required to meet these section 182 requirements to implement RACT for major sources of NOx and VOCs.[5]

a. Cost effectiveness

Cost effectiveness is a figure in dollars per ton of emissions reductions per year (i.e., the cost per ton of pollutant controlled). An analysis of cost effectiveness could include, for example, consideration of process capital equipment, total plant cost and investment, fixed and variable operating cost, total capital requirements, and consumable costs. Because sources (e.g., a large boiler) will vary in age, condition, and size, the actual costs, emission reductions, and cost effectiveness levels for an individual source to apply a given control technology will vary from unit to unit and from area to area.

The inflation calculator can be used to identify increase of costs over time. A reliable cost calculator to adjust the economic feasibility threshold for inflation is the U.S. Department of

[5] Section 182 of the CAA can be found at: https://www.govinfo.gov/content/pkg/USCODE-2013-title42/html/USCODE-2013-title42-chap85-subchapI-partD-subpart2-sec7511a.htm

Labor, Bureau of Labor Statistics inflationary calculator at https://www.bls.gov/data/inflation_calculator.htm.

For a summary of cost assessments of the Facility's control technologies that were considered in this action, refer to Section VIII, Feasibility of RACT control technology.

IV. New York State RACT Requirements

The 2013 New York Department of Environmental Conservation (NYSDEC) RACT policy entitled, "DAR-20 Economic and Technical Analysis for Reasonably Available Control Technology (RACT)" (DAR-20), outlines the process and conditions for granting Source-specific RACT determinations[6] that must be re-evaluated upon renewal of the emission source Title V operating permit. A RACT re-evaluation must assess the latest control technologies and strategies available, and account for an inflation-adjusted[7] economic threshold. Under the DAR-20, a major source of VOC or NOx emissions will not be required to implement any emission reduction or control strategy that is more costly than the established economic threshold adjusted over time for inflation. Under the DAR-20, NYSDEC established the following cost threshold, based on 1994 dollars, to define economic feasibility:

- VOC (Severe Ozone nonattainment Area) – $5,000/ton reduced (1994 dollars)
- VOC (Marginal Ozone nonattainment Area) - $3,000/ton reduced (1994 dollars)
- NOx (statewide) - $3,000/ton reduced (1994 dollars)

The Facility's re-evaluated RACT plan is dated August 2021. Accounting for inflation, $3,000 in 1994 dollars for NOx equates to $5,613.55 in August 2021 dollars.

The following State regulations have been approved into New York's SIP and are applicable to the Facility:

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[6] 2013 DAR-20 Economic and Technical Analysis for Reasonably Available Control Technology (RACT) https://www.dec.ny.gov/docs/air_pdf/dar20.pdf.

[7] The State of New York relies on the U.S. Department of Labor, Bureau of Labor Statistics inflationary calculator to adjust the RACT economic feasibility threshold over time for inflation. See, https://www.bls.gov/data/inflation_calculator.htm.

- 6 NYCRR Subpart 227–2, ‘‘Reasonably Available Control Technology (RACT) For Major Facilities of Oxides of Nitrogen (NOx).” Approved by the EPA on July 12, 2013 and published in the Federal Register at 78 FR 41846
- 6 NYCRR Part 212, “General Process Emission Sources.” Approved by the EPA on October 1, 2021 and published in the Federal Register at 86 FR 54375.

NYCRR subpart 227-2 provides for a “case-by-case RACT” emission limit, and NYCRR part 212 provides for a “Source-specific RACT” emission limit. If a source meets either the Source-specific or case-by-case RACT emission limit, it is considered to have implemented RACT under these regulations.

If the source cannot meet the Source-specific or case-by-case RACT emission limit, then the facility must conduct a RACT analysis. If the source can demonstrate that no additional technically feasible cost-effective controls are achievable, or that the existing control(s) currently employed on the source sufficiently implement RACT, then the source may request a higher emission limit or a different monitoring program under 227-2, or a new emission limit under 212.

The process for requesting approval of an alternative emission limit is as follows: 1) The facility communicates with the state to request a new or revised emission limit through a title V permit modification; 2) the facility conducts a RACT analysis and proposes a RACT plan; 3) the state works with the facility to establish an emission limit that implements RACT based on the source’s RACT analysis and the Federally approved state RACT regulations; 4) the state provides public notice for the draft RACT emission limit that is included in the title V operating permit as a RACT permit condition; 5) the state considers all public comments, revises the emission limit as appropriate, and submits a SSSIP revision to the EPA; 6) the EPA considers the RACT plan and supporting documentation and publishes a proposed action on the SSSIP revision in the Federal Register; 7) the EPA considers all public comments, revises its final action as appropriate, and publishes a final action approving or disapproving the SSIP revision. If the SSSIP is approved into the SIP, the RACT emission limit becomes Federally enforceable.

With respect to this SSIP revision, the Facility’s power boiler is subject to Title 6 of the New York Codes, Rules and Regulations (6 NYCRR), 6 NYCRR part 227, because power boilers are a major source of NOx emissions. Subpart 227-2.4(a) specifically covers very large boilers. However, because of the power boiler's permitted fuel mix, there are no presumptive NOx RACT limits (6 NYCRR 227-2.4(a)(2)) applicable to the power boiler. Therefore, the power boiler must use one or more of the four compliance options outlined in 6 NYCRR 227-2.5 to implement RACT. The Facility's lime kiln and the recovery furnace are subject to 6 NYCRR part 212 because they are process sources. The Facility is not in one of the subpart 212-3 listed counties, and thus falls under subpart 212-3(a)(2)[8].

The Facility's emission limits and monitoring requirements for the power boiler, lime kiln, and recovery furnace, are included in the Facility's title V operating permit and have been submitted to the EPA as a SSSIP revision to satisfy the requirement to implement RACT for major sources of NOx under sections 182 and 184 of the CAA.

V. Title V operating permit

a. Overview

The RACT emission limits are contained in the facility's title V operating permit. The title V operating permit includes pollution control requirements from federal or state regulations that apply to large sources, "major" sources, and a limited number of smaller sources, including some "area," "minor," and non-major" sources. New York State has primary responsibility for administering the permitting program, which includes reviewing permit applications and issuing permits. The EPA has oversight responsibility over state title V permitting programs.

The title V operating permit contains only enforceable terms and conditions, as well as additional information, such as the identification of emission units, emission points, emission sources and processes, that make the permit terms meaningful. Under 40 CFR Part 70.7(a)(5), State Operating Permits Programs, Permit issuance, Renewals, Reopening, Revisions, there is a requirement that each title V permit have an accompanying "...statement that sets forth the legal and factual basis for the draft permit conditions…" New York refers to this as the permit review report (PRR). The Facility PPR provides pertinent details regarding the permit, application data,

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[8] Under NYCRR 212-3(a)(2): Owners and/or operators of facilities located outside of the Lower Orange County towns of Blooming Grove, Chester, Highlands, Monroe, Tuxedo, Warwick, and Woodbury and New York City metropolitan area with an annual potential to emit of 100 tons or more of NOx or 50 tons or more of VOCs must comply with the requirements of this section.

and permit conditions in an understandable format. The Facility PRR also includes background narrative and explanations of regulatory decisions made by the state permit reviewer. The Facility PRR is a separate document and is not itself an enforceable term or condition of the Facility's Title V operating permit.

The following RACT limits contained in the Facility's title V operating permit, 5-1548-00008/00081, Effective Date: 3/19/2022; Expiration Date: 3/18/2027 are pending EPA approval through this SSSIP action:

1) Permit condition 52, one power boiler, applicable requirement 6 NYCRR 227-2.5(c). The NOx RACT emission limits are: 0.23 lb NOx/MMBtu per 24-hour average (0.22 lb NOx/MMBtu per 30-day rolling average) during the ozone season May 1 through September 30, and 0.23 lb NOx/MMBtu per 30-day rolling average during the non-ozone season October 1 through April 30. These seasons are along the same time periods as defined in the ozone section above. The emissions are monitored with Continuous Emission Monitoring System (CEMS).

2) Permit condition 78, one lime kiln, applicable requirement 6 NYCRR 212-3.1(a)(2). The NOx RACT emission limit is 120 parts per million by volume (ppmv) (wet, corrected to 10% O_2). Emission testing using Method 7E to demonstrate compliance will be performed once every five years.

3) Permit condition 85, one recovery furnace, applicable requirement 6 NYCRR 212-3.1(a)(2). The NOx RACT emission limit is 100 ppmv (dry, corrected to 8% O_2). Emission testing using Method 7E to demonstrate compliance will be performed once every five years.

The NYSDEC Air Title V Permit for this Facility is available at: https://www.dec.ny.gov/dardata/boss/afs/permits/515480000800081_r4.pdf.

The Permit Review Report for this Facility is available at: https://www.dec.ny.gov/dardata/boss/afs/permits/prr_515480000800081_r4.pdf.

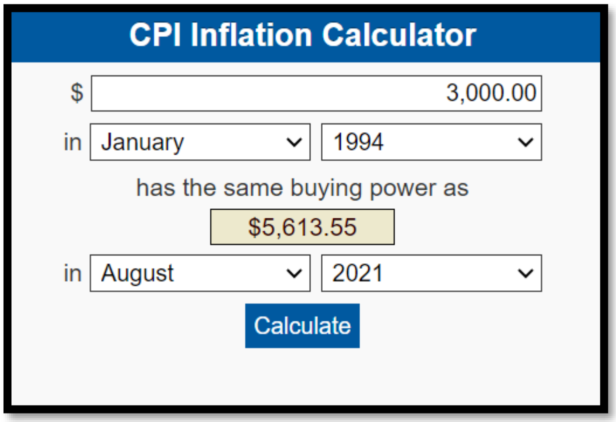
b. EPA approved test methods

- Method 7E, Nitrogen Oxide Instrumental Analyzer, https://www.epa.gov/emc/method-7e-nitrogen-oxide-instrumental-analyzer

- All EPA approved test methods, https://www.epa.gov/emc/emc-promulgated-test-methods

VI. EPA's RACT review

The Facility's re-evaluated RACT plan is dated August 2021. The economic feasibility for all control technologies must be adjusted for inflation. One way to calculate this inflation is by using the U.S. Bureau of Labor Statistics inflation calculator, https://www.bls.gov/data/inflation_calculator.htm. The inflation calculator requires a comparison of two dates to estimate the buying power (i.e., "has the same buying power as"). For EPA's review of the RACT analysis, we used the year that NYSDEC established the cost threshold under the DAR-20 RACT policy, 1994, and the date of the most recent Facility RACT re-evaluation, August 2021. We used the DAR-20 $3,000/tons NOx reduced. The result is that $3,000 in 1994 dollars is equivalent to $5,613.55 in August 2021 dollars.



In its RACT analysis, the Facility identified control options that are not currently implemented but that are technically feasible given its operations. The Facility then determined which of the identified control options were cost-effective. If control options are both technically feasible and cost-effective, the Facility should adopt those control options to implement RACT. In this case, the Facility's RACT analysis demonstrated that no additional cost-effective controls were technically feasible. For a summary of cost assessment for each control technology, refer to Section VIII, Feasibility of RACT control technology.

NYSDEC reviewed and considered the Facility's RACT analysis and made a RACT determination for the purposes of New York's regulations. The EPA reviewed the RACT analysis included in the SSSIP submittal and consulted with NYSDEC permit writers and the

EPA Region 2 enforcement team. The RACT requirements contained in the title V operating permit will become Federally enforceable if the EPA approves the SSSIP.

The following describes EPA's analysis for each of the sources in this Facility that are subject to RACT requirements, the (a) power boiler, (b) lime kiln, and (c) recovery furnace. This analysis includes an overview, the applicable state RACT regulations, and title V permit conditions.

a. Power boiler (EU P-OWERH)

Overview – power boiler

The Facility operates one power boiler. The power boiler supplies steam and electricity to the mill. The Facility's power boiler is characterized as a "very large boiler" under 6 NYCRR 227-2.2, with a rated fuel heat input capacity of 855 MMBtu/hr. The multi-fuel fired stoker boiler is permitted to burn No. 2 fuel oil, No. 6 fuel oil, waste fuel type "A," wood/bark, rejected digester wood knots, primary clarifier fiber, dried secondary biomass, and natural gas delivered to the mill by truck as compressed natural gas (CNG). Natural gas is the primary fuel for the power boiler. The power boiler is also used as a combustion/destruction device for the non-condensable gases produced in the pulping and chemical recovery processes. Non-condensable gases are gases that cannot be condensed under normal cooling conditions such that a temperature of -150°C is required to condense them.

The power boiler (and lime kiln) was converted in 2015 to burn natural gas (in addition to its other fuel sources) under the assumption that a future natural gas pipeline would be feasible. However, the pipeline project costs doubled, and the timeline for delivery to the mill was extended by a year and a half, so the Facility withdrew from the project.

New York RACT regulation – power boiler

6 NYCRR Subpart 227–2, ''Reasonably Available Control Technology (RACT) For Major Facilities of Oxides of Nitrogen (NOx)," applies to the power boiler and was approved by the EPA on July 12, 2013, and published in the Federal Register at 78 FR 41846. When a very large boiler uses fuel other than the fuel types listed in 227-2.4(a)(1) (gas, gas/oil , pulverized coal, coal wet bottom or coal dry bottom), then a RACT proposal must include, a proposed emission limit for the other fuel in accordance with subpart 227-2.4(a)(2).

The power boiler is a multi-fuel boiler that burns fuel that is not one of the listed fuel types, and an appropriate emission limit for the boiler must be determined that adequately implements RACT. The state-proposed NOx limit is 0.22 lb/MMBtu during ozone season and 0.23 lb/MMBtu during non-ozone season.

Title V operating permit – power boiler

The NOx emission limit and different compliance averaging times for the power boiler are included in the title V operating permit and comply with the New York state process required in the Federally approved Subpart 227–2, ‘‘Reasonably Available Control Technology (RACT) For Major Facilities of Oxides of Nitrogen (NOx),” approved by the EPA on July 12, 2013 and published in the Federal Register at 78 FR 41846.

The emission limits are defined on page 60 (bottom), **Condition 52**. The **NOx RACT emission limits** are: 0.23 lb NOx/MMBtu per 24-hour average (0.22 lb NOx/MMBtu per 30-day rolling average) during the ozone season May 1 through September 30, and 0.23 lb NOx/MMBtu per 30-day rolling average during the non-ozone season October 1 through April 30. The NOx emissions from the power boiler are continuously monitored using monitoring system protocols in accordance with 40 CFR Part 75 (Continuous Emission Monitoring) and reported to the EPA. The CEMS for the very large power boiler satisfies the testing, monitoring, and reporting requirements under the Federally approved 6 NYCRR subpart 227-2.6(a)(1). Under this section, any large boiler must measure NOx emissions with a CEMS or an equivalent monitoring system approved by the NYSDEC. Continuous emissions monitoring system (CEMS) Facility reports indicate that the power boiler has been operating at or below its current RACT limits.

b. **Lime kiln (EU R-CAUST)**

Overview – lime kiln

The lime kiln’s function is to calcine the lime mud into quicklime. The kiln fires No. 6 fuel oil and/or CNG, with propane used for startup and process stabilization. In operation since 1970, the lime kiln is 250 feet long and 9 feet in diameter and is equipped with a wet venturi scrubber to control particulate matter emissions. In addition, the mill adds caustic to the scrubber to control total reduced sulfur (TRS) compound emissions from the kiln’s flue gases. Like the recovery furnace described in section VI.c. below, the lime kiln predates New Source Performance Standards (NSPS) which are technology-based standards applicable to pollutant emissions for new and modified stationary sources. The lime kiln predates NSPS subpart BB[9], which dictates standards of performance for kraft pulp mills, and is therefore not subject to those regulatory requirements. The lime kiln is, however, subject to a TRS limit of 10 parts per million by volume, dry (ppmvd) (or 0.7 lb/hr, whichever is more restrictive).

New York RACT regulation – lime kiln

The lime kiln's function is to calcine lime mud into quicklime. That is its normal operation, and it is a "process operation," as defined at 6 NYCRR Subpart 212-3 ''Reasonably Available Control Technology (RACT) For Major Facilities," which was approved by the EPA on October 1, 2021 and published in the Federal Register at 86 FR 54375. The Facility is requesting a Source-specific RACT emission limit because the lime kiln is a "process operation" and subject to RACT requirements under 6 NYCRR Subpart 212-3.

Title V operating permit – lime kiln

The NOx emission limits for the lime kiln are included in the title V operating permit and comply with the New York state process required in the Federally approved Part 212, "General Process Emission Sources," approved by the EPA on October 1, 2021 and published in the Federal Register at 86 FR 54375.

The RACT emission limit is defined on page 82 (bottom), **Condition 78**. The **NOx RACT emission limit** is 120 parts per million by volume (ppmv) (wet, corrected to 10% O_2). Emission testing to verify compliance with this limit will be performed once every five years as an arithmetic average of stack test runs.

NYSDEC confirms that, "Most stack testing conditions require retesting once per permit term unless the applicable requirement specifies some other frequency. Subpart 212-3 does not specify a testing frequency or any other compliance demonstration method, so testing frequency authority is given using subpart 201-6.4(b)(2): (2) where the applicable requirement does not require periodic testing or instrumental or non-instrumental monitoring (which may consist of

[9] https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-60/subpart-BB

recordkeeping designed to serve as monitoring), the permit shall specify the periodic monitoring sufficient to yield reliable data from the relevant time periods that are representative of the major facility's compliance with the permit. Such monitoring requirements shall assure use of terms, test methods, units, averaging periods, and other statistical conventions consistent with the applicable requirements; and Title V facilities are also required to submit annual compliance certifications where a responsible official certifies that the facility complies (or not, if appropriate) with its permit conditions. For the sake of completeness, Title V facilities also submit semiannual (and occasionally quarterly) reports certifying compliance with the various monitoring requirements in their permit."

c. **Recovery furnace (EU R-ECOVB)**

Overview – recovery furnace

The recovery furnace is an indirect water-walled steam generator used to recover inorganic chemicals from spent cooking liquors and to produce steam as a collateral benefit. The recovery furnace predates NSPS subpart BB and is therefore not subject to those regulatory requirements. The fuel used in the recovery furnace is spent concentrated cooking liquor (black liquor). The black liquor goes through dehydration and combustion to form ash, which is then exposed to active reducing conditions to convert sodium-sulfur-oxygen compounds to sodium sulfide. The organic materials from the liquor are oxidized, and the remaining inorganic material from the liquor is drained from the furnace.

The furnace consists of a large vertical combustion chamber lined with water tubes. The heat exchanger section consists of a boiler/furnace, a superheater, and an economizer. The fuel used in the furnace is spent concentrated cooking liquor (black liquor). TRS compounds from the recovery furnace are limited to 10 ppm (or 8 ppmvd, corrected to 8% O_2). The start-up fuel in the mill's recovery furnace is No. 6 fuel oil that is fired through five guns at a level several feet below the liquor guns. Three additional oil guns are located above the liquor guns at the tertiary air port level. Each oil gun has a maximum oil firing rate of approximately five gallons per minute (5gpm). Besides startup and shutdown, the auxiliary fuel oil may also be fired when the liquor flow is interrupted for reduced to maintain steam supply to the mill's process units.

New York RACT regulation – recovery furnace

The recovery furnace is an indirect water-walled steam generator used to recover inorganic chemicals from spent cooking liquors and to produce steam as a collateral benefit. That is its normal operation, and it is a "process operation," as defined at 6 NYCRR Subpart 212-3 ‘‘Reasonably Available Control Technology (RACT) For Major Facilities," which was approved by the EPA on October 1, 2021 and published in the Federal Register at 86 FR 54375. The Facility is requesting a Source-specific RACT emission limit because the recovery furnace is a "process operation" and subject to RACT requirements under 6 NYCRR Subpart 212-3.

Title V operating permit – recovery furnace

The NOx emission limits for the recovery furnace are included in the title V operating permit and comply with the New York state process required in the Federally approved Part 212, "General Process Emission Sources," approved by the EPA on October 1, 2021 and published in the Federal Register at 86 FR 54375.

The RACT emission limit is defined on page 88 (bottom), **Condition 85**. The **NOx RACT emission limit** is 100 ppmv (dry, corrected to 8% O_2). Emission testing to verify compliance will be performed every five years as an arithmetic average of stack test runs.

NYSDEC confirms that, "Most stack testing conditions require retesting once per permit term unless the applicable requirement specifies some other frequency. Subpart 212-3 does not specify a testing frequency or any other compliance demonstration method, so testing frequency authority is given using subpart 201-6.4(b)(2): (2) where the applicable requirement does not require periodic testing or instrumental or non-instrumental monitoring (which may consist of recordkeeping designed to serve as monitoring), the permit shall specify the periodic monitoring sufficient to yield reliable data from the relevant time periods that are representative of the major facility's compliance with the permit. Such monitoring requirements shall assure use of terms, test methods, units, averaging periods, and other statistical conventions consistent with the applicable requirements; and Title V facilities are also required to submit annual compliance certifications where a responsible official certifies that the facility complies (or not, if appropriate) with its permit conditions. For the sake of completeness, Title V facilities also submit semiannual (and occasionally quarterly) reports certifying compliance with the various monitoring requirements in their permit."

VII. RACT control technology analysis

The following are pertinent sections of the Facility's plan to implement RACT for the power boiler, the lime kiln, and the recovery furnace, followed by EPA's own analysis. In its analysis, the EPA reviewed the Alternative Control Technology (ACT) document *NOx Emissions from Industrial/Commercial/Institutional (ICI) Boilers* (i.e., EPA guidance document EPA-453/R-94-022) and consulted NYSDEC technical experts.

a. Power boiler

Six LNB assemblies (three levels with two burners on each level) are available in the power boiler for firing No. 6 oil or CNG. Normally, two burners are fired with CNG and additional burners are fired with No. 6 oil as needed to meet the mill's steam demand. As a result of the Facility's 2011 NOx RACT analysis, six Dynaswirl-LN LNBs were installed. The burner design includes a tertiary air sleeve setup to allow increased flexibility for combustion staging and flame shaping. Overfire air improvements, an alternative control technology to enhance combustion and suppress NOx emissions, achieves the same level of NOx control in combination with LNB as LNB assemblies alone (approximately 8%). Since the Facility has already installed LNB assemblies on the power boiler to comply with the previous RACT determination, overfire air improvements were not considered in the RACT analysis.

A1. Facility RACT Plan explains the following:

"NYSDEC guidance[10] defines criteria related to cost-effectiveness of a particular RACT alternative. A RACT alternative is cost-effective if the annualized cost of that control is less than $5,500 per ton of NOx removed based on potential annual emissions. (NYSDEC RACT

[10] The Facility is referring to the following New York State regulations as "guidance": 6 NYCRR Part 200 General Provisions, Subpart 201-3 Exemptions and Trivial Activities, and Subpart 227-2 Reasonably Available Control Technology (RACT) for Oxides of Nitrogen (NOx), Assessment of Public Comments, Page 31.

guidance document (DAR 20) has the cost-effectiveness threshold as $3,000 in 1994 dollars. Adjusted for inflation, this is approximately $5,500.)"

A2. EPA analysis:

The inflationary calculator states that $3,000 in January 1994 is $5,613.55 in August 2021. (https://www.bls.gov/data/inflation_calculator.htm) This is $113.55 over the cost-effectiveness threshold the Facility estimated in their RACT plan. However, the costs per ton NOx removed of the control technologies analyzed in the RACT plan are above the $5,613.55 threshold, so EPA determines that the $5,500 approximation stated in the Facility's RACT plan is sufficient.

B1. Facility RACT Plan explains the following:

"Implementing OFA improvements does not offer any additional NOx reduction over the 8% already achieved by the LNB improvements and is therefore, not evaluated further and is rejected as RACT."

B2. EPA analysis:

The ACT guide for *NOx Emission from Industrial Commercial Institutional Boilers 1994* states the following: "The average reduction achieved with the retrofit of LNB on seven industrial commercial institutional (ICI) boilers was 55 percent with a controlled level of 0.35 lb/MMBtu. A combination of LNB plus OFA also achieved an average of 0.35 lb/MMBtu on eight industrial commercial institutional boilers." Therefore, there do not seem to be any significant NOx reductions associated with implementing OFA improvements for boilers that already have LNBs installed.

C1. Facility RACT Plan explains the following:

"Firing natural gas in lieu of No. 6 fuel oil in the power boiler is a technically feasible NOx control option. Natural gas has no fuel bound nitrogen; therefore, formation of fuel NOx is minimized."

C2. EPA analysis:

The ACT guide for *NOx Emission from Industrial Commercial Institutional Boilers 1994* states the following: "When fuel is burned with air, nitric oxide (NO), the primary form of NOx, is formed mainly from the high temperature reaction of atmospheric nitrogen and oxygen (thermal

NOx) and from the reaction of organically bound nitrogen in the fuel with oxygen (fuel NOx). When low-nitrogen fuels such as natural gas, higher grade fuel oils, and some nonfossil fuels are used, nearly all the NOx generated is thermal NOx. The nitrogen content of natural gas can vary over a wide range, from zero to as high as 12.9 percent, depending on the source of the gas." EPA's analysis confirms what was stated in the Facility RACT plan as accurate.

D1. Facility RACT Plan explains the following:

Firing No. 2 fuel oil in lieu of No. 6 fuel oil in the power boiler is a technically feasible NOx control option. The typical fuel bound nitrogen content of No. 2 fuel oil ranges from 10 parts per million by weight (ppmw) to 400 ppmw, significantly less than the nitrogen content of No. 6 fuel oil.

D2. EPA analysis:

The Facility's RACT plan included a broken url to corroborate the information above. EPA consulted with the permit writer at NYSDEC about the fact that the website provided was no longer working. NYSDEC contacted the Facility and their response is as follows: "This was the source of the fuel bound nitrogen range of #2 fuel oil, documenting that it is lower than the nitrogen content of # 6 fuel oil. This data is really just being used to show that switching from #6 fuel oil to #2 fuel oil could potentially lower NOx emissions. For the cost effectiveness evaluation in the RACT Analysis document, projected NOx emissions from #2 fuel oil were based on manufacturer guarantees (Coen) for the burners in use on the boiler. They were not based on the values shown on the website that is not working." EPA deems the Facility's response to the issue presented as sufficient.

E1. Facility RACT Plan explains the following:

Selective catalytic reduction (SCR) systems are widely used on coal fired boilers as well as natural gas and distillate oil fired combustion turbines in the U.S. However, a high dust SCR is not technically feasible for wood fired boilers because the high sodium and potassium concentrations that result from wood combustion would quickly poison the catalyst.

E2. EPA analysis:

According to the *EPA Air Pollution Control Cost Manual*, the most common SCR design is the high-dust SCR. High-dust configurations have SCR reactors located upstream of the particulate control device and the air heater, and the flue gas contains particulates when it enters the SCR reactor. Certain fuel constituents that are released during combustion act as catalyst poisons, which include potassium and sodium. EPA confirms that a high dust SCR would not work for the power boiler because the potassium and sodium released during wood combustion would poison the catalyst.

b. Lime kiln

The lime kiln is equipped with a wet venturi scrubber to control particulate matter emissions. In addition, the mill adds caustic to the scrubber to control TRS compound emissions from the kiln's flue gases. A stack test must be performed every five years to verify compliance. A search of the RBLC indicated that the recommended NOx control method for lime kilns is to employ "good combustion controls." The Facility concludes that the lime kiln as currently equipped and operated using good combustion practices adequately implements RACT.

A1. Facility RACT Plan explains the following:

As discussed previously, firing liquefied natural gas (LNG) in lieu of No. 6 fuel oil is a technically feasible NOx control option. Effective February 26, 2015, the NYSDEC established a permitting program for siting, construction and operation of LNG facilities in New York (6 NYCRR Part 570). Pursuant to Part 570.2, a facility can apply for, and obtain a permit to store no more than 70,000 gallons of LNG onsite. Such limited fuel quantities (70,000 gallons is equivalent to about 5,800 MMBtu) are insufficient to maintain availability and reliability of the lime kiln.

A2. EPA analysis:

An online search of LNG and MMBtu returns conversions that there is 12.1 LNG gallons per MMBtu (e.g.,). This equates 70,000 gallons of LNG to approximately 5,785.12 MMBtu. EPA deems what was stated in the Facility RACT plan as accurate.

c. Recovery furnace

The recovery furnace is a complex chemical reactor with specific emission limits established by the NYSDEC for particulate matter, opacity, and TRS. Recovery furnaces are designed to operate under reducing (oxygen-deficient) conditions in the ash bed. In addition, the recovery furnace is designed to minimize emissions of un-combusted organics (including TRS) by providing secondary and tertiary air above the bed. A stack test must be performed every five years to verify compliance. The design of the recovery furnace results in an environment that minimizes NOx emissions through "staged air" combustion control, and NOx is principally the result of fuel-bound nitrogen in the black liquor. The NOx concentrations measured during the recent stack test conducted in August 2020 show that the recovery furnace at the mill operates well below the levels specified in recent RBLC determinations. The Facility asserts the current recovery furnace design and operating practices adequately implement RACT.

A1. Facility RACT Plan explains the following:

The use of LNB has not been demonstrated for black liquor combustion in recovery furnaces. Additionally, use of LNB has not been demonstrated on a recovery furnace.

A2. EPA analysis:

EPA searched the RBLC for control technologies utilized by recovery furnaces for kraft processes over the past 20 years and did not find any instances of installing LNBs on a recovery furnace.

B1. Facility RACT Plan explains the following:

According to the National Council of Air and Stream Improvement (NCASI), flue gas recirculation (FGR) is not a viable option for recovery furnaces. FGR contributes to additional flue gas volume in the furnace. This leads to an increase in velocities of the flue gas, which may cause liquor entrainment which in turn can cause fouling of the recovery furnace tubes. Additionally, the NOx generated in recovery furnaces is primarily fuel NOx from black liquor, and FGR reduces only thermal NOx formation. Therefore, the minimal thermal NOx control offered by the technology is not justified in light of the issue of liquor entrainment and tube fouling.

B2. EPA analysis:

The Technical Association of the Pulp and Paper Industry (TAPPI) cites Forssén et al's "NOx reduction in black liquor combustion – reaction mechanisms reveal novel operational strategy options" in stating that "recovery boiler NOx emissions originate mostly in the small amounts of nitrogen originally present in the black liquor." The ACT guide for *NOx Emission from Industrial Commercial Institutional Boilers 1994* states the following: 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. EPA confirms that FGR will provide minimal NOx control on the recovery furnace due to fact that most of the NOx emissions would be from the black liquor fuel.

C1. Facility RACT Plan explains the following:

AECOM (the company that prepared Facility's NOx RACT analysis document) has not found any commercially demonstrated uses of selective non-catalytic reduction (SNCR) in recovery furnaces. Like SNCR, the use of SCR to reduce NOx emissions has not been commercially demonstrated on recovery furnaces.

C2. EPA analysis:

A search of the RBLC for recovery furnaces for kraft processes in the past 20 years did not find any instances of SNCR or SCR installed on a recovery furnace.

VIII. Feasibility of RACT control technology

The following tables display the proposed Facility NOx control technologies for the power boiler, lime kiln, and recovery furnace and their corresponding feasibilities. For those RACT control technologies that have been shown to be not cost effective, the EPA reviewed the cost estimates provided by the Facility and agrees that the costs are over the threshold and not cost effective. For details on cost estimates, please refer to the Facility RACT plan. All three emission units considered the same 8 control technologies (4 fuel switching methods, LNB, FGR, SCR, and SNCR). In addition, the power boiler also considered FGR with baghouse and OFA improvements, and the recovery furnace also considered air staging.

a. Power boiler

The following table displays the RACT control technologies that were considered by the Facility for the power boiler. The table identifies which of these controls are technically or reasonably feasible, and whether they are also cost effective.

RACT control technology	Determination	Reasoning
Low-NOx Burner (LNB) Improvements	Technically and economically feasible. Already implemented.	During the 2011 RACT analysis, Facility deemed this option to be technically and economically feasible and therefore a candidate technology for retrofit to the power boiler. In 2015, the mill installed Coen's Dynaswirl-LN LNB to meet the RACT limit of 0.23 lb/MMBtu. Since this option has already been implemented, no further evaluation is being conducted for this option.
Fuel switching No. 6 oil with pipeline natural gas	Not technically feasible. Not implemented.	There is currently no natural gas pipeline servicing the mill. The Facility originally planned to be a customer of Vermont Gas Systems, however the proposed pipeline costs nearly doubled from initial estimates and timeline for delivery to the mill was extended by more than a year and a half. As a result, the Facility withdrew from the pipeline project. Therefore, the use of pipeline natural gas in lieu of No. 6 fuel oil is not an available control measure at the present time.
Flue Gas Recirculation (FGR)	Not technically feasible. Not implemented.	FGR is technically infeasible because in the past, the Facility had a system installed which had trouble running and no viable solutions were found. In 1995, Facility had installed a system for 15% flue gas recirculation on the power boiler. The mill had trouble running this system because dust from the discharge of the cyclones routinely entered the windbox which blinded the flame scanners causing them to trip. During

		the 2011 NOx Control Evaluation Studies, Coen had recommended installing sight tubes through the windbox on all of the flame scanners and upgrading the purge air blower in order to keep the flame scanners from being blinded by dust. However, the mill was skeptical of this proposed solution based on previous experience with sight tubes on the mill's lime kiln's oil burner. The lime kiln tubes routinely warped and eventually had to be removed. The mill concluded that it would be a substantial risk to run 15% FGR with the particulate laden flue gas as will be the case with the power boiler since it fires bark fuel. The FGR system was removed from service in 2012. Therefore, FGR alone (i.e., without a particulate control device) is considered to be technically infeasible and is rejected as RACT.
Selective Catalytic Reduction (SCR)	Not technically feasible. Not implemented.	A high dust SCR is not technically feasible for wood fired boilers because the high sodium and potassium concentrations that result from wood combustion would quickly poison the catalyst. In a few cases, a regenerative SCR system has been installed after a fabric filter on boilers burning only wood. Regenerative SCR is technically feasible for boilers burning only wood with a fabric filter due to insignificant concentrations of sulfuric acid mist but is not technically feasible for boilers using wet scrubbers or those burning oil. The power boiler burns other fuel in addition to wood, so a regenerative SCR system is technically infeasible. Therefore, this technology is not technically feasible for this boiler and rejected as RACT.

Fuel switching No. 6 oil with liquefied natural gas (LNG)	Technically feasible but not reasonably available. Not implemented.	Firing LNG in lieu of No. 6 fuel oil is a technically feasible NOx control option. However, a Facility can only store up to 70,000 gallons of LNG onsite pursuant to 6 NYCRR Part 570 because there are several safety concerns associated with transportation and onsite storage. Such limited fuel quantities are insufficient to maintain power boiler availability. Therefore, the use of LNG in lieu of No. 6 fuel oil is not a reasonably available control measure at this time.
Fuel switching No. 6 oil with compressed natural gas (CNG)	Technically feasible but not reasonably available. Not implemented.	The power boiler currently uses 57% CNG, 22% No. 6 oil, and 21% bark/wood. The immediate supply of CNG on site may not be reliably sufficient depending on fluctuating mill fuel needs which can change over short periods of time. The facility gets CNG fuel deliveries by truck on a regular basis except during interruption/curtailment. Delivery of CNG, which is by truck, can be interrupted/curtailed for numerous reasons including weather, road closures, and natural gas availability. Sufficient enough quantities of CNG cannot be stored safely on site. Trucks arrive with fuel, the fuel is used, and trucks depart to retrieve more. Therefore, a reliable fuel oil system and supporting infrastructure needs to be maintained to keep the mill functional during periods when CNG is unavailable or inadequate for meeting mill fuel needs. The option of displacing fuel oil with CNG is rejected as RACT.
Fuel switching No. 6 oil with No. 2 oil	Technically feasible but not economically feasible. Not implemented.	The difference between the cost of No. 2 and No. 6 fuel oil is projected to be approximately $5.90 per MMBtu for July 2021 - June 2024. No. 2 fuel oil combustion would result in annual NOx emission reductions of 19 tons per year. The cost effectiveness of implementing

		this control option would be approximately $1,764,000/ton NOx controlled, well above the NYSDEC NOx RACT economic threshold of $5,613/ton NOx controlled. Replacing No. 6 fuel oil with No. 2 fuel oil is therefore considered economically infeasible.
Flue Gas Recirculation with Baghouse	Technically feasible but not economically feasible. Not implemented.	Implementation of a 15% FGR with baghouse would cost $1,318,100 annually and result in 112 tons of additional NOx reductions per year. The cost effectiveness of $11,730/ton of NOx controlled is well in excess of the $5,613/ton threshold accepted by NYSDEC. Thus, this control method is therefore considered to be economically infeasible and rejected as RACT.
Selective Non-Catalytic Reduction (SNCR)	Technically feasible but not economically feasible. Not implemented.	SNCR is technically feasible for application to No. 6 oil, natural gas, and wood fired stoker boilers. However, the annual cost of an SNCR system is $1,690,300 for an annual NOx reduction of 183 tons. This equates to a cost effectiveness of $9,230/ton NOx controlled, well above the acceptable NYSDEC threshold of $5,613/ton NOx controlled. The cost estimations were conducted as part of the 2011 NOx RACT analysis. EPA confirms, using the Bureau of Labor Statistics inflation calculator, that it would be $11,465/ton in August 2021 (the date of the RACT plan). Therefore, SNCR is considered to be economically infeasible due to its high cost.
Overfire Air (OFA) Improvements	Technically feasible. The cost effectiveness	Facility installed LNB to demonstrate compliance with the NOx RACT limit of 0.23 lb/MMBtu as vendor information suggested that relocating overfire air as a

	determination is not needed because a similar control method is being implemented and the addition of this control method would not result in further reductions. Not implemented.	standalone control would not offer significant reductions in NOx emissions over the LNB. In fact, OFA and LNB together offer the same amount of NOx reductions as LNB alone: a NOx emission rate of 0.23 lb/MMBtu (or an 8% reduction of the previous NOx emissions). Implementing OFA improvements therefore does not offer any additional NOx reduction over the 8% already achieved by the LNB improvements and is therefore, not evaluated further for RACT implementation purposes.

b. Lime kiln

The following table displays the RACT control technologies that were considered by the Facility for the lime kiln. The table identifies which of these controls are technically or reasonably feasible, and whether they are also cost effective.

RACT control technology	**Determination**	**Reasoning**
Low-NOx Burners (LNB)	Not technically feasible. Not implemented.	It is infeasible to install secondary air ports in the lime kiln that would be necessary for LNB technology so this control method is considered technically infeasible. NCASI also states that LNB are technically infeasible for lime kilns due to complex factors that result in poor efficiency,

		increased energy usage, and decreased calcining capacity.[11]
Flue Gas Recirculation	Not technically feasible. Not implemented.	Flue gas recirculation is not possible for a lime kiln due to the moisture and pollutants present in the flue gas, which would cause the FGR system to not function properly from the dust.
Selective Catalytic Reduction System	Not technically feasible. Not implemented.	The temperature of the lime kiln exhaust gases is well below the low end of the SCR's optimal operational window. Additionally, the levels of TRS compounds and particulates present in the lime kiln's exhaust could potentially cause poisoning of the SCR catalyst. Therefore, an SCR is not considered technically feasible for the lime kiln.
Selective Non-Catalytic Reduction System	Not technically feasible. Not implemented.	The temperature of the lime kiln exhaust gases is well below the low end of the SNCR's optimal operational window. Therefore, an SNCR is not considered technically feasible for this application without some kind of a re-heat of the flue gases which would result in more NOx emissions. Moreover, there are no commercial installations of SNCRs on lime kilns. Therefore, SNCR is rejected as RACT.
Fuel Switching (Replace No. 6 Oil with Pipeline Natural Gas)	Technically feasible but not reasonably available. Not implemented.	Firing natural gas in lieu of No. 6 fuel oil in the lime kiln is a technically feasible NOx control option. There is currently no natural gas pipeline servicing the mill. The Facility originally planned to be a customer of Vermont Gas Systems, however the proposed pipeline costs nearly doubled from initial estimates and timeline for delivery to the mill was extended by more than a year and a half. As a result,

[11] https://paperenvironment.org/PDF/SOxNOx/NOx/NOx_lime_kiln.pdf

		the Facility withdrew from the pipeline project. Therefore, the use of pipeline natural gas in lieu of No. 6 fuel oil is not an available control measure at the present time.
Fuel Switching (Replace No. 6 Oil with LNG)	Technically feasible but not reasonably available. Not implemented.	Firing LNG in lieu of No. 6 fuel oil is a technically feasible NOx control option. However, a facility can only store up to 70,000 gallons of LNG onsite pursuant to 6 NYCRR Part 570 because there are several safety concerns associated with the transportation and onsite storage. Such limited fuel quantities are insufficient to maintain lime kiln availability and reliability. Therefore, the use of LNG in lieu of No. 6 fuel oil is not a reasonably available control measure at this time.
Fuel Switching (Replace No. 6 Oil with CNG)	Technically feasible but not reasonably available. Not implemented.	The mill began combustion of natural gas in 2015. All of the CNG purchased by the mill is shared between the power boiler and the lime kiln. Although the lime kiln is often fired on only CNG, CNG is considered a "just-in-time" fuel compared to the existing No. 6 fuel oil, which can be stored in the million-gallon storage tank at the mill to ensure adequate and reliable supply at all times. The immediate supply of CNG stored on site may not be reliably adequate depending on fluctuating mill fuel needs which can change over short periods of time. CNG supply is interruptible as well as curtailable. The facility gets CNG fuel deliveries by truck on a regular basis except during interruption/curtailment. Delivery of CNG, which is by truck, can be interrupted/curtailed for numerous reasons including weather, road closures, and natural gas availability.

		Sufficient enough quantities of CNG to meet fuel needs cannot be stored safely on site. Therefore, a reliable fuel oil system and supporting infrastructure needs to be maintained for when CNG is unavailable or inadequate for meeting mill fuel needs. For these reasons, the option of displacing the fuel oil with CNG is rejected as RACT.
Fuel Switching (Replace No. 6 Oil with No. 2 Oil)	Technically feasible but not economically feasible. Not implemented.	This option is considered to be economically infeasible because the cost effectiveness of this fuel switching is $47,600 per ton of NOx which is above the NYSDEC RACT threshold of $5,613/ton. Due to its economic infeasibility, this measure is rejected as RACT.

c. Recovery furnace

The following table displays the RACT control technologies that were considered by the Facility for the recovery furnace. The table identifies which of these controls are technically feasible or reasonably available, and whether they are cost effective.

RACT control technology	Determination	Reasoning
Low-NOx Burners (LNB)	Not technically feasible. Not implemented.	The highly staged combustion design of recovery furnaces, the inherent low reducing zone oxygen concentrations needed for efficient recovery of chemicals, and the dominance of temperature-sensitive fuel nitrogen precursors of NOx combine[12] to make LNB use for the recovery furnace unproductive and technically infeasible and is rejected as RACT.

[12] https://paperenvironment.org/PDF/SOxNOx/SOxNOx_Full_Text.pdf

Flue Gas Recirculation (FGR)	Not technically feasible. Not implemented.	According to NCASI, FGR is not a viable option for recovery furnaces. FGR contributes to additional flue gas volume in the furnace. This leads to an increase in velocities of the flue gas, which may cause liquor entrainment which in turn can cause fouling of the recovery furnace tubes. Additionally, the NOx generated in recovery furnaces is primarily fuel NOx from black liquor, and FGR reduces only thermal NOx formation. Therefore, the potential minimal thermal NOx control offered by the technology is not justified in light of the issue of liquor entrainment and tube fouling. Therefore, FGR is not technically feasible and rejected as RACT.
Air Staging	Not technically feasible. Not implemented.	The mill's recovery furnace already includes a tertiary air system. Physical dimensions of this furnace will not allow for the installation of a fourth level of combustion air (quaternary air staging). Therefore, adding an additional level of air staging is not technically feasible for the recovery furnace at the mill and is rejected as RACT.
Selective Catalytic Reduction (SCR)	Not technically feasible. Not implemented.	The exhaust from the electrostatic precipitator would foul the catalyst and make it ineffective. The exhaust gas temperature at the recovery furnace stack is also too low for SCR, and reheating the cooled flue gas would result in heightened energy requirements as well as additional NOx emissions from auxiliary fuel combustion. Therefore, SCR is technically infeasible and rejected as RACT.
Selective Non-Catalytic Reduction (SNCR)	Not technically feasible. Not implemented.	SNCR achieves NOx reductions by injecting ammonia or urea into the exhaust stream, which reacts with the NOx to form N_2 and H_2O at sufficiently high temperatures. The introduction of ammonia would interfere with the reducing environment that is required to convert the sodium compounds in the recovery furnace. Ammonia also reacts

		with sulfur compounds to form ammonium sulfate, which could cause serious operational problems due to cold end corrosion, and reduced heat transfer as a result of deposits forming on tubes. The presence of ammonia contaminants in the black liquor feed would increase the nitrogen content of the fuel fed to the furnace, thereby increasing NOx levels in the flue gases. Recovery furnace explosions because of the explosive mixture of water and smelt are possible and pose a safety concern – with ammonia and urea in aqueous form also posing serious safety concerns. Due to these multiple concerns, installing the SNCR is technically infeasible and rejected as RACT.
Fuel Switching (Replace No. 6 Oil with Pipeline Natural Gas)	Technically feasible but not reasonably available. Not implemented.	Firing natural gas in lieu of No. 6 fuel oil in the recovery furnace is a technically feasible NOx control option. Natural gas has no fuel bound nitrogen; therefore, formation of fuel NOx is minimized. There is currently no natural gas pipeline servicing the mill. The Facility originally planned to be a customer of Vermont Gas Systems, however the proposed pipeline costs nearly doubled from initial estimates and timeline for delivery to the mill was extended by more than a year and a half. As a result, the Facility withdrew from the pipeline project. Therefore, the use of pipeline natural gas in lieu of No. 6 fuel oil is not an available control measure at the present time and is rejected as RACT.
Fuel Switching (Replace No. 6 oil with LNG)	Technically feasible but not reasonably available. Not implemented.	Firing LNG in lieu of No. 6 fuel oil is a technically feasible NOx control option. However, a Facility can only store up to 70,000 gallons of LNG onsite pursuant to 6 NYCRR Part 570 because there are several safety concerns associated with the transportation and onsite storage. Such limited fuel quantities are insufficient to maintain recovery furnace

		availability and reliability. Therefore, the use of LNG in lieu of No. 6 fuel oil is not a reasonably available control measure at this time and is rejected as RACT.
Fuel Switching (Replace No. 6 oil with CNG)	Technically feasible but not reasonably available. Not implemented.	CNG is currently available at the mill but is preferentially used by the power boiler and then the lime kiln. There is currently no surplus CNG available for the recovery furnace to use. Therefore, fuel switching is not a reasonably available control option at the present time and is rejected as RACT.
Fuel Switching (Replace No. 6 Oil with No. 2 Oil)	Technically feasible but not economically feasible. Not implemented.	The cost effectiveness of this fuel switching is found to be $47,600 per ton of NOx reduced, well in excess of NYSDEC's threshold of $5,613/ton. Fuel switching, specifically switching from No. 6 oil to No. 2 oil, would not result in significant NOx reductions due to the fact that a relatively small quantity of oil is fired in the furnace. The recovery furnace is permitted to burn no more than 2,470,000 gallons of fuel oil. Switching the fuel would result in a fuel-NOx emission reduction of greater than 99% but at a cost of $47,600/ton of NOx, and is therefore rejected as RACT due to high cost.

IX. EPA review of RBLC

Reasonably Available Control Technology/Best Available Control Technology/Lowest Achievable Emission Rate Clearinghouse (RBLC). The RBLC contains case-specific information on the best available air pollution control technologies that have been required to reduce the emission of air pollutants from stationary sources (e.g., power plants, steel mills, chemical plants, etc.). The state and local permitting agencies provide the data that constitutes the RBLC. **https://cfpub.epa.gov/rblc/index.cfm?action=Search.BasicSearch&lang=en**

A range of possible NOx control technologies were identified by conducting a review of the RACT/BACT/LAER Clearinghouse (RBLC), state permits, and EPA Alternative Control Techniques documents.

The Facility's RACT Plan, with regards to the lime kiln, states that "practically all the NOx generated from oil firing in kilns originates from the fuel (i.e., fuel NOx). Therefore, for the oil burning scenario, burner replacement, or employment of combustion air staging techniques, will not offer any significant reductions in NOx emissions as these measures target thermal emissions only." A search of the RBLC indicated that the recommended NOx control available for lime kilns is to employ "good combustion controls." The current existing NOx limit of 120 ppm by volume, wet @ 10% O_2 as RACT is consistent with the NOx limits found in the RBLC for other lime kilns.

The Facility's RACT Plan, with regards to permitted NOx emission rates for recovery furnaces, states that "the NOx concentrations measured during the recent stack test conducted in August 2020 show that the recovery furnace at the mill operates well below the levels specified in recent RBLC determinations." They also state that for every instance of new or modified recovery furnaces in the last 20 years, "recovery furnaces have not been required to apply any combustion modifications or post combustion technologies." Lower permitted NOx rates presented in the RBLC are due to the addition of a fourth stage of combustion (quaternary air), which is not feasible for the mill's recovery furnace due to the unavailability of space above the tertiary air ports.

The EPA conducted a RBLC search in the USA over the last 20 years to confirm the Facility RBLC findings. There were 35 facilities with power boilers, 26 facilities with recovery furnaces, and 13 facilities with kraft lime kilns. The EPA confirms that there are thirteen facilities that are like the Facility process type (integrated bleached kraft pulp and paper mill) with at least one of the same emission units (power boiler, lime kiln, or recovery furnace) in the USA that have NOx controls. The NOx controls implemented at the thirteen facilities are either already implemented at the Facility (i.e., pollution prevention controls) or are not applicable based on the Facility emission unit configurations (i.e., vertical profile limitations). The table below summarizes the EPA's RBLC search findings.

RBLC ID: FL-0302

Corporate/Company: GEORGIA-PACIFIC PALATKA MILL, Putnam, Florida

Facility description: An existing kraft sulfate processing paper and pulp mill that includes bleaching.

- Pollutant: **NOx**
- Process: **Recovery Boiler with a primary emission limit of 80 ppmvd:** Installed new over-fire air system (quaternary air) combustion improvements (Pollution prevention).

RBLC ID: SC-0141

Corporate/Company: RESOLUTE FP US INC, York, South Carolina

Facility description: Resolute operates an integrated kraft bleached pulp and paper mill that produces coated and uncoated as well as dried market pulp.

- Pollutant: **NOx**
- Process: **Recovery Furnace with a primary emission limit of 78 ppmv @ 8% O_2:** Addition of a 4th level of air for NOx reduction to aid in good combustion control that includes the installation of NOx CEMS (Add-on control equipment).
- Process: **Lime Kiln with a primary emission limit of 138 ppmv @ 10% O_2:** Good combustion control with low-NOx burners and required NOx CEMS (Pollution prevention).

RBLC ID: OR-0044

Corporate/Company: HALSEY PULP MILL, Linn, Oregon

Facility description: Produces bleached pulp using the kraft process. (Please note that this facility description does not include paper.)

- Pollutant: **NOx**
- Process: **Lime kiln with a primary emission limit of 112 ppm @ 10% O_2:** Good combustion control (Pollution prevention).

RBLC ID: WA-0303

Corporate/Company: LONGVIEW FIBRE PAPER AND PACKAGING, INC, Washington

Facility description: Permit issued for the modification to the Longview, WA kraft pulp and paper mill that will increase paper machine primary production capacity from approximately 3,000 machine dry tons of paper per day (MDTP/D) to approximately 3600 MDTP/D on an annual AV basis. (Please note that this facility description does not include bleached.)

- Pollutant: **NOx**

- Process: **Recovery furnace 18 with a primary emission limit of 95 ppmdv @ 8% O_2:** Good combustion practice (Pollution prevention).
- Process: **Recovery furnace 19 with a primary emission limit of 95 ppmdv @ 8% O_2:** Good combustion practices (Pollution prevention).

RBLC ID: AL-0266

Corporate/Company: GEORGIA PACIFIC BREWTON LLC, Escambia, Alabama

Facility description: Kraft Pulp & Paper mdu. (Please note that this facility description does not include bleached.)

- Pollutant: **NOx**
- Process: **No. 4 Recovery & Smelt Tank with a primary emission limit of 90 ppm @ 8% O_2:** Staged air combustion (Pollution prevention).
- Process: **No. 4 REC & Smelt with a primary emission limit of 0.2 lb/mmbtu:** Gas combustion (Pollution prevention).

RBLC ID: LA-0207

Corporate/Company: MANSFIELD MILL, Desoto, Louisiana

Facility description: Pulp & paper mill. PSD addresses the 2004 Mansfield production increase plan (MPIP) which increased pulp production to 3616 ODTP/D. Maximum paper production remained unchanged at 5900 SWT/D. (Please note that this facility description does not include kraft or bleached.)

- Pollutant: **NOx**
- Process: **Recovery boilers No. 1 & 2 (EQT036 & 037) with a primary emission limit of 135 lb/h:** Low-NOx burners (for fossil fuels) & proper boiler design and good combustion practices (black liquor solids firing) (Pollution prevention).

RBLC ID: MI-0450

Corporate/Company: VERSO CORPORATION – QUINNESEC, MI MILL, Dickinson, Michigan

Facility description: Bleached kraft pulp and paper mill.

- Pollutant: **NOx**
- Process: **EU0185-1: Chemical Recovery Furnace with a primary emission limit of 110 ppm:** Good combustion practices (Pollution prevention).

RBLC ID: NC-0107 **Corporate/Company:** INTERNATIONAL PAPER – RIEGELWOOD MILL, Columbus, North Carolina Facility description: Bleached kraft pulp facility. (Please note that this facility description does not include paper.) • Pollutant: **NOx** • Process: **No. 5 Recovery Boiler with a primary emission limit of 100 ppmv:** Proper design and good combustion control (Pollution prevention).
RBLC ID: SC-0083 **Corporate/Company:** WEYERHEAUSER COMPANY – MARLBORO PAPER MILL, Marlboro, South Carolina Facility description: Bleached kraft pulp and paper mill (market pulp and fine paper products). • Pollutant: **NOx** • Process: **No. 1 Recovery Furnace with a primary emission limit of 100 ppm @ 8% O_2:** Addition of a 4^{th} level of air to recovery furnace/good combustion practice/recovery furnace firing rate and pulp production limits (4.4 mmlb bls/d and 1410 adtbp/d) (Pollution prevention).
RBLC ID: WI-0208 **Corporate/Company:** DOMTAR NEKOOSA MILL, Wood, Wisconsin Facility description: Not provided. • Pollutant: **NOx** • Process: **Kraft Black Liquor Recovery Furnace, B14 with a primary emission limit of 90 ppmdv @ 8% O_2:** Good combustion control (Pollution prevention).
RBLC ID: AL-0250 **Corporate/Company:** BOISE WHITE PAPER, Clarke, Alabama Facility description: Not provided. • Pollutant: **NOx** • Process: **Lime kiln with a primary emission limit of 3.5 lb/ton cao:** Proper design/good combustion practices (Pollution prevention).

RBLC ID: ME-0037 **Corporate/Company:** VERSO BUCKSPORT LLC, Hancock, Maine Facility description: Existing pulp (groundwood and thermomechanical) and paper making facility. (Please note that this facility description does not include kraft or bleached.) • Pollutant: **NOx** • Process: **Biomass Boiler 8 with a primary emission limit of 0.15 lb/mmbtu:** SNCR (Add-on control equipment).
RBLC ID: WA-0337 **Corporate/Company:** BOISE WHITE PAPER LLC, Walla Walla, Washington Facility description: The Boise Cascade Corporation Wallula integrated bleached kraft pulp and paper mill proposed in the original permit application to increase No. 3 recovery furnace firing rate, upgrade the hog fuel boiler's combustion system, and make upgrades to the slaker and evaporators. Projects would be done as money was approved. In 2005 money was approved for the hog fuel boiler project, but the supplier would not guarantee NOx at the permitted level. Amendment 1 was proposed to allow NOx at a level that would be guaranteed. • Pollutant: **NOx** • Process: **Utility-and large industrial-size boilers/furnaces (>250 million btu/h) with a primary emission limit of 0.3 lb/mmbtu:** Overfire air system added to improve boiler combustion system. Boiler has an ESP (Pollution prevention).