MEMORANDUM

To: Aaron Manley, Olympic Region Clean Air Agency

cc: Jennifer DeMay, Olympic Region Clean Air Agency; Michael Nolan and Christine Yanik, Weyerhaeuser NR Company

From: Nancy Liang and Matt Goldman, Trinity Consultants

Date: February 22, 2024

RE: Weyerhaeuser Raymond NOC Application Addendum (23NOC1614) – EPA Comments

On February 13, 2024, Weyerhaeuser NR Company (Weyerhaeuser) received draft comments from the Environmental Protection Agency (EPA) Region 10 via Jennifer DeMay of the Olympic Region Clean Air Agency (ORCAA) regarding the Best Available Control Technology (BACT) determinations in its Notice of Construction (NOC) application #23NOC1614. The NOC application was submitted to authorize the installation of a direct-fired continuous dry kiln (CDK) at the Raymond facility (the "Facility"). Weyerhaeuser received a follow-up comment from Jennifer DeMay on February 16, 2024 regarding an emission factor. This memo serves as an addendum to the NOC permit application and provides Weyerhaeuser's responses to ORCAA's and EPA's comments.

Weyerhaeuser emphasizes that the proposed Raymond CDK project will utilize state-of-the-art technology incorporating Weyerhaeuser's experience with constructing, commissioning, and operating CDKs around the US in the last decade. The proposed CDK project will also enable an overall emissions reduction for the Facility, in addition to boosts in operational efficiency. Table 1 compares the pre-project and post-project potential-to-emit criteria pollutant emission rates.

Table 1. Comparison of Pre- and Post-Project PTE Emission Rates (tpy)

Source	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
Pre-Project (Hog Fuel Boiler + Batch Kilns)	282	271	24.1	24.1	12.6	263.6
Post-Project (CDK - Drying and Combustion)	116	44	19.0	17.8	5.5	224.9

Source: Pre-Project emissions come from the 12AOP915 TSD.

EPA Draft Comments, Comment 1 – BACT Analysis

EPA: The Proposed PCWP MACT is a proposed rule based on the information available to EPA at the time, and should not preclude a rigorous, site-specific BACT analysis by ORCAA with respect to either capture, testing, or control of emissions from the proposed new CDK.

Response: Further technical and economic details regarding Weyerhaeuser's BACT assessment are presented in the response to Comment 4. However, Weyerhaeuser maintains the determination that add-on control technology is infeasible for the CDK. In its November 15, 2023 addendum to the 23NOC1614 permit application, Weyerhaeuser proposed the following work practice standards as BACT for the emissions of VOC, PM, and related TAPs:

1. Operation and maintenance (O&M) plan
2. Burner tune-up
3. Over-drying prevention methods:
    a. Operate below a maximum temperature setpoint;
    b. Conduct in-kiln moisture monitoring; or,
    c. Follow a "site-specific plan (for temperature and lumber moisture monitoring)"
4. Set dried lumber minimum moisture content limits

These work standards are identified in EPA's preamble for the proposed changes to 40 CFR 63, Subpart DDDD, otherwise known as National Emission Standards for Hazardous Air Pollutants (NESHAP) for Plywood and Composite Wood Products (PCWP). While this determination comes from a proposed rule, these work practice standards are identified as the best available control methods since they address over-drying, which is a major concern for lumber kiln VOC emissions. As shared in Appendix C to the NOC application, the CDK will be equipped with in-kiln moisture and temperature monitoring, which work in tandem to optimize lumber drying and minimize occurrences of over-drying, and therefore minimize VOC emissions from over-drying.

EPA Draft Comments, Comment 2 – Emission Capture and Testing

EPA: Region 10 considers capture and emission testing of the emissions from the proposed CDK to be technically feasible. While it is reasonable that the exhaust flow rate from the proposed vapor extraction modules may not be increased sufficiently to achieve 100% capture of the emissions due to kiln performance concerns, this does not preclude additional hooding or enclosure added at the ends of the kiln to capture the emissions that escape out the open ends. Further, the construction of the CDK at the Katerra facility in Spokane, WA demonstrates that capture of emissions from CDKs is technically feasible.

Response: Based on Appendix G of the original NOC application, the proposed CDK will have two powered vapor extraction modules (VEMs) on each end of the CDK. Each VEM will have an exhaust flow rate of 25,000 acfm (21,986 scfm), for a total exhaust flow rate of 50,000 acfm (43,973 scfm) on each kiln end. As explained in the November 15, 2023 addendum, fan-powered stacks, like the proposed CDK's VEMs, are able to direct 40-80% of the kiln exhaust upward, but fans cannot be operated at levels necessary for emission capture and control as this would disrupt the CDK's ability to precondition green lumber with the heat and steam from dried lumber, an essential energy-transfer function.[1] The proposed Raymond CDK represents the vendor's most recent design concept and is expected to direct closer to 80% of the kiln exhaust upward.

Upon review of Mercer Mass Timber's (formerly Katerra) NOC permit (NOC #1773) under Spokane Regional Clean Air Agency's (SRCAA) jurisdiction, each side of the Spokane facility's CDK (the "Katerra CDK") is equipped with a hood, baffles, and a fan powered for a 13,500 scfm exhaust flow rate. The Katerra CDK is similar in design to the proposed Raymond CDK and should operate similarly. Since the Raymond CDK will dry lumber from about 50% to approximately 12-14% moisture content, unlike the Katerra CDK which dries received lumber from 19% to 11% moisture content, the Raymond CDK is expected to have greater exhaust from the kiln since more emissions are released when drying lumber from a higher moisture content. Therefore, while the Raymond CDK will not have a hood, the VEMs are designed with higher flow rates to minimize the fugitive emissions coming out the ends of the CDK.

[1] "National Emission Standards for Hazardous Air Pollutants: Plywood and Composite Wood Products." Docket ID No. EPA–HQ–OAR–2016–0243. Federal Register 88:96 (May 18, 2023) p. 31856-31887. Available from: https://www.federalregister.gov/d/2023-10067; Accessed 10/31/2023.

To ensure best practices are followed to minimize exhaust out the kiln doors, which is both an air quality and worker safety concern, Weyerhaeuser proposes to develop a maintenance plan, for approval by ORCAA, in which the Raymond facility conducts routine inspections and repair of the CDK to minimize leaks.

EPA Draft Comments, Comment 3 – Emission Capture and Testing

EPA: Capture of the CDK emissions, venting via exhaust stack(s), and emission testing is critical for the proposed CDK due to the low quality of existing emission factors. Emission inventory, modeling, and the BACT analysis all rely on accurate emission data as critical inputs. Site-specific emission testing is critical if the results of each of these analyses is to be considered credible.

Response: As discussed above in the response to Comment 2, 100% emission capture is not technically feasible, so EPA Method 204 testing, as proposed in NOC #1773 for the Spokane facility, is not a viable testing option. Weyerhaeuser is a member of the National Council for Air and Stream Improvement, Inc. (NCASI), a professional organization that serves the forest product industry as a center of excellence providing unbiased, scientific research and technical information. Weyerhaeuser will continue working with NCASI experts to identify more appropriate emission factors for the CDK process. Since 100% emission capture is not technically feasible, a stack test will not provide a comprehensive emissions profile of the CDK, and therefore, high quality emission factors are not expected to be developed based on stack test results.

EPA Draft Comments, Comment 4 – Technical and Cost Feasibility

EPA: The arguments offered asserting technical infeasibility for the wet control technologies are not well supported. Specifically, Region 10 considers wet scrubbing technologies, wet electrostatic precipitation, and downstream oxidation technologies to be technically feasible for the CDK exhaust stream. The costs and capabilities of these control technologies to achieve pollutant reductions must be based on current evaluations by experienced control equipment vendors, not 20-year-old EPA fact sheets. Region 10 can provide more detailed comments regarding what constitutes a rigorous BACT analysis at a later date as this project moves forward.

Response: Weyerhaeuser has prepared cost calculations for the referenced control technologies, including regenerative thermal oxidation (RTO), regenerative catalytic oxidation (RCO), wet scrubber, and wet electrostatic precipitator (Wet ESP). Cost effectiveness values are presented below in Table 2 and detailed calculations are attached in Attachment B. Values were estimated using annualized costs ($/scfm) provided in EPA Air Pollution Control Technology Fact Sheets and scaling them using Chemical Engineering Plant Cost Index (CEPCI) values. Calculations assume two control devices will be installed, one on each end of the CDK.

Table 2. Control Technology Cost Effectiveness

Control Device	Pollutant	Cost Effectiveness ($/ton controlled)	
		Low	High
RTO	VOC	$12,989	$53,580
RCO	VOC	$17,860	$68,192
Wet Scrubber	PM	$36,773	$706,037
Wet Scrubber	SO_2	$166,723	$3,201,086
Wet ESP	PM	$174,919	$670,523

According to NOC #1773's statement of basis for the Spokane facility, SRCAA asserts that the BACT cost effectiveness threshold is $5,000 per ton of pollutant controlled. As seen in Table 1, all control device and pollutant combinations presented are above $5,000 per ton of pollutant controlled, so they are considered cost ineffective.

ORCAA Follow-Up – CDK VOC Combustion Emission Factor

ORCAA: The CDK VOC combustion emission factor was converted incorrectly to WPP1. Please review EPA's Interim VOC Measurement Protocol for the Wood Products Industry document, Section 8.0, Equation 1 (as referenced in your emission spreadsheet). The Method 25A VOC in the equation must be as propane, not as carbon.

Response: Weyerhaeuser added the conversion of the CDK VOC combustion emission factor from an as-carbon basis to an as-propane basis. The conversion follows Equation 2 of the EPA's Interim VOC Measurement Protocol for the Wood Products Industry document. The updated potential-to-emit calculations are attached to this addendum and do not show a significant impact on project emissions.

Attachment A

Emissions Calculations

Submitted electronically.

Attachment B

BACT Cost Calculations

Project Data

Parameter	Value	Unit
# Vapor Extraction Modules (VEMs)	4	
Flow Rate per VEM	25,000	acfm
Flow Rate per Control Device [1]	50,000	acfm
Exhaust Temperature	140	F
Flow Rate per VEM [2]	21,986	scfm
Flow Rate per Control Device [1,2]	43,973	scfm
CDK PM Emission Rate	24.8	tpy
CDK VOC Emission Rate	224.9	tpy
CDK SO_2 Emission Rate	5.5	tpy

[1] Assuming that the exhaust flow will be combined on each end of the kiln.

[2] Exhaust flow converted to scfm assuming exhaust at 1 atm, with standard temperature of 68 °F.

BACT Cost Calculations

	Annualized Cost (2002) ($/scfm)		Annualized Cost (2022) [5] ($/scfm)				Per Device						Total	
						Control Efficiency [1] (%)	CDK Emissions (tpy)	Emissions Controlled (tpy)	Annualized Cost (2022) ($)		Cost Effectiveness ($/ton controlled)		Cost Effectiveness ($/ton controlled)	
Control Device	Low	High	Low	High	Pollutant				Low	High	Low	High	Low	High
RTO [2]	$8	$33	$16.44	$67.82	VOC	99%	112.44	111.32	$722,945	$2,982,149	$6,494	$26,790	$12,989	$53,580
RCO [2]	$11	$42	$22.61	$86.31	VOC	99%	112.44	111.32	$994,050	$3,795,463	$8,930	$34,096	$17,860	$68,192
Wet Scrubber [3]	$2.50	$48	$5.14	$98.65	PM	99%	12.41	12.29	$225,920	$4,337,671	$18,386	$353,018	$36,773	$706,037
Wet Scrubber [3]	$2.50	$48	$5.14	$98.65	SO_2	99%	2.74	2.71	$225,920	$4,337,671	$83,362	$1,600,543	$166,723	$3,201,086
Wet ESP [4]	$12	$46	$24.66	$94.53	PM	99.9%	12.41	12.40	$1,084,418	$4,156,935	$87,459	$335,261	$174,919	$670,523

[1] Conservatively assuming the high end of the control efficiency ranges provided in the source files.

[2] RTO/RCO Source: https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P1008OH5.txt

[3] Spray-Chamber/Spray-Tower Wet Scrubber Source: https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P1008OGT.txt

[4] Wet ESP Source: https://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=P1008OHR.txt

[5] Costs are scaled using Chemical Engineering Plant Cost Index (CEPCI) values. (https://personalpages.manchester.ac.uk/staff/tom.rodgers/Interactive_graphs/CEPCI.html?reactors/CEPCI/index.html)

2002 CEPCI	395.6
2022 CEPCI	813.0