Pacific Wood Laminates
Brookings, Oregon
Source Number: 08-0003
AQ520 Emissions Inventory Form
Emissions Inventory Report

This report accompanies the Emissions Inventory (AQ520 Form) submittal for Pacific Wood Laminates (PWL). It provides detailed calculations, notes, emission factor references, and justifications for exempt and significant Toxic Emissions Units (TEUs) as required by Cleaner Air Oregon (CAO).

The actual annual production information for the emission factor-based emissions calculations is based on the PWL reported production from 2020 on the Air Toxics Emissions Inventory report. The year 2020 data was chosen because it was considered more representative of typical operations that the year 2023 data. The requested PTE production information is based on the production limits in the PWL air quality permit.

The annual actual material usage for the material balance calculations was based on the reported usage from October 1 2024 through October 1, 2025. The reported values were multiplied by 110% to represent estimated usage at maximum potential production.

Exempt and Non-Exempt TEUs

PWL has multiple emitting units (EUs), some of which are categorized as TEUs under Oregon Administrative Rules (OAR) 340-245-0050. Each TEU was evaluated based on its: potential to emit air toxics, emission magnitude and toxicity, and also the regulatory exemptions criteria under OAR 340-245-0050(4).

The table below lists the TEUs and if they are significant or exempt in CAO.

TEU Name	Status
PH2 (Hog Fuel Boiler)	Non-Exempt
Dryers	Non-Exempt
Presses	Non-Exempt
Spray Paint	Non-Exempt
Plywood Layup	Non-Exempt
Welding – E7018	Non-Exempt
Welding – E308, E309, E70S	Exempt
Laminated Veneer Lumber	Exempt
Maintenance Shop	Categorically Exempt

Non-Exempt TEUs

Hog Fuel Boiler, PH2

The onsite hog-fired boiler is a non-exempt TEU due to its significant potential to emit multiple regulated air toxics. The boiler provides heat and is fueled by hogged wood waste. While combustion of certain clean fuels may qualify for exemption, biomass fuels such as hog fuel are not included. As such, the boiler does not meet exemption criteria under OAR 340-245-0060(3). It emits a broad mix of pollutants, including particulate matter (PM), carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxide (SO_2), volatile organic compounds (VOCs), formaldehyde, polycyclic aromatic hydrocarbons (PAHs), metals, and dioxins and furans (PCDD/Fs). The boiler is equipped with a wet scrubber for particulate matter emissions control.

Dryers

The four veneer dryers at the facility are classified as non-exempt TEUs under CAO due to their continuous operation and reliance on steam heat generated by the onsite hog fuel boiler (PH2). These units remove moisture from green veneer sheets before pressing, and the drying process releases VOCs and hazardous air pollutants (HAPs), including formaldehyde and acetaldehyde. The veneer dryers at the facility process softwood and are steam heated. The four dryers are controlled by a regenerative catalytic oxidizer (RCO). Based on a stack test conducted in 2024, the RCO presented results of 92.7% destruction removal efficiency (DRE) for VOCs. The 92.7% DRE was applied in the AQ520 form. Since the dryers emit air toxics and operate continuously as part of production, they do not qualify for exemption under OAR 340-245-0060(3). Emissions from the dryers represent a significant source of toxics and were included in the CAO emissions inventory.

Presses

The facility's four plywood presses are also treated as non-exempt TEUs. These units emit formaldehyde and other VOCs as part of the curing and bonding process. Emissions occur from the volatilization of glues and resins during pressing – not from combustion of the use of exempted materials. Since these emissions are directly tied to production and contain regulated air toxins, the presses do not meet exemption criteria under OAR 340-245-0060(3) and are included in the CAO emissions inventory.

Spray Paint

The facility uses spray paint to mark finished veneer and plywood panels. Nine different colors of spray paint are used on site. According to the CAO Exempt TEU Guidance Document (Appendix A-1), acetone emissions from spray paint usage exceeded the 1,000 pound per

year threshold. Therefore, spray painting activities are classified as a non-exempt TEU at the facility.

Plywood Layup

The plywood layup operation is treated as a non-exempt TEU. During layup, veneer sheets are coated with adhesive resins and assembled into panels prior to hot pressing. Adhesive applications are performed using curtain coating and dip methods, which are industry standard techniques with transfer efficiencies of 90% or greater, resulting in minimal overspray and uncontrolled emissions. A conservative 90% transfer efficiency was applied in the AQ520 form. Emissions primarily consist of formaldehyde and other VOCs released from the glues and resins during pressing. These emissions result from the use of regulated air toxics and are directly associated with production activities. The plywood layup process is included in the CAO emissions inventory.

Welding Operations – E7018

The facility uses multiple rods to carry out maintenance operations on site. For E7018, the facility used 410 pounds of welding rod. This exceeds the 50 pounds per year threshold stated in Appendix B of the Cleaner Air Oregon: Emissions Inventory and Exempt/Categorically Exempt Units Guidance. Therefore, emissions for this welding rod were included in the AQ520 form.

Exempt TEUs

Welding Operations – E308L, E70S, ER309

Welding at the facility is conducted on an as-needed basis for equipment maintenance. Filler metals include E308L, ER309, and E70S, which contain regulated toxics such as chromium, manganese, nickel, and cobalt. Although welding is not categorically exempt, it qualifies as an exempt TEU under DEQ's pollutant specific exemption threshold in Appendix B of the Cleaner Air Oregon: Emissions Inventory and Exempt/Categorically Exempt Units Guidance. Welding is not associated with production and occurs intermittently in ventilated areas. Emissions were quantified using AP-42 Section 12.19, Table 12.19-2 and the San Diego Air Pollution Control District.

Laminated Veneer Lumber Plant

The facility has a laminated veneer lumber (LVL) plant on site. The LVL operation is a small secondary production line that processes approximately 16% of the total facility throughput and functions as an extension of the primary production line. The LVL process produces specialty boards, structural members and trim from finished plywood. The LVL uses a methylated melanin resin system that is cured using radio frequency (RF) technology. RF curing uses dielectric heating to rapidly and uniformly heat the glue line within a wood

product assembly, significantly reducing the required press or clamping time compared to traditional hot pressing.

Finished sheets of plywood are cut and/or finger-jointed to be rejoined into specialty boards and structural members. The LVL resins contain TACs, but the compounds are consumed during the resin reaction. Emissions of TAC's during the adhesive application and curing process are eliminated by the enclosed nature of the system and the RF technology. No emissions of TAC's occur as a result of the LVL operation. Therefore, the LVL plant is classified as an exempt TEU.

Categorically Exempt TEUs

Maintenance Shop

The maintenance shop at the facility is recognized as a Categorically Exempt Toxic Emitting Unit (CETEU) under OAR 340-245-0060(23)(m). Based on the throughput data provided by PWL, all maintenance activities fall well below the 100,000 pounds per year threshold outlined in OAR 340-200-0020 (23)(a) for categorically insignificant chemical mixtures. Therefore, the maintenance shop qualifies as a CETEU and does not require further review under the CAO program.

Emission Factor Methodology

Hog Fuel Boiler, PH2

Emission factors were selected based on boiler configuration, fuel type, and pollutant specific data available. Both AP-42 (Section 1.6, April 2022) and the National Council for Air and Stream Improvement (NCASI) sources were evaluated, with the most representative and facility-relevant factors used for each pollutant. The emission factors used in the PWL Title V permit were reviewed and retained for the CAO emissions inventory.

AP-42 Emission Factors:

AP-42, Section 1.6, Table 1.6-3, and Table 1.6-4 were utilized for most pollutants, particularly organic compounds where no more recent or source-specific factors were available, PAHs, and several trace metals and halogenated organics. Table 1.6-4 emission factors used in the permit were replaced by the emission factors in the current version of AP-42. The AP-42 emission factors are provided in units of pound per million Btu (lb/MMBtu) heat input. These were converted to units of pounds per thousand pounds of steam output (lb/Mlb steam) using a heat factor of 1.5 MMBtu/Mlb steam.

NCASI Emission Factors:

Emission factors from NCASI were used in addition to the AP-42 factors. NCASI emission factors were used in cases where they are more representative of the facility's boiler design, fuel type, and the pollutant form. The NCASI 2018 database was sorted to identify appliable boiler emission rates.

The following NCASI Technical Bulletins were utilized:

> NCASI Technical Bulletin No. 1013 – for hydrochloric acid, and PCDD/Fs based on testing of biomass boiler with similar control equipment. See the "**Toxic Equivalency Quotient (TEQ) Emission Factor Derivation**" section of this report for further details.
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> 08-0003-TV RR 2019 – Title V Permit – Emission factors for wood-fired boiler are primarily sourced from the facility's Title V permit emissions inventory. The permit references NCASI Database 2018 (DB2018) as the source for these values. These factors are considered representative of emissions from wood-fired boilers used in plywood and composite wood manufacturing. By using the permit-referenced NCASI DB2018 factors, the emissions inventory is consistent with the facility's current permitted basis.

This combined approach ensured use of the most accurate and representative emission factors available, tailored to the facility's design and emission control configuration.

Dryers & Presses

Emission factors for the dryers and presses were obtained from NCASI Technical Bulletin 768, Volatile Organic Compound Emissions from Wood Products Manufacturing Facilities. These factors are derived from industry testing at plywood facilities and are considered an appropriate representation of emissions from drying and pressing operations. Use of NCASI Technical Bulletin 768 is consistent with EPA and Oregon DEQ guidance and provides standardized basis for CAO emission inventories.

Material Balance Methodology

Emissions for spray paint activities, plywood layup, and the LVL plant, were all calculated through a material balance, based on the Safety Data Sheets (SDS) along with the annual usage of each product through these different activities on site. For example, the facility uses approximately 756 ten-ounce cans of Gloss Red spray paint per year, equivalent to 7,560 ounces (472.5 pounds or 55.6 gallons per year). Composition data were obtained from the product SDS (Section 3 – Composition/Information on Ingredients). The percent-by-weight

ranges for each ingredient were adjusted to represent the higher bound of the range, allowing for a more conservative calculation.

Annual emissions for each ingredient were then calculated using the following material balance equation:

Emissions (lb/yr) = Throughput (lb/yr) x Adjusted weight fraction of ingredient

Relevant sections of the SDS sheets are included with the submittal.

Toxic Equivalency Quotient (TEQ) Emission Factor Derivation

Background/Purpose for TEQ:

The emission factor listed in the AQ520 form for CAS#646, of polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/Fs) from the wood fired boiler, was developed to estimate the toxic equivalent (TEQ). The TEQ represents the cumulative toxicity of the multiple PCDD/F congeners and normalizes it to the most toxic form, 2,4,7,8-TCDD. This allows for a smooth comparison of all congeners, with respect to 2,3,7,8-TCDD, to evaluate the potential health risks from dioxins and furans. Emission factors were derived from NCASI Technical Bulletin No. 1013. This technical bulletin provided emission data for wood fired combustion units. The **mean value** from the emissions data was used to conservatively calculate emissions for each of the congeners. The goal in using this technical bulletin was to calculate the facility specific emission factor (in lbs TEQ/MMBtu) for use in the AQ520 form, and for the following steps thereafter.

Emission Factor Source for TEQ:

The emission data used to calculate the TEQ came from the NCASI Technical Bulletin No. 1013, which includes results from emissions testing on wood fire boilers burning a variety of wood residuals. The bulletin presents congener specific emission rates in micrograms per oven dry (OD) ton of wood. For this analysis, the mean emission values were used as a reasonable and conservative estimate. Seventeen individual congeners – seven dioxins and ten furans – were included, each with a corresponding Toxic Equivalency Factor (TEF) based on the World Health Organization (WHO) 2005 guidance.

The seven dioxins are:

- 2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD)
- 1,2,3,7,8-Pentachlorodibenzo-p-dioxin (1,2,3,7,8-PeCDD)
- 1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,4,7,8-HxCDD)
- 1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (1,2,3,6,7,8-HxCDD)
- 1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (1,2,3,7,8,9-HxCDD)
- 1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (1,2,3,4,6,7,8-HpCDD)

- 1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (1,2,3,4,6,7,8,9-OCDD).

The ten furans are:

- 2,3,7,8-Tetrachlorodibenzofuran (2,3,7,8-TCDF),
- 1,2,3,7,8-Pentachlorodibenzofuran (1,2,3,7,8-PeCDF),
- 2,3,4,7,8-Pentachlorodibenzofuran (2,3,4,7,8-PeCDF),
- 1,2,3,4,7,8-Hexachlorodibenzofuran (1,2,3,4,7,8-HxCDF),
- 1,2,3,6,7,8-Hexachlorodibenzofuran (1,2,3,6,7,8-HxCDF),
- 1,2,3,7,8,9-Hexachlorodibenzofuran (1,2,3,7,8,9-HxCDF),
- 2,3,4,6,7,8-Hexachlorodibenzofuran (2,3,4,6,7,8-HxCDF),
- 1,2,3,4,6,7,8-Heptachlorodibenzofuran (1,2,3,4,6,7,8-HpCDF),
- 1,2,3,4,7,8,9-Heptachlorodibenzofuran (1,2,3,4,7,8,9-HpCDF),
- 1,2,3,4,6,7,8,9-Octachlorodibenzofuran (1,2,3,4,6,7,8,9-OCDF).

These congeners and their TEFs were used to derive the TEQ emission factor applied in the emissions inventory, ensuring consistency with WHO 2005 guidance and recognized emission reporting standards.

Wood Combustion Rate for TEQ Calculations:

To align the NCASI emission data with the facilities actual fuel use, the wood-fired boiler's annual heat input (MMBtu/year) was converted to a mass basis. Since the NCASI emission factors are given in micrograms per oven dry ton of wood, a standard conversion was used: 1 OD ton of wood equals 16.8 MMBtu, assuming 8,400 Btu per pound of dry wood. The conversion factors were found in the note below the table in Technical Bulletin 1013, which happens to be the same conversion factors NCASI used in their calculation. This allowed us to convert the reported MMBtu/year into OD tons/year, making the emission factor calculations consistent with the units used in the technical bulletin.

TEQ Concept and WHO TEFs:

Each dioxin and furan congener has its own level of toxicity. The WHO developed Toxic Equivalency Factors (TEFs) to make them comparable. These TEFs scale each congener's toxicity relative to 2,3,7,8-TCDD, which has a TEF of 1.0. By multiplying each congener's emission rate by its TEF, we can convert the emissions into toxic equivalents (TEQ). This gives us a single number – total TEQ – that accounts for the varying toxicity across the congener group and provides a clearer picture of potential health risks.

Calculation Steps for TEQ:

To get from the NCASI emission values to a final emission factor in lb/ TEQ/MMBtu, the following steps were used:

1. The mean emission value for each congener (µg/OD ton) was multiplied by the total annual OD tons of wood combusted to find the annual emission in µg/yr.
2. The annual emission for each congener was then multiplied by its associated WHO 2005 TEF to find ug TEQ/year.
3. All the µg TEQ/year values were then summed across all seventeen congeners to find the total annual TEQ emissions (1,190.5 µg TEQ/Year).
4. The total annual TEQ emission in ug TEQ/yr was then converted to pounds per year using a standard unit conversion of 1 pound equals 453,592,370 micrograms.
5. The final value in pounds per year was then divided by the annual heat input (MMBtu/year) to yield an emission factor in lb TEQ/MMBtu.
6. The TEQ emission factor was then converted from lb/MMBtu to lb/Mlb-steam for unit consistency within the AQ520 form. The lb/Mlb-steam TEQ emission factor was used to calculate emissions in the AQ520 form.

Final Emission Factor for TEQ:

Using the steps above, the final emission factor for dioxins and furans from the wood fired boiler was calculated to be:

8.23×10^{-12} lb TEQ/Mlb-steam

While the calculation uses the mean congener values from the NCASI Technical Bulletin No. 1013, it still takes a conservative approach. The TEQ method already scales emissions by toxicity, and since 2,3,7,8-TCDD (the most toxic congener) is the benchmark, the result captures worst-case toxicity even without using the maximum raw emission values.

Supporting Calculations

In the "PWL Additional Calculations" additional excel workbook attachment, please see the following tabs for supporting calculations and methodology:

- Dioxins and Furans
- MMBtu to Mlb Conversion
- Welding Data