Murphy Company dba Murphy Veneer
Rogue River, Oregon
Source Number: 15-0014
AQ520 Emissions Inventory Form
Emissions Inventory Report
February 6, 2026.

This report accompanies the Emissions Inventory (AQ520 Form) submittal for Murphy Company dba Murphy Veneer (Murphy). The report addresses responses to the DEQ letter received after the original submittal. 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).

Non-Exempt and Exempt TEUs

Murphy 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
Wood-Fired Boiler	Non-Exempt
RCO-NG	Non-Exempt
Veneer Dryers	Non-Exempt
Presses	Non-Exempt
Plywood Layup	Non-Exempt
Welding – E7018	Non-Exempt
Welding	Exempt

Non-Exempt TEUs

Wood-Fired Boiler

The on-site wood-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, including sander dust. 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 criteria under OAR 340-245-0060(3). It emits a broad mix of pollutants, including particulate matter (PM), carbon monoxide (CO), volatile organic compounds (VOCs), formaldehyde, polycyclic

aromatic hydrocarbons (PAHs), metals, and dioxins and furans (PCDD/Fs). The boiler is equipped with a dry electrostatic precipitator (ESP) for particulate control. Under the Boiler MACT rule, EPA identifies unadulterated wood residues (including sawdust and sander dust) as a biomass fuel, but only when free of additives. Sander dust used in the Murphy boiler is free of resins, adhesives, or other additives.

RCO-NG (Regenerative Catalytic Oxidizer – Natural Gas)

The RCO-NG is a non-exempt TEU under CAO. While combustion of natural gas alone may be exempt under OAR 340-245-0050(4)(b), the RCO-NG is used to treat process exhaust from other TEUs (veneer dryer and presses) and therefore plays a direct role in air toxics control. The RCO-NG is directly connected to the upstream TEUs and functions as part of the emissions control system. The RCO-NG combusts gas to heat the exhaust stream and destroy HAP and VOC compounds in the process exhaust. The RCO-NG also generates combustion biproducts (formaldehyde, acrolein) and can thermally transform incoming compounds, potentially creating secondary toxics. Additionally, the RCO-NG serves as a combined emission point for the multiple upstream units. Under CAO, that makes this RCO-NG a consolidated TEU, which is not exempt.

Veneer Dryers

The two veneer dryers at the facility process softwood, are classified as non-exempt TEUs under CAO due to their continuous operation and reliance on steam heat generated by the onsite wood-fired boiler. These units remove moisture from green veneer sheets before pressing, and the drying process releases VOCs and hazardous air pollutants (HAPs), including methanol, formaldehyde and acetaldehyde. The veneer dryers are controlled by a regenerative catalytic oxidizer (RCO) that has a destruction removal efficiency (DRE) of 90%. The 90% DRE has been applied to the dryers 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 plywood presses are also treated as non-exempt TEUs. These units can potentially 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.

Plywood Layup

The facility uses several coating and patching products in plywood manufacturing, including urethane plywood patch, patch catalyst, putty, stencil paint, and coating. These materials are applied to veneer surfaces to repair defects, seal edges, or provide protective finishes. During application and curing, the volatile portion of these products may be released as VOCs, and certain formulations may also contain trace HAPs.

Under CAO, coatings, adhesives, sealants, and other surface-applied production materials are not exempt under OAR 340-245-0050(4). Because these products are directly tied to production and may result in the release of regulated air toxics, they are classified as non-exempt TEUs and are included in the facility's emissions inventory.

Welding Operations – E7018

The facility uses multiple rods to carry out maintenance operations on site. For E7018, the facility has used 100 pounds of welding rod per year. 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 – E70S and 309L

Welding at the facility is conducted on an as-needed basis for equipment maintenance. Filler metals used include E70S and 309L stainless, which contain regulated toxics such as manganese, nickel, and hexavalent chromium. Although welding is not categorically exempt, it qualifies as an exempt TEU under OAR 340-245-0050(4)(f), which covers routine maintenance activities with low emissions potential. In addition, based on calculated emissions and the materials used, welding emissions fall below DEQ's pollutant specific exemption thresholds listed 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.

Emission Factor Methodology

Veneer Dryers and Presses

Emission factors for both the veneer dryers and the presses were sourced from the Oregon DEQ Air Permit HAP Emission Factor list. These values reflect DEQ-approved factors for plywood operations and are considered appropriate for use in CAO emissions inventories.

Wood-Fired Boiler

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.

AP-42 Emission Factors:

AP-42, Section 1.6, Table 1.6-3 was 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.

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 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 for further details.
>
> NCASI Technical Bulletin No. 858 – for trace metals, using data from fabric filter/ESP, controlled wood boilers.
>
> NCASI Handbook of Substance-Specific Information – for pollutants such as acrolein, formaldehyde, lead, manganese, and chromium VI, where the chemical form is relevant and NCASI provided more detailed information than AP-42.

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

RCO-NG

Emission factors for the RCO-NG were sourced from AP-42, Section 1.4 , Tables 1.4-2 thru -4 (July 1998). These tables provide pollutant-specific emission factors for natural gas combustion in external combustion sources, which is representative of RCO-NG operation. Although the primary fuel is natural gas, emissions reflect combustion of process exhaust, so the combustion-related HAPs and criteria pollutants must be accounted for. Criteria pollutant emission factors were from AP-42, Table 1.4-1 and 1.4-2, and HAP emission factors for formaldehyde, benzene, toluene, and acrolein were from AP-42, Table 1.4-3. Although the RCO-NG is a control device, it combusts air with potential HAPs from upstream sources, making it a potential emitter itself. This conservative approach ensures all combustion-related HAPs are captured in the emissions inventory.

Plywood Layup

The emissions from the coating and patching products (U-100-B Patch Catalyst and W.B. Face 254 Lt. Fir) were calculated on the mass balance pages of the AQ520 form using product information sourced directly from the manufacturer-supplied VOC/HAP reports and the product's Safety Data Sheet. The VOC/HAP reports provide product specific values for VOC content (expressed as percent by weight and density, which were converted to lb/gal), and HAP content where applicable.

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 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:

To align the NCASI emission data with the facility's 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 (ODT) of wood, a standard conversion was used: 1 ODT of wood contains 16.8 MMBtu heat content, 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 is the same conversion factor NCASI used in their calculation. This allowed us to convert the reported MMBtu/year into ODT/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 World Health Organization (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 – which 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 in units of micrograms per oven dry ton (µg/ODT) was multiplied by the total annual dry weight 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 (1,133.81 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 µg.
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, which was then used to calculate the emissions for the TEQ in respect to the wood-fired boiler for the AQ520 from.

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:

6.46×10^{-12} lb TEQ/MMBtu

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.

Additional Calculations

Please see in the attached Excel Workbook "MUP Additional Calculations" for more details regarding TEQ derivation, conversions, and welding calculations.