Monterey Bay Air Resources District
Serving Monterey, San Benito, and Santa Cruz Counties

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Winery Emission Factor Guidance

The Monterey Bay Air Resources District (MBARD) issues permits to operate for various operations associated with wineries. This notice is to inform you that MBARD will use the California Air Resources Board's wine fermentation methodology to estimate ethanol (ETOH) emissions when evaluating winery permit applications for fermentation in both tanks and oak barrels. For estimating ETOH emissions from storage/aging in oak barrels, MBARD will use the methodology in San Joaquin Valley Air Pollution Control District's (SJVAPCD) Rule 4695, including a refined calculation from Santa Barbara County Air Pollution Control District (SBCAPCD) for white wine. In addition, the District has developed ETOH emission factors for wastewater ponds using Commonwealth Scientific & Industrial Research Organization (CSIRO) research. Table 1 summarizes the emission factors that will be used to estimate annual ETOH emissions. MBARD assumes emissions from tank breathing and working losses are insignificant compared to tank fermentation and oak barrel storage emissions and will not include these emissions in the assessment of wineries.

To calculate the daily potential to emit (lbs/day) for fermentation and storage/aging operations, the emission factors in Table 1 are multiplied by the maximum quarterly production rates, and then divided by the default fermentation, and storage/aging cycles presented in Table 2. To calculate the daily potential to emit (lbs/day) from wastewater ponds, the emission factor in Table 1 is multiplied by the maximum annual process throughput, and then divided by the default wastewater processing cycle presented in Table 2.

For oak barrel storage, MBARD will use January 1, 2014 as the start date for including barrels as a new emission source. Oak barrels in existence prior to January 1, 2014 will be considered part of the existing source emissions and will not be subject to Best Available Control Technology (BACT) or offsets. Oak barrels added on or after January 1, 2014 will be evaluated in accordance with Rule 207 and may trigger BACT and/or offsets.

MBARD will request three years of historical production data immediately preceding the date of application to determine Rule 207 applicability. If a new or modified permit unit has a potential to emit 25 lbs/day or greater of volatile organic compounds (VOCs), or the total VOC emissions from all permit units at the winery stationary source has a potential to emit 150 lbs/day or greater, then the source is subject to BACT requirements. If triggered, a BACT an analysis shall be required for the new or modified proposed project. MBARD's current policy is to follow the South Coast Air Quality Management District's BACT Guidelines which can be downloaded here: http://www.aqmd.gov/home/permits/bact/guidelines.

Wineries may also be subject to District offset requirements. Offsets are an emissions reduction necessary to

mitigate an emissions increase of an affected pollutant and are required from a new or modified stationary source that has the potential to emit greater than or equal to the 137 lbs/day of VOCs. A stationary source may be exempt from offsets if the facility's actual emissions are less 10 tons/year.

Table 1. Summary of Annual Emission Factors for Wine Fermentation, Oak Barrel Aging/Storage and Wastewater Ponds

Winery Operation	Emission Factor[1]	Reference
Red Wine Fermentation in Tanks and Oak Barrels	6.2 lbs ethanol/ 1,000 gallons wine	ARB, 2005
White Wine Fermentation in Tanks and Oak Barrels	2.5 lbs ethanol/ 1,000 gallons wine	ARB, 2005
Red Wine Storage/Aging in Oak Barrels	27.83 lbs ethanol/1,000 gallons wine[2,3]	SJVAPCD, 2009
White Wine Storage/Aging in Oak Barrels	25.83 lbs ethanol/1,000 gallons wine[2,3]	SBCAPCD, 2009
Wastewater Ponds	0.23 lbs ethanol/1,000 gallons[4,5] wastewater	CSIRO, 2009 & Chouinard, 2009

Notes:

1. For the emission calculations, Ethanol = ETOH = VOC.
2. Calculated based on default value of 3% loss. A different loss percentage may be considered by MBARD on a case-by-case basis.
3. The storage/aging emission factor in lbs ethanol/1,000 gallons is calculated as follows:

$$= \frac{\%\ Wine\ Loss\ by\ Volume}{100}, \frac{gal\ wine}{gal\ wine}\ x\ Density\ of\ Wine, \frac{lb\ wine}{gal\ wine}\ x\ \frac{ETOH\ Weight\ \%\ Wine}{100}, \frac{lb\ ETOH}{lb\ wine}\ x\ \frac{1000}{1000}$$

Specific Gravity ETOH =	0.79		MSDS
Density of Water =	8.34	lb/gal	standard
Density ETOH =	6.59	lb/gal	Calculated
ETOH Volume % Red =	14.00%	gal ETOH/gal wine	MBARD Default
ETOH Volume % White =	13.00%	gal ETOH/gal wine	MBARD Default
ETOH Weight % Red =	11.40%	lb ETOH/lb wine	Calculated
ETOH Weight % White =	10.56%	lb ETOH/lb wine	Calculated
Density (Red Wine) =	8.14	lb/gal	Calculated
Density (White Wine) =	8.16	lb/gal	Calculated
% Wine Loss by Volume =	3.0%	gal/gal wine	SJVAPCD Rule 4695

4. Calculated based on default values of ethanol concentrations of 2,086 mg/L during a 75-day crush season, and 608 mg/L during a 290-day non-crush season (912 mg/L annual average ethanol concentration), and a 3% evaporation loss. If substantiating ethanol concentrations or evaporation loss can be provided, a different emission factor may be considered by MBARD on a case-by-case basis.
5. The wastewater (ww) pond emission factor in lbs ethanol/1,000 gallons is calculated as follows:

$$= \frac{\%\ Evap\ Loss}{100}, \frac{gal\ ww\ evap}{gal\ ww\ processed}\ x\ annual\ avg\ ETOH\ Conc, \frac{mg\ ETOH}{L\ ww}\ x\ \frac{1\ g}{1{,}000\ mg}\ x\ \frac{1\ lb}{454\ g}\ x\ \frac{3.78\ L\ ww}{1\ gal\ ww}\ x\ \frac{1000}{1000}$$

Table 2. Default Winery Operation Cycles Used to Estimated Daily Emissions

Winery Operation	Length of Cycle
Maximum Quarterly Production Rates (gallons/quarter) of Red Wine Fermentation in Tanks and Oak Barrels	Quarter 1 = 90 days Quarter 2 = 91 days Quarter 3 = 92 days Quarter 4 = 92 days
Maximum Quarterly Production Rates (gallons/quarter) White Wine Fermentation in Tanks and Oak Barrels	Quarter 1 = 90 days Quarter 2 = 91 days Quarter 3 = 92 days Quarter 4 = 92 days
Maximum Quarterly Production Rates (gallons/quarter) Red and White Wine Storage/Aging in Oak Barrels	Quarter 1 = 90 days Quarter 2 = 91 days Quarter 3 = 92 days Quarter 4 = 92 days
Wastewater Processed	365 days

MBARD believes this approach will maintain consistency between the VOC emissions estimated in our region with the statewide inventory developed by the California Air Resources Board. This approach also provides consistency with the methodology used by other air districts. MBARD may consider the use of different emission factors than these default emission factors on a case-by case-basis. These emission factors will be applied to applications currently under review and all future applications.

The Winery Emission Calculation Spreadsheet can be used to calculate both daily and annual potential-to-emit (PTE) emissions from wine production. We request wineries provide the maximum anticipated annual and daily throughput values when submitting permit applications for these calculations.

Please be advised that additional equipment items used in the winery may need to obtain permits, (e.g. boilers, water heaters, engines, laboratories). The emissions from such equipment must be included in the facility-wide emissions inventory. Separate District guidance documents defining BACT for boilers and internal combustion engines are available on the District website: www.mbard.org. For detailed information or questions regarding the permitting of the wine-making operations or its ancillary equipment, please contact the District's Engineering Division at (831) 647-9411.

References

California Air Resources Board (ARB). 2005 Section 5.1 Food and Agriculture, Wine Fermentation. March. Available to download here: http://www.arb.ca.gov/ei/areasrc/fullpdf/full5-1.pdf.

San Joaquin Valley Air Pollution Control District (SJVAPCD). 2009. Rule 4695 Brandy Aging and Wine Aging Operations. Available to download here: http://www.valleyair.org/rules/currntrules/r4695.pdf.