

American Oak in the Lab: What Each Barrel Gives the Wine

One 2012 Napa Valley Merlot was aged in nine Barrel Associates American oak barrels, then sent to an independent lab to measure the oak compounds each barrel left in the wine. Every barrel had the same toast, so the only differences were how the staves were bent, how long the wood was seasoned, and whether the barrel was a Ripple Effect barrel.

WINE

2012 Napa Valley Merlot

TOAST

Medium plus, toasted heads

WOOD

Air-seasoned 24 or 36 months

TEST

Oak volatiles panel, GC/MS

LAB

Independent lab, Nov. 2013

Compound results in µg/L	Fire Bent			Water Bent			Deep Toast		
	24 mo	36 mo	24 mo Ripple	24 mo	36 mo	24 mo Ripple	24 mo	36 mo	24 mo Ripple
cis-Oak lactone coconut, sweet oak	201	290	333	135	204	384	197	177	396
trans-Oak lactone coconut, woody	29	30	38	18	43	44	24	36	26
Vanillin vanilla	458	353	507	428	394	501	454	333	500
Eugenol clove, spice	16	18	35	16	15	38	18	17	24
Isoeugenol clove, sweet spice	14	16	28	17	16	34	17	16	25
Guaiacol smoke, toast	22	20	37	18	32	45	26	35	26
4-Methylguaiacol smoky spice	10	8	12	10	11	11	10	11	10
Furfural caramel, toasted bread	15,170	10,640	17,859	18,141	19,499	19,444	18,406	8,120	15,377
5-Methylfurfural toasted almond, caramel	1,412	1,327	1,879	1,690	1,891	2,321	2,010	748	1,857

Below average  Above average · shading compares each compound across all nine barrels

What Stands Out

- **Ripple Effect barrels gave the most coconut and vanilla.** All three Ripple Effect barrels led in cis-oak lactone (333 to 396 µg/L) and vanillin (500 to 507 µg/L), and the fire bent and water bent versions roughly doubled the clove spice (eugenol) of the others.
- **Water bent is the gentler barrel.** The 24-month water bent barrel gave the least oak lactone of all nine (135 µg/L cis, 18 µg/L trans) and the lowest smoke (guaiacol, 18 µg/L).
- **Longer seasoning softened the toast.** Going from 24 to 36 months of seasoning cut furfural (caramel, toasted bread) by about 30% in the fire bent barrel and by more than half in the deep toast barrel, and lowered vanillin in all three bending methods.
- **Smoke stayed modest.** Guaiacol ran only 18 to 45 µg/L across all nine barrels, highest in the Ripple Effect fire and water bent barrels.