

Smoke Taint Update

FEBRUARY 2023

CURRENT KNOWLEDGE AND BEST PRACTICES

Presented by Clark Smith,

WineSmith Wines & Consulting

Director, Int'l Working Group

Postmodern Winemaking Symposium 2017

Request a copy of this Powerpoint
from Clark@Winemaking411.com

Poll Question # 1

Have you experienced Smoke Taint?

International Smoke Taint Working Group

Peter Salamone	Research Oenovation Collective
Clark Smith	WineSmith Wines & Consulting
Anita Oberholster	U. C. Davis
Tom Collins	Washington State University
Kerry Wilkinson	University of Adelaide
Mark Krstic	AWRI
Eric Herve	ETS Labs
Fabio Mencarelli	Purovino
Zandberg, Wesley	University of British Columbia

Resources

[Home](#)[Shop](#)[Consulting](#)[Courses](#)[Music](#)[Video](#)[Books](#)[About Us](#)

Postmodern Winemaking

SMOKE TAIN



We have learned a lot about smoke taint, but much mystery remains, and much currently widely held belief is likely false. For example, two eminent carbohydrate chemists in our working group, Wesley Zandberg of UBC and Kerry Wilkinson of U. Adelaide have independently determined that glycoside-bound forms of cresols are quite stable and do not hydrolyze, despite many claims to the contrary. It is true that post-RO treatment, smoke aromas will often return, but the source and mechanism are unknown.

The list of known compounds involved in taint is, in my view, quite incomplete because treatments highly effective in removing taint do not show much change in these compounds. Further, the aggressive parch on the front of the tongue is not likely to be caused by bound forms because they are present in very small quantities insufficient for cooperative binding to salivary protein.

Here is basic information you can look over. Begin with my article from WBM 2018 "Fire Down Below." Right now we must take action despite imperfect knowledge. We have to concentrate on what seems to be working. It will likely be a long time before we know what the chemistry really is, if we ever do. I don't want to waste too much



Resources

- winemaking411.com/smoke-taint/
- Postmodernwinemaking.com/theory

[Home](#)[Philosophy](#)[Glossary](#)[Wine & Music](#)[Winemaking Blog](#)[Links](#)[About Clark](#)[Contact](#)[Books](#)[Events](#)[Theory](#)[Full Disclosure of Winemaking Practices](#)[Buy Postmodern Wine](#)

POSTMODERN WINEMAKING

The practical art of connecting the human soul
to the soul of a place by rendering its grapes
into liquid music.

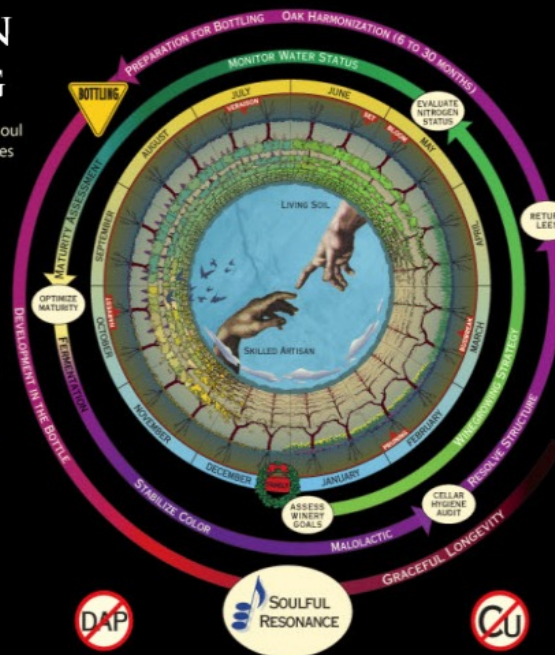


GOALS

- [DISTINCTIVE TERROIR EXPRESSION](#)
- [FINESSE](#)
- [AROMATIC INTEGRATION](#)
- [BALANCED REDUCTIVE STRENGTH](#)
- [VISCERALITY](#)
- [LONGEVITY](#)

VINEYARD ENOLOGY

- [BALANCE VINE METABOLISM](#)
- [PROMOTE SOIL HEALTH](#)
- [HARVEST AT OPTIMUM](#)
- [FLAVOR MATURITY](#)



- [TOOLS FOR STRUCTURAL ELEVAGE](#)
- [BLEND FOR PHENOLIC BALANCE](#)
- [MICRO OXYGENATION](#)
- [SEVEN FUNCTIONS OF OAK](#)
- [LEES RE-INCORPORATION](#)
- [ALCOHOL SWEET SPOT TRIALS](#)
- [BOTTLE W/O COMPROMISING STRUCTURE](#)

- [INTEGRATED BRETT MANAGEMENT](#)
- [CREATE A NUTRIENT DESERT VIA COMPLETE FERMENTATION OF HEALTHY MUST](#)
- [PROMOTE MICROBIAL EQUILIBRIUM STRUCTURE TO INTEGRATE FLAVORS](#)



- [PURCHASE GRAPECRAFT POSTER](#)
- [WHAT IS GRAPECRAFT?](#)
- [HOME](#)

Topics In Postmodern Winemaking

This area is designed to provide access to information, speculation, theory and scientific evidence regarding a variety of themes of current inquiry. Visitors are encouraged to submit contributions. Clark's Dropbox contains assorted articles and presentations on these topics:

<https://www.dropbox.com/sh/0608xq8x47kxnwr/AAC-UQV2HEPXvX7RB93OlqMCA7dl=0>.

[Postmodern winemaking principles](#)

[Vineyard Enology: Vine balance, living soil, ripeness](#)

[Fermentation & co-extraction strategies](#)

[Comparing & contrasting the enological oxygen spectrum](#)

[Structure building & aromatic integration, oak functions](#)

[America's Winemaking Diversity](#)

[Wine as liquid music: harmony & astringency](#)

[Pros & cons of indigenous yeast fermentation](#)

[Microbial balance \("Integrated Brett Management"\)](#)

[Reduction management](#)

[Minerality](#)

[Biodynamics](#)

[Sulfite-free winemaking](#)

["Natural Wines", manipulation, & technology pros and cons of full disclosure](#)

[Smoke Taint](#)







































[Home](#)[Philosophy](#)[Glossary](#)[Wine & Music](#)[Winemaking Blog](#)[Links](#)[About Clark](#)[Contact](#)[Books](#)[Events](#)[Theory](#)[Full Disclosure of Winemaking Practices](#)[Buy Postmodern Wine](#)

Smoke taint articles and files not supported on this page, such as pdfs and powerpoints, are resident on my [DropBox](#).

The [Australian Wine Research Institute](#) has led the industry in smoke taint research and has a wealth of information and [papers](#) on their website.

[Tom Collins at University of Washington](#) has done [good recent research](#) on vine physiology.

[Join Our Email List](#)[Get Clark Smith's Book Postmodern Winemaking](#)

	Grape contract language	1/12/2021 7:39 PM	File folder	
	Grape cuticle barriers	2/10/2021 4:14 PM	File folder	
	Post-treatment mitigations	2/10/2021 4:55 PM	File folder	
	Protocols	11/16/2020 9:45 AM	File folder	
	Sensory	2/10/2021 5:28 PM	File folder	
	Smoke compounds	2/10/2021 5:27 PM	File folder	
	Smoke Taint Collaborative Working Group	2/10/2021 5:31 PM	File folder	
	Treatment	2/10/2021 4:58 PM	File folder	
	2018-01-24 15.01.18	2/21/2018 6:37 PM	JPG File	4,016 KB
	185451_Kennison2012 PhD dissertation Smoke Taint in Grapes and Wine	1/7/2018 6:26 PM	Adobe Acrobat D...	1,352 KB
	Embracing Smoke Taint as an Expression of Terroir SevenFifty Daily	6/25/2018 5:42 PM	Adobe Acrobat D...	372 KB
	Fire Down Below WBM Clark Smith (1)	10/20/2020 9:41 AM	Adobe Acrobat D...	1,624 KB
	Fire Down Below WBM Clark Smith	9/8/2018 9:54 AM	Adobe Acrobat D...	1,624 KB
	Fire Down Below	4/25/2018 8:12 AM	Microsoft Word D...	31 KB
	Grape vines exposed to smoke to test taint from wildfires WSU News Washin...	8/18/2016 10:16 AM	Adobe Acrobat D...	656 KB
	Grapevine March-April 2018 Grape Purchase Agreements & Smoke Taint	6/15/2018 6:58 AM	Adobe Acrobat D...	2,532 KB
	Hartl(2017)JAF65(28)p5681-5689 Glycosylation via Promiscuous Resveratrol ...	12/5/2017 11:24 AM	Adobe Acrobat D...	830 KB
	Impacts of Bushfire Smoke Scoping Study Krstic 2007	4/13/2018 4:18 PM	Adobe Acrobat D...	1,147 KB
	jan-feb-2013-awri-report	4/13/2018 3:58 PM	Adobe Acrobat D...	852 KB
	Krstic(2015)AJGWR	12/5/2017 12:11 AM	Adobe Acrobat D...	191 KB
	Laffort recommendations for smoke taint	8/23/2018 9:44 AM	Adobe Acrobat D...	96 KB
	Laffort Smoke Taint Newsletter	10/15/2017 11:11 AM	Adobe Acrobat D...	502 KB
	Latest Information Viticulture & Enology	10/17/2017 8:46 AM	Adobe Acrobat D...	955 KB
	MPCI Smoke_Claims_Brochure__(1)	9/17/2018 5:25 PM	Adobe Acrobat D...	322 KB
	North Bay Bus Journal 11.06.17 Jeff Quackenbush	11/6/2017 9:12 PM	Adobe Acrobat D...	757 KB
	North Coast Wildfire Impact Study	1/25/2018 1:14 AM	Adobe Acrobat D...	390 KB
	PMWinemaking_SmokeTaint_Dec2017_AOnn	12/5/2017 12:11 AM	Microsoft PowerP...	1,556 KB
	Postmodern Smoke Taint Herve Dec 2017	12/4/2017 10:17 PM	Microsoft PowerP...	3,001 KB
	Six Misconceptions About Smoke Taint - Wines & Vines	10/17/2017 8:39 AM	Adobe Acrobat D...	505 KB
	Smartvin_EN	10/20/2020 9:41 AM	Adobe Acrobat D...	2,343 KB
	Smoke Phenols Berries Noestheden JAF6 2017	12/5/2017 11:25 AM	Adobe Acrobat D...	326 KB
	smoke taint - EC2017 -ClarkSmith Symposium	1/22/2018 12:30 PM	Adobe Acrobat D...	1,194 KB
	smoke taint links	9/12/2017 4:32 PM	Microsoft Word D...	12 KB
	Smoke taint lore	8/4/2015 3:30 PM	Microsoft Word D...	12 KB
	Smoke Taint papers - The Australian Wine Research Institute	1/7/2018 6:02 PM	Adobe Acrobat D...	140 KB
	Smoke_CA_stakeholder_final	6/12/2020 12:06 AM	Adobe Acrobat D...	986 KB
	smoke_kwilkinson 2009 RO and fining trials	1/7/2018 5:58 PM	Adobe Acrobat D...	437 KB
	SmokeTaint_K.WilkinsonPresentation	8/4/2015 3:32 PM	Adobe Acrobat D...	437 KB

Resources

- winemaking411.com/smoke-taint/
- PostmodernWinemaking.com/theory
- WineBusiness.com June 2018 issue

WINE BUSINESS MONTHLY

June 2018 • \$5.95

The Industry's Leading Publication for Wineries and Growers

www.winebusiness.com

The Secret Life of Smoke Taint

Clark Smith

OUR KNOWLEDGE OF SMOKE taint is far from complete. I present here a snapshot of today's understanding at a time when rapid progress is underway and immediate practical answers are essential. My challenge is to clarify for winemakers the choices they face and the research they ought to support while avoiding oversimplifications that might annoy academic readers and lead winemakers to improper conclusions and actions. I have done my best to detail the perspectives and directions of specific researchers, and I include extensive references in full knowledge that most **WBM** readers do not have access to primary journals.

If the North Coast wildfires of 2017 precipitated a silver lining, it is the astonishing degree to which our winemaking community has coalesced. For the first time in recent memory, transparency and cooperation among winemakers, academics, laboratories and suppliers have spawned profitable discussions at the Dec. 5-6, 2017 **Postmodern Winemaking Symposium** (PMWS⁵) and a series of events sponsored by **UC Davis**, the **American Society for Enology and Viticulture** (ASEV) and the recent **Innovation +**

Fire and Desire

The human jaw got weaker 1.8 million years ago when we tamed fire and started cooking food. We must have been social since it takes a tribe to keep a fire going. Since that moment, our nature has been crafted around a passionate, addictive love of controlled fire, which distinguishes us from other species.

Our addictive relationship with controlled fire takes many forms. Families arrayed around a campfire or a roaring fireplace have wired our brains to stare at meaningless images, now largely replaced by flickering screens everywhere. Many of the foods we crave—hickory barbecue, French roast coffee, toffee and applewood bacon—are products of controlled fire. A vast array of beverages are heavy in fire flavors: Scotch whisky's peated malt, Bourbon's charred oak, tequila's mesquite-roasted agave, **Guinness** Stout, Salted Caramel **Kahlua** and gunpowder green tea all evoke the hearth and touch us profoundly in aromatic caress. Vanilla is so compelling that the **Alcohol and Tobacco Tax and Trade Bureau** (TTB) singles out four of its elements for special treatment. The ingre-

Here's what's new

- Myths debunked
- Breakthroughs in vineyard practices
- Ozone treatment of tainted grapes
- Better contracts
- Improved availability of analysis
- Improved winemaking – What works and doesn't work
- Much more effective treatments
- Way more post-treatment mitigation products

True (or likely true)

- Like cancer, smoke taint is no longer a death sentence.
- September lightning events are very rare, not the new normal.
- Free guaiacol > 0.5 ppb on grapes is a useful index for a smoke event (except Syrah)
- Guaiacol is NOT a taint. 4-methyl guaiacol is irrelevant.
- Glycosolated forms are not prone to hydrolyze at wine pH, and do not cause parch.
- Leaves and other MOG are a major source of taint
- Clarification of suspended particulates is always beneficial



purfresh[®]
wine

**New Technology for
the Wine Industry**

High Tech Approach Forced O₃ Air Powered by Container



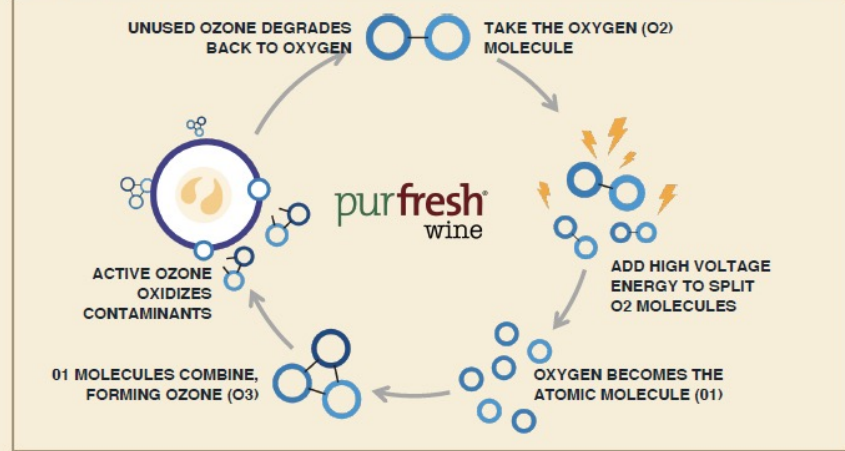
Timing & Concentration of O₃ Directly Impacts Smoke Taint

- › Temperature, Humidity, O₃ Level, & Air Flow
- › Self-powered, temperature-controlled container.
- › Decontamination of grapes via 24-hour treatment.
- › On-demand O₃ generation with high air flow.



Monitor, Control, Document via Cloud-Based IOT Software

- › Manage O₃, CO₂, temp., and RH in real-time
- › On-demand corrective and proactive remote control
- › Monitor location and security of each device



Useful analysis

- The existing standard analysis for the big ten compounds, free and bound, is reproducible for contracts and insurance.
- These analyses cannot guide taint assessment. Expert sensory is the best thing going at the moment.



TESTING GRAPES AND WINES FOR SMOKE IMPACT: OPTIONS AND CURRENT RECOMMENDATIONS

PRE-HARVEST: GRAPE SAMPLES AND MICROFERMENTS

- **VOLATILE GUAIACOL AND 4-METHYL GUAIACOL IN WHOLE BERRIES** (volatile fraction) is the routine pre-harvest screening test for smoke impact at ETS laboratories. Submit approximately 250 berries per sample, undamaged as much as possible. Use preferably hard plastic "Tupperware-style" container - necessary if you are shipping samples. Avoid submitting cluster samples: the additional sample preparation time in the lab will delay results. We do not recommend submitting juice samples.
- **GUAIACOL AND 4-METHYL GUAIACOL** (volatile fraction) in small scale ferments, also called "bucket ferments" or "microferments" is a useful complement to direct grape tests and have gained popularity in recent years. A protocol for preparing microferments can be found here: https://www.atwri.com.au/wp-content/uploads/small_lot_fermentation_method.pdf. At (or near) completion of fermentation (brix <0), transfer fermented wine into a bottle, let settle in fridge for a few hours, decant and submit sample in a 60 mL plastic tube.

GRAPE TESTS VS. MICROFERMENTS AS PREDICTION TOOLS

	GRAPES	MICROFERMENTS
Sample Preparation Time (before sending to the laboratory)	Immediate	>1 week
Sensory Evaluation	Not very useful	Useful, but difficult (need for multiple trained testers including sensitive individuals)
Analysis Turnaround Time	Enquire	Enquire
Prediction of Smoke Characters in Production Wines	Indirect (variable "multipliers" between grape and wine results)	Reds: more direct, but delayed Whites: uncertain (ferment with skins for "worst case scenarios"?)

POST-HARVEST : PRODUCTION WINES

- **VOLATILE GUAIACOL AND 4-METHYL GUAIACOL** are useful to assess smoke impact in unoaked wines, starting right at completion of primary fermentation, when quick answers are needed for production wines.
- **VOLATILE MARKERS - EXTENDED PANEL** - We have chosen to not offer this during the 2020 firestorm emergency. In addition to guaiaicol and 4-methylguaiaicol, this panel includes cresols, phenol and syringols.
- **GLYCOSYLATED MARKERS** - We have chosen to not offer

Useful analysis

- The existing standard analysis for the big ten compounds, free and bound, is reproducible for contracts and insurance.
- These analyses cannot guide taint assessment. Expert sensory is the best thing going at the moment.
- OSU Research by Elizabeth Tomasino implicates thiophenols.

Oregon State researchers discover compounds contributing to smoke taint in wine and grapes

June 23, 2022



CORVALLIS, Ore. – An Oregon State University-led research team has discovered a class of compounds that contribute to smoke taint in wine and grapes.

“This is a critically important for winemakers who are increasingly dealing with the impact of wildfire smoke on their grapes,” said Elizabeth Tomasino, an associate professor of enology at Oregon State. “It provides them markers that are much more

STORY BY:

Sean Nealon, 541-737-0787,
sean.nealon@oregonstate.edu

SOURCE:

Elizabeth Tomasino, 541-602-8322,
elizabeth.tomasino@oregonstate.edu

Click photos to see a full-size version. Right click and save image to download.

Useful analysis

- The existing standard analysis for the big ten compounds, free and bound, is reproducible for contracts and insurance.
- These analyses cannot guide taint assessment. Expert sensory is the best thing going at the moment.
- OSU Research by Elizabeth Tomasino implicates thiophenols
- Tastry's AI-derived holistic analysis seems promising for assessment, human sensory profiling and blending recommendations.
- Decades of research have completely ignored pyrolysis.



Pyrolysis

Pyrolysis is the thermal decomposition of materials at elevated temperatures in an inert atmosphere.^[1] It involves a change of chemical composition. The word is coined from the Greek-derived elements *pyro* "fire" and *lysis* "separating".

Pyrolysis is most commonly used in the treatment of organic materials. It is one of the processes involved in charring wood.^[2] In general, pyrolysis of organic substances produces volatile products and leaves a solid residue enriched in carbon, char. Extreme pyrolysis, which leaves mostly carbon as the residue, is called carbonization. Pyrolysis is considered as the first step in the processes of gasification or combustion.^{[3][4]}

The process is used heavily in the chemical industry, for example, to produce ethylene, many forms of carbon, and other chemicals from petroleum, coal, and even wood, to produce coke from coal. Used also in the conversion of natural gas (primarily methane) into non-polluting hydrogen gas and non-polluting solid carbon char, initiating production in industrial volume.^[5] Aspirational applications of pyrolysis would convert biomass into syngas and biochar, waste plastics back into usable oil, or waste into safely disposable substances.

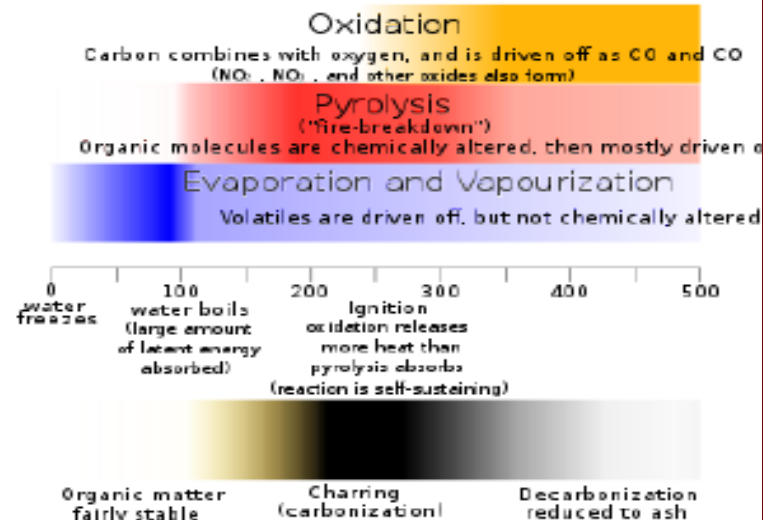
At 200–300 °C, if oxygen has not been excluded, the carbonaceous residue may start to burn, in a highly exothermic reaction, often with no or little visible flame. Once carbon combustion starts, the temperature rises spontaneously, turning the residue into a glowing ember and releasing carbon dioxide and/or monoxide. At this stage, some of the nitrogen still remaining in the residue may be oxidized into nitrogen oxides like NO₂ and N₂O₂. Sulfur and other elements like chlorine and arsenic

Acrolein (ə-krō'-lē-ĭn, systematic name: **propenal**) is the simplest unsaturated aldehyde. It is a colourless liquid with a piercing, acrid smell. The smell of burnt fat (as when cooking oil is heated to its smoke point) is caused by glycerol in the burning fat breaking down into acrolein. It is produced industrially from propylene and mainly used as a pesticide and a building block to other chemical compounds,

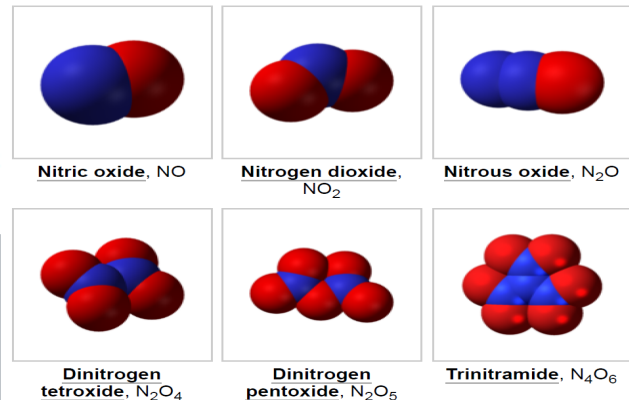


Burning pieces of wood, showing various stages of pyrolysis followed by oxidative combustion.

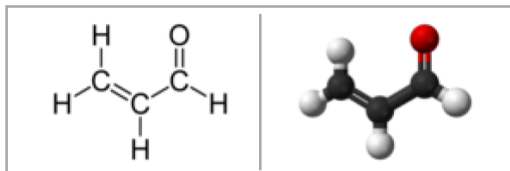
Thermal decomposition of organic matter



Processes in the thermal degradation of organic matter at atmospheric pressure.



Acrolein



In the Vineyard

- Guaiacol and other compounds do migrate through phloem from leaves to berries, but not very much. Don't pull all your leaves.
- Parka (Cultiva) is an inexpensive promising application with many proven benefits and good preliminary evidence of shielding. You should use it anyway. It pays for itself in weight alone.
- Explore “make it anyway” agreements with winery customers.
- Pick clean.
- Investigate deployment of hoop houses.

Better Grower Contracts

- Explore “make it anyway” agreements with winery customers.
- Assume taint treatment costs.
- Find custom crush or other alternatives for your fruit.
- Unvetted in-house analysis is “smoke and mirrors”. Make sure rejection is based on well-defined third-party objective criteria.

At the Winery

- Minimize hang time. Pick as early as possible.
- Sort and remove MOG.
- Crush whites quickly, minimizing skin contact. Remove solids. Whites and rosés can be effectively fined. Pelletized vs powders.
- For reds, make the big wine. Use techniques like maceration acceleration, flash détente, copigmentation, ozone (PurFresh)
- Make all the Petit Verdot you can find.
- Alternatively, use a radical saignée strategy.
- Use fruit-enhancing yeasts like Alchemy4 and Enartis Red Fruit
- Avoid toasted oak, especially vanilla.

Treatment Options

- Clarification (centrifugation, DE, crossflow, Mastervin Compact)
- Enzyme pretreatments (Zimarom by Juglas/BSG)
- SRx adsorbent (VinSci.com)
- Very loose RO, adsorption (Della Tofolla, WineSecrets)
- Spinning Cone process (Conetech) for truckload-size lots
- Combination UF / RO (WineSecrets)
- Fining protocols (Juglas/BSG, Enartis, Lamothe-Abiet, ScottLabs)
- Always have an experienced expert on hand to optimize treatment parameters and duration. (Like me.)

Post-Treatment Mitigation Options

- Clever blending (Tastry, GoFermentor Smartblender)
- Softening agents (yeast autolysates, mannoproteins, lees)
- Aromatic woods (Cherry wood chips from Toriga Nacional)
- Fruit enhancers (Oak-Wise, BSG)
- Combination UF / RO (WineSecrets)
- Alcohol sweet-spotting for harmonious balance.

What remains to do

- PG&E refinements and investment in fire prevention.
- Further research on what smoke taint is.
- Better techniques to prevent recurrence in the bottle.
- Workable insurance contracts.
- Refinements in vineyard practices, e.g. Parka timing
- Federal and State relief and research funding
- Winemaking techniques for earlier picking of Cab Sauv and other late harvest varieties
- Improved sensory language, especially for astringency.
- Enhanced selectivity of membranes and adsorbents.

Poll Question # 2

Have you
successfully treated
Smoke Taint?

Expert consulting at reasonable prices:
Winemaking411.com

Request a copy of this Powerpoint
from Clark@Winemaking411.com

Questions?