# Quality Control Guidelines

**I. Wine Quality Control**

**The key to adequate quality control is to monitor how each production activity affects wine palatability and to make adjustments accordingly. Complete and accurate record keeping is the corner-stone of a successful quality control program. Only when proper up-to-date accounts of wine production activities are kept can a full understanding of the parameters affecting wine quality occur.**

**Aging and Storage Quality Control**

**1. *Sanitation*: Each winery should have an established sanitation program and periodically monitor the effectiveness of that program. Such simple procedures as tasting barrel and tank rinse water can be a significant step in insuring quality. Alcohol is an excellent solvent. Therefore, any off character in the rinse water may be picked up in the wine.**

**2. *Chemical Analysis*. A procedure should be established for running a specific set of analyses according to a specific timetable. The analysis performed depends somewhat upon the philosophy of the winemaker. However, pH, free and total sulfur dioxide, titratable acidity, reducing sugar, alcohol, protein, potassium bitartrate stability and paper chromatography for M/L are the very minimum analyses which the winery should be capable of performing.**

**It is essential that the vintner know how each processing step affects his product, both chemically and organoleptically. For example, reference samples should be held for comparison of color and body stripping due to filtration, cold stabilization, etc.**

**3. *Oxygen Pickup*. Most winemakers strive to retain as much of the 'fruit' as possible in their wines. The loss of aroma components between fermentation and bottle release is a significant problem. The colder the wine the greater is the solubility of molecular oxygen in the wine. When the wine is then allowed to warm, oxidation occurs. This is a principle disadvantage of conventional cold stabilization for potassium bitartrate stability. Such procedures often result in prolonged refrigeration of wines resulting in oxidative degradation. Each winemaker must know how processing and equipment affect $O_2$ uptake. Free sulfur dioxide analysis is a good indication of $O_2$ uptake since sulfurous acid is oxidized by the dissolved oxygen in wine. Therefore a rapid decline in the free $SO_2$ level in a short period of time is indicative of $O_2$ pickup. Such preventive steps as proper equipment, nitrogen blanketing, $CO_2$ sparging flushing lines and receiving tanks all have their place in reducing the likelihood of excessive oxidation.**

**There is no substitute for storing wines in full containers with the possible exception of barrels. Richard Peterson showed that partial vacuums form in *properly sealed* barrels over time. Prior to his work many assumed that barrels should be topped regularly to prevent oxidation and biological growth. Topping too often can result in possible oxidation due to partial pressure lost within the barrel.**

**As stated, wine temperature is important because of its effect on oxygen solubility. Knowing storage temperatures and temperature fluctuations is a key to understanding the aging potential of a wine.**

**4. *Pre-Bottling*. A check list should be established to insure that important factors are not overlooked.**

**a. Chemical analysis. Has the wine met the proper analytical criteria for bottling?**

**b. Stability analysis. Has the wine met such stability criteria as protein, color, bitartrate and microbiological stability?**

**c. Sensory analysis. All bottling lots should be determined by a review panel, not solely by the winemaker. It is easy for those in the commercial wine industry to overestimate their own sensory abilities. The fact that winemakers can distinguish between ethyl acetate and ethyl mercaptans does not necessarily mean they are the best judge of what the buying public desires.**

**5. *Materials Quality Control*. Are all materials needed for bottling present and in the proper condition?**

**II. Bottling Quality Control**

**1. *Sanitation Program*. The winery should have a set sanitation program and know its effectiveness.**

**2. *Biological and Oxidative Quality Control*. Aside from packaging, the two most important considerations during bottling are biological and oxidative. Spoilage organisms which are present in the winery can easily find an adequate growth media in spilled wine, particularly if the wine is not removed properly. The major sources of contamination during bottling include the following:**

**a. Filter pad drip trays. This is of increased importance due to the use of cellulosic pads which drip heavily. Trays must be drained often during bottling runs if wine is being filtered during bottling.**

**b. Fill bowls. Leaky spouts, wine blown from snifter valves, residue wine on bell rubbers, etc., can harbor wine contaminants. It may be desirable, particularly during long runs, to occasionally mist bell rubbers and filler stems with a 60-70% ethanol solution to inhibit microbial growth.**

**c. Corking machines. Corkers are a significant source of potential sanitation difficulties due to the likelihood of wine spillage. Corkers are a large source of contamination. These units should be completely dismantled and cleaned before and after each bottling. Ethanol misting of the corker jaws during bottling can be a significant asset in minimizing biological problems.**

**d. Work activity. Increased worker activity in the bottling area increases the spread of airborne wine microbes. It is desirable to limit the number of employees around the filling and corking area to as few as possible.**

**3. *Wine Oxidation*. Another potential problem during bottling is wine oxidation. It is not unusual for bottling to impart from 0.5 to greater than 2 mg of $O_2$/L into the wine. Such addition can have a profound effect on wine quality and shelf life. It is therefore essential to know your bottling equipment and how it affects wine oxidation. Such production practices as sulfur dioxide additions just prior to bottling, nitrogen sparging, carbon dioxide or nitrogen flushing bottles prior to filling, vacuum corkers and fillers, etc., can be useful in limiting $O_2$ problems.**

**The loss of free sulfur dioxide in wine is proportional to the dissolved oxygen content. Producers not using vacuum fillers, corkers or bottle gas flushing can have up to 5 mL of air in the head space of their bottled wine (750 mL). This amounts to approximately 1 mL (1.4 mg) oxygen. Four mg of sulfur dioxide are needed to neutralize the effects of 1 mg of oxygen. Using this relationship, an additional 5-6 mg of free sulfur dioxide is needed to reduce molecular oxygen in the head space. This represents a rather significant loss of free sulfur dioxide which could otherwise be available as an antimicrobial agent. If the extent of potential oxidation is high, wines should not be bottled cold due to the increased solubility of molecular oxygen. High levels of oxygen are particularly detrimental to wines which contain sorbic acid (potassium sorbate) due to the development of oxidative products which impart an unpleasant character to the wines.**

**4. *Warehousing and Bottle Release*. Bottled wines should be periodically tasted by a panel against reference samples to determine how the wine is developing. Too early a release date results in a less than fully developed bottle bouquet, too late may mean a large segment of the consumers could receive the wine after its quality began to diminish. Bottle aging is dependent upon the wine chemistry and the warehousing conditions. It is essential that the winemaker understands how each processing step affects wine chemistry and therefore wine shelf life.**

**5. *Label Coding*. Label coding is a means by which the winemaker can extend his quality control into the market place. By placing very small notches, one for day, month and year on the label, winery personnel can determine the bottling date and from there the complete history of the wine.**

**Label coding can be done by simply placing a stack of labels in a vice and using a saw to cut a small notch on each axis. Using a standard - usually a piece of plastic - the vintner can identify the bottling date. This can be highly important if the winery is forced to have several to many bottling runs of a particular wine lot.**

Premium wine quality is the result of quality fruit and many processing steps. These steps, viewed individually, may be insignificant. However, collectively they make the difference between standard and outstanding wines. It is the responsibility of the winemaker to understand how production parameters affect wine quality and to make adjustments accordingly.

III. Wine Corks

As a generalization, if corks are transported at 20°C, then they should be maintained below 8% moisture. At this temperature and moisture content the water activity is generally low enough to inhibit mold growth. Fortunately, this moisture content is consistent with the operation of most corkers.

To help ensure that corks are free of microorganisms that may affect wine quality winemakers either treat corks with sulfur dioxide before bottling and/or purchase treated corks from suppliers. Generally suppliers treat corks with gaseous $SO_2$ or with ionizing radiation. It's been demonstrated that $SO_2$ treatment achieves nearly 100% inactivation of molds present in corks. Bacterial counts were not as effectively reduced, possibly because of resistance of spores from organisms such as Bacillus. Sulfur dioxide treatments satisfy the major prerequisite of elimination of mold from corks; however, direct mold growth in corks stoppered into wine may not be the sole cause of cork related off odors and flavors. As stated, mold growth during processing or shipping may produce metabolites which are both responsible for tainted wines and which are unaffected by $SO_2$ treatments.

To help minimize the likelihood of cork problems - know what you are buying. Are the corks bleached? What is the moisture content when shipped? How are the corks sterilized? Do they remain sterile in your cellar?

# Quality Control Checkpoints

## Receiving Grapes

- Documents
  - Weight tags
  - Sugar test papers
- Maturity of grapes
  - Soluble solids, TA, pH, YAN, etc.
- Conditions of grapes as received
  - MOG (materials-other-than-grapes)
  - Rot, sunburn and mildew
  - Field heat temperature
  - Grape juicing
  - Grape color
  - Insects and reptiles
- Varietal confirmation
- Field spray residues
- Vineyard practices

## Crushing and fermenting

- Equipment cleaning and inspection
- Pomace and stem removal and area sanitation
- Cleaning compounds
  - Types
  - Storage
  - Safety

- Doses
- Scheduling
- Rinsing

- $SO_2$ additions
  - Timing
  - Form
  - Quantity
  - Location of application
  - Distribution
- Prefermentation additions
  - Nitrogen additives
  - Enzymes
  - Tannins
  - Bentonite
  - Other
    - Preparation of additive
    - Amount of additive
    - Timing of addition
    - Distribution of additive
- Prefermentation treatments
  - Direct to press
  - Stems retained
  - Whole berries retained
  - Carbonic maceration
  - Cold maceration and skin contact
    - Duration
    - Temperature
  - Free run and press fractions used
  - Juice settling
    - Duration
    - Temperature
  - Centrifuge or decanter
    - Solid in effluent
  - Rotary vacuum filter
- Fermentation temperature control
  - Measuring
  - Remedies
  - Monitoring schedule
  - Varietal guidelines
- Yeast: Pure vs. wild
  - Pure Cultures
  - Storage
  - Inoculum
    - Preparation method
    - Quantity
    - Method of inoculation

- Time of inoculation
- Follow-up on inoculation
- Fermentation
  - Monitoring
    - Temperature
    - Soluble solids progress
    - Visual observation
    - Taste and smell for cleanliness
    - Expected progress
    - Maceration procedures
  - Insect control
    - Screens
    - Lights
    - Sanitation
    - Cleanliness
  - Malo-lactic bacteria: Pure vs. wild
    - Pure Cultures
    - Storage
    - Inoculum
      - Preparation method
      - Quantity
      - Method of inoculation
      - Time of inoculation
    - Follow-up on inoculation
  - Fermentation targets
    - Ferment to dryness
    - Arrest fermentation with residual sugar
  - Post fermentation treatment
    - Rack
    - Filter
    - *Sur lie*
    - $SO_2$
      - Levels
      - Scheduling

## Processing and aging

- Wine tank inspection
- Cellar inspection
- Equipment inspection
- Fittings and tool inspection
- Sampling
  - Timing
  - Scheduling
  - Size
  - Quantity
  - Sterility considerations
  - For analysis

- For QC
- For organoleptic analysis
- Methods
  - Thief
  - Siphon hose
  - Sample tube
  - Sterile

**Lab analysis**
- Scheduling
- Timing
  - Chemical
  - Microbiological
  - Quality Control

**Organoleptic analysis**
- Timing
- Before and after movements and operations
- Inventory evaluation
- Blending
- Clarification series

**Sanitation**
- Tanks
- Hoses
- Fittings
- Pumps
- Equipment
- Walls & Floors

**Use if $N_2$ and $CO_2$ for oxygen control**

**Dissolved oxygen measurements on wine movements**

**Topping**

**Ambient and tank temperature control**

**Cooperage**
- Inspecting
- Cleaning
- Filling
- Emptying
  - Inspecting barrels
  - Smelling wooden bungs

**Filtration**
- Sterilizing filters, lines and equipment
- Inspecting sheets, pads, cartridges, powders and filter aids
- Monitoring before and after
- Monitoring pressure and flow rate
- Sampling
- Proper breakdown, cleaning and storage

**Equipment maintenance**
- Scheduled preventative maintenance

- Scheduled equipment servicing
  - Electrical
  - Mechanical
  - Pneumatic
  - Structural
- Equipment
  - Training staff
  - Storing
  - Safety
- Bottling preparation
  - Blends
  - Tanks
  - Equipment
  - Supplies
  - Schedule
  - Bottling line

## Incoming equipment and supplies

- Purchase order
- Receiving documents
- Receiving
- Inspection before acceptance of items
- Specifications of item
- Inspection and count of item(s)
  - Equipment
  - Cooperage and auxiliaries
  - Filter pads, powder, sheets and aids
  - Organic acids; tartaric, malic and citric
  - Grape and wine additives
  - Lab supplies
  - Clarifying agents
  - Cleaning compounds
  - Wine samples

## Monthly Inventory

- Bulk wine
- Case goods
- All supplies

# Bottling

## Incoming bottling equipment and supplies

- Purchase order
- Receiving documents
- Receiving
- Inspection before acceptance of items
- Specifications of item
- Inspection and count of item(s)
  - Glass

- Cased glass
- Knock downs (KD'S)
- Special packs
- Closures
  - Screwcaps
  - Corks
- Capsules
- Labels
- Wire hoods (sparkling)
- Pallets
- Pallet integrity
  - Shrink wrap
  - String

Sanitation practices
- Line in general
  - Sanitary environment
  - Ambient air sanitation
  - Poor layout of line
- Bottle cleaner
- Cork/capsule delivery mechanism
- Filler
- Corker/capsuler
- Key affirmative checkpoints

Delivery by cellar to bottling
- Sterile
- Coordination
- Communication

Personnel
- Trained
- Clean
- Work habits

Wine
- Confirm correct wine, plus $SO_2$ level
- Temperature
- $CO_2$ level

Supplies
- Confirm specified items
- Confirm quantities of all items
- Confirm qualities of all items
- Confirm ease of delivery of all items
- Confirm timely supply of all items
- Confirm timely removal of filled wine case and spent supply cackages
  - Glass
  - Cases
  - Closures
    - Corks

- Screw caps
- Capsules
- Labels

**Bottling**

- Fill point
- CO2, if specified
- $O_2$ after corking
- Cork seal
- Capsule integrity
- Label integrity
- Label location(s)
- Case integrity
- Case sealing
- Pallet integrity

## Warehousing and Shipping

- Warehouse ambient temperature and humidity and safety
  - Highs
  - Lows
  - Stability
  - Ingress/egress problems
  - Proper lighting maintained
- Storage of case goods
  - Corks down or on side
  - Screwcaps up
- Stock rotation for bottling date chronology
- Pallets with case goods
  - Straightly stacked
  - Not too high a stacking
  - No damaged cases
- Empty glass and bottling supply consolidation and ease of transport to bottling
- Picking racks
  - Partial pallets
  - Rare wines
  - Bottling supplies
- Wine Library
  - Corner of warehouse or other secure location
  - Rare wines
  - Vintages of wines
  - Research samples
- Receiving and loading
  - Flatbed trucks
  - Bobtails & vans
  - Vans
  - Rail cars
  - 20' Containers
- Handling integrity

**Paper work**

- **Work orders**
- **Bills or lading**
- **Purchase orders**

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**Vol. 12, No. 3 May - June, 1997 Bruce Zoecklein Department of Food Science and Technology VPI & SU**
**Chemistry of Winemaking, A. D. Webb, Ed. ""Wine Quality Control and Evaluation", Richard G. Peterson.**