Best Practices Guide for Sustainable Management of Winery Water, Wastewater and Associated Energy Resources

37th Annual New York Wine Industry Workshop
27 March 2008

Robert S. Chrobak
Kennedy/Jenks Consultants

Overview

- Background
- Best Practices Document
  - Timeline
  - Sources of information
  - Scope of guidance
- Outreach and education plan
- Acknowledgements

Regulatory and Legal Challenges

- Tightening of regulations and permits
- Increased enforcement
- Increased monitoring

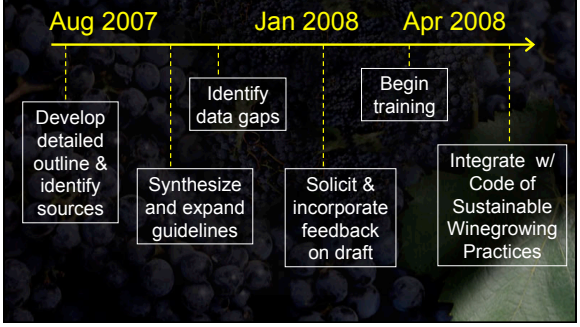
Technical Challenges & Sustainability

- Surface Water/Groundwater Quality
  - Point source vs. non-point source
  - NPDES/SPDES
  - TMDLs
  - Part 360 land application

Winery Process Water Characteristics

- Organics
  - BOD, COD, TOC, organic acids
- Nitrogen
  - Total, TKN, nitrate, ammonia
- Salts
  - TDS, FDS, VDS, EC, cations, anions

Project Timeline



Sources of Information

- Wine Institute and CAWG
  - Code of Sustainable Winegrowing Practices (2002)
  - Land Application Studies and Literature Review (2004)
  - Sustainable Winery Practices for Process Water Management (2007)

Sources of Information (cont'd)

- CLFP Manual of Good Practices for Land Application (2007)
- BEST Winery Guidebook, Ernest Orlando Lawrence Berkeley National Laboratory (2005)
- Sustainable Winemaking Ontario (2007)

Sources of Information (cont'd)

- International Proceedings – Specialised Conference on Sustainable Viticulture and Winery Waste Management (2004 and 2006)
- Environmental Protection Agency (1988) Waste Minimization Opportunity Assessment Manual

Sources of Information (cont'd)

- Pacific Gas and Electric Company (PG&E) recommendations for energy efficiency in wineries
- EPA Energy Star Reports

Approach

Conventional Operations

⇩

Step 1: Planning and Organization

Step 2: Assessment

Step 3: Data Evaluation & Option Identification

Step 4: Feasibility Analysis

Step 5: Implementation

⇩

Sustainable Operations

Monitor effectiveness and repeat process for further reductions, as necessary

Step 1: Planning and Organization

- Seek management commitment
- Define assessment program objectives
- Organize implementation team

Step 2: Assessment

- Compile existing facility data
- Collect additional information

Supporting Materials

- Worksheets
  - Water use and sanitation inventories
  - Flow and analytical monitoring plans
- Case study
  - Includes waste stream chemistry data
  - Illustrates biggest sources
- Sampling tips for each waste stream (Section 2.2)
- Guidelines for data collection (Guideline 1)
  - Flow monitoring
  - Sampling

Water Use Inventory

Winery Unit Oper.	Water Use Task	Flow Duration (mins)	Water Use Rate (gpm)	Task Water Use (gals/ task)	Task Freq. (x /day)	Daily Water Use (gal/ day)	Annual Water Use (gal/yr)
Tank Wash (60k gal)	Rinse	15	25	375	10 tanks	3,750	0.7M
Tank Wash (60k gal)	Caustic	20	25	500	10 tanks	5,000	0.9M
				Subtotal:		8,750	1.6M

Flow Monitoring Plan

Winery Unit Operation	Process Water Source	Flow Type	Access	Flow Meter Type	Manual or Data Logger	Rent, Buy or Own?
Filtration	Sanitation	Batch	Drain	Area Velocity	Data Logger	Rent
Barreling	Cleaning	Batch	Drain	Transit-Time Ultrasonic	Data Logger	Rent

Case Study: Waste Streams

- Wine processing
- Distillation
- Equipment and tank washing
- Barrel and bottle washing

- Sanitation
- Floor washing
- Softener regeneration
- Cooling tower and boiler blowdown
- Wine ion exchange regeneration

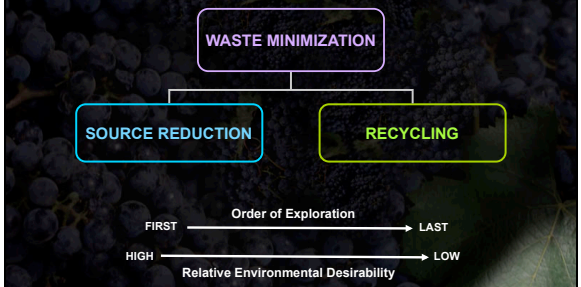
Step 3: Data Evaluation & Option Identification

- Generate options for source reduction, recycling and treatment
- Screen and select options for further study

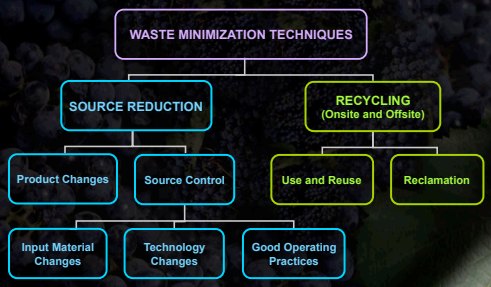
Supporting Materials

- Worksheets
  - Brainstorming options
  - Option description form
  - Option evaluation by statistical methods
- Overview of Waste Minimization Techniques (Figure 3-1)
- Waste Minimization and Treatment Options (Appendix E)

Waste Minimization



Waste Minimizing Techniques



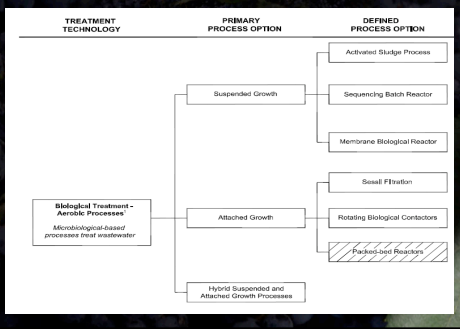
Examples of Options

- Source Reduction
  - Good operating practices
  - Technology changes or upgrades
  - Input material/product changes
- Recycling
  - Use and reuse
  - Reuse facilitated by treatment
  - Reclamation

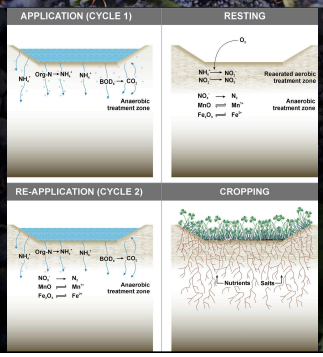
Examples of Options (cont'd)

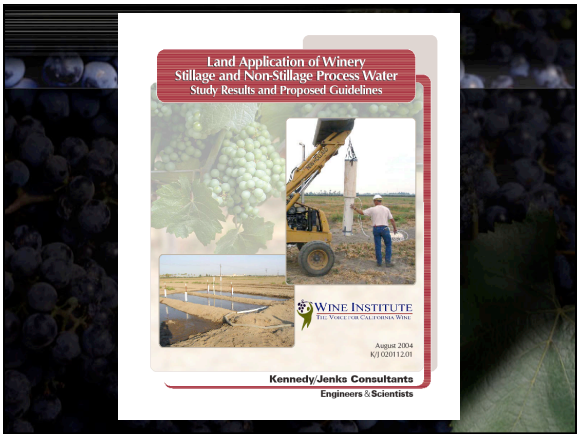
- Treatment
  - At the source
  - End of pipe

Technology Screening (Appendix E)

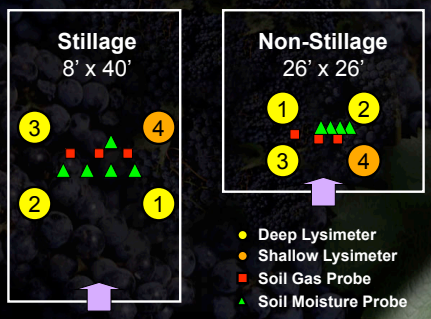


Land Application





Test Basin Instrumentation



Constituents Analyzed

Process Water and Lysimeter Samples	
pH	
Organics	BOD_5, VDS, Alkalinity
Nitrogen	NH_4^+, NO_2^-, NO_3^-, Organic-N, Total N
Salts, salinity	EC, TDS, IDS, VDS, Na^+, Cl, Ca^{2+}, Mg^{2+}, SO_4^{2-}, K^+, Alkalinity or acidity
Reduction – oxidation status	Total Fe, Tota l Mn
Soil Samples	
Collected at depths of 0-1, 1-2, 2-3, 3-4, and 4-5 feet	
pH	
Organics	% Total Carbon
Nitrogen	% Total Nitrogen, NH_4^+-N, NO_2–N
Salts, salinity	EC, TDS, IDS, VDS, ESP, Ca^{2+}, , Mg2+, Na, K^+, Cl, SO4, P
Reduction – oxidation status	Total Fe, Total Mn

Field Summary

- Load/rest cycles
  - – Non-Stillage:
    - 10 cycles – 6 to 29 days/cycle
  - – Stillage:
    - 12 cycles – 7 to 21 days/cycle
- Samples collected
  - – 128 water samples
  - – 91 soil samples

Guideline Flowcharts (End of Year 2)

1. Characterization for initial site selection
   - – Site soil and groundwater
2. Limiting constituent analysis
   - – BOD, TDS, pH, TN, IDS (salt)
3. Process water application management
   - – Hydraulic load, cycle time, infiltration, treatment
4. Program management
   - – Nitrogen and salt management, rotation schedule, basin management

Basic Results (2002 and 2003)

- Land application was shown to be a viable natural treatment technology at stillage and non-stillage sites
- Effective management results in:
  - Odor control
  - pH buffered to neutral values
  - Near complete BOD_5 removal at 5 feet
  - Effective total nitrogen treatment

Basic Results (2002 and 2003)

- Natural soil processes affect ion ratios regardless of source of water
- Salt treatment is complex
  - Load in approximately equal to load out
  - Some ions accumulate in soils
  - Some ions move with water
  - Some ions are generated in soil profile

Step 4: Feasibility Analysis

- Conduct technical evaluation
- Conduct economic evaluation
- Identify preferred options
- Develop action plan

Supporting Materials

- Worksheets
  - Capital costs for proposed improvements
  - Utility costs
  - Impact on operating costs/revenues
  - Impact on profitability/payback
- Guidelines
  - Land Application (Guideline 2)
  - Treatment Technology Selection (Guideline 3)

Step 5: Implementation

- Justify projects and obtain funding
- Install equipment
- Implement procedural changes
- Evaluate performance
- Re-check periodically

Outreach and Education

- Solicit and incorporate feedback
  - CSWA and PG&E workshops
  - Geographic outreach
- Integrate Guidance with the Code of Sustainable Winegrowing Practices
- Develop online application
- Training program


Acknowledgements
• American Vineyard Foundation
• Wine Institute
• California Association of Winegrape Growers
• California Sustainable Winegrowing Alliance
• National Grape and Wine Initiative
• Pacific Gas and Electric