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Inspiration to Application

+ product development
+ process development
+ effective packaging
+ efficient manufacturing
+ sensory evaluation
+ analytical chemistry
+ winemaking
+ fermentation

Wastewater: Tackle the Source, not the symptom.

Dr Darren Oemcke, Provisor

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Inspiration to Application

- Current best practices in Australian wineries for wastewater minimisation and management
  - Project lead by CSIRO funded by GWRDC, with water engineering element of project by Provisor
  - Penny Frost, Darren Oemcke – Provisor
  - Anupama Kumar – CSIRO

- Current best practices in Australian wineries stage 2 site audits
  - Project lead by CSIRO funded by GWRDC, with water engineering element of project by Provisor
  - Vincent O'Brien, Darren Oemcke – Provisor
  - Anupama Kumar, Rai Kookana, Sonia Grocke, Hai Doan, Jeanne Young, Evan Christen and team – CSIRO

- Winery and Spirit Manufacturing: NPI Emissions
  - Contract to Australian Government Department of Environment and Water Resources
  - Julie Culbert, Vince O'Brien and Darren Oemcke of Provisor

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W/water sources

- Waste from operations
  - winemaking
  - saturation
  - Storage
- Surfaces
  - roads
  - deliveries and loading
  - outdoor operations
- Environment
  - stormwater

The symptoms

- wastewater system costs
- system under/over load
- odour
- discharge fees
- irrigation restrictions
- carbon footprint
- NPI emissions
- wasted product

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Why understand sources

- Without measurement we cannot understand and therefore not improve.
- Handling only outputs means we will be tackling the most expensive component – treating waste.
- There are significant opportunities to improve, but without data on the generation of waste within wineries we are left with guesswork, individual experience and anecdotal evidence.
- Anecdotal evidence suggest that about 5% of product is wasted in wineries.
- Our experience suggests that anecdotal estimates are typically biased towards a positive view and we believe that overall waste is more likely to be over 10%.

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First cut at getting to the sources

- The first component of our attack on sources of wastewater was overall plant audits to get the maximum possible information with minimal effort.
- This helped us understand the issues at an industry level.
- We came to terms with a number of plant level issues.
- We came to terms with a few of the source issues within wineries.
- Data limitations hampered us.

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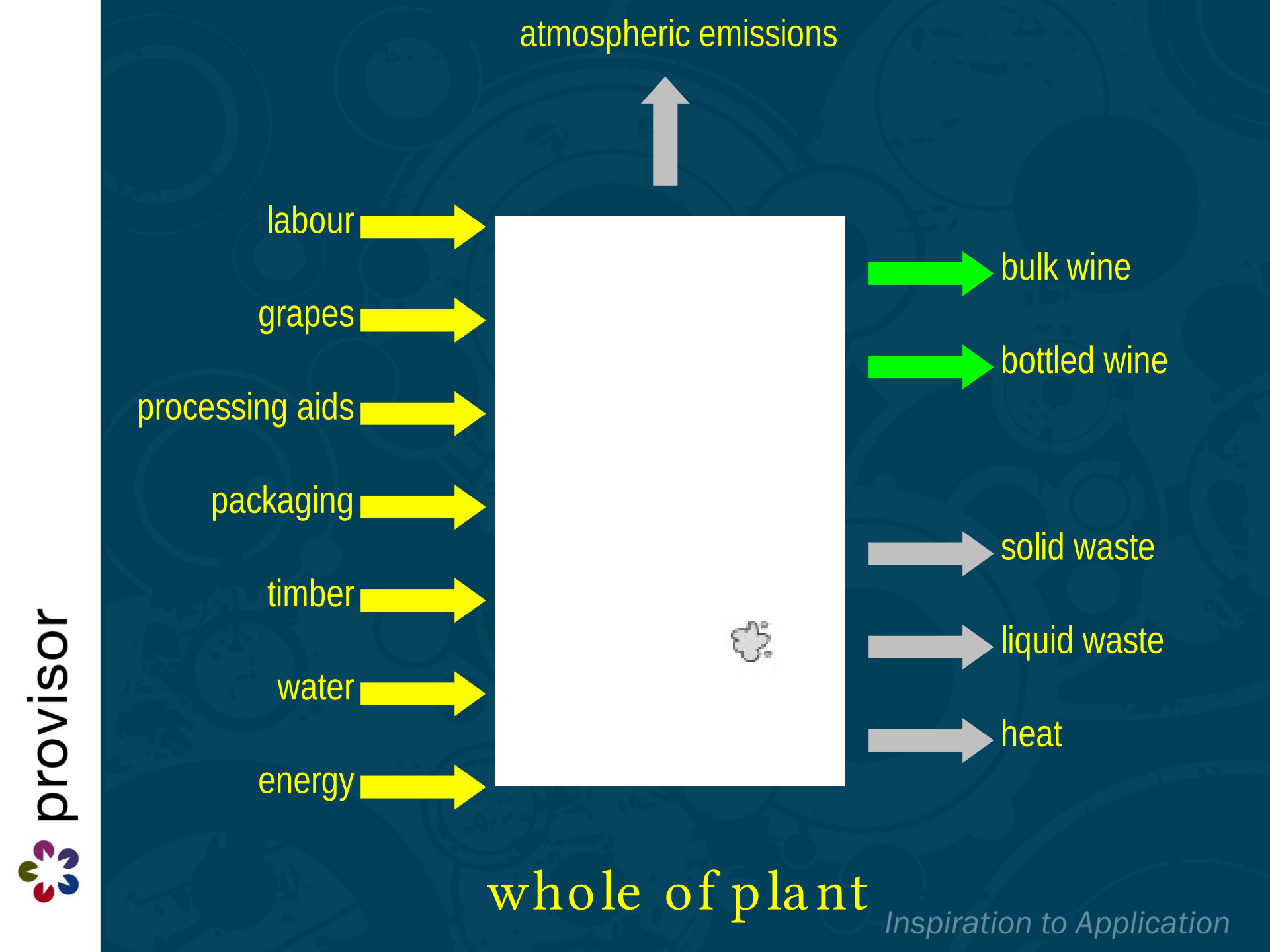

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	Current practice	Best practice	Sample comments
Diatomaceous earth	1.2 kg/t crush[1]	0.3 kg/t crush	1. lower use in large wineries. 2. Higher with use of RDV & DE filter.
DE disposal	composting, offsite disposal / recovery	Minimise DE to wastewater	1. small wineries composting. 2. large wineries offsite recovery. 3. Proximity to recovery facilities.
Lees disposal	wastewater or offsite recovery	Offsite recovery	1. small wineries use wastewater. 2. large use offsite recovery. 3. Proximity to recovery facilities.
Complexity – process steps	White – 11.5 steps Red – 10.2 steps	White – 6 steps Red – 7.3 steps	1. less steps in wineries under 10 years. 2. lower number of red wine steps in medium wineries with > 20% bulk.
Complexity – # of transfers	0.6 transfers /tonne	0.02 transfers /t	Lower number of estimated transfers with increasing winery size.
Cleaning Chems Caustic & Citric	0.7 kg caustic /t 0.5 kg citric /tonne	0.04 kg/t 0.01 kg/t	Lower in large and very large wineries.
Cleaning chems KOH	Not frequently used 5/45 wineries	Use	1. higher use with irrigation. 2. higher use in McLaren Vale.

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	Current practice	Best practice	Sample comments
Cleaning chem PAA	Not frequently used, 11/45 wineries	Use	Used in v. large or small wineries.
Cleaning chem re-use	Re-use in ~ 1/3 of wineries	Re-use	-
Process water	2.0 kL/tonne crush[2] (2 L/ 750 mL bottle)	0.4 kL/t (0.4 L/ bot)	1. lowest use in large wineries (> 20,000 tonnes), highest use in medium wineries ~ 8,000 tonnes. 2. water use more likely in SA.
Stream segregation	Minimal segregation of sewage, kitchen waste and clean stormwater.	segregate -	
Water minimisation practices	High use of sweeping, high pressure cleaning, automatic nozzles. Lower use of inert gas push-throughs and pigging.	High use of all practices with either in inert gas push-throughs and pigging. -	
Contaminated Stormwater	Stormwater combined with wastewater.	Re-use as winery process or for irrigation	
Clean Stormwater	Stormwater combined with treated wastewater with some re-use for process or irrigation.	Re-use without combining with effluent stream as winery process water or for irrigation. -	

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Breaking it down to unit processes

- The previous slides all showed elements of process change to reduce water use and to improve the quality of wastewater than can be determined at a whole of operation level.
- The work to date demonstrated clearly that a process unit view of the water use, wastewater generation and interactions with the process units is required to reduce water use, improve stream separation, reduce wastewater generation and improve wastewater quality.
- Work commenced in the 2007 vintage to conduct site audits on individual process units.

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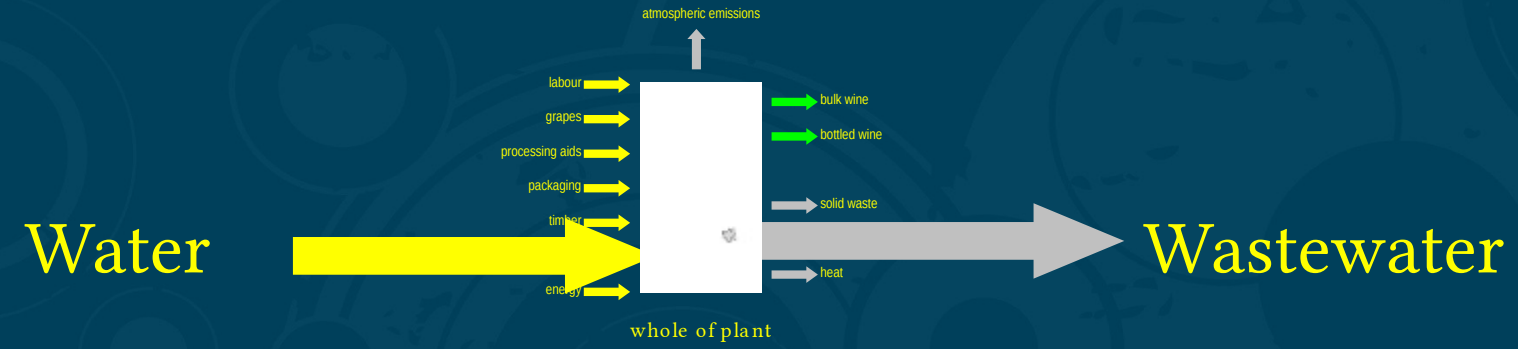

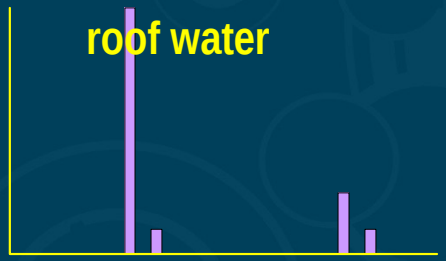

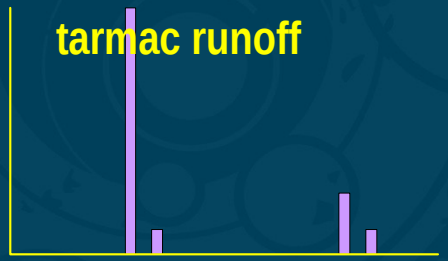

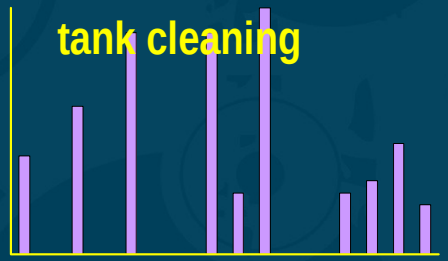

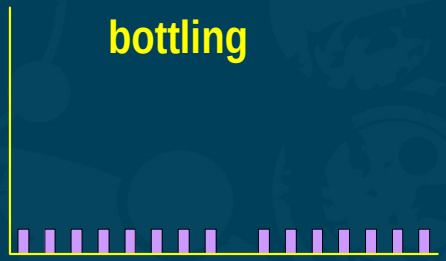

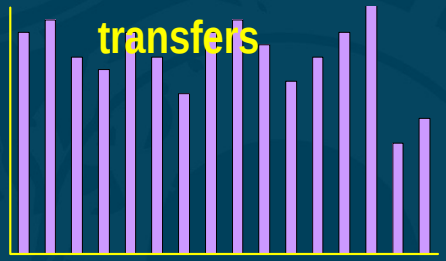

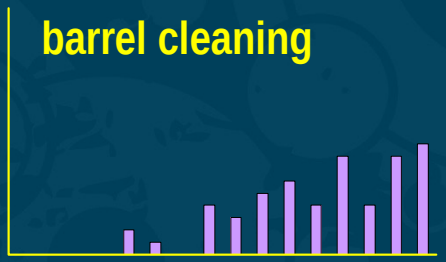

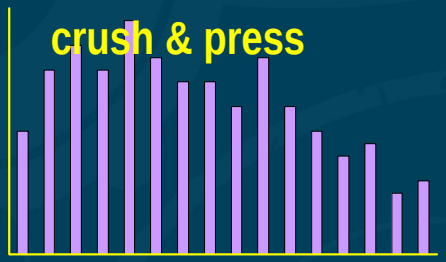

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ethanol, sulphur, carbon dioxide

labour

must

sulphur

water

electricity

juice

marc

wastewater

grape pressing

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Source	Greatest VOLUME	Greatest LOAD
	% of total responses	
Cleaning		
Washing crush / press	34%	16%
General cleaning	18%	6%
Barrel cleaning	15%	11%
Line washing / transfers	15%	6%
Tank cleaning	10%	32%
Tank sediment		
Lees from tanks	-	16%
Tartrate removal	-	6%
Other		
Stormwater	3%	-
Bottling	1%	-
Centrifuge washing	1%	2%
Filter regeneration	1%	-
Marc bay run-off	-	3%

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NPI emission factors review

- Almost half of typical winery ethanol emissions are in wastewater.
- High BOD from ethanol contributed to wastewater treatment loads and therefore CAPEX and OPEX.
- BOD to wastewater is also lost income from product sales

Process	Product	Emmission Factor (kg/kL)[2]
Fermentation	Red Wine	0.524
	White Wine	0.274
Crush & press	Red Wine	0.0682
Marc	Red Wine	6.65
	White Wine	4.49
Barrel Maturation	Red Wine	4.4
	White Wine	4.1
Bottling	Red & White	0.012
Disposed to Wastewater	Red Wine	5.65
	White Wine	5.3

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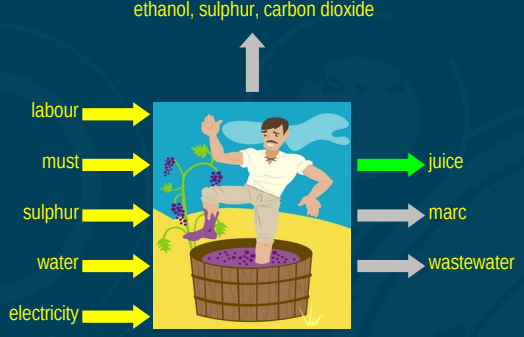

grape pressing

crushing & pressing

- From the current analysis of stage 2 audits we know:
  - Scheduling a major impact on water use in C&P
    - Product changes lead to more intense cleaning.
    - Need to determine minimum clean necessary.
  - Pressing has a wastewater with a high particulate solids.
    - Easy to separate and transfer BOD to the solid waste stream
  - Concentration of waste reduces over washing cycle.
    - Being partially quantified at present
    - Minimum clean and water use to satisfactory clean unknown

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Unit process audits progress

- Data analysis from 2007 vintage is ongoing
- It is already clear that there are a number of significant opportunities:
  - Separating solid BOD and separating
  - Improving scheduling
  - Separating and reusing streams at process level rather than plant level
  - Determining cleaning requirements and altering cellar standard operations
  - More effective salt management

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- These studies have enhanced our understanding of wastewater source issues in the wine industry.
- We are able to work with clients through specific issues with wastewater composition from a source perspective
- We are able to work with clients on source-based strategies for:
  - Extending wastewater asset lives,
  - Reducing intermittent wastewater problems as source,
  - Improving volumetric and load consistency to wastewater systems,
  - Identifying water use savings, and
  - Identifying water and wine waste recovery opportunities.

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