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WEA Presidents Report

With the heat well and truly providing challenges not only to growing grapes, but also completing pre vintage and other works, we find ourselves once again back into the swing of vintage.

With the urgency of vintage upon us it is mindful to remind ourselves that we need to do things safely. A simple adoption of the STOP principle (Stop, Think, Observe, Proceed) which takes very little time will ensure that we, and our peers, all manage to survive vintage in one piece.

As vintage starts, it is also the start of a new year for the WEA with planning of events underway, so please keep a look out for conference and other event details as they begin to unfold.

From this, it heads down and wishing all our members a successful, but most importantly a safe vintage.

Cheers,

Ben

Ben McDonald – WEA President
**Venue & Date**
As advised in the November 2015 edition of “WineLines” the 2016 National conference and exhibition will be held at the Serafino Winery in the McLaren Vale area of South Australia during **Wednesday 7th and Thursday 8th September.**

**Conference Theme**
The theme title for the 2016 National conference will be **‘Innovation for Smarter Solutions’**

The conference will therefore focus on innovative ideas and concepts that in turn will provide smarter solutions for improving methods of production, increased efficiency, waste reduction and product quality.

**Speaker Program**
Formulisation of the speaker program is in its early stages and we would therefore be extremely interested in what subject matter (that fits with this year’s theme) you would like to see included in the program.

It may well be that you have been associated with innovation at your enterprise that you believe would be of interest to your colleagues and therefore be interested in presenting a technical paper or know of a potential presenter.

Please contact David Clark at either djc2@bigpond.com or (03) 5358 2059 in regards to topic suggestions, potential speakers or your interest in participating in the speaker program.

**Exhibiting**
Regarding suppliers interested in exhibiting at the exhibition please contact Trevor Leighton at either trevorleighton@wea.org.au or 0417 597 956.

**Pre-Conference Event**
Many of you will be aware that we have run a pre-conference event during the day prior to the conference in recent year’s which basically have consisted of private site tours of plant installations that are either directly associated with the wine industry or like industries, examples being wastewater treatment plants, Glass manufacturing, brewery’s and wineries.
Once again planning is in the early stages for this year’s pre-conference event and we would welcome any suggestions you may have in regards to the format of the event and potential facilities to visit, it may well be that your preference would be to attend a half day workshop dealing with issues associated with a particular topic be it filtration, refrigeration etc., etc.

Please forward any suggestions you may have for a pre-conference event ASAP to Geoff Leighton at gpuch39@gmail.com or contact Geoff on 0412 971 837.

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**2016 New Zealand Conference & Exhibition**

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**Venue & Date**

The biennial WEA New Zealand conference and exhibition will take place in 2016 in Blenheim in the Marlborough area of the South Island during Thursday 21st and Friday 22nd July with the venue being the Marlborough Convention Centre which is centrally located and within close proximity (walking distance) to a variety of accommodation options.

**Conference Theme**

The theme title for the 2016 New Zealand conference will be *‘Winery Resource Management = Sustainability’.*

As the theme suggests the conference will focus on the efficient usage and application of resources such as water, energy, refrigeration, wastewater treatment & reuse plus a number of other winery resource areas.

**Speaker Program**

Following discussions with a number of our New Zealand colleagues regarding what topics (that fall in line with the theme) they would like to see included in the conference program contact has been made with a number of potential speakers including Wine NZ and Massey University and plans are therefore well underway with the speaker program, it is also planned to include presentations from a couple of leading NZ wine companies covering case studies on projects that they have been associated with in the winery resources and sustainability area. In addition to the topics already mentioned and given that new legislation comes into effect in April regarding “Health & Safety at Work”, arrangements have been made with WorkSafe New Zealand to present on the new legislation in order to ensure that the conference delegates have a clear understanding of the requirements and their obligations.
Should you have any further suggestions for the speaker program, be interested in presenting a technical paper or know of a potential presenter please contact David Clark at either djc2@bigpond.com or +64 (0)3 5358 2059.

The following is a general program of the 2 day event and a detailed speaker program will be published in the May edition of “WineLines”

**WineEng 2016 – NZ - Program Outline**

**Thursday July 21st**

- **9.00am**  Registration commences - (coffee and view exhibition)
- **10.00am**  Conference Opens
- **12:15pm**  *LUNCH (exhibition area)*
- **1.45pm**  Conference Resumes
- **3.15pm**  *BREAK (exhibition area)*
- **4.00pm**  Sensory Tasting
- **5.00pm**  End
- **7.00pm**  *Pre-dinner Drinks*
- **7:30pm**  Conference Dinner

**Friday July 22nd**

- **8.45am**  Conferences Resumes
- **10.30am**  *BREAK (exhibition area)*
- **11.00am**  Conference Sessions
- **1.00pm**  Conference Concludes - *LUNCH*
- **2:00pm**  Optional winery site visits

**Sensory Tasting**

When perusing the above program, you will have noted that a sensory tasting has been scheduled in the final session on day one, at this point in time it is hoped to have personnel from the Plant & Food Department of the Marlborough Research Centre conduct an educational tasting in which delegates will be shown the different characteristics of Sauvignon Blanc from the various wine growing regions in New Zealand.

**Exhibiting**

For those suppliers interested in exhibiting at the associated exhibition please contact Trevor Leighton at either trevorleighton@wea.org.au or +64 (0)417 597 956.

**Pre-Conference Event**

As a lead up to the New Zealand conference a number of options are being looked at for a pre-conference event on the day prior to the conference being Wednesday 20th July for a limited number of people.

At this point in time some of the options being considered are as follows:-

- A tour of wineries that have undertaken significant expansion and development in recent times.
- A workshop covering alternatives to barrels for wine maturation plus the reclamation of oak staves and infra-red toasting of the former staves for use in alternative vessels.
- A workshop looking at issues associated with winery wastewater treatment.
Please note that if it is decided to proceed with the suggested or similar workshop options for a pre-conference event then subject to sufficient interest being shown a tour of wineries could possibly be organized on the Friday afternoon following the conclusion of the conference.

Should you have any suggestions or preferences regarding a pre-conference event in NZ please contact David Clark at either djc2@bigpond.com or +64 (0)3 5358 2059.

**Regional Events**

Given that vintage is now underway in many areas the next WEA Regional event will not take place until around May/June.  
As always we are extremely keen to hear from you in regards to topics that you would like to see a Regional event focus on in your area.

**WEA Membership**

The renewal of WEA memberships falls due each year on April 1st with renewal notifications being sent out in March; in the past when our National conference was traditionally held around the June/July time of year the majority of members renewed their WEA membership at the conference however given that our National conference is now being held later in the year it has been decided that we will now handle memberships separately from the conference. This change will ensure that your membership does not lapse and that in turn you are kept fully informed of all WEA events well in advance of them taking place.  
As a WEA member you will also have access to the members only section of our website therefore allowing you to access presentation materials from previous WEA conferences.

If you know of any colleagues who you believe would benefit by becoming a member of the WEA, application for membership can be made by either going to our website [www.wea.org.au](http://www.wea.org.au) or contacting Trevor Leighton on 0417 597 956 / trevorleighton@wea.org.au

The annual cost of being a member is currently only $65 which not only entitles members to receive the newsletter and other updates but also entitles them to reduced registration fees to our conferences which in itself can result in savings of around $45 / year.
**Investing in Knowledge**

**By Don Allen – Gas & Applications Specialist**

Firstly my apologies to Benjamin Franklin (1706 – 1790), for modifying his quote, ("An investment in knowledge pays the best interest"). I could equally use a quote by Greek Philosopher Plato (429-347 BC), “A good decision is based on knowledge and not on numbers”. Both serve to illustrate my point.

The point is that Australian wine personnel are held in high regard; due largely to an ongoing thirst for knowledge and innovation, influenced by forward thinking people, and organisations like Roseworthy, AWRI, and Adelaide University Wine School etc. Their enthusiasm and drive resulted in a vast number of tests, trials, research and developments over the years; some successful leading to equipment, applications or processes we use every day. It also meant suppliers in Australia and overseas developed new equipment and applications to satisfy these requirements. Typically those needs were quality driven, maybe today they are more efficiency or cost driven, but the point is it still provides a blueprint for today’s wine operation.

It was highlighted late last year when a winemaker was seeking input to round out his (gas related) knowledge for a project The particular enquiries concerned gas properties, gas usage and gas related equipment used in storage and bottling area. He was looking at acquiring equipment and the information aided decision making.

If we look at a generic graphic of a typical winery, you’ll note it shows a number next to many of the process areas, representing a gas application area. In fact, there’s the first piece of knowledge. When I started, I was told “the main application in the wine industry today is for the ‘Charmat’ process and the main gas used is CO2”. Today it’s probably 40 or more! Based on a cost sheet I complied some years ago, across various crush sizes, we use ~15 litres of gas per litre of wine and it costs ~$0.08 - $0.12 per case; that’s probably understated today. We can touch briefly on the three marked areas, summarising one or two developments implemented and use the knowledge for today:

1. Gas and gas supply options.
2. Storage, assembling and ageing.
Gas and Gas Supply
The ideas of those researchers and winemakers led to a raft of developments, because they were questioning what happened in a wine tank when it was gassed, different gases were trialled, including dry ice; with analysers recording the results. Yes, I still have many of these early results and yes, it continues to be essential in daily winery operations.

The significant developments, subsequently implemented include the practical selection and application of gas or gas mix, to suit the requirement. With CO2 being the main gas used 40 years ago and if the winery was large enough, a bulk vessel was installed. Invariably this was a 6 tonne or larger vessel and ran at 2,000kPa. The theoretical conversion rate to dry ice (snow) at 2,000kPa is ~35%; practically, we found it was closer to 25%. This however provided an accurate costing of operations as dry ice usage was trialled.

The next development therefore involved one or two gas companies introducing different storage vessel sizes, including a lower storage pressure for CO2 (700kPa). This increased the conversion rate efficiency to 54%, making that dry ice production operation just that cheaper. With the new gases and gas supply came vacuum insulated (VI) vessels and a range of smaller sizes, from 240kg upwards (with CO2) and 160 litres with N2. The smaller vessels mean you can place the gas supply right next to (say) a bottling line, thereby reducing pipeline losses. Other gases were introduced to satisfy that changing requirement including oxygen and argon. N2 generators (PSA initially then membranes) were introduced around that time, providing more options.

What can we apply today? Firstly analyse carefully the annual usage of the required gases and assess the financial viability of a bulk supply. From that annual usage, an appropriate vessel size can be selected, minimising delivery disruptions. Is a pipeline required, if so look at the material selection and size, ensuring it can supply the requirement without a pressure drop?

If liquid (CO2 or N2) is required, can a smaller vessel be placed next to the usage point? Lastly, if the main gas is N2, can a generator suit? If so, what type, what size and what buffer size is needed?

Storage, Assembling and Ageing
The knowledge shift impacted greatly here. All that College and industry field testing showed (1) that dry ice tank inerting worked well BUT was short-lived (see graph below). (2) It supported overseas research that showed the benefits of a mixed gas, including argon. (3) It demonstrates the real impact turbulence has on the gas operation efficiency, regardless of the gas. The resulting developments, widely used today, are the use of a gas diffuser of some design in the tank, the importance of flow control, and on site gas mixing. All are just routine today and we add PLC control; more knowledge!

Applying the knowledge to today consider the use of gas diffusers (floating or suspended), argon, mixed gas (supplied as a mix, mixed at main storage point or mixed at usage point), gas mixers (fixed or portable), orifice flow control, flow timers and small oxygen analysers at least.
Bottling and Packaging.
The measurement and understanding of TPO today shows clearly the impact of oxygen at this (final) stage. The research and testing also show that the oxygen impact at bottling can be greatly affected by gassing inefficiency and by pipeline supply length. It’s far better to have the supply close if you can. This was the essence of that question and its critical today.

The search for knowledge meant the development of liquid CO2 (Snow Drop) and Liquid N2 injection systems (at least 4 types) becoming available. Both systems are still in use globally; both require a liquid supply, meaning pipeline losses need to be considered. Remember when selecting them that “close is better” unless you invest more in a well-insulated liquid supply line. I’d add that the design, engineering and operation of each item selected in this case needs careful analysis. Far be it for me to be sceptical of some claims made. I’ve seen some very good results with liquid N2 injection from NZ and I’ve also seen some poor ones with less than efficient design.

Perhaps I’ll wrap up by adding that there are good, efficient developments and some that are not. I wrapped up my advice to that winemaker before Christmas by saying “consider carefully what you are hoping to achieve, examine all the alternatives, particularly the equipment selected and thoroughly research all the assertions made”. I guess Benjamin Franklin and Plato both hit the nail on the head, it is still all about good decision making and investing in knowledge.

WineEng NZ 2016

Put this in your diary!
July 2016, Blenheim, Marlborough NZ
- Pre-conference event
- Two day conference

A chance to visit NZ wineries and meet with New Zealand colleagues to discuss common issues.
Further information will be on our website www.wea.org.au
Harnessing the power of information to help you meet rapidly changing packaging demands

Publication from Rockwell Automation

Global competition is increasingly challenging manufacturers to offer an exhaustive breadth of products to meet rapidly changing customer needs. This means that packaging machinery must be flexible enough to keep up with frequent line changes and scalable enough to handle the introduction of new products.

Michael Vlahos, OEM sales lead at Rockwell Automation discusses the benefits that the Connected Enterprise delivers to help packaging machinery builders and their customers remain competitive.

The recent acceleration of the Internet of Things enables new levels of connectivity for people, processes, data and things—ultimately providing greater productivity, better utilisation of assets, and improved decision-making to industrial companies. The magnitude of this evolution is momentous with more than 80 billion Internet-connected devices projected to be in use in 2024, up from less than 20 billion in 2014.1

Establishing a Connected Enterprise can help manufacturers optimise their production and supply chain by integrating information technology (IT) with operations technology (OT) to improve business performance and minimise risks.

To achieve this, end-users are looking to machine builders to provide smart machines that can provide real time access to production information, enable flexibility in relation to changing markets and demands and also easily integrate into their facility.

The need for smart manufacturing is growing, particularly in high-cost to manufacture countries, with more and more manufacturers requiring the capabilities to access intelligent, real-time data from their machines.

Seamless connectivity

There is a growing need for our customers to merge their information technology and operational technology to harness real time data and improve productivity and agility. This convergence improves connectivity across enterprise operations and provides the platform to integrate information across business systems and the plant floor.

To support and accelerate this network convergence, Rockwell Automation and Strategic Alliance Partner Cisco® have collaborated on products, services and educational resources. The EtherNet/IP™ communications platform enables manufacturers to converge their network infrastructure and tightly integrate technical and business systems.

Effectively managing real time control and information flow provides enterprise-wide machine and device-level information gathering. This connectivity provides access to real time production data and helps packaging manufacturers increase agility and productivity while also reducing engineering time and costs for machine builders.

While having access to real time data is invaluable from a diagnostic, production throughput, safety, quality and efficiency perspective; increasing connectivity and visibility into the system opens it up to potential security risks that require careful consideration and mitigation.

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1 IHS Ranks the Top 10 Technologies that are Transforming the World, January 2015
Effectively developing a complete Connected Enterprise requires a comprehensive approach to industrial security that extends beyond the control system to include policies and procedures that address people, process and technology-related risks.

Why connect?

The value proposition that the Connected Enterprise delivers to both machine builders and end-users is focused on information. It provides the technology to dramatically increase the amount of data available for analysis. It enables a variety of opportunities for improving business models and performance for machine builders, from reduced downtime and optimised capacity to improved machine design and monitoring capabilities.

Better information sharing drives better decision-making, exposes process inefficiencies, facilitates best-practice collaboration and uncovers new competitive opportunities. Packaging machine builders and their customers are increasingly realising the benefits that more information, insights and data can offer them to improve profitability in a competitive marketplace.

About Rockwell Automation

Rockwell Automation Australia and Rockwell Automation New Zealand are subsidiaries of Rockwell Automation, Inc.—a leading global provider of industrial automation and information solutions that helps manufacturers achieve a competitive advantage in their businesses. The company brings together leading global brands in industrial automation which include Allen-Bradley® controls and services and Rockwell Software® factory management software. Its broad product mix includes control logic systems, sensors, human-machine interfaces, drive controllers, power devices, and software.

Rockwell Automation, Inc. (NYSE:ROK), the world’s largest company dedicated to industrial automation and information, makes its customers more productive and the world more sustainable. Headquartered in Milwaukee, Wis., Rockwell Automation employs about 22,500 people serving customers in more than 80 countries.

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It can be surprising to learn that compressed air can account for as much as 30% of a factory’s total energy consumption. With business today continuously trying to drive operating costs down, it is no wonder that compressed air efficiency is often at the top of most company agenda’s. Searching for the right solution can be difficult, with many companies claiming to offer energy efficient solutions. But as that famous add once said “oils aint ois” and choosing the right solution can make a significant difference.

At the top of the pyramid for energy efficient compressed air solutions is Variable Speed Drive (VSD). Without getting too technical, VSD is a way to control the speed of an air compressor motor and therefore amount of air produced. By speeding up and slowing down the motor the compressor can produce the exact amount of air needed to meet the plant air demands, as opposed to running at full speed and then idling until the storage capacity is used before running at full speed again like a traditional compressor. This technology is quite common place now in ducted air conditioning systems, with the air conditioner speeding up and slowing down to provide a constant temperature atmosphere, as opposed to turning on at full speed and then turning off once the desired temperature is reached. The theory is similar for air compressors, where the system pressure is controlled rather than the temperature.

What most people don’t realise however is that the ability of the compressor to slow down to as much as 20% of its full speed is paramount in ensuring that the full benefit of VSD is realised, and only the best quality systems with motors and components specifically designed to operate this way can achieve this level.

Up until recently, a variable speed drive compressor with up to 20% speed turn down could on average save 35% of energy consumption. Most people are surprised when they do the maths and calculate just how expensive it is to run their air compressor(s). So 35% percent savings is already significant enough to consider VSD. The cutting edge technology VSD compressors however, such as the VSD+ produced by Atlas Copco Compressors, will now provide average savings of 50%. The VSD+ compressor is a massive leap forward in air compressor design, with unmatched robustness, performance and energy savings combined into one compressor.

In today’s market every business is looking long and hard at their expenses. Often the price-tag becomes the deciding factor as to what equipment to buy. However, looking only on the price-tag can end up costing a lot more over the lifetime of your compressor. If the capital budget is not available it is worth considering financing the compressor. Financing your VSD+ compressor through can help businesses access market leading equipment from their operating budgets. Consider also that the VSD+ compressors commonly have a payback period between 12 and 24 months depending on the application, and in some cases the energy savings can pay for the financed solution, so from an operating budget perspective it could work out to be cost neutral.
Nitrogen generator cuts winery’s operational costs & improves productivity

**Atlas Copco case study**

One of Australia’s leading wineries, Salena Estate Wines, believes its decision to invest in an Atlas Copco nitrogen generator in 2012 was one of the easiest it has had to make, and has not looked back since. The family-owned winery, based in South Australia’s picturesque Riverland district has been crafting wines since 1998 and is now recognised as a major industry player having been awarded 20 trophies, 100 Gold medals and over 500 Silver, Bronze and other awards.

Operations Manager, Claude Sarti, said once he had shown Bob Franchitto, MD of the winery, the potential cost savings of investing in an Atlas Copco nitrogen generator, it was an easy decision for him to make. “Once he saw the figures he did not hesitate,” Mr Sarti said.

Before having the nitrogen generator, the winery used the G-sized Nitrogen cylinders, which Mr Sarti said made life very difficult and often dangerous for the workers. “We had to wheel each cylinder on a trolley to the bottling line, dragging it over hoses and other obstacles. It was very difficult to man-handle them into place. And then the problem was they would only last an hour and a half on the bottling line, when we were in full production.”

He also said it was important to be aware when the cylinder was going to run out, as the machine doesn’t operate unless there is a certain amount of pressure in the cylinder. “Often the bottling line would just stop until someone went to change the bottle. On top of that, on a couple of occasions, someone had forgotten to re order the nitrogen gas bottles for the week, creating a significant amount of costly downtime.”
“And while the gas was quite economical to buy, when you include the delivery charges and the cylinder rental charges, it starts getting expensive, especially when you have to buy in 30 to 40 cylinders in any given period, depending on the time of the year.

“For me the nitrogen generator was a godsend, and has made my life a lot easier,” Mr Sarti said. “The nitrogen generator and the Atlas Copco compressor driving it have been very reliable, with no issues with the machines at all.”

From memory, Mr Sarti believes the ROI (Return on Investment) was quite short, especially when he added in the considerable reduction in costly production downtime. “For example, if we had to stop the bottling line for just a half an hour, to change gas bottles or whatever, and we had six people on the bottling line that day, that’s three man hours lost that we had to pay for. “If that happens on a regular basis, those costs soon add up, let alone the loss of production, which sometimes had to continue on to the next day because we haven’t finished the run,” he said.

The Application
Mr Sarti explained that the nitrogen is used on the winery’s MBF bottling line for gas blanket cover and flushing the bottling line. “The system pre-evacuates the bottle with a jet of nitrogen to eliminate the oxygen, and the same on the exit of the filler, so that we have the nitrogen protecting the wine, making it last a little bit longer.

“We also use the nitrogen to empty our filters when we need to change product. Basically we use nitrogen to blow all the previous wine out of the system; the hoses, the filter cartridges, and the filler.”

Mr Sarti said the nitrogen is also used in the winery’s cellar operations, replacing the labour intensive dry ice system. “Carrying the dry ice in buckets up the stairs to the top of the 60 to 70 foot high tanks was not only a manual handling issue, but a very hard task.

“When all the tanks get hooked up properly to the nitrogen plant, all that will be eliminated,” he said. “So rather than having two people working all day on a Friday, hauling buckets of dry ice up all those stairs, the nitrogen plant will eliminate all those costs and safety risks.”

“Like the wine bottles, by taking up the air space with an inert gas, you are protecting the wine inside the tank,” Mr Sarti said.

MD and Founder of the winery, Mr Franchitto said the substantial cost savings were the biggest benefit of the Atlas Copco nitrogen generator. “It is a much more effective, cheaper and more reliable way of providing nitrogen. We already had a couple of Atlas Copco compressors and had always found their equipment very dependable. “And dealing with Atlas Copco has been very good, they are a very professional company,” Mr Franchitto said.

The winery’s current annual production is around 15,000 tonnes of grapes, with plans to expand that figure to 30,000 over the next four years. The bulk of the wine, 80%, is destined for the export market, going into Asia, Europe and North America in bottles and bulk containers.

The family owns 210 hectares of vineyards made up of Shiraz, Cabernet Sauvignon, Chardonnay, Sangiovese and various other varieties grown on a range of soils from clay and limestone to deep sandy ridges. They also buy fruit from other local producers as well as from the Barossa, Clare and McLaren Vale.
The vineyards are fully irrigated by computerised drip irrigation, have vertical two-wire trellis and the fruit is machine harvested with yields of around 15 tonnes per hectare which is quite light cropping for the area. Salena Estate has 14 million litres of temperature controlled stainless steel storage on-site, which is fed by large and small capacity bag presses and an assortment of fermenting vessels.

The Technology
Sonik Barot, Product Manager - CNG & Industrial Gas Projects with Atlas Copco, said replacing gas bottles with on-site nitrogen generator made a lot of sense. “As well as saving up to 80% on the cost of nitrogen compared to nitrogen bulk supply, on site production provides continuous supply from a fix installation. Users never have to worry about delivery management.”

And as well as saving space, with no gas bottles/liquid nitrogen tanks in the yard minimising risk and handling errors, Mr Barot says payback is usually under 18 months. “Once wine makers see the figures it is an easy decision for them to make,” he said.

Mr Barot says traditionally, on-site gas generators were only economically viable in very large applications. “But with constant development, today's high efficiency products ensure that generators are economically viable for the smallest of applications, and an ever increasing number of companies are moving to generate their own nitrogen,” he said.

Plus he said getting a quote is very straight forward, with no need for lots of meetings with engineers. “In order for us to size and price a system for a potential client, all we need is the required flow and purity of nitrogen and the pressure of the nitrogen needed in the application.”

Mr Barot explained that the nitrogen generator installed at the Salena Estate winery is Atlas Copco’s NG12 model (working on PSA – Pressure Swing Adsorption technology) delivering 99.5% pure nitrogen driven by an Atlas Copco GA11VSD FF: 13 FM energy-efficient air compressor.

THE SETUP FOR ENDLESS NITROGEN

Connect our NGP+ nitrogen generator to your air compressor and you will be able to access a constant flow of nitrogen at purity levels of up to 99.999%. With this set up you will be able to get an endless supply of nitrogen at a substantially reduced cost. The NGP+ has a return on investment with 18 to 24 months in most scenarios, call us today to learn more. With the NGP+ you can cancel all future deliveries of bottled nitrogen.

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Compressed Air | Vacuum | Industrial Gas | Blowers | Service
Shifting phenological development is the most conspicuous biological effect of recent warming, with advanced maturity of grapevines being reported for Europe, North America and Australia (Duchene and Schneider 2005, Petrie and Sadras 2008, Wolfe et al. 2005). Between 1993 and 2006, maturity of grapevines in Australia advanced between 0.5 and 3.0 days per year across a range of regions (Petrie and Sadras 2008).

Warmer temperatures and an advancement in maturity can affect fruit quality and wine style, often causing ‘unbalanced fruit’ where high sugar levels are reached before optimum colour (and potentially flavour) development has been achieved (Sadras and Moran 2012). Associated with the advancement in maturity have been anecdotal reports of compression of the harvest period, with different varieties grown in the same region now reaching optimal maturity at similar dates and a narrower period during which a single variety matures (Coulter et al. 2015). Given the capital-intensive nature of the wine industry (processing capacity is used at most for 8–12 weeks per year), climatic trends that compress harvests have the potential to affect financial viability. Considerable investment would be required to increase processing capacity (for example red fermenter space) to allow production to be completed over a shorter time period.

To date the anecdotal reports of more compressed vintages have been difficult to validate and quantify. However, the analysis of commercial maturity data, dating from 1995 to 2014, from a major Australian wine company offered the opportunity to investigate these reports further. The sugar accumulation of individual blocks (based either on grower-reported values or samples delivered to the winery laboratory for maturity analysis) across a region was tracked and the day of the year when each block reached 12 Baume was interpolated from the maturity samples collected immediately below and above this level. Basing maturity assessment on Baume rather than harvest date gives a more accurate assessment of the impact of climate on fruit maturity, as it is independent of human decisions that can be influenced by other factors such as target wine style or winery capacity.

The analysis showed a continuation of a trend first reported by Petrie and Sadras (2008). For example, the average date that Chardonnay in McLaren Vale reached 12 Baume has advanced at 1.3 days per year and McLaren Vale Cabernet Sauvignon has advanced at 1.9 days per year (Figure 1). Analysis of a longer data sequence highlighted not only the advancement in maturity, but also that in many regions the later ripening varieties (i.e. Shiraz and Cabernet Sauvignon) were advancing in maturity at a faster rate than the earlier ripening varieties such as Chardonnay. This means that the time window between the maturity of Chardonnay and Cabernet Sauvignon has narrowed. In the early 1990s the range in dates between when the average maturity of these two varieties reached 12 Baume in McLaren Vale was just over 20 days; it is now averaging closer to five days and Shiraz also needs to be processed during this period (Figure 1). Note that while McLaren Vale was used in this example, a similar trend was observed across many Australian regions.

Individual varieties are also reaching maturity over a shorter period within one region. The technique described above to determine the date when a block reaches 12 Baume was also used to calculate the proportion of blocks for a specific variety within a region that had reached 12 Baume. For example, the Shiraz blocks across the Barossa region (both Barossa and Eden Valley) reached maturity over a 30-day period in the late 1990s and this reduced to a 15-day window by the mid-2010s (Figure 2). Once again this increases pressure on vineyard and winery infrastructure. While Figure 2 shows the extremes of the time series (1998–2013), the shortening of the vintage period has occurred gradually over time.
Figure 1. The advancement in the date at which 12 Baume was reached for vineyards in McLaren Vale. Chardonnay – blue diamonds ($r^2=0.58$); Cabernet Sauvignon – red squares ($r^2=0.83$); Shiraz – green triangles ($r^2=0.84$).

Figure 2. The proportion of the Shiraz blocks in the Barossa and Eden Valleys that reached 12 Baume on a given date in 1998 (red - right line) and 2013 (blue - left line).
This analysis does not allow separation of the effects of warming, other environmental factors and changes in management practices. However there have not been step changes in management during the study period. While reduced yield is often suggested as a driver of earlier fruit maturity (e.g. Pearce and Coombe 2004), no consistent yield trends were observed across the regions included in this study. Regardless of the causes, the advancement in maturity and compression of the window of peak maturity illustrate the challenges faced by wineries to process fruit over a shorter and more intense period.

Acknowledgements
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Paul Petrie – Viticulture Scientist (Research and Extension), AWRI and SARDI, paul.petrie@awri.com.au
Victor Sadras – Principal Crop Ecophysiologist, SARDI

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Early Oxygenation During Winemaking: From Research to Industry Adoption


This article is based on part of the talk given by the authors at the WEA Conference in August 2015

Oxygenation or exposure to oxygen, whether deliberate or accidental, can occur at different amounts and at different times during winemaking. It can start as soon as a berry is machine picked and can occur up until bottling. The AWRI recently published a literature review on the impact of oxygen in areas such as yeast development and survival, reduction in the production of stinky sulfur aromas and beneficial modification of tannins and other phenolics and other aspects affecting mouth-feel (Day et al. 2015).

The quest to understand the role of oxygen in winemaking is not a new one. There are reports of experiments exposing grapes to air conducted by the famous French scientist Louis Pasteur as far back as 1875. In Australia, in 1970, AWRI scientists assessed how ideas coming from California about protection from oxygen spoilage should be embraced (Pocock 1970). This was the beginning of ‘reductive winemaking’ in Australia, which to some has become the complete fear of oxygen. Of course, the possibility of wine spoilage through exposure to oxygen during the later stages of winemaking remains high and requires utmost vigilance. The AWRI has devoted a lot of time to understanding this impact, particularly in managing ullage (Roget and Forsyth 2013) and during bottling (O’Brien et al. 2009). There is, however, an opportunity to use oxygen to benefit winemakers either in terms of fermentation efficiency or improved wine style.

The AWRI is currently carrying out research looking at the careful, controlled use of oxygen during the early stages of winemaking in order to:

- modify and diversify wine style
- prevent development of stinky sulfurous aromas
- modify colour and tannin composition
- encourage yeast growth (typically at the end of the exponential growth phase)
- produce a fuller, softer mouth-feel.

One of the most dramatic outcomes of this research program has been the observation of a simultaneous reduction in sulfurous aroma production and beneficial softening of tannins when active red ferments were sparged with air or oxygen-enriched air. Pilot-scale ferments were conducted in 900 L rotary fermenters installed at the Hickinbotham-Roseworthy Wine Science Laboratory at the University of Adelaide. The fermenters were modified to contain three 2 µm stainless steel sinters on a bottom-mounted gas supply, fitted with a quick-release gas valve. The vessels were filled with 740 kg of Shiraz and were sparged with air, or air enriched to 40% oxygen, at a nominal flow rate of 10 L/min for 60 min every 12 hours, starting 18 hours from inoculation and continuing until day 6, 24 hours before pressing. The production of hydrogen sulfide was curtailed by this treatment within 48 hours and it did not subsequently return. Some of the more insidious sulfur compounds were not present in the resulting wine. The initial results of this work were presented by Smith et al. (2014) and more complete scientific findings were presented on the modification of the sulfur compounds (Bekker et al. 2015) and the tannin composition (McRae et al. 2015).
**Measuring dissolved oxygen and adding it to ferments**

As part of its research on oxygen and winemaking, the AWRI has reviewed different techniques for measuring dissolved oxygen (DO) in the winery. Of the many tools available, those based on oxoluminescent techniques are the most adapted for winery use, particularly during vintage. Several robust process-grade probes, capable of being integrated into supervisory control and data acquisition (SCADA) systems or other electronic monitoring networks, are available. Careful thought has to be given to the interpretation of DO measurements in a fermenting juice, largely due to the differences in oxygen saturation values in high sugar media.

Technology to introduce oxygen into an active ferment is very dependent on the scale of the winery but generally involves formats using stainless steel or ceramic sinters. A recent addition to the wine industry is a low-cost, purpose-built venturi injector that allows oxygenation in a pump-over line without being fed with compressed gas. Its efficiency is very much determined by pump flow rates and these need careful consideration. More details on these topics were presented in an AWRI Technical Review article (Day and Wilkes 2014).

**Industry adoption – Case study from The Oxford Landing Winery**

Research of this type has little meaning if it is not trialled and ideally adopted by industry. Following a workshop held at the Australian Wine Industry Technical Conference in 2013, the AWRI was approached by The Yalumba Wine Company about trialling oxygen additions to production-scale ferments at The Oxford Landing Winery (OLW) during the 2014 vintage.

**2014 Vintage trials**

The trials were conducted in four 100 tonne sweeping arm Potter (SWAP) fermenters using Cabernet Sauvignon fruit from the Oxford Landing vineyards. The project team decided to use a more conservative dose of 1.6 g/L oxygen compared to the doses added during the pilot-scale trials (2.8 g/L and 5.5 g/L), based on the site equipment and an achievable cost/benefit return.

Three different types of oxygen introduction device were tested:

- 3 inch venturi injector (Mazzei) placed at bottom or top of pump-over line
- Pulsair tanks in normal operation
- Air sparger at bottom of tank.

Results from the trial were very encouraging, with all of the wines ending up in their intended blends, a decision which was a small leap of faith for the winemakers! No sulfide aromas were detected, although this is not normally a significant problem for Cabernet Sauvignon wines. With the venturi configuration, the DO measured before and during the aerated pump-over (probe placed just before irrigator) rose to 19.9% air saturation which, from the given TSS at the time of aeration, gave a DO of 1.43 mg/L. When the venturi injector was at the top of the SWAP fermenter, the DO rose to 42.2% air sat or 2.92 mg/L. From a practical point of view, the venturi injectors – placed directly after the pumps at the bottom of the tanks – did not work well in the set-up at OLW because the in-place pump-over pumps are a high flow, low pressure design. This meant that the flow rate was dramatically reduced and changed the dynamic of the pump-over system, creating another variable in the trial. It also would not be feasible to retrofit the venturi injector in the
existing pump system. With the right pump design a venturi system might be suitable for a new installation. Because of the passive nature of the venturi device and the fact that the inlet pressure was not measured, which meant the actual volume of gas delivered could not be calculated, the project team reluctantly decided not to continue with this device.

2015 Vintage trials

Following the positive outcomes from the 2014 vintage, the OLW project team decided to continue and expand their trials in 2015 to include rotary fermenters as well as SWAPs. The necessary compressed air lines were attached to the existing Pulsair fittings and connected to the SCADA system for solenoid control and logging. Compressed air was only supplied to the fermenter while it was being pumped over to ensure mixing. The air flow rate was set at 200 L/min and 130 kg O\textsubscript{2} were delivered over 5 days to 100 t of Cabernet and Shiraz grapes from the Riverland. Treated wines were compared with similar untreated batches.

The rotary fermenters had a capacity of 30 t and were fitted with a manifold containing several stainless steel sinters. The air supply was connected to a gas turret fitted with a safety switch to prevent rotation with the gas line attached, and they were also connected to the SCADA system. The air flow rate in this case was 100 L/min delivering 33 kg of O\textsubscript{2} over the five days of fermentation. Because of the smaller head height in the rotary fermenters compared to the SWAPs, the bubble residence time was much lower. However, with the mixing that occurred during rotation, it was hoped that the headspace oxygen would be incorporated back into the fermenting must. Three batches of Cabernet Sauvignon and one each of Merlot and Shiraz (all from the Riverland) were used in the trial. Control wines were made with the same fruit without addition of air. After the first day or so, the sinters in the rotary fermenters became blocked and were replaced with 1-2 mm holes drilled along the length of the gas supply line in the fermenter. Fortunately, these did not block and were well suited to purpose. No other major engineering problems occurred. One key observation during the trial was that none of the ferments treated with oxygen required the addition of DAP to stop stinky sulfur odours, compared to three out of the five control experiments.

The trial wines were tasted at OLW and Yalumba three months after bottling. For the Shiraz wines made in the rotary fermenters, six of the nine tasters preferred the oxygen-treated wines (one no-preference) over the control. No negative impacts on colour were noted and the tannins were considered to be smoother. A slight sour and aldehydic note was picked up by the two tasters that preferred the control Shiraz. All tasters preferred the oxygen-treated Cabernet wines made in the rotary fermenters. For the wine fermented in SWAPs there were unfortunately no control wines available at the time of tasting; however, the oxygen-treated samples looked very good, in particular the Shiraz wines, which had smoother tannins than other wines of similar age.
Analysis of the wines was undertaken by the AWRI at the time of tasting. Volatile sulfur compounds were analysed by GC-SCD (gas chromatography with sulfur-chemiluminescence detection) which detected the presence of hydrogen sulfide ($\text{H}_2\text{S}$), methanethiol ($\text{MeSH}$), dimethylsulfide (DMS) and carbon disulfide ($\text{CS}_2$). As with the AWRI trials, the concentration of MeSH was lower in the air-treated wines, however, there was little difference for the other compounds. The trends in tannin composition were also similar to the AWRI pilot-scale trial. Free anthocyanins and total tannin concentrations were lower in oxygen-treated wines as they had been combined into more complex and evolved tannins in which the colour is stabilised. Such tannins tend to be less astringent and are associated with wine ageing.

Looking forward
Now that the OLW winemakers have seen noticeable and positive effects from adding oxygen as air, they are developing a proposal to implement air addition across all SWAP and rotary fermenters at OLW and the rotary fermenters at Yalumba in Angaston. Although it may not be the case that all wines will receive the maximum addition rate, it is expected that oxygen addition will be a useful tool for some blend components. It also appears to reduce yeast stress. Having observed that the addition rates used in 2015 were not detrimental, trials involving higher rates of added oxygen will be carried out in future vintages.

This is a very encouraging example of how carefully controlled and replicated research can be implemented in industry and achieve similar results. It is not only rewarding for researchers to see their efforts applied but also validates the work carried out for and on behalf of the whole industry. The AWRI engages with industry through its extension program throughout the year and through the triennial Australian Wine Industry Technical Conference (AWITC). An AWITC workshop entitled ‘Oxygen and sulfur: a breath of fresh air?’ will be held on Sunday 24 July 2016. To register for the conference or find out more information about the program, visit www.awitc.com.au or contact info@awitc.com.au.

Acknowledgements
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References


**Advancing Wine Through Simple Solutions**

**Gilbert Erskine & Scott Russell – AMS Filtration**

AMS Filtration founder, Gilbert Erskine (formerly of SF Fabrication) has worked with wine producers for 25 years, engineering and fabricating robust production plant and equipment. Armed with first-hand knowledge of the challenges producers’ face with existing filtration technologies, Gilbert Erskine embarked on 10 years of R & D. The technology that has stemmed from this R & D is set to revolutionise filtration in wine production, bringing businesses significant opportunities for quality and efficiency improvements and capital savings.

As with all businesses, wine producers are continually looking for ways to improve efficiency and productivity, whilst reducing costs and improving product quality. Filtration is a key component of the production process and is a driver of productivity and quality; therefore any improvements in filtration technology are attractive to wine producers. AMS Filtration’s patented technologies have made substantial advances in chemical resistance, durability and throughput, energy savings, material efficiency and cost competitiveness.

AMS Filtration has two unique filtration technologies:

1. **Tubular Cross-flow Titanium Filtration Membrane**:
   - A sintered titanium hollow capillary surface filtration membrane with a high percentage of open area. The membranes can be included in a complete system designed and fabricated by AMS filtration or retrofitted to an existing filtration system.

2. **Rotary Drum Vacuum (RDV)**: with a radius flat sheet titanium membrane. The flat sheet membranes can be included in a complete RDV fabricated by AMS filtration or retrofitted to existing RDVs.

**Tubular Cross-flow Titanium Filtration Membrane**

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**OPERATING AND DESIGN INFORMATION**

| **Maximum Operating Pressure:** | 10 bar |
| **Maximum Operating Temperature:** | 120°C |
| **Cleaning (CIP) temperature:** | Up to 120°C for cleaning with steam |
| **Allowable pH Continuous Operation:** | 0.0 – 14.0 |
| **Allowable pH – CIP** | 0.0 – 14.0 |
AMS Filtration membranes adopt the superior performance qualities of titanium, particularly strength, biological inertness (think titanium implants), temperature, pressure and chemical resistance and hydrophilicity.

**Membranes have a high filtrate flux with a high quality finish:** unfiltered feedstock (juice or wine) is pumped with a low shear pump, to flow across the inner surface of the membrane at an average of 0.6 metres per second. This is a laminar flow, which means that the juice/wine that is in contact with the membrane is virtually still. The juice/wine that is crossing the membrane surface and flowing through the porous tube wall is flowing at less than 0.1 mm per second. This means that this particular type of membrane is gentle on the juice/wine whilst delivering high flux rates so ultimately the juice/wine spends less time being pumped.

**Membranes are long lasting:** being titanium the membranes are stronger than any polymeric or ceramic filter material. High temperatures, pressure shocks and aggressive cleaning do not compromise membrane integrity.

**Membranes can be cleaned in place to day one condition:** being temperature resistant, shock resistant and non-corrosive, the membranes can withstand aggressive cleaning regimes with steam or chemicals in the entire pH range. The membranes do not foul and therefore flux and wine quality is maintained for the life of the membrane. Titanium is also organoleptically neutral, meaning it will not react with or taint wine. Effectively these cleaning regimes are quick and provide the wine producer significant opportunities for productivity gains and cost reductions.

**Membranes able to withstand high absolute, differential and shock pressures in both directions:** by applying a small physical pulse to the membrane during operation, surface particles are dislodged and therefore high flux is maintained over an extended period when compared with polymeric and ceramic membranes. Again, this provides the wine producer significant opportunities for productivity gains and cost reductions.

**Filtration systems are designed for safety and product integrity:** built-in safety mechanisms sees all pumps and valves immediately set to safe mode if the system loses power or air pressure, or if a pump or sensor fails. This protects the wine, the filter and any staff in the area. Also, membranes are sealed in their stainless steel housing with an integrity indicating, double block and bleed compression seal, eliminating the risk of unfiltered wine passing into the filtrate.

**Cost effective:** patented production processes enable AMS Filtration to deliver solutions in line with polymeric technologies, whilst providing superior performance, productivity gains and production cost reductions.

**Easy to operate:** the filtration systems have a user-friendly touch screen interface. Filtration and CIP cycles can be selected on-screen from pre-programmed sequences or customised according to business needs. Automation includes:

- setting flow or differential pressure profiles,
- optimising back flush and flow control parameters,
- adjusting warning and alarm levels,
- setting chemical dosing,
- cleaning solution heating, and
- flux testing.

Additional sensors, such as dissolved oxygen and inlet temperature, can be added to the system as required and can be setup on-screen. The measured values used in warnings and alarms, as well as
triggers for filtration or cleaning sequences are presented graphically on-screen. Optional reporting packages provides filtration and CIP records as tables and charts in .xlsx format to view, analyse and validate. With a combination of a user-friendly control panel, robust membranes and sophisticated automation, AMS filtration systems eliminate the need for continuous and highly skilled monitoring.

2. Rotary Drum Vacuum (RDV) Filter

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Once again, this particular RDV design adopts the superior performance qualities of titanium. It provides a reliable and economical solution for continuous dewatering and separation. The RDV dewaterers by pulling liquid through the pores in the flat sheet titanium membrane, while solids too large to pass through are held on the membrane surface. The solids are then blown off the drum as it turns and passed through to a collection vessel.
The design removes the need for carcinogenic consumables (e.g. diatomaceous earth and perlite) and centrifuges: the radius flat sheet titanium membrane separates sludge and slurries into thick, spadeable dry solids without the use of filter aids or centrifuges. This effective separation method produces a clean and clear filtrate free from filter aid and a spadeable solid retentate that is easy to dispose of or recycle. By producing a high quality filtrate, the wine producer is able to blend it back into the main filtrate therefore delivering a greater yield of high value product.

RDV is offered in an open or closed system: two RDV systems are available from AMS Filtration. An open system that is operated in the atmosphere and a closed system that is operated in an inert environment. The main benefit of an inert environment is that it mitigates oxidisation and maintains the quality and integrity of the filtrate.

Easy to operate: AMS RDVs are operated with minimal supervision and operator training. This is a significant opportunity for productivity gains (decreasing labour hours), OHS&W gains (removing dangerous materials handling) and cost savings (purchase of consumable and disposal of filter aid).

RDV radius flat sheet membranes are long lasting: being titanium they withstand high temperatures, thermal shock, aggressive cleaning and pressure shock without compromising membrane integrity.

RDV radius flat sheet membranes can be cleaned to day one condition: being temperature resistant, shock resistant and non-corrosive, the membranes can withstand aggressive cleaning regimes with steam or chemicals in the entire pH range. The membranes do not use a filter aid and therefore maintain flux and produce high quality and non-diluted filtrate for the life of the membrane. Titanium is also organoleptically neutral, meaning it will not react with or taint the filtrate. Effectively these cleaning regimes are quick and provide the wine producer significant opportunities for productivity gains and cost reductions.

This particular RDV design is cost effective: when compared to traditional RDVs and centrifuges. The AMS RDV delivers wine producers financial benefits through:
- revenue gains: greater yields of higher quality filtrate and value from sale of uncontaminated spadeable dry retentate,
- cost savings: low energy consumption, elimination of consumable filter aid, elimination of disposal costs of waste stream and less labour hours for preparation and monitoring, and
- productivity gains: higher throughput and employee satisfaction and wellbeing.

For additional information contact Scott Russell at AMS Filtration via scott.r@ams100.com or sales@ams100.com