ozone
technologies ltd

protecting our environment

sustainable solutions

food processing, storage and disinfection

PO Box 655, Napier, 4110, Hawke's Bay, New Zealand
email: info@ozonenz.com | office: +64 6 843 2881 | fax: +64 6 843 2441
www.ozonenz.com

sustainable, chemical free solutions for food processing, storage and extended shelf life

Municipal & industrial potable water treatment O3T

Wineries and aquatic disinfection O3T

Nurseries and greenhouses O3T

Fresh meat, fish & poultry processing O3T

beverage and water production O3T

Produce packhouses & post harvest storage O3T

Recirculating aquaculture systems (RAS) O3T

Dairy and processed food facilities O3T

Low cost of ownership,
energy efficient and low water consumption or gas phase disinfection.
O3T's range of self-contained mobile or stationary treatment plants,shown here with contactor & storage tank for a recirculation loop. These modular systems can incorporate air supply or draw from existing supply, and will come supplied with your choice of monitoring and process control, automation and data logging.

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state of the art
sanitation and water treatment solutions for food processing and primary industries

Over the past two decades Ozone Technologies have been providing turnkey solutions for our clients, and intend to remain at the leading edge of solution providers, regardless of the industry in question.
Primary industries and food preparation facilities have found our systems and processes are easy to incorporate into existing production facilities. These systems reduce ongoing operations costs, including chemical, power and labour involved in downtime for regularly scheduled CIP (clean in place) procedures and waiting for cooling of vessels in wine and dairy facilities. All this can be done with no residuals and have a positive environmental effect.

O3T development and the pursuit of excellence

Our process engineers and designers have spent considerable time and resources implementing the best possible solution for our clients from the farm (land or aquatic), through processing, storage, shelf life extension to trade waste or wastewater treatment, for re-use and reduction of discharge costs.
Our research is thorough, and we constantly strive to improve procedures and handling in the interest of providing the most cost-effective solutions for our clients, compliant to the most stringent international and national legislation.

Craggy Range SH50 Winery Ozone disinfection reticulating system-storage tank and injection point

SH50 Ozone plant and process controls

O3T Treatment Systems are compliant with:

USA Legislations:

USDA, USEPA, US FDA approval of GRAS (Generally Recognised As

Safe) approved in 1987, in 2001 was allowed as a direct food additive in contact with food including meat and poultry (Title 21 part 173 section 173.368) This is further supported by the (US) National Organic Program (NOP) as a certified organic treatment (205.206 (b)).

IBWA (International Bottled Water Association)

EEC; IQSIQ; WHO

Australian Legislation:

FSANZ as a food contact substance.

New Zealand Legislation:

MAF: approved chemicals for processing plants, to reduce odours, reduce VOC's, pathogens, micro-organisms & fungal spores, (p.9 sec.2.8), for direct food contact. schedule 1-1, water management for potable supply

NZDWS 2005 (NZ Drinking Water Standards 2005)

Please talk to our team if there are further legislative bodies your industry needs to be compliant with.

Wairau RIver Wines, CIP ozone plant

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Our designers can build a system for your facility from the ground up at conception, and to any degree of process control.

Alternately, we can provide modular systems to enhance your existing plant facilities.

Touchscreen operator interface SCADA water bottling plant, Whakatane

O3T Automation, data logging, PID, process control

All elements of your treatment system can be designed with full automation and process control elements as may be required. This can significantly improve production, hygience, servicing downtime, monitoring of any variables and enable product tracking from the date and time of production, making quality control simple and providing fully compliant data logging for international supply.

Please discuss your requirements with one of our process designers, we can outline a package suitable for your requirements.

Coolstore gas-phase control elements, Seeka Kiwifruit Industries, Te Puke.

O3T can provide

CAD engineered drafting of plant production equipment, facility layout inclusion, fabrication drawings and P&ID process control documentation as required.

On-site scaled trials if required.

Advise treatment outlines, and sourcing of equipment to meet these requirements, either direct or through us.

Process control philosophy for automation and control elements.

We have designed and successfully implemented our technology and solutions for all aspects of water treatment into numerous commercial plants in the last two decades, and will continue to improve efficiencies in all designs and processes in the future.

Muriwai township potable water system, fully self-contained design, Rodney DC.

Tip Top CIP factory disinfection plant, Modular design DC-80, Auckland.

Artists 3D drafting for this range below.

Production facility turn-key solutions include:

Potable water treatment to NZDWS 2005. Includes options to provide the best possible treatment for your incoming water supply.

Process water re-claimation from dairy evaporate condensate and

drainage, returning wastewater to process condition.

Reticulated factory Sanitation System, for cold-water wash-down and final sterilization. Ideal for food handling areas, meat or fish processing, wineries, beverages and water bottling plants.

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specific processes and proven systems for food processing, storage and extended shelf life

brief outlines of treatment options

Potable water treatment, incoming supply, from bore or town.

O3T provide full treatment outlines from the bore up, with full filtration, water analysis and recommendations to keep this source water compliant to NZDWS, remove colour, odour, poor taste, iron, manganese and provide full disinfection against possible pathogens, giardia, cryptosporidium and e-coli. Production facilities of a certain size must comply with the NZDWS, and ofen require cleaner water for processing than is available from municipal supply.

botrytis storage treatment vines

Vine cuttings (nurseries), produce, fish, meat, poultry disinfection wash

O3T provide wash-bath, spin chiller, or process line disinfection systems which protect against pathogens, micro-organisms, fungal contamination and spoilage without leaving chemical residues on your product.

For organic fruit and vegetable handlers the post harvest wash cannot at any time contain prohibited substances in dissolved form. Ozone in water is the only organic method of washing fruit & vegetables to kill pathogens including E. coli, Salmonella, Listeria, Shigella and Cryptosporidium, Hepatitis and Cyclospora. These are among the disease causing organisms that have been associated with fresh fruits and vegetables.

Each system is designed specifically to meet the clients particular requirements and loading.

Greenshell mussell processing

Product storage protection and shelf life improvement systems

This gas-phase system protects agains air-borne contaminants, remove odours, stops the spread of fungal infection and rots, reduces VOC's (volatile organic compounds), converts ethylene (the ripening agent in produce) to carbon dioxide and water, and increases the life-span of your product through this process retarding spoilage.

When compared to existing chemical sanitising methods it can be shown to cause little or no change to the food product itself, and leaves no residue to harm or taint the product.

Careful and proven process control and air-sampling monitoring within the storage facility controls the ozone level output to maintain a low desired residual level once initial consumption has been met. Systems can be fully automated, or timer set to work through the night and allow personnel to work in the area during the day with a reduction of levels to those well below OSH requirements.

Greenhouse recirculation feed water pathogen treatment system

modular coolstorage treatment systems

Production facility wide ozonated water ring-main system

There are many advantages to using an ozonated water supply factory wide, all make sound enconomic arguments for maintaining a sanitized environment, save on power consumption, heating, cleaning chemical costs and downtime in production while cleaning in place (CIP) is carried out. The uses for this water are many, and well espoused worldwide.

Ozone Technologies system with it's reticulated 'ring-main' distribution line goes so much further than a standard use or lose system. A storage tank of ozonated water is maintained at a desired disinfection level, and this water is recirculated throughout the plant to be used as and where needed. The system is set-up to meet the desired level under maximum usage, and the water not used is returned to this tank.

This system reduces the consumption of precious water resources, minimises wastewater, reduces the overall footpad and size of the ozone plant (once the level is met the power is turned down to maintain the desired level. This is our most popular design, and the capital cost is returned in savings in power, chemicals and labour in an extremely short time.

Waitaki DC Oamaru water treatment plant, 2008.

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O3T ring-main disinfection systems - fast, effective, proven

At Ozone Technolgies, we don't simply supply generators. Our custom built Ozone On-Site Systems encompass all aspects of the ozone sanitation process from feed supply to off-gas treatment, and are tailored to each client's individual loading requirements. In processing plants, we find articulated system that pumps ozonated water throughout the facility for use on demand works well. The systems are run full time, and automatically monitored to ensure that the water on return is still at the correct levels for sanitation. Management of off-gas and ozone monitoring for safety and efficacy is incorporated into the Ozone On-Site System. Data logging for ozone levels, pH and temperature is an option available for those clients who need this degree of comprehensive monitoring for export requirements or to meet regulations.

We now offer a modular, two part ozone based treatment system

The O3T modular series covers a range of treatment sizes and flows. These range from wall mounted, air cooled systems to fully self-contained plant wide disinfection systems. The nature of the treatment determines whether this is a an air or water distributed system, and we offer a comprehensive range of monitoring and automation options in conjunction with the supply units. Finally, a straighforward, cost effective approach to a range of applications.
Your system will be sized to suit your individual requirements. As we build systems to meet each clients napplication, there is no 'making do' with close enough. The O3T range will be tailored for you, and can be expanded as your production or facility grows.

Ozone contacting, injection and storage facility

Ideal for ring-main or flow through requirements, with all contact elements ozone inert, and built to food grade hygienic standards. This is the 'battery' of a reticulation system. Combined with advanced gas diffusion and injection manifolds, we offer superior gas transfer efficiency in aqueous operation.

Ozone generation, air preparaton and process control centre

The O3T modular series can be housed in it's own portable plant room, designed by our engineers, or installed into your existing control plant room. Smaller systems are air-cooled, oxygen fed systems, and can be mounted beside the treatment site or in existing plant rooms. These range from 2 to 120 gram systems, and are ideal for smaller (often gas-phase) applications. The DC-160 to 980 series are water cooled corona-discharge systems, and are offered with their own portable, self-contained plant rooms, or can be fitted into supplied plant rooms.

Our modular range for disinfection of water generally comprises of:

- 200-300gram per hour ozone generator, variable from 10 – 100% output
- PSA oxygen generator, oxygen receiver, pressure control valves, valves, regulator, hoses
- Air compressor (if not to be supplied from factory instrument air facility) filters receiver, hose, fittings & valves as required for air preparation
- Process control cabinet with cooling & ventilation facilities, IP56 rated, 230v supply required
- Process controller, manufacture, programming, 4-20mA output to existing PLC. Residual ozone monitor, sensor and addition to process controller
- Cooling water pipework (within plant room only, to be connected to outside source)
- Ozone contacting chamber, injection pump, venturi, manifold, level control & valves
- Ozonated water storage chamber, connections to contactor, with level control & connecting flanges for ring-main system (distribution pipwork throughout facility by others).

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Surface Sanitation

Many industries sanitize surfaces with ozonated water. It can be sprayed directly on floors, drains, walls, tanks (inside and outside), fruit bins and any other wettable, non-rubber, non-fiberglass equipment or surface. Typically, the equipment is first cleaned, then ozonated water is used as a final sanitizing rinse. This very effectively reduces microbial loads on the surfaces.

With repeated use, surface applications of ozonated water will remove biofilms. These are tough, resilient layers of microbes which adhere tenaciously to surfaces. Biofilms can be invisible or they can create a foggy haze on tank walls and production area floors. First-time users of ozone sometimes measure post-treatment surface bacteria counts higher than pre-treatment counts. This is due to the destruction of the upper part of the biofilm by the initial ozone treatment, exposing the microbes below. Subsequent treatments quickly destroy those microbes, leaving the surface microbiologically sanitized as well as clean to sight and touch.

Without ozone, CIP sanitation must be done either by chemicals, requiring multiple rinses afterwards to remove noxious residues, or by heat (usually high temperature water or steam), which is very expensive to produce and creates a danger for workers. In contrast, ozone achieves CIP sanitation at low cost, at ambient room temperatures, and without chemical residues. Further, hot water or steam causes the expansion and contraction of welds, one of the biggest causes of line degradation and repair. Heat also can bake on materials inside the lines, making them more difficult to clean. Since ozone is used in cold water, it avoids these and other problems of heat-based CIP sanitation.

extracted from article for wineries by Marne Coogan, at http://www.vwm-online.com//Magazine/Archive/2003/Vol29_No2/Ozone_In_Wineries.htm

Antimicrobial Efficacy

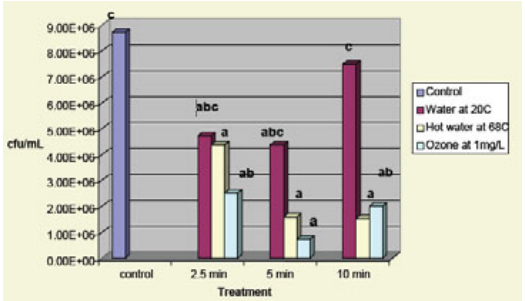
Efficacy studies conducted according to AOAC Official Method 961.02, Germicidal Spray Products as Disinfectants Test and AOAC Official Method 960.09, Germicidal and Detergent Sanitizing Action of Disinfectants (EPA formulated test and performance requirements), provided the following results using ozonated water in a washdown/spray treatment:*

CT reductions in some micro-organisms, CIP ozonated wash down/hosing treatment (not gas phase):

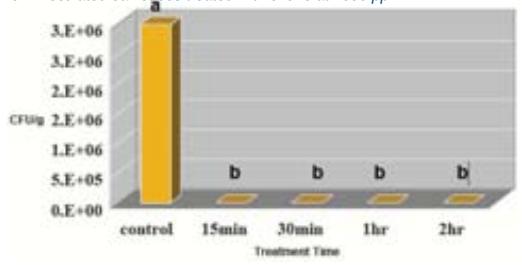
Organism	Ozone Residual	Duration	Reduction
Trichophyton mentagrophytes	1.85-2.25 PPM	30 seconds	6 log (99.9999%)
Salmonella choleraesuis	1.85-2.25 PPM	3 minutes	6 log (99.9999%)
Staphylococcus aureus	1.85-2.25 PPM	10 minutes	6 log (99.9999%)
Pseudomonas aeruginosa	1.85-2.25 PPM	5 minutes	6 log (99.9999%)
Listeria monocytogenes	1.85-2.25 PPM	3 minutes	4 log (99.99%)
Aspergillus flavus	1.85-2.25 PPM	5 minutes	4 log (99.99%)
Brettanomyces bruxellensis	1.85-2.25 PPM	3 minutes	4 log (99.99%)
Escherichia coli	2.1 PPM	30 seconds	5 log (99.999%)

Some gas phase ozone treatment (not aqueous) results:

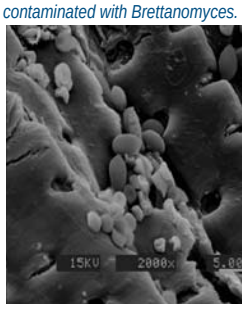
Population of Brettanomyces bruxellensis recovered from core barrel samples treated with ozonated water, hot water and water in a barrel



TimePopulation of Brettanomyces bruxellensisrecovered from inoculated oak cubes treated with ozone at 1300 ppm



Control: Surface of oak cube contaminated with Brettanomyces.



surface of oak cube treated with ozone

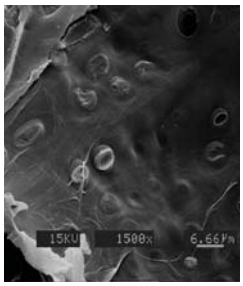
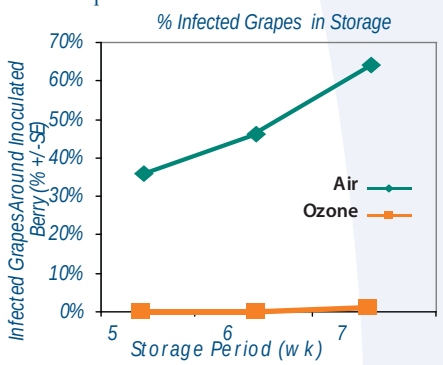


Table Grape Test Shows Reduction in Infection



Source: 2002 study by UC Davis, UC Riverside

control grapes, no ozone

ozonated storage grapes

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the proof is in the commercial outcome

Seafood Processing facilities

Southern Seafoods Limited

To whom it may concern:

RE: Ozone wash bath microbial control in Seafood Processing Facility

Southern Seafoods processes half shell greenshell mussels for export. As a way of controlling micro organisms we add ozone to the pre-freezing water-cooling bath, resulting in a considerable drop in the Aerobic Plate Counts count on final product. Laboratory results of micro-organism indicator's on plate counts for fresh mussels in pre-packaging have shown a reduction from pre-wash levels of 150,000 to 200,000 were reduced to a plate count of 70 after a two minute exposure to ozonated bath water (because of production volumes we can only expose the product for this length of time, if you are able to expose it to the ozonated water for a longer period of time and still maintain expected product output, I believe the plate count would be even lower). The temperature of the wash averages 14 – 16 oC, and a ozone residual of 0.2ppm – 0.3ppm is maintained at all times. The product is conveyed through the bath for approximately 2 minute exposure time before going into a spiral freezer. The reduced plate count on product was a result of stricter plant cleaning and sanitation, but the greater reduction of plate count was due to the introduction of ozone into our product chilling operation.

In addition to ozone being applied in the aqueous phase of the processing, ozone has also been incorporated into the foam fractionation system (protein skimming) utilized in our live lobster division. With the addition of only a very small amount of ozone into our protein skimmers, water quality has improved considerably, notably the water is much cleaner in appearance, less demand on the bio filter and has resulted in a better holding facility for live lobster.

Any future operation that we are involved in where ozone could be used to help sterilize or improve water or air quality we would adopt without question because of the high quality of the resulting final product.
Yours Faithfully

M A Moodie
General Manager

Sanitation for the nation…ozone in the winery

Exerpts from the NZ Grape Growers and Winemakers Magazine, January/February issue 2004, by Ruby Andew.

Ask a New Zealand winemaker about ozone, and you're liable to hear about sunburned grapes and a "hole" in the atmosphere. Yet ozone has been employed as a disinfectant for more than a century, typically in municipal water supplies, swimming pools, and sewage treatment plants. It was only in 1997, however, that ozone was recognized in the United States as being safe for food processing: since then, US wineries have eagerly adopted its use as an efficient and highly effective means of sanitizing everything from winery work surfaces to tanks and barrels to bottling lines.

Most of us already know what ozone smells like:
O3 is that fresh clean scent in the air that comes after a thunderstorm. It's created when oxygen (O2) and electricity interact, which is why the smell is often evident around copy machines, electric motors, and arc welders.
In nature, ozone levels range from 0.01 ppm (parts per million) to 0.15 ppm, although concentrations can reach higher levels in urban areas. Ozone is also a highly reactive substance: it doesn't last long (its half life is just 10 to 20 minutes), because its third oxygen atom is transferred to any organic compound it touches, causing the gas to revert back to the oxygen from which it was generated.
As a sanitizing agent, ozone is used in higher concentrations, typically ranging anywhere from about 2.0 to 10.0 ppm. The amount required is determined by "concentration and time" for each application. In other words, as the ozone concentration gets higher, the time required to produce an acceptable microbial kill rate goes down.

At these levels, contact with ozone instantly kills enzymes, microbial membranes and unpleasant taste- and odour-causing compounds. Ozone destroys all known bacteria, virus, molds spores, yeast, mildew, microscopic fungi and biofilms (colonies of microorganisms that cling to surfaces).
Given ozone's effectiveness as a sanitizer, it's not surprising that winemakers are becoming keen proponents of its use – particularly in terms of keeping Brettanomyces at bay. Today, small portable ozone generators are a commonplace sight at many wineries in California's Napa Valley.
The generators produce ozonated water that can be sprayed directly on floors, drains, walls, destemmer-crushers, tanks (interiors and exteriors), fruit bins, barrels, and just about anything else, provided it's a non-rubber, non-fibreglass piece of equipment or surface. Usually, surfaces are first cleaned, and then ozonated water is used as a final rinse.
Where ozone really comes into its own is with repeated use. Easier and environmentally friendlier than frequent use of chemicals or heat, ozone sanitizing is cumulative in effect – the more you use it, the cleaner the winery equipment will be. As word of its efficacy has spread, a few New Zealand winemakers have also begun to experiment with ozone systems. Doug Wisor, the winemaker at Craggy Range, is one of them (given that he originally hails from California, perhaps that's not too surprising). Wisor had the luxury of building a new winery from scratch, and right from the start he knew that ozone was going to play a big role in the operation.
"We actually designed this winery around the use of ozonated

water for sanitation," he explains. "And so that had an impact on our technical specifications, such as the polymers and stainless steel used in equipment."

Wisor initially looked to the States for his ozone generator – with mixed results. "We did our research and purchased a portable unit from a reputable California manufacturer," he says. "But maintenance became an ongoing problem, and the cost of the circuit boards and electrical units required for replacement is fairly high."

Ozone generators, he notes, are actually rather delicate. They run into difficulty in environments subject to high humidity and/or situations where frequent bumps can occur. "A generator will take more than a couple of hard knocks as it's wheeled over the bumpy surfaces in a winery, and we ended up blowing a few circuit boards," he adds. "Then we discovered that servicing can be difficult with an overseas supplier."

Wisor's experience is not unique in this regard. Although servicing may be less of a pain when you're not separated from your supplier by the Pacific Ocean, the fact remains that ozone systems require regular maintenance and monitoring in order to work as they should.

There's another reason why monitoring is so essential: ozone is a toxic gas, with standards in place for exposure to it in the workplace. At the higher concentrations required to kill microbes, ozone off-gasses into ambient air, and care must be taken to monitor the level of ozone exposure over time. New Zealand, like many other countries, sets the maximum human exposure to ambient ozone at 0.1 ppm over an extended (8 hour) period. It's worth noting, however, that in more than 100 years of industrial use, there has never been a human death attributed to overexposure to ozone.

Workers require safety training on the correct use of ozone equipment, and, if a system is to remain effective, the ozone concentration and flow rates must be checked on a regular basis. All ozone generated should be accounted for, by checking for leaks in the system and by proper destruction of any excess gas.

Hampson underlines one of the key factors in making ozone work in the winery:

"It is not enough to just purchase an ozone generator. Your winery must also have maintenance, verification of performance, monitoring, and, especially in the case of mobile ozone units, an in-place systems approach that ensure the safe use of ozone in the workplace. Properly used, these ozone sanitizing systems are much safer than chemical (chlorine and caustics) or heat-based sanitizing systems."

At Craggy Range's Highway 50 winery in Hawke's Bay the elements outlined by Hampson are now firmly in place. Wisor's frustration with the delays and costs involved with his overseas supplier eventually led him to explore what the domestic market could offer. The search led him to Dirk Haselhoff, director of Ozone Technologies Ltd., in nearby Napier.

Haselhoff's company already had a sturdy track record: it's been in business for 15 years, supplying ozone equipment to city water and wastewater treatment facilities, municipal swimming pools, and large-scale industry. Working with a winery was new to him, however, and he had some reservations about the company's portable generator.

"We won't supply portable systems," he says. "Ozone generators are simply too delicate and they require a correct environment that's stable and dry."

After consulting with Wisor, Haselhoff proposed a stationary generator, located in the winery's works area. The copyrighted unit will run a reticulated system that pumps ozonated water throughout the facility for use on demand from the service towers dotted throughout the winery. The system will run full time, and is automatically monitored to ensure that the water on return is still at the correct levels for sanitation.

Craggy Range will also use ozone, rather than hot water, for clean-in-place applications, such as on the winery's newly installed bottling line. "This is the first ozonated bottling line the guys have built, but in terms of making sure the equipment can withstand the treatment, there's only a very small cost increase over a traditional hot water system," says Wisor. "It's a million dollar unit, and you're looking at only a few extra thousand dollars to use ozone."

The contact time required for ozone to kill off all the organics is a mere 20 to 30 minutes for the entire bottling line – compared to two to three hours using heat sterilisation – and Wisor notes that the energy savings will soon pay for the additional installation costs.

Because each application has its own contact-time requirements, Wisor appreciates the full-time monitoring that's part of the new system. But Craggy Range goes further, double checking everything fortnightly with a small kit similar to those used on home swimming pools, and also by taking swab tests on surfaces so that the company's lab can test again for microbial levels.

"You can smell ozone at fairly low levels, and when you do smell it that generally means you've sanitized whatever piece of equipment you're working on," notes Wisor. "However, you need to constantly monitor your outputs and test equipment to ensure that you have killed the organics."

Asked about ozone's uses at Craggy Range, Wisor cites a very long list: the floors of tank and barrel rooms, drains (after any big procedure), catwalks, tanks, hoses, pumps, bins, punch-down tools, barrels, wooden tanks, and the destemmer. About the only thing that doesn't come in for an ozone treatment is the company's wine press, which requires chemical sanitization.

That's a lot of ozonated water going into the winery's wastewater system, but Wisor points out that by the time the water from an application reaches the treatment system, it's already been pumped into five different settling chambers over a number of days. "Ozone has a reaction time of minutes," he explains, "so there's no worry about the water killing off any beneficial microbes in the treatment system – as there would be if we were pumping the same amount of water that had been treated with chlorine or ammonia."

At the moment, the wastewater is then treated chemically before being recycled to irrigate Craggy Range's vineyards; eventually it, too, will be ozonated – virtually eliminating chemical disinfectants at the winery.

Because Craggy Range has decided to use ozone so extensively, Wisor trains all staff on its safe use as part of their orientation. "New employees have to read the information from the US Food and Drug Administration along with a number of other materials I've put together in a 'FYI' package," says Wisor. "The main thing people have to know is that we can smell ozone long before it reaches dangerous levels in our immediate environment. If you can smell it before you finish the designated contact time for your particular application, you need to consider whether the reaction is, in fact, complete, or whether you should be doing the job in a more ventilated area – and that's why monitoring is so crucial."

Haselhoff says that Wisor's training programme is exemplary. "It's quite common for workers to be reluctant to use ozone, simply because they don't know enough about it," he adds. "But Doug is so thorough that his people understand how to use the equipment, the safety considerations, and so on. Ozone is a safe product, but without that sort of training and monitoring, you're faced with people's fear of the unknown."

Wisor is equally complementary about Haselhoff's contribution to Craggy Range: "Dirk's expertise is phenomenal. His professionalism is in a totally different league compared to anyone we've spoken to overseas." And best of all, Wisor adds, "He's not even a long-distance call away."