



Australian Water Recycling
Centre of Excellence



Industry Forum: Water Recycling in Food Production and Manufacturing

Summary Report



Held at CSIRO Food and Nutrition, Werribee, Victoria

10 September 2014

www.australianwaterrecycling.com.au

1. Introduction

In September 2014 the Australian Water Recycling Centre of Excellence (AWRCoE) and CSIRO organised an industry forum to present the results of a three-year project to identify and enable water recycling opportunities in Australia's agri-food industry through integrated systems analysis, technology assessment, and targeted research to address implementation barriers. The project focussed on addressing industry challenges, including regulatory and policy pressures, by developing knowledge, tools and strategies for increased acceptance of water recycling in the food processing industry and by consumers. Approximately 45 participants attended the forum.

Purpose and objectives:

- Disseminate learnings and outcomes from the project to stakeholders in the food, dairy and meat sectors
- Shared understanding of learnings from the project and opportunities for adoption within the industries
- Guide researchers for their final reports and products to the Australian Water Recycling Centre of Excellence
- Recommendations for industry application and uptake

Target audience: Environmental Managers, Plant Managers, Policy Makers, Technology Managers, Water Regulators

The forum featured presentations by CSIRO project leaders and representatives from the Australian Food and Grocery Council (AFGC), Australian Meat Processor Corporation (AMPC), Meat and Livestock Australia (MLA), Dairy Innovation Australia Ltd (DIAL), and ADI Systems. A webcast of the forum is available on the Centre's website:

<http://www.australianwaterrecycling.com.au/videos-presentations.html>

Presentations outlined decision-support frameworks, assessment tools, nutrient and salt models, and case study results to assist the food industry with technical, environmental, regulatory and economic decisions on water recycling. Participants held group discussions on how the project results could be applied at a company and industry level to overcome barriers for water recycling in the dairy, meat and food processing industries. Summaries of the group discussions are attached. Group discussions were facilitated by Angela McClowry (AFGC), Alex Duplex (WCBF), David Barr (DIAL), Grenville Delfs (ADI), Don Alcock (AWRCoE) and Don Begbie (AWRCoE).

2. Summary of discussion

By Dr John Radcliffe, Chair, AWRCoE Research Advisory Committee

From the discussions, it is evident that perceptions are important. These include:

- The retail consumer market, where the more transparent the knowledge of the recycling processes held by consumers, the greater the likelihood of positive acceptance,
- The "middle" market of food processing ingredient buyers,
- The "regulatory market" comprising the water recycling and food quality and safety regulators, noting the propensity for change in standards over time.

Discussions confirmed that the recycling issues to be faced in each recycled water use development are unique. The group accepted the benefits of ensuring that any proposed treatment train includes development in a pilot plant specific to the site and food product involved.

The proponents need to have clearly established the drivers for any proposal to consider recycling for incorporation into a food production system. This was demonstrated in discussions at the Forum of one of the projects undertaken by the research team. Limits in capacity to dispose of effluent constrained any scope to increase the volume through-put of the plant and its potential longer term profitability. The intention of the company to continue operating the pilot plant for a further period beyond the original experimental term was noted.

It was recognised that any recycled water to be used directly in contact with food during processing would have to be of potable quality, whereas when not in contact with food, a "fit-for-purpose" standard could be adopted depending on the projected use.

There would be variations in the risks involved, to be considered on a case-by-case basis. Where the recycled water was sourced from processes involving non-animal sources, the risks were low, whereas much higher risks were potentially present where the water supply was sourced from animal product systems. However, it was recognised that the food industry was especially well experienced in the development and use of HACCP principles in late-stage processing.

Where a recycled water was to be ultimately used for enhancing crop or pasture production which supported the commodity being taken into the processing plants, such as milk, beef or lambs, the relationship between recycled water production (likely to be relatively constant throughout the season in some industries) might have to be equated with the supplementary irrigation demand, which was likely to be quite seasonal. This could involve considerable storage costs having to be incurred, whether for land on which to build storage dams, or for high level recycling treatment that would gain regulatory acceptance for use in a Managed Aquifer Recharge environment. The balancing of recycled water supply and demand received little consideration during the Forum discussions. The local environment, the specifics of soil types and infiltration rates would also have to be considered along with salinity and nutrient management in any irrigation proposals.

The ultimate reality was that any recycled water use had to be supported by an economic business case for the proposed use. The first consideration must be for the market. Where a company is exporting or might ever wish to propose to export, if the importing country mandates freedom from use of recycled water in processing (Japan was quoted as an example), there is little point in taking a business case further.

However, where there is “freedom to operate” with incorporation of recycled water into food processing, there was seen to be worth in the “Value Proposition” tool developed as part of the AWRCoE project. Incorporation of issues such as a potential change in product value; increased production; value of resources recovered (water, energy, nutrients); pollution reduction and lowered trade waste charges; the potential for offsets from a local authority (for example by not having to increase the size of a trunk sewer main) and the capital cost were all seen as appropriate issues to consider. Participants were also advised of the University of Technology, Sydney, case studies project which examined the policy settings, regulatory frameworks and experience in developing eight recycled water schemes, available online at: <http://waterrecyclinginvestment.com/>

The timeframe was also considered a significant factor. An example was discussed where the benefits and costs over a ten-year horizon were about equal, but if a twenty-year horizon were chosen, the proposal developed a clear surplus. But this raised risks of being locked into potential technological obsolescence and even regulatory obsolescence. The question was raised as to how often plant managers and company boards committed to decisions with a time horizon as long as twenty years.

The group discussions concluded that the “Value Proposition” tool had merit but that in each case it would need to be adapted to the specific knowledge and location of an individual processor. It needed to be an “Industry Friendly” tool. The scope to further extend the tool was recognised, but so too were the limits of the tool and that other issues would need to be considered beyond those encompassed in the use of the tool.

It was evident that the Forum audience, drawn from science, engineering and food processing industry from both Australia and New Zealand, had appreciated discussing the principles and their experiences with recycled water. The audience valued the outputs from the project, whether they were the meat ball consumer testing, fact sheets for the meat industry, case studies of several industry uses, or the discussions about decision-making tools.

Consideration might be given to an industry person periodically convening a “closed” conference among industry participants to discuss new developments, changes in the regulatory environment, market attitudes and industry experiences with water recycling in the food industry, operating under “Chatham House” rules. Such a meeting might be held just before or after one of the major food industry conferences.

The bottom line is to know the quality of the recycled water one wishes to achieve and use, rather than just where it comes from.

3. Notes from group discussion

Participants were asked to write comments on highlights from the project presentations for discussion at their tables. The following is a summary:

Participant highlights from Consumer Studies project

“Consumer choice modelling shows no real barriers to consuming meat products. Perhaps consumers expect a lower cost product even though there’s an increase in cost to produce it with purified recycled water. Industry can increase level of trust and demonstrate purified recycled water is better quality than tap water. Recycled water within the plant, not recycled wastewater.”

“The meat consumer study results were not as expected – consumers liked the product.”

Highlights from technology assessment

“Combine the technology assessment with value proposition and regulatory assessment. Use the tool from a ‘base’ framework and pilot/trial to introduce new technology. Warrnambool Butter and Cheese noted big limitation in getting rid of wastewater but still needs treatment to reduce salt and nutrients. The value proposition tool highlighted company options. WCBF will run the pilot for another 3 months for confirmation.”

“Understand the needs and drivers of a proposal. Effluent handling rather than scarcity. Security of water supply is a big driver only when supply is under threat.”

“Should be treating water at the source – easier to treat further up the chain – decreases the volume to treat – look at the whole system to reduce.”

“Consider timeframe – 20 years is too long as there will be technology advancements.”

Highlights of the regulations and guidelines assessment

“Recycled water from non-animal sources is not a health problem. It may have operational needs for managing water quality (treatment) and if used for irrigation, may need treatment to meet Australian Guidelines for Water Recycling values.”

“Recycled water from animal sources, if used in feed production – must be treated to potable standard. Or if for non-potable use such as wash down, is allowed. AGRW is more focussed on recycling human effluent than recycling of potable quality in food manufacturing plants. There is an opportunity for AFGC to work with industry to bring water quality guidelines.”

“Reduce barriers to trade – what if a company has invested in a water recycling plant – important on the local supply.”

Highlights of the salt and nutrient modelling

“At Bega Cheese, Agricultural Production Systems sIMulator (APSIM) was used to evaluate management options. Key parameters include crop/pasture biomass, N, P and water uptake and leaching. Options include biomass removal for N reduction and limiting N leaching. Model identified critical N concentrations in irrigation. Usability and availability of APSIM model – is it accessible/can it be used easily? It is available but needs a user experienced in the model and good local data for parameters.”

Highlights from value proposition tool

“Can it incorporate community values (externalities)? Tool will soon be widely available. Tool can be enhanced but it will need additional industry investment to refine. It needs to be used in context of the case-specific decision making within the industry.”

Highlights of red meat processing case study

“Red meat processing is already fairly water efficient. Regulations limit use of recycled water in meat processing (prohibited for export to some countries and if used for pet food, must be treated to potable quality). There is an opportunity for treatment for fat removal, also for N reduction, with wastewater for irrigation.”

4. General comments from discussion – key learning

“Be clear on what we mean by using recycled water in the manufacturing process. Can we separate the technical and the emotional issues? Do we need a better definition of potable quality water and its uses in the food manufacturing industries? Should regulations and approval process be revised?”

“Treatment technology has to fit the solution. Invest in pilot treatment projects, don’t just rely on modelling. There is useful modelling software targeted to industry.”

“There are opportunities to integrate outcomes for water and energy. Solutions will be different for different industries. The drive is to reduce wastewater constituents in the first place.”

“Cleaning products have a major impact on quality of effluent, not just on N, P and solids in wastewater.”

“Industry needs hard data on comparative costs of alternative supply and treatment options – and built into treatment selection and economic models. Economic assessment should include community and environment values and benefits. Rapid assessment tool is useful.”

“Need to know other impacting issues when using the technology selection tool, such as what are the major issues that need to be addressed and can we list questions at the beginning to help make the business case (eg cost of water, constraints, key drivers).”

“Need to better understand the institutional maze of regulatory approval, especially in Victoria. Victorian regulator was risk adverse for Radford Meats recycled water system at Warragul. Queensland regulator was supportive of Inghams chicken processing water recycling system in Brisbane.”

“Can associations develop a list of incentives and resources, encouraging water use for the higher values, demand management, guidelines for food processors, working with local municipality to get offsets for implementing water recycling?”

“Establish key decision-making parameters. As there are many case-specific issues, can companies and industry associations define common variables, sustainability targets and key priorities that need to be addressed by our plants?”

“Use consistent language to describe recycled water. At present there are too many descriptions and mixed messages (treated effluent, wastewater reuse, A-C class recycled water, purified recycled water, advanced water treatment) which confuses industry professionals and the public. Describe quality, not source. ‘Fit-for-purpose’ water or ‘purified’ water may be better.”

“NSW Food Authority has a useful guide for food businesses in NSW considering reusing water and explains what a business needs to demonstrate. Can this be reviewed by AFGC, AMPC and DIAL for something similar in Victoria?”

5. Industry Perceptions

Representatives of Dairy Innovation Australia, the Australian Meat Processor Corporation, and the Australian Food and Grocery Council attended the forum. They outlined key water management issues in their industry and how project results can be used by members. The following is a summary that can be viewed on the forum webcast.

View webcast: www.australianwaterrecycling.com.au/videos-presentations.html

5.1 Dairy Industry

Dairy Innovation Australia Ltd is research based, not-for-profit organisation, composed of six commercial company members which represent 70% of all milk processed in Australia. At the beginning of the project, David Barr, DIAL's Sustainability Leader, said he had expectations it would clarify barriers to increase water recycling in the dairy sector, test possible solutions to these barriers, and recommend how industry can implement solutions. David listed the assumptions he believed were preventing dairy processing companies from increasing their use of recycled water. His first assumption was that the cost to treat wastewater for reuse was much higher than the cost of purchasing potable water from conventional supplies. His second assumption was, in any competition for capital, a company would generally choose an investment to generate more income from increased production rather than an investment that saved money from reduced potable water and trade waste costs.

His third assumption was the disposal challenges of salt from wastewater treatment systems using reverse osmosis technology, particularly at inland facility locations. His fourth assumption was that water recycling, particularly using advanced treatment systems, ranked lower in a company's overall wastewater reduction hierarchy, lower even than implementing water conservation measures, and dairy companies disposing of wastewater via irrigation believe this is a valid, beneficial use of wastewater – in effect de-facto effluent treatment and disposal. David said his personal target was for the dairy industry to move towards 'zero liquid discharge'. He assessed the Australian Water Recycling Centre of Excellence-CSIRO project as having provided some of the necessary data, information and knowledge for the dairy industry to overcome the barriers for increased use of water recycling, and move along a route to 'zero liquid discharge', but it had not achieved all.

See Dairy Innovation Australia web address: <http://www.dairyinnovation.com.au>

Pre-conceived barrier	Expectation met?	Comment
Sources and sinks of recycled water	No	Although not in project scope, was attempted but didn't get anywhere due to a lack of data
Salt disposal from treatment	No	No support for idea. Remains a barrier to inland processing plants. Not in project scope.
Cost to recycle and produce potable water	Yes	Good information from value proposition tool and Warrnambool Cheese and Butter Factory case study
Benefits of recycled water to irrigation	Yes	Good information from Bega Cheese case study and modelling salt, N&P uptake in soil
Removal of phosphorus from effluent	Uncertain	Case study results of P removal in meat industry may not transfer to dairy industry

5.2 Meat industry

Australian Meat Processor Corporation (AMPC) is the research & development provider for Australia's red meat processing industry. Doug McNicholl, AMPC's Program Manager for Environment and Sustainability, said the red meat processing industry contributes \$16.2 billion to Australia's GDP, \$5.8 billion in exports, and 148,000 jobs, the majority of which are in semi-regional and rural areas. The red meat processing industry is heavily export dependent with over 60% of production exported. It is a high volume, low margin industry dominated by large efficient plants. The top five red meat processing businesses account for around half of national processing throughput.

He said issues of interest in water management relate to cost, consumption, wastewater treatment, food safety, and reuse. According to survey data captured from 26 Australian red meat processing plants as part of the CSIRO project, water input costs varied from \$0.80 to \$3.46 per kilolitre depending on location and water source. Doug said AMPC's target was to reduce water consumption per tonne of Hot Standard Carcass Weight across the industry by 10% by 2015. He valued a number of CSIRO's project outputs including the analysis of innovative biological treatment technologies for recovering nutrients in abattoir wastewater, in addition to the Value Proposition Tool for evaluating water recycling initiatives. AMPC and CSIRO have produced a number of fact sheets and reports on the project which will be available soon on their websites.

See Australian Meat Processor Corporation: <http://www.ampc.com.au/>

See Meat and Livestock Australia: <http://www.mla.com.au>

5.3 Food and grocery industry

The Australian Food and Grocery Council is the lead national organisation representing Australia's packaged food, drink and grocery products manufacturer. Angela McClowry, AFGC's Sustainability Manager, said the Council's water efficiency target is to reduce water consumption by 20 per cent to 2.61 kL per tonne of production by 2020. Angela said her industry members had responded to the issue of water scarcity by implementing a range of water saving initiatives. These include: installing fit for purpose water recycling plants, improving trade waste disposal, reverse osmosis water recycling plants, installing water meters, and training staff to use water more efficiently. Many large companies had implemented water recycling systems. Angela said AFGC supported the CSIRO project and was keen to disseminate results to members through newsletters, technical summaries, industry workshops and forums.

Australian Food and Grocery Council web address: <http://www.afgc.org.au>

6. Group discussion: Opportunities and adoption pathways

Three discussion groups identified major recycled water challenges in the food industry, where they wanted water recycling to be in the future, and suggested adoption pathways. The following is a summary of the discussion.

Current state	Pathways to get there	Desired future state
Economic viability assessment of recycled water options inadequate	Engage economic regulators and utilities. Better use of tools and CBAs to assess water supply and recycling options. Training courses, case studies and demonstration sites.	Increased water, N and P recovery from wastewater. Increased investment in treatment plant upgrades. Reduced kL cost of recycled water.
Water is too cheap	Improve public perception of recycled water through education, rebranding and non-food contact only.	Purified recycled water accepted and used by community.
Where does industry go to start the process to assess viability and best treatment options?	Conduct pilot projects. Develop independent resources to determine the best outcomes. Companies don't know how to get impartial advice.	Use independent resources and knowledge eg CSIRO and Government. Wide access to advice, value proposition tools, models and technology assessment resources by industry.
Commercialisation and awareness of recycled water not high – need industry training.	Publish in-depth case studies. Networking and annual workshops + events to discuss issues, learn from others.	Industry capacity and technical skill to manage projects and continued investment by companies. Public private partnerships.
Regulations not adequate in describing the situation for water recycling.	Industry associations to work with regulators to look at improving /revising the regulations.	Water is treated to a potable standard no matter what the source.
Drivers for reduced water use.	Define and implement industry best practice. Industry to get involved in defining water recycling in the food manufacturing industry.	Agreed targets for water consumption and water reuse (eg x ML by 2030). Companies apply TBL water assessment.
Ambiguity in the regulations about use of recycled water.	Develop clear industry guidelines with regulators. Industry to lead a two-way discussion with govt. authorities.	Widely understood guidelines and regulations.
Some countries prevent recycled potable water in contact on food products or surfaces.	Put potable definitions in place. Basis for bilateral negotiations on use of recycled water in the process. Categories of recycled water quality.	Removal of barriers to increase export opportunity and access.
Ad-hoc and limited access to knowledge.	Industry conferences and councils. General information sessions. Better use of award systems.	Shared knowledge and responsibility.
Reuse of sewage wastewater not permitted in a food business.	Validate advanced water treatment technology. Confidence in technology, plant performance and monitoring.	Removal of barrier. Potable recycled water to be judged on quality, not source.

7. AGENDA

Time	Topic	Presenter
10.00 – 10.10	Welcome, overview of the Centre and knowledge adoption	Don Alcock (AWRCoE)
10.10 – 10.15	Innovation for food processing industries	Martin Cole, CSIRO Food and Nutrition Flagship
10.15 - 10.45	Introduction from an industry sector viewpoint	AMPC/MLA/AFGC/DIAL
10.45 – 11.00	Overview of the water recycling project <ul style="list-style-type: none"> • Objectives and Methodology • Key outputs and outcomes • Introduction to the case studies 	Jay Sellahewa (CSIRO)
11.00 – 11.10	Short break	
11.10 – 1.15	Presentations and short discussion on the key activities, outcomes and learnings based on case studies <ul style="list-style-type: none"> • Consumer attitude studies • Technology selection framework • Regulatory framework • Nutrient and salt uptake modelling • Value proposition methodology • Fact sheets and position papers for the meat sector 	David Cox (CSIRO) Tim Muster (CSIRO) Simon Toze (CSIRO) Jay Sellahewa (CSIRO) Kirthi Desilva (CSIRO) Raymond Mawson (CSIRO) Industry / industry sector representatives <i>(10 min CSIRO speaker, 5 min industry speaker, 5 min discussion for each topic)</i>
1.15 – 2.00	Lunch	
2.00 – 2.45	Group discussion around the key learnings from the case studies <i>(four group discussions)</i>	Facilitated by Don Alcock, AWRCoE
2.45 – 3.30	General discussion / Cross sector learnings	Facilitated by Don Alcock, AWRCoE
3.30 – 3.45	Wrap up / Next steps	John Radcliffe, AWRCoE
3.45 – 4.15	Afternoon tea and networking	

8. Participants

Mr	Jay	Sellahewa	CSIRO	Research Scientist
Mr	Kirthi	De Silva	CSIRO	Team Leader
Mr	Don	Alcock	Australian Water Recycling Centre of Excellence	Knowledge Adoption Manager
Mrs	Angela	McClowry	AFGC	Manager, Sustainability
Dr	Simon	Toze	CSIRO	Research Director
Dr	David	Cox	CSIRO Food and Nutrition	Senior Research Scientist
Mr	Doug	McNicholl	AMPC	Manager: Environment & Sustainability
Mr	Peerasak	Sanguansri	CSIRO	Research Group Leader
Mr	Linton	Ryan	Ryan Meat Company	General Manager
Mr	Gerard	McAloon	Frewstal Pty Ltd	Environment Manager
Mr	Don	Begbie	Australian Water Recycling Centre of Excellence	Program Manager, Research and Development
Dr	Tim	Muster	CSIRO	Senior Research Scientist
Mr	Damien	Sullivan	SPC Ardmona	National Environment Manager
Mr	Tim	Jolley	Radford & Son Pty Ltd	Supervisor
Mr	Russell	Vickery	Murray Goulburn Cooperative	Utilities Engineer
Dr	Michael	Adelana	Department of Environment & Primary Industries	Research Scientist - Hydrogeology
Mr	Allan	Stevenson	Lion Dairy and Drinks	Engineering Manager
Dr	John	Radcliffe	Australian Water Recycling Centre of Excellence	Chair
Mr	Hudson	Cameron	Inghams Enterprises Pty Ltd	AWTP Manager
Mr	David	Barr	Dairy Innovation Australia	Sustainability Leader
Mr	Gren	Delfs	ADI Systems Asia Pacific	President
Dr	Aaron	Gosling	Gardiner Foundation	Program Manager
Dr	Nigel	Barrett	Lion Dairy and Drinks	R&D manager
Ms	Angela	Ganley	City West Water	Senior Project Development Engineer
Mrs	Tejaswi	Giri	City West Water	Civil Engineer
Mr	Bill	Snodgrass	GE Water and Process Technologies	Commercial Leader
Mr	Nathan	Clarke	ADI Systems Asia Pacific	Technical Director
Mr	Chris	Porter	Office of Living Victoria	Project Officer
Mr	Llew	Sandford	Bega Cheese	Environmental Manager
Mr	Steve	Brewster	ADI Systems Asia Pacific	Senior engineer
Mr	Nigel	Goodman	CSIRO	Scientist
Mr	Alex	Dupleix	Warrnambool Cheese and Butter	Manager
Mr	Greg	Finlayson	GHD	Senior Principal Water
Mr	Shankar	Cumarasamy	VCSCM	Senior Sector Specialist (Food Manufacturing)
Mr	Benn	Hor	La Ionica Poultry	Production Manager
Mr	Lloyd	Simons	CSIRO	Business Development

9. Further reading

Water reuse guidelines for food businesses in NSW considering reusing water, NSW Food Authority (2008).

http://www.foodauthority.nsw.gov.au/Documents/industry_pdf/water-reuse-guidelines.pdf

AQIS (2007). *Water recycling methodology in Australia*. Australian Quarantine and Inspection Service

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NHMRC & NRMCC (2004). *Australian Drinking Water Guidelines - National Water Quality Management Strategy*. National Health and Medical Research Council and Natural Resource Management Ministerial Council - available for download at www.nhmrc.gov.au

NRMCC, EPHC and AHMC (2006). *Australian Guidelines for Water Recycling: Managing Health and Environmental Risks (Phase 1)*. Natural Resource Management Ministerial Council, Environmental Protection and Heritage Council and Australian Health Ministers' Conference - available for download at www.ephc.gov.au

Australian Water Recycling Centre of Excellence (2013). *Economic viability framework for non-potable recycled water schemes*: Technical report - available for download: www.australianwaterrecycling.com.au

Australian Water Recycling Centre of Excellence (2013). *Making better recycled water investment decisions: Case studies and investment guide* - website: www.australianwaterrecycling.com.au

Victoria Department of Primary Industry (2006). *Using Recycled Water in Horticulture: A Growers Guide*. To assist growers in managing irrigation with recycled water. Available online:

<http://www.recycledwater.com.au/uploads/File/documents/Growers%20Guide%20web.pdf>

Images of forum discussion: Industry forum water recycling for food processing



Industry Forum: Water recycling advances in food production and manufacturing, September 2014, Werribee