Final report

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Tripe wash water reuse in beef processing

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Executive summary

The purpose of this project was to demonstrate the benefit of water recycling in the processing of beef tripe and omasa (bible). This project also relates to the processing of tripe in small ruminants and pig stomachs.

The current project was to design and implement a new process to reclaim hot white water waste stream from the refining process stage 2 and re-use it in the first stage dirty wash in the tripe washer / cooker stage 1.

An Australian beef processing plant introduced a water management program part way through the project that impacted negatively on the water available for the process and therefore the quality of the final cooked tripe product. While the plant has significantly reduced available reuse water since the start of the project, currently available reuse water to run the tripe process is insufficient and subsequently non-viable to operate the proposed new tripe washing process. The current tripe process requires additional water at cost that exceeds the benefits gained by the reuse process.

The outcome of the project was that the process was proven to be non-viable for beef processing at a large beef processing plant. A key aspect in this project was ensuring that regulatory considerations were satisfied. The outcome of the project will be the submission of an 'approved arrangement' to AQIS, in order for the new water reuse methodology to be adopted by industry. However, due to the early termination of the project AQIS verification for the process was not confirmed.

Photo 1: Tripe wash water reuse pilot system in beef processing at a large beef processing plant.

Contents

Background

Environmental impacts have become key issues in determining the long term sustainability of meat processing operations. Water is a key element in the environmental equation at abattoirs because of the high volume of usage under normal operating conditions. The issue of water relates not only to primary use but to discharge back into the environment.

After opening and emptying the contents, tripe processing is generally a two-step process using commercial centrifuges wherein:

1. The tripe is scalded and blanched with hot water to wash the tripe and remove the inner linings; and
2. Then refined by hot water and steam to degrease and polish the tripe.

In this project, a trial was to be undertaken over a two week period at an export establishment with a custom fit recycling unit returning thermostatically controlled hot water from the refining process to the scalding process in a single recycle operation. A schematic describing the process is included below (see Diagram 1).

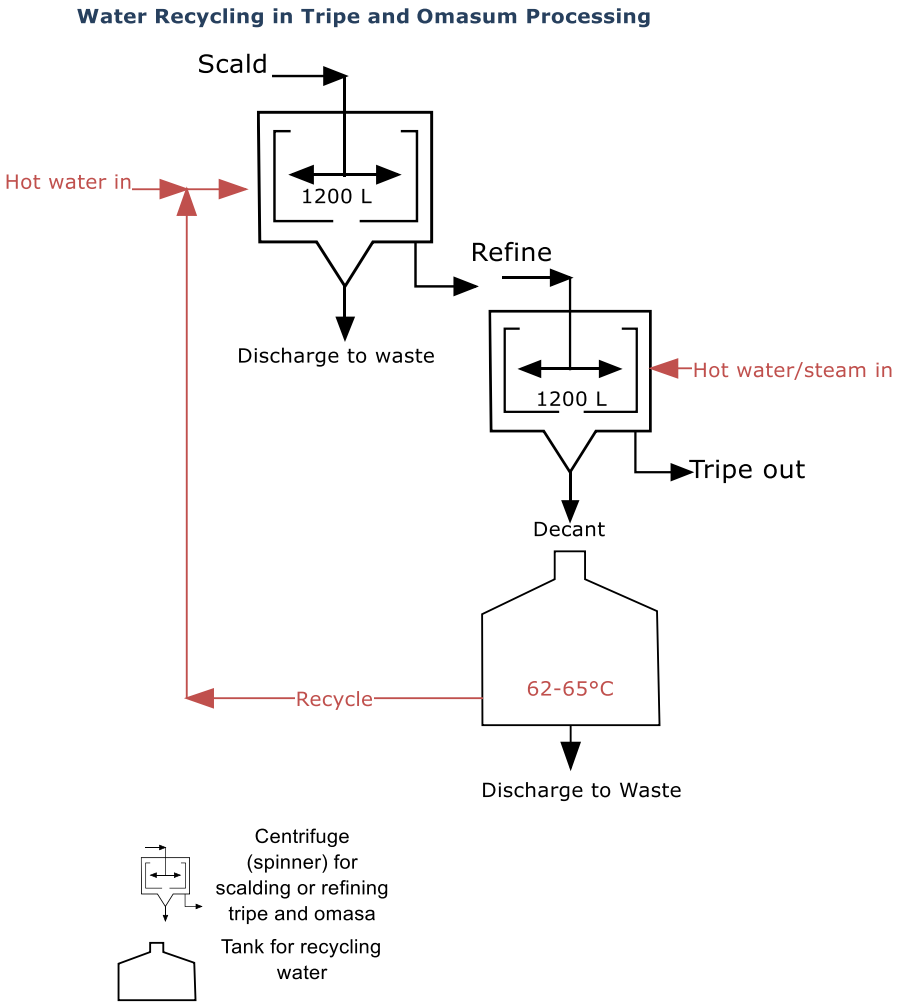

Diagram 1: Process flow diagram of water recycling in tripe and omasum processing**.**

Project Objectives

The project objective was to demonstrate that water recycling in the processing of beef tripe and omasa could be accomplished by:

1. substantially reducing quantities of hot water (approx 50% reduction in water use in tripe processing);
2. with corresponding reduction in waste water; and
3. reduction in the energy used in the heating of the water

Project Outline

The purpose of this project was to demonstrate the benefit of water recycling in the processing of beef tripe and omasa (bible). This project also relates to the processing of tripe in small ruminants and pig stomachs. A key aspect in this project was ensuring that regulatory considerations are satisfied.

After opening and emptying the contents, tripe processing is generally a two-step process using commercial centrifuges wherein:

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In this project, a trial was to be undertaken over a two week period at an export establishment with a custom fit recycling unit returning thermostatically controlled hot water from the refining process to the scalding process in a single recycle operation. Microbiological quality of the tripe was assessed prior to and during the trial for comparative purposes.

The proposed trial was schedueld as follows:

- Complete engineering work including electrics and plumbing and making of tank
- Trial of new reuse system, including microtesting
- Final report submitted to and approved by MLA

Microbiological quality of the tripe was assessed prior to and during the trial for comparative purposes. Microbiological testing of the recycled water was also conducted during the trial.

Experimental work

The current project proposed to design and implement a new process to reclaim hot white water waste stream from the refining process stage 2 and re-use it in the first stage dirty wash in the tripe washer / cooker stage 1. After opening and emptying the contents, tripe processing is generally a two-step process using commercial centrifuges wherein:

1. The tripe is scalded and blanched with hot water to wash the tripe and remove the inner linings; and
2. Then refined by hot water and steam to degrease and polish the tripe.

In this project, a trial was undertaken over a two week period at an export establishment with a custom fit recycling unit returning thermostatically controlled hot water from the refining process to the scalding process in a single recycle operation.

The design of the process was initially drafted by the processor to accommodate the current tripe processing system (see below Diagram 2).

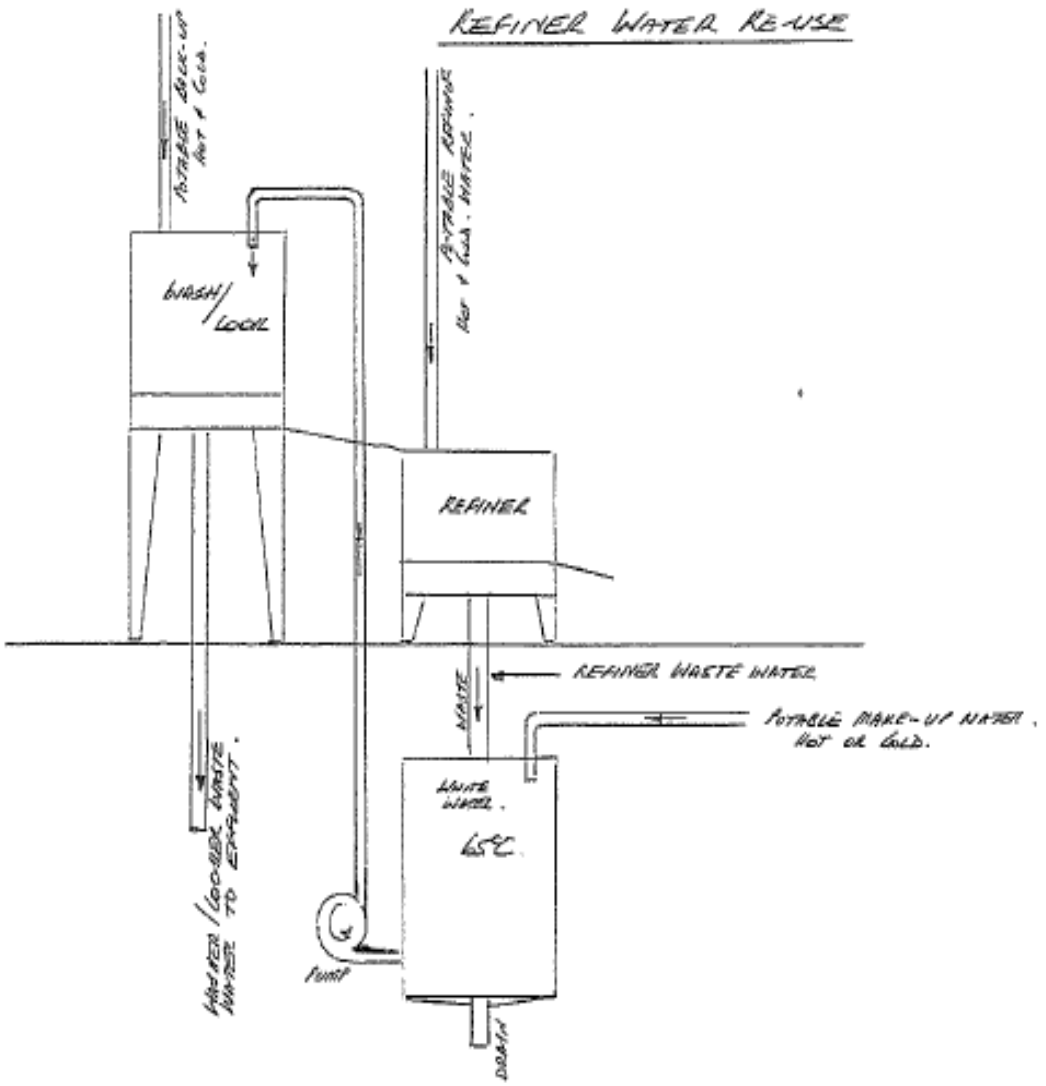

Diagram 2: Process flow sketch of water recycling in tripe and omasum processing at a large beef procesing plant**.**

The following scope of work was carried out at a large beef processing plant:

Achievement Criteria
Complete engineering work including electrics and plumbing and making of tank
Trial of new reuse system, including microtesting
Final report submitted to and approved by MLA

An external service provider (Richard Ford of Richard Ford & Associates Pty Ltd) assisted with the build of the prototype from the processor's sketches and design drawings. Parts were designed and manufactured from scratch as required with the assistance of the plant's engineering department.

Results & Discussion

The process configuration that was initially evaluated and then trialled in preliminary commercial trials was designed as per the process flow diagram (see Diagram 2) and then commissioned at a beef processing tripe room (refer to Photo 1). Subsequent evaluations were conducted as follows:

i) Initial Trial (Stage 1 Testing) :

In the initial preliminary pilot trial (October 2011), the service provider observed the hot water waste from the refiner has little protein and fat and with discharges at approximately 75°C. This stage was calculated to use based on a large beef processor's usage of approximately 1300 litres per cycle. Stage 1 of the initial prototype machine (i.e. machine 1) uses approximately 1200 litres per cycle of 65°C water in its washing cycle.

Through initial trials it was proposed that the 1300 L from the machine into a thermostatically controlled tank for re-work. It was further proposed that this tank would need both hot- and cold-make-up water to provide an effective and sustainable process. With these assumptions applied, preliminary trials were able to estimate potential water savings of 24105kL per annum for a large beef processing operation.

Initial trials were considered positive with estimated water savings being calculated from preliminary trials (see Cost Benefit Analyses section page 9).

ii) Further Commercial Trials (Stage 2 Testing) :

In further commercial testing (2nd May 2012), the service provider observed flow rates of water to be very different to those experienced in earlier trials conducted several weeks earlier. The latest flow rates of hot water available at the tripe room were measured at 0.9 L/sec compared to previous trial work measured at 1.6 L/sec. Correspondingly cold water flows had significantly reduced from 2.5L sec to 1.6 L/sec. It was noted that the manual values on both hot and cold water supplies to the tripe room were notably in different positions than observed in earlier trials. It is subsequently assumed that alterations to the values had significantly altered the volumes previously determined several weeks earlier in the kick-off trials. It should be noted that all planning and designing of the tripe washing process using recycled water had been established on the initial flow-rates (prior to changing value positions).

It was established that between design / build and subsequent implementation phases of the project that a beef processor concurrently implemented (by another department to the R&D group) a major water conservation cost-saving initiative across the beef processing operation including water savings in the beef processing tripe room. This resulted in not enough water being available to feed the process. The resultant product now processed at significantly different retention and temperature as designed now meant the product extracted from the process was stained and low aesthetic quality. The brown appearance of the cooked product after water from these preliminary trials demonstrated the wash process to be inadequate and therefore not enough waste materials being removed. Any waste materials residing after washing is then cooked into the product during subsequent cooking steps. Because this initiative had demonstrated significant water savings it was not able to be reversed.

It was evident that after the change in water flow rates significantly affected the colour and quality of the cooked tripe product. The change to the water flow rate also affected the temperature of the product during processing. It was concluded that unless totally designed with the new flow rate the current system was not viable to produce consistent and premium lightly coloured cooked tripe. While it was proposed to redesign the system, it was considered non-viable because the lower flow rates were not able to provide enough water / recirculated water to accommodate the process.

On further consideration by the processor, an extensive evaluation was not able to recommend a cost-effective process alteration to allow the product to be processed in the current configuration with the low water rates now being experienced at beef processor's tripe room. In addition, a review of alternative sites to relocate the tripe washing system was not able to identify any other sites that had equivalent high wash water usage (i.e. related to beef production capacity). For example, one of the other site might be next logical consideration to relocate the equipment, however to use the equipment in the same configuration as designed for a large beef processor there would need to be large storage of recycled water and huge heating requirements. A review of all other beef processing sites resulted in the same conclusion that the process would be non-viable in similar operating conditions.

The processor's initial consideration is it also unlikely that other non- beef operating plants might be able to implement the prototype design, again because of the high production rates of a large beef processor. For any processor to consider adopting the current process in an alternative plant, the primary consideration is that there must be enough water and product volume. Excessive costs to store imbalances or excesses of product and/or water makes this process potential non-viable.

Further analyses were conducted on the quality of refiner waste water by the processor's NATA approved laboratory (see Appendix A). The total load of bacteria was found to be very low as temperatures of the sample was approximately 70°C which kills most of the bacteria. The result of suspended solids was found to be low. Finally it was noted that there were few mucosal linings (possibly from washings) in the samples.

Project Outcomes

It was anticipated that the outcomes from this project will be developed as a case study for publication and distribution within the red meat industry generally. As well, the outcomes will be presented at suitable industry workshop or conference to assist in facilitating adoption across the industry more broadly.

The outcome of the project was that the process was proven to be non-viable for beef processing at a large beef processing plant. The processor advises that no further validation or trial work is required.

A key aspect in this project was ensuring that regulatory considerations were satisfied. The outcome of the project will be the submission of an 'approved arrangement' to AQIS, in order for the new water reuse methodology to be spread out and adopted by industry. However, due to the early termination of the project, it was not possible to confirm AQIS verification for the process.

Cost Benefit Analysis

Tripe processing is a 2-step process. In the first step the tripe is scalded in 82°C water and the second step is for polishing in hot water. For a 600 cattle/day abattoir each of these steps uses 1,200 litres per cycle and it takes 12-15 tripes per cycle. This means that each process step uses 48,000 litres of water per day. This project, if successful, will enable a 50% water saving for tripe processing, i.e. 48,000 litres per day, by eliminating the need for raw water use in the first step of the process. At a price of $1.5-2/kL this means a daily saving of $72-96 and a yearly saving of $17,000 - $23,000.

With these assumptions applied, initial processor trials were able to estimate potential water savings of 24105kL per annum for a large beef processing operation.

Commercialisation of findings

This project is one of a number of key projects with the objective of providing proven methods of achieving significant water efficiency at red meat establishments within the present regulatory framework. It is strategically important for the red meat industry to assess, measure and reduce its environmental impact from processing operations. Accordingly, this project proposed to deliver a pathway for improved environmental outcomes and improvement to the sustainability of meat processing operations.

The outcome of the project was expected to be the submission of an “approved arrangement” to AQIS, in order for the new water reuse methodology to be spread out and adopted by industry. However, due to unforeseen changes implemented part way through the trial, the process was not able to be verified and validated by AQIS and therefore AQIS approval is pending. Therefore, due to the early termination of the project, it was not possible to confirm AQIS verification for the process.

Conclusion

The conclusions of the work were:

- A process was design and implemented specific to the high beef production capacity of a large beef processor (i.e. highest production rates in beef processing in Australia).
- Preliminary trials whilst not conclusive demonstrated an insight that the system may operate effectively in producing.
- A water conservation initiative implemented part way through the project across the entire beef production process including tripe room meant that previously designed components were now not suitable. Small pilot trial with changes flow rates demonstrated the process to be non-viable. The process with lower water flow rates produced stained product with unacceptable aesthetic quality unfit for commercial sale.
- Trials were not able to verify the proposed benefits nor the sustainability of the process.
- Alternative configurations were evaluated to allow tripe to be produced at lower water flow rates. These lower flow rates were simply not enough water to match the processing demands. Introduction of combinations of both recycled water and water from potable supply was evaluated to be non-viable.
- A review of other beef processing sites was not able to identify alternative sites to relocate the equipment.

- It was therefore concluded that while the process on paper and in first trials may show promise an effective and cost-efficient water saving initiative, this was able to be substantiated
- There are no options available to further evaluate the water recycling tripe processing equipment.

It was concluded that unless totally designed with the new flow rate the current system was not viable to produce consistent and premium lightly coloured cooked tripe. While it was proposed to redesign the system, it was considered non-viable because the lower flow rates were not able to provide enough water / recirculated water to accommodate the process.

Recommendations

Overall, the processor considers the process is a good concept but not practical at a large beef processor due to recent changes in water usage. This project was suggested by the AMPC Environment Committee and a beef processor was the only plant that put their hands up to do the testing for this project. If a stage two was consider, it is recommended that change of water flows after the recycling initiative. It is currently not an option to alter the water flow rates (after the water conservation measures implemented) which are now fully adopted.

Appendix A – Water quality analyses

Analyses of tripe water were conducted by the processor's NATA approved laboratory.

The results of the tripe water is as follows:

Sample A:

- Total load of bacteria: 30 cfu/ml
- Suspended solid: 0.0032mg/L

Sample B:

- Total load of bacteria: 80 cfu/ml
- Suspended solid: 0.005 mg/L

Note: We could not do the fat test from the samples, as we are unable to collect fat droplets (not many) floating on the surface of the sample. However we kept the samples and if you wish to know the exact fat value of the samples, we have to send to Symbio but I am not sure whether they can do it from this kind of sample. My feeling is that fat value will be less. The total load of bacteria was found very low as temperature of the sample was around 70C, which kills most of the bacteria. The result of suspended solid was found low. We have noticed that there are few mucosal linings (possibly from washings) in the samples.

Kind regards.

Kalyan Pandit
Laboratory Manager

Appendix B – Statement of AQIS Water Recylcing Requirements

AQIS Meat Notice 2008 / 06 – Efficient Use of Water in Export Meat Establishments

The establishment must ensure that verification activities associated with the use of recycled water are included in their Approved Arrangement. All testing undertaken as part of these requirements (including biological, chemical and physico-chemical testing), must be carried out in a laboratory, NATA accredited for those analyses.

On-selling of this recycled water will require the approval of the relevant domestic authorities,

5.7 Reused water

Occupiers of establishments wishing to use water reclaimed from a process on another process within the establishment area must meet the following requirements:

5.7.1 exclude human effluent from the water stream to be reused;

5.7.2 have no physical connection between the potable and the reused supply;

5.7.3 follow the risk analysis and management process outlined in the Attachment to this Notice (i.e. HACCP principles):

- the detail required at each stage may vary, based on the risks posed to the product;
- The reused water may require some form of treatment to make it suitable for its intended use;
- The process may include further step(s) after the water has been reused to minimise risk to product. Examples include a final potable rinse of a contact surface, use of detergents and sanitisers; and

5.7.4 ensure that there is access to the potable municipal supply or acceptable alternative supply in case of system failure.

Examples of reuse processes already approved:

a) Steriliser and hand-wash water collected and used to wash cattle yards.
b) Carcase decontamination wash water collected, coarsely filtered, and reused immediately for the same purpose whilst maintaining a temperature that is lethal to pathogens.
c) Steriliser water collected from clean end on the viscera table and used for the initial viscera table wash
d) Steriliser water collected and used to wash moving dry landing area (hide on area)
e) Tertiary treated effluent water used as the initial wash in the antemortem yards and as an initial wash of stock
f) Chlorinated tertiary treated water used as final wash in antemortem yards and as final wash of stock.

Note:

1. It is intended to add to this list as other reuse possibilities are validated.
2. AQIS still expects establishments to run similar proposals through the analysis and management process outlined in the attachment although the detail required will be significantly less than that required in the original proposal. The focus needs to be on demonstrating that the idea will work on their site.

5.8 Non-potable recycled water

Recycled non-potable water provided for restricted purposes such as irrigation, watering gardens, flushing toilets, washing down external areas, is permitted for use in accordance with the local environmental laws and doesn't require special approval just a reference in the water procedures within the Approved Arrangement. There must be no risk that it could contaminate meat or meat contact surfaces. The occupier should ensure that any necessary Occupational Health and safety risks are managed in accordance with laws that govern this area of business.